2017 L.G. Hanscom Field

Environmental Status & Planning Report

Bedford, Massachusetts • EEA Number: 5484/8696 • May 2019

Massachusetts Port Authority
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May 15, 2019

Secretary Kathleen Theoharides
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
Alex Strysky, EEA No. 5484/8696
100 Cambridge Street, Suite 900
Boston, MA 02114

Re: 2017 L.G. Hanscom Field Environmental Status & Planning Report (ESPR) (EEA # 5484/8696)

Dear Secretary Theoharides and Director Buckley:

The Massachusetts Port Authority (Massport) is pleased to submit for your review this *2017 L.G. Hanscom Field Environmental Status and Planning Report* (*2017 ESPR*) (EEA #5484/8696). The *2017 ESPR* is being submitted in accordance with the provisions of the Massachusetts Environmental Policy Act (MEPA), G.L. Chapter 30, Sections 62-62H and its implementing regulations, 301 Code of Massachusetts Regulations (CMR) 11.00. The *2017 ESPR* responds to the November 16, 2017 Certificate on the Proposed Scope for the *2017 ESPR*.

This ESPR provides updated forecasts looking at potential future scenarios for 2025 and 2035. The analyses also incorporate use of the Federal Aviation Administration's (FAA) newest aviation noise and air quality model. The Aviation Environmental Design Tool (AEDT) has replaced the legacy Integrated Noise Model (INM) and the Emissions and Dispersion Modeling System (EDMS). Chapters 7 and 8 describe the new model and present the detailed noise and emissions findings. This is also the first Hanscom ESPR that presents an estimate of current and future greenhouse gas (GHG) emissions.

As we have done in the past, Massport is requesting an extension of the public comment period to approximately 50 days with the close of public comments on July 11, 2019. The MEPA consultation session is scheduled for June 11, 2019 at 6:30PM in the Civil Air Terminal at Hanscom Field. Two additional technical meetings are scheduled for 6:00PM on June 4 and June 6 in the Civil Air Terminal at Hanscom Field.

Members of Massport staff and the consultant team are available to discuss the attached document with you at your earliest convenience. Please contact me at (617) 568-3524 or sdalzell@massport.com with any questions or comments.

Sincerely,

Massachusetts Port Authority

Stewart Dalzell, Deputy Director
Environmental Planning and Permitting

Cc: S. Williams, A. Goodspeed, A. Gallagher, M. Gove/Massport
K. Preston/HMMH

Enclosures

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May 2019

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1 Executive Summary

Laurence G. Hanscom Field (Hanscom Field) is the Massachusetts Port Authority's (Massport) premier general aviation airport in the region and a reliever airport to Boston Logan International Airport. Hanscom Field is approximately 20 miles northwest of Boston, located within the municipalities of Lincoln, Concord, Lexington, and Bedford.

Massport has regularly reviewed and analyzed the environmental impacts associated with the operation of Hanscom Field, potential future development based on demand, and the anticipated cumulative effects of those projects. Massport prepared Generic Environmental Impact Reports (GEIR) from 1985 to 1995, and Environmental Status & Planning Reports (ESPR) approximately every five years since 2000.

This introduction to the 2017 ESPR provides background information on Hanscom Field, describes the environmental review process, identifies the analytical framework for the ESPR, summarizes the primary changes since the 2012 ESPR, and provides the organization for the report. A summary of the key findings from each chapter is presented in the sections below: Facilities and Infrastructure, Activity Levels, Airport Planning, Regional Transportation Context, Ground Transportation, Noise, Air Quality, Cultural and Historical Resources, and Sustainability and Environmental Management.

1.1 Environmental Status & Planning Report

The Massachusetts Port Authority (Massport) has filed this Environmental Status & Planning Report (ESPR) for calendar year 2017, in compliance with Massachusetts Environmental Policy Act (MEPA), to provide a status report on activity levels and environmental conditions at Laurence G. Hanscom Field (Hanscom). The Secretary of the Executive Office of Energy and Environmental Affairs (EEA) defined the scope for the *2017 ESPR* in a Certificate issued November 16, 2017.

This ESPR reports on current conditions at Hanscom Field and compares them to historical data from the *2000, 2005* and *2012 ESPRs* and other available sources as described in each chapter. The *2017 ESPR* informs future planning by presenting and evaluating the potential cumulative environmental effects of future scenarios for the planning years 2025 and 2035 based on forecasts of airport activity levels. The 2025 and 2035 scenarios represent estimates of what *could* occur (not what *will* occur) in the future using certain planning assumptions, but are not necessarily recommended outcomes. The future scenarios are consistent with Massport's 1978 Master Plan and 1980 Regulations for Hanscom Field, which prohibit scheduled commercial passenger services with aircraft having more than 60 seats.

The retrospective and prospective information presented in this ESPR provide a planning tool for assessing and reviewing changes at Hanscom Field and its environs over time. The aviation activity forecasts in the *2017 ESPR* account for a realistic level of aviation growth based on local and national aviation trends and forecasts. Additionally, the *2017 ESPR* serves as a reference for regional planning activities for the Towns of Bedford, Concord, Lexington, and Lincoln, as well as State agencies and other interested parties. For reference, Figure 1-1 shows the location of Hanscom on the U.S. Geological Survey (USGS) map.

EEA #5484/8696

Submitted by:

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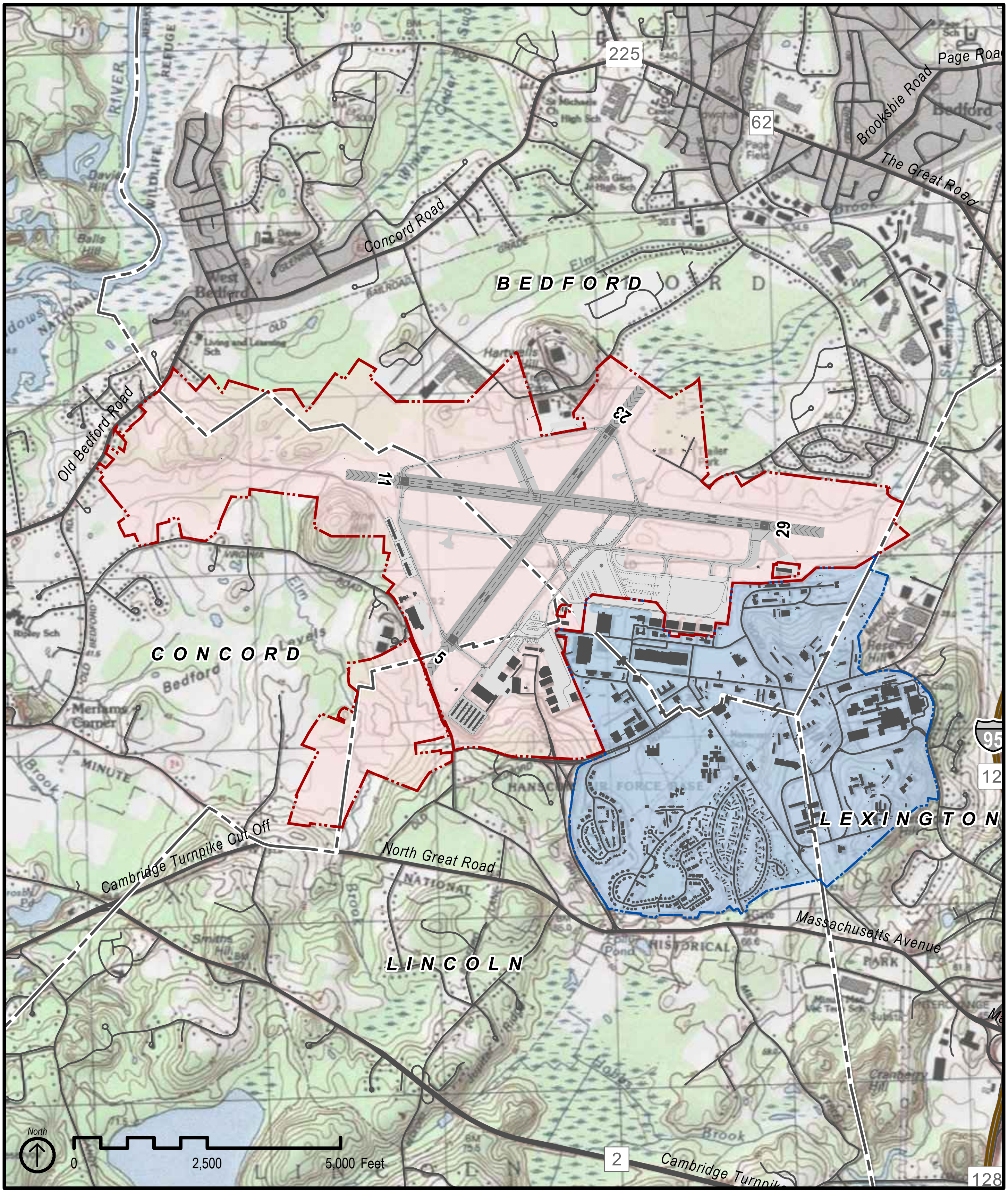


Hanscom Field Property Boundary

Hanscom AFB Property Boundary

Municipal Boundary

massport

L. G. Hanscom Field

2017 Environmental Status & Planning Report

Locus Map

Data Sources: ESRI (USGS Topographic Maps), March 4, 2013; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (Building Footprints), July 30, 2018

Figure **1-1**

1.2 Hanscom Field Overview

Hanscom Field is New England's premier, full-service general aviation (GA) airport and serves as a GA reliever for Boston Logan International Airport. It is located approximately 20 miles northwest of Boston, comprising approximately 1,300 acres of land, in close proximity to Minute Man National Historical Park (MMNHP) and Great Meadows National Wildlife Refuge (GMNWR). Hanscom lies just outside Route 128/I-95, and is convenient to most of metropolitan Boston. Route 2A serves as a primary commuter route and it is also the primary access route to the airport, Hanscom Air Force Base (AFB), and MMNHP. Figure 1-3 provides the site location of Hanscom Field in relation to these roads and its boundaries with MMNHP, GMNWR, and Hanscom AFB.

Hanscom Field is located within parts of four different municipalities: Bedford, Concord, Lexington, and Lincoln. To the south, it abuts the MMNHP, which comprises over 900 acres. The 800-acre Hanscom AFB also adjoins Hanscom to the south. GMNWR, which includes 3,600 acres along the Concord and Sudbury Rivers, is located to the west of Hanscom Field. These large land holdings provide a buffer between Hanscom Field and residential areas. Despite its proximity to public recreational areas and adjacent communities, the airport is visible from few locations due to its location within a low-lying, flat area in the landscape.

Hanscom Field Fast Facts:

- **Hanscom Field was constructed in 1941 and has been owned and operated by Massport since 1974.**
- **It is a general aviation reliever airport for Boston Logan, with approximately 129,000 operations in 2017.**
- **Hanscom Field is located in parts of four municipalities: Bedford, Concord, Lexington, and Lincoln.**
- **Two national parks are in the vicinity: Minute Man National Historical Park and Great Meadows National Wildlife Refuge.**

The FAA identifies Hanscom Field as a reliever airport. As such, its primary role in the regional aviation system is to accommodate regional GA needs, while providing supplemental service to meet small-scale, niche demands. This allows larger nearby airports to concentrate on large-scale commercial and cargo activity.

Massport assumed ownership of Hanscom Field in 1974 and prepared a Master Plan for the airport in 1978, which included a comprehensive public outreach process. In 1980, after additional stakeholder engagement, Massport adopted the Hanscom Field Noise Rules (740 CMR 25.00), which were an important outgrowth of the Master Plan. The Master Plan and the 1980 Noise Rules remain the framework for airport planning and operations today.

The variety of aviation activities at Hanscom Field include private and corporate aviation, recreational flights, pilot training, air charter, cargo, and limited military use. The Master Plan and 1980 Noise Rules contemplated and provided for scheduled commercial airline service specifically allowing for scheduled commercial passenger aircraft with 60 seats or fewer.

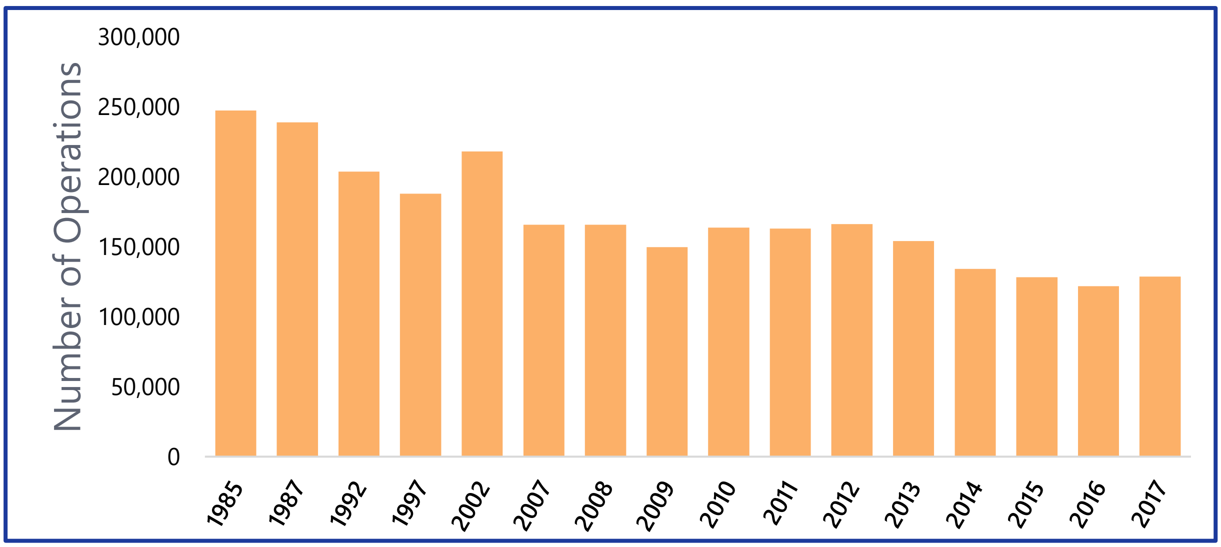
Commercial airlines have operated periodically at Hanscom Field since the mid-1970s. Pan Am was the most recent airline to provide scheduled commercial passenger services and Streamline Air provided scheduled charter service until September 2012. There have been no scheduled commercial passenger operations since 2012.

In 1970, four years before Massport assumed operation of Hanscom Field, airport activity peaked at slightly more than 300,000 total annual aircraft operations. By 2000, operations at Hanscom Field had decreased to 212,400, with GA representing 96 percent of total activity, scheduled commercial passenger service accounting for three percent, and military at less than one percent.

Hanscom's total aircraft operations have declined by about 5 percent each year since 2012, down from approximately 166,000 operations in 2012 to approximately 129,000 operations in 2017. This is well below the operations in 1985, which were close to 250,000 when Massport developed the first GEIR. GA now accounts for 99 percent of all operations.

Despite these trends, Hanscom Field continues to play an important role as a regional transportation asset that is linked to the economic health of the region. This is reflected in the expanding market for corporate aviation. Business jet operations at Hanscom have increased at a compound annual rate of 2.6 percent from 2012 to 2017.

Figure 1-2 Operations at Hanscom Field 1985-2017



Source: Massport EXP NOMS System, Annual Noise Report for Hanscom Field; Operations between 7:00AM-11:00PM, the hours that the air traffic control tower (ATCT) is open

1.2.1 Economic Impact of Massachusetts Airports

The aviation industry and airports, including Hanscom Field, comprise a significant element of Massachusetts' economy. The FAA and the Massachusetts Department of Transportation (MassDOT) continue to invest in airport infrastructure to improve and enhance economic development opportunities. MassDOT published the *Massachusetts Statewide Airport Economic Impact Study* in 2011, which was updated in 2019, summarizing the economic benefits that Massachusetts derives from its public-use airports. The study describes how the local economy builds on aviation and enumerates the other benefits that air transportation provides to its host communities.

Economic benefits of Hanscom Field to Massachusetts:

- **2,243 jobs supported by Hanscom Field.**
- **$680 million in economic activity.**

The study found that Massachusetts public use airports generate $24.7 billion in total economic activity, including $7.2 billion in total annual payroll resulting from 199,237 jobs that can be traced to the aviation industry. In particular, Massport's three airports (Boston Logan International Airport, Hanscom Field and Worcester Regional Airport) have made significant contributions to the regional economy, generating approximately $23.1 billion (94 percent) of the overall annual economic benefits generated by the Massachusetts airport system. Hanscom Field is particularly important for its function as the airfield for Hanscom AFB, an active military facility, which is aided by its proximity to the Boston-area technology and research industries. Hanscom Field alone supports 2,243 jobs and generates $680 million in economic activity, but combined with Hanscom AFB, the two entities together support 19,587 jobs and have a total economic impact of $6.7 billion. For every $100 spent by aviation-related businesses, an additional multiplier impact of $56 is created within Massachusetts, according to the study.[1] While the economic impact of the region's airports was the focus of the study, it also noted qualitative benefits of the state's airports.

Qualitative benefits of the state's airports include:

- **Facilitating emergency medical transport;**
- **Providing police support;**
- **Supporting aerial surveying, photography and inspection operations;**
- **Supporting U.S. military and other government operations; and**
- **Providing youth outreach activities.**

[1] Massachusetts Statewide Airport Economic Impact Study Update, January 2019, Massachusetts Department of Transportation. Available at https://www.mass.gov/files/documents/2019/03/25/AeroEcon_ImpactStudy_January2019.pdf

1.3 Hanscom Field Environmental Review Process

Since 1985, the Massachusetts Secretary of the Executive Office of Energy and Environmental Affairs (EEA) has requested that Massport prepare a report every five years, in order to evaluate the cumulative effect of growth and change at Hanscom Field and provide data and analyses on noise, ground transportation, air quality, and water quality. The original *1985 GEIR* (Generic Environmental Impact Report), the *1995 GEIR Update*, the *2000 ESPR*, the *2005 ESPR*, the *2012 ESPR*, and now the *2017 ESPR* provide a retrospective analysis of the environmental effects of Hanscom Field while including analyses for potential future conditions. The role of the ESPR and relationship to project-specific environmental review is described below.

1.3.1 Role of the ESPR as an Airport-wide Review

Environmental review of Hanscom Field activities is undertaken at the state level through the ESPR process, which provides a public forum to assess the cumulative environmental effects of airport operations and informs Massport and the community regarding the implications of those environmental effects. The ESPR presents an overview of the operational environment and planning status of Hanscom Field, and long-range projections of environmental conditions, against which the effects of future individual projects can be compared. It allows the reader to see past and current environmental information, and a forecast of potential future environmental effects at Hanscom Field based on realistic changes in activity levels.

Massport has developed the *2017 ESPR* primarily for review under MEPA. However, the document is utilized in a broader context. For example, potential future development documented within the ESPR (see Chapter 4 Airport Planning) may be subject to further environmental review under the National Environmental Policy Act (NEPA) prior to a project being implemented.

Massport collaborated with the FAA during the preparation of this ESPR regarding future plans for the airport and the forecast of aviation demand, and Massport is committed to working with the FAA on an ongoing basis to conduct the necessary environmental reviews under NEPA and other applicable special purpose laws such as the Endangered Species Act. As the FAA reviews future development, it will determine what specific analysis is required depending on the nature and anticipated impacts of the potential future projects.

The ESPR is also an important tool in early public engagement for future development activities. It provides a list and description of capital projects that may be undertaken or supported by Massport within the timeframes of the 2025 and 2035 scenarios. Additionally, the ESPRs are a comprehensive source of technical data and planning information for use by the towns of Bedford, Concord, Lexington, and Lincoln, State agencies and other interested parties. The ESPR does not replace the requirement for filing an Environmental Notification Form (ENF) for a specific project that meets or exceeds a NEPA or MEPA regulation threshold.

1.3.2 Project-Specific Review

While the ESPRs are an important part of the regulatory process, environmental review must also be undertaken on a project-specific basis.

In cases where the state environmental review thresholds are triggered, Massport or the project proponent will prepare the appropriate environmental filing, including an ENF or, for projects of significant scale requiring more extensive MEPA review, an Environmental Impact Report (EIR). Where NEPA environmental review thresholds are triggered at the federal level, projects typically are also reviewed under the NEPA environmental review process with the FAA acting as the lead federal agency responsible for NEPA compliance. Both MEPA and NEPA review processes include opportunities for public comment. For example, the recent Hanscom Field Aviation Facility Improvement Project, which comprised the development of several new hangars and associated apron space, and replacement of existing hangars, required the preparation of an Environmental Assessment (EA) in compliance with FAA's NEPA requirements.

Massport also meets monthly with the Hanscom Field Advisory Commission (HFAC) to review activities at Hanscom Field. HFAC was established by an act of the state legislature in 1980 and includes 16 members appointed by constituent groups and approved by the selectmen from the four host municipalities. HFAC includes representatives from the towns of Bedford, Concord, Lexington, and Lincoln; local citizens groups; other area towns affected by Hanscom Field; businesses basing aircraft at Hanscom Field; aviation or aviation-related businesses at Hanscom Field; and business aviation and/or general aviation organizations. The HFAC process provides an opportunity to review projects that are not subject to formal MEPA or NEPA review.

The ESPR and Project review:

- **The ESPR does not replace the MEPA or NEPA review of specific projects at Hanscom Field.**
- **Projects that meet or exceed regulatory thresholds (with the exception of routine maintenance and replacement projects) must comply with MEPA and NEPA environmental review requirements.**
- **The ESPRs provide important cumulative context for these environmental reviews.**
- **The ESPR ensures that the long-term planning activities inform the review and implementation of individual actions at Hanscom Field.**

Massport filed the *2012 ESPR* in December, 2013 and the Secretary issued the MEPA Certificate on March 21, 2014, which determined that the *2012 ESPR* "adequately and properly complies with the Massachusetts Environmental Policy Act."

Using the 2012 Certificate as a starting point, Massport filed a proposed scope for the *2017 ESPR* with MEPA on October 2, 2017 and MEPA published notice of the proposed scope in the October 10, 2017 edition of the "Environmental Monitor." After a public comment period which included a scoping meeting at Hanscom Field on October 24, 2017, the Secretary issued the scope for the *2017 ESPR* in its Certificate on November 16, 2017.

Detailed ESPR technical studies are summarized in a readable format to illustrate clearly the implications of recent trends, existing conditions and potential future scenarios. The ESPR presents policy considerations and an overview of the airport's current and potential future role within the regional planning context, including a status report on Massport's proposed planning initiatives and projects.

1.4 Development of the *2017 ESPR*

This section outlines the enhancements to the technical analysis since the *2012 ESPR*, describes the outreach program for the development of the *2017 ESPR*, and provides a schedule for the *2017 ESPR* public review and comment.

1.4.1 Technical Analysis and Data Gathering for the *2017 ESPR*

Massport has responded to the Secretary's Certificate and prepared a detailed study of existing and projected future conditions at Hanscom. The *2017 ESPR* includes a comprehensive analysis of information collected over the past three ESPRs to show important trends in Hanscom activities and in regional activities and the associated trends in environmental conditions over time. The preparation of forecast scenarios for the two planning years (2025 and 2035) based on realistic development assumptions provides a practical and effective way to evaluate potential future environmental effects.

Issues that are addressed in the *2017 ESPR* include airport facilities and infrastructure; aviation activity levels; airport planning; regional transportation context; ground transportation; noise; air quality; wetlands, wildlife, and water resources; historical and cultural resources; sustainability, environmental management, and a summary of potential beneficial measures. Technical appendices are provided, along with responses to comments on the proposed *2017 ESPR* Scope and supportive material for the technical studies.

1.4.2 Outreach for Preparation of the *2017 ESPR*

In addition to the MEPA scoping process, Massport engaged with state, regional and local agencies and commissions in the preparation of the *2017 ESPR,* and provided a briefing on the project to the Hanscom Field Advisory Committee (HFAC) (correspondence with agencies and organizations is included in Appendices C, F and G).

Massport sent letters to each of the local Historic Commissions and participated at one of their regularly scheduled public meetings where the *2017 ESPR* planning effort was described and input solicited. Specifically, each commission was asked to discuss any updates to cultural and historic resources since 2012 that should be included in the *2017 ESPR*. This information has been incorporated into Chapter 10 Cultural and Historical Resources.

Massport also contacted the planners from the surrounding four towns informing them of the *2017 ESPR* and requesting information about planned development and infrastructure projects, the status of their long-range comprehensive plans and changes in conservation and recreational land. This information has been incorporated in Chapter 4 Airport Planning, Chapter 6 Ground Transportation, and Chapter 10 Cultural and Historical Resources.

MMNHP staff reviewed existing material about the Park and provided updates. Staff from the Hanscom AFB provided information about their recent and upcoming development projects and sustainability efforts as part of the data collection process for the *2017 ESPR*. Finally, all Hanscom Field tenants were contacted to provide information, including their environmental management activities, sustainable development, vehicle and fuel use, spill information, and planned developments for example. This information is contained in Chapter 2 Facilities and Infrastructure, Chapter 4 Airport Planning, Chapter 6 Ground Transportation, Chapter 8 Air Quality, and Chapter 11 Sustainability and Environmental Management.

Finally, Massport coordinated with the FAA for the preparation of the *2017 ESPR*. Hanscom Field is under the purview of the FAA's New England Region, whose regional office is located in Burlington, Massachusetts. The FAA administers the Airports Improvement Program (AIP), which provides grants for planning and development projects, funded through user fees and fuel taxes. The FAA provides air traffic control and navigation services and is the regulator of the airport and airspace system to ensure safe and efficient operations at public-use airports, including Hanscom Field. Lastly, as a federal agency the FAA is responsible for implementing NEPA. The FAA is therefore an important stakeholder in the ESPR development process, and a central partner to Massport in the operation of Massport facilities.

1.5 Primary Findings of the *2017 ESPR*

This section provides a summary of the *2017 ESPR* key findings, corresponding with the subject matter of each chapter, in the order in which they appear in this document.

1.5.1 Airport Facilities and Infrastructure

Since the *2012 ESPR*, Massport has made key improvements to fundamental airport infrastructure at Hanscom Field and third-party developers have upgraded corporate aviation facilities. Chapter 2 contains a listing of significant projects by year in its Key Findings section and details of each in the subsequent sections. These include rehabilitation of pavement in multiple areas, relocation of portions of the perimeter road, construction of Rectrix[2] and Jet Aviation fixed-base operator facilities, commencement of Massport Fire-Rescue operations, and the reconstruction of Runway 11/29.

1.5.2 Airport Activity Levels

Chapter 3 details the airport activity levels. In 2017 Hanscom Field accommodated approximately 129,000 day-time aircraft operations (7:00 AM-11:00 PM, the hours that the air traffic control tower (ATCT) is open), and 1,902 nighttime operations[3, 4] (11:00 PM – 7:00 AM), with GA accounting for over 99 percent, and military operations accounting for the remainder. More than 60 percent of the operations performed at Hanscom in 2017 were in single-engine piston (SEP) aircraft, consisting primarily of training operations and recreational or personal flying. Business aviation operations conducted in jets, turboprops, and multi-engine piston aircraft accounted for 32 percent of Hanscom's activity (see Table 1-1). The airport has not had scheduled passenger commercial service since 2012, when the last ESPR was completed.

Hanscom Field's total aircraft operations have declined from approximately 166,000 day-time operations in 2012. Although GA activity nationwide has decreased, the decline in operations at Hanscom Field has been more pronounced. However, the business aviation activity at Hanscom Field has mirrored the growth of the Massachusetts economy, continuing the growth trend observed in the previous ESPR following the 2008 recession. Overall business aviation operations (in both propeller and jet aircraft, combined) increased at an annual rate of 2.6 percent from 2012 to 2017.

Though total operations decreased between 2012 and 2017, operations by jet aircraft and the number of nighttime flights increased. Construction at Boston Logan International Airport in 2017 caused some aircraft to operate out of Hanscom Field that otherwise would have operated out of Logan Airport, contributing to some of the increase in jet aircraft activity. In addition, Runway 11/29 was closed for repaving during the month of August 2017, which caused an increase in operations on Runway 5/23 for the duration of that project. As discussed

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[2] On February 15, 2019 Ross Aviation completed its acquisition of Rectrix Aviation. Ross Aviation facilities will retain the Rectrix brand at Hanscom Field, and is therefore referred to as Rectrix throughout the *2017 ESPR*. See "Ross Aviation Completes Acquisition of Rectrix Aviation" (February 15, 2019). Available at: http://www.rossaviation.com/news/ross-aviation-acquires-rectrix-aviation

[3] The definition of "nighttime" operations under Massachusetts law, and as reported in the Hanscom Field Annual Noise Report is from 11:00 PM to 7:00 AM. The FAA defines "nighttime" as the period from 10:00 PM to 7:00 AM for the purposes of calculating exposure to aircraft noise with the Day-Night Sound Level (DNL) metric. Therefore, the number of operations characterized as "nighttime" for use in determining DNL (described in Chapter 7 of this document) is higher than the number of nighttime operations reported in this chapter.

[4] Massport's official aircraft operation counts are based on the FAA Air Traffic Control Tower (ATCT) counts from 7:00 AM to 11:00 PM when the tower is operational. In 2017, there were 1,902 additional aircraft operations during the late night / early morning hours when the tower is closed. The nighttime operations presented in the *2017 ESPR* differ from those published in the Hanscom Field Annual Noise Report. This discrepancy is due to the difference in the timing of the preparation for the two reports. Each report used the best available data at the time of the analysis for that report. The difference of approximately 0.4 daily nighttime operations, or 0.3% of all daily operations would change computed noise levels by an imperceptible amount and would not change the conclusions of the analysis as presented.

later in this chapter and in Chapter 7 Noise, the shape of the 2017 noise contours reflect increased operations on Runway 5/23.

Total aircraft operations are forecast at 131,900 in 2025 and 138,840 in 2035. This is an annual forecast growth rate of 0.4 percent, consistent with the FAA's national forecast.[5] Business aviation is the driver of the growth with an annual growth rate of 1.9 percent through the forecast period. Although the forecast does plan for a small number of possible future scheduled commercial traffic, it assumes that Hanscom Field will continue to function primarily as a GA reliever for Logan Airport, and as the premier business aviation airport in the Greater Boston area. The current forecast levels for 2025 and 2035 remain below the actual 2012 levels and below forecast levels for 2020 and 2030, respectively, at Hanscom Field.

Table 1-1 Summary of Aircraft Activity at Hanscom Field, 2005 – 2017

Activity	Year			Compound Annual Growth Rate (CAGR)[2]	
Aircraft Operations (7:00AM-11:00PM)[1]	2005	2012	2017	2005-17	2012-17
General Aviation					
Training (SEP)	58,535	70,196	46,014	-2.0%	-8.1%
Personal Flying (SEP)	57,894	51,477	33,040	-4.6%	-8.5%
Business Non-Jet (MEP+Turbo)	9,646	10,178	10,846	1.0%	1.3%
Business Jet	32,345	25,638	29,862	-0.7%	3.1%
Helicopter	7,004	7,345	8,256	1.4%	2.4%
Subtotal GA	**165,424**	**164,834**	**128,018**	**-2.1%**	**-4.9%**
Military	**904**	**745**	**759**	**-1.4%**	**0.4%**
Commercial Scheduled Airline	**3,627**	**635**	**0**	**-100.0%**	**-100.0%**
Total Operations	**169,955**	**166,214**	**128,777**	**-2.3%**	**-5.0%**
Based Aircraft	**387**	**340**	**350**	**-0.4%**	**0.6%**

Note:
1. Operations between 7:00 AM and 11:00 PM, the hours that the air traffic control tower is open.
2. Average growth rates over multi-year periods are calculated using compounded annual growth rates, or CAGR. The CAGR is the annual growth rate from the Year 1 value (e.g., aircraft operations, etc.) to the value at the end of the historic or forecast period, with the effect of compounding taken into account. This accurately measures the year-to-year growth.
Source: *2012 ESPR* for Hanscom Field and Massport EXP NOMS System.

[5] FAA Aerospace Forecast 2018-2038

1.5.3 Airport Planning

Planning for Hanscom Field, described in detail in Chapter 4, describes scenarios that could occur depending on the future demand. The planning scenarios in Chapter 4 are based on the airport activity levels that have been forecast for 2025 and 2035 in Chapter 3. The planning concepts take into account the 1978 Master Plan and Massport's 1980 Regulations, which establish the general planning framework for Hanscom Field. Detailed environmental analysis would occur for projects that move from conceptual screening to the proposal stage when those projects exceed MEPA or NEPA review thresholds.

Massport Regulations and Noise Rules contain the following provisions:

1) **Limit scheduled commercial airline service to passenger aircraft with 60 seats or less;**
2) **Impose a nighttime field use fee to discourage activity between 11:00 PM and 7:00 AM;**
3) **Prohibit touch-and-go operations between the hours of 11:00 PM and 7:00 AM;**
4) **Prohibit touch and go operations at any time by aircraft exceeding 12,500 pounds;**
5) **Limit APU and GPU usage to 30 minutes, with further limitations between 11:00 PM and 7:00 AM.**

The five planning areas described in Chapter 4 Airport Planning include:

- North Airfield;
- Northeast Airfield;
- East Ramp;
- West Ramp; and
- Pine Hill.

This ESPR assesses current planning initiatives and projects at Hanscom Field, and compatible development consistent with activity forecasts for the 2025 and 2035 planning scenarios.

Table 1-2 summarizes the current planning initiatives and projects at Hanscom Field, supporting Hanscom Field’s role as a premier full-service GA airport. Figure 1-3 depicts the possible location of planning initiatives and concepts in the 2025 and 2035 scenarios.

Massport also considers the following when formulating the plan for the future development of the Airport:

- FAA Advisory Circular 150/5070-6b, *Airport Master Plans;*[6]

[6] FAA. January 27, 2015. Advisory Circular 150/5070-6b Change 2. https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_150_5070-6B_with_chg_1&2.pdf

- FAA Advisory Circular 150/5300-13, *Airport Design;*[7]
- FAA Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design;*
- FAA Terminal Area Forecast for the airport;
- Federal, state, and local environmental regulatory requirements and review processes;
- Executive Order 385, *Planning for Growth*[8], (Growth Management Policy for Massachusetts);
- Executive Order 438, *State Sustainability Program*[9], which initiated the new State Sustainability Program;
- Regional planning framework and local comprehensive and growth management plans; and
- Long-range plans for the MMNHP and Hanscom AFB.

This approach provides a planning context for potential improvements at the airport.

[7] FAA. February 26, 2014. Advisory Circular 150/5300-13 Change 1. https://www.faa.gov/documentLibrary/media/Advisory_Circular/150-5300-13A-chg1-interactive-201804.pdf
[8] Commonwealth of Massachusetts. April 23, 1996. *Executive Order 385: Planning for Growth.* https://www.mass.gov/executive-orders/no-385-planning-for-growth
[9] Commonwealth of Massachusetts. July 23, 2002. *Executive Order 438: State Sustainability Program.* https://www.mass.gov/executive-orders/no-438-state-sustainability-program

Table 1-2 2025 and 2035 Hanscom Field Planning Concepts

Planning Area	2017 Existing Uses	2025 Scenarios (2017 – 2025)	2035 Scenarios (2026 – 2035)
North Airfield	Currently vacant	General aviation (GA) facilities with aircraft parking utilizing existing impervious surface where possible.	Additional GA Hangars.
Northeast Airfield	Currently vacant	None	Development reserve on Parcel B site, upon reversion to Massport.
East Ramp	General aviation, including FBO and fueling facilities	GA facilities with new aircraft parking spaces; Expansion of GA facilities and upgrading or replacement of existing GA hangars; Expansion of the airport maintenance facility.	GA facilities with new aircraft parking spaces; Alternative landside access; Further expansion of the airport maintenance facility.
West Ramp	General aviation, including FBO and T-hangars; Civil Air Terminal	Upgrading or replacement of GA facilities with new aircraft parking spaces; Salt storage facility relocation; Civil Air Terminal enhancements.	New GA hangars; Civil Air Terminal enhancements; New and replacement public parking spaces as needed; Land reserved for development along Hanscom Drive (prior potential projects have been identified as office space, a hotel, and a museum). Precise use to be determined by demand.
Pine Hill	GA including T-hangars and FBO	GA facilities with new aircraft parking spaces.	Additional GA facilities.

Source: Massport 2018.

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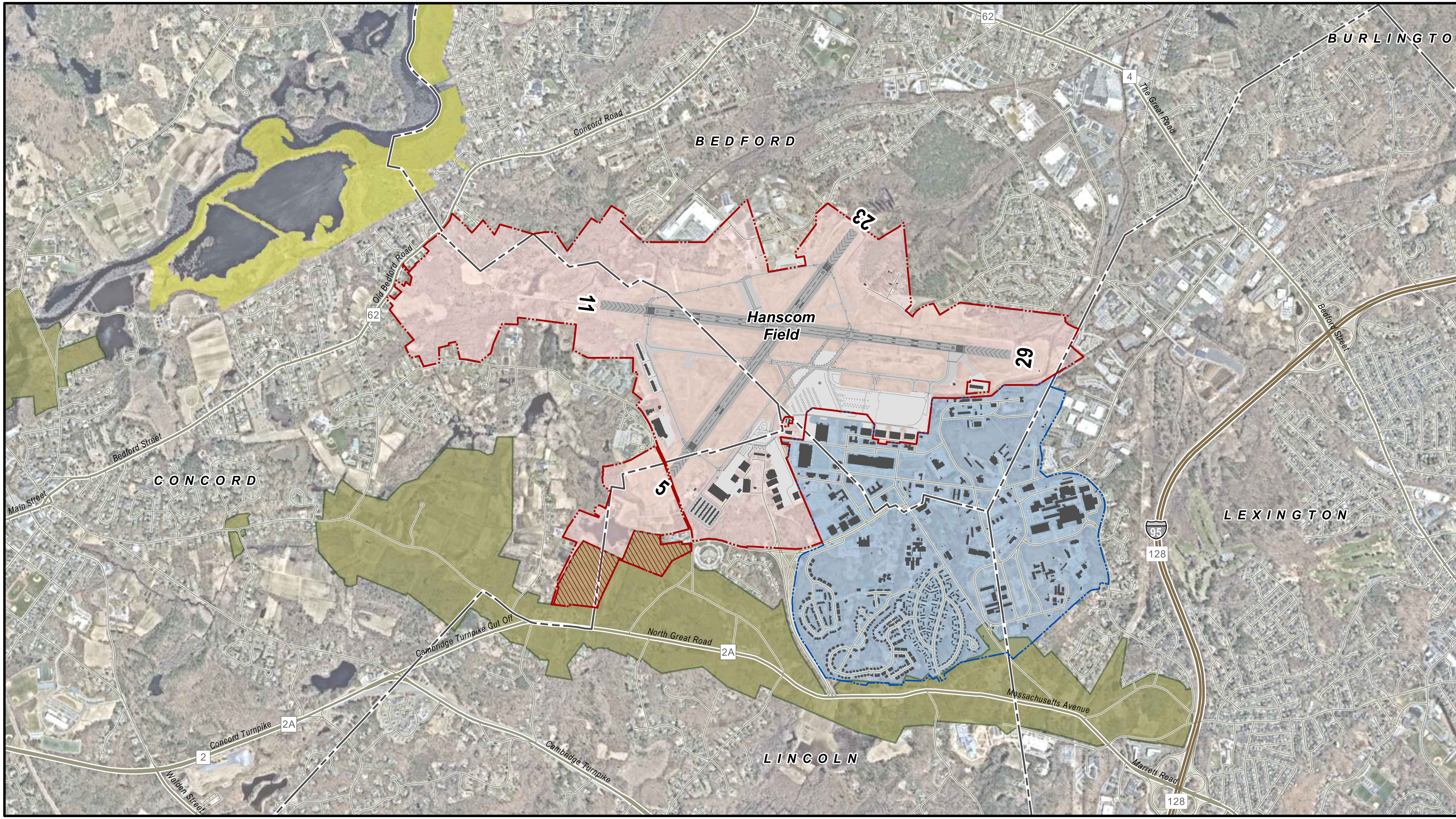

North

0 2,000 4,000 Feet

Hanscom Field Property Boundary
Massport Property within MMNHP Congressional Boundary
Hanscom AFB Property Boundary
Municipal Boundary
MMNHP Boundary
Great Meadows
Interstate
Highway
Road

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Site Location Map

Data Sources: MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018

Figure 1-3

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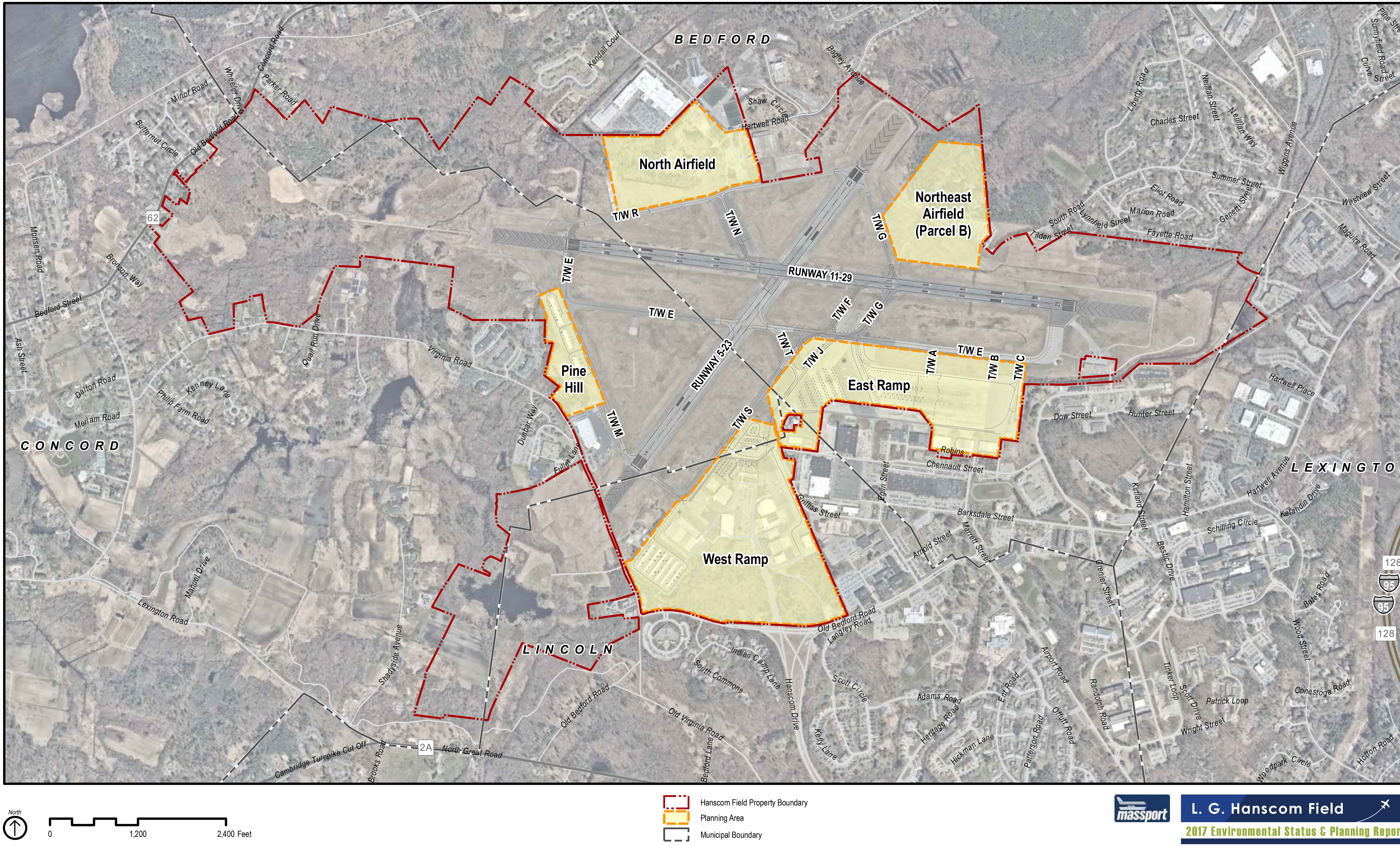

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Planning Areas

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; NearMap USA (Aerial) July 30, 2018

Figure 1-4

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1.5.4 Regional Transportation Context

Massport advocates a multi-modal regional transportation policy to improve the efficient use of the region's transportation infrastructure by appropriate use of regional airports and alternative transportation modes. Massport has formed partnerships with federal, state, and regional agencies to improve inter-city travel options for the New England region by supporting an integrated, multi-modal, regional transportation network.

Within this context, Massport is committed to maintaining Hanscom Field as a vital transportation resource within the regional airport system. Because of its proximity to Boston and Route 128/I-95 area businesses that rely on corporate aviation, Hanscom Field handles more GA activity than any other airport in the region. GA operations at airports in the greater Boston area fell by about 3 percent per year between 2012 and 2017, which is a slightly greater decline than the national trend. GA activity levels at Hanscom Field declined at an average compound annual rate of about 5 percent during the same years.

Hanscom Field will continue to function within the regional airport network primarily as a GA reliever for Logan Airport. Chapter 5 details the roles of all the airports in the region.

Table 1-3 General Aviation Operations at Airports in the Boston Metropolitan Area

Airport	NPIAS Category[1]	2012 General Aviation[2]		2017 General Aviation[2]	
		Operations	Percent	Operations	Percent
Hanscom Field	Nonhub primary	164,834	29.2%	128,018	26.3%
Norwood Memorial	Nonprimary reliever	68,405	12.1%	66,823	13.7%
Nashua/Boire Field	Nonprimary reliever	55,620	9.9%	56,352	11.6%
Beverly Municipal	Nonprimary reliever	58,203	10.3%	53,401	11.0%
Laurence Municipal	Nonprimary reliever	52,157	9.2%	36,822	7.6%
Portsmouth International (Pease)	Nonhub primary	38,132	6.8%	36,717	7.6%
Boston Logan International	Large hub	28,144	5.0%	31,120	6.4%
Worcester Regional	Nonhub primary	44,070	7.8%	25,683	5.3%
T.F. Green	Small hub	26,274	4.7%	24,797	5.1%
Bradley International	Medium hub	15,589	2.8%	13,233	2.7%
Manchester-Boston Regional	Small hub	12,504	2.2%	13,169	2.7%
Total		**563,902**	**100.0%**	**486,135**	**100.0%**

Notes:

1. The National Plan of Integrated Airport Systems (NPIAS) includes all commercial service airports, all reliever airports, and selected public-owned general aviation airports.

2. Operations include itinerant air taxi, general aviation, and local civic operations. Manchester-Boston Regional, T.F. Green, and Bradley International Airport operations exclude air taxi operations as their operations counts are comingled with regional commuter airline operations.

Sources: FAA Traffic Flow Management System Counts (TFMSC), FAA Terminal Area Forecast (TAF); Hanscom Field and Logan International Airport counts are provided by Massport.

1.5.5 Ground Transportation

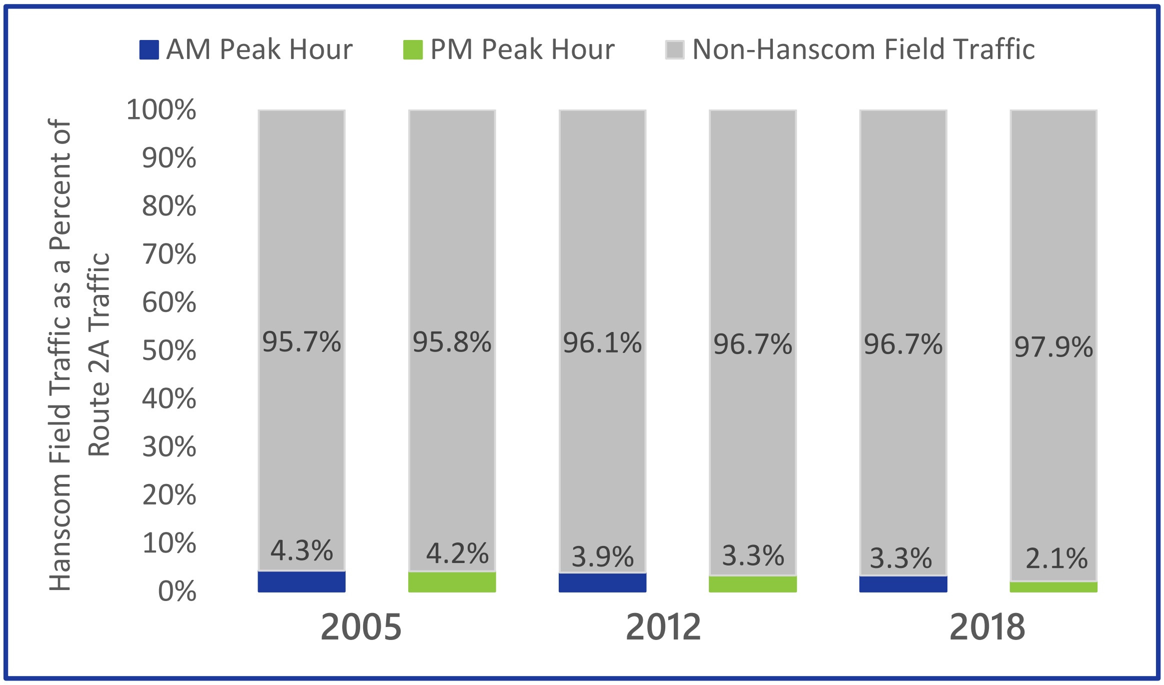
Chapter 6 provides analysis of Hanscom Field's relationship to local ground transportation systems. As reported in the *2012 ESPR,* Hanscom Field is not a significant contributor to traffic volumes on the roadways that surround the airport. Commercial and residential developments, coupled with reliance on single occupancy vehicles, remain the most significant source of traffic volume on area roadways. Hanscom Field traffic comprised only about 2 percent of both morning and afternoon peak hour traffic on Route 2A in 2018[10], a decrease from almost 4 percent of traffic during the morning peak hour and about 3.3 percent during afternoon peak

[10] Data collection for traffic analysis at Hanscom Field occurred in April of 2018, therefore when referencing ground transportation current conditions, the year 2018 is used as opposed to 2017 (the base year for the ESPR and other technical analyses).

hours in 2012 (see Figure 1-5). Hanscom Field traffic has decreased since 2012, while overall Route 2A peak hour traffic volumes have increased.

The projected increased amount of peak hour traffic volumes associated with Hanscom Field activity for the 2025 and 2035 forecast scenarios is tied to the projected increased in aviation activity. It is expected that Hanscom Drive traffic volumes measured as a percentage of total traffic on Route 2A would remain relatively stable throughout the forecast years, reaching 2.4 percent in 2035. Projected increases to peak hour traffic volumes generated by Hanscom Field return to levels similar to 2005, not representing a substantial increase from historical traffic volumes.

Figure 1-5 Percent of Hanscom Field Traffic on Route 2A East of Hanscom Drive



1.5.6 Noise

Overall, there has been a decrease in operations at Hanscom Field over the last several years, and operations remain well below historical peaks. Noise also remains well below historical peaks, with the Day-Night Sound Level (DNL) 65 decibel (dB) contour[11] entirely contained over Hanscom Field property. However, there have been some increases in jet operations and nighttime flights. Forecast increases in GA jet activity contribute to the growth in operations to

[11] FAA land use compatibility guidelines generally consider aircraft noise greater than 65 dB DNL to be incompatible with residential and other noise-sensitive land uses. No residential land uses were exposed to a DNL value above the FAA land use compatibility recommendation of 65 dB in 2017.

approximately 142,000 annual operations in 2035, driving a modest projected increase in overall noise levels in the future. Chapter 7 presents the current and forecast noise analyses.

As described in Section 1.5.2, the year 2017 was an anomaly for noise due to construction impacts. Construction at Boston Logan International Airport in 2017 caused some aircraft to operate out of Hanscom Field that otherwise would have operated out of Logan Airport. In addition, Runway 11/29 was closed for repaving during the month of August 2017, which caused an increase in operations on Runway 5/23 for the duration of that project. As a result, the shape of the 2017 noise contours reflect both increased jet operations and increased operations on Runway 5/23. The size and shape of the 55 dB contours in 2017 shows the effect of the temporary closure of Runway 11/29 with the increase in the contour lobes associated with Runway 5/23 operations, and increases due to flights diverted from Boston Logan due to construction (see Figure 1-6).

Due to the anomalous activity in 2017, Massport considered activity in years 2013 – 2016 as well as 2017 in developing the future year forecasts for noise impacts in 2025 and 2035. The methodology is further explained in Chapter 7.

Massport continues to implement an initiative begun in 2009 to reduce noise over the MMNHP. Using radar data, Massport staff monitors the number of touch-and-go operations over the MMNHP. This data is a critical part of ongoing quarterly meetings between Massport, FAA Air Traffic Control Tower, and flight school staff to review touch-and-go flight paths. Since the initiation of this program, flights over MMNHP have been reduced by 22 percent.

FAA land use compatibility guidelines generally consider aircraft noise greater than 65 dB DNL to be incompatible with residential and other noise-sensitive land uses. DNL 55 dBA is the level for analysis requested by MEPA.

Comparison of year 2017 DNL noise contours to 2012 contours shows that overall noise levels have increased somewhat. No residential land uses were exposed to a DNL value above 65 dB in 2017. With the forecasted level of aircraft operations, noise is anticipated to increase in 2025 over 2017 and then again in 2035. However, noise in 2025 and 2035 is projected to remain lower than what was experienced in 2005. No residents are expected to be within the 65 dB contour, which will remain confined Hanscom Field property. Populations exposed to 55 dB DNL or greater in the forecast scenarios will remain below 2005 actual levels. Figure 1-6 provides a visual comparison of the 2012 and 2017 DNL noise contours.

The analysis of the 2025 and 2035 scenarios suggest that the greatest noise exposures would occur in the 2035 scenario since it has the highest projected activity levels. Even with activity increases over current levels, no noise analysis locations (including historic sites) would experience a DNL value greater than 60 dB under any future scenario. The Deacon John Wheeler/Capt. Jonas Minot Farmhouse in Concord, the Wheeler-Meriam House in Concord, and Simonds Tavern in Lexington are the only three historic sites that would experience noise levels between 55 and 60 dBA in the 2025 and 2035 scenarios.

No portion of the MMNHP is located in the 60 or 65 DNL contours in 2017 or in the forecasted 2025 and 2035 planning scenarios. The 2017 and forecast future 55 DNL contours do extend slightly into MMNHP. Only one of the 31 specified sites in MMNHP, Noah Brooks Tavern, experienced a DNL of 55 dB in 2017 due to higher than typical use of Runway 5/23 during the closure of Runway 11/29 in August 2017 for repaving. None of the 31 sites in the MMNHP are projected to experience a DNL value of 55 dB or greater for either of the future scenarios.

Noise and air emissions were modeled using FAA's Aviation Environmental Design Tool (AEDT), as required by the FAA. AEDT replaced FAA's prior model, the Integrated Noise Model (INM), which was used for previous ESPRs. Because AEDT is designed to model both noise and air emissions simultaneously, AEDT also replaced FAA's Emissions and Dispersion Modeling System (EDMS). Chapter 7 provides a more complete description of AEDT as it relates to noise modeling, and Chapter 8 and Appendix E provide a more complete description of the model changes for the air quality analysis.

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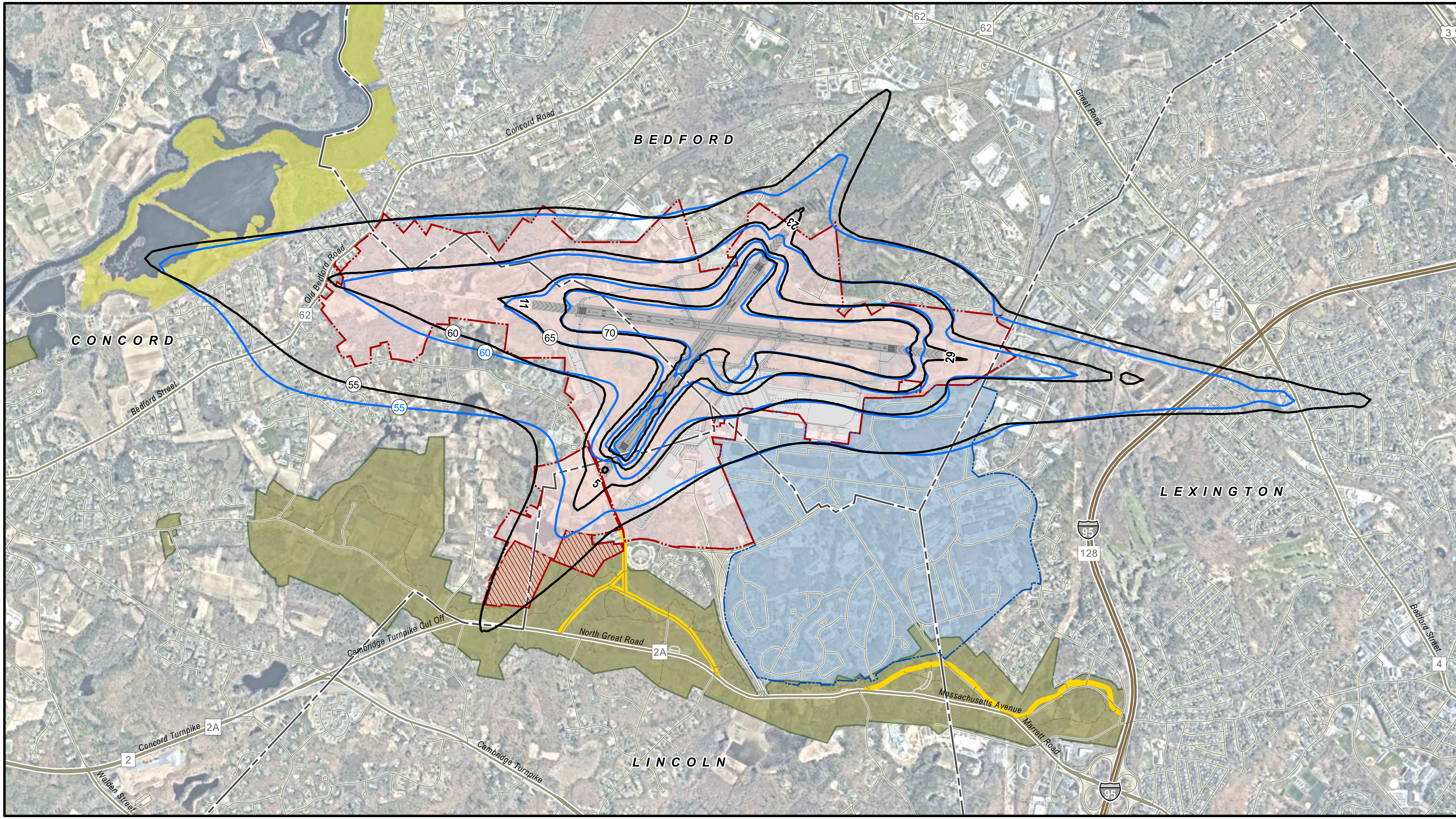

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; NearMap USA (Aerial) July 30, 2018

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2012 and 2017 DNL Noise Contour Comparison

Figure **1-6**

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1.5.7 Air Quality

The *2017 ESPR* provides a current emissions inventory for six criteria pollutants carbon monoxide, lead, nitrogen oxides, ozone, particulate matter and sulfur dioxide) as well as models future air emissions from aircraft operations and vehicular traffic. The six criteria pollutants are regulated by the National Ambient Air Quality Standards (NAAQS), set by the U.S. Environmental Protection Agency (EPA), and Massachusetts Ambient Air Quality Standards (MAAQS) set by MassDEP, to protect human health and welfare. Emissions of criteria pollutants from aircraft operations and motor vehicles accessing Hanscom Field represent a very small fraction of regional emissions.

Aircraft emissions data for all pollutants decreased between 2012 and 2017, except for carbon monoxide (CO) and nitrogen dioxide (NO_2) which increased (Table 1-4). These increases are primarily attributed to a change in modeling methodology (the use of FAA's Aviation Environmental Design Tool [AEDT] in place of FAA's older model, the Emissions and Dispersion Modeling System [EDMS]). Chapter 8 provides a detailed description of the air quality analyses and Appendix E provides additional information on the differences between AEDT and EDMS.

Future emissions from aircraft operations are expected to increase for NO_2, carbon dioxide (CO_2), volatile organic compounds (which do not have their own ambient air quality standards but are measured and modeled because they are precursors to ground level ozone), and particulate matter, based on the increase in forecasted activity levels presented in Chapter 3. Emissions levels of CO are anticipated to decrease based on estimated changes in the fleet mix over time (more jet aircraft and fewer single engine piston aircraft, as jet engines emit less CO than piston engines).

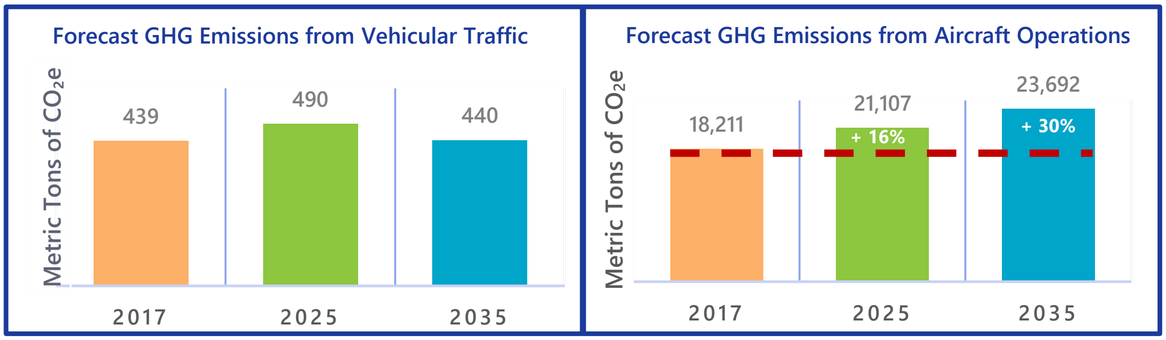
Forecasted emissions from vehicular traffic in 2025 and 2035 associated with Hanscom Field are modeled to decrease for CO, nitrogen oxides and volatile organic compounds (VOCs). They are modeled to decrease slightly for particulate matter in 2025 before increasing again to 2017 levels in 2035. These changes are anticipated to occur because of improvements in the average vehicle fleet fuel economy over time (assumed to be more efficient in future years).

The forecasted emission levels from aircraft operations and motor vehicles for the future scenarios are not anticipated to result in adverse air quality effects. For all scenarios, air quality concentrations in Bedford, Concord, Lexington, Lincoln, MMNHP and GMNWR remain in compliance with the NAAQS and MAAQS.

The *2017 ESPR* Scope Certificate requires the development of the first airport-wide Greenhouse Gas (GHG) emissions inventory for Hanscom Field, to be used as a baseline to measure and compare future GHG emissions reductions. As this is the first airport-wide GHG emissions inventory, there are no prior year comparisons. Overall, GHG emissions that are owned and controlled by Massport (such as vehicles owned by Massport and energy use in Massport buildings) are minor (approximately 5 percent over total GHG emissions) compared to sources of GHGs that are owned and controlled by tenants. GHG emissions from aircraft are expected to grow moderately in 2025 and 2035 (an increase of 16 percent and 30 percent over 2017 levels, respectively, as shown in Figure 1-7) consistent with the forecasted increase in activity levels described in Chapter 3. Because AEDT does not include assumptions about efficiency improvements in future aircraft models, these estimates are conservative.

GHG emissions from vehicular traffic are expected to grow in the 2025 scenario due to growth in operations, then decrease back down to current levels in 2035, due to anticipated efficiency gains in vehicle technology.

Figure 1-7 Forecast Greenhouse Gas Emissions from Vehicular and Aircraft Operations, in Carbon Dioxide Equivalent at Hanscom Field



Source: HMMH 2018.

Table 1-4 Total Air Emissions at Hanscom Field (1,000s of kg/yr)

Year	Source	CO	NO_x	VOC	PM_{10}	$PM_{2.5}$	CO_2 [1]
1995	Aircraft	409.2	14.9	27.9	2.3	2.3	6,728
	Ground Vehicles	30.3	3.9	2.9	0.6	0.6	-
	Total	**439.5**	**18.8**	**30.8**	**2.9**	**2.9**	-
2000	Aircraft	591.2	25.4	39.4	2.3	2.3	10,108
	Ground Vehicles	60.8	6.9	3.0	0.2	0.2	1,496
	Total	**652.0**	**32.3**	**42.4**	**2.5**	**2.5**	**11,604**
2005 (EDMS 5.1.4.1)[2]	Aircraft	1,670.0	34.1	112.7	13.5	13.5	19,233
	Ground Vehicles	36.1	4.1	1.6	0.1	0.1	1,312
	Total	**1,706.1**	**38.2**	**114.3**	**13.6**	**13.6**	**20,545**
2012[3]	Aircraft	1,123.0	31.9	80.4	9.9	9.9	16,356
	Ground Vehicles	19.1	2.18	0.9	0.1	0.1	1,555
	Total	**1,142.1**	**34.1**	**81.3**	**10.0**	**10.0**	**17,911**
2017 (AEDT)	Aircraft	1,557.0	34.8	51.4	1.9	1.9	17,735
	Ground Vehicles	2.9	0.4	0.1	0.0	0.0	407
	Total	**1,559.9**	**35.2**	**51.5**	**1.9**	**1.9**	**18,141**

Notes:
1. Data to calculate the ground vehicle CO2 emissions for 1985 and 1995 were not were available; therefore, total CO_2 emissions for these years are not available for comparison with later years.
2. The *2005 ESPR* used EDMS version 4.3 however the emissions were recalculated using EDMS version 5.1.4.1 when it was released for consistency with the *2012 ESPR*.
3. The *2012 ESPR* used EDMS 5.1.4.1.
4. Emissions of all pollutants except CO_2 are calculated to the first decimal place.

1.5.8 Wetlands, Wildlife and Water Resources

Wetlands, wildlife, and water resource areas at Hanscom Field are fundamentally unchanged from the *2012 ESPR*. With only minor exceptions, the surrounding habitat areas are well established with little variation from year-to-year.

Updates to wetland mapping at Hanscom Field tend to occur on a project-by-project basis. There have been a series of airport facility and infrastructure improvements, initiatives, and/or studies undertaken at Hanscom Field since the *2012 ESPR*. During the planning process for each of these improvements, project-specific wetland delineations, if needed, were undertaken. Section 9.2.2 of this document provides a complete listing of wetland resource areas at Hanscom Field and identifies projects which included wetland delineations over the past 20 years. Most new development is located outside of wetlands and buffer zones. Activities proposed in areas subject to review under the Massachusetts Wetlands Protection Act (MAWPA) are subject to review by the municipal conservation commission and Massport will make the necessary filings.

The Massachusetts Natural Heritage and Endangered Species Program (NHESP) revised the statewide inventory mapping in 2016. As a result, some areas in the North Airfield area that were formerly designated as critical rare species habitat were no longer designated as such, since those areas did not contain the requisite special habitat requirements of the rare bird species known to inhabit other areas of the airfield. NHESP has indicated that four species listed under the Massachusetts Endangered Species Act (MESA) have been found on Hanscom Field: two of these are bird species which were identified in the *2000 ESPR*, and two are turtle species not previously listed. Work within mapped Estimated Habitat of Rare Species or certified vernal pools would need to be reviewed by the NHESP. Additionally, since the last ESPR document was published, the northern long-eared bat (*Myotis septentrionalis*) was listed as threatened under the Federal Endangered Species Act. As its range overlaps the Hanscom Field property, impact to this species would be considered in future activities on the property that result in tree disturbance.

Massport updated and revised the Hanscom Field SWPPP in October 2015 in compliance with the Stormwater Multi-Sector General Permit that was reissued under the NPDES in June 2015.

Massport continues to comply with its Spill Prevention Control and Countermeasure (SPCC) Plan. The "State of Hanscom" reports indicate that there have been 16 fuel spills at Hanscom Field since 2012, only four of which involved a reportable quantity necessitating reporting to MassDEP. Appropriate measures were taken to protect the environment regardless of the Responsible Party or spilled quantity.

1.5.9 Cultural and Historical Resources

The Massachusetts Historical Commission (MHC) maintains the State Register of Historic Places, MHC Inventory, and the Massachusetts Cultural Resource Information System (MACRIS). These resources provided baseline information for Bedford, Concord, Lexington, and Lincoln, which was supplemented through research of the MHC Inventory and the MACRIS files, discussions with the historic commissions for each of the four towns and research of their files, and discussions with the National Park Service (NPS). The inventory of existing cultural and historical resources included the identification of historic buildings and landscapes in MMNHP.

The *2017 ESPR* updates the *2012 ESPR* comprehensive reconnaissance survey (that was initially completed for the *2005 ESPR)* of historic and archaeological resources that are listed in or eligible for the National and State Registers, in the state inventory and the Massachusetts Cultural Resource Information System (MACRIS), or are 50 years or older.

This study showed that currently there are a total of 65 historic properties, 41 individual properties and 24 districts, with the MMNHP counted as one district included in, or determined eligible for the National and State Registers. These properties include 13 National Historic Landmarks (NHL), with the MMNHP counting as one NHL. The 2017 survey update includes a few additional resources within the four Hanscom towns (properties that are now more than fifty years old). There have been no changes to the historic resources within the boundaries of MMNHP. The NPS has identified approximately 106 historic resources that contribute to the historical significance of MMNHP.

Chapter 10 describes the potential environmental effects of traffic, air quality, and noise on cultural and historical resources. The findings documented in Chapters 6 and 8 show that the environmental effects of traffic and air quality on cultural and historic resources have decreased between 2012 and 2017, both of which decreased from 2005. There are no expected adverse effects attributable to air quality in 2017 or under the 2025 and 2035 scenarios for any cultural and historic resources. The noise analysis conservatively incorporates the largest area potentially affected based on the maximum forecasted noise values; this is the area within the 2035 planning year 55 DNL noise contour line.

Table 1-5 lists noise exposure for State Register properties, the MMNHP, Great Meadows National Wildlife Refuge (GMNWR), and key conservation and recreational facilities, comparing 2012 and 2017 to the 2025 and 2035 forecast year scenarios. Figure 1-8 illustrates the location of historic resources relative to noise contours for each of those years. No historic buildings, historic districts, or cultural resources have exposure above 65 dB DNL in 2017 or in either of the forecast scenarios.

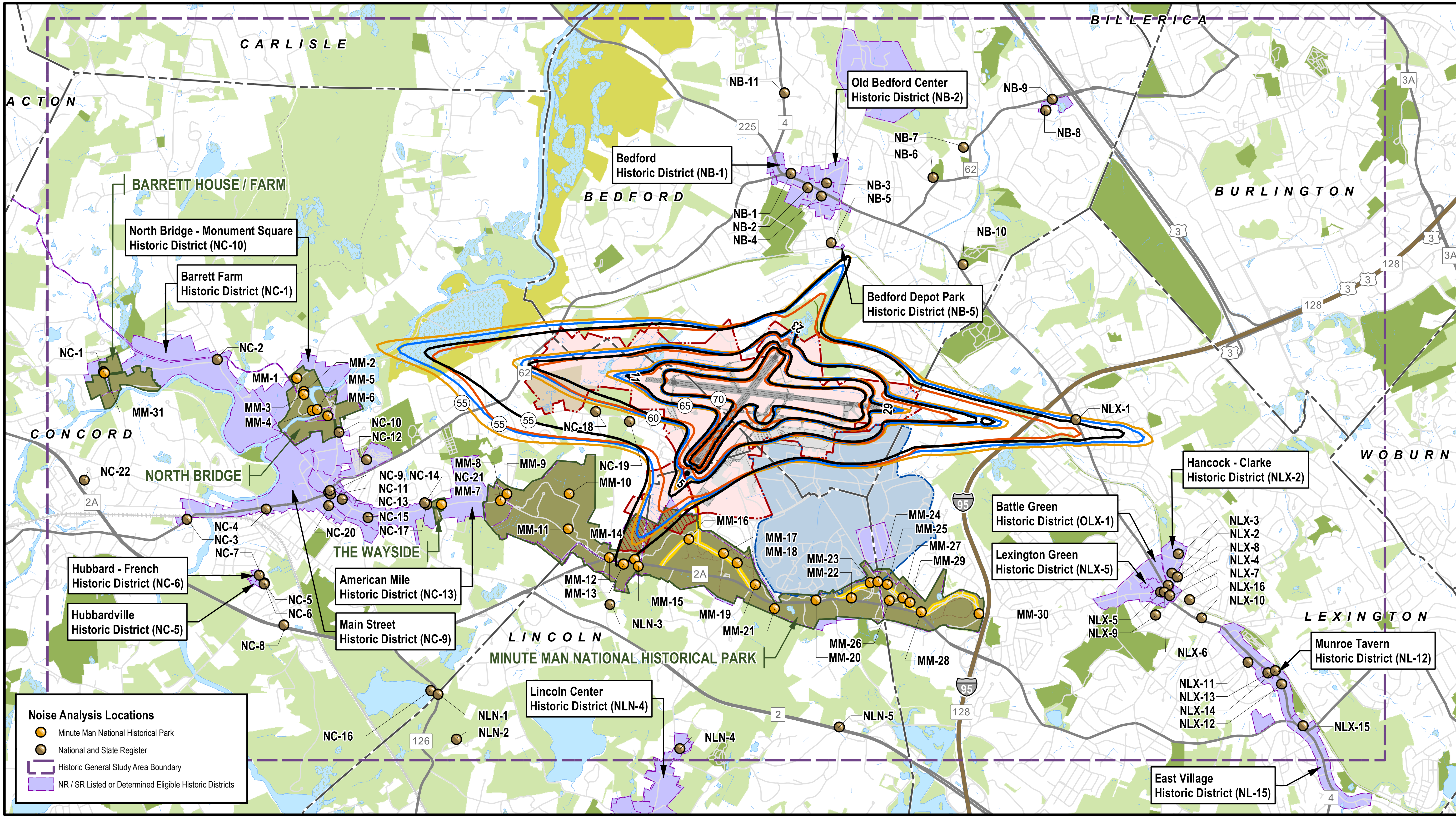
The analysis completed for the *2017 ESPR* found little change in the status of archaeological information since the reconnaissance survey conducted for the *2005 ESPR* and the *2012 ESPR* update. Massport encourages new development in areas with existing impervious or disturbed surfaces that take advantage of existing infrastructure. The update for the *2017 ESPR* determined that no new archaeological sites have been identified within study area.

Table 1-5 Summary of Noise Effects on Cultural and Historic Resources

Resource[1]	Total Quantity[2]	Properties/Geographic Areas within 65 DNL Contour[3]			
		2012	2017	2025	2035
National and State Registers Individual Properties[4]	41 properties	0 properties	0 properties	0 properties	0 properties
National and State Register Historic Districts[5]	1646.2 acres	0 acres	0 acres	0 acres	0 acres
Minute Man National Historical Park	975.4 acres	0 acres	0 acres	0 acres	0 acres
Battle Road Interpretive Trail	4 miles	0 miles	0 miles	0 miles	0 miles
Resource[1]	**Total Quantity[2]**	**Properties/Geographic Areas within 55 DNL Contour**			
		2012	**2017**	**2025**	**2035**
National and State Register Individual Properties[4]	41 properties	3 properties	3 properties	3 properties	3 properties
National and State Register Historic District[5]	1646.2 acres	0 acres	0 acres	0 acres	0 acres
Minute Man National Historical Park	975.4 acres	0 acres	55 acres	30 acres	43 acres
Battle Road Interpretive Trail	4 miles	0 miles	0 miles	0 miles	0 miles

Notes:

1. See Tables 10-2 through 10-5 for more detail on National and State Registers individual properties and historic districts.
2. All surveyed historic properties; total acreage of surveyed historic districts and Minute Man National Historical Park.
3. This is the exposure level that the FAA identifies as a guideline for determining potential land use incompatibilities.
4. In General Study Area. Does not include Minute Man National Historical Park sites. In this table, the noise effects are quantified through the estimation of park acreage within a given contour.
5. In General Study Area. Includes Bedford Depot Park Historic Dist., Bedford Historic Dist., and Old Bedford Center Historic Dist. in Bedford; American Mile Historic Dist., Barrett Farm Historic Dist., Concord Monument Square-Lexington Road Historic Dist., Hubbard-French Historic Dist., Hubbardville Historic Dist., Main Street Historic Dist., and North Bridge-Monument Square Historic Dist. in Concord; Battle Green Historic Dist., East Village Historic Dist., Hancock-Clarke Historic Dist., Lexington Green Historic Dist. and Munroe Tavern Historic Dist. in Lexington; and, Lincoln Historic Dist. in Lincoln. Areas of overlap in districts are counted once.



North

0 3,500 7,000 Feet

2012 DNL Noise Contour
2017 DNL Noise Contour
2025 DNL Noise Contour
2035 DNL Noise Contour
Hanscom Field Property Boundary
Massport Property within MMNHP Congressional Boundary
Hanscom AFB Property Boundary
Municipal Boundary
Historic Road
Interstate
Highway
Road
Trail
Open Water
Wetland/Marsh
Stream
MMNHP Boundary
Great Meadows
Open Space Non-protected
Open Space Protected in Perpetuity

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

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Historic Resources within the 2012, 2017, 2025 and 2035 DNL Noise Contours

Figure 1-8

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1.5.10 Sustainable Development / Environmental Management

Massport is a leader among Massachusetts agencies in the promotion and implementation of sustainable design and operations. In 2015, Massport developed a Sustainability Management Plan (SMP) for Logan Airport and the following year, Massport published its first Boston Logan International Airport Annual Sustainability Report to document the progress and challenges of its sustainability initiatives included in the SMP. In 2018, Massport expanded the scope of the Sustainability and Resiliency Report to include all of its facilities, including Hanscom Field. [12] Chapter 11 details the current environmental sustainability initiatives at Hanscom Field.

Massport continues to build on its efforts and commitments to sustainable development. Massport requires that all new development, including development at Hanscom and by its tenants, meet the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) Silver certification requirements. [13] LEED certification is achieved through the incorporation of sustainability commitments in building design and operation, including energy efficiency, water efficiency, use of environmentally friendly building materials and products, reuse and recycling, and renewable energy.

1.5.11 Environmentally Beneficial Measures

Environmentally beneficial measures are those actions identified in each of the technical chapters of the ESPR that could be implemented to minimize potential effects of existing activities at Hanscom. Massport recognizes the importance of operating and developing Hanscom Field in a manner that maximizes its contribution to the regional transportation system while minimizing potential impacts on local communities and stakeholders.

The aviation activity forecasts that are described in Chapter 3 provide for a realistic and practical level of growth based on local and national aviation trends, including forecasts from the New England Regional Aviation System Plan. The 2025 and 2035 scenarios represent estimates of what could occur in the future, using certain planning assumptions, and are highly dependent on demand. In accordance with the EEA Scope Certification for the *2017 ESPR*, Table 11-2 presents the environmentally beneficial measures in place at Hanscom, along with the responsible parties, implementation schedule, and the estimated cost (where applicable and data is available) for each measure. Additional details are described in section 11.6.

[12] Massport. 2018. *Sustainable Massport, Annual Sustainability & Resiliency Report.* http://www.massport.com/media/2774/massport-annual-sustainability-and-resiliency-report-2018_lr.pdf

[13] The U.S. Green Building Council LEED Green Building Rating System is a global framework to guide the development of sustainable, energy-efficient buildings.

1.6 MEPA Documentation

Appendix A of the *2017 ESPR* contains the Proposed Scope submitted to the MA Executive Office of Energy and Environmental Affairs, the MEPA certificate, the response to all comments and copies of all comments received on the Proposed Scope.

The *2017 ESPR* is posted on Massport's web site and is publicly available.[14] Hard copies of the report are available upon request. All four town libraries, town planning departments, conservation commissions, MMNHP, and individuals who submitted comments on the *2012 ESPR* or the *2017 ESPR* scope received printed copies of the *2017 ESPR*. Other entities listed in the Distribution List in Appendix A were provided with a notice of availability letter, which shares the link to the electronic version of the document on Massport's website.

In addition to the ESPR process, Massport publishes two annual reports for public review: the "State of Hanscom" and the "Annual Noise Report." Both documents are distributed to the Hanscom Field Advisory Commission (HFAC) and are available on Massport's website. The "State of Hanscom" describes Massport's financial performance, economic benefits and accomplishments, as well as its plans for the near future. The report also includes information on aircraft activity from the past year. Massport will continue to use this process to distribute information about Hanscom Field. The first noise report for Hanscom Field was prepared in 1982, and it compared data for 1978 and 1981. Annual updates were started in 1984 (based on the previous year's data), making 2017 the 36th Hanscom noise report.

All projects that meet the threshold for NEPA or MEPA review undergo project-specific environmental analysis. These documents are also available on Massport's Project Environmental Filings website, organized by airport.[15]

[14] Massport Project Environmental Filings website for Hanscom Field can be accessed at: http://www.massport.com/massport/about-massport/project-environmental-filings/hanscom-field/
[15] Massport Project Environmental Filings website for all Massport facilities can be accessed at: http://www.massport.com/massport/about-massport/project-environmental-filings/

1.7 Organization of the *2017 ESPR*

The *2017 ESPR* contains planning information, technical analyses, and supportive data, including the Secretary's November 16, 2017 Scope Certificate, comment letters on the Draft Scope for the *2017 ESPR*, responses to the Certificate and the comment letters, a list of reviewers and technical appendices. The Executive Summary provides a brief overview of the content and key findings of each chapter. The technical appendices provide additional analytical data and methodological documentation for the various environmental analyses conducted for this *2017 ESPR*.

Chapter 1: Executive Summary

- ⇨ **Provides background of Hanscom Field**
- ⇨ **Discusses the environmental and regulatory context**
- ⇨ **Identifies the analytical framework for the ESPR**
- ⇨ **Presents an overview of the outreach program and public engagement process**
- ⇨ **Summarizes the primary changes since 2012**
- ⇨ **Provides the organization for the report**

Chapter 2: Airport Facilities and Infrastructure

- ⇨ **Describes the airfield and its supporting infrastructure, including parking and utility systems serving the airport**
- ⇨ **Provides an assessment of facilities in inventory**
- ⇨ **Provides information about the tank management program and hazardous material spill prevention efforts at Hanscom Field**

Chapter 3: Airport Activity Levels

- ⇨ **Presents an overview of national General Aviation trends**
- ⇨ **Quantifies the aircraft operations at Hanscom Field in 2017 in comparison to previous years, and in the context of operations at other regional airports**
- ⇨ **Compares the 2017 data to prior forecasts from the *2012 ESPR***
- ⇨ **Presents 2025 and 2035 aircraft operation and air passenger forecasts for the future planning scenarios**
- ⇨ **Discusses nighttime aircraft operations**

Chapter 4: Airport Planning

- ⇨ **Describes the status of planning initiatives and projects for the five planning areas (North Airfield, Northeast Airfield, East Ramp, West Ramp, Pine Hill)**
- ⇨ **Evaluates the potential effects of the 2025 and 2035 scenarios on the airport infrastructure**
- ⇨ **Presents the relationship between the *2017 ESPR* and FAA regulations and guidance related to airport planning**
- ⇨ **Describes projects in the five-year capital improvement program and identifies which projects may require individual MEPA or NEPA review**

- ⇨ Updates any new planning and development initiatives at the MMNHP, Hanscom AFB, and the four contiguous towns

Chapter 5: Regional Transportation Context

- ⇨ Provides a summary of the regional transportation system
- ⇨ Describes the role of Hanscom Field in the region's transportation system
- ⇨ Describes aircraft activities and planned improvement projects at other regional airports
- ⇨ Discusses rail and ground access improvements in the region

Chapter 6: Ground Transportation

- ⇨ Reports on current conditions and potential conditions in the 2025 and 2035 analysis years for traffic, roadway and access, including intersection operations and Average Daily Traffic volumes
- ⇨ Provides mode share data including tenant survey results
- ⇨ Describes the review process with local towns; presents information on Transportation Demand Management
- ⇨ Reviews, summarizes and analyzes existing metropolitan planning documents
- ⇨ Discusses the status of existing and future parking needs at Hanscom Field

Chapter 7: Noise

- ⇨ Updates the status of the noise environment around Hanscom Field for 2017 conditions and for the 2025 and 2035 analysis years, including the following:
  - Total Noise Exposure (EXP) calculations
  - DNL, Time-Above (TA) and Single Event contours
  - Single Event Level (SEL) Distribution metrics
  - Ranked tabulation of take-off noise levels
- ⇨ Reports past trends and the projections for the forecast activity levels and years and adjustments for such changes in the Integrated Noise Model (INM)
- ⇨ Addresses engine run-ups and the operation of Auxiliary Power Units and Ground Power Units
- ⇨ Addresses measures to reduce noise impacts from airport operations

Chapter 8: Air Quality

- Reports on 2017 conditions and conditions in the 2025 and 2035 analysis years including the following:
  - Carbon monoxide
  - Oxides of nitrogen
  - Volatile organic compounds
  - Particulate matter
  - Monitoring results for ozone precursors and nitrogen dioxide
  - Summary of national lead emission standards
- Presents a review of environmentally beneficial measures including the following:
  - Ground service and landside conversion to alternative fuels
  - Building heating and cooling
  - Aviation support emissions reductions
  - Clean fuel vehicle program at Hanscom Field

Chapter 9: Wetlands, Wildlife and Water Resources

- Describes the natural environment at Hanscom Field including the following:
  - Wetlands delineations
  - Vernal pools
  - Wildlife habitats
- Reports on the surface stormwater management system
- Provides an update on the Vegetation Management Plan (VMP)
- Presents information about Massport's National Pollution Discharge Elimination System (NPDES) permit
- Provides figures that illustrate the current wetlands resources at Hanscom Field and the location of local water supplies
- Identifies current and proposed use of de-icing chemicals

Chapter 10: Cultural and Historical Resources

- Reviews the existing data on historical and archeological resources located at and near Hanscom Field
- Presents information about the MMNHP and historical properties in the park
- Evaluates the potential effects of traffic, air quality and noise on historical and cultural sites in the current and future planning scenarios

Chapter 11: Sustainability and Environmental Management

- Discusses reduction in the use of toxic materials at Hanscom Field
- Reports on Massport's sustainable design program at Hanscom Field
- Provides information on the sustainable design approaches for new and existing facilities
- Provides information on the EMS Program
- Summarizes environmentally beneficial measures that are identified in previous chapters
- Identifies, in general terms, parties responsible, costs and schedule for implementation

References and Appendices:

- Glossary of Terms: Defines key terms, abbreviations and acronyms used in the *2017 ESPR*
- List of Reviewers
- Appendix A: Executive Office of Energy and Environmental Affairs Secretary’s Certificate on the *2017 ESPR* Scope and a Response to Comments section
- Appendix B: Airport Layout Plan
- Appendix C through Appendix G: Technical appendices that provide detailed analytical data and methodological documentation for the various environmental analyses conducted for the *2017 ESPR*.

2 Facilities & Infrastructure

Hanscom Field is a Federal Aviation Administration (FAA) certified airport (per 14 CFR Part 139). It is one of three airports owned and operated by the Massachusetts Port Authority (Massport). (The other two are Boston Logan International Airport and Worcester Regional Airport.) Located about 20 miles northwest of Boston, Hanscom Field plays an important role as a corporate and General Aviation (GA) reliever to Boston Logan International Airport. Massport operates Hanscom Field as a Class 1 airport facility which serves all types of scheduled operations of air carrier aircraft (designed for more than 30 passenger seats), whose major users are a mix of corporate aviation, private pilot operations, flight schools, commuter /commercial air services, as well as some charter and light cargo operations.

This chapter provides updated information about Hanscom's aviation facilities and infrastructure since the publication of the previous Environmental Status & Planning Report (ESPR) in 2012. The description of existing airside and landside facilities includes runways, taxiways, taxilanes, aprons, hangars, general aviation facilities, roadways, parking, and utility systems. The chapter also discusses the status of programs designed to prevent, reduce, and mitigate the occurrence of environmental impacts related to the use and storage and handling of fuel.

2.1 Key Findings Since 2012

Efforts undertaken toward improving and updating airport facilities and infrastructure at Hanscom Field since the *2012 ESPR* are represented in Table 2-1.

Table 2-1 Key Projects Since 2012

Year	Project(s)
2012	⇨ Portions of the perimeter road at the approach of Runway 11 were relocated to comply with the FAA runway safety area standards.
2013	⇨ Massport rehabilitated the pavement surrounding the old T-hangars (hangars for small general aviation aircraft). ⇨ Massport relocated portions of the perimeter road at the approach of Runway 29.
2014	⇨ Rectrix Aviation (referred to as Rectrix throughout the chapter) completed construction of a new Fixed Base Operator (FBO) and Hangar. This project resulted in additional parking at that location. ⇨ Massport rehabilitated the Pine Hill Apron. ⇨ Massport replaced the electrical feeds for Hangar 3.
2015	⇨ Massport installed a wildlife exclusion fence near the headwaters of the Shawsheen River to prevent wildlife from entering the airfield. ⇨ Massport installed new signage and landscaping at the entrance to Hanscom Drive abutting Route 2A. ⇨ Massport rehabilitated the Runway 5 safety area beyond the runway end including a portion of Taxiway Golf and installed a new run-up area along Taxiway Golf. ⇨ Massport Fire-Rescue began operations.
2016	⇨ Runway 23 safety area and a portion of Taxiway Juliet were rehabilitated. The West ramp aircraft tie-down areas were adjusted to protect Taxiway Juliet and Sierra safety areas. ⇨ Massport rehabilitated the pavement on Hanscom Drive. ⇨ A vehicle bay for the Airport Rescue and Fire Fighting (ARFF) vehicle was constructed as an addition to the Field Maintenance Garage in 2016.
2017	⇨ Jet Aviation completed FBO facilities, ramp, and Hangar 17 replacement construction. This project reduced the number of parking spaces available at the Civil Air Terminal. ⇨ The first floor of the Civil Air Terminal flooded and rehabilitated. Engineering studies have been completed to improve drainage. ⇨ In August, Runway 11/29 was re-paved, repainted, and excess shoulder pavement was removed. The runway was last paved in 1994.

Year	Project(s)
2017 (continued)	⇨ Boston MedFlight began construction activities to re-develop Hangar 12A. Completion of the new Leadership in Energy and Environmental Design (LEED) facility occurred in late 2018. ⇨ T-hangar rows A-C reached the end of their useful lives and will be replaced.

Source: Massport, 2018.

2.2 Airport Facilities Inventory and Assessment

Hanscom Field has two intersecting grooved asphalt-paved runways and additional supporting infrastructure. Runway 11/29 is oriented in an east/west configuration and Runway 5/23 is oriented in a northeast/southwest configuration. Supporting infrastructure includes taxiways, an FAA-owned and operated Air Traffic Control tower (ATCT) and navigational aids (NAVAIDs), aircraft aprons, hangars, passenger terminal buildings, U.S. Customs and Border Protection (CBP), and other aviation support facilities. These facilities are described in more detail below.

2.2.1 Runways

Runway 11/29 is the primary runway and is 150 feet wide and 7,011 feet long. Both runways are equipped with an Instrument Landing System (ILS) including Distance Measuring Equipment (DME), Medium Intensity Approach Lighting System and Runway Alignment Indicator Lights (MALSR) and High Intensity Runway Lighting System (HIRL). Both runway ends have paved runway safety areas that are 200 feet wide and 1,000 feet long and are equipped with a four-light Precision Approach Path Indicator (PAPI).

Runway 5/23 is the secondary, crosswind runway. The runway is 150 feet wide, and 5,107 feet long. This runway is a non-precision instrument runway. The runway is equipped with a Medium Intensity Runway Lighting (MIRL) system and runway end identifier lights.

Beyond both runway ends are graded Runway Safety Areas (RSAs). At the approach end of Runway 23, the paved RSA is 200 feet wide and 200 feet long. At the approach end of Runway 5, the paved RSA is 200 feet wide and 645 feet long at the centerline. Both runway ends are equipped with a Visual Approach Slope Indicator (VASI).

2.2.2 Taxiways

A system of taxiways provides access between the two runways and aircraft parking aprons. Taxiway widths at Hanscom Field range from 50 to 75 feet.

All four runway ends are connected by taxiways that allow aircraft to utilize the full runway length without the need to backtaxi. Taxiways F and G provide mid- point access to the runway. Taxiway G crosses Runway 11/29 and provides direct access to Runway 23. There is a paved run-up area on the northeast most portion of Taxiway G. Taxiway R connects the ends of Runway 11 and 23 with the north side of the airfield. Taxiway N provides mid-point access to Runway 11/29. Taxiway M connects Runway 5 and 11 to the Pine Hill T-hangars and FBO. Finally, Taxiway S is a partial parallel to Runway 5/23.

In addition to the taxiways that provide direct access to the runways, Hanscom Field has a series of taxiways that provides connectivity between these taxiways and the aircraft parking aprons. Taxiways A, B, and C provide connection to the East Ramp that is north of the U.S. Air Force (USAF) hangars, and the CBP building. Taxiway T connects Taxiway E, Taxiway J, and Taxiway S, while Taxiway J also provides access from Taxiway E to the West Ramp.

2.2.3 Air Traffic Control Facilities and Navigational Aids

The ATCT is located on the south side of the airfield east of Taxiway J. The FAA owns the ATCT, operating it daily between 7:00 AM and 11:00 PM. The tower staff directs the operations of aircraft within a five- mile radius of the airport. Air traffic controllers are responsible for controlling Hanscom Field's airspace. Close coordination is maintained between the ATCT and the FAA’s Consolidated TRACON.

FAA-owned and maintained, electronic NAVAIDs serving Hanscom Field are located on and near the airport and are used to support instrument approach procedures. Runways 11 and 29 are both equipped with a Category I ILS. The ILS provides pilots with electronic guidance for aircraft alignment (horizontal), descent gradient (vertical), and aircraft position until visual contact is made with the runway. Runway 11 is also supported with a runway visual range (RVR) system consisting of a projector and receiver. The RVR provides a measurement of horizontal visibility. A Very-High-Frequency Omni-Directional Range (VOR) station, located near Laurence Massachusetts, provides a non-precision instrument approach to Runways 5 and 23 at Hanscom Field.[16]

The FAA manages Hanscom’s airspace and provides air traffic control at Hanscom Field.[17] FAA rules and regulations govern the movement of air traffic. The FAA’s Consolidated Terminal Radar Approach Control (TRACON), located at Merrimack, New Hampshire, has authority and responsibility for Instrument Flight Rule (IFR) arrivals, departures, and low-altitude (above 2,500 feet) over-flights in the controlled airspace surrounding Hanscom Field. By means of remote communication between air/ground facilities, direct communication is maintained between TRACON controllers and individual pilots. The communication system is further augmented by radar coverage that enables TRACON controllers to monitor the location and movement of each aircraft.

[16] Airport IQ 5010: Airport Master Records and Reports. http://www.gcr1.com/5010web/airport.cfm?Site=BED

[17] Massport. *Hanscom Field Flight Operations, FAA and Massport Responsibilities*. http://www.massport.com/hanscom-field/about-hanscom/airport-activity-monitor/flight-operations/.

2.2.4 Buildings and Hangars

Most existing facilities at Hanscom Field are considered to be in good condition. Some of the older buildings lack amenities. Table 2-2 provides a summary of existing building size and condition (i.e., excellent, good, fair, or poor). Figure 2-1 serves as a reference guide to the facilities listed in Table 2-2 and illustrates the location of leased and Massport owned properties. One parcel of land in the North Airfield Area, consisting of area above and below Hartwell Road, was returned to Massport control in 2011. The available vehicle parking for these facilities is presented in this chapter in Table 2-3.

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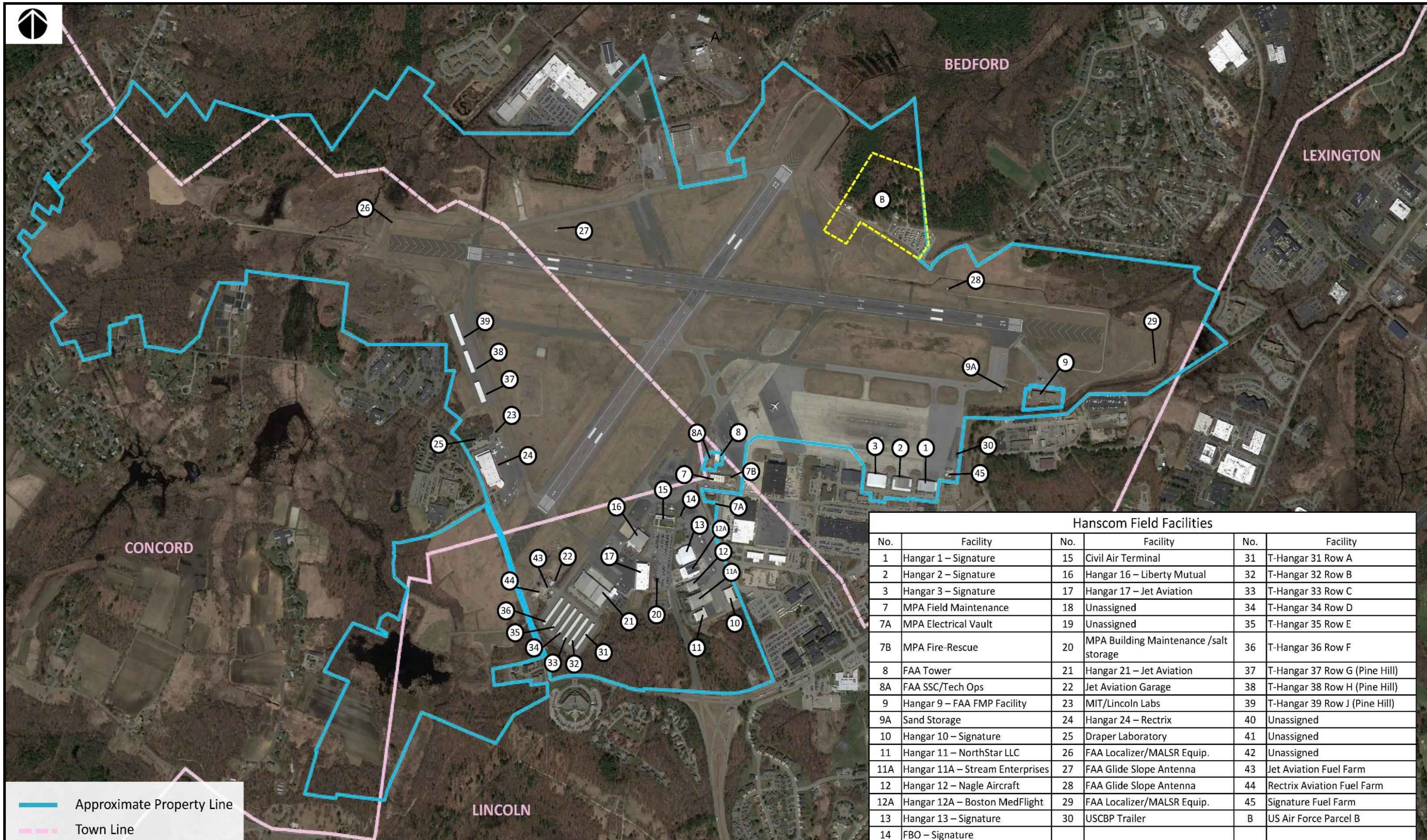

Hanscom Field Facilities

No.	Facility	No.	Facility	No.	Facility
1	Hangar 1 – Signature	15	Civil Air Terminal	31	T-Hangar 31 Row A
2	Hangar 2 – Signature	16	Hangar 16 – Liberty Mutual	32	T-Hangar 32 Row B
3	Hangar 3 – Signature	17	Hangar 17 – Jet Aviation	33	T-Hangar 33 Row C
7	MPA Field Maintenance	18	Unassigned	34	T-Hangar 34 Row D
7A	MPA Electrical Vault	19	Unassigned	35	T-Hangar 35 Row E
7B	MPA Fire-Rescue	20	MPA Building Maintenance /salt storage	36	T-Hangar 36 Row F
8	FAA Tower	21	Hangar 21 – Jet Aviation	37	T-Hangar 37 Row G (Pine Hill)
8A	FAA SSC/Tech Ops	22	Jet Aviation Garage	38	T-Hangar 38 Row H (Pine Hill)
9	Hangar 9 – FAA FMP Facility	23	MIT/Lincoln Labs	39	T-Hangar 39 Row J (Pine Hill)
9A	Sand Storage	24	Hangar 24 – Rectrix	40	Unassigned
10	Hangar 10 – Signature	25	Draper Laboratory	41	Unassigned
11	Hangar 11 – NorthStar LLC	26	FAA Localizer/MALSR Equip.	42	Unassigned
11A	Hangar 11A – Stream Enterprises	27	FAA Glide Slope Antenna	43	Jet Aviation Fuel Farm
12	Hangar 12 – Nagle Aircraft	28	FAA Glide Slope Antenna	44	Rectrix Aviation Fuel Farm
12A	Hangar 12A – Boston MedFlight	29	FAA Localizer/MALSR Equip.	45	Signature Fuel Farm
13	Hangar 13 – Signature	30	USCBP Trailer	B	US Air Force Parcel B
14	FBO – Signature				

Source: Massport, Google Earth April 2018

Figure 2-1 Hanscom Field Facilities

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Table 2-2 Hanscom Field Facilities and Infrastructure Inventory and Assessment

GLP[1] No.	Facility	Primary User	Total S.F.[2] Footprint	Year Built	Condition[4]	Facility Type/ Comments
1	Hangar 1	Signature Flight Support	28,400	1955	Good	Fixed Base Operator
2	Hangar 2	Signature Flight Support	36,000	1955	Good	Fixed Base Operator
3	Hangar 3	Signature Flight Support	36,000	1955	Good	Fixed Base Operator
7	Field Maintenance	Massport	11,300	1984	Good	Airfield Maintenance
7A	Electrical Vault	Massport	1,000	n/a	Good	
7B	Fire-Rescue Quarters	Massport	900	2016	Excellent	
8	Air Traffic Control Tower	FAA-owned property	5,200	2002	n/a	FAA Control Tower
8A	FAA SSC/ Tech Ops	FAA-owned property	1,800	n/a	n/a	
9	FMP Facility	FAA-owned property	21,000	n/a	n/a	Field Maintenance Program Storage
9A	Sand Storage	Massport	2,400	2005	Good	Airfield Sand Storage
10	Hangar 10	Signature Flight Support	20,600	1950s	Good	Fixed Base Operator
11	Hangar 11	NorthStar	15,600	1969	Good	Corporate/ Conventional GA Hangar
11A	Hangar 11A	Stream Enterprises	26,700	2001	n/a	Corporate/ Conventional GA Hangar
12	Hangar 12	Nagle Aircraft	14,500	2002	n/a	Aircraft Maintenance Facility
12A	Hangar 12A	Boston MedFlight	30,000	2017/ 2018	n/a	Medical Flights and training
13	Hangar 13	Signature Flight Support	40,000	2001	n/a	Fixed Base Operator

GLP[1] No.	Facility	Primary User	Total S.F.[2] Footprint	Year Built	Condition[4]	Facility Type/ Comments
14	FBO Facility	Signature Flight Support	6,500	1988	n/a	Fixed Base Operator
15	Civil Air Terminal Building	Massport	12,700	1953	Fair	Passenger Terminal and Aviation Support
16	Hangar 16	Liberty Mutual	37,300	2005	n/a	Corporate/ Conventional GA Hangar
17	Hangar 17	Jet Aviation	45,900	2017	n/a	Fixed Base Operator
20	Maintenance Building	Massport	2,100	1954	Poor	Building Maintenance and salt storage
21	Hangar 21	Jet Aviation	84,700	2001, 2017	n/a	Fixed Base Operator
22	Garage	Jet Aviation	2,800	1985	n/a	Fixed Base Operator
23	MIT/Lincoln Labs	Lincoln Laboratory	4,500	n/a	n/a	Leased from Massport
24	Hangar 24	Rectrix Aviation	89,714	2014	n/a	
25	Draper Laboratory	Draper Laboratory	13,100	1948	n/a	
26	FAA Localizer	FAA	n/a	n/a	n/a	
27	FAA Glide Slope	FAA	n/a	n/a	n/a	
28	FAA Glide Slope	FAA	n/a	n/a	n/a	
29	FAA Localizer	FAA	n/a	n/a	n/a	
30	USCBP	U.S. Customs and Border Protection	1,900	n/a	n/a	
31	T-Hangar Row A	Massport	13,700	1972	Good	Reached end of useful life, will be replaced

GLP[1] No.	Facility	Primary User	Total S.F.[2] Footprint	Year Built	Condition[4]	Facility Type/ Comments
32	T-Hangar Row B	Massport	14,200	1973	Good	Reached end of useful life, will be replaced
33	T-Hangar Row C	Massport	14,300	1973	Good	Reached end of useful life, will be replaced
34	T-Hangar Row D	Massport	13,900	1982	Good	
35	T-Hangar Row E	Massport	13,900	1982	Good	
36	T-Hangar Row F	Massport	13,900	1982	Good	
37	T-Hangar Row G	Massport	16,500	1987	Good	New roof coating in 2011
38	T-Hangar Row H	Massport	14,500	1987	Good	New roof coating in 2011
39	T-Hangar Row J	Massport	21,200	1987	Good	New roof coating in 2011
43	FBO Fuel Farm	Jet Aviation	2,400	2008	n/a	Fixed Base Operator
44	FBO Fuel Farm	Rectrix Aviation	2,300	2014	n/a	Fixed Base Operator
45	FBO Fuel Farm	Signature Flight Support	3,300	1976	n/a	Fixed Base Operator
B	USAF Parcel B	U.S. Air Force	n/a	n/a	n/a	Leased from Massport by the U.S. Air Force

Notes:
1. L.G. Hanscom Field 2017 General Location Plan (GLP). Does not include USAF or U.S. Navy facilities, except properties leased from Massport.
2. Building footprints determined from airport drawing provided by Massport
3. Not applicable (n/a) applies to unused Building ID or facilities where information was not available
4. Property condition determined from HNTB FY 2018 Massport Facilities Annual Report of Conditions

2.2.5 Full-service Fixed Base Operator Facilities

A full-service Fixed Base Operator (FBO) is a company that handles a range of needs for based and transient aircraft, their operators, and their passengers. Services may include cleaning, maintaining, fueling and parking, hangaring, flight planning for pilots, and arranging for the specific needs of passengers and flight crews, (such as ground transportation or overnight accommodations). Although the majority of FBO activity involves servicing corporate GA aircraft activity, the FBOs also serve some charter activity. The majority of flights depart between 7:00 and 9:00 AM and return the same day between 3:00 and 7:00 PM on weekdays. Saturday is typically the lightest day of the week. Occasionally, activity resumes Sunday afternoon with departures in support of the following workweek.

Hanscom Field currently has three full-service FBOs: Jet Aviation, Signature Flight Support, and Rectrix. These FBOs typically operate 24/7.

Jet Aviation operates approximately 130,000 square feet of hangar space and a 6,000-square-foot FBO on the West Ramp. Its new, replacement hangar opened in June 2017 and can accommodate aircraft up to the Global 7000 or G650. The adjacent 92,000-square-foot ramp was also upgraded in 2017. Jet Aviation also operates a fuel farm nearby.

Signature Flight Support operates an FBO facility on the West Ramp, directly east of the Civil Air Terminal. South of this FBO facility, Signature leases a primary, 38,000-square-foot hangar (Hangar 13). The hangar was constructed by the Mercury Air Group in 2001. In addition to its primary hangar, Signature leases Hangar 10 (20,000 square feet), Hangar 1 (28,000 square feet), and Hangars 2 and 3 (36,000 square feet each). The buildings are primarily used for aircraft maintenance and storage with some area available for general office activities. Signature also operates a fuel farm on the East Ramp.

Rectrix is the newest FBO at Hanscom Field. It opened in 2014. Rectrix is located on the southwest side of the airfield, west of Taxiway M. Facilities include a 60,000-square-foot hangar and a 20,000-square-foot guest and office space. Rectrix operates a fuel farm located west of the Jet Aviation Fuel Farm.

All three FBOs report to be sold out, with waiting lists for corporate jet customers at each.

2.2.6 Maintenance Facilities

An aircraft maintenance facility provides service and repairs to aircraft including engines, flight aircraft maintenance facility provides service and repairs to aircraft including engines, flight instruments, interiors, and structural components. These services are provided on both a scheduled and as-needed basis to locally-based and transient aircraft. All of the above-mentioned FBOs at Hanscom Field provide aircraft maintenance, as does Nagle Aircraft Services (some of the maintenance services are outsourced through aviation maintenance companies). Nagle Aircraft Services operates a 14,300-square-foot hangar (Hangar 12), on the east side of the West Ramp.

2.2.7 Corporate/Conventional Hangars

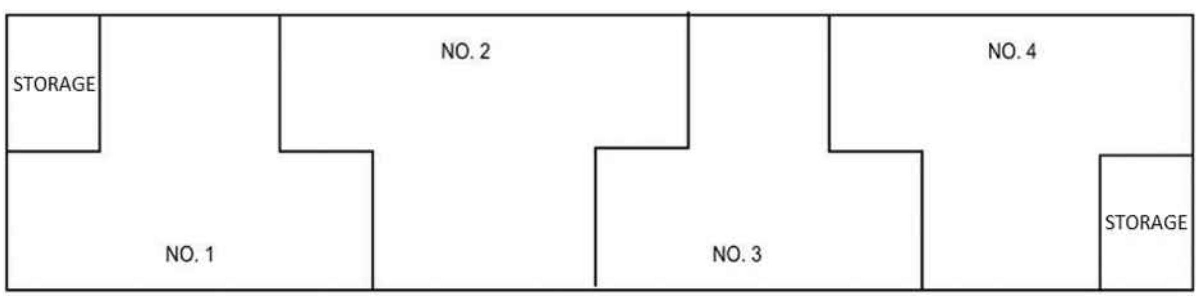
Corporate and conventional hangars are generally large, open span hangars for storage of one or multiple aircraft. Corporate hangars at Hanscom Field are designed to accommodate turbo prop or jet aircraft that are used for business or commercial operations.

Active corporate and conventional hangars at Hanscom Field include a 15,608-square-foot Hangar 11 (Northstar LLC) and a 26,250-square-foot Hangar 11A (Stream Enterprises), both located on the east side of the West Ramp, and a 37,800-square-foot Hangar 16 (Liberty Mutual) on the west side of the West Ramp. These hangars are used by corporate entities to support their flight departments or businesses. Most corporate hangars include office or storage space to accommodate the needs of those entities that are using the hangar.

2.2.8 T-Hangars

T-hangars are smaller than corporate and conventional hangars and offer private storage for GA aircraft. The name refers to the shape of each unit, which affords the most efficient space storage for small, individual aircraft. Figure 2-2 displays a typical T-Hangar layout (areas labeled storage space can also be office space). Six T-hangar buildings with 12 individual T-hangar units each are located in the southwest portion of the West Ramp. These are commonly referred to as the "South T Hangars." Each individual hangar unit contains approximately 1,344 squre feet of space and can accommodate one small aircraft.

Figure 2-2 Standard T-Hangar Layout



On the southwest side of the airfield in the Pine Hill Area, there are three T-hangar buildings (Hangars 37, 38, and 39), commonly referred to as the "Pine Hill Ts." These were constructed in 1987. One building has 18 units and the second has 12 units. Each unit in these buildings is 1,312 square feet and can accommodate a single-engine aircraft. The third building has eight 1,886-square-foot units. The larger units can accommodate light to medium twin- engine aircraft.

In 2016 sections of the landside roadways and T-hangars that were damaged during the winter of 2014-2015 were repaired. In 2017 T-Hangar Rows A-C have reached the end of their useful life and are being replaced. Re-construction is expected to be completed in summer of 2019.

2.2.9 Flight Schools

Flight schools provide flight training to individuals learning to fly aircraft. Training is provided in classroom facilities as well as in an aircraft with a certified instructor. Currently, two flight schools at Hanscom Field operate out of the Civil Air Terminal: East Coast Aero Club and Mike Goulian Aviation. A longtime flight school, Executive Flyers Aviation, closed its Hanscom Field location. The flight schools use the tie-down facilities (areas on an airport specifically designed for the outdoor storage of aircraft) on the East and West Ramps for aircraft parking and storage.

2.2.10 Commuter Services

Commuter service is not currently offered from Hanscom Field. The previous operator, Streamline Air, which commenced operations on April 4, 2011, suspended service on September 15, 2012. Various companies operate on-demand air taxi and charter service at Hanscom Field.

2.3 Other Aviation-Related and Ancillary Businesses Inventory

In addition to the services referenced above, there are varieties of mostly aviation-related businesses that operate out of offices located in the Civil Air Terminal or the FBOs, such as Boston MedFlight, car rental agencies, and food services. Hangar 12A was occupied and used by the National Aviation Academy as an aircraft mechanic training school until the lease expired in 2015. In 2016 Massport accepted a proposal from Boston MedFlight to redevelop the site. The new facility is multi-purpose facility incorporating hangar space, office space and training space. Boston MedFlight completed its new facility in 2018.

2.3.1 Civil Air Terminal

The three-story Civil Air Terminal building has a total gross floor area of approximately 36,000 square feet, consisting of space for passenger holding areas, public seating, general office space, flight schools, rental agencies, and Massport administrative offices.

In 2017, Massport moved all administrative offices to the vacant office space on the 2nd floor of the Civil Air Terminal, consolidating resources and utilizing a smaller footprint. In July 2017, a rain storm flooded the building with 30 inches of water in under half hour. As a result, first floor tenants were temporarily relocated and a full rehabilitation of the first-floor facility was undertaken. Massport has also allocated capital funding to improve the building's drainage system.

2.3.2 Aircraft Parking Areas

Aircraft that are not kept inside hangars are parked on apron areas. Aprons are open, paved spaces that provide no shelter from the elements. Small aircraft are tied down with anchors provided for securing aircraft.

Spaces for aircraft parking are located at the East Ramp, and the West Ramp. The West Ramp includes areas to the east, west, and north of the Civil Air Terminal. The East Ramp abuts the Hanscom AFB. This ramp is comprised of approximately two million sf of gross apron space. Approximately 350,000 square feet are used for aircraft tie-downs. The remainder is currently used for taxiway access and other transient aircraft parking for civilian and military aircraft.

2.3.3 Fire Fighting and Police

has been standardizing Airport Rescue and Fire Fighting (ARFF) procedures across all three Massport-owned airports in order to enhance safety and coordination efforts. This allows Massport Fire-Rescue to leverage additional resources from other Massport facilities (airports) for use at Hanscom Field. Massport Fire-Rescue began operations in 2015 with a temporary ARFF vehicle bay added to the maintenance garage. Construction on a permanent facility began in 2018 and it is expected to be completed by 2019. This requires removal of approximately 17 aircraft tie downs that currently exist at the site. The aircraft tie downs will be absorbed by FBOs at Hanscom Field.

The Massachusetts State Police is located inside the Civil Air Terminal and provides policing and law enforcement services to Hanscom Field.

2.3.4 Miscellaneous Terminal Support Facilities

Additional terminal and general airport support facilities exist at Hanscom Field, including fuel storage and airfield maintenance facilities. The three FBOs store and dispense fuel for civil and military aircraft. The Jet Aviation and Rectrix fuel farm facilities are located on the southwest side of the airfield, near the old T-hangars. The Signature fuel farm facility is located on the east side, adjacent to Hangar 1. Massport maintenance vehicles, including trucks, snowplows, construction equipment, and other general maintenance equipment are stored adjacent to or inside an 11,300-square-foot Airfield Maintenance Building located adjacent to the FAA Air Traffic Control Tower.

2.4 Infrastructure Inventory and Assessment

Hanscom Field is served by an infrastructure system of transportation and utility facilities. Roadway conditions are described generally below, with more detail provided in Chapter 6 Ground Transportation. In the *2012 ESPR*, a detailed inventory of parking areas was conducted to describe the number and location of spaces. Updates provided by site personnel have been used to prepare the *2017 ESPR*. Information regarding the water distribution system's supply and demand and the wastewater system serving Hanscom Field is based upon information in the *1995 GEIR*, the *2012 ESPR*, plus updates provided by Massport. Information regarding the stormwater management and drainage system is based on the *1995 GEIR*, *2000 ESPR*, *2005 ESPR*, *2012 ESPR*, the Stormwater Pollution Prevention Plan (SWPPP) and updates to the SWPPP supplied by Massport.

2.4.1 Surface Access Roadways and Ground Transportation

Hanscom Drive provides the primary access to the Massport facilities on Hanscom Field. Hanscom Drive intersects with Route 2A, which in turn provides connections to Route 128/I-95. These designated state and federal highways form the main surface transportation connections to points north, east, and south of the airport. Route 2A also provides connections to Route 2 origins and destinations to the west. Old Bedford Road, which intersects with Hanscom Drive at the entrance to Hanscom Field and Virginia Road, provides connection to Routes 62, 4, and 225.

Hanscom Drive is a paved, four-lane divided roadway from Route 2A that provides access to Hanscom Field and the Hanscom AFB. After crossing Old Bedford Road, Hanscom Drive becomes an undivided two-lane roadway providing access to the Civil Air Terminal, the main parking lot, and other facilities on the West Ramp of the airport.

Hanscom Drive feeds into a two-lane roadway around the perimeter of the main lot. The roadway is one- way in front of the Civil Air Terminal with designated areas for passenger drop-off and pick-up, taxis, and bus stops. This roadway is in good condition, and the capacity of the roadway is adequate to meet its internal circulation needs.

Ground transportation to Hanscom Field is provided by the Massachusetts Bay Transportation Authority (MBTA). The Routes 62 and 76 buses stop in front of the Civil Air Terminal and provide connection to Lexington, Arlington, Bedford and the MBTA Red Line train in Cambridge. From the Red Line, commuters can continue anywhere within the MBTA transit system. Currently the 62 bus stops at Hanscom Field on Saturdays only.

The Airport is easily accessible by bike and has convenient cycling access via the Minuteman Bikeway and other bike paths. Bike racks are available at multiple locations throughout the Airport, including the Civil Air Terminal.

2.4.2 Automobile Parking

There are approximately 1,380 automobile parking spaces at Hanscom Field (excluding USAF Parcel B). This includes both marked and unmarked spaces around the Civil Air Terminal, aircraft hangars, and other facilities on airport property. Parking spaces were counted through visual inspection and recent satellite imagery.

Table 2-3 summarizes available parking by facility. The *2017 ESPR* inventory represents an approximate 14 percent decrease over the results that were reported in the *2012 ESPR* (excluding USAF Parcel B). The drop is mostly due to the relocation of Hangar 17, which displaced parking spaces from the lot in front of the Civil Air Terminal. Some of these spaces were recovered by the construction of a new lot off Hanscom Drive, by the airport entrance, but the net capacity decreased.

Additional automobile parking may be available in the future, as described in the recent Environmental Assessment[18] in the North Airfield Area (property that was formerly leased from Massport by the USAF).

Table 2-3 Summary of Vehicular Parking Spaces

GLP No.[3]	Facility	Primary User	Number of Parking Spaces			Comments
			2005	2012	2017	
1	Hangar 1	Signature Flight Support	37	37	37*	
2	Hangar 2	Signature Flight Support	20	20	22*	
3	Hangar 3	Signature Flight Support	22	20	20*	
7	Field Maintenance	Massport	18	18	18*	
7A	Electrical Vault		n/a	n/a	n/a	
7B	Fire-Rescue Quarters		n/a	n/a	4	
8	Air Traffic Control Tower	FAA-owned property	107	107	105*	
8A	FAA SSC/ Tech Ops	FAA-owned property	n/a	n/a	n/a	
9	FMP Facility	FAA-owned property	n/a	18	18*	
9A	Sand Storage	Massport	0	0	0*	

[18] Massport, "Environmental Assessment for L.G. Hanscom Field Aviation Facility Improvements Project". September, 2018. http://www.massport.com/media/2970/hanscom-final-ea-facility-improvements-9-26-18.pdf

GLP No.[3]	Facility	Primary User	Number of Parking Spaces			Comments
			2005	2012	2017	
10	Hangar 10	Signature Flight Support	64	64	37	
11	Hangar 11	NorthStar	34	34	11	
11A	Hangar 11A	Stream Enterprises	25	25	18	
12	Hangar 12	Nagle Aircraft	12	12	12	
12A	Hangar 12A	Boston MedFlight	57	57	34	Under construction
13	Hangar 13	Signature Flight Support	15	15	14	
14	FBO Facility	Signature Flight Support	10	10	10	
15	Civil Air Terminal Building	Massport	667	667	444	
16	Hangar 16	Liberty Mutual	45	45	46	
17	Hangar 17	Jet Aviation	25	25	31	
18	Unassigned	n/a	n/a	n/a	n/a	
19	Unassigned	n/a	n/a	n/a	n/a	
20	Maintenance Building	Massport	23	23	0	
21	Hangar 21	Jet Aviation	142	142	178	
22	Garage	Jet Aviation	0	0	0	
23	Draper Lab	Draper Laboratory	17	17	17*	
24	Hangar 24	Rectrix Aviation	42	70	97	
25	MIT/Lincoln Labs	Lincoln Laboratory	26	26	26*	
26	FAA Localizer	n/a	n/a	n/a	n/a	

GLP No.[3]	Facility	Primary User	Number of Parking Spaces 2005	2012	2017	Comments
27	FAA Glide Slope	n/a	n/a	n/a	n/a	
28	FAA Glide Slope	n/a	n/a	n/a	n/a	
29	FAA Localizer	n/a	n/a	n/a	n/a	
30	USCBP	U.S. Customs and Border Protection	5	5	5*	
31	T-Hangar Row A	Massport	12	12	12	Based on aircraft occupancy
32	T-Hangar Row B	Massport	12	12	12	Based on aircraft occupancy
33	T-Hangar Row C	Massport	12	12	12	Based on aircraft occupancy
34	T-Hangar Row D	Massport	12	12	12	Based on aircraft occupancy
35	T-Hangar Row E	Massport	12	12	12	Based on aircraft occupancy
36	T-Hangar Row F	Massport	12	12	12	Based on aircraft occupancy
37	T-Hangar Row G	Massport	8	8	8	Based on aircraft occupancy
38	T-Hangar Row H	Massport	12	12	12	Based on aircraft occupancy
39	T-Hangar Row J	Massport	18	18	18	Based on aircraft occupancy
40	Unassigned	n/a	n/a	n/a	n/a	
41	Unassigned	n/a	n/a	n/a	n/a	
42	Unassigned	n/a	n/a	n/a	n/a	
43	FBO Fuel Farm	Jet Aviation	n/a	n/a	n/a	
44	FBO Fuel Farm	Rectrix Aviation	n/a	n/a	n/a	

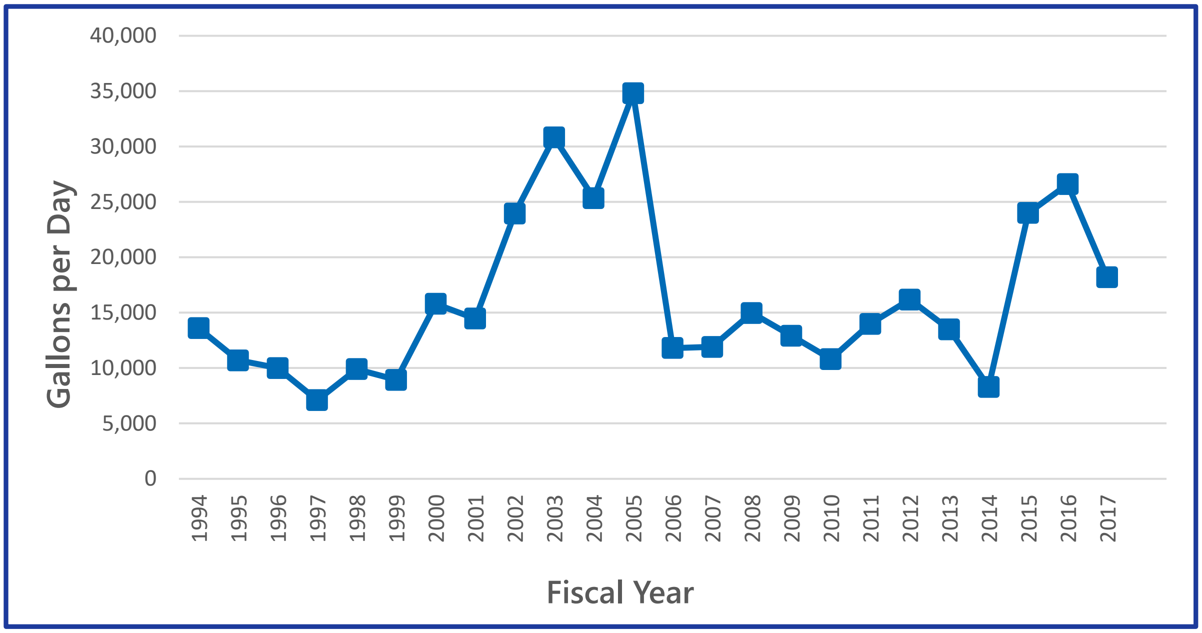
GLP No.[3]	Facility	Primary User	Number of Parking Spaces			Comments
			2005	2012	2017	
45	FBO Fuel Farm	Signature Flight Support	n/a	n/a	n/a	
-	Jet Aviation Lot	n/a	n/a	n/a	71*	Located off Hanscom Drive, near entrance
Total			**1,523**	**1,567**	**1,351**	

Notes:
1. L.G. Hanscom Field 2017 General Location Plan (GLP). Does not include USAF or U.S. Navy facilities, except properties leased from Massport.
2. Not applicable (n/a) applies to unused Building ID or facilities where information was not available.
* Parking space count based on satellite imagery (Google Earth, April, 2017)

2.4.3 Water Supply and Demand

A 24-year history of water usage from 1994 to 2017 is provided in Figure 2-3. Water meter readings from 1994 through 2012 are based upon the *2012 ESPR*. Data from 2016 includes only USAF Main. Data from 2013 are based upon information from Massport; data from May 2013 was not available. Water usage for fiscal years 2014 through 2016 do not include data from August in any year due to unavailability. Figure 2-4 shows the Massport water distribution system.

Figure 2-3 History of Water Usage from 1993 to 2017



Source: Massport, 2018

Massport's water supply is provided primarily by the adjacent Hanscom AFB water distribution system. Hanscom AFB purchases its water from the towns of Lexington and Bedford, Massachusetts. Lexington is supplied by the Massachusetts Water Resources Authority (MWRA). Bedford also receives most of its water from the MWRA and a small amount from the Shawsheen Groundwater Treatment Facility.[19] The MWRA water comes from the Quabbin Reservoir, about 65 miles west of Boston, and the Wachusett Reservoir, 35 miles west of Boston. Both reservoirs are protected naturally and by both the MWRA and the Massachusetts Department of Conservation and Recreation (DCR). MWRA's licensed treatment operators provide state-of-the-art treatment to the drinking water.

Hanscom AFB has one interconnection with Bedford that is used to supply the FamCamp. Bedford has its own groundwater supply and it purchases surface water from Lexington. In 2017, the entire system was supplied with 180 million gallons of water. Approximately 97 percent of this water supply came from the MWRA, while the remaining amount came from the Shawsheen Groundwater Treatment Facility.

The Massport water mains vary in size (6, 8, or 12 inches in diameter) and composition (cast iron, ductile iron, asbestos cement, and polyvinyl chloride).

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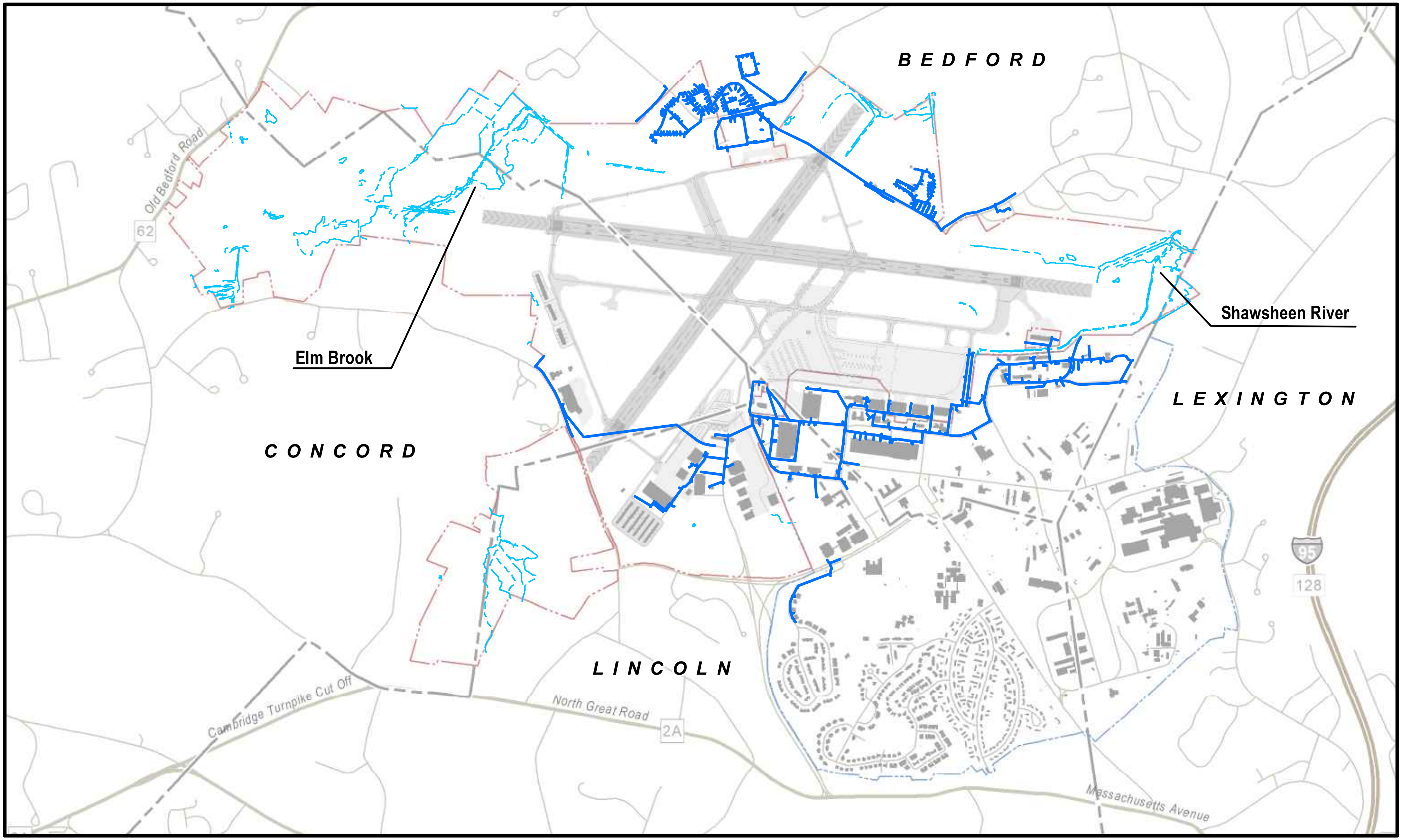
[19] Hanscom Air Force Base. June 21, 2018. *2017 Annual Drinking Water Quality Report*. https://www.hanscom.af.mil/News/Article-Display/Article/1556619/2017-annual-drinking-water-quality-report/

The Massport water distribution system primarily serves the West Ramp and the East Ramp Area. The Hanscom AFB system can provide a maximum flow rate of 1,500 gallons per minute (gpm) at 20 pounds per square inch (psi) at the master meter that supplies the West Ramp. Each of the hangars on the East Ramp have their own separate connection to the Hanscom AFB system. The Hanscom AFB system includes approximately 22 hydrants for firefighting purposes. Twenty of these hydrants are fed from the USAF water distribution system and two are fed from the Town of Concord. These hydrants are all located strategically near the major buildings and hangars. The fire flow assessment for each area is described in Table 2-4.



North

0 2,000 4,000 Feet

Massport Property within MMNHP Congressional Boundary
Hanscom AFB Property Boundary
Municipal Boundary
Interstate
Highway
Road
Existing Water Line
Hydrology

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Existing Water System

Figure **2-4**

Data Sources: InterVistas (Utilities) May 2019; Massport (ALP) October 24, 2017

Table 2-4 Existing System Fire Flow Modeling

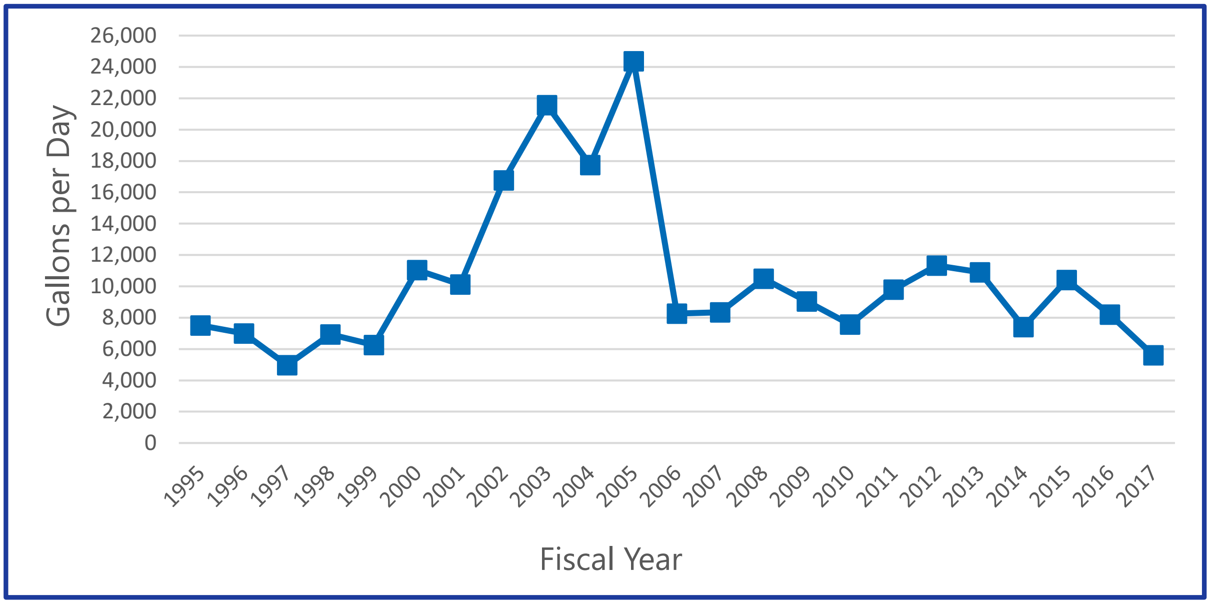
Area/Facility	Available Fire Flow at 20 psi (gpm)
West Ramp	
Civil Air Terminal	1,410
Hangar 11	1,160
Hangars 1 & 3	1,230
Hangar 10	1,020
Hangar 12A	n/a
Hangar 2	1,150
Old T-Hangars	990
MPA Maintenance Buildings	1,460
Pine Hill Area	1,500
East Ramp Area	2,000
Hangars 1, 2, and 3	2,000
FAA Storage Facility	n/a

Source: Massport

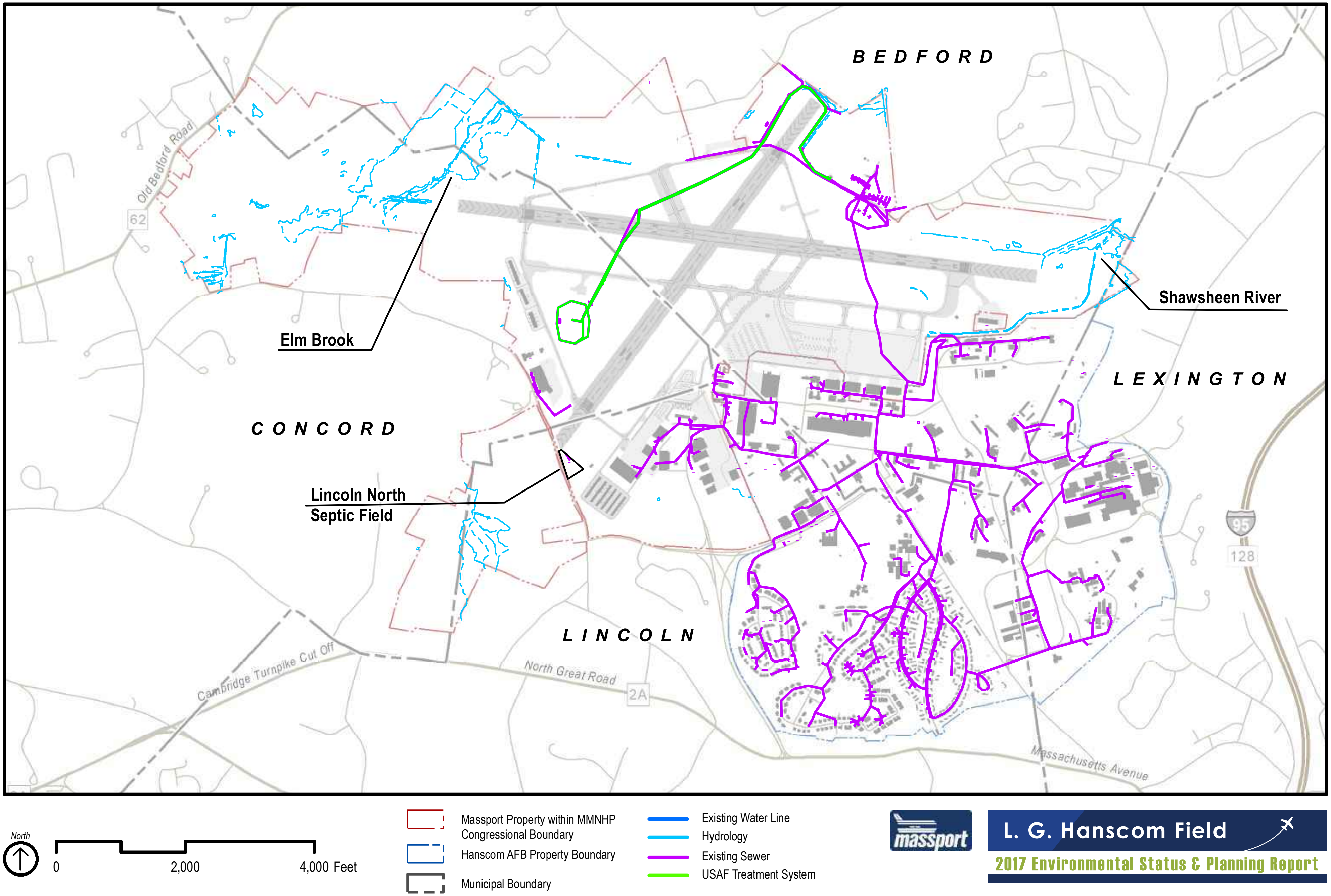
2.4.4 Sanitary Sewer System

Figure 2-5 provides average daily wastewater flows at Hanscom Field. Figure 2-6 shows Massport's existing sewer system, the location of the septic system serving Lincoln North, which is sited on Massport land west of the West Ramp, and the septic system used in the Pine Hill Area. The Rectrix sewer system is connected to the West Ramp.

Figure 2-5 Daily Average Wastewater Flows



Notes: Flows south to the Massachusetts Water Resources Authority System. Wastewater leaving the site is estimated to be 70 percent of water usage (see Figure 2-3). This reflects some on-site septic systems that do not tie into the MWRA. Data for some individual months between 2013 and 2016 are unavailable as utility bills often aggregate multiple months of usage. Specifically, May 2013 data was unavailable and thus not included. Years 2014 through 2016 do not include data for August.
Source: Massport



Data Sources: InterVistas (Utilities) May 2019; Massport (ALP) October 24, 2017

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Existing Sanitary Sewer System

Figure 2-6

Massport's wastewater is pumped to the Town of Bedford's force main and then into the Town of Lexington's force main. The USAF has two pump, or lift, stations on base: the lower lift station at Building 1539 and the upper lift station at Building 1306. The lower lift station was last upgraded in 2011 and has three 40-horsepower (HP) pumps. That station has a total capacity of 900 gpm and serves Massport's Hanscom Field facilities and Hanscom AFB housing. The upper station receives flow from the lower pump station as well as the Officers Club and Lincoln Laboratory. The upper station was upgraded in 2005-2006. It is equipped with two 50 HP pumps, and one 125 pump, and two wet wells swith a combined storage capacity of 240,000 gallons.

The flow from the upper station is pumped to a 10-inch force main that discharges wastewater to a force main along Hartwell Avenue. This main connects to a 20-inch force main from the Town of Bedford near the intersection of Hartwell Avenue and Bedford Street. The capacity of the force main leaving the Hanscom AFB is 1,725 gpm but use is limited to 1,500 gpm in keeping with the USAF's agreement with the Town of Bedford and the MWRA.

Massport's wastewater system was initially constructed in the 1950s. The system underwent expansion in the 1970s and 1980s to service new facilities. It was upgraded in 1994 on the West Ramp. The upgraded pipe network, along with upgrades to the manholes in the same area, eliminated a problem of infiltration and inflow. According to the "Water System Improvements Study," the on-site 6-inch and 8- inch vitrified clay pipes have capacities of 230,000 gpd and 500,000 gpd respectively.[20] Neither is currently near full capacity. Additionally, the Supplement to Site Development Plan and Design Guidelines by Greiner Engineering Services, Inc. (1987) states, prior to the lower pumping station on the Hanscom AFB, the system expands from an 8-inch to a 12-inch line with a capacity of 1,045,000 gpd.

2.4.5 Stormwater Management and Drainage System

Hanscom Field is located in the Shawsheen River Basin. Runoff from Massport property and the USAF property is conveyed by open channels and a closed storm drainage system. The system discharges directly and indirectly into the Shawsheen River to the east, Elm Brook (a tributary to the Shawsheen) to the west, and wetlands to the north of the site. Most of the soil types on Hanscom Field are classified as Hydrologic Soils Group C. This soil type is characterized by a slow rate of infiltration after the soils have become saturated during long duration storm events and high groundwater levels.

Hanscom Field employs an extensive drainage system that was designed and constructed in the early 1950s when the USAF enlarged and improved the airfield. The system was expanded and modified over the ensuing years to serve the additional development. The storm drainage system consists of a series of catch basins placed along most of the edges of the runways, taxiways, and apron areas. The stormwater system's original design, containing pervious bottom catch basins and perforated/open jointed pipes, was intended to drain groundwater

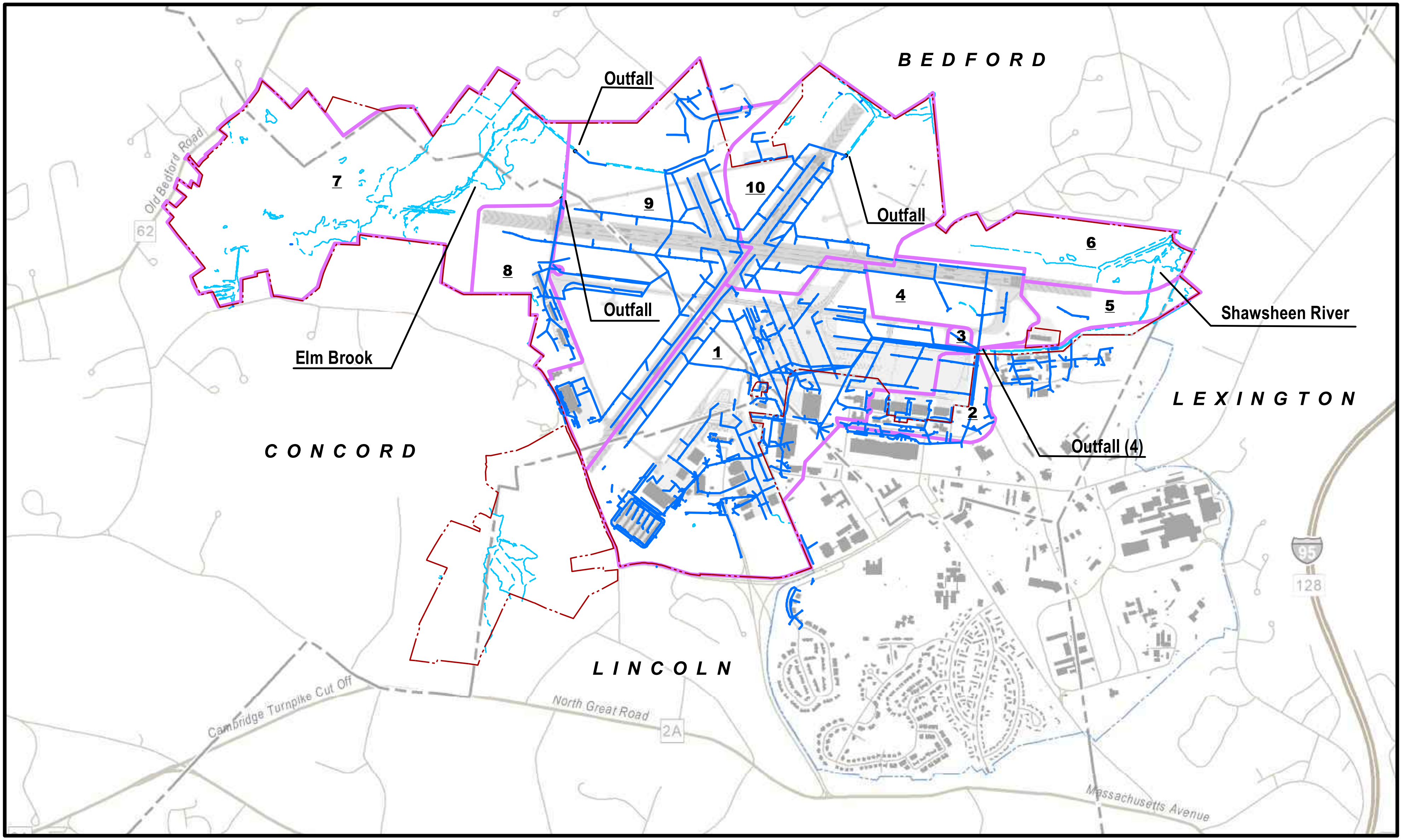
[20] Metcalf & Eddy. 1992. *Water System Improvements Study*.

as well as convey surface water away from the airfield's paved surface and infield areas. The collection system conveys stormwater and groundwater to eight outfall locations and two overland flow areas that in turn discharge directly or indirectly into the Shawsheen River.

Massport has been working cooperatively with the Massachusetts Department of Environmental Protection (MassDEP) and the USAF to improve the flow characteristics and profile of stormwater discharges into the Shawsheen River. Massport continues to remove pavement to decrease impermeable areas on the airfield and has incorporated water quality and water quantity improvements into ongoing projects using Low Impact Development (LID) technologies. Massport has also taken measures to control stormwater discharges into the river directly.

Massport and the USAF continued joint discussions with MassDEP regarding the Shawsheen Watershed Initiative. In 2011, Massport received internal approval to proceed with a plan for future improvements to the Shawsheen River headwaters, to be completed jointly by Massport and the USAF. With approval from MassDEP, Massport developed a new, more comprehensive computer model to assess how various stormwater recharge structures and best management practices could improve base flow. This model was presented in a Technical Memorandum, dated September 2015, which also provided an evaluation of existing and potential stormwater BMPs for Hanscom Field. As documented in the Technical Memorandum, the model indicated that Hanscom Field is divided into ten separate drainage areas encompassing on and off-site tributaries totaling approximately 1,216 acres. Table 2-5 lists the volume of stormwater that is projected to occur during specific storm events under existing conditions for the ten drainage areas that are illustrated in Figure 2-7.

As part of the stormwater BMPs for Hanscom Field, in the summer of 2017, Massport also removed 9.5 acres of excess airfield pavement around Runway 11/29 to reduce impervious surfaces on the airfield.



Massport Property within MMNHP Congressional Boundary
Hanscom AFB Property Boundary
Municipal Boundary
Interstate
Highway
Road
Existing Sewer
Hydrology
Drainage Area Boundary
1 Drainage Area Designation

North

0 2,000 4,000 Feet

Data Sources: InterVistas (Utilities) May 2019; Massport (ALP) October 24, 2017

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Drainage Area and Outfall Locations

Figure **2-7**

Table 2-5 Hanscom Field Runoff Summary

Basin/ Discharge Location	Drainage Area (Acres)	Percent Impervious	Storm Event Runoff (Cubic Feet per Second)				
			2 Year	5 Year	10 year	25 Year	100 Year
Shawsheen River							
1	312.9	62	139.5	195.8	246.4	304.8	400.4
2	37.3	99	38.1	47.9	56.4	66.2	81.9
3	2.2	50	4.1	5.9	7.6	9.5	12.6
4	53.3	36	6.3	13.2	19.2	26.6	39.5
5	33.1	36	10.4	18.1	25.6	34.9	50.9
6	75.4	36	6.8	13.2	19.9	28.5	43.8
Elm Brook							
7	242.0	0	19.4	40.2	62.8	92.3	146.3
8	51.9	42	21.7	33.6	44.7	58.0	80.4
9	237.8	25	26.8	45.1	63.0	84.9	123.0
Wetlands							
10	170.7	21	38.6	62.4	85.5	113.5	161.2

Notes:
1. Drainage Area No. 1 Includes 39 acres of USAF property.
2. Drainage Area No. 2 Includes 20.5 acres of USAF property.
3. Drainage Area No. 9 Includes 5.5 acres of USAF property.
4. Drainage Area No. 10 Includes 11.5 acres of USAF property.
Source: SWPPP, Massport, 2017.

Drainage Area 1: Drainage Area 1 drains to three 72-inch (1A, B, and C) and two 54-inch (1D and 1E) circular storm drains that discharge to the Shawsheen River. The five pipes collect runoff from an area of approximately 313 acres that includes land areas occupied by Massport, Signature, Jet Aviation, Nagle Aircraft, Liberty Mutual, and a portion of USAF property. Jet Aviation's fuel farm is also included in the drainage area for Outfalls lA-1E.

Drainage Area 2: The contributing drainage area to Outfalls 2A-2C consists of approximately 37 acres from Hanscom Field, which drains into three 72-inch circular storm drains (Outfalls 2A-2C) that discharge to the Shawsheen River. These 72-inch drains also collect runoff from USAF Property (upstream of Hanscom Field), which is not included in the SWPPP. The area contributing to these outfalls includes the land occupied by the Signature hangars and its fuel farm.

Drainage Area 3: This drainage area collects runoff from a small mostly vegetated area of approximately 2 acres and discharges to the Shawsheen River through an 18-inch pipe (Outfall 3).

Drainage Area 4: This 53-acre tributary area drains to Outfalls 4A and 4B and includes runway and infield area that discharges through two 24-inch pipes to the Shawsheen River.

Drainage Area 5: Drainage Area 5 includes runway and infield area of approximately 33 acres that contributes runoff via an overland flow to the Shawsheen River.

Drainage Area 6: Drainage Area 6 includes runway and infield area of approximately 75 acres that contributes runoff via drainage swale to the Shawsheen River.

Drainage Area 7: This is an undeveloped vegetated area of approximately 242 acres that contributes runoff to Elm Brook via overland flow.

Drainage Area 8: This drainage area collects runoff from approximately 52 acres of runway and infield area and discharges through a 36-inch pipe (Outfall 8). The discharge flows via drainage swale (approximately 900 feet) to Elm Brook.

Drainage Area 9: This area is a 238-acre basin that contributes runoff to Outfall 9. A large portion of this area (Area B) is comprised of a runway with associated grassed infield. This area includes approximately 5.6 acres of U.S. Navy property. Rectrix and Draper Laboratory are located in this drainage area. It discharges through a 54-inch reinforced concrete pipe at a location approximately 500 feet from Elm Brook.

Drainage Area 10: Outfall 10 receives runoff from 170 acres of land that consist of runway and infield areas. This area discharges through a 48-inch reinforced concrete pipe to the wetland area north of the airport.

2.4.6 Hazardous Material Management

Drainage areas 1 and 2 contain facilities that are reported to store and use hazardous materials, including fuel oils and chemicals. Massport has developed a Spill Prevention Control and Countermeasures (SPCC) Plan that covers general Massport operations. Tenants that store a total of more than 42,000 gallons of oil in underground storage tanks (USTs) or more than 1,320 gallons of oil in above-ground storage tanks (AST) or containers are required to have a SPCC Plan as required under 40 CFR 112 (Oil Pollution Prevention). Table 2-6 lists the hazardous materials that are likely to be present at Hanscom.

Table 2-6 Hanscom Field List of Hazardous Materials

Fuels	Miscellaneous Materials	Waste Materials	Vehicle Maintenance Materials
Jet Fuel A	Parts Cleaners	Waste mix oils	Hydraulic Fluid
Low Lead 100 Fuel	Ethylene Glycol	Battery Acid	Transmission Fluid
Gasoline	Propylene Glycol	Waste Jet Fuel	Brake Fluid
Kerosene	Paint		
Number 2 Heating Oil	Magnesium Chloride		
Motor Oil	Calcium Chloride		
Turbine Oil	Sodium Formate		
Gasoline	Cleaners/Detergents		
Source: Massport, 2018.			

Spills of hazardous materials on site must be immediately reported to the Massport Fire Department. Notification to the National Response Center and the MassDEP is also required if the amount exceeds the Reportable Quantity threshold or enters a catch basin or drain. All spills shall be documented in writing to Massport's Operations and Environmental Management Departments.

Spills exceeding the reportable quantity limits established in Table 302.4 - List of Hazardous Substances and Reportable Quantities of 40 CFR 302 and Table 1 - Massachusetts Oil and Hazardous Materials List 310 CMR 40.1600, Subpart P, must be reported to the National Response Center and MassDEP, respectively. The Reportable Quantities established by these regulations for the most common materials handled at Hanscom are provided in the SWPPP, Laurence G. Hanscom Field, Bedford, Massachusetts, along with the spill reporting contact list.

2.4.7 Floodplain

The latest Federal Emergency Management Agency (FEMA) mapping was completed in 2010 with an additional revision in 2014 for Middlesex County, which included the Towns of Bedford, Concord, Lexington, and Lincoln. Previously, separate Flood Insurance Rate Maps (FIRMs) were prepared for each identified flood prone incorporated community and the unincorporated areas of the county. The last FIRM revision for the Town of Bedford and Town of Concord took place in 1988, for the Town of Lexington in 1983, and for the Town of Lincoln in 1986.

2.4.8 Electrical Distribution System

Hanscom Field electrical power is provided primarily by Eversource Energy (formerly NSTAR Electric and Gas). Electrical services for facilities located in Concord are provided by Concord Municipal Power and Light (CMPL). For the most part, the Hanscom Field and Hanscom AFB electrical distribution systems are separate. The few exceptions are power supplies to some navigational aids.

The overall capacity of the electrical system is approximately 800kVA. The existing system has sufficient capacity to accommodate some additional power demands by existing tenants and buildings. To meet future demands, additional electrical capacity may be required. The 5kV supply from Eversource is small, considering the demand placed by the airfield and buildings. Electricity generation is also conducted at one location at Hanscom Field. A solar photovoltaic array was constructed on the roof and south-facing exterior walls of the Civil Air Terminal in 2011 as part of a roof renovation project. The system was modeled to produce over 57,233 kilowatt-hours (kWh) of electricity per year, or up to 10 percent of the total building electricity requirement. Currently, the installation provides 4 percent of the building's annual energy needs.[21]

For any periods when it is producing more electricity than the building requires, the electricity flows back to the on-site distribution system for consumption by other facilities.

2.4.9 Natural Gas

Natural gas is supplied by National Grid through a 4-inch high pressure main that comes onto airport property from Route 2A along Hanscom Drive. Gas is used for heating purposes with demand peaking during the winter months. This gas service was increased from a 2-inch high pressure main in order to supply the new hangars and conversion of the Civil Air Terminal building to gas heat, and construction by the USAF of a new Commissary facility. This four-inch line can accommodate future development.

2.4.10 Telephone/Communications

Comcast internet and telephone services are wired for the West Ramp at Hanscom Field. Verizon also provides telephone services at the Airport. Telephone service lines enter along Hanscom Drive on overhead poles to the West Ramp. The lines then run in underground conduits, which are routed to each of the facilities at Hanscom Field. Telephone conduit capacity is adequate to meet current demand although routine service upgrades may be required to provide a sufficient number of lines for future conditions.

2.4.11 Tank Management Program

Beginning in 1993, Massport instituted a tank management program designed to track the age and physical characteristics of all Massport-owned and operated fuel storage tanks at Hanscom Field. The purpose of this program is to maintain current tank information and ensure that tanks comply with the current AST and UST regulatory requirements.

[21] Massport. 2018. *Sustainable Massport, Annual Sustainability & Resiliency Report*. http://www.massport.com/media/2774/massport-annual-sustainability-and-resiliency-report-2018_lr.pdf

In 1995, the Massport Environmental Management Unit established a database of all Massport- and tenant-owned tanks identified at Hanscom. This regularly updated database tracks more than 50 tanks that are currently in use, have been removed, or have been replaced. Information on tenant tanks is obtained from tank permits filed with the Massport Fire Department. Massport records show that its existing tanks are currently in compliance with applicable state and federal regulations. Massport will continue to monitor the condition of all active tanks to ensure proper functioning and regulatory compliance.

Since 2005, the ASTs at Hangar 10 were removed. In 2010, Massachusetts State Tank Regulations were revised, and regulatory jurisdictions are now assigned by tank size and position (above or below the ground). Storage tanks on Massport property are now regulated by various jurisdictions—ASTs of less than 10,000-gallon capacity by the Massport Fire Department, ASTs of greater than 10,000-gallon capacity by the Massachusetts Department of Fire Services, and USTs by the MassDEP. As of 2010, AST permits must be renewed annually; however, UST permits no longer expire. Active smaller ASTs, larger ASTs, and USTs at Hanscom Field are listed in Table 2-7, Table 2-8 and Table 2-9, respectively.

Table 2-7 Active ASTs Less Than 10,000 Gallons at Hanscom Field

Tank ID	Owner	Location	Volume (gals.)	Content
HANAM-0073	Massport	T-hangar Building 37	275	D
HANAM-1801	Massport	Building #20, Maintenance Shop	275	HO
HANAM-1802	Massport	Airfield Lighting Vault	925	D
HANAM-1900*	Massport	Building #31	215	D
HANAT-0050	Jet Aviation	380 Hanscom Drive	3,000	G
HANAT-0054	Stream Enterprises	140 Hanscom Drive	1,000	D
HANAT-0061	Signature Flight Support	East ramp	6,000	G
HANAT-0062	Signature Flight Support	East ramp	6,000	D
HANAT-0064	Signature Flight Support	NW corner of Building 13	275	D
HANAT-0071	Signature Flight Support	Hangar 1	275	HO
HANAT-0072	Signature Flight Support	Hangar 1	275	D
HANAT-0076	Liberty Mutual	230 Hanscom Drive, Building #16	2000	D
HANAT-0079	Boston MedFlight	Hangar 2 (in front, airside)	400	D
HANAT-1004	Jet Aviation	Building #17, Jet Aviation	350	D
HANAT-1005	Jet Aviation	Building #17, Jet Aviation	600	WO
HANAT-1048	Rectrix	Building #44	5000	Avgas
HANAT-1049	Rectrix	Building #44	500	D

Notes:
D = diesel G = gasoline
HO = heating oil WO = waste oil
*Proposed AST
Source: Massport AST and UST Monthly Inspection Matrix – April, 2019

Table 2-8 Active ASTs Greater Than 10,000 Gallons at Hanscom Field

Tank ID	Owner/ Operator	Location	Volume (gals.)	Content	Permit Expiration
HANAT-0047	Jet Aviation	380 Hanscom Drive	20,000	JA	1/15/2022
HANAT-0048	Jet Aviation	380 Hanscom Drive	20,000	JA	1/15/2022
HANAT-0049	Jet Aviation	380 Hanscom Drive	12,000	AG	1/15/2022
HANAT-0059	Signature Flight Support	East Ramp	15,000	JA	1/15/2022
HANAT-0060	Signature Flight Support	East Ramp	10,000	AG	1/15/2022
HANAT-0063	Signature Flight Support	East Ramp	15,000	JA	1/15/2022
HANAT-0066	Signature Flight Support	East Ramp	15,000	JA	1/15/2022
HANAT-1046	Rectrix	Building #44	20,000	JA	1/15/2022
HANAT-1047	Rectrix	Building #44	20,000	JA	1/15/2022

Notes:
AG = AvGas
JA = Jet A
Source: Massport 2018

Table 2-9 Active USTs at Hanscom Field

Tank ID[1]	Owner/ Operator[2]	Location	Volume	Content
HANBM-0026	Massport	Building maintenance shop	1,000	HO
HANBM-0043	Massport	Field maintenance garage	6,000	G
HANBM-0044	Massport	Field maintenance garage	6,000	HO
HANBM-0045	Massport	Field maintenance garage	6,000	D
HANBT-0065	FAA	ATCT	2,500	D
HANBT-0067	Liberty Mutual	Liberty Mutual Hangar	25,000	JA

Note:
1. Tank list updated May 2018.
2. All underground storage tanks on Massport property are permitted by Massport Fire and no longer expire.
HO = heating oil
G = gasoline
D = diesel
JA = Jet A
Source: Massport AST and UST Monthly Inspection Matrix – April, 2019

Information about Massport's Tenant Audit Program and MassDEP-listed disposal sites at Hanscom Field is provided in Chapter 9 Wetlands, Wildlife and Water Resources. As spills of oil and hazardous materials or wastes occur, or subsurface contamination is encountered, notification is made to the MassDEP and appropriate cleanup is conducted. The location of the spill or area of subsurface contamination is further addressed in accordance with the Massachusetts Contingency Plan (MCP) and the site achieves regulatory closure when no further response actions are needed. The site closure is documented in a Permanent Solution Statement indicating that a condition of no significant risk to human health or the environment exists at the site.

A search of the MassDEP's Online 21E Site File Review database returned data indicating that there are three 21E cases associated with Hanscom Field since 2012, with two notification dates in 2014 and one in 2015, with response action outcome (RAO) status listed. All three have a RAO status that indicates response actions were sufficient to achieve a level of no signficant risk.

3 Airport Activity Levels

Aviation activity levels form the basis of the evaluations of ground transportation, noise, and air quality impacts associated with Hanscom Field. This ESPR provides an opportunity to re-assess the forecasts presented in the 2012 ESPR and update the forecasts to reflect current conditions and industry trends. Base year (2017) traffic is compared to forecast activity from the 2012 ESPR and new forecasts for the mid (2025) and long-term (2035) planning horizons are presented and described. The actual operations for 2017 are compared with actual operations in past years to reveal activity trends.

Hanscom Field accommodates all segments of the general aviation (GA) industry including business aviation, air taxi/private charter services, personal flying and flight training. Scheduled commercial passenger services have been available at Hanscom Field in the past, but have not occurred since 2012. This chapter summarizes aviation activity at Hanscom Field and forecasts future levels for both aircraft operations by type and category, and based aircraft.

3.1 Key Findings Since 2012

Forecasts of aviation activity at Hanscom Field were prepared for the near-term 2025 and long-term 2035 planning periods. A key assumption underlying the forecasts is that Hanscom Field will continue to function as a GA reliever for Logan Airport and as the premier business aviation airport in the Greater Boston area.

- Hanscom Field functions as a premier full-service GA airport and corporate reliever for Boston Logan International Airport (Logan Airport). There were approximately 129,000 daytime aircraft operations at Hanscom Field in 2017. GA accounted for 99 percent of the operations. Military operations in 2017 account for less than 1 percent.
- Single-engine piston (SEP) aircraft account for more than 60 percent of the aircraft operations including approximately 46,000 local training operations and 33,000 itinerant operations for personal flying use.
- Hanscom Field also serves the needs of business aviation users, including corporations that own their own aircraft and businesses that charter private flights. Business aviation operations conducted in jets, turboprops and multi-engine piston (MEP) aircraft accounted for 32 percent of Hanscom Field's activity or around 41,000 operations.
- In 2017, Hanscom Field had no scheduled passenger commercial service. The airport has not had scheduled passenger commercial service since 2012, when the last ESPR was completed.
- Since the last forecast conducted in 2012, Hanscom Field's total aircraft operations have declined by a compound annual growth rate (CAGR)[22] of 5 percent annually from approximately 166,000 operations in 2012 to 129,000 in 2017. GA activity is down nationally since 2012, but not to the same extent that Hanscom Field has experienced.[23]

Hanscom Field peak operations compared to 2017:

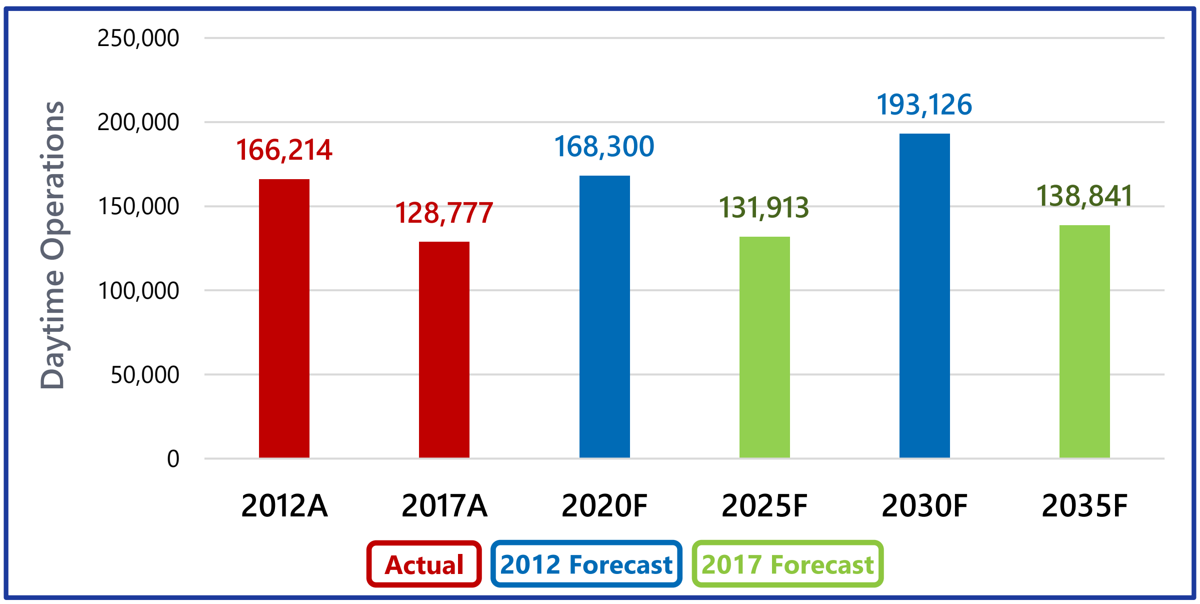
- **In 1970 tower counts peaked at more than 300,000.**
- **In 1985, after U.S. airline deregulation, operations peaked at 247,000.**
- **In 2017, there were 119,000 fewer operations than in 1985.**

[22] Throughout this section, average growth rates over multi-year periods are calculated using compounded annual growth rates, or CAGR. The CAGR is the annual growth rate from the Year 1 value (e.g., aircraft operations, etc.) to the value at the end of the historic or forecast period, with the effect of compounding taken into account. This accurately measures the year-to-year growth.
[23] General Aviation Manufacturers Association (GAMA). 2017 GAMA Annual Report. https://gama.aero/wp-content/uploads/GAMA_2017_AnnualReport_ForWeb.pdf

- Business aviation at Hanscom Field has increased at a rate of 2.6 percent from 2012 to 2017. Since 2012, the Massachusetts economy has grown by 2.5 percent with total personal income increasing 1.9 percent.[24]
- Total aircraft operations are forecast to be approximately 131,900 in 2025 and 138,840 in 2035. This is an annual forecast growth rate of 0.4 percent, consistent with the FAA's national forecast.[25] Business aviation is the driver of growth with an annual growth rate of 1.9 percent through the forecast period.
- The 2017 forecast levels for 2025 and 2035 remain below the actual 2012 levels at Hanscom Field and the *2012 ESPR* forecast levels, but are consistent with the FAA's Terminal Area Forecast growth rates for Hanscom Field.

Figure 3-1 presents the total daytime operations in 2012 and 2017 compared to the forecast totals for the *2012 ESPR* future years (2020 and 2030) and *2017 ESPR* future years (2025 and 2035).

Figure 3-1 Summary of Actual and Forecast Activity at Hanscom Field



Source: *2012 ESPR* for Hanscom Field and Massport EXP NOMS System; Operations are counted between 7:00AM-11:00PM, the hours that the air traffic control tower is open.

[24] Woods & Poole Economics, 2017

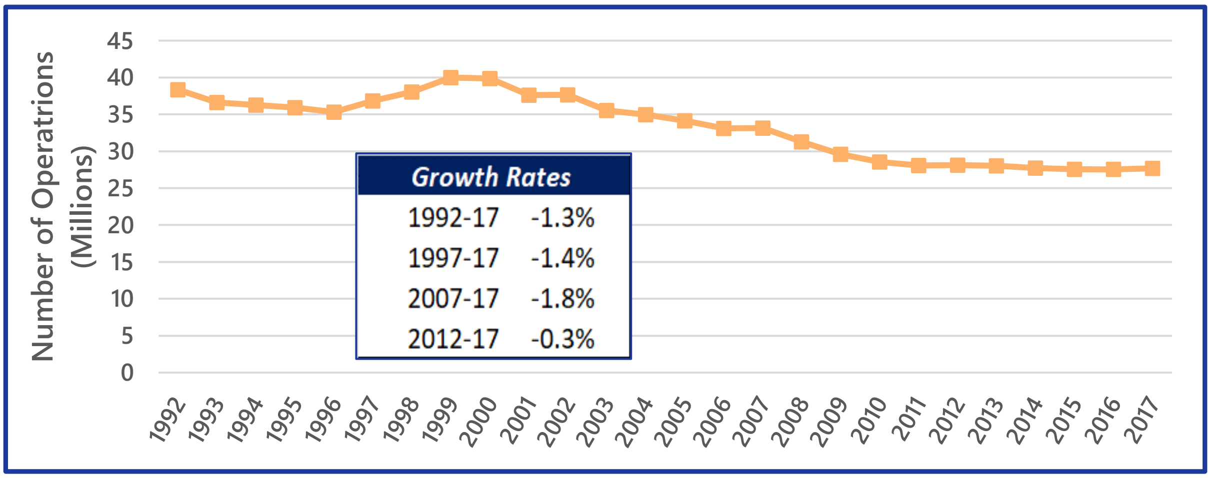
[25] FAA. FAA Aerospace Forecast Fiscal Years 2018-2038. https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2018-38_FAA_Aerospace_Forecast.pdf

3.2 Overview of National General Aviation Trends

Airports are vital parts of the local and regional economy. Hanscom Field is an important contributor to the Massachusetts economy. In 2017, the airport contributed $679 million in economic output that supported over 2,200 jobs and approximately $134 million in payroll.[26]

As shown in Figure 3-2, General Aviation in the U.S. has declined since its peak in 1999 due to a combination of dramatic increases in fuel prices and an unprecedented global recession. GA has yet to recover from the recession in 2008 and 2009, and the decline in operations has continued from the reporting in the previous ESPR in 2012.

Figure 3-2 U.S. GA Operations 1992-2017 (Millions)



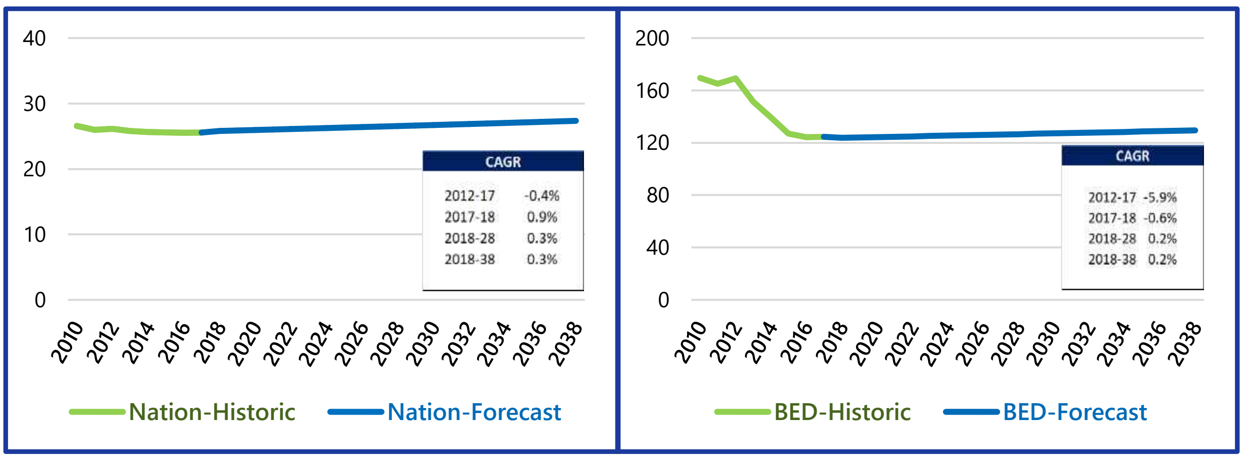
Source: GAMA

While GA shows a declining trend on a national level, a minor increase occurred nationally in 2017 of 0.1 percent due to an increase in local activity. The FAA is forecasting GA operations to continue to grow nationally at 0.3 percent per year through 2038. The FAA develops forecasts for GA operations based on a forecast of fleet size, hours flown and utilization rates. The 0.3 percent growth in GA operations is forecast to come from the business-related sectors of GA. As the largest component of growth nationwide, the turbine aircraft fleet is forecast to grow at 2.0 percent per year through 2038, while their hours flown are forecast to increase 2.4 percent. Operations of rotorcraft, experimental and light sport aircraft are also expected to grow throughout the FAA forecast period of 2038. Despite the growth in business related aviation, overall, the FAA forecasts the GA fleet to remain flat, while hours flown are expected to increase 0.8 percent per year.

[26] Massachusetts Statewide Airport Economic Impact Study Update EXECUTIVE SUMMARY JANUARY 2019

The FAA forecasts GA operations to increase modestly between 2018 and 2038 in the United States. As illustrated in Figure 3-3, the FAA's forecasts for Hanscom Field reflects this modest outlook for increases in GA activity with a growth rate of 0.2 percent per year between 2018 and 2038. Some factors contributing to the limited growth rates nationally include the decrease in number of student pilots/leisure GA flights with non-corporate aircraft, due to a combination of the high cost of training and limited employment prospects. Increases in fuel prices between 2009 and 2014 further increased the cost of leisure GA. Nevertheless, higher corporate profits, post-2008 economic recovery, safety and security concerns, and scheduled commercial flight delays make corporate aviation a somewhat more attractive alternate to scheduled commercial aviation.

Figure 3-3 FAA Aerospace Forecast for GA Operations in the U.S. (Millions) and FAA's Terminal Area Forecast for Hanscom Field (Thousands)

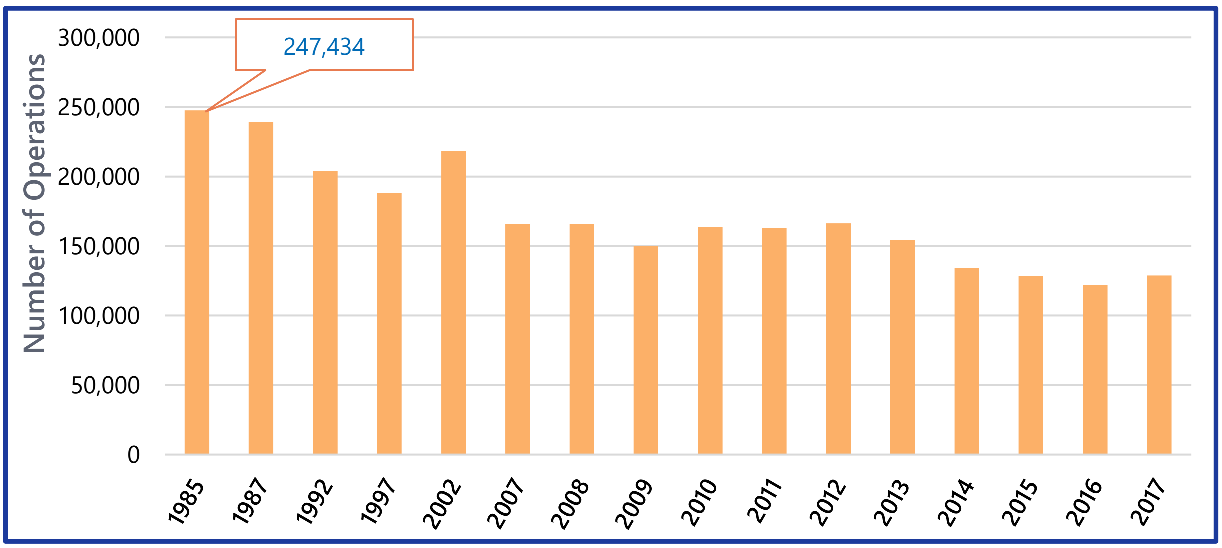


Source: FAA Aerospace Forecast GA and FAA Terminal Area Forecast for Hanscom Field; Includes Itinerant and Local operations

3.3 Overview of Hanscom Field

In 2017, there were approximately 129,000 daytime operations at Hanscom Field. As shown in Figure 3-4, this is a 6 percent increase over 2016, the first year of growth since 2012. This increase in operations from 2016 to 2017 is due in large part to the strong economy in Massachusetts.[27] Hanscom Field's operation levels react to the economic stimulus of the region. Hanscom Field's total operations are down 2 percent per year since 2005 and 5 percent per year since 2012, depicted in Table 3-1. This decline has largely been due to a decline in single-engine piston operations both in flight schools and in personal flying. Another difference that has occurred in the past five years is the lack of scheduled commercial passenger service. While scheduled commercial passenger service did not represent a large share of Hanscom Field's operations in 2012, this category of operations is currently not occurring at all at Hanscom Field.

Figure 3-4 History of Total Operations at Hanscom Field



Source: Massport EXP NOMS System, Annual Noise Report for Hanscom Field; Operations between 7:00 AM - 11:00 PM, the hours that the air traffic control tower (ATCT) is open.

[27] University of Massachusetts. January 2018. *MassBenchmarks.* http://www.donahue.umassp.edu/business-groups/economic-public-policy-research/massbenchmarks/benchmarks-bulletin-january-2018

Table 3-1 Summary of Aircraft Activity at Hanscom Field, 2005 – 2017

Activity	Year			Compound Annual Growth	
Aircraft Operations (7:00AM-11:00PM)	2005	2012	2017	2005-2017	2012-2017
General Aviation					
Training (SEP)	58,535	70,196	46,014	-2.0%	-8.1%
Personal Flying (SEP)	57,894	51,477	33,040	-4.6%	-8.5%
Business Non-Jet (MEP+Turbo)	9,646	10,178	10,846	1.0%	1.3%
Business Jet	32,345	25,638	29,862	-0.7%	3.1%
Helicopter	7,004	7,345	8,256	1.4%	2.4%
Subtotal GA	**165,424**	**164,834**	**128,018**	**-2.1%**	**-4.9%**
Military	**904**	**745**	**759**	**-1.4%**	**0.4%**
Scheduled Commercial Airline	**3,627**	**635**	**0**	**-100.0%**	**-100.0%**
Total Operations	**169,955**	**166,214**	**128,777**	**-2.3%**	**-5.0%**
Based Aircraft	**387**	**340**	**350**	**-0.4%**	**0.6%**

Note:
Operations between 7:00AM and 11:00PM, the hours that the air traffic control tower is open.
Source: *2012 ESPR* for Hanscom Field and Massport EXP NOMS System.

In 2017, GA accounts for almost all of the operations that occurred at Hanscom Field with military operations accounting for 0.6 percent. The share of Hanscom Field's 2017 operations is shown in Figure 3-5.

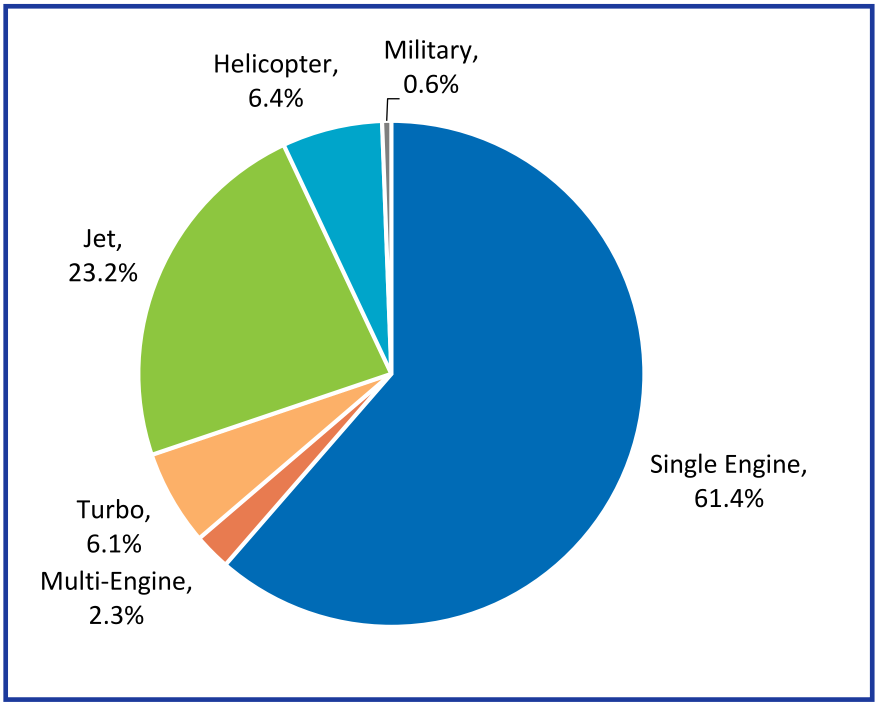
More than 60 percent of the operations that occurred at Hanscom Field were in single-engine piston aircraft utilized for training or personal flying. Hanscom Field is home to two flight schools, and in 2017 more than 46,000 training operations occurred there. While training operations are the largest sector of operations at Hanscom Field, they have declined 8 percent per year since the *2012 ESPR*.

Personal flying represents the remainder of the single-engine piston aircraft operations at Hanscom Field. In 2017, approximately 33,000 personal flying operations were performed on single-engine piston aircraft.

Business aviation is the second largest sector of operations at Hanscom Field. In 2017, Hanscom Field had about 41,000 business aviation operations. These users may have aircraft based at Hanscom Field, or the aircraft might be based at another airport. Business aviation users include corporations that own their own aircraft, on-demand air taxi and charter operators that provide private air transportation service for hire, or fractional aircraft operators whose customers own a share of an aircraft. Business aviation is conducted by both jet and non-jet aircraft.

Helicopters at Hanscom Field provide medical and emergency services, training, and charter operations. They represent 6.4 percent of Hanscom Field's total operations with 8,300 operations in 2017. Military operations represent less than 1 percent of Hanscom Field's operations, or 759 operations in 2017.

Figure 3-5 Share of Hanscom Field Activity by Operation Type



Source: Massport EXP NOMS System, Operations between 7:00 AM-11:00 PM, the hours that the air traffic control tower is open.

3.3.1 Nighttime Operations at Hanscom Field

Activity at Hanscom Field occurs largely during the day, however, there are limited operations that are performed during the nighttime period. Any operation that occurs between 11:00 PM and 7:00 AM must pay a nighttime fee. [28] Nighttime activity varies from year to year. In 2017, there were 1,902 nighttime operations[29], accounting for 1.5 percent of total operations at

[28] The definition of "nighttime" operations under Massachusetts law, and as reported in the Hanscom Field Annual Noise Report is from 11:00 PM to 7:00 AM FAA defines "nighttime" as the period from 10:00 PM to 7:00 AM for the purposes of calculating exposure to aircraft noise with the Day-Night Sound Level (DNL) metric. Therefore, the number of operations characterized as "nighttime" for use in determining DNL (described in Chapter 7 of this document) is higher than the number of nighttime operations reported in this chapter.

[29] Massport's official aircraft operation counts are based on the FAA Air Traffic Control Tower (ATCT) counts from 7:00 AM to 11:00 PM when the tower is operational. In 2017, there were 1,902 additional aircraft operations during the late night / early

Hanscom Field. This activity largely consists of jet operations, with 1,422 in 2017, which was 75 percent of total nighttime operations. Since the *2012 ESPR*, nighttime activity has increased 3 percent from 1,631 to 1,902. As shown in Table 3-2, the biggest absolute increases since 2012 have occurred in the jet category, which increased by 249 operations.

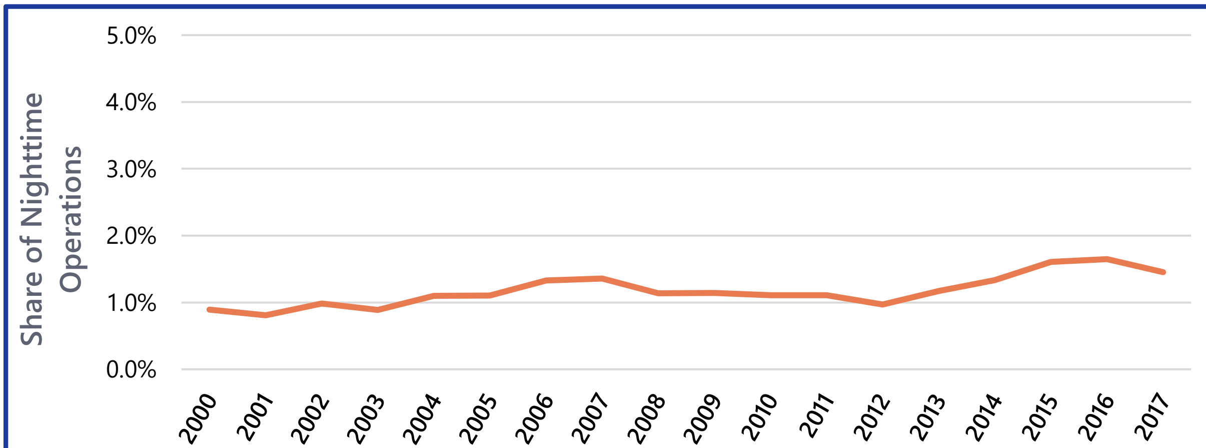
Table 3-2 Nighttime Operations at Hanscom Field by Aircraft Category

Nighttime Operations[1]							
Year	Jet	MEP+TP	SEP	Helicopter	Military	Scheduled Commercial Airline	Total
2012	1,173	251	63	141	3	0	1,631
2017	1,422	202	40	219	19	0	1,902
Difference	**249**	**-49**	**-23**	**78**	**16**	**0**	**271**

Note:
1. Operations between 11:00 PM and 7:00 AM.
Source: *2012 ESPR* for Hanscom Field and Massport EXP NOMS System.

As demonstrated in Figure 3-6, annual nighttime activity at Hanscom Field fluctuates by year, but remains a small share of total operations at Hanscom Field. Nighttime operations share of total operations have ranged from a low of 0.8 percent of total operations in 2001 to a high of 1.6 percent in 2016.

Figure 3-6 Historical Share of Nighttime Activity at Hanscom Field



Source: *2012 ESPR* for Hanscom Field, Annual Noise Reports, Massport EXP NOMS System; Operations between 11:00 PM and 7:00 AM.

morning hours when the tower is closed. The nighttime operations presented in the *2017 ESPR* differ from those published in the Hanscom Field Annual Noise Report. This discrepancy is due to the difference in the timing of the preparation for the two reports. Each report used the best available data at the time of the analysis for that report. The difference of approximately 0.4 daily nighttime operations, or 0.3% of all daily operations would change computed noise levels by an imperceptible amount and would not change the conclusions of the analysis as presented.

3.3.2 Hanscom Field's GA Operations as Part of the Region

As the premier full-service GA airport and corporate reliever for Boston Logan, Hanscom Field has more GA operations than the other airports that serve the Boston Metropolitan Area.

3.3.3 Review of the *2012 ESPR* Forecast

Long-term forecasts are imperfect because a number of unforeseen factors may occur over time. This is especially true when forecasting GA trends. GA at Hanscom Field has experienced declines for the following reasons that are specific to this sector:

- Higher aircraft costs;
- New aircraft instrument requirements by the FAA;
- Increasing costs to obtain a pilot's license;
- Higher insurance costs, and;
- Decreased production of single engine aircraft.

For example, both the spike in fuel prices in 2007 and the Global Recession in 2008 - 2009 were unforeseen and both of these events have had significant effects on aviation activity.

Figure 3-7 compares actual aircraft operation levels at Hanscom Field to predicted levels based on the 2012 ESPR forecast. Forecast activity levels for 2013-2017 were interpolated based on 2020 forecasts presented in the 2012 ESPR. Hanscom Field's actual aircraft operations for 2017 were lower than the activity levels predicted in 2012 ESPR by approximately 37,000 operations. Although the recession occurred nearly a decade ago, GA at Hanscom Field has still not recovered to pre-recession levels. Table 3-3 compares Hanscom Field to the other airports serving the region.

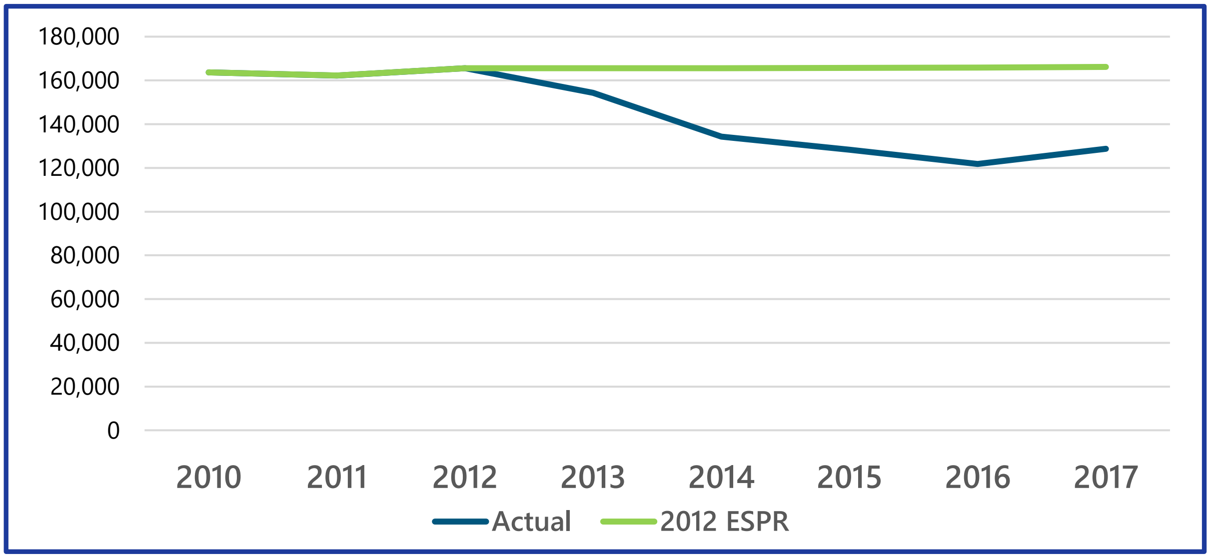
Since 2012, Hanscom Field's GA operations have declined 4.9 percent annually. Similarly, 7 of the 10 other airports that serve the region have also experienced declines in GA. Logan Airport, Manchester-Boston Regional Airport and Nashua Boire Field experienced increases in GA activity since 2012, with Logan Airport increasing 2.1 percent per year.

Table 3-3 GA Operations at General Aviation Reliever and Commercial Service Airports in the Boston Metropolitan Area, 2012 – 2017

Airport	NPIAS Category[1]	General Aviation Operations[2] 2012	General Aviation Operations[2] 2017	Compound Annual Growth Rate	Percent Local 2017	Number of Based Aircraft 2017
Hanscom Field	Nonhub primary	164,834	128,018	-4.9%	36.0%	370
Norwood Memorial	Nonprimary reliever	68,405	66,823	-0.5%	36.2%	118
Nashua/Boire Field	Nonprimary reliever	55,620	56,352	0.3%	52.4%	251
Beverly Municipal	Nonprimary reliever	58,203	53,401	-1.7%	49.3%	102
Laurence Municipal	Nonprimary reliever	52,157	36,822	-6.7%	41.3%	213
Portsmouth International (Pease)	Nonhub primary	38,132	36,717	-0.8%	71.5%	143
Boston Logan International	Large hub	28,144	31,120	2.1%	0.0%	-
Worcester Regional	Nonhub primary	44,070	25,683	-10.2%	32.6%	75
T.F. Green	Small hub	26,274	24,797	-1.2%	36.1%	37
Bradley International	Medium hub	15,589	13,233	-3.2%	1.8%	65
Manchester-Boston Regional	Small hub	12,504	13,169	1.0%	21.0%	67
Total		**563,902**	**486,135**	**-2.9%**	**38.6%**	**1,441**

Notes:
1. The National Plan of Integrated Airport Systems (NPIAS) includes all commercial service airports, all reliever airports, and selected public-owned general aviation airports.
2. Operations include itinerant air taxi, general aviation, and local civic operations. Manchester-Boston Regional, T.F. Green, and Bradley International Airport operations exclude air taxi operations as their operations counts are comingled with regional commuter airline operations.
Sources: FAA Traffic Flow Management System Counts (TFMSC), FAA Terminal Area Forecast (TAF); Hanscom Field and Logan International Airport counts are provided by Massport.

Figure 3-7 ESPR Forecast Operations Compared to Actual Operations (GA Plus Military Activity at Hanscom Field



Source: *2012 ESPR* for Hanscom Field, Massport EXP NOMS System and Annual Noise Reports

Table 3-4 presents the comparison of actual 2017 operations to the previous forecast, broken down by aircraft category. The biggest discrepancies between the forecast and actual 2017 operations were in the single-engine piston categories. Flight training is 30 percent lower than the *2012 ESPR* predicted, while personal flying is 35 percent lower. However, turboprop and helicopter operations at Hanscom Field were higher than predicted by 15 and 12 percent respectively.

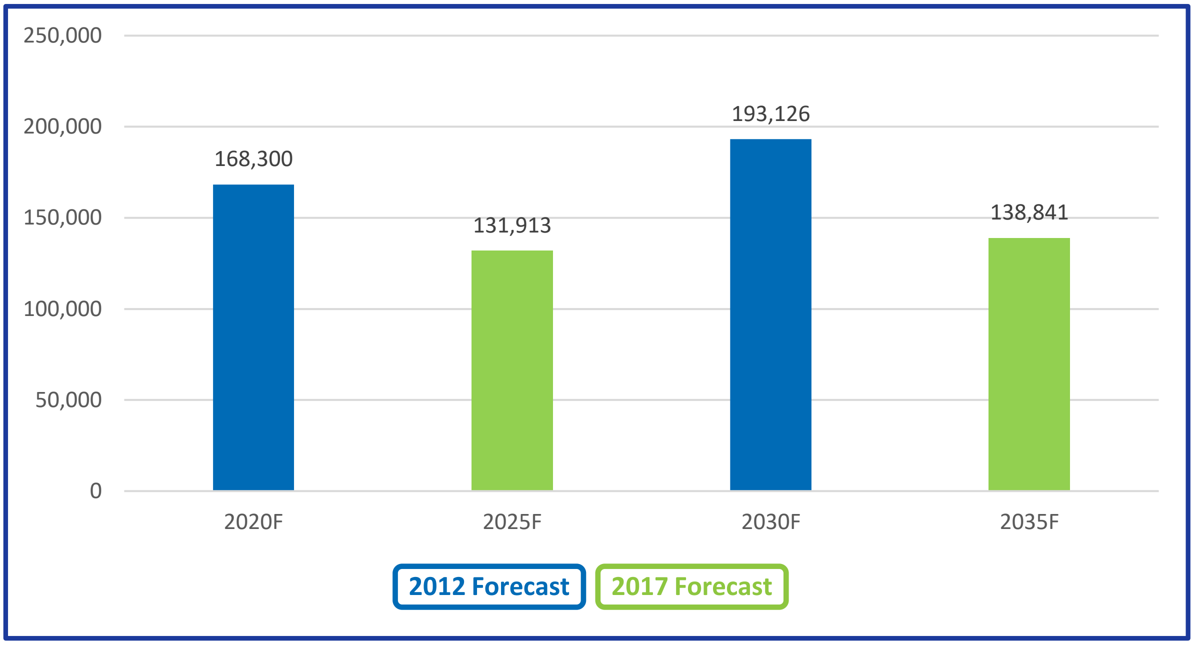
Table 3-4 2012 ESPR Forecast and Actual 2017 GA Daytime Activity at Hanscom Field

Activity	Actual	*2012 ESPR*	Difference	
	2017	2017	Absolute	Percent
Training SEP	46,014	65,350	-19,336	-30%
Personal SEP	33,040	50,965	-17,925	-35%
MEP	3,015	3,809	-794	-21%
Turbo	7,831	6,789	1,042	15%
Jet	29,862	31,168	-1,306	-4%
Helicopter	8,256	7,345	911	12%
Military	759	745	14	2%
Total	**128,777**	**166,172**	**-37,395**	**-23%**

Source: Massport EXP NOMS System and *2012 ESPR* for Hanscom Field, Operations between 7:00AM-11:00PM, the hours that the air traffic control tower is open

The *2012 ESPR* included forecast operations for 2020 and 2030 at Hanscom Field. This forecast of operations included all sectors of GA, scheduled commercial passenger service and military. While the overall growth rate of the 2012 forecast was only 0.8 percent per annum, the overall forecast levels were expected to be higher in 2020 and 2030 than the current forecast predicts for 2035. This is shown in Figure 3-8 and Table 3-5.

Figure 3-8 2012 ESPR Operations Forecast (2020F and 2030F) Compared to the 2017 ESPR Operations Forecast (2025F and 2035F) at Hanscom Field



Source: *2012 ESPR* for Hanscom Field

Table 3-5 2012 vs. 2017 ESPR Operations Forecast at Hanscom Field

Activity	*2012 ESPR* Forecast		*2017 ESPR* Forecast	
	2020	2030	2025	2035
Training (SEP)	62,605	65,164	41,795	40,723
Personal Flying (SEP)	50,661	58,285	29,208	28,252
Business MEP	3,837	4,321	2,907	2,879
Business Turbo	7,024	8,664	10,189	12,205
Business Jet	35,043	46,782	36,515	41,907
Helicopter	7,345	7,345	9,522	10,332
Military	745	745	759	759
Scheduled Commercial Airline	1,040	1,820	1,019	1,783
Total[1]	**168,300**	**193,126**	**131,913**	**138,841**

Note:
1. Operations between 7:00AM and 11:00PM, the hours that the Air Traffic Control Tower is open.
Source: *2012 ESPR* for Hanscom Field.

3.4 Aviation Activity Forecasts

The forecasts for aviation activity at Hanscom Field include projections of aircraft operations and based aircraft for the near-term (2025) and the long-term (2035). The forecasts assume that Hanscom Field continues to act as a GA reliever for Logan Airport, and as the premier business aviation airport for the Greater Boston area. The forecast also assumes that military operations will remain limited. In addition, the forecast assumes that the airport could again offer scheduled commercial airline operations in 2025. The addition of scheduled commercial service is a scenario that could occur given that the airport has had scheduled commercial service in the past. The scheduled commercial service forecast is consistent with previous forecasts and illustrative of what may occur in the future (not necessarily what will occur). However, for scheduled commercial service to commence at Hanscom Field, the carrier must comply with Massport's 1980 Regulations for Hanscom Field, which prohibit scheduled commercial passenger services in aircraft with more than 60 seats. The operations forecast is based on historical trends at Hanscom Field along with national trends for GA. The forecast also takes economic projections into consideration, given the well-documented relationship between the economy and GA activity. The forecast for Hanscom Field is shown in Table 3-6.

Table 3-6 Forecast of Operations at Hanscom Field

Activity	Actual		Forecast		Compound Annual Growth			
	2012	2017	2025	2035	2012-17	2017-25	2025-35	2017-35
Training (SEP)	70,196	46,014	41,795	40,723	-8.1%	-1.2%	-0.3%	-0.7%
Personal Flying (SEP)	51,477	33,040	29,208	28,252	-8.5%	-1.5%	-0.3%	-0.9%
Business MEP	3,763	3,015	2,907	2,879	-4.3%	-0.5%	-0.1%	-0.3%
Business Turbo	6,415	7,831	10,189	12,205	4.1%	3.3%	1.8%	2.5%
Business Jet	25,638	29,862	36,515	41,907	3.1%	2.5%	1.4%	1.9%
Helicopter	7,345	8,256	9,522	10,332	2.4%	1.8%	0.8%	1.3%
Military	745	759	759	759	0.4%	0.0%	0.0%	0.0%
Scheduled Commercial Airline	635	0	1,019	1,783	-100.0%	N/A	5.8%	N/A
Total	**166,214**	**128,777**	**131,913**	**138,841**	**-5.0%**	**0.3%**	**0.5%**	**0.4%**

Source: *2012 ESPR* for Hanscom Field and Massport EXP NOMS System, Inter*VISTAS* for forecast years.

3.4.1 General Aviation Forecast Operations

In 2017, over 99 percent of Hanscom Field's operations were GA related. GA activity at Hanscom Field is forecasted to grow at a rate of 0.3% per year through 2035. This growth is driven by the business aviation sector, while single engine piston flying continues to decline.

Training Operations

Training operations are expected to decline over the forecast period from approximately 46,000 in 2017 to approximately 41,000 in 2035. This is an average annual decline of 0.7 percent, which is a slower decline than the historical rate of 8.1 percent per year from 2012-2017. The forecast decline reflects the national FAA projection of a decline in both the number of single-engine piston aircraft, and the number of hours flown by student pilots.

Personal Flying Operations

Similar to projected reduction of training operations, personal flying operations in single-engine piston aircraft are expected to decline throughout the forecast period. Over the past 5 years, personal flying has declined at Hanscom Field by an average 8.5 percent per year. This is a decrease of more than 18,000 operations over 5 years. While the decline is projected to continue, it is not anticipated to occur at the same rate as has occurred since 2012. For the forecast period of 2018 - 2035, personal flying operations in single-engine piston aircraft are projected to decline an overall average of 0.9 percent per year. By 2035, personal flying operations are projected to be about 28,000, down from 33,000 in 2017.

Business Aviation

The near- and long-term outlook for business aviation is strong. The FAA assumes that business aviation will continue to grow nationally as the economy is projected to continue to grow. [30] Business aviation remains an attractive option for corporations given the greater flexibility of schedules, ability to reach destinations without stops, and the ability to avoid lengthy check in and security screening times, thus allowing corporate passengers to use their time more effectively. Business aviation activity has historically been closely linked to the health of the overall economy.

Business aviation activity at Hanscom Field has historically tracked with the state of Massachusetts' Gross Regional Product and is predicted to increase at 1.9 percent per year. Total annual business aviation operations are forecast to reach around 57,000 by 2035, an increase from the approximately 41,000 total annual business operations in 2017.

[30] FAA Aerospace Forecast FY 2018-2038

Helicopter Operations

Since 2012, helicopter operations have increased 2.4 percent annually, with 8,256 operations in 2017. Since there has been an increase in recent years, helicopter operations are forecast to grow throughout the specified period at 1.3 percent per year. Total helicopter operations are predicted to reach approximately 10,300 annually in 2035.

3.4.2 Military Operations

Since the military's function at Hanscom Field does not involve an active flying mission, annual military operations are less than one percent of the total aircraft operations at the airport. The forecast assumes that the military operations continue throughout the forecast period but remain constant at the 2017 level of 759 operations.

3.4.3 Scheduled Commercial Airline Activity

Hanscom Field has been without scheduled commercial airline passenger services since Streamline Air discontinued its operations at the airport in September 2012. Since the *2012 ESPR*, airlines have continued the trend of withdrawing from or scaling back services at many smaller, secondary markets. As the industry continues to evolve, Hanscom Field is forecast to support a modest level of scheduled commercial activity consistent with the previous forecast. The scheduled commercial airline services forecast is based on a scenario of the type of services and the type of airline that may initiate operations at Hanscom Field and is not a continuation of past trends, but considers the current and projected operating environment for U.S. air carriers.

The scheduled commercial airline forecast scenario assumes that the types of service that may be implemented at Hanscom Field would be similar to the service most recently provided. This includes a small regional airline or public charter provider operating small turboprop or regional jet aircraft to short-haul business markets.

The forecast services would comply with Massport's 1980 Regulations for Hanscom Field, which prohibit scheduled commercial passenger services in aircraft with more than 60 seats. The Hanscom Field forecast specifically assumes weekday service operated with a 30-seat turboprop aircraft (Embraer Brasilia) serving one or two destinations in the Northeast. This service could also be conducted by a 50-seat regional jet, but for the purposes of this analysis the Embraer Brasilia is the assumed aircraft. The forecast scenario details are summarized in Table 3-7. The scheduled commercial service forecast is illustrative of a potential scenario that could occur at Hanscom Field in the future. The future scenarios in Table 3-7 are based on a number of assumptions and are not based on specific plans proposed by any potential service providers. The forecasts represent a high-level analysis as part of the overall future activity forecast.

Table 3-7 Summary of Forecast Scheduled Commercial Passenger Service Assumptions, 2025 and 2035

Forecast Scheduled Commercial Passenger Service Assumptions	
Aircraft Type:	Small turboprop with 30 seats, e.g. Embraer 120
Number of Nonstop Markets:	One in 2025 Two in 2035
Types of Markets:	Business destination in the northeast, e.g., Trenton
Service Frequency:	Two roundtrips per market, five days a week
Average Load Factor:	70.0% in 2025 72.5% in 2035
Completion Factor:	0.98

As shown in Table 3-8, Hanscom Field could potentially accommodate 21,403 scheduled commercial airline passengers by 2025 and 44,335 in 2035. With weekday-only services provided to one destination in 2025, annual scheduled commercial airline operations are forecast at 1,019, with a 0.98 completion rate. In 2035, under the assumption of weekday services to two destinations, annual operations increase to 2,038, with the same 0.98 completion rate. Since the scenario assumes that services would be targeted to the business traveler, the 2035 forecast assumes that one daily departure would occur in the early morning before 7:00 AM. Thus, in the 2035 forecast, 1,783 scheduled commercial airline operations would occur between 7:00 AM and 11:00 PM, and 255 scheduled commercial airline are assumed for the 11:00 PM to 7:00 AM period.

As can be seen in Table 3-8, the *2017 ESPR* forecast for scheduled commercial passenger service predicts slightly lower numbers of operations than the *2012 ESPR* forecasts for 2020 and 2030.

Table 3-8 Forecast Scheduled Commercial Passenger Airline Activity at Hanscom Field, 2025 and 2035

Activity	Actual		*2017 ESPR* Forecast		*2012 ESPR* Forecast	
	2005	2012	2025	2035	2020	2030
Aircraft Operations	3,627	635	1,019	2,038	1,040	2,080
Passengers	17,457	8,609	21,403	44,335	20,280	40,560
Passengers per Operation	4.8	13.6	21.0	21.8	19.5	19.5

Source: *2012 ESPR* for Hanscom Field, Inter*VISTAS* Analysis for forecast years.

Procedures for New-Entrant Airlines

An airline proposing to commence scheduled service at Hanscom Field must comply with established FAA and Massport requirements for new entrant airlines. At the federal level, a new entrant to Hanscom Field must have its Operations Specifications ("OpSpecs") amended by the FAA to permit services to Hanscom Field with a specified type of aircraft. OpSpecs must be amended each time an airline adds a new destination from any airport or uses a new type of aircraft at an airport. Once an amendment is granted for a specific market and aircraft type, additional amendments or approvals are not needed to increase the frequency of service.

New scheduled commercial service at Hanscom Field proposed by new airline entrants must be consistent with the Master Plan and 1980 Massport Regulations. The Master Plan provides that the economic, noise and ground access impacts of new passenger or air cargo service proposals will be reviewed with the Hanscom Field Advisory Commission. Massport Regulations prohibit commercial passenger services at Hanscom with aircraft that have more than 60 seats.

As a prerequisite to entering into an operating agreement with Massport, an airline must submit to Massport all valid and current certifications, authorizations, and approvals from all state, federal and other governmental bodies applicable to the proposed aircraft type and operations. Specifically, an airline must submit its FAA-approved OpSpecs authorizing the proposed service at Hanscom Field, in accordance with applicable provisions of federal law. Thus, no new carrier may begin service until all necessary approvals have been secured.

3.4.4 Nighttime Operations

Total nighttime aircraft operations (11:00 PM to 7:00 AM) are forecast to increase from 1,902 in 2017 to 2,972 in 2035. This is shown in Table 3-9. The forecast of nighttime operations for Hanscom Field are based on the forecast of annual activity by aircraft type. In 2017, approximately 4.5 percent of jet operations and 1.8 percent of turboprop/ multi-engine piston operations occur during the nighttime hours.

By 2035, jet aircraft are forecast to fly approximately 2,000 nighttime operations, which accounts for 66 percent of the forecast nighttime activity. Turboprop and multi-engine piston operations during nighttime hours are forecasted to reach 292 operations by 2035. Nighttime scheduled commercial airline operations are included in the 2035 forecast at 255 annual operations.

Table 3-9 Forecast of Nighttime Activity at Hanscom Field

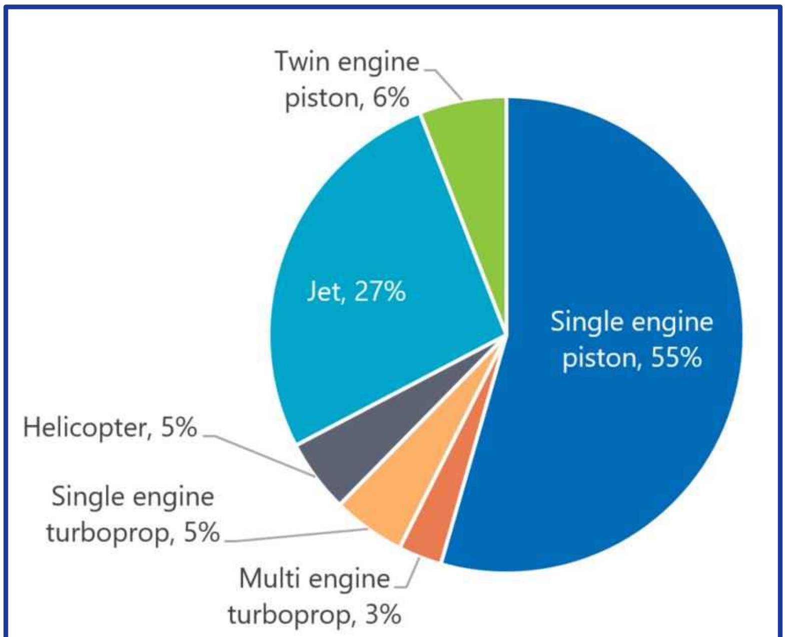
Year	Nighttime Operations						
	Jet	MEP+TP	SEP	Helicopter	Military[1]	Scheduled Commercial Airline	Total
2012	1,173	251	63	141	3	0	1,631
2017	1,422	202	40	219	19	0	1,902
2025	1,716	254	88	342	-	0	2,399
2035	1,969	292	85	371	-	255	2,972

Notes:
1. The future years forecast does not include consideration of military nighttime operations.
2. Total future operations are rounded up.
Source: *2012 ESPR* for Hanscom Field and Massport EXP NOMS System

3.4.5 Based Aircraft Forecast

As of June 2018, Hanscom Field had 350 based aircraft. This figure is higher than 2012, when there were 340 aircraft based at the airport. Since 2012, based aircraft has grown 0.5 percent per year. This slower growth can be attributed to a decline in total operations between 2012 and 2017, along with hangar capacity constraints. Almost 55 percent of the based aircraft are of the single engine piston type, with the majority of them stored in T-Hangars on the Airport. Jets comprise the next largest share of based aircraft with an almost 27 percent share, and these are primarily sponsored by the three FBOs. The distribution of aircraft by type is provided in Figure 3-9.

Figure 3-9 Hanscom Field Based Aircraft by Type, 2017



Source: Massport

Aircraft based at Hanscom Field are projected to increase over the forecast period from 350 aircraft in 2017 to 447 aircraft in 2035, as shown in Table 3-10. This represents a compound annual growth of 0.9% between 2017 and 2025 and 1.8 percent between 2025 and 2035. Forecast growth for each aircraft type was calculated from the operations forecast and adjusted based on the overall shifts toward business jet operations and away from piston aircraft, as personal flying decreases and business aviation increases. As jet aircraft shift from 23 percent of the operations in 2017 to almost 31 percent in 2035, the share of based jet aircraft increases to 34 percent of the fleet. Single engine pistons decline to 44 percent of the based aircraft fleet as their share of total operations decline in the operations forecast.

Table 3-10 Based Aircraft Forecast

Aircraft Type	2012	2017	2025	2035
Single Engine Piston (SEP)	217	191	178	195
Single Engine Turboprop[1]	-	17	23	31
Multi Engine Piston (MEP)[1]	-	21	21	23
Multi Engine Turboprop	29	12	16	22
Jet	79	93	118	153
Helicopter	15	16	19	23
Total	**340**	**350**	**376**	**447**

Note:
1. The 2012 based aircraft totals are combined for Single Engine Turboprop, Multi Engine Piston and Multi-Engine Turboprop. In 2012 there were 29 based aircraft for these three types combined.
Source: *2012 ESPR*, Massport for 2017 numbers, and Inter*VISTAS* for forecast years.

3.5 Summary of Changes in Airport Activity Levels

In conclusion, GA operations at Hanscom and the nation are down and are still recovering from the global recession of 2008/09. However, looking to the future, GA operations for the nation and Hanscom Field are forecast to grow. The main source of this growth will be in business operations largely those operations occurring in Turbo and Jet aircraft. Hanscom Field could also experience a return of scheduled commercial airline service.

4 Airport Planning

Massport's primary responsibility at Laurence G. Hanscom Field (Hanscom Field) is to maintain a safe, secure, and efficient regional General Aviation airport while minimizing the environmental impact of its operations. Planning is critical to ensure that an airport's facilities will continue to be safe and secure while accommodating future operating conditions. Proper planning also allows Massport to manage development in a fiscally and environmentally responsible manner. The Hanscom Field Environmental Status & Planning Report (ESPR) addresses potential development needs to address the forecasted future activity levels.

This chapter focuses on the development and planning framework for Hanscom Field, as well as the plan's alignment with Federal Aviation Administration (FAA) guidance and requirements, and local and regional planning activities. This chapter presents potential physical and operational conditions consistent with the 2025 and 2035 activity forecast scenarios described in Chapter 3 Airport Activity Levels, and baseline conditions and needs described in Chapter 2 Facilities and Infrastructure.

The 1978 Hanscom Field Master Plan and Environmental Impact Statement (Master Plan) and Massport's 1980 regulations, which establish the general planning framework for Hanscom Field, informed forecasts and planning assumptions presented in this ESPR. Massport has consulted with the FAA on the future development scenarios documented herein, and will continue to do so, as part of the Airport Layout Plan (ALP) approval process, to ensure all federal requirements are met.

For context, this chapter describes the key aspects of the Master Plan and the 1980 regulations, as well as other planning criteria, including federal, state and local regulations and guidance. The forecasts are projections of what might occur with respect to future demand assumptions that may or may not come to fruition.

Further, the planning for potential development associated with the forecast may be advanced as demand warrants their implementation.

This ESPR also evaluates the near-term Massport projects as well as the potential development associated with the demand projected through 2035 for their consistency with applicable local and regional planning.

4.1 Airport Planning Context

Massport regularly assesses the changing dynamics of the aviation industry, including shifts in the general aviation (GA) demand profile from private flying and business jets, and the evolution of airport security needs due to Transportation Security Administration (TSA)-issued security directives. Furthermore, legislative and regulatory mandates inform and affect airports' near- and long-term planning efforts.

Scenario-based planning approach:

Massport has employed a scenario-based approach to plan for the future of the Airport. The projects presented here are based on aviation demand forecasts that are subject to changes in economic growth and development. Accordingly, projects will be implemented as demand warrants.

Massport is committed to ensuring that planning and development at Hanscom Field is consistent with these mandates and in compliance with federal and state laws affecting the airport. Massport acknowledges the importance of managing Hanscom Field in an environmentally sensitive and sustainable manner that recognizes the significance of the Minute Man National Historical Park (MMNHP), Great Meadows National Wildlife Refuge (GMNWR), Hanscom Air Force Base (AFB), and the towns of Bedford, Concord, Lexington, and Lincoln (Chapter 11 Sustainability and Environmental Management, discusses Massport's approach to sustainable practices as part of the agency's general operating and development philosophy). The following sections describe local and regional planning initiatives, including overviews of the comprehensive plans of the four towns, and information gathered through discussions with local officials and the National Park Service (NPS) as part of the process to prepare the *2017 ESPR*.

Massport has developed the planning concepts evaluated in this *2017 ESPR* within the framework of the 1978 Master Plan and Massport's 1980 regulations. Massport also considers the following when formulating the plan for the future development of the Airport:

- FAA Advisory Circular 150/5070-6b, *Airport Master Plans;*[31]
- FAA Advisory Circular 150/5300-13, *Airport Design;*[32]
- FAA Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design;*[33]
- FAA Terminal Area Forecast for the airport;
- Federal, state, and local environmental regulatory requirements and review processes;

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[31] FAA. January 27, 2015. Advisory Circular 150/5070-6b Change 2. https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_150_5070-6B_with_chg_1&2.pdf

[32] FAA. February 26, 2014. Advisory Circular 150/5300-13 Change 1. https://www.faa.gov/documentLibrary/media/Advisory_Circular/150-5300-13A-chg1-interactive-201804.pdf

[33] FAA Advisory Circular 150/5325-4B. July 1, 2005. https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_150_5325-4B.pdf

- Executive Order 385, *Planning for Growth*[34], which is the Growth Management Policy for Massachusetts;
- Executive Order 438, *State Sustainability Program*[35], which initiated the new State Sustainability Program;
- Regional planning framework;
- Local comprehensive and growth management plans; and
- Long-range plans for the Minute Man National Historical Park (MMNHP) and Hanscom AFB.

This approach provides a planning context for potential improvements at the airport.

4.1.1 Airport Plans and Regulations

In 1978, Massport issued the *Hanscom Field Master Plan and Environmental Impact Statement*. In response to community concerns that arose when Massport became responsible for the operation of Hanscom Field in 1974, Massport drafted a number of policies in the Master Plan that still guide Massport's management of and planning for Hanscom Field. The adoption of the *Massport Regulations and Noise Rule* in 1980 was an outgrowth of the Master Plan.

Massport Regulations and Noise Rules contain the following provisions:

1) **Limit scheduled commercial airline service to passenger aircraft with 60 seats or less;**
2) **Impose a nighttime field use fee to discourage activity between 11:00 PM and 7:00 AM;**
3) **Prohibit touch-and-go operations between the hours of 11:00 PM and 7:00 AM;**
4) **Prohibit touch and go operations at any time by aircraft exceeding 12,500 pounds; and**
5) **Limit Auxiliary Power Unit (APU) and Ground Power Unit (GPU) usage to 30 minutes, with further limitations between the hours of 11:00 PM and 7:00 AM.**

In 1978, the Master Plan described aviation-related development on lands dedicated to aviation-related uses on U.S. Air Force (USAF) land that later changed ownership to Massport. Other development, according to the Master Plan, would be compatible with existing, adjacent land uses and airport operations. These policies and regulations have guided Massport's development of the *2017 ESPR*, which reaffirms the role of Hanscom Field as a premier regional general aviation airport.

[34] Commonwealth of Massachusetts. April 23, 1996. *Executive Order 385: Planning for Growth*. https://www.mass.gov/executive-orders/no-385-planning-for-growth

[35] Commonwealth of Massachusetts. July 23, 2002. *Executive Order 438: State Sustainability Program.* https://www.mass.gov/executive-orders/no-438-state-sustainability-program

4.1.2 Overview of the Aviation Forecast

The forecasts for aviation activity at Hanscom Field in this ESPR include projections of aircraft operations and based aircraft for the near-term (2025) and the long-term (2035). The forecasts assume that Hanscom Field continues to act as a GA reliever for Logan Airport, and as the premier business aviation airport for the Greater Boston area. The forecast also assumes that military operations will remain limited. In addition, the 2025 forecast assumes that the airport could again offer scheduled commercial airline operations. The operations forecast is based on historical trends at Hanscom Field along with national trends for GA. The forecast also takes economic projections into consideration, given the well-documented relationship between the economy and GA activity. The forecast update for Hanscom Field is presented in Table 4-1.

Notably, the forecast for 2035, which projects just under 139,000 annual aircraft operations, is considerably lower than the *2012 ESPR* forecast for the year 2030 at nearly 193,000 operations.[36] The reduced demand is primarily due to changes in the market, specifically changes within the single engine piston market segment comprised of training and personal flying. This forecast drives the planning for future development discussed in Section 4.2.

Table 4-1 Forecast of Operations at Hanscom Field

Activity	Actual		Forecast		Compound Annual Growth			
	2012	2017	2025	2035	2012-17	2017-25	2025-35	2017-35
Training (SEP)	70,196	46,014	41,795	40,723	-8.1%	-1.2%	-0.3%	-0.7%
Personal Flying (SEP)	51,477	33,040	29,208	28,252	-8.5%	-1.5%	-0.3%	-0.9%
Business MEP	3,763	3,015	2,907	2,879	-4.3%	-0.5%	-0.1%	-0.3%
Business Turbo	6,415	7,831	10,189	12,205	4.1%	3.3%	1.8%	2.5%
Business Jet	25,638	29,862	36,515	41,907	3.1%	2.5%	1.4%	1.9%
Helicopter	7,345	8,256	9,522	10,332	2.4%	1.8%	0.8%	1.3%
Military	745	759	759	759	0.4%	0.0%	0.0%	0.0%
Scheduled Commercial Airline	635	0	1,019	1,783	-100.0%	N/A	5.8%	N/A
Total	**166,214**	**128,777**	**131,913**	**138,841**	**-5.0%**	**0.3%**	**0.5%**	**0.4%**

[36] Daytime operations between 7:00 AM and 11:00 PM, the hours that the FAA Air Traffic Control Tower is open.

4.1.3 Investments in Safety, Equipment, and Facilities Between 2012 and 2017

Hanscom Field is the region's leading full-service general aviation airport and it plays a critical role in New England's regional aviation system as a corporate reliever for Logan International Airport. In order to maintain this role, Massport continues to invest in important safety and efficiency projects that improve operations and management of the airfield. As part of this effort, several airport facility improvements, initiatives, and studies have occurred since the *2012 ESPR*. Like most airports, much of the investment over the last five years, involve maintenance of the airfield pavements to ensure that they remain in good operating condition. More specifically, Massport continues its airfield maintenance and improvement program by rehabilitating several areas, including the pavement on Runway 11/29. The Runway 11/29 project occurred in 2017, and it required a month-long closure of the runway, as well as weekend closure of the airport. Other recent pavement rehabilitation included the T-hangar areas, Taxiway J, and Taxiway G.

As part of its commitment to safe operations, Massport continues to identify and remove vegetation that penetrates, or is close to penetrating FAA runway approach and departure surfaces, based on Hanscom's Five Year 2014-2018 Vegetation Plan (VMP) and following state guidelines (The VMP is updated every five years). Further, Massport has enhanced airport safety by standardizing Airport Rescue and Fire Fighting (ARFF) operations across Massport-owned airports to leverage resources across the state. Massport fire-rescue began operations at Hanscom Field in 2015 and plans to move into a new state-of-the-art facility in 2019.

Facility improvements included upgrading electrical and fire protection infrastructure at various locations across the airfield, and evaluating the drainage system and flooding issues associated with the Civil Air Terminal in order to continue to maintain an effective stormwater management plan. In Fiscal Year 2017 (FY2017), Massport invested $4.3 million in airfield, terminal, equipment and other facility improvements required to ensure the safe and efficient operation of the airport.[37] In addition, in 2018 Massport began construction on a new ARFF and U.S. Customs and Border Protection (CBP) building (designed to LEED Gold standards), which will accommodate an increase in fire rescue staffing. In this ESPR, Massport has updated the primary planning areas considered in the *2012 ESPR* to reflect changes in aircraft mix, infrastructure issues, and the latest aviation activity forecast discussed in Chapter 3 Airport Activity Levels.

4.1.4 Airport Layout Plan

The Federal Aviation Administration (FAA) defines the Airport Layout Plan (ALP) as a set of scaled drawings depicting existing and potential future airport facilities and property. The ALP enables the airport operator to seek federal funding for certain improvements, provide

[37] Massport. April 2018. *The State of Hanscom, 2017*.

information for environmental review of the same, and enable FAA and airport management to make prudent decisions regarding near-term projects consistent with the overall plan for the airport. Appendix B presents the 2017 ALP for Hanscom Field, which reflects the planning conducted since the FAA approved the previous ALP update in 2011.

Planning considerations that could be addressed as conditions warrant include:

- **Airfield capacity, in accordance with FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay;***
- **Runway length requirements, in accordance with FAA Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design;* and**
- **Airport development beyond that considered at present in future updates to the Airport Layout Plan in accordance with FAA Advisory Circular 150-507-6B, *Airport Master Plans.***

The 2017 ALP reflects planning improvements discussed in the *2005* and *2012 ESPRs*. The ALP described here offers a graphic representation of the existing conditions at Hanscom Field, potential development projects, the protected airspace as defined by FAA Part 77 regulations[38], and the existing land use in and around Hanscom Field. The ALP is prepared in compliance with FAA standards, including those outlined in Advisory Circular 150/5070-6b, *Airport Master Plans, Change 2*, and Chapter 10.[39] The ALP indicates areas that might be suitable for future aviation-related or compatible aviation land uses, as well as buildings that might be suitable for future aviation-related facilities. Specifically, areas shown as potential locations for future aviation-related use include the North Airfield, West Ramp (which encompasses the terminal area and Airport Traffic Control Tower), the East Ramp, and Pine Hill.

According to the Existing Land Use sheet in the ALP, the majority of land use at Hanscom is designated as Transportation. A small percentage of land within the Runway Protection Zones (RPZs) is designated as Open Land, Wetlands, Agriculture, and Forest. The ALP is considered a living document, and it evolves on a routine basis to accurately represent existing conditions and potential future development.

Massport has identified the need for further study of the airfield, which would address airfield standards for design, airfield geometry, and runway incursion mitigation in accordance with FAA Advisory Circular (AC), 150/5300-13A, *Airport Design*.[40] Pursuant to the airfield study, Massport will update the 2017 ALP by late 2019 or early 2020.

[38] Title 14 C.F.R. §77 - Safe, Efficient Use, and Preservation of the Navigable Airspace. July 21, 2010.

[39] FAA. January 27, 2015. Advisory Circular 150/5070-6b Change 2. https://www.faa.gov/documentLibrary/media/Advisory_Circular/150-5070-6B-Change-2-Consolidated.pdf

[40] Massport, along with close coordination with FAA, has planned a near-term study of airfield geometry with the goal of mitigating the risk of runway incursions.

4.1.5 Procedures for New Airline Tenants

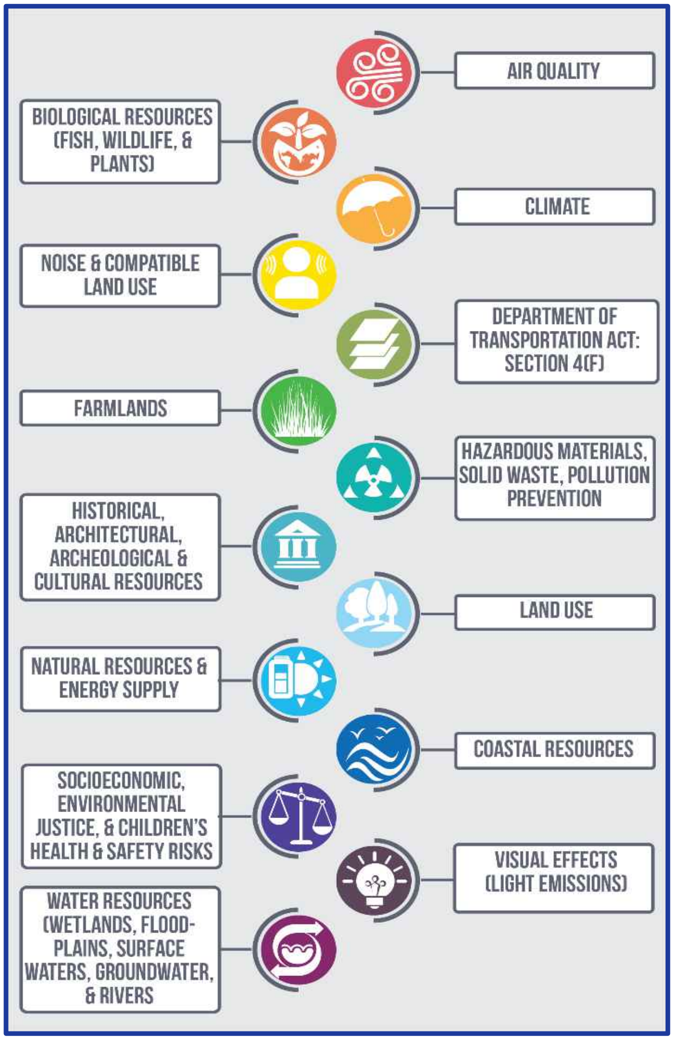
Scheduled commercial passenger service continues to be only a small component of Hanscom Field's future forecasted aviation activity. An airline must follow FAA and Massport procedures to commence scheduled services at Hanscom, including adhering to the limitations described in Section 4.1.1. The forecast for scheduled commercial air travel at Hanscom Field is discussed in Chapter 3 Airport Activity Levels and is incorporated into the airport planning process. Notably, no new passenger facilities would be required to meet the forecast for potential scheduled commercial activity in the future, given the prohibition of passenger aircraft with more than 60 seats.[41]

[41] Massport. 1980. *General Rules and Regulations for Laurence G. Hanscom Field*. http://www.massport.com/hanscom-field/about-hanscom/airport-activity-monitor/hanscom-rules-regulations/

4.1.6 Environmental Planning

Massport has developed the *2017 ESPR* primarily for review under the Massachusetts Environmental Policy Act (MEPA). However, the document is utilized in a broader context. For example, potential future development documented within the ESPR may be subject to further environmental review under the National Environmental Policy Act (NEPA) prior to a project being implemented as identified in Section 4.2.5 (see Figure 4-1 for environmental impact categories analyzed under NEPA). Further, the FAA could review future development and determine that additional analysis is required beyond that indicated herein and that a Categorical Exclusion, Environmental Assessment (EA) or Environmental Impact Statement (EIS) is warranted, depending on the nature and anticipated impacts of the proposed action(s). In addition, Massport coordinates with FAA on ALP changes to reflect future development as mentioned in Section 4.1.4 of this chapter.

Figure 4-1 Impacts Analyzed in Environmental Review for Compliance with NEPA (FAA Orders 1050.1F, 5050.4B)



Massport collaborated with the FAA during the preparation of this ESPR regarding future plans for the airport and the forecast of aviation demand, and Massport is committed to working with the FAA on an ongoing basis to conduct the necessary environmental reviews. Table 4-9 provides the likely level of environmental review required for the projects described herein.

In addition to the role that the FAA plays in the environmental review process for airport projects, it also requires air service operators to meet specific safety requirements. Massport requires that air service operators obtain FAA approval as well as all applicable state approvals prior to initiating scheduled commercial passenger service on the airport. Further, Massport does not allow any new air service operator to begin service until it has secured all necessary environmental approvals. FAA Orders 1050.1F, *Environmental Impacts: Policies and Procedures* (FAA 2015), and 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions* *for Airport Actions* (FAA 2006), provide instructions and guidelines for preparing and processing NEPA documents for airport development proposals and other airport actions as required by law.[42, 43]

In accordance with FAA regulations, some projects may be "categorically excluded" from additional environmental review due to minimal potential for adverse environmental impact (commonly referred to as a CatEx). Examples of projects that may be categorically excluded include: acquiring security equipment that is required for the safety of security personnel and property on the airport, or safety equipment required by rule or regulation for the certification of an airport. The specific action being requested determines the type of environmental processing required by the FAA. In the event that a project is not categorically excluded from environmental review, the potential environmental consequences associated with a proposed action would be assessed as determined by the FAA. Such environmental review, as specified in the aforementioned FAA Orders 1050.1F and 5050.4B, includes an analysis of the impacts in Figure 4-1. Some of these categories, such as impacts to coastal resources, would not apply to an action at Hanscom Field.

There is potential that some projects included in this ESPR could require development proximate to wetland areas, particularly those within the West Ramp and North Airfield. Massport is committed to minimizing environmental impacts and would avoid these impacts to the maximum extent practicable, and fully mitigate any unavoidable impacts. None of the projects considered would require filling of wetlands, which would require permits from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and the Massachusetts Department of Environmental Protection under the Massachusetts Wetlands Protection Act and Section 401 of the Clean Water Act.

The Vegetation Management Plan (VMP) provides Massport with a methodology to remove vegetation in order to maintain aviation safety while complying with various local, state, and federal regulations. Vegetation removal projects take place at Hanscom Field approximately every five years. The vegetation removal involves several steps. Aerial photography and other imaging techniques are used to collect information identifying where trees and other structures penetrate protected airspace. The protected airspace is determined from runway approach categories defined by the FAA. Once the analysis is complete, the penetrating vegetation can be removed following environmental constraints, based on several documents, such as the Vegetation Generic Environmental Impact Report (GEIR) and the Massachusetts Wetlands Protection Act regulations. Further details about the VMP are discussed in Chapter 9.

4.1.7 Local Municipality Planning Initiatives

Hanscom Field is located within the towns of Bedford, Concord, Lexington, and Lincoln; which are suburban communities of metropolitan Boston with strong economic ties to the high-tech

[42] FAA. July 16, 2015. Order 1050.1f. https://www.faa.gov/documentLibrary/media/Order/FAA_Order_1050_1F.pdf
[43] FAA. April 28, 2006. Order 5050.4B. https://www.faa.gov/airports/resources/publications/orders/environmental_5050_4/

and service economies that are located along Route 128/Interstate 95. The four towns have undergone significant changes since 1970 when Hanscom Field accommodated over 300,000 operations (landings and takeoffs) per year. The combined population of the four towns remained steady between 1970 and 2007 but has seen a 0.7 percent compound annual growth rate (CAGR)[44] in the last ten years, as described in Table 4-2. Lexington has seen the greatest annual population growth of 1.1 percent, while Lincoln's population has decreased at an annual rate of 1.9 percent.

Table 4-2 Population Trends in Bedford, Concord, Lexington, and Lincoln

Town	1970	2007	2017	Compound Annual Growth Rate - CAGR (1970-2007)	Compound Annual Growth Rate – CAGR (2007-2017)
Bedford	13,513	13,074	14,197	-0.1%	+0.8%
Concord	16,148	17,712	19,237	+0.3%	+0.8%
Lexington	31,886	30,109	33,727	-0.2%	+1.1%
Lincoln	7,567	8,206	6,781	+0.2%	-1.9%
TOTAL	**69,114**	**69,101**	**73,942**	**0.0%**	**+0.7%**

Source: U.S. Census Data, 1970, 2007, and 2017

The Metropolitan Area Planning Council (MAPC) studied population projections in 2014 and considered a low and a high growth rate scenario for the Metro Boston area, based on population counts taken in 2010 (Decennial Census data).[45] As shown in Table 4-3, the 2017 cumulative population of the four towns has already reached the projected population under the high economic growth scenario for the year 2030 (MAPC projections are only provided for 2020 and 2030). Bedford's population in 2017 approximately matched the 2020 projected level, while Concord's population has surpassed the 2030 projection. Lexington's 2017 population is also near the 2030 projection, while Lincoln's is already higher. As the current population numbers indicate, the future population in the four towns will likely increase at a rate higher than projected by the MAPC in 2014. In the fall of 2018, MAPC launched a two-year planning process to update Greater Boston's regional plan. The UMASS Donahue Institute also continuously studies population projections in the state. The population estimates presented in Table 4-3 for 2025 and 2035 are based on 2010 U.S. Census Data reconciled to 2014 state population numbers. In these UMASS estimates, the 2025 projected population for the four towns is higher than the MAPC projection for 2030. The 2017 population for Concord has already exceeded the 2035 projection, but the other three towns' population trends are closer to the UMASS projections.

[44] The compound annual growth rate (CAGR) calculates a constant rate of growth for each year over the time period.

[45] Metropolitan Area Planning Council (MAPC): Population and Housing Demand Projections for Metro Boston, 2014

Table 4-3 Population Projections for Bedford, Concord, Lexington, and Lincoln

Town	2017 (Actual)	Metropolitan Area Planning Council (2014 Projection)		UMASS Donahue Institute (2015 Projection)	
		2020	2030	2025	2035
Bedford	14,197	14,157	15,329	15,248	16,458
Concord	19,237	17,878	18,354	18,166	18,022
Lexington	33,727	32,359	33,908	34,293	36,943
Lincoln	6,781	6,090	5,949	10,033	10,400
TOTAL	**73,942**	**70,484**	**73,540**	**77,740**	**81,823**

Source: U.S. Census Data - 2017, MAPC Population and Housing Demand Projection (data shown for 2020 and 2030 Stronger Region Scenario); UMASS Donahue Institute, updated March 2015

The MAPC forecast indicates that the number of housing units of the four towns will increase to 29,195 by 2020 and to 31,608 by 2030, as shown in Table 4-4. Based on actual housing data for 2017 obtained from the American Community Survey, the 2020 projection would require an average annual growth rate of 2.2% and the 2030 projection would require an average annual growth rate of 1.1%. The fastest growth is projected to occur in the Town of Bedford, and the slowest growth is projected in the Town of Lincoln.

Table 4-4 Housing Unit Projections for Bedford, Concord, Lexington, and Lincoln

Housing Units	2017 (Actual)	2020 (2014 Projection)	2030 (2014 Projection)
Bedford	5,260	5,959	6,612
Concord	7,327	7,559	8,143
Lexington	12,161	13,068	14,184
Lincoln	2,564	2,609	2,669
TOTAL	**27,312**	**29,195**	**31,608**

Source: American Community Survey – 2017, MAPC projection for 2020 and 2030 for Stronger Region Scenario - 2014

Bedford

The Town of Bedford approved a comprehensive plan in 2014.[46] The plan includes six key areas: land use; natural and cultural resources; economic development; transportation; housing needs; and services, facilities, recreation and energy. According to the plan, the town-controlled inventory of open space expanded by more than 200 acres since 2002, and hundreds of new dwelling units have been added. Approximately 95 percent of Bedford's area is developed land. Hanscom Field occupies approximately 645 acres in the Town of Bedford, including the areas on airport referred to as the North Airfield and East Ramp which are shown in Figure 4-2. The

[46] Bedford Planning Board. December 2013. *The Bedford We Want: Shaping Our Future, Comprehensive Plan*

U.S. Navy hangar located in Bedford on the North Airfield, was recently sold at public auction administered by the General Services Administration (GSA). New residential development projects have taken place on the northeast side of Hanscom Field, near Summer Street and South Road, and new residential, industrial, and retail projects have been added on the northwest side of Hanscom Field, near Hartwell Road. Additionally, the Route 3 corridor continues to feature new large-footprint developments with close proximity to the Airport. These new developments, paired with growing population, are contributing to road congestion.[47] Bedford's major job centers and corridors are highly automobile dependent, resulting in heavy traffic volumes during commute hours. Hanscom Field-related traffic is considered a minimal contributor to traffic volumes on Bedford roadways. See Chapter 6 for more information about traffic volumes.

Massport works through the Bedford Conservation Commission to address projects in or adjacent to regulated wetlands, such as the ongoing *Vegetation Management Plan* (VMP). In past years, Massport implemented multiple phases of the VMP in accordance with Bedford's and other Hanscom town Orders of Condition.[48] Phase I of the VMP was prepared in 2002 to guide the maintenance of protected airspace at Hanscom Field. The VMP was designed to serve as a guide for future airfield vegetation removal. An update to this VMP was published in 2008, titled *Hanscom Field 2009-2013 Vegetation Management Plan November 2008 Update*. The update included lessons learned from previous removal projects and associated maintenance projects implemented between 2003 and 2007. Massport submitted copies of the updated VMP to the four towns' conservation commissions as part of the permitting process that was completed in 2009.

The updated VMP identified obstructions in Bedford's Jordan Conservation Area (JCA). In 2010, the Bedford Conservation Commissions, Massport, and the Bedford Selectmen signed a Memorandum of Agreement (MOA) that allows Massport to periodically access the JCA for future vegetation management projects, subject to the Commission's review under the state's Wetlands Protection Act. As part of the MOA, Massport worked with Bedford to develop access to a trail system on Massport-owned parcels.

The Town of Bedford has also completed topic specific plans and studies subsequent to the 2014 Comprehensive Plan, which include the Pedestrian and Bicycle Master Plan in 2015, the Great Road Business District Assessment in 2016, and a brand-new Bedford Housing Study.

Concord

The Town of Concord adopted its comprehensive long-range plan, *Envision Concord*, in 2018.[49] The comprehensive plan includes analysis of historic resources, economic resources, housing,

[47] Metropolitan Area Planning Council (MAPC). 2013. *Burlington/Bedford Commuter Transit Analysis*.

[48] Massport. *The State of Hanscom, 2017 and 2018.*

[49] Town of Concord. July 2018. *Envision Concord – Bridge to 2030: Balancing Change with Tradition.*

land use and zoning, mobility and transportation, open space and natural resources, public facilities and infrastructure, and fiscal planning.

The Town aims to protect scenic quality and historical significance, as well as the rural character of its roads, such as Virginia Road (near the Pine Hill area). The report states that roadway congestion has increased in recent years due in part to increased use of navigational tools by commuters. Additionally, several federal offices are planning to relocate to Hanscom AFB. Among them, the U.S. Army Corps of Engineers (with 350 employees) is relocating from Virginia Road in Concord beginning in 2019.[50] To reduce automobile traffic, the town is exploring multi-modal transportation opportunities, particularly from transit hubs to work destinations. Discussions are ongoing with Hanscom AFB and other partners to develop shuttle service for first-mile/last-mile commute from Concord's train stations to work destinations.

Hanscom Field occupies 385 acres of land in Concord, about 2.3 percent of all land, including the areas referred to as Pine Hill, shown in Figure 4-2. Massport has worked through the applicable local processes to address environmental considerations in Concord, such as the VMP. Since the publication of the first VMP, Massport has conducted vegetation removal projects in accordance with Concord's Order of Conditions.

Lexington

The Town of Lexington is in the process of updating its comprehensive plan. This will be the first update since the publication of its *2003 Comprehensive Plan*.[51] An advisory board has been appointed to oversee the work, in consultation with Town staff and the Planning Board. As part of the planning process, the Town has already facilitated small group conversations with the public and presented updates on the Comprehensive Plan regarding demographics and housing trends. Additional sessions are planned on transportation and economic development. The new Comprehensive Plan is expected to take a few years to complete.

Given its proximity to Hanscom Field and the AFB relative to Metropolitan Boston, the Town of Lexington is focused on potential transportation impacts of Hanscom and works with Massport to attempt to mitigate impacts from proposed development and air travel, and to improve vehicle traffic safety at intersections that are high-accident locations. Lexington is currently reviewing its zoning in the manufacturing district at the end of Hartwell Avenue, on the east side of Hanscom Field.[52] Re-zoning of this area would allow for the development for higher density small-scale residential units, which could impact road traffic in the area. Hanscom Field occupies approximately one acre of land in Lexington. In Lexington, Massport has worked through the applicable local processes to address environmental issues. For example, Massport has implemented the VMP in accordance with Lexington's Order of Conditions.

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[50] Hanscom Area Towns Selectmen. Minutes from July 27, 2017 Meeting.

[51] Town of Lexington. *2003 Comprehensive Plan: The Lexington We Want 2002-2003.*

[52] Town of Lexington. Board of Selectman Meeting, 2017.

A relatively small area of land off the eastern end of Runway 11/29 is located within the Town of Lexington.

Lincoln

Lincoln is the smallest of the four Hanscom area towns in terms of population and economic base. Hanscom AFB and Hanscom Field comprise approximately 8.2 percent of Lincoln's land area, at approximately 544 and 241 acres, respectively. The passenger terminal area located within the area referred to as the West Ramp including the areas shown in Figure 4-2 comprises most of the land within the town of Lincoln on the airport.

The Town of Lincoln last published its comprehensive plan in 2009, with a second printing in 2010.[53] The plan presents issues, goals, and recommendations pertaining to the following sections: land use and zoning, natural resources, cultural and historic resources, the built environment, open space, housing, economic development, transportation and circulation, community services and facilities, and governance.

In Lincoln, Massport has worked through the applicable local processes to address environmental issues, such as the Order of Conditions on the VMP.

Hanscom Area Towns Committee Master Plan

The four towns surrounding Hanscom (Bedford, Concord, Lexington, and Lincoln) established the Hanscom Area Towns Committee (HATS) to review activities that involve Hanscom AFB, Hanscom Field and other major organizations that operate in the Hanscom Field area. These organizations include the U.S. Air Force, the NPS, Massport, Lincoln Laboratories, and other private corporations. Through HATS, the four towns coordinate their planning efforts, growth projections, land use plans, and environment protection roles. HATS prepared a Master Plan in July 1997, soon after the completion of the *1995 Generic Environmental Impact Report* (GEIR).[54] The Hanscom Field *ESPR* considers the *HATS Master Plan* as it applies to Hanscom Field.

Massport takes a comprehensive approach to managing airfield operations at Hanscom Field and protecting natural resources. Massport has implemented many recommendations of the Hanscom Noise Workgroup (a working group comprised of interested, knowledgeable members of the communities surrounding Hanscom Field), and is exploring Transportation Demand Management (TDM) strategies. Rideshare programs and other alternative transportation modes at Hanscom Field are challenging to implement due to the nature of work at the airport and employees working non-traditional hours (more details on TDM are described in Chapter 6). Massport has also periodically met with NPS to discuss issues of concern and to identify historic resources as described in Chapter 10 Cultural and Historical Resources.

[53] Town of Lincoln. 2009. Comprehensive Plan.

[54] Hanscom Area Towns Committee. July 1997. Hanscom Area Towns (HATS) Master Plan.

Similar to the *2012 ESPR*, the future planning scenarios in the *2017 ESPR* describe potential additional aviation and aviation-related uses on the airport and retain many areas in their current, natural state.

4.1.8 Stakeholder Planning Initiatives

In addition to the associated municipalities, Hanscom Field also has three key stakeholders who are central partners to Massport and the future of Hanscom Field: the FAA, MMHNP, and Hanscom AFB. Both the MMNHP and Hanscom AFB are located immediately adjacent to Hanscom Field. Activities proposed on the airfield and on their properties can have a direct impact on one another. As a result, Massport engages with the NPS and the USAF periodically to discuss mutually beneficial projects to improve each organization in accordance with their mission.

Federal Aviation Administration

Hanscom Field is under the purview of the FAA's New England Region whose regional office is located in Burlington, Massachusetts. The FAA participates as a stakeholder and is a central partner to Massport.

The FAA administers the Airports Improvement Program (AIP) that provides grants for planning and development projects, funded through user fees and fuel taxes. The FAA is also the operator of the ramp, ground, local, and departure/arrival air traffic through providing air traffic control and navigation services. Lastly, the FAA is the regulator of the airport and airspace system to ensure safe and efficient operations at public-use airports, including Hanscom Field.

Further, operational and infrastructure improvements require the FAA's review, as the lead agency responsible for compliance with NEPA regulations. The FAA aims to ensure timely and effective environmental reviews of proposed projects at Hanscom Field.

Minute Man National Historical Park

The MMNHP, created in 1959 and operated by the NPS, consists of three discontinuous parcels: Battle Road, Wayside, and North Bridge. This park covers approximately 967 acres spread out along Route 2A in Concord, Lexington, and Lincoln. The congressionally-approved boundaries of the MMNHP abut the southern boundary of Hanscom Field and include 48.5 acres of Massport property in the Runway 5 approach area.

The MMNHP is nationally significant as the site of the Battle of Concord, one of the first battles of the Revolutionary War, for its association with prominent literary figures of the 19th and 20th centuries, and as one of the earliest places in the nation to be commemorated.

The NPS reports that over a million people visited the MMNHP in 2016, the NPS's centennial year, and it anticipates that annual visitations will continue at current levels.[55] While the Park is open year-round, its main season is the 7-month period between April and October. Major attractions are the North Bridge area in Concord and Battle Road in Concord, Lexington, and Lincoln. Two parking lots at the North Bridge unit and one at the Visitor Center in the Battle Road unit accommodate automobile and bus parking; six other parking lots are located in the Park. Chapter 10 Cultural and Historical Resources provides additional information about the MMNHP.

The preservation of Battle Road, which makes up 80 percent of the Park, is of particular importance to the NPS. The potential impacts of transportation activity from Hanscom and Route 2A are important issues for the NPS. Working cooperatively with the local community, aviation groups and MMHNP, Massport has developed a noise abatement program for business, commercial, flight school and private aircraft. The implementation of 'Fly Friendly' flight pattern keeps aircraft closer to the airfield rather than over sensitive park areas. Prior to this initiative, most touch-and-go operations on Runways 11/29 and 5/23 circled to the south of the Airport, over areas of the Battle Road Trail that are used for outdoor programs and interpretive talks. In a partnership involving coordination with the NPS, the FAA, the flight schools, and the pilots at Hanscom, it was determined that small aircraft could reduce the flight pattern in touch-and-go operations that would provide a larger buffer between training operations and the Park. Additionally, Massport also developed recommended helicopter procedures to help reduce noise over the Park.

Other noise reduction efforts include regulations that prohibit touch-and-go activity between 11:00 PM and 7:00 AM. and touch-and-go activity for aircraft weighing over 12,500 pounds. There is also a fee for operations between 11:00 PM and 7:00 AM. In 2012, Congress passed the *FAA Modernization and Reform Act*[56], which included the phase out of all non-Stage 3 aircraft by the end of 2015. Review of airport use in the Hanscom Field 2016 Annual Noise Report determined that all civilian jets utilizing Hanscom Field have been modified to meet Stage 3 noise level requirements. [57]

Hanscom Field Advisory Commission

Massport meets with the Hanscom Field Advisory Commission (HFAC) monthly at the Civil Air Terminal to review activities at Hanscom Field. HFAC is an advisory committee that was established by the state legislature in 1980. It includes representatives from residential communities (Bedford, Concord, Lexington, Lincoln, and other towns in the area affected by Hanscom Field), business and general aviation groups, advisory members who represent

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[55] National Park Service. March 21, 2017. *Over One Million visit Minute Man National Historical Park in 2016.* https://www.nps.gov/mima/learn/news/over-one-million-visit-minute-man-national-historical-park-in-2016.htm,

[56] Public Law 112-95: FAA Modernization and Reform Act of 2012. 126 Stat. 11; Date 2/14/2012. Text from United States Public Laws. Accessed November 1, 2018 at https://www.congress.gov/112/plaws/publ95/PLAW-112publ95.pdf

[57] Massport. November 2017. *Hanscom Field 2016 Annual Noise Report.* http://www.massport.com/media/2632/2016-annual-noise-report.pdf

MMNHP, Hanscom AFB, the FAA, and Massport (the meetings are open to the residents of surrounding towns as well). Massport provides HFAC with information regarding Massport's goals, policies, and plans for its facilities in the future. Massport also reports on monthly and annual operations and noise statistics. The HFAC process affords the community the opportunity to review and comment on projects that are not subject to formal Massachusetts Environmental Policy Act (MEPA), or NEPA, review. Further, it provides the public an opportunity to comment on proposed projects and issues related to Hanscom operations.

Hanscom Air Force Base

Hanscom AFB, which is directly adjacent to Hanscom Field on the southern side of the airfield, occupies 846 acres of land with 4.1 million square feet of facilities. Hanscom AFB and the firms that do business at the base are important employers in the region. Over 10,000 employees work at the Base, which includes active duty, National Guard, civilian, contractor, and MIT Lincoln Laboratory personnel. There are also 731 homes on the Base, most occupied by Air Force personnel. Additionally, Hanscom AFB supports approximately 130,000 retired military personnel, annuitants and spouses living in the six-state New England area and New York area. According to information published by the Hanscom AFB, as of April 2018, the total estimated economic impact is approximately $6.03 billion per year.[58] Primary Hanscom jobs total 10,015 (including MIT Lincoln Laboratory), and secondary jobs total 10,050.

The USAF is spending about $225 million on construction at the Base and on two new buildings for the MIT Lincoln Laboratory. The USAF is constructing a new dormitory and renovating several other buildings. These renovations and investments will provide offices for 675 personnel who will commute to the Base once the construction ends; of these, 325 currently work in Boston and 350 currently work in Concord.

Construction of a relocated Vandenburg Gate, newly renamed as the Sartain Gate, commenced in 2018 and is ongoing. The USAF has been working with Massport and the Massachusetts Department of Transportation (MassDOT) on the design of the new gate structure and entrance facility that is planned to replace the one at the intersection of Old Bedford Road, Vandenberg Drive, and Hanscom Drive with a roundabout.[59] Along with the improvements to the roadways, a bicycle lane is also included in the design to increase safety of cyclists. As a result of traffic changes, the MBTA bus stop will also be relocated onto AFB property.

Metropolitan Area Planning Council Regional Plan

The MAPC is the regional planning agency for metropolitan Boston, representing 101 cities and towns. MAPC encourages sustainable development practices. The primary areas of focus

[58] Hanscom Air Force Base. April 2018. *Hanscom Air Force Base Fact Sheet.* https://www.hanscom.af.mil/About-Us/Fact-Sheets/Display/Article/379461/hanscom-air-force-base/

[59] U.S. Army Corps of Engineers, U.S. Air Force. 2014. *Environmental Assessment, Hanscom Air Force Base Vandenberg Gate Complex Construction.*

are land use, transportation, housing and economic development, climate and clean energy, public safety, and municipal administration. The most recent plan published by the MAPC is the MetroFuture in 2008.[60] In 2018, MAPC launched a new two-year planning process to develop an update to Greater Boston's regional plan, called MetroCommon 2050: Shaping our Region Together.[61]

The MetroFuture plan aims to make the lives of people who live and work in the Metropolitan Boston area better, between its publication and 2030. MetroFuture envisions a region where growth is focused in areas where it already exists and linked by an efficient transportation system; land and natural resources are conserved; investments are made in health and education; and opportunities are available to all residents of the region. Through this plan, MAPC has created demographic and economic projections of the region's future, including the four towns located adjacent to Hanscom Field. MetroFuture identified 65 "Goal Statements" that are specific to Metropolitan Boston, and not specifically applicable to Hanscom Field. Noteworthy goal statements that pertain to future planning at Hanscom are included in Table 4-5.

The current and future use of Hanscom Field is consistent with smart growth principles.[62] Table 4-6 presents MAPC's 15 Smart Growth principles and their relationship to Hanscom Field.

Table 4-5 Applicable Goals to Hanscom Field for Metropolitan Boston's MetroFuture's Goal Statements

Goal #	Goal Statement
1	Population and job growth will be concentrated in municipalities already well served by infrastructure, with slower growth in less developed areas where infrastructure is more limited.
36	Businesses will grow expeditiously thanks to consistent and predictable economic development policies set by an informed public sector.
37	A strong supply of educated and skilled workers—of all ages—will encourage businesses to locate and expand here.
44	An expanded transit system will provide better service to both urban and suburban areas, linking more homes and jobs.
46	Commuters will have more options to avoid congestion.
47	Most people will choose to walk or bike for short trips.
49	Outlying areas will see little increase in traffic congestion.

[60] Metropolitan Area Planning Council. 2008. *MetroFuture, Making a Greater Boston Region, Regional Plan.*
[61] Metropolitan Area Planning Council. 2018. *MetroCommon 2050.* https://metrocommon.mapc.org/
[62] According to the MAPC, smart growth includes "sound municipal management, sustainable land use, protection of natural resources, efficient and affordable transportation, diverse housing stock, public safety, economic development, clean energy, healthy communities, an informed public, and equity and opportunity among people of all backgrounds", https://www.mapc.org/aboutus/#missionsgp.

Goal #	Goal Statement
51	Regional transportation planning will be linked with sustainable land use planning.
52	The transportation system will be reliably funded and transportation agencies will demonstrate accountability to the public.
55	The region's businesses will access the global marketplace through an efficient freight transportation network.
Source: MetroFuture Goals and Objectives, MetroFuture, Making a Greater Boston Region, Regional Plan, Metropolitan Area Planning Council, 2008	

Table 4-6 MAPC Smart Growth Principles and their Applicability to Hanscom Field

Principle	Response/Applicability
1) Encourage community and stakeholder collaboration in development decisions.	Massport is engaged in on-going meetings and discussions with the four towns through the Hanscom Field Advisory Commission (HFAC).
2) Integrate people and place.	Not Applicable. This principle is oriented toward development within communities.
3) Promote regional equity and reduce local and regional disparities.	The presence of air travel at Hanscom Field offers a service for residents and businesses in the surrounding region who would otherwise be traveling greater distances to use a facility elsewhere.
4) Strengthen regional cooperation.	Massport is engaged in on-going community discussions through the Hanscom Field Advisory Commission (HFAC) process.
5) Promote distinctive, attractive communities with a strong sense of place.	The ESPR provides a comprehensive evaluation of the cumulative environmental effects of Hanscom Field and a retrospective analysis of changes at the airport. The ESPR process provides a framework to identify and plan for potential environmental effects at the airport and in the surrounding communities.
6) Preserve open space, farmland, and critical environmental resources.	Massport manages the environmental resources at Hanscom Field to address issues related to wetlands, watersheds, and drinking water supplies. In addition, Massport maintains open space/trails at Hanscom Field.
7) Encourage development in currently developed areas to take advantage of existing community assets.	Hanscom Field is an existing resource that is well served by existing infrastructure. Massport encourages any development at Hanscom Field in areas of previous development, where applicable.

Principle	Response/Applicability
8) Mix land uses.	Hanscom Field integrates a mix of land uses compatible with airport use, which in turn supports economic development around the airport and transportation demand management initiatives.
9) Take advantage of compact development design and create walkable neighborhoods.	Massport seeks to make effective use of existing impervious surface, utility systems and built areas at Hanscom Field. Wherever possible, new development is planned for previously developed areas.
10) Promote economic development in ways that produce jobs, strengthen low and moderate-income communities, and protect the natural environment.	Hanscom Field supports air travel needs of existing businesses in the region and provides jobs for area residents. Massport is a responsible manager of environmental resources at Hanscom Field. Massport requires third-party development as well as its own development at Hanscom Field to achieve the US Green Building Council's Leadership in Energy and Environmental Design (LEED) Certification.
11) Create a range of housing opportunities and choices in cities and towns throughout the region.	Not Applicable.
12) Promote more transportation choices through the appropriate development of land.	Hanscom Field satisfies a regional demand for air travel for people in the surrounding region who would otherwise be traveling greater distances to use a facility elsewhere.
13) Develop predictable, fair, and cost-effective regulatory approvals for smart growth-oriented developments.	Not Applicable.
14) Encourage fiscal policies that support smart growth.	Massport is guided by fiscal prudence with respect to plans for smart growth at Hanscom Field.
15) Enable smart growth by reforming existing zoning.	Not Applicable.

Source: MAPC, Smart Growth Principles for the Metropolitan Area Planning Commission, 2018

4.2 Airport Planning

This *2017 ESPR* includes a series of conceptual plans developed as options to meet potential future demand associated with the forecast of activity as described in Chapter 3 Airport Activity Levels. The planning concepts represent a vision of what could occur, not necessarily what will occur and they provide a basis for consideration of potential future environmental and operating impacts. These concepts place a priority on sustainable development including the reuse of existing facilities and developed land, fiscal prudence, and natural resource conservation.

4.2.1 Description of Existing Conditions & Planning Areas

As with earlier ESPRs, for the purposes of the *2017 ESPR*, Hanscom Field has been divided into planning areas based on geographic considerations, in order to facilitate the discussion of planning for future aviation-related facilities and the evaluation of the conceptual development scenarios.

Five planning areas in 2017 ESPR (shown in Figure 4-2):

- North Airfield
- Northeast Airfield
- East Ramp
- West Ramp
- Pine Hill

The FAA Airport Traffic Control Tower and apron, previously identified in the *2012 ESPR*, is now included as part of the East Ramp planning area in this ESPR. The Terminal Area, previously identified in the *2012 ESPR*, has been renamed the West Ramp in this ESPR.

Third-party developers undertake the majority of development at Hanscom Field. In preparing the ESPR and assessing locations for future development, Massport must consider a range of aviation compatible and non-aviation compatible development types. This requires Massport to identify a variety of sites capable of accommodating future development opportunities. To do so, Massport assesses areas at Hanscom Field that can be developed to meet all safety and security requirements with the fewest environmental impacts. This includes setting aside all land required by FAA per their safety regulations (e.g. runway safety areas, object free areas). The development areas that are evaluated within the ESPR provide market-driven development opportunities to third-party developers.

The *2017 ESPR* follows a similar planning method to the ones outlined in earlier ESPRs with a few differences. The *2005 ESPR* divided Hanscom Field into six planning areas: North Airfield, East Ramp, Terminal Area, Runway 5 Approach Area, Pine Hill, and West Airfield. The North Airfield area has been divided into two planning areas for the purpose of this ESPR (North and Northeast Airfields, west and east of Runway 5/23) and the Terminal area has become part of the West Ramp. Although the Runway 5 Approach and West Airfield Areas were included in the *2005 ESPR*, these areas had no aviation-related initiatives and facilities planned. Similarly, these two areas have been excluded from consideration for aviation-related facilities in this

ESPR and therefore they are not listed among the five planning areas. The *2012 ESPR* also divided Hanscom Field into six planning areas: North Airfield, East Ramp, Terminal Area, ATCT Apron, Pine Hill, and West Airfield. Pine Hill and West Airfield areas were provided for consistency with the *2005 ESPR*, but no new development was planned in these areas. The ATCT Apron was a new planning area identified in the *2012 ESPR*, which has been merged with the East Ramp planning area in the *2017 ESPR*.

North Airfield

The North Airfield encompasses property northwest of Runway 11/29, with a focus on sites accessible from Taxiway R. Currently, there is limited development on the North Airfield. Raytheon operated a 16-acre section on the eastern portion of North Airfield until 2000, the U.S. Navy currently owns this land. It includes two connected aviation hangars, and associated apron. In recent years, Massport had worked with the Government Services Administration (GSA) regarding a transfer of ownership for this property; however, in April 2018, this effort was discontinued. In February 2019, the Navy Hangar site was sold at public auction administered by the General Services Administration (GSA). The development of this land by third parties would be governed by state and local regulations, subject to FAA review. Edge Sports leases a portion of the North Airfield site north of Hartwell Road from Massport and two synthetic turf athletic fields were constructed in 2013 adjacent to their existing facility.

The North Airfield was also identified in the *2005 ESPR* as a future development area with a potential limousine garage planned for an airport tenant and additional GA facilities with parking spaces. The *2012 ESPR* also defined the North Airfield area as the property north of Runway 11/29, both west and east of Runway 5/23. Planned initiatives included new GA and corporate hangar facilities, at this time, reuse of the Navy Hangar would be by third parties.

Northeast Airfield

Massport leases a large portion of the Northeast Airfield to the USAF, known as Parcel B. The Northeast Airfield site also houses the FamCamp, a Recreational Vehicle (RV) campsite open to military personnel, including employees of Hanscom AFB. FamCamp offers a total of 73 RV sites, most equipped with water, sewer, and electric hookups. This area is primarily comprised of wooded open space on the airport property.

The Northeast Airfield was part of the North Airfield planning area in the both the *2005* and *2012 ESPRs*. No new facilities were planned east of Runway 5/23 (now called Northeast Airfield) in either of these ESPRs.

East Ramp

The East Ramp includes the apron and hangar facilities in the area southeast of the Runway 11/29 and Runway 5/23 intersection and properties previously identified as the Air Traffic Control Apron. Hartwell Avenue and the Shawsheen River in the Towns of Lexington and Bedford bound the East Ramp area on the east side. On the west, Taxiway S and the Air Traffic

Control Tower bound it. A mix of Hanscom AFB and Massport property hangars occupy the southern edge of the East Ramp. A Fixed Base Operator (FBO) occupies Hangars 1, 2, and 3 on Massport property. Additionally, the USAF Fire Department, an FBO fuel farm, the ARFF, the CBP trailer, and Massport's fueling facility are located in this area. Other facilities include sand storage, FAA equipment storage, and navigational aids.

The Airport Traffic Control Tower, Massport Field Maintenance, and ARFF occupy the western portion of the East Ramp. The CBP trailer plans to relocate from the eastern edge of the East Ramp to a new location just north of the Air Traffic Control Tower (as shown on Figure 4-5).

Massport does not have direct landside access to the East Ramp, as Hanscom AFB and other stakeholder properties surround it. Currently the USAF controls access through the AFB to the East Ramp for any non-military tenants wanting access to the East Ramp. Access is controlled through the AFB main gate on Vandenberg Drive and airside access occurs at a gate adjacent to Hangar 3.

The East Ramp area in the *2017 ESPR* is the same planning area that was described in the *2005 ESPR*, and it is the combined area of the East Ramp and ATCT Apron from the *2012 ESPR*. Both the *2005* and *2012 ESPRs* identified this area for new GA and corporate facilities with a possibility of providing alternative land side access. The *2005 ESPR* also recommended potential cargo facilities, while the *2012 ESPR* recommended the relocation of customs from this area.

West Ramp

The West Ramp includes properties previously identified as the Terminal Area. The Air Traffic Control Tower, on the west by Runway 5/23 and Virginia Road bound the West Ramp on the north, on the south by Old Bedford Road, and on the east by Hanscom AFB. Primary landside access is provided from Hanscom Drive and Old Bedford Road. Specific facilities located within the West Ramp include the Civil Air Terminal as well as supporting facilities, such as public parking, FBOs, flight schools, T-hangars, airport maintenance facilities, fuel farms, and several privately-operated facilities.

The *2005 ESPR* identified the West Ramp (then called Terminal Area) as a potential area for new GA facilities and a hotel with parking spaces. It also recommended relocating the T-hangars to the East Ramp. The *2012 ESPR* identified this area as the potential new home of the Air and Space Museum with additional GA and corporate aviation facilities.

Pine Hill

Pine Hill is located southwest of the Runway 11/29 and Runway 5/23 intersection and is served on the airside by Taxiway M. It is the narrowest planning area given the property boundaries and Taxiway M. Landside access is limited and provided from Virginia Road. It is primarily occupied by T-hangars and an FBO.

The *2005 ESPR* recommended new GA facilities including hangars and ramp, with parking spaces to be built in the Pine Hill area. No updates or new planned initiatives were provided in the *2012 ESPR*. The *2012 ESPR* included the Ross-Rectrix Aviation FBO facility as part of the Pine Hill planning area, which now exists on this site.

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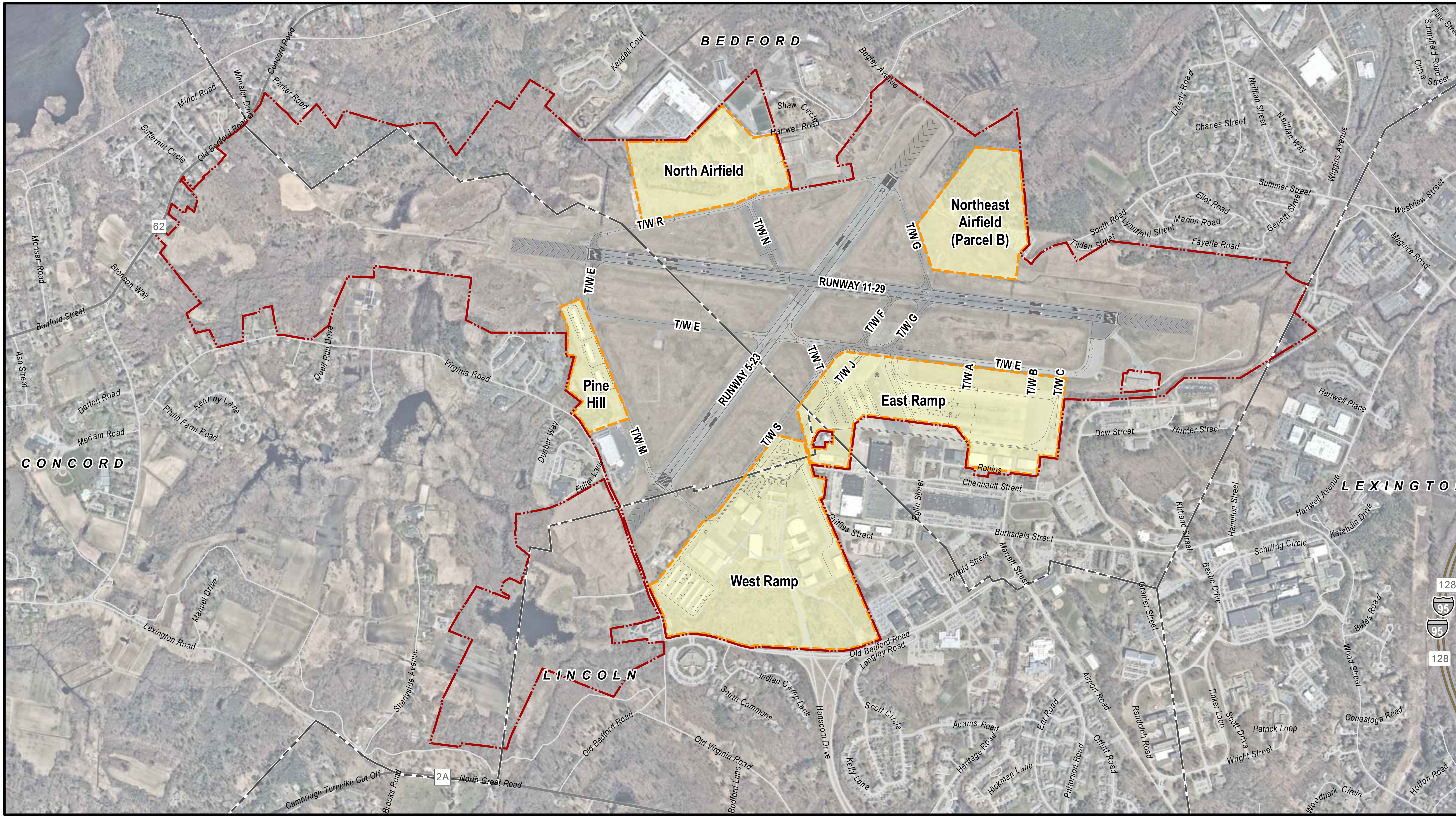

Hanscom Field Property Boundary
Planning Area
Municipal Boundary

Data Sources: Massport (ALP) October 24, 2017;
MassGIS (Roads, Rail), July 30, 2018;
MassGIS (Community Boundaries), July 30, 2018;
NearMap USA (Aerial) July 30, 2018

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Summary of Planning Areas

Figure 4-2

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4.2.2 Current Planning Initiatives

To inform the planning and site development processes, Massport reviews forecasts of future aviation activity and future operations by different types of aircraft (e.g. single engine piston, jet) to inform plans for airfield development. For example, runway length can be evaluated to determine if it is sufficient for future aircraft operations, and airfield geometry can be reviewed to ensure that the airfield meets the FAA standards for the critical aircraft operating on various portions of the airport. One near-term study Massport has planned, with close coordination with FAA, is a review of airfield geometry with the goal of mitigating the risk of runway incursions.

In addition to considering forecasts during the planning process, Massport promotes development of its facilities in sustainable manner and takes steps to minimize the environmental impacts of Hanscom Field. The ISO 14001 Certification of Hanscom Field recognizes Massport's progressive environmental program and policies, including Best Management Practices (BMPs), described in Chapter 11 of the ESPR. Massport supports the more efficient use of Hanscom Field within the broader context of growth management and sustainability.

Massport is a leader among Massachusetts agencies in promoting and implementing sustainable designs. New facilities at Hanscom Field must meet certain energy efficiency and sustainable design standards, and achieve the US Green Building Council's (USGBC) Leadership in Energy and Environment Design (LEED) Silver Certification.[63] In 2017, Jet Aviation's new Hangar 17 and FBO facility achieved LEED Silver certification. Boston MedFlight also expects to achieve LEED Silver certification for the re-developed Hangar 12A in 2019. Additional information on Massport's sustainable design standards can be found in Chapter 11 Sustainability and Environmental Management.

Finally, Massport has initiated a number of projects since the *2012 ESPR* including the rehabilitation of existing apron and runway pavements, third-party redevelopment of Hangar 17 and Hangar 12A, and various other maintenance activities at Hanscom Field. Massport will continue to describe planned and potential projects in this and forthcoming ESPRs.

4.2.3 Facility & Infrastructure Requirements

The forecasts of aviation activity levels discussed in Chapter 3 Airport Activity Levels, project the majority of the operational growth at Hanscom Field to be related to the business aviation segment of the market. Conversely, personal and single engine piston flying have declined and are expected to continue to do so during the forecast period.

Facility requirements are derived, in part, from the number of based aircraft expected to be located on the airport, which are projected in Chapter 3. Based on a 2017 survey, 350 aircraft

[63] LEED is an internationally recognized green building rating system that is credit-based, with different certification levels awarded depending on number of credits achieved. More information at https://new.usgbc.org/leed.

are based at Hanscom Field. This is an increase from 2012 when there were 272 based aircraft. A breakdown of the aircraft types is provided in Table 4-7. Using the forecast growth of each aircraft type, a based aircraft projection for 2025 and 2035 is provided. Business aviation based aircraft are expected to grow in alignment with the operations forecast.

Table 4-7 Existing and Forecast Based Aircraft

Aircraft Type	Existing 2017	Forecast	
		2025	2035
Single Engine Piston (SEP)	191	178	195
Single Turboprop	17	23	31
Multi Engine Piston (MEP)	21	21	23
Multi Engine Turboprop	12	16	22
Jet	93	118	153
Helicopter	16	19	23
TOTAL	**350**	**376**	**447**

Source: 2017 data is based on Massport records provided in 2018; forecast data is from InterVISTAS, 2018.

T-Hangar occupancy was reviewed to determine the future facility needs for single engine piston aircraft. Current occupancy of the 110 stalls serving the nine existing T-hangars is nearly 100 percent. In addition, corporate and FBO hangar occupancy was evaluated. The three FBOs at Hanscom Field, which store primarily jets, also reported nearly 100 percent occupancy. The three corporate hangars located on the East Ramp, West Ramp, and Pine Hill are nearly 100 percent occupied with jet aircraft as well. In the recent past, the FBOs on the Airport have been turning away customers that are seeking aircraft storage space. These capacity constraints result in additional aircraft operations at Hanscom Field as aircraft must be ferried from FBOs at other airports in order to serve customers at Hanscom. An arrival and departure operation instead result in two arrivals and two departures.

Based on the occupancy and fleet mix, the facility requirements project a continued capacity shortfall for corporate and FBO hangar space. Further, T-Hangars A, B, and C have reached the end of their useful life and construction of replacement hangars will be completed in 2019. No additional capacity for T-hangars or tie-down is expected in 2025, but existing hangars will be replaced or relocated as they reach the end of their useful life.

New corporate and FBO hangars must be capable of accommodating jets as well as turboprops. Given the proposed fleet mix, approximately 7,500 square feet of hangar area is required per aircraft. With the expected growth in based aircraft of 25 business jets and six turboprops in 2025, approximately 210,000 square feet of hangars would be required. Between 2025 and 2035, projected growth of ten business jets and eight turboprops results in the need for an additional 120,000 square feet of hangars by 2035.

4.2.4 Development Sites to Meet Demand

This section describes the characteristics of the potential future planning concepts for the 2025 and the 2035 scenarios. Figure 4-2 illustrates the potential development opportunity areas at Hanscom Field.

The planning concepts considered provide flexibility to respond to the anticipated variability of future demand in a coordinated fashion. The concept layouts are shown for illustrative purposes only and are expected to evolve over time. Detailed environmental analyses would be required for projects that move from conceptual planning to the proposal stage whenever MEPA, NEPA or other regulatory thresholds are triggered. However, because third-party developers complete most new development at Hanscom Field, Massport's planning is programmed to be flexible and able to respond to changing conditions and regional demands.

Future airport planning concepts are based on:

- **The facility requirements described in this chapter, based on the forecasts of aviation activity level discussed in Chapter 3 Airport Activity Levels;**
- **Infrastructure condition described in Chapter 2 Facilities and Infrastructure; and**
- **Market and industry forces and disrupters that shape and alter demand for airport facilities and infrastructure.**

The following discussion of development sites presents a general context for the future planning of potential general aviation facility development. The array of general aviation hangars identified in Table 4-8 exceeds the expressed facility requirements in Section 4.2.3 for aircraft storage for both the 2025 and 2035 scenarios, while providing a range of potential development options. Providing for a range of development accounts for the inherent uncertainty with future general aviation demand, and allows Massport to facilitate general aviation hangars as demand materializes. The concepts for the Hanscom Field planning areas provide a basis to evaluate the range of cumulative environmental impacts of these potential development options under the 2025 and 2035 scenarios. Table 4-8 summarizes potential planning concepts for the 2025 and 2035 scenarios for each of the areas on the airport.

General approach to identifying development sites in each of the four planning areas:

- **Infilling development in the West Ramp, specifically the terminal area, which has existing infrastructure to support new general aviation facilities;**
- **Reusing previously developed areas in the North Airfield Area that utilize the northern edge of the airport;**
- **Optimizing Pine Hill facilities given limited available geometry of this area; and**
- **Accommodating aviation-related facilities on the East Ramp, which includes maximizing the use of the existing apron area.**

Table 4-8 Hanscom Field Planning Concepts for 2025 and 2035

Planning Area	2017 Existing Uses	2025 Scenarios (2017-2025)	2035 Scenarios (2026-2035)
North Airfield	Currently vacant	General aviation (GA) hangars with aircraft parking utilizing existing impervious surface where possible; T-hangars and corporate hangars.	Additional corporate hangars
Northeast Airfield	Currently vacant	None	Development reserve on Parcel B site, upon reversion to Massport.
East Ramp	General aviation, including FBO and fueling facilities	GA hangars with new aircraft parking spaces; Expansion of GA facilities and upgrading or replacement of existing GA hangars; Expansion of the airport maintenance facility and corporate hangars.	Corporate hangars with new aircraft parking spaces; Alternative landside access; Further expansion of the airport maintenance facility.
West Ramp	General aviation, including FBO and T-hangars; Civil Air Terminal	Upgrading or replacement of corporate hangars with new aircraft parking spaces; Salt storage facility relocation; Civil Air Terminal enhancements.	New corporate hangars; Civil Air Terminal enhancements; New and replacement structured public parking spaces as needed; Strategic development reserve along Hanscom Drive (e.g., office, hotel, museum).
Pine Hill	General aviation, including T-hangars and FBO	Corporate facilities with new aircraft parking spaces.	Additional corporate facilities (on former Draper labs site).

North Airfield

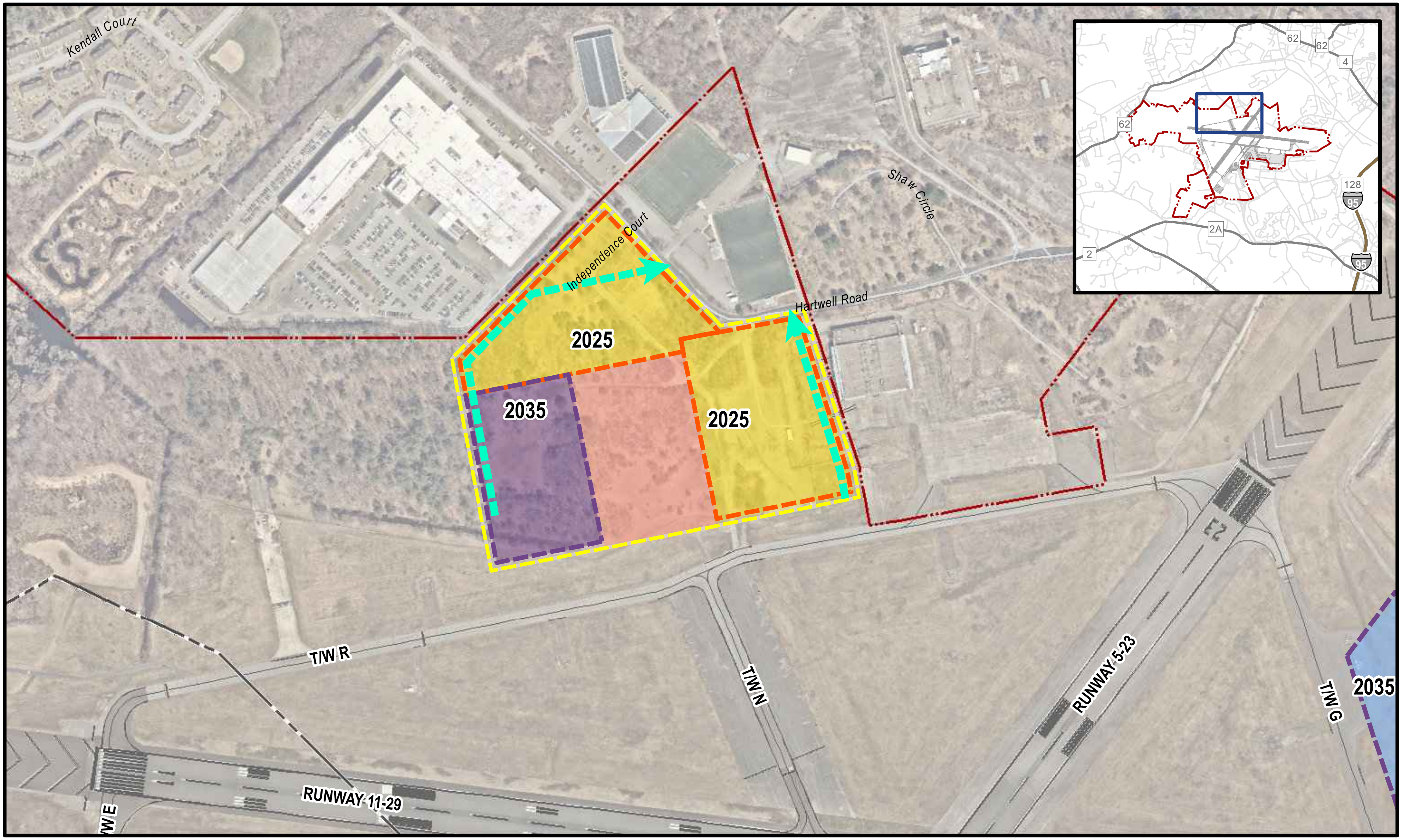
Figure 4-3 illustrates 2025 and 2035 planning concepts for the North Airfield. North Airfield concepts include new GA and corporate hangar facilities, primarily along Taxiway R and Hartwell Road. The development site is approximately 15 acres and also bordered by the U.S. Navy Hangar to the east. As of March 2019, the Navy Hangar site was sold at public auction administered by the General Services Administration (GSA). The development of this land by third parties would be governed by federal, state and local regulations.

Multiple corporate hangars could be accommodated in the 2025 scenario just west of the U.S. Navy Hangar. In addition, T-hangars will be demolished on the Pine Hill site, replacement T-hangars are planned to be constructed between Hartwell Avenue and the Instrumentation Laboratory. This site makes use of existing impervious surfaces and will avoid wetlands. In 2035, additional hangars could be constructed adjacent to the wetlands, just west of the proposed 2025 development. To prepare for future development on this site, an Environmental Assessment for development of aviation facility projects on the North Airfield was completed in September 2018. This EA and the subsequent Finding of No Significant Impact (FONSI) by the FAA found that proposed developments were consistent with national policies and other applicable environmental requirements and they will not affect the quality of the human environment. According to the EA, the North Airfield planned development area would be able to accommodate up to 165,000 square feet of new hangar space and associated administrative offices.

In February, 2018, Massport issued a Request For Proposals (RFP) for hangar development in the North Airfield area. Due to the relocation of the Pine Hill T-hangars to the North Airfield, Massport reserved approximately 55,000 square feet of space that is not available for other hangar development. As a result, approximately 110,000 square feet of hangar development remains available.

Northeast Airfield

Figure 4-4 illustrates 2025 and 2035 planning concepts for the Northeast Airfield. U.S. Air Force Parcel B, located adjacent to Taxiway G, should be preserved for future aviation or aviation compatible use in the 2035 planning scenario. Massport owns this property and leases it to the USAF. The lease is expected to expire in 2027. Landside access would be provided from South Road and airfield access would be provided from Taxiway G. This site is isolated from the other developments on the airport and would also require clearing of the FamCamp RV campsite.



North

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Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; NearMap USA (Aerial) July 30, 2018

- 2025 Planning Scenario
- 2035 Planning Scenario
- Apron Development
- Hangar Parcel Development
- Aviation Compatible Development Parcel
- Proposed Roadway
- Hanscom Field Property Boundary
- Municipal Boundary
- Development Areas

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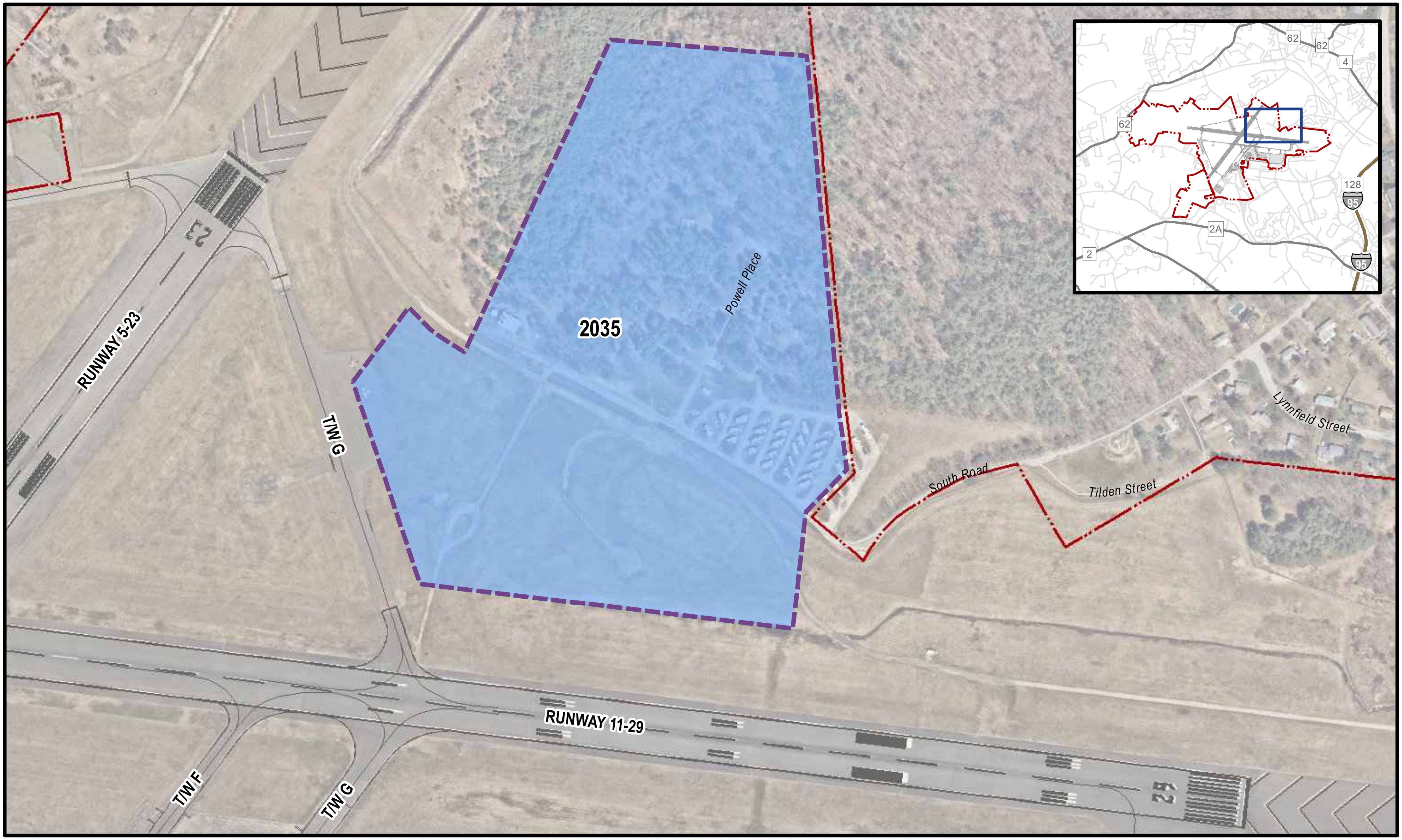
North Airfield Planning Concepts

Figure 4-3



North

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2025 Planning Scenario
2035 Planning Scenario
Apron Development
Hangar Parcel Development
Aviation Compatible Development Parcel
Proposed Roadway

Hanscom Field Property Boundary
Municipal Boundary

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; NearMap USA (Aerial) July 30, 2018

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Northeast Airfield (Parcel B)
Planning Concepts

Figure **4-4**

East Ramp

Figure 4-5 illustrates 2025 and 2035 planning concepts for the East Ramp. The concepts include proposed GA and corporate hangar facilities along with reconfigured aircraft access from Taxiway E and a possible landside connection that would not require controlled access through the Hanscom AFB. The East Ramp is a suitable site for hangar development because the apron, taxiway, and utility infrastructure are already available.

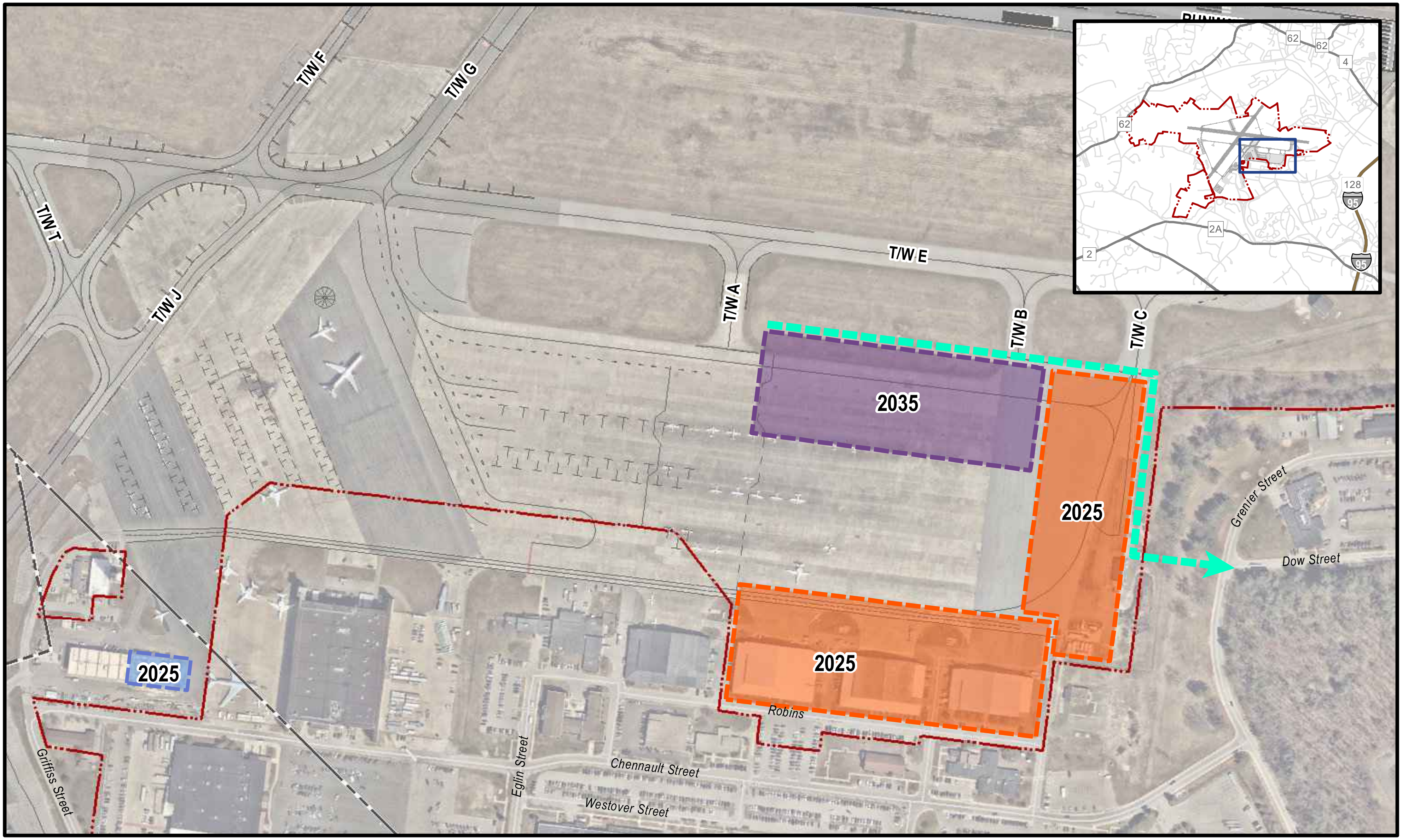
Recent development has already occurred near the ATCT. New ARFF facilities and U.S. CBP facilities are under construction just north of the ATCT. The field maintenance facility, currently located just south of the ATCT, is proposed to be expanded before 2025. Accordingly, there are limited opportunities to expand on this western portion of the East Ramp beyond the proposed projects.

The relocation of the U.S. CBP facility opens the eastern edge of the East Ramp for aviation development. Apron frontage along the eastern edge of the apron could provide hangars totaling approximately 60,000 square feet. Additional hangars could be constructed on the northeast corner of the East Ramp in the 2035 scenario, but this development scenario would require the closure of Taxiway C and the widening of Taxiway B to accommodate the Aircraft Design Group (ADG) Group IV (e.g. Boeing 757) aircraft that often use the ramp. Taxiways A and G would continue to provide access to the East Ramp. Landside roadway access from Grenier Street and utility infrastructure would have to be constructed to provide access to any development on the northeast corner of the East Ramp. Airside access for existing FBOs on the West Ramp would remain as is.

There is also the potential opportunity for renovation of the Hangars 1, 2, and 3 located on Massport property. These hangars could be expanded by building additional depth toward the north. Limited expansion opportunities are available to the south for these existing hangars, however, due to the property line bordering Hanscom AFB.

Any development along the East Ramp would need to be coordinated with both the line of sight from the ATCT as well as the Federal Regulation Title 14 Part 77, Safe, Efficient Use and Preservation of the Navigable Airspace (FAR Part 77) imaginary airspace surfaces emanating from Runway 11/29. Neither the surfaces nor the line of sight requirements is likely to present a considerable constraint to aviation development on the site.

As discussed in the description of the planning areas, the East Ramp does not have direct landside access without passing through the AFB and its multiple layers of security vetting and credential checks. Future access to the East Ramp could include escorted travel from a point near the Civil Air Terminal, through the Hanscom AFB, or via a new roadway connection from Hartwell Avenue. Potential alignments for direct access between Hartwell Avenue and the East Ramp are provided in Chapter 6; these alignments have been presented in previous ESPRs dating back to 2000.



North

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2025 Planning Scenario
2035 Planning Scenario
Apron Development
Hangar Parcel Development
Aviation Compatible Development Parcel
Proposed Roadway

Hanscom Field Property Boundary
Municipal Boundary

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; NearMap USA (Aerial) July 30, 2018

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East Ramp Planning Concepts

Figure **4-5**

West Ramp

Figure 4-6 illustrates 2025 and 2035 planning concepts for the West Ramp, which focuses on the terminal area off Hanscom Drive. West Ramp concepts include possible corporate hangar facilities, improvements in and around the passenger terminal, as well as strategic reserve areas located along the main entrance roadway corridor to the terminal area. Non-aeronautical development within the strategic reserve area could include offices, hotels, museums or other commercial opportunities, as have been mentioned in the *2005* and *2012 ESPRs*.

Within the terminal area, several development opportunities exist. More specifically, expansion or redevelopment of the hangars on the east side of Hanscom Drive is possible to optimize the site. With increased demands in the terminal area, especially if scheduled commercial service returns during the planning period, alternative parking sites should be identified. Relocating the salt storage facility from the south end of the existing parking lot to a site near the Hanscom Drive and Vandenberg Drive intersection would improve environmental controls and allow for replacement of surface parking facilities adjacent to the new Jet Aviation Hangar. As demand warrants in the longer-term 2035 scenario, structured parking may be required adjacent to the Civil Air Terminal. In the 2035 scenario, additional general aviation hangars are possible with redevelopment of the T-Hangar area.

Property along the southern edge of Hanscom Field, along Old Bedford Road and Vandenberg Drive should be maintained as strategic reserve for future aviation compatible use. Several wetlands exist in these parcels, so the specific parameters of development would have to be further evaluated to avoid, minimize or mitigate any potential environmental impacts. In addition, Hanscom AFB is relocating its main gate on Vandenberg Drive. The relocated gate is proposed to the west of the current location, just before Hanscom Drive. The new gate limits landside access to the future development sites on the west side of the southern edge of Hanscom Field, but access to Hanscom Field would be maintained via Hanscom Drive.

Pine Hill

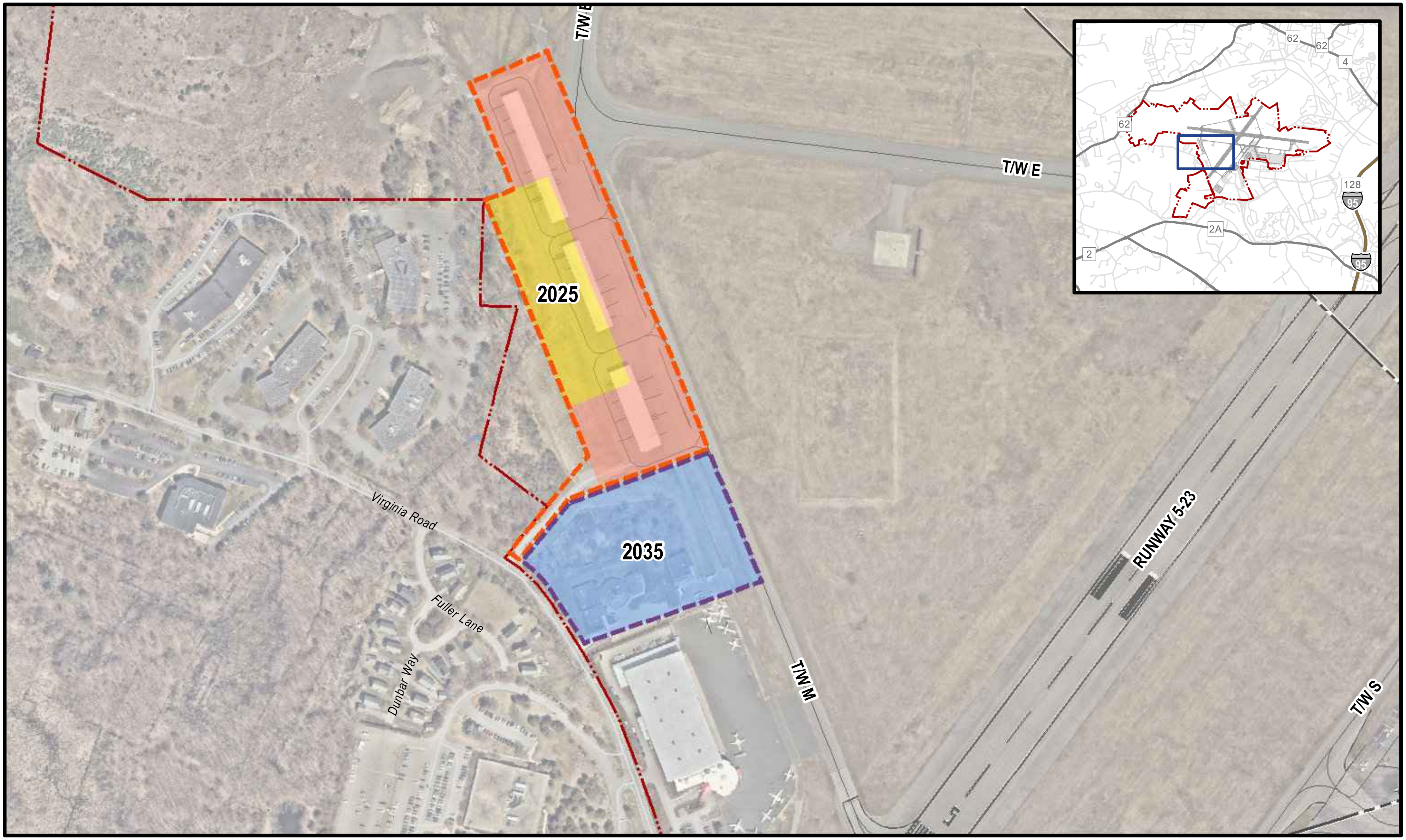
Figure 4-7 illustrates the 2025 and 2035 planning concepts for the Pine Hill development site. Pine Hill was reevaluated in the 2005 and 2012 ESPRs, and recent third-party interest has introduced changes to the future recommendations on Pine Hill. The development area on Pine Hill consists of just over 10 acres, currently encompassing the three T-hangars north of Hangar 24.

As part of the recent Hanscom Aviation Facility Improvement project, the T-Hangars are to be moved to the North Airfield which would open up over 100,000 square feet of general aviation development space, as indicated in the September 2018 Environmental Assessment submitted to FAA.[64] The FAA issued a Finding of No Significant Impact (FONSI) on September 25, 2018. The Pine Hill development area is narrow and bordered by Middlesex Green office complex on

[64] Massport. September 2018. *L.G. Hanscom Field Aviation Facilities Improvements Project, Environmental Assessment.*

the west and Taxiway M on the east. Vehicle access would occur from Virginia Road as it does today. The depth of any proposed hangars would need to be compatible with the Taxiway M object free area, which is depicted on the ALP described in Section 4.2.2.

The site immediately to the south, currently occupied by Draper Laboratory, should be preserved for future aviation or aviation compatible use in the 2035 planning concept.



Data Sources: Massport (ALP) October 24, 2017;
MassGIS (Roads, Rail), July 30, 2018;
MassGIS (Community Boundaries), July 30, 2018;
NearMap USA (Aerial) July 30, 2018

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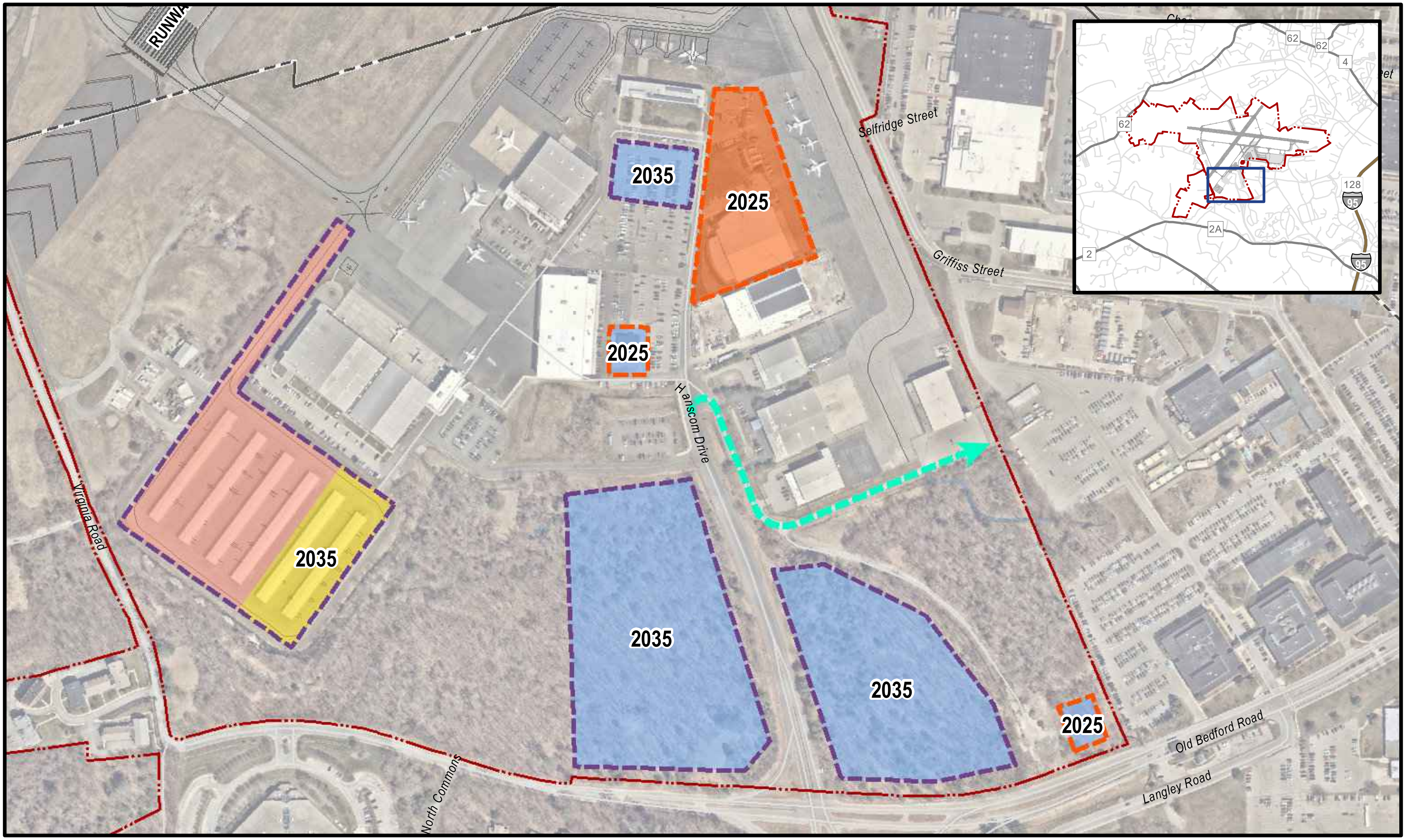
Pine Hill Planning Concepts

Figure **4-7**



North

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2025 Planning Scenario

2035 Planning Scenario

Apron Development

Hangar Parcel Development

Aviation Compatible Development Parcel

Proposed Roadway

Hanscom Field Property Boundary

Municipal Boundary

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; NearMap USA (Aerial) July 30, 2018

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West Ramp Planning Concepts

Figure **4-6**

4.2.5 Five-Year Capital Improvement Program

Massport's five-year capital improvement program spanning from FY18 to FY23 contains various projects such as T-hangar replacement, ARFF and CBP facility relocation, taxiway and apron pavement rehabilitation, and new equipment as identified in Table 4-9. Massport would file an EIR for the projects in the capital improvement program at Hanscom Field requiring MEPA review; however, as shown in Table 4-9, none of the projects in the five-year plan are anticipated to require such review.

Table 4-9 Current Hanscom Field Planning Initiative Projects

Planning Area	Current Planning Initiatives/Projects	Timing	MEPA Review	NEPA Review[1]
North Airfield	Rehabilitation of Taxiway R	FY20	None anticipated	CatEx[2] unless extraordinary circumstances exist
	Rehabilitation of Taxiway N	FY21	None anticipated	CatEx unless extraordinary circumstances exist
	Replacement T-Hangars from Pine Hill	FY19	None anticipated	EA Aviation Facilities Improvement Project, Sept. 2018
	New corporate hangars	FY18-19	None anticipated	EA Aviation Facilities Improvement Project, Sept. 2018
East Ramp	Joint Repair	FY18-20	None anticipated	CatEx unless extraordinary circumstances exist
	Pavement Rehabilitation	FY19	None anticipated	CatEx unless extraordinary circumstances exist
	Rehabilitation of Taxiway B		None anticipated	CatEx unless extraordinary circumstances exist
	New ARFF and CBP Facilities	FY18-20	None anticipated	CatEx Issued
	Hangars 1, 2, and 3 Feeder and Distribution System Replacement	FY18	None anticipated	CatEx unless extraordinary circumstances exist
West Ramp	Old T-Hangar Replacement, Rows A, B, C	FY18-19	None anticipated	CatEx unless extraordinary circumstances exist
	Civil Air Terminal Stormwater/ Drainage Improvements	FY18-19	None anticipated	CatEx unless extraordinary circumstances exist
	Relocation of Salt Storage Facility	FY18-19	None anticipated	CatEx unless extraordinary circumstances exist
	Rehabilitation of West Ramp Pavement	FY18	None anticipated	CatEx unless extraordinary circumstances exist

Planning Area	Current Planning Initiatives/Projects	Timing	MEPA Review	NEPA Review[1]
West Ramp (cont)	Potential FBO Redevelopment		None anticipated	CatEx or EA
	Potential Hangar Redevelopment		None anticipated	CatEx unless extraordinary circumstances exist
Pine Hill	T-Hangar Relocation	FY19	None anticipated	EA Aviation Facilities Improvement Project, Sept. 2018
	New Corporate Hangars	FY18-FY19	None anticipated	EA Aviation Facilities Improvement Project, Sept. 2018
Other	Replacement of Airfield Perimeter Fence	FY19-FY20	None anticipated	CatEx unless extraordinary circumstances exist
	Rehabilitation of Runway 5/23	FY23+	None anticipated	CatEx unless extraordinary circumstances exist
	Airfield Equipment Replacement	Ongoing	None anticipated	CatEx unless extraordinary circumstances exist
	Electrical Infrastructure	FY18-21	None anticipated	CatEx unless extraordinary circumstances exist
	Fire Protection Infrastructure	Ongoing	None anticipated	CatEx unless extraordinary circumstances exist
	Hanscom Airfield Lighting Control System	FY18	None anticipated	CatEx unless extraordinary circumstances exist

Note:
1. NEPA requirements described in FAA Order 1050.1F and FAA Order 5050.4B
2. CatEx = Categorical Exclusion; EA = Environmental Assessment.
Source: Massport, *The State of Hanscom*, April 2018

4.3 Analysis of Future Utilities

As with any airport, utilities are required to support the infrastructure and local tenants, including: potable water; sanitary sewer; stormwater infrastructure; electricity; natural gas; and telephone and communications. This section presents the potential changes in utility infrastructure that would be needed to serve the 2025 and 2035 development scenarios. In general, any improvements and new facilities specified in the 2025 and 2035 scenarios would require new connections and maintenance of the existing utility system; however, the current system capacity is expected to be sufficient to serve the proposed facilities. Further, given the volatility of historical utility data, it is not possible to produce a reasonable forecast of future utility demand. More specifically, trend analysis is not possible given wide fluctuations in the annual data, particularly with respect to water and sanitary sewer flows. Historical relationships cannot be established and independent variables are not available to enable regression analysis. That said, it can reasonably be expected that electricity usage will continue to be relatively stable in future years as the range of daily demand has remained steady between 5,000 and 6,000 kWh for the last eleven years. Similarly, natural gas daily demand has averaged 58 therms[65] for the previous 11 years, ranging between 36 and 56 therms for the most recent five years.

4.3.1 Water Supply and Demand

In the *2005* and *2012 ESPRs*, water demands were estimated for 2010 and 2020 based on existing conditions in 2005 and the projected development scenarios. In 2005, the reported total average daily water demand was 34,800 gallons, which served as a baseline for future projections. The 2010 projection ranged from 44,100 gallons to 48,000 gallons, while the 2020 projection ranged from 59,200 gallons to 66,900 gallons. In recent years, however, water use has stayed well below both the 2005 demand and the 2010 projection. Between 2007 and 2017, the total average daily water demand fluctuated between a maximum of 24,370 gallons and a minimum of 7,570 gallons, as shown in Figure 4-8. As noted in the figure, several months of water usage were not available.

Water demand has stayed below earlier ESPR projections, possibly due to a decrease in the number of aircraft operations at Hanscom Field. There were approximately 170,000 operations in 2005, but only 129,000 in 2017. The future operations forecast predicts 132,000 operations in 2025, and 139,000 in 2035, both of which are below the number of operations observed in 2005 and the projected operations for the 2010 and 2020 scenarios.

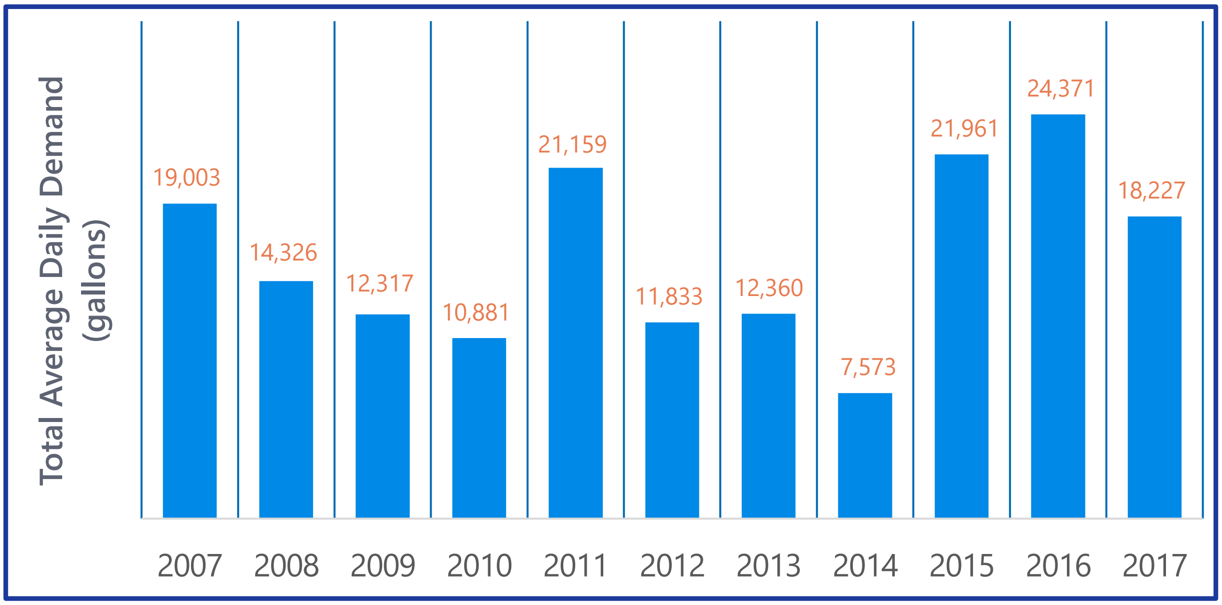
The development scenarios evaluated in this *2017 ESPR* are of similar nature and size as the proposed improvements in the *2012 ESPR* with a few notable exceptions. The number of based aircraft is forecast to grow at a slightly higher rate than predicted earlier. The *2012 ESPR* projected 360 based aircraft in 2020 and 416 in 2030. The *2017 ESPR* forecasts 376 based

[65] Therm is a unit of heat equal to 100,000 British thermal units, or BTUs.

aircraft in 2025 and 447 in 2035. The based aircraft growth focuses on business jets, requiring hangar space. Further, some projects documented in the *2012 ESPR* are not currently under consideration by Massport, e.g. the Air and Space Museum originally slated for the northeastern corner of Hanscom Drive and Old Bedford Road/Vandenberg Drive intersection. Moreover, the National Aviation Academy no longer operates a training facility at Hanscom Field, which has also contributed to lower water usage.

Based on the existing water use, available system flow capacity, and the projected development scenarios, the existing water systems are sized to supply potable water flows required for each of the future growth scenarios. Potential new facilities in undeveloped areas would tie into the existing water lines.

Figure 4-8 Hanscom Field Water Usage, 2007-2017



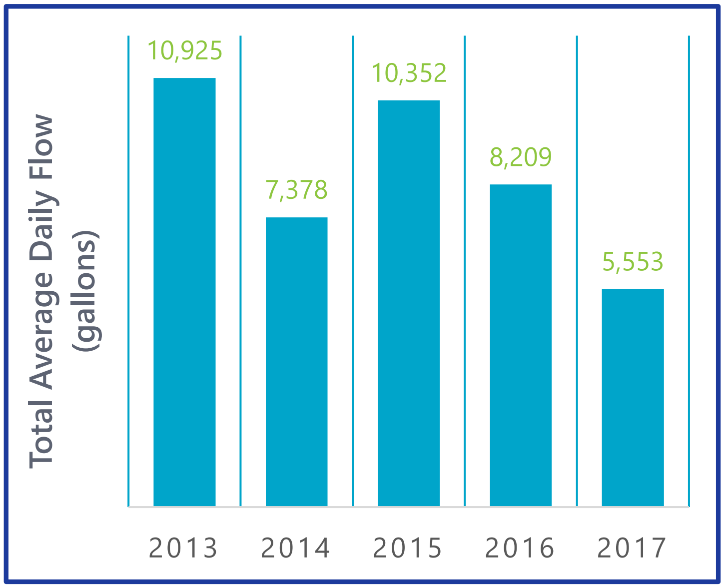
Note: Data unavailable for 3/2010, 3/2011, 10/2011, 5/2013, 8/2014, 8/2015, 8/2016
Source: Hanscom utility Data 2007-2017, Massport, 2017

4.3.2 Sanitary Sewer System

Wastewater generation in recent years has stayed below the levels analyzed in the *2005* and *2012 ESPRs*. The total average daily flow in 2005 was 27,800 gallons per day, with future projections of 35,300 to 38,400 gallons in 2010 and 47,400 to 53,500 gallons in 2020. The greatest wastewater generation total experienced in the last five years was approximately 11,000 gallons per day in 2013, while only 5,600 gallons were generated in 2017, as shown in Figure 4-9.

The existing on-site wastewater system is expected to have the capacity to accommodate the projected growth scenarios in the *2017 ESPR*, which are lower than the future projections in the *2012 ESPR*. Potential new facilities would tie into the existing sewer lines. If additional capacity becomes necessary, options could include obtaining additional capacity to discharge to the Massachusetts Water Resource Authority system, mitigating increases through on-site measures such that the peak pumping rate does not exceed the fore main capacity, and/or constructing on-site septic systems meeting Title 5 requirements.[66]

Figure 4-9 Hanscom Field Wastewater Generation, 2013-2017



Source: Historical Water & Sewer Volumes 2013-2017, Massport, 2017

4.3.3 Stormwater Management and Drainage System

Since the *2012 ESPR*, approximately 9.2 acres of impervious surfaces were removed that included the Runway 11/29 shoulders, pavement at the end of Runway 5, and blast pad/stopway pavement at the end of Runway 23. Over the same time, approximately 2.3 acres of impervious areas were added as the result of Jet Aviation's new Hangar 17 and FBO facility, and the construction of the Taxiway G run up area. These changes resulted in a net removal of 6.9 acres of impervious surfaces between 2012 and 2017, as shown in Table 4-10. It is estimated that if the 2025 scenario were implemented in full, approximately 8.7 acres of new impervious surfaces could result. The 2035 scenario could add as much as an additional 56 acres for a total of approximately 64.7 acres of new impervious surfaces compared to 2012. Massport remains committed to offsetting some or all of the pavement addition on the field wherever it's practical to do so. For example, in the North Airfield EA the preferred alternative was identified in part to minimize new impervious surfaces on the airport.[67]

[66] Massachusetts Department of Environmental Protection (DEP). 2018. *Title 5/Septic Systems Policies and Guidance.*
[67] Massport. September 2018. *L.G. Hanscom Field Aviation Facilities Improvements Project, Environmental Assessment.*

Table 4-10 Potential Changes in Impervious Surface (Acres) in 2025 and 2035 Scenarios

Planning Area	2025 Scenario (acres)	2035 Scenario (acres)
North Airfield	12.5	2.5
Northeast Airfield (Parcel B)	-	To be determined[2]
East Ramp	0.3	1.0
West Ramp	0.5	17.2
Pine Hill	2.3	2.3
Total increase/(decrease)[3]	**15.6**	**23.0**
Change since 2012 ESPR	(6.9)	(6.9)
Total increase/(decrease) since 2012	**8.7**	**31.7**

Notes:
1. Changes since 2012 include Runway 11/29 shoulder removal, and new impervious areas created by the vehicle parking areas associated with Jet Aviation's new Hangar 17 and FBO facility, as well as the addition of Taxiway G run-up area near Runway 23.
2. Development plans have not yet been determined.
3. Total acres dependent on future plans for the Northeast Airfield area.

The potential new development projects in the 2025 and 2035 scenarios would be designed to meet the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Standards[68] for water quality and quantity. Stormwater at Hanscom Field outfalls to the Shawsheen River, Elm Brook and on-site wetland areas. The stormwater runoff would be treated for water quality prior to discharging into the areas. Peak stormwater runoff rates would be mitigated such that they do not exceed existing conditions. Massport continues to monitor stormwater runoff and maintains an effective stormwater management plan.

In 2017, as part of the stormwater management plan, Massport initiated a study to evaluate the existing drainage system and flooding issues associated with the Civil Air Terminal area, which includes the terminal building, the parking lot, and the surrounding roadways.[69] The study recommended increasing existing pipe diameter sizes and installing new pipes to increasing the outflows from drainage, as well as cleaning the existing drainage system between the Civil Air Terminal and Shawsheen River, and increasing the detention basin storage capacity to the maximum available. Future alternatives include providing additional outlets and two new stormwater basins adjacent to Hanscom Road outside the terminal building.

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[68] Massachusetts Department of Environmental Protection. *Massachusetts Stormwater Handbook and Stormwater Standards*. https://www.mass.gov/guides/massachusetts-stormwater-handbook-and-stormwater-standards

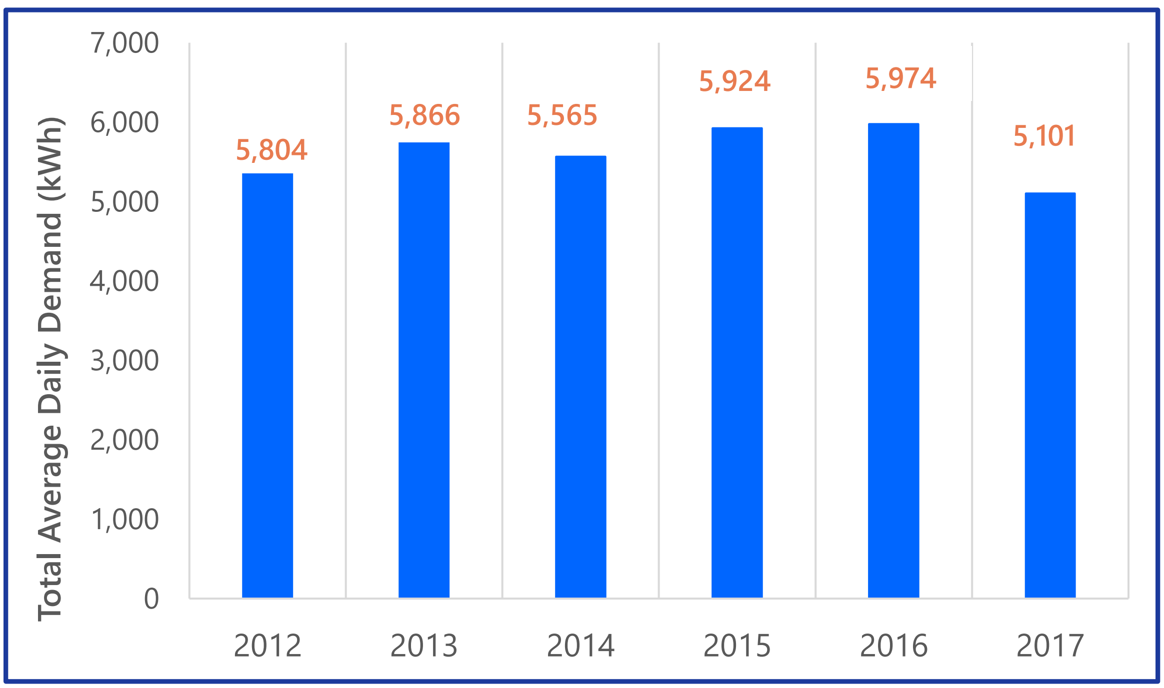
[69] Massport. 2018. *Hanscom Terminal Building Drainage Evaluation and Recommended Improvements.*

4.3.4 Electrical Distribution System

The on-site distribution system delivers electricity to all of Hanscom Field, provided by Eversource Energy. According to the *2012 ESPR*, additional capacity and an expanded distribution system would not be necessary to support operations today, but may need to be implemented to support future growth. Massport has included upgrades to the electrical utility system as part of the five-year capital program, including the replacement of the electrical distribution system for Hangars 1, 2, and 3 and additional electrical infrastructure improvements.

The photovoltaic array on the roof of the Civil Air Terminal also generates electricity and Boston MedFlight is in the process of installing solar panels on the roof of Hangar 12A with the intent of providing nearly all of the energy needed to power the facility. As Massport continues to make smart energy investments, there is no reason to believe that the electrical distribution systems will require investment directed at provision of additional capacity. As shown in Figure 4-10, electricity usage has remained relatively stable since 2012.

Figure 4-10 Hanscom Field Electricity Demand, 2012-2017

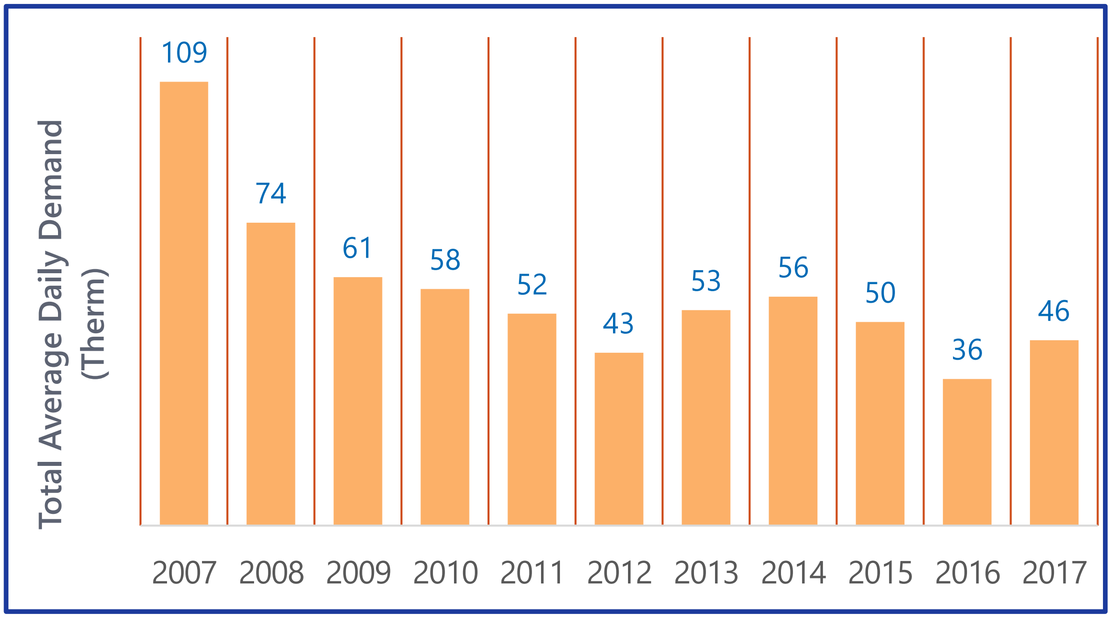


Note: Data unavailable for December 2017
Source: Hanscom Utility Data 2007-2017, Massport, 2017

4.3.5 Natural Gas

Enhancement of the natural gas distribution system occurred circa 2010 with the installation of a 4-inch high-pressure line. This condition remains unchanged for the *2017 ESPR*. The demand in 2007 was 58 percent higher than the demand currently experienced at Hanscom.

Figure 4-11 Hanscom Field Natural Gas Demand, 2012-2017



Note: Data unavailable for October 2016
Source: Hanscom Utility Data 2007-2017, Massport, 2017

As Massport continues to improve the energy efficiency of their facilities, it is unlikely that the natural gas distribution systems will require investment directed at provision of additional capacity. As shown in Figure 4-11, natural gas usage since 2012 has remained relatively stable.

4.3.6 Telephone and Communications

As previously discussed in Chapter 2, both Comcast and Verizon provide internet and phone services at Hanscom Field. The existing telephone conduit capacities are adequate for current demand, but additional capacity and routine service upgrades may be required to provide a sufficient number of lines for the 2025 and 2035 growth scenarios.

4.4 Consistency of 2017 ESPR with Plans and Regulations

Massport is a state authority that owns and operates public-use transportation facilities that include Boston-Logan International Airport, Worcester Regional Airport, Hanscom Field, marine terminals within the Port of Boston, and a range of real-estate properties in the Boston area. Massport's goals and objectives are consistent with local plans of the towns of Bedford, Concord, Lexington, and Lincoln and regional plans such as MAPC's ongoing effort to update the regional plan for the Greater Boston area. Massport supports many of the principles described in these plans, including the creation and operation of environmentally friendly facilities, sustainability, promoting regional equity, economic development opportunities, and the efficient use of existing resources. Massport seeks to achieve these results within the context of managing public-use facilities.

Hanscom Field has existed as an airport since being constructed by the federal government in 1941. After providing primarily military service from 1941-54, Hanscom became a GA airport and control of the airfield's general operations and maintenance was transferred to Massport in 1974. Much of the infrastructure and impervious surfaces of the airfield has remained largely unchanged under Massport's tenure. However, the predominately rural, agricultural character of the area surrounding Hanscom Field continues to be transformed by increasing residential and commercial development independent of and unrelated to Hanscom Field.

Activities at Hanscom Field are consistent with local, regional, and other plans, to the extent that these plans or policies apply to Hanscom Field. The future scenarios described in the *2017 ESPR* are consistent with those that were evaluated in the *2012 ESPR*; however, the plans have been updated to reflect the current aviation demand forecast, in particular the change in the segments of the market expected to grow. The 2025 and 2035 scenarios describe potential additional aviation and aviation-related uses on the airport and retain many areas in their current, natural state. Hanscom Field continues to have a minimal effect on local traffic, air quality, water quality, and wetland resources. However, Hanscom Field remains an airfield facility and, therefore, has the accompanying effects implicit to aircraft operations, including aircraft noise. Noise analysis and mitigation are discussed in detail in Chapter 7 Noise.

Massport's plans are currently limited to those investments described in Section 4.3.5. These plans support Hanscom Field's role as a premier full-service GA airport with the potential for limited scheduled commercial passenger service. The future scenarios that were evaluated in this document present estimates of what could happen at Hanscom Field using certain assumptions, not necessarily what will happen. Should the plans associated with the future scenarios become under consideration further for implementation, Massport would study management approaches for consistency with the local and regional plans.

4.4.1 Federal and State Regulations

This ESPR identifies potential projects that could occur based on the aviation forecasts described in Chapter 3 Airport Activity Levels. Massport will follow applicable local, state, and federal review for any future project that triggers such reviews. For example, both the 2025 and 2035 scenarios identify additional aircraft hangar and apron facilities that would involve an update to the ALP, which in turn may require NEPA and/or MEPA review. Before proposing such changes, Massport would review NEPA and MEPA regulations and coordinate with the FAA to determine the appropriate level of review.

4.4.2 Consistency with the 1978 Master Plan and Massport's 1980 Regulations

Massport's 1978 Master Plan and 1980 regulations for Hanscom continue to guide Massport's long-range planning. The *2017 ESPR* reaffirms the role of Hanscom Field as a premier regional GA airport with the potential for limited scheduled commercial air service. While the 1978 Master Plan anticipated cargo operations at the airport and commercial air passenger services, this activity is anticipated to be minimal going forward, if present at all. The *2017 ESPR* evaluates future scenarios that include scheduled passenger service utilizing turboprop aircraft with approximately 30 seats, but did not consider cargo services given current market conditions. The 2035 scenario forecasts approximately 138,000 annual operations, which is well below the Master Plan's estimated practical capacity of 320,000 operations per year.

4.4.3 Consistency with Local Plans

In general, the plans articulated by Bedford, Concord, Lexington, and Lincoln and their planning documents address the desire to preserve the historical character and natural resources of the towns, while balancing the demands of changing social and economic conditions. Economic development, which has occurred throughout the four towns and the larger suburban area, has resulted in the associated traffic and environmental impacts experienced in the area, particularly related to population growth, which has outpaced recent forecasts of the same.

The basic use of Hanscom Field for aviation purposes takes place within a local planning and zoning context that only describes non-aviation related uses. The towns' plans do not provide for aviation-related land uses. The Commonwealth's policy is to maintain Hanscom Field as a key aviation resource. While Massport considers local planning and zoning, it is not subject to local regulations unless specified by state law.

4.4.4 Consistency with Regional Plans

The efficient use of Hanscom Field as an existing part of the region's transportation infrastructure is consistent with "Smart Growth" policies, including those outlined in MAPC's MetroFuture. In addition, through the ESPR process, Massport has identified and clearly described potential environmental effects of future scenarios to provide a comprehensive evaluation of potential conditions that would be associated with forecasted aviation activity levels.

5 Regional Transportation

Chapter 5 Regional Transportation reviews the role of Hanscom Field in the region's broader airport and long-distance transportation system, with a brief overview of the role Boston Logan International Airport plays in the region. It provides an overview of aviation activity trends in the region for both general aviation and commercial air service, while also describing airport improvement plans for the region's airports, including:

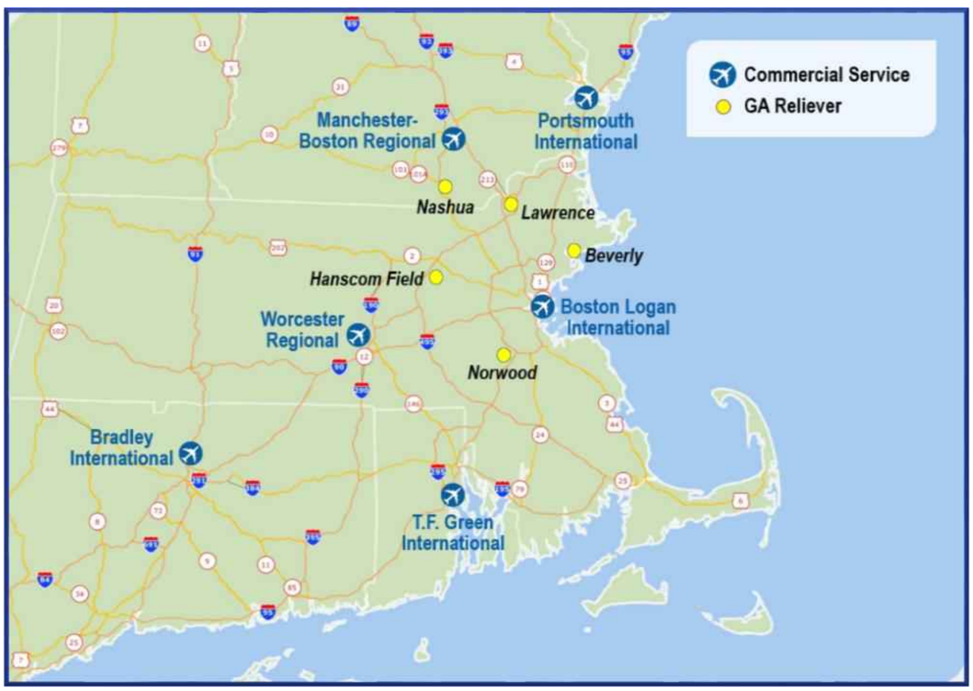
- *Hanscom Field;*
- *Worcester Regional Airport;*
- *T.F. Green International Airport;*
- *Manchester-Boston International Airport;*
- *Bradley International Airport;*
- *Portsmouth International Airport; and*
- *Tweed-New Haven Regional Airport*

This chapter also describes Massport's efforts to work with other state and regional transportation agencies within a cooperative planning context to strengthen the regional transportation network. It reports on the regional transportation planning initiatives that Massport is undertaking relative to Hanscom Field, Worcester and Logan airports. Finally, this chapter provides an overview of long-range transportation planning initiatives that are currently underway in the region, and developments in both air and rail transportation infrastructure.

5.1 Key Findings Since 2012

Hanscom Field is the busiest general aviation (GA) airport in New England, and overall second busiest GA airport in the country. Hanscom Field has historically accommodated a wide variety of aviation activity, including business/corporate aviation, air taxi/private charter services, recreational and personal flying, and pilot flight training. In addition to general aviation, Hanscom Field has accommodated some limited scheduled commercial airline and light air cargo services as well as limited military flights associated with Hanscom Air Force Base (AFB). Figure 5-1 shows the relative locations of the GA and commercial airports in the Greater Boston Metro Area. In part due to its close proximity to Boston and the Route 128/I-95 and Route 495 high-tech corridors, Hanscom Field accommodates more GA activity than any other airport in the region. Hanscom Field handles over four times as many general aviation operations per year as Boston Logan International Airport (Logan Airport) and serves an important role as a reliever to Logan, alleviating demand for airfield capacity.

Figure 5-1 General Aviation and Commercial Service Airports in the Greater Boston Metropolitan Area



Changes to the regional aviation system since 2012 airport include:

- Operations at general aviation reliever and commercial service airports in the Boston Metropolitan Area fell by 2.9 percent per year between 2012 and 2017. This decline is primarily due to higher fuel prices, declining number of student pilots and high cost of aircraft ownership.

- Hanscom Field experienced an average 4.9 percent decline over the same period but remains the leading GA airport in the region in terms of overall GA activity.
- Scheduled commercial passenger traffic at New England airports continued to grow during this period. From 2012 – 2017 the combined passenger traffic at New England airports increased by 4.3 percent on average annually. Much of this growth has occurred at Logan Airport. Hanscom Field has not had any scheduled commercial passenger service since 2012.
- Boston Logan International Airport has continued to exceed historical passenger activity levels on an annual basis. In 2018 the airport handled 40.9 million passengers. This represents 70 percent of all scheduled commercial airline passengers in the region.
- Since its peak in 2005, the market share of scheduled commercial air passenger traffic has continued to decrease at the other airports in the region. From 2012-2017, T.F. Green passenger numbers increased 1.7 percent annually, which passenger traffic at Manchester-Boston declined by 4.3 percent annually. The combined market share of scheduled commercial passenger traffic at these primary commercial relieve airports decreased from 17 percent in 2012 to 13 percent in 2017. The decrease can be attributed to consolidation of airlines at hubs such as Logan.
- Since 2012, commercial aircraft operations at Logan Airport and New England generally grew 2.6 percent and 1.1 percent annually, respectively. Despite the retirement of many small regional jet and turboprop aircraft, airlines continued to add new service and increased the frequency of service to various markets from the region.
- Regional airports have continued to attract new scheduled airline service. Portsmouth International Airport (Pease) for example, launched scheduled service by Allegiant Air. At Worcester Regional Airport, JetBlue commenced new services to Florida in 2013, American Airlines commenced new flights to Philadelphia starting in the fall of 2018, and Delta announced new flights to Detroit starting in 2019.

Additional information regarding improvement projects being planned or currently underway at Hanscom Field can be found in Section 5.5.1.

5.2 Role of Hanscom Field in the Regional Airport Network

The following section describes the roles of Hanscom Field, Worcester Regional Airport and Logan Airport and the manner in which Massport has promoted a successful regional airport network.

5.2.1 Role of Hanscom Field

Hanscom Field serves as the premier full-service general aviation facility for Massachusetts and New England. The airport accommodates a variety of corporate and private general aviation activities, as well as air taxi/charter, and public service operations that might otherwise use

Boston Logan International Airport. Hanscom Field's role as a GA reliever with limited scheduled commercial service was established in the airport's 1978 Master Plan and clarified in Massport's 1980 Regulations for Hanscom Field. These plans restrict scheduled commercial passenger services to aircraft with 60 seats or less, though.

Hanscom Field has not had scheduled passenger commercial service since 2012. The ability of Hanscom Field to provide more significant air passenger services is also affected by its proximity to the region's commercial service airports including Logan, Worcester, T.F. Green, and Manchester-Boston.

5.2.2 Role of Boston Logan International Airport

By virtue of its location in New England's population and commercial center, Logan Airport is the region's dominant airport for scheduled commercial airline service. Logan Airport is New England's largest and busiest airport with flights to destinations across the U.S., Canada, Central and South America, Europe, Asia, and the Middle East. Logan Airport also provides more than 50 daily departures to small and/or remote communities including Cape Cod and the islands as well as markets in northern New England and upstate New York, connecting these communities to the national air transportation network.

Logan Airport is also the largest cargo airport in New England and the 28th largest in the nation in terms of cargo moved in the U.S. The airport accommodated 452,000 metric tons of air freight and mail through its facilities in calendar year 2017.[70]

5.2.3 Role of Worcester Regional Airport

Worcester Regional Airport is an important part of the transportation network and economic development of the central Massachusetts region, with Worcester being the second largest city in New England. The airport is located approximately 50 miles west of Boston. It accommodates both scheduled commercial airline service and corporate GA activity.

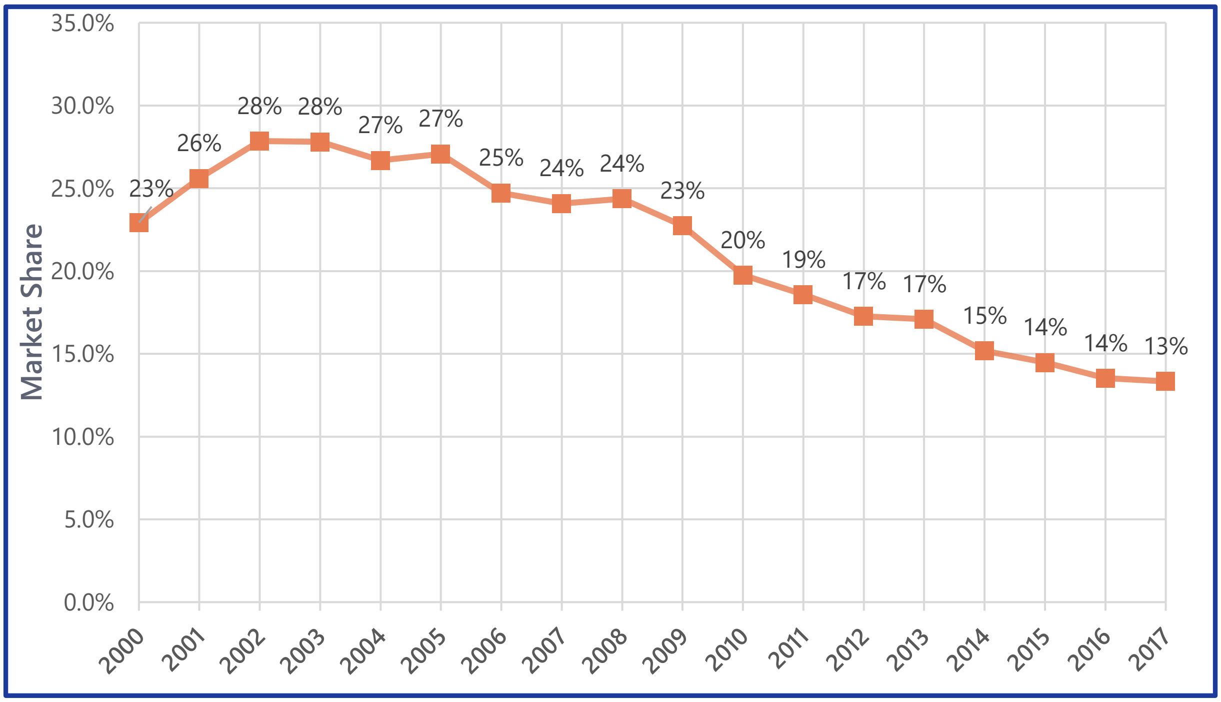
Massport acquired the airport from the City of Worcester in 2010 and it continues to invest in modernizing facilities and working with airlines to expand scheduled commercial service from Worcester. Since JetBlue began service in 2013, the carrier has served more than 500,000 passengers. Massport actively markets the air service at Worcester Regional Airport as an additional commercial service airport in the region that can conveniently accommodate passengers in central MA and west of Boston, while simultaneously alleviating congestion at Logan.

[70] FAA Air Carrier Activity Information System (ACAIS), Qualifying Cargo Airports, Rank Order, and Percent Change from 2016, 2018

5.2.4 Massport's Efforts to Support Regional Airport Network

The regional airports that are closest to Logan and have the greatest influence on its passenger traffic and aircraft activity are Worcester Regional Airport in Worcester, Massachusetts, T.F. Green International Airport in Providence, Rhode Island and Manchester-Boston Regional Airport in Manchester, New Hampshire. Given their close proximity to Boston, relative ease of access, as well as scheduled service to an array of markets, these airports serve as the primary alternatives to Logan. Massport's efforts to promote commercial service at the Worcester Regional Airport have recently succeeded in bringing three major carriers to that airport by late 2019.

Figure 5-2 T.F. Green, Manchester-Boston, and Worcester Combined Share of Boston Area Passengers



Note: Market share represents T.F. Green, Manchester-Boston, and Worcester passengers as a percent of total T.F. Green, Manchester-Boston, Worcester Regional, and Logan Airport passengers.
Source: Massport Airport Statistics, T.F. Green Airport Statistics, Manchester-Boston Airport Statistics

An increase in scheduled passenger service and the introduction of service from low cost carriers such as Southwest Airlines resulted in these secondary airports accommodating a higher share of the region's commercial air passengers in the early 2000s. As shown in Figure 5-2, T.F. Green, Manchester, and Worcester airports together accounted for more than 25 percent of total passengers in the combined market area in the early 2000s. This market share declined to approximately 24 percent in 2007 and has been steadily decreasing ever since. In 2017, these three airports accounted for 13 percent of total market area, less than half of their historical peak. Worcester Regional Airport has recently experienced a significant increase in commercial service; more than 500,000 passengers have been served by JetBlue at ORH since their flights began in 2013.

T.F. Green and Manchester lost approximately 2.8 million passengers between 2003 and 2017, whereas Logan Airport gained 15.6 million passengers in the same period. One of the reasons for this passenger trend is that competition in secondary markets, combined with efforts to consolidate operations at large hubs, led to renewed activity in large hub airports. Southwest entered the Boston market in 2009, while JetBlue grew its presence at Logan Airport significantly in the past seven years.

As noted above, despite these trends, Massport has been successful in actively promoting air service activity at Worcester Regional Airport as a way to reduce congestion at Logan Airport. As a result of these efforts, JetBlue began non-stop services to Orlando International and Fort-Lauderdale-Hollywood airports in 2013, starting with one daily departure to each destination. As of 2017, JetBlue increased the frequencies to two daily departures to both Orlando and Fort-Lauderdale. In addition, JetBlue began flights to New York JFK starting in May 2018, American Airlines began flights to Philadelphia beginning in October 2018, and Delta announced a new non-stop daily flight to Detroit starting in August 2019.

5.2.5 Expected Future Role of Hanscom Field

As part of its regional approach, Massport is committed to maintaining Hanscom Field as a vital link in the transportation infrastructure of Massachusetts and New England. Hanscom Field will continue to function within the regional airport network primarily as a GA reliever to Logan Airport and as the region’s premier, full-service general aviation and business aviation airport with the possibility of limited scheduled commercial passenger service.

5.3 Regional General Aviation Activity Trends

In 2017, Hanscom Field handled roughly 128,000 general aviation operations, approximately 29 percent of all general aviation operations in the region. This is compared to approximately 164,000 GA operations at Hanscom in 2012. Hanscom Field remains the busiest general aviation airport in the region, handling almost twice the operations as the second busiest general aviation airport, Norwood Memorial Airport, and four times as many general aviation operations as Logan Airport in 2017. Table 5-1 compares general aviation operations at Hanscom Field to other general aviation reliever and commercial service airports in the greater Boston metropolitan area.

Overall, general aviation operations in the greater Boston metropolitan area fell by an average of 3.0 percent per year between 2012 and 2017, which is a slightly greater decline than the national trend. General aviation operations at U.S. airports with Federal Aviation Administration (FAA) contract traffic control services declined 0.4 percent per year from 2012 to 2017.[71] This decline in general aviation operations is less pronounced than it had been in the years leading up to 2012, but the demand for general aviation continues to weaken as personal flying becomes more expensive and the number of student pilots remains depressed relative to historical levels. In spite of the downward trend in operations, 2017 did produce an increase in piston aircraft sales, while business jet sales remained steady compared to previous years.

As shown in Table 5-1, general aviation activity declined at Hanscom Field by an average of 4.9 percent per year between 2012 and 2017, about twice the rate of the region. Most of this decline is due to a decline in what the FAA defines as local operations, which are operations that remain within the local area (e.g., flight training activity, simulated instrument approaches). Among other airports in the region, general aviation operations at Logan Airport grew the fastest at an annual average rate of 2.1 percent per year, while general aviation operations at Worcester Regional Airport experienced the greatest decline at an annual average rate of 10.2 percent per year. General aviation growth at Logan Airport is primarily attributed to business aviation. The decline at Worcester Regional Airport, similar to at Hanscom Field, is due mostly to a decline in local operations.

[71] FAA. FAA Aerospace Forecast Fiscal Years 2018-2038. https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2018-38_FAA_Aerospace_Forecast.pdf

Table 5-1 Operations at General Aviation Reliever and Commercial Service Airports in the Boston Metropolitan Area

Airport	NPIAS Category[1]	General Aviation Operations[2]		CAGR[3]	Percent Local 2017	Number of Based Aircraft
		2012	2017			2017
Hanscom Field	Nonhub primary	164,834	128,018	-4.9%	36.0%	370
Norwood Memorial	Nonprimary reliever	68,405	66,823	-0.5%	36.2%	118
Nashua/Boire Field	Nonprimary reliever	55,620	56,352	0.3%	52.4%	251
Beverly Municipal	Nonprimary reliever	58,203	53,401	-1.7%	49.3%	102
Laurence Municipal	Nonprimary reliever	52,157	36,822	-6.7%	41.3%	213
Portsmouth International (Pease)	Nonhub primary	38,132	36,717	-0.8%	71.5%	143
Boston Logan International	Large hub	28,144	31,120	2.1%	0.0%	-
Worcester Regional	Nonhub primary	44,070	25,683	-10.2%	32.6%	75
T.F. Green	Small hub	26,274	24,797	-1.2%	36.1%	37
Bradley International	Medium hub	15,589	13,233	-3.2%	1.8%	65
Manchester-Boston Regional	Small hub	12,504	13,169	1.0%	21.0%	67
Total		**563,902**	**486,135**	**-2.9%**	**38.6%**	**1,441**

Notes:
1. The National Plan of Integrated Airport Systems (NPIAS) includes all commercial service airports, all reliever airports, and selected public-owned general aviation airports.
2. Operations include itinerant air taxi, general aviation, and local civic operations. Manchester-Boston Regional, T.F. Green, and Bradley International Airport operations exclude air taxi operations as their operations counts are comingled with regional commuter airline operations.
3. Compound Annual Growth Rate
Sources: FAA Traffic Flow Management System Counts (TFMSC), FAA Terminal Area Forecast (TAF); Hanscom Field and Logan International Airport counts are provided by Massport.

5.4 Regional Commercial Service Trends

The region's air passengers are primarily served by a network of commercial service airports throughout New England. Figure 5-3 depicts the location of the airports that are included in the FAA's New England Regional Airport System Plan (NERASP): Bangor International Airport, Boston Logan International Airport, Bradley International Airport, Burlington International Airport, Hanscom Field, Manchester-Boston Regional Airport, Portland International Jetport, Portsmouth International Airport, T.F. Green International Airport, Tweed-New Haven Regional Airport, and Worcester Regional Airport.

5.4.1 Commercial Airline Trends in the Region

The largest commercial service airports in the New England region experienced strong growth since the late 1990s. Southwest Airlines, for example, expanded services through the region's secondary airports rather than at Logan Airport, introducing services at T.F. Green International Airport, Manchester-Boston Regional Airport, and Bradley International Airport. At the end of the 2000s, this trend began to shift as Southwest initiated service at Logan Airport in 2009 and reduced service at the other airports in the region. Since 2012, other airlines have also shifted the focus away from growing activity at the secondary regional airports.

Logan Airport experienced rapid passenger and operations growth in recent years. Southwest almost doubled its daily departures from 35 in 2012 to 66 in 2017, while JetBlue grew from 94 daily departures in 2012 to 136 daily departures in 2017. Boston Logan International Airport is not dominated by any one airline in terms of passenger market share. In 2017, JetBlue had approximately 27 percent share of total passengers, followed by American Airlines at 18 percent, Delta Air Lines at 16 percent, United Airlines at 10 percent, and Southwest at eight percent.[72] In addition, international airlines (e.g. Emirates, Qatar Airways, Norwegian Air, Scandinavian Airlines, Cathay Pacific, Hainan Airlines, COPA, and

Figure 5-4 New England Regional Airport System Plan

[72] U.S. DOT T-100, 2017

TAM) have added several new non-stop destinations to Europe, the Middle-East, Asia, and Central America. These new international destinations also attracted long-haul low-cost carriers to the region (e.g. Norwegian Airlines).

Ultra-low-cost carriers (ULCCs) have added service to secondary airports in the region, with a focus at T.F. Green, which gained new European services offered by Norwegian Airlines and new domestic services offered by Frontier Airlines and Allegiant Airlines. These new carriers compensated for the loss of traffic that was a result of Southwest's shift of focus from secondary airports.

Worcester Regional Airport and Bradley International Airport experienced passenger traffic growth in recent years. Worcester attracted new nonstop services by JetBlue as well as to Philadelphia by American Airlines and in 2019 to Detroit by Delta Air Lines, while Bradley International grew by approximately one million passengers from 2012 to 2017, despite a small decrease in scheduled commercial operations. This is primarily due to airlines up-gauging from regional jet and turboprop aircraft to mainline narrow-body aircraft. At Bradley, average seats per aircraft increased from 97 to 115 over this time.

5.4.2 Commercial Airline Passengers

Table 5-2 presents the change in commercial airline passenger levels at Logan Airport, Hanscom Field, and other New England commercial air service airports between 2012 and 2017. Over this period, combined passenger traffic at the ten secondary regional airports increased by a rate of 1.6 percent per year. In contrast, at Logan Airport passenger traffic grew by a rate of 5.5 percent per year. Passenger traffic at Hanscom Field ceased in 2012 (hence the 100 percent decrease shown in the table). The current passenger operations at Hanscom are mostly charter flights and all are comprised of non-scheduled service.

Logan Airport's passenger traffic reached an all-time peak of 40.9 million in 2018, which represented over 70 percent of the region's airline passengers. As mentioned previously, new airline service contributed to Worcester's, T.F. Green's and Portsmouth's growth, whereas Manchester-Boston continued to see a decline of passengers due to airlines adjusting frequency and aircraft size to match market demand and meet profitability goals.

Table 5-2 Passenger Activity at Logan Airport, Hanscom Field and Other New England Commercial Service Airports

Airport	Airport Code	Passengers (millions)[1]		CAGR	2012 Passenger Share	2017 Passenger Share
		2012	2017	2012-2017		
Logan Airport, MA	BOS	29.33	38.41	5.5%	66.3%	70.5%
Bradley International, CT	BDL	5.32	6.44	3.9%	12.2%	11.8%
T.F. Green International, RI	PVD	3.62	3.94	1.7%	8.2%	7.2%
Manchester-Boston, NH	MHT	2.45	1.97	-4.3%	5.5%	3.6%
Portland International, ME	PWM	1.67	1.86	2.2%	3.7%	3.4%
Burlington International, VT	BTV	1.23	1.16	-1.3%	2.8%	2.1%
Bangor International, ME	BGR	0.46	0.49	1.4%	1.0%	0.9%
Worcester Regional, MA	ORH	0.03	0.11	32.0%	0.1%	0.2%
Portsmouth International, NH	PSM	<0.01	0.10	99.6%	0.1%	0.2%
Tweed-New Haven Regional, CT	HVN	0.08	0.06	-5.2%	0.2%	0.1%
Hanscom Field, MA	BED	0.01	-	-100.0%	0.0%	0.0%
Subtotal Regional Airports		14.88	16.12	1.6%	33.7%	29.5%
Total		**44.19**	**54.52**	**4.3%**	**100.0%**	**100.0%**

Notes:
1. Includes scheduled commercial, charter, and other non-scheduled passengers.
Source: Massport and U.S. Department of Transportation T-100 via Diio

5.4.3 Commercial Airline Operations

Passenger airline operations are summarized in Table 5-3 for airports in the FAA's NERASP (operations refer to aircraft takeoffs and landings). Logan Airport remained the busiest in 2017, growing 2.5 percent per year between 2012 and 2017, handling over 370,000 scheduled passenger operations in 2017 (approximately 66 percent of such operations, and 70.5 percent of the passenger share in the region.) At the other ten airports, collective commercial operations declined slightly at a rate of 1.0 percent per year between 2012 and 2017. However, a few of those airports experienced growth. Bangor International Airport experienced approximately a 2 percent increase in scheduled airline operations. Worcester Regional and Portsmouth International airports accommodated new airline service.

While passenger numbers have increased at many of these airports, overall aircraft operations have declined due to increasing load factors (the percentage of seats occupied on the aircraft) and the introduction of larger aircraft into the markets. Further the retirement of small regional jets and turboprop aircraft is expected to continue despite fuel prices dropping in recent years.

Scheduled commercial passenger activity has not been present at Hanscom in recent years; the last operator, Streamline Air, ceased operations in 2012 and no new operators have since initiated service.

Table 5-3 Commercial Airline Operations at Logan Airport, Hanscom Field and Other New England Commercial Service Airports

Airport	Airport Code	Scheduled Commercial Airline Operations[1]		CAGR	2012 Operations Share	2017 Operations Share
		2012	2017	2012-2017		
Logan Airport, MA	BOS	326,755	370,251	2.5%	61.2%	65.8%
Bradley International, CT	BDL	67,396	65,225	-0.7%	12.6%	11.6%
T.F. Green International, RI	PVD	45,698	39,973	-2.6%	8.6%	7.1%
Manchester-Boston, NH	MHT	27,553	27,352	-0.1%	5.2%	4.9%
Portland International, ME	PWM	32,070	24,555	-5.2%	6.0%	4.4%
Burlington International, VT	BTV	22,744	21,582	-1.0%	4.3%	3.8%
Bangor International, ME	BGR	8,808	9,882	2.3%	1.6%	1.8%
Worcester Regional, MA	ORH	2,606	1,929	-5.8%	0.5%	0.3%
Portsmouth International, NH	PSM	3	1,371	240.4%	0.0%	0.2%
Tweed-New Haven Regional, CT	HVN	2	678	220.7%	0.0%	0.1%
Hanscom Field, MA	BED	635	0	-100.0%	0.1%	0.0%
Subtotal Regional Airports		207,515	192,547	-1.5%	38.8%	34.2%
Total		**534,270**	**562,798**	**1.0%**	**100.0%**	**100.0%**

Notes:
1. Does not include charter and other non-scheduled operations.
Source: U.S. Department of Transportation T-100 via Diio Mi, Scheduled Passenger Operations

5.5 Regional Airport Improvement Plans and Projects

The following section describes airport improvement projects being planned or currently underway at the regional airports in light of the commercial service trends and the roles of the Massport airports as described in the previous sections. The plans described are in response to the aviation industry trends playing out at the region's airports.

5.5.1 Hanscom Field, Bedford, MA

Massport continues to invest in Hanscom Field to improve and upgrade facilities and maintain a safe, secure and efficient airport. Past and future capital investments ensure that Hanscom can continue to serve its role as a general aviation reliever to Logan and as the premier business aviation facility for the region. Hanscom's five-year capital improvement program spanning from Massport's fiscal year 2018 to fiscal year 2023 contains a variety of maintenance and improvement projects in addition to projects recently completed or currently underway.

Planned Massport Hanscom Field capital projects for fiscal year 2018 and beyond:

- **Improvements to civil air terminal drainage;**
- **Replacement of salt storage enclosure;**
- **Replacement of Hangars 1, 2, and 3 electrical feeder and distribution systems;**
- **Repair of East Ramp pavement;**
- **Rehabilitation of Taxiway N and R;**
- **Rehabilitation of pavement on West ramp;**
- **Rehabilitation of Runway 5/23;**
- **Replacement of airfield perimeter fence sections;**
- **Planning and permitting for the 2019-2023 VMP Update; and**
- **Replacement of T-Hangar Rows A-C.**

Ongoing or expected third-party projects at Hanscom Field include:

- Construction of Boston MedFlight new facility, Hangar 12A, in place of the old National Aviation Academy facility. The new facility, which incorporates hangar space, office space, and training spaces, was completed in 2018.
- T-hangar relocation and new general aviation aircraft hangar development on Pine Hill.
- Replacement T-hangars and new general aviation aircraft hangar development on North Airfield.

In addition to the federal funding sources for capital improvements (e.g., FAA Airport Improvement Program funding), Massport solicits third-party development of facilities that support and enhance Hanscom's role in the regional transportation system. [73] Many of the

[73] Local tax revenue is not used to fund improvements at the airport

hangars at Hanscom Field are owned or leased by tenants who are responsible for maintaining them. Chapter 4 Airport Planning contains more information about other improvements under consideration at Hanscom Field.

5.5.2 Worcester Regional Airport, Worcester, MA

Worcester Regional Airport has undertaken many maintenance and improvement projects since Massport assumed operational control of the airport. Most importantly, in 2017, Massport upgraded the Runway 11 landing system from Category I to Category III, to allow for low-visibility operations in inclement weather conditions. The new landing system, which became fully operational in 2018, enables landings in nearly all weather and visibility conditions, thereby enhancing the airport's ability to attract new commercial service.

Ongoing capital projects at Worcester Regional Airport:

- **Rehabilitation of Taxiway B between Runway 29 and Taxiway F;**
- **Upgrading of the water pump station;**
- **Upgrading fire protection and fire alarms;**
- **Replacement / repair of airfield equipment; and**
- **Installation of new electric equipment. The FAA awarded a $463,000 grant for new equipment that can provide power and air conditioning for aircraft parked at Gates 1 and 2 at the airport. This allows the aircraft to shut off their on-board auxiliary power units, thereby reducing emissions.**

Other planned projects for Worcester Regional Airport are listed below:

- Rehabilitation of Runway 15-33 pavement.
- Replacement of Runway 11 and 29 runway safety area engineered materials arrestor system (EMAS).
- Rehabilitation of Runway 11 pavement.
- Relocation of Runway 11/29 distance remaining signs.
- Installation of two new passenger boarding bridges.

5.5.3 T.F. Green International Airport, Warwick, RI

The Green Airport Improvement Program was initiated by T.F. Green International Airport in 2011 to lengthen the primary Runway 5/23 by about 1,500 feet to a total of 8,700 feet and to enhance the safety areas around Runway 16-34. The FAA conducted an Environmental Impact Statement (EIS) and issued a Record of Decision allowing for the airport to implement the project. The lengthened Runway 5/23 enables coast to coast and long-range international flights from Providence. Work on the runway extension began in 2013 and was completed in

October 2017. As part of the project, a park was relocated, and a public roadway was realigned to allow for the longer runway and its associated safety areas.

Other airport improvement plans and projects at T.F. Green include:

- Demolition of Hangar 1 in 2013, and paving the site to provide additional aircraft parking.
- Installation of a system for the collection and treatment of deicing fluids in 2015.
- Improvements to the Runway 16 runway safety area were completed in 2014. As part of this project, an engineered materials arrestor system (EMAS) was installed to quickly slow down and stop aircraft in case of an aircraft overrun at the end of the runway.
- Acquisition of a new 1,500-gallon Airport Rescue and Firefighting (ARFF) vehicle is planned in late 2018.
- Other runway improvements and wetland protection projects (the FAA awarded $500,000 toward acquiring easements for a runway).
- Renaming the airport to airport to Rhode Island International Airport, reflecting the airport's recent addition of international services.

5.5.4 Manchester-Boston Regional Airport, Manchester, NH

Since the early 1990s, Manchester-Boston Regional Airport has invested over $500 million to improve and develop landside and airside facilities and infrastructure at the airport. Projects included: a 158,000 square foot passenger terminal and two subsequent 75,000 square foot terminal expansions; a 4,800-space parking garage with an elevated pedestrian walkway connection to the terminal; roadway improvements; and extensive runway reconstruction. In 2003, Runway 35 was extended from 7,000 feet to 9,250 feet to allow for non-stop services to Las Vegas and other West Coast destinations. Recent and on-going improvements at Manchester-Boston Regional Airport include:

- Rehabilitation of the concrete apron adjacent to the terminal building, completed in 2013.
- Opening of a new 11,000 square foot consolidated rental car facility in 2016. The facility is home to eight car rental agencies.
- Completion of a passenger-flow improvement project in 2016. The project included the construction of a new, six-lane, consolidated passenger screening checkpoint and the renovation of the existing terminal atrium to allow for more efficient flow of passengers. Lights, flooring, and aesthetics were also upgraded.
- Reconstruction of Taxiway H and relocation of Taxiway B in 2017.
- Realignment of two additional taxiways, planned to begin in 2018. The project will require a two-year construction period.

5.5.5 Bradley International Airport, Windsor Locks, CT

A $200 million airport modernization project at Bradley International Airport was completed in 2010. As part of this program, Terminal A was expanded with a new concourse; ticket counters, gates, and waiting areas were renovated; and an international arrivals building was also constructed.

In 2011, the Connecticut Airport Authority (CAA) was established to oversee the operation and development of Bradley International Airport. The goal of the CAA is to the transform Bradley and the state's five general aviation airports (Danielson, Groton/New London, Hartford-Brainard, Waterbury-Oxford, and Windham) into economic drivers for the state. Since the CAA took over operations in 2013, several airport development projects have been completed or are underway including:

- Completion of a sound insulation project in 2013. There were 249 neighboring homes that met certain criteria and received sound insulation.
- Rehabilitation projects for taxiways at multiple locations around the airfield (Taxiway C and R).
- Development of a new state-of-the-art ground transportation center. In the fall of 2014, the Bradley Development League initiated an alternatives analysis and feasibility study to improve public transportation connectivity and accessibility between Bradley International Airport and the New Haven-Hartford-Springfield rail line. As part of this project, the old Terminal B (Murphy Terminal) building was demolished to make space for the ground transportation center.
- Completion of a three-year renovation project of the airport hotel in 2011.
- Completion of the terminal food court renovation project in 2013.
- With new flights introduced to Canada and Europe, opening of a duty-free shop in 2016 for international passengers.

The CAA is also planning a $1.4 billion renovation at Bradley as part of the 20-year master plan, which includes a new Terminal B connected to the current Terminal A, an onsite car rental center with 830 vehicle parking spaces, and modifications of roadways and roundabouts for smoother traffic flow on the airport.

5.5.6 Portsmouth International Airport, Pease, NH

Portsmouth International Airport is a commercial service airport in the Seacoast region of New Hampshire and also home to several general aviation and flight training facilities, as well as the New Hampshire Air National Guard. A significant number of aircraft operations are generated by refueling aircraft and cargo freighters. It is currently served by Allegiant Air, while Frontier Airlines will begin service in December, 2018.

Current airport improvement projects include both military and civilian projects. Upgrades are being made to accommodate the new KC-46A Pegasus air refueling aircraft, which will replace the Air National Guard's aging KC-135 fleet. In addition, the airport is planning to upgrade one of the runway approach systems to a Category-III instrument landing system.

Additional future airport improvement projects in the seven-year capital improvement plan include:

- Additional improvements of airside and landside infrastructure, including a terminal expansion.
- Maintenance and rehabilitation of apron, taxiway, and runway pavement.
- Renovation of parking lots.
- Improvements to airport access roadways.
- Airport planning, environmental, and specialty studies.

5.5.7 Tweed-New Haven Regional Airport, New Haven, CT

Tweed New Haven, the smaller of the two airports in Connecticut with regularly-scheduled passenger service, currently has flights offered by American Airlines. The airport has identified the existing runway length to be a constraining factor for attracting new airlines business, and has been seeking approval to extend the runway from 5,600 to 6,600 feet.

Recent or ongoing airport improvement projects include:

- Residential sound insulation program for properties surrounding the airport.
- Construction of wildlife hazard deterrent fence.

5.6 Regional Airport Improvement Plans and Projects

This section reports on state and regional planning efforts to achieve a balanced regional intermodal transportation network to reduce reliance on Logan Airport and provide travelers with a greater range of long-distance, intercity transportation options.

5.6.1 Regional Aviation Economic Impact Study

The aviation industry and airports comprise a significant element of Massachusetts's economy. The FAA and the Massachusetts Department of Transportation (MassDOT) continue to invest in airport infrastructure to improve and enhance economic development opportunities. MassDOT published the *Massachusetts Statewide Airport Economic Impact Study* in 2011, which was updated in 2019, summarizing the economic benefits that Massachusetts derives from its public-use airports. The study describes how the local economy builds on aviation and enumerates the other benefits that air transportation provides to its host communities.

The study found that Massachusetts public use airports generate $24.7 billion in total economic activity, including $7.2 billion in total annual payroll resulting from 199,237 jobs that can be traced to the aviation industry. In particular, Massport's three airports are noted to make significant contributions to the regional economy, generating approximately $23.1 billion (94 percent) of the overall economic benefits generated by the Massachusetts airport system. Specifically, Logan Airport supported over 162,000 jobs in Massachusetts with a total economic impact estimated at approximately $16.3 billion per year. Worcester Regional Airport supported 587 jobs with a total economic impact of $96.7 million. Hanscom Field is particularly important for its function as the airfield for Hanscom AFB, an active military facility, which is aided by its proximity to Boston-area technology and research industry. Hanscom Field alone supports 2,243 jobs and generates $680 million in economic activity, but combined with Hanscom AFB, the two entities together support 19,587 jobs and have a total economic impact of $6.7 billion. For every $100 spent by aviation-related businesses, an additional multiplier impact of $56 is created within Massachusetts, according to the study.[74] While the economic impact of the region's airports was the focus of the study, it also noted qualitative benefits of the state's airports.

Qualitative benefits of the state's airports include:

- ⇨ **Facilitating emergency medical transport;**
- ⇨ **Providing police support;**
- ⇨ **Supporting aerial surveying, photography and inspection operations;**
- ⇨ **Supporting U.S. military and other government operations; and**
- ⇨ **Providing youth outreach activities.**

5.6.2 Massachusetts Statewide Airport System Plan (MSASP)

Airports are an essential element of Massachusetts' intermodal transportation system, and the MassDOT Aeronautics Division (formerly the Massachusetts Aeronautics Commission or MAC) is responsible for being an effective steward for the state's 39 public use airports (nine commercial service airports, 30 general aviation airports). In 2009, the MassDOT initiated development of the Massachusetts Statewide Airport System Plan in order to provide an assessment of current conditions and long-term development of the statewide airport system as a whole. The technical report was published in 2010 and it provides an inventory of the existing facilities, current airport roles, aviation demand forecast, adequacy of existing and future systems, as well as the financial needs and recommendations.[75] The report recommends that MassDOT Aeronautics Division update the system plan in five-year increments, but an update in the 2015-2016 timeframe has not yet been published.

[74] Massachusetts Statewide Airport Economic Impact Study Update, January 2019, Massachusetts Department of Transportation
[75] https://www.mass.gov/files/documents/2018/02/08/TechnicalRpt_1_Entire.pdf

5.6.3 Boston Region Long-term Transportation Vision

Massport is member of the Boston Region Metropolitan Planning Organization (MPO). The Boston MPO developed a long-range vision for the region and its transportation network out to the year 2040, which was published in 2015. An update of the *Long-Range Transportation Plan* (LRTP), *Charting Progress to 2040*, is expected in 2019.[76] In a departure from prior long-range plans, *Charting Progress to 2040* will balance the need for regionally significant roadway-improvement projects with projects that will improve transit, bicycle, and pedestrian access. The plan focuses on six goals: safety, preservation, mobility, environment, transportation equity, and economic vitality.

5.6.4 Statewide Long-term Transportation Vision

MassDOT released the Commonwealth's Long-Range Transportation plan in 2014, called *weMove Massachusetts: Planning for Performance*. This report provides a summary of MassDOT's approach to multimodal capital planning and the use of scenario planning. The report analyzes several key components of the transportation system: bridges, roadways, buses, trains, and bicycle paths to provide a data-driven decision-making methodology to assist MassDOT in implementing its priorities transparently and measurably. Along with the report, a Planning for Performance tool was also published that can be used to calculate the performance outcomes that would result from different levels of funding available.

Massport was an active participant in the development for the MassDOT's Rail Plan and Freight Plan. The *Massachusetts State Rail Plan*, published in 2018, is the Commonwealth's 20-year plan for the state's rail system. It describes a set of strategies and initiatives aimed at enhancing rail transportation so that it can effectively fulfill its critical role in the state's multimodal transportation network.[77] MassDOT's vision for passenger and freight service is to strategically look for opportunities to better serve the Commonwealth over the next 20 years.

The *Massachusetts Freight Plan*, which was also published in 2018, describes the important role that Logan plays in the air transport of freight and the important connections with highway and railways networks.[78] Out of the 39 public-use airports in Massachusetts, Logan Airport is by far the largest in terms of passenger and freight traffic. Massport continues to explore opportunities to increase air cargo attractiveness at Worcester Regional Airport. Given the activity at Logan and the commercial service at Worcester, air cargo at Hanscom Field is unlikely to occur. MassDOT's long-term rail freight rail projects include plans to extend the freight rail from the New Bedford Secondary Line to the New Bedford Airport. This added service would support intermodal connections between freight rail and cargo transported via air.

[76] http://www.ctps.org/lrtp
[77] https://www.mass.gov/service-details/rail-plan
[78] https://www.mass.gov/service-details/freight-plan

The intercity rail system connects Massachusetts with other parts of the Northeast region and relieves demand for air service and requisite terminal capacity at Logan Airport. The Northeast Regional and Acela service allow Logan Airport to optimize its limited aircraft gate capacity for long-haul and international flights rather than short trips to other northeast corridor cities. For example, ridership on the Acela trains from Boston to New York is 50 percent higher than via air travel, which reduces the need for short haul flights between Logan Airport and New York's system of airports.

In 2018, the Massachusetts Bay Transportation Authority (MBTA) unveiled a future investment plan, entitled *Focus 40*, to meet the public transportation needs of the region by 2040. The plan includes a new downtown superstation connecting multiple subway lines (e.g. Blue Line and Red Line), possible extension of the existing subway lines (Blue, Green, and Orange Lines), new fleets of trains and buses, and a new fare collecting system. *Focus 40* aims to position the MBTA to make investments that will create a reliable, robust, and resilient transit system in the region. Also in 2018, the MBTA launched a 2-year, $3 million study, called Rail Vision, to identify cost-effective strategies for the commuter-rail system. The study is expected to identify what infrastructure upgrades would be needed to expand service, improve existing commuter lines, and to increase ridership outside of peak commuting times.

5.6.5 New England Regional Airport System Plan (NERASP)

The New England Regional Airport System Plan (NERASP) is the product of more than a decade of work by the New England Airport Coalition, a collaboration of 11 of the region's major airports, the six New England state aviation agencies, the Massachusetts Port Authority, the New England Council, and the FAA. The results of this study provide a foundation of a regional strategy for the airports with air service to support the needs of passengers through 2020.[79]

The New England state aviation officials, in partnership with the FAA, also conducted a study of the general aviation airports in New England, including primary commercial service airports, titled *The Evolving Role of Our General Aviation Airports and Their Significance to New England*.[80] This report, published in 2015, provides a greater understanding of airport roles and aviation services for their communities and states, the resources required to maintain the existing runway and taxiway infrastructure, and both a short-range and long-range perspective on the future performance of the New England general aviation system.

5.6.6 Coalition of Northeastern Governors (CONEG)

The Coalition of Northeastern Governors (CONEG), a non-partisan association of the governors of the seven northeastern states, provides support to the Conference of New England Governors and Eastern Canadian Premiers (NEG/ECP). NEG/ECP is a formally established body which coordinates regional policy programs including the areas of economic development,

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79 https://www.faa.gov/airports/new_england/planning_capacity/airport_system_plan/

80 http://www.pvdairport.com/documents/planning%20docs/neraspgasummarybrochure.pdf

transportation, environment, energy and health. Members include the governors of the six New England states, and Canadian premiers of Quebec, Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador.

In 2012, the New England Governor's Conference was absorbed into the Coalition of Northeastern Governors. The CONEG recognizes the unique characteristics of the Northeast's transportation system and focuses its priority transportation initiatives on the region's intercity and commuter passenger rail system and surface transportation network. The 42nd Conference of New England Governors and Eastern Canadian Premiers was held in Vermont in August 2018. Sessions focused on energy storage, electric vehicle innovation, tourism, and trade in the region. During the conference the region's two leading international airports, Boston Logan and Montreal Trudeau were highlighted as key gateways to Asian tourism in particular, with services offered to China, Hong Kong, and beyond.

5.7 Regional Transportation Developments

This section provides updates on both rail and ground access improvements in Boston and the airports in the surrounding region.

5.7.1 Rail Transportation Improvements

This subsection reports on recent developments and current long-distance rail service originating in Boston, the status of air-rail linkages in the Northeast Corridor, and the expanding Pilgrim Partnership, which provides commuter rail between Massachusetts and Rhode Island.

Amtrak Northeast Corridor High-Speed Rail

Amtrak's Northeast Corridor (NEC) is a 457-mile intercity rail line that operates between Boston-South Station and Washington, DC via New York City. Other major destinations served by the route include Providence, Rhode Island; New Haven, Connecticut; Philadelphia, Pennsylvania; and Baltimore, Maryland. Logan Airport passengers can connect directly to Boston-South Station via Silver Line bus rapid transit (BRT) service or via taxi. Amtrak operates two services between Boston and Washington, DC: the Acela Express (high-speed, limited-stop service) and the Northeast Regional (lower-speed service that makes local stops along the route). A total of 19 daily departures are offered from Boston-South Station to Penn Station in New York, of which about half are Acela Express. Most trains continue south to Washington, DC, and a smaller number of Northeast Regional trains continue further south to Newport News, Virginia.

System-wide Amtrak ridership was 31.7 million one-way trips in its fiscal year 2017, which ended September 2017. The NEC represented 38 percent of total system-wide Amtrak ridership. In fiscal year 2017, the NEC carried 12 million passengers, an increase of one percent over fiscal year 2016. Acela Express accounted for nearly 3.4 million passengers, while the Northeast Regional accounted for 8.6 million passengers. Amtrak's share of the Northeast total passenger market has increased substantially since the introduction of Acela service in 2000. Amtrak captures more than half of the total air/rail market between Boston and New York, up from 20 percent in 2000, before the introduction of Acela. Several developments and trends have contributed to Amtrak's ridership growth including the introduction of Wi-Fi, high gas prices, overall growth in business travel along the corridor, and traveler frustration with increasing highway congestion and the inconveniences of airline travel.

Northeast Corridor Infrastructure Master Plan and Next-Generation High Speed Rail Plan

The *Northeast Corridor Infrastructure Master Plan*, a new regional rail planning study, was released in May 2010.[81] This master plan documents NEC growth needs through 2030, including expanded capacity and improvements in Boston-New York and New York-Washington intercity travel times. A 76 percent increase in rail ridership from 13 million to 23 million, a 36 percent increase in train movements from 154 to 210 average weekday, and the need for $52 billion in additional capital investment is expected over the next 20 years.

Following up on the release of the *Northeast Corridor Infrastructure Master Plan*, Amtrak also unveiled a next-generation high-speed rail proposal in September 2010 titled *A Vision for High-Speed Rail in the Northeast Corridor*. The proposal outlines a brand-new 426-mile two-track corridor running from Boston to Washington, offering high-speed rail service with sustained maximum speeds of 220 mph. The route would allow for an 84-minute trip time between Boston and New York and a three-hour trip time between Boston and Washington. Under this high-speed rail plan, the New York City – Boston market could see a further shift from auto and air to rail due to the dramatic improvements in rail travel times, and the plan projects the air market between the two city-pairs to be nearly eliminated by 2050. This plan states that the traveler shift to high speed rail would reduce delays on competing modes, and the shift away from short-haul flights would free up air transport capacity for higher-value transcontinental and international flights.

An update to the *Northeast Corridor Infrastructure Master Plan* and *A Vision for High-Speed Rail in the Northeast Corridor* was released in July 2012.[82] Since these two documents were released, the two programs have been integrated into a single, coherent service and investment program, called the Northeast Corridor Capital Investment Program. The *Northeast Corridor Capital Investment Plan: Fiscal Years 2017 to 2021* would advance the near-term projects outlined in the Master Plan to benefit the NEC while incrementally phasing improvements to the Acela high-speed service to support the next-generation high-speed rail proposed. The near-term NEC improvements are identified to occur between 2012 and 2025 and the long-

[81] https://nec.amtrak.com/wp-content/uploads/2017/08/Northeast-Corridor-Infrastructure-Master-Plan.pdf
[82] http://www.gcpvd.org/wp-content/uploads/2012/07/Amtrak_Amtrak-Vision-for-the-Northeast-Corridor.pdf

term next-generation high-speed rail improvements are identified to occur between 2025 and 2040. The publication of the 2012 update is the first step in "improving the NEC for all users in order to sustainably support the population and economic growth facing the Northeast over the next 30 years" but more planning work is required by all stakeholders.

Amtrak is building the foundation for its Northeast Corridor vision to enable next generation high-speed rail service with trip time reductions and trains that are more frequent. As part of the first of many phased improvements, Amtrak signed a purchase agreement for 28 next-generation high-speed trains to replace the equipment currently used for the Acela Express service. The trains will increase passenger capacity by 35 percent, cut down energy consumption by 20 percent, and will be lighter to decrease track wear and tear. The first of these trainsets is expected to enter service in 2021, and the current fleet will be retired by the end of 2022. The full build-out of the next generation vision is anticipated to be complete by 2040.

Boston-South Station Expansion

The *Northeast Corridor Capital Investment Plan: Fiscal Years 2017 to 2021* documents the investments required over the fiscal year 2018-2022 period. States, commuter railroads, and Amtrak will provide approximately $3.3 billion over the next five years in basic infrastructure capital funding. In support of the CIP, MassDOT is designing and planning the expansion of the Boston-South Station to meet the infrastructure and capacity needs of the NEC. With over 320 daily trains, South Station is Amtrak's third busiest station on the NEC, the busiest in the MBTA commuter rail system, and the second busiest of all the Red Line subway stations.[83]

At present, South Station operates above its design capacity for efficient train operations and orderly passenger queuing. MBTA Commuter Rail ridership has grown 25 percent, and Amtrak ridership has grown 43 percent in the past ten years at South Station.[84] Due to limited space at the nearby Southampton Street Yard, trains are stored on station tracks, taking up space from the already limited capacity station. The passenger experience is also due for enhancements, as the station's tracks are exposed to nature's elements, forcing riders to travel through snow or rain to reach their trains.

The Boston-South Station Expansion projects would expand the station beyond its current capacity. Plans may include new tracks and new passenger facilities with more amenities, as well as additional storage space for MBTA trains. The project is awaiting additional funding to advance to the design and construction stages.

Amtrak Downeaster Rail Service

The Downeaster is a regional passenger rail service that is managed by the Northern New England Passenger Rail Authority and operated by Amtrak. The service links Boston's North

[83] NEC Capital Investment Plan 2018-2022
[84] MassDOT, South Station: A Growing Demand for Expansion, 2018

Station to Brunswick, Maine with 10 intermediate stops. The full extension to Brunswick opened in late 2012. Five daily roundtrips are operated between Boston and Portland, Maine and three trains continue on to Brunswick. The Downeaster expects to make five round trips per day on its entire line as soon construction of a secondary passing rail line in Falmouth and Cumberland, called Royal Junction Siding, is completed. Expanded service could start as early as 2019.

In Amtrak's fiscal year 2017, ending September 2017, ridership on the Downeaster increased by 5.2 percent over the prior year to more than 526,000 passengers. The 2017 ridership was below the peak ridership seen in fiscal year 2014 when average gas prices were more than $1.30 per gallon higher. Amtrak's fiscal year 2018 ridership is expected to continue to increase from the 2017 level.

Initial approval was given by the Northern New England Passenger Rail Authority board to trial and extension of Downeaster service from Brunswick to Rockland during the summer of 2018, but plans were discontinued when Amtrak was unable to conduct a risk assessment of the 58 miles of track along the route. Amtrak is planning to reevaluate service along this proposed route in 2019.

Pilgrim Partnership Commuter Rail Services

The Pilgrim Partnership is an arrangement between the MBTA and the Rhode Island Department of Transportation (RIDOT), under which RIDOT allocates some of its federal funding to the MBTA in return for commuter rail service between Boston from Rhode Island. Twenty daily (weekday) round-trips are provided between Boston and Providence. Expanded commuter rail service to T.F. Green Airport in Warwick, RI was introduced in 2010. Travel time between Boston and Warwick is approximately 1 hours and 25 minutes, and eight of the 20 daily Boston-Providence departures currently continue on to Warwick. Expanded service to Wickford Junction Station in Kingstown, RI commenced in 2012.

This extended commuter rail enhances ground access options from the Boston metropolitan area to T.F. Green Airport. Based on the NERASP Study, the passenger catchment areas of T.F. Green and Logan Airport overlap, and this new commuter rail service has the potential to attract passengers in the overlapping catchment area living along the Providence/Stoughton MBTA commuter rail line to T.F. Green Airport.

The Pilgrim Partnership Agreement continues through a series of amendments between the two agencies, which also includes providing rail service for special occasions, such as major sport events or airshows. In 2016, the MBTA, RIDOT, and the Rhode Island National Guard launched the Trains to Planes program. This initiative provides free rail service between Providence and Quonset during the Air National Guard Airshow.

Worcester to Boston Commuter Rail

Commuter service has grown between Worcester and Boston in recent years. In 2010, there were 12 daily round trips between Worcester's Union Station and Boston's South Station. In

2018, the daily frequency has increased to 20 round trips a day. In 2012, the Commonwealth of Massachusetts acquired the tracks between Worcester and Boston and moved the CSX freight operations from Allston to Worcester, Westboro, and West Springfield. This enabled more passenger commuter trains to operate on the line.

In 2016, the MBTA launched the "Heart to Hub" Worcester Line Commuter Rail express train, which provides service between the two cities in less than an hour. It typically operates each weekday with one morning nonstop train from Worcester to Boston and one evening nonstop train on the reverse route.

5.7.2 Airport Ground Access Improvements

This section reports on recent improvements to landside access that have occurred at the airports in the region, including Logan, Bradley, and Worcester.

Boston Logan International Airport Improvements

Massport provides frequent, scheduled, express bus service to Logan Airport for air passengers and Logan Airport employees from park-and-ride lots in Braintree, Framingham, Woburn, and Peabody (Logan Express network). Full service bus terminals and secure parking are provided at these four locations. Travel time is approximately 30-45 minutes. In 2015, a 1,100-space parking garage was opened at the Framingham station, doubling the amount of parking available. Early-bird trips have also been added to increase the ability for passengers to make early morning flights and for employees to make shift changes.

In 2014, as part of a pilot program, Massport initiated new bus service to the heart of Boston. The Back Bay Logan Express service connects Logan Airport to Boston's Back Bay (with stops at Hynes Convention Center and Copley Square). The bus service runs on a 20-minute schedule between 5AM and 10PM and the ride takes approximately 20 minutes in normal traffic conditions, more time during rush hour periods. As of May 1, 2019, the pick-up and drop-off site will move from Copley Square to the MBTA's Back Bay Station, and further, passengers taking the Back Bay Logan Express service will have access to the front of the security line upon arrival to the passenger terminal.

In 2013, Massport opened a new consolidated rental car facility known as a consolidated Rental Car Center (RCC), to accommodate all of the rental car companies at one single location (two of the rental car companies were previously located at an off-airport location). The facility houses a four-level parking structure for 3,200 ready, return, and storage parking spaces, a 120,000 square-foot customer service center, and four limited-maintenance service areas for rental car fleets. As part of the construction, multiple roadways were modified to improve and reduce roadway and curbside congestion. A bus access ramp was also built to support the customer terminal, and the shuttle bus system was unified to eliminate rental car shuttle buses. The new consolidated rental car facility is LEED Gold certified, and it provides 616 solar panels on its roof which produce 150 kilowatts of power.

In 2018, the U.S. Environmental Protection Agency (EPA) approved a State Implementation Plan (SIP) that increases the total number of commercial parking spaces in the Logan Airport Parking Freeze area by 5,000 parking spaces to a total of 26,088. The goal of the plan is to reduce carbon monoxide and nitrogen oxide emissions by reducing vehicle miles traveled resulting from insufficient parking at Logan Airport.[85] Permitting of the additional parking spaces is underway.

Bradley International Airport Improvements

In 2017, the Connecticut Airport Authority began construction of a new roadway system at Bradley International Airport's Route 20 entrance. The project involves the realignment of Schoephoester Road along with a portion of the airport's lower roadway system, as well as the construction of a new roundabout to handle greater traffic volume. Construction is expected to be complete in the fall of 2018.

The new roadway system will also provide access to the future development of the airport's consolidated rental car facility and ground transportation center. This new facility is expected to provide 830 parking spaces for the rental car companies, and it will eliminate shuttle buses to the rental car facilities. Construction is planned to begin in 2019.

The Connecticut Airport Authority is also in discussions to provide a shuttle service between the airport and Windsor Locks train station. With the launch of the Hartford Line commuter rail service between New Haven and Springfield, Massachusetts in 2018, more trains will stop at the Windsor Locks train station, which is located three miles away from the airport. Currently, bus service is provided only between the airport and downtown Hartford via CT*transit*'s 30-Bradley Flyer. The service operates hourly, seven days a week.

Worcester Roadway Improvements

The ground access infrastructure at Worcester Regional Airport does not currently inhibit the growth of air service, as passenger activity is dictated by the services offered and not the roadways leading to the airport. If robust passenger growth continues, Worcester Regional Airport's limited ground access infrastructure is expected to require improvements to maintain efficient traffic flow. Improvements have previously been made to Goddard Memorial Drive and other existing roadways. A 2013 study by MassDOT evaluated several connector roadway alternatives around I-495 and Route 9, but residential areas and wetlands would limit development.[86] The study also examined building a train station in Leicester and extending commuter service but concluded that insufficient numbers of people would use the service to justify the cost.

[85] Environmental Protection Agency, Air Plan Approval; Massachusetts, Logan Airport Parking Freeze, 2018

[86] MassDOT, Interstate 495 and Route 9 Interchange Improvement Study, 2013.

Interstate 495 and Route 9 Interchange Improvements

The area in Southborough and Westborough in the vicinity of I-495 and Route 9 have experienced significant growth in population and employment that contributed to high commuter traffic volumes and road congestion in the past years. This area is also the home of large industrial and office parks, as well as shopping centers. To ease congestion and to identify future improvements, the MassDOT initiated the *Interstate 495 and Route 9 Interchange Improvement Study* in 2011. The study involved the development and evaluation of a wide range of transportation improvement alternatives, including roadway safety improvements, braided ramps to separate merging and diverging traffic, construction of new ramps and widening of existing ramps, and realignment of existing roadways. The study also provided recommendations to reduce single occupancy vehicle traffic and to enhance public transit options via bus and rail. Recommendations of the study were published in 2013.

6 Ground Transportation

Chapter 6 describes the ground transportation system serving Hanscom Field and the relationship between the airport and that system. This chapter (1) compares current traffic data with data from the 2012 ESPR, (2) makes a retrospective comparison of existing conditions with forecasts from the 2012 ESPR, and (3) provides a prospective assessment of the 2025 and 2035 future airport activity scenarios.

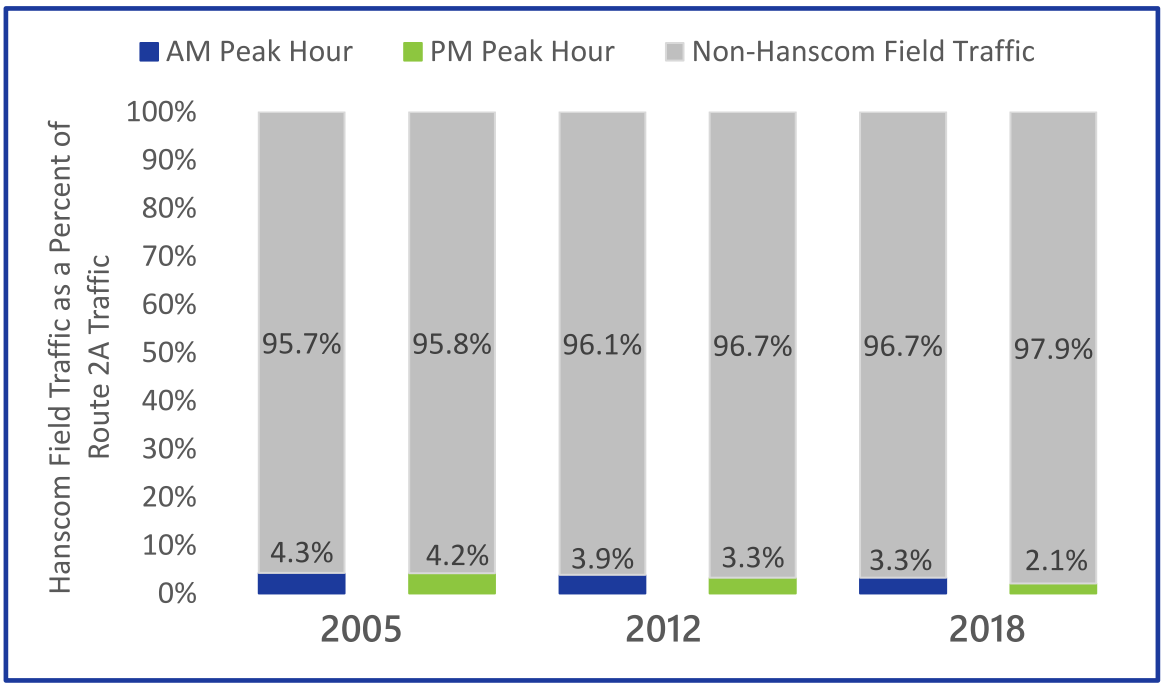
This chapter presents the current transportation demand management (TDM) activities in proximity to Hanscom Field, describes current efforts to reduce single occupancy vehicle (SOV) trips to Hanscom and discusses opportunities for expanding on existing demand reduction efforts.

The 2017 ESPR future scenarios were used to evaluate the potential cumulative environmental effects that could occur if Hanscom Field reaches the airport activity levels that are described in Chapter 3 of this document. The 2025 and 2035 scenarios represent estimates of what could occur depending on demand, based on forecasted operations related to airport ground transportation in the future .

6.1 Key Findings Since 2012

Traffic in and out of Hanscom Field has traditionally occurred outside of the morning and afternoon peak traffic hours of the surrounding area. The traffic analyses conducted for this ESPR confirm that this finding has not changed since the *2012 ESPR*. Furthermore, Hanscom Field-related traffic on surrounding roadways remains minimal in relation to other traffic present on these facilities. This analysis does not include review of traffic impacts related to Hanscom Air Force Base (AFB) – which is not included in the impact analysis of this ESPR. Based on the traffic analysis Hanscom Field-related traffic only contributes to approximately two percent of peak hour traffic volumes along Route 2A, east of Hanscom Drive. This represents a decline from the *2012 ESPR* where Hanscom Field-related traffic contributed to between three and four percent of peak hour traffic volumes on this facility. Additionally, Hanscom Field-related traffic now contributes 10 percent or more of the total traffic at only three of the ten nearby intersections studied. This also reflects a reduction as compared to the 2012 findings. The recent relocation of the National Aviation Academy of New England off airport property has considerably reduced parking and associated vehicle trips.

Figure 6-1 Percent of Hanscom Field traffic on Route 2A East of Hanscom Drive



Note: Traffic data for the *2017 ESPR* was collected in April, 2018. Traffic volume, vehicle occupancy, and parking demand in 2018 is likely comparable to what occurred in 2017.
Source: FHI, 2018

The traffic forecasts include vehicle trips generated by Hanscom Field, future background traffic growth, and planned developments in the area. The traffic analysis reconfirms previous ESPR findings that Hanscom Field is not a significant contributor to traffic volumes on the surrounding roadways, particularly during morning and evening peak hours. Commercial and residential developments, coupled with the local reliance on single occupancy vehicle (SOV), remain the most significant sources of existing and future traffic volumes on area roadways.

As Figure 6-1 indicates, Hanscom Field traffic accounts for approximately two percent of the morning and afternoon peak hour traffic volumes on Route 2A, east of Hanscom Drive, which is a reduction from the *2012 ESPR* findings. Hanscom Field traffic has decreased since 2012, while overall Route 2A peak hour traffic volumes have increased. Furthermore, due to the nature of operations at General Aviation airports like Hanscom Field, traffic activity by employees and passengers typically occurs outside of traditional peak commuting periods, because activity tends to occur either very early or late in the day, or at midday. This type of operation does not follow typical peak period commuting patterns. In addition, the employee travel survey, which implied more typical peak hour commuting patterns, accounts for only a portion of the total arriving and departing trips; a more representative measure of travel patterns for all Hanscom Field trips is illustrated by the traffic count data at driveways to Hanscom Field (see Section 6.1.4)

The average daily traffic volumes on Hanscom Drive, the primary access road to Hanscom Field from the surrounding roadways, decreased from 2,200 vehicles in 2012 to 1,700 in 2018. This extends the long-term trend seen on Hanscom Drive since 2005, as traffic volumes have declined from an observed 2,600 vehicles per day (vpd) in 2005, to the 1,700 vpd observed during the preparation of the *2017 ESPR*.

The projected increased amount of peak hour traffic volumes associated with Hanscom Field activity for the 2025 and 2035 forecast scenarios is tied to the projected increased in aviation activity described in Chapter 3 Airport Activity Levels. However, in a shift from the *2012 ESPR*, this analysis of future scenarios no longer includes the construction of a hotel or a museum on Massport property.

This traffic analysis for the *2017 ESPR* also includes trips generated at the recently-constructed Rectrix on Virginia Road in the Pine Hill area of Hanscom Field. While the peak-hour trips generated at Rectrix are minimal, the construction of this facility represents a small shift in travel patterns for trips generated by Hanscom Field. Prior to the construction of Rectrix, nearly all Hanscom Field-related traffic accessed the airport via the main entrance at Hanscom Drive. With the opening of Rectrix, however, a proportion of Hanscom Field-related traffic now accesses Hanscom Field via the entrance on Virginia Road. Additionally, the 2025 and 2035 forecast scenarios also include an increase in aviation activity; as a result, peak hour vehicle trips are anticipated to increase at both the Pine Hill area and the North Airfield area off Hartwell Road as redevelopment of those parcels is expected before 2025. Future ESPR documents should include these locations in the traffic count program as appropriate.

Table 6-1 Hanscom Field Vehicular Trip Generation (Vehicles per Hour)

Year / Scenario	Morning Peak Hour	Afternoon Peak Hour
2005 Actual	157	154
2012 Actual	165	121
2018 Actual	110	107
2025 Forecast	138	125
2035 Forecast	167	146

Source: 2012 Hanscom Field ESPR and FHI, 2018.

Table 6-1 presents actual Hanscom Field peak hour trip generation since 2005 and the forecast trip generation for 2025 and 2035. As presented, the data shows a decrease in Hanscom Field-related peak hour vehicular trips since 2005. Furthermore, Table 6-1 shows projected increases to peak hour traffic volumes generated by Hanscom Field returning to similar levels to those of 2005, and does not represent a substantial increase from historical traffic volumes seen at the airport in past years.

6.2 Existing Conditions

This section describes the existing ground transportation and traffic conditions both to and from, and in the vicinity of Hanscom Field.

6.2.1 Data Collection

While the *2017 ESPR* documents Hanscom Field activities from 2012 to 2017, Chapter 6 extensively utilizes data from traffic, vehicle occupancy, and parking demand counts conducted in April 2018. The data collection period was selected in order to capture typical traffic volumes and patterns and avoid any anomalies that could result from winter storms; federal or religious holidays when many offices and schools are closed; and local school vacation weeks. Therefore, all traffic volume, vehicle occupancy, and parking demand data used for the traffic analyses in this ESPR will be labeled and referenced as 2018 data throughout this chapter. Traffic volume, vehicle occupancy, and parking demand in 2018 is likely comparable to what occurred in 2017. Data collection methods are discussed in the following sections.

6.2.2 Regional Ground Transportation Context

This section describes the regional ground transportation system surrounding Hanscom Field including: (1) the regional highway system, (2) regional rail and transit (commuter rail and local service), (3) the regional pedestrian, bicycle and recreation network, and (4) adjacent trip generators that contribute to trip demands in the area.

Regional Highway System

A roadway network of major expressways, including Routes 128/I-95, 2, and 3, surrounds Hanscom Field (see Figure 6-2). Route 128/I-95 Exit 30 (at Route 2A) is the closest highway exit for Hanscom Field, although Exit 31 (at Route 4-225) also provides access to Hanscom Field. Route 2A, which is designated as the Battle Road Scenic Byway, provides primary east/west access to and from Hanscom Field with direct access to Hanscom Field provided via Hanscom Drive. Traffic to and from the north may approach Hanscom Field from Route 4/225 and Route 62 or from Route 128/I-95 while traffic to and from the south primarily use Route 128/I-95. Route 2 generally provides connection to areas to the west of Hanscom via Route 2A and Bedford Road. In the vicinity of Hanscom Field, most intersections are unsignalized, with the exception of Massachusetts Avenue. A left-turn lane is provided in the eastbound direction at Hanscom Drive. Traffic flows follow general commuting patterns of the area, with heavier eastbound flows toward Route 128/I-95 and Boston during the morning peak hour and heavier westbound traffic flows during the afternoon peak hour.

Regional Rail and Transit

The nearest commuter rail stations to Hanscom Field are located less than 5 miles away in Concord Center at Concord Station and in Lincoln at Lincoln Station. Both Concord Station and Lincoln Station are serviced by the Wachusett/Fitchburg Line of the Massachusetts Bay Transportation Authority (MBTA) Commuter Rail, which provides the station with 17 inbound and 17 outbound trains every weekday with service to Boston's North Station (inbound) and to Wachusett Station (outbound). Wachusett Station opened for full service on November 21, 2016. Service frequency is provided roughly every half hour in the peak hour in the peak direction only, and approximately hourly at all other times. Commuter rail service operates at Concord Station between 5:30 AM and 12:30 AM. Weekend service is provided both Saturday and Sunday with 7 trains inbound and 7 trains outbound, and with frequencies of roughly every 2 hours. Weekend service operates from approximately 7:15 AM to 12:15 AM Currently, no shuttle or transit service is available between Hanscom Field and either Concord Station or Lincoln Station, limiting convenient access of commuter rail to commuters to and from the Hanscom Field area.

For commuters, Hanscom Field is primarily served by MBTA Bus Route 76. This route operates between Alewife Station (northern terminus of the MBTA Red Line in Cambridge), Lincoln Labs, and Hanscom Civil Air Terminal. This service operates locally between Alewife Station and the Civil Air Terminal; serving customers along Massachusetts Avenue in Lexington and those in Lexington Center before serving Hanscom Field. Furthermore, Route 76 is designed with preference to customers commuting from Alewife Station to Lincoln Labs in the morning peak hours and the reverse in the evening peak hours. This preference is implemented by servicing Lincoln Labs first on the outbound runs in the morning periods and then the reverse in the afternoon periods. These two factors in the route design (local service and preference to Lincoln Labs) result in a commute from Alewife Station to Hanscom Civil Air Terminal that takes approximately 49 minutes in the AM Peak Hour, while the reverse commute in the PM Peak Hour takes approximately 58 minutes. This compares to roughly 30-minute peak hour service provided by the express REV BUS to and from Alewife Station and the Hartwell Road area described below. Route 76 operates between the hours 6:00 AM and 10:30 PM on weekdays, with frequency provided roughly every half hour in the morning and afternoon peak hours. Saturday service is provided on an hourly basis with a combined 62/76 route between the hours of 8:00 AM and 8:30 PM. This combined route connects Hanscom Civil Airfield with Alewife Station to the south and Bedford V.A. Hospital to the north. No MBTA bus service is provided for these routes on Sundays.

Additionally, the towns of Lexington and Bedford each operate their own transit systems, called LEXPRESS and Bedford Local Transit, respectively. Lexington's system operates on six fixed routes, each with one-hour headways, running from 6:30 AM to 6:30 PM on weekdays. LEXPRESS routes operate almost entirely within Lexington town limits; however, several of the LEXPRESS routes cross the MBTA Route 76, which services Hanscom Field. The LEXPRESS routes closest to Hanscom Field are Routes #4 and #2, which are approximately two to three miles from Route 2A and Hanscom Drive. Bedford's transit system is oriented more towards shopping trips for seniors within the town, as service is provided via a single round trip each weekday.

Another transit service in the area includes the Route 128 Business Council's REV BUS service, which provides express service for commuters of the Hartwell Avenue area in Lexington from Alewife Station. Service is provided over three peak hour trips, in a 32-passenger bus; fares are $1 for employees of member organizations and $3 for the public. Trip times vary between 15 minutes to a half hour, based on time of departure from Alewife Station and traffic conditions.

Furthermore, MIT and Lincoln Labs operate a private shuttle between the Lincoln Labs campus on Hanscom AFB and MIT in Cambridge. Service is provided every two hours and runs between the hours of 7:00 AM and 7:00 PM.

Regional Pedestrian, Bicycle, and Recreation Network

The Minuteman Commuter Bikeway is a 10-mile paved trail that extends from Alewife Station in Cambridge to Depot Park in Bedford. This popular trail provides direct access to the MBTA Red Line, which provides service to and from Cambridge and Boston. To the north, the Minuteman Commuter Bikeway connects to the Reformatory Branch Trail and the Narrow Gauge Rail Trail. The Narrow Gauge Rail Trail extends north three miles to Billerica via a crushed stone surface, while the Reformatory Branch Trail extends four miles to Lowell Road in Concord. The Reformatory Branch Trail is currently an improved natural surface path; however, funds have been allocated in the Boston Metropolitan Planning Organization's (Boston MPO) Transportation Improvement Program (TIP) to upgrade this trail to a paved surface for the two-mile distance between Depot Park and Wheeler Drive in Bedford in 2022.

In addition to these three trails, the six-mile Battle Road Trail, within the borders of the Minute Man National Historical Park, is also a resource for bicycle riders offering cycling, pedestrian, and wheelchair access to the National Park Service's historic and natural resources. However, these trails are not paved and do not directly link to the other regional trails. Efforts by the Town of Lexington to connect the Battle Road Trail to the Minuteman Commuter Bikeway were undertaken with the development of a conceptual plan for a 4.4-mile West Lexington Greenway plan.

Finally, in addition to these trails, there are several on-road bicycle facilities in the towns surrounding Hanscom Field. These facilities are mostly bike lanes or unmarked shoulders. Marked bike lanes are sporadic in all four communities adjacent to Hanscom Field; however, bike lanes currently exist on Hartwell Avenue in Lexington and on Route 4 north of Lexington Center.

Adjacent Trip Generators

Hanscom Field is surrounded by other trip generators that contribute to the demands for travel on the roads, transit system, bicycle, and pedestrian network described here. This document is intended to isolate the impacts of trip generation to and from Hanscom Field in order to plan for the transportation needs associated with changes at Hanscom Field. That said, it's important to recognize the presence of adjacent trip generators in order to put the Hanscom Field operations into perspective. These adjacent generators include:

- Hanscom AFB;
- Numerous commercial offices and research facilities including MIT Lincoln Labs;
- The Minute Man National Historical Park; and
- Minute Man Regional High School.

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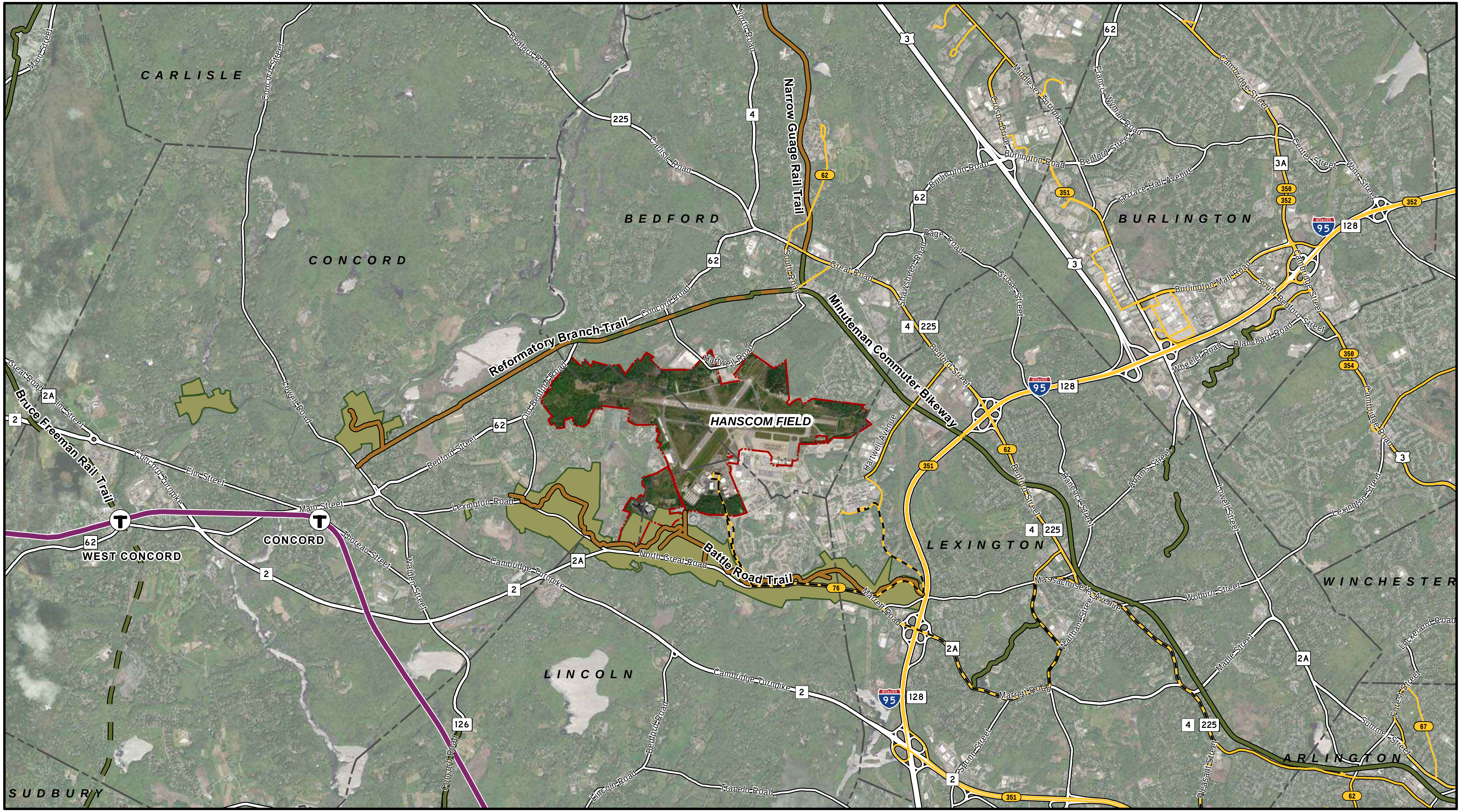

North

0 0.25 0.5 0.75 1 Mile

Hanscom Field Property Boundary
Municipal Boundary
Minute Man National Historical Park
Interstate
U.S. Highway
State Route
Local Road
Paved Bike Path
Paved Bike Path - Future
Improved Natural Surface Bike Path
MBTA Commuter Rail Station
MBTA Commuter Rail Line (Fitchburg Line)
MBTA Bus Route 76
MBTA Bus Route (Multiple Routes)

Data Sources: Bike Paths (MassGIS - 12/9/17, OpenStreetMaps - 9/27/18, FHI verified with aerial imagery dated 4/22/18 and government and project websites); Minute Man National Historical Park Boundary (National Park Service - 2/22/18); Municipal Boundaries (MassGIS - 3/5/13); Streets, MBTA Bus Routes, MBTA Commuter Rail (MassGIS - 7/17/2018); Aerial Imagery (ESRI)

massport

L. G. Hanscom Field

2017 Environmental Status & Planning Report

Hanscom Field
Regional Transportation Network

Figure 6-2

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6.2.3 Regional Ground Transportation Planning Context

Regional transportation planning is primarily conducted through the Boston Metropolitan Planning Organization (MPO), which was established to direct federally-funded transportation plans and programs. The Boston MPO is responsible for prioritizing transportation projects in the region and is the key organization that programs federal transportation funding to specific projects. This section describes the structure of the MPO planning process and the key planning documents affecting ground transportation access at Hanscom Field.

In addition, other organizations such as the Massachusetts Department of Transportation (MassDOT), the MBTA, and other organizations such as the Route 128 Business Council undergo their own planning efforts, which are described in further detail below.

Boston Region Metropolitan Planning Organization

The Boston MPO region encompasses 97 cities and towns in the Boston region, including Bedford, Concord, Lexington, and Lincoln. The MPO has 22 voting members, one of which is Massport. Other voting members include other state agencies such as MassDOT and the MBTA; other regional organizations such as the MBTA Advisory Board, the Metropolitan Area Planning Council, and the Regional Transportation Advisory Council; the City of Boston; and 12 elected members from the remaining 96 cities in town in the region.

Among the most critical planning documents produced by the Boston Region MPO are the Transportation Improvement Program (TIP)[87] and the Long-Range Transportation Plan (LRTP).[88] Together, these documents prioritize and program federal transportation funds in the region, with the TIP providing project programming over the course of five years and the LRTP proving broader thematic goals in the area of transportation investment and funding over a 25-year planning horizon. Specific projects may be sponsored by organization members for consideration for federal funding, with the final list of programmed transportation projects representing a list of considered projects that have been prioritized and voted upon by the region.

The current TIP, approved by the MPO in May of 2018, includes a program of transportation funds for the years 2019-2023. The current LRTP, approved by the MPO in 2015, includes thematic goals and projects in the region for the years 2016-2040. Furthermore, each of these documents includes projects listed in a so-called "Universe of Projects" list, which identifies projects sponsored throughout the region, but not programmed in any document. Table 6-2 includes a list of relevant projects close to Hanscom Field programmed within the 2019-2023 TIP, as well as projects identified in the 2016-2040 LRTP that are not identified in the TIP.

[87] Boston Region Metropolitan Planning Organization, *Transportation Improvement Program, Federal Fiscal Years 2019-2023*, May 24, 2018. Accessed at: http://bostonmpo.org/data/pdf/plans/TIP/FFYs_2019-2023_Final_TIP_20180605.pdf
[88] Boston Region Metropolitan Planning Organization, *Charting Progress to 2040,* Accessed at: http://www.ctps.org/data/pdf/plans/LRTP/charting/2040_LRTP_Full_final.pdf

Table 6-2 Boston MPO TIP and LRTP projects relevant to Hanscom Field

MPO Planning Document	Project Title	Project Description	Status
2019-2023 TIP	Bruce Freeman Rail Trail (BFRT) Phase 2B – Acton and Concord	This proposed project would connect a 4,500-foot gap between the already completed phases of the BFRT with a pedestrian bridge over Route 2.	Currently programed for funding in 2019
2019-2023 TIP	Minuteman Bikeway Extension – Bedford	This proposed project would extend the Minuteman Commuter Bikeway by paving the existing natural surface Reformatory Branch Trail.	Currently programed for funding in 2022
2019-2023 TIP	Resurfacing on Route 2A – Concord, Lincoln, and Lexington		Currently programed for funding in 2023
2016-2040 LRTP	Middlesex Turnpike Phase 3 Improvements between Plank Street and Manning Road – Bedford and Billerica	This project involves widening a historic 2-lane arterial to a 4-lane arterial with medians and dedicated turn lanes throughout the project limits.	Under construction as of October 2018
2016-2040 LRTP	Route 4/225 and Hartwell Avenue Project – Lexington	This project involves the installation of access management controls on Route 4/225 while increasing capacity to and from Hartwell Avenue.	Planned

Projects identified in the "Universe of Projects" in both the TIP and LRTP, but not identified for funding in either plan include:

- West Lexington Greenway – Lexington;
- Connect the Minuteman Commuter Bikeway with the Battle Road Trail;
- Route 2 Capacity Improvements – Acton, Concord, and Lexington;
- Reconstruction of South Road between Washington Street and Summer Street – Bedford;
- Reconstruction of Wiggins Avenue – Bedford;
- Reconstruction of Massachusetts Avenue between Marrett Road and Pleasant Street – Lexington;
- Reconstruction of Waltham Street – Lexington; and
- Reconstruction of Hayden Avenue – Lexington.

MassDOT Planning Efforts

The Massachusetts Department of Transportation frequently engages in their own internal planning efforts to direct investment to MassDOT transportation assets across the state. These planning efforts are documented in individual plans such as the MassDOT Bicycle Plan, the MassDOT Freight Plan, the MassDOT Pedestrian Plan, and the MassDOT Rail Plan. Additionally, MassDOT is currently engaged in developing the MBTA Focus40 plan with a focus on strategies to enhance MBTA service through 2040. Review of the MassDOT Pedestrian Plan, the MassDOT Freight Plan, and the MassDOT Rail Plan does not reveal any projects that would affect access to Hanscom Field. As the MassDOT Bicycle Plan and the MBTA Focus40 are still under development, review of these documents could not be completed.

Furthermore, MassDOT is responsible for the development of the five-year Capital Investment Plan, which directs state funds to MassDOT-sponsored transportation investments. While similar to the TIP developed by the Boston MPO for the Boston region, the CIP identifies additional projects outside the scope of the TIP that do not utilize federal funds. If only state funds are used, a project may appear in the CIP while not appearing in the TIP.

Relevant projects identified in the CIP for funding between 2019 and 2023 include:

- Minuteman Bikeway Extension – Bedford;
- Resurfacing on Route 2 – Concord;
- Bruce Freeman Rail Trail (BFRT) Phase 2C;
- Reconstruction of Massachusetts Avenue between Marrett Road and Pleasant Street – Lexington;
- Replacement of Route 126 Bridge over the B&M Railroad; and
- Yankee Doodle Bike Path Phase 1 (extension of the Narrow Gauge Rail Trail) – Billerica.

MBTA Planning Efforts

Focus40 is the 25-year investment plan to position the Massachusetts Bay Transportation Authority (MBTA) to meet the needs of the Greater Boston Region by 2040. A draft of the Focus40 Plan was released on July 30, 2018. Review of the draft of the Focus40 plan does not indicate that any changes should be expected to directly affect Concord or Lincoln Station on the Fitchburg/Wachusett Commuter Rail Line. The MBTA Rail Vision Study is expected to be completed in 2019, and further review of these plans with respect to changes on the Fitchburg/Wachusett Line should continue to be evaluated at the time of release. Furthermore, MBTA is embarking on a multi-year effort called the Better Bus Project to reevaluate the MBTA bus network from the ground up. MBTA anticipates the study to be complete by 2020. Likewise, review of this planning study should continue as more information is released by the MBTA.

Metropolitan Area Planning Council Planning Efforts

The Metropolitan Area Planning Council (MAPC) is the regional planning agency serving 101 cities and towns in the Metropolitan Boston region. MAPC focuses much of their transportation planning efforts as part of their participation in the Boston MPO, although the organization does conduct independent studies from time to time. A review of publications published by MAPC revealed that relevant projects were limited to the LandLine-Metro Boston Greenway Network released by MAPC in spring 2018. This plan reiterates the intention to connect the Battle Road Trail to the Minuteman Commuter Bikeway to the east in Lexington Center, and to the Reformatory Branch Trail to the west in Concord Center.

Middlesex 3 Coalition

The Middlesex 3 Coalition is a regional partnership of nine Middlesex County Communities including Bedford, Billerica, Burlington, Chelmsford, Lexington, Lowell, Tewksbury, Tyngsborough, and Westford. The coalition communities share a common goal of fostering economic development, job growth and retention, diversification of the tax base, and enhancement of quality of life. Members include stakeholders in local government, business, finance, education, and development who have combined resources to promote the competitive advantages of the region and advance the economic vitality of the Route 3 Corridor.

Due to the significant amount of business development happening along the Route 3 Corridor, traffic and transportation resources continues to be a top priority for the Coalition. Several transportation-related efforts undertaken by the Coalition include:

- The Middlesex 3 Transportation Sub-committee was created as a way for members to collaborate and strategize methods for tracking transportation issues in member communities.
- The Middlesex 3 Transportation Community Compact was received in 2015; it allows the Coalition to work with the state and transportation agencies to evaluate current

public transportation services in the area and develop recommendations for improvements to services that fail to meet current and future transportation demand.

- The Middlesex 3 Transportation Management Association (M3TMA) was formed in 2014 to address transportation issues such as traffic congestion and to improve air quality in the region. The M3TMA offers transportation resources to public or private businesses, educational institutions or residential institutions.

Hanscom AFB Planning Efforts

Hanscom AFB is currently expected to conduct improvements at the Vandenburg Gate at Old Bedford Road which is expected to include gatehouse relocation and improvements to the intersection of Hanscom Drive and Old Bedford Road. In a US Army Corps drawing dated May 2018, key modifications include the installation of a single-lane roundabout at Hanscom Drive and Old Bedford Road with Hanscom AFB bound traffic on the northbound leg separating from through traffic via a free-flow right turn ramp to the gatehouse. In addition, the southbound right turn ramp from Hanscom Drive to Old Bedford Road is expected to remain. All other movements will be made via a single lane entry or exit at the roundabout. Construction is expected to be completed before the 2025 scenario year and the roundabout design is utilized in reporting 2025 and 2035 capacity results in later sections. A copy of the US Army Corps drawing from May 2018 is included in the appendix.

Other Organizational Planning Efforts

The Route 128 Business Council was established in 1987 as Massachusetts' first Transportation Management Association (TMA) to provide alternative transportation services to the Route 128 corridor between Route 2 and Route 20. Since their establishment, they have expanded to the Hartwell Avenue area and provide direct shuttle service between Alewife Station (MBTA Red Line) and member businesses. Due to logistical challenges, it is not likely feasible to extend one of the existing shuttles to serve Hanscom Field; however, service continues to evolve at the direction of the TMA's members and their needs.

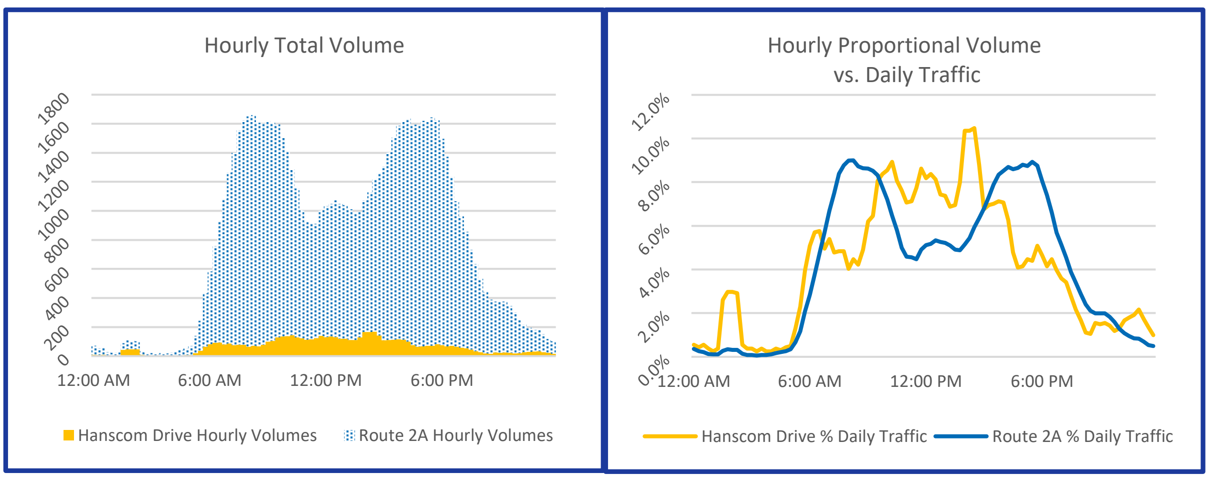
6.2.4 Hanscom Field Trip Characteristics

There are a variety of activities at Hanscom Field that generate automobile traffic and create ground transportation needs. These include general aviation, employment, student programs at the two flight schools that operate at Hanscom Field, and other business activities that support Hanscom Field operations. Employers include Massport, Rectrix, Linear Air, Jet Aviation, Signature Flight Support, East Coast Aero Club, Mike Goulian Aviation, and Boston Med Flight, among others. Trips to and from Hanscom AFB *are not included* in the ground transportation impacts of this ESPR. For the purposes of the *2017 ESPR* analysis, Hanscom AFB activity includes any trips to and from any of the Hanscom AFB gates at Old Bedford Road, Airport Road, Hartwell Avenue, or Lincoln Labs.

Automatic Traffic Recorder (ATR) Observations

In April 2018, Automatic Traffic Recorder (ATRs) were used to conduct 24-hour traffic counts over a seven-day period on Hanscom Field roadways. Hanscom Field is an off-peak traffic generator, meaning that the peak traffic volumes for many Hanscom activities occur at a different time from the peak hours of the adjacent street traffic. That is, regional roadway traffic volumes generated by activities at Hanscom Field tend to occur outside of peak commuting hours. As shown in in Figure 6-3, the peak hours of overall traffic volumes on Route 2A occur in the morning from 7:30 AM to 8:30 AM and in the evening from 4:30 PM to 5:30 PM Hanscom Field, however, generates peak hour volumes outside of these hours. In general, Hanscom Field-related traffic is characterized by a small peak in traffic earlier in the morning (6:00 AM – 7:30 AM) before the start of the Route 2A morning commuter peak hour (generally 7:30 AM – 9:30 AM), followed by higher but steady traffic volumes at Hanscom Field observed throughout the middle of the day. Then traffic drops considerably before the afternoon peak hour on Route 2A begins (generally 4:00 PM).

Figure 6-3 Characteristics of Hanscom Field and Route 2A Vehicle Traffic Compared Based on ATB Location A and B (Total Hourly Volumes on the Left, Proportional Traffic vs. Total Daily Traffic on the Right)



Travel Survey Findings

As part of this ESPR update, Massport conducted a commute/travel survey. The purpose of this survey was to get a better understanding of how Hanscom Field employees and tenants are currently traveling to/from Hanscom Field and how they *would like* to travel to/from Hanscom Field in the future. This survey was conducted over a one-month period in May 2018; although this survey is used to support the *2017 ESPR* update, survey data were collected in 2018 and, for consistency, will be labeled and referenced as such throughout this chapter.

Table 6-3 Mode of Choice to Hanscom Field

Mode	2005 ESPR Survey	2012 ESPR Survey	2017 ESPR Survey
Drive alone	87%	86%	90%
Dropped off	1%	0%	0%
Car pool	10%	0%	5%
Public Transportation	2%	12%	0%
Bicycle	0%	2%	0%
Other	0%	0%	5%
Total	**100%**	**100%**	**100%**

Source: *2012 ESPR*, and FHI, 2018

In total, 62 survey responses were received: approximately 77 percent of respondents were tenants; 11 percent were Massport employees; and almost 12 percent indicated they were employees of MIT/Lincoln Labs, SATCS, or ECAC. Table 6-3 provides a comparison of survey results of similar surveys conducted for the *2005* and *2012 ESPRs* as well as the 2018 survey. The 2018 results show that 90 percent of survey respondents drive alone to Hanscom Field while the remainder carpool. Overall, the results of the 2018 survey are consistent with previous ESPR surveys, showing that the majority of commuters traveling to the study area with personal vehicles. This high level of auto use is consistent with the general travel patterns in the area. Additional details on the results of the survey can be found in Appendix C.

Vehicle Occupancy Survey

Vehicle occupancy data were collected on Wednesday, April 4, 2018 to quantify the number of persons per vehicle entering and exiting Hanscom Field. While Massport recognizes that occupancy counts in 2018 are likely similar to 2017 conditions, these counts were conducted in 2018 and are therefore labeled and referenced as such throughout this chapter. More detailed information on these counts is provided in Appendix C.

The number of vehicles, as well as passengers per vehicle, entering and exiting Hanscom Field were counted from 6:00 AM to 9:00 AM and from 3:00 PM to 6:00 PM to estimate an average Vehicle Occupancy Rate (VOR) for Hanscom Field; the VOR is calculated by dividing the total number of passengers by the number of vehicles entering and exiting Hanscom Field. It should be noted that MBTA bus ridership is not included in the VOR. Bicyclists and pedestrians are counted in the numerator of the calculation (total number of passengers); however, they are recorded as not having arrived in a vehicle. The results of the vehicle occupancy survey are presented in Table 6-4.

Table 6-4 Comparison of Vehicle Occupancy Rates

Morning/Afternoon	2018 Entering	2018 Exiting	2018 Overall	2012 ESPR
Morning Peak Hour	1.13	1.26	1.16	1.06
Afternoon Peak Hour	1.38	1.21	1.27	1.11

Source: *2012 ESPR,* FHI, 2018

As shown in Table 6-4, VOR for Hanscom Field have increased since 2012. The 2018 vehicle occupancy survey equates to 31 percent of people entering and exiting the site during the AM and PM peak hours doing so in a vehicle with one or more other passengers. This suggests that carpooling might occur with higher frequency than the *2017 ESPR* travel survey indicates; however, it should be noted that the vehicle occupancy survey recorded *all* vehicles traveling to and from Hanscom Field, therefore freight and other business vehicles could skew results. The same methodology used in the *2012 ESPR* was applied to the 2018 counts, which still suggests an increase in vehicle occupancy during that time.

Parking Survey

A parking demand survey was conducted from 11:00 AM to 1:00 PM on Thursday, April 12, 2018 (conditions in 2018 were substantially similar to those in 2017). As described in Chapter 2, vehicles were counted at the parking lots located at Hanscom Field. The parking demand survey assessed 984 of the 1,437 spaces currently available at Hanscom Field. Surveyors could not gain access to the parking facilities for Hangars 1, 2, and 3; the T-Hangars; and other secured facilities on the day of the survey. Instead, these spaces in these facilities were counted using aerial mapping (dated April 2017) and previous counts, including in the *2012 ESPR*. These secured parking spaces account for an additional 453 parking spaces. Since the *2012 ESPR*, there has been a reduction of 130 parking spaces at Hanscom Field, largely due to the construction of a new hangar on a portion of the Civil Air Terminal parking lot.

Of the 984 parking spaces surveyed, 467 were occupied on the day of the parking survey, which equates to an occupancy rate of approximately 47 percent. The largest parking lot at Hanscom Field – the 444-space public lot associated with the Civil Air Terminal Building – was approximately 46 percent occupied on the day of the survey. The recent relocation of the National Aviation Academy of New England to an off-airport location has significantly reduced student parking and associated vehicle trips.

6.2.5 Hanscom Field Peak Hour Trip Generation

The number of trips generated by Hanscom Field (which is distinct from Hanscom AFB traffic) during the peak hour is used to determine the impacts of Hanscom Field-related traffic on study area intersections. The peak hours for the analysis represent the time of day when traffic volumes along the adjacent roadways are highest. The morning and afternoon peak hour vehicular trip generation for Hanscom Field is presented in Table 6-5 and indicates that the number of morning and afternoon peak hour vehicle trips to and from Hanscom Field in 2018 is less than the trips generated in the *2012 ESPR*. Between 2012 and the 2018 traffic counts, there has been an approximately 33 percent reduction in morning peak hour trips and a 12 percent reduction in afternoon peak hour trips. This is similar to the 21 percent reduction in daily traffic volumes seen at Hanscom Drive between 2012 and 2018 presented later in Figure 6-5. Trip generation at Hanscom Field furthermore exhibits directionality, with 67 percent of peak hour traffic entering Hanscom Field in the morning peak hour and 70 percent of peak hour traffic exiting Hanscom Field in the afternoon peak hour.

Table 6-5 also includes the *2012 ESPR* projections for the 2020 and 2030 forecast scenarios. Comparison of actual year 2018 traffic data with year 2020 projections from the *2012 ESPR* show that actual 2018 traffic volumes are considerably below the *2012 ESPR* projections for the morning and afternoon peak hours. This difference can be attributed to actual total aircraft operations at Hanscom Field in 2018 being almost 23 percent below the forecasts presented in the *2012 ESPR*. Specifically, declines in Training (SEP) operations (70,196 in 2012 to 46,014 in 2017) and the Personal Flying (SEP) operations (51,477 in 2012 to 33,040 in 2017), likely accounted for the reduction in peak hour vehicular trips to/from Hanscom Field. Additionally, the forecasted vehicle trips generated from the construction of a hotel and aeronautics museum included the 2020 forecast in the *2012 ESPR* have not been included in this analysis, since these facilities have not been constructed. Furthermore, the recent relocation of the National Aviation Academy of New England off-airport property has considerably reduced student parking and associated vehicle trips.

Table 6-5 Hanscom Field Peak Hour Trip Generation in Prior Years and 2018 Compared to 2012 Forecasts

Traffic Count Data	Morning Peak Hour			Afternoon Peak Hour		
	In	Out	Total	In	Out	Total
1996	61	33	94	43	70	113
2002	109	52	161	47	112	159
2005	115	42	157	75	79	154
2012	136	29	165	37	84	121
2018	74	36	110	32	75	107
2012 ESPR Scenarios						
2020 Forecast	178	42	220	46	120	166
2030 Forecast	291	99	390	122	223	345

Source: *2005 ESPR* and *2012 ESPR*

2018 Traffic Count Results

Traffic counts were collected on roadways in the study area during a 7-day period from Thursday, April 5, 2018 through Wednesday, April 11, 2018 by ATRs. These counts provide detailed information on the current traffic patterns in certain areas surrounding Hanscom Field. The locations were based on previous ESPR's as well as coordination with Massport. The year 2018 ATR count locations are shown in Figure 6-4 and include:

- Location A: Route 2A, east of Airport Road (Lexington);
- Location B: Bedford Road, south of Route 2A (Lincoln);
- Location C: Cambridge Turnpike Cutoff, southwest of Lexington Road (Lincoln, near Concord line);
- Location D: Old Bedford Road, north of Virginia Road (Concord);
- Location E: Route 62, west of Old Bedford Road (Concord); and
- Location F: Hanscom Drive, north of Old Bedford Road (Lincoln).

In addition to these 7-day ATR counts, manual intersection/turning movement counts were conducted on Thursday, April 5, 2018 in the morning peak period between 6:00 AM and 9:00 AM and in the afternoon peak period between 3:00 PM and 6:00 PM Manual counts were conducted at 10 intersections; these are shown on Figure 6-4, and include:

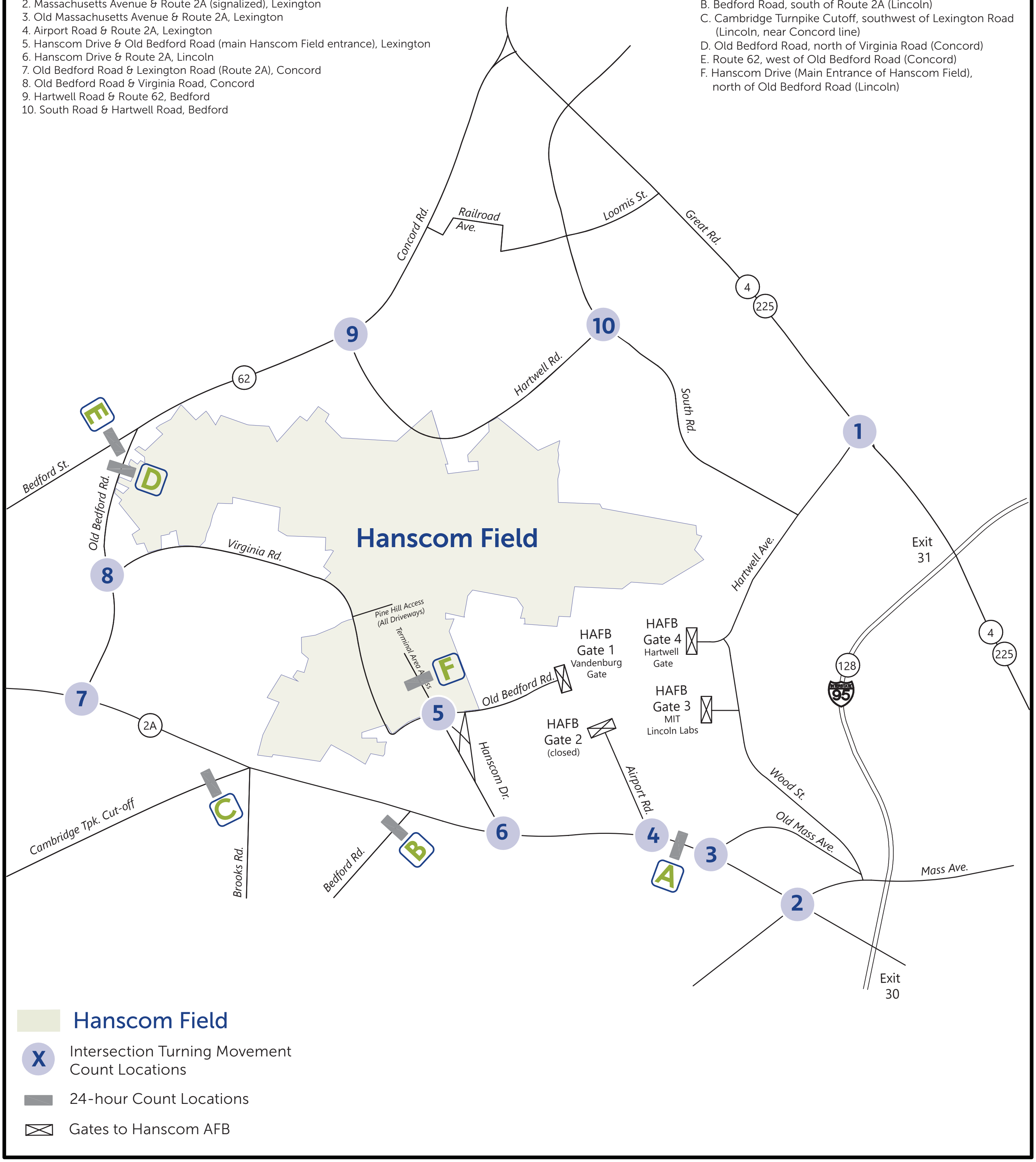
- Location 1: Route 4/225 & Hartwell Avenue (signalized), Lexington;
- Location 2: Massachusetts Avenue & Route 2A (signalized), Lexington;
- Location 3: Old Massachusetts Avenue & Route 2A, Lexington;
- Location 4: Airport Road & Route 2A, Lexington;
- Location 5: Hanscom Drive & Old Bedford Road (main entrance), Lexington;
- Location 6: Hanscom Drive & Route 2A, Lincoln;
- Location 7: Old Bedford Road & Lexington Road (Route 2A), Concord;
- Location 8: Old Bedford Road & Virginia Road, Concord;
- Location 9: Hartwell Road & Route 62, Bedford; and
- Location 10: South Road & Hartwell Road, Bedford.

Study Intersections:

1. Route 4/225 & Hartwell Avenue (signalized), Lexington
2. Massachusetts Avenue & Route 2A (signalized), Lexington
3. Old Massachusetts Avenue & Route 2A, Lexington
4. Airport Road & Route 2A, Lexington
5. Hanscom Drive & Old Bedford Road (main Hanscom Field entrance), Lexington
6. Hanscom Drive & Route 2A, Lincoln
7. Old Bedford Road & Lexington Road (Route 2A), Concord
8. Old Bedford Road & Virginia Road, Concord
9. Hartwell Road & Route 62, Bedford
10. South Road & Hartwell Road, Bedford

Daily Count Locations:

A. Route 2A, east of Airport Road (Lexington)
B. Bedford Road, south of Route 2A (Lincoln)
C. Cambridge Turnpike Cutoff, southwest of Lexington Road (Lincoln, near Concord line)
D. Old Bedford Road, north of Virginia Road (Concord)
E. Route 62, west of Old Bedford Road (Concord)
F. Hanscom Drive (Main Entrance of Hanscom Field), north of Old Bedford Road (Lincoln)



North

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Traffic Study Area Count Locations

Figure **6-4**

Traffic Volume Adjustments

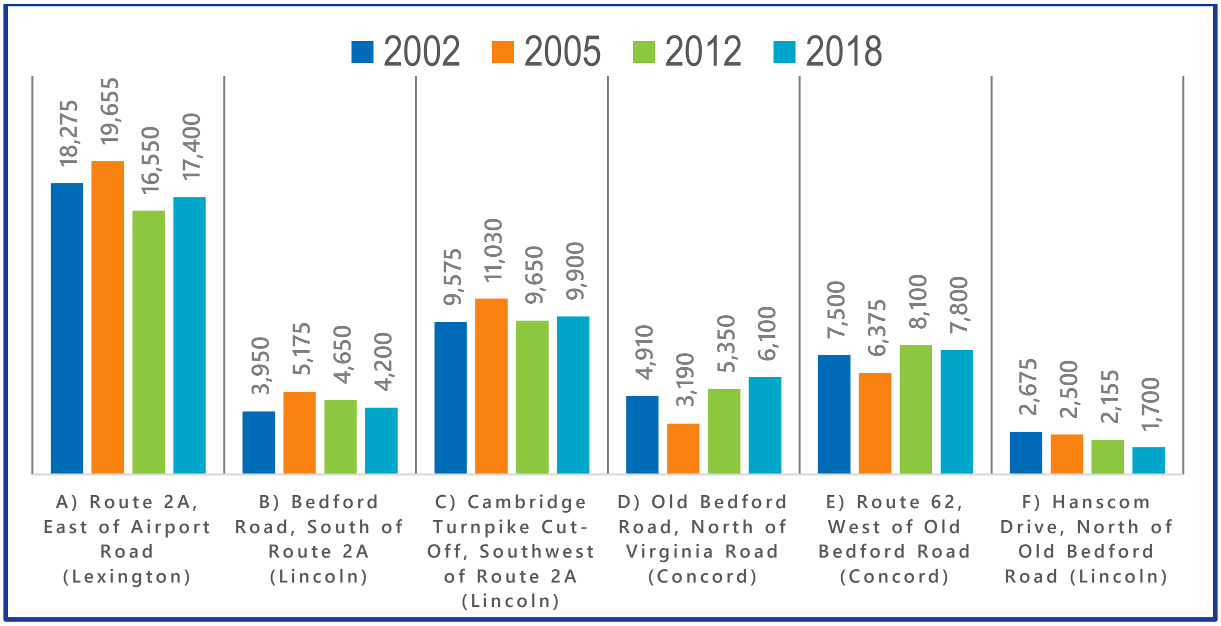
Development of the 2018 AM and PM peak hour traffic networks required the adjustment of the manual intersection and ATR counts from April 2018 to account for the seasonal variation in traffic volumes. Based on *Massachusetts Department of Transportation (MassDOT) Traffic Impact Assessment (TIA) Guidelines*, analysis of the nearby Continuous Count Stations was reviewed for 2017 (the most recent calendar year available). Station H8509 on I-95 at the Route 2A interchange was found to have an average day of traffic in April of 96.5 percent of the yearly average. Thus, based on data from this counter, all traffic figures in this document incorporate a baseline upward adjustment of 3.6 percent to account for the seasonal variation in traffic. An original report from Continuous Count Station H8509 is provided in Appendix C.

Additionally, adjustments were made to the Hanscom Field turning count movements at the Hanscom Drive / Old Bedford Road intersection based on the ATR placed on Hanscom Drive. Review of weekly peak hour data revealed that the volumes counted during the morning and afternoon on the day of the manual turning movement counts were approximately 12 to 19 percent below the weekday average (Tu/W/Th only). Therefore, to accurately demonstrate the trip distribution of Hanscom Field, traffic volumes to and from Hanscom Field were increased by the appropriate percentages to represent a typical daily average. Further detail of this process is shown in Appendix C.

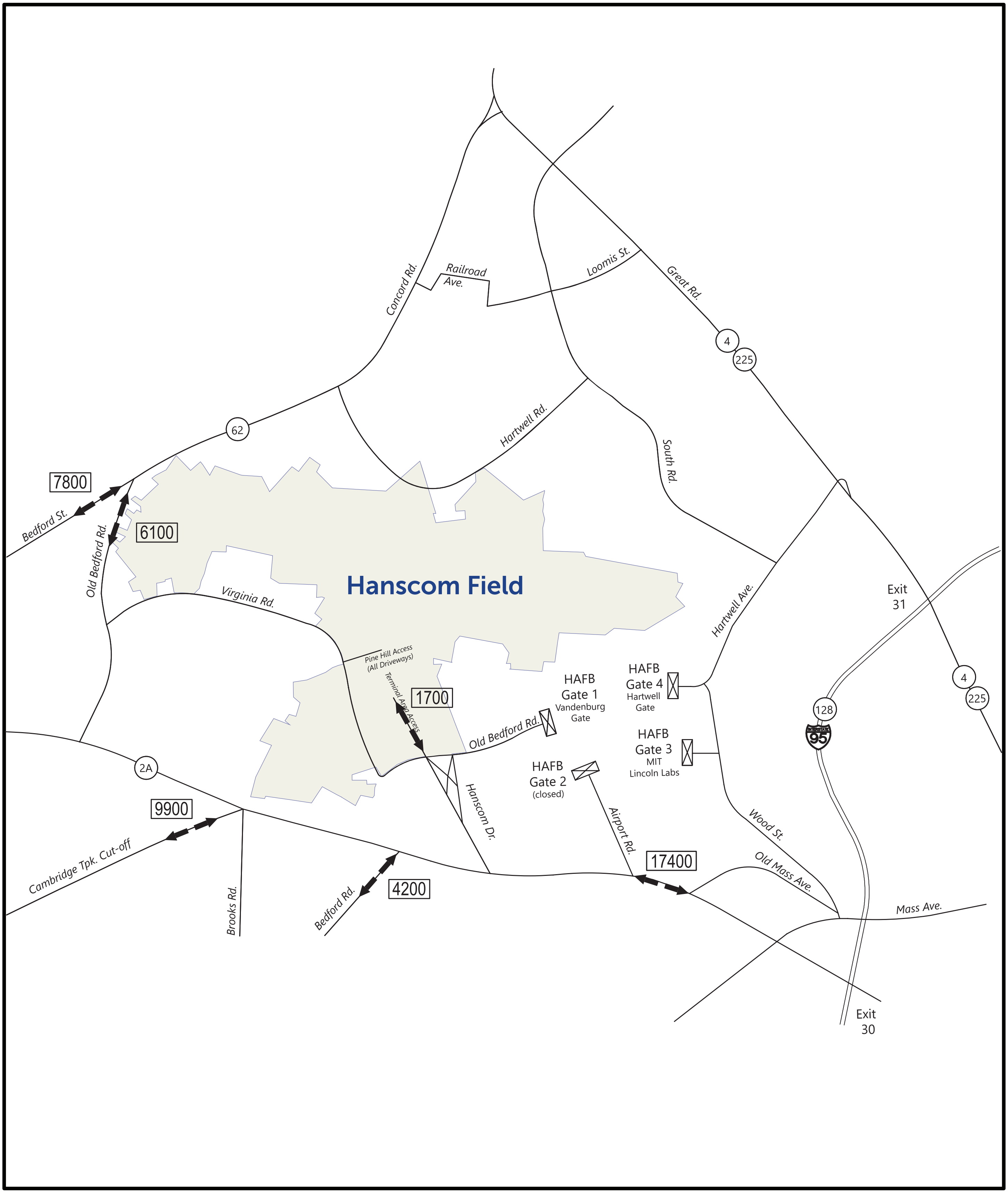
Historic Traffic Trends

Figure 6-5 presents a comparison of average weekday traffic volumes from 2002 to 2018; Year 2018 average weekday traffic volumes are also shown on Figure 6-6. In 2018, average weekday traffic volumes on Hanscom Drive are approximately 1,700 vehicles per day (vpd), which is 21 percent less than the 2012 volumes at this same location. This decrease is likely attributable to the reduced private aircraft operations at Hanscom Field between 2012 and 2017 and the relocation of the aviation school from Hanscom Field. Route 2A, Cambridge Turnpike Cut-off, and Old Bedford Road all experienced increases in average weekday traffic volumes between 2012 and 2018, while Bedford Road and Route 62 both experienced decreases in average weekday traffic volumes.

Figure 6-5 Comparison of 2002, 2005, 2012, and 2018 Average Weekday Traffic Volumes



Source: *2005 ESPR* and *2012 ESPR* for historical data, FHI, 2018 for 2018 data.



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2018 Average Weekday Traffic Volumes

Figure 6-6

6.2.6 Capacity Analysis

Detailed analyses of peak hour intersection operations and traffic conditions were conducted for the 10 intersections shown in Figure 6-4.

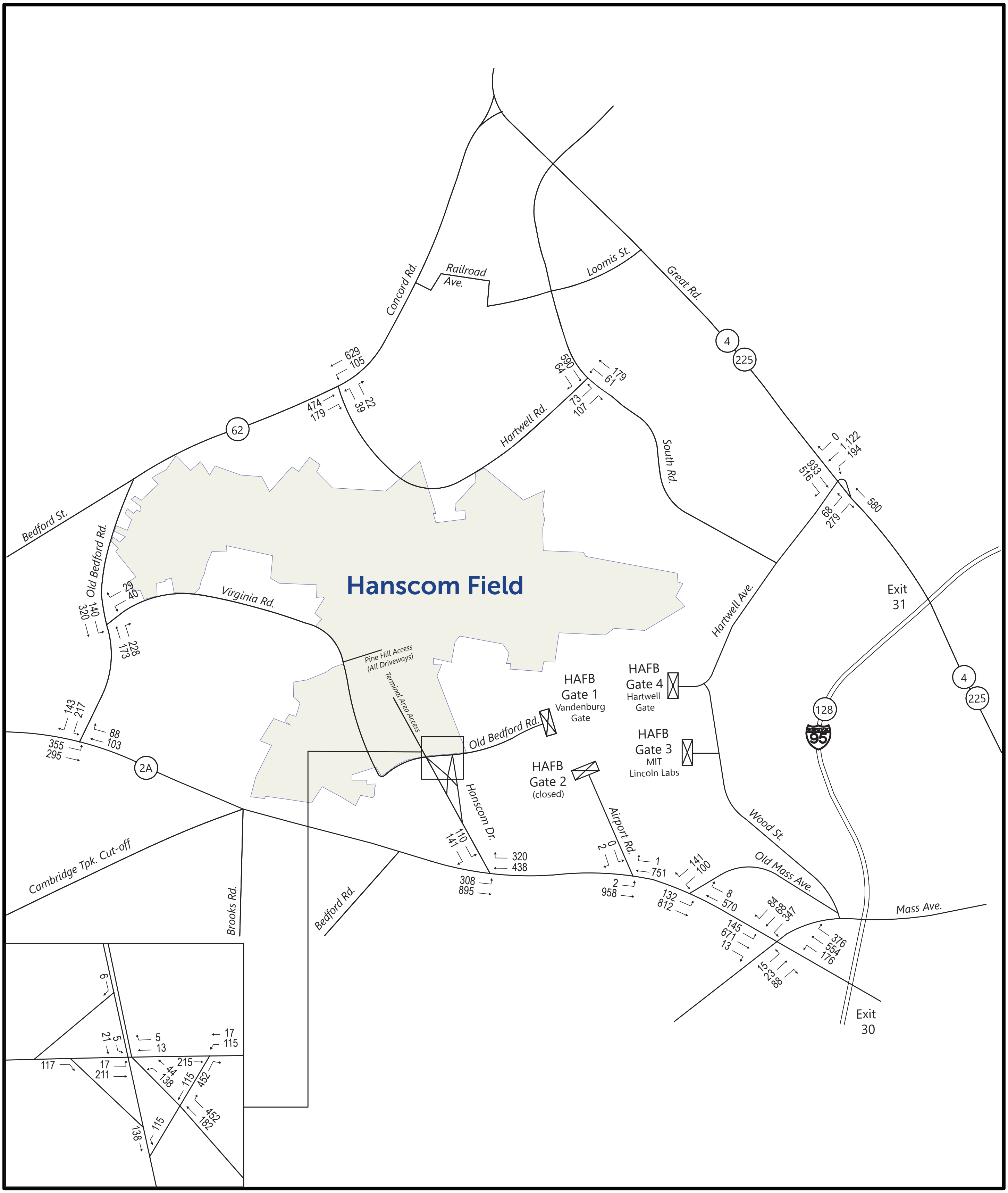
Peak Hour Networks

Figure 6-7 and Figure 6-8 present the morning and afternoon peak hour volumes for the intersections studied in April of 2018. In the morning, most of the traffic on Route 2A travels eastbound to Route 128/I-95. In the afternoon, most traffic on Route 2A travels westbound from Route 128/I-95. These trends primarily reflect commuting patterns between the surrounding towns and regional employment centers along and within the Route 128/I-95 corridor and the Boston Metro area to the east. Along Route 4/225, traffic counts show that morning commuters are destined to Route 128/I-95 but also to the Hartwell Avenue area. This is because Hartwell Avenue serves as a hub of employment and also serves as one of several access points to Hanscom AFB.

Hanscom Field Trip Distribution

Figure 6-9 and 6-10 present the 2018 peak hour trip distribution and traffic volumes during the April 2018 study period for Hanscom Field-related traffic for morning and afternoon peak hours, respectively. The existing trip distribution of Hanscom Field traffic was determined based on Hanscom main entrance directional peak hour traffic volumes and modeling of the distribution of peak hour traffic volumes at intersections within the study area.

The opening of Rectrix since 2012 has added aviation-based traffic along Virginia Road. For the purposes of this capacity analysis, the driveways serving the Pine Hill area of Hanscom Field (Rectrix Aviation Hangar and the Pine Hill T-Hangars) were assumed to be located at one access point, as illustrated in Figure 6-9 and Figure 6-10. Furthermore, while dedicated turning movement counts were not conducted at Rectrix, trips to/from this facility were estimated in proportion to the parking survey conducted on April 12, 2018. Trip distribution was assigned to match the trip distribution observed at the main Hanscom Drive access. The trip estimation and distribution estimation procedures are provided in Appendix C.



North

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Source: April 5, 2018 Traffic Counts.

Note: All counts seasonally adjusted. Hanscom Field movements via Hanscom Drive adjusted based on weekly traffic observed on Hanscom Drive ATR.

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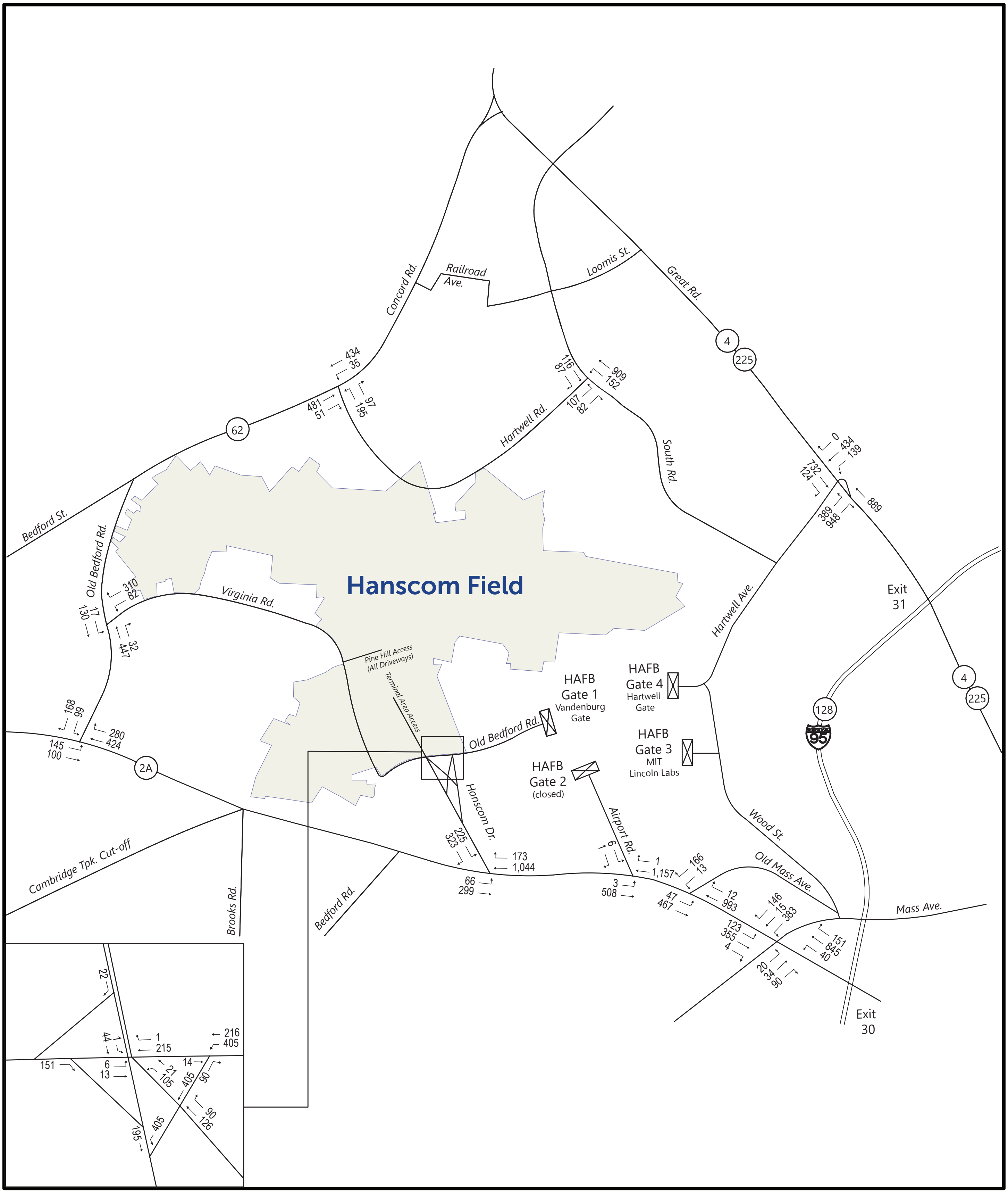
2018 Morning Peak Hour Traffic Volumes

Figure 6-7



North

NOT TO SCALE

Source: April 5, 2018 Traffic Counts.

Note: All counts seasonally adjusted. Hanscom Field movements via Hanscom Drive adjusted based on weekly traffic observed on Hanscom Drive ATR.

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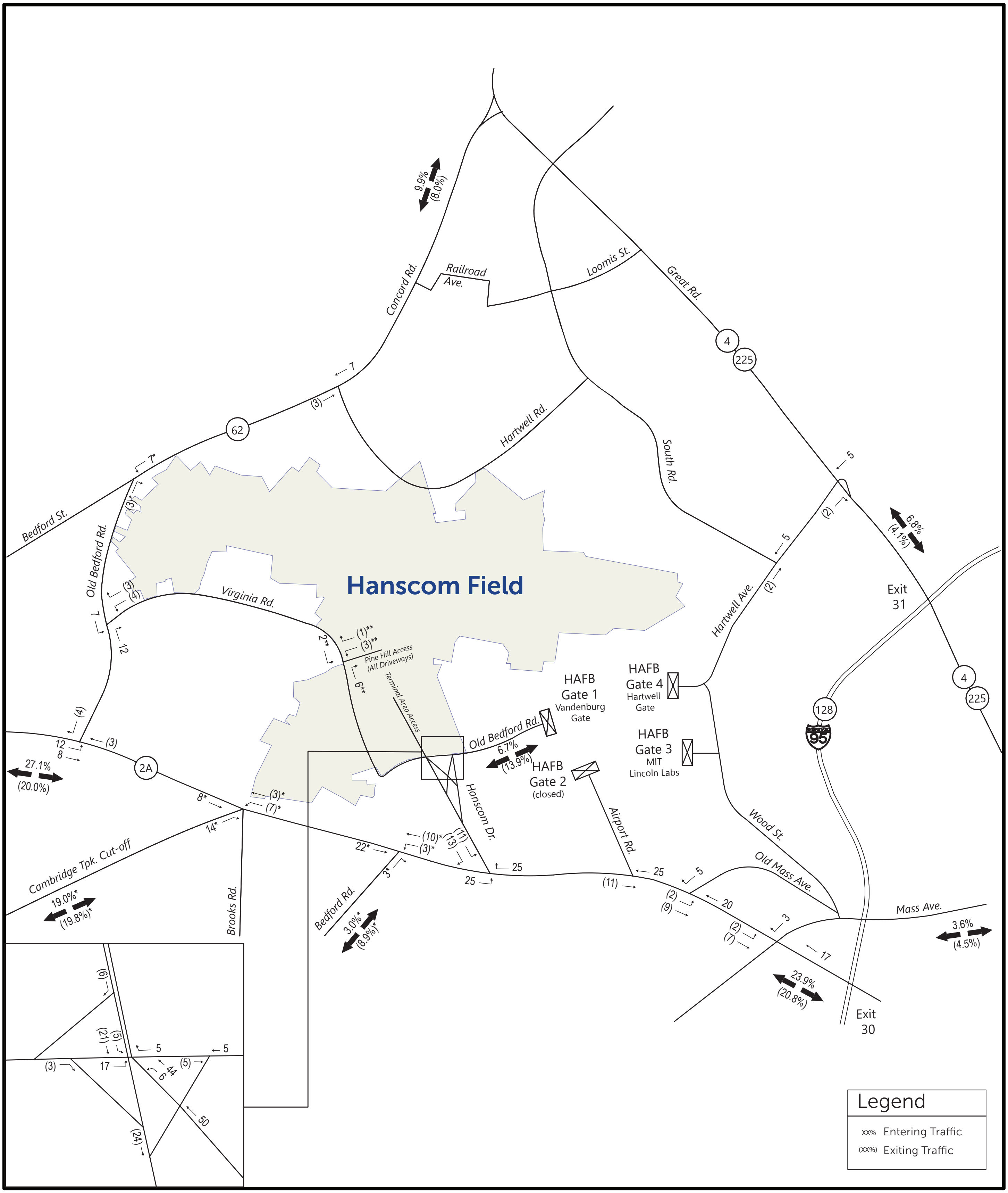
2018 Afternoon Peak Hour Traffic Volumes

Figure **6-8**



North

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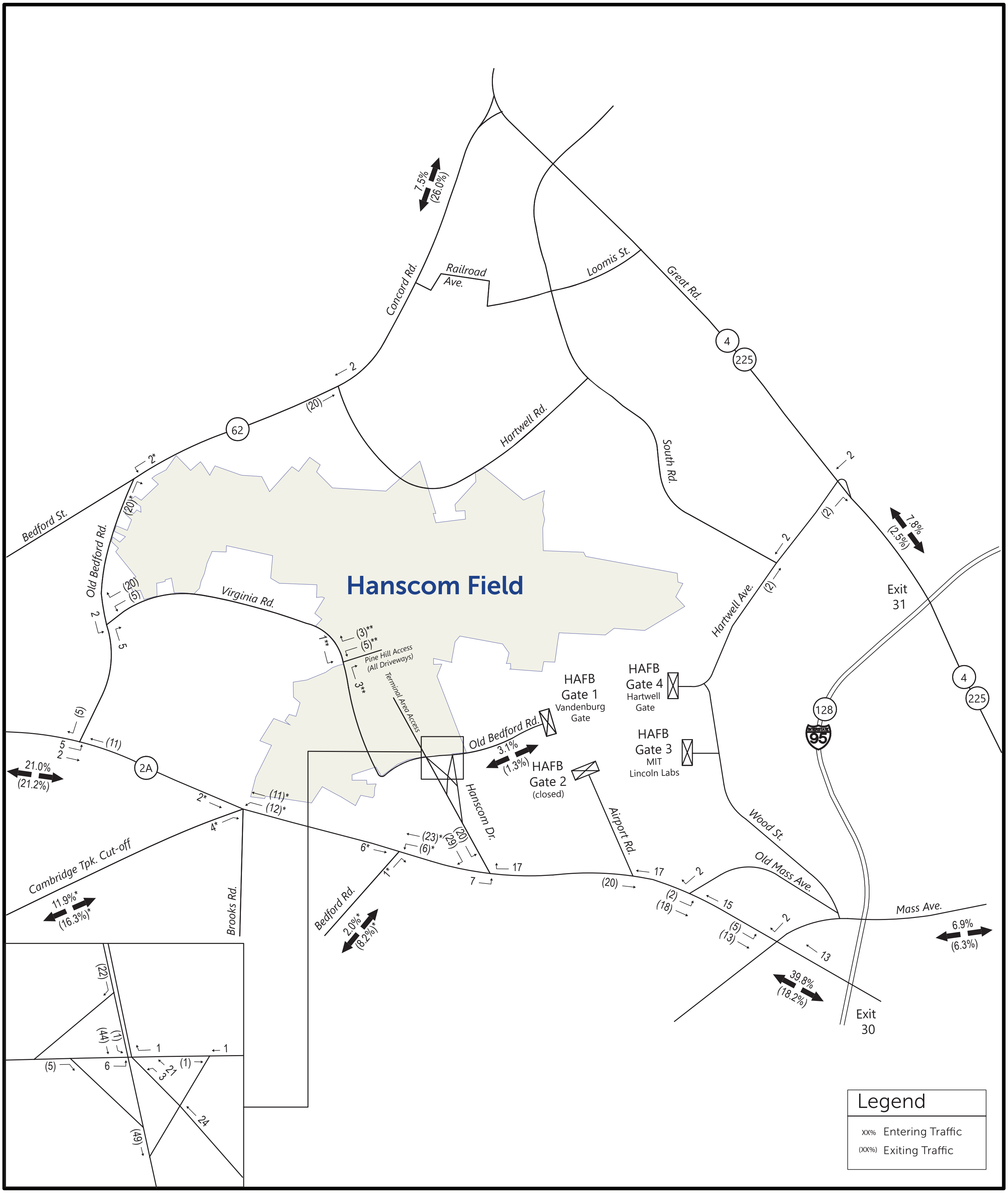
2018 Morning Peak Hour Trip Distribution (Hanscom Field Only)

Note: * Designates estimated distribution based on 2012 ESPR and 2018 observed counts at adjacent locations.
** Designates trip generation and turn counts based on estimates by FHI



North

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2018 Afternoon Peak Hour Trip Distribution (Hanscom Field Only)

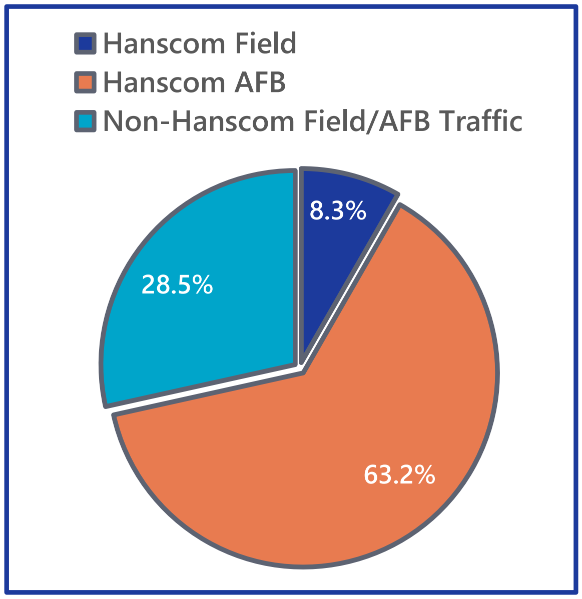
Note: * Designates estimated distribution based on 2012 ESPR and 2018 observed counts at adjacent locations.
** Designates trip generation and turn counts based on estimates by FHI

Figure **6-10**

Hanscom Drive Traffic Volumes

Figure 6-11 and Figure 6-12 illustrate the different traffic contributors on Hanscom Drive in 2018 during the morning and afternoon peak hours using data from the turning movement counts. In 2018, Hanscom Field-related traffic accounts for 8.3 percent of volumes during the morning peak hour and 8.9 percent of volumes during the afternoon, as compared to 14 percent in the morning peak and 13 percent in the afternoon peak hours in 2012. The reduction in Hanscom Field-related volumes reflects a decrease in traffic traveling to and from Hanscom Field for the reasons previously discussed in this chapter. Hanscom AFB traffic continues to grow as the largest component of Hanscom Drive traffic. In 2018, Hanscom AFB accounted for 63 percent of traffic in the morning peak hour and 60 percent of traffic in the afternoon peak hour, as compared to 59 percent and 62 percent, respectively in 2012.

Figure 6-11 2018 Morning Peak Hour Traffic on Hanscom Drive



Intersection Screening Process

The Massachusetts Environmental Policy Act (MEPA) has established a threshold for identifying intersections with significant impacts related to Hanscom Field. Hanscom Field traffic is considered to impact an intersection if one or more of the intersection's individual peak hour traffic movement(s) consists of 10 or more percent Hanscom Field-related traffic. The traffic volumes at each of the 10 study intersections were assessed to determine which intersections had individual turning movements that met or exceeded the 10 percent MEPA threshold. Table 6-6 lists the four intersections that have exceeded the 10 percent threshold for the 1996 through 2018 analysis years. Intersection operations were calculated for year 2018 conditions for intersections that exceeded the threshold.

Figure 6-12 2018 Afternoon Peak Hour Traffic on Hanscom Drive

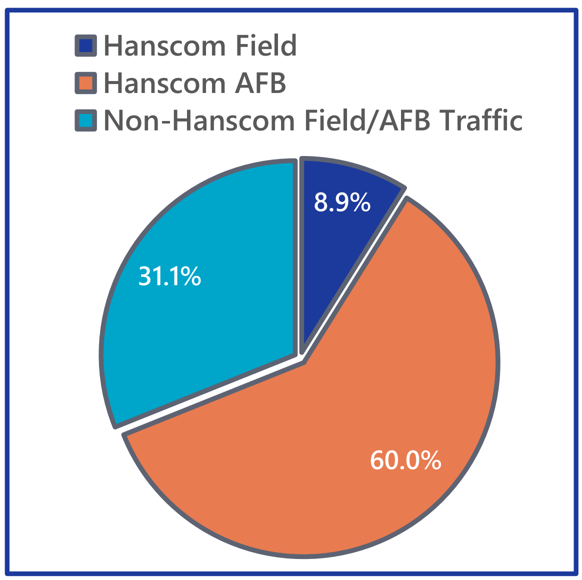


Table 6-6 Intersections Exceeding Ten-Percent Threshold: 1996-2018

Intersection	Peak Hour	Analysis Years				
		1996	2002	2005	2012	2018
#5 Hanscom Drive/Old Bedford Road (Lincoln)	Morning	X	X	X	X	X
	Afternoon	X	X	X	X	X
#6 Hanscom Drive/Route 2A (Lincoln)	Morning	X	X	X	X	X
	Afternoon		X	X	X	X
#10 Old Bedford Road/Virginia Road (Concord)	Morning	X	X	X		X
	Afternoon	X	X	X	X	X
#11 Old Bedford Road/Route 62 (Concord)	Morning					
	Afternoon			X		

Note: "X" denotes intersection with turning movement exceeding 10 percent MEPA threshold.
Source: 2000, 2005 and 2012 Hanscom Field ESPR and FHI, 2018

Analysis of Intersection Operations

This section provides the results of the intersection operation analysis in terms of overall intersection level of service (LOS), volume-to-capacity (v/c) ratios, and intersection delay (in seconds) for the screened intersections. LOS calculation sheets are provided in Appendix C. The performance of the study intersections was analyzed using the traffic modeling software program Synchro 10 and measured using LOS, which is a generally accepted measure of the quality of service determined based on the process specified in the 6th Edition of the Transportation Research Board *Highway Capacity Manual* (HCM).[89] Intersection LOS ranges from 'A' to 'F' where LOS 'A' represents optimal conditions with fewer than 10 seconds of delay, while LOS 'F' represents failing conditions where delay exceeds 50 seconds at unsignalized intersections or 80 seconds at signalized intersections. Table 6-7 shows the delay thresholds for LOS at signalized and unsignalized intersections.

[89] Transportation Research Board, *Highway Capacity Manual 6th Edition: A Guide for Multimodal Mobility Analysis.* National Academies of Sciences, Engineering and Medicine. 2016.

Table 6-7 Intersection Level-of-Service (LOS) Criteria (HCM, 6th Edition)

LOS	Average delay per vehicle (seconds)	
	Signalized intersections	Unsignalized intersections
A	<10.0	<10.0
B	10.1 to 20.0	10.1 to 15.0
C	20.1 to 35.0	15.1 to 25.0
D	35.1 to 55.0	25.1 to 35.0
E	55.1 to 80.0	35.1 to 50.0
F	>80.0	>50.0

Source: FHI, 2018

Tables 6-8 and 6-9 summarize the 2018 peak hour traffic operations for the intersections where Hanscom Field traffic represented more than 10 percent of all traffic movement. Detailed traffic capacity analysis reports are included in Appendix C. Interpretation of Tables 6-8 and 6-9 for the Hanscom Drive/Old Bedford Road intersection requires an understanding of how this single intersection is modeled using Synchro. While the main intersection functions as a two-way, stop-controlled intersection, with Hanscom Drive given priority, the entire intersection is, in fact, controlled by three other separately modeled intersections (see Figure 6-13 for a diagram of the Hanscom Drive/ Old Bedford Road intersection).

This includes: (1) the stop-controlled intersection between northbound traffic on Hanscom Drive and southbound traffic from Hanscom AFB (intersection #51); (2) the stop-controlled intersection between eastbound traffic on Old Bedford Road and southbound traffic from Hanscom AFB (intersection #52); and (3) the yielding action that northbound vehicles headed to Hanscom AFB must make to vehicles continuing eastbound on Old Bedford Road (intersection #53). It should be noted that the delay to vehicles would thus be a compound delay by multiple movements and should be considered in any future intersection configuration.

Figure 6-13 Diagram of Sub-Intersections Analyzed at the Hanscom Drive and Old Bedford Road Intersection

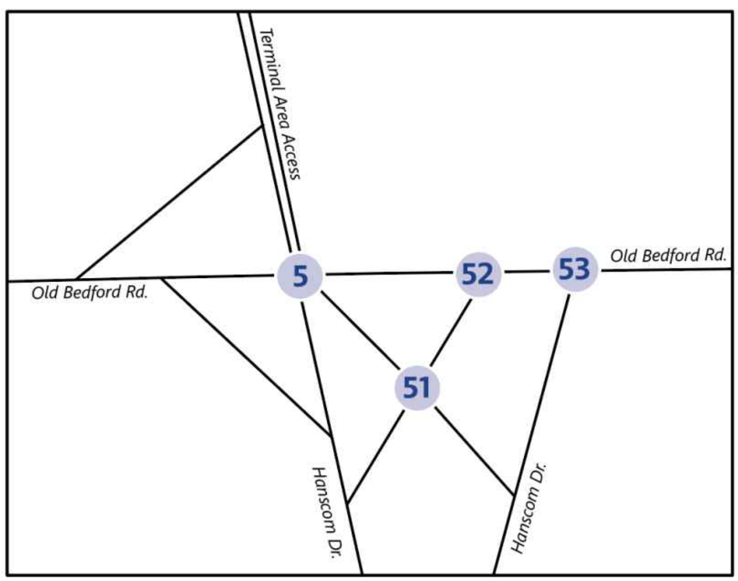


Table 6-8 Morning Peak Hour Operations at Screened Intersections

Intersection	Weekday morning peak hour		
	LOS	Delay [s]	v/c
#5 Hanscom Drive/Old Bedford Road			
Hanscom Drive NB (L)	A	7.5	0.10
Hanscom Drive SB (L)	A	7.3	0.01
Old Bedford Road EB (L T)	C	16.8	0.34
Old Bedford Road WB (T)	B	13.1	0.03
#51 Hanscom Drive/Old Bedford Road WB L Ramp			
Hanscom Drive NB (T)	B	11.7	0.28
#52 Hanscom Drive/Old Bedford Road WB L Turn			
Old Bedford Road EB (T)	B	10.7	0.17
#53 Hanscom Drive NB R Ramp/Old Bedford Road			
Hanscom Drive NB (R)	B	14.6	0.59
#6 Hanscom Drive/Route 2A			
Hanscom Drive SB (L)	F	>300.0	3.68
Hanscom Drive SB (R)	B	13.4	0.29
Route 2A EB (L)	A	9.8	0.32
#8 Old Bedford Road/Virginia Road			
Virginia Road WB (L R)	C	21.6	0.36
Old Bedford Road SB (L)	A	8.7	0.13

Note: “L” denotes left-turn, “T” denotes thru-traffic, “R” denotes right-turn
Source: FHI, 2018

Table 6-9 Afternoon Peak Hour Operations at Screened Intersections

Intersection	Weekday afternoon peak hour		
	LOS	Delay [s]	v/c
#5 Hanscom Drive/Old Bedford Road			
Hanscom Drive NB (L)	A	7.5	0.08
Hanscom Drive SB (L)	A	7.3	0.01
Old Bedford Road EB (L T)	C	15.0	0.05
Old Bedford Road WB (T)	B	13.8	0.23
#51 Hanscom Drive/Old Bedford Road WB L Ramp			
Hanscom Drive NB (T)	B	14.7	0.27

Intersection	Weekday afternoon peak hour		
	LOS	Delay [s]	v/c
#52 Hanscom Drive/Old Bedford Road WB L Turn			
Old Bedford Road EB (T)	B	12.4	0.02
#53 Hanscom Drive NB R Ramp/Old Bedford Road			
Hanscom Drive NB (R)	A	8.7	0.09
#6 Hanscom Drive/Route 2A			
Hanscom Drive SB (L)	F	>300.0	3.00
Hanscom Drive SB (R)	F	228.3	1.38
Route 2A EB (L)	B	11.5	0.14
#8 Old Bedford Road/Virginia Road			
Virginia Road WB (L R)	F	92.8	1.08
Old Bedford Road SB (L)	A	8.9	0.04

Note: "L" denotes left-turn, "T" denotes thru-traffic, and "R" denotes right-turn
Source: FHI, 2018

At the intersection of Hanscom Drive and Route 2A, the analysis indicates that southbound Hanscom Drive experiences significant delays during both the morning and afternoon peak hours. However, it appears that the analysis is not accurately representing actual operating conditions. Based on field observations, several unique behaviors are occurring at this intersection requiring additional interpretation:

- Motorists offer other motorists "courtesy gaps". For example, motorists on Route 2A were observed stopping to allow motorists to turn left from Hanscom Drive onto Route 2A. Additionally, motorists on westbound Route 2A were observed stopping to allow other motorists on Route 2A to turn left onto to Hanscom Drive.
- Motorists in both the left-turn lane and the right-turn lane on Hanscom Drive were seen doing "rolling stops", or not stopping fully before traveling through the intersection.
- Due to the longer wait times experienced by left-turning vehicles on Hanscom Drive, several vehicles were observed making "risky" turns, or turning during a gap between vehicles that is smaller than what is typically considered safe.

Thus, real-world conditions differ from modeled conditions, which are based on vehicles following standard driving rules. Therefore, non-standard behaviors, such as drivers on Route 2A giving "courtesy gaps" to the minor movement, drivers not making a full and complete stops, and drivers making "risky" turns in small gaps, mean that modeled conditions can be substantially different than observed conditions. These factors result in Synchro over estimating the delay and queues at this intersection. However, while these observed behaviors may improve the capacity of the intersection, the large delay at this intersection can encourage drivers to make riskier maneuvers than they otherwise might, increasing risks of collision and causing a safety hazard for all users of the intersection.

6.2.7 Safety Analysis

The crash history of the three screened intersections was evaluated to identify safety deficiencies and determine if any location experiences a higher than average annual crash rate. The safety data is summarized in Table 6-10.

Table 6-10 Intersection Crash Summary: 2012 - 2016

Traffic Control	#5) Hanscom Drive / Old Bedford Road (Lincoln)	#6) Hanscom Drive / Route 2A (Lincoln)	#8) Old Bedford Road / Virginia Road (Concord)
	Unsignalized	Unsignalized	Unsignalized
Year			
2012	0	2	0
2013	0	2	0
2014	2	1	0
2015	0	6	1
2016	1	2	0
Total	3	13	1
Type			
Angle	2	8	0
Rear-End	0	3	0
Head-on	1	0	0
Sideswipe	0	1	1
Single Vehicle	0	1	0
Total	3	13	1
Severity			
Property Damage Only	2	11	1
Personal Injury	1	1	0
Fatality	0	0	0
Other	0	1	0
Total	3	13	1
Weather			
Clear	1	10	0
Cloudy	0	1	1

Traffic Control	#5) Hanscom Drive / Old Bedford Road (Lincoln)	#6) Hanscom Drive / Route 2A (Lincoln)	#8) Old Bedford Road / Virginia Road (Concord)
	Unsignalized	Unsignalized	Unsignalized
Rain	0	0	0
Snow	1	2	0
Unknown/Other	1	0	0
Total	3	13	1
Time			
7:00 AM to 9:00 AM	1	1	1
9:00 AM to 4:00 PM	1	4	0
4:00 PM to 6:00 PM	0	4	0
6:00 PM to 7:00 AM	1	4	0
Total	3	13	1
Rates			
State Wide Rate	**0.57**		
District Wide Rate	**0.57**		
Intersection Rate	**0.14**	**0.30**	**0.08**

Source: FHI, 2018

Seventeen crashes were reported at the three screened intersections from 2012 to 2016. The majority of crashes involved property damage only; no fatalities were reported. Angled crashes, rear-end crashes and single-vehicle crashes, combined, comprised approximately 82 percent of the crashes at the intersections. The 13 crashes that occurred at Hanscom Drive/Route 2A (Lincoln) ranked highest among the three screened intersections, with an average of 2.6 crashes per year; this is lower than the 3.4 crashes per year reported in the *2012 ESPR*. Additionally, the crash rate at this intersection is lower than the statewide and district-wide averages (0.57 crashes per year) for unsignalized intersections. The MassDOT Crash Rate Worksheets for the three screened intersections are provided in Appendix C.

6.2.8 Multi-Modal Assessment

Single Occupancy Vehicle (SOV) trips are more frequently associated with higher transportation impacts than alternative modes of travel. Transit, carpooling, bicycling, and walking have the potential to reduce Hanscom Field-related vehicle trips and traffic impacts on area roadways. Thus, it is important to document existing conditions to understand recommendations for the future.

2018 Pedestrian and Bicycle Count Results

Tables 6-11 and 6-12 present the bicycle and pedestrian counts collected at the studied intersections. Manual traffic counts collected in April 2018 for this project also included counts of bicycles and pedestrians at all 10 count locations. The ATR counts recorded bicycle movements.

It is important to note that pedestrian and bicycle counts are sensitive to seasonal temperature patterns as well as daily weather. Weather conditions at Hanscom Field on April 5th were reported to be between 28°F and 43°F with partly cloudy skies and no participation. While seasonal variation between peak summer conditions and winter season likely exists in this area, no equivalent to a seasonal adjustment factor is available for these counts; however, these modes are not a significant component of Hanscom Field ground access activity.

Table 6-11 Total Cyclists and Pedestrians Counted in AM and PM Peak Hours on Thursday, April 5, 2018

Location	Cyclists Counted		Pedestrians Counted	
	AM Total	PM Total	AM Total	PM Total
Bedford Street & Hartwell Avenue	1	1	13	4
Mass Avenue and Route 2A	4	2	0	1
Old Mass Avenue and Route 2A	4	2	0	0
Airport Road and Route 2A	4	3	0	0
Hanscom Drive and Old Bedford Road	4	10	1	0
Hanscom Drive and Route 2A	4	6	0	0
Old Bedford Road and Lexington Road	6	9	0	0
Old Bedford Road and Virginia Road	6	15	5	8
Concord Road and Hartwell Road	3	4	1	0
South Road and Hartwell Road	5	3	1	0

Note: AM peak hour is 6:00 AM to 9:00 AM; PM peak hour is 3:00 PM to 6:00 PM
Source: FHI 2018

Table 6-12 Total Cyclists Counted During the Day of Thursday, April 5, 2018

Location	Cyclists Counted
Route 2A east of Airport Road (Bidirectional)	47
Bedford Road South of Route 2A	5
Cambridge Turnpike Cutoff South of Lexington Road	20
Old Bedford Road north of Virginia Road	20
Route 62 west of Old Bedford Road	18
Hanscom Drive north of Old Bedford Road	8
Source: FHI, 2018	

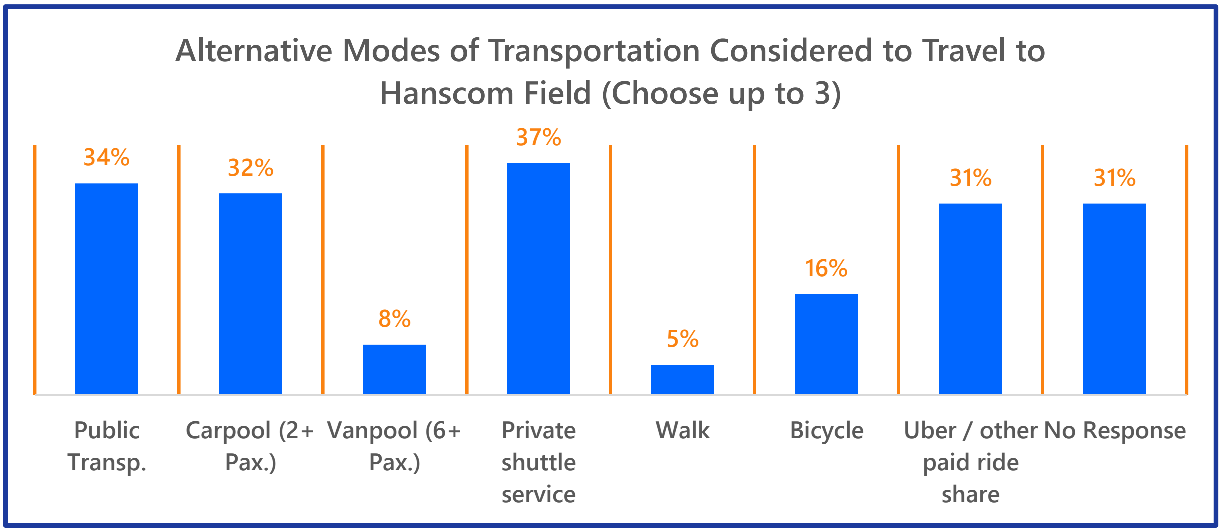
Travel Survey Findings

An online commute/travel survey was administered to Hanscom Field employees and tenants in May 2018 to identify and understand current travel patterns and opportunities to reduce SOV trips to and from Hanscom field. In total, 62 survey responses were collected in 2018, which is comparable to the number of responses (65) collected in 2012. The results of the travel survey can be found in Appendix C.

Survey respondents were asked questions on their travel habits and specific actions that could be taken which may make commuting via an alternative mode of transportation more viable. Overall, 90 percent of survey respondents stated they drive to Hanscom Field alone, while five percent indicated that they carpool with other Hanscom employees. These results confirm past findings which show that the majority of commuters to Hanscom Field do so by SOV.

Many respondents showed moderate interest in exploring alternative modes of transportation to get to, from, and around the Hanscom Field area as shown in Figure 6-14. These findings demonstrate that while SOV trips remain the dominant means of transportation to and from Hanscom Field, further exploration into other modes of transportation is valuable.

Figure 6-14 Travel Survey Results Showing Interest in Alternative Travel to Hanscom Field



Source: FHI, 2018

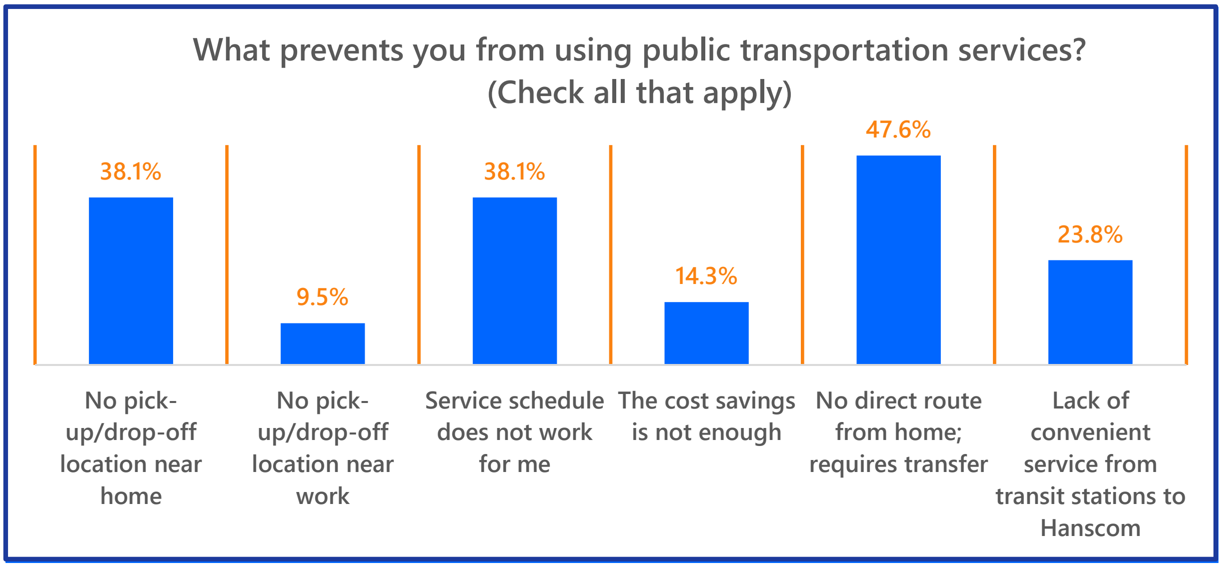
In particular, interest in exploring transit, private shuttle service, and promoting carpooling were identified by survey respondents. This is likely since nearly all respondents (98 percent) of respondents live more than a mile away, and most respondents (74 percent) live more than 10 miles away. This means that walking and bicycling trips to and from Hanscom Field are not a reasonable option for many commuters to and from Hanscom Field.

Public Transportation and Shuttle Services

Figure 6-14 illustrates that twenty-one respondents (34 percent) responded that they would consider taking public transportation as an alternative mode of transportation, however survey respondents identified significant barriers in current public transportation access to Hanscom Field. This includes the lack of direct routes from home, no pick-up/drop-off location near home, and a transit schedule which is perceived as inconvenient. One survey respondent indicated that faster service between either the MBTA Red Line at Alewife station, or the MBTA commuter rail in Lincoln or Concord would be necessary before that person would take public transportation.

Notably, and as illustrated in Figure 6-15, nine of the 21 respondents (41 percent) who responded that they would consider taking public transportation as an alternative mode of transportation (34 percent of total survey respondents) stated they would consider taking public transportation if there was more convenient bus services and/or more frequent private shuttles between the Alewife Station on the MBTA red line or Concord Station or Lincoln Station on the MBTA commuter rail.

Figure 6-15 Travel Survey Results Showing Factors Constraining Use of Public Transportation of Those Indicating Interest in Using Public Transportation



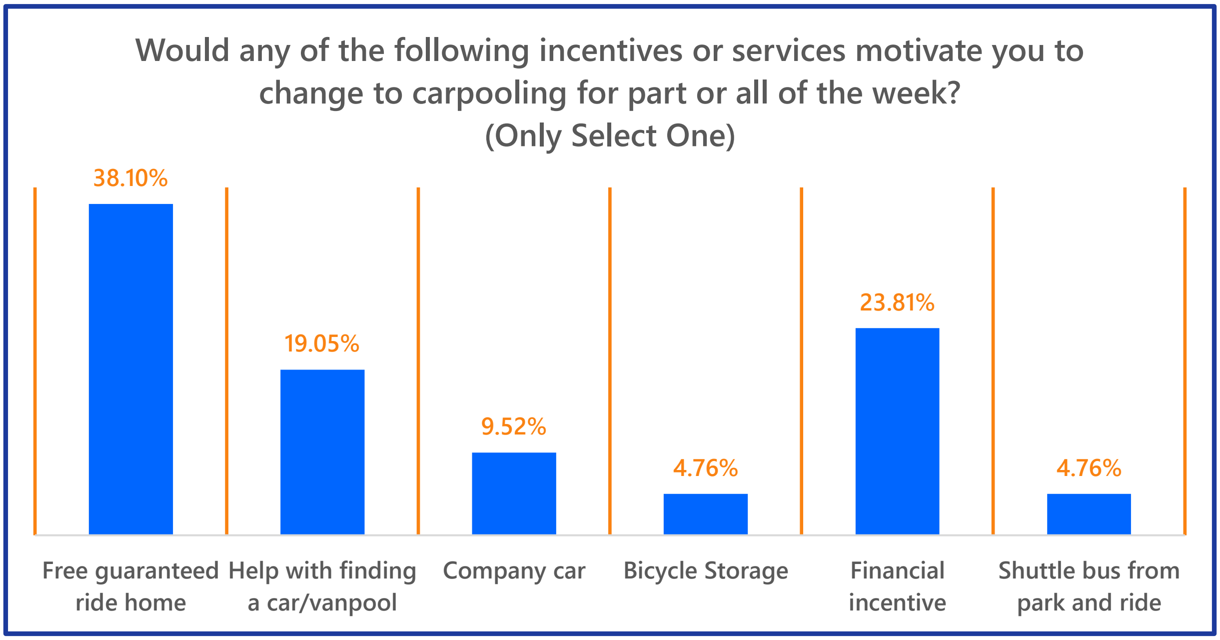
Source: FHI, 2018

Car/Vanpooling

Of all respondents of the travel survey, five percent indicated they carpool on most days, while an additional three percent indicated they sometimes carpool as secondary means to get to Hanscom Field. Furthermore, many respondents were receptive to the prospect of carpooling with other Hanscom employees, with 49 percent of employees indicating interest. However, analysis of the respondent data shows that carpooling may be difficult to implement. For example, only 37 percent of respondents indicated they travel to Hanscom Field five or more days a week, and analysis of respondent zip code data shows a wide geographic spread of commuters to Hanscom Field. Both these factors make finding adequate carpooling matches difficult.

As illustrated in Figure 6-16, of the 21 respondents who indicated interested in carpooling and responded to a question posed soliciting responses on incentives which would motivate respondents to do so, eight respondents (38 percent) indicated that a free guaranteed ride home program would be most likely to promote a switch to carpooling, followed by financial incentives at 24 percent, and help finding a car/vanpool at 19 percent.

Figure 6-16 Travel Survey Results Showing Factors Which Would Encourage Carpooling of Those Indicating Interest in Carpooling or Vanpooling



Source: FHI, 2018

Active Transportation

In general, the commute/travel survey highlights the wide geography of commuters to the study area. Notably, less than 2 percent of survey respondents indicated they live less than one mile away from Hanscom Field, while 24 percent live between 1 and 10 miles from Hanscom Field. Therefore walking cannot be considered a viable means of commuting for survey respondents.

However, bicycling could be an option for commuters to Hanscom Field. While no respondents indicated that cycling was a primary means of travel to the study area, 11 percent indicated that they sometimes walk or bicycle to Hanscom Field and 23 percent of respondents indicated some level of interest in bicycling as an alternative to their primary means of travel. The travel survey further shows that a sizable percentage (26 percent) of commuters live 10 miles or less to Hanscom Field, making cycling a reasonable alternative for this population.

Even with a sizable percentage of respondents indicating some level of interest in bicycling to Hanscom Field, 70 percent of respondents indicated that bicycle facilities are not adequate to make biking a viable option. This includes street infrastructure – as many respondents feel there is no safe route for them to bike – and on-site amenities not currently provided to cyclists such as showers and covered bike storage.

In particular, respondents noted several locations on and near the study area in need of pedestrian and bicycling improvements. These include: (1) Hanscom Drive between the Civil Air Terminal to Route 2A, (2) the intersection of Hanscom Drive and Old Bedford Road, (3) Virginia Road to the north of Old Bedford Drive, and (4) Route 2A connecting Hanscom Drive to Lexington to the east.

MBTA Bus Ridership Data

MassDOT releases MBTA bus ridership data by bus stop on an annual basis. As of the release of this report, the most recent data available was for the year 2016.

As described in earlier in this chapter, Hanscom Field is served by MBTA Route 76 on weekdays and a combined Route 62/76 on Saturdays; service is not provided on Sundays. Route 76 service is provided approximately every half-hour during peak hours and hourly during mid-day hours. Saturday service is provided hourly. Average weekday ridership at the Civil Air Terminal averages roughly 8 boardings and alightings per day while ridership at the intersection of Hanscom Road and Old Bedford Road on weekdays averages about 17 boardings and alightings per day.

Route 76 provides local service between Alewife Station via Lincoln Lab and Lexington Center. However, this route requires a stop-over at the Lincoln Labs stop before connecting to the Civil Air Terminal at Hanscom Field. Additionally, the Route 76 bus route between Alewife and Hanscom Field utilizes local roadways instead of traveling on Route 2. The design of this route with the stop-over at Lincoln Labs and the design of this route utilizing only local roadways reduces the time-competitiveness of transit when compared to driving a private automobile.

128 Business Council Shuttle Service

The 128 Business Council operates The Rev Bus-Hartwell Area Shuttle, which is a commuter shuttle service that operates each rush hour between the MBTA Red Line Alewife Station in Cambridge and worksites along Hartwell Avenue. The REV Bus is partially funded by major property developers in the Hartwell Avenue corridor of Lexington and Bedford, and partially funded by the Towns of Lexington and Bedford. In the AM peak hour, shuttles depart Alewife Station at 6:30 AM, 7:30 AM and 9:00 AM arriving at 131 Hartwell Avenue (near the Hartwell Gate to the Hanscom AFB) within 15 to 25 minutes; in the PM peak hour shuttles depart 131 Hartwell Avenue at 4:26 PM, 5:51 PM, and 7:21 PM, arriving at Alewife Station about 35 minutes later.

6.3 Future Analysis Conditions

This section describes the background assumptions and methodology used to evaluate future roadway and traffic volume conditions within the study area for the 2025 and 2035 scenarios. The *2017 ESPR* future scenarios are used to evaluate the potential cumulative environmental effects that could occur if Hanscom Field reaches the airport activity levels that that are described in Chapter 3 Airport Activity Levels. The 2025 and 2035 scenarios represent estimates of what could occur (not what will occur) in the future using certain planning assumptions and are not necessarily recommended outcomes.

Future increases in weekday, peak hour traffic volumes were estimated for the 2025 and 2035 scenarios and were added to the study area roadway network. The potential increases in traffic volumes include vehicle trips generated by future background growth, or specific, non-Hanscom developments planned or programmed in the area by the towns, as well as forecast activity growth at Hanscom Field. In addition to the components of future traffic growth, this section describes planned roadway improvements in the area and their expected effects on the transportation network.

The analysis identified traffic increases on key roadways such as Route 2A and conducted level-of-service (LOS) analysis for study area intersections where Hanscom Field traffic represents 10 percent or more for any traffic movement, as required by MEPA.

6.3.1 Future Background Growth

Future growth in traffic volumes occurs because of regional background growth and the traffic associated with specific plans/developments in the individual towns. This section describes background growth trends and planned developments within the towns of Bedford, Concord, Lexington, and Lincoln.

Regional Background Growth

To develop future traffic networks, a general growth rate was determined to account for the increase in all non-Hanscom related trips in the analyzed roadway network. For this effort, four sources of information were reviewed including 1) the seasonally-adjusted turning movement counts for both the 2012 and *2017 ESPR*; 2) the seasonally-adjusted ATR volumes for both the *2012* and *2017 ESPR*; 3) the five-year traffic growth measured at nearby MassDOT continuous count stations; and 4) projections of vehicle miles traveled (VMT) for the four Hanscom Field area towns (Bedford, Concord, Lexington, and Lincoln) from the Boston Region MPO published in 2012. A summary of this data is provided in Table 6-13.

Table 6-13 Background Traffic Growth Sources Reviewed for 2017 ESPR

Source	Commentary
2012 and 2017 ESPR Peak Hour Turning Counts	⇨ AM Peak Period experienced an average of a 0.51 percent annual increase in traffic volumes between 2012 and 2018. ⇨ PM Peak Period experienced an average of a 0.78 percent annual increase in traffic volumes between 2012 and 2018.
2012 and 2017 ESPR Automated Traffic Recorders (ATRs)	⇨ Review of the seasonally adjusted weekly counts by the automated traffic recorders in 2012 and 2018 at four locations shows an average annual growth of 0.07 percent. ⇨ These four locations include: 1) Bedford Road South of Route 2A, 2) Cambridge Turnpike Cutoff South of Lexington Road, 3) Old Bedford Road south of Bedford Street, and 4) Bedford Street west of Old Bedford Road.
MassDOT Continuous Count Stations	⇨ Station H8509 on I-95 at Route 2A experienced an average annual increase of 1.21 percent between the years of 2012 and 2017. ⇨ Station 4013 on Route 2 just west of I-95 experienced an average annual increase of 0.50 percent between the years of 2012 and 2017. ⇨ Station 403 on Route 2 just East of Commonwealth Ave in Concord experienced an average annual increase of 1.21 percent between the years of 2012 and 2017.
Boston Region Metropolitan Planning Organization	⇨ The Boston Region MPO predicts an average annual VMT growth of 0.40 percent between the years 2018 and 2025 for the four-towns in the Hanscom Field area (Bedford, Concord, Lexington, and Lincoln). ⇨ The Boston Region MPO predicts an average annual VMT growth of 0.65 percent between the years 2025 and 2035 for the four-towns in the Hanscom Field area (Bedford, Concord, Lexington, and Lincoln).

Note: While 2 other locations were counted for this project, these were not included in this analysis as one counter was placed on Hanscom Drive north of Old Bedford Road and the other at Route 2A east of Airport Road was miscounted in the original dataset for the 2012 ESPR.
Source: FHI, 2018

Based on review of this data, a background traffic growth rate of 0.75 percent per year between 2018 and the 2025 model year was used to reflect a blended rate that considers recent traffic growth trends and predictions from the Boston Region MPO. A 0.65 percent annual growth rate between 2025 and 2035 was used to reflect the recommendations by the Boston Region MPO. It should be noted that while higher growth has been observed at the MassDOT Continuous Count Stations, it appears from other datasets that this level of growth has not been seen on non-arterial roadways in the study area. Therefore, the near-term annual growth rate of 0.75 percent reflects a conservative blend of these values. This represents a higher growth rate than otherwise expected if evaluating traffic growth based on MPO VMT projections and the difference in traffic counts between the *2012 ESPR* and the *2017 ESPR*. However, the high growth seen at the MassDOT Continuous Count Stations led to the selection of higher traffic growth numbers.

For the 2025 to 2035 period, the model applies a 0.65 percent annual growth rate to reflect the recommendations by the Boston Region MPO. The MPO rate was chosen for the ten-year period from 2025 to 2035 since it was determined that previous trends from the *2012* and *2017 ESPR* documents might be inconsistent with long-term traffic growth projections.

Planned and Potential Future Developments

A review of planned, future developments indicated that development within the study area is limited to the addition of 675 jobs to the Hanscom AFB campus. As these new jobs will be originating from outside the campus, AFB trips in the background development were increased to appropriately represent potential future conditions.

While a traffic study for these additional jobs could not be obtained, the additional impact to traffic was estimated by scaling the number of trips proportional to the increase in employment that the AFB will see in the coming years. U.S. Census (2015) estimates that approximately 3,400 employees currently work at the AFB, therefore, an increase of 675 jobs will result in approximately 20 percent more trips to and from the AFB during peak hours. The 20 percent increase in trips was applied to only those trips originating from and destined to the Hanscom AFB Vandenburg Gate located on Old Bedford Road. These additional trips were then distributed through the network given the same proportional distribution as used in 2018 morning and afternoon peak hour trip distribution networks. Trips originating from and destined to the Hartwell Gate or the Lincoln Labs gates were not included in the analysis; an increase in traffic/trips at these gates may impact traffic at the Route 4/225 and Hartwell Avenue intersection, however the lack of count information at the gate locations prohibits this estimation. It should also be noted that the background growth between 2025 and 2035 was not applied to these additional trips.

6.3.2 Hanscom Field Future Traffic Volume Scenarios

To assess the potential future traffic impacts of Hanscom Field-related trips, trips generated by possible future activity at Hanscom Field for the 2025 and 2035 forecasts were estimated. Vehicular traffic at Hanscom Field is generated by both general and commercial aviation activities, and other airport-related land uses. General aviation (GA) includes flights for training, personal use, and business/corporate use. Future growth estimates for airside operations (GA, commercial aviation, and light cargo operations) were based on aviation forecasts presented in Chapter 3. Future growth based on these forecasts was applied to existing peak hour activity levels at Hanscom Field to estimate the number of new weekday morning and afternoon vehicular trips generated by aviation activities under each of the two future scenarios. Future trips largely derive from the addition of commercial service as noted in Chapter 3.

Table 6-14 presents vehicle trip generation estimates for current and the 2025 and 2035 scenarios. In general, the *2017 ESPR* Hanscom Field trip generation estimates for future years are lower than the forecasted rates in the *2012 ESPR*. These differences reflect a reduction of aviation activity at Hanscom Field since 2012. The *2012 ESPR* growth scenarios also included traffic from an airport-based hotel and aviation museum, neither of which were developed between 2012 and 2017. However, some type of aviation-compatible development is still possible by 2035 for these two parcels in the West Ramp area (as indicated in Table 4-8) but are not included in the trip generation estimates in Table 6-14 because specific details for future development are not currently known. A full report on projected trip generation by year is presented in Appendix C.

Table 6-14 Hanscom Field Trip Generation for 2025 and 2035 Scenarios

Scenario	Morning peak hour			Afternoon peak hour		
	In	Out	Total	In	Out	Total
2018	74	36	110	32	75	107
2025 Forecast	90	48	138	40	85	125
2035 Forecast	106	61	167	48	98	146
2012 ESPR Scenarios						
2020 Forecast	178	42	220	46	120	166
2030 Forecast	291	99	390	122	223	345
Source: FHI, 2018						

As mentioned, two sites in the West Ramp area continue to be identified as strategic reserves for development in the 2035 scenario (see Table 4-8). While no specific proposals currently exist, the sites could accommodate a range of potential developments. The possible types of development could generate a range of traffic impacts, such as the hotel, conference center, or museum previously considered. As such, and for purposes of this study, up to 150 new morning peak hour and 180 new afternoon peak hour trips could be generated. These trips would likely access Hanscom Field primarily from Route 2A and would contribute to traffic at the main entrance to the site at Hanscom Drive and Route 2A. When this potential development is more specifically defined, its impacts on traffic at specific locations (as well as air quality and natural resources) can be more fully evaluated.

6.3.3 Hanscom Field Trip Distribution

To account for increased development at the Pine Hill area (adjacent to Virginia Road) and the North Airfield area (located on Hartwell Road), traffic was first estimated and assigned to either the Terminal Area access, the Pine Hill access, or the North Airfield access. This estimation process is detailed in Appendix C and the assumptions are summarized below in Table 6-15. While the trip assignment to other Hanscom access points was not considered in the *2012 ESPR*, it was determined that these access points would account for a proportion of new future aviation activity, therefore they were included in the *2017 ESPR*. While Table 6-15 indicates that 25 percent of GA trips will be assigned to the North Airfield Access in 2035, it should be noted that, based on trip generation estimates provided in Appendix C, no more than 5 vehicles were assigned to any particular movement on the Hartwell Road access in either the morning or afternoon peak hours as shown in the following figures for the 2025 and 2035 distribution results.

Table 6-15 Hanscom Field Trip Distribution Assumptions

Location	2025 Assumptions	2035 Assumptions
Pine Hill Access	Receives 2017 Trips + 10 percent of 2025 GA Trips	Receives 2017 Trips + 15 percent of 2035 GA Trips
North Airfield Access	Receives 20 percent of 2025 GA Trips	Receives 25 percent of 2035 GA Trips
Terminal Area	Receives remainder of GA trips, receives all commercial related trips, receives all 'other'-based trips	Receives remainder of GA trips, receives all commercial related trips, receives all 'other'-based trips

Source: FHI, 2018

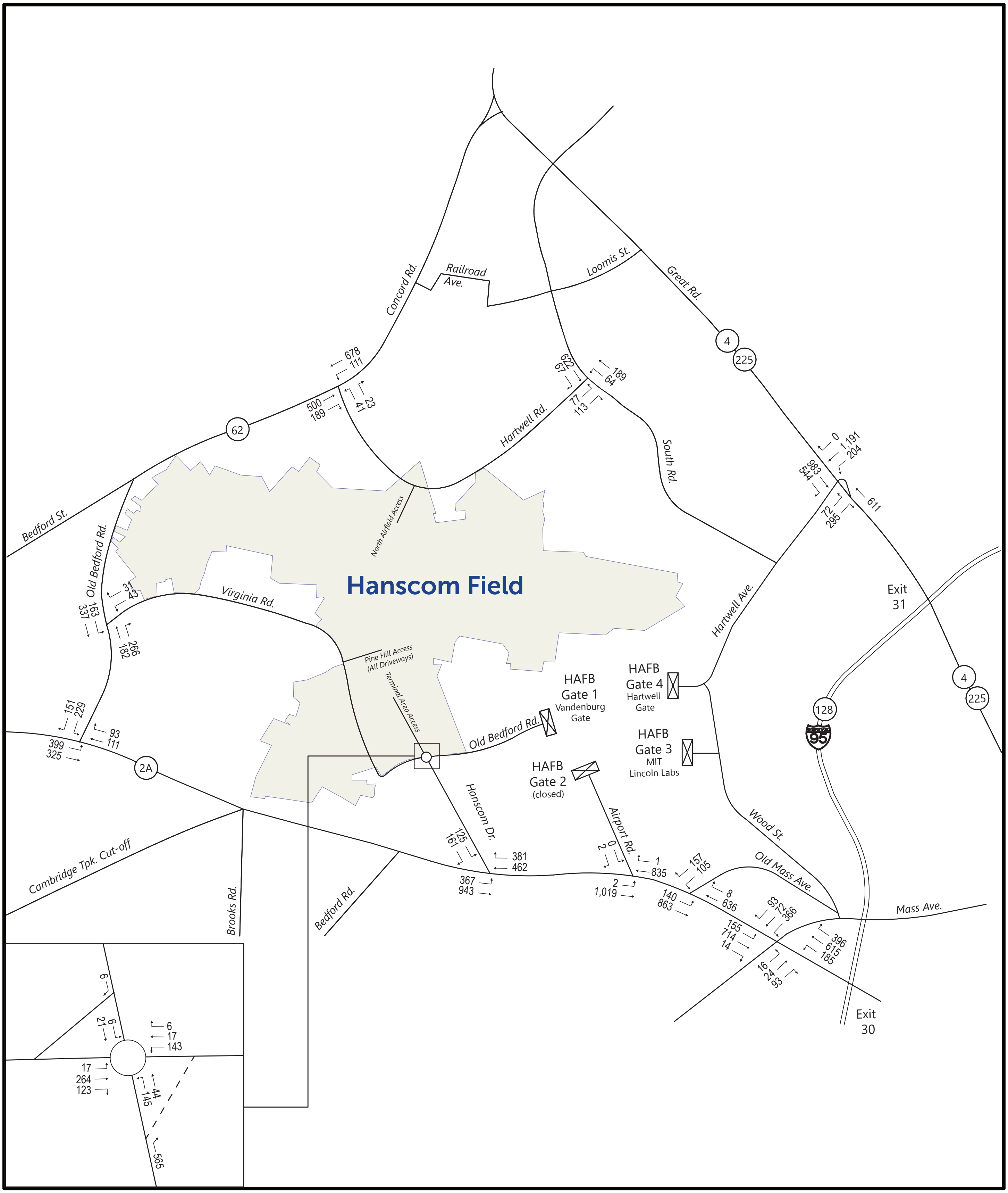
Table 6-16 shows the distribution of all trips aggregated by driveway access in the current and future scenarios as a percentage of total trips either inbound or outbound to Hanscom Field. This table shows that even with future development outside the Terminal Area, the majority of trips into and out of the airport will still be found at this access point on Hanscom Drive. Based on the assumptions above, no less than 65% of trips in any one direction (inbound or outbound to Hanscom Field) is slated to occur throughout the forecast years (in the 2035 forecast year, 65% of vehicles destined to Hanscom Field are estimated to use the main entrance at Hanscom Drive to access the Terminal Area while the remaining 35% are estimated to access either the Pine Hill or North Airfield access points). Thus, Table 6-16 shows that even with the development of future GA facilities at both the North Airfield and Pine Hill areas, the predominant access to Hanscom Field will remain at Hanscom Drive.

Table 6-16 Trip Distribution by Driveway

Scenario	Location	Morning peak hour		Afternoon peak hour	
		In	Out	In	Out
2017	Pine Hill	11%	11%	12%	11%
	North Airfield	0%	0%	0%	0%
	Terminal Area	89%	89%	88%	89%
	Total	100%	100%	100%	100%
2025 Forecast	Pine Hill	16%	13%	17%	17%
	North Airfield	9%	6%	13%	8%
	Terminal Area	75%	81%	70%	75%
	Total	100%	100%	100%	100%
2035 Forecast	Pine Hill	17%	15%	23%	18%
	North Airfield	9%	5%	12%	10%
	Terminal Area	74%	80%	65%	72%
	Total	100%	100%	100%	100%

Source: FHI, 2018

Trips destined to and originating from the Terminal Area access were then distributed based on existing trip distribution patterns as in the *2012 ESPR*. Volumes at intersections that were not counted for the *2017 ESPR* were estimated using 2012 travel patterns and the 2018 ATR count. Traffic originating from and destined to the Pine Hill area was distributed using the same method used for the Terminal Area access. Traffic originating from and destined to the North Airfield area was assigned to entry and exits into the network at Bedford Street towards Concord to the southwest, with Concord Road towards Bedford to the north and Route 4/225 to the southeast. These trips were assigned and estimated based on estimated travel patterns of traffic accessing the Terminal Area. Figure 6-17 through Figure 6-28 2035 present future traffic volume scenarios as analyzed in the *2017 ESPR*.



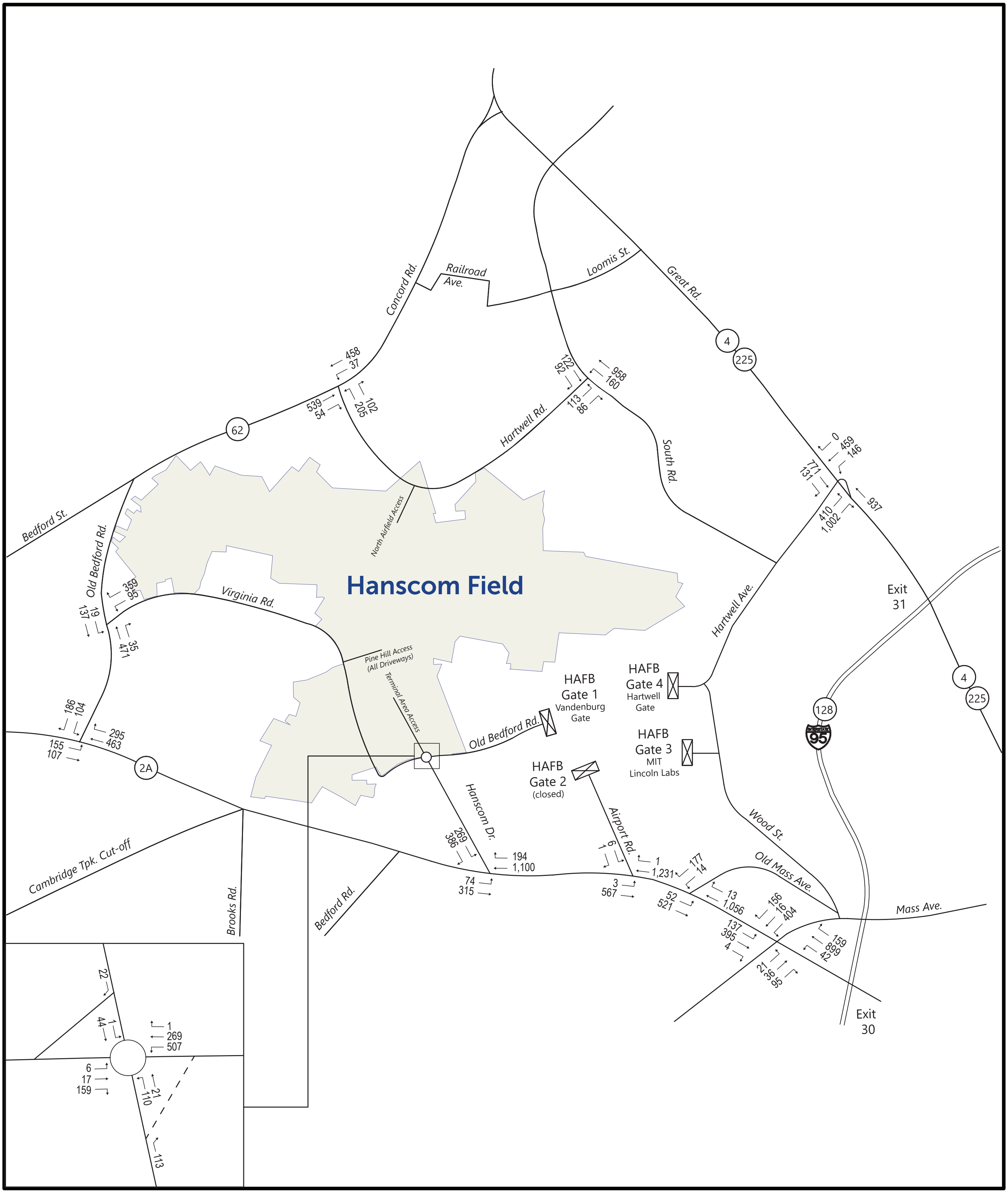
![massport]

L. G. Hanscom Field

2017 Environmental Status & Planning Report

2025 Background Growth Only
Morning Peak Hour Traffic Volumes

Figure **6-17**



North

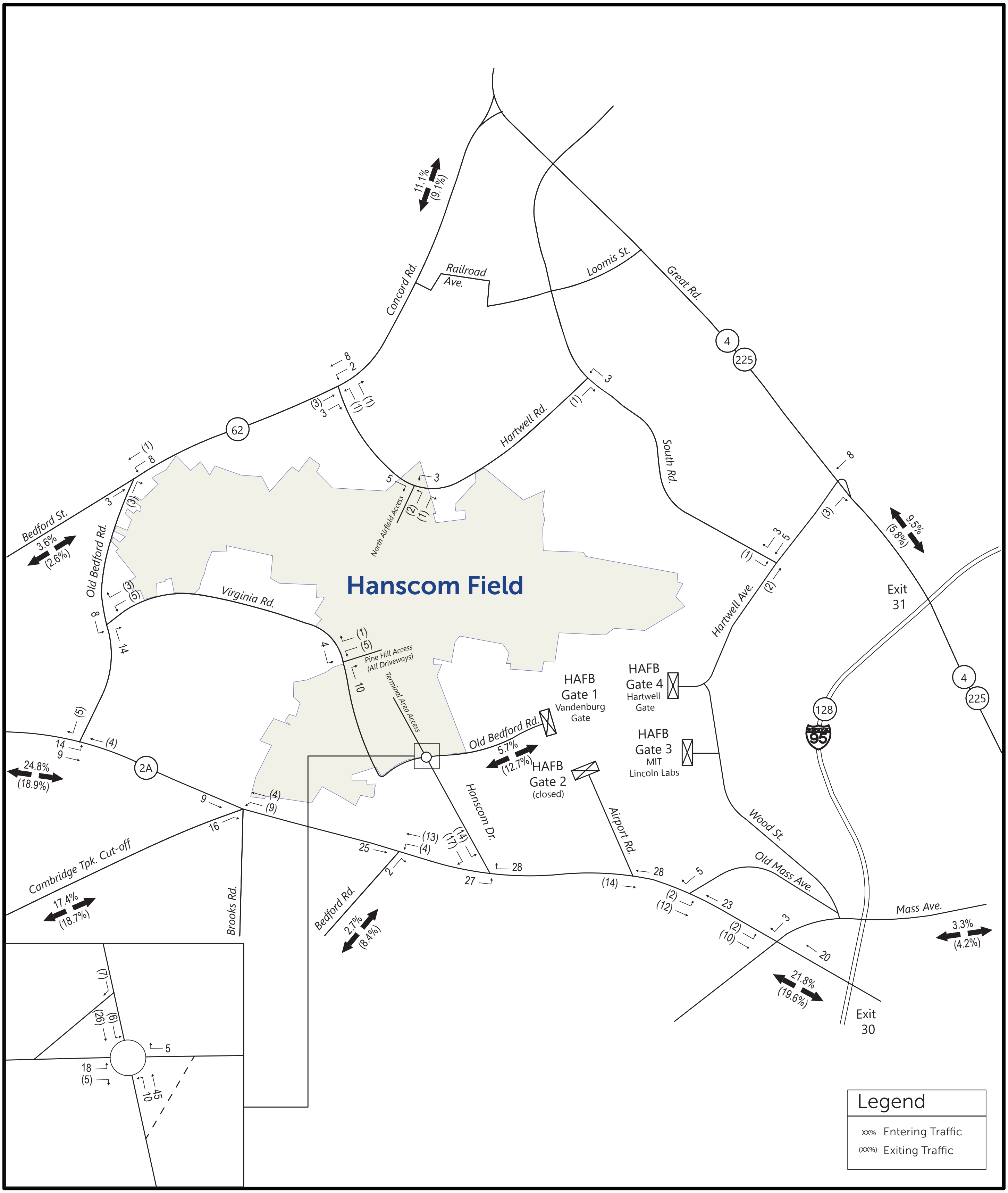
NOT TO SCALE

L. G. Hanscom Field

2017 Environmental Status & Planning Report

2025 Background Growth Only
Afternoon Peak Hour Traffic Volumes

Figure **6-18**

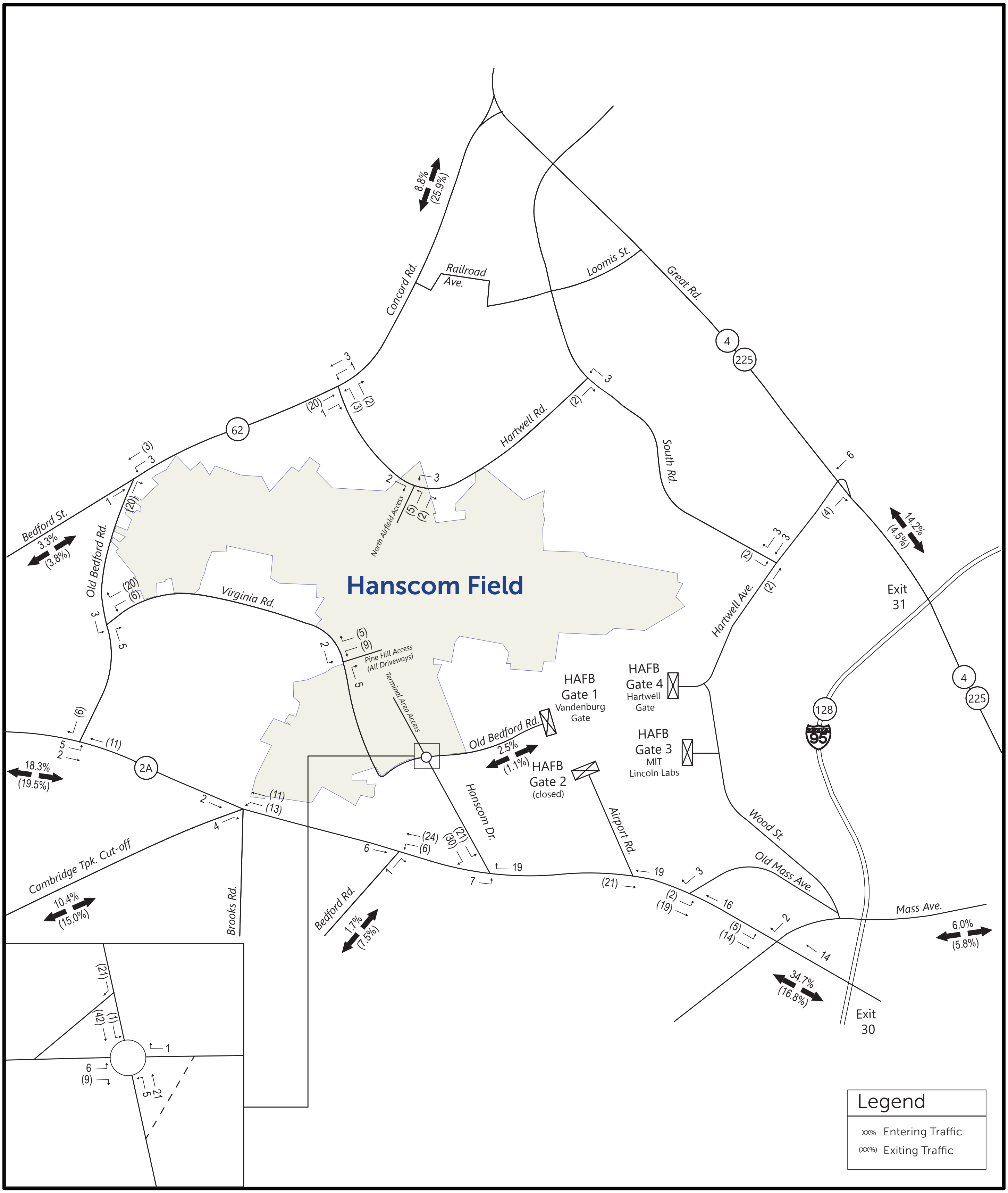


L. G. Hanscom Field

2017 Environmental Status & Planning Report

2025 Morning Peak Hour
Trip Distribution (Hanscom Field Only)

Figure 6-19



North

NOT TO SCALE

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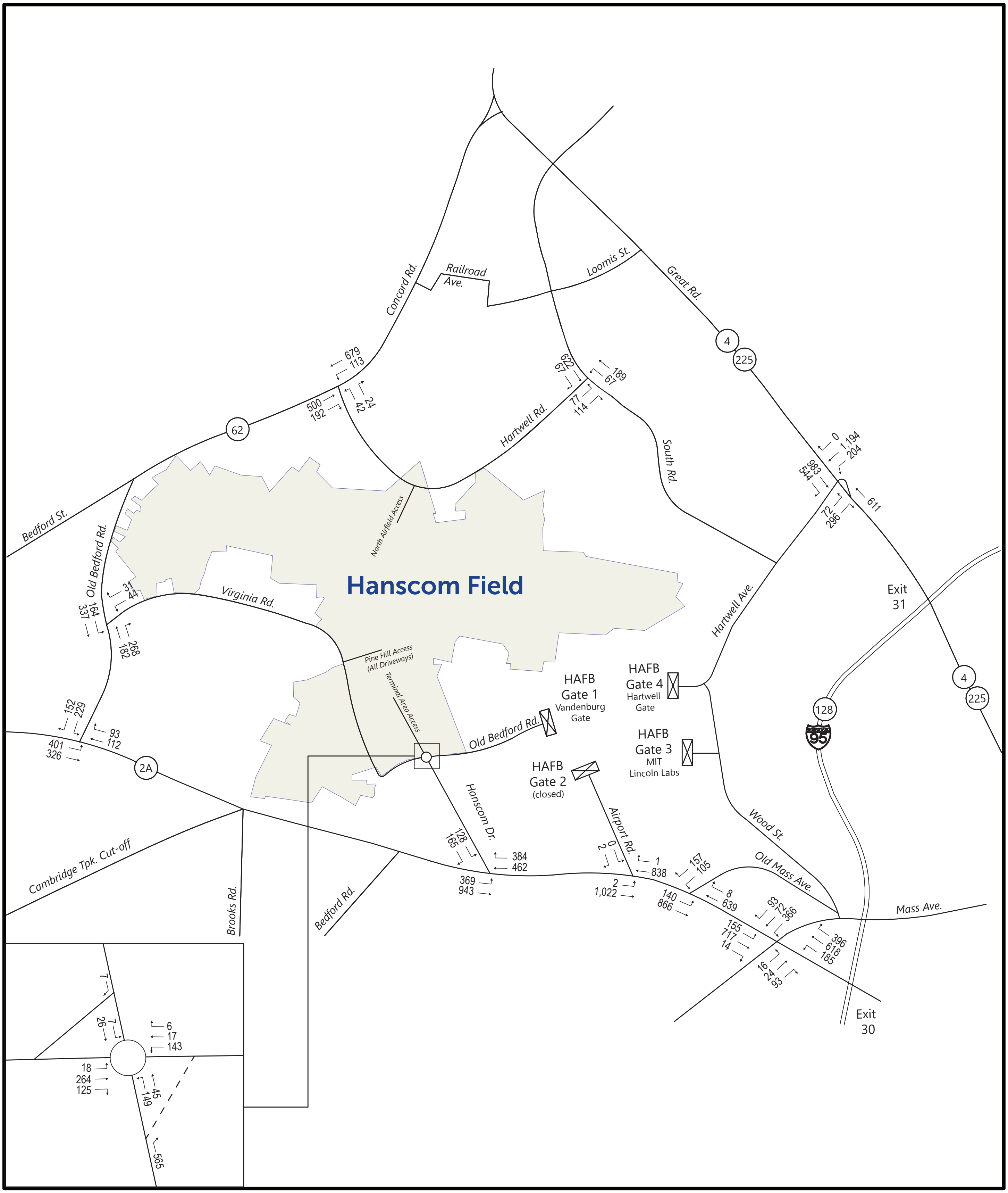
L. G. Hanscom Field

2017 Environmental Status & Planning Report

2025 Afternoon Peak Hour
Trip Distribution (Hanscom Field Only)

Figure 6-20



North

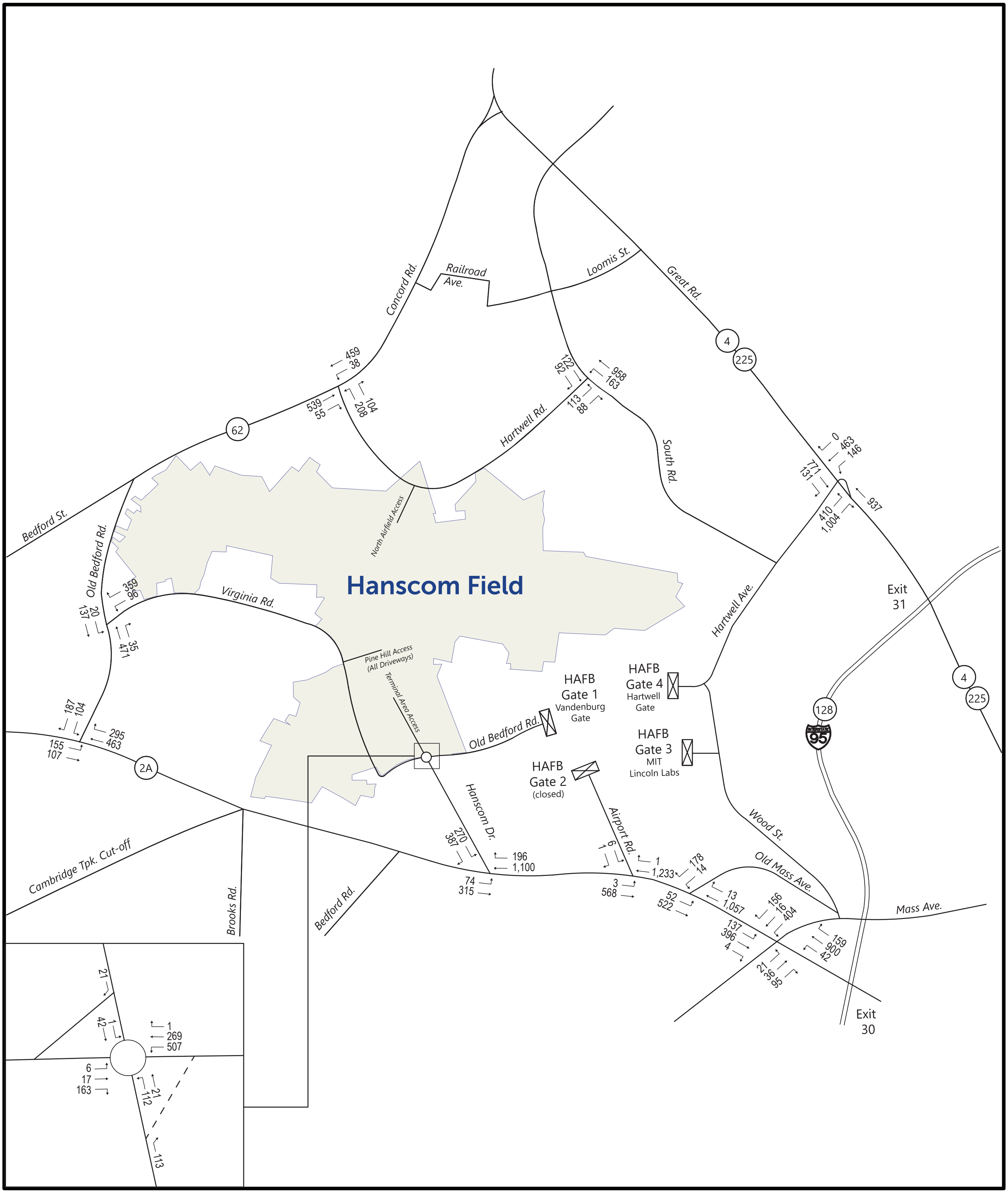
NOT TO SCALE

L. G. Hanscom Field

2017 Environmental Status & Planning Report

2025 Hanscom and Background Growth Morning Peak Hour Traffic Volumes

Figure **6-21**



North

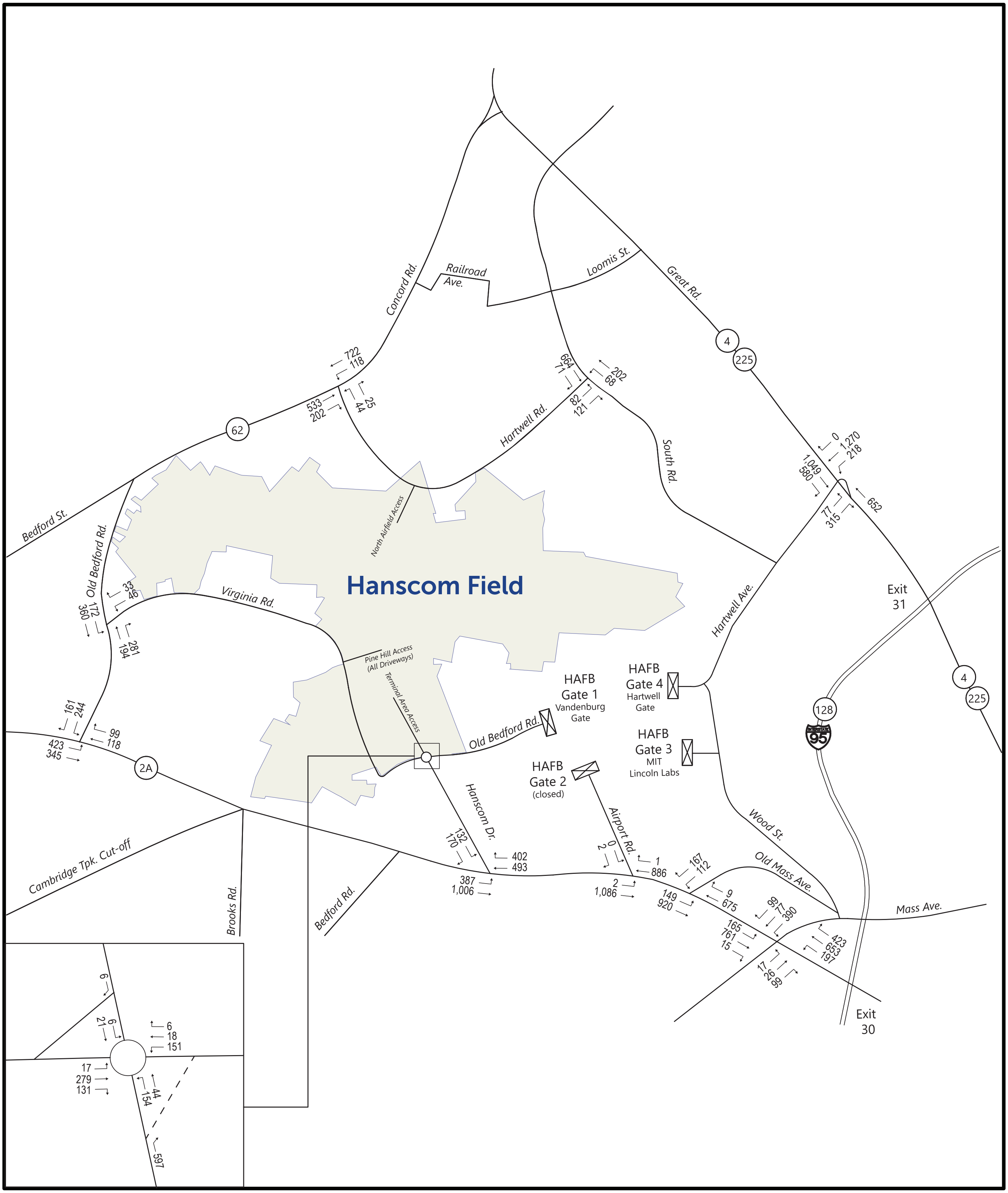
NOT TO SCALE

L. G. Hanscom Field

2017 Environmental Status & Planning Report

2025 Hanscom and Background Growth Afternoon Peak Hour Traffic Volumes

Figure 6-22



North

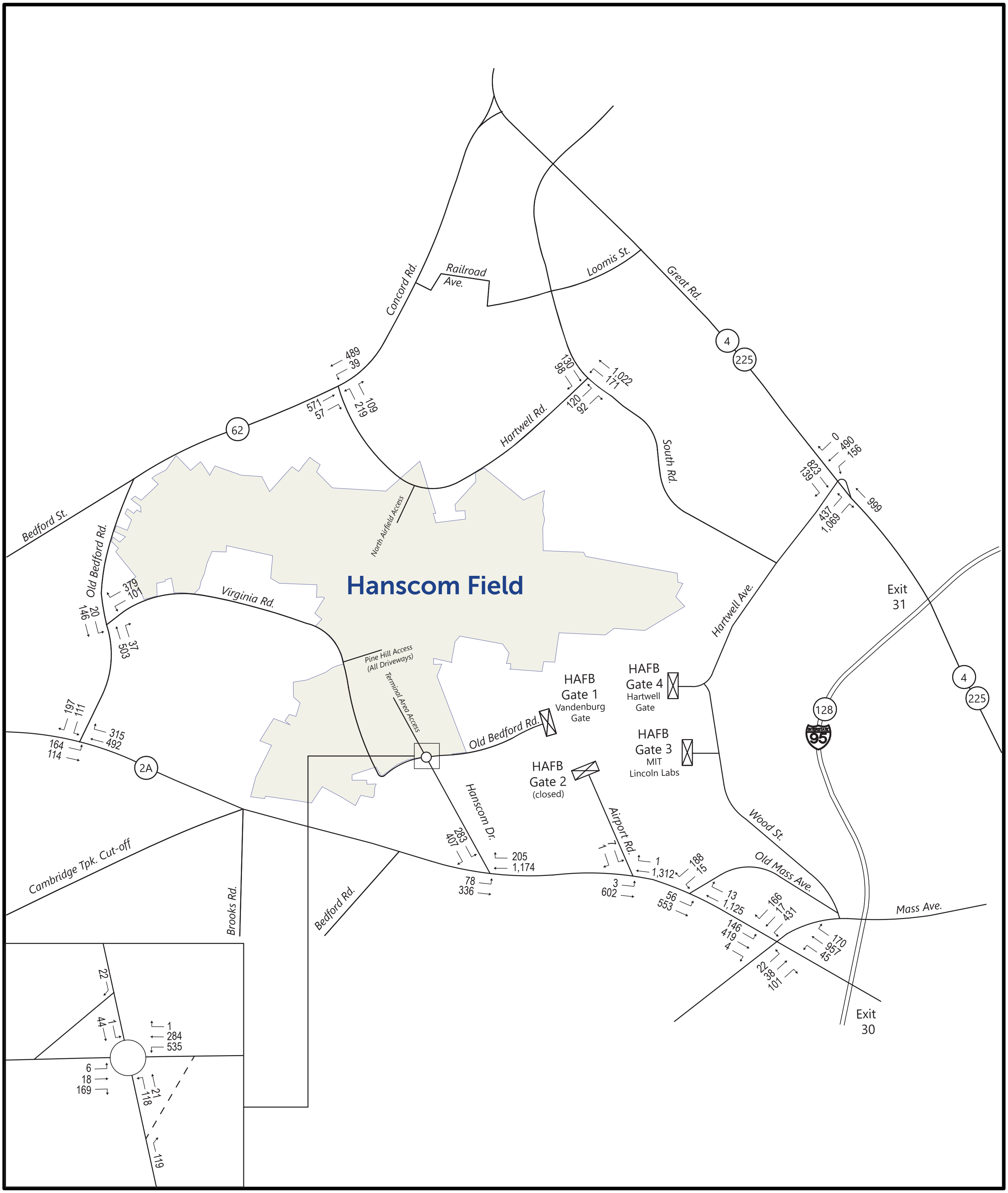
NOT TO SCALE

L. G. Hanscom Field

2017 Environmental Status & Planning Report

2035 Background Growth Only
Morning Peak Hour Traffic Volumes

Figure **6-23**



North

NOT TO SCALE

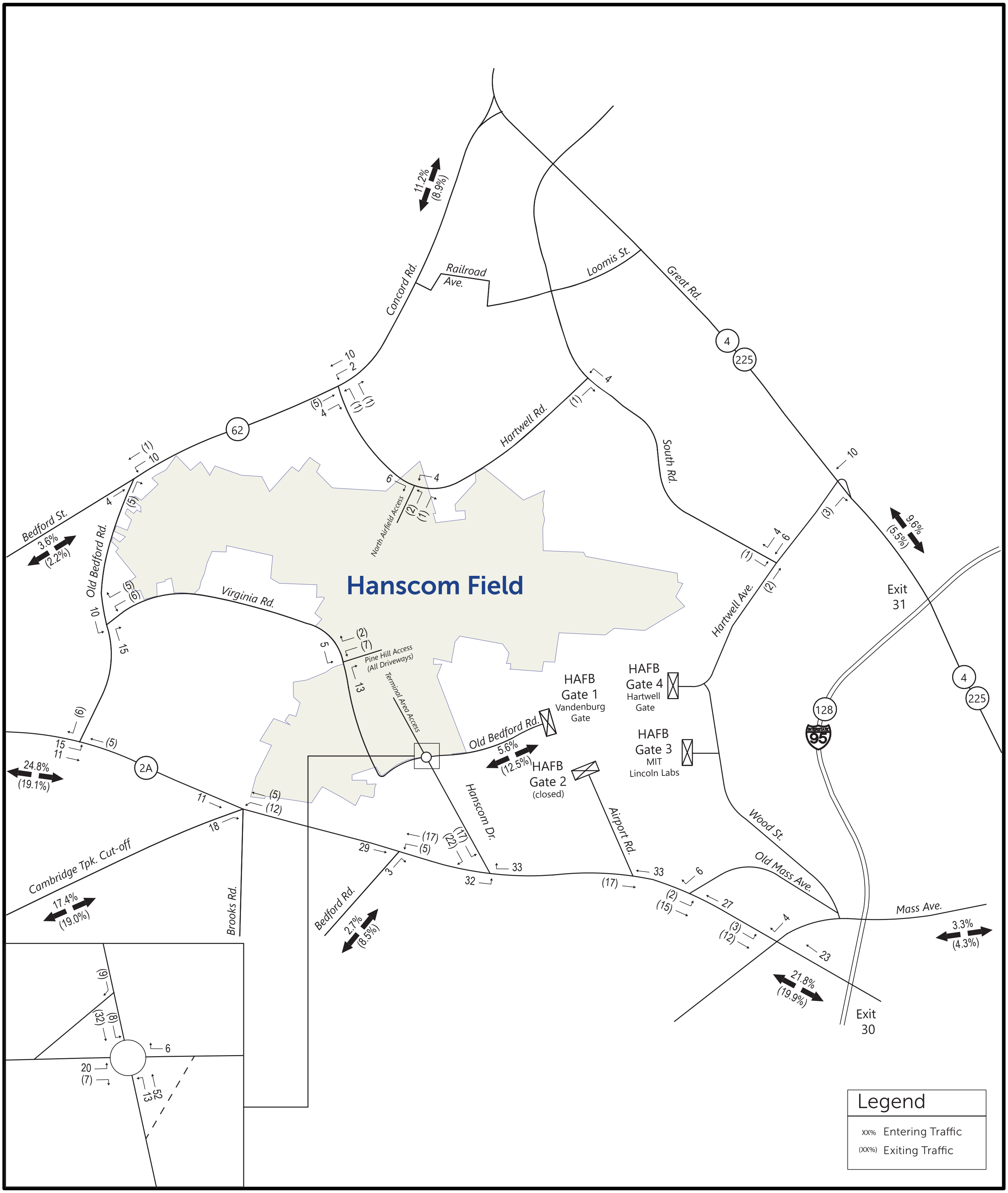
massport

L. G. Hanscom Field

2017 Environmental Status & Planning Report

2035 Background Growth Only
Afternoon Peak Hour Traffic Volumes

Figure **6-24**



North

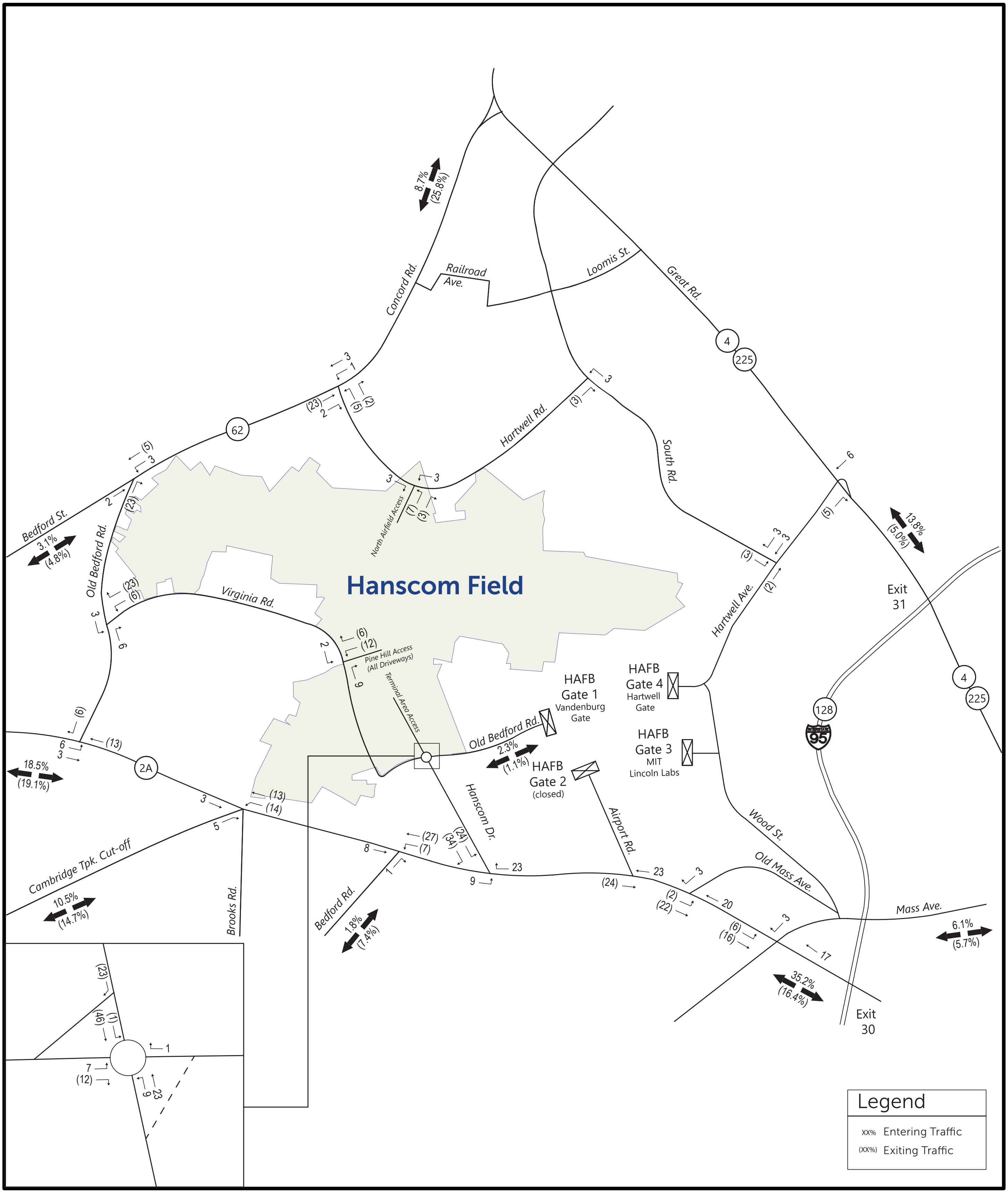
NOT TO SCALE

L. G. Hanscom Field

2017 Environmental Status & Planning Report

2035 Morning Peak Hour Trip Distribution (Hanscom Field Only)

Figure **6-25**



North

NOT TO SCALE

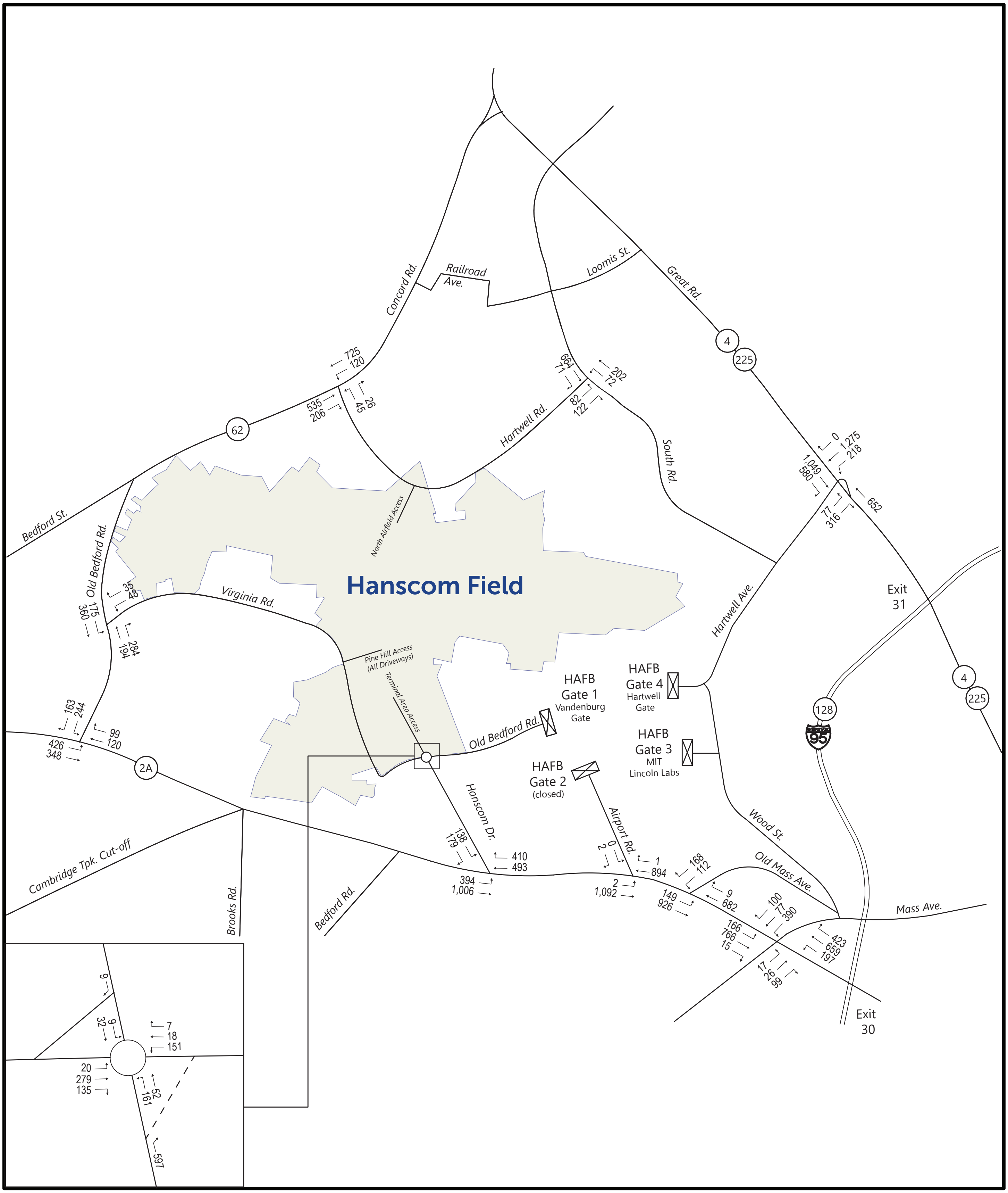
massport

L. G. Hanscom Field

2017 Environmental Status & Planning Report

2035 Afternoon Peak Hour Trip Distribution (Hanscom Field Only)

Figure **6-26**



North

NOT TO SCALE

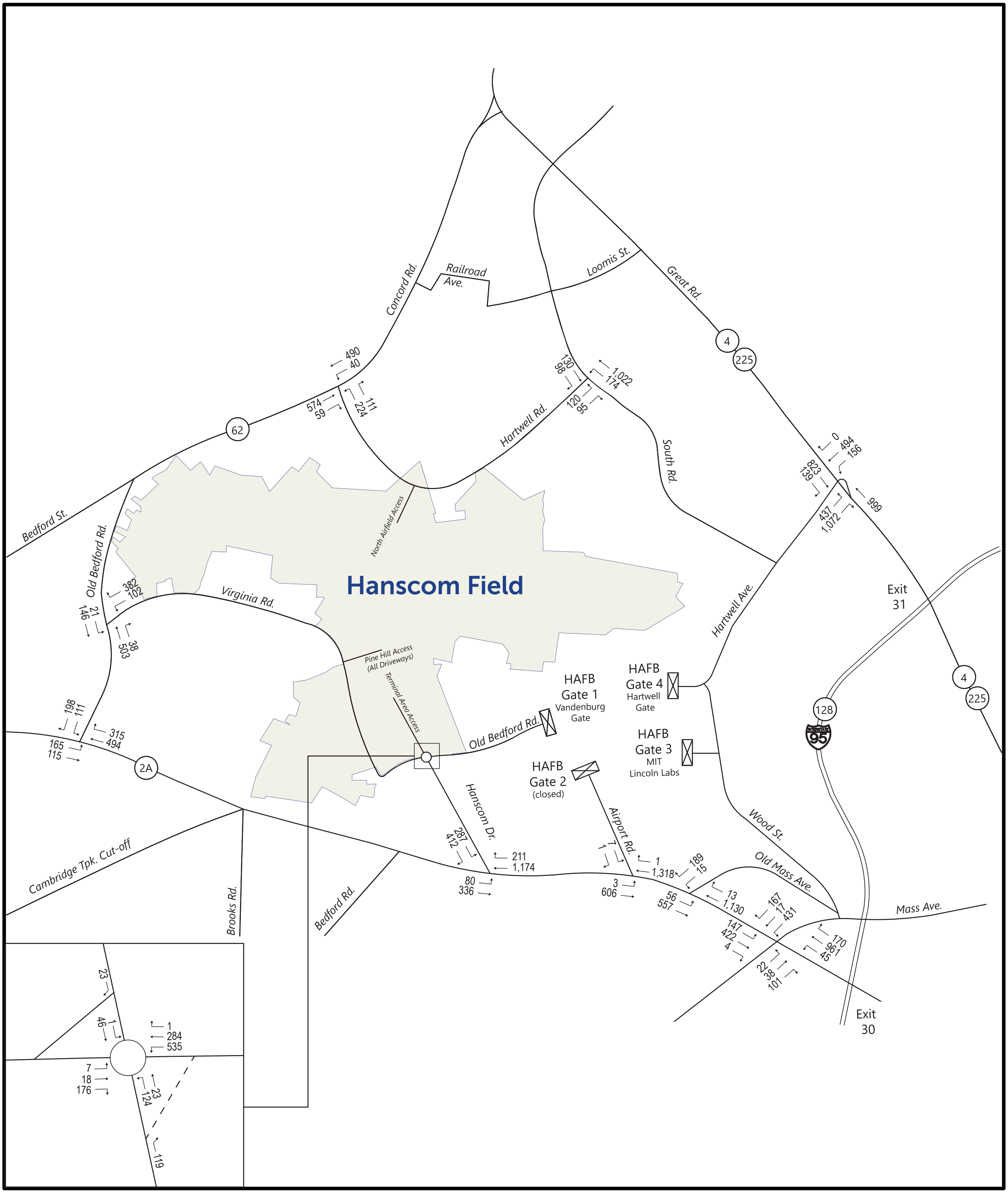
massport

L. G. Hanscom Field

2017 Environmental Status & Planning Report

2035 Hanscom and Background Growth Morning Peak Hour Traffic Volumes

Figure **6-27**



L. G. Hanscom Field

2017 Environmental Status & Planning Report

2035 Hanscom and Background Growth Afternoon Peak Hour Traffic Volumes

Figure 6-28

6.3.4 Planned Roadway Improvements

In order to analyze future intersection operations and build a comprehensive set of recommendations, it is necessary to understand planned and proposed roadway improvements in the study area.

The modification of the intersection of Hanscom Drive and Old Bedford Road through a Hanscom AFB project as described earlier in this chapter is a key project affecting traffic operations into and out of Hanscom Field. This improvement project will install a modern, single-lane roundabout at this location and is expected to be operational by 2025; therefore it is used to evaluate capacity results in the 2025 and 2035 planning scenario. Capacity results for the 2025 and 2035 volumes under the existing configuration are included in the appendix for reference.

Review of other ongoing planning efforts, as detailed earlier in this chapter, revealed that the future identified modifications to Route 4/225 and Hartwell Avenue are the only other relevant projects. However, since this project is not on the Transportation Improvement Program (TIP), funding has not yet been identified and thus not included in either the 2025 or 2035 scenario.

In order to provide a conservative analysis of the 2025 and 2035 scenarios; only the modification of Hanscom Drive and Old Bedford Road to a single-lane roundabout was assumed.

6.3.5 Capacity Analysis

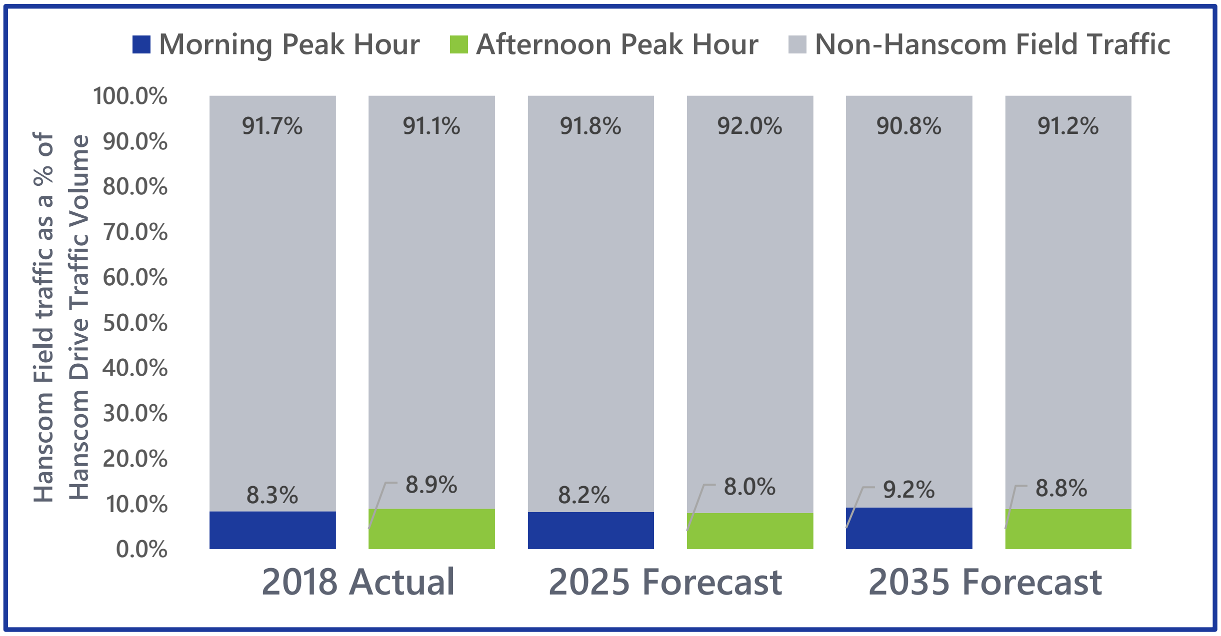
In order to quantify to impacts of expected changes in activity at Hanscom Field on the ground transportation network, a capacity analysis of intersections with movements accounting for more than 10 percent of total volume were analyzed for the following conditions:

- 2025 and 2035 morning and afternoon peak hour networks, including background growth but without Hanscom Field traffic growth;
- 2025 and 2035 morning and afternoon peak hour networks including both background and Hanscom Field traffic growth.

Hanscom Drive Traffic Volumes

Figure 6-29 illustrates the percentage of Hanscom Field-related peak hour traffic volumes on Hanscom Drive for the Existing (2018) and the 2025 and 2035 forecast scenarios. In the 2025 forecast scenario, Hanscom Field traffic on Hanscom Drive, as a proportion of total traffic, is projected to decline by approximately 8 percent for the morning and afternoon peak periods. This is primarily due to the increase in future traffic at Hanscom AFB accessing the campus through the Vandenburg Gate. Therefore, it is expected that this Hanscom AFB growth will outpace the growth anticipated at Hanscom Field. Furthermore, the opening of the North Airfield development is expected to redistribute several peak hour trips away from the main access at Hanscom Drive.

Figure 6-29 Hanscom Field 2025 and 2035 Peak Hour Traffic Volumes as a Percent of Hanscom Drive Traffic Volume



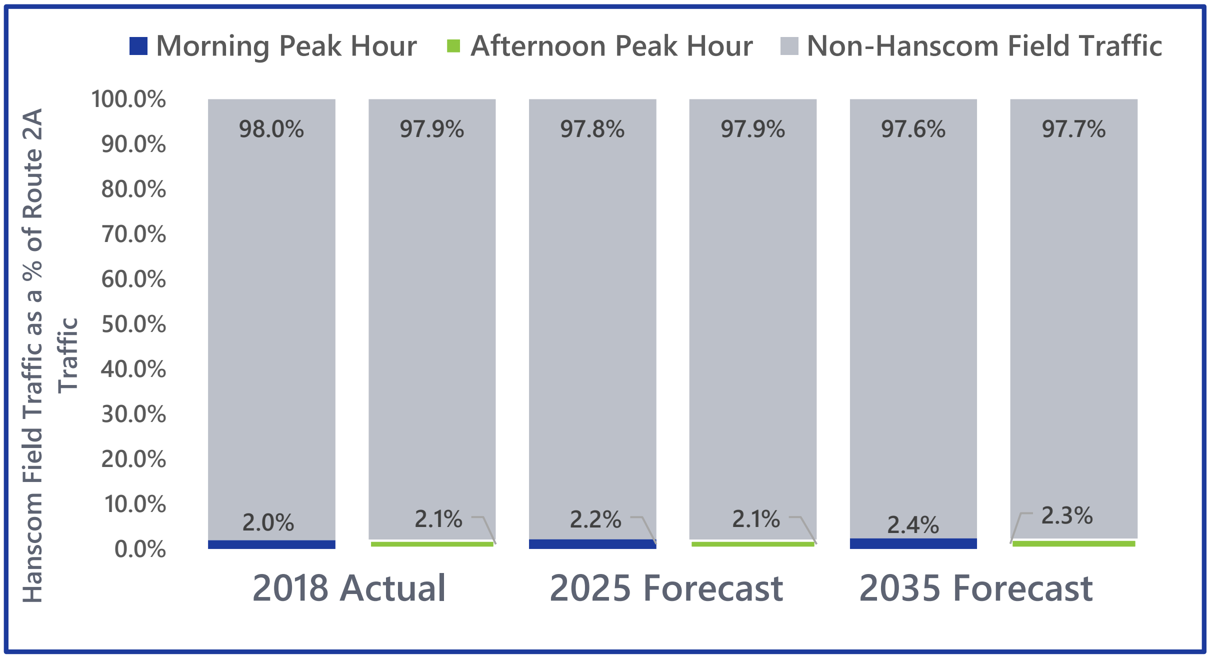
Source: FHI, 2018

For the 2035 forecast scenario, Hanscom Field traffic on Hanscom Drive is expected to return close to its current levels. This is because the growth projected at Hanscom Field is expected to outpace the general 0.65 percent growth rate applied to background traffic between 2025 and 2035. However, it should be noted that this is still much lower than the *2012 ESPR* estimates, which predicted 22 percent of Hanscom Drive traffic (for the 2030 forecast year) to be destined to or originating from Hanscom Field. The traffic growth reflected in the *2017 ESPR* reflects a more modest growth rate, which is supported with trends seen over previous ESPR documents.

Route 2A Traffic Volumes

Figure 6-30 illustrates the percentage of Hanscom Field-related peak hour traffic volumes on Route 2A for Existing (2018) and the 2025 and 2035 forecast scenarios. It is expected that Hanscom Drive traffic volumes measured as a percentage of total traffic on Route 2A would remain stable throughout the forecast years of the *2017 ESPR*. This is a reduction in the findings of the *2012 ESPR*, which found that in the 2030 forecast year, Hanscom Field-related traffic would account for roughly 7 percent of traffic on Route 2A east of Hanscom Drive.

Figure 6-30 Hanscom Field 2025 and 2035 Peak Hour Traffic Volumes as a Percent of Route 2A (East of Hanscom Drive) Traffic Volumes



Source: FHI, 2018

Future Intersection Analysis

Future intersection operations were evaluated for study intersections with movements that exceed the 10 percent threshold under the 2025 and 2035 forecasts. Table 6-17 shows the intersections that could have one or more traffic movements with 10 percent or higher Hanscom Field-related traffic volumes under the future 2025 and 2035 growth scenarios. The procedures described earlier in this chapter were used to determine future weekday, peak hour intersection operations. To identify the potential effects related to Hanscom Field and those that would be regional in nature, an analysis was also conducted for the 2025 and 2035 scenarios that assumed no growth in Hanscom Field traffic volumes. These "background growth only" scenarios were compared with the forecast scenarios for each future analysis year. Detailed traffic capacity analysis reports are included in Appendix C.

Table 6-17 shows that Hanscom Field traffic only exceeds the ten-percent threshold at three locations. This varies from ESPR documents, as shown earlier in this chapter in Table 6-6.

Table 6-17 Intersections Exceeding Ten-Percent Threshold

Intersection	Peak Hour	Analysis Years		
		2018 Existing	2025 Forecast	2035 Forecast
#5 Hanscom Drive/Old Bedford Road (Lincoln)	Morning	X	X	X
	Afternoon	X	X	X
#6 Hanscom Drive/Route 2A (Lincoln)	Morning	X	X	X
	Afternoon	X	X	X
#8 Old Bedford Road/ Virginia Road (Concord)	Morning	X	X	X
	Afternoon	X	X	X

Note: "X" denotes intersection with turning movement exceeding 10 percent MEPA threshold
Source: FHI, 2018

2025 Forecast Scenarios

Table 6-18 and Table 6-19 present the comparison of traffic operations for the 2025 forecast scenarios with and without potential increases in Hanscom Field traffic, for the morning and afternoon peak hours, respectively. These results indicate that most intersections would operate at the same LOS or with only slight increases in delay regardless of Hanscom Field-related traffic growth. At the intersection of Route 2A and Hanscom Drive, the analysis indicates that the southbound movements would operate with significant delay during the morning and afternoon peak hours. However, as described in earlier in this chapter (Section 6.2.5), the analysis does not accurately represent actual operating conditions based on observations of several unique motorist behaviors at this intersection. Therefore, the expected delay in the 2025 forecast year is likely to be less than indicated by the Synchro results. However, the continuance of non-standard driving behavior, as described earlier in this chapter, creates a potential safety concern due to heavy traffic conditions projected to increase in future forecast years.

Modification of the intersection of Hanscom Drive and Old Bedford Drive to a single-lane roundabout is projected to improve operations in the 2025 forecast year over existing conditions. LOS results show notable improvements in traffic operations on many approaches to this intersection over existing conditions. Furthermore, the removal of the non-standard intersection design (i.e., where some approaches have multiple locations making it necessary for vehicles to yield) would further reduce control delay at this intersection. Hanscom Field development is expected to have a minimal impact on future operation of this new roundabout.

The increase in traffic volumes from all sources at the intersection of Old Bedford Road and Virginia Road would increase delay at this intersection. In particular, the westbound approach from Virginia Road is projected to experience measurable delay in both the morning and afternoon peak hours in both the no-build scenario and build scenario.

While the Synchro analysis indicates that these two movements (southbound approach at Hanscom Drive/Route 2A and westbound approach at Old Bedford Road/Virginia Road) are of concern in the 2025 forecast, attention to the difference between the no-build and build scenarios indicate that growth in projected Hanscom Field traffic has limited impact on the operational deficiencies of these intersections. Furthermore, analysis indicates that Hanscom Field will contribute approximately eight percent to 11 percent of traffic to these movements in the 2025 forecast year. As such, these operational deficiencies are largely the result of regional background traffic growth and traffic from planned and anticipated projects near Hanscom Field, not Hanscom-field related traffic.

Table 6-18 Level of Service for 2025 Forecast: Morning Peak Hour

Intersection	No-Build Scenario			Build Scenario		
	LOS	Delay [s]	v/c	LOS	Delay [s]	v/c
#5 Hanscom Drive/Old Bedford Road (Single-Lane Roundabout)						
Hanscom Drive NB	A	5.7	0.21	A	5.8	0.22
Hanscom Drive SB	A	4.0	0.03	A	4.1	0.04
Old Bedford Road EB	A	7.3	0.39	A	7.4	0.40
Old Bedford Road WB	A	4.9	0.17	A	4.9	0.17
#6 Hanscom Drive/Route 2A						
Hanscom Drive SB (L)	F	>300.0	6.55	F	>300.0	6.71
Hanscom Drive SB (R)	B	14.4	0.34	B	14.5	0.35
Route 2A EB (L)	B	10.5	0.39	B	10.5	0.40
#8 Old Bedford Road/Virginia Road						
Virginia Road WB (L R)	D	27.1	0.45	D	27.9	0.46
Old Bedford Road SB (L)	A	9.0	0.16	A	9.1	0.17

Source: FHI, 2018

Table 6-19 Level of Service for 2025 Forecast: Afternoon Peak Hour

Intersection	No-Build Scenario			Build Scenario		
	LOS	Delay [s]	v/c	LOS	Delay [s]	v/c
#5 Hanscom Drive/Old Bedford Road (Single-Lane Roundabout)						
Hanscom Drive NB	A	3.6	0.11	A	3.6	0.11
Hanscom Drive SB	A	8.5	0.10	A	8.5	0.10
Old Bedford Road EB	A	8.2	0.27	A	8.3	0.28
Old Bedford Road WB	B	14.6	0.73	B	14.7	0.73
#6 Hanscom Drive/Route 2A						
Hanscom Drive SB (L)	F	>300.0	4.26	F	>300.0	4.27
Hanscom Drive SB (R)	F	>300.0	1.78	F	>300.0	1.78
Route 2A EB (L)	B	12.1	0.17	B	12.1	0.17
#8 Old Bedford Road/Virginia Road						
Virginia Road WB (L R)	F	180.6	1.31	F	182.8	1.32
Old Bedford Road SB (L)	A	9.0	0.04	A	9.0	0.04

Source: FHI, 2018

2035 Forecast Scenarios

Table 6-20 and Table 6-21 present the comparison of traffic operations for the 2035 forecast scenarios, with and without potential increases in Hanscom Field- related traffic, for the morning and afternoon peak hours, respectively. These results indicate that most intersections would operate at the same LOS or with only slight increases in delay regardless of Hanscom Field-related traffic growth.

Similar to the 2025 forecast scenario, the intersection of Route 2A and Hanscom Drive would continue to experience the most operational deficiencies on the southbound approach from Hanscom Drive. The analysis indicates that the southbound movements would operate with lengthy delays during the morning and afternoon peak hours, regardless of Hanscom Field growth.

Furthermore, the 2035 forecast scenario indicates continued operational deficiencies at the intersection of Old Bedford Road and Virginia Road on the westbound approach. As a two-way, stop-controlled intersection, the Synchro analysis suggests that, as traffic volumes increase on Old Bedford Road and Virginia Road, there would not be enough adequately-sized gaps in traffic that would allow vehicles to make turns and efficiently flow through this intersection from the Virginia Road approach.

Finally, similar to the findings in the 2025 forecast scenario, the 2035 forecast scenario shows adequate traffic operations in the single-lane roundabout, which is expected to be constructed before the 2025 forecast year. With the exception of the westbound approach in the afternoon peak hour, the roundabout is expected to operate at LOS A. The westbound approach would operate at LOS C in the afternoon peak hour, which is considered to be adequate. Future growth in Hanscom Field traffic would have minimal impact to the operations of this intersection.

Similar to the 2025 forecast, however, the 2035 forecast analysis indicates that these operational deficiencies would exist at these intersections regardless of the forecasted growth at Hanscom Field. Furthermore, Hanscom Field would contribute approximately eight percent to 13 percent of traffic to these movements. As such, these operational deficiencies are likely a result of regional background traffic growth and traffic from planned and anticipated projects near Hanscom Field, not Hanscom-field related traffic.

Table 6-20 Level of service for 2035 forecast: morning peak hour

Intersection	No-Build Scenario			Build Scenario		
	LOS	Delay [s]	v/c	LOS	Delay [s]	v/c
#5 Hanscom Drive/Old Bedford Road (Single-Lane Roundabout)						
Hanscom Drive NB	A	5.9	0.22	A	6.2	0.24
Hanscom Drive SB	A	4.1	0.03	A	4.3	0.05
Old Bedford Road EB	A	7.7	0.42	A	8.0	0.43
Old Bedford Road WB	A	5.0	0.18	A	5.2	0.18
#6 Hanscom Drive/Route 2A						
Hanscom Drive SB (L)	F	>300.0	8.83	F	>300.0	9.78
Hanscom Drive SB (R)	C	15.3	0.38	C	15.6	0.40
Route 2A EB (L)	B	11.0	0.43	B	11.0	0.44
#8 Old Bedford Road/Virginia Road						
Virginia Road WB (L R)	D	33.7	0.53	E	35.7	0.56
Old Bedford Road SB (L)	A	9.2	0.18	A	9.3	0.18

Source: FHI, 2018

Table 6-21 Level of service for 2035 forecast: afternoon peak hour

Intersection	No-Build Scenario			Build Scenario		
	LOS	Delay [s]	v/c	LOS	Delay [s]	v/c
#5 Hanscom Drive/Old Bedford Road (Single-Lane Roundabout)						
Hanscom Drive NB	A	3.7	0.12	A	3.7	0.12
Hanscom Drive SB	A	9.1	0.11	A	9.2	0.11
Old Bedford Road EB	A	8.8	0.30	A	9.1	0.32
Old Bedford Road WB	C	17.0	0.78	C	17.5	0.79
#6 Hanscom Drive/Route 2A						
Hanscom Drive SB (L)	F	>300.0	5.43	F	>300.0	5.59
Hanscom Drive SB (R)	F	>300.0	2.08	F	>300.0	2.11
Route 2A EB (L)	B	12.8	0.19	B	12.8	0.19
#8 Old Bedford Road/Virginia Road						
Virginia Road WB (L R)	F	249.9	1.47	F	258.2	1.49
Old Bedford Road SB (L)	A	9.2	0.04	A	9.2	0.05

Source: FHI, 2018

6.4 Traffic Management Approaches

Analysis of the ten-intersection network presented earlier in the chapter reveals that Hanscom Field has limited operational impact on the ground transportation network in the area of Hanscom Field for the scenarios analyzed (2018 existing, 2025 forecast, and 2035 forecast). Hanscom Field accounts for 10 percent of individual turning movements at only three intersections: Hanscom Drive and Old Bedford Drive; Hanscom Drive and Route 2A; and Virginia Road and Old Bedford Road. Potential improvements for each of these three intersections have been identified in the following sections. It should be noted, however, that the improvements described are only general recommendations to alleviate current and projected operational problem areas. While Hanscom Field-related traffic impacts the operation of these intersections, these impacts are minimal compared to other users. Furthermore, future build-out estimates show minimal impact regardless of currently projected growth at Hanscom Field.

6.4.1 Hanscom Drive and Old Bedford Road

As discussed throughout this chapter, the intersection of Hanscom Drive and Old Bedford Road is expected to be modified to a single-lane roundabout through a Hanscom AFB-led project associated with gate improvements. The capacity analysis shows that this intersection would operate efficiently throughout the future, even with expected traffic growth. Furthermore, the project is expected to clarify vehicular navigation through the intersection and improve transit accommodations with the inclusion of a bus pull-out south of the proposed roundabout on Hanscom Drive. Bike lanes along Hanscom Drive and sidewalks from the proposed bus pull-out and eastbound and southbound approaches with crosswalks also appear in initial drawings dated May 2018 by the US Army Corps.

These proposed modifications to this intersection are expected to alleviate findings in the travel survey conducted for this study which revealed that some motorists find this intersection confusing to navigate.

6.4.2 Hanscom Drive and Route 2A

Similar to the findings of the *2012 ESPR* analysis, the intersection of Hanscom Drive and Route 2A continues to be operationally deficient, with the southbound movements lacking enough gaps to continue either east or west on Route 2A. The results of the Synchro analysis indicate that this approach is over capacity in the afternoon peak hour.

While the traffic analysis indicates that Hanscom Field-related traffic at this intersection represents a small proportion of total traffic volumes, operational and geometric changes at this intersection would improve conditions. Specifically, further study of the installation of a traffic signal could be evaluated. Initial review suggests that the criteria for a signal warrant would be met based on forecasted growth, and that a traffic signal may need to be installed at this intersection in the future. The TIP includes repaving Route 2A in 2023; modifications to this intersection could be considered at that time.

6.4.3 Virginia Road and Old Bedford Road

Analysis of current conditions at the intersection of Virginia Road and Old Bedford Road indicates that Virginia Road is currently operating slightly above capacity on the westbound approach. This condition is likely to worsen over the analysis years, as background traffic increases on Old Bedford Road, which would result in less acceptable gaps for traffic on Virginia Road. Widening the westbound approach to add dedicated left-turn and right-turn lanes could improve operations at this intersection and reduce problematic delays for this approach already experienced in the afternoon peak period. Additionally, the removal of nearby brush would improve sight lines for vehicles at Old Virginia Road looking at oncoming traffic from the north. Similar to the findings at the intersection of Hanscom Drive and Route 2A, this report finds that Hanscom Field-related traffic contributes a minority of traffic at the approaches to this intersection. However, as a key access point to Hanscom Field facilities, this intersection will continued to be monitored in future.

6.4.4 Transportation Demand Management

In addition to adding capacity to nearby transportation infrastructure, reducing peak-hour trips through transportation demand management (TDM) to and from Hanscom Field can improve conditions. While Hanscom Field operations are projected to continue to have a small impact on ground transportation infrastructure in the surrounding area, development of demand management programs could have mutually beneficial effects for area traffic conditions and employees/tenants at Hanscom Field alike. However, options are limited for managing vehicle demand – largely due to the geographic context in which Hanscom Field exists. As a large airport in a suburban environment, many traditional TDM strategies frequently promoted in urban areas are less suitable for implementation at Hanscom Field. Even so, the following sections describe the steps that could be undertaken at Hanscom Field to manage demand.

Enhancing Transit Connections

As discussed earlier in this chapter, Hanscom Field benefits from its proximity to the Fitchburg Line of the MBTA Commuter Rail, as well as a direct connection to the MBTA Route 76 bus route with service to the MBTA's Alewife Station (with direct service to the Red Line). As demonstrated in the Existing Conditions section of this chapter, service via the Route 76 bus route is slow and not convenient as a direct connection for Hanscom Field travelers. Not only does Route 76 operate as a local bus between Alewife Station and its terminus at Hanscom Field, the route is circuitous (see Figure 6-2) and is designed with preference to the larger employment base at the MIT-Lincoln Labs.

The Route 128 Business Council (128BC) continues to have success since it launched express bus service for commuters destined to Hartwell Avenue from Alewife Station. Coordination between Hanscom Field, Hanscom AFB, and the Virginia Road corporate neighbors on an express shuttle connecting these three facilities with either the MBTA Alewife Station or the MBTA Concord commuter station could increase transit options for daily commuters. An express shuttle could also be combined with a free, guaranteed ride home program to further increase transit options and use.

Furthermore, the on-going MassDOT RailVision and Better Bus Project plans have the potential to reimagine commuter rail transit and bus services in the region which will directly impact the accessibility of Hanscom Field from these systems.

Promoting Ride Share

Approximately 49 percent of the travel survey respondents indicated an interest in carpooling; however, only 9 percent of survey respondents actually carpool as a primary or secondary means of travel to and from Hanscom Field on a daily basis. Therefore, while ridesharing and carpooling may be a viable travel demand management strategy, the variability in daily commuter schedules the dispersion of employee origins, and the relatively low volume of peak-hour commuters to and from Hanscom Field, may make carpooling programs difficult to establish and sustain. Other ways to reduce single occupancy vehicle (SOV) trips include:

- Offer parking incentives to carpool participants (such as designative parking spaces close to destinations);
- Promote app-based tools (e.g. Waze Carpool and NuRide) to provide ride-matching services with nearby employees with similar commutes.

6.4.5 Active Transportation

Since more than 98 percent of travel survey respondents live more than one mile away from Hanscom Field, walking is not a viable commute option. However, survey respondents noted that several local improvements could be made to enhance the pedestrian environment at Hanscom Field. Specifically, recommendations include:

- Pedestrian improvements at the intersection of Hanscom Drive and Old Bedford Road to include crosswalks and sidewalks along Hanscom Drive to the Terminal Building. MBTA ridership data shows daily riders at the bus stop at this location, and pedestrian accommodations should be improved accordingly.
- Enhanced pedestrian connections to the Battle Road Trail. Restriping on Old Bedford Road to remove the painted median could create increased flexible shoulder space, while also connecting to the branch of the Battle Road Trail located at the intersection of Virginia Road and Old Bedford Road (Lincoln).
- Greater pedestrian connectivity at the Hanscom Field Main Terminal between all major facilities and parking locations.

While these improvements may not increase the number of walking trips to Hanscom Field, they may increase the number of walking trips to the Battle Road Trail for recreation or those between buildings/internal to Hanscom Field.

Cycling to and from Hanscom Field may provide a reduction in SOV trips. With approximately 26 percent of employees living 10 miles or less from Hanscom Field, and with 23 percent of survey respondents indicating an interest in cycling to Hanscom Field as an alternative means to their primary mode of travel, cycling may account for a larger mode share in the future. However, 70 percent of survey respondents indicated that bicycle facilities are not adequate to make cycling a viable commute option. Recommendations to improve the viability of cycling in the future include:

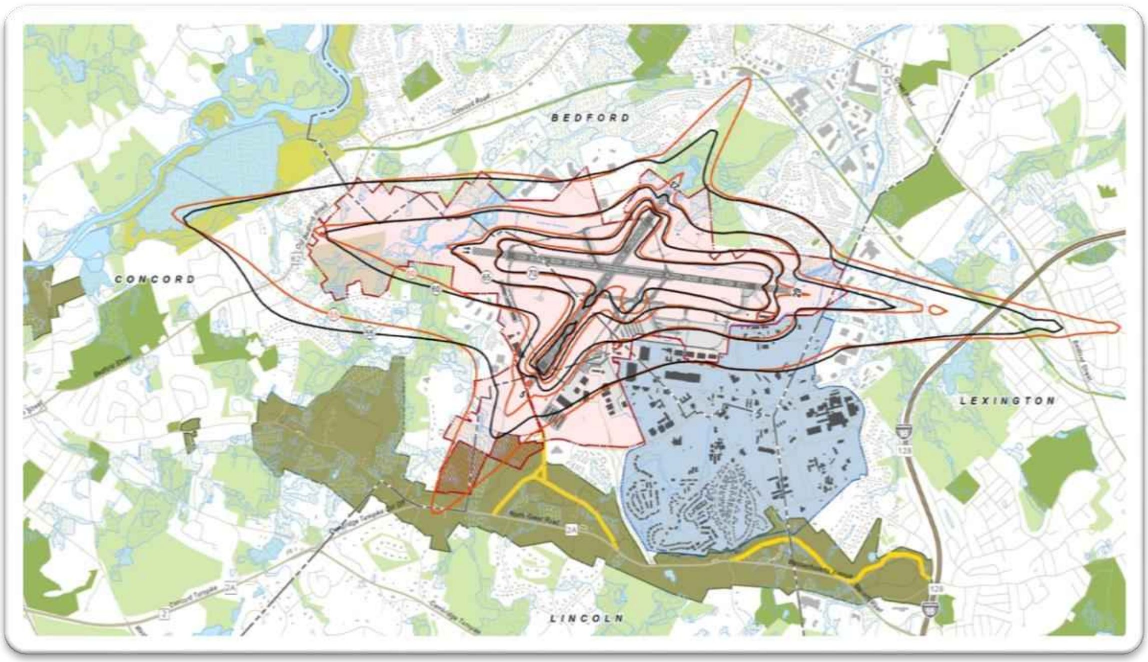
- Improve cycling accommodations on Hanscom Drive between the Civil Air Terminal and Route 2A by converting existing shoulder space on Hanscom Drive to a bike lane and installing “Share the Road” signs at the southern and northern entrances to the drive.
- Install “Share the Road” signs at bicycle crossing locations at the intersection of Hanscom Drive and Old Bedford Road and install bicycle chevrons on turning lanes

while maintaining consideration of bicycle users in any long-term plans to reconfigure the geometry of the intersection.

- Improve Virginia Road to its intersection with Old Bedford Drive by installing bike chevrons and "Share the Road" signs along this route.

Expand the shoulder for bicyclists on Route 2A to the east to Massachusetts Avenue.

7 Noise



This chapter presents the noise conditions at Hanscom Field for 2017 to illustrate present conditions, and for the 2025 and 2035 scenarios to predict future noise for the airport activity levels forecasted. A broad array of metrics is used to describe noise conditions including Day-Night Sound Level (DNL), Time Above a decibel threshold (TA), Total Noise Exposure (EXP), and distribution of Sound Exposure Levels (SEL). Noise levels for each of the metrics are evaluated at noise-sensitive receptors including hospitals schools, religious sites, public facilities, and sites on the National Register of Historic Places and/or State Register of Historic Places presented in the chapter by municipality. Massport's noise abatement program is also described, including how Massport is working with local stakeholders to assess noise and mitigate impacts.

The 2017 ESPR future scenarios are used to evaluate the potential cumulative environmental effects that could occur if Hanscom Field reaches the airport activity levels that are described in Chapter 3 Airport Activity Levels. The 2025 and 2035 scenarios are estimates of what could occur (not what will occur) in the future using certain planning assumptions and are heavily dependent upon demand. The future service scenarios are fully consistent with Massport's 1980 Regulations for Hanscom Field, which prohibit scheduled commercial passenger services with aircraft having more than 60 seats.

7.1 Key Findings Since 2012

Overall operations have decreased in at Hanscom Field over the last several years, and operations remain well below historical peaks. Noise also remains well below historical peaks, with the Day-Night Sound Level (DNL) 65 decibel (dB) contour entirely within Hanscom Field property.[90] However, there have been some increases in jet operations and nighttime flights. Forecast increases in general aviation (GA) jet activity contribute to the projected growth in operations to approximately 142,000 annual operations in 2035, driving a modest projected increase in overall noise levels as compared to today. These recent and projected trends align with Hanscom Field's role in New England's regional aviation system as the premier GA reliever for Logan International Airport.

Massport has continued to pursue measures to reduce noise impacts, including an initiative begun in 2009 to reduce noise over the Minute Man National Historical Park (MMNHP). Previously, touch-and-go operations circled to the south of the airport often taking the aircraft over areas of the Battle Road Trail that are used by the Park for outdoor programs and interpretive talks. A partnership of Massport, National Park Service (NPS), the FAA, the flight schools and Hanscom pilots determined that small aircraft could increase the use of a tight touch-and-go pattern that keeps the aircraft over the airfield rather than over sensitive park areas. Using radar data, Massport staff monitors the number of touch-and-go operations over the MMNHP. This data is a critical part of ongoing quarterly meetings between Massport, FAA air traffic control tower, and flight school staff to review touch-and-go flight paths. Since the initiation of this program, flights over MMNHP have been reduced by 22 percent.

Key noise statistics since 2012 analysis:

- **The total population exposed to DNL greater than 65 dB remains at zero in 2017 (from zero in 2012), which is a decrease from 17 in 2005 (which were all in Bedford).**
- **The total population in the four towns exposed to DNL values of 55 dB or greater increased from 1,041 residents in 2012 (down from 2,953 in 2005) to 1,271 in 2017 (see Table 7-1).**
- **In all future scenarios, there are no residents exposed to noise levels exceeding 65 dB DNL.**

Massport's Fly Friendly program at Hanscom Field continues to support quiet arrival and departure procedures, including supporting the use of the National Business Aviation Association's (NBAA's) noise abatement procedures for jet aircraft, publicizing the Aircraft Owners and Pilot Association's (AOPA's) noise abatement procedures for piston aircraft, and by developing and publicizing quiet flying procedures for helicopters. Part of this effort included the development of a multi-faceted publicity program that results in pilots

[90] FAA land use compatibility guidelines generally consider aircraft noise greater than 65 dB DNL to be incompatible with residential and other noise-sensitive land uses. No residential land uses were exposed to a DNL value above the FAA land use compatibility recommendation of 65 dB in 2017.

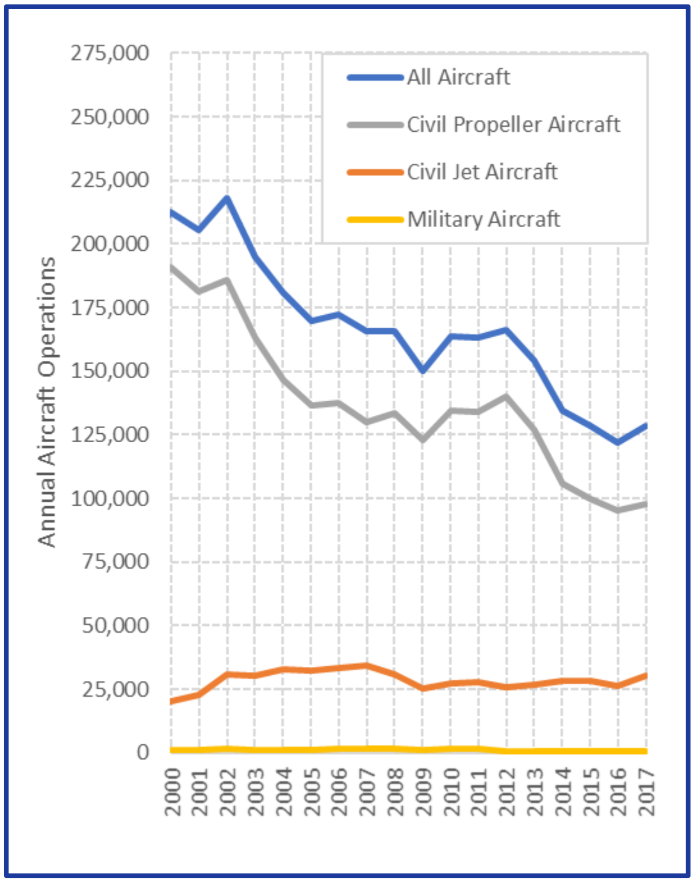
being exposed and re-exposed to the importance and understanding of the quiet-flying techniques (see Section 7.9.7 for additional discussion of the Fly Friendly Program).

The noise analysis for this ESPR utilized the FAA's next-generation airport noise software, the Aviation Environmental Design Tool (AEDT). AEDT combines the FAA's legacy tools for airport noise, emissions, and fuel burn into a single package to ensure consistency across the analyses. The database structure of this new tool allows for the use of a nearly unlimited number of aircraft flight paths and operations to model the full detail of operations at an airport. Several new aircraft types have been added to AEDT relative to the Integrated Noise Model (INM), which was used for the *2012 ESPR*, and some noise and performance computation algorithms have been updated. However, the current AEDT aircraft noise and performance database and algorithms are largely the same as the most recent versions of the INM and the change in noise model had little impact on the differences in computed noise levels between 2012 and 2017.

Comparison of year 2017 DNL noise contours to 2012 contours shows that overall noise levels have increased somewhat. Though total operations decreased between 2012 and 2017 (see Figure 7-1), operations by jet aircraft and the number of nighttime flights increased. The shape of the 2017 noise contours reflect increased operations on Runway 5/23 due to the closure of Runway 11/29 for repaving during the month of August. Additionally, construction at Boston Logan International Airport in 2017 caused some additional aircraft to operate out of Hanscom Field.

Modeled noise values for 2005 are also included in this section and demonstrate a longer-term trend of decreasing noise. This is largely due to overall lower activity levels and the elimination of activity by Stage 2 GA jets. FAA land use compatibility guidelines generally consider aircraft noise greater than 65 dB DNL to be incompatible with residential and other noise-sensitive land uses. No residential land uses were exposed to a DNL value above the FAA land use

Figure 7-1 Historical Aircraft Operations Trends



Source: Massport 2017 Hanscom Annual Noise Report compatibility recommendation of 65 dB in 2017, as the DNL 65 dB contour does not extend beyond Massport property.

With the forecasted level of aircraft operations, noise is anticipated to increase in 2025 over 2017 and then again in 2035. However, noise in 2025 and 2035 is projected to remain lower than what was experienced in 2005.

Table 7-1 presents population estimates within the 65 and 55 DNL contours for 2005, 2012, 2017, and the forecasted 2025 and 2035 scenarios.

Table 7-1 Summary of U.S. Census Population Counts within DNL Contours

Year/Scenario	Population[1]	
	65 dB or Greater[2]	55 dB or Greater[3]
2000	26	2,848
2005	17	2,953
2012	0	1,041
2017	0	1,271
2025	0	1,675
2035	0	2,047

Notes:
1. Based on the 2010 U.S. Census except for 2000 and 2005 which were computed for the *2000 and 2005 ESPRs* using the 2000 U.S. Census
2. These population estimates fall within the 65 and 70 DNL contours.
3. These population estimates include population within the 55, 60, 65, and 70 DNL contours
Source: HMMH 2018

In addition to noise contours, the *2017 ESPR* includes detailed noise results at noise analysis locations throughout the four towns and MMNHP.

- No historic sites were within the 60 DNL contour for the *2012 ESPR* or the *2017 ESPR*. There are only two historic sites that have DNL values greater than 55 dB in 2017 and noise levels decreased at both sites in 2017 relative to 2012:
  - The Deacon John Wheeler/Capt. Jonas Minot Farmhouse (NC-18) in Concord; and,
  - The Wheeler-Meriam House (NC-19) in Concord.
- No noise analysis locations in the four town are predicted to experience a DNL value greater than 60 dB under the 2025 or 2035 scenarios. The Deacon John Wheeler/Capt. Jonas Minot Farmhouse in Concord, the Wheeler-Meriam House in Concord, and Simonds Tavern (NLX-1) in Lexington are the only three sites with a projected DNL of 55 dB or greater in these scenarios.
- No portion of the MMNHP is located within the 60 DNL contour in 2017 or in the forecasted 2025 and 2035 planning scenarios. The 2017 and forecast future 55 DNL contours do extend into MMNHP.

- ⇨ One site in MMNHP, Noah Brooks Tavern (MM-13) experienced a DNL of 55 dB in 2017 due to higher than typical use of Runway 5/23 during the closure of Runway 11/29 for repaving. Though the 55 dB DNL contours do extend into the park, no identified noise analysis sites in the MMNHP are projected to experience a DNL value of 55 dB or greater for any future scenario.

7.2 Noise Terminology

Noise, often defined as unwanted sound, is an environmental issue associated with aircraft operations. Aircraft are not the only sources of noise in an urban or suburban environment where interstate and local roadway traffic, rail, industrial, and neighborhood sources intrude on the everyday quality of life. Nevertheless, aircraft are readily identified by their noise and are typically singled out for special attention and criticism. Consequently, aircraft noise often dominates analyses of environmental impacts. To help understand and interpret these impacts, it is important to be familiar with the various metrics that are used to describe the noise from an aircraft and from the collection of noise events that comprise an airport noise environment. This introductory section describes those commonly used noise metrics, in increasing complexity.

The *2017 ESPR* reports noise levels at Hanscom Field in terms of these metrics, including SELs for typical individual events, and Time Above contours and DNL contours for typical 24-hour exposure periods. All three of these metrics utilize A-weighted Sound Levels as their basic unit of measurement. The *2017 ESPR* uses the highlighted metrics (i.e., SEL, EXP, and TA) to supplement DNL contours and DNL values at noise analysis locations. Appendix D provides a discussion of the effects of aircraft noise on people.

Commonly used noise metrics include:

- **Decibel (dB);**
- **A-weighted decibel, or sound level (dBA);**
- **Sound Exposure Level (SEL);**
- **Equivalent Sound Level (Leq);**
- **Day-Night Sound Level (DNL);**
- **Total Noise Exposure (EXP);**
- **Time Above (TA).**

7.2.1 The Decibel (dB)

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Whether that sound is interpreted as pleasant (e.g., music) or unpleasant (e.g., jackhammer) depends largely on the listener's current activity, experience, and attitude toward the source of that sound. It is often true that one person's music is another person's noise.

The loudest sounds the human ear can comfortably hear have one trillion (1,000,000,000,000) times the acoustic energy of sounds the ear can barely detect. Because of this vast range, any attempt to represent the intensity of sound using a linear scale becomes unwieldy. As a result, a logarithmic unit called the decibel is used to represent the intensity of sound. This representation is called Sound Pressure Level.

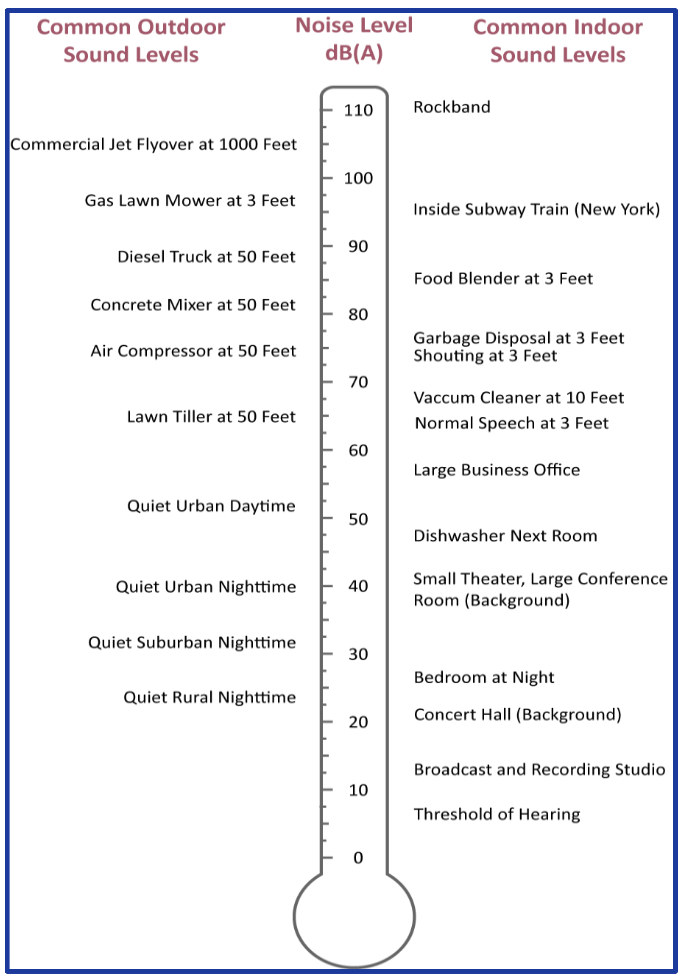
A Sound Pressure Level of less than 10 dB is approximately the threshold of human hearing and is barely audible under extremely quiet conditions. Normal conversational speech has a sound pressure level of approximately 60 to 65 dB. Sound pressure levels above 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels.

7.2.2 A-Weighted Sound Level (dBA)

Additionally, not all sound pressures are heard equally well by the human ear. Some tones are easier to detect than others are, and are perceived as being louder or noisier. Thus, in measuring community noise, frequency dependence is taken into account by adjusting the very high and very low frequencies to approximate the human ear's reduced sensitivity to those frequencies. This adjustment is called "A-weighting" and is commonly used in measurements of environmental noise.

A-weighted Sound Levels for some common sounds are shown in Figure 7-2. In this document, all Sound Pressure Levels are A-weighted and, as is customary, are referred to simply as "Sound Levels," where the adjective "A-weighted" has been omitted. Sound Levels are designated in terms of A-weighted decibels, abbreviated dBA. With A-weighting, a noise source having a higher Sound Level than another is generally perceived as louder. Also, the minimum change in Sound Level that people can detect outside of a laboratory environment is on the order of 3 dB. A change in Sound Level of 10 dB is usually perceived by

Figure 7-2 Common A-weighted Sound Levels



Source: HMMH, 2016

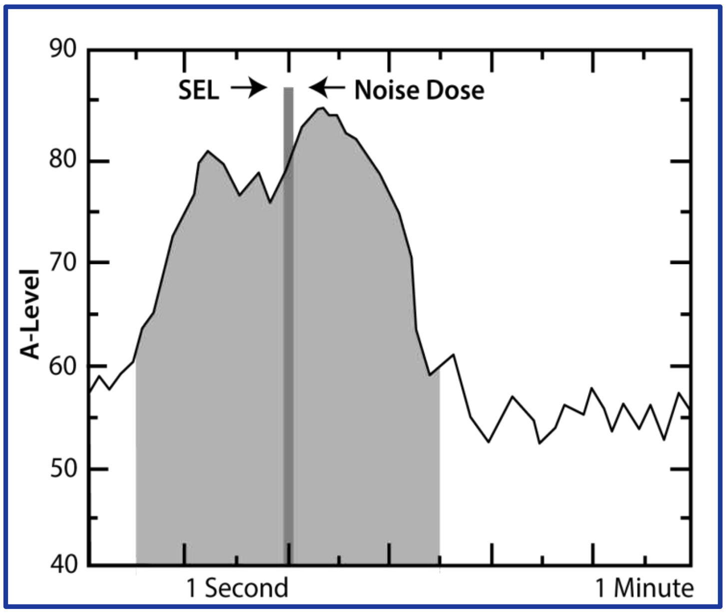
the average person as a doubling (or halving) of the sound's loudness, and this relationship remains so for loud sounds as well as for quieter sounds.

7.2.3 Sound Exposure Level (SEL)

A further complexity in judging the impact of a sound is how long it lasts. Long duration noises are generally more annoying than short ones. The period over which a noise is heard is accounted for in noise measurements and analyses by integrating sound pressures over time. In the case of an individual aircraft flyover, this can be thought of as accounting for the increasing noise of the airplane as it approaches, reaches a maximum, and then falls away to blend into the background (see Figure 7-3). The total noise dose, or exposure, resulting from the time-varying sound is normalized to a one-second duration so that exposures of different durations can be compared on an equal basis. This time-integrated level is known as the Sound Exposure Level, measured in A-weighted decibels.

Because aircraft noise events last longer than one second, the time-integrated SEL always has a value greater in magnitude than the maximum sound level of the event – usually about 7 to 10 dB higher for most airport environments. SELs are used in this study as a means of comparing the noise of several significant aircraft types; they are also correlated with sleep disturbance, an impact that is discussed in Appendix D.

Figure 7-3 Illustration of Sound Exposure Level



Source: HMMH, 2016

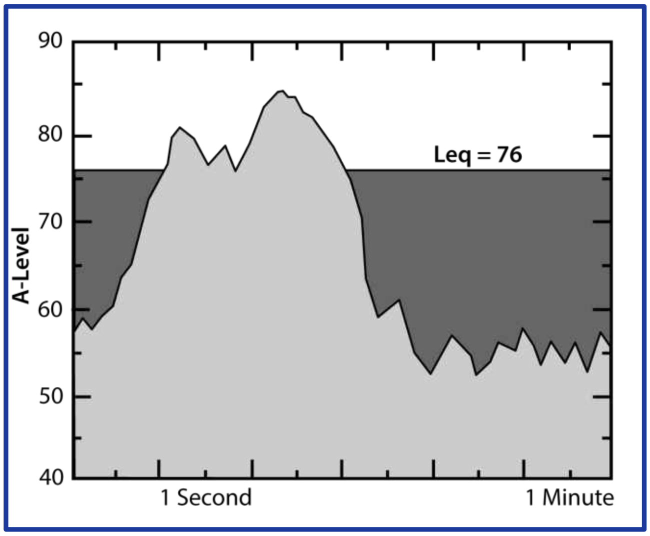
The remaining noise metrics discussed in this section refer to the accumulation of exposure caused by multiple noise events over time. While such metrics are often viewed as downplaying the importance of individual aircraft operations, they are extremely good indicators of community annoyance with complex noise environments, and they have become widely accepted as the most appropriate means of evaluating land use planning decisions.

7.2.4 Equivalent Sound Level (Leq)

The most basic measure of cumulative exposure is the Equivalent Sound Level. It is a measure of exposure resulting from the accumulation of A-weighted Sound Levels over a particular period (as opposed to an event) of interest such as an hour, an eight-hour school day, nighttime, a single 24-hour period, or an average 24-hour period. Because the length of the period can differ, the applicable period should always be identified or clearly understood when discussing the metric. Such durations are often identified through a notation, for example Leq (8) or Leq (24).

Conceptually, the Leq may be thought of as the constant sound level occurring over the designated period of interest and having as much sound energy as that created by the actual rising and falling sound pressures from multiple noise sources as they become more or less pronounced. This is illustrated in Figure 7-4 for the same representative one-minute of exposure shown earlier in Figure 7-3. Both the dark and light gray shaded areas have a one-minute Leq value of 76 dBA. It is important to recognize, however, that the two representations of exposure (the constant one and the time-varying one) would sound very different from each other were they to occur in real life.

Figure 7-4 Illustration of Equivalent Sound Level



Source: HMMH, 2016

Often the Leq is referred to as an "average" sound level. This can be confusing since a simple average of the Sound Levels over the period will not yield the correct Leq. Because decibels are logarithmic quantities, loud events contain much more sound energy than quieter events and dominate the calculation of the Leq. For example, if an aircraft produced a constant sound level of 85 dBA for 30 seconds of a minute then immediately disappeared, leaving only ambient noise sources to produce a level of 45 dBA for the remaining 30 seconds, the Leq for the full minute would be 82 dBA – just 3 dBA below the maximum caused by the aircraft, not the 65 dBA suggested by normal averaging.

More typical timeframes of interest are daytime, nighttime, and annual average 24-hour exposure levels, but all of these same principles of combining sound levels apply to those periods as well. Loud noise events occurring during any timeframe are going to have the greatest influence on the overall exposure for the period.

7.2.5 The Day-Night Sound Level (DNL)

The most widely used cumulative noise metric is a variant of the 24-hour Leq known as the Day-Night Sound Level, or DNL, a measure of noise exposure that is highly correlated with community annoyance. The long-term (yearly) average DNL is also associated with a variety of FAA land use guidelines that suggest where incompatibilities are expected to exist between the noise environment and various human activities. Because of these strengths, the metric is required to be used for airport noise studies funded by the FAA. The FAA's recommended guidelines for noise/land use compatibility evaluation, found in 14 CFR Part 150, are based on a compilation of extensive scientific research and state that DNL values of 65 dB and lower are compatible with all land uses including residential land use.

In simple terms, DNL is the Leq for a 24-hour period, modified so that noises occurring at night (defined specifically as 10:00 PM to 7:00 AM) are artificially increased by 10 dB. This "penalty" reflects the added intrusiveness of nighttime noise events as community activity subsides and ambient noise levels get quieter. The penalty is mathematically equivalent to multiplying the number of nighttime noise events by a factor of ten.

The U.S. Environmental Protection Agency (EPA) identified DNL as the most appropriate means of evaluating airport noise based on its criteria, as follows:[91]

- ⇨ The measure should be applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods of time.
- ⇨ The measure should correlate well with known effects of the noise environment and on individuals and the public.
- ⇨ The measure should be simple, practical and accurate. In principal, it should be useful for planning as well as for enforcement or monitoring purposes.
- ⇨ The required measurement equipment, with standard characteristics, should be commercially available.
- ⇨ The measure should be closely related to existing methods currently in use.
- ⇨ The single measure of noise at a given location should be predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.
- ⇨ The measure should lend itself to small, simple monitors, which can be left unattended in public areas for long periods of time.

Despite DNL meeting these criteria, the lay public often criticizes the use of DNL as an inaccurate representation of community annoyance and land use compatibility with aircraft noise. Much of that criticism stems from a lack of understanding of the measurement or calculation of DNL. One frequent criticism is based on the feeling that people react more to single noise events than to "meaningless" time-average sound levels. In fact, DNL takes into account both the noise levels of all individual events occurring during a 24-hour period and the number of times those events occur. The logarithmic nature of the decibel causes noise levels of the loudest events to control the 24-hour average, just as they were shown to do in the previous discussion of shorter-term Leqs.

Most federal agencies dealing with noise have formally adopted DNL, though they also encourage the use of supplemental noise metrics to aid the public in understanding the complex noise environment of an airport. For example, Massport frequently uses the SEL,

[91] U.S. Environmental Protection Agency. September 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, U.S EPA Report No. 550/9-74-004.

Maximum Sound Level, or Time Above threshold sound levels to help describe the environments around Hanscom Field and Logan International Airport.

Even so, the Federal Interagency Committee on Noise (FICON), comprising of member agencies such as the FAA, Department of Defense (DoD), U.S. EPA, Department of Housing and Urban Development (HUD), National Aeronautics and Space Administration (NASA), Council on Environmental Quality (CEQ), and the Department of Veterans Affairs, reaffirmed the appropriateness of DNL in 1992. The FICON summary report stated, "There are no new descriptors or metrics of sufficient scientific standing to substitute for the present DNL cumulative noise exposure metric".[92] The Federal Interagency Committee on Aviation Noise (FICAN) more recently supported the use of supplemental metrics in its statement that "supplemental metrics provide valuable information that is not easily captured by DNL".[93]

DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for a relatively limited number of points, and, except in the case of a permanently installed noise monitoring system, only for relatively short time periods. The vast majority of airport noise studies are based on computer-generated DNL estimates, depicted in terms of equal-exposure noise contours, much as topographic maps have contours of equal elevation.

7.2.6 Total Noise Exposure (EXP)

The EXP metric was developed in 1982 as a screening tool for Massport to assess changes in the fleet mix of aircraft operating at Hanscom Field over time. Although EXP does not show how noise levels change in specific communities, it does indicate changes in total noise exposure and expected resultant changes in DNL, without the need to prepare noise contours. The 2017 EXP uses the FAA aircraft noise database from the most recent version of the AEDT, Version 2d. This is an upgrade over INM 7.0c, which had been used to compute EXP since the *2012 ESPR*.

EXP is calculated by logarithmically summing the representative SELs for each departure of an airplane assuming it flies over a single point on the ground. EXP uses the same summation formula as DNL: logarithmic summation of all noise events over a 24-hour day, with a 10 dB penalty applied to events occurring between 10:00 PM and 7:00 AM. Similar aircraft types are grouped together in the calculations, creating a "partial EXP" for the group. Partial EXP values for each group are then summed to obtain a single number estimate of departure noise exposure at that reference location. Separate computations are performed for civil and military operations. Similar calculations are performed for arrival operations.

Historically, departure noise has been the largest contributor to the DNL contours and Massport has used civil departure EXP as the annual tracking metric for changes in noise

[92] Federal Interagency Committee on Noise. August 1992. *Federal Agency Review of Selected Airport Noise Analysis Issues*.
[93] Federal Interagency Committee on Aviation Noise. February 2002. *The Use of Supplemental Noise Metrics in Aircraft Noise Analyses*.

exposure at Hanscom Field. Over time, aircraft manufacturers have made significant decreases in aircraft engine noise and thus departure noise levels. Arrival noise has not decreased at the same rate due to its lower proportion of engine noise and higher proportion of airframe noise from deployed flaps, slats, and landing gear. The increased relative importance of arrival noise means that changes in EXP may not align with changes in DNL contours in areas where arrivals provide a large share of the total aircraft noise.

7.2.7 Time Above a Threshold (TA)

Because analyses of decibels are complex and often unfamiliar to the public, the FAA has developed a supplemental noise metric that is non-logarithmic: the amount of time (in minutes or seconds) that the noise source of interest exceeds a given A-weighted Sound Level threshold. Every time a noise event goes above a given threshold, the number of seconds is accumulated and added to any previous periods that the noise exceeded the threshold. These time-above-thresholds, or Time Above, are usually reported for a 24-hour period.

Note that Time Above does not tell the loudness of the various noise events. Just as a single value of the A-weighted Sound Level ignores the dimension of time, so the Time Above ignores the dimension of loudness. Nevertheless, Time Above can be helpful in better understanding a noise environment.

This section documents the noise prediction methodology for preparing the DNL and Time Above calculations for the *2017 ESPR* and discusses changes in the AEDT. The AEDT is a complex computer program that calculates aircraft noise levels around an airport from user input data and an extensive internal database of aircraft noise and performance statistics. Outputs can include DNL and Time Above in the form of contours and values at specific points.

7.3 Noise Prediction Methodology

The FAA developed the AEDT as the primary tool for analyzing and evaluating noise impacts from aircraft operations. Its use is prescribed for all FAA-sponsored projects requiring environmental evaluation. The AEDT contains a set of noise and profile databases, which can be altered by the analyst to enable input of data for new aircraft and engine types, and account for specific changes in flight procedures. The FAA requires that any changes to these databases be approved prior to use on any FAA-related project.

The AEDT interprets all inputs and computes the noise exposure around an airport as a grid of values for many different metrics including the DNL. The grid information is the input for the development of noise contours. This study used the most recent version of the AEDT at the time of analysis, Version 2d (AEDT 2d).

7.3.1 Physical Input

The first two categories of AEDT input, airport layout and flight tracks, are categorized as the physical input. They determine the paths on the runways and in the air where the aircraft travel in the noise model.

Airfield Geometry

The layout of an airfield is an important modeling input. Accurate runway information places modeled flights in the correct locations. Elevation data allow the AEDT to calculate runway gradients, which influence modeled take-off roll distances. The runway end locations, elevations, displaced thresholds and the location and elevation of the airport reference point were taken from the FAA's Form 5010 airport data system. The Form 5010 data do not contain a helipad nor does Hanscom Field have a designated helipad, though helicopters operate at Hanscom Field. The location of a representative helipad was chosen through the examination of helicopter radar tracks, aerial photographs, and the FAA airport diagram. This is discussed in the section on runway use.

The preparation of airport noise exposure contours requires compilation of several categories of information about the operation of an airport, including:

- **Airfield Geometry – Location, length, orientation, elevation, and thresholds of all runways;**
- **Flight Tracks – Paths followed by aircraft departing from, or arriving to, each runway;**
- **Runway Use – Percentage of operations by each type of aircraft that occur on each runway;**
- **Flight Track Usage – Percentage of operations by each aircraft type that use each flight track;**
- **Operations Numbers – Number of departures, arrivals, and pattern operations by type of aircraft during the year;**
- **Aircraft Noise and Performance – Specific noise and performance data is required for each aircraft.**

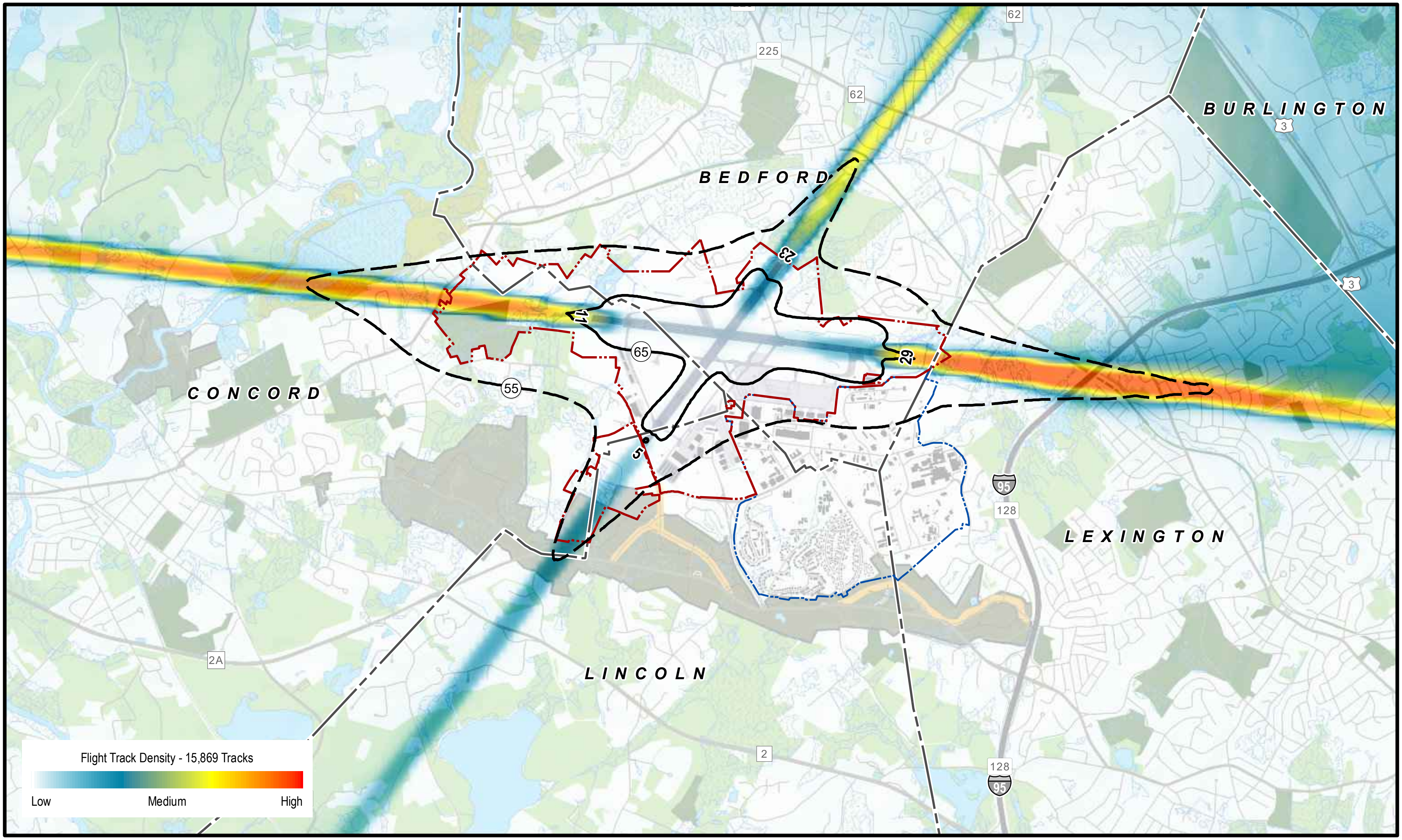
Flight Tracks

Flight tracks represent the ground projection of paths flown by aircraft to and from an airport. Prior to the *2012 ESPR*, the very broad range of operations and conditions actually occurring at Hanscom Field were represented using a set of average or model tracks. Starting with the *2012 ESPR*, individual flight tracks from Massport's NOMS were used. HMMH prepared the 2017, 2025, and 2035 contours using an AEDT pre-processor, named RealContours for AEDT™. RealContours for AEDT converts aircraft flight track data into FAA's AEDT input data, runs the AEDT, and provides the AEDT results based on the modeling of each individual flight track.

Flight tracks were provided from Massport's NOMS. In total, 52,335 individual flight tracks were directly used for the preparation of the 2017 contours; these operations were scaled to the 130,679 total actual operations (128,777 daytime and 1,902 nighttime operations). The difference between the number of flight tracks modeled and the total operations counts are expected, and can occur because RealContours for AEDT filters data to make sure it is suitable for modeling. Each flight track must meet several criteria, including having a runway assignment, valid aircraft type designator and enough suitable flight track points. The most important of these factors at Hanscom Field is the presence of a valid aircraft type designator. Operations by piston aircraft are often unidentified in the radar data. Over 40,000 local and over 30,000 itinerant operations were conducted by piston aircraft at Hanscom Field in 2017. The approximately 12,000 valid radar tracks modeled in the ESPR for these aircraft represent an excellent sample showing the distribution of flight paths off all runway ends.

It should be emphasized that the AEDT is used for all noise calculations. RealContours for AEDT provides an efficient method for creating AEDT input for the large volume of individual flight tracks modeled in the ESPR.

Figure 7-5 and Figure 7-6 present density plots for jet arrivals and departures in and out of Hanscom Field. Areas of red represent the highest density of flight paths. Areas of blue show the lowest density. Figure 7-7 and Figure 7-8 are arrival and departure density plots for propeller aircraft, including piston propeller aircraft, turbo-propeller aircraft, and helicopters. Figure 7-9 shows the density of tracks for local activity (tracks that both depart and arrive at Hanscom Field) by light propeller aircraft. Appendix D provides additional flight track graphics, showing samples of the individual flight paths for jet aircraft arrivals and departures, propeller aircraft arrivals and departures, and local tracks by propeller aircraft.



North

0 2,000 4,000 Feet

2017 - 65 dB DNL Contour
2017 - 55 dB DNL Contour
Hanscom Field Property Boundary
Hanscom AFB Property Boundary
Municipal Boundary

Historic Road
Interstate
Highway
Road
Trail

MMNHP Boundary
Great Meadows
Open Space Non-protected
Open Space Protected in Perpetuity
Open Water / Wetland
Stream

Data Sources: Massport Noise and Operations Monitoring System (flight tracks) March 1, 2018; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018

Note: 55 dB DNL contour included to show the effect of flight track distribution on the noise contours.

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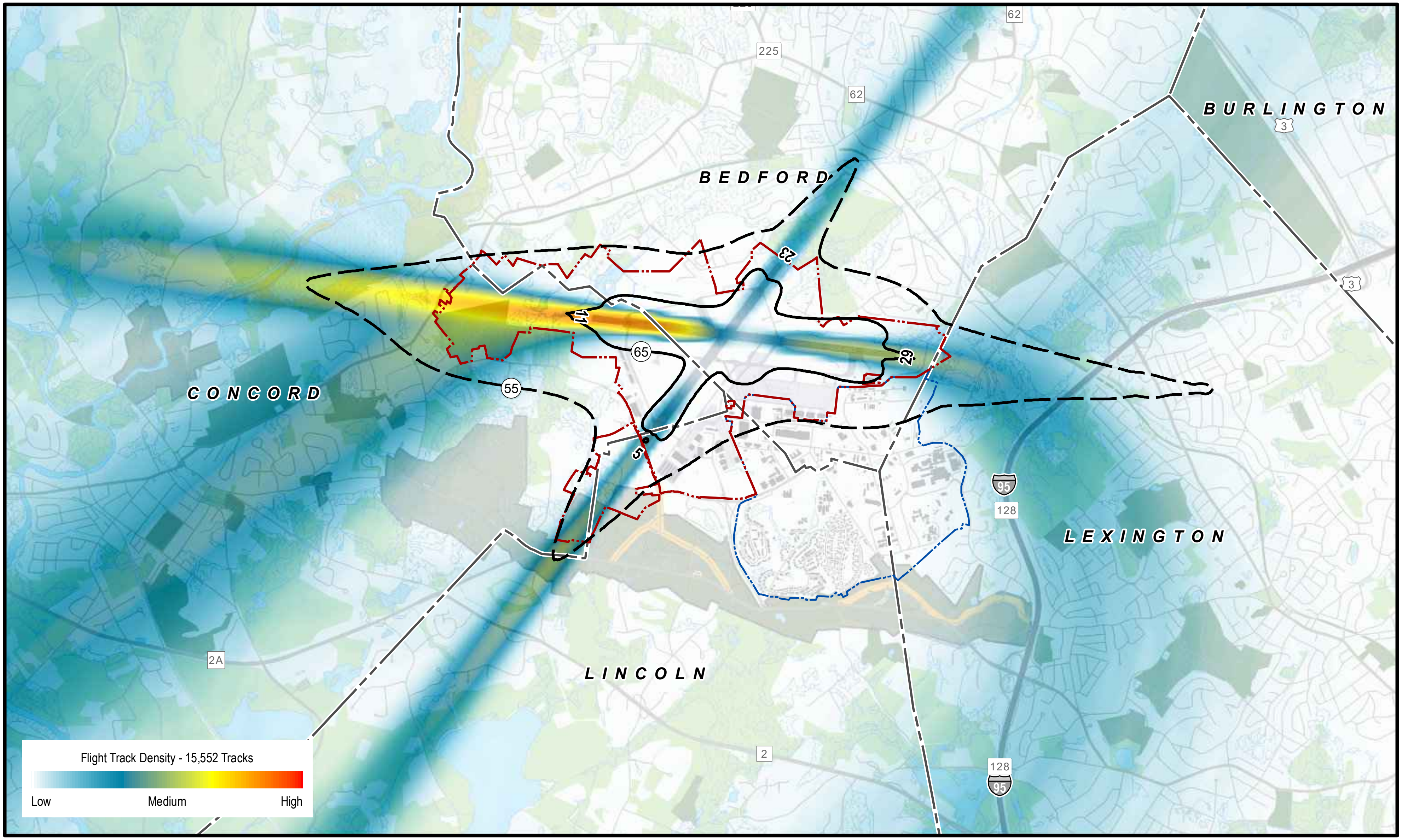
Turbojet Radar Track Density Plot - Arrivals

Figure 7-5



North

0 2,000 4,000 Feet

Data Sources: Massport Noise and Operations Monitoring System (flight tracks) March 1, 2018; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018

- 2017 - 65 dB DNL Contour
- 2017 - 55 dB DNL Contour
- Hanscom Field Property Boundary
- Hanscom AFB Property Boundary
- Municipal Boundary
- Historic Road
- Interstate
- Highway
- Road
- Trail
- MMNHP Boundary
- Great Meadows
- Open Space Non-protected
- Open Space Protected in Perpetuity
- Open Water / Wetland
- Stream

Note: 55 dB DNL contour included to show the effect of flight track distribution on the noise contours.

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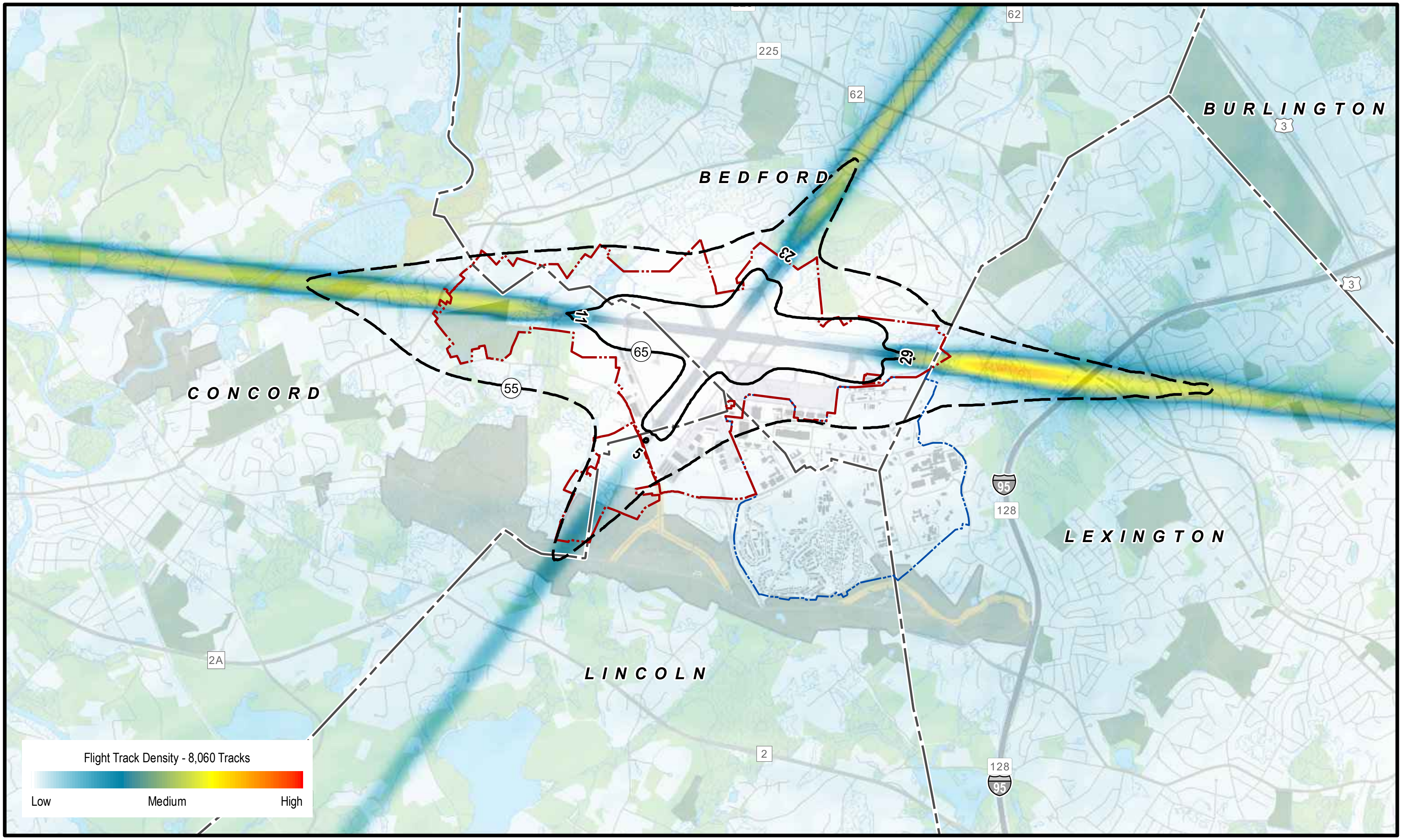
Turbojet Radar Track Density Plot - Departures

Figure 7-6



North

0 2,000 4,000 Feet

Data Sources: Massport Noise and Operations Monitoring System (flight tracks) March 1, 2018; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018

- 2017 - 65 dB DNL Contour
- 2017 - 55 dB DNL Contour
- Hanscom Field Property Boundary
- Hanscom AFB Property Boundary
- Municipal Boundary

Note: 55 dB DNL contour included to show the effect of flight track distribution on the noise contours.

- Historic Road
- Interstate
- Highway
- Road
- Trail

- MMNHP Boundary
- Great Meadows
- Open Space Non-protected
- Open Space Protected in Perpetuity
- Open Water / Wetland
- Stream

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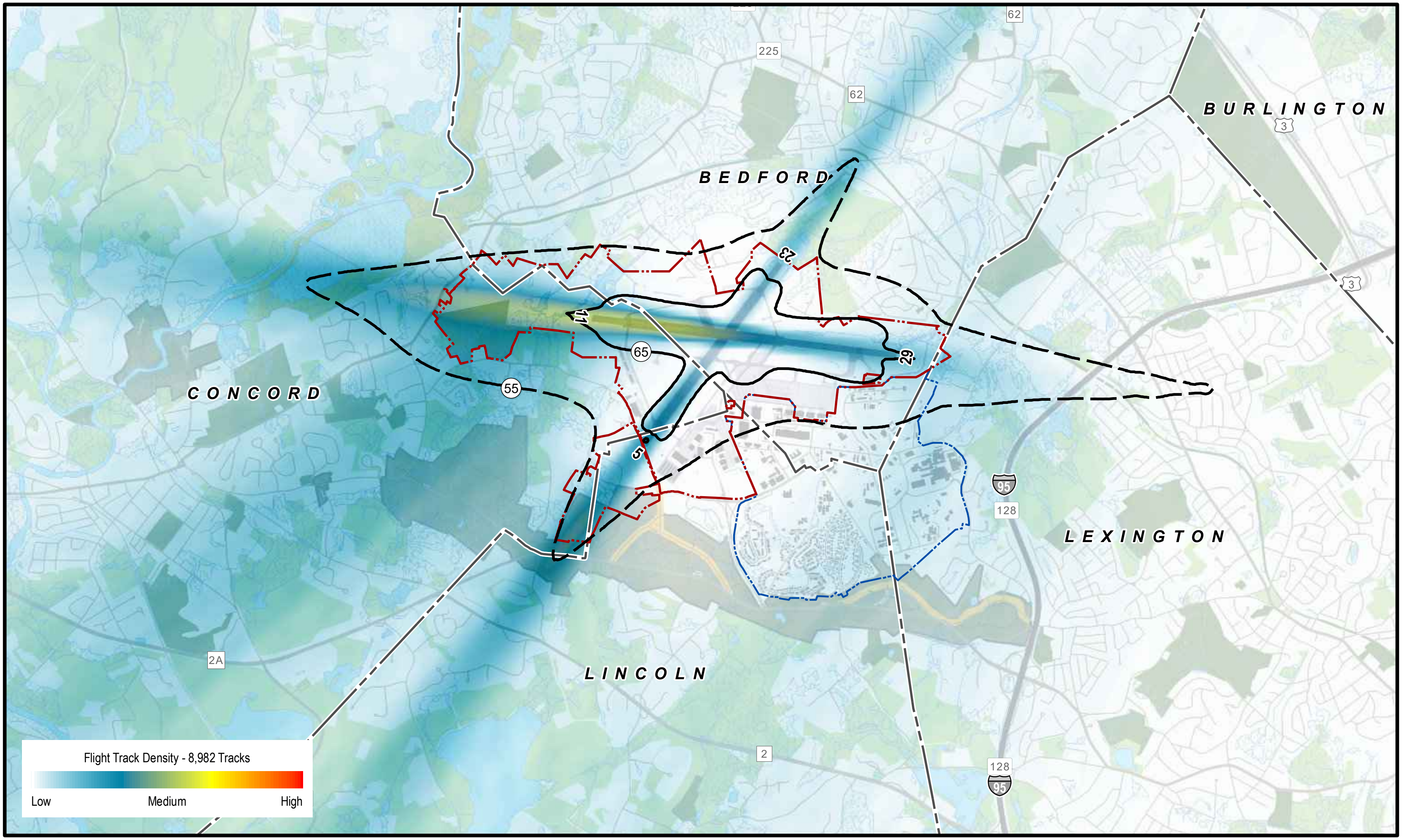
Propeller Aircraft Radar Track Density Plot - Arrivals

Figure 7-7



North

0 2,000 4,000 Feet

2017 - 65 dB DNL Contour
2017 - 55 dB DNL Contour
Hanscom Field Property Boundary
Hanscom AFB Property Boundary
Municipal Boundary

Historic Road
Interstate
Highway
Road
Trail

MMNHP Boundary
Great Meadows
Open Space Non-protected
Open Space Protected in Perpetuity
Open Water / Wetland
Stream

Data Sources: Massport Noise and Operations Monitoring System (flight tracks) March 1, 2018; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018

Note: 55 dB DNL contour included to show the effect of flight track distribution on the noise contours.

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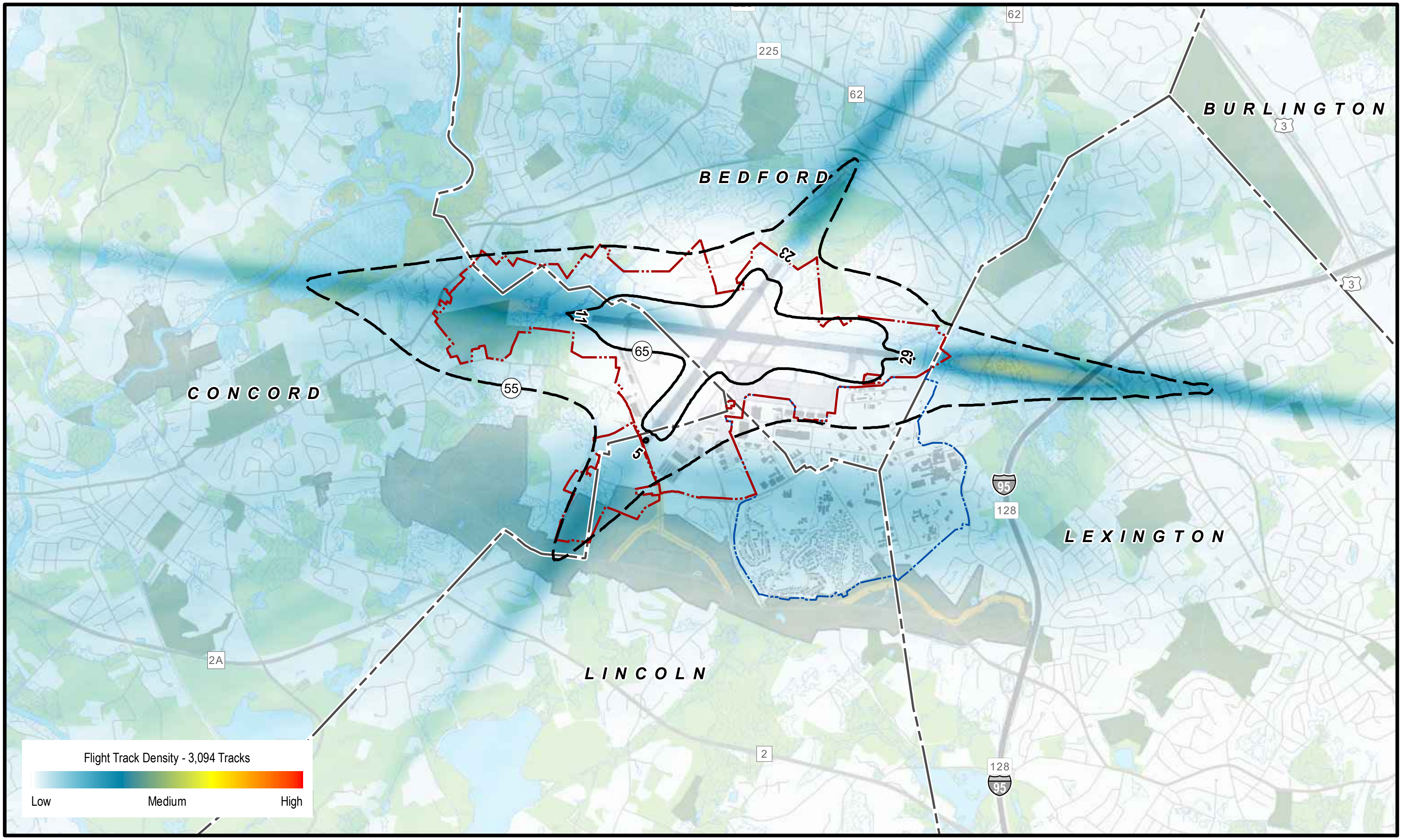
Propeller Aircraft Radar Track Density Plot - Departures

Figure 7-8



North

0 2,000 4,000 Feet

2017 - 65 dB DNL Contour
2017 - 55 dB DNL Contour
Hanscom Field Property Boundary
Hanscom AFB Property Boundary
Municipal Boundary

Historic Road
Interstate
Highway
Road
Trail

MMNHP Boundary
Great Meadows
Open Space Non-protected
Open Space Protected in Perpetuity
Open Water / Wetland
Stream

Data Sources: Massport Noise and Operations Monitoring System (flight tracks) March 1, 2018; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018

Note: 55 dB DNL contour included to show the effect of flight track distribution on the noise contours.

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Propeller Aircraft Radar Track Density Plot - Local

Figure 7-9

7.3.2 Operational Input

The remaining AEDT input falls under the category of operational input and includes runway use, operations, and aircraft noise and performance data. These data determine the number, type, flight time, and other characteristics of the aircraft traveling on the paths defined in the physical input.

Runway Use

The operational runway use of the airport is a critical component in the computer modeling of aircraft noise. As described in above, all valid individual flight tracks from Massport's NOMS for the entire year of 2017 were used in the noise modeling. This large sample of over 50,000 flight tracks provides an excellent estimate of runway use for 2017 at Hanscom Field. For reporting purposes, each flight track was assigned to a category based on the type of propulsion and size of the aircraft. Once in these categories, the data were used to calculate runway use percentages.

Table 7-2 through Table 7-6 show the calculated runway use by operation and aircraft group. Helicopter runway use is not included in these tables. Table 7-6, Touch and Go Runway Utilization, is not differentiated by aircraft group as all pattern activity was modeled using piston aircraft. The 2017 runway use below reflects the closure of Runway 11/29 for repaving during the month of August. This main result of this closure was an increase in the annual use of Runway 5/23 and a decrease in the use of Runway 11/29 as compared to 2012.

Many of the helicopters in the radar sample followed runway headings on arrival and dispersed quickly off the runway centerline after departure, similar to light propeller aircraft. However, with their maneuverability, helicopters often hover along taxiways and depart or land from ramp areas as well as runway ends, and no hard data on arrival and departure locations on the airfield are maintained, by Massport or the FAA. To simplify the modeling of these conditions, helicopter operations were assumed to originate or terminate at a single point just north of the control tower. The radar flight track defined the remainder of the modeled flight path, the portion that determines the noise exposure away from the center of the airport.

Table 7-2 Daytime (7:00 AM to 10:00 PM) Departure Runway Utilization

Runway	Aircraft Group			
	Corporate Jet	Large Jet	Turboprop	Piston
05	4.9%	0.5%	7.9%	7.3%
11	23.0%	32.8%	21.0%	15.4%
23	12.1%	1.0%	16.9%	20.3%
29	60.0%	65.7%	54.2%	57.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Massport Noise and Operations Monitoring System flight tracks, 2017

Table 7-3 Nighttime (10:00 PM to 7:00 AM) Departure Runway Utilization

Runway	Aircraft Group			
	Corporate Jet	Large Jet	Turboprop	Piston
05	11.7%	0.0%	22.7%	15.8%
11	19.9%	17.7%	17.1%	11.4%
23	5.7%	0.0%	11.9%	37.7%
29	62.6%	82.3%	48.3%	35.2%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Massport Noise and Operations Monitoring System flight tracks, 2017

Table 7-4 Daytime (7:00 AM to 10:00 PM) Arrival Runway Utilization

Runway	Aircraft Group			
	Corporate Jet	Large Jet	Turboprop	Piston
05	3.2%	0.0%	4.5%	5.4%
11	27.3%	35.7%	25.0%	20.6%
23	14.3%	0.7%	20.6%	22.4%
29	55.3%	63.6%	49.9%	51.7%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Massport Noise and Operations Monitoring System flight tracks, 2017

Table 7-5 Nighttime (10:00 PM to 7:00 AM) Arrival Runway Utilization

Runway	Aircraft Group			
	Corporate Jet	Large Jet	Turboprop	Piston
05	1.8%	0.0%	4.8%	4.9%
11	39.6%	38.7%	34.4%	24.0%
23	10.7%	0.0%	22.8%	35.8%
29	48.0%	61.3%	38.0%	35.4%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Massport Noise and Operations Monitoring System flight tracks, 2017

Table 7-6 Touch-and-Go Runway Utilization

Runway	Daytime (7:00 AM to 10:00 PM)	Nighttime[1] (10:00 PM to 11:00 PM)
05	9.8%	0.0%
11	12.4%	18.8%
23	18.1%	0.0%
29	59.7%	81.3%
Total[2]	**100.0%**	**100.0%**

Note:
1. Touch-and-go operations are not allowed from 11:00 PM to 7:00 AM
2. Aircraft other than single engine pistons are not allowed to perform touch-and-go operations.
Source: Massport Noise and Operations Monitoring System flight tracks, 2017

Operations

Massport's database of operations at Hanscom Field described in the EXP section, Section 7.6.4 provided the information necessary for the calculation of the average daily operations by aircraft type for 2017. Table 7-7 presents a summary of the 2017 operations modeled for the noise analysis. Appendix D provides a refined breakdown of the activity by individual aircraft types with their corresponding noise model representation.

Table 7-7 Year 2017 Average Daily Operations Summary by Group

Group	Departures		Arrivals		Total
	Daytime (7:00 AM to 10:00 PM)	Nighttime (10:00 PM to 7:00 AM)	Daytime (7:00 AM to 10:00 PM)	Nighttime (10:00 PM to 7:00 AM)	
Jets	40.5	2.4	39.4	3.5	**85.8**
Turboprops	10.6	0.3	10.5	0.4	**21.8**
Piston	112.4	0.2	112.2	0.3	**225.1**
Military	1.1	0.0	1.0	0.0	**2.1**
Helicopters	11.3	0.3	11.1	0.5	**23.2**
All Groups	**175.9**	**3.1**	**174.3**	**4.7**	**358.0**

Source: Massport EXP System, HMMH 2018

Aircraft Noise and Performance Data

Specific noise and performance data are necessary to model each aircraft type. The AEDT database contains noise data in the form of SELs at a range of distances (from 200 feet to 25,000 feet) from a particular aircraft with engines at a specific thrust level. Performance data in the AEDT database include thrust, speed, and altitude profiles for takeoff and landing operations. The AEDT database contains standard noise and performance data for over 300 different fixed wing aircraft and rotorcraft types, most of which are civil aircraft. The AEDT has over 5,000 airframe and engine combinations that are specifically defined in the AEDT database to use these noise and performance data.

The program automatically accesses the applicable noise and performance data for departure and approach operations by those aircraft. For aircraft not included in the database, aircraft with incomplete information in the database, or aircraft using non-standard flight profiles, the data must be manually entered into the model. Due to the large number of airframe and engine combinations in the AEDT standard database, there was no need to include any such non-standard aircraft data in this study.

7.3.3 Noise Model Differences

For this *2017 ESPR*, Massport has transitioned from using FAA's legacy modeling software, INM, to FAA's next generation software, AEDT. AEDT is the required model for noise studies seeking FAA approval. While the Massachusetts Environmental Policy Act (MEPA) ESPR process does not require FAA approval, Massport performed the analyses to FAA standards. All noise calculations in the *2017 ESPR* were prepared with AEDT 2d, which was the most current version available at the time of the analysis. The *2012 ESPR* calculations used INM 7.0c.

The EXP for 2017 was computed in both INM 7.0c and AEDT 2d to aid in comparing current and future calculations of EXP to past values. Civil Departure EXP, used to track trends in total noise exposure at Hanscom Field, was 106.8 dB for INM 7.0c and 106.7 dB for AEDT 2d. This minimal difference reflects the fact that though AEDT has added some new aircraft types and updated some aircraft noise and performance calculations, the database and algorithms remain very similar to those used in INM.

Thirty-nine of the EXP aircraft groups had changes to their SELs plus or minus 1.0 dB or less. Four aircraft groups had changes ranging from minus 5 dB to plus 4 dB due to changing the AEDT aircraft, which represents the group. One aircraft group that with an aircraft code that could represent either a Stage 2 or Stage 3 aircraft decreased in SEL by 16 dB due to using a Stage 3 aircraft to replace the former Stage 2 aircraft representing the group. These changes were primarily due to recent updates in the FAA recommended aircraft in AEDT. Additionally, four new EXP groups, all jets, were added.

7.4 Year 2017 Noise Levels

This section describes current (year 2017) noise levels at Hanscom Field. Figure 7-10 depicts noise exposure levels in terms of DNL contours resulting from 2017 operations at Hanscom Field. The figure shows contour values from 55 to 70 dB in 5 dB increments. DNL contours are a graphical representation of how the noise from Hanscom Field's aircraft operations is distributed over the surrounding area on an average day of a given year. The *2012 ESPR* DNL contours are included in Figure 7-10 for comparison.

Table 7-8 presents the acreage within each contour for 2000, 2005, 2012, and 2017 and indicates a general increase in the size of the 2017 contours as compared with the 2012 contours and a decrease relative to the 2000 and 2005 contours. The size and shape of the contours also shows the effect of the August 2017 temporary closure of Runway 11/29 with the increase in the contour lobes associated with Runway 5/23 operations and the effects of increased traffic due to diversions from Boston Logan due to construction.

Table 7-8 Area within Year 2017 DNL Contours

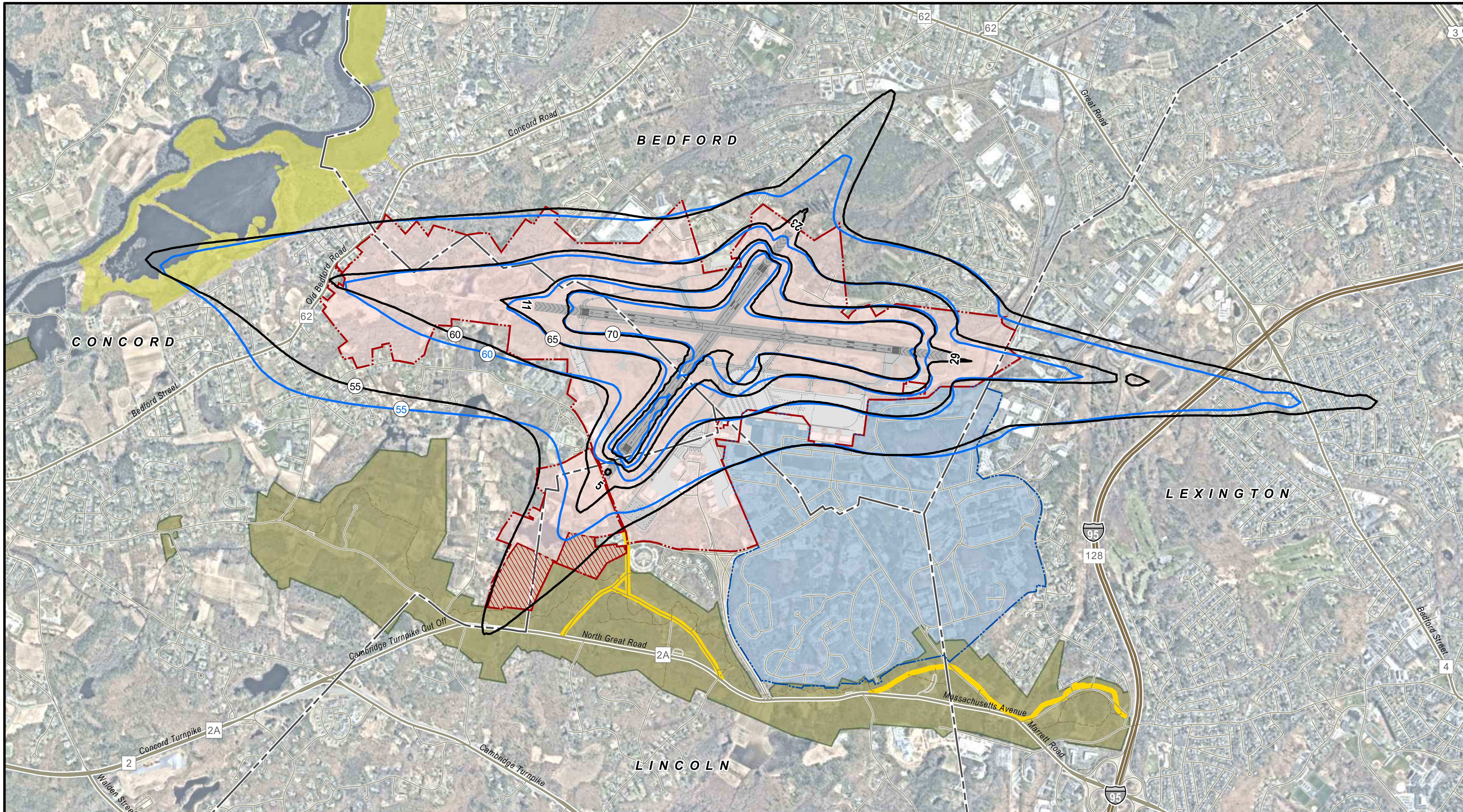
DNL Contours (dB)	Cumulative Area[1] (Acres)			
	2000	2005	2012[2]	2017
70	334	311	181	216
65	688	635	391	423
60	1,550	1,437	856	909
55	3,480	3,291	2,045	2,227

Note:
1. Area within contour includes all greater DNL values.
2. All areas within 65 DNL contour in 2012 and 2017 are contained within Hanscom Field boundaries.
Source: HMMH 2018.

7.4.1 Comparison of Year 2017 Contours with 2012 Contours

The differences between the Year 2017 contours and the Year 2012 contours are influenced by a number of factors, as discussed below:

- The number of total operations decreased by 21 percent in 2017 relative to 2012.
- Daily jet operations increased by 28 percent in 2017 relative to 2012.
- The phase out of civil Stage 2 jet operations in 2015 eliminated civil Stage 2 jet operations in 2017 from less than one percent of civil jet operations in 2012.
- The number of average daily nighttime operations (between 10 PM and 7:00 AM) increased by 26 percent from 2012 to 2017.
- The size and shape of the contours shows the effect of the August 2017 temporary closure of Runway 11/29 with the increase in the contour lobes associated with Runway 5/23 operations, and increases due to flights diverted from Boston Logan due to construction.



North

0 2,000 4,000 Feet

- 2017 DNL Noise Contour
- 2012 DNL Noise Contour
- Hanscom Field Property Boundary
- Massport Property within MMNHP Congressional Boundary
- Hanscom AFB Property Boundary
- Municipal Boundary
- MMNHP Boundary
- Great Meadows
- Historic Road
- Interstate
- Highway
- Road
- Trail

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018;
MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018;
MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018;
MassGIS (Building Footprints), July 30, 2018; NearMap USA (Aerial) July 30, 2018

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2012 and 2017 DNL Noise Contour Comparison

Figure 7-10

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7.4.2 Measured vs. Modeled Noise Levels

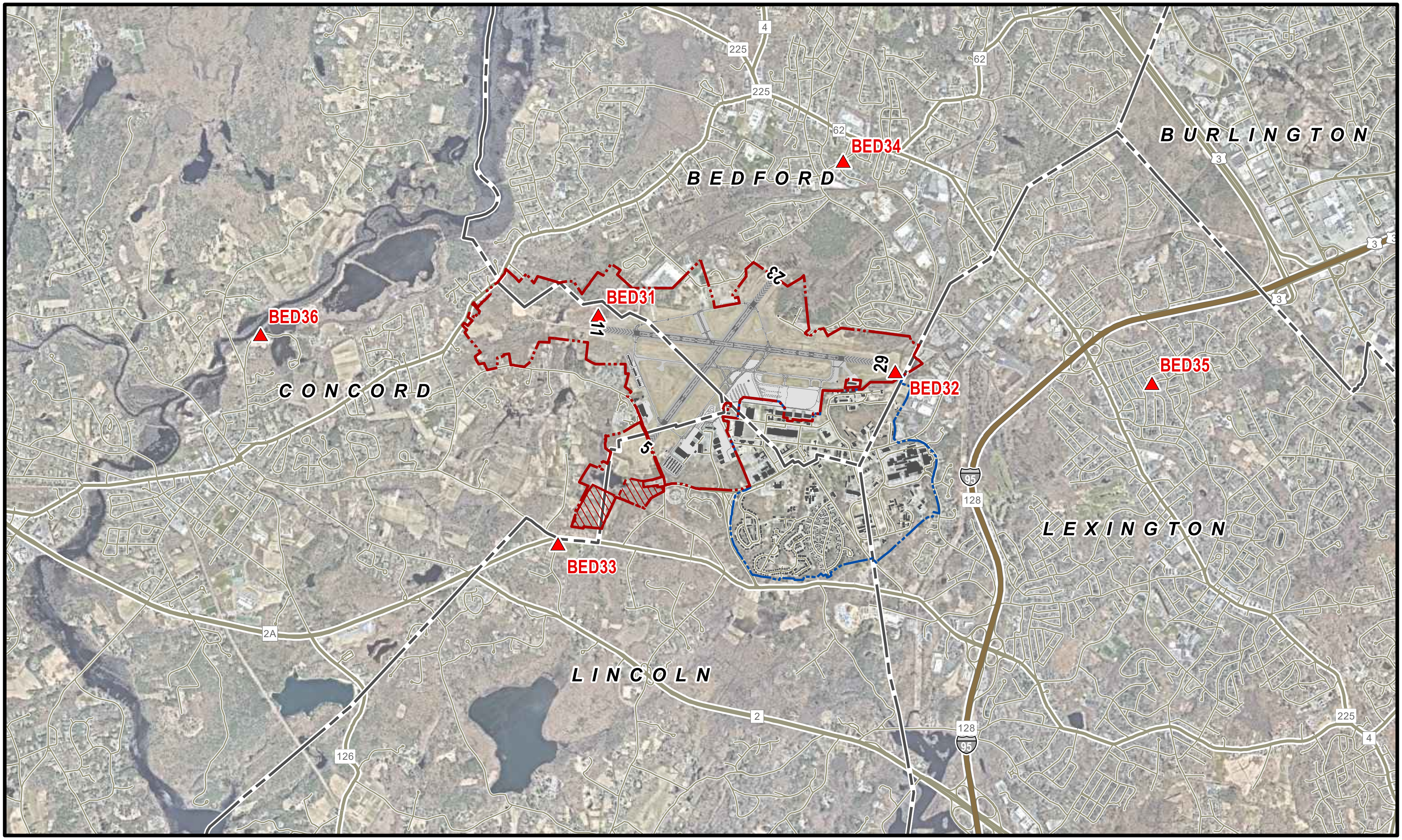
Hanscom Field has a system of six permanent noise monitors (see Figure 7-11). Table 7-9 presents the minimum, the mean, and the maximum total DNL values including all aircraft and ambient noise as measured at each of these locations in 2017, as well as the modeled value at each point for aircraft only.

Table 7-9 Measured and Modeled DNL Values (in dB) at Permanent Monitoring Locations

Site Number	Location	Measured Noise (Aircraft and Ambient Sources)			Modeled Aircraft Noise (Aircraft Only)	Measured Minus Modeled
		Minimum	Mean	Maximum		
31	Concord Localizer[1]	55.2	68.9	88.1	60.5	8.4
32	Bedford Localizer	53.4	62.8	73.8	61.2	1.6
33	Lincoln Brooks Road	48.6	56.5	67.3	54.2	2.3
34	Bedford De Angelo Road	52.4	60.2	71.2	53.8	6.4
35	Lexington Preston Road	50.8	59.2	74.9	55.2	4.0
36	Concord Wastewater	56.7	61.3	69.4	49.9	11.4

Note:
1. High noise levels in 2017 are likely due to wildlife damage to the windscreen
Source: Massport Noise and Operations Monitoring System, HMMH 2018

Generally, near the airport, where aircraft noise dominates, agreement with the modeled values is best. Farther from Hanscom Field, where community noise is a significant contributor to the total DNL, agreement is not as good because the measured value includes all noise sources and the modeled value only includes aircraft-related noise. A notable exception to this general trend is Site 31, the Concord Localizer, which is on airport property. In 2017, wildlife damaged the windscreen on the microphone at Site 31 causing higher levels of wind noise to be included in the total DNL.



North

0 2,000 4,000 Feet

Noise Monitoring Locaitons

Hanscom Field Property Boundary

Massport Property within MMNHP Congressional Boundary

Hanscom AFB Property Boundary

Municipal Boundary

Interstate

Highway

Road

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; NearMap USA (Aerial) July 30, 2018

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Noise Monitoring Locations

Figure **7-11**

7.5 Residential Land Use Impacts

The following sections describe the assessment of land use impacts around Hanscom Field using techniques and criteria based on scientific research, federal law, and FAA recommended guidelines.

7.5.1 Land Use Compatibility Standards

Based on the relationships between noise and the collective response of people to their environment, DNL is the standard noise metric for evaluating community noise exposure and decision-making regarding the compatibility of land uses by most federal agencies in the U.S.

In their application to airport noise in particular, DNL projections have two principle functions:

- **To provide a means for comparing existing noise conditions with those that may result from the implementation of noise abatement procedures and/or from forecast changes in airport activity.**
- **To provide a quantitative basis for identifying and judging potential effects of aviation noise on people.**

Both of the principle functions of DNL projections suggest the need for objective criteria. Government agencies dealing with environmental noise have devoted significant attention to this issue, and thus have developed noise/land use compatibility guidelines to help federal, state, and local officials with this evaluation process.

To help address land use planning issues, the FAA has determined that DNL is the official cumulative noise exposure metric for use in airport noise analyses, as prescribed by 14 CFR Part 150. Part 150 includes FAA's recommended guidelines for noise/land use compatibility evaluation, based on a compilation of extensive scientific research into noise-related activity interference and attitudinal response. These guidelines suggest that DNL values of 65 dB and lower are compatible with all land uses including residential land use.

Research by the U.S. EPA

Pursuant to the Noise Control Act of 1972, the U.S. EPA initiated this effort by publishing scientific data on the effects of noise on people under various levels of exposure. The Agency's preliminary findings were followed in 1974 by a technical report entitled Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, otherwise known as the “Levels Document.” This document is still widely cited for its applicability to environmental assessments, and many of its original findings, while refined in more recent years, remain pertinent to understanding how people respond to noise.

EPA is careful to point out that the Levels Document in no way constitutes a regulation or standard. The report, which is the first report to identify a DNL value of 55 dB as a relevant noise level, offers no guidelines for determining land use compatibility. The Levels Document is informational only, and does not account for economic or technological feasibility or for peoples' attitudes regarding the desirability of undertaking a project that produces impacts caused by noise. Appendix D discusses additional implications of various DNL levels and their effects on people.

Land Use Analysis Methodology

The number of people residing in the DNL contours for 2017 was estimated from existing land use data and 2010 census data obtained from the U.S. Census Bureau. A detailed discussion of this methodology is provided in Appendix D. Table 7-10 presents the population by town exposed to DNL ranges of 65 dB and above (the FAA's compatibility guideline), and also within lower DNL ranges of 60 to 65 dB, and 55 to 60 dB. The information generated for Year 2017 is compared to past analyses for 2005 and 2012.

Table 7-10 Estimated Population within Hanscom Field 2017 DNL Contours

Town	Total Population between DNL Contours:				
	70 dB or Greater	65 to 70 dB	60 to 65 dB	55 to 60 dB	Total 55 dB or Greater
2005					
Bedford	0	17	256	872	1,145
Concord	0	0	209	1,075	1,284
Lexington	0	0	0	524	524
Lincoln	0	0	0	0	0
Total	**0**	**17**	**465**	**2,471**	**2,953**
2012					
Bedford	0	0	87	369	456
Concord	0	0	0	542	542
Lexington	0	0	0	43	43
Lincoln	0	0	0	0	0
Total	**0**	**0**	**87**	**954**	**1,041**
2017					
Bedford	0	0	78	491	569
Concord	0	0	3	446	449
Lexington	0	0	0	245	245
Lincoln	0	0	0	8	8
Total	**0**	**0**	**81**	**1,190**	**1,271**

Source: HMMH 2018

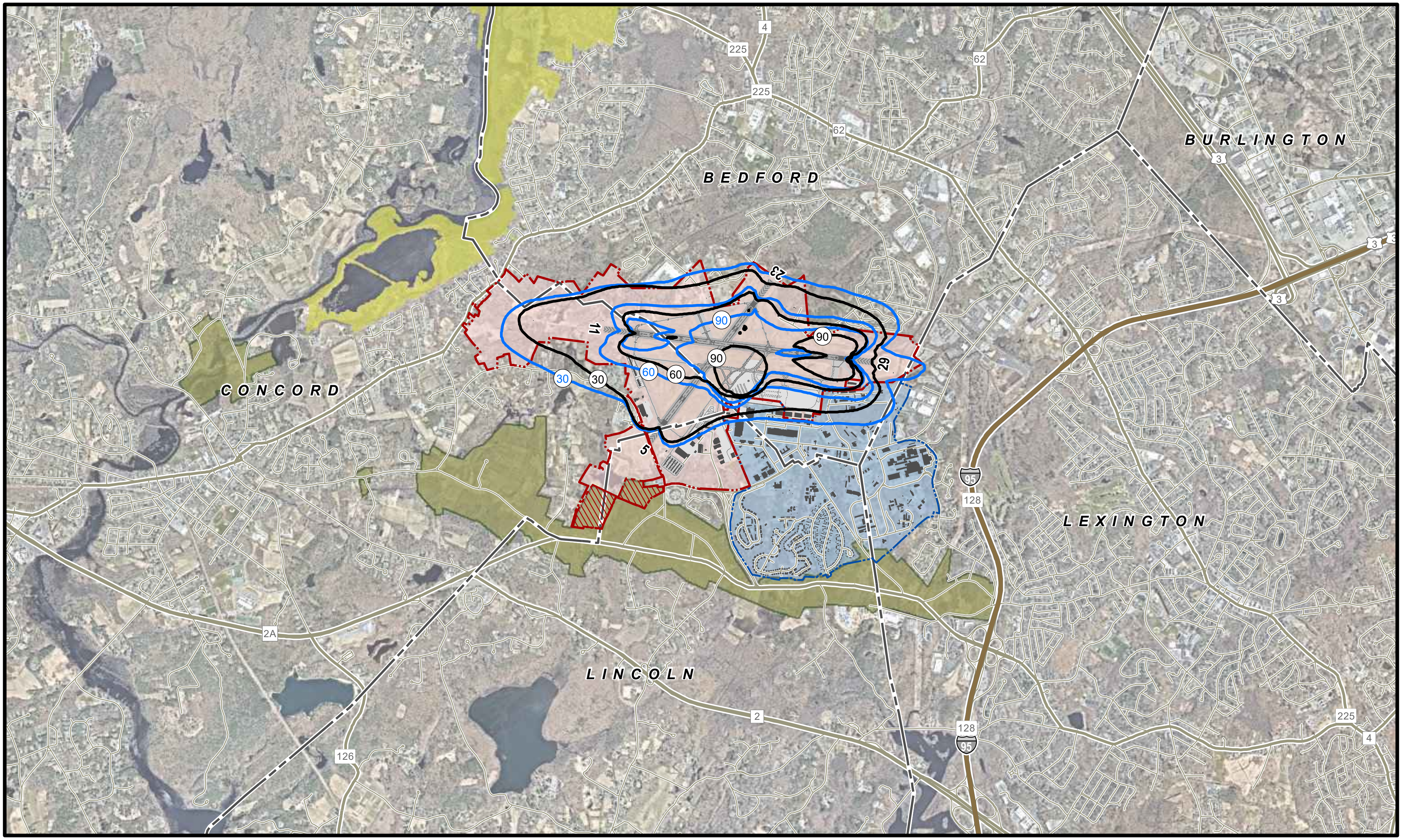
Total population exposed to DNL greater than 65 dB decreased from 17 residents in 2005 to zero in 2012 and 2017. The total population in the four towns exposed to DNL values of 55 dB or greater decreased from 2,953 in 2005 to 1,411 in 2012 and increased to 1,271 in 2017. Concord was the only town recording a decrease in the population exposed to a DNL of 55 dB or greater between 2012 and 2017 due the decreased annual use of Runway 29 associated with the runway closure.

7.5.2 Time Above

A Time Above threshold level of 65 dBA is considered useful when considering speech interference. People can generally carry on acceptable outdoor conversations in a normal voice at typical communication distances of three to four feet as long as the background noise (in this case, aircraft) remains less than 65 dBA. In addition, in a house with open windows, a 65 dBA sound level outdoors produces an indoor sound level that is low enough to permit relaxed conversation at communication distances up to about six feet.

In the *2017 ESPR*, like the 2005 and *2012 ESPR*s, Massport has also provided information on Time Above a lower threshold of 55 dBA. Outdoor conversations at a normal voice effort in the presence of these lower levels are typically acceptable to distances of ten to 15 feet, and indoors with windows open conversations would be acceptable using a normal voice effort at distances of 15 feet or more (see Appendix D).

The *2017 ESPR* reports the results in the form of contours showing areas where aircraft noise exceeds the two threshold sound levels of 65 and 55 dBA for periods of 30, 60, and 90 minutes per day. Figure 7-12 presents TA 65 dBA contours and Figure 7-13 presents the TA 55 dBA contours. The cumulative areas within the TA contours for 2005, 2012, and 2017 are presented in Table 7-11. The data is divided between Massport property, Hanscom Air Force Base (AFB), and off property (meaning outside Hanscom Field and Hanscom AFB). The sizes of the TA 55 dBA and TA 65 dBA contours generally decreased in 2017 relative to 2012 for the 30 minute, 60 minute, and 90 minute contours. Slower aircraft, such as single engine piston propeller aircraft, have higher contributions to Time Above than a faster aircraft with a similar sound level due to the increased time the aircraft spends in the vicinity of the airport for each operation. Both local and itinerant operations by these aircraft decreased between 2012 and 2017.



North

0 2,000 4,000 Feet

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; NearMap USA (Aerial) July 30, 2018

2017 Time Above 65 dBA Contours (Minutes)
2012 Time Above 65 dBA Contours (Minutes)
Hanscom Field Property Boundary
Massport Property within MMNHP Congressional Boundary
Hanscom AFB Property Boundary
Municipal Boundary
Historic Road
Interstate
Highway
Road
MMNHP Boundary
Great Meadows

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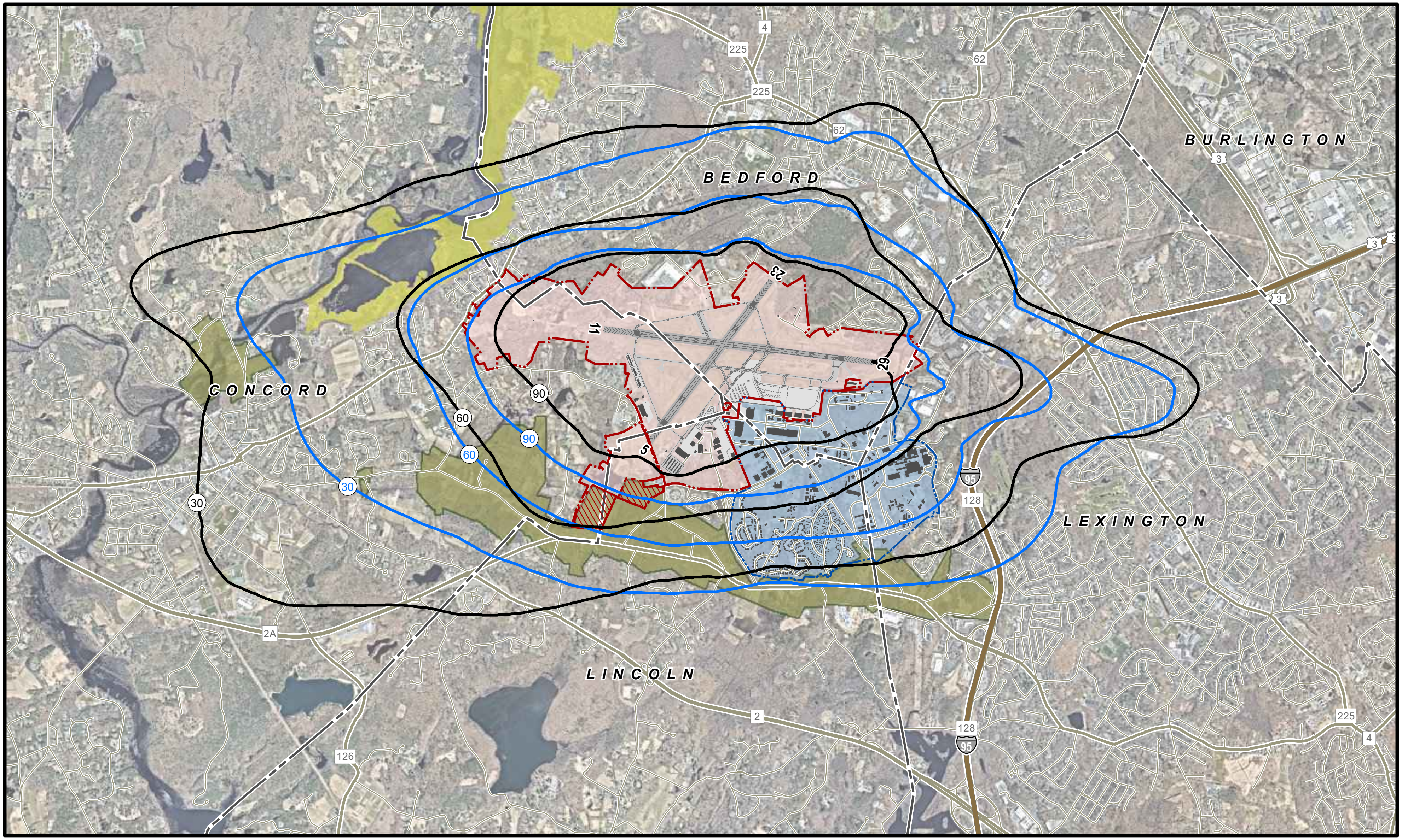
2017 Time Above 65 dBA Contours

Figure **7-12**



North

0 2,000 4,000 Feet

- 2017 Time Above 55 dBA Contours (Minutes)
- 2012 Time Above 55 dBA Contours (Minutes)
- Hanscom Field Property Boundary
- Massport Property within MMNHP Congressional Boundary
- Hanscom AFB Property Boundary
- Municipal Boundary
- Historic Road
- Interstate
- Highway
- Road
- MMNHP Boundary
- Great Meadows

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; NearMap USA (Aerial) July 30, 2018

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2017 Time Above 55 dBA Contours

Figure **7-13**

Table 7-11 2017 Area within Time Above 65 and 55 dBA Contours

Time Above Contour Level	Cumulative Area (Acres)											
	2005	2005 Massport	2005 AFB	2005 Off Airport	2012	2012 Massport	2012 AFB	2012 Off Airport	2017	2017 Massport	2017 AFB	2017 Off Airport
TA 65 dBA Contour												
90 mins	281	279	0	2	289	275	0	14	100	100	0	0
60 mins	498	468	8	22	526	489	12	25	405	394	0	11
30 mins	1,326	956	78	292	1,238	933	89	216	996	833	43	120
TA 55 dBA Contour												
90 mins	1,828	1,060	166	602	2,362	1247	336	779	1,729	1,078	166	485
60 mins	3,551	1,254	447	1850	4,006	1301	640	2,065	3,566	1,301	398	1,868
30 mins	8,405	1,302	761	6342	7,542	1,302	782	5,458	9,209	1,302	762	7,146
Source: HMMH 2018												

Table 7-12 presents the population between the contour levels for the TA 65 and 55 dBA metrics for 2005, 2012, and 2017. The upward trend in jet operations contributes to the increased size of the TA 55 dB 30 minute contour, which is the farthest TA contour from the airport. The largest area of increase in the TA 55 dB 30 minute contour lies under the Runway 29 departure turn to the south of Hanscom Field. This area lies over a relatively well-populated area of Concord, which results in an increase in the population within the TA 55 dB 30 minute contour in 2017 compared to 2012. Appendix D describes the methodology used to compute these population counts based on the contour geometry, US Census data, and land use polygons.

Table 7-12 2017 Population within Time Above 65 and 55 dBA Contours

Time Above Contour Level	Population between Contours		
	2005	2012	2017
TA 65 dBA Contour			
90 minutes or greater	0	0	0
60 to 90 minutes	50	52	6
30 to 60 minutes	470	349	175
Total 30 minutes or greater	**520**	**401**	**181**
TA 55 dBA Contour			
90 minutes or greater	937	1,139	696
60 to 90 minutes	1,301	2,610	2,001
30 to 60 minutes	9,112	6,234	9,391
Total 30 minutes or greater	**11,350**	**9,983**	**12,088**
Source: HMMH 2018			

7.5.3 Total Noise Exposure (EXP)

Table 7-13 presents the EXP for 2017 at Hanscom Field. Appendix D presents detailed results of the 2017 EXP calculation. The total EXP for civil departures was 106.7 dB using AEDT Version 2d. Table 7-14 presents a historic comparison of EXP values from 1987 to 2017 using increasingly updated versions of the INM as discussed earlier in this chapter.

Table 7-13 Year 2017 Total Noise Exposure (EXP) (in dB)

Groups	Departure Only	Arrival Only	Total
All civil aircraft except single piston	105.8	109.6	111.1
All civil aircraft	106.7	110.4	111.9
All military aircraft	102.6	95.3	103.3
All civil and military aircraft except single piston	107.5	109.8	111.8
All civil and military aircraft	108.2	110.5	112.5
Source: Massport EXP System 2018			

Table 7-14 Historic Trends in EXP

Noise Model	Year	Civilian Aircraft Departure EXP
INM Version 3.9	1987	112.0
	1988	112.4
	1989	111.6
	1990	110.8
	1991	110.7
	1992	111.4
	1993	110.6
	1994	111.4
	1995	111.6
INM Version 5.1	1996	112.0
	1997	112.3
	1998	113.1
	1999	113.0
INM Version 6.0c	2000	112.3
	2001	111.6
	2002	112.4
	2003	111.9
	2004	111.9
INM Version 6.1	2005	111.4
	2006	111.0
	2007	111.3
	2008	110.2
	2009	109.2
	2010	109.2
	2011	109.1
	2012	107.4
	2013	108.5
	2014	108.6
	2015	108.2
INM Version 7.0c	2016	106.8
AEDT Version 2d	2017	106.7

Source: Massport and HMMH, 2018

7.5.4 SEL Contours

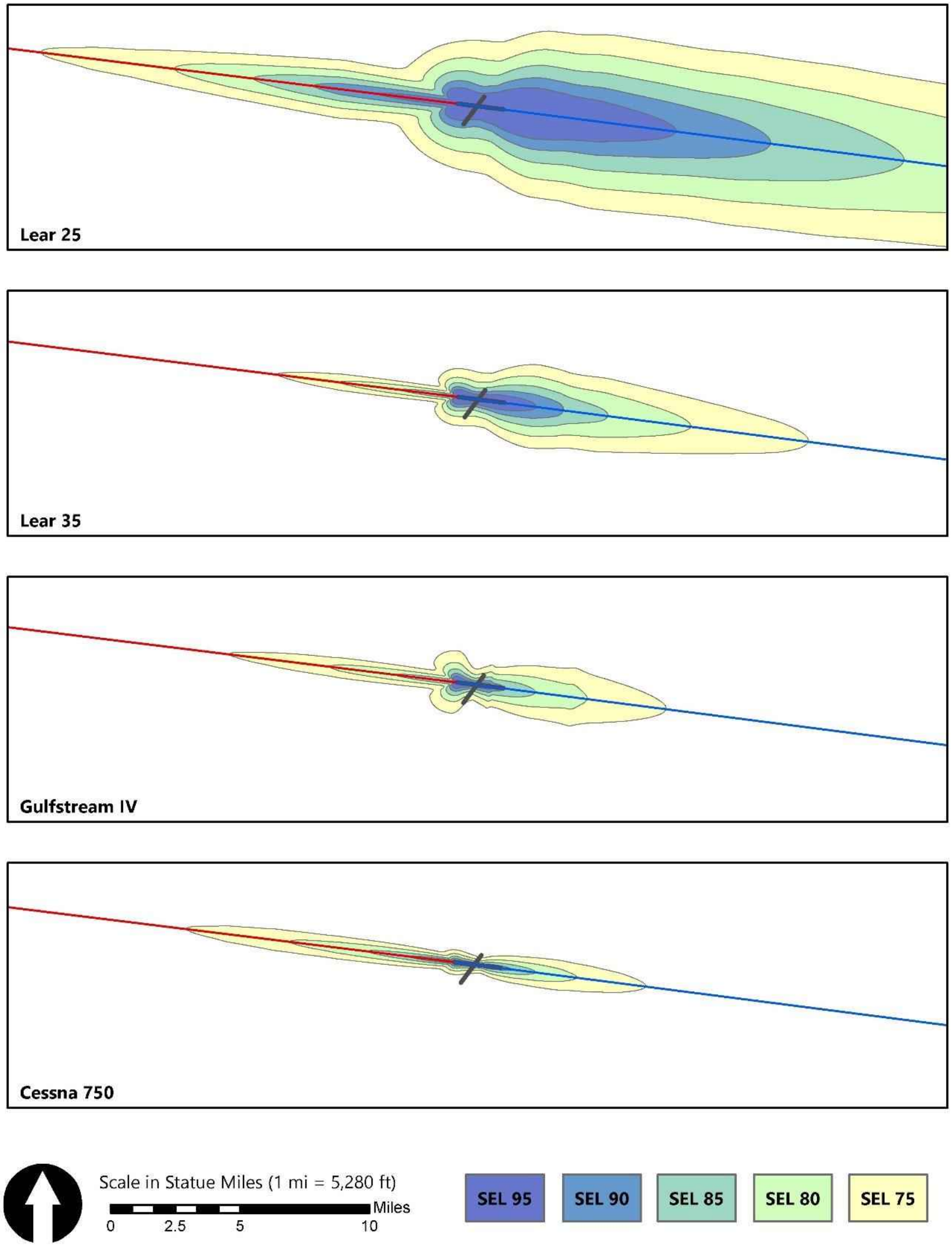
Figures 7-14 and 7-15 depict contours for comparison of single-event noise levels for some common aircraft types at Hanscom Field. Figure 7-14 presents SEL contours for departure and arrival of four typical general aviation jets: the Lear 25, the Lear 35, the Gulfstream IV, and the Cessna 750. The Lear 25 is a typical Stage 2 Corporate Jet, whereas the Lear 35, the Gulfstream IV, and the Cessna 750 are Stage 3 Corporate Jets.[94]

This figure shows that at any given location, SELs for Stage 2 aircraft are typically 10 to 15 dB higher than the Stage 3 aircraft. Keeping in mind the logarithmic nature of decibels, a single operation by one of the Stage 2 jets will have 10 times the influence on the total noise level (DNL or EXP) as a Stage 3 jet. At the end of 2015, Stage 2 civil jets were prohibited by federal law from operating in the United States, so while these jets were present in small numbers in the *2012 ESPR* noise contours, they are not present in the *2017 ESPR*. Note that the phase out of Stage 2 jets does not apply to military aircraft.

Figure 7-15 shows the departure single-event noise contours for common propeller aircraft at Hanscom Field: a de Havilland DHC-6 twin turboprop, a Cessna 208 single engine turboprop, a Beechcraft Baron 58 twin-engine piston propeller, and a single engine piston propeller.

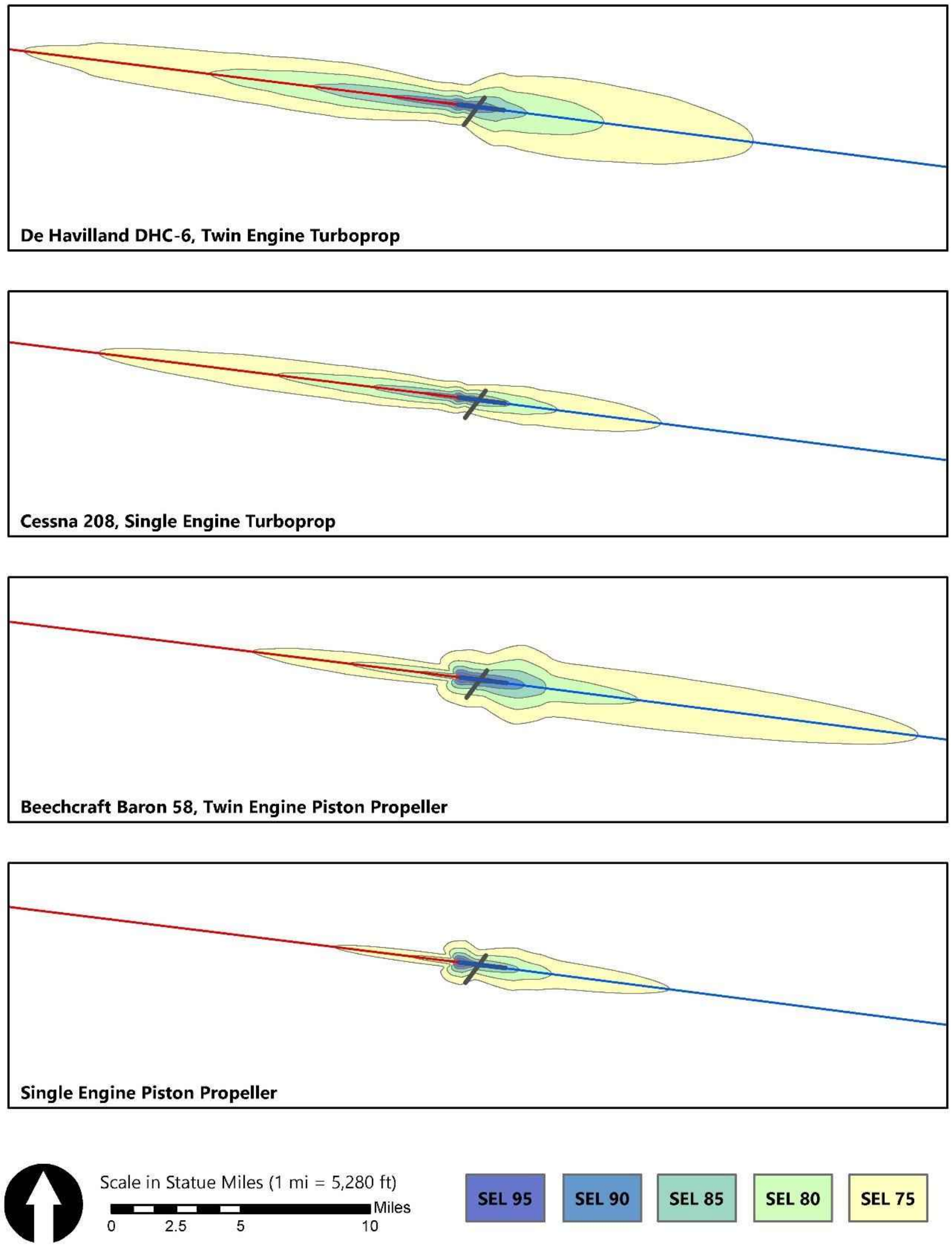
[94] In 2012, Congress passed the FAA Modernization and Reform Act, which included the phase out of all non-stage 3 civil aircraft by December 31, 2015.

Figure 7-14 SEL Contours for Common General Aviation Jet Aircraft



Source: HMMH 2018

Figure 7-15 SEL Contours for Common Propeller Aircraft

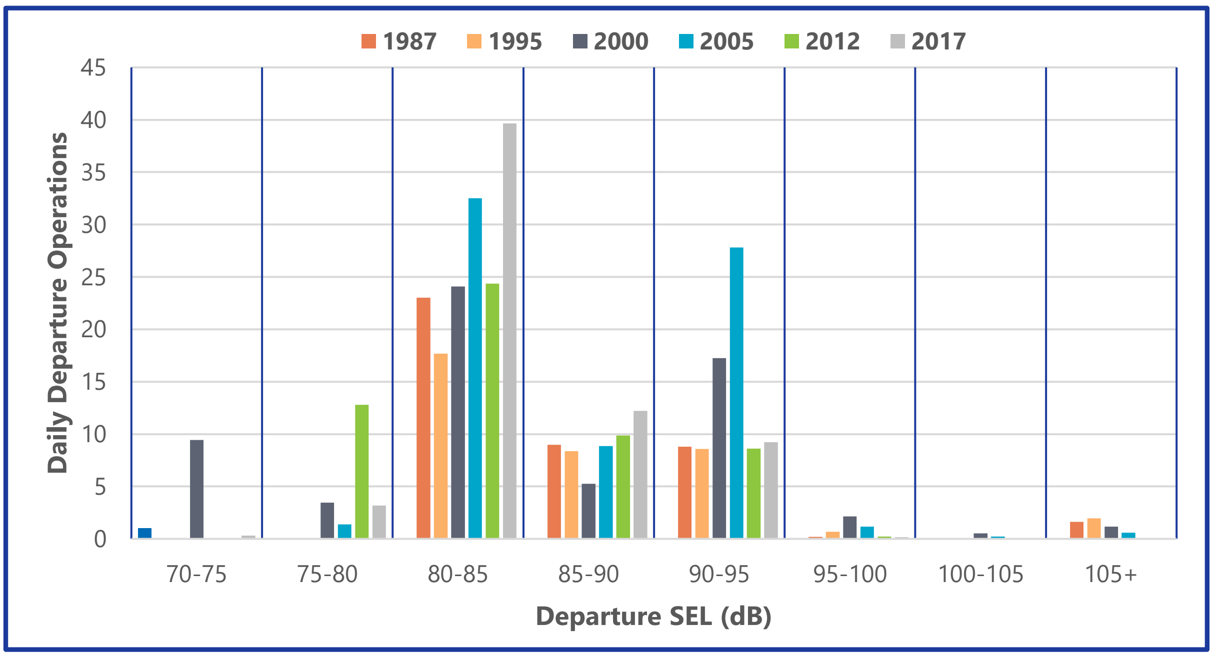


Source: HMMH 2018

In order to understand the distribution of noise levels created by aircraft at Hanscom Field, the AEDT-computed SEL for each aircraft departing the airport (the same metric used in the computation of EXP) was grouped into a 5-decibel increment with all other aircraft producing similar noise levels, and the number of daily occurrences was tallied for 2017.

Figure 7-16 presents a plot of the distribution of the SEL values from the EXP calculations for historical data: 1987, 1995, 2000, 2005, 2012, and 2017. Data were derived from Massport's Annual Noise Report for 1987, the 1995 GEIR for 1995, and the ESPRs for 2000, 2005, and 2012. Single engine piston propeller aircraft were excluded from the presentation so that differences between the numbers of operations by louder aircraft for the various scenarios would be clear. Inclusion of these departures (114 per day in 2017) would have compressed the y-axis to the point that these differences would have been unreadable. The figure shows that operations by the noisiest aircraft types (SEL greater than 95 dBA) decreased over time, while operations by relatively quieter aircraft types increased during that same period.

Figure 7-16 Historical Distribution of Daily Departure SELs (Excluding Single Engine Prop)



Source: Massport, HMMH 2018

7.6 Analysis of Future Scenarios

All aspects of model input required for the 2017 calculations were also necessary for analysis of future impacts. No changes were made to the airfield layout, flight tracks, or aircraft noise and performance data for the future cases. The runway use assumptions for 2025 and 2035 were derived from the average of data from 2013-2016, all years since the last ESPR, excluding 2017. Data from 2017 was excluded due to the increased use of Runway 5/23 during the closure of Runway 11/29, making this year non-representative of likely future runway use. The operations data, which consist of the types of aircraft and number of operations, were changed to reflect forecast future activity levels.

Table 7-15 through Table 7-19 show the calculated runway use by operation and aircraft group. In general, the use of Runway 11/29 is somewhat higher and the use of Runway 5/23 is somewhat lower as compared to the 2017 values presented in Tables 7-2 through Table 7-6 and better reflects historical norms at Hanscom Field.

Table 7-15 Daytime (7:00 AM to 10:00 PM) Departure Runway Utilization

Runway	Aircraft Group			
	Corporate Jet	Large Jet	Turboprop	Piston
05	4.6%	1.6%	9.9%	7.4%
11	19.4%	19.1%	18.1%	18.1%
23	6.6%	0.4%	11.8%	13.2%
29	69.4%	78.9%	60.1%	61.3%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Massport Noise and Operations Monitoring System flight tracks 2013-2016

Table 7-16 Nighttime (10:00 PM to 7:00 AM) Departure Runway Utilization

Runway	Aircraft Group			
	Corporate Jet	Large Jet	Turboprop	Piston
05	6.2%	0.0%	27.0%	33.6%
11	20.3%	18.4%	13.1%	10.7%
23	2.9%	0.0%	8.1%	10.4%
29	70.6%	81.6%	51.8%	45.4%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Massport Noise and Operations Monitoring System flight tracks 2013-2016

Table 7-17 Daytime (7:00 AM to 10:00 PM) Arrival Runway Utilization

Runway	Aircraft Group			
	Corporate Jet	Large Jet	Turboprop	Piston
05	1.6%	0.0%	2.7%	3.4%
11	25.5%	25.8%	23.3%	25.5%
23	9.8%	1.0%	16.7%	15.2%
29	63.1%	73.1%	57.2%	55.9%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Massport Noise and Operations Monitoring System flight tracks 2013-2016

Table 7-18 Nighttime (10:00 PM to 7:00 AM) Arrival Runway Utilization

Runway	Aircraft Group			
	Corporate Jet	Large Jet	Turboprop	Piston
05	0.2%	0.0%	1.9%	2.1%
11	44.7%	39.0%	34.5%	33.8%
23	4.2%	0.0%	15.5%	16.1%
29	50.9%	61.0%	48.1%	48.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Massport Noise and Operations Monitoring System flight tracks 2013-2016

Table 7-19 Touch-and-Go Runway Utilization

Runway	Daytime (7:00 AM to 10:00 PM)	Nighttime[1] (10:00 PM to 11:00 PM)
05	5.5%	0.0%
11	18.4%	27.2%
23	12.1%	0.0%
29	64.1%	72.8%
Total[2]	**100.0%**	**100.0%**

Notes:
1. Touch-and-go operations are not allowed from 11:00 PM to 7:00 AM
2. Aircraft other than single engine pistons are not allowed to perform touch-and-go operations.
Source: Massport Noise and Operations Monitoring System flight tracks 2013-2016

The *2017 ESPR* future scenarios are used to evaluate the potential cumulative environmental effects that could occur if Hanscom Field reaches the airport activity levels that are described in Chapter 3 Airport Activity Levels. The 2025 and 2035 scenarios represent estimates of what could occur (not what will occur) in the future, using certain planning assumptions and are not necessarily recommended outcomes. The future service scenarios are consistent with Massport's 1980 Regulations for Hanscom Field, which prohibit scheduled commercial passenger services with aircraft having more than 60 seats. Table 7-20 summarizes the average daily operations for the two forecast scenarios. A more detailed breakdown of operations by individual aircraft types is included for each scenario in Appendix D.

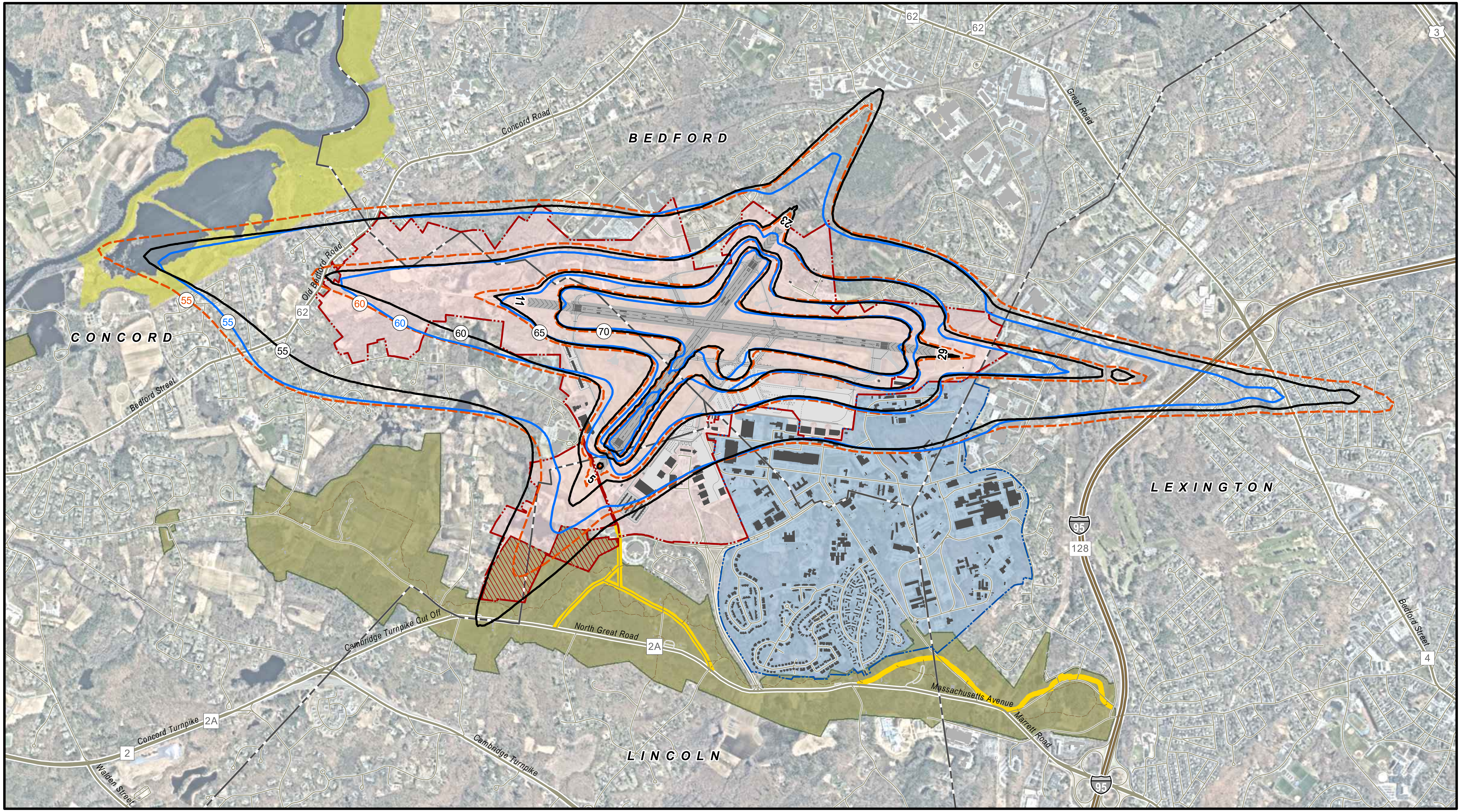
Table 7-20 Forecast Average Daily Operations

Group	Departures		Arrivals		Total
	Daytime (7:00 AM to 10:00 PM)	Nighttime (10:00 PM to 7:00 AM)	Daytime (7:00 AM to 10:00 PM)	Nighttime (10:00 PM to 7:00 AM)	
2025					
Jets	49.6	2.9	48.2	4.2	104.9
Turbo Prop	15.2	0.4	15.1	0.5	31.1
Piston	101.2	0.2	101.1	0.4	202.9
Military	1.1	0.0	1.0	0.0	2.1
Helicopters	13.1	0.4	12.8	0.7	27.0
All Groups	**180.1**	**3.9**	**178.2**	**5.8**	**368.0**
2035					
Jets	56.9	3.3	55.3	4.9	120.4
Turbo Prop	19.0	0.8	18.8	0.9	39.5
Piston	98.4	0.2	98.3	0.4	197.3
Military	1.1	0.0	1.0	0.0	2.1
Helicopters	14.2	0.4	13.9	0.8	29.3
All Groups	**189.5**	**4.7**	**187.3**	**7.0**	**388.5**

Source: InterVISTAS, HMMH 2018

7.6.1 DNL Contours

Figure 7-17 and 7-18 depict the 55, 60, 65, and 70 dB DNL contours for the two future scenarios. In each figure, the 2012 and 2017 contours are also shown for comparison. In both figures, the area within each contour level increases in the future scenarios. Note that the contour lobes associated with Runway 5/23 operations are generally smaller in the future scenarios than in 2017. The larger size of these lobes in 2017 was due to the closure of Runway 11/29 in August of 2017 and the associated increase in the use of Runway 5/23. The area within each contour interval is presented in Table 7-21 for 2012 and 2017 for comparison to the forecast years of 2025 and 2035. The data show growth in the DNL contours for each year from 2012 to 2035.



North

0 2,000 4,000 Feet

- 2012 DNL Noise Contour
- 2017 DNL Noise Contour
- 2025 DNL Noise Contour
- Hanscom Field Property Boundary
- Massport Property within MMNHP Congressional Boundary
- Hanscom AFB Property Boundary
- Municipal Boundary
- MMNHP Boundary
- Great Meadows
- Historic Road
- Interstate
- Highway
- Road
- Trail

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; NearMap USA (Aerial) July 30, 2018

2012 and 2017 DNL Noise Contours Compared to 2025 Forecast DNL Noise Contours

Figure 7-17

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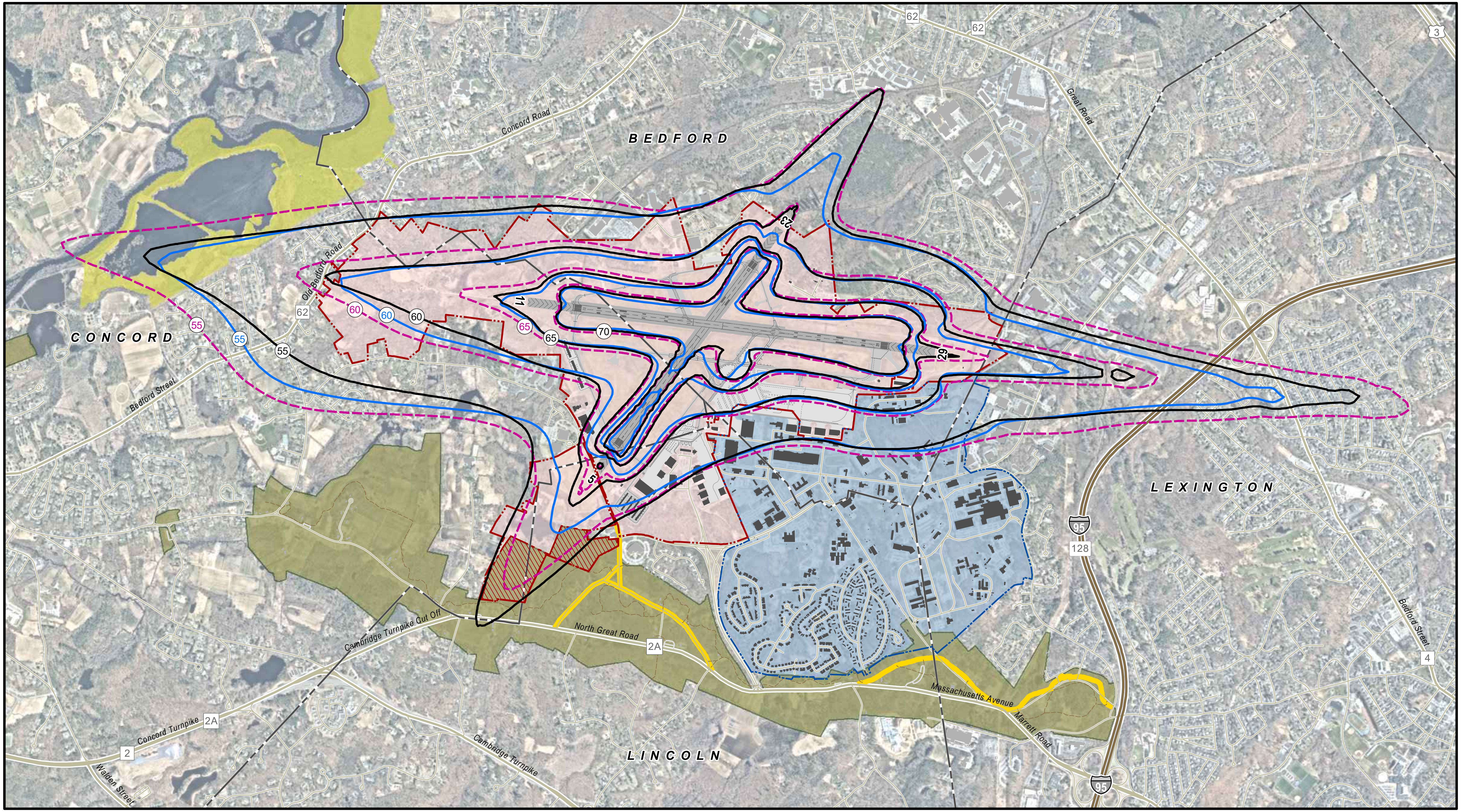

North

0 2,000 4,000 Feet

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; NearMap USA (Aerial) July 30, 2018

2012 DNL Noise Contour
2017 DNL Noise Contour
2035 DNL Noise Contour
Hanscom Field Property Boundary
Massport Property within MMNHP Congressional Boundary
Hanscom AFB Property Boundary

Municipal Boundary
MMNHP Boundary
Great Meadows

Historic Road
Interstate
Highway
Road
Trail

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2012 and 2017 DNL Noise Contours Compared to 2035 Forecast DNL Noise Contours

Figure 7-18

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Table 7-21 Forecast Area within DNL Contours

DNL Contours (dB)	Cumulative Area (Acres)					
	2000	2005	2012	2017	2025	2035
70	334	311	190	214	218	228
65	688	635	391	419	434	459
60	1,550	1,437	857	904	962	1,035
55	3,480	3,291	2,045	2,216	2,371	2,581
Source: HMMH 2018						

7.6.2 Residential Land Use Impacts

Population estimates were prepared for the forecast cases using year 2010 U.S. Census data and the same Geographic Information Systems (GIS) techniques described previously for the 2017 operating conditions. Table 7-22 presents the population within the 55, 60, 65, and 70 dB DNL contours for the forecast cases in 2025 and 2035. The values calculated for 2012 and 2017 are included for comparison. The areas of future growth in the contours relative to 2017 shown in Figure 7-17 and Figure 7-18 are reflected in Table 7-22. In the future, if all project operations occur, the population between the 55 dB and 60 dB DNL contours is projected to increase in all four towns except Lincoln and the population between the 60 dB and 65 dB DNL contours is projected to increase in Bedford and Concord relative to 2017.

In both forecast years, the population within the 65 dB DNL contour remains zero in all four towns.

Table 7-22 U.S. Census Population Counts within Current and Forecast DNL Contours

Town	Total Population between DNL Contours:				
	70 dB or Greater	65 to 70 dB	60 to 65 dB	55 to 60 dB	Total 55 dB or Greater
2012					
Bedford	0	0	87	369	456
Concord	0	0	0	542	542
Lexington	0	0	0	43	43
Lincoln	0	0	0	0	0
Total	**0**	**0**	**87**	**954**	**1,041**
2017					
Bedford	0	0	78	491	569
Concord	0	0	3	446	449
Lexington	0	0	0	245	245
Lincoln	0	0	0	8	8
Total	**0**	**0**	**81**	**1,190**	**1,271**
2025					
Bedford	0	0	95	499	594
Concord	0	0	11	601	612
Lexington	0	0	0	469	469
Lincoln	0	0	0	0	0
Total	**0**	**0**	**106**	**1,569**	**1,675**
2035					
Bedford	0	0	110	578	688
Concord	0	0	24	695	719
Lexington	0	0	0	639	639
Lincoln	0	0	0	1	1
Total	**0**	**0**	**134**	**1,913**	**2,047**

Source: HMMH 2018

7.6.3 Time Above (TA)

The amount of time that aircraft noise is projected to be above the 65 and 55 dBA thresholds during the full day was also computed for the two forecast scenarios using the AEDT. Figure 7-

19 through Figure 7-22 display the contours for areas where aircraft noise exceeds each threshold of 65 and 55 dBA for 30, 60, and 90 minutes per day for each future scenario. Each figure also includes the 2017 contours for comparison. The cumulative area within each contour interval is presented for each forecast scenario in Table 7-23, with 2017 values for comparison. TA increases in area coverage for both the 65 and 55 dBA thresholds over time, which is expected with increasing activity levels. The table shows existing and future levels as well as those for 2012 for comparison. This shows that the area of the 2025 TA contours will be greater than the 2017 contours and the 2035 contours will have the largest area, assuming operations increase in accordance with the forecast. The trends of population within the TA contours will be similar to area, with increases from 2017 through 2035, as shown in Table 7-24.

No federal or other criteria exist for judging the relevance of these reported numbers. Both the acreage and the selected TA contour levels serve primarily as a secondary means of helping to judge the change in noise environment that is expected under the forecast scenarios.

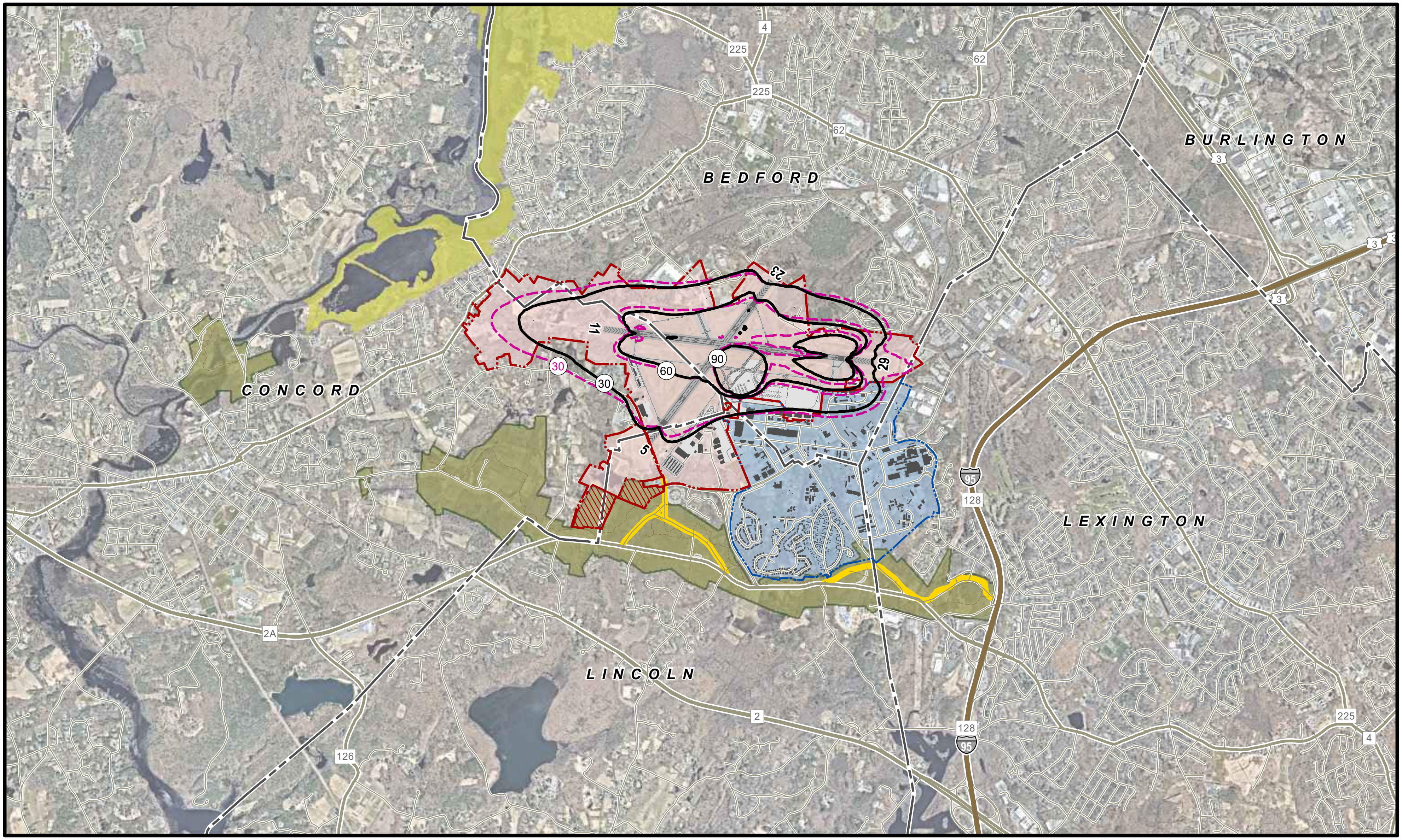
Table 7-23 Areas within Time Above 65 and 55 dBA Contours for Existing and Forecast Operations

Contour Level	Cumulative Area (Acres)			
	2012	2017	2025	2035
Time Above 65 dBA				
90 minutes	289	100	149	205
60 minutes	526	405	443	478
30 minutes	1,238	996	1,122	1,233
Time Above 55 dBA				
90 minutes	2,362	1,729	1,911	2,134
60 minutes	4,006	3,566	3,907	4,278
30 minutes	7,542	9,209	10,083	10,975
Source: HMMH 2018				

Table 7-24 Population within Time Above 65 and 55 dBA Contours for Existing and Forecast Operations

Contour Level	Population between Time Above Contours			
	2012	2017	2025	2035
Time Above 65 dBA				
90 minutes or greater	0	0	0	0
60 to 90 minutes	52	6	30	47
30 to 60 minutes	349	175	233	267
Total 30 minutes or greater	**401**	**181**	**263**	**314**
Time Above 55 dBA				
90 minutes or greater	1,139	696	861	1,072
60 to 90 minutes	2,610	2,001	2,321	2,513
30 to 60 minutes	6,234	9,391	10,568	11,396
Total 30 minutes or greater	**9,983**	**12,088**	**13,750**	**14,981**

Source: HMMH 2018



North

0 2,000 4,000 Feet

2017 Time Above 65 dBA Contours (Minutes)

2025 Time Above 65 dBA Contours (Minutes)

Hanscom Field Property Boundary

Massport Property within MMNHP Congressional Boundary

Hanscom AFB Property Boundary

Municipal Boundary

Historic Road

Interstate

Highway

Road

MMNHP Boundary

Great Meadows

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; NearMap USA (Aerial) July 30, 2018

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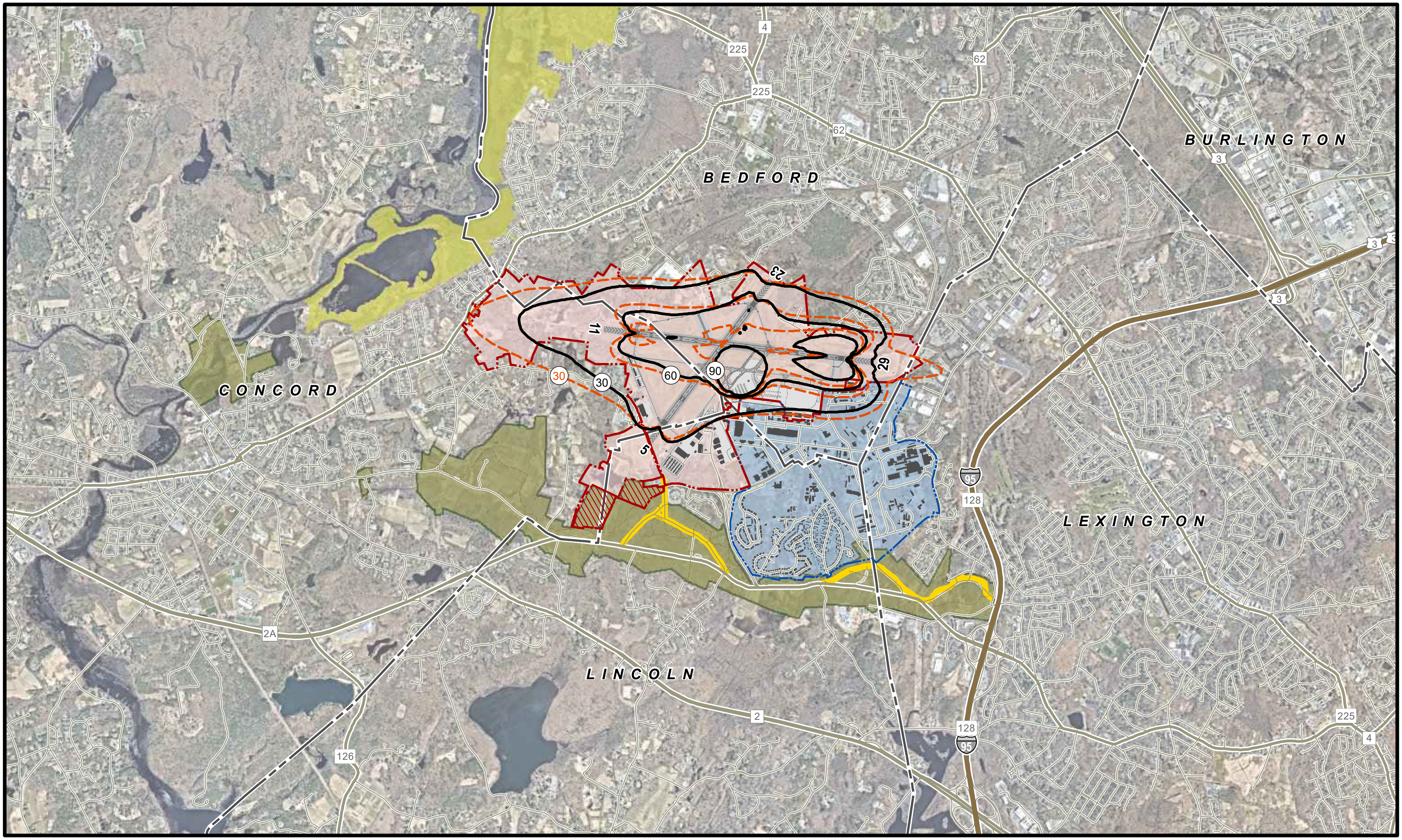
2017 and 2025 Forecast Time Above 65 dBA Contour Comparison

Figure **7-19**



North

0 2,000 4,000 Feet

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; NearMap USA (Aerial) July 30, 2018

- 2017 Time Above 65 dBA Contours (Minutes)
- 2035 Time Above 65 dBA Contours (Minutes)
- Hanscom Field Property Boundary
- Massport Property within MMNHP Congressional Boundary
- Hanscom AFB Property Boundary
- Municipal Boundary
- Historic Road
- Interstate
- Highway
- Road
- MMNHP Boundary
- Great Meadows

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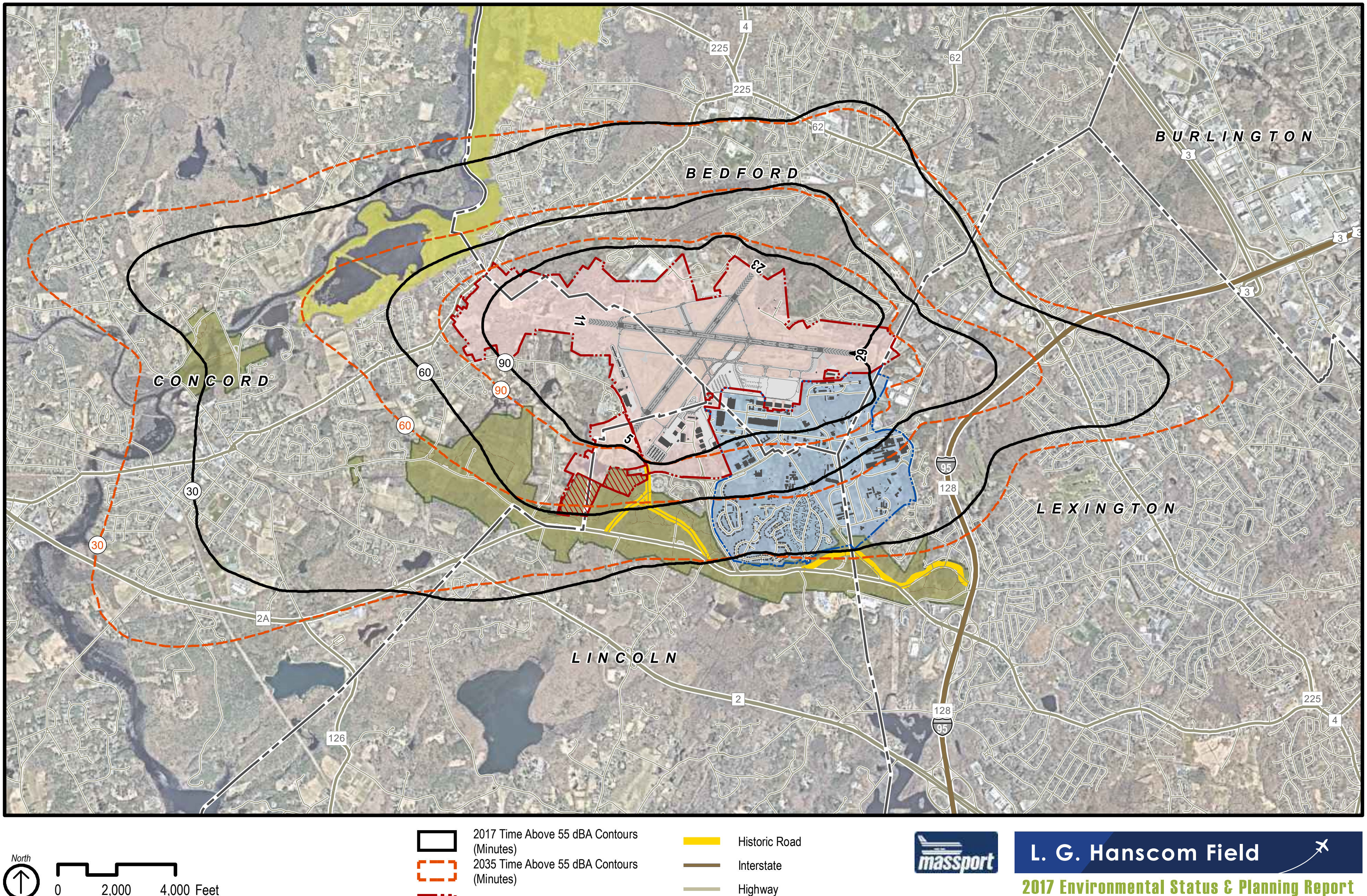
2017 and 2035 Forecast Time Above 65 dBA Contour Comparison

Figure 7-20



Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; NearMap USA (Aerial) July 30, 2018

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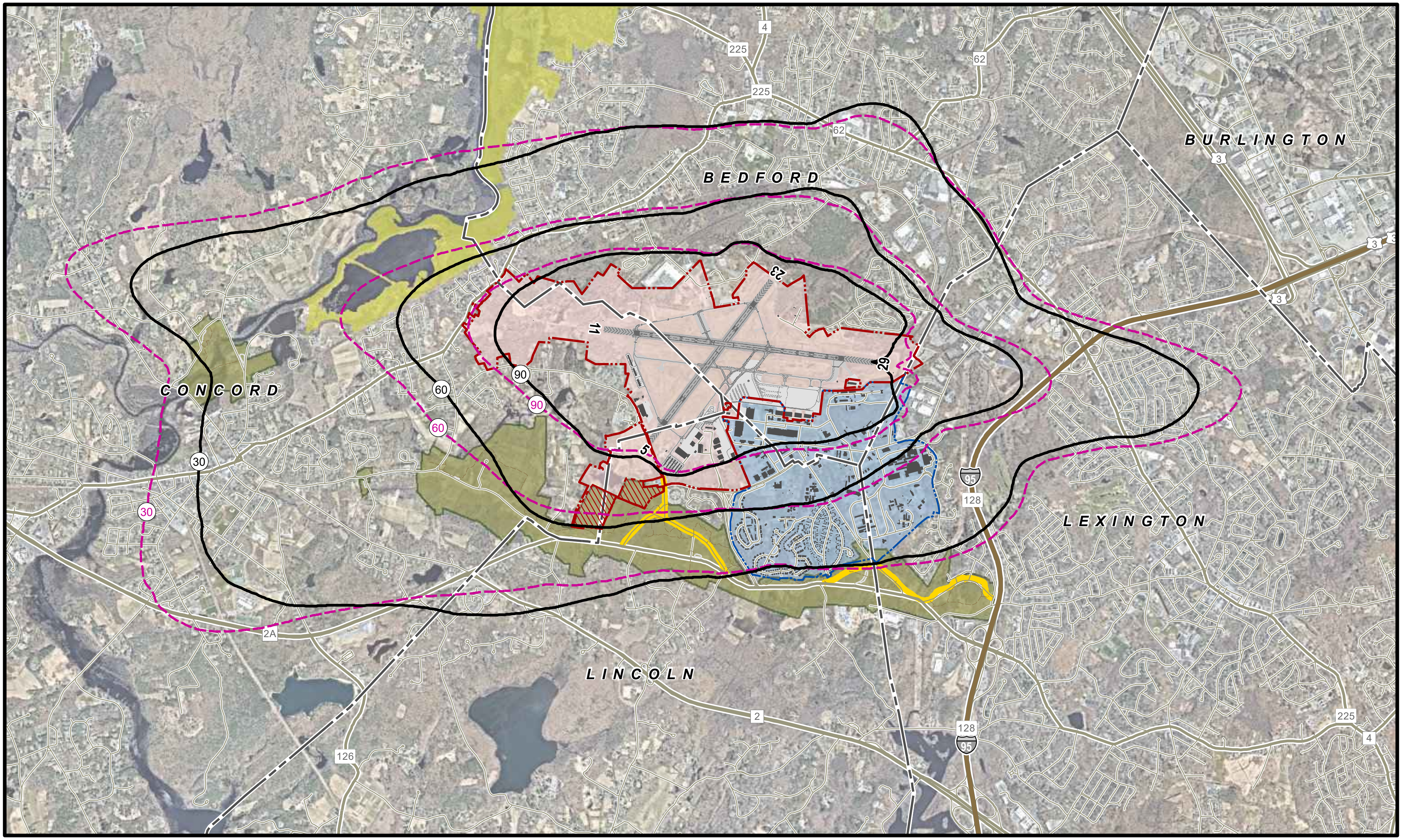
2017 and 2035 Forecast Time Above 55 dBA Contour Comparison

Figure **7-22**



North

0 2,000 4,000 Feet

2017 Time Above 55 dBA Contours (Minutes)

2025 Time Above 55 dBA Contours (Minutes)

Hanscom Field Property Boundary

Massport Property within MMNHP Congressional Boundary

Hanscom AFB Property Boundary

Municipal Boundary

Historic Road

Interstate

Highway

Road

MMNHP Boundary

Great Meadows

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; NearMap USA (Aerial) July 30, 2018

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2017 and 2025 Forecast Time Above 55 dBA Contour Comparison

Figure **7-21**

7.6.4 Total Noise Exposure (EXP)

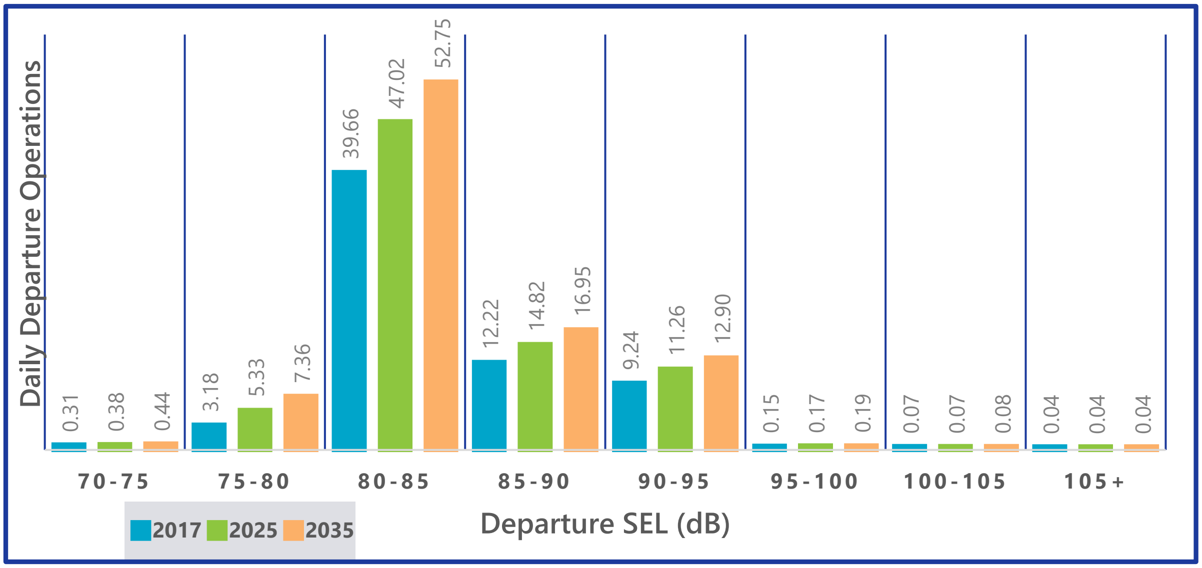
The operations forecasts were also analyzed to compute EXP values, as summarized in Table 7-25. The primary means of tracking the metric is through civil air departures, highlighted in bold in the table. As expected, the EXP computations show the same trends as the DNL forecasts. Compared to 2017, the component attributable to civil departures is projected to increase for both the 2025 and 2035 forecasts from 106.7 dB in 2017 and to 107.4 in 2025 and 107.9 dB in 2035, respectively. These are broadly indicative of the change in DNL values among the various scenarios, consistent with the original reason for developing EXP in the first place.

Table 7-25 Year 2017 Total Noise Exposure (EXP) for Existing and Forecast Operations (in dB)

Groups	Departure Only	Arrival Only	Total
2017			
All civil aircraft except single piston	105.8	109.6	111.1
All civil aircraft[1]	106.7	110.4	111.9
All military aircraft	102.6	95.3	103.3
All civil and military aircraft except single piston	107.5	109.8	111.8
All civil and military aircraft	108.2	110.5	112.5
2025			
All civil aircraft except single piston	106.7	110.5	112.0
All civil aircraft	107.4	111.1	112.7
All military aircraft	102.5	94.9	103.2
All civil and military aircraft except single piston	108.1	110.7	112.6
All civil and military aircraft	108.6	111.2	113.1
2035			
All civil aircraft except single piston	107.3	111.3	112.7
All civil aircraft	107.9	111.8	113.3
All military aircraft	102.5	94.9	103.2
All civil and military aircraft except single piston	108.5	111.4	113.2
All civil and military aircraft	109.0	111.9	113.7

Note:
1. Civil air departures, which are the primary means of tracking EXP, are highlighted in bold.
Source: HMMH 2018

Figure 7-23 Existing and Forecast Distribution of Daily Departure SELs (Excluding Single Engine Prop)



Source: HMMH 2018

7.6.5 Distribution of Noise Events

Figure 7-23 shows the forecasted distribution of daily departure SELs from the EXP calculations for each of the two future scenarios with the values for 2017 shown for comparison. As with the historical data, single engine piston operations are excluded for the clarity of the figure. The figure illustrates the changes in operations over time: growth is forecasted for operations at all noise level categories with the exception of the noisiest groups (greater than 95 dB). Operations by these louder aircraft are generally very small in number and are expected to remain small. Operations by single engine pistons which would be shown in the 75-80 dB SEL category are expected to decrease in the future.

7.7 Noise Analysis Locations

Noise analysis locations are described in this section. Information from the *2012 ESPR* was reviewed and updated to confirm use and address location and identify new facilities. Tables 7-26 through 7-29 list the locations of noise analysis locations within the vicinity of Hanscom Field. Further input was solicited from the Town Planners and Historic Commissions of Bedford, Concord, Lexington, and Lincoln and the National Park Service. The labeling format of the noise analysis locations indicates their use. Consistent with the *2012 ESPR*, this format also delineates the location of the site by town.

None of these sites is currently exposed to a DNL value above the FAA land use compatibility recommendation of 65 dB and none is within the 60 dB DNL contour. Only two sites (both in Concord) that have DNL values greater than 55 dB in 2017:

- ⇨ Deacon John Wheeler/Capt. Jonas Minot Farmhouse, NC-18, in Concord at 57.8 dB; and
- ⇨ Wheeler-Meriam House, NC-19, in Concord at 57.7 dB.

The DNL generally increased between 2012 and 2017. The average increase in DNL across all sites was 1.1 dB, with sites in Bedford recording an average of increase of 1.6 dB, 0.5 dB in Concord, 1.1 dB in Lexington, and 2.5 dB in Lincoln.

The largest individual DNL increase was 4.0 dB, from 42.5 dB to 46.5 dB, at the Henry Higginson House on Baker Farm Rd. in Lincoln. The largest individual DNL decrease was -0.9 dB, from 53.6 dB to 52.7 dB, at the Ripley School on Meriam Rd. in Concord. Generally, areas with lower noise levels are more susceptible to larger changes due to normal shifts in runway and flight corridor utilization.

The largest changes for sites with a 2012 or *2017 ESPR* DNL of 50 dB or more were the aforementioned decrease of 0.9 dB at the Henry Higginson House and an increase of 3.5 dB, from 48.4 dB to 51.9 dB, at the Daniel Brooks House on Brooks Rd. in Lincoln. All six of the locations with a DNL decrease had a DNL of 50 dB or greater in 2012.

The computed noise levels at the noise analysis locations show results consistent with the DNL contours and population assessments. The 2035 forecast scenario would yield the highest DNL values with the exception of sites within Bedford and Lincoln that experienced atypical noise levels in 2017 due to the closure of Runway 11/29.

No noise analysis locations are projected to be exposed to a DNL of 60 dBA or above in 2025 or 2035. Three sites would be exposed to DNL values between 55 and 60 dB in the 2025 and 2035 scenarios including:

- ⇨ Deacon John Wheeler/Capt. Jonas Minot Farmhouse, NC-18, in Concord at 58.6dB DNL in 2025 and 59.0 dB DNL in 2035;
- ⇨ Wheeler-Meriam House in Concord, NC-19, at 58.4 dB DNL in 2025 and 58.8 dB DNL in 2035;
- ⇨ Simonds Tavern, NLX-1, in Lexington at 55.3 dB DNL in 2025 and 55.9 dB DNL in 2035.

While future noise levels at noise analysis locations are generally predicted to increase relative to the year 2017, the importance of any differences from one scenario to the next depends both on the absolute value of the projected DNL as well as on the magnitude of the change. Noise impact criteria are used to determine areas for further analysis and possible mitigation when completing environmental documentation for a specific project at an airport. Though the *2017 ESPR* is not an environmental permitting document for a specific project, the use of these criteria help to highlight notable changes in the noise environment at Hanscom Field.

FAA Order 1050.1F, "Environmental Impacts: Policies and Procedures"[95], identifies a change of 1.5 dB or more at a "noise-sensitive area"[96] as a threshold for further analysis. FICON clarifies the FAA position by recommending a tiered approach be used to screen noise impacts. The 1.5 dB threshold of significance for noise-sensitive areas within the 65 dBA DNL contour is used for initial screening. If such changes are found to occur, additional analysis of noise analysis locations is to be conducted between DNL values of 60 and 65 dB to determine whether those noise analysis locations would experience changes of 3 or more dB.[97] No noise analysis sites had a DNL of 60 dB or greater in 2017 and no site is projected to have a DNL of 60 dB or greater in either of the forecast years.

Table 7-26 through Table 7-29 present the DNL at the noise analysis locations at each town, accompanied by a summary of the results. Time Above results for the noise analysis locations in each town are presented in Appendix D.

Table 7-26 presents the DNL at the noise analysis locations in Bedford for 2005, 2012, 2017 and the projected DNL for 2025 and 2035. Examination of the results yields the following conclusions:

- ⇨ No sites in Bedford were at or above 55 dB DNL in 2017.
- ⇨ In 2017, all sites increased in DNL relative to 2012 due to increased operations on Runway 5/23.
- ⇨ Most sites are forecast to be slightly below 2017 DNL levels in 2025 and slightly above 2017 DNL levels in 2035.
- ⇨ No sites are forecast to be at or above 55 dB DNL in 2025 and 2035.

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[95] U.S. Department of Transportation, Federal Aviation Administration, Office of Environment and Energy, Environmental Impacts: Policies and Procedures, FAA Order 1050.1F, Washington, DC.

[96] Using FAA guidelines, "noise-sensitive areas" are generally assumed to be residential areas within the DNL 65 dB contour.

[97] Federal Interagency Committee on Noise (FICON), Federal Agency Review of Selected Airport Noise Analysis Issues. August 1992. FICON did not address noise levels below DNL 60 dBA because it considered noise predictions below that level to be less reliable.

Table 7-26 DNL at Noise Analysis Locations in Bedford (dB)

Label[1]	Name[2]	Address (Bedford)	DNL				
			2005	2012	2017	2025	2035
HB-1	Veterans Administration Medical Center*	200 Springs Rd	43.1	41.8	43.8	43.8	44.2
NB-1	Bedford Historic District	Great Rd.	44.3	44.6	46.1	46.0	46.2
NB-2	Old Bedford Center Historic District	Great Rd.	46.0	45.4	47.1	46.9	47.1
NB-3	Old Burying Ground	7 Springs Rd.	47.0	45.7	47.4	47.2	47.5
NB-4	Old Town Hall	16 South Rd.	47.5	46.1	47.8	47.6	47.9
NB-5	Bedford Depot Park Historic District	80 Loomis St./120 South Rd.	53.7	49.8	52.0	51.6	52.1
NB-6	Nathaniel Page House	89 Page Rd.	50.7	45.9	48.4	48.1	48.6
NB-7	Christopher Page House	50 Old Billerica Rd.	48.9	44.2	46.9	46.6	47.1
NB-8	Bacon-Gleason-Blodgett Homestead	118 Wilson Rd.	44.2	41.5	43.3	43.5	43.9
NB-9	Historic Wilson Mill-Old Burlington Road Historic Dist.	Old Burlington and Wilson Rds.	44.1	41.3	43.1	43.4	43.8
NB-10	Shawsheen Cemetery **	Shawsheen Rd.	46.4	45.2	46.4	46.6	46.8
NB-11	David Lane House	137 North Rd.	-	42.1	43.9	43.8	44.0
OB-1	Old Billerica Road Area ** (NR nomination form in process)	Old Billerica Rd	48.0	44.0	47.6	47.1	47.7
PB-1	Town Hall *	10 Mudge Way	45.9	45.5	47.1	47.0	47.2
PB-2	Library **	7 Mudge Way	44.7	45.0	46.4	46.3	46.5
PB-3	Bedford School District	11 Mudge Way	45.9	45.6	47.1	47.0	47.2
PB-4	Department of Public Works	314 Great Rd.	47.8	45.4	46.8	46.9	47.2
RB-1	The Lutheran Church of the Savior	426 Davis Rd.	50.4	48.6	49.3	49.8	50.2
RB-2	First Baptist Church of Bedford	155 Concord Rd.	44.8	46.0	47.1	47.2	47.3
RB-3	St. Michael's Church	90 Concord Rd.	43.7	44.9	46.1	46.1	46.2
RB-4	Boston Buddha Vararam Temple	125 North Rd.	41.7	42.2	44.0	43.8	44.1

Label[1]	Name[2]	Address (Bedford)	DNL				
			2005	2012	2017	2025	2035
RB-5	The First Church of Christ Congregational/ United Church of Christ *	25 Great Rd.	45.2	45.1	46.7	46.5	46.8
RB-6	The First Parish in Bedford Unitarian Universalist *	75 Great Rd.	47.1	46.0	47.7	47.5	47.8
RB-7	St. Paul's Episcopal Church	100 Pine Hill Rd.	41.6	41.8	43.7	43.5	43.9
RB-8	March for Jesus	54 Summer St.	54.7	52.2	52.4	52.8	53.1
RB-9	Immanuel Baptist Church	400 Great Rd.	47.1	45.8	46.8	47.0	47.3
SB-1	Davis School	Davis Rd.	42.5	43.1	45.0	45.0	45.2
SB-2	Bedford High School **	9 Mudge Way	44.6	45.1	46.4	46.4	46.5
SB-3	John Glenn Middle School	99 McMahon Rd.	45.9	46.7	47.6	47.6	47.8

Notes:
1. The first letter of the label indicates the nature of each site: H for hospital, N for sites in the National Register of Historic Places and/or State Register of Historic Places, O for other, P for public facilities, R for religious sites, S for schools. Other is the category for sites that town representatives specifically requested be added to the noise receptor list, but do not fit into the other categories. The second letter (or second and third) indicates the town where the site is located: B for Bedford, C for Concord, LX for Lexington, LN for Lincoln. The labels are unchanged from the *2012 ESPR*.
2. Historic districts and cemeteries are evaluated at a central location within the district or cemetery. Sites that are not designated as "N" sites are marked with an asterisk (*) if they are listed in the National Register of Historic Places and two asterisks (**) if they are listed in the State Inventory/MACRIS. Sites are marked with a (†) if they are only listed in the State Register of Historic Places. Sites marked with a (††) contribute to the Old Bedford Center Historic District.
Source: HMMH 2018

Table 7-27Table 7-27 presents the DNL at the noise analysis locations in Concord for 2005, 2012, 2017 and the projected DNL for 2025 and 2035. Examination of the results yields the following conclusions:

- Two sites in Concord, NC-18 and NC-19, were at or above 55 dB DNL in 2017.
- In 2017, some sites increased in DNL, while others decreased relative to 2012.
- All sites are forecast to be at or above 2017 DNL levels in 2025 and 2035.
- Two sites, NC-18 and NC-19, are forecast to be at or above 55 dB DNL in 2025 and 2035.

Table 7-27 DNL at Noise Analysis Locations in Concord (dB)

Label[1]	Name[2]	Address (Concord)	DNL				
			2005	2012	2017	2025	2035
NC-1	Barrett Farm Historic District†	Barrett's Mill Rd.	46.6	43.5	44.8	45.5	45.9
NC-2	Jonathan Hildreth House	8 Barrett's Mill Rd.	50.3	47.4	48.1	48.9	49.4
NC-3	Joseph Hosmer House	572 Main St.	45.0	44.3	45.4	45.9	46.3
NC-4	Thoreau-Alcott House	255 Main St.	47.9	46.1	46.9	47.6	48.0
NC-5	Hubbardville Historic District†	324-374 Sudbury Rd.	49.2	46.5	47.3	48.0	48.4
NC-6	Hubbard-French Historic District	324-374 Sudbury Rd.	49.2	46.5	47.3	48.0	48.4
NC-7	Deacon Thomas Hubbard/ Judge Henry French House	342 Sudbury Rd.	49.0	46.4	47.2	47.9	48.3
NC-8	Pest House	158 Fairhaven Rd.	49.9	46.3	47.1	47.8	48.2
NC-9	Main Street Historic District†	Main St. between Monument Sq. and Wood St.	50.8	48.0	48.3	49.1	49.5
NC-10	North Bridge-Monument Square Historic District†	Monument St., Liberty St. and Lowell St.	50.5	48.2	48.4	49.2	49.6
NC-11	Wright Tavern	Lexington Rd. & Main St.	51.0	48.2	48.4	49.2	49.6
NC-12	Sleepy Hollow Cemetery	24 Court Ln.	52.2	49.0	49.0	49.9	50.4
NC-13	American Mile Historic District†	Lexington Rd.	51.7	48.5	48.6	49.5	49.9

Label[1]	Name[2]	Address (Concord)	DNL				
			2005	2012	2017	2025	2035
NC-14	Concord Monument Square-Lexington Road Historic District	Monument Sq. and Lexington Rd.	50.9	48.1	48.3	49.1	49.6
NC-15	Ralph Waldo Emerson House	28 Cambridge Turnpike	52.9	49.1	49.1	49.9	50.4
NC-16	Walden Pond	MA Rte 126 (Main Beach)	45.8	43.4	46.2	46.2	46.6
NC-17	Orchard House	399 Lexington Rd.	53.8	50.2	50.0	50.8	51.3
NC-18	Deacon John Wheeler/ Capt. Jonas Minot Farmhouse	341 Virginia Rd.	60.4	58.4	57.8	58.6	59.0
NC-19	Wheeler-Meriam House	477 Virginia Rd.	59.9	58.1	57.7	58.4	58.8
NC-20	Concord Armory-Concord Veteran's Building	51 Walden St.	-	48.1	48.3	49.1	49.6
NC-21	Concord School of Philosophy	391 Lexington Rd.	-	50.3	50.1	51.0	51.4
NC-22	Hosmer Homestead	138 Baker Ave.	-	41.6	43.1	43.5	43.8
PC-1	Library **	129 Main St.	49.4	47.1	47.6	48.4	48.8
PC-2	Town Hall ††	22 Monument Sq.	50.8	48.1	48.3	49.1	49.6
PC-3	Middlesex County Court House	305 Walden St.	52.4	48.4	48.6	49.4	49.8
RC-1	Trinity Episcopal Church **	81 Elm St.	46.0	45.0	46.0	46.6	47.0
RC-2	Redeemer Presbyterian Church	191 Sudbury Rd.	49.0	46.7	47.4	48.1	48.5
RC-3	New Life Community Church (meeting at the Emerson School Building **)	40 Stow St.	50.0	47.4	47.8	48.6	49.0
RC-4	Trinitarian Congregational Church **	54 Walden St.	50.9	48.0	48.2	49.0	49.5
RC-5	First Church of Christ Scientist††	7 Lowell Rd.	50.2	47.7	48.0	48.8	49.3
RC-6	St. Bernard's Parish††	70 Monument Square	50.5	47.9	48.2	49.0	49.4
RC-7	Christian Science Reading Room	20 Main St.	50.7	47.9	48.2	49.0	49.4

Label[1]	Name[2]	Address (Concord)	DNL				
			2005	2012	2017	2025	2035
RC-8	First Parish in Concord ††	20 Lexington Rd.	51.2	48.2	48.4	49.2	49.7
SC-1	Nashoba/Brooks School	200 Strawberry Hill Rd.	49.3	46.5	47.8	48.6	49.1
SC-2	Middlesex School**	1400 Lowell Rd.	41.3	40.4	42.3	42.7	43.0
SC-3	Fenn School **	498-516 Monument St.	53.7	50.9	51.2	51.9	52.4
SC-4	Concord Academy **	166 Main St.	48.6	46.6	47.2	48.0	48.4
SC-5	Alcott School	91 Laurel Rd.	51.8	48.1	48.4	49.2	49.6
SC-6	Concord/Carlisle High School	500 Walden Rd.	50.8	46.8	47.6	48.3	48.7
SC-7	Ripley School	120 Meriam Rd.	56.4	53.6	52.7	53.7	54.3

Notes:
1. The first letter of the label indicates the nature of each site: H for hospital, N for sites in the National Register of Historic Places and/or State Register of Historic Places, O for other, P for public facilities, R for religious sites, S for schools. Other is the category for sites that town representatives specifically requested be added to the noise receptor list, but do not fit into the other categories. The second letter (or second and third) indicates the town where the site is located: B for Bedford, C for Concord, LX for Lexington, LN for Lincoln. The labels are unchanged from the *2012 ESPR*.
2. Historic districts and cemeteries are evaluated at a central location within the district or cemetery. Sites that are not designated as "N" sites are marked with an asterisk (*) if they are listed in the National Register of Historic Places, and two asterisks (**) if they are listed in the State Inventory/MACRIS. Sites are marked with a (†) if they are only listed in the State Register of Historic Places. Sites marked with a (††) contribute to the Concord Monument Square-Lexington Road Historic District.
Source: HMMH 2018

Table 7-28 presents the DNL at the noise analysis locations in Lexington for 2005, 2012, 2017 and the projected DNL for 2025 and 2035. Examination of the results yields the following conclusions:

- ⇨ No sites in Lexington were at or above 55 dB DNL in 2017.
- ⇨ In 2017, all sites increased in DNL relative to 2012.
- ⇨ All sites are forecast to be at or above 2017 DNL levels in 2025 and 2035.
- ⇨ One site, NLX-1, is forecast to be at or above 55 dB DNL in 2025 and 2035.

Table 7-28 DNL at Noise Analysis Locations in Lexington (dB)

Label[1]	Name[2]	Address (Lexington)	DNL				
			2005	2012	2017	2025	2035
NLX-1	Simonds Tavern	331 Bedford St.	55.5	53.0	54.5	55.3	55.9
NLX-2	Hancock-Clarke Historic District†	Hancock St.	47.0	42.8	42.9	43.5	43.9
NLX-3	Hancock-Clarke House	35 Hancock St.	46.6	42.6	42.9	43.5	43.8
NLX-4	Garrity House	9 Hancock St.	47.1	42.7	42.9	43.5	43.8
NLX-5	Lexington Green Historic District	Mass. Ave., Harrington Rd. and Bedford St.	47.4	42.9	43.1	43.6	44.0
NLX-6	Lexington Green	Mass. Ave., Harrington Rd. and Bedford St.	47.2	42.7	42.9	43.5	43.9
NLX-7	Buckman Tavern	1 Bedford St.	46.9	42.5	42.7	43.2	43.6
NLX-8	General Samuel Chandler House	8 Goodwin Rd.	46.8	42.5	42.7	43.3	43.7
NLX-9	Hancock School	33 Forest St.	47.3	42.6	43.0	43.6	44.0
NLX-10	U.S. Post Office Building	1661 Mass. Ave.	44.9	40.8	41.1	41.7	42.1
NLX-11	Warren E. Shelburne House	11 Percy Rd.	42.0	38.4	39.3	40.0	40.3
NLX-12	Munroe Tavern Historic District†	Mass. Ave.	39.5	36.6	37.9	38.6	39.0
NLX-13	Sanderson House-Munroe Tavern	1314 & 1332 Mass. Ave.	40.7	37.4	38.5	39.2	39.6
NLX-14	John Mason House	1303 Mass. Ave.	41.0	37.7	38.7	39.4	39.8
NLX-15	East Village Historical District†	Mass Ave.	37.7	35.3	37.4	38.2	38.6
NLX-16	M.H. Merriam and Company	7-9 Oakland Ave.	-	41.6	41.9	42.4	42.8
OLX-1	Battle Green Historic District**	Worthen Rd., Woburn St., Hastings Rd., Mass. Ave. and B&M Railroad	47.2	42.8	42.9	43.5	43.9
OLX-2	National Heritage Museum	33 Marrett Rd.	39.2	36.2	38.1	38.9	39.3
PLX-1	Library **	1874 Mass. Ave.	47.7	43.1	43.3	43.8	44.2

Label[1]	Name[2]	Address (Lexington)	DNL				
			2005	2012	2017	2025	2035
PLX-2	Town Hall **	1625 Mass. Ave.	42.9	39.3	39.8	40.4	40.8
PLX-3	Lexington School District Administration **	1557 Massachusetts Ave.	43.9	40.0	40.4	41.0	41.4
RLX-1	Lexington United Methodist Church/ St. John's Korean United Methodist Church[3]	2600 Massachusetts Ave.	48.1	45.9	47.4	48.1	48.5
RLX-2	Temple Isaiah	55 Lincoln St.	48.5	44.2	45.6	46.2	46.7
RLX-3	Grace Chapel of Lexington	59 Worthen Rd.	49.3	44.6	44.8	45.4	45.8
RLX-4	St. Brigid's Parish *	2001 Mass. Ave.	48.7	44.0	44.2	44.8	45.2
RLX-5	First Parish-Unitarian Church††	7 Harrington Rd.	47.8	43.2	43.4	43.9	44.3
RLX-6	Hancock United Church of Christ ††	1912 Mass. Ave.	47.5	43.0	43.2	43.7	44.1
RLX-7	Church of Our Redeemer	6 Meriam St.	46.7	42.3	42.5	43.1	43.5
RLX-8	Christian Science Reading Room	10 Muzzy St. #12	46.3	41.8	42.1	42.7	43.1
RLX-9	Greek Orthodox Church of St. Nichols **	17 Meriam St.	46.1	42.0	42.2	42.8	43.1
RLX-10	Chabad Center **	9 Burlington St.	52.0	49.9	50.9	51.7	52.2
RLX-11	Pilgrim Congregational Church	55 Coolidge Ave.	48.0	44.9	45.8	46.5	46.9
RLX-12	First Baptist Church of Lexington **	1580 Mass. Ave.	44.0	40.1	40.5	41.1	41.5
RLX-13	Jehovah's Witnesses	196 Woburn St.	38.1	36.7	38.3	39.0	39.4
RLX-14	Follen Church Society-Unitarian Universalists *	755 Massachusetts Ave.	35.6	34.0	37.4	38.2	38.6
RLX-15	Countryside Bible Chapel	480 Lowell St.	39.2	37.3	40.2	41.1	41.5
RLX-16	St. Paul Evangelical Church	451 Lowell St.	37.4	36.2	39.2	40.1	40.4
SLX-1	Minuteman Regional Vocational High School	758 Marrett Rd.	45.9	44.8	45.5	45.9	46.3
SLX-2	Maria Hastings School	2618 Mass. Ave.	47.8	45.4	47.1	47.8	48.2
SLX-3	Methodist Weekday School	2600 Massachusetts Ave.	48.1	46.0	47.5	48.1	48.5

Label[1]	Name[2]	Address (Lexington)	DNL				
			2005	2012	2017	2025	2035
SLX-4	Community Nursery School	2325 Massachusetts Ave.	48.9	45.8	47.0	47.6	48.1
SLX-5	Bridge Elementary School**	55 Middleby Rd.	47.1	42.2	44.5	45.2	45.8
SLX-6	Lexington High School	251 Waltham St.	46.7	41.7	43.0	43.6	44.0
SLX-7	Jonas Clarke Middle School	17 Stedman Rd.	43.5	37.6	41.9	42.8	43.1
SLX-8	Estabrook School**	117 Grove St.	48.6	44.5	45.7	46.3	46.8
SLX-9	Diamond Middle School	99 Hancock St.	51.5	50.1	51.4	52.2	52.8
SLX-10	Fiske Elementary School	146 Maple St.	44.8	42.4	43.9	44.6	45.0
SLX-11	Armenian Sisters Academy	20 Pelham Rd.	40.7	37.2	38.9	39.6	40.0
SLX-12	Harrington Elementary School	148 Maple St.	34.4	33.5	36.1	36.8	37.2

Notes:
1. The first letter of the label indicates the nature of each site: H for hospital, N for sites in the National Register of Historic Places and/or State Register of Historic Places, O for other, P for public facilities, R for religious sites, S for schools. Other is the category for sites that town representatives specifically requested be added to the noise receptor list, but do not fit into the other categories. The second letter (or second and third) indicates the town where the site is located: B for Bedford, C for Concord, LX for Lexington, LN for Lincoln. The labels are unchanged from the *2012 ESPR*.
2. Historic districts and cemeteries are evaluated at a central location within the district or cemetery. Sites that are not designated as "N" sites are marked with an asterisk (*) if they are listed in the National Register of Historic Places and two asterisks (**) if they are listed in the State Inventory/MACRIS. Sites are marked with a (†) if they are only listed in the State Register of Historic Places. Sites marked with a (††) contribute to the Lexington Green Historic District.
3. The Lexington United Methodist Church and St. John's Korean United Methodist Church are at the same address.
Source: HMMH 2018

Table 7-29 projected DNL for 2025 and 2035. Examination of the results yields the following conclusions:

- No sites in Lincoln were at or above 55 dB DNL in 2017.
- In 2017, all sites except SLN-2 increased in DNL relative to 2012.
- Some sites are projected to increase in DNL in 2025 and 2035 relative to 2017 and others decrease.

No sites are forecast to be at or above 55 dB DNL in 2025 and 2035.

Table 7-29 DNL at Noise Analysis Locations in Lincoln (dB)

Label[1]	Name[2]	Address (Lincoln)	DNL 2005	DNL 2012	DNL 2017	DNL 2025	DNL 2035
NLN-1	Walden Pond	Rte. 126, Walden St., Concord Rd.	45.9	42.6	46.2	46.2	46.6
NLN-2	Henry Higginson House	44 Baker Farm Rd.	45.1	42.5	46.5	46.1	46.5
NLN-3	Daniel Brooks House	Brooks Rd.	49.5	48.4	51.9	50.8	51.2
NLN-4	Lincoln Center Historic District	Bedford Rd. Lincoln Rd., Old Lexington Rd. Sandy Pond Rd. Trapelo Rd. Weston Rd.	41.0	41.0	43.1	43.2	43.5
NLN-5	Hoar Tavern	268 Cambridge Tpke.	43.0	41.8	44.0	44.5	44.8
SLN-1	Carroll School	25 Baker Bridge Rd.	41.7	40.8	44.3	44.0	44.4
SLN-2	Hanscom Middle School	Hanscom AFB	49.1	50.2	49.9	50.2	50.4
SLN-3	Hanscom Primary School	Hanscom AFB	45.9	42.6	46.2	46.2	46.6

Notes:
1. The first letter of the label indicates the nature of each site: H for hospital, N for sites in the National Register of Historic Places and/or State Register of Historic Places, O for other, P for public facilities, R for religious sites, S for schools. Other is the category for sites that town representatives specifically requested be added to the noise receptor list, but do not fit into the other categories. The second letter (or second and third) indicates the town where the site is located: B for Bedford, C for Concord, LX for Lexington, LN for Lincoln. The labels are unchanged from the *2012 ESPR*.
2. Historic districts and cemeteries are evaluated at a central location within the district or cemetery. Sites that are not designated as "N" sites are marked with an asterisk (*) if they are listed in the National Register of Historic Places and two asterisks (**) if they are listed in the State Inventory/MACRIS.
Source: HMMH 2018

7.8 Minute Man National Historical Park (MMNHP)

In 1991, Congress directed the National Park Service (NPS) to conduct research on the impacts of aircraft overflying the National Park System in Public Law 100-91, the National Parks Overflights Act. The National Park Service issued Director's Order 47 (DO47) "Soundscape Preservation and Noise Management" in December 2000. The purpose of the order is to "articulate National Park Service operational policies that will require, to the fullest extent practicable, the protection, maintenance, or restoration of the natural soundscape resource in a condition unimpaired by inappropriate or excessive noise sources."

DO47 directs park managers to develop soundscape preservation and noise management plans that are consistent with the individual objectives for the park set forth in the Park General Management Plan. The individual park superintendent is tasked with identifying appropriate noise levels and criteria, as well as a plan for noise management and soundscape preservation. The NPS completed an internal draft soundscape plan for MMNHP in 2010, including noise monitoring with professional and volunteer staff. Sound monitoring was conducted in 2008-09 at MMNHP by the NPS Natural Sounds Division and is included in the internal draft plan. The scope for the soundscape plan at MMNHP incorporated aspects of approaches that have been used at other NPS properties.

In order to address noise levels at various locations in MMNHP, 31 locations were included in the list of noise analysis locations. These sites were also included in the *2012 ESPR*. Table 7-30 presents the DNL at the noise analysis locations in MMNHP for 2005, 2012, 2017 and the projected DNL for 2025 and 2035.

The table shows that none of these 31 locations fell within the 65 dB or 60 dB DNL contours in 2017 or are projected to fall within these contours in 2025 or 2035. Additionally, no portion of the park fell within the 60 dB or 65 dB DNL contours in 2017 (see Figure 7-10) or is projected to in 2025 or 2035 (see Figure 7-17 and Figure 7-18). None of the Historic Battle Road Interpretive Trail fell within the 55 dB DNL contours in 2017 or is projected to in 2025 or 2035.

Due to the increased use of Runway 5/23 during the closure of Runway 11/29 for repaving in August of 2017, the 55 dB DNL contour did extend into the park in 2017. The area of the park within the 55 dB DNL contour is projected to decrease in 2025 and 2035 relative to the area in 2017. The Noah Brooks Tavern (MM-13) had the highest DNL in 2017 at 55.0 dB and is projected to remain the site with the highest DNL in 2025 and 2035, but below current levels.

Table 7-30 DNL at Noise Analysis Locations in the Minute Man National Historical Park (dB)

Label[1]	Name[2]	Unit/Town[3]	DNL				
			2005	2012	2017	2025	2035
MM-1	Major John Buttrick House	North Bridge Unit / Concord	51.2	48.7	48.9	49.6	50.1
MM-2	NPS Headquarters and Visitor Center at 174 Liberty St. (Stedman Buttrick Residence)	North Bridge Unit / Concord	50.5	48.3	48.4	49.1	49.6
MM-3	North Bridge Comfort Station	North Bridge Unit / Concord	50.3	48.2	48.3	49.0	49.4
MM-4	The Minuteman (Statue)	North Bridge Unit / Concord	49.7	47.9	47.9	48.6	49.1
MM-5	North Bridge	North Bridge Unit / Concord	49.9	48.0	48.1	48.8	49.3

Label[1]	Name[2]	Unit/Town[3]	DNL				
			2005	2012	2017	2025	2035
MM-6	Old Manse *	North Bridge Unit / Concord	50.2	48.1	48.2	49.0	49.4
MM-7	The Wayside (Samuel Whitney House) *	Wayside Unit / Concord	53.6	50.3	50.1	50.9	51.4
MM-8	Meriam's Corner Monument	Battle Road Unit / Concord	51.9	50.3	50.3	50.9	51.3
MM-9	Meriam House	Battle Road Unit / Concord	52.1	50.6	50.5	51.2	51.6
MM-10	Historic Farming Fields	Battle Road Unit / Concord	51.4	50.7	50.9	51.1	51.5
MM-11	Olive Stow House/Farwell Jones House/Carty Barn	Battle Road Unit / Concord	50.5	49.2	50.6	50.3	50.6
MM-12	Samuel Brooks House	Battle Road Unit / Concord	52.5	50.8	54.4	53.2	53.6
MM-13	Noah Brooks Tavern (and Carriage House)	Battle Road Unit / Lincoln	53.4	51.4	55.0	53.6	54.0
MM-14	Job Brooks House	Battle Road Unit / Lincoln	53.0	51.5	54.6	53.3	53.7
MM-15	Joshua Brooks, Jr. House	Battle Road Unit / Lincoln	51.7	50.7	53.6	52.4	52.8
MM-16	Bloody Angle	Battle Road Unit / Lincoln	50.1	50.9	51.7	51.0	51.3
MM-17	Ephraim Hartwell Tavern	Battle Road Unit / Lincoln	47.8	49.2	49.3	49.2	49.4
MM-18	Sgt. Samuel Hartwell House Site	Battle Road Unit / Lincoln	47.1	48.5	48.7	48.7	48.9
MM-19	Captain William Smith House	Battle Road Unit / Lincoln	45.8	47.0	47.6	47.7	48.0
MM-20	Paul Revere Capture Site and Marker	Battle Road Unit / Lincoln	45.2	45.8	46.3	46.6	46.8
MM-21	Mile Three Location (Approximate)	Battle Road Unit / Lincoln	44.5	45.5	46.6	46.8	47.1
MM-22	John Nelson House and Barn	Battle Road Unit / Lincoln	45.9	46.0	46.3	46.6	46.8
MM-23	Josiah Nelson, Jr. House Foundation	Battle Road Unit / Lincoln	47.2	47.0	46.9	47.2	47.4

Label[1]	Name[2]	Unit/Town[3]	DNL				
			2005	2012	2017	2025	2035
MM-24	Thomas Nelson, Jr. House Foundation	Battle Road Unit / Lincoln	47.5	47.1	46.9	47.3	47.5
MM-25	Parkers Revenge	Battle Road Unit / Lexington	47.6	47.0	46.8	47.2	47.5
MM-26	Minute Man Visitor Center	Battle Road Unit / Lexington	46.9	46.1	46.2	46.6	46.9
MM-27	Jacob Whittemore House	Battle Road Unit / Lexington	47.6	46.4	46.5	46.9	47.2
MM-28	The Bluff and Monument	Battle Road Unit / Lexington	47.7	45.9	46.3	46.8	47.2
MM-29	Mile Four Location (Approximate)	Battle Road Unit / Lexington	47.7	46.2	46.4	46.8	47.2
MM-30	Ebenezer Fiske House Foundation	Battle Road Unit / Lexington	48.4	46.2	47.6	48.2	48.6
MM-31	Col. James Barrett Farm*	Barrett Farm Unit/Concord	-	43.5	44.8	45.5	45.9

Notes:
1. The Minute Man National Historical Park (MMNHP) is a national historic landmark district. All sites are in the National Register of Historic Places.
2. Sites within MMNHP are marked with an asterisk (*) if they are individually listed in the National Register of Historic Places.
3. Sites in the Battle Road Unit are located on the Battle Road Interpretive Trail. MM-21 and MM-29 do not refer to specific historic resources, but provide additional coverage of sites along the Trail. MM-21 is approximately three miles east of Meriam's Corner and MM-29 is approximately four miles east of Meriam's Corner.
Source: HMMH 2018

Time Above computations with thresholds of 65 dBA and 55 dBA estimate the length of time during an average day in which people could experience outdoor speech interference or require the use of a raised voice at distances of three to four and ten to 15 feet, respectively. This is relevant to activities such as outdoor interpretive programs within Minute Man National Historical Park. Available research data also suggest that noticeability of aircraft occurs at the point at which aircraft noise equals or exceeds the ambient levels. Given that daytime ambient levels in many areas in the MMNHP range from high-30s to mid-40s dBA, the TA55 data suggest that these are times when park visitors could notice aircraft.

Table 7-31 and Table 7-32 show the Time Above values for the 31 points within MMNHP ranged from one to 11 minutes per day over 65 dBA and 17 to 65 minutes per day over 55 dBA. The higher Time Above values occurred in an area stretching from the western end of the Battle Road Unit at sites near Meriam's Corner to the Sgt. Samuel Hartwell House Site, directly south of the intersection of Runways 11/29 and 5/23. These are the closest sites in the Park to

Hanscom Field's runways, and receive noise from several types of aircraft operations including departures turning south off of Runway 29, aircraft departing Runway 23, and pattern operations on Runway 11/29. Location MM-10, the Historic Farming Fields, had the highest TA55 in 2017 and is projected to have the highest TA55 and TA65 in 2025 and 2035.

The sites in MMNHP are expected to experience TA 65 for the future scenarios, ranging from two to eight minutes for the 2025 scenario and two to nine minutes per day for the 2035 scenario. The highest times above 65 dBA were in the range of eight to nine minutes per day and occurred at the Wayside Unit and in the western end of the Battle Road Unit at sites near Meriam's Corner and in Lincoln near the Brooks Tavern and houses. These are among the closest sites in the Park to Hanscom Field's runways, and receive noise from several types of aircraft operations including departures turning south off of Runway 29, aircraft departing Runway 23, and pattern operations on Runway 11/29. The sites in MMNHP are expected to experience TA 55 for the future scenarios, ranging from 19 to 67 minutes for the 2025 scenario and 21 to 71 minutes per day for the 2035 scenario.

Table 7-31 Time Above 65 dB at Noise Analysis Locations in the Minute Man National Historical Park (minutes)

Label[1]	Name[2]	Unit/Town[3]	2005	2012	2017	2025	2035
MM-1	Major John Buttrick House	North Bridge Unit / Concord	5.9	3.1	4.2	5.2	5.9
MM-2	NPS Headquarters and Visitor Center at 174 Liberty St. (Stedman Buttrick Residence)	North Bridge Unit / Concord	5.1	2.8	3.9	4.9	5.5
MM-3	North Bridge Comfort Station	North Bridge Unit / Concord	4.9	2.7	3.8	4.8	5.4
MM-4	The Minuteman (Statue)	North Bridge Unit / Concord	4.5	2.5	3.4	4.3	4.8
MM-5	North Bridge	North Bridge Unit / Concord	4.7	2.7	3.5	4.5	5.0
MM-6	Old Manse *	North Bridge Unit / Concord	5.1	2.9	3.7	4.8	5.3
MM-7	The Wayside (Samuel Whitney House) *	Wayside Unit / Concord	8.8	5.7	6.3	7.8	8.6
MM-8	Meriam's Corner Monument	Battle Road Unit / Concord	8.4	5.7	6.3	7.4	8.1
MM-9	Meriam House	Battle Road Unit / Concord	8.8	6.2	6.7	7.9	8.6
MM-10	Historic Farming Fields	Battle Road Unit / Concord	8.0	7.0	7.9	8.1	8.7

Label[1]	Name[2]	Unit/Town[3]	2005	2012	2017	2025	2035
MM-11	Olive Stow House/Farwell Jones House/Carty Barn	Battle Road Unit / Concord	4.9	4.7	6.9	6.0	6.3
MM-12	Samuel Brooks House	Battle Road Unit / Concord	4.2	6.6	10.5	7.7	8.1
MM-13	Noah Brooks Tavern (and Carriage House)	Battle Road Unit / Lincoln	4.1	7.3	10.4	7.6	8.0
MM-14	Job Brooks House	Battle Road Unit / Lincoln	4.4	8.0	10.5	7.7	8.0
MM-15	Joshua Brooks, Jr. House	Battle Road Unit / Lincoln	4.0	7.1	9.6	7.0	7.4
MM-16	Bloody Angle	Battle Road Unit / Lincoln	4.2	7.3	8.1	6.5	6.9
MM-17	Ephraim Hartwell Tavern	Battle Road Unit / Lincoln	2.8	4.1	4.9	4.3	4.5
MM-18	Sgt. Samuel Hartwell House Site	Battle Road Unit / Lincoln	2.1	2.9	3.6	3.3	3.4
MM-19	Captain William Smith House	Battle Road Unit / Lincoln	1.2	1.5	2.3	2.4	2.5
MM-20	Paul Revere Capture Site and Marker	Battle Road Unit / Lincoln	1.1	1.1	2.0	2.2	2.3
MM-21	Mile Three Location (Approximate)	Battle Road Unit / Lincoln	0.8	1.0	2.0	2.1	2.2
MM-22	John Nelson House and Barn	Battle Road Unit / Lincoln	1.4	1.3	2.0	2.1	2.2
MM-23	Josiah Nelson, Jr. House Foundation	Battle Road Unit / Lincoln	2.2	1.8	2.2	2.4	2.5
MM-24	Thomas Nelson, Jr. House Foundation	Battle Road Unit / Lincoln	2.6	1.9	2.3	2.5	2.6
MM-25	Parkers Revenge	Battle Road Unit / Lexington	2.5	1.9	2.3	2.5	2.6
MM-26	Minute Man Visitor Center	Battle Road Unit / Lexington	2.2	1.4	2.0	2.2	2.3
MM-27	Jacob Whittemore House	Battle Road Unit / Lexington	2.8	1.6	2.2	2.4	2.6
MM-28	The Bluff and Monument	Battle Road Unit / Lexington	2.9	1.5	2.4	2.6	2.8

Label[1]	Name[2]	Unit/Town[3]	2005	2012	2017	2025	2035
MM-29	Mile Four Location (Approximate)	Battle Road Unit / Lexington	2.8	1.6	2.3	2.5	2.6
MM-30	Ebenezer Fiske House Foundation	Battle Road Unit / Lexington	3.6	2.0	3.2	3.4	3.8
MM-31	Col. James Barrett Farm*	Barrett Farm Unit/Concord	-	0.7	1.4	1.7	1.9

Notes:
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2. Sites within Minute Man National Historical Park are marked with an asterisk (*) if they are individually listed in the National Register of Historic Places.
3. Sites in the Battle Road Unit are located on the Battle Road Interpretive Trail. MM-21 and MM-29 do not refer to specific historic resources, but provide additional coverage of sites along the Trail. MM-21 is approximately three miles east of Meriam's Corner and MM-29 is approximately four miles east of Meriam's Corner.
Source: HMMH 2018

Table 7-32 Time Above 55 dB at Noise Analysis Locations in the Minute Man National Historical Park (minutes)

Label[1]	Name[2]	Unit/Town[3]	2005	2012	2017	2025	2035
MM-1	Major John Buttrick House	North Bridge Unit / Concord	38.5	26.6	33.4	39.0	42.6
MM-2	NPS Headquarters and Visitor Center at 174 Liberty St. (Stedman Buttrick Residence)	North Bridge Unit / Concord	35.5	26.1	32.2	37.6	41.2
MM-3	North Bridge Comfort Station	North Bridge Unit / Concord	34.5	25.8	32.0	37.3	40.9
MM-4	The Minuteman (Statue)	North Bridge Unit / Concord	30.1	25.1	31.4	36.6	40.0
MM-5	North Bridge	North Bridge Unit / Concord	31.0	25.8	32.1	37.5	41.0
MM-6	Old Manse *	North Bridge Unit / Concord	30.6	26.3	32.8	38.2	41.7
MM-7	The Wayside (Samuel Whitney House) *	Wayside Unit / Concord	43.8	34.4	42.3	46.4	49.9
MM-8	Meriam's Corner Monument	Battle Road Unit / Concord	53.8	47.0	49.6	53.0	56.9
MM-9	Meriam House	Battle Road Unit / Concord	55.6	51.0	51.4	55.1	59.2
MM-10	Historic Farming Fields	Battle Road Unit / Concord	70.8	77.2	65.1	66.8	71.1

Label[1]	Name[2]	Unit/Town[3]	2005	2012	2017	2025	2035
MM-11	Olive Stow House/Farwell Jones House/Carty Barn	Battle Road Unit / Concord	53.2	57.1	58.3	56.7	59.9
MM-12	Samuel Brooks House	Battle Road Unit / Concord	38.9	52.3	55.3	49.1	51.1
MM-13	Noah Brooks Tavern (and Carriage House)	Battle Road Unit / Lincoln	34.8	51.1	52.4	45.9	47.7
MM-14	Job Brooks House	Battle Road Unit / Lincoln	37.0	57.2	54.9	48.4	50.2
MM-15	Joshua Brooks, Jr. House	Battle Road Unit / Lincoln	32.9	53.2	51.5	44.9	46.5
MM-16	Bloody Angle	Battle Road Unit / Lincoln	46.9	84.4	64.0	58.8	60.3
MM-17	Ephraim Hartwell Tavern	Battle Road Unit / Lincoln	42.9	72.5	50.7	48.5	49.4
MM-18	Sgt. Samuel Hartwell House Site	Battle Road Unit / Lincoln	39.4	63.5	44.7	43.0	43.7
MM-19	Captain William Smith House	Battle Road Unit / Lincoln	28.7	45.7	33.3	32.0	32.6
MM-20	Paul Revere Capture Site and Marker	Battle Road Unit / Lincoln	21.0	31.0	24.9	25.0	25.7
MM-21	Mile Three Location (Approximate)	Battle Road Unit / Lincoln	17.7	25.9	22.5	21.6	22.2
MM-22	John Nelson House and Barn	Battle Road Unit / Lincoln	26.5	32.7	25.2	26.1	27.0
MM-23	Josiah Nelson, Jr. House Foundation	Battle Road Unit / Lincoln	36.6	42.6	30.0	31.2	32.4
MM-24	Thomas Nelson, Jr. House Foundation	Battle Road Unit / Lincoln	38.4	43.1	30.1	31.4	32.7
MM-25	Parkers Revenge	Battle Road Unit / Lexington	38.2	41.1	28.7	30.1	31.4
MM-26	Minute Man Visitor Center	Battle Road Unit / Lexington	31.6	31.3	23.9	25.2	26.4
MM-27	Jacob Whittemore House	Battle Road Unit / Lexington	35.3	32.5	24.2	25.7	27.0
MM-28	The Bluff and Monument	Battle Road Unit / Lexington	29.5	24.4	20.3	21.7	23.0

Label[1]	Name[2]	Unit/Town[3]	2005	2012	2017	2025	2035
MM-29	Mile Four Location (Approximate)	Battle Road Unit / Lexington	34.1	29.7	22.9	24.4	25.7
MM-30	Ebenezer Fiske House Foundation	Battle Road Unit / Lexington	30.7	19.8	18.1	19.5	20.9
MM-31	Col. James Barrett Farm*	Barrett Farm Unit/Concord	-	11.9	16.5	18.8	20.5

Notes:
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2. Sites within Minute Man National Historical Park are marked with an asterisk (*) if they are individually listed in the National Register of Historic Places.
3. Sites in the Battle Road Unit are located on the Battle Road Interpretive Trail. MM-21 and MM-29 do not refer to specific historic resources, but provide additional coverage of sites along the Trail. MM-21 is approximately three miles east of Meriam's Corner and MM-29 is approximately four miles east of Meriam's Corner.
Source: HMMH 2018

7.9 Stakeholder Engagement and Beneficial Measures

Massport has a long history of noise abatement at Hanscom Field, dating back to at least 1978, when it introduced measures to minimize noise. These measures were officially adopted as Massport regulations in 1980.[98] The regulation included restrictions on touch-and-go training activity, as well as a nighttime field use surcharge to discourage operations between 11:00 PM and 7:00 AM. More recently, Massport has implemented measures to monitor and reduce noise in the communities near Hanscom Field. These include guidelines for run-ups and the use of Auxiliary and Ground Power Units, a Noise and Operations Monitoring system, a Fly Friendly program, and membership in Sound Initiative. In 2009, Massport made some adjustments to the touch-and-go flight tracks, which reduced the amount of direct flights over the MMNHP and nearby residences. A brochure describing the changes was jointly released by Massport and the NPS, and is distributed to pilots and the public directly, through Massport's website, and is required training for all tenants who receive airport badges. [99]

7.9.1 Community Meetings

Massport strives to build positive community relations and public confidence by maintaining open communications and by supporting programs that assist in addressing the concerns of Hanscom Field's stakeholders and host communities. Massport staff regularly attends monthly community meetings to inform the public of airport planning and policy developments.

[98] Part F of the General Rules and Regulations for Laurence G. Hanscom Field Effective July 31, 1980.
[99] Massport Noise Abatement at Hanscom Field website, accessed at: https://www.massport.com/hanscom-field/about-hanscom/noise-abatement/

Massport also sponsors informational meetings with the communities and other interested parties when appropriate. Massport staff regularly attend the monthly meetings of the Hanscom Field Advisory Commission (HFAC) and the Hanscom Area Towns Committee (HATS).

The HFAC was established by the legislature in 1980 to review Massport decisions regarding its goals, policies and plans for the airport. It includes representatives from the aviation and residential communities as well as advisory members who represent MMNHP, Hanscom AFB, the FAA, and Massport. Massport staff members provide HFAC with information regarding Massport's goals, policies and plans for the airport. Additionally, staff members prepare and present monthly aircraft activity and noise reports, capital program and third party development status reports, as well as the annual State of Hanscom report and the Annual Noise Report.

HATS was created to consider matters of common interest to the four towns that are contiguous to Hanscom Field and Hanscom AFB. One select-board member from each town serves on HATS along with planning board representatives and at-large members from the towns. HATS representatives consider regional traffic, planning, land use and other issues. Massport staff members attend the HATS meetings to address Massport-related agenda items, participate in discussions, and respond to questions relating to Hanscom Field and Massport.

7.9.2 Community Contributions

Massport's Charitable Contribution, Scholarship, Summer Internship, and Community Summer Jobs Programs benefit organizations located in communities that host its facilities. The organizations serve a diverse constituency and a variety of worthwhile purposes. In 2017, Massport contributed over $7,000 to educational, scholarship, and youth programs in the Hanscom area. Additionally, Massport provided approximately $12,000 to sponsor summer internship positions at various municipal departments in the four Hanscom towns and over $14,000 for the salaries of local college students that worked directly for Massport.

7.9.3 Run-up Procedures

Massport has a well-defined aircraft engine maintenance run-up procedure for Hanscom Field. Aircraft are directed to the "run-up pad" located due south of Runway 11/29, west of the intersection with Runway 5/23. At the run-up pad, aircraft are directed to maintain a west heading when conducting run-ups; there is a short "blast fence" on the east side of the pad, which deflects jet exhaust, prop wash, and debris. Furthermore, Massport discourages operators from conducting nighttime run-ups.

After Shuttle America began performing regular aircraft maintenance at Hanscom Field, there were times when nighttime run-ups occurred for maintenance purposes. After receiving multiple complaints, mostly from residents in newly constructed homes along Virginia Road, Massport re-located those nighttime run-ups to the east end of the East Ramp, away from this residential community. Shuttle America has since discontinued service to Hanscom Field, and subsequently there have been no regular nighttime maintenance run-ups at Hanscom.

Massport will continue to direct operators to the run-up pad during the day, and to the East Ramp at night, should extenuating circumstances require such activities. The optimal orientation for run-ups at the East Ramp is a magnetic heading of approximately 230 degrees, aligned with Runway 5/23, whenever feasible based on wind conditions. This heading will minimize sound levels at homes north of the approach end of Runway 11/29, while providing a substantial reduction in sound levels at the more recently constructed homes along Virginia Road (relative to levels during run-ups conducted at the run-up pad). This heading is desirable for use regardless of aircraft type, though jet aircraft are likely to be more sensitive to crosswind conditions and may not be able to use the preferred heading as often as propeller aircraft can.

7.9.4 Auxiliary Power Units and Ground Power Units

Massport has additional ground noise procedures in effect minimizing the use of on-board Auxiliary Power Units (APUs) and Ground Power Units (GPUs). APUs and GPUs provide electricity, heat and air conditioning to an aircraft when its engines are off.

At Hanscom Field, APU and GPU use is prohibited outside of hangars between 11:00 PM and 7:00 AM, unless their use is part of takeoff procedures, or for necessary maintenance procedures. Between 7:00 AM and 11:00 PM, the use of APUs is limited to 30 minutes.

When operationally feasible, the use of GPUs is preferred over APUs. Although the noise levels produced by GPUs are not insignificant, (they are similar to an idling diesel truck), they are considerably lower than the noise levels produced by a typical APU. In addition, GPUs generally are more fuel efficient than APUs and less expensive to run from a maintenance standpoint. Reduction of APU use may also have the benefit of reducing emissions. It should be noted that it is not feasible to completely eliminate APU use, because APUs may be needed to start the aircraft main engines, and maintenance requiring operation of the APU may sometimes need to be performed at locations where alternative power is not readily available.

7.9.5 Field Use Fee

Although the FAA control tower is closed from 11:00 PM to 7:00 AM, Hanscom Field is a public facility and is open for use 24 hours a day. In the summer of 1980, an 11:00 PM to 7:00 AM “nighttime field use fee” surcharge was instituted to discourage the use of the field between 11:00 PM and 7:00 AM. The fee is based on aircraft weight and doubles for aircraft that conduct more than five night operations in a calendar year. In 1980 the surcharge were $20 for aircraft weighing 12,500 pounds or fewer and $150 for aircraft weighing more than 12,500 pounds.

In 1989, the Massport Board voted to increase the surcharge to reflect the Consumer Price Index (CPI) increase between 1980 and 1989 and to institute an annual CPI increase, effective each July 1. This schedule coincides with Massport’s fiscal years, which run from July 1 to June

30 annually. As a result, the surcharges were $59 and $428 for the first six months of 2017, and $60 and $438 for the second half of 2017.

Some operations are exempted from the fee. The overwhelming majority of exemptions are medical flights, which are dominated by the medical evacuation service Boston MedFlight based at Hanscom Field. Exemptions also included military, FAA, and Civil Air Patrol operations, as well as Hanscom Field based aircraft that used the airport between 11 p.m. and 7 a.m. due to unavoidable circumstances, such as weather, mechanical, or FAA delays.

7.9.6 Noise and Operations Monitoring System

Massport's original Noise and Operations Monitoring System (NOMS) was installed in 1989. It included six permanent noise monitors near Hanscom Field. In 2004, Massport selected Rannoch Corporation, now Harris Corporation, to replace the system's microphones and software. The replacement NOMS incorporates state-of-the-art capabilities that have improved the accuracy, efficiency, usefulness, reliability, and user-friendliness of the system.

Hanscom Airport Activity Monitor website includes:

- **Complaint entry;**
- **Near-real-time[1] and historical aircraft flight tracks; and**
- **Customized reports for any time period for DNL, hourly Leq, and noise events at the permanent noise monitors.**

Note[1]: Flight track data is delayed by ten minutes for security purposes.

Hanscom staff members began experiencing the benefits of the new system in 2007, and have been able to provide callers with more information about disturbing flights than was available in the past. An interactive website has been developed for public use.[100] Data from the system are shared with the communities on a monthly basis at the HFAC meetings. The NOMS is continuously improved to increase the accuracy and usefulness of the data as well as ease of use.

7.9.7 Fly Friendly Program

Although Massport began supporting the use of the National Business Aviation Association's (NBAA's) noise abatement procedures for jet aircraft in the mid-1980s, the Fly Friendly program at Hanscom Field provided an opportunity to broaden such efforts. Massport expanded its support of quiet arrival and departure techniques by publicizing the Aircraft Owners and Pilot Association's (AOPA's) noise abatement procedures for piston aircraft and by developing and publicizing quiet flying procedures for helicopters. Part of this effort included the development of a multi-faceted publicity program that results in pilots being exposed and re-exposed to the importance and understanding of the quiet-flying techniques, as follows:

[100] http://www.massport.com/hanscom-field/about-hanscom/airport-activity-monitor/

- ⇨ Handouts outlining the procedures are distributed at the FBOs, the flight schools, and in Massport's Hanscom Field offices.
- ⇨ Framed posters describing noise abatement procedures are located in the flight schools' offices, Massport's offices, and the fixed base operators' facilities.
- ⇨ Videos describing the techniques for both jet and piston aircraft are incorporated into the training required to qualify for a Hanscom Field security badge.
- ⇨ Descriptions of these quiet flying procedures are posted on Massport's website.
- ⇨ Signage on the airfield provides a last minute reminder to departing pilots to use quiet flying techniques.

7.9.8 Touch and Go Program

In late 2009, Massport staff began using flight track data created by the new noise monitoring system to identify potential opportunities for reducing touch-and-go traffic over the Hartwell Tavern area in the Minute Man National Historical Park. Massport also initiated communications with the FAA and the Hanscom Field flight schools to identify practical recommendations and help create an implementation program. By working together, touch-and-go patterns for each runway were devised to safely increase the number of flights that fly over the airport, which inherently minimizes aircraft noise for the park's visitors. An aggressive publicity program was implemented, including the display of framed posters, mailings, and meetings with pilots and flight instructors, as well as local press coverage.

Massport staff has since continued to work with local pilots and the FAA to reduce the number of flights over the MMNHP. Flight track data is reported quarterly. Results of the touch and go program are shared with pilots, certified flight instructors, the FAA and MMNHP staff. Massport also communicates MMNHP special events to local pilots and encourages the flying community to review Hanscom's Fly Friendly recommendations. The result is an average of 22% fewer flights over the Park since the inception of the program in 2009.

7.9.9 Sound Initiative

Massport was an active participant in Sound Initiative, a coalition that supported the federal phase out of Stage 2 aircraft weighing less than 75,000 pounds. Stage 2 aircraft were manufactured before today's stringent noise standards were adopted for new airplanes. The use of Stage 2 aircraft weighing over 75,000 pounds was phased out nationally by 2000, but most of Hanscom Field's jets weigh less than 75,000 pounds. In 2012, Congress passed the FAA Modernization and Reform Act, which included the phase out of all non-stage 3 aircraft by December 31, 2015. Section 506 of the Act prohibits the operation, within the 48 contiguous states, of jets weighing 75,000 pounds or less that do not comply with Stage 3 noise levels. Military aircraft are exempt from the Stage 3 Rule.

8 Air Quality

This chapter of the 2017 ESPR describes air quality and air emissions in the study area from aircraft activity and from motor vehicles accessing the airport. The 2025 and 2035 growth scenarios represent estimates of what could occur (not what will occur) in the future using certain planning assumptions, described in Chapter 3 Airport Activity Levels.

This chapter provides background information on regulations addressing air quality at the state and federal levels, and includes a summary of the current state of FAA research into a replacement for leaded aviation fuel. Carbon monoxide, nitrogen oxides, volatile organic compounds, lead, sulfur dioxide and particulate matter emissions from aircraft operations, ground support equipment, stationary sources (such as generators) and vehicular traffic are described and quantified. Current emissions levels are compared to those described in prior ESPRs, as well as future forecasted levels in 2025 and 2035.

Massport has a sustainability and resiliency plan, which includes the preparation of Greenhouse Gas (GHG) emissions inventories from their facilities and operations. This document includes the first GHG emissions inventory for Hanscom Field, which will be used as a baseline to track changes over time.

8.1 Air Quality Key Findings

Massport calculated 2017 annual emissions of criteria pollutants from aircraft operations at Hanscom Field and from motor vehicles accessing the airport. These were compared to the emissions data for 1985, 1995, 2000, 2005 and 2012, which were published in the *2012 ESPR*. Results of the analysis demonstrate that emissions associated with Hanscom Field activity continue to represent a very small fraction of regional emissions.

The forecasted emission levels from Hanscom Field for the future scenarios are not anticipated to result in adverse air quality effects. For all scenarios, air quality concentrations in Bedford, Concord, Lexington, Lincoln, Minute Man National Historical Park (MMNHP), and Great Meadows National Wildlife Refuge (GMNWR) will be in compliance with the Massachusetts and National Ambient Air Quality Standards. Key findings from this chapter include:

- Aircraft emissions for all pollutants except carbon monoxide (CO) and nitrogen oxides (NO_x) decreased between 2012 and 2017.
- While overall operations were lower in 2017 than in 2012, which resulted in fewer emissions for most pollutants, emissions levels for CO and NO_x increased. These increases are due primarily to modeling differences between the Federal Aviation Administration's [FAA] Aviation Environmental Design Tool [AEDT] and the Emissions and Dispersion Modeling System (EDMS). AEDT is now required and has replaced EDMS, which was used for prior ESPRs.
- Emissions of pollutants forecasted for 2025 and 2035 presented in the *2017 ESPR* are below those forecasted for 2020 and 2030 in the *2012 ESPR*.
- For the first time, Massport has added an estimate of Greenhouse Gas (GHG) to the Hanscom Field emissions inventory. While the MEPA regulations require GHG analyses for projects, consistent with the Logan ESPR/EDR process, Massport has agreed to add an airport-wide GHG inventory to the Hanscom ESPR process. This initial inventory will serve as a baseline for future ESPR analyses.

Air quality in the region currently meets all National and Massachusetts Ambient Air Quality Standards (NAAQS & MAAQS) set by the U.S. Environmental Protection Agency and the Massachusetts Department of Environmental Protection.

- **NAAQS / MAAQS are set for six criteria pollutants to protect human health and welfare. Criteria pollutants include:**
  - **Carbon monoxide (CO);**
  - **Lead (Pb);**
  - **Nitrogen dioxide (NO_2);**
  - **Ozone (O3);**
  - **Particulate matter (PM), and;**
  - **Sulfur dioxide (SO_2).**
- **The region is forecasted to be in attainment for all pollutants in both future year scenarios (2025 and 2035).**
- **Aircraft emissions decreased for Pb, O_3, PM and SO_2 between 2012 and 2017, and increased for CO and NO_2.**

- Aircraft emissions of criteria pollutants and greenhouse gases (GHG) for each of the future year scenarios (2025 and 2035) are forecasted be higher than those for the year 2017 based on a predicted growth in operations. The exception is emissions of CO for 2025 and 2035, which show a slight decrease compared to 2017 due to changes in fleet mix. Specifically, forecasts for 2025 and 2035 (as described in Chapter 3 Airport Activity Levels) indicate a growth in jet aircraft operations and a reduction in single engine piston aircraft operations compared to 2017. Jet engines emit less CO than piston engines, which accounts for the estimated reduction in CO despite a forecasted growth in overall operations for 2025 and 2035.
- These estimates are conservative because the air quality model does not assume any improvements in engine performance and efficiency over time.
- Ground transportation emissions of all criteria pollutants are expected to decrease in the future year scenarios due to more efficient vehicles which will offset the increase in vehicle miles traveled.

8.1.1 Changes Since 2012

The Greater Boston area, including Hanscom Field communities, is currently in attainment with all National Ambient Air Quality Standards (NAAQS) and Massachusetts Ambient Air Quality Standards (MAAQS), established by the U.S. Environmental Protection Agency (EPA). Areas that are "in attainment" are determined by the EPA to meet applicable air quality standards (i.e. the concentration of specific air emissions is below the level required to protect human health and welfare). As reported in the *2012 ESPR,* the Greater Boston area was at the time designated as in non-attainment for the 1997 8-hour ozone (O_3) NAAQS (i.e. measured concentrations of O_3 exceeded those set by the EPA as necessary to protect public health and welfare). Figure 8-1 provides definitions of air quality designations under the NAAQS.

The 1997 O_3 standard was updated and replaced by a new O_3 standard in 2015. In September 2016, Massachusetts recommended to EPA that all areas in the Commonwealth be designated as in attainment of the 2015 standards, based on 2013-2016 monitoring data. In a response dated November 2017, EPA designated all counties in Massachusetts as in attainment for the 2015 O_3 standards, including Middlesex County and its surrounding counties.[101]

The Massachusetts Department of Environmental Protection (MassDEP) air monitoring data for the Greater Boston area were analyzed for the *2017 ESPR* to evaluate air quality trends in the region for 10 to 20 years (varies by type of air pollutant) prior to and including 2017. As with prior ESPRs, Massport utilized MassDEP air quality monitoring data from Kenmore Square and Chelmsford monitoring locations to determine air quality levels for the current year and to compare those levels with air quality levels in the past. Historical air quality monitoring data from MassDEP reveal that air quality in the Greater Boston area has improved substantially

[101] U.S. EPA. December 2017. *Letter from Deborah A Szaro, EPA Acting Regional Administrator, to Massachusetts Governor Charles Baker*. https://www.epa.gov/sites/production/files/2017-12/documents/ma-epa-resp-ozone.pdf

during this period, including improvements since the *2012 ESPR*. The Kenmore Square and Chelmsford monitoring locations were selected to ensure the monitoring data is conservative (i.e. levels are higher) than concentrations in Hanscom Field area communities (discussed further in Section 8.3).[102]

Aircraft emissions of four of the six criteria pollutants (sulfur dioxide, ozone, lead, and particulate matter) decreased from 2012 to 2017 primarily due to a reduction in operations. Emissions of the remaining two criteria pollutants, CO and NO_x (represented by nitrogen dioxide, or NO_2) increased. These increases are largely attributable to modeling differences between EDMS (used for the *2012 ESPR)* and AEDT, which was used for the *2017 ESPR* (as per current FAA requirements). Criteria pollutants are described in Section 8.2 and Table 8-1.

Roadway emissions estimates for all pollutants at Hanscom declined between 2012 and 2017 due to a variety of factors, including:

- Lower traffic volumes;
- The use of an updated and more accurate EPA mobile source emission model to estimate motor vehicle emissions;
- The effects of more stringent vehicle emissions inspection and maintenance regulations;
- Phasing out of older, less efficient vehicles.

8.1.2 Emissions Model Updates

The *2017 ESPR* used FAA's AEDT to model air emissions from aircraft operations at Hanscom Field. Prior ESPRs used FAA's EDMS. While the models are similar in some ways, AEDT includes more precise flight paths and weather models, and more current airframe and engine data. These improvements result in more accurate estimates of fuel burn and emissions.[103] These changes can cause some differences in emissions estimates. For example, as noted in the preceeding section, while there were fewer operations at Hanscom Field in 2017 than in 2012, estimated levels of CO and NO_2 increased. This increase is primarily attributed to methodology differences between AEDT and EDMS. More discussion on the differences between AEDT and EDMS is included in Appendix E and on FAA's AEDT website.[104]

[102] MassDEP. 1997-2017. MassDEP Annual Air Quality Reports. https://www.mass.gov/lists/massdep-air-monitoring-plans-reports-studies
[103] Federal Aviation Administration, 2016. *AEDT & Legacy Tools Comparison.* June, 2016. Accessed at: https://aedt.faa.gov/Documents/Comparison_AEDT_Legacy_Summary.pdf
[104] https://aedt.faa.gov/

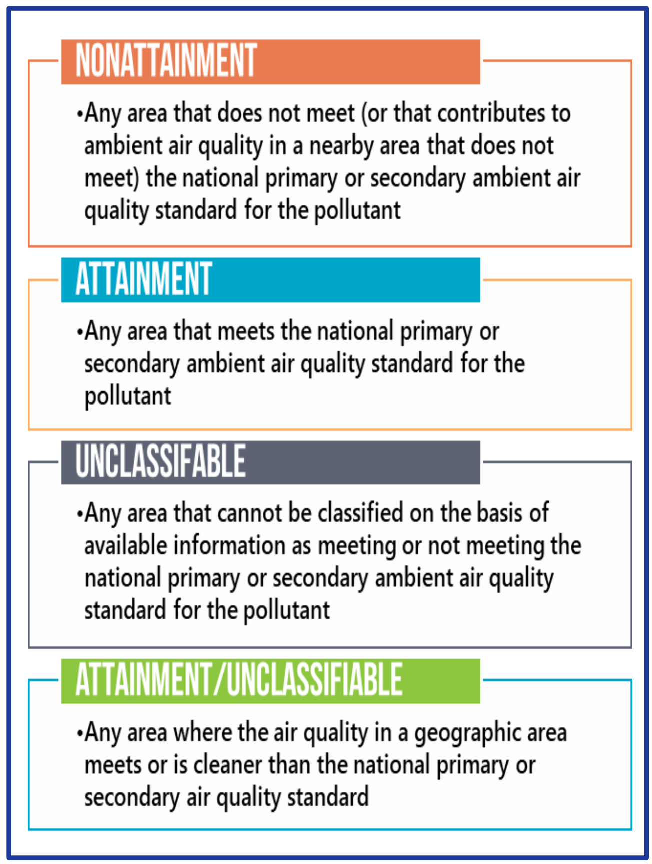
8.2 Regulatory Background

The U.S. Clean Air Act (CAA) requires EPA to set, review, and periodically update the NAAQS for six common air pollutants, called criteria air pollutants: carbon monoxide (CO); lead (Pb); nitrogen dioxide (NO_2); ozone (O_3); particulate matter (PM); and sulfur dioxide (SO_2).

The EPA sets NAAQS at levels intended to protect public health and the environment, and designates all areas of the country as either in attainment (in compliance), or nonattainment areas (not in compliance) regarding the standards.[105] Areas without sufficient air quality monitoring data to make a determination of attainment are designated as unclassifiable. States are required to develop State Implementation Plans (SIPs) to meet and maintain air quality standards, working with EPA to set timeframes and milestones for compliance. Figure 8-1 depicts this process.[106]

MassDEP is the designated state agency for the implementation of the SIP. MassDEP is responsible for monitoring outdoor air quality in the state as well as developing plans and regulatory programs to reduce emissions of pollutants that adversely affect public health, welfare, and the environment. MassDEP ensures compliance with the Massachusetts Clean Air Act (MCAA) and its associated MAAQS for criteria pollutants in addition to the federal air quality regulations. The MAAQS are state level air quality standards, which vary from federal standards in some cases for both acceptable levels and methodology to determine compliance (see Table 8-1). The relationship between the federal and

Figure 8-1 Clean Air Act (CAA) Designations for NAAQS



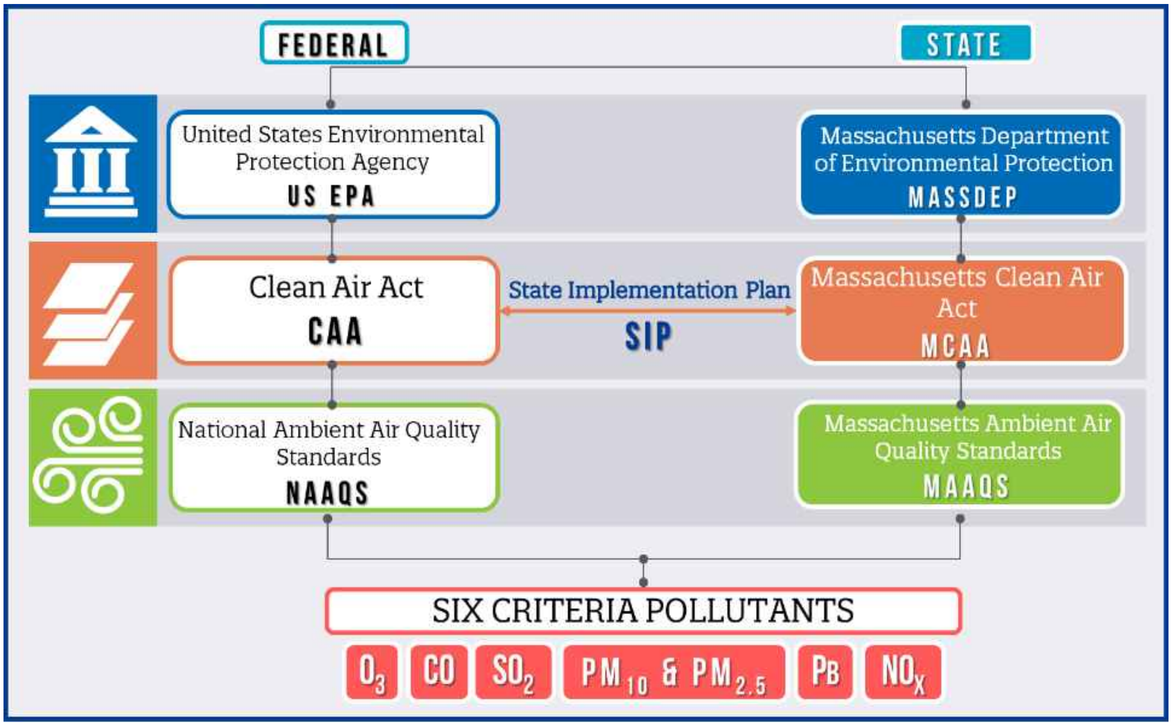
Sources: 42 U.S.C. §§ 7401 §107(d)

[105] The NAAQS include primary standards designed to protect public health, including the most vulnerable populations, and secondary standards, intended to protect public welfare (i.e. visibility, animals, crops, vegetation and buildings).

[106] U.S. EPA. February 2018. *NAAQS Implementation Process*. https://www.epa.gov/criteria-air-pollutants/naaqs-implementation-process

state air quality regulations is shown in Figure 8-2. Associated air quality regulations, plans, and policies are discussed throughout the remainder of this section.

Figure 8-2 Relationship Between Federal and State Air Quality Regulations



8.2.1 Criteria Air Pollutant Definition and Air Quality Standards

The six criteria pollutants listed above are subject to monitoring at the federal level under the CAA, through the NAAQS, as well as at the state level through MCAA and MAAQS under the SIP for Massachusetts.

The Hanscom Field sources of SO_2, O_3, CO, and NO_2 include aircraft, vehicles, ground support equipment (GSE), stationary sources (such as generators), and construction activity. Fuel storage and transfer is a source of both NO_2 and volatile organic compounds (VOCs), which are precursors to O_3.

Carbon monoxide (CO)

CO is a colorless, odorless, and tasteless gas. It may temporarily accumulate, especially in cool, calm weather conditions, when fuel use reaches a peak, because CO is chemically most stable in low temperatures. CO from natural sources usually dissipates quickly, posing no threat to human health. Transportation sources (e.g., motor vehicles), energy generation, and open burning are among the predominant man-made sources of CO.

Lead (Pb)

Lead in the atmosphere is generated from industrial sources including waste oil and solid waste incineration, iron and steel production, lead smelting, and battery and lead manufacturing. The lead content of motor vehicle emissions, which was the major source of air-borne lead in the past, has significantly declined with the widespread use of unleaded fuel. Low-lead fuel used in some general aviation (GA) aircraft is still a source of airport-related lead in the atmosphere. Lead emissions can enter the body through inhalation or be ingested via plants, water or soil.

The most recent lead NAAQS were set in 2008, when the EPA revised the prior NAAQS following a finding that serious health effects occur at much lower levels of lead in the blood stream than previously identified.[107] Periodic strengthening of the standard is intended to protect public health, specifically protecting at-risk groups in the population, including children.

The EPA is also currently conducting an analysis, including modeling and monitoring, to evaluate whether lead emissions from avgas could cause or contribute to air pollution that endangers public health and welfare (also called an "endangerment finding") which could lead to additional regulations in the future. More information on the current status of lead research is included in Appendix E.

Nitrogen dioxide (NO_2)

Nitric oxide (NO), nitrogen dioxide (NO_2), and the nitrate radical (NO_3) are collectively called oxides of nitrogen (NO_x). These three compounds are interrelated, often changing from one form to another in chemical reactions, and NO_2 is the compound commonly measured for comparison to the NAAQS. NO_x is generally emitted in the form of NO, which is oxidized to NO_2. The principal man-made source of NO_x is fuel combustion in motor vehicles and power plants – aircraft engines are also a source. Reactions of NO_x with other atmospheric chemicals can lead to formation of ozone (O_3) and acidic precipitation.

The state's 1-hour value for NO_2 of 320 $\mu g/m^3$ is a MassDEP policy guideline (not a regulatory standard) that is only applicable to major stationary sources emitting over 250 tons per year of NO_2. Although it is not applicable to Hanscom Field in a regulatory sense (as Hanscom Field is not considered a stationary source), Massport has used the guideline value in previous airport air quality assessments, and it is included in the *2017 ESPR* for consistency. It should be noted that the federal 1-hour value for NO_2 of 100 $\mu g/m^3$ is applicable to Hanscom Field, and was considered in the modeling of future conditions in 2025 and 2035.

[107] Since then, the EPA has reviewed the lead NAAQS and in 2016 issued a determination confirming that the 2008 NAAQS will be retained. See "Review of the National Ambient Air Quality Standards for Lead". Federal Register 81-201 (October 18, 2016), page 71906. Available from Government Publishing Office at www.govinfo.gov

Oxygen (O_3)

O_3 is a secondary pollutant, formed from daytime reactions of NO_x and volatile organic compounds (VOCs) in the presence of sunlight. VOCs, which are a subset of hydrocarbons (HC) and have no NAAQS, are released in industrial processes and from evaporation of gasoline and solvents. Sources of NO_x are discussed above.

Ground-level (Tropospheric) O_3 and Stratospheric O_3 (in the upper atmosphere) are the same chemical compound, just found at different places in the atmosphere. Stratospheric O_3 at greater than 30,000 feet above the surface of the earth is beneficial to all life because it filters out the sun's harmful UV radiation before it reaches the earth's surface. However, ground-Level O_3 is a health and environmental problem. The discussion of O_3 in this report pertains exclusively to ground-level O_3.

Particulate Matter (PM)

Particulate matter comprises very small particles of dirt, dust, or soot, or liquid droplets called aerosols. The NAAQS for PM are segregated by size (i.e., less than 10 microns and less than 2.5 microns are designated as PM_{10} and $PM_{2.5}$, respectively). PM is formed as an exhaust product in an internal combustion engine or can be generated from the breakdown and dispersion of other solid materials (e.g., fugitive dust).

Sulfur dioxide (SO_2)

SO_2 is emitted in natural processes and by man-made sources such as combustion of sulfur-containing fuels and sulfuric acid manufacturing. Sulfur oxides (SO_x) are primarily composed of SO_2. The national and state standards are summarized in Table 8-1. Concentration units for the standards are given in parts per million (ppm) and micrograms of pollutant per cubic meter of air (µg/m^3). Since 2012, the national standards have remained unchanged, except for ozone.[108]

[108] The EPA has strengthened the 8-hour ozone standard to 0.070 ppm.

Table 8-1 National (NAAQS) and Massachusetts (MAAQS) Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS (Primary Standards)	NAAQS (Secondary Standards)	MAAQS Standard
CO	8-Hour[1]	9 ppm (10 µg/m³)	None	9 ppm (10 µg/m³)
	1-Hour[1]	35 ppm (40 µg/m³)	None	35 ppm (40 mg/m3)
Lead	Rolling 3-Month Average	0.15 µg/m³	Same as Primary	1.5 µg/m³
NO_2	Annual	0.053 ppm (100 µg/m³)	Same as Primary	100 µg/m³
	1-Hour[2]	0.1 ppm (188 µg/m³)	None	320 µg/m³
Ozone	8-Hour (1997 Standard) (Revoked)[8]	0.08 ppm	Same as Primary	None
	8-Hour[6] (2008 Standard)	0.075 ppm	Same as Primary	None
	8-Hour (2015 Standard)[9]	0.070 ppm	Same as Primary	None
	1-Hour[7]	None	None	235 µg/m³ (0.12 ppm)
PM_{10}	Annual[3]	None	None	50 µg/m³
	24-Hour[1]	150 µg/m³	Same as Primary	150 µg/m³
$PM_{2.5}$	Annual[4]	12 µg/m³	15 µg/m³	None
	24-Hour[5]	35 µg/m³	Same as Primary	None
SO_2	Annual	None	None	80 µg/m³
	24-Hour[1]	None	None	365 µg/m³
	3-Hour[1]	None	0.5 ppm (1,300 µg/m³)	0.5 ppm (1,300 µg/m³)
	1-Hour	75 ppb (196 µg/m³)	None	None

Notes:
1. Not to be exceeded more than once a year.
2. MassDEP NO_2 Policy Guideline level not to be exceeded more than one day per year.
3. The annual PM_{10} standard was revoked nationwide in 2006.
4. Three-year average of annual $PM_{2.5}$ arithmetic needs.
5. Three-year average of 98th percentile 24-hour $PM_{2.5}$ concentrations.
6. Three-year average of annual 4th highest daily maximum 8-hour ozone concentration.
7. The 1-hour ozone standard was revoked for most areas nationwide in 2012. https://www.gpo.gov/fdsys/pkg/FR-2012-05-29/pdf/2012-12505.pdf#page=1
8. The 1997 8-hour ozone standard was revoked in 2012. https://www.gpo.gov/fdsys/pkg/FR-2012-05-29/pdf/2012-12505.pdf#page=1
9. The 2015 8-hour ozone standard was lowered in 2015 to 0.070 ppm. Standard based on the annual fourth-highest daily maximum concentration averaged over 3 years.

Source: 40 CFR 50, 310 CMR 6.0

8.2.2 Non-criteria Pollutant Emissions

Non-criteria pollutants do not have NAAQS, but can contribute to the formation of ozone and particulate matter and/or be toxic. The non-criteria pollutants monitored by MassDEP include Total Suspended Particulates (TSP), and air toxics, which include certain VOCs, a precursor to ozone, and toxic metals.

Other emissions that occur as a result of aviation activity and vehicular operations are described below.

Ultrafine Particulate Matter

Ultrafine particles (UFP) are defined as airborne particles with diameters of less than 0.1 microns.[109] Some primary sources of UFP are combustion processes associated with burning wood or fuel or associated with industrial manufacturing processes. UFPs also occur naturally in the environment from sand or dust.[110] For example, in the region surrounding Hanscom Field, aircraft emissions are just one of many potential sources contributing to UFP concentrations. Other contributors include but are not limited to motor vehicle exhaust and generators.

To date, there are no EPA or MassDEP air quality regulations that exist for UFP due to limited health studies to substantiate an air quality standard, however the EPA has begun to consider developing a standard for UFPs on the basis of unique physical attributes and potential human health hazards. The agency is currently reviewing existing NAAQS for PM_{10} and $PM_{2.5}$, which provides an opportunity to include UFPs; a determination is due by 2022. While studies are ongoing to examine the health impacts of UFP exposure, the results may not be sufficient or clear enough to develop a standard. Appendix E contains additional information about relevant ongoing and recently completed air quality studies that include consideration of UFPs.

Black Carbon

While particulate matter at all sizes is comprised of multiple components, one of the more significant components is Black Carbon (BC). BC particles, also referred to as soot, form as a result of incomplete combustion, particularly at the higher temperatures at which aircraft burn fuel. Therefore, BC emissions are common from aircraft. According to EPA, BC is associated with respiratory distress, cardiovascular disease, cancer and birth defects. The FAA conducts research on BC through a program called ASCENT, the agency's Center of Excellence for research on aviation environmental topics. To fully understand the extent of impacts from airport related BC emissions, more research is needed.

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[109] Health Effects Institute. January 2013. *Understanding the Health Effects of Ambient Ultrafine Particles*. http://pubs.healtheffects.org/getfile.php?u=893

[110] ACI Europe. 2012. *Ultrafine Particles at Airports*. http://dit.cph.dk/wp-content/uploads/2015/06/ACI-study-on-ultrafine-particles-at-airports.pdf

8.2.3 Climate Change and Greenhouse Gas Emissions

As defined by the EPA, climate change refers to "significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer".[111] These changes have both natural and man-made causes, and the latter are the result of increasing atmospheric concentrations of carbon dioxide (CO_2), methane (CH_4), nitrogen dioxide (NO_2) and other GHGs. Human activities that produce these gases include energy production and transportation activities, and have resulted in unprecedented warming of the Earth's surface.[112]

In 2009, the EPA issued a finding that GHGs also contribute to air pollution that may endanger public health or welfare, referred to as the "Endangerment Finding".[113] This finding laid the groundwork for regulation of GHGs under the CAA, however there are no current federal laws regulating GHG emissions from airports.[114] The EPA has established a Greenhouse Gas Reporting Program, which requires certain entities directly emitting more than 25,000 metric tons (MT) of CO_2 equivalent annually to report their emissions. [115]

Massachusetts acknowledges climate change as an important environmental and economic issue, and has taken a number of actions designed to address both the Commonwealth's contribution to climate change as well as preparing for the anticipated effects of climate change. For example, Governor Baker issued Executive Order 569 in 2016 to establish a climate change strategy.[116] State regulatory actions addressing climate change are described in Appendix E. Massport also acknowledges climate change as an important environmental and economic issue, and has published their most recent Annual Sustainability and Resiliency Report in 2018 (see Chapter 11 for details). The report outlines how Massport is preparing its infrastructure to be more resilient, and efforts taken to reduce GHG emissions from Massport facilities and operations.

The first GHG emissions inventory for Hanscom Field is a component of this *2017 ESPR,* using 2017 as a baseline year. Section 8.5 presents this inventory.

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[111] Environmental Protection Agency definition of climate change. Available at: https://19january2017snapshot.epa.gov/climatechange/climate-change-basic-information_.html

[112] IPCC 2014: *Climate Change 2014: Synthesis Report. Contribution of Working Groups I. II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer)]. IPCC, Geneva, Switzerland.

[113] https://www.epa.gov/sites/production/files/2016-08/documents/federal_register-epa-hq-oar-2009-0171-dec.15-09.pdf

[114] The EPA is in the process of developing CO2 emission standards for aircraft engines.

[115] Total carbon dioxide equivalent, or CO_2e, is calculated by applying the Global Warming Potential (GWP) values for each type of GHG in order to convert each to its equivalent mass in CO_2.

[116] Massachusetts Executive Order 659: Establishing an Integrated Climate Change Strategy for the Commonwealth. September 16, 2016. https://www.mass.gov/executive-orders/no-569-establishing-an-integrated-climate-change-strategy-for-the-commonwealth

8.2.4 Federal and State Mobile Source Emissions Standards and Regulations

Both the EPA and Massachusetts have enacted various vehicle emissions standards and measures to improve air quality and reduce airborne pollutant emissions from mobile sources.

The Corporate Average Fuel Economy (CAFE) standards were enacted in 1975 with the intention of improving the average fuel economy of passenger cars and light trucks, and decreasing national fuel consumption. Today, the standards set fleet-wide average fuel economy requirements for automakers manufacturing passenger cars and light trucks, as well as medium and heavy-duty vehicles. The standards are regulated by the National Highway Traffic Safety Administration (NHTSA) and supported by EPA GHG standards.[117]

MassDEP has enacted various vehicle emissions and fuel standards designed to improve air quality and reduce airborne pollutant emissions from mobile sources, such as the enhanced Motor Vehicle Emissions Inspection and Maintenance (I/M) Program. The program requires vehicles to pass an annual emissions test if they have an onboard diagnostic system and were manufactured after model year 2002.[118] The Commonwealth of Massachusetts has also adopted other state programs to reduce emissions from mobile sources, including the California Low Emissions Vehicle program (LEV) and the California Zero Emissions Vehicle program (ZEV). See Appendix E for details on these regulations.

These regulations and standards are intended to further reduce mobile source emissions while increasing the prevalence of alternative fuel vehicles such as hybrid, electric, and biodiesel vehicles in the fleet mix. Alternative fuel vehicles are more efficient, resulting much lower emissions, compared to conventional gasoline and diesel vehicles. As these vehicles replace older, less efficient vehicles, emissions are expected to decrease.

The Multi State Zero Emission Vehicle (ZEV) Action plan is governed by the following initiatives:

- **Increase consumer awareness and confidence in ZEVs;**
- **Make ZEV more affordable and provide incentives; and**
- **Support the development of electric charging and hydrogen fueling infrastructure.**

Reformulated Gasoline and Vapor Recovery Systems

Massachusetts has adopted the federal regulations for reformulated gasoline, although it is not a required area under the Clean Air Act. Reformulated gasoline (RFG) is designed to

[117] U.S. Department of Transportation. August 2014. *Corporate Average Fuel Economy (CAFE) Standards*. https://www.transportation.gov/mission/sustainability/corporate-average-fuel-economy-cafe-standards
[118] Mass.gov. *Basic Inspection Information.* https://www.mavehiclecheck.com/motorists-basicinfo

produce lower emissions of toxic substances from evaporation and to burn cleaner than conventional gasoline, resulting in improved air quality and less smog-forming pollutants.

Massport does not own or operate fuel distribution facilities at Hanscom Field. A survey of fixed based operators (FBOs) at Hanscom Field found that vapor recovery is being used on all fuel storage tanks subject to MassDEP regulation and that Stage II vapor controls are used at all gasoline-dispensing facilities.

8.3 Year 2017 Existing Conditions

The sections that follow provide climate data and discuss ambient air quality standards, and present air quality data related to the Hanscom Field region. Air quality in Bedford, Concord, Lexington, and Lincoln is very good and in compliance with all existing NAAQS as classified by the EPA.[119] Ozone levels remain in compliance with the new 8-hour standard and no violations were detected at the nearby Chelmsford monitoring location. Ozone concentrations in by end of Eastern Massachusetts are greatly affected by air pollution transported from the New York/New Jersey/Connecticut metropolitan area, and these changes are likely influenced by conditions to the west.

8.3.1 Climate

The climate for Hanscom Field is determined in part by its proximity to the Atlantic Ocean. The airport is located 16 miles inland at an elevation of approximately 130 feet above mean sea level. Wind patterns at Hanscom Field are different from those in Boston, including a greater occurrence of calm winds, which are characteristic of inland locations. On a large scale, Hanscom Field is subject to the rapid weather changes typical to southern New England. The largest storms move up the east coast of the United States from the Carolinas and in most cases pass to the south and east of the area, resulting in northeast and easterly winds with rain, snow, and fog. Annual winds are predominantly from the west, with winter winds from the northwest and summer winds from the southwest. Figure 8-3 presents a windrose for Hanscom

[119] Title 40 Code of Federal Regulations Part 81, Section 81.322 – Massachusetts. https://www.govinfo.gov/content/pkg/CFR-2018-title40-vol20/pdf/CFR-2018-title40-vol20-sec81-322.pdf

Field, depicting a five-year climatological average of hourly measurements taken at the airport from 2012 to 2016 by MassDEP.

Determinant factors for climate include:

- **Wind Direction: Determines where emissions will travel during dilution and dispersion in the atmosphere.**
- **Wind Speed: Determines the dilution rate, with higher speeds resulting in greater dilution and lower air pollutant concentrations.**
- **Atmospheric Stability: Determines the rate at which pollutants released near the ground are mixed and dispersed in the atmosphere, with a neutral to unstable atmosphere providing rapid dispersion and a stable atmosphere providing slower dispersion. Atmospheric instability is caused by the difference in temperature between a parcel of air and the surrounding atmosphere. Warmer air masses are less dense than the surrounding cooler atmosphere, and thus the warmer air parcel will rise. Stable conditions occur when there is less differential in temperature between an air parcel and the surrounding atmosphere – for example, at night when there is no solar heating of the ground to produce thermal air turbulence.**

8.3.2 Background Air Quality Data Sources

Following EPA guidance,[120] background concentrations of pollutants are determined using monitoring data from regional state monitoring sites (collected over a year of continuous measurements). Because there are no MassDEP monitoring stations in the four Hanscom Field communities, MassDEP stations in the Greater Boston area that have historically had the highest pollution levels and the longest historical records were selected to represent the Hanscom Field communities. These stations (Kenmore Square in Boston, Harrison Avenue in Boston, and Chelmsford) are located in more urban areas than the Hanscom Field communities and therefore result in estimates that are more conservative (i.e. higher pollutant concentrations) than the immediate Hanscom Field area. This approach was approved by both the MassDEP and the Secretary of Energy and Environmental Affairs as part of the scoping process for this *2017 ESPR*.

For the purposes of the *2017 ESPR*, the existing background air quality concentrations are added to the calculated Hanscom Field effects to form total concentrations for comparison with air quality standards. Historical records from the same monitoring stations are used to provide a perspective on how air quality in the region today compares with that in the recent past.

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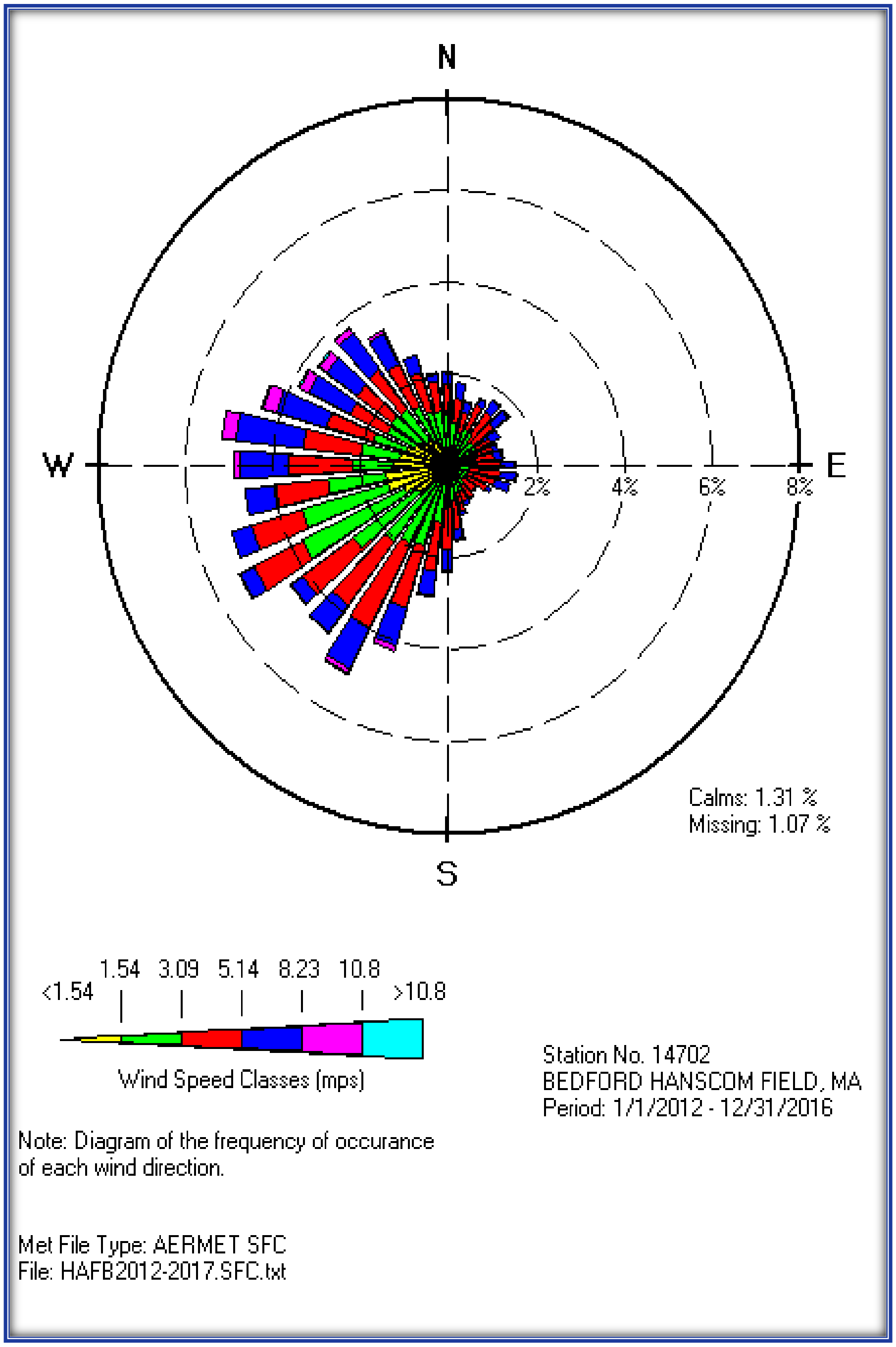
[120] Title 40 Code of Federal Regulations Part 51, Appendix W – Guideline on Air Quality Models. December 20, 2016. https://www.gpo.gov/fdsys/pkg/CFR-2017-title40-vol2/xml/CFR-2017-title40-vol2-part51.xml

Figure 8-3 Annual Frequency of Wind Speed, Direction and Atmospheric Stability Observed at Hanscom Field



Source: MassDEP AERMOD Surface Meteorological Files, Station #14702, Hanscom Field, Bedford, Mass., (2012-2016).

The Massachusetts Environmental Policy Act (MEPA) requires the confirmation of the appropriateness of the data used for background levels in the ESPR air quality analysis. Since the preparation of the *1995 Generic Environmental Impact Report (GEIR),* Massport has worked with MassDEP Division of Air Quality Control to ensure that the selected monitoring data was appropriate for the Hanscom Field communities. MassDEP determined that the selected monitoring data were both conservative and acceptable for use in the *1995 GEIR*.[121] Since the background data are chosen to be conservatively elevated, their use in forming total predicted concentrations, which are then compared to air quality standards, serves to protect public health with an added margin of safety.

Site-specific monitoring for NO_2 was performed for the *1995 GEIR* to test the accuracy of the analysis. This monitoring was not performed to establish background levels in the Hanscom Field communities. Its purpose was to test and confirm the assumption that MassDEP's monitoring data from Boston represented conservative estimates of local Hanscom Field community air quality. The monitoring data demonstrated that NO_2 concentrations close to the airport were safely in compliance with the air quality standard and well below those measured by MassDEP at Kenmore Square in Boston. Thus, the Kenmore Square data were shown to be conservative, and the MassDEP did not recommend additional air quality monitoring be performed for subsequent ESPRs.[122] The air quality analysis for this *2017 ESPR* is consistent with this approach approved by MassDEP for the *2000, 2005* and *2012 ESPR* documents.

Table 8-2 presents the background level data for the six criteria pollutants (CO, NO_2, SO_2, PM_{10}/ $PM_{2.5}$, lead, and ozone). MassDEP does not perform VOC monitoring on a regular basis because there is no state or national air quality standard for VOC. While MassDEP has undertaken some special VOC monitoring programs in the past, these were limited in their scope and duration and are not applicable to the Hanscom Field communities. Similarly, CO_2, is not a regulated air pollutant under the NAAQS and therefore it is not included in the MassDEP data. Although there are no background level data for VOCs, later sections of this chapter include year 2017 VOC emission inventories from Hanscom Field aircraft operations and motor vehicle traffic.

The data in Table 8-2 for CO, NO_2, PM_{10}, and $PM_{2.5}$, are from the Kenmore Square monitoring station. All lead data as well as 2016 and 2017 CO and 2017 PM_{10} come from the Harrison Avenue Monitor in Boston.[123] Data for ozone are from the Chelmsford monitor.

There are no ambient lead monitors at or near Hanscom Field; however MassDEP actively monitors lead at its Harrison Avenue site in Boston. A review of lead monitoring data from the Harrison Avenue location shows that lead levels are well below the national lead standard of 0.15 $\mu g/m^3$.

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[121] Personal communication, Mr. Charles Mentos, MassDEP Division of Air Quality Control, Boston, July 9 and 30, 1996.

[122] Refer to the *2017 ESPR* Scope Certificate in Appendix B.

[123] MassDEP. Air Monitoring Plans, Reports & Studies. (http://www.mass.gov/eea/agencies/massdep/air/quality/air-monitoring-reports-and-studies.html.

For all pollutants except ozone the selected monitor is in the City of Boston, where emission densities are higher than in the Hanscom Field communities. Ozone is not directly emitted from any source, and tends to have higher concentrations downwind of large urban areas. Hanscom Field air quality assessments over the past three decades have used ozone data from monitoring stations in the nearby towns of Sudbury, Stow, and Chelmsford.[124] An air quality monitoring station near Hanscom Field, operated by the EPA at their Lexington laboratory from 1991 to 1993, measured ozone and recorded levels approximately 10 percent below those in Sudbury/Stow. No violations of the ozone standard were ever recorded at the Lexington monitoring site near Hanscom Field.

Table 8-2 Background Air Quality Levels (µg/m3) at Monitoring Locations

Pollutant[1]	Averaging Time	Levels[4] Measured In:			Background Selected
		2015	2016	2017	
CO^2	8-Hour	344	1,370	1,375	1,375
	1-Hour	344	2,750	1,490	2,750
Lead[2]	Monthly	0.016	0.017	0.000	0.017
NO_2	Annual	33	28	48	48
	1-Hour	105	88	87	105
Ozone[3]	8-hour	0.061	0.070	0.065	0.070
PM_{10}	Annual	14	14	11	14
	24-Hour	30	30	27	30
$PM_{2.5}$	Annual	6.5	6.2	6.1	6.5
	24-Hour	15.0	13.0	12.0	15.0
SO_2	1-hour	14.0	11.0	7.3	14.0
	Annual	1.4	1.1	1.3	1.4

Note:
1. Data for many pollutants come from Kenmore Square, Boston, exceptions are noted below. Concentrations for 1-hour, 8-hour and 24-hour averages are annual second-highest values, except for 1-hour NO_2 and 24-hour average $PM_{2.5}$ which are 98th percentile values. Selected $PM_{2.5}$ background values are the three-year averages. For all other pollutants, the selected background values are the highest of the value measured in the three-year period.
2. The 2016 and 2017 CO monitor values were collected at Harrison Avenue as well as the 2017 PM_{10} and all lead values.
3. The Ozone values were collected at Chelmsford. Ozone values are presented in PPM consistent with the standard.
4. Levels above 10 micrograms/m^3 are rounded to the nearest whole number.
Source: Massachusetts DEP Air Monitoring Reports (http://www.mass.gov/eea/agencies/massdep/air/quality/air-monitoring-reports-and-studies.html)

[124] These are the closest ozone monitoring stations to Hanscom Field. The Massachusetts DEP discontinued ozone monitoring at the Sudbury location after 1998, and commenced monitoring at the Stow location in 1998 which was discontinued in 2011. Monitoring commenced in 2012 at the EPA Chelmsford location.

8.3.3 Summary of Background Conditions

Since the *2012 ESPR*, the Greater Boston area has been in attainment for all criteria pollutants except ozone. However the area was designated as in attainment for ozone after the EPA promulgated a new ozone standard in 2015 (strengthening it to 0.070 ppm). EPA designated Middlesex County and the surrounding counties as in attainment/unclassifiable for the 2015 ozone standards in November of 2017.[125] In 2017, there were 12 days when the 8-hour ozone standards of 0.070 ppm were exceeded in Massachusetts; however, there were no monitors in the Hanscom area that violated the 0.070 ppm standards. While ozone concentrations have trended downward over the past several decades due to air pollution control programs, ozone concentrations vary each year due to weather patterns.[126] Figure 8-4 displays the 1-hour and 8-hour ozone levels in Middlesex County for the last twenty years.

Since the 2012 ESPR, the Greater Boston area has had "clean air" (i.e., no violations of the air quality standards for these pollutants):

- **PM_{10}, NO_2, SO_2 and Lead (Pb) – For over 25 years;**
- **CO – For over 20 years;**
- **$PM_{2.5}$ – Since 1999 when monitoring for this pollutant commenced;**
- **O_3 (Ozone) – With the new 2015 Ozone standard, Massachusetts was designated as in attainment/unclassifiable.**

Using actual air quality measurements collected throughout the region by the MassDEP over the last 25 years, the following progress has been documented:

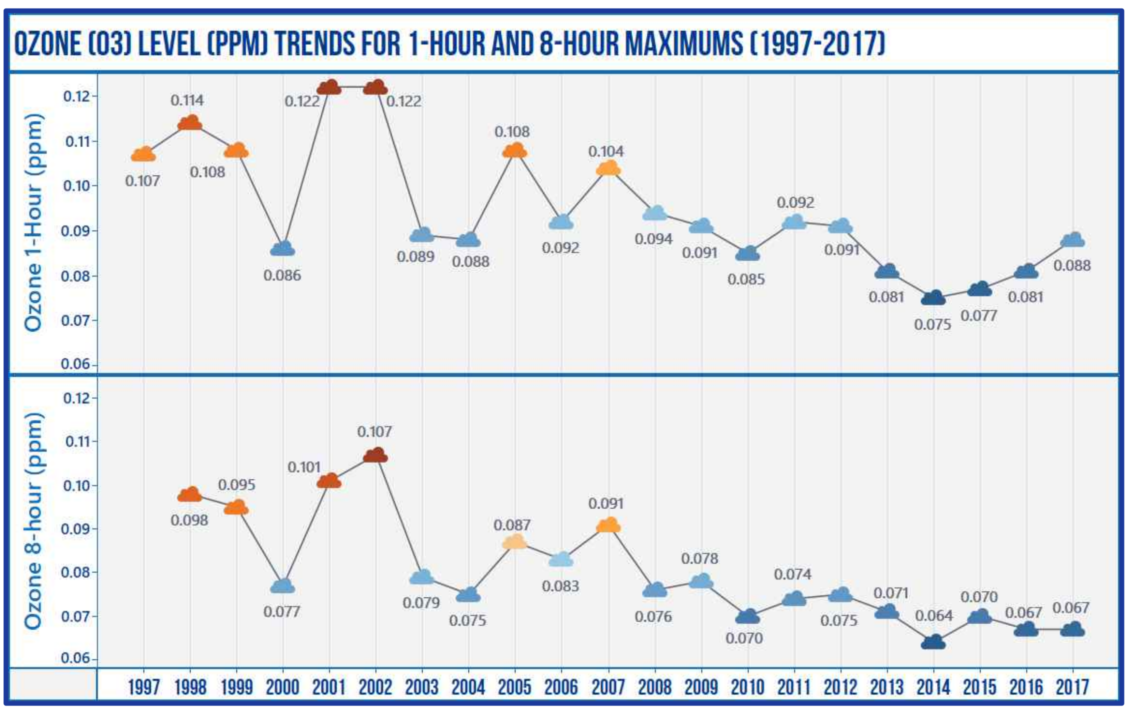
- CO levels in the Greater Boston area have steadily declined since their peak in the 1970s. The entire state, including the Hanscom Field area has been considered in attainment with the CO standard since April 2002.
- In January of 2010, EPA established a new 1-hour NO_2 standard of 100 ppb. In January of 2012, EPA designated all of Massachusetts as in attainment with the new NO_2 standard.
- In June of 2010, EPA established a new 1-hour SO_2 standard of 75 ppb along with new monitoring requirements that began in January of 2013. In December of 2017, EPA designated all of Massachusetts as in attainment for the 1-hour standard. All six monitors in the Commonwealth show levels that meet the new 1-hour standard.
- In 2006, the EPA revoked the annual PM_{10} standard. There have been no violations of the PM_{10} air quality standard recorded in the Hanscom area.

[125] https://www.gpo.gov/fdsys/pkg/FR-2017-11-16/pdf/2017-24640.pdf
[126] https://www.mass.gov/files/documents/2018/10/09/17aqrpt.pdf

- In December of 2014, EPA designated all of Massachusetts as unclassifiable/attainment with the 2012 $PM_{2.5}$ standard. No violations of the $PM_{2.5}$ air quality standard have been recorded in the Hanscom area.
- Lead levels in the air have declined significantly since the early 1980s mostly due to the removal of lead in gasoline. In October of 2008, the EPA tightened the lead standard from 1.5 µg/m^3 to 0.15 µg/m^3, averaged over a 3-month period. No violations of the lead air quality standard have ever been recorded in the Greater Boston area.

The current ozone standards were set in 2015. No violations of the 2015 standard have occurred in the Middlesex County area since they were set, and EPA designated Middlesex County as attainment/unclassifiable with the 2015 ozone standards (see Figure 8-4).

Figure 8-4 Middlesex County Ozone Level (PPM) Trends for 1-hour and 8-hour Maximums (1997-2017)



Notes: [1]O_3 measurements are taken from Middlesex County monitor locations: 1997-2012 values are from US MILITARY RES monitor in Stow, MA, 2012-present values from 11 TECHNOLOGY monitor Chelmsford, MA
[2]O_3 8-hour data became available in 1998
[3]Blue icons in the figure represent years in which the O_3 levels met the standard; orange and red icons indicate an exceedance.
Source: MassDEP, 1997-2017, Annual Air Quality Reports.

8.4 Hanscom Field Emissions

This section and the next provide estimates of total annual air emissions generated by activities associated with Hanscom Field for the year 2017 and for the forecast scenarios. The primary sources of air pollution at Hanscom Field are aircraft operations and groundside roadway traffic. Other sources include space heating emissions and fugitive emissions from fuel storage, fuel spillage, and aircraft refueling activities. Prior studies have shown that emissions from these latter sources are very small compared to aircraft emissions and groundside roadway traffic emissions, so they are excluded.

The five specific operating modes in a Landing/Take-off (LTO) cycle are:

6) **Approach from 3,000 feet;**
7) **Taxi/idle-in;**
8) **Taxi/idle-out;**
9) **Takeoff; and**
10) **Climb out to 3,000 feet.**

Annual aircraft emissions were calculated for the year 2017 at Hanscom Field. Pollutants associated with aircraft engines are CO, NO_x, PM_{10}, $PM_{2.5}$, CO_2, and VOCs. The methodology for calculating the aircraft emissions is outlined below. For reference, the complete list of NAAQS and MAAQS levels for the pollutants are listed earlier in this chapter in Table 8-1.

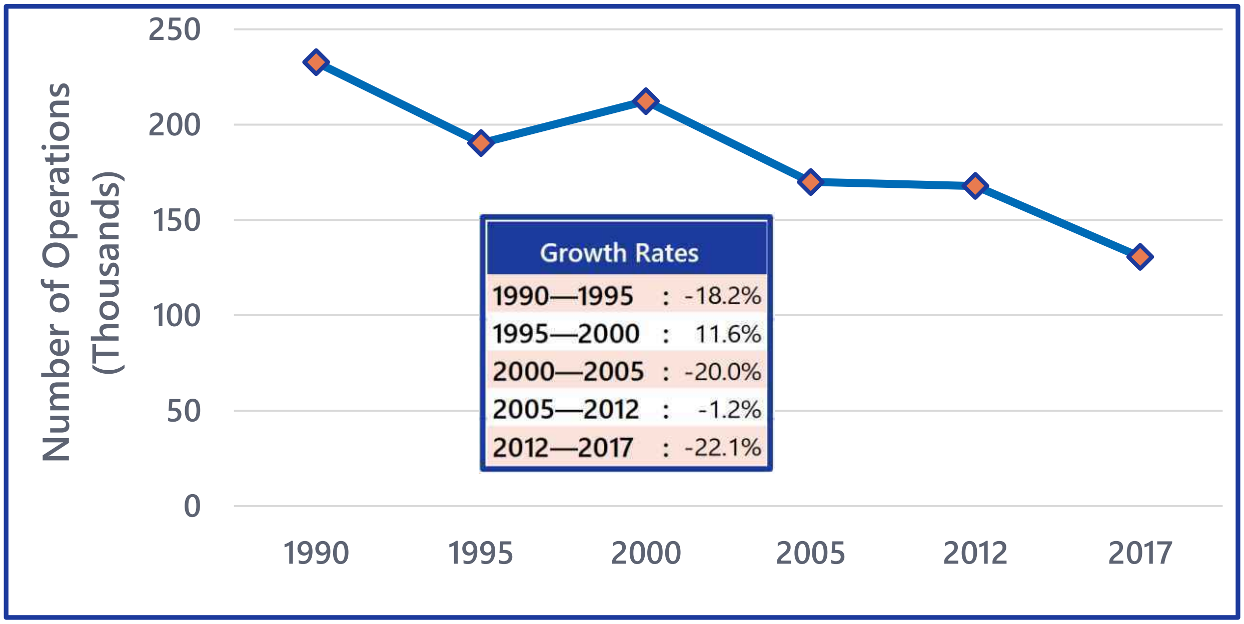
According to the EPA, an airport emissions inventory should concentrate on the emission characteristics of aircraft relative to the vertical column of air around and above the airport that ultimately affects ground level pollutant concentrations. [127] This portion of the atmosphere, which begins at the earth's surface and extends upward 3,000 feet, is simulated in air quality models, and is often referred to as the mixing zone. The aircraft operations of interest within this column are defined as the landing and takeoff (LTO) cycle. The cycle begins when the aircraft approaches the airport on its descent from cruising altitude, lands, and taxis to the gate. It continues as the aircraft taxis back out to the runway for subsequent takeoff and climb out as it heads back up to cruising altitude.

Actual numbers of aircraft operations at Hanscom Field for the years 1990, 1995, 2000, 2005, 2012 and 2017 are described in detail in Chapter 3 Airport Activity Levels, and relative levels are shown below in Figure 8-5 for reference. The data show that the number of aircraft operations at Hanscom Field in 2017 decreased by 22 percent compared to the 2012 total. The annual aircraft operations data used for the air quality analysis were consistent with the operations presented in the noise analysis (See Chapter 7 Noise). To convert the aircraft operations for use in the FAA's Aviation Environmental Design Tool (AEDT), the Integrated Noise Model (INM) type for each aircraft from the noise analysis was assigned an aircraft and engine type using the databases provided within AEDT (See tables D-1 through D-3 in Appendix D). Annual emissions were calculated by multiplying the number of operations for

[127] U.S. EPA, Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources, Office of Air and Radiation, EPA-450/4-81-026d (Revised), 1992.

each AEDT aircraft/engine classification by the emission factor for that classification for each mode of the LTO cycle.

Figure 8-5 Aircraft Operations at Hanscom Field Over Time



8.4.1 Analysis of 2017 Conditions

Year 2017 Aircraft Emissions

The aircraft emission factors for CO, NO_x, PM_{10}, $PM_{2.5}$, CO_2, and VOCs used to calculate the annual aircraft emissions at Hanscom Field in the *2017 ESPR* were taken from the FAA AEDT model (Version 2d). For previous ESPR documents, annual emission inventories were developed using the FAA's EDMS. As of May 2015, FAA requires the use of AEDT to compile air emissions inventories from aircraft operations. The AEDT model is a combined noise and air quality model designed to evaluate environmental impacts from aircraft activities. To model air quality, AEDT has the ability to calculate air quality impacts, pollutant emissions and fuel burn. For the *2017 ESPR*, AEDT was used to estimate air quality pollutant emissions from aircraft operations at Hanscom (with the exception of CO_2, which was based on the Airport Cooperative Research Program [ACRP] Report 11 guidance consistent with the GHG inventory presented in Section 8.5 of this chapter). [128]

[128] ACRP Report 11 can be accessed at: https://www.nap.edu/catalog/14225/guidebook-on-preparing-airport-greenhouse-gas-emissions-inventories

Aircraft emissions calculated using AEDT for 2017 are shown in Table 8-3 and are compared to the aircraft emissions data published in previous ESPRs, calculated using EDMS.

Table 8-3 Emissions from Aircraft Operations at Hanscom Field (1,000s of kg/yr)

Year	CO	NOx	VOC	PM_{10}[2]	$PM_{2.5}$[2]	CO_2[4]
1995[3]	409.2	14.9	27.9	2.3	2.3	6,728
2000[3]	591.2	25.4	39.4	2.3	2.3	10,108
2005 (EDMS Version 5.1.4.1)[4]	1,670.0	34.1	112.7	13.5	13.5	19,233
2012	1,123.0	31.9	80.4	9.9	9.9	16,356
2017[8]	1,557.0	34.8	51.4	1.9	1.9	17,735
Percent Change: 2005-2012[5]	-33%	-7%	-29%	-27%	-27%	-15.0%
Percent Change: 2012-2017[6, 7]	+39%	+9%	-36%	-81%	-81%	+8.4%

Notes:
1. PM_{10} and $PM_{2.5}$ emissions for some aircraft and CO_2 emissions for all aircraft were calculated separately with a spreadsheet. EDMS does not contain PM emission rates for some aircraft and doesn't include CO_2 emissions for any aircraft.
2. Emissions for 1995 and 2000 were revised from the *2000 ESPR* using the EDMS Version 4.3.
3. Emissions for 2005 were revised from the *2005 ESPR* using EDMS Version 5.1.4.1.
4. Percent change is based on 2012 EDMS Version 5.1.4.1.
5. Percent change is based on the difference in results between 2012 when EDMS Version 5.1.4.1 was in use, and 2017 when AEDT Version 2d was used.
6. CO_2 emissions increased due to the ACRP emissions factors, and that methodology differed compared to the 2012 ESPR in which the CO_2 emissions came from EDMS, and were not broken down by fuel.
7. The emissions for CO, NPx and CO_2 show an increase in 2017 from the *2012 ESPR*. Because there was a decrease in aircraft operations from 2012 to 2017, the change is attributed to the change in model from EDMS to AEDT.

Aircraft engine emission factors (e.g. expressed as the mass of emissions per unit of time, such as grams per second or kilograms per hour) are based on the AEDT default factors for each aircraft and engine type for operating modes (idle, takeoff, climb out, and approach movements). Operating modes are a function of the engine's power setting and resultant fuel flow. AEDT default time-in-mode (TIM) data were also used for each of the phases of the LTO cycle. Aircraft emissions for each of the modes of the LTO were calculated for each type of aircraft by multiplying the number of operations by the emission factor for each operation phase and the TIM. These calculations were performed by AEDT.

As shown in Table 8-3 emissions estimates for VOCs, PM_{10}, and $PM_{2.5}$ decreased between 2012 and 2017, while estimates for CO, NOx, and CO_2 increased. The decreases in VOCs, PM_{10}, and $PM_{2.5}$ are primarily attributed to a decrease in operations between 2012 and 2017. While a reduction in operations would normally lead to a decrease in all pollutants, the change in model from EDMS to AEDT from 2012 to 2017 resulted in increases in CO, NO_x and CO_2, but are still below the emissions forecast highs of 2005. It should be noted that CO_2 emissions for 2017 are not calculated directly from AEDT and calculated using the ACRP GHG methodology consistent with the GHG inventory as discussed in Section 8.5. The differences between AEDT and EDMS results are primarily due to differences in aircraft operational modes and engine emission factors in each model. The FAA notes that these adjustments are expected; methods used by AEDT are based on the best available science (which evolves and improves over time) and result in outputs that are more accurate.[129] More information on the differences between the models is in Appendix E.

The percentage changes in the aircraft emissions between the different years shown in Table 8-3 do not correlate with the percent changes in the number of aircraft operations shown in Figure 8-5 for two reasons. First, the fleet mix of aircraft types is different in each of the six years and, second, the aircraft emissions for 1995, 2000, 2005 and 2012 were developed using various versions of the EDMS model (as the models were updated over time the emissions factors in the models also changed).

Changes in emissions estimates over time are dependent on:

- **The number of operations;**
- **The fleet mix of aircraft types using Hanscom Field; and**
- **The use of various versions of the EDMS model, now replaced by AEDT.**

Aircraft emissions rates:

- **Do not change over time for each individual aircraft and are dependent on two major characteristics unique to aircraft types:**
  1) **The time each aircraft spends in each mode of the LTO cycle at the airport;**
  2) **The passenger-carrying capacity of the aircraft.**

To provide some perspective on the relative contribution of Hanscom Field aircraft emissions to regional air quality and to demonstrate that the increases that have occurred are small, Table 8-4 shows the total air emissions for Middlesex County. The emissions data for Middlesex County were obtained from the U.S. EPA National Emission Inventory for the most recent available year, 2014.[130]

Table 8-4 Total Criteria Pollutant Emissions from all Sources in Middlesex County (2014) (1,000s of kg/yr)

Source Type	CO	NO_x	VOC	PM_{10}	$PM_{2.5}$	CO_2[1]
Point	9,427	6,519	13,456	6,647	1,827	-
Mobile	120,323	15,297	9,755	8,236	3,443	-
Total	**129,750**	**21,816**	**23,211**	**14,883**	**5,277**	**6,894,604**
2017 Hanscom Field aircraft emissions as a % of Middlesex County total emissions[2]	***1.2%***	***0.16%***	***0.22%***	***0.01%***	***0.04%***	***0.26%***

Notes:
1. GHG emissions obtained from MassDEP's latest inventory for entire state, completed in 2015 (for 2014 emissions levels), https://www.mass.gov/service-details/ma-ghg-emissions-trends.
2. The 2017 aircraft emissions totals as a percentage of the total Middlesex County emissions in 2014.

[129] FAA, AEDT Legacy Tools Comparison , June 2016,
[130] https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data

Year 2017 Motor Vehicle Emissions

A mesoscale air quality analysis was conducted for the motor vehicle traffic associated with activities at Hanscom Field. In comparison to a microscale analysis which focuses on smaller areas (e.g. an intersection), a mesoscale analysis calculates emissions over a larger area. [131] Consistent with MassDEP guidance for performing a mesoscale analysis,[132] total annual emissions of CO, NO_x, PM_{10}, $PM_{2.5}$, CO_2, and VOC were calculated using the U.S. EPA's Motor Vehicle Emissions Simulator (MOVES).[133] The mesoscale air quality study area in this *2017 ESPR* is the same as the traffic study area analyzed for the *2005 and 2012 ESPRs*.

The vehicle miles traveled (VMT) for each roadway segment in the study area was calculated by multiplying the length of each segment by that segment's average daily weekday Hanscom Field traffic volume. Average 24-hour traffic volumes were based on peak AM and PM volumes, using the assumption that peak volumes represent 10 percent of the daily traffic. The average weekday daily traffic volumes are typically greater than the average daily volumes for an entire week including weekends. To give a conservative estimate of annual emissions for the study area, the average weekday volumes were multiplied by 365 (days).

Air pollutant emissions for each roadway segment were calculated by multiplying the VMT on each segment by the MOVES2014a predicted pollutant specific emission factor in grams per mile. These calculations were performed in an excel spreadsheet using emission rates predicted by the MOVES2014a model; MassDEP provided inputs used in the MOVES2014a model. The average annual emissions factor for each pollutant took into consideration the time of year of concern for each pollutant (i.e. winter and summer), averaging the two, and utilized an average daily speed range of 25 to 40 mph for each roadway link.

As shown in Table 8-5 emissions from Hanscom Field vehicular traffic for 2017 declined for all pollutants when compared to all prior years shown. The general decline in motor vehicle emissions is primarily attributed to a decrease in traffic generated by Hanscom Field in 2017 compared to 2012 (a decrease of approximately 39 percent, as detailed in Chapter 6 Ground Transportation) as well as upgrades to the vehicle fleet mix through the replacement of older less efficient vehicles and stricter vehicle emissions standards promulgated by the EPA over that time. This decline can also be attributed to the use of the MOVES model, which is more accurate in deriving mobile source emissions factors than its predecessor, MOBILE 6.2.

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[131] A mesoscale analysis covers an area larger than the immediate project area, but smaller than an entire regional network. The size of a mesoscale analysis depends on the specific project, but typically includes all roadways affected by the project.

[132] Massachusetts Department of Environmental Protection, *Guidelines for Performing Mesoscale Analysis of Indirect Sources*, Division of Air Quality Control, May 1991.

[133] MOVES replaced the MOBILE6.2 model and is consistent with the FAA *Air Quality Handbook* for estimating mobile source emissions.

Table 8-5 Emissions from Hanscom Field Vehicular Traffic (1,000s of kg/yr)

Year	CO	NO_x	VOC	PM_{10}	$PM_{2.5}$	CO_2
1995	30.0	3.9	2.9	0.6	0.6	-
2000	61.0	6.9	3.0	0.2	0.2	1,496
2005	36.0	4.1	1.6	0.1	0.1	1,312
2012	19.1	2.2	0.9	0.1	<0.1	1,555
2017[1]	2.9	0.3	0.1	<0.1	<0.1	407
Percent Change: 2005 to 2012	-47%	-46%	-46%	-29%	-40%	+19%
Percent Change: 2012 to 2017	-85%	-86%	-92%	-90%	-83%	-74%

Notes:
1. The 2017 emissions were estimated using the MOVES2014a version with MassDEP inputs, which replaced the MOBILE6.2 model which was used for the *2012 ESPR*.

Total Year 2017 Emissions

The combined pollutant emissions from both aircraft operations and groundside motor vehicle travel at Hanscom Field are shown in Table 8-6 for each of the six pollutants in 1995, 2000, 2005, 2012, and 2017. The data show that the sum of emissions for aircraft operations and motor vehicle traffic for VOC, PM_{10}, and $PM_{2.5}$ have decreased between 2012 and 2017, while CO, NOx, and CO_2 increased. The reasons for the changes are included with the results for each component, above. CO_2 for aircraft emissions were estimated based on ACRP guidance using AEDT fuel usage and ACRP emission factors for jet fuel and AVGAS. Tables containing the aircraft data used for the emissions calculations can be found in Appendix E.

Table 8-6 Total Air Emissions at Hanscom Field for Prior and Current Years (1,000s of kg/yr)[1]

Year	Source	CO	NO_x	VOC	PM_{10}	$PM_{2.5}$	CO_2 [1]
1995	Aircraft	409.2	14.9	27.9	2.3	2.3	6,728
	Ground Vehicles	30.3	3.9	2.9	0.6	0.6	-
	Total	**439.5**	**18.8**	**30.8**	**2.9**	**2.9**	**-**
2000	Aircraft	591.2	25.4	39.4	2.3	2.3	10,108
	Ground Vehicles	60.8	6.9	3.0	0.2	0.2	1,496
	Total	**652.0**	**32.3**	**42.4**	**2.5**	**2.5**	**11,604**
2005 (EDMS 5.1.4.1)[2]	Aircraft	1,670.0	34.1	112.7	13.5	13.5	19,233
	Ground Vehicles	36.1	4.1	1.6	0.1	0.1	1,312
	Total	**1,706.1**	**38.2**	**114.3**	**13.6**	**13.6**	**20,545**
2012[3]	Aircraft	1,123.0	31.9	80.4	9.9	9.9	16,356
	Ground Vehicles	19.1	2.18	0.9	0.1	0.1	1,555
	Total	**1,142.1**	**34.1**	**81.3**	**10.0**	**10.0**	**17,911**
2017 (AEDT)	Aircraft	1,557.0	34.8	51.4	1.9	1.9	17,735
	Ground Vehicles	2.9	0.4	0.1	0.0	0.0	407
	Total	**1,559.9**	**35.2**	**51.5**	**1.9**	**1.9**	**18,141**

Notes:
1. Data to calculate the ground vehicle CO2 emissions for 1985 and 1995 were not were available; therefore, total CO_2 emissions for these years are not available for comparison with later years.
2. The *2005 ESPR* used EDMS version 4.3 however the emissions were recalculated using EDMS version 5.1.4.1 when it was released for consistency with the *2012 ESPR*.
3. The *2012 ESPR* used EDMS 5.1.4.1.
4. Emissions of CO, NOx, VOC and PM are calculated to the first decimal place.

8.4.2 Analysis of Future Scenarios

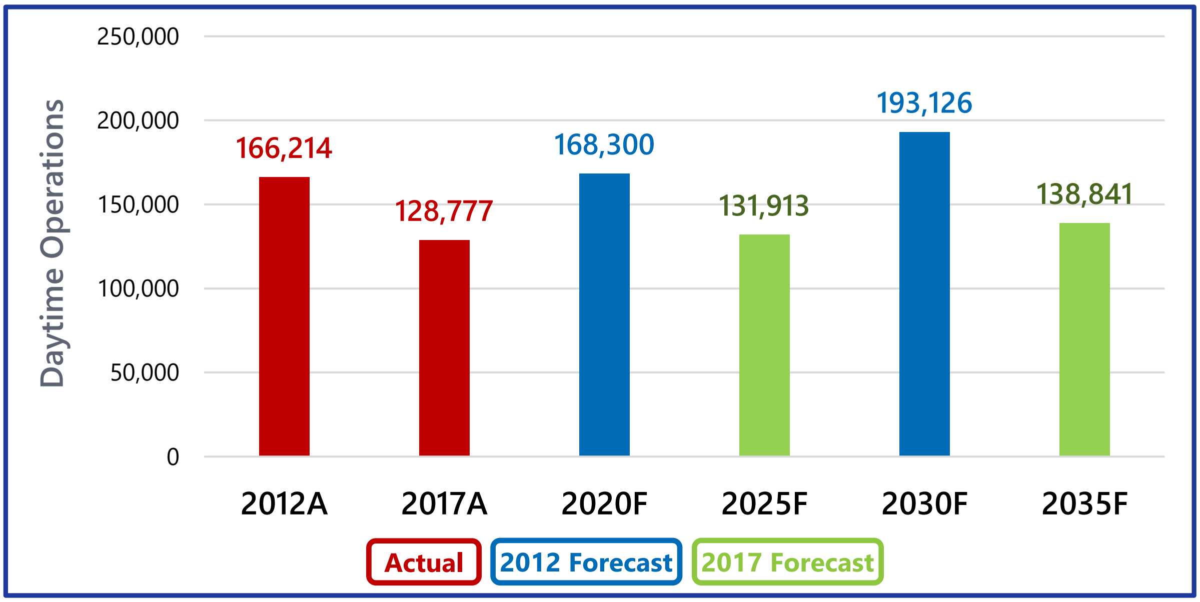
As discussed, predictions of future air quality effects from Hanscom Field are based on an emissions analysis of airside operations and groundside motor vehicle traffic for the 2025 and 2035 future planning scenarios. The *2017 ESPR* planning scenarios are used to evaluate the potential cumulative environmental effects that could occur if Hanscom Field reaches the airport activity levels described in Chapter 3 Airport Activity Levels. The 2025 and 2035 scenarios represent estimates of what could occur (not what will occur) in the future using certain planning assumptions. The future service scenarios are consistent with Massport's 1980 Regulations for Hanscom Field, which prohibit scheduled commercial passenger services with aircraft having more than 60 seats.

As both future scenarios forecast an increase in aircraft operations over current levels (see Figure 8-6), the airport's current emission levels are expected to rise. However, there are limitations in predicting future emissions beyond 15-20 years from the baseline for aircraft operations using AEDT. The AEDT model is constantly reviewed and updated to include new aircraft, engine types, and the latest emission factors from the International Civil Aviation Organization (ICAO) engine exhaust emission data bank. It does not incorporate expected or potential future technology changes such as the use of alternative fuels, more efficient engines or future regulatory emissions standards which would decrease emissions. Therefore, the predicted 2025 and 2035 year emission levels represent a conservative estimate of future conditions. Estimated emissions level increases and their associated impacts on air quality under the future scenarios are described below.

Future Aircraft Emissions

The estimation of future aircraft emissions follows the methodology outlined earlier in this chapter. For comparative purposes, Figure 8-6 shows the annual number of operations for 2012 and 2017, as well as the future planning scenarios analyzed in this ESPR in comparison with the *2012 ESPR* forecasts. Tables containing the aircraft data used for the emissions calculations can be found in Appendix D.

Figure 8-6 Actual and Forecast Aircraft Operations at Hanscom Field



Source: *2012 ESPR* Table 8-9. InterVISTAS, 2018 and Massport EXP NOMS System

Table 8-7 summarizes the expected annual aircraft emissions for the 2025 and 2035 future planning scenarios, and compares these to actual emissions from years 2012 and 2017. In general, aircraft emissions forecasted for each of the future scenarios would be higher than those for the year 2017 based on a predicted growth in operations. The exception is emissions of CO for 2025 and 2035, which show a slight decrease compared to 2017. This is largely attributed to the forecast change in fleet mix in future scenarios, with an increase in jet aircraft operations and a decrease in single engine piston aircraft (which emit higher levels of CO than jet aircraft). The percent decrease in CO for 2025 and 2035 is -5.9 percent and -6.7 percent, respectively.

The largest increases in aircraft emissions are predicted for NO_x, VOC and CO_2, with the smallest increases predicted for PM_{10} and $PM_{2.5}$. The increases in these pollutants are expected due to the increase in operations.

The air pollutant emission rates for each aircraft/engine combination are not assumed to change with time in the model, therefore the forecasts are conservative.

Table 8-7 Emissions from Aircraft Operations at Hanscom Field for 2012, 2017 and Forecast Scenarios (1,000s of kg/yr)[1]

Year	CO	NO_x	VOC	PM_{10}	$PM_{2.5}$	CO_2
2012[1]	1,123.0	31.9	80.4	9.9	9.9	16,356
2017[2]	1,557.0	34.8	51.4	1.9	1.9	17,734
2025	1,455.3	42.0	56.1	2.0	2.0	20,553
2035	1,444.6	48.1	61.0	2.1	2.1	23,069

Notes:
1. EDMS was used to estimate emissions for 2012.
2. Calculations generated using AEDT version 2d for 2017 and 2025 and 2035 forecasts.

Future Vehicular Emissions

A mesoscale (intermediate range) air quality emissions analysis was conducted for the motor vehicle traffic associated with Hanscom Field. In comparison to a microscale analysis, which focuses on smaller areas (e.g. an intersection), a mesoscale analysis calculates emissions over a larger area. Consistent with MassDEP guidance[134] for performing a mesoscale analysis, total annual emissions of CO, NO_2, PM_{10}, $PM_{2.5}$ CO_2 and VOCs were calculated using the EPA's Motor Vehicle Emissions Simulator (MOVES).[135] The study area and methodology for calculating groundside vehicular emissions is the same as described earlier for 2017. Table 8-8 summarizes the annual emissions from groundside vehicular traffic for the future growth scenarios. Tables showing the data used to calculate the motor vehicle emissions are included in Appendix E. Emissions for 2025 and 2035 are estimated to decrease for all pollutants (except CO_2) when compared to 2017.

The predicted decrease in motor vehicle emissions reflect projected decreases in vehicle emission rates predicted by MOVES 2014a even though additional traffic volumes are predicted in 2025 and 2035. The MOVES model also incorporates assumptions about the changes in average fleet fuel economy over time. Ongoing fleet turnover and the continued implementation of increasingly more stringent emission and fuel quality regulations are expected to reduce pollutants.

[134] MassDEP, *Guidelines for Performing Mesoscale Analysis of Indirect Sources.* Division of Air Quality Control, May 1991.
[135] MOVES replaced MOBILE6.2 model and is consistent with the FAA's *Air Quality Handbook* for estimating mobile source emissions.

Table 8-8 Emissions from Hanscom Field Vehicular Traffic for 2012, 2017 and Forecast Scenarios (1,000s of kg/yr)[1]

Year	CO	NO_x	VOC	PM_{10}	$PM_{2.5}$	CO_2
2012	19.1	2.2	0.9	0.1	<0.1	1,555
2017	2.9	0.3	0.1	<0.1	<0.1	407
2025	2.8	0.2	<0.1	<0.1	<0.1	457
2035	1.9	0.1	<0.1	<0.1	<0.1	436

Notes:
1. Emissions levels for CO. NOx, VOC and PM are calculated to one decimal place.
Source: HMMH, 2018.

Hanscom Field generated traffic is only a small percent of the total traffic in the nine square mile traffic study area (i.e., approximately two and half percent of the total traffic in the year 2017).

Total Future Emissions and Air Quality Concentrations

As described earlier in the chapter, Massport used AEDT (the FAA required model) to estimate future scenario emissions from aircraft operations at Hanscom Field, and the EPA MOVES model to estimate motor vehicle emissions in future year scenarios. The results were combined to obtain total emission forecasts for the criteria pollutants, VOCs and CO_2.

The combined emissions from both aircraft operations and motor vehicle traffic at Hanscom Field are shown in Table 8-9 for the six pollutants. This table shows that with the exception of CO, total emissions will increase in the forecast cases as compared to 2017 emissions. Aircraft operations dominate the emission totals, and, as one would expect, the higher emissions for the two future planning years would occur for the 2035 scenario. The predicted increases in pollutant emission and slight decreases in CO in total emissions for 2025 and 2035 are a result of the assumed changes in the fleet mix, the assumed increase in aircraft operations and passengers carried, and the assumed increase in associated motor vehicle traffic.

Table 8-9 Total Air Emissions at Hanscom Field for 2000, 2005, 2012, 2017 and Forecast Scenarios (1,000s of kg/yr)[1]

Year	Source	CO	NO_x	VOC	PM_{10}	$PM_{2.5}$	CO_2
2000	Aircraft	591.2	25.4	39.4	2.3	2.3	10,108
	Ground Vehicles	60.8	6.9	3.0	0.2	0.2	1,496
	Total	**652.0**	**32.3**	**42.4**	**2.5**	**2.5**	**11,603**
2005[2]	Aircraft	1,670.0	34.1	112.7	13.5	13.5	19,233
	Ground Vehicles	36.1	4.1	1.6	0.1	0.1	1,312
	Total	**1,706.1**	**38.2**	**114.3**	**13.6**	**13.6**	**20,545**
2012	Aircraft	1,123.0	31.9	80.4	9.9	9.9	16,356
	Ground Vehicles	19.1	2.2	0.9	0.1	0.1	1,555
	Total	**1,142.1**	**34.1**	**81.3**	**10.0**	**10.0**	**17,911**
2017	Aircraft	1,557.0	34.8	51.4	1.9	1.9	17,734
	Ground Vehicles	2.9	0.3	0.1	0.0	0.0	407
	Total	**1,559.9**	**35.1**	**51.5**	**1.9**	**1.9**	**18,141**
2025	Aircraft	1,455.3	42.0	56.1	2.0	2.0	20,553
	Ground Vehicles	2.8	0.2	0.1	0.0	0.0	457
	Total	**1,458.1**	**42.2**	**56.2**	**2.0**	**2.0**	**21,010**
2035	Aircraft	1,444.6	48.1	61.0	2.1	2.1	23,069
	Ground Vehicles	1.9	0.1	0.0	0.0	0.0	436
	Total	**1,446.5**	**48.2**	**61.0**	**2.1**	**2.1**	**23,505**

Notes:
1. Emissions levels for CO. NOx, VOC and PM are calculated to one decimal place.
2. The emissions levels for 2005 were originally calculated using an earlier version of EDMS, version 4.3 but were subsequently revised using the later model EDMS version 5.1.4.1. The values depicted here are those generated by version 5.1.4.1.

8.4.3 Community Receptor Analysis

An analysis of expected air quality for the 2035 future scenario was prepared for a set of points representing community locations near the airport. Maximum air quality concentrations in the future year scenario 2035 for CO, NO_2, PM_{10} and $PM_{2.5}$ were estimated at ten receptors surrounding Hanscom Field (the same ones used for the *2012 ESPR* analysis). Ozone was not modeled as it is not directly emitted (rather it is formed by the emission of precursors including VOCs and NO_2), and SO_2 was not modeled due to the extremely low concentrations in the region.

The first six receptors were located at the closest downwind distance from the center of the airfield to residential or conservation land outside the Massport boundary in the respective towns. Since air pollutant concentrations due to Hanscom Field operations decrease with distance from the airfield, concentrations at any other homes in one of the four adjoining towns will be less than those predicted for receptors one through four.

The maximum concentrations calculated for the ten community locations for the year 2012 presented in the *2012 ESPR* were scaled with the emissions calculated for the *2017 ESPR* to obtain year 2017 results. Scaling is appropriate given that modeling parameters (i.e. source and receptor locations) have not changed from the *2012 ESPR* and only the emission rate for each pollutant is changing.

Maximum air quality concentrations in 2035 for CO, NO_2, PM_{10}, and $PM_{2.5}$ were estimated at the following ten receptors:

1) **Concord: closest residential area;**
2) **Bedford: closest residential area;**
3) **Lexington: closest residential area;**
4) **Lincoln: closest residential area;**
5) **Minute Man National Historical Park;**
6) **Great Meadows National Wildlife Refuge;**
7) **Concord Center;**
8) **Bedford Center;**
9) **Lexington Center; and**
10) **Lincoln Center.**

To derive the scale factors, the total emissions for the scenario with the largest forecasted emissions levels (i.e., the 2035 growth scenario) was divided by the 2012 total emissions presented in the *2012 ESPR*. Then the concentration of each air pollutant for the year 2012 was multiplied by the corresponding scaling factor. After adding in current (2017) background concentrations, the maximum predicted concentration for each air pollutant for the 2035 growth scenario was obtained (see Table 8-10). This scaling methodology is consistent with that used for prior ESPRs.

The concentration levels presented in Table 8-10 are conservative since they are derived from the SCREEN3 dispersion modeling originally presented in the *1995 GEIR* that assumes all airborne emissions up to 3,000 feet are simulated as being released at ground level (see *1995 GEIR*, p. 2-152). Actual air concentrations from Hanscom Field operations will be less than these estimates. Note that the majority of the total predicted concentrations in Table 8-10 come from the conservative background levels assumed in the analysis, not Hanscom Field operations. Thus, actual concentrations for the 2035 planning scenario will be less than those listed, even if activity levels reach those of the future scenarios.

Table 8-10 Modeled Maximum Air Concentrations in 2035 at Ten Community Receptors (μg/m3)4

Source	Receptor	CO 1 Hour[4]	CO 8 Hour	NO_2 1 Hour	NO_2 Annual	PM_{10} 24 Hour	PM_{10} Annual	$PM_{2.5}$ 24 Hour	$PM_{2.5}$ Annual
Concentration from Hanscom Operations[1]	1	3,588	2,410	69	5	1.5	0.2	1.5	0.2
	2	2,977	2,083	59	4	1.5	0.2	1.5	0.2
	3	1,863	1,304	37	3	0.7	0.1	0.8	0.2
	4	1,804	1,262	34	3	0.7	0.1	0.8	0.2
	5	2,215	1,485	44	4	0.7	0.1	0.8	0.2
	6	1,285	899	25	2	0.4	0.1	0.4	0.1
	7	868	609	17	2	0.4	0.1	0.4	0.1
	8	1,699	1,190	32	3	0.7	0.1	0.8	0.1
	9	855	598	17	2	0.4	0.1	0.4	0.1
	10	876	615	17	2	0.4	0.1	0.4	0.1
Total Concentration Including Background[2]	1	6,338	3,785	174	52	32	14.2	17	7
	2	5,727	3,458	164	52	32	14.2	17	7
	3	4,613	2,679	142	51	31	14.1	16	7
	4	4,554	2,637	139	51	31	14.1	16	7
	5	4,966	2,860	149	51	31	14.1	16	7
	6	4,035	2,274	130	49	30	14.1	16	7
	7	3,619	1,984	122	49	30	14.1	16	7
	8	4,449	2,565	137	51	31	14.1	16	7
	9	3,605	1,973	122	49	30	14.1	16	7
	10	3,626	1,990	122	49	30	14.1	16	7
Air Quality Standard or Guideline (μg/m^3)		40,000	10,000	188/320[3]	100	150	50	35	12

Notes:
1. Air concentrations are derived from the SCREEN3 dispersion modeling from Hanscom Field operations that assumes all airborne emissions up to 3,000 feet are simulated as being released at ground level. Actual air concentrations will be less than these estimates because emissions above ground level will have a significantly reduced impact on ground-level locations.
2. Background levels measured at various MassDEP monitoring locations, see Table 8-2.
3. For NO_2, the 188 μg/m^3 represents the EPA 1-hour NAAQS, while the 320 μg/m3 represents the MassDEP 1-hour NO_2 Policy Guideline.
4. Emissions levels above 10 MT/yr are rounded to the nearest whole number.

Comparison with the standards guidelines shows that the estimated maximum concentrations predicted for 2035 would be in compliance with the NAAQS and the MassDEP 1-hour NO_2 Policy Guideline. Concentration levels for the 2025 future growth scenario would be lower because forecasted activity levels and emissions for 2025 are lower than those forecasted for 2035. Thus, it can be concluded that the air pollutant emissions shown in this *2017 ESPR* for aircraft and motor vehicles at Hanscom Field for all future planning scenarios would not have an adverse impact on local air quality. Aircraft emissions from Hanscom Field are minimal compared to air emissions from all sources within Middlesex County and that will remain so in the future operating scenarios.

Residents in Bedford near Runway 29 have expressed concerns about particulate deposition. Visible particles that settle from the air onto surfaces like outdoor lawn furniture or cars originate from many sources. For Bedford, these sources include motor vehicles on Route 128/I-95 and local roads, aircraft, and fuel oil combustion used to heat homes and businesses.

Conservative air concentration estimates of 24-hour PM_{10} levels at the homes near the end of Runway 29 reveal relatively low levels of particulate matter from aircraft operations equal to only one percent of the NAAQS for the 2035 planning scenario.

8.5 Greenhouse Gas (GHG) Emissions inventory

The *2017 ESPR* Scope Certificate requires the development of the first airport-wide GHG emissions inventory for Hanscom Field, to be used as a baseline to measure and compare future GHG emissions. This aligns with Massport's actions to prepare and update GHG emissions inventories for other facilities, including Logan Airport.

As this is the first GHG Inventory being conducted for Hanscom Field, a few pieces of information are worth noting:

- The emission source categories in this *2017 ESPR* are consistent with MEPA's GHG source categories used to analyze the environmental impacts of direct and indirect mobile and stationary source emissions.
- This 2017 baseline GHG emissions inventory was prepared following methodological guidance by the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP) and the World Resources Institute's Greenhouse Gas Protocol, consistent with the approach used for Boston Logan's GHG emissions inventories.[136]
- The 2017 GHG emissions inventory includes aircraft operations within the ground-based taxi-idle/delay mode and up to the top of the 3,000–foot LTO cycle. For estimating GHGs, the LTO cycle (up to 3,000 feet) uses the default mixing height in AEDT. GHG emissions associated with aircraft ground support equipment (GSE) and aircraft auxiliary power units (APUs), motor vehicles, a variety of stationary sources, and electricity usage were also included.
- Although the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) guidelines for the preparation of GHG inventories are designed for specific projects, the GHG inventory prepared for the *2017 ESPR* follows the guidelines as they use widely accepted emission factors that are considered appropriate for airports (including

[136] Transportation Research Board, Airport Cooperative Research Program, ACRP Report 11, Project 02-06, Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories. http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_011.pdf.

International Organization for Standardization (ISO) New England electricity-based values). The analysis is also consistent with ACRP guidance.

For consistency with the GHG Emissions Inventories conducted at Boston Logan International Airport since 2008, as well as for comparative purposes, GHG emissions are segregated by ownership and control into categories.[137] These three categories (listed in Table 8-11) are further characterized by the degree of control that Massport has over the GHG emission sources.

- **Category 1: Massport Owned** – These GHG emissions arise from sources that are owned and controlled by the reporting entity (in this case, Massport). Precise definition of Category 1 is sources which are owned by the entity, or sources which are not owned by the entity, but over which the entity can exert control. At Hanscom Field, these sources include Massport-owned and controlled stationary sources (boilers, generators, etc.), Massport fleet vehicles, and purchased electricity. On airport ground transportation and off-airport employee vehicle trips are also included as Category 1 emissions as they are partly controlled by Massport.
- **Category 2: Tenant Owned** – This category comprises sources owned and controlled by airport tenants, and include aircraft (on-ground taxi/idle and within the LTO up to 3,000 feet), GSE/APU, electrical consumption, and tenant employee vehicles.
- **Category 3: Public/Private Owned** – This category comprises GHG emissions associated with passenger ground access vehicles. These include private automobiles, taxis, limousines, buses, and shuttle vans operating on the off-airport roadway network.

Consistent with ACRP guidelines, the operational boundaries of the GHG emissions are also delineated, reflecting the scope of the emission source according to the GHG Protocol. Table 8-11 lists the scope of each source, which include:

- **Scope 1/Direct** – GHG emissions from sources that are owned and controlled by the reporting entity (in this case, Massport) such as stationary sources and airport-owned fleet motor vehicles.
- **Scope 2/Indirect** – GHG emissions associated with the generation of electricity consumed on-site, but generated off-site at public utilities.
- **Scope 3/Indirect and Optional** – GHG emissions that are associated with the activities of the reporting entity (in this case, Massport), but are associated with sources that are owned and controlled by others. Scope 3 emissions include aircraft-related emissions, emissions from airport tenant's activities, as well as emissions from ground transportation to and from the airport.

[137] Categorization is based on the methodological precedent set by Greenhouse Gas (GHG) Emissions Inventories over the past decade for Boston Logan International Airport's annual EDR and 5-year ESPR updates.

Table 8-11 Massport Ownership Categorization and Emissions Scope

Massport Emission Ownership Category	Source	GHG Protocol Scope
Category 1 – Massport Owned and/or Controlled	Massport Fleet Vehicle	Scope 1
	On-airport Ground Transportation	Scope 1
	Off-airport Employee Vehicle Trips, including employee commuting	Scope 3
	Ground Service Equipment/Auxiliary Power Units	Scope 1
	Stationary Sources (generators, boilers, etc.)	Scope 1
	Electrical Consumption	Scope 2
Category 2 - Tenant Owned and/or Controlled (includes airlines, government, aircraft operators, fixed-based operators, etc.)	Aircraft (on-ground, within the LTO up to 3,000 feet)	Scope 3
	Auxiliary Power Units/Ground Support Equipment	Scope 3
	Off-airport Employee Vehicle Trips, including employee commuting	Scope 3
	Stationary Sources (including generators, boilers, etc.)	Scope 3
	Electrical Consumption	Scope 2
Category 3 – Public Owned & Controlled	Off-airport Vehicle Trips (Includes private automobiles, taxis, limousines, buses, shuttle vans, etc., operating on the off-airport roadway network)	Scope 3

2017 Greenhouse Gas Emissions Inventory Summary

Table 8-12 displays the summary GHG inventory for Hanscom Field, categorized both by ownership category as well as scope. Emissions for CO_2, CH_4 and NO_2 were calculated and collectively converted to carbon dioxide equivalent, CO_{2e} (a measurement based on the Global Warming Potential of each GHG). The total CO_{2e} for Hanscom Field in 2017 is estimated at 23,892 metric tons (MT). Massport-controlled emissions are around 5 percent of the total.

Table 8-12 2017 Hanscom Field GHG Emissions Inventory Summary (Emissions Expressed in MT/ year)

Massport Ownership Category	Source	Scope	CO_2[1]	N_2O[1]	CH_4[1]	Total CO_{2e}[2]
Category 1 – Massport Owned/ Controlled Emissions	GSE/APUs	1	0.90	0.00	0.00	0.91
	Stationary Sources	1	209	0.00	0.00	211
	Off-Airport Roadways[3]	3	169	0.01	0.01	170
	Electricity Consumption[4, 5]	2	822	0.08	0.01	844
	Total Massport Emissions		**1,201**	**0.09**	**0.02**	**1,226**
Category 2 - Tenant Owned and/or Controlled	Aircraft[6] – Ground Operations	3	8,021	0.24	0.23	8,092
	Aircraft[6] – Ground to 3000 ft.	3	9,966	0.24	3.16	10,119
	Stationary Sources[7]	3	1,177	0.00	0.02	1,183
	GSE/APUs	3	290	0.01	0.02	293
	Off-Airport Roadways[3]	3	1,150	0.04	0.06	1,161
	Electricity Consumption[4]	2	1,342	0.13	0.02	1,379
	Total Tenant Emissions		**21,946**	**0.66**	**3.51**	**22,227**
Category 3 – Public Owned/ Controlled	Off-Airport Roadways[8]	3	407	0.12	0.00	439
Total Hanscom Field GHG Emissions			**23,554**	**0.87**	**3.53**	**23,892**
Massachusetts Statewide Totals (2016)[9]			**65,210,677**	**2,131**	**71,232**	**74,165,054**
Hanscom Field Emissions as a % of Statewide Totals			**0.04%**	**0.04%**	**<0.01%**	**0.03%**

Notes:
1. Fuel emissions were calculated utilizing EPA emission factors https://www.epa.gov/climateleadership/center-corporate-climate-leadership-ghg-emission-factors-hub.
2. Total carbon dioxide equivalent, or CO_2e, is calculated by applying the Global Warming Potential (GWP) values for each type of GHG in order to convert each to its equivalent mass in CO_2. GWP values are from the IPCC's Fifth Report (AR5), 2014.
3. Employee commuting travel was calculated utilizing 2017 Hanscom Travel Survey.
4. Electricity was calculated utilizing ISO New England and EPA standards.
5. Solar PV energy production at Hanscom provides a 20.02 MT reduction in CO_{2e} emissions from what would otherwise be generated by electricity use from the grid.
6. Aircraft emissions rates were produced by AEDT v2.0d.
7. For hourly generator use, these are assumed to be diesel generators with <600 hp. The source for CO_{2e} emissions rates is https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf.
8. MOVES2014a was used to calculate vehicle emissions rates for off-airport roadway traffic associated with Hanscom Field.
9. Figures obtained from the MassDEP Greenhouse Gas Inventory. https://www.mass.gov/lists/massdep-emissions-inventories#greenhouse-gas-baseline,-inventory-&-projection-. MA Statewide totals are calculated based on GWPs in IPCC AR4, where the GWP for N_2O is 298 in CO_2e, as opposed to the most recent set of GWP values, IPCC AR5, where the GWP for N_2O is 265 in CO_2e, resulting in a .09% difference. The statewide total for CO_2e in MT includes a wider range of GHGs, whereas the scope of this inventory and the character emissions from materials used on site at the airport are primarily limited to CO_2, N_2O, and CH_4.
10. Emissions levels above 10 MT/yr are rounded to the nearest whole number.

Figure 8-7 Sources of GHG Emissions According GHG Protocol Scopes

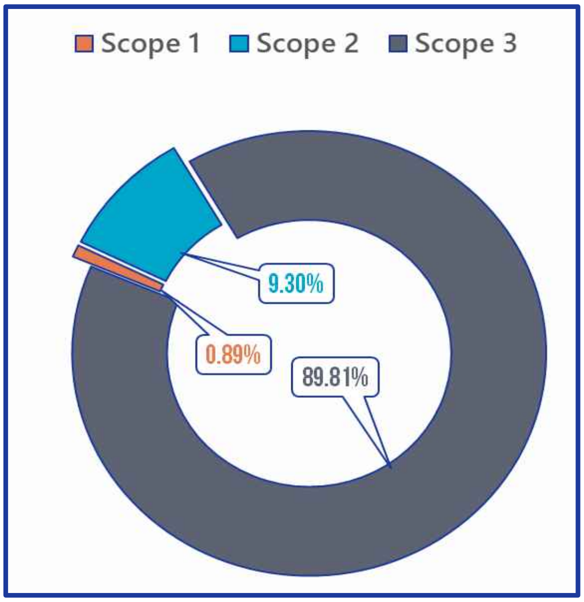
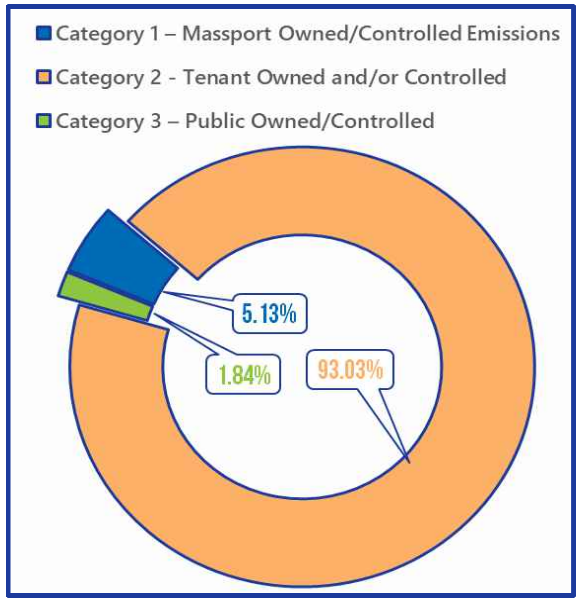


Figure 8-8 Sources of GHG Emissions According to Massport Ownership / Control Category



As Figure 8-7 and Figure 8-8 show, both methods of categorization demonstrate that Massport owned or controlled emissions make up a small percentage of the total GHG emissions for Hanscom Field. Category 1 emissions account for just 5 percent of total emissions, while Scope 1 emissions account for less than 1 percent of emissions. The major difference between the two categorizations is that "Category 1 – Massport Owned/Controlled Emissions" includes emissions from electricity usage, which is considered Scope 2 under the GHG Protocol.

When segregated by the GHG Protocol scopes, as displayed in Figure 8-7, Scope 3 GHG emissions include aircraft operations up to 3,000 feet, APUs/GSEs, tenant roadway use, tenant stationary sources (including emergency generators and boilers), and public roadway use. These Scope 3 sources represent the largest source of GHG emissions at Hanscom Field, at nearly 90 percent. Scope 2 GHG emissions from electrical consumption on site are the second largest source at 9 percent. Finally, Scope 1 GHG emissions, including Massport-owned and controlled emissions from vehicles and stationary sources (like generators and boilers) represent less than 1 percent of total emissions.

Analysis of Future Greenhouse Gas Emissions

Based on results from the aircraft operational analysis in AEDT v2.0d as well as the mesoscale traffic analysis conducted in MOVES2014a, future GHG emissions scenarios for 2025 and 2035 were forecasted. As stated in this document, these projections represent conservative estimates due to a variety of reasons including model limitations, unknown future regulatory requirements, technological advancements, and potential use of alternative fuels.

Figure 8-9 displays the GHG emissions in metric tons of CO_2e[138] from public owned/controlled vehicular traffic according to the mesoscale analysis conducted for this *2017 ESPR,* as documented in Section 8.4 [this number is larger than the CO_2 emissions from vehicular traffic reported earlier in the chapter because it incorporates methane (CH_4), and nitrous oxides (N_2O) as modeled in MOVES].

As the figure shows, there is an expected increase in GHG emissions from vehicular traffic in 2025, and a return to 2017 levels by 2035. Although the forecasted VMT in 2025 and 2035 are higher than 2017 (see Appendix E, Table E-1, Table E-2 and Table E-3), the CO_2 emissions rate per mile is forecasted to drop in future years by MOVES2014a (as future vehicle fleets are assumed to be more fuel efficient). The 2017 average CO_2 grams/mile in the mesoscale analysis is 354, while the values for 2025 and 2035 are 271 grams/mile and 213 grams/mile, respectively (see Tables E-1, E-2 and E-3).

Figure 8-9 Forecast GHG Emissions from Vehicular Traffic

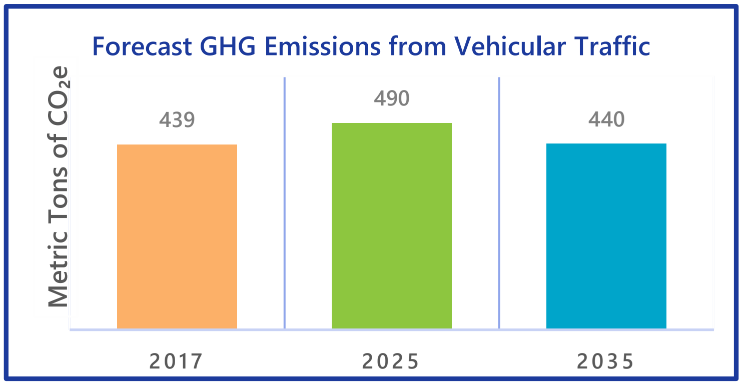


Figure 8-10 Forecast GHG Emissions from Aircraft Operations

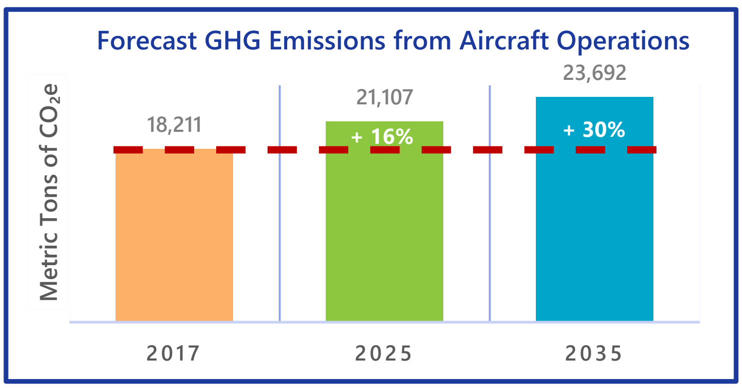


Figure 8-10 displays a steady increase in GHG emissions from aircraft operations in the forecast scenarios, which aligns with the increase in number of operations predicted in Chapter 3. GHG emissions levels for the 2025 and 2035 are forecasted to increase by 16 and 30 percent over 2017 levels, respectively. As this is the baseline GHG inventory, historical data is unavailable, preventing a comparison of 2017 to prior years, and limiting future forecasting. Future inventories will allow for better predictions as well as better contextualization of inventory results.

[138] Emissions of various GHGs can be converted to an equivalent amount of CO_2 based on global warming potential values. This measure is referred to as carbon dioxide equivalent (CO_2e).

8.6 Potential Environmentally Beneficial Measures

As described in this chapter, the maximum air quality concentrations for all future planning scenarios will comply with the NAAQS. In addition, Massport continues to implement beneficial measures to reduce on-site emissions where practicable. These measures are discussed below for fuel handling, ground service equipment, building heating/cooling, aviation support, airside operations, and the clean fuel vehicle program.

8.6.1 Fuel Conversion of Ground Service Equipment and Massport Groundside Vehicles

An inventory of current GSE and Massport groundside fleet vehicles at Hanscom Field is provided in Table 8-13. At present, approximately ten percent of the GSE and fleet vehicles at Hanscom Field are alternatively fueled, either by electricity or by propane (compared to eight percent in 2012).

Table 8-13 Ground Service Equipment and Vehicles by Fuel Type at Hanscom Field

Type of Vehicle or Equipment	Gasoline	Diesel[1]	Propane	Electric
Massport Fleet				
Cars/Vans/SUVs/Pick-up Trucks	10	3		
ARFF Truck		1		
Golf Carts				2
Snowplow Trucks/Snowblowers/Sweepers	1	18		
Large Field Tractors		2		
Front-end Loaders		2		
Forklifts			1	
Small Tractors/Mowers/Bobcat	1	7		
FBO: Signature				
Cars/Vans/Pickup Trucks	14			
Snowplows/Deicing Trucks		2		
Fuel Tanker Trucks		8		
Belt Loader/Tugs/Air Stairs	6	4		3
Golf Carts				2
Forklifts			1	
Ground Power Units		3		
FBO: Jet Aviation				
Cars/Vans/Pickup Trucks	8			
Tugs/Belt Loaders/Air Stairs	10	2		6
Deicing Trucks	2	1		
Fuel Tanker Trucks		8		
Golf Carts				1
Ground Power Units	2	6		
Forklifts			1	
FBO: Rectrix				
Cars/Vans/Pickup Trucks	2			
Tugs/Belt Loaders/Air Stairs	2			2
Deicing Trucks				
Fuel Tanker Trucks		2		2
Golf Carts				1
Ground Power Units		2		
Small Tenants[2]				
Cars/Vans/SUVs	44	4		
Tugs	1	2		2
Heavy Equipment-		8		
Snow Removal Contractors (seasonal)				
Heavy Equipment – Trucks, Loaders	1	25		
Total[3]	**104**	**110**	**3**	**21**

Notes:
[1] As part of EPA regulations, ultra-low sulfur diesel fuel for on-road diesel vehicles was phased-in starting in 2006.
[2] Tenant vehicles not specifically addressed as part of the Jet Aviation or Signature Flight support fleet.
[3] Electric and propane represent 10.1% of total GSE and fleet vehicles (24 of 238).

Ground service and landside conversions to alternative fuels were considered and discussed in the *2012 ESPR*. GSE operations are not a significant source of emissions at Hanscom Field in comparison to aircraft emissions. The majority of GSE operations with Massport-owned equipment involve airport maintenance (e.g. snow plowing, snow blowing and runway sweeping) with large vehicles that, given their power needs, are not presently candidates for conversion to alternate fuels. Fleet vehicles are more likely candidates for the use of alternative fuels along with electric GSE and gate electrification. Alternative fuels include electric, hybrid, biodiesel, propane, and natural gas.

As cited above, Massport has made progress in this area and owns two electric vehicles at Hanscom Field. Massport will consider additional Alternative Fueled Vehicles (AFVs) for new vehicle purchases in the future. Some tenants also have electric-only vehicles in their fleet that require 110/220v wall plug connections. Chapter 11 provides additional information on electric vehicles. As part of their electric vehicle and ground service equipment charging initiative, Massport has recently investigated the installation of electric charging stations at Hanscom Field to support the use of electric vehicles to help reduce GHG emissions. GSE operations by the tenants involve a mix of large and small equipment, some of which are electric-powered. While power needs for some of this equipment (e.g. the snowplows, tanker fuel trucks) preclude their use of alternative fuels, Massport will encourage tenants to consider alternatively fueled GSE, where appropriate, when making purchases of new equipment.

Building Heating and Cooling

In October of 2011, Hanscom installed 222 PV solar panels, mounted on the roof and side of the Civil Air Terminal building. Panels are located on the south-facing side of the building roof and a series of wall-mounted panels are on the façade of the building. The system has a nameplate capacity[139] of 51 kilowatts, and produced over 79,000 kWh of electricity in 2016, equivalent to approximately 4 percent of Massport's total electricity consumption at Hanscom Field.[140] As described in Chapter 11, Hanscom Field tenant Boston MedFlight also added solar panels.

Massport and Hanscom Field tenants have undertaken other measures to improve energy efficiency and reduce emissions from their facilities, using green design and construction standards, such as the U.S Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system. For example:

- Massport's permanent Airport Rescue & Firefighting (ARFF) and United States Customs and Border Protection (USCBP) Building facility at Hanscom Field (which began construction in 2018) is designed to LEED Gold standards. Sustainability considerations were incorporated throughout the buildings' planning, design, and construction phases. Innovative whole-building energy simulation modeling was utilized by

[139] Nameplate capacity is the intended, full load sustained output of a power plant or renewable energy system.
[140] Figure obtained from Massport annual utility data renewable energy generation statistics

architects during the design process to optimize energy performance, projected to achieve 30 percent energy savings.

- ⇨ The Rectrix FBO facility is designed to LEED Silver standards and is awaiting certification (by the U.S. Green Building Council). The facility uses energy efficient LED lighting and natural gas for heating.
- ⇨ Jet Aviation's new hangar and FBO facility are designed to LEED Silver standards (and are awaiting completion of the certification as of May 2019). Jet Aviation uses LED lighting and high efficiency condensing boilers for heating, and their vehicle maintenance shop uses a recycled oil-fired burner for heating.
- ⇨ Boston MedFlight's new facility is designed to LEED Silver standards (and is awaiting completion of the certification as of May 2019).

Clean Fuel Vehicle Program

Massport has made progress in bringing alternative fueled vehicles (AFVs) into its fleet at Hanscom Field. At present, two of Massport-owned fleet vehicles are electric. Massport will continue to consider AFVs for any new vehicle purchase in the future. Also, as Massachusetts has adopted the California Low Emission Vehicle program, any new conventional-fueled vehicle added to the Hanscom fleet in the future will have very low emissions, and will automatically comply with the low emission goals of the federal Clean Fuel Fleet Program (40 CFR Part 88).[141]

Status of Lead Free Avgas in the United States

The FAA is currently working through a collaborative industry-government program, known as the Piston Aviation Fuels Initiative (PAFI), to facilitate and evaluate development of an alternate fuel for leaded aviation gasoline.[142] As of May 2019, development of PAFI fuels is ongoing; research and testing of alternatives continue at the FAA's William J. Hughes Technical Center in Atlantic City, NJ. PAFI plans to facilitate deployment of the alternative when a suitable alternative is identified. See Appendix E for additional information on the current status of lead free Avgas research.

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[141] Published March 1, 1993, amended May 4, 1999. Title 40 CFR Part 88, Subpart C. Clean Fuel Fleet Program. https://ecfr.io/Title-40/pt40.20.88 and see also EPA, August 1998, Clean Fuel Fleet Program Implementation. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1009ZL8.txt

[142] FAA Unleaded AVGAS Transition Aviation Rulemaking Committee (UAT ARC). February 2012. *Final Report, Part I: Body Unleaded AVGAS Findings & Recommendations.* Available at: http://www.faa.gov/regulations_policies/rulemaking/committees/documents/media/Avgas.ARC.RR.2.17.12.pdf

9 Wetlands, Wildlife & Water Resources

This chapter presents an overview of the natural environment at Hanscom Field as well as a summary of Massport's current efforts to minimize impacts to the natural environment from airport activities. The potential impacts to the natural environment and water quality are presented for the 2025 and 2035 scenarios.

This chapter provides information about wetlands, wildlife and water resources. The information establishes year 2017 conditions by reporting data from various sources that include the 2012 Environmental Status & Planning Report (ESPR), 1998 Hanscom Field Wetlands Delineation Location Map and updates, the 2004-2008 and 2009-2013 Hanscom Field Vegetation Management Plan (VMP), the Massachusetts Natural Heritage and Endangered Species Program's (NHESP) current inventory of rare species, Geographic Information System (GIS) data provided by MassGIS, and reports to the National Wildlife Strikes Database. This chapter also reports on the status of the VMP, the Stormwater Pollution Prevention Plan (SWPPP), the Shawsheen River water quality monitoring program, and the 2009 National Pollutant Discharge Elimination System (NPDES) permit that includes nine Hanscom Field tenants.

9.1 Key Findings

Wetlands, wildlife, and water resource areas at Hanscom Field are fundamentally unchanged from the *2012 ESPR*. With only minor exceptions, the surrounding habitat areas are well established with little variation from year-to-year. Based on the relatively static nature of field conditions and the large extent of the airfield, updates to wetland mapping tend to occur on a project-by-project basis. There have only been a few project-specific new wetland delineations of existing wetlands at Hanscom Field since 2012. As stated in Chapter 2, there have been a series of airport facility and infrastructure improvements, initiatives, and/or studies undertaken at Hanscom Field since the *2012 ESPR*. During the planning process for each of these improvements, project-specific wetland delineations, if needed, were undertaken.

Since the 2012 ESPR, Massport prepared a 2014-2018 VMP update and continued to mitigate runway safety obstructions using the recommendations during that time period. The next VMP update will address the management interval period of 2019-2023 and will be completed later in 2019.

The Massachusetts Natural Heritage and Endangered Species Program (NHESP) revised the statewide inventory mapping in 2016. As a result, some areas in the North Airfield area that were formerly designated as critical rare species habitat were no longer designated as such, since those areas did not contain the requisite special habitat requirements of the rare bird species (Grasshopper Sparrow and Upland Sandpiper) known to inhabit other areas of the airfield.

Consultation with the Massachusetts Division of Fisheries & Wildlife (MADFW) (August 2018) revealed that Hanscom Field, "*or a portion thereof, is located within Priority Habitat 1128 and 1555 (PH 1128, PH 1555) and estimated Habitat 1623 and 1096 (EH 1623 and EH 1096) as indicated in the Massachusetts Natural Heritage Atlas (14th Edition)*" for two turtle and two bird species. The priority and estimated habitat designations for the two turtle species – the State Threatened Blanding's Turtle and the State Special Concern Wood Turtle – were recent additions to the MADFW consultation response since the *2012 ESPR*. Habitat for the Blanding's Turtle lies adjacent to but outside of the Hanscom Field property, while the mapped habitat for the Wood Turtle lies on Hanscom Field property. Also, since the last ESPR document was published, the Northern Long-eared Bat (*Myotis septentrionalis*) was listed as threatened under the federal Endangered Species Act on April 2, 2015.

Because Massport's long-standing strategy is to maximize reuse of pre-developed areas of the airport, the 2025 and 2035 scenarios are designed to avoid impacts on vernal pools, wetlands, rare or endangered species habitat, and water quality. Wherever practicable, Massport also looks for opportunities to enhance existing environmental conditions.

All of the future planning concepts that could occur over these time periods are focused on areas more than one-half mile from any of the certified vernal pools in the western portion of the airport. As has been Massport's policy, planning for any facilities would seek to avoid or minimize both direct and indirect adverse impacts to resource areas through the design process. In the event there are unavoidable impacts, mitigation would be proposed.

When considering potential habitat impacts, indirect impacts are not expected to disrupt these populations since these species currently occupy an active airport environment with a managed (regularly mowed) airfield (see Figure 9-2). Potential water quality impacts would be avoided through the continued implementation of construction-phase stormwater pollution prevention plans (SWPPPs) under the EPA's Construction General Permit (CGP), the update of the airport operations SWPPP required by the Multi-Sector General Permit (MSGP), and conformance with applicable standards for stormwater management required for site development or redevelopment by the Massachusetts Department of Environmental Protection (MassDEP). Where practicable, Massport also looks for opportunities to enhance groundwater infiltration.

Some of the planning areas in the 2025 and 2035 scenarios contain wetland resources or are located near wetlands. Massport will make every effort to avoid, minimize, and mitigate potential wetland impacts for future Massport or tenant projects. Projects involving work within wetland resource areas or their buffer zones require applications to the appropriate conservation commissions for permitting under jurisdiction of the Massachusetts Wetland Protection Act (WPA).

During 2003 and 2004, Massport conducted a deicing study (Hanscom Field Deicing Study, 2003) and monitoring effort at Hanscom Field. That study concluded that neither current nor future scenario deicing activities at Hanscom Field would adversely affect the water supply for Bedford or Burlington, nor would they adversely affect the ecosystem of the Shawsheen River or Elm Brook. Hanscom uses less than 100,000 gallons of deicing fluid on an average annual basis (<30,000 gallons of aircraft deicing fluid was used during the 2017-2018 deicing season [November 1 – April 15]), and is therefore not subject to benchmark monitoring that is typically required as part of the National Pollutant Discharge Elimination System (NPDES) MSGP (see Runway Deicing section for more details). Since future scenario deicing efforts are not expected to change, the conclusion of no adverse outcomes remains.

9.2 Year 2017 Conditions

The following section describes the existing Hanscom Field environment in terms of geographic and geologic characteristics, wetlands and surface water features, wildlife habitat, rare and endangered species, and groundwater. It also describes Massport's efforts to maintain and improve the quality of stormwater runoff from the site. In addition, an update on the environmental auditing programs, MassDEP-listed sites, and the Hanscom Air Force Base (AFB) environmental restoration program is provided.

9.2.1 Geographic and Geologic Conditions

A general discussion of the geographic and geologic characteristics is provided below.

Geography and Topography

Hanscom Field is situated in the Eastern Plateau Physiographic Region, a low-lying and well-dissected[143] region of eastern Massachusetts. Primary drainage for this region is provided by the Merrimack, Parker, Rowley, Ipswich, Concord, Sudbury, Assabet, Charles and Neponset Rivers. The United States Geological Survey (USGS) maps the elevation of Hanscom Field ranging from a high of about 250 feet above mean sea level (AMSL) just west of the airfield to a low of approximately 118 feet AMSL east of the runways, with the majority of the study area below 150 feet AMSL.

Geology and Soils

Hanscom Field is underlain by a complex assortment of Pleistocene Epoch glacial and recent deposits that overlay Silurian and Ordovician Period igneous and metamorphic bedrock. Repeated advances and retreats of continental glaciers removed the pre-glacial deposits, shaped the bedrock, and deposited unconsolidated material in the form of glacial till and outwash deposits. Following retreat of the last glacier approximately 13,000 years ago, peat developed in wetland areas, and fill material was added during the development of the airfield in the last century.

Native soils within the perimeters of Hanscom Field have been disrupted by construction and associated earth-moving activities. The Natural Resource Conservation Service (NRCS) has classified most of the soils on the airfield as udorthents. Udorthents are defined by the United States Department of Agriculture (USDA) Natural Resources Conservation Services (NRCS), as a map unit consisting of well-drained to excessively well-drained soil composed of cut areas, filled areas, or both. They are often in association with urban areas. In areas that were cut, the surface layer has been removed and in fill areas, typically more than 20 inches of soil material has been placed on the surface. Often both cut and fill areas occur in close proximity, as areas were often graded and smoothed forming a complex pattern of cuts and fills. Middlesex County-wide soils data was obtained from the Soil Survey Geographic Database (SSURGO), which includes updates to soil boundaries and their respective acreages. Based on these updates, no changes to the mapped soils have been identified since 2012.

9.2.2 Wetlands

The following section describes the current status of the state and federally-protected wetland resource areas at Hanscom Field in the towns of Bedford, Concord, Lexington, and Lincoln. Descriptions of wetland resource types and the criteria for their identification follow.

[143] Refers to the dissection of the land by many streams and rivers.

Descriptions of the individual Hanscom Field wetland areas' vegetation, soils, and hydrology are presented in Table 9-1. Wetland areas are depicted in Figure 9-1. This information was derived from a review of existing documents, including the *2012 ESPR*; wetland delineations performed for the 2004-2008 Hanscom Field Vegetation Management Plan; wetland delineations performed in 2010 and 2012 in association with onsite activities, information collected for a variety of environmental studies associated with airport facility and infrastructure improvement projects; and a review of all available GIS data from multiple sources including MassGIS. No on-site field investigations or delineations were conducted as part of this wetland update.

The *2012 ESPR* evaluation of Hanscom Field divided the airfield into three distinct zones: Zone 1 occupies most of the airfield, including all runways and taxiways as well as the ends of Runways 5 and 11; Zone 2 refers to the areas west of Runway 29; and Zone 3 is located southwest of Runway 23. The *2017 ESPR* update utilizes these same boundaries for consistency.

The wetland resource areas at Hanscom Field include wetlands subject to regulation by both the Commonwealth of Massachusetts and U.S. Army Corps of Engineers (USACE). The regulations of the Massachusetts WPA (310 Commonwealth of Massachusetts Regulations [CMR] 10.00 et seq.) define five freshwater wetland resource areas subject to protection: Banks; Bordering Vegetated Wetlands; Land Under Waterbodies/Waterways; Bordering/Isolated Land Subject to Flooding; and Riverfront Area. Each of these resource area types is defined as follows:

- **Banks** are land areas that normally abut and confine a water body. Banks occur between a waterbody and a vegetated wetland or adjacent floodplain, or between a waterbody and an upland.
- **Bordering Vegetated Wetlands** (BVW) include those vegetated freshwater wetlands that border on water bodies and waterways. The technical criteria and methodology utilized to identify and delineate BVW is set forth in Delineating Bordering Vegetated Wetlands under the Massachusetts WPA (DEP, 1995). Criteria for identifying and delineating this resource area include the presence of a plant community dominated by wetland indicator species, and signs of hydrology. The presence of hydric soils within the wetland is considered an indicator of hydrology.
- **Land Under Water Bodies/Waterways** (LUWB) is the land area under any creek, river, stream, pond, or lake and is a resource area subject to protection under the Massachusetts WPA.
- **Bordering Land Subject to Flooding** (BLSF) is an area with low, flat topography adjacent to and inundated by flood waters rising from creeks, rivers, streams, ponds or lakes. BLSF extends from the banks of these waterways and water bodies; where a bordering vegetated wetland occurs, it extends from said wetland. BLSF boundaries are the maximum lateral extent of floodwater, which will theoretically result from the statistical 100-year storm. The extent of Bordering Land Subject to Flooding is typically derived from examining FEMA Flood Insurance Rate Maps.

- **Isolated Land Subject to Flooding** (ILSF) are isolated depressions or closed basins without an inlet or outlet. It is an area which, at least once per year, confines standing water to a volume of at least one-quarter acre-feet and an average depth of at least six inches.
- **Riverfront Area** is land between a perennial river's mean annual high-water line and a parallel line located 200 feet away, measured horizontally outward from the river's mean annual high-water line. The perennial status of a waterway is generally determined by examination of the USGS topographic map.

A 100-foot buffer zone is associated with state-regulated Bank and Bordering Vegetated Wetland.

The USACE regulations that accompany the Federal Clean Water Act [33 CFR Parts 321-330 (November 12, 1986)] define waters of the United States as aquatic habitats that include open water areas and wetlands. Wetlands are further defined as those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. The USACE requires the acquisition of permit approvals for impacting federal-jurisdictional wetland resources. The USACE has approved 23 General Permits for the Commonwealth of Massachusetts under which projects with minor impacts to federal wetlands may receive USACE approval. For projects with very minor impacts to federal wetlands, the USACE allows approval under the "Self-Verification" process, which does not require submittal of a permit application. In this case, Massport would still need to obtain approvals from local commissions, per the Massachusetts Wetland Protection Act (WPA). No separate USACE filings have been made at Hanscom Field.

Wetlands generally include swamps, marshes, bogs, and similar areas [33 CFR 328.3(b)]. This definition emphasizes a wetland's attributes of hydrophytic vegetation, hydric soils, and hydrology. Pursuant to the USACE Wetlands Delineation Manual (Environmental Laboratory, 1987) (the Manual), the mandatory technical criteria that characterize these parameters are outlined as follows:

- **Hydrophytic Vegetation:** The predominant vegetation consists of macrophytes, which typically grow in soils that are periodically deficient in oxygen as a result of excessive water content. The U.S. Fish and Wildlife Service (USFWS) publication, "National List of Plant Species that Occur in Wetlands: Northeast (Region 1)" (Reed, 1988) and its 1995 supplement, were used to classify plant species according to their frequency of occurrence in wetlands.
- **Hydric Soils:** These are soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions (typified by thick organic surface layers, gleying, or mottles) within a depth of 18 inches.
- **Hydrology:** Addresses areas that are saturated to the surface or inundated at some time during the growing season of the prevalent vegetation. Typical indicators include surface-scoured areas and water-stained leaves.

Based on a review of the existing site and relevant information, the current status of the wetland resource areas at Hanscom Field is relatively unchanged from those identified in the *2012 ESPR*. A description of the vegetation, soils, hydrology, and presumed values of these areas is provided in Table 9-1 (Large wetland complexes are described as single wetlands on the figure and in the table).

Table 9-1 Description of Wetland Resources

Wetland I.D.	Resource Areas[1]	Wetland Type[2]	Soil Type[3]	Notes	2017 Update
1-1 2010	BVW, Bank, LUWB, Riverfront	PFO1, PSS, R3	Saco	This wetland complex is comprised of forested and scrub/shrub wetland types with several channelized drainage swales which flows into the Shawsheen River. Dominant species include Red Maple, Trembling Aspen, Glossy Buckthorn, Highbush Blueberry, Silky Dogwood, Speckled Alder, and Cinnamon Fern. This wetland boundary was left open at the property limit.	No change since 2012.
1-2 2010, 1998	BVW, Bank, LUWB	PFO1, PSS1, R4, PEM	Scarboro, Freetown	This wetland complex is primarily a red maple swamp with scrub/shrub and emergent portions. Dominant vegetation includes Red Maple, Highbush Blueberry, Glossy Buckthorn, Tussock Sedge, Soft Rush, and Sphagnum. Beaver activity has flooded a portion of this wetland between 2012 and 2017, but recent 2018 aerials reveal the flooded areas have been drained.	No change since 2012.
1-3 GZA -K 2010 2016	BVW	PSS6	Udorthents - Sandy	This scrub/shrub wetland wraps around the end of Runway 23.	Based on GZA wetland delineation report 2016.
1-4 1998 2016	BVW, Bank	PSS1, PEM1	Scarboro, Udorthents -Sandy	Wetland 1-4 is a detention basin that borders on a larger red maple swamp.	No change since 2012.

Wetland I.D.	Resource Areas[1]	Wetland Type[2]	Soil Type[3]	Notes	2017 Update
1-5 1998	Non-Jurisdictional	PSS1	Udorthents -Sandy	This wetland is a relatively small isolated depression within a mowed area. It is not a state jurisdictional area.	No change since 2012.
2-1 1998, 2010 2016	BVW, Bank, LUWB, Riverfront	PFO1, PSS1, PEM1, R3, R4	Freetown, Wareham, Scarboro, Swansea	This wetland complex is associated with Elm Brook and contains a 200-ft riverfront area. It contains forested, scrub/shrub and emergent wetland types. Dominant species include Red Maple, Highbush Blueberry, Glossy Buckthorn, Northern Arrowwood, Woolgrass, Tussock Sedge, Soft Rush, and Sphagnum Moss.	No change since 2012.
2-2 2010	Non-Jurisdictional	PSS1, PEM1	Udorthents -Sandy	Not a state-jurisdictional wetland area	No change since 2012.
2-3 2010	Non-Jurisdictional	PUB3	Deerfield	This is an isolated non-jurisdictional wetland area with limited vegetation. This area was previously identified in the 1995 GEIR and *2000 ESPR* as a possible vernal pool.	No change since 2012.
2-4 2010	Certified Vernal Pools	PSS1, PUB, PEM1	Windsor, Deerfield	This wetland area is composed of several isolated wetlands apparently formed within depressions created by past earth moving activities. They are scrub/shrub and emergent wetlands dominated by willow, Silky Dogwood, Purple Loosestrife, and Sensitive Fern. According to the Massachusetts Natural Heritage Atlas 13th edition, this area contains two certified vernal pools.	No change since 2012.
2-5 2010	Certified Vernal Pools	PSS1	Deerfield	This isolated area is also apparently formed in a man-made depression and contains Purple Loosestrife and Sphagnum Moss. According to the Massachusetts Natural Heritage Atlas, this area has been certified as a vernal pool.	No change since 2012.

Wetland I.D.	Resource Areas[1]	Wetland Type[2]	Soil Type[3]	Notes	2017 Update
2-6 1998, 2010	Non-Jurisdictional	PSS1 PFO1	Deerfield	This isolated wetland has possibly formed in a man-made depression in a disturbed area. It is a forested and scrub/shrub wetland type dominated by Red Maple, American Elm, Glossy Buckthorn, Silky Dogwood, Northern Arrowwood, and Multiflora Rose.	No change since 2012.
2-7 2010	Non-Jurisdictional	PFO1 PSS1	Scarboro	This isolated wetland has possibly formed in a man-made depression in a disturbed area. It is a forested and scrub/shrub wetland type dominated by Red Maple, American Elm, Glossy Buckthorn, Silky Dogwood, Northern Arrowwood, and Multiflora Rose.	No change since 2012.
2-8 1998, 2010	BVW	PFO1, PSS1, PEM1	Scarboro	This wetland is a red maple swamp that also contains portions of scrub/shrub wetland and emergent wetland. It receives road drainage from Old Bedford Road.	No change since 2012.
2-9 1998 2016	Bank, LUWB	R4	Udorthents - Loamy	This area is an open drainage ditch that outlets to Elm Brook.	No change since 2012.
3-1 1998	ILSF Possible	PFO1	Canton	Wetland 3-1 appears to be man-made, either inadvertently or for stormwater management purposes. Wetlands 3-1 is forested and scrub/shrub wetlands with small emergent areas. Dominant species in the forested and scrub/shrub areas include Red Maple, Glossy Buckthorn, Gray Birch, Trembling Aspen, Speckled Alder, and Cinnamon Fern.	Mapping shows a hydrology connection adjacent to this wetland.

Wetland I.D.	Resource Areas[1]	Wetland Type[2]	Soil Type[3]	Notes	2017 Update
3-2 1998	Potential BLSF or BVW	PFO1	Canton	Wetland 3-2 appears to be man-made, either inadvertently or for stormwater management purposes. Wetland 3-2 Wetlands 3-1 is forested and scrub/shrub wetlands with small emergent areas. Dominant species in the forested and scrub/shrub areas include Red Maple, Glossy Buckthorn, Gray Birch, Trembling Aspen, Speckled Alder, and Cinnamon Fern.	Mapping shows a hydrology connection adjacent to this wetland.
3-3 1998 2016	BLSF	PEM1	Canton	Wetlands 3-3 is a vegetated swale dominated by emergent species such as Cattail and Purple Loosestrife.	Was Delineated in 2016 as wetland flag line D 30-36.
3-5 1998	Non-Jurisdictional	PFO1	Canton	Wetland 3-5 appears to be relatively undisturbed forested wetland dominated by Red Maple, Trembling Aspen, and Winterberry.	Connected to No.3 Delineated 2012.
3-8 1998, 2010	BVW, Bank, BLSF, Riverfront	PFO1, PSS1, PEM1, R4	Freetown, Wareham, Deerfield, Birdsall	This relatively large and undisturbed wetland complex consists of forested, scrub/shrub, and emergent communities. It is also within the Elm Brook floodplain which generates a 200-ft riverfront area. Recent aerials show an area of PUB (shallow Marsh or Fen) within the system. Forested red maple swamp with a Glossy Buckthorn understory is the dominant type of wetland in this complex. Portions of the complex also include Purple Loosestrife dominated marsh and farmed areas.	No change since 2012.
Wetland No. 1 (3-9) 2012 2016	BVW	PEM1	Canton	This wetland consists of an emergent plant community, with a large number of soft rush present. Hydric soils are present with abundantly mottled and saturated at the surface, with some standing water.	Was Delineated in 2016 as wetland flag line D 1-20.

Wetland I.D.	Resource Areas[1]	Wetland Type[2]	Soil Type[3]	Notes	2017 Update
Wetland No. 2 2012	BVW	PSS1, PEM1, PFO1	Canton	This wetland contains forested scrub/shrub and emergent wetlands. It is located south of Wetland No. 1, (wetland 3-9) but is not connected to it. The most abundant canopy species includes Red Maple and Eastern Cottonwood. The most common understory species includes Speckled Alder, Pussy Willow, Oriental Bittersweet, Jewelweed, and Cattail. Within a portion of this wetland, the characteristics of a certified vernal pool have been observed. To date the pool has not been certified by the Massachusetts Natural Heritage and Endangered Species Program.	No change since 2012.
Wetland No. 3 2012	BVW	PFO1	Canton	This wetland is primarily forested and drains in a westerly direction to the drainage channel adjacent to the existing T hangars. Dominant canopy species include Red Maple and Yellow Birch, while understory species consist of Northern Arrowwood, Norther Spicebush, Skunk Cabbage, and Sensitive Fern. Within a portion of this wetland, the characteristics of a certified vernal pool have been observed. To date the pool has not been certified by the Massachusetts Natural Heritage and Endangered Species Program.	Wetland 3-5 connected to this system from the south. No change since 2012.

Wetland I.D.	Resource Areas[1]	Wetland Type[2]	Soil Type[3]	Notes	2017 Update
Wetland No. 4 2012	BVW	PSS1, PEM1	Canton	This wetland is primarily scrub/shrub and emergent wetland. Dominant species include Pussy Willow, Blue Vervain, Woolgrass, and Tussock Sedge. Groundwater and surface runoff flow in the direction of the drainage channel adjacent to the existing T-hangars.	There has been recent development to the north and west of this wetland. The developments have not affected the wetland as described.
S 2018 2001	BVW	R4	NA	This is a drainage channel which circles the T-hangar facility. Several existing wetlands drain into this system. Vegetation is unknown at this point. There is a culverted inlet located at the northeast corner and northwest corner of the T-hangars.	This was delineated in 2001 and 2018.
Y 2012	BVW	PEM1	NA	Small isolated wetland area identified as having been delineated in March 2012. Vegetation unknown.	This was delineated in March 2012.

Notes:
1. Massachusetts WPA Resource Areas (310 CMR 10.00):
RA - 200 Foot Riverfront Area
BVW - Bordering Vegetated Wetland
Bank – Bank (Land which abuts and confines a water body)
LUWB – Land Under Water Bodies Waterways
ILSF – Isolated Land Subject to Flooding
Isolated Wetland is hydrologically isolated (Not a Massachusetts WPA Resource Area)
2. Wetland Type (Cowardin et al, 1977)
PFO 1 – Palustrine Forested/Broad-Leaved Deciduous PFO 4 Palustrine Forested/Needle-Leaved Evergreen
PSS 1 – Palustrine Scrub-Shrub/Broad-Leaved Deciduous
PEM 1 – Palustrine Emergent/Persistent
PUB – Palustrine Unconsolidated Bottom (unvegetated wetland)
R3 – Riverine (perennial)
R4 – Riverine (intermittent)
B – Beaver Influenced
3. Soil Series Mapped by USDA SCS (Middlesex Conservation District, 1986)
Source: 2014 Hanscom Field Vegetation Management Plan ; 2014 Jet Aviation Draft Environmental Assessment

The wetland resources at Hanscom Field have been delineated many times over the past 20 or more years as part of various airport facility and infrastructure improvement projects.

Additional site-specific reviews have been conducted under VMP, SWPP, and drainage planning.

The naming and mapping convention used in previous ESPRs and other planning documents has been retained to ensure a consistent means to evaluate the known wetland resources at Hanscom Field. Except where noted, the wetland descriptions provided in Table 9-1 remain applicable to the updated wetlands. For the most recent wetland surveys, updated information is provided in Table 9-1. Delineations undertaken since the *2012 ESPR* were project-specific and included small elements of larger systems previously delineated in 2012. These boundaries were incorporated into the wetland systems depicted shown in Figure 9-1. The jurisdictional determination for four delineated bordering vegetated wetlands (wetlands No. 1 through No. 4) was approved by the Lincoln Conservation Commission through an Advanced Notice of Resource Area Delineation (ANRAD) in 2012. Previously delineated wetlands (3-4 and 3-5) in proximity to these four wetlands were considered non-jurisdictional; the jurisdiction of these areas, as well as any other wetlands on Hanscom Field, will be re-evaluated if any development or other activity is proposed within or adjacent to these locations.

Wetland delineations are conducted on a project-specific basis and include the following:

- **1998 – MPA**
- **2001 – Dufresne-Henry, Inc.**
- **2008 – McFarland Johnson**
- **2010 – Stantec**
- **2011 – McFarland Johnson**
- **2012 – Wetlands & Wildlife, Inc.**
- **2016 – McFarland Johnson**
- **2016 – GZA**
- **2017 – McFarland Johnson**
- **2018 – Stantec**

The boundaries and regulatory status of the wetlands beyond the vegetation management areas would be subject to review and approval by the applicable conservation commission(s) through the submission of appropriate applications under the Massachusetts WPA for any future proposed work within a jurisdictional area.

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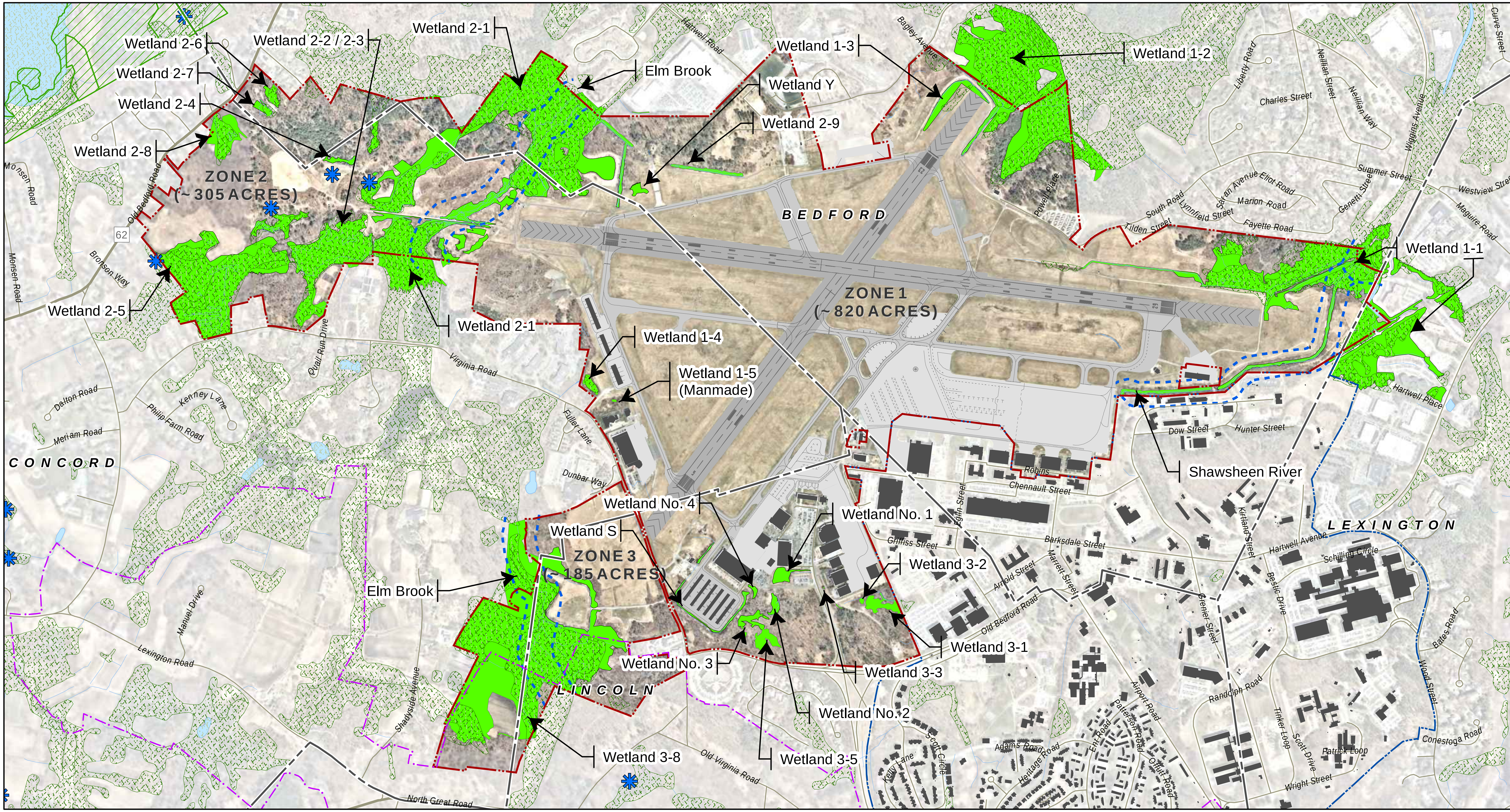

North

0 2,000 4,000 Feet

Data Sources: MassGIS 2018; NeoMap 2018, MassPort

Hanscom Field Property Boundary
Hanscom AFB Property Boundary
Municipal Boundary
Great Meadows National Wildlife Refuge Boundary
Minute Man National Park Boundary

Historic Road
Interstate
Highway
Road
Trail
Active Rail Service

Stream
Open Water
MA DEP Wetland/Marsh 2018
Delineated Wetland/Marsh (2012 and Older)
NHESP Certified Vernal Pool Updated 2018
200-foot Riverfront Area

massport

L. G. Hanscom Field
2017 Environmental Status & Planning Report

Wetlands Location Map

Figure **9-1**

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9.2.3 Vernal Pools

Three vernal pools have been certified at Hanscom Field outside of the existing airfield. Based on a review of NHESP 2018 GIS data, there are no changes to these resources since 2012. Additionally, no new vernal pools have been certified and no previously-existing certified vernal pools have been removed since 2012. These three vernal pools (within Wetlands 2-4 and 2-5), are located within the Town of Concord to the west of Runway 11/29, and are shown on Figure 9-1. A fourth area with potential vernal pool characteristics occurs within Wetland 2-3 in the same vicinity as the three certified vernal pools in Concord. During 2012 wetland delineations, characteristics of certified vernal pools were identified in wetlands No. 3 and No. 4. However, these areas have not been certified by the NHESP. A plan to protect the certified vernal pools during vegetation management operations was developed as part of the current Hanscom Field VMP.

9.2.4 Perennial Streams

Two perennial waterways exist at Hanscom Field: the Shawsheen River in Bedford and Elm Brook in Bedford, Concord, and Lincoln. The USGS topographic map (Maynard Quadrangle, 1987) indicates that both the Shawsheen River and Elm Brook are perennial waterways. Elm brook is tributary of the Shawsheen River. Additionally, the Massachusetts WPA specifically states that the entire length of the Shawsheen River, a major river, has an associated Riverfront Area. As such, both the Shawsheen River and Elm Brook have a 200-foot wide Riverfront Area extending landward from each Bank within which work is subject to regulation under the Massachusetts WPA. There have been no changes to these resources since 2012. Hanscom Field is located in the upper reaches of the Shawsheen River watershed, and comprises small areas with basin nos. 15002 and 15005.

9.2.5 Vegetation and Wildlife

Native vegetation in the vicinity of Hanscom Field is composed of a mixture of hardwood-forested uplands and wetlands with scattered softwoods, upland and wetland shrub stands, and mowed grasslands. Wetlands including forested swamps, shrub swamps, emergent marshes, and streams are situated around much of the perimeter of Hanscom Field. The airport infield areas are grasslands mowed regularly to maintain operational safety.

The variety of vegetative cover types, presence of wetlands and waterways, and undeveloped parcels on and in the vicinity of Hanscom Field provide known and potential habitat for wildlife species capable of coexisting with human activities and development, but can sometimes pose a hazard to aircraft operations and thus require appropriate management. Wildlife that may be expected to inhabit the area includes larger mammals such as whitetail deer and red fox, and smaller mammals such as eastern cottontail rabbit, gray squirrel, and various species of mice, voles, and shrews.

Characteristic bird species that would typically populate such habitat include various insectivorous and seed-eating passerines, ground-oriented species such as woodcock, and predators such as hawks. According to the Cornell Laboratory of Ornithology, a total of 139 species of birds have been recorded by birders in an around Hanscom Field. Various reptiles and amphibians may be expected to occupy portions of the property as well. Perennial watercourses (i.e., Elm Brook and Shawsheen River) around the periphery of Hanscom Field are Class B surface waters according to Massachusetts Surface Water Quality Standards (314 Code of Massachusetts Regulations, Section 4.05), suitable as "habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation".[144]

State Rare and Endangered Species

Portions of Hanscom Field are situated within an area identified by the NHESP as a Priority Habitat of Rare Species and are shown on Figure 9-2. Pursuant to the Massachusetts Endangered Species Act[145] and implementing regulations[146], all state agencies are required to "review, evaluate, and determine the impact to endangered, threatened, or special concern species or their habitats for all works, project, or activities conducted by them."

Work within mapped Estimated Habitat of Rare Species (a subset of Priority Habitat within the jurisdiction of the WPA) or certified vernal pools would need to be reviewed by the NHESP through the submission of a copy of a Notice of Intent prepared as part of the WPA and National

Implementing regulations for the Massachusetts Endangered Species Act define three categories of species [321 CMR 10.03(6)]:

- **Endangered: “any species of plant or animal in danger of extinction throughout all or a significant portion of its range, and species of plants or animals in danger of extirpation as documented by biological research and inventory."**
- **Threatened: "any species of plant or animal likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and any species declining or rare as determined by biological research and inventory and likely to become endangered in the foreseeable future."**
- **Special Concern: "any species of plant or animal which has been documented by biological research and inventory to have suffered a decline that could threaten the species if allowed to continue unchecked or that occurs in such small numbers or with such a restricted distribution or specialized habitat requirements that it could easily become threatened within Massachusetts."**

[144] Code of Massachusetts Regulations (CMR) Title 314, Massachusetts Surface Water Quality Standards. Section 4.05 (3) (b). https://www.mass.gov/regulations/314-CMR-400-massachusetts-surface-water-quality-standards.
[145] Massachusetts General Laws, Part I, Title 19, Ch. 131A. https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXIX/Chapter131A.
[146] Code of Massachusetts Regulations Title 321, Massachusetts Endangered Species Act. Section 10.05. https://www.mass.gov/regulations/321-CMR-1000-massachusetts-endangered-species-act.

Environmental Policy Act (NEPA) filing process for work in or near wetlands.

As listed in Table 9-2, there are four species identified as state endangered or threatened that have been observed at Hanscom by the NHESP or others or for which priority or estimated habitats (or portions thereof) are mapped on or adjacent to Hanscom Field.

Table 9-2 State Endangered, Threatened, or Special Concern Species at Hanscom Field

Common Name	Scientific Name	MA State Status[1]	Location of Habitats in Relation to the Airfield
Avifauna (Birds)			
Upland Sandpiper	*Bartramia longicauda*	Endangered	Within the airfield
Grasshopper Sparrow	*Ammodramus savannarum*	Threatened	Within the airfield
Herpetofauna (Reptiles & Amphibians)			
Blanding's Turtle	*Emydoidea blandingii*	Threatened	Outside of but adjacent to the west end of the airfield property
Wood Turtle	*Glyptemys insulpta*	Special Concern	Within the airfield

Notes:

1. In accordance with the Massachusetts Endangered Species Act (M.G.L. Ch. 131A) and regulations (321 CMR 10.03)

Source: Natural Heritage and Endangered Species Program, August 24, 2018 letter

Avifauna

The known bird species have remained the same since the *2000 ESPR*. Both the Upland Sandpiper and the Grasshopper Sparrow require grassland habitat (e.g. hayfields and pastures), such as those found adjacent to airfields. Both Species have previously been observed within several areas of maintained grassland vegetation between runways and taxiways at Hanscom Field, and nesting by these two species was confirmed during past field surveys. The specific locations of nesting pairs of these species have varied somewhat over the years based on previous Massachusetts Audubon Society observations at Hanscom Field.

Herpetofauna

The Blanding's Turtle requires a variety of wetland and terrestrial habitat, including marshes, scrub-shrub wetlands, and open uplands. The Wood Turtle requires riparian areas, such as stream bottoms and banks. During the spring and summer, Wood Turtles will spend time in mixed or deciduous forests, fields, and wet meadows. Fact sheets obtained from the NHESP for all four species are included in Appendix F. The priority habitats for all MA NHESP is depicted in Figure 9-2.

Federal Rare and Endangered Species

Species listed under the Federal Endangered Species Act as Threatened or Endangered would also automatically be protected by the Massachusetts Endangered Species Act. The United States Fish and Wildlife Service (USFWS) has jurisdiction over protection of terrestrial and aquatic (i.e., non-marine) species that are listed and therefore protected under the Federal Endangered Species Act. The potential occurrence of federally listed threatened and endangered species on the Hanscom Field property was evaluated using the United States Fish and Wildlife Service (USFWS) online Information for Planning and Conservation (IPaC) system (USFWS, 2018). The results of the USFWS IPaC query indicate that the range of the Northern Long-eared Bat (NLEB) (*Myotis septentrionalis,* Threatened) overlaps the Hanscom Airfield property and therefore impact to this species should be considered in future activities on the property that result in tree disturbance. NLEBs spend winter hibernating in caves and mines, called hibernacula. During the summer, NLEBs roost singly or in colonies underneath tree bark, in tree cavities or in crevices of both live trees and dead trees.

The species is generally associated with old-growth forests with an intact forest interior habitat.[147] Males and non-reproductive females may also roost in caves and mines where it is cooler. This species of bat has also been found roosting in structures, like barns and sheds, though rarely. The NLEB population in the northeast has been greatly impacted by the spread of *Pseudogymnoascus destructans*, a fungal pathogen that causes a respiratory disease in bats known as "white-nose syndrome." Massachusetts is wholly within the white-nose syndrome zone.

In January 2015, the USFWS issued a Final 4(d) Rule under the federal Endangered Species Act (ESA) for the NLEB. Under the Rule, focused, rather than broad, protections were provided to the species, emphasizing its vulnerable habitat areas, specifically known hibernacula and maternity roost trees within white-nose syndrome affected counties. USFWS directs project proponents to consult with state Natural Heritage Inventory databases to obtain records of known hibernacula and maternity roost trees. The Massachusetts NHESP maintains these records for municipalities in the Commonwealth. According to their records, there are no caves or mines on, or within ¼-mile of Hanscom Field, nor do any within the towns of Lexington, Concord, Lincoln, and Bedford this species (see Attachment A). There are no Massachusetts NHESP records of known maternity roost trees within the project area or the surrounding area.

Other Species of Conservation Concern

In the past, there have been observations of other grassland bird species of interest at Hanscom Field co-occurring with the Upland Sandpiper and Grasshopper Sparrows. These included the American Kestrel, Bobolink, and Eastern Meadowlark. According to the Massachusetts Wildlife Action Plan (MAWAP), the American Kestrel is a Regional Species of Greatest Conservation

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[147] U.S. Fish and Wildlife Service. April 2015. *Northern Long-Eared Bat (Myotis septentrionalis) Fact Sheet.* https://www.fws.gov/midwest/endangered/mammals/nleb/pdf/NLEBFactSheet01April2015.pdf.

Need with a high priority for conservation (RSGCN – high priority), while the Bobolink and Eastern Meadowlark are RSGCN concern species of very high priority.

The shrub stands at Hanscom Field provide habitat for five bird species with declining populations, presented in Table 9-3 below. While Massport understands the value of habitat protection under federal law, the airport's primary responsibility is to maintain aviation safety. When habitat management can be implemented in compliance with federal safety standards, Massport will continue to strive to achieve balance between those objectives.

Table 9-3 Bird Species of Conservation Concern Inhabiting Hanscom Shrub Stands

Common Name	Scientific Name	State or Regional Concern and associated Priority[1]
Field Sparrow	*Spizella pusilla*	MAWAP – RSGCN concern – very high
Brown Thrasher	*Toxostoma rufum*	MAWAP – RSGCN concern – very high PIF Watch List Species
Prairie Warbler	*Setophaga discolor*	MAWAP – RSGCN concern – very high PIF Watch List Species BCC for BCR 30 (USFWS, 2008)
Indigo Bunting	*Passerina cyanea*	RSGCN responsibility – high RSGCN concern – very high PIF Watch List Species
Blue-winged Warbler	*Vermivora cyanoptera*	BCC for BCR 30 (USFWS, 2008)

Source: .S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, VA. 85 pp. [Online version available at http://www.fws.gov/migratorybirds/]

Wildlife Hazards to Aircraft

Massport must balance the maintenance of wildlife habitat with protection of public safety. In response to increasing concern about the risk of aircraft strikes associated with certain wildlife species, the FAA issued an Advisory Circular (AC) on Hazardous Wildlife Attractants on or near Airports (AC 150/5200-33B) to provide guidance on land uses that have the potential to attract wildlife that pose hazards (the FAA released a draft update to this document in January of 2019, AC 150/5200-33C). The FAA also maintains a wildlife strikes database and provides guidance to pilots on reporting strikes to gather more information about the number of strikes and species that pose the greatest risk to life and property.

The National Wildlife Strike Database is also a source of information on wildlife that occur at particular airports. Table 9-4 provides a list of wildlife strikes that have been reported at Hanscom Field between September 1990 and January 2018. A total of 240 strikes have been recorded during that time though not all strikes include a confirmed wildlife species.

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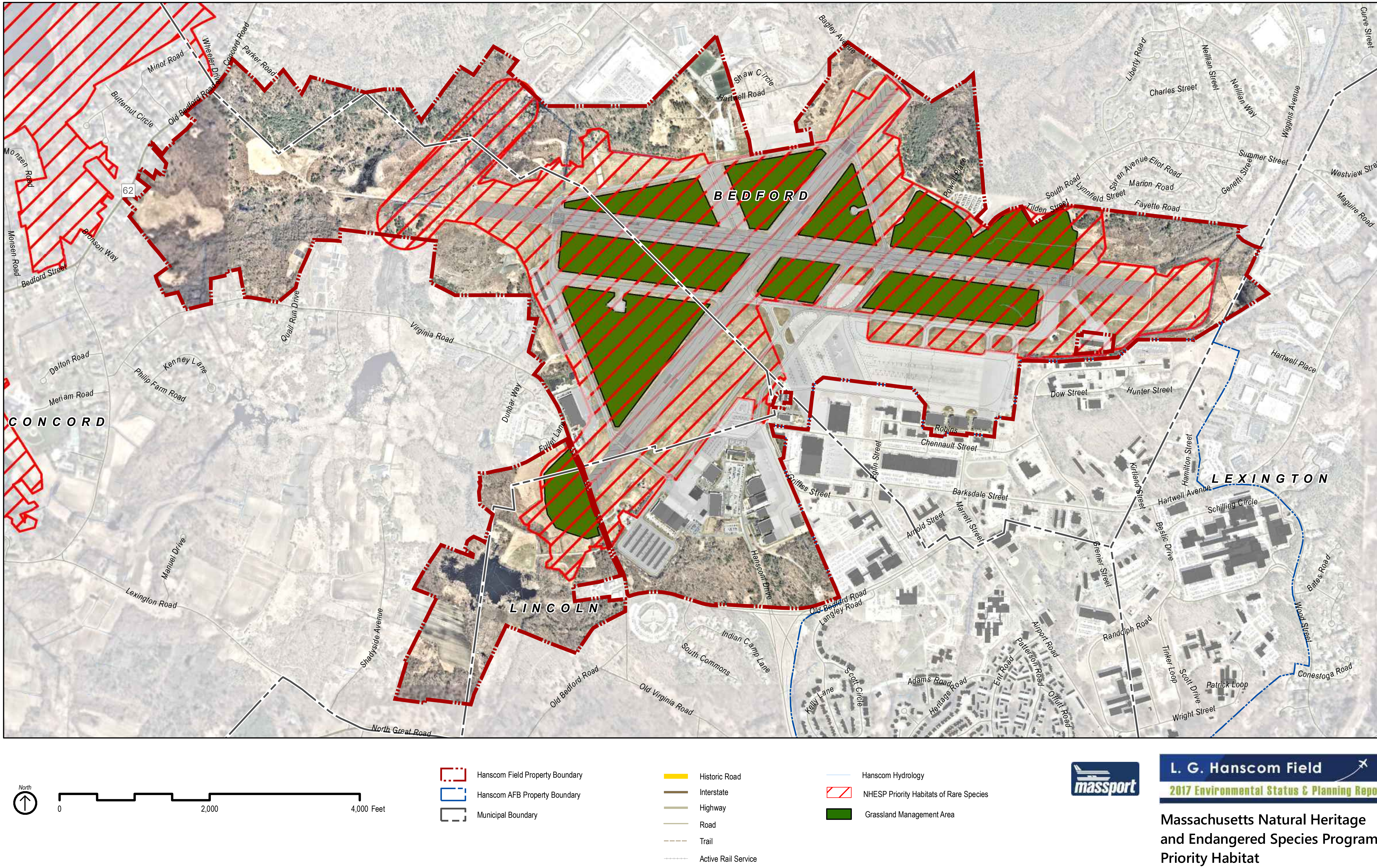

Data Sources: MassGIS 2018; NeoMap 2018, MassPort

Massachusetts Natural Heritage and Endangered Species Program Priority Habitat

Figure **9-2**

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Table 9-4 Species Reported in the National Wildlife Strike Database at Hanscom Field 1990-2018

Common Name	Scientific Name	Animal Category	Number of Strikes
Unknown sp. (small)		Bird	35
American Kestrel	*Falco sparverius*	Bird	26
Barn Swallow	*Hirundo rustica*	Bird	15
Mourning Dove	*Zenaida macroura*	Bird	15
Unknwon sp. (medium)		Bird	14
European Starling	*Sturnus vulgaris*	Bird	11
Tree Swallow	*Tachycineta bicolor*	Bird	10
Eastern Meadowlark	*Sturnella magna*	Bird	9
Gulls	*Laridae (family)*	Bird	9
Killdeer	*Charadrius vociferous*	Bird	8
Red-tailed Hawk	*Buteo jamaicensis*	Bird	6
Chimney Swift	*Chaetura pelagica*	Bird	5
Ducks	*Anatidae (Family)*	Bird	5
Horned Lark	*Eremophilia alpestris*	Bird	5
Snow Bunting	*Plectrophenax nivalis*	Bird	5
Bank Swallow	*Riparia*	Bird	4
Bobolink	*Dolichonyx oryzivorus*	Bird	3
Canada Goose	*Branta canadensis*	Bird	3
Hawks	*Buteo sp., Accipiter sp.*	Bird	3
Striped Skunk	*Mephitis*	Mammal	3
Swallow sp.	*Hirundinidae (family)*	Bird	3
Unknown sp. (not otherwise specified)		Bird	3
American Crow	*Corvus brachyrhynchos*	Bird	2
Crows	*Corvus spp.*	Bird	2
Great Horned-Owl	*Bubo virginianus*	Bird	2
Least Sandpiper	*Calidris minutilla*	Bird	2
Peregrine Falcon	*Falco peregrinus*	Bird	2
Savannah Sparrow	*Passerculus sandwichensis*	Bird	2
Sparrows	*Passeridae (family)*	Bird	2
Unknown sp. (large)		Bird	2

Common Name	Scientific Name	Animal Category	Number of Strikes
American Golden-Plover	*Pluvialis dominica*	Bird	1
American Pipit	*Anthus rubescens*	Bird	1
American Robin	*Turdus migratorius*	Bird	1
Big Brown Bat	*Eptesicus fuscus*	Bat	1
Black-Bellied Plover	*Pluvialis squatarola*	Bird	1
Blackpoll Warbler	*Setophaga striata*	Bird	1
Black Duck	*Anas rubripes*	Bird	1
Budgerigar	*Melopsittacus undulatus*	Bird	1
Cedar Waxwing	*Bombycilla cedrorum*	Bird	1
Coyote	*Canis latrans*	Mammal	1
Dark-eyed Junco	*Junco hyemalis*	Bird	1
Eastern Bluebird	*Sialia sialis*	Bird	1
Geese	*Anatidae (family)*	Bird	1
Great Blue Heron	*Ardea herodia*	Bird	1
Gulls/Terns/Kittiwakes	*Laridae/Sternidae /Laridae (family)*	Bird	1
Herring Gull	*Larus argentatus*	Bird	1
Mallard	*Anas platyrhynchos*	Bird	1
Ring-billed Gull	*Larus delawarensis*	Bird	1
Sandpipers	*Scolopacidae (family)*	Bird	1
Semi-palmated Plover	*Charadrius semipalmatus*	Bird	1
Short-billed Dowitcher	*Limnodromus griseus*	Bird	1
Snowy Owl	*Bubo scandiacus*	Bird	1
Swainsons Thrush	*Catharus ustulatus*	Bird	1
Turkey Vulture	*Cathartes aura*	Bird	1

Status of Vegetation Management Plan

Massport routinely develops Vegetative Management Plans (VMP) in order to comply with FAA regulations and Massachusetts General Laws regarding protected airspace. Massport developed a comprehensive VMP in 2004, which was updated first in 2008, and then again in 2014; the next scheduled update is in 2019. The 2014 update served as a guide for vegetation removal projects conducted at the airport for management years 2014 through and including 2018. Notices of Intent (NOIs) were submitted to the Conservation Commissions of Bedford, Concord, Lexington and Lincoln under the limited project provisions of the Massachusetts WPA for airport vegetation removal [310 CMR 10.53(n)]. The NOIs were for Phase 1 of the 2004, 2009, and 2014 VMP updates for each town. They clearly described the elements of the VMP and proposed mitigation.

Massport received Orders of Conditions from the Bedford, Concord, Lexington, and Lincoln Conservation Commissions. The initial phase of the VMP was completed in 2004. In accordance with the environmental permits, most of the work was completed while the ground was frozen; work in remaining areas was completed in the spring and fall.

Work associated with the VMP within or adjacent to the three certified vernal pools in Concord was reviewed by the NHESP through the submission of a copy of the NOIs prepared under the Massachusetts WPA for work in or near wetlands. A plan to protect the certified vernal pools during vegetation management operations is incorporated in the VMP, and will continue to be addressed in subsequent updates.

Massport performed a new obstruction analysis for the airport in 2007 as part of its five year VMP update. The 2007 aerial photogrammetric mapping of all four runways concluded the following:

- **The first Five Year VMP had minimized the need for additional vegetation removal in the areas that had removal in 2004;**
- **Vegetation removal was required in areas that were not part of the first five year VMP; and**
- **Using the FAA-approved 20:1 approach surfaces for Runway 23, there were obstructions in Bedford's Jordan Conservation Area (JCA), but no obstructions in the Bedford Hartwell Town Forest.**

A 34:1 approach surface analysis was initially prepared by Massport for the Runway 23 end, as required by the FAA. In response to Massport and community concerns regarding the extent of vegetation removal needed to maintain a 34:1 surface off-airport in the Bedford Hartwell Town Forest and the JCA, Massport worked with the FAA and prepared a 20:1 approach surface analysis. Based on this 20:1 approach surface analysis, FAA agreed that required safety margins could be maintained while reducing impact on the JCA and eliminating all impacts on the Bedford Hartwell Town Forest.

These conclusions were used to develop the second Five Year VMP (2009-2013), which was submitted to the four towns' Conservation Commissions along with NOIs for the required vegetation removal in wetland areas on Massport property. Vegetation removal began in 2009 following the receipt of Orders of Conditions from the towns' Conservation Commissions. The Orders of Conditions required that wetland work be conducted in frozen or dry ground conditions.

Shortly after the 2009-2013 VMP update received its Order of Conditions, Massport worked with the Town of Bedford to develop an agreement to remove obstructions from the JCA. As part of this agreement, Massport made available trails across its property to facilitate trail connections between Bedford and Concord conservation lands. The planned vegetation removal was completed in 2011, and also included the removal of several obsolete obstruction light poles at the end of Runway 23. By February of 2011, all obstructions identified in the 2007 airspace analysis had been removed. Throughout 2012, Massport continued with maintenance of vegetation removal areas and the trail system, which was opened in September 2011. In 2012, Massport also performed aerial photogrammetric mapping of the airport to generate data to inform the successive VMP update prepared in 2014 for management years 2014 to 2018.

Soon after the 2012 ESPR was completed, Massport began development of the 2014-2018 VMP. The update was based on analysis of the findings from the 2012 aerial photogrammetric mapping of the airport. Monitoring of VMP results since 2008 helped to inform the alternatives analyses of the 2014-2018 VMP update which was put in place since the 2012 ESPR. The update included revisions in various vegetation management areas (VMAs) that reflected changes in the vegetation cover from past management actions, revised strategies for future management, and appropriate best management practices (BMPs) to be applied at each VMA. An example of strategies that were eliminated from consideration included helicopter removal of mature tree penetrations where such penetrations occurred in wetland areas inaccessible to heavy equipment (a strategy that was replaced by the top and girdle alternative).

Sixteen VMAs were identified in the previous VMP. The 2014-2018 VMP update added five more VMAs (VMAs 17, 18, 19, 20, and 21) to be addressed during the plan period. They are summarized as follows:

- **VMA 17** – An area associated with Runway 23 that contained penetrations from trees growing in wetland and upland areas associated with the Jordan Conservation Area in Bedford. Penetrations addressed by the Top-and-Girdle method with subsequent invasive species control in selected areas.
- **VMA 18** – An area associated with Runway 23 that contained penetrations from trees growing in wetland and upland areas associated with the Jordan Conservation Area in Bedford. Penetrations addressed by the Cut and Chip method with subsequent invasive species control in selected areas.
- **VMA 19** – An upland area associated with Runway 11 in Concord. Penetrations addressed by Selective Mechanized Felling with subsequent foliar treatment and invasive species control in selected areas.
- **VMA 20** – An area associated with Runway 5 that contained penetrations from trees growing in an upland area associated within and adjacent to the Minute Man National Historic Park in Lincoln. Penetrations addressed by the Top-and-Girdle method with subsequent invasive species control in selected areas.
- **VMA 21** – An area associated with Runway 23 that contained penetrations from trees growing in upland areas associated with private, residential properties adjacent to the Jordan Conservation Area (VMA 17) in Bedford. Penetrations addressed by the Top-and-Girdle method.

The 2014-2018 VMP update was submitted to the four towns' Conservation Commissions along with Notices of Intent for the required vegetation removal in wetland areas. The Orders of Conditions for vegetation removal in wetland areas was issued by all four towns' Conservation Commissions after which Massport continued obstruction mitigation in 2015 using the recommendation in the 2014-2018 VMP update and in accordance with the Orders of Conditions.

Obstructions were removed from all four runway ends in 2016 in accordance with the 2014-2018 VMP update and results were subjected to monitoring studies. In 2017, Massport continued to mitigate obstructions using the recommendations in the 2014-2018 VMP update. The next scheduled update, the 2019-2023 VMP Update, is currently being developed and will include updated aerial mapping.

Grassland Management Plan

Areas of Hanscom Field are mapped as Priority Habitat under the Massachusetts Endangered Species Act. Many of these areas require regular mowing as required by the FAA to meet aviation safety standards. In 2004, Massport developed a Grassland Management Plan, the goal of which is to provide safe operating conditions at Hanscom Field while protecting rare grassland bird species such as the Grasshopper Sparrow and Upland Sandpiper. The plan was finalized with input from the U.S. Department of Agriculture/Wildlife Services (USDA), FAA, and the NHESP. There are no recent changes to the Plan.

The Grassland Management Plan includes the following guidelines for maintenance of portions of the grass infield areas between runways and taxiways at Hanscom Field as well as selected grassed approach areas.

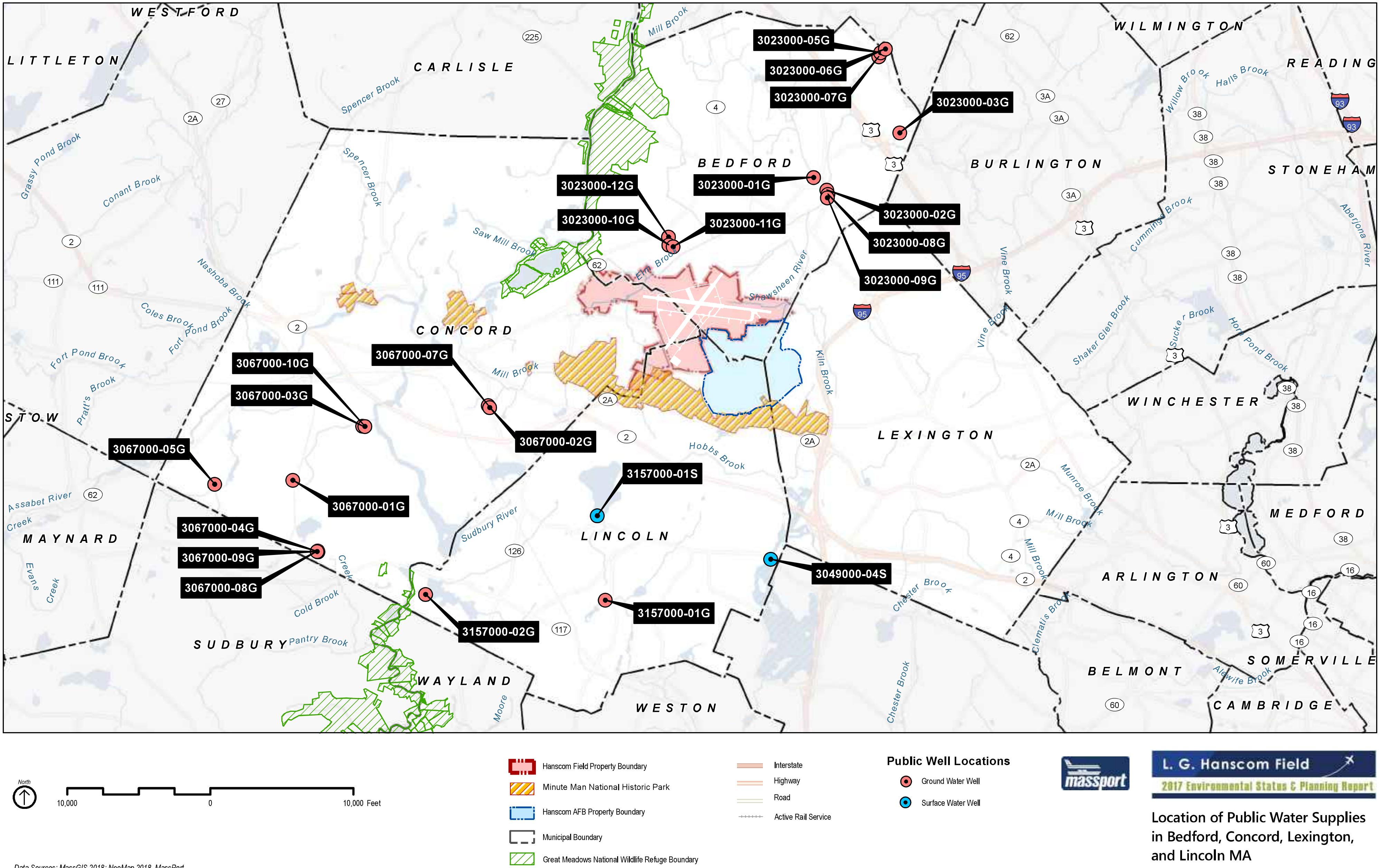
- Conduct annual pre-breeding season review of grassland management procedures and protected grassland birds identification (Upland Sandpiper and Grasshopper Sparrow) with operations staff.
- Develop a plan of the managed areas.
- Develop an annual mowing schedule that would maintain managed grassland areas at a height of four to 14 inches.
- Mow runway and taxiway areas prior to May 1, when feasible, to avoid conflicts with breeding season.
- Maintain mowed strips along runways (250 feet from runway centerlines) and taxiways (85 feet from taxiway centerline) throughout the breeding season to discourage birds from nesting in these areas.
- Restrict mowing during the breeding (nesting and brood-rearing) season (May 1 to July 31) on designated portions of the airfield not directly adjacent to runways and taxiways.
- Conduct pre-mowing field reconnaissance to observe and mark locations of nesting birds in "critical areas" along runways and taxiways.
- Inspect grassland management areas for young prior to mowing.

- Avoid, as practical, activities on grassland portions of the airfield and approach area not directly adjacent to runways and taxiways during breeding season (May 1 to July 31).

If, after implementation of these recommendations, there is a documented increase in wildlife hazards, bird strikes, or other safety issues, the plan will be modified. NHESP would be notified of any modifications of the plan and the process will involve timely notification of the Conservation Commissions in Bedford, Concord, Lexington, and Lincoln.

9.2.6 Water Resources

The locations of public water supplies within Bedford, Concord, Lexington, and Lincoln are shown on Figure 9-3. Table 9-5 presents the name, location, type (well or surface water), and community served by each public water supply facility, as well as the approximate distance from the water supply to Hanscom Field. As shown in the table, the municipal water supplies vary in distance from Hanscom Field from 0.9 to 6.8 miles. The only change in the public water resources since the *2012 ESPR* was removal of a transient well from the list.



Location of Public Water Supplies in Bedford, Concord, Lexington, and Lincoln MA

Figure 9-3

Table 9-5 Public Water Supply in Bedford, Concord, Lexington, and Lincoln

Town[1]	Source[2] ID Number	Site Name	Type	Distance from Hanscom Field[3]
Bedford	3023000-11G	Well No. 11 (Hartwell Rd. G.P. Well No. 11	Groundwater	0.9 miles
	3023000-10G	Well No. 10 (Hartwell Rd. G.P. Well No. 10)	Groundwater	0.9 miles
	3023000-12G	Well No. 12 (Hartwell Rd. G.P. Well No. 12)	Groundwater	1.0 miles
	3023000-09G*	Well No. 5 (Shawsheen G.D. Well No. 5)	Groundwater	2.2 miles
	3023000-08G*	Well No. 4 (Shawsheen G.D. Well No. 4	Groundwater	2.2 miles
	3023000-02G*	Well No. 2 (Shawsheen Rd. G.P. Well No. 4	Groundwater	2.3 miles
	3023000-01G	Well No. 1 (Page School G.P. Well)	Groundwater	2.3 miles
	3023000-03G	Well No. 3 (MITRE/Rte. 62 G.P. Well	Groundwater	3.5 miles
	3023000-05G	Well No. 7 (Turnpike G.P. Well No. 7)	Groundwater	4.0 miles
	3023000-07G	Well No. 9 (Turnpike G.P. Well No. 9)	Groundwater	4.0 miles
	3023000-06G	Well No. 8 (Turnpike G.P. Well No. 8)	Groundwater	4.2 miles
Concord	3067000-02G	Hugh Cargill G.P. Well	Groundwater	3.1 miles
	3067000-07G*	Hugh Cargill Wellfield (Replacement)	Groundwater	3.2 miles
	3067000-06G*	Robinson G.P. Well	Groundwater	4.3 miles
	3067000-03G*	Deaconess G.P. Well	Groundwater	4.7 miles
	3067000-01G*	Jennie Dugan Well	Groundwater	5.9 miles
	3067000-04G*	White Pond Well	Groundwater	6.0 miles
	3067000-08G	White Pond Satellite No. 1 GP Well	Groundwater	6.0 miles
	3067000-09G	White Pond Satellite No. 2 GP Well	Groundwater	6.0 miles
	3067000-05G*	Second Division GP Well	Groundwater	6.8 miles

Town[1]	Source[2] ID Number	Site Name	Type	Distance from Hanscom Field[3]
Concord		Annursnac Hill Reservoir	Surfacewater	
Lincoln	3157000-02G	Farrar Pond GP Well	Groundwater	3.1 miles
	3157000-01S	Flints Pond	Surface Water	3.1 miles
	3049000-04S	Hobbs Brook Res. Upper	Surface Water	3.5 miles
	3157000-01G	Tower Rd. GP Well	Groundwater	5.3 miles

Notes:
1. Lexington is served by the Massachusetts Water Resource Authority and has no municipal water supply resources.
2. MassGIS database (includes currently active and inactive wells).
3. Approximate distances measured from Hanscom Field runway intersection.
* active wells

Most of the Bedford water supply is provided by the Massachusetts Water Resources Authority (MWRA), with the remainder provided by three public water supply wells, which are used primarily during high use (e.g., summer dry seasons). Concord is served by six active public water supply sources. Lexington is served by the MWRA and has no municipal water supply sources, while Lincoln is served by four public water supply sources.

Wellhead Protection Areas, which are also known as Zone II areas, are approved under the MassDEP's Drinking Water Program to protect the recharge area around public water supply ground water sources. The Massachusetts Drinking Water Regulations require that public water suppliers delineate Zone IIs and restrict certain land uses and activities in Zone IIs which may result in the contamination of a groundwater drinking supply. Figure 9-4 shows the approved Zone II Wellhead Protection Area that overlaps Hanscom Field. The Zone II area is associated with three Hartwell Road wells in Bedford: Well #10, Well #11, and Well #12. There are no Surface Water Supply Protection Areas (Zone A, B, C) in Hanscom Field.

Rectrix developed a new above-ground fuel storage facility that was completed in early 2014 adjacent to the existing Jet Aviation current fuel farm. These fuel farms are located outside of the Zone II area. Furthermore, the implementation of the SPCC Plans by Massport and its tenants, and the airport's SWPPP provide additional protections of the groundwater resources. All fuel storage facilities are subject to the regulatory requirements of Title 527 of the CMR, Chapter 9.00, "Board of Fire Prevention Regulations: Tanks and Containers." Massport's Fire Chief required that the new Rectrix fuel farm meet MassDEP regulatory standards applicable to fuel storage.[148] These measures, as well as elements of Massport's spill prevention program, are designed to protect the recharge area of the Bedford public wells.

[148] Code of Massachusetts Regulations. Part I, Title 310, Chapter 22. Drinking Water. Section 21. https://www.mass.gov/law-library/310-cmr

9.2.7 Regulated Remediation Sites

Hanscom Field

Currently, there are no active MassDEP-listed disposal sites that Massport is responsible for bringing to regulatory closure under the Massachusetts Contingency Plan (MCP). As reported in 2005, there had been only one site, Release Tracking Number (RTN) 3-13953, that was active during the time of the *2005 ESPR*. By 2006, this site had been brought to regulatory closure.

For this document, a search of MassDEP Reportable Releases database was conducted for sites where a release of oil or hazardous material was reported to the MassDEP. Table 9-6 shows a listing of the MassDEP-listed disposal sites for locations at Hanscom Field for which releases were reported since the beginning of 2012.

Table 9-6 2012-2017 MassDEP Reported Releases at Hanscom Field that Reached Response Action Outcome (RAO) Status

RTN	City/ Town	Release Address	Site Name Location Aid	Notification Date	Compliance Status	Date	RAO Class
3-0033376	BEDFORD	380 Hanscom Drive	["JET AVIATION] Apparently incorrect site name entered in MADEP Database	01/20/16	PSNC[1]	04/18/17	PN
3-0033757	CONCORD	777 Virginia Road	L.G. HANSCOM FIELD[5]	08/18/16	PSNC	09/29/16	PN[3]
3-0032985	BEDFORD	380 Hanscom Drive	L.G. HANSCOM FIELD[5]	06/24/15	PSNC	08/24/15	PN
3-0032635	BEDFORD	380 Hanscom Drive	L.G. HANSCOM FIELD	12/12/14	PSNC	01/26/15	PN
3-0031973	BEDFORD	180 Hanscom Drive	L.G. HANSCOM FIELD	02/04/14	RAO[2]	04/15/14	A1[4]
3-0031035	BEDFORD	180 Hanscom Drive	L.G. HANSCOM FIELD[5]	08/10/12	RAO	10/12/12	A1

Notes:
1. PSNC (Permanent Solution No Conditions) = A site/release where a Permanent Solution Statement was submitted indicating that response actions were sufficient to achieve a level of No Significant Risk for all current and foreseeable future uses of the site without the need to restrict the use of the property. (Classification used post-2014).
2. RAO (Response Action Outcome) = A site/release where a Permanent or Temporary Solution Statement (formerly RAO Statement) was submitted. This statement asserts that response actions were sufficient to achieve a level of no significant risk (for Permanent Solutions) or at least ensure that all substantial hazards (for Temporary Solutions) were eliminated. (Classification used pre-2014).
3. PN = Permanent Solution with No Conditions (unrestricted use)
4. AI = A permanent solution has been achieved. Contamination has been reduced to background or a threat of release has been eliminated.
5. Data has been corrected from what was entered in the MADEP database

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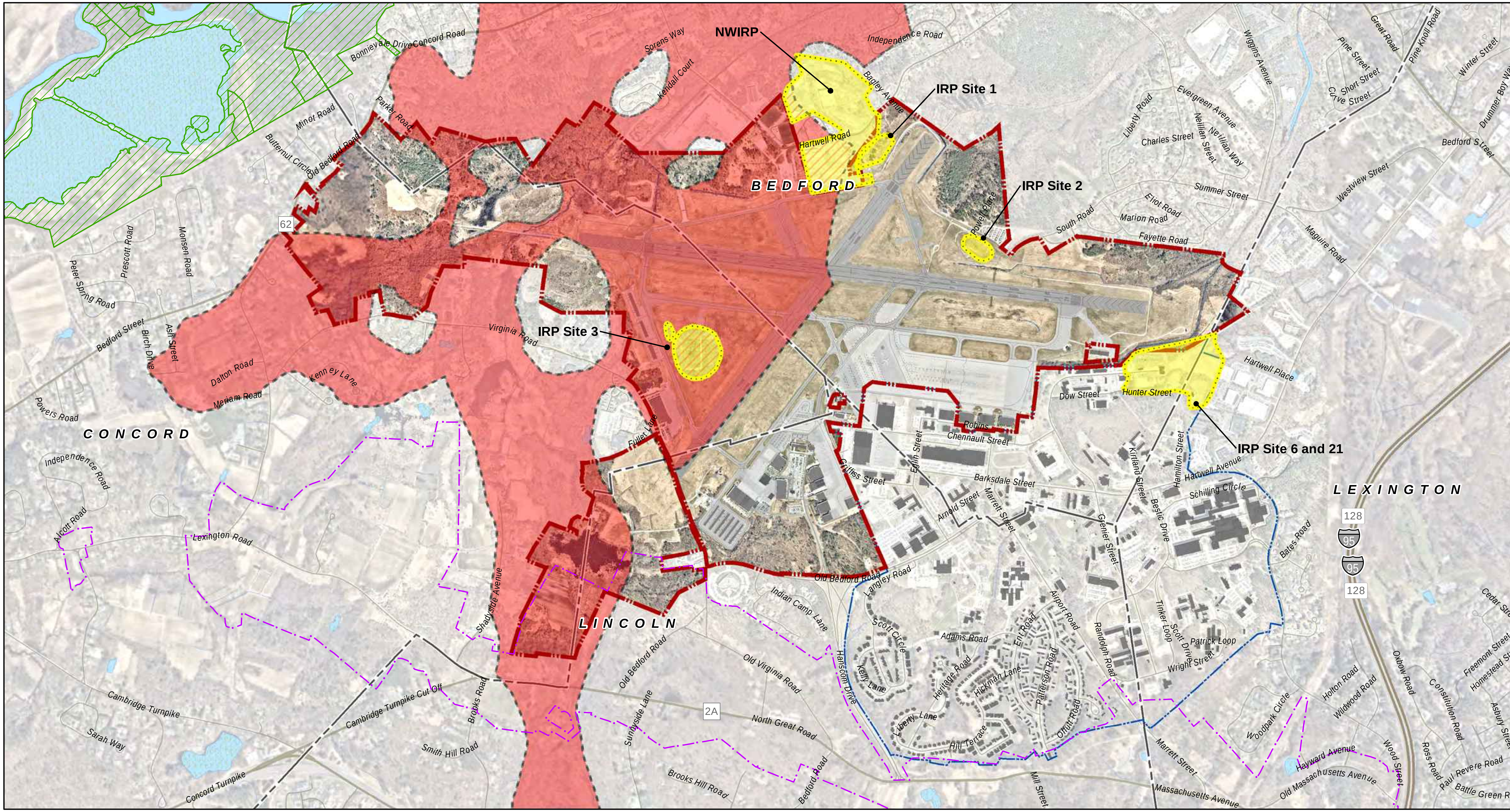

North

0 2,000 4,000 Feet

Hanscom Field Property Boundary
Hanscom AFB Property Boundary
Municipal Boundary
Great Meadows National Wildlife Refuge Boundary
Minute Man National Park Boundary
Historic Road
Interstate
Highway
Road
Trail
Active Rail Service
Hanscom Hydrology
Zone II Wellhead Protection Area
IRF Site Locations
IRF Site within Zone II Wellhead Protection Area

Data Sources: MassGIS 2018; NeoMap 2018, MassPort

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L. G. Hanscom Field
2017 Environmental Status & Planning Report

Zone II Wellhead Protection Areas

Figure **9-4**

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Hanscom Air Force Base

Hanscom AFB maintained and operated Hanscom's airfield until 1974 and retains responsibility for any required clean-up that stems from this time, as well as for any sites on Hanscom AFB property. Hanscom AFB is conducting environmental restoration efforts under the U.S. Air Force Installation Restoration Program (IRP), a federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or "Superfund")-based program. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) is the primary IRP response process for releases identified under this program.

However, because petroleum releases are excluded from the Superfund program, the MCP is the primary IRP response process at the sites where a release of petroleum has occurred. The U.S. EPA is the lead agency for the NCP sites, and the MassDEP is the regulatory agency for the MCP sites.

The objectives of the Hanscom AFB IRP program are generally summarized as the following: protect human health and the environment; characterize risks associated with the release sites; commence restoration as soon as practicable; initiate removal actions as necessary; develop remedial actions as necessary; conduct long term operation and maintenance of remedial systems implemented for cleanup; and comply with all deadlines, commitments, and regulations applicable to the program.

As part of the IRP, initial field investigations commenced in the summer of 1982. The preliminary assessment/site investigation phase of the IRP resulted in the identification of 22 specific sites as areas with the potential for environmental contamination from past waste management practices. Of the 22 sites, seven are located on Massport property. Investigations and appropriate response actions have been completed at 16 IRP Sites and one IRP Area of Concern, and they have been closed out within the applicable regulatory framework. In addition, investigations have been completed and long-term remedies are in place at the six remaining IRP Sites (including three IRP Sites on Hanscom Field).

There have been no additional sites added to the IRP list at Hanscom since the *2012 ESPR*. Figure 9-5 illustrates the location of the remaining active IRP sites/Operable Units (OUs). All of the waste sites identified through the IRP studies have been investigated and, where deemed necessary, have been or are currently being remediated.

Five-Year Reviews of ongoing remedial actions will be conducted as long as any hazardous pollutants or contaminants remain at the site above levels that allow for unlimited and unrestricted exposure as required by CERCLA. The most recent (fifth) "Five-Year Review for the Hanscom Field/Hanscom AFB Superfund Site" was completed in August 2017. Hanscom AFB Records of Decision (RODs), other Decision Documents, including an MCP Licensed Site Professional (LSP) Opinions/Response Action Outcome (RAO) Statements, and Five-Year Review Reports issued for IRP actions are all subject to concurrence from the U.S. EPA and/or MassDEP. Site Close-Out designation indicates that all required actions are complete and the USAF has received concurrence from the regulatory agencies to that effect, as applicable.

Operable Unit 1 / IRP Sites 1, 2, 3

An Interim Record of Decision (IROD) was issued for NPL OU-1 which includes IRP Site 1 (Fire Training Area II), IRP Site 2 (Paint Waste Disposal Area), and IRP Site 3 (Jet Fuel Residue/Tank Sludge Disposal Area) in January 2001 by the USAF, which set forth the requirements for the continued operation of the existing groundwater treatment system, the implementation of institutional controls, and the monitoring of the groundwater and surface water at Hanscom Field/Hanscom AFB. Groundwater beneath OU-1 is contaminated with chlorinated volatile organic compounds (VOCs) as a result of the previous USAF airfield maintenance and training activities, and the remedy includes a vacuum-enhanced recovery (VER) system and groundwater treatment.

The following information was summarized in the fifth "Five-Year Review for the Hanscom Field/Hanscom AFB Superfund Site" prepared by USEPA. According to the fifth Five-Year Review, the OU-1 remedial action has been and continues to be protective of human health and the environment because long-term monitoring confirms that operation of the pump and treat system, in conjunction with supplemental treatment measures in place at the site, is working to prevent further migration of Contaminants of Concern (COCs) in groundwater, and to prevent the discharge to surface water bodies and wetlands of groundwater containing COC concentrations above regulatory criteria. Recent supplemental treatment and optimization measures will continue with the goal of reducing the time it takes to meet the regulatory criteria including EPA Safe Drinking Water Act Maximum Contaminant Levels (MCLs) and Massachusetts Contingency Plan (MCP) standards.

Operable Unit-2 / IRP Site 4

IRP Site 4 was used as the Hanscom AFB municipal waste landfill from December 1964 until December 1974. The site covers 10.5 acres and is located approximately 1,800 feet southeast of the approach end of Runway 5/23 on Hanscom Field. The landfill is situated predominantly in the town of Lincoln, with a small portion protruding into the bordering town of Concord. The landfill ranges from 10 to 15 feet deep and is estimated to have a volume of 210,000 cubic yards of mixed waste from various sources. An impervious cap was placed over the landfill in 1988. The area is also bermed with drainage ditches to channel runoff from the capped area to the wetlands. Today the area is grassed open space with a softball field in the southern half.

According to the data review, site inspections, and interview conducted in late 2016 and 2017, the Fifth Five-Year Review found that the remedy at OU-2/IRP Site 4 remains protective of human health and the environment. The remedy is functioning as intended by the 1988 Remedial Action Plan, the integrity of the low permeability landfill cap is being maintained, and a long-term inspection and maintenance program is in place to ensure continued protectiveness.

Operable Unit 3 / IRP Site 6

This approximately 15-acre site is located in the northeast portion of Hanscom AFB in the towns of Bedford and Lexington. The site is bounded to the north by a former railroad spur, to the northeast by a wetland area and small pond, to the east by a commercial industrial park, to the south by a service road (Hunter Street), and to the west by IRP Site 21 (the former aviation fuel facility).

IRP Site 6 consists of three distinct areas as follows:

- **The former filter beds (which includes the former sludge beds) and two hillside landfill areas;**
- **The south landfill (including a suspected ash disposal area and Building 1855 Underground Storage Tank [UST] site); and**
- **The west landfill.**

The former filter bed area is the original sanitary waste treatment system (used from 1947 until the mid-1950's) for Hanscom AFB before it was abandoned in place and the Base connected to a municipal sanitary waste system. Following the abandonment of the treatment system, this area became a disposal site for municipal wastes, construction debris, and clean fill. As a result, the filter beds were overlain by approximately 5 to 15 feet of solid waste material. Immediately adjacent to, and to the south of the filter bed area are two hillside landfill areas (south and west). Disposal in these two areas was mainly clean fill and/or construction debris.

The south landfill was used for the disposal of building foundation excavation and construction debris in the late 80's/early 90's. The southernmost portion of the south landfill includes a suspected ash disposal area and the former location of a 1,000-gallon No. 2 fuel oil UST on the west side of Building 1855. When the UST was removed in 1990, evidence of a petroleum release was found. Building 1855 formerly housed an incinerator and is currently a licensed solid waste transfer station for Hanscom AFB.

The Remedial Investigation (RI) of the site was completed in 1998 and Human Health and Ecological Risk Assessments were completed in 1999. Taken together, these assessments found potential for future adverse impact to human health and the environment.

Based on the RI and risk assessments a Focused Feasibility Study, Operable Unit 3, Site 6 – Landfill and a Proposed Plan for Hanscom AFB Operable Unit 3/Site 6 were prepared and approved by the Commonwealth. The remedial action remedy (containment and capping, removal of contaminated sediment, and the implementation of engineering and institutional controls) was implemented in September 2001. Immediately following construction of the remedy, a long-term inspection, maintenance and monitoring program commenced to ensure the continued protectiveness of the remedy.

A Five/Thirty Year Monitoring Plan was specified by the Remedial Design (RD) for the wetland areas remediated during the construction phase of the Site 6 Remedial Action. The initial 5-year wetland mitigation monitoring program was successfully completed in 2006. Subsequent wetland mitigation and ecosystem evaluation events were successfully completed in the ensuing 5-year interval years of 2011 and 2016, with the latter event documenting that the objectives of the initial five-year monitoring plan and long-term operation and maintenance plan have been met. The Five-Year Wetlands Ecosystem Evaluations were thus discontinued as recommended in the 2016 wetland report.

Long-term monitoring data continues to indicate that the surface water quality in the adjacent wetlands and the Shawsheen River are not being adversely impacted by residual groundwater contamination. A Downgradient Investigation was conducted in 2014 and 2015 to determine the source of arsenic detected at and north of the compliance boundary at concentrations above the MCL. The evaluation determined that arsenic concentrations that exceed the MCL beyond the compliance boundary are representative of background concentrations and thus the compliance boundary is adequate as currently delineated.

Groundwater monitoring has detected the compound Pentachlorophenol (PCP) at monitoring well number MW-112U at concentrations reported as "non-detect meaning the reporting limit concentration of the compound (if present in the media being tested) was below a concentration that could be detected by the laboratory instrumentation." However, the laboratory's reporting limit concentrations were above the applicable state regulatory criteria (MCL/MCP GW-1 Standard). This means that it cannot be said with certainty that PCP does not exceed the cleanup standards at that monitoring location. Therefore, it was recommended that subsequent sampling events for PCP require the use of an analytical method that is sensitive enough to achieve a reporting limit below the MCL/ MCP GW-1 Standard.

According to the data review, site inspections, and interviews conducted in late 2016 and 2017, the Fifth Five-Year Review concluded that the remedy at OU-3/IRP Site 6 was protective of human health and the environment.

OU-3/IRP Site 21

IRP Site 21 is an area with groundwater contamination and three separate areas of petroleum products floating on the groundwater table that were identified by the Remedial Investigation. These areas are technically referred to as light non-aqueous phase liquid (LNAPL) pools which means that the liquid contaminant is not dissolved in the water column but remains in a separate phase (i.e., "non-aqueous) and this phase floats atop the groundwater surface because the contaminant's specific gravity is lighter than water. The site is approximately 5 acres in area, situated in the town of Bedford in the northeast portion of Hanscom AFB and adjacent to IRP Site 6. IRP Site 21 is the area of a former aviation fueling facility that was used for storage, off-loading, and dispensing of jet fuel and aviation gasoline from at least 1945 through 1973, and to store and distribute No. 2 fuel oil during the early 1970s. Fuel was stored in aboveground and underground storage tanks, which had associated pump houses and a network of underground piping. This area was also used for the storage of cleaning solvents and other petroleum products (oils and lubricants) associated with aircraft and vehicle maintenance.

Following the discovery of IRP Site 21 in 1990 several interim remedial actions were conducted prior to 2001, to include a RI and risk assessments. These assessments were completed in July 2000. Based on these documents and data gathered during the interim remedial actions, a *Feasibility Study, Operable Unit 3/ Site 21* dated June 2001 and a *Proposed Plan for Hanscom AFB Operable Unit 3/Site 21* dated July 2001 were prepared, and released for public comment (for which the Air Force received none). Subsequently, a Record of Decision, dated October 2001 selecting the remedy for OU3/IRP Site 21 was signed by the Air Force on August 20, 2002 and by the USEPA on August 29, 2002. The Commonwealth of Massachusetts formally concurred with this ROD by letter dated January 22, 2002.

The construction of the final remedy in accordance with the IRP Site 21 ROD commenced in June 2003 and was substantially completed in September 2003. The selected remedial action for cleaning up OU-3/IRP Site 21 (engineered solutions) centered about a 10-well recovery system. While the active recovery system had made progress towards the response action outcome (RAO) to return groundwater to federal and state drinking water standards and state groundwater risk characterization standards within an acceptable time period (<100 years), the recent focus has changed from active remedial efforts to passive in-situ treatment methods, with a goal of achieving a higher rate of contaminant mass destruction. Land Use Controls/Institutional Controls prevent exposure to and use of contaminated groundwater, ensure that excavation at the Site is controlled to prevent exposure to any residual contamination in the subsurface soil or groundwater, and that future land use does not increase the risk of exposure to contaminants remaining on-site.

The current status of the IRP at Hanscom AFB as of 2017 can be found in the following document: https://semspub.epa.gov/work/01/100000682.pdf

Naval Weapons Industrial Reserve Plant (NWIRP), Bedford

The NWIRP site is located on 46 acres of land on the north side of the airfield within the Bedford town limits. It is bounded by Hanscom Field and Hanscom AFB to the south; businesses (Instrumentation Laboratory and Edge Sports Center), wetlands, and residences to the west; by forested upland and wetlands to the north; and by woodland, residences, and wetlands to the east. NWIRP Bedford is divided into northern and southern sections that are separated by Hartwell Road.

NWIRP Bedford was established in 1952 and its mission was to design, fabricate, and test prototype equipment for missile guidance and control systems. This facility was involved in active research from the mid-1950s until December 2000 when its mission ended, and the facility was closed. The Navy retains ownership of this property yet the facility – composed of two main structures – the Components Laboratory north of Hartwell Road, and the Southern Flight Test Area Facility to the south– remains closed. It is the intent of the Navy to transfer the southern portion of the facility to the Massachusetts Port Authority for continued aviation-related industrial operations at Hanscom Field

The Naval Facilities Engineering Command (NAVFAC) reports the following major investigations and studies that have been conducted at NWIRP Bedford to date since the 2012 Environmental Status & Planning Report:

- **Construction Completion Report for the Remedial Actions at Site 3 and Site 4 (2014);**
- **Explanation of Significant Difference to the Site 3 ROD (Inclusion of Southern Flight Test Area) (2014);**
- **(First) Five-Year Review for Site 3, Southern Flight Test Area, and Site 4 (2014); and**
- **Interim Remedial Action Completion Report for the Southern Flight Test Area (2015).**

An Initial Assessment Study (IAS) was conducted in 1986 which identified potentially contaminated sites at NWIRP Bedford. Initially four sites were identified for investigation. The results of the IAS led to the placement of NWIRP Bedford on the National Priorities List (NPL) on May 31, 1994. The Navy and U.S. USEPA signed a Federal Facilities Agreement on February 2, 2000 related to conducting investigations at NWIRP Bedford.

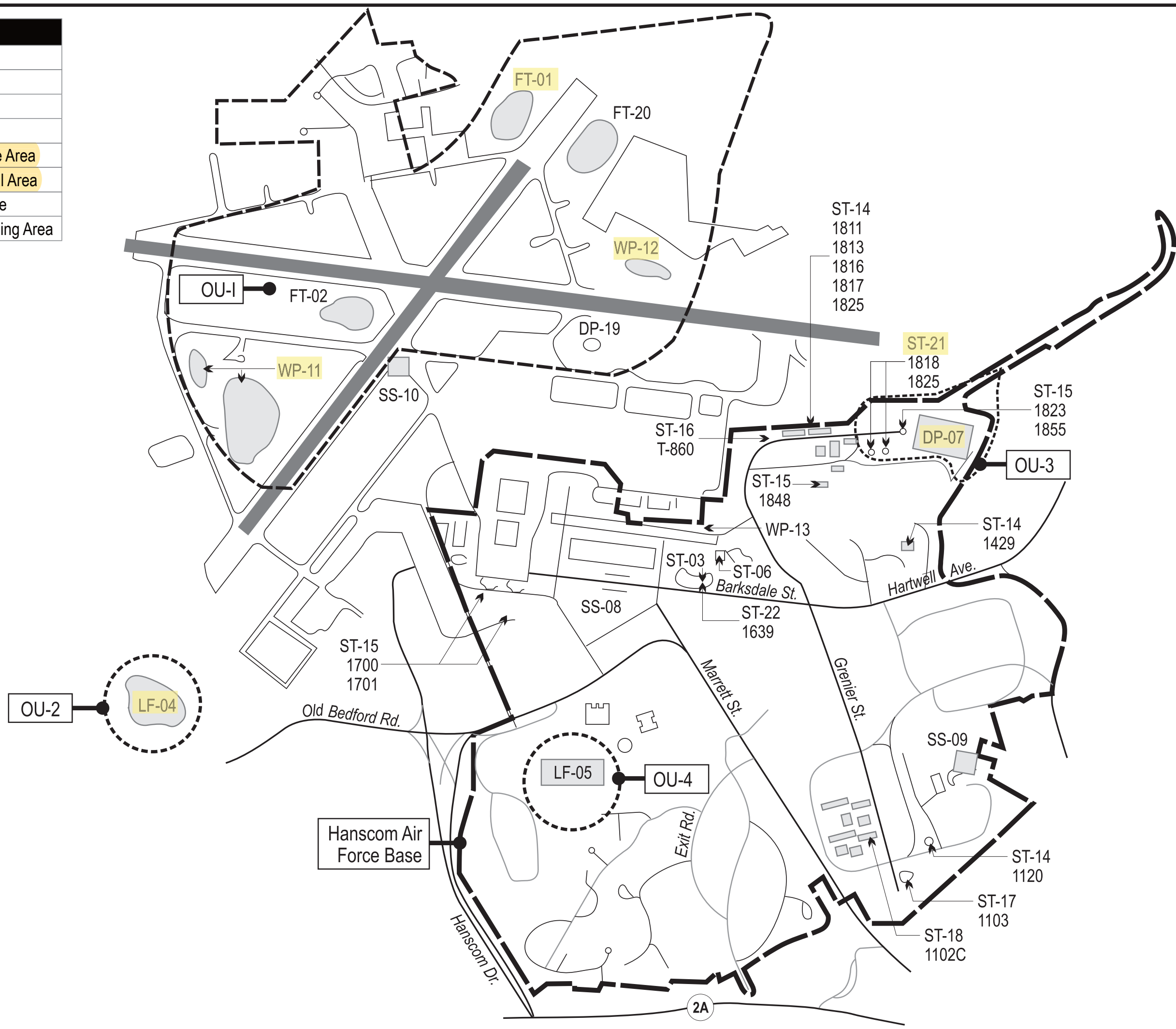
Two sites (Sites 1 and 2) received no further action (NFA) decisions in September 2000. However environmental investigations ensued for over the next two decades at Sites 3 and 4. An interim remedial action (IRA) for Site 3 was initiated in 1997; this IRA consisted of constructing and continually operating a groundwater extraction system to contain a subsurface contaminant plume at Site 3. Additional IRAs were conducted for both Sites 3 and 4 in early 2000s. A decision was reached for Site 4 in 2009 and for Site 3 in 2010.

In 2014, a fifth site (Southern Flight Test Area [SFTA]) was added. Sites 3 and 4; and Site 5 (the SFTA) are all reportedly in the post-decision phase. The Navy will conduct Five-Year Reviews at these three sites while contamination remains in the subsurface.

Hanscom Field Sites

Site#	WIMS-ES No.*	Description
1	FT-01	Fire Training Area II
5	FT-02	Fire Training Area I
11	SS-10	Multiple Fuel Spills
3	WP-11	Jet Fuel/Tank Sludge Area
2	WP-12	Paint Waste Disposal Area
19	DP-19	Suspected Dump Site
20	FT-20	Temporary Fire Training Area

Sites 1, 2, and 3 are currently active.



Hanscom Air Force Base Sites

Site#	WIMS-ES No.*	Description
12	ST-03	AAFES Gasoline Leak (UST Site)
4	LF-04	Sanitary Landfill
8	LF-05	Scott Circle Landfill
13	ST-06	Motor Pool Gasoline Leak (UST Site)
6	DP-07	Former Filter Beds
9	SS-08	Administration Building Jet Fuel Spill
10	SS-09	Mercury Spill at Building 1128
7	WP-13	Industrial Waste Treatment System
14	ST-14	Multi-Site Underground Storage Tank Investigation (UST Site)
15	ST-15	Multi-Site Underground Storage Tank Removal (UST Site)
16	ST-16	Contamination at Building T-660 (UST Site)
17	ST-17	Contamination at Building 1103 (UST Site)
18	ST-18	Contamination at Building 1102C (UST Site)
21	ST-21	Unit 1 Petroleum Spill (UST Site)
22	ST-22	AAFES Spill Site Investigation (UST Site)

Note: Sites 4, 6, and 21 are currently active.

Legend

Hanscom Air Force Base

Operable Unit

FIGURE09-05.ai Hanscom Field 2013 ESPR Wetlands

2000 0 500 1000 2000

Approximate Scale In Feet

Currently Active Sites

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L. G. Hanscom Field

2017 Environmental Status & Planning Report

Installation Restoration Program Sites / Operable Units

Data Source: USAF

Figure 9-5

9.2.8 Stormwater

Massport strives to guide new development to areas of existing impervious surfaces that takes advantage of existing infrastructure to enhance groundwater recharge and minimize runoff.

Chapter 2 Facilities and Infrastructure, presents information about impervious surfaces at Hanscom Field. The following sections describe the stormwater management program for Hanscom Field, including stormwater modeling, stormwater-related permitting and monitoring programs undertaken by Massport.

Massport has undertaken a comprehensive stormwater modeling study, which is being coordinated with the MassDEP for the Shawsheen River watershed. The purpose of the modeling effort is to assess current peak and base flows within the river and to evaluate potential Best Management Practices (BMPs) and stormwater controls to reduce the peak flows and increase base flows.

National Pollution Discharge Elimination System Permit

Airports in the United States, including Hanscom Field, are required to apply for coverage under a Stormwater MSGP in accordance with the NPDES permit program, a part of the federal Clean Water Act.[149] Under this permit program administered by the U.S. EPA, owners and/or operators of airports must satisfy specific requirements for operations conducted at the facility that may affect stormwater quality. Massport applied for coverage under the current MSGP in 2009 and the reissued MSGP in 2015. Tenants who lease property on Hanscom Field and engage in activities covered under the permit program are listed in Table 9-7.

Table 9-7 Massport Tenants Covered under the Hanscom Field NPDES Permit

Tenant	Address
Signature Flight Support	180 Hanscom Drive, Bedford
Jet Aviation	380 Hanscom Drive, Bedford
Rectrix	777 Virginia Road, Concord
Stream Enterprises	140 Hanscom Drive, Bedford
Liberty Mutual	230 Hanscom Drive, Bedford
Nagle Aircraft	145 Hanscom Drive, Bedford
Boston Medflight	Robins Street, Hangar 1727, Bedford
East Coast Aero Club	200 Hanscom Drive, Bedford
North Star Aviation	130 Hanscom Drive, Bedford

Source: Hanscom Field NPDES Permit MAR05CY14; J. Stolecki personal communication)

[149] Federal Water Pollution Control Act, (33 USC 1251 et seq). https://www.epa.gov/sites/production/files/2017-08/documents/federal-water-pollution-control-act-508full.pdf.

The current NPDES Permit Tracking Number is MAR05CY14; the Master Permit Number is MAR050000. The permit effective date was June 4, 2015, and it remains valid for five years. Hanscom Field operates under this MSGP.

Stormwater Pollution Prevention Plan (SWPPP)

Massport updated and revised the Hanscom Field SWPPP in October 2015 in compliance with the Stormwater Multi-Sector General Permit that was reissued under the NPDES in June 2015. As stated in the SWPPP, the responsibilities of Massport and the tenants include the following:

- Implementing the policies and procedures (Best Management Practices) presented in the SWPPP for the facilities and operations;
- Conducting periodic reviews of policies and procedures to evaluate the effectiveness of the current SWPPP;
- Updating the SWPPP and related information whenever there is a significant physical change at the facility and/or a significant change in the operational procedures of a facility that could result in the discharge of toxic or hazardous pollutants to stormwater or an increased risk of such discharge; and
- Maintaining records of required inspections, operations, materials use, etc. as required in the SWPPP.

Best Management Practices (BMPs) identified in the SWPPP are divided into two sections: Baseline BMPs and Activity-specific BMPs. Baseline BMPs include general procedures to reduce stormwater pollution regardless of the type of operation at Hanscom Field. These BMPs are implemented by all tenants covered by the SWPPP. Activity-specific BMPs address particular features or operations at a facility and are applied to a tenant's specific operational situation. The two types of BMPs are identified in Table 9-8.

The Hanscom Field SWPPP also identifies the following:

- **Site drainage areas and stormwater outfall locations (shown on Figure 9-6);**
- **Activities occurring at the airport and inventory of materials having the potential to affect stormwater quality;**
- **Recorded significant leaks and spills;**
- **Observations of dry-weather flow conditions ("non-stormwater discharges") from the storm drainage system; and**
- **Descriptions of potential pollutant sources and risks; and Best Management Practices Plan.**

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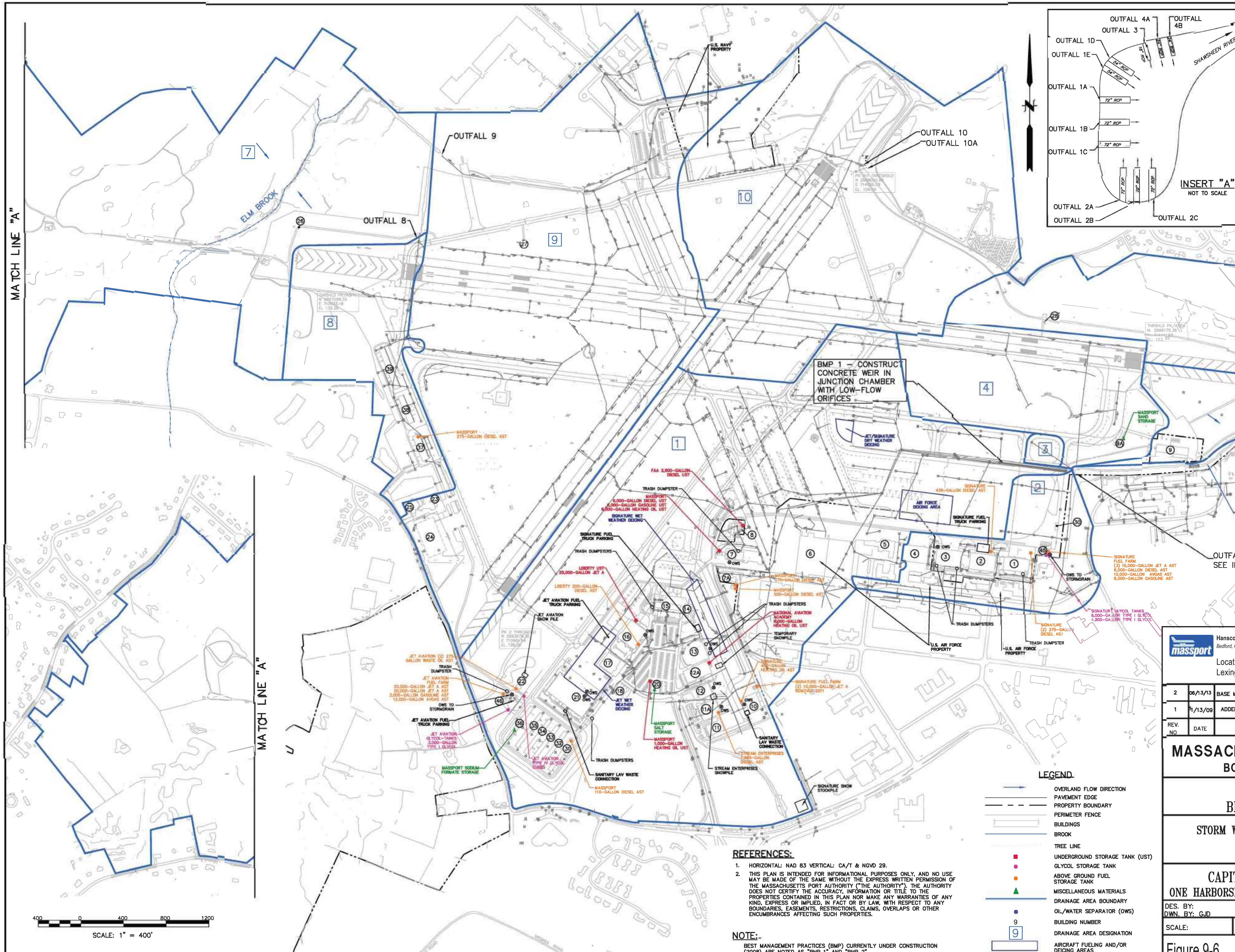

AIRPORT FACILTIES

ID	DESCRIPTION	ID	DESCRIPTION
1	SIGNATURE HANGAR	15	MASSPORT TERMINAL
2	SIGNATURE HANGAR	16	LIBERTY MUTUAL
3	SIGNATURE HANGAR	17	JET AVIATION HANGAR
4	AERO CLUB	18	BUILDING DEMOLISHED
5	FIRE DEPARTMENT	20	MASSPORT BUILD MAINT.
6	MIT HANGAR	21	JET AVIATION HANGAR
7	MASSPORT FIELD MAINTENANCE FACITLITY	22	JET AVIATION MAINT. BLDG
		23	DRAPER LABS
7A	ELECTRICAL VAULT	24	HANGAR 24 (DEMOLISHED)
8	TOWER	25	DRAPER LABS
9	FAA HANGAR 1840	26	LOCALIZER BLDG
9A	MASSPORT SAND STORAGE	27	GLIDE SLOPE BLDG
10	HANGAR 10	28	GLIDE SLOPE BLDG
11	NORTHSTAR	29	LOCALIZER BLDG
11A	STREAM ENTERPRISES	30	US CUSTOMS
12	NAGLE	31–39	T–HANGARS
12A	NATIONAL AVIATION ACADEMY	45	SIGNATURE FUEL FARM
13	SIGNATURE HANGAR	46	JET AVIATION FUEL FARM
14	SIGNATURE TERMINAL		

REFERENCES:

1. HORIZONTAL: NAD 83 VERTICAL: CA/T & NGVD 29.
2. THIS PLAN IS INTENDED FOR INFORMATIONAL PURPOSES ONLY, AND NO USE MAY BE MADE OF THE SAME WITHOUT THE EXPRESS WRITTEN PERMISSION OF THE MASSACHUSETTS PORT AUTHORITY ("THE AUTHORITY"). THE AUTHORITY DOES NOT CERTIFY THE ACCURACY, INFORMATION OR TITLE TO THE PROPERTIES CONTAINED IN THIS PLAN NOR MAKE ANY WARRANTIES OF ANY KIND, EXPRESS OR IMPLIED, IN FACT OR BY LAW, WITH RESPECT TO ANY BOUNDARIES, EASEMENTS, RESTRICTIONS, CLAIMS, OVERLAPS OR OTHER ENCUMBRANCES AFFECTING SUCH PROPERTIES.

NOTE:-

BEST MANAGEMENT PRACTICES (BMP) CURRENTLY UNDER CONSTRUCTION (2008) ARE NOTED AS "BMP 1" AND "BMP 2".

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Hanscom Field 2018 ESPR

Bedford, Concord, Lexington, Lincoln, Massachusetts

Location of Public Water Supplies in Bedford, Concord, Lexington, and Lincoln

REV. NO	DATE	DESCRIPTION	MADE BY	CHK. BY	APPD. BY
2	06/13/13	BASE MAP & LABELS UPDATED	GJD		JS
1	1/13/09	ADDED OUTFALL 10A			JS

MASSACHUSETTS PORT AUTHORITY
BOSTON, MASSACHUSETTS

HANSCOM AIR FIELD
BEDFORD, MASSACHUSETTS

STORM WATER POLLUTION PREVENTION PLAN
SITE PLAN

CAPITAL PROGRAMS DEPARTMENT
ONE HARBORSIDE DRVIE, EAST BOSTON, MA. 02128–2909

DES. BY:
DWN. BY: GJD
CHKD. BY: JS
LOC. CODE:
SCALE:
APPROVED:
DATE: 201B
DWG. NO.:

Figure 9-6

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Table 9-8 Best Management Practices for Stormwater Protection at Hanscom Field

Baseline Best Management Practice	Activity-specific BMPs
Good Housekeeping	Emergency Spill Cleanup Plans
Preventative Maintenance	Elimination of non-stormwater discharges to storm drains
Materials Compatibility and Inventory System	Aircraft, vehicle and equipment maintenance
Spill prevention and Response Plan	Aircraft, vehicle and equipment fueling
Employee Training	
	Aircraft, vehicle and equipment washing
	Aircraft deicing
	Outdoor handling of material
	Outdoor material storage
	Waste handling and disposal
	Building and grounds maintenance
	Annual stormwater pollution prevention education
	Lavatory service operations
	Equipment cleaning/degreasing
	Runway maintenance
	Oil/water separators
	Maintenance of existing drainage systems

Source: Hanscom Field Stormwater Pollution Prevention Plan, January 2009 (last update 10/15).

NPDES Visual Inspection Program

Massport has a visual inspection program, as required under the NPDES Multi-sector General Permit for Hanscom Field, for monitoring the quality of stormwater discharges. The NPDES Multi-sector General Permit for Hanscom Field does not require laboratory water quality monitoring beyond Total Suspended Solids (TSS). TSS monitoring is required for Elm Brook which is impaired water due to turbidity.

The visual inspections are conducted on a quarterly basis. The inspection procedures consist of collecting samples at stormwater outfall locations at Hanscom Field and visually inspecting the samples for color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other indications of storm water pollution. A visual assessment is performed on samples from the following outfall locations: 1, 2, 4, and 10. Because Outfalls 3, 5, 6, 9, and 10 are from similar drainage areas, only a sample from Outfall 10 is required. A data form is then completed for each observation (see SWPPP for blank data form). If contaminants are observed during the inspections, follow-up investigations are to be performed to determine the probable source of contamination. The results of such investigations are also to be recorded and appropriate actions taken to address the situation. To date, inspections conducted at the outfalls have not identified any non-stormwater discharges.

Impaired Waters Monitoring

Elm Brook is considered a waterbody requiring a total maximum daily loads (TMDL) in Massachusetts and is listed on the "Massachusetts Year 2016 Integrated List of Waters." Annual monitoring for TSS was originally required from either Outfall 8 or 9. In April 2010, a sample was collected from Outfall 9 for impaired waters monitoring per the SWPPP. The sample was analyzed for TSS, and had a result of <5.0 micrograms per liter. Because this result was below natural background levels, further impaired waters monitoring was not required and EPA was notified that sampling was terminated at the Outfall 9 location. Elm Brook remained on the Massachusetts Year 2012 Integrated List of Waters. Based upon this designation, 2015 SWPPP for Hanscom Field identified the need to sample the water quality in Elm Brook for TSS concentrations once per year at Outfall 8.

Stormwater Mitigation

Massport requires all Hanscom Field site development, including that performed by tenants, to conform to the MassDEP Stormwater Management Standards when feasible or applicable. Improved stormwater runoff control has been achieved through the requirement that compensatory storage for stormwater be provided for any projects resulting in increases in impervious surfaces, in order to not increase peak runoff rates.

Spill Prevention Efforts

Massport has maintained a Spill Prevention Control and Countermeasures (SPCC) Plan for Hanscom Field since the 1995 Generic Environmental Impact Report. The SPCC, which was updated in 2013 is a plan outlining the steps to be taken in the event of an accidental petroleum release. Massport tenants are responsible for maintaining their own individual SPCC plans specific to their operations, as needed. The SPCC plan identifies potential discharge or spill activities that may result in a release, as well as spill prevention measures, control methods and an action plan in the event of a release. The action plan includes notification procedures, key personnel, a listing of available response equipment, tank and fuel delivery checklists, and contact numbers in case of an emergency. The SPCC includes a listing of all active oil storage tanks owned and operated by Massport as well as a general listing of other types of smaller volume (55-gallon drum) storage of petroleum-based products including motor oil, waste oil, and hydraulic fluid.

Massport maintains contracts with emergency response cleanup contractors that will respond to Massport or Massport tenant spill events at Hanscom Field. In addition, the Massport Fire Rescue Department is responsible for responding to emergency situations, including hazardous material spills, at Hanscom Field. The Fire Department maintains detailed spill reports for all reported spills at Hanscom.

The 2015 SWPPP prepared by Massport in October 2015 listed 16 fuel spills that occurred at Hanscom Field Between January 1, 2012 and November 01, 2015. All but one of these spills were caused by tenants at the airport and all but two involved the release of Jet Fuel A. The remaining two involved a release of hydraulic fluid. Of the 16 spills recorded during this time period, only four involved a reportable quantity as follows: 10 gallons of Jet Fuel A on January 9th, 2012; 200 gallons of Jet Fuel A on December 12, 2014; 30 gallons of Jet Fuel A on June 24th, 2015, and 10 gallons of hydraulic fluid released on October 30th, 2015. All spills were contained and removed in accordance with the owner/operator spill prevention control and countermeasures plan. No spills appear on the MA Executive Office of Energy and Environmental Affairs (EOEEA) Data Portal of Waste Site and Reportable Releases from 2016 to present.

The 2015 SWPPP provided revised and updated Activity-specific BMPs to address all activities at the site that could impact stormwater quality. These BMPs included an Emergency Spill Cleanup Plan.

Massport also requires annual environmental health and safety training for its employees at Hanscom Field. The training is designed to review hazardous materials used at the facilities, hazardous waste management, stormwater pollution prevention and SPCC requirements, first responder procedures and general environmental health and safety information. In addition, Massport has developed an Environmental Management Policy and has implemented an Environmental Management System (EMS) at Hanscom Field, which provides the framework for tracking, managing and improving environmental performance. As part of the EMS, spill prevention and emergency preparedness and response procedures were reviewed. A more detailed discussion of the EMS is included in Chapter 11 Sustainability and Environmental Management.

9.2.9 Environmental Audits

Beginning in the late 1980s, Massport has required environmental audits for all tenants located at Hanscom Field. The purpose of this program is to ensure that Massport's tenants are operating their businesses in compliance with applicable laws and regulations. Massport works closely with each tenant to ensure that regulatory compliance is achieved and maintained. Any issues raised during the audits are followed up with the tenant until all compliance issues have been resolved.

The tenant audits focus on hazardous waste management, water management, storage tank programs, record keeping practices, training requirements and spill response procedures. Additionally, tenants receive information on BMPs that focus on pollution prevention. Massport tenant facilities have been audited annually since 2001 and biannually for Massport operations at Hanscom Field to ensure compliance as part of Hanscom's EMS. No significant events relative to tenant noncompliance have been reported since the *2005 ESPR*.

9.2.10 Deicing Activities

Chemical deicers (i.e., sodium formate) are periodically used on Hanscom runways or taxiways to supplement mechanical equipment such as plows and blowers to enhance safety during inclement winter weather. Sand is applied to the airfield to increase traction. Salt is applied to roadways and parking areas, and its use on the airfield is prohibited. Sodium formate has shown its effectiveness in snow and ice removal, and has been found to have significantly fewer environmental effects compared with traditional glycol-based deicers.

Aircraft deicing and anti-icing activities at Hanscom Field are currently conducted by Jet Aviation, Signature Flight Support, and Rectrix. These entities use products that are a dilute solution of propylene glycol. Most aircraft deicing is conducted near the Civil Air Terminal or the hangars.

Massport employs BMPs both as a part of its sustainability efforts to manage stormwater runoff quality at Hanscom Field, and as a component of its NPDES permit. Aircraft deicing is listed as an Activity-Specific component of Hanscom Field's Best Management Practices. Aircraft deicing is done during snow and ice events by commercial and business aircraft operators, using propylene glycol, which is included in the NPDES permit.

2003 Deicing Study

In April 2003, Massport conducted a computer modeling study of proposed airfield and existing aircraft deicing at Hanscom Field. The purpose of the study was to summarize existing aircraft deicing practices, evaluate potential airfield deicing alternatives and assess current and potential effects on receiving waters from deicing activities. Neither the EPA nor the MassDEP has identified an "unsafe" concentration of deicing fluid.

The study found that the deicing compounds that were used or were under consideration for use at Hanscom Field at the time of the study exhibited little to no human toxicity and that none was considered harmful by ingestion or has known long-term health effects. The study showed that neither current nor future scenario deicing activities at Hanscom Field would adversely affect the water supply for Bedford, Burlington or any other nearby communities.[150]

Stormwater and In-stream Monitoring Program

Massport conducted a stormwater and in-stream monitoring program between November 2003 and March 2004 to assess any actual impacts from deicing activities and to confirm the results of the modeling study. No additional sampling has occurred since then. The sampling program consisted of seven sampling events for nine parameters. One event determined background concentrations while five events targeted stormwater and in-stream water quality during storm events when sodium formate and propylene glycol were being applied at the

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[150] CDM, 2003. *Hanscom Field Deicing Study*, Prepared by CDM, April 15, 2003, for Massachusetts Port Authority

airport. One event quantified sodium concentrations in stormwater discharged to the Shawsheen River from road salt (sodium chloride) applications.

During each event, several rounds of samples were collected from up to ten locations (three in-stream locations, five outfall locations, one manhole location, and one culvert location). Samples were analyzed for propylene glycol concentration, sodium concentration, dissolved oxygen, chemical oxygen demand, carbonaceous biological oxygen demand, salinity, conductivity, temperature, and pH. Sodium measurements were used to calculate the sodium formate concentration in the aqueous samples. Dissolved oxygen, chemical oxygen demand and carbonaceous biological oxygen demand were used to determine the potential environmental effects of the use of the deicers on aquatic life. Salinity, conductivity, temperature and pH were used to monitor changes in the general characteristics of the stormwater and surface water bodies. Data from the monitoring program are presented in Appendix F.

The data collected during the monitoring program indicated that the concentrations of sodium formate and propylene glycol in the Shawsheen River and Elm Brook do not exceed aquatic toxicity levels. The data also demonstrated that water quality parameters, such as dissolved oxygen, are not affected by the discharge of the sodium formate and propylene glycol to the surrounding aqueous environments. The sodium concentrations measured in stormwater flow from the airfield ranged between 2.2 milligrams per liter and 92 milligrams per liter. When the highest sodium concentration of 92 milligrams per liter is converted to a sodium formate equivalent, the corresponding sodium formate concentration is 272 milligrams per liter, which is well below the established aquatic toxicity level of 1,000 milligrams per liter. Propylene glycol was found to be discharged primarily at one outfall located at the headwaters of the Shawsheen River. The in-stream propylene glycol concentrations found in the Shawsheen River ranged between not detected (with a detection limit of 2 milligrams per liter) and 270 milligrams per liter. The highest in-stream propylene glycol concentration found in the Shawsheen River, 270 milligrams per liter, is well below the reported aquatic toxicity level of 3,200 milligrams per liter. Propylene glycol was not detected in the Elm Brook sample.

Decreases in dissolved oxygen in the Shawsheen River due to propylene glycol discharge were not observed. The lowest dissolved oxygen measurement at the in-stream location of the Shawsheen River on Hanscom AFB during the study was 7.1 milligrams per liter, which is comparable to the background concentration of 7.3 milligrams per liter and above the state minimum standard of 5.0 milligrams per liter. Levels of chemical oxygen demand and carbonaceous biological oxygen demand above background concentrations at this location were observed to be directly correlated to propylene glycol discharge. The dissolved oxygen data suggests that this aquatic system is able to buffer the oxygen demand imposed by discharges of propylene glycol.

Based on the data collected during the Hanscom Field deicing study, it was determined that the concentrations of both sodium formate and propylene glycol in the Shawsheen River and Elm Brook do not exceed established levels for aquatic toxicity and do not adversely affect other aquatic parameters (e.g. dissolved oxygen). Therefore, the use of these deicing/ anti-icing agents does not result in adverse effects on the receiving waters.

9.3 Analysis of Future Scenarios

The *2017 ESPR* future scenarios are used to evaluate the potential cumulative environmental effects on natural resources that could occur if Hanscom Field reaches the airport activity levels that that are described in Chapter 3 Airport Activity Levels. The 2025 and 2035 scenarios are estimates of what could occur (not what will occur) in the future using certain planning assumptions and are not necessarily recommended outcomes. The 2025 and 2035 planning scenarios are presented in Chapter 4 Airport Planning. Massport encourages that new development be focused within areas with existing impervious surfaces that take advantage of available infrastructure and minimize impacts on habitat and water quality.

Because Massport's long-standing strategy is to maximize reuse of pre-developed areas of the airport, the 2025 and 2035 scenarios are designed to avoid impacts on vernal pools, rare or endangered species habitat, and water quality. Wherever practicable, Massport also looks for opportunities to enhance existing environmental conditions. Each of the future planning concepts that could occur over these time periods are focused on areas more than one-half mile from any of the certified vernal pools in the western portion of the airport. Several of the potential future development areas are in proximity to protected resource areas including wetlands and habitat areas. As has been Massport's policy, planning for any facilities would seek to avoid or minimize both direct and indirect adverse impacts through the design process. In the event there are unavoidable impacts, mitigation options will be considered.

Several of the facilities described in these scenarios could overlap potential habitat of the rare species of grassland birds in the infields of the airport runways or aquatic areas and adjacent uplands utilized by Blanding's and Wood Turtles. Potential indirect impacts from projects in the vicinity of these nesting areas are not be expected to disrupt these populations since these species currently occupy an active airport environment. Potential water quality impacts will be avoided or minimized to the maximum extent practicable through the continued implementation and updating of the SWPPP and conformance with applicable standards for stormwater management required for site development or redevelopment by the MassDEP. Where practicable, Massport also looks for opportunities to enhance groundwater infiltration.

Some of the planning areas in the 2025 and 2035 scenarios contain wetland resources or are located near wetlands. Massport would assess every practicable effort to avoid, minimize, and mitigate potential wetland impacts for future Massport or tenant projects. Projects involving work within wetland resource areas or their buffer zones would require applications to the appropriate conservation commissions for permitting under jurisdiction of the WPA. Potential effects of the planning scenarios on wetlands, wildlife and water resources are described below.

9.3.1 Wetlands

The assessment of potential wetland impacts is a worst-case analysis assuming all the facilities described in the Planning Year Scenarios were constructed for each study year. Table 9-9 shows the facilities and the potential wetlands affected, based on the planning scenarios provided in Chapter 4.

Table 9-9 Potential Planning Concepts near Wetlands in 2025 and 2035 Scenarios

Location	Planning Concepts	Location of Potential Wetland Impacts[1]	
		2025 Scenarios	2035 Scenarios
West Ramp	⇨ Upgrading or replacement of general aviation (GA) facilities with new parking spaces; new GA hangars ⇨ Salt storage facility relocation ⇨ Civil Air Terminal enhancements ⇨ New and replacement structured public parking ⇨ Expansion of the airport maintenance facility	No delineated wetlands potentially affected; small ditch feature is shown on Figure 9-1.	Wetland 3-1 Wetland 3-2 Wetland 3-3 Wetland 3-5 Wetland 1 Wetland 2 Wetland 3 Wetland 4
Pine Hill	⇨ GA facilities with new parking spaces ⇨ GA facilities on former Draper Lab site	Wetland 1-4 buffer zone	Wetland 1-4 buffer zone Wetland 1-5
East Ramp	⇨ GA facilities with new parking spaces ⇨ Alternative landside access ⇨ Expansion of GA facilities and upgrading or replacement of existing GA hangars	Wetland 1-1 buffer zone	Wetland 1-1 buffer zone
North Airfield	⇨ GA facilities with parking in area with existing parking spaces	Wetland 2-9 buffer	Wetland 2-9 buffer
Northeast Airfield	⇨ Development reserve on Parcel B site, upon reversion to Massport	None	Wetland 1-2 potentially impacted

Note:
1. Direct impacts could occur to the wetland, unless it specifically states “buffer zone”, which means potential buffer zone impacts only.

Projects undertaken at Hanscom Field that involve work within wetland resource areas (including Riverfront Area) or buffer zones would require review and approval by the applicable conservation commission(s) through the submission of appropriate applications (NOI, Requests for Determination of Applicability, etc.) under the WPA. Approval of work within a resource area generally requires conformance with WPA performance standards identified in Title 310 of the Code of Massachusetts Regulations, Chapter 10 (Section 54 through 58) for each resource area category, and an Order of Conditions issued by the conservation commission(s). Impacts to wetlands regulated under the Federal Clean Water Act, but not by the WPA, or impacts exceeding the area thresholds established in the WPA performance standards, could also require a Section 404 Individual Permit from the USACE, and/or Water Quality Certification from the MassDEP under Section 401 of the Federal Clean Water Act. Massport would work to refine plans to avoid or minimize potential wetlands impacts to the extent practicable.

2025 Scenario

Work may occur near wetlands in four of the five planning areas in the 2025 scenario. Work would potentially be conducted within the state 100-ft wetland buffer zone(s) at the Pine Hill, East Ramp, and North Airfield planning areas. At the West Ramp planning area, no delineated wetlands are near the site, however, a small ditch feature is located within the planning area that should be investigated prior to future activities at this site. No activities are proposed at the Northeast Airfield planning area.

2035 Scenario

For the 2035 scenario, all of the planning areas could have potential impacts to wetland areas, either direct, or to the wetland's buffer zone. In the Northeast Airfield Area, the 2035 scenario shows potential work areas directly within Wetland 1-2. Wetland 1-5 may potentially be directly impacted under the 2035 scenario for the Pine Hill planning area. Work would potentially be conducted within the 100-foot wetland buffer zone(s) at the Pine Hill, East Ramp, West Ramp, and North Airfield planning areas. In all cases, efforts would be made to avoid impacts where possible.

9.3.2 Vernal Pools

Any future projects proposed within or adjacent to the certified vernal pools would need to be reviewed by the NHESP through the submission of a copy of a Notice of Intent (NOI) prepared under the WPA. None of the proposed projects proposed for either the 2025 or 2035 scenarios would be located near the three vernal pools and therefore no impacts are expected to occur.

The certified vernal pools are located near the end of Runway 11 where vegetation management operations may occur. As with the current VMP, which details vegetation management at Hanscom Field, future vegetation removal projects developed for the period from 2018 through 2020 will be based on the VMP and will incorporate plans to protect vernal pools. Also, Massport is in the process of preparing the 2019-2023 VMP update, which may recommend additional vegetation management work. These future projects, which are within the guidelines established in the VMP, would also undergo review by the appropriate conservation commissions and the NHESP. A plan to protect the certified vernal pools during vegetation management operations has been incorporated in the Hanscom Field VMP, which was approved by the four conservation commissions.

During wetland delineations in 2012, it was noted that Wetland Nos. 2 and 3 may have characteristics of vernal pools. In the event any future work is considered in these areas, additional evaluation of these potential resource areas would be warranted.

2025 Scenario

No impacts to three certified vernal pools near the western end of Runway 11/29, or their wildlife habitat value, would result from the potential locations for new facilities in the 2025 scenario. The potential location of a facility nearest to the vernal pools would be the Pine Hill Area, situated approximately 3,100 feet to the southeast.

2035 Scenario

No impacts to vernal pools would occur from development in the 2035 scenario. Development areas are approximately the same as the 2025 scenario, and therefore risk of impact is the also very similar.

9.3.3 Rare and Endangered Species

Four of the five potential action areas considered under the 2025 or 2035 scenarios include areas of critical habitat of rare and endangered species. As noted in the Rare and Endangered Species section above, two rare species of grassland birds have been observed at Hanscom Field: upland sandpiper (endangered) and grasshopper sparrow (threatened). Each of these species nests within runway infield areas that are periodically mowed to maintain grassland vegetation for safe aircraft operation. Any work within critical grassland habitat areas would need to be reviewed by the NHESP before commencement of activities.

In addition, two turtle species have more recently been identified. These reptiles inhabit aquatic areas and the adjacent uplands. Any project proposed in the buffer zone of a wetland or in the Riverfront Area associated with a perennial stream must file a NOI with the conservation commission. Should any work be proposed in areas previously utilized by Blanding's or Wood Turtles, the project would also need to be reviewed by the NHESP. The future development scenarios do not include work near these brooks and streams.

Since the 2012 report, the Northern Long-eared Bat has been listed under the Federal ESA. As discussed in Section 9.2.5.1, the Massachusetts Natural Heritage and Endangered Species Program maintains records for municipalities in the Commonwealth for known hibernacula and roost trees; there are no Massachusetts NHESP records of known maternity roost trees or hibernacula within the project area or the surrounding area. Any proposed activity within wooded areas should be conducted in accordance with BMPs provided by the USFWS to ensure no impacts to this species. Since four of the five potential planning areas will have some level of tree removal, measures will need to be taken to ensure this species is not impacted.

2025 Scenario

The 2025 scenarios for the Pine Hill and North Airfield planning areas would overlap small areas of critical grassland habitat along the edge of the airport; much of this planning unit is currently developed. Small areas of suitable grassland habitat for Grasshopper Sparrows may be impacted, however, the loss of these areas would be small relative to the overall habitat on the airport. Impacts to these areas would be avoided and minimized to the extent practicable, but would also need to be reviewed by the NHESP. Where possible, Massport would look to offset any grassland losses through removal of excess airfield pavement.

Protected turtle species are located in brooks and streams and occur in adjacent uplands. These species are primarily associated with Elm Brook and the Shawsheen River on Hanscom which occur on the western and northern part of the airport and flow north. No work in the 2025 scenario is proposed across or adjacent to either of these waterways. The closest planning area to Elm Brook is North Airfield, which is approximately 1,000 feet at its closest point; the Pine Hill planning area is approximately 1,600 feet from Elm Brook at its closest point. The closest planning area to the Shawsheen River is the East Ramp, which is approximately 3,300 feet at its closest point.

Under the 2025 scenario, the West Ramp area may have minor tree clearing, while the North Airfield planning area shows a large tree removal area. As discussed above, removal of these trees should be coordinated with the NHESP and USFWS to ensure no impacts to the NLEB and that proper BMPs are undertaken, to ensure no impacts to this species.

2035 Scenario

The 2035 scenarios for Pine Hill and East Ramp planning areas also overlap small areas of critical grassland habitat along the edge of the airport. The 2035 Northeast Airfield planning area is shown to impact a larger area of critical grassland habitat, part of which is also within a vegetation management area. Impacts to these areas would be avoided and minimized to the extent practicable, but would also need to be reviewed by the NHESP.

No impacts to the Blanding's or Wood turtles are anticipated under this scenario. No work in the 2035 scenario is proposed across or adjacent to either of these waterways. Similar to the 2025 scenario, the activities under the 2035 scenario are far from the Shawsheen River and Elm Brook and would have no impact on these species' habitats.

Under the 2035 scenario, the Pine Hill area may have minor tree clearing, the North Airfield area has moderate tree clearing, and the Northeast Airfield and West Ramp planning areas show larger tree removal areas. As with the 2025 scenario, removal of these trees should be coordinated with the NHESP and USFWS to ensure no impacts to the NLEB and that proper BMPs are undertaken, to ensure no impacts to this species.

9.3.4 Water Quality

Since all components under the 2025 or 2035 scenarios would be required to meet requirements of the NPDES Permit and applicable MassDEP standards for stormwater management, the potential for water quality impacts under the planning year scenarios are expected to be similar to each other. In addition, many of the developments contemplated in the Master Planning areas would occur in areas of existing impervious development and would minimize water quality and quantity impacts. Some areas of potential development would occur in areas of pervious grassland or woodland. Massport would ensure any development meets their standard of zero increase of post-development discharge through appropriate measures to store and treat stormwater. Also, Massport typically tries to offset any impervious surface increases by removal of excess pavement on other portions of the airfield.

2025 Scenario

Massport will continue to follow, and require tenants at Hanscom Field to follow, the development and facility operational requirements under the then-current NPDES Permit. All potential new facilities in the 2025 scenarios would also be required to meet applicable MassDEP standards for stormwater management, when feasible. Therefore, the 2025 scenario is not anticipated to result in any impacts to water quality, and the continued Best Management Practice efforts would be expected to result in improvements to water quality over time. Stormwater management would be integrated into all future development to ensure compliance. Ongoing groundwater remediation efforts noted in the Groundwater Conditions and Water Quality portion of this chapter would also be expected to improve water quality on and off site. In addition, many of the planning areas located in existing impervious areas, with a total projected increase of 8.7 acres over the 2012 base condition. Massport would review areas where existing pavement can be removed to achieve no net increase in impervious surface if these projects are to move forward.

The potential North Airfield and Pine Hill areas are located in the Zone II Wellhead Protection Area for the Bedford wells. Massport would work with potential developers of these sites to ensure that any potential facilities are designed to protect the recharge area of the Bedford public wells. These measures, as well as elements of Massport's spill prevention program, are designed to protect the recharge area of the Bedford public wells.

2035 Scenario

Conditions for the 2035 scenario would be similar to those described for 2025. Larger potential areas of impervious surface would be created at the West Ramp and Northeast Airfield planning areas, due to possible development of grassland and woodland areas. In addition, many of the planning areas located in existing impervious areas, with a total projected increase of 64.7 acres over the 2012 base condition. There are large increases in impervious surface for the Northeast Airfield in the 2035 scenario. Since this area is reserved for future aviation strategic development, there are no specific development plans at this time, but it is nonetheless included in this evaluation. The West Ramp also shows a large increase in 2035 due to the areas on either side of the terminal area access roadway which are also reserved for future aviation strategic development. Massport would review areas where existing pavement can be removed to achieve no net increase in impervious surface if these projects are to move forward.

10 Cultural & Historical Resources

This chapter provides information about existing cultural and historical resources at Hanscom Field and in areas adjacent to Hanscom Field. The documentation of historical and archaeological resources in the area includes resources currently listed in both State and National Registers of Historic Places, the Inventory of the Historic and Archaeological Assets of the Commonwealth (Inventory), and the Massachusetts Cultural Resource Information System (MACRIS).

The Massachusetts Historical Commission (MHC) maintains these sources. The 2005 ESPR and update in the 2012 ESPR provided the foundation for the update presented in this 2017 ESPR. The current analysis entailed research, field data collection, and discussions with the historical commissions for each of the four towns and the incorporation of any information they provided.

The inventory update of existing cultural and historical resources also included a review of the status of historic buildings and landscapes in Minute Man National Historical Park (MMNHP).

10.1 Key Findings Since 2012

Incorporating input from the four host towns and Minute Man National Historical Park (MMNHP) into the results of research in state files and field review, there have been just a few additions to the cultural and historic resources inventory for the area in and around Hanscom Field since 2012. The analysis of potential impacts on cultural and historical resources demonstrates that no residential land uses, including historic resources, were exposed to a Day-Night Average Sound Level (DNL) value above the Federal Aviation Administration (FAA) land use compatibility recommendation of DNL 65 dB in 2017. Both total operations and noise levels remain well below historical peaks. Hanscom Field continues to follow operational measures that have been implemented to limit noise including the Fly Friendly Program in place since 2009.

The *2017 ESPR* updates the *2012 ESPR* conditions for comprehensive reconnaissance surveys of historic and archaeological resources that are listed in or eligible for the National and State Registers, in the state inventory and the Massachusetts Cultural Resource Information System (MACRIS), or are 50 years or older. The 2017 survey update includes a few additional resources within the four Hanscom towns.[151] There have been no changes to the historic resources within the boundaries of MMNHP.

Key findings from the comprehensive reconnaissance survey updates:

- **No historic resources are exposed to noise of DNL 65 dB in 2017.**
- **No changes to historic resources within the MMNHP; one survey area and two local landmark new properties have been added to the four towns surrounding Hanscom Field.**
- **The 2035 forecast scenario shows fewer cultural and historic resources within the DNL 55 dB noise contour than was forecast for 2030 in the *2012 ESPR*.**
- **Impacts to cultural and historic resources from traffic and air quality have decreased since 2012.**

In 2015, Massport initiated the design and fabrication of an interpretive display and brochure in accordance with the Memorandum of Agreement (MOA) among the FAA, the Massachusetts State Historic Preservation Officer, and Massport regarding the replacement of Hangar 24 at Hanscom Field. To seek public comment, Massport issued a draft copy of the Hangar 24 Interpretive Display ("the display") on the week of August 8, 2016. No comments were received. On March 17, 2017, Massport completed and installed the display

[151] The 2017 survey update consists of two reports: Adams et al. (PAL) Historic Resources Reconnaissance Survey Update, for Hanscom Field 2017 Environmental Status & Planning Report, Bedford, Concord, Lexington, and Lincoln, Massachusetts, 2018; and Banister and Herbster (PAL), Archaeological Reconnaissance Survey Update, for Hanscom Field 2017 Environmental Status & Planning Report, Bedford, Concord, Lincoln, and Lexington, Massachusetts, 2018. These two reports update information compiled in comprehensive surveys completed for the 2005 ESPR and updates prepared for the 2012 ESPR, which are referenced in the relevant sections below.

and published notification of its completion in each of the surrounding town newspapers on the week of December 18, 2017. The display may be viewed daily on the first floor of the Civil Air Terminal Building, 200 Hanscom Drive and an image of the display is published on the Massport website.[152] The accompanying interpretive display brochures are located at the following locations: Bedford Library, Bedford Town Clerk, Bedford Town Manager's Office, Concord Library, Concord Visitors Center, Concord Town Hall, Lexington Library, Lexington Visitors Center, Lexington Service Plaza, Lincoln Library, Lincoln Town Hall, and Hanscom AFB Education and Training Center.

Figure 10-1 Hangar 24 Interpretive Display at Hanscom Field Civil Air Terminal

As in the *2012 ESPR*, the *2017 ESPR* provides a new noise analysis for historic resources. It is a conservative analysis that incorporates the largest area potentially affected based on the maximum forecasted noise values, as presented in Chapter 7 Noise. In 2017, this is the area contained within the 2035 planning year 55 DNL noise contour line (depicted in Figure 7-18). The *2012 ESPR* similarly presented information about resources in the forecasted 2030 scenario. The projected 2035 noise contour in the *2017 ESPR* generally covers a smaller area than the forecasted 2030 high growth noise contour in the *2012 ESPR*, except at the east end where the noise contour extends slightly further east in the 2035 forecast. The numbers of historic properties within this contour are reduced in several locations, and increased at the

[152] http://www.massport.com/massport/about-massport/project-environmental-filings/hanscom-field/

east end where the contour is longer. A reconnaissance area surveyed in the 2005 and *2012 ESPR*s, was added to the state historic inventory since 2012.

The *2017 ESPR* also provides an analysis of historic and archaeological properties encompassed within a 200-foot radius of 10 Traffic Study Areas (TSAs) at various road intersections outside of the Hanscom Field boundary. The TSAs are described in Chapter 6 Ground Transportation. The historic and archaeological properties present at the TSAs are the same for the *2012 ESPR* and the *2017 ESPR*. The *2017 ESPR* describes the environmental effects of traffic and air quality, as discussed in Chapter 6 and in Chapter 8 Air Quality, on cultural and historic resources. The findings show that the environmental effects of traffic and air quality on cultural and historic resources have decreased between 2012 and 2017.

10.1.1 Overview of Survey Areas and Updates

Historic Resources Overview

The 2017 historic resources survey updated information on National and State Register historic properties in the 6,000-acre, roughly 3 by 4-mile, ESPR General Study Area within and around Hanscom Field.[153] The General Study Area is defined as an area of approximately 45 square miles that is depicted in Figure 10-2, in which a file review and field verification update of National and State Register properties was completed to provide a broad understanding of the historic resources in the vicinity of Hanscom Field. The General Study Area remains consistent between the ESPRs. The historic resources survey for the Reconnaisance Study Area also updated information on resources included in the MHC's statewide Inventory and MACRS. The Reconnaissance Survey Area, superimposed within the General Study Area, can vary as it is comprised of the area within the future 55 DNL noise contour and a 200-foot radius around the Traffic Study Areas (TSAs). It includes all of Hanscom Field, part of Hanscom AFB, part of MMNHP, and parts of Bedford, Concord, Lexington, and Lincoln. The *2017 ESPR* historic resources survey updated information gathered for two previous ESPRs to reflect current conditions.[154]

This survey in the General Study Area showed that currently there are a total of 65 historic properties (i.e., 41 individual properties and 24 districts [with the MMNHP counted as one district]) included in, or determined eligible for the National and State Registers. These properties include 13 National Historic Landmarks (NHL), with the MMNHP counting as one NHL. The *2017 ESPR* totals represent a small increase by 2 for both individual properties and districts, and an increase of 1 NHL, from the *2012 ESPR* (additional details are in Section 10.4.1).

[153] The General Study Area consists of the portions of the towns of Bedford, Concord, Lexington, and Lincoln that are shown as a rectangular area in the map figures in this chapter.
[154] Adams et al. (PAL) Historic Resources Reconnaissance Survey Update, for Hanscom Field 2017 Environmental Status & Planning Report, Bedford, Concord, Lexington, and Lincoln, Massachusetts, 2018. Adams et al. (PAL) Historic Resources Reconnaissance Survey Update, for Hanscom Field 2012 Environmental Status & Planning Report, Bedford, Concord, Lexington, and Lincoln, Massachusetts, 2013. Adams et al. (PAL) Historic Resources Reconnaissance Survey, for Hanscom Field 2005 Environmental Status & Planning Report, Bedford, Concord, Lexington, and Lincoln, Massachusetts, 2006.

The properties range from individual houses to large historic districts with structures and associated landscape settings. The analyses included properties on Hanscom Field and Hanscom AFB. The National Park Service (NPS) has identified approximately 106 historic resources that contribute to the historical significance of MMNHP.

In addition to updating information on the historic properties listed in or eligible for the National and State Registers, the *2017 ESPR* also upates the survey of historic resources within a Reconnaissance Survey Area defined as maximum forecasted noise value for the ESPR within the 2035 55 DNL noise contour (including Hanscom Field) and a 200-foot radius around each of 10 TSAs (see Figure 7-18). The survey update for this area also encompassed historic resources in the Massachusetts Historical Commission's (MHC) Inventory and MACRIS, and provided an update of the preliminary identification of resources that are 50 years old or older that have not been previously surveyed on Hanscom Field and in the four towns. The 2017 survey update for the Reconnaissance Survey Area inside the forecasted 2035 55 DNL noise contour line showed no change since 2012 (see Figure 10-9). There continue to be three individual historic properties (Deacon John Wheeler/Capt. Jonas Minot Farmhouse (aka Thoreau Birthplace), 341 Virginia Road in Concord; Wheeler-Meriam House, 477 Virginia Road in Concord; and Simonds Tavern, 331 Bedford Street in Lexington) and a small section of one historic district/NHL, MMNHP, that are listed in or eligible for inclusion in the National and State Registers. Noise analysis was completed for these National and State Register properties.

The 2017 update of the Reconnaissance Survey Area in the 2035 55 DNL noise contour also identified all or portions of 10 survey areas and 175 individual resources that are in the MHC Inventory and MACRIS. This information is included in Appendix G. It also includes within the noise contour potential reconnaissance historic resources as parts of 3 survey areas and 2 individual properties. This is compared with 8 areas/historic districts and 58 individual properties in MACRIS in 2012, and 20 districts and 32 individual properties in 2005. The increases by 1 or 2 resources are attributed to new historic resources being added to the inventory over the five year period. The larger increase from 58 individual resources in 2012 to 175 in 2017 is due to the addition of one survey area in Lexington (Lexington Manor Area) and also to the availability of more precise GIS- and parcel-based mapping.

The 2017 survey update within the Reconnaissance Survey Area at the 10 TSA intersections identified no historic resources at three of the TSAs. Seven of the TSAs fall within the boundaries of the MMNHP. Inventoried historic resources also are present, outside of the MMNHP boundaries, at three TSAs. As in the survey for the *2012 ESPR*, the 2017 survey update verified that all historic resources within the 10 TSAs were already included in the MHC Inventory and MACRIS and/or the State and National Registers. No previously undocumented historic resources were identified at any of the 10 TSAs.

The survey in the General Study Area of properties that are 50 years or older completed for the *2012 ESPR* identified 359 individual properties and 51 areas in the Inventory and MACRIS, and an additional 336 individual properties and 11 locations within that survey area that had not been previously documented. One of these undocumented areas (East of Bedford Street) in

Lexington has been added to the Inventory and MACRIS as a survey area (Lexington Manor Area) since 2012.

Archaeological Resources Overview

For archaeological resources, the survey update for the *2017 ESPR* updated information gathered for two previous ESPRs to reflect current conditions.[155] It included a review of National and State Register files, MHC inventory and site files, and the online database MACRIS to update information on recorded archeological sites within Hanscom Field and near the 10 TSAs. The review completed for *2012 ESPR* identified one recorded site outside Massport property near the intersection of Hanscom Drive and Old Bedford Road. An additional previously recorded 39 sites that have not been evaluated for eligibility for listing in the National and State Registers were identified in Bedford, Concord, Lexington, and Lincoln. This included six sites completely or partially within the property line of Hanscom Field. A 2005 archaeological overview and assessment of MMNHP for NPS reported that there were more than 100 prehistoric and historic period archaeological sites identified within the Park.[156]

The analysis completed for the *2017 ESPR* found little change in the status of archaeological information since the reconnaissance survey conducted for the *2012 ESPR*. The prior reconnaissance archaeological survey found that most of Hanscom Field has been previously disturbed by construction. Areas of high pre-contact archaeological sensitivity include previously undisturbed, dry, level areas located adjacent to the natural brooks and wetlands in the peripheral portions of Hanscom Field. The extreme southern section of Hanscom Field and the intersections along Route 2A have moderate to high archaeological sensitivity for post-contact resources associated with the April 19, 1775 engagement along Battle Road, now part of the MMNHP. The update for the *2017 ESPR* determined that existing conditions within the Hanscom area have remained largely unchanged since the *2012 ESPR* and that no new archaeological sites have been identified within study area.

Noise Analysis Overview

The *2017 ESPR* updates the noise analyses for historic properties forecasted to have maximum noise exposure. Chapter 7 Noise, reports noise levels at Hanscom Field in terms of DNL contours for 55, 60, 65 and 70 DNL exposure. DNL is a noise metric that refers to Day-Night Sound Level for typical 24-hour exposure periods. Further detail on DNL analysis is presented in Chapter 7, and an explanation of noise terminology is in Section 7.2. No residential land uses

[155] Banister and Herbster (PAL), Archaeological Reconnaissance Survey Update, for Hanscom Field 2017 Environmental Status & Planning Report, Bedford, Concord, Lincoln, and Lexington, Massachusetts, 2018. Banister and Herbster (PAL), Archaeological Reconnaissance Survey Update, for Hanscom Field 2012 Environmental Status & Planning Report, Bedford, Concord, Lincoln, and Lexington, Massachusetts, 2013. Banister and Herbster (PAL), Archaeological Reconnaissance Survey, for Hanscom Field 2005 Environmental Status & Planning Report, Bedford, Concord, Lincoln, and Lexington, Massachusetts, 2006.

[156] Herbster (PAL), Archaeological Overview and Assessment, Minute Man National Historical Park, Concord, Lincoln, and Lexington, Massachusetts, 2005.

were exposed to a DNL value above the FAA land use compatibility recommendation of 65 dB in 2017. Table 10-1 summarizes noise exposure on National and State Register properties and the MMNHP by identifying those resources within the 65 DNL and 55 DNL contours. Of these resources, consistent with the 2012 findings, no part of the Hartwell Town Forest/Jordan Conservation Area, which is included in MACRIS, is within the 65 DNL contour; this compares to 1.4 acres in 2005. Locations within the 55 DNL contour align with runway ends and air traffic patterns to the south and west or within close proximity to Hanscom Field (e.g., historic sites on Virginia Road). Massport and the NPS continue to cooperate on the implementation of the Fly Friendly program instituted in 2009 with a noise abatement program and voluntary measures to minimize noise impacts on the MMNHP and residential areas.

The DNL values at National and State Registers historic properties in 2017 experienced changes ranging from a decrease of 0.6 dB to an increase of 4.0 dB relative to 2012 (see Table 7-26, Table 7-27, Table 7-28 and Table 7-29). Changes in DNL in the 2025 and 2035 scenarios for the *2017 ESPR* are projected to range from a decrase of 1.1 dB to an increase of 1.4 dB relative to 2017 levels.

Traffic and Ground Transportation Impacts Overview

As discussed in Chapter 6 Ground Transportation, in 2018[157], Hanscom Field represented approximately 2 percent of peak hour traffic on Route 2A, which is a reduction from 2012. The traffic level on Route 2A attributed to Hanscom Field in the *2012 ESPR* was between three and four percent. For both the 2025 and 2035 scenarios, Hanscom Field-related traffic on Route 2A is expected to remain steady at approximately two percent of peak hour traffic.

In addition, there has been a reduction in traffic volumes on Hanscom drive of between four and five percent for morning and afternoon peak hours between 2012 and 2018.

In 2012 and in 2018, Hanscom Field traffic exceeded the ten percent MEPA threshold at only one intersection on Route 2A in the MMNHP: #6) Hanscom Drive/Route 2A in Lincoln. Hanscom Field traffic exceeds ten percent of a single traffic movement at one Route 2A intersection (Hanscom Drive/Route 2A) in the 2025 and 2035 scenarios.

Massport supports Transportation Demand Management (TDM) strategies to reduce its contribution to traffic on area roadways, as well as potential traffic management strategies that do not require physical modification to intersections. No physical modifications are currently proposed by Massport to the three (of 10 studied) TSA intersections that meet the threshold for analysis in the ESPR, and, therefore, there are no adverse effects to the identified historic and archeological resources in 2018 for the 2025 and 2035 forecast scenarios.

[157] As described in Chapter 6 Ground Transportation, data collection for the traffic analysis occurred in April of 2018. Therefore 2018 is referenced when discussing current conditions for traffic as opposed to 2017 for other categories of current conditions.

Air Quality Impacts Overview

As described in Chapter 8, there are no adverse effects attributable to air quality in 2017 or the 2025 and 2035 scenarios. Air quality in the region currently meets federal and state ambient air quality standards as established by the U.S. Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP), and is forecasted to remain well below the regulatory thresholds in the future years 2025 and 2035. Therefore, this analysis concluded that no adverse air quality effects to historic resources, including MMNHP, are anticipated now or in future analysis years from activities at Hanscom Field.

10.2 2017 Conditions

This section presents conditions in 2017 for cultural and historic resources within Hanscom Field and in the General Survey Area and Reconnaissance Survey Area illustrated in Figure 10-2. The noie analysis location labels in this figure refer to information presented in Chapter 7 and in Table 10-2, Table 10-3, Table 10-4, and Table 10-5 for the four host towns and in Table 10-13 for MMNHP. The description of 2017 resources focuses first on the survey update for historic resources, then archaeological resources, and concludes with MMNHP. Current conditions in each group are followed by analyses of current and projected noise, traffic and traffic study area intersections (TSAs), and air quality. The noise analysis evaluates the 65 DNL noise contour and the 55 DNL noise contour. The 65 DNL noise contour was used as a guideline for determining potential land use incompatibilities, in accordance with FAA guidelines. The EEA Scoping Certificate for the *2017 ESPR* identified the 55 DNL noise contour for inclusion in the noise analysis.

Historic and archaeological resources were identified for areas within 200 feet of the 10 traffic study area intersections to provide baseline data to assess potential traffic effects on these resources. Traffic concerns are related to overall traffic volumes on roadways, particularly Route 2A through the MMNHP, and the operation of intersections. Although Hanscom Field traffic made up only 2 percent of the traffic on Route 2A during the morning peak hour and afternoon peak hours in 2018, Massport will continue to assess traffic management approaches that do not involve physical changes to intersections, if potential improvements are warranted to address identified needs. Appendix G summarizes historic resources near the 10 intersections.

Table 10-1 Summary of Noise Effects on Cultural and Historic Properties

Resource[1]	Total Quantity[2]	2012	2017	2025	2035
Properties/Geographic Areas within 65 DNL Contour[3]					
National and State Registers Individual Properties[4]	41 properties	0 properties	0 properties	0 properties	0 properties
National and State Register Historic Districts[5]	1,646 acres	0 acres	0 acres	0 acres	0 acres
Minute Man National Historical Park	975 acres	0 acres	0 acres	0 acres	0 acres
Battle Road Interpretive Trail	4 miles	0 miles	0 miles	0 miles	0 miles
Properties/Geographic Areas within 55 DNL Contour[3]					
National and State Register Individual Properties[4]	41 properties	3 properties	3 properties	3 properties	3 properties
National and State Register Historic District[5]	1,646 acres	0 acres	0 acres	0 acres	0 acres
Minute Man National Historical Park	975 acres	0 acres	55 acres	30 acres	26 acres
Battle Road Interpretive Trail	4 miles	0 miles	0 miles	0 miles	0 miles

Notes:
1. See Tables 10-2 through 10-5 for more detail on National and State Registers individual properties and historic districts.
2. All surveyed historic properties; total acreage of surveyed historic districts, MMNHP.
3. This is the exposure level that the FAA identifies as a guideline for determining potential land use incompatibilities.
4. In General Study Area. Does not include MMNHP sites. In this tale, the noise effects are quantified through the estimation of park acreage within a given contour.
5. In General Study Area. Includes Bedford Depot Park Historic Dist., Bedford Historic Dist., and Old Bedford Center Historic Dist., Hubbard-French Historic Dist., Hubbardville Historic Dist., East Village Historic Dist., Hancock-Clarke Historic Dist., Lexington Green Historic Dist., and Munroe Tavern Historic Dist. In Lexington; and Lincoln Historic Dist. In Lincoln. Areas of overlap in districts are counted once.

10.3 Identification and Designation Process

Information on historic and archaeological resources in the *2017 ESPR* is based on updated identification data collected in a series of planning steps. Data collection consisted of reviewing the *2012 ESPR* reconnaissance survey , updating baseline research, and conducting a drive over/walkover field survey to verify the current conditions. This process resulted in an updated reconnaissance-level preliminary list of known resources and sensitive areas. The majority of the resources identified in the data collection are previously recorded, including historic resources currently included in the MACRIS on-line database, resources listed in the National and State Registers of Historic Places (National and State Registers); and resources designated as National Historic Landmarks (NHLs).

The National Register is the nation's official list of historic properties deemed worthy of protection by the NPS. To be eligible, resources must:

- **Meet criteria established by the NPS;**
- **Possess historic integrity;**
- **Be significant in local, state or national history; and**
- **Properties are nominated by the MHC.**

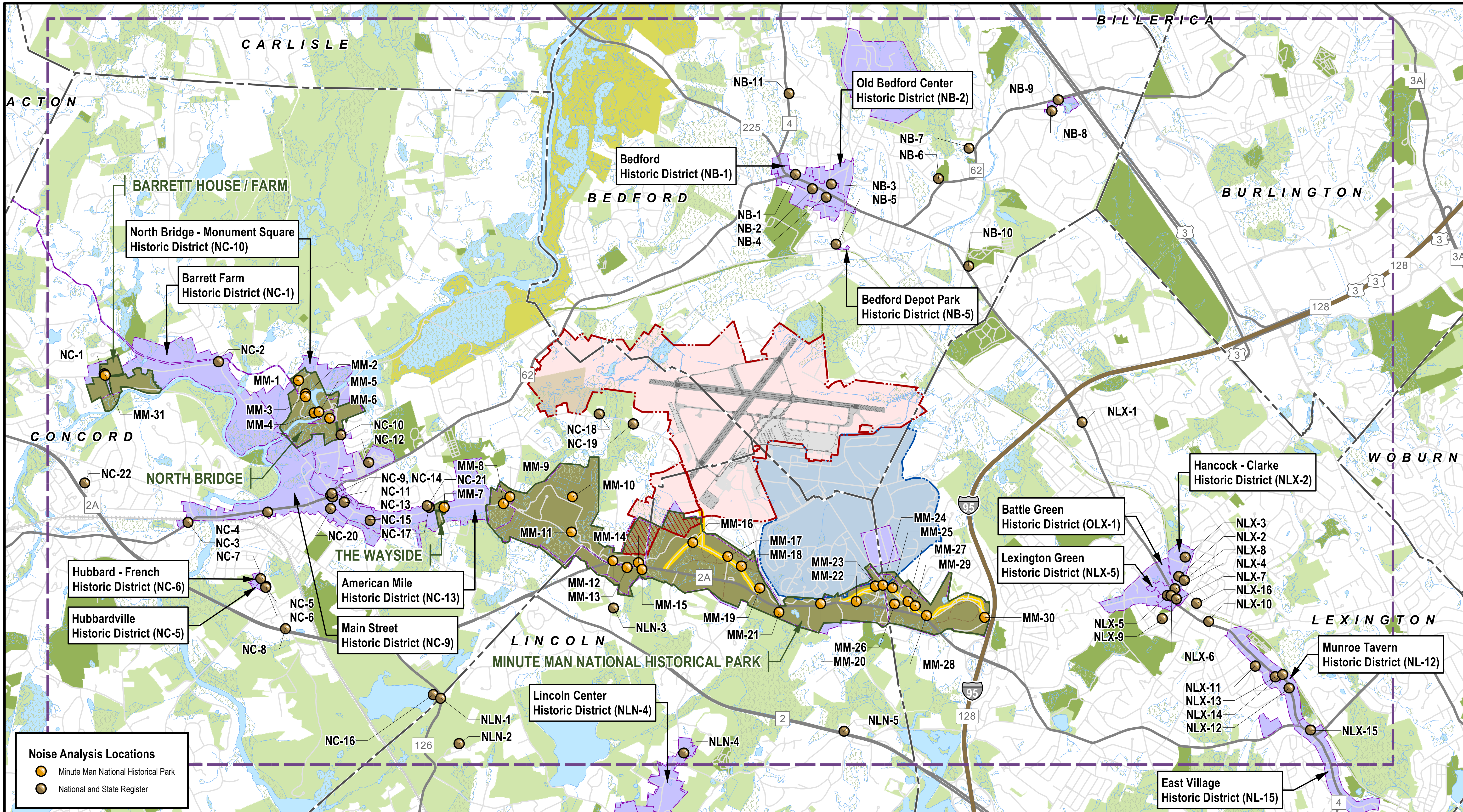
The collected information is appropriate for the planning purposes of the *2017 ESPR*, but is not finite. In the future, as additional historic resources reach 50 years of age, the towns, state or federal agencies may conduct intensive-level surveys for general or specific planning purposes. These surveys would include examination of the history, context, and physical characteristics of all or selected unrecorded historic resources in more detail. The results would involve completion of Massachusetts Historical Commission (MHC) Inventory forms, entry in the Inventory of the Historic and Archaeological Assets of the Commonwealth and inclusion in the MACRIS, and evaluation of eligibility for listing in the National and State Registers. Listing or eligibility for listing in the National and State Registers is a threshold factor for environmental review of historic and archaeological resources during project planning.

The State Register of Historic Places (State Register), maintained by the MHC, is an umbrella compilation of historic properties and districts that have been designated as historically significant in one or more different programs at the local, state, and national level.

The State Register consists of inventoried historical resources that have been evaluated and formally designated as historically significant due to meeting the criteria for listing in one of the following categories:

- NHLs designated by the U.S. Congress;
- Resources listed or formally determined eligible for inclusion in the National Register;
- Massachusetts Archaeological or Historic Landmark designated by MHC;
- Local Landmark or Local Historic District determined by a community;
- Regional Historic District established by State legislature; and
- Resources subject to a Preservation Restriction managed by the MHC.

The MHC updates the State Register regularly, and the current edition was consulted for information included in the *2017 ESPR*. Section 10.4 presents information from the National and State Registers.



North
0 3,500 7,000 Feet

NR / SR Listed or Determined Eligible Historic Districts
Historic General Study Area Boundary
Hanscom Field Property Boundary
Massport Property within MMNHP Congressional Boundary
Hanscom AFB Property Boundary
Municipal Boundary
Historic Road
Interstate
Highway
Road
Trail
Open Water
Wetland/Marsh
Stream
MMNHP Boundary
Great Meadows
Open Space Non-protected
Open Space Protected in Perpetuity

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

massport

L. G. Hanscom Field

2017 Environmental Status & Planning Report

Historic Resources Included as Noise Analysis Locations

Figure 10-2

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10.4 Historic Resources

This section updates the status of historic resources within two overlapped areas. Research and field survey for a reconnaissance survey update for inclusion in the *2017 ESPR* was completed for National and State Register properties, resources included in the MHC's Inventory and MACRIS, and unrecorded resources that are 50 years old but have not been inventoried. Data collection methodologies included review of documents, reports, agency files and databases, archival materials, and historic maps. Interviews and information sharing meetings were conducted with National Park Service representatives from MMNHP, and the local historical commissions of Bedford, Concord, Lexington, and Lincoln. Available planning studies conducted within or adjacent to Hanscom Field were also consulted. The results informed the list of noise analysis receptors and locations that were the basis of the *2017 ESPR* Chapter 7 noise analysis.[158]

The following historic properties are located in each town:

- **Bedford contains five historic districts and seven individual properties.**
- **Concord contains eight historic districts (including a portion of the MMNHP, an NHL) and 19 individual properties, including eight individual NHLs.**
- **Lexington contains 10 historic districts (including a portion of the MMNHP, an NHL) and seven individual properties, including one district and three individual NHLs. The Richard Gleason Tower Estate local historic district was added in 2017.**
- **Lincoln contains two historic districts (including a portion of the MMNHP, an NHL) and five individual properties, including one individual NHL.**

10.4.1 National and State Registers Properties

The existing conditions for National and State Registers-listed historic properties were assessed for the area shown in Figure 10-2. As noted above in Section 10.1, the survey for the *2012 ESPR* identified a total of 61 historic properties, or 39 historic buildings and 22 districts (with the MMNHP counted as one district) included or eligible for inclusion in the National and State Registers. Based on the investigations for the *2017 ESPR*, a total of 65 historic resources, or 41 individual historic properties and 24 districts (with the MMNHP counted as one district), are currently included in, or determined eligible for inclusion in, the National and State Registers within the General Study Area. These resources include 13 National Historic Landmarks, with MMNHP counted as one NHL, and are listed in Table 10-2, Table 10-3, Table 10-4, Table 10-5 and shown in Figure 10-2. The resources listed in or eligible for the National and State Registers range from individual houses to large historic districts with structures and associated

[158] Adams et al. 2006, 2013, 2018. See footnotes 1 and 4.

landscape settings, and are distributed as follows in the four towns. There has been one additional historic property added, a State Register property in Lexington, since the *2012 ESPR*.[159]

The largest single historic resource is MMNHP, an NHL district with four separate units in Concord, Lexington, and Lincoln that contains numerous historic buildings and places, including individual NHLs. MMNHP and its historic resources are discussed in Section 10.6.

10.4.2 Existing Noise Conditions for National and State Registers Properties

All 41 individual properties and 24 historic districts (including MMNHP) listed in the National and State Registers were evaluated in Chapter 7. The relationship of these properties to 2012 and 2017 noise levels is shown in Figure 10-3. None of the individual properties or historic districts is within the 65 DNL contour in 2012 or 2017, which the FAA has defined as the threshold for significant noise exposure. No historic properties fall within the 65 DNL contour for the *2012 ESPR* or the *2017 ESPR*. There are no National and State Registers historic districts within the 55 DNL contour in the *2012 ESPR* or the *2017 ESPR*, except for a small portion of MMNHP, which is reduced in size from 2012 to 2017 and is discussed below in Section 10.6.

Two individual National and State Registers-listed properties in Concord have DNL values greater than 55 dBA in 2012 and 2017. The term dBA refers to A-weighted decibel, or sound level, as measured to approximate how the human ear hears different frequencies. Noise levels at both of the following sites have decreased relative to 2012:

- The Deacon John Wheeler/Capt. Jonas Minot Farmhouse (aka Thoreau Birthplace) (NC-18), 341 Virginia Road in Concord at 57.8 dBA; and
- The Wheeler-Meriam House (NC-19), 477 Virginia Road in Concord at 57.7 dBA.

The highest DNL noise exposure at a historic National and State Registers noise analysis location in 2017 is 57.8 dBA. This level was calculated at the Deacon John Wheeler/Capt. Jonas Minot Farmhouse (aka Thoreau Birthplace). The 2017 noise value is 0.3 dBA lower than the 2012 value (58.4 dBA), which was 2.0 dBA lower than the 2005 value (60.4 dBA). These were also the highest DNL exposure levels for a historic property in 2005 and 2012.

[159] Some resource numbers are slightly adjusted from 2012 to reflect more accurate GIS mapping.

Table 10-2 Historic Architectural Properties Listed in the National and State Registers of Historic Places in Bedford

MHC #	NAL Label[1]	Name	Street Address	Style-Date	National Register/ State Register Status
BED.V	NB-5	Bedford Depot Park Historic District	80 Loomis St. and 120 South Rd.	Eclectic 1874-1877	National Register of Historic Places
BED.A	NB-1	Bedford Historic District	Great Road	Various ca. 1730-1850	Local Historic District
BED.Z	NB-2	Old Bedford Center Historic District	Great Road	Various ca. 1730-1860	National Register of Historic Places
BED.K	NB-9	Historic Wilson Mill-Old Burlington Road Area	Old Burlington, Burlington, and Wilson Roads	Various 1676-1924	National Register of Historic Places
BED.D	HB-1	Veterans Administration Hospital	Springs Road	Georgian Colonial ca. 1920	National Register Determination of Eligibility
BED.21	NB-8	Bacon-Gleason-Blodgett Homestead	118 Wilson Road	Georgian ca. 1750	National Register of Historic Places
BED.23	NB-4	Bedford Old Town Hall	16 South Road	1856	Local Historic District, National Register of Historic Places
BED.37	NB-7	Christopher Page House	50 Old Billerica Road	Federal ca. 1730	National Register of Historic Places
BED.17	NB-6	Nathaniel Page House	89 Page Road	First Period 1687	National Register of Historic Places
BED.AD	NB-3	Old Burying Ground	7 Springs Road	1729	Local Historic District
BED.801	NB-10	Shawsheen Cemetery	Shawsheen Road	1849	National Register of Historic Places
BED.36	NN-11	David Lane House	137 North Road	Federal 1781	National Register of Historic Places

Notes:
1. 2017 Noise Analysis Location label.

Table 10-3 Historic Architectural Properties Listed in the National and State Registers of Historic Places in Concord

MHC #	NAL Label[1]	Name	Street Address	Style- Date	National Register/ State Register Status
CON.DS	NC-13	American Mile Historic District	Lexington Road	Various ca. 1650-1950	Local Historic District
CON.DT	NC-1	Barrett Farm Historic District	Barrett's Mill and Lowell Roads, Liberty Street	Various ca. 1700-1940	Local Historic District
CON.A	NC-14	Concord Monument Square- Lexington Rd Historic District	Monument Square and Lexington Road	Various ca. 1720-1890	National Register of Historic Places
CON.EA	NC-6	Hubbard-French Historic District	324-374 Sudbury Road	Georgian 1787-1950	National Register of Historic Places
CON.DZ	NC-5	Hubbardville Historic District	324-374 Sudbury Road	Georgian 1787-1950	Local Historic District
CON.DU	NC-9	Main Street Historic District	Main St. bet. Monument Sq. & Wood St.	Various 1757-1976	Local Historic District
CON.C CON.DW CON.EC	Multiple	Minute Man National Historical Park	Lexington and North Great Rds., Massachusetts Ave.	Various ca. 1655-1959	National Historic Landmark, National Register of Historic Places
CON.DV	NC-10	North Bridge- Monument Square Historic District	Monument Sq., Monument St., Lowell Rd.	Various 1635-1979	Local Historic District
CON.177	NC-18	Deacon John Wheeler- Captain Jonas Minot Farmhouse (Henry David Thoreau Birthplace)	341 Virginia Rd.	Colonial ca. 1730	National Register of Historic Places
CON.405	NC-7	Deacon Thomas Hubbard-Judge Henry French House	342 Sudbury Rd.	Georgian ca. 1787	Local Historic District, National Register of Historic Places
CON.241	NC-2	Jonathan Hildreth House	8 Barrett's Mill Rd.	Georgian ca. 1750	Local Historic District, National Register of Historic Places
CON.269	NC-3	Joseph Hosmer House	572 Main St.	Colonial 1672	Local Historic District, National Register of Historic Places

MHC #	NAL Label[1]	Name	Street Address	Style- Date	National Register/ State Register Status
CON.347 CON.EE	MM-6	Old Manse 3	269 Monument St.	Georgian 1769	Local Historic District, National Register of Historic Places National Historic Landmark
CON.170	NC-17	Orchard House	399 Lexington Rd.	Georgian ca. 1750	Local Historic District, National Register of Historic Places National Historic Landmark
CON.414	NC-8	Pest House	158 Fairhaven Rd.	Vernacular ca. 1750	National Register of Historic Places
CON.317	NC-15	Ralph Waldo Emerson House	28 Cambridge Turnpike	Greek Revival 1828	Local Historic District, National Register of Historic Places National Historic Landmark
CON.802 (CON.DY)	NC-12	Sleepy Hollow Cemetery	24 Court Ln.	Burial Ground 1823	National Register of Historic Places
CON.56	NC-4	Thoreau-Alcott House	255 Main St.	Greek Revival 1820	Local Historic District, National Register of Historic Places
CON.936	NC-16	Walden Pond 4	MA Rte. 126	Pond 1845	National Register of Historic Places, National Historic Landmark
CON.71 CON.EF	MM-7	The Wayside – Samuel Whitney House 3	455 Lexington Rd.	Colonial ca. 1714	Local Historic District, National Register of Historic Places, National Historic Landmark
CON.178	NC-19	Wheeler-Meriam House	477 Virginia Rd.	Colonial 1690	National Register of Historic Places
CON.329	NC-11	Wright Tavern	1-8 Lexington Rd.	Georgian 1747	Local Historic District, National Register of Historic Places, National Historic Landmark

Notes:
1. 2017 Noise Analysis Location label.
2. See Table 10-13 for historic resources in MMNHP in Concord, Lexington, and Lincoln.
3. Old Manse and The Wayside are individually listed National Historic Landmarks in MMNHP.
4. Walden Pond State Reservation is in Concord and Lincoln.

Table 10-4 Historic Architectural Properties Listed in the National and State Registers of Historic Places in Lexington

MHC #	NAL Label[1]	Name	Street Address	Style-Date	National Register/ State Register Status
LEX.AQ	Multiple	Minute Man National Historical Park[2]	Lexington and North Great Rds., Mass. Ave.	Various ca. 1655-1959	National Register of Historic Places, National Historic Landmark
LEX.B	OLX-1	Battle Green Historic District	Worthen Rd., Woburn St., Hastings Rd., Mass. Ave., & B&M Railroad	Various 1713-1960	Local Historic District
LEX.E	NLX-15	East Village Historic District	Massachusetts Ave.	Various ca. 1750-1950	Local Historic District
LEX.C	NLX-2	Hancock-Clarke Historic District	12-41 Hancock St., 3-13 Hancock Ave., 8 Goodwin Rd.	Various 1698-1900	Local Historic District
LEX.AG	NLX-6	Lexington Green	Massachusetts Ave., Harrington Rd., Bedford St.	Town Common 1711	Local Historic District, National Register of Historic Places, National Historic Landmark
LEX.AC	NLX-5	Lexington Green Historic District	Massachusetts Ave., Bedford St., Harrington Rd.	Various 1713-1960	Local Historic District, National Register of Historic Places
LEX.D	NLX-12	Munroe Tavern Historic District	Massachusetts Ave.	Various 1700-1900	Local Historic District
LEX.51 LEX.AH	NLX-7	Buckman Tavern	1 Bedford St.	Georgian ca. 1690	Local Historic District, National Register of Historic Places, National Historic Landmark
LEX.52	NLX-4	Garrity-Col. John Parkhurst Meriam House	9 Hancock St.	Federal/ Greek Revival ca. 1830	Local Historic District, National Register of Historic Places, National Historic Landmark
LEX.101	NLX-8	General Samuel Chandler House	8 Goodwin Rd.	Italianate 1846	Local Historic District, National Register of Historic Places
LEX.119	NLX-3	Hancock-Clarke House	35 Hancock St.	Colonial 1698	Local Historic District, National Register of Historic Places, National Historic Landmark

MHC #	NAL Label[1]	Name	Street Address	Style-Date	National Register/ State Register Status
LEX.440	NLX-9	Hancock School	33 Forest St.	Victorian 1890	National Register of Historic Places
LEX.129	NLX-14	John Mason House	1303 Massachusetts Ave.	Federal ca. 1715	Local Historic District, National Register of Historic Places
LEX.127 LEX.128	NLX-13	Sanderson House - Munroe Tavern	1314-1332 Massachusetts Ave.	Colonial ca. 1720	Local Historic District, National Register of Historic Places
LEX.413	NLX-1	Simonds Tavern	331 Bedford Street	Georgian 1795-1810	National Register of Historic Places
LEX.16	NLX-10	United States Post Office	1661 Massachusetts Ave.	Colonial Revival 1938	National Register of Historic Places
LEX.134	NLX-11	Warren E. Sherburne House	11 Percy Rd.	Eclectic 1893	Local Historic District, National Register of Historic Places
LEX.AZ	LEX.	Richard Gleason Tower Estate	39 Marrett Road	Colonial Revival 1905	Local Historic District

Notes:
1. 2017 Noise Analysis Location label.
2. See Table 10-13 for historic resources in MMNHP in Concord, Lexington, and Lincoln.

Table 10-5 Historic Architectural Properties Listed in the National and State Registers of Historic Places in Lincoln

MHC #	NAL Label[1]	Name	Street Address	Style-Date	National Register/ State Register Status
LIN.A LIN.D	NLN-4	Lincoln Center Historic District	Bedford, Lincoln, Old Lexington, Sandy Pond, Trapelo, & Weston Rds.	Various ca. 1850	Local Historic District National Register of Historic Places
LIN.F LIN.G	Multiple	Minute Man National Historical Park [2]	Lexington & North Great Rds., Massachusetts Ave.	Various ca. 1655-1959	National Historic Landmark National Register of Historic Places
LIN.63	NLN-3	Daniel Brooks House	Brooks Rd.	Colonial 1695	National Register of Historic Places

MHC #	NAL Label[1]	Name	Street Address	Style-Date	National Register/ State Register Status
LIN.182	NLN-2	Henry Higginson House	44 Baker Farm Rd.	Tudor Revival 1905	National Register of Historic Places
LIN.60	NLN-5	Hoar Tavern	268 Cambridge Turnpike	Colonial ca. 1713	National Register of Historic Places
LIN.917	NLN-1	Walden Pond [3]	MA Rte. 126	Pond 1845	National Register of Historic Places National Historic Landmark

Notes:
1. 2017 Noise Analysis Location label.
2. See Table 10-13 for historic resources in MMNHP in Concord, Lexington, and Lincoln.
3. Walden Pond State Reservation is in Concord and Lincoln.

Time Above (TA) is a separate noise analysis metric that calculates the time during a 24-hour period that aircraft noise exceeds either a threshold level of 65 dBA (TA65) or 55 dBA (TA55). Time Above 65 dBA indicates periods when speech interference is possible unless the speaker uses a raised voice. Further detail on Time Above analysis is presented in Chapter 7. TA values generally decreased in 2017 when compared to 2012. TA65 values in 2017 range from 0.2 minute a day at the East Village Historic District in Lexington to approximately 27.5 at the Wheeler-Meriam House in Concord (compared to 0.1 and 32.5 in 2012). TA55 values in 2017 range from 2.4 per day at the East Village Historic District to 121.5 minutes per day at the Wheeler-Meriam House (compared to 0.5 to 113 in 2012).

10.4.3 Existing Traffic Conditions for National and State Registers Properties

The relationship of National and State Registers properties and the 10 Traffic Study Area (TSA) intersections is shown in Figure 10-4. In accordance with the EEA Scope for the *2017 ESPR*, as with standard traffic reviews, traffic associated with Hanscom Field is considered to have a significant impact on an intersection if one or more of the intersection's individual traffic movements consist of 10 percent or more of Hanscom Field-related traffic. For the *2017 ESPR* traffic analysis, three intersections met this threshold: #5) Hanscom Dr./Old Bedford Rd., Lincoln; #6) Route 2A/Hanscom Dr., Lincoln; and #8) Old Bedford Rd./Virginia Rd., Concord. National and State Registers-listed historic properties are located near #6) Route 2A/Hanscom Dr., Lincoln, which is next to the MMNHP. Hanscom Field contributes less than ten percent at the other 10 ESPR study area intersections. Intersections 5, 6 and 8 and nearby historic resources are listed in Table 10-6.

Table 10-6 Historic Architectural Resources in the MHC Inventory and MACRIS near 2017 TSA Intersections

Traffic Study Area Intersection[1]	MHC #	Name	Designation[2]
#5) Hanscom Dr./Old Bedford Rd. (Lincoln)	None	None	None
#6) Route 2A /Hanscom Dr. (Lincoln)	Multiple	Minute Man National Historical Park	NHL, NR
#8) Old Bedford Rd./Virginia Rd. (Concord)	CON.BL	Lower Old Bedford Rd./Virginia Rd. Area	MACRIS
	CON.1068	Frank Peterson House	MACRIS (CON.BL)
	CON.1069	Patrick Dalton House	MACRIS (CON.BL)

Notes:

1. Based on MEPA Scope Certificate for the *2017 ESPR,* Hanscom Field traffic is considered to impact an intersection if one or more of the intersection's individual traffic movement(s) consists of ten or more percent Hanscom Field-related traffic.

2. NHL – National Historic Landmark; NR – National Registers of Historic Places; MMNHP – Minute Man National Historical Park; CON.BL – survey area in Concord; MACRIS – Massachusetts Cultural Resource Information System.

10.4.4 MHC Inventory Resources

The MHC Inventory is a compilation of paper and online database MACRIS inventory forms for historic resources that are typically 50 years old or older. It serves as a basic planning tool for communities and for state and federal agencies in the recording, evaluating, and protecting of historical resources. Resources in the MHC Inventory may not have been formally evaluated and designated as historically significant according to specific regulatory criteria, but the Inventory includes properties that may be eligible for inclusion, and those currently listed, in the National and State Registers. The methodology for the inventory update for the *2017 ESPR* is discussed below.

The 2017 update of historic resources identified the following (state total or newly identified) in each town:

- **Bedford contains two areas within the National Register-listed/NHL MMNHP and 2 survey areas and 14 individual historic resources in the MHC Inventory and MACRIS.**
- **Concord contains 2 National Register-listed individual properties and 6 survey areas and 25 individual historic resources in the MHC Inventory and MACRIS.**
- **Lexington contains 1 National Register-listed individual property and 2 survey areas and 137 individual historic resources in the MHC Inventory and MACRIS.**
- **Lincoln contains 2 areas within the National Register-listed/NHL MMNHP and no survey areas and no individual historic resources in the MHC Inventory and MACRIS.**

Within the more than 6,000 acres that comprises the ESPR General Study Area, there are extensive entries of historic resources in the MHC Inventory and MACRIS. For long range planning, the *2012 ESPR* included a baseline comprehensive reconnaissance survey within the General Study Area (see Figure 10-1). Appendix G includes the full baseline set of historic resources information in the *2012 ESPR* with minor updates for the *2017 ESPR*. Twenty-four of the areas/districts and 41 of the individual resources in the Inventory within the ESPR General Study Area are also included, wholly or partially, in the National and State Registers, as noted above in Section 10.4.1.

The *2017 ESPR* focused on updating the reconnaissance survey of resources in the MHC Inventory and MACRIS only within the projected 2035 55 DNL noise contour and within 200-feet diameter around the ten TSA intersections. There have been no major changes to the MHC Inventory and MACRIS in these areas since 2012.

10.4.5 Existing Noise Conditions for MHC Inventory Resources

Table 10-7 summarizes by town the number of historic resources in the MHC Inventory and MACRIS identified as within the 55 DNL contour in the 2017 existing conditions. Based on reductions in overall noise at Hanscom, the 55 DNL contour is smaller for 2017 than was the case in 2012. As a result, there are fewer historic resources within the 55 DNL contour as compared to 2012, which had 13 of 45 survey areas and 99 of 340 individual properties within the 55 DNL contour. None of the historic resources in the MHC Inventory and MACRIS are within the 65 DNL contour in 2017, which is consistent with the findings of the *2012 ESPR*.

Table 10-7 Comparing MHC Inventory and MACRIS Historic Resources within the 65 and 55 DNL Contours for 2012 and 2017

Location[1]	2012 MHC Inventory	2012		2017 MHC Inventory[2]	2017[3]	
		65 dBA	55 dBA		65 dBA	55 dBA
AREAS						
Bedford	6	-	5	2	-	2
Concord	38	-	7	8	-	6
Lexington	1	-	1	2	-	2
Lincoln	-	-	-	2	-	2
Total	45	0	13	14	0	12
INDIVIDUAL PROPERTIES						
Bedford	59	-	19	14	-	12
Concord	218	-	47	25	-	17
Lexington	63	-	33	137	-	56
Lincoln	-	-	0	-	-	-
Total	340	0	99	176	0	85

Notes:
1. Based on research for the *2017 ESPR*.
2. Appendix G lists these historic resources.
3. The numbers of areas listed are fully or partially within the 55 DNL contour.

10.4.6 Existing Traffic Conditions for MHC Inventory Resources

Ten traffic instersections were studied for the *2017 ESPR*. Historic resources are located at 8 of the 10 traffic study area intersections, with no resources at #1 Route 4/225 (Great Rd)/Hartwell Ave (Lexington) and #5 Hanscom Drive/Old Bedford Road (Lincoln). Three intersections meet the study threshold of 10 percent of traffic generated by Hanscom Field: #5 Hanscom Dr./Old Bedford Rd. (Lincoln), #6 Route 2A/Hanscom Dr. (Lincoln), and #8 Old Bedford Rd./Virginia Rd. (Concord). There are one area and two individual resources in the MHC Inventory and MACRIS near #8 Old Bedford Road/Virginia Rd. These intersections and historic resources are listed in Appendix G.

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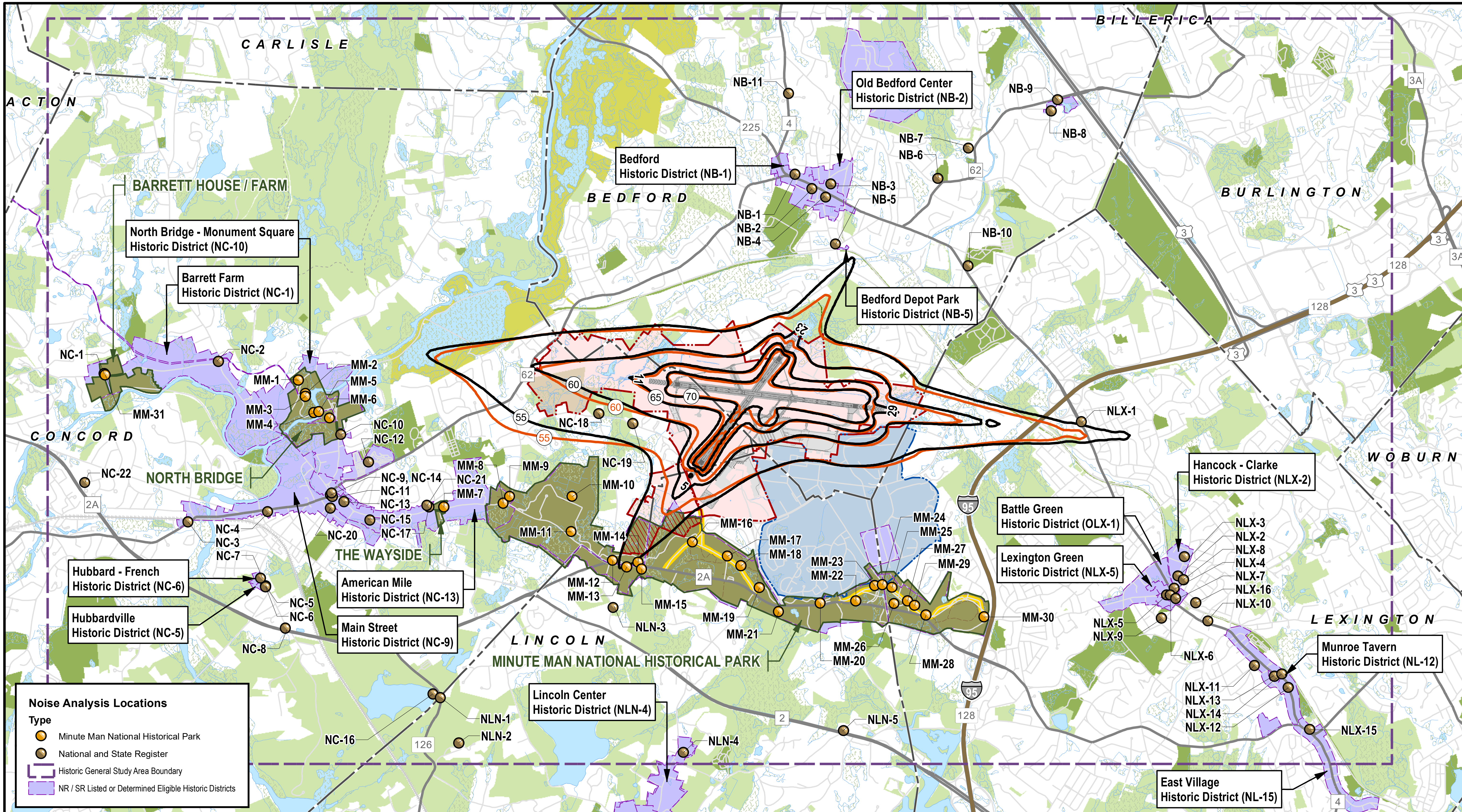

North

0 3,500 7,000 Feet

- 2017 DNL Noise Contour
- 2012 DNL Noise Contour
- Hanscom Field Property Boundary
- Massport Property within MMNHP Congressional Boundary
- Hanscom AFB Property Boundary
- Municipal Boundary
- Historic Road
- Interstate
- Highway
- Road
- Trail
- Open Water
- Wetland/Marsh
- Stream
- MMNHP Boundary
- Great Meadows
- Open Space Non-protected
- Open Space Protected in Perpetuity

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Streets and Trails), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

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Historic Resources within the 2012 and 2017 DNL Noise Contours

Figure 10-3

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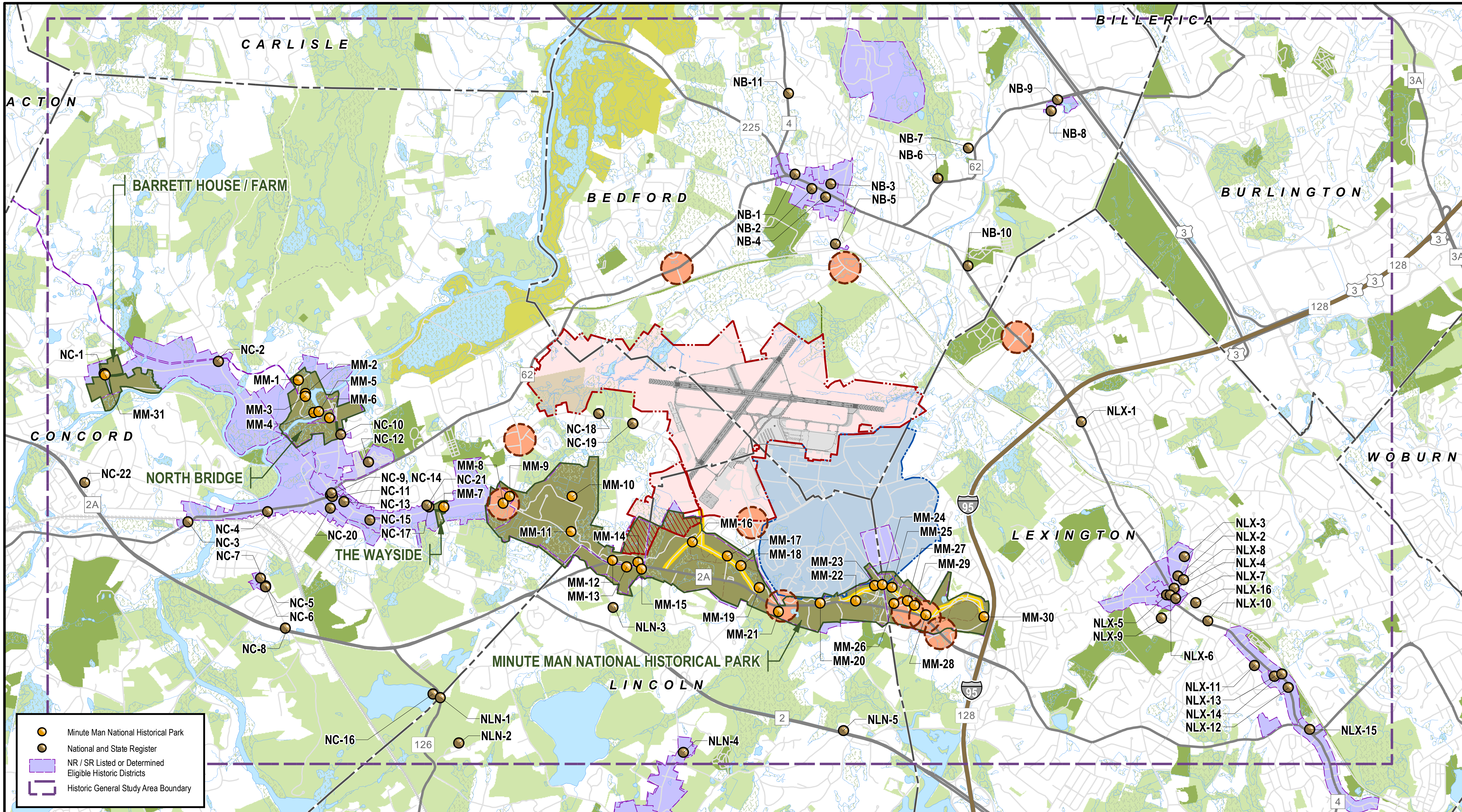

North

0 3,500 7,000 Feet

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

- Traffic Study Intersection
- Hanscom Field Property Boundary
- Massport Property within MMNHP Congressional Boundary
- Hanscom AFB Property Boundary
- Municipal Boundary
- Historic Road
- Interstate
- Highway
- Road
- Trail
- Open Water
- Wetland/Marsh
- Stream
- MMNHP Boundary
- Great Meadows
- Open Space Non-protected
- Open Space Protected in Perpetuity

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Historic Resources Near Traffic Study Intersections

Figure 10-4

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10.5 Local Historical Commissions

Meetings were held with the local historical commissions in Bedford, Concord, Lexington, and Lincoln and with representatives of the MMNHP (discussed separately below) to explain the purpose and process of the ESPR and to collect updated data on any additional notable historic resources updated since the *2012 ESPR*. Each historical commission provided information about updates to the MHC Inventory and historic districts and individual historic resources that are listed or may be eligible for listing in the National and State Registers for consideration as noise analysis locations for the *2017 ESPR* noise analysis:

- Bedford Historic Preservation Commission noted that the existing Old Bedford Center Historic District was expanded in 2014 and one property is pending listing, David Fitch House, 109 Old Billerica Road. Neither the Town of Bedford nor any other entity has made new entries in the MHC Inventory or other new National and State Registers listings within the *2017 ESPR* General Study Area.
- Concord Historical Commission noted that neither the Town of Concord nor any other entity has made new entries in the MHC Inventory or new National and State Registers listings within the *2017 ESPR* General Study Area.
- Lexington Historical Commission noted that two areas have been added to the MHC Inventory and MACRIS, the Lexington Manor Area partially within the 2035 55 DNL noise contour and Meriam Hill within the *2017 ESPR* General Study Area. There are no new National and State Registers listings within the *2017 ESPR* General Study Area.
- Lincoln Historical Commission stated that one property in the *2017 ESPR* General Study Area, 5 Partridge Lane, is being designated a Local Landmark and will be added to the MHC Inventory, MACRIS, and the State Register. Neither the Town of Lincoln nor any other entity has made new entries in the MHC Inventory or other new National and State Registers listings within the *2017 ESPR* General Study Area.

10.6 Reconnaissance Survey Update

To support the *2017 ESPR* analyses, an update of the reconnaissance-level historic and archaeological surveys was conducted.[160]

10.6.1 Historic Resources

The 2017 historic resources survey information consistent with the 2017 Secretary of the Interior and MHC standards was the basis for the analysis of noise, traffic and other factors

[160] Adams et al. 2018; Banister and Herbster 2018. See footnotes 1, 4, and 5.

discussed in this chapter. The survey update for the *2017 ESPR* covered the Reconnaissance Survey Area within Hanscom Field, the forecasted 2035 55 DNL contour and 200 feet around the 10 TSAs. A drive-by/walkover of the Reconnaissance Study Area was completed to verify any changes in the status of previously recorded and any new historic resources since the reconnaissance survey update for the *2012 ESPR*. During the field review, information on properties that have been listed in the National or State Registers or that are unrecorded and have reached 50 years of age since 2012, as well as major demolitions, new construction, or alterations were recorded in written notes, digital photographs, and located on a base map. In addition, all National and State Registers-listed properties within the General Study Area were field-verified.

The 2017 survey update used current Geographic Information System (GIS) mapping, including MACRIS, and indicated the boundary of the General Study Area and the Reconnaissance Study Area. The locations of National and State Registers properties and historic resources in the MHC Inventory were mapped using the GIS mapping function of the MACRIS online database. The high level of accuracy in current GIS mapping resulted in a few minor corrections to the 2012 survey information in the *2017 ESPR*. This information is summarized in Appendix G.

10.6.2 55 DNL Noise Contour for 2035 in Bedford, Concord, Lexington, and Lincoln, Historic Resources

The Reconnaissance Survey Area update within the 55 DNL noise contour for the projected 2035 planning scenario identified three individual National and State Registers-listed properties, portions of MMNHP, and all or part of 10 survey areas and 179 individual properties in the Inventory and MACRIS in Bedford, Concord, and Lexington. A summary of these 2017 results is presented here. The National and State Registers properties are shown in Figure 10-3. These resources are listed in Appendix G:

- Bedford There are no National or State Registers historic resources. For historic resources in the Inventory and MACRIS, there are two survey areas and 14 individual resources, including a small portion of the Hartwell Town Forest.
- Concord: There are a portion of MMNHP and two individual National Register-listed historic properties, the Deacon John Wheeler – Capt. Jonas Minot House, 341 Virginia Road, and the Wheeler-Merriam House, 477 Virginia Road. For historic resources in the Inventory and MACRIS, there are six survey areas and 25 individual resources.
- Lexington: There are a portion of MMMHP and one National Register-listed historic property, Simonds Tavern, 331 Bedford Street. For historic resources in the Inventory and MACRIS, there are two survey areas and 140 individual resources.
- Lincoln: There are no National or State Registers historic resources, nor any historic resources in the Inventory and MACRIS.
- Hanscom Field: The reconnaissance survey update completed for the *2017 ESPR* identified a total of seven buildings within Hanscom Field proper that are currently 50

years old or older. Since the *2012 ESPR*, three resources 50 years old or older have been removed, Hangars 12A, 16, and 17. Massport consulted with the MHC and there was a determination that the buildings were not eligible for the National Register, therefore, no historic properties were affected by the proposed demolition actions.[161]

- Hanscom AFB: Portions of Hanscom AFB and Massport property leased by the U.S. Air Force are located within the 2017 55 DNL contour, including the north one-quarter of the main Base. One resource in the General Study Area, but outside the Reconnaissance Study Area boundary, the Air Force Cambridge Research Laboratories Historic District, has been determined eligible for the National Register.

10.6.3 Traffic Study Areas, Historic Resources

The traffic study areas are shown in Figure 10-4, and the resources at each location are listed in Appendix G. The reconnaissance survey update completed for the 10 TSA intersections included in the *2017 ESPR* identified no historic resources at two of the TSAs, numbered 1 and 5. Five of the TSAs fall within the boundaries of the MMNHP, numbered 2, 3, 4, 6, and 7.

Inventoried historic resources also are present, outside of the MMNHP boundaries, at TSA number 10. As in the *2012 ESPR* survey, the survey update for the *2017 ESPR* verified that all historic resources within the 10 TSAs were already included in the MHC Inventory and MACRIS and/or the State and National Registers. No previously undocumented historic resources were identified at any of the TSAs.

10.7 Environmental Effects for Historic Resources

As presented in Chapter 7, no historic resources noise analysis locations are projected to experience a DNL greater than 60 dB under the 2025 or 2035 scenarios. The Deacon John Wheeler/Capt. Jonas Minot Farmhouse and the Wheeler-Meriam House, both in Concord, and Simonds Tavern in Lexington are the only three sites with a DNL of 55 dB or greater in the forecasted scenarios. The projected future noise levels at the Deacon John Wheeler/Capt. Jonas Minot Farmhouse and the Wheeler-Meriam House show a slight increase and at the Simonds Tavern are reduced from the *2012 ESPR* scenarios.

In Bedford, no historic resource noise analysis locations are exposed to a DNL of 55 dBA or above in 2017, or in the 2025 and 2035 scenarios. The property with the highest exposure level is Bedford Depot Park Historic District (NB-5), which has DNL exposure value of 52.0 dBA in 2017 and projected exposures in the planning scenarios of 51.6 dBA in 2025 and 52.1 dBA in 2035.

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[161] Hangar 12A: Letter, Massport to MHC, February 6, 2017, and MHC concurrence, March 24, 2017. Building 16: xxxx. Hangar 17: Massport, Jet Aviation Final Environmental Assessment, 2014.

In Concord, two historic properties have current and projected DNL noise exposure values between 55 and 60 dBA:

- The Deacon John Wheeler/Capt. Jonas Minot Farmhouse (NC-18), 341 Virginia Road, has a current noise exposure level of 57.8 dBA and in the planning scenarios has values of 58.6 dBA in 2025 and 59.0 in 2035. These forcasted levels are reduced from the 2020 and 2030 forecasts, which in 2012 were estimated to be 58.7 and 59.8, respectively.
- The Wheeler-Meriam House (NC-19), 477 Virginia Road, has a current noise exposure level of 57.7 dBA and in the plannng scenarios has values of 58.4 dBA in 2025 and 58.8 in 2035. These levels are similar to the 2020 and 2030 forecasts, which in 2012 were estimated to be 58.4 and 59.4, respectively.

In Lexington, there are no historic sites with 2017 DNL noise values above 55 dBA. The property with the highest exposure in 2017 is Simonds Tavern (NLX-1), 331 Bedford Street, with a value of 54.5 dBA. In the forecast scenarios, Simonds Tavern has exposure levels of 55.3 dBA in 2025 and 55.9 dBA in 2035. In Lincoln, no historic resource noise analysis location are exposed to a DNL of 55 dBA or above in 2017, or in the 2025 and 2035 scenarios. The property with the highest noise exposure level is the Daniel Brooks House (NLN-3), which has a DNL exposure value of 51.9 dBA in 2017 and projected exposures in the planning scenarios of 50.8 dBA in 2025 and 51.2 dBA in 2035, both below existing conditions.

As stated previously, three of the 10 TSA intersections studied for the *2017 ESPR* meet the threshold of 10 percent of traffic generated by Hanscom Field: #5 Hanscom Dr./Old Bedford Rd. (Lincoln), #6 Route 2A/Hanscom Dr. (Lincoln), and #8 Old Bedford Rd./Virginia Rd. (Concord). There are no historic resources near #5 Hanscom Dr./Old Bedford Rd. Intersection #6 Route 2A/Hanscom Dr. is near Minute Man National Historical Park, and #8 Old Bedford Rd./Virginia Rd. has one area and two individual resources in the MHC Inventory and MACRIS (see Table 10-7). As discussed in Chapter 6, Ground Transportation, no physical modifications are proposed by Massport for these intersections. As described in Chapter 8 Air Quality, there are no adverse effects attributable to air quality in the 2025 and 2035 scenarios.

10.8 Archaeological Resources

The archaeological reconnaissance survey completed in the towns of Bedford, Concord, Lexington, and Lincoln for the *2012 ESPR* was updated for the *2017 ESPR*. The reconnaissance survey was conducted within the Hanscom Field property boundaries and within a 200-foot radius of 10 traffic study intersections. The primary objectives of the reconnaissance survey were to identify the locations of documented archaeological sites and archaeologically sensitive areas within Hanscom Field and near the traffic study intersections.

10.8.1 Methodology for Archaeological Resources

The archaeological survey used results of the *2012 ESPR* and other previous surveys, including archival research, informant interviews, and field walkover, that provide information about known and potential archaeological resource areas. This information was used to compile environmental and cultural pre-contact and post-contact contexts for the periods before and after initial European contact with New England, about AD 1500, and to develop sensitivity models for undocumented archaeological sites.

For the *2017 ESPR* survey update, a site file review and field walkover were conducted to update recorded archeological sites and sensitive areas within Hanscom Field and near 10 traffic study intersections to assess any environmental changes that have occurred since the survey for the *2012 ESPR*.

Table 10-8 Pre-Contact and Post-Contact Archaeological Sites in the MHC Inventory of the Archaeological Asset of the Commonwealth in Bedford near Hanscom Field

MHC Site #	Site Name	Temporal Association	Site Type
19-MD-77	M-23-54	PaleoIndian	Campsite
19-MD-78	M-23-116	Unknown	Campsite
19-MD-889	Wamesit Crossing	Unknown	Find Spot
19-MD-994	Turf Meadow	Unknown	Lithic Scatter
19-MD-1022	Hanscom School Findspot	Middle Archaic	Find Spot
19-MD-1023	Fitch Farm Native American Site	Early Archaic – Late Woodland	Campsite
BED-HA-6	HAFB-2	20th C.	Other
BED-HA-7	West Railroad Station Site	19th C.	Transportation
BED-HA-11	Town Center Railroad Station And Coal Yard	19th – 20th C.	Transportation
BED-HA-20	Boston & Lowell Railroad Line Site	19th – 20th C.	Transportation
BED-HA-22	Princeton At Bedford 1	19th – 20th C.	Agriculture Other
BED-HA-23	South School Site	19th C.	Education
BED-HA-24	Barn Foundation Site	Unknown	Agriculture
BED-HA-27	Yellow Ochre Mine Site	19th C.	Industry
BED-HA-28	William W Mudge Garden	19th C.	Agriculture
BED-HA-29	Wheeler Mill Site	Unknown	Industry
BED-HA-30	West School Site	19th C.	Education

Table 10-9 Pre-Contact and Post-Contact Archaeological Sites in the MHC Inventory of the Archaeological Assets of the Commonwealth in Concord near Hanscom Field

MHC Site #	Site Name	Temporal Association	Site Type
19-MD-79	Munson Farm	Late Archaic	Campsite
19-MD-80	Munson Farm 2	Unkown	Campsite
19-MD-111	Meriam's Corner (MMNHP)	Middle–Late Archaic	Campsite
19-MD-180	Revolutionary Ridge (MMNHP)	Unknown	Campsite
19-MD-472	Pine Hill (Elm Brook Farm)	Unknown	Campsite
19-MD-687	Ox Pasture (MMNHP)	Unknown	Camp
19-MD-946	Fox House	Middle–Late Archaic	Campsite
19-MD-948	Kaveski Farm	Unknown	Find Spot
19-MD-1008	Joshua Brooks	Unknown	Lithic Workshop
19-MD-1010	Vossberg	Unknown	Find Spot
19-MD-1028	Fox House Site	Early–Late Archaic	Listed "Cultivated field"; likely campsite
19-MD-1000	Wayside	Middle Archaic	Find Spot
19-MD-1001	Eliphelet Fox House Site	Unknown	Campsite
19-MD-86	Asparagus Farm/Peter'S Field	PaleoIndian-Woodland	Burial
19-MD-97	Campsite 3	Late Archaic	Campsite
19-MD-98	Campsite 2	Middle-Late Archaic	Campsite
19-MD-74	Balls Hill	Late Archaic	Unkown
19-MD-112		Middle Archaic-Woodland	Campsite
19-MD-1149	Burke House Site	Middle-Late Woodland	Campsite
19-MD-1150	Farwell Jones Find Spot	Late Archaic	Find Spot
19-MD-397		Late Archaic	Campsite
19-MD-412	Asparagus Farm/Davis Farm	Middle Archaic-Early Woodland	Unkown
19-MD-476	North Of Revolutionary Ridge	Archaic, Contact	Lithic Workshop
19-MD-527	Dee's Farm	Unknown	Lithic Workshop
CON-HA-14	Eliphelt Fox House Site (Casey's House)	17th- 19^{th} C.	Other

MHC Site #	Site Name	Temporal Association	Site Type
CON-HA-15	Wayside	18th – 20th C.	Other
CON-HA-19	Job Brooks Site	18th – 19th C.	Other
CON-HA-24	Ebenezer Peirce Homestead	Unkown	Other Agriculture
CON-HA-25	George Minott Homestead	Unkown	Other Agriculture
CON-HA-26	Meriam House	Unkown	Other
CON-HA-30	Mary Ingall Site	Unkown	Other
CON-HA-33	Albano Barn Foundation	20th C.	Agriculture
CON-HA-34	Hastings Barn Foundation	19th C.	Agriculture

Table 10-10 Pre-Contact and Post-Contact Archaeological Sites in the MHC Inventory of the Archaeological Assets of the Commonwealth in Lexington near Hanscom Field

MHC Site #	Site Name	Temporal Association	Site Type
19-MD-685	Thomas Nelson Jr. Farm P1 (MMNHP)	Unknown	Activity Area
19-MD-688	Jacob Whittemore Farm P1 (MMNHP)	Middle Archaic	Campsite/workshop
19-MD-1005	David Fiske Site	Unknown	Lithic Scatter
LEX-HA-6	Thomas Nelson Farm Site	18th C.	Archaeology, Historic Agriculture Military
LEX-HA-7	The Ebenezer Fiske Site	17th – 20th C.	Agriculture Other
LEX-HA-8	The David Fiske Site	17th – 18th C.	Agriculture Other
LEX-HA-9	HAFB-1	20th C.	Other Residential
LEX-HA-13	Battle Road On Fiske Hill	18th C.	Industry
LEX-HA-14	Blacksmith Shop	17th – 20th C.	Other Agriculture
LEX-HA-16	Bashian Barn Foundation	Unknown	Agriculture
LEX-HA-17	Parker's Revenge	18th C.	Military

Table 10-11 Pre-Contact and Post-Contact Archaeological Sites in the MHC Inventory of the Archaeological Assets of the Commonwealth in Lincoln near Hanscom Field

MHC Site #	Site Name	Temporal Association	Site Type
19-MD-119	Hartwell Farm	Woodland	Campsite
19-MD-587	Black Rabbit[1]	Late/Transitional Archaic	Campsite (fall/winter)
19-MD-588	Black Walnut	Unknown	Campsite
19-MD-589	Perk Site	Unknown	Chipping Station
19-MD-676	William Smith Farm P2 (MMNHP)	Unknown	Campsite
19-MD-677	Joshua Brooks Farm P1 (MMNHP)	Unknown	Campsite
19-MD-678	Ephraim Hartwell Farm P4 (MMNHP)	Unknown	Campsite
19-MD-679	Ephraim Hartwell Farm P3 (MMNHP)	Unknown	Campsite
19-MD-680	William Smith Farm P1 (MMNHP)	Unknown	Campsite
19-MD-681	Aaron Brooks Farm P1 (MMNHP)	Unknown	Campsite
19-MD-682	Ephraim Hartwell Farm P2 (MMNHP)	Unknown	Campsite
19-MD-683	Ephraim Hartwell Farm P1 (MMNHP)	Unknown	Campsite
19-MD-684	Thomas Nelson Jr. Farm P2 (MMNHP)	Unknown	Campsite
19-MD-686	Holt Pasture (MMNHP)	Unknown	Campsite
19-MD-995	Block 2	Unknown	Find Spot
19-MD-996	Captain W. Smith House Findspot 1 (MMNHP)	Unknown	Find Spot
19-MD-997	Rogers Property (MMNHP)	Middle–Late Archaic	Flake Scatter
19-MD-1006	Joseph Mason Site (MMNHP)	Unknown (possibly Woodland)	Campsite
19-MD-1007	Daniel Brown Site	Unknown	Lithic Scatter
LIN-HA-2	Corner House	19th- 20th C.	Agriculture Other
LIN-HA-3	19th Century Cottage and Barn	19th- 20th C.	Agriculture Other
LIN-HA-4	Hartwell Tavern	18th – 20th C.	Agriculture Commerce
LIN-HA-6	Thomas Nelson Jr. House	18th – 19th C.	Other
LIN-HA-7	Site 23	18th C.	Other
LIN-HA-8	Josiah Nelson House Site	18th – 20th C.	Other
LIN-HA-9	Site 22	18th C.	Other
LIN-HA-21	Site Old Hop House	19th C.	Agriculture Industry

MHC Site #	Site Name	Temporal Association	Site Type
LIN-HA-22	Joseph Mason Site	17th – 19th C.	Other
LIN-HA-23	Rogers Property Site	18th – 20th C.	Other Agriculture
LIN-HA-46	Brooks Saw Mill Damn	18th C.	Industry
LIN-HA-47	Ebenezer Lameson Homestead	Unknown	Other Agriculture
LIN-HA-48	Nathan Whittemore Homestead	Unknown	Other Agriculture
LIN-HA-49	Jacob Foster Homestead	Unknown	Other Agriculture
LIN-HA-50	Ebenezer Lameson Homestead 2	Unknown	Other Agriculture
LIN-HA-51	Schoolhouse	18th C.	Other
LIN-HA-52	Thomas Brooks Farm Foundation	19th C.	Agriculture
LIN-HA-53	Lincoln Boulder Structures	Unknown	Other

Notes:
1. The Black Rabbit Site has a State Preservation Restriction.

10.8.2 National and State Registers, Archaeological Resources

A review of the current National and State Registers, site files of the MHC Inventory, and MACRIS maintained by the MHC was completed for the *2017 ESPR* to identify recorded archaeological sites within and in proximity to Hanscom Field. The review consulted previously conducted cultural resource management studies conducted within or adjacent to Hanscom Field.[162, 163, 164, 165]

The site file review update for the *2017 ESPR* concluded that no new pre- or post-contact archaeological sites have been recorded within the survey area or the 10 TSAs since the *2012 ESPR*. There were also no new recorded survey reports listed.

Table 10-8, Table 10-9, Table 10-10, and Table 10-11 list the archeological sites that have been identified in Bedford, Concord, Lexington, and Lincoln within and/or in a half-mile radius of Hanscom Field. Other than 19-MD-587, none of these sites has been evaluated for eligibility in the State and National Registers. A total of six archaeological sites have been documented either completely or partially within the Hanscom Field boundaries. These include three pre-contact period sites (Pine Hill [19-MD-472], Fox House [19-MD-1028], and Hartwell Farm [19-MD-119) and three post- contact period sites (Wheeler Mill [BED-HA-29], Yellow Ochre Mine [BED-HA-27], and South School [BED-HA-23]). To date, no below-ground archaeological

[162] King (PAL), Archaeological Reconnaissance Survey of Hanscom Air Force Base, 1992.
[163] Ritchie et al. (PAL), Archaeological Investigations of Minute Man National Historical Park, Concord, Lexington, and Lincoln, Massachusetts, 1990.
[164] Herbster (PAL), Archeological Overview and Assessment, Minute Man National Historical Park, Concord, Lexington, and Lincoln, Massachusetts, 2005.
[165] Banister and Herbster (PAL) 2006; Banister and Herbster (PAL) 2013. See footnote 5.

investigations have been conducted for any of these sites and their eligibility for listing in the National Register has not been determined.

10.8.3 Reconnaissance Survey of Hanscom Field, Archaeological Resources

Past reconnaissance archaeological surveys of Hanscom Field have found that a few relatively undisturbed portions exist, including tracts of woodland peripheral to the runways, terminal, and supporting facilities. These areas generally contain secondary growth woodlands with both deciduous and coniferous species of trees. Interspersed are wetland areas and some drainage improvements/alterations to the existing waterways. Most of Hanscom Field, however, has been previously disturbed by construction. Disturbance activities include landfilling, installation of utilities, and construction of buildings, parking lots, roadways, and runways. Areas of high pre-contact archaeological sensitivity in Hanscom Field and around intersections include previously undisturbed, dry, level areas located adjacent to the natural brooks and wetlands in the peripheral portions of the project area. The extreme southern portion of Hanscom Field and the intersections along Route 2A were assigned moderate to high archaeological sensitivity for post-contact resources associated with the April 19, 1775 engagement along Battle Road, now part of the MMNHP.

A portion of the North Airfield Area now developed as a sports center with two outdoor turf fields was designated as a low sensitivity area for both pre and post-contact archaeological resources.

The 2017 field walkover noted no areas where new development has occurred within the moderate and high sensitivity areas since the *2012 ESPR*. Some changes to the built environment were noted during the field walkover within the Hanscom Field property boundary, however all changes were within areas previously assessed as having low archaeological sensitivity and the sensitivity for these areas remains the same for the *2017 ESPR*.

No other portions of the Hanscom Field study area or any areas managed by the Transportation Security Agency (e.g. airside secure areas) have undergone new development since the reconnaissance survey for the *2012 ESPR*, and the sensitivity for these areas remains the same for the *2017 ESPR*.

10.8.4 Proximity of Sites to TSAs, Archaeological Resources

As presented in Table 10-12, a total of 17 archaeological sites have been documented within a 200 foot-radius at five of the 10 TSA intersections. This total includes 10 pre-contact and 7 post-contact period sites, of which 14 are within the boundaries of MMNHP. Five of the intersections were determined to have areas that are undisturbed, defined as no obvious signs of previous ground disturbance, except for the immediate intersection right-of-way. The condition of three intersection areas was assessed as unknown due to intersection improvements, and one intersection area appeared to have both undisurbed and recently disturbed areas.

Table 10-12 Pre-Contact and Post-contact Archaeological Resources at Traffic Study Area Intersections

Intersection	Archaeological Sites	Condition[1]
#1) Route 4-225/Hartwell Ave. (Lexington)	None documented	Unknown/intersection improvements
#2) Mass. Ave./Rte 2A (Lexington)	None documented	Unknown/intersection improvements
#3) Old Mass. Ave./Rte. 2A (Lexington)	19-MD-688 (MMNHP) LEX-HA-13 (MMNHP) LEX-HA-15 (MMNHP)	Undisturbed
#4) Airport Rd./Rte. 2A (Lexington)	19-MD-684 (MMNHP) 19-MD-685 (MMNHP) 19-MD-688 (MMNHP) LEX-HA-12 (MMNHP) LEX-HA-13 (MMNHP)	Undisturbed
#5) Hanscom Dr./Old Bedford Rd. (Lincoln)	19-MD-587	Unknown/intersection improvements
#6) Hanscom Dr./Rte. 2A (Lincoln)	19-MD-678 (MMNHP) 19-MD-679 (MMNHP) 19-MD-682 (MMNHP) 19-MD-683 (MMNHP)	North Side = disturbed (recent construction for pedestrian underpass); South Side= Undisturbed
#7) Old Bedford Rd./Lexington Rd. (Concord)	19-MD-111 (MMNHP) 19-MD-180 (MMNHP) CON-HA-26 CON-HA-27 CON-HA-31	Undisturbed
#8) Old Bedford Rd./Virginia Rd. (Concord)	None documented	Undisturbed; possible house lot/landscaping disturbance
#9) Hartwell Rd./Rte. 62 (Bedford)	None documented	Undisturbed; possible house lot/landscaping disturbance
#10) South Rd./Hartwell Rd. (Bedford)	None documented	Undisturbed; possible house lot/landscaping disturbance

Notes: Undisturbed (no obvious signs of previous disturbance) except for immediate intersection right-of-way.

10.8.5 Environmental Effects for Archaeological Resources Proximity of Sites to TSAs, Archaeological Resources

There are several new redevelopment activities projected at Hanscom Field in Chapter 2 Facilities and Infrastructure in the 2025 and 2035 scenarios with the potential for ground disturbance in sensitive areas. Therefore there is the potential for effects to archaeological sites or sensitive areas for the 2025 and 2035 scenarios. Specifc projects will be assessed as appropriate for impacts at the time of development. No physical changes are forecasted at the three traffic intersections that meet the threshold for analysis, so there will be no effects to any archaeological sites or sensitive areas in 2025 and 2035.

10.9 Minute Man National Historical Park (MMNHP)

MMNHP (the Park) is operated by the NPS. Since 1959, when MMNHP was created within the towns of Concord, Lexington, and Lincoln, the Park and Hanscom have been neighbors. As two regionally and nationally significant land uses, MMNHP and Hanscom Field encounter both shared investment in the improvement of the region and the need for visitor access. A meeting was held with the NPS on July 27, 2018 to solicit input on the *2017 ESPR* and communicate periodically to discuss Hanscom Field and its relationship to MMNHP.

10.9.1 Visitation Levels

The NPS has reported that as of 2017, visitation to the Park is trending slightly upwards, with more than one million people visiting the facilities and attending the programs of MMNHP annually. The Park is recognized as an important asset to the region and the nation. The park sits in the suburbs of a major metropolitan area with modern, vibrant and expanding residential, industrial and commercial sectors.

Major attractions are the North Bridge area in Concord and the Visitor Center off North Great Road in the Battle Road Park unit in Lincoln. Two parking lots at the North Bridge unit and one at the Visitor Center accommodate auto and bus parking; six other parking lots are located in the Park. While the park is open year-round, its main season is the seven-month period between April and October. The early spring, starting with Patriot's Day in Massachusetts, represents the first major influx of park visitors. Fall foliage season is the other very popular period. The park is open daily from sun-up to sundown, but buildings are generally open from 9 a.m. to 5 p.m.

10.9.2 Overview of Park

MMNHP is the largest National and State Registers resource in the vicinity of Hanscom Field. It consists of four discontinuous sections referred to as the Battle Road, Wayside, North Bridge and Barrett Farm units, which are illustrated in Figures 10-5 and 10-6. The park covers approximately 970 acres along Route 2A in Concord, Lexington, and Lincoln and off Monument Street in Concord.

When Congress created MMNHP in 1959, Hanscom Field had already been operating for 18 years, having been established by the Commonwealth in 1941. A portion of the Congressional boundaries of the Park, comprising 50 acres in Lincoln, is within Massport land at the southwest area of Hanscom Field. There are no buildings or structures on this wooded parcel.

MMNHP itself and a number of individual historic properties within the Park are historic resources of national significance that are designated National Historic Landmarks. The Park is nationally significant as the site of the Battle of Concord, one of the two battles that marked the beginning of the Revolutionary War; for its association with prominent literary figures of the nineteenth and twentieth centuries; and as one of the earliest places in the nation to be commemorated. The Park was created to preserve and interpret the historic sites, structures, and properties that exist along the route of battle that took place in April 1775. The Col. Barrett Farm unit in Concord is also individually listed in the National Register as the Col. James Barrett House.

Battle Road Unit

The Battle Road unit, the largest unit, covers approximately 849 acres and stretches five miles along present-day Route 2A, consisting of Lexington Road (Concord), North Great Road (Lincoln), and Massachusetts Avenue (Lexington). At the time of the battle, as today, the road was a much traveled regional route that linked the town of Concord with Cambridge, Boston, and the sea. Some sections of the Battle Road have been restored to their unpaved appearance, while others form parts of the paved automobile road (Route 2A). The original route is readily discernible and is lined almost continuously with stone walls in the central and eastern parts of the park unit. Hanscom Field, Hanscom AFB, and its associated military housing abut the northern boundary of the eastern half of the Battle Road unit.

Modern residential developments line much of the southern boundary, and the interstate highway and commercial/office developments mark the east terminus at Route 128/I-95.

Two of the 10 traffic study intersections are located within the Battle Road Unit of the MMNHP. All of the areas around the intersections encompass historic farming and/or wooded landscapes, and five contain historic buildings.

The Wayside Unit

The Wayside unit is the smallest section, containing approximately six acres on the north side of Route 2A in Concord. This unit centers around The Wayside, the home of three notable American authors: Louisa May Alcott, Nathaniel Hawthorne, and Margaret Sidney.

North Bridge Unit

The North Bridge unit contains approximately 112 acres in Concord and is crossed by the Concord River. It contains the North Bridge where, on April 19, 1775, Colonial militia men fired the famous "shot heard 'round the world." The surrounding tranquil, commemorative landscape includes Daniel Chester French's Minute Man Statue.

Barrett Farm Unit

The Barrett's Farm unit contains the Col. James Barrett Farm and 3.4 acres of land at 448 Barrett's Mill Road in Concord. Built in 1705, it was the house of James Barrett, a Colonel of the Concord, Massachusetts Militia during the Battles of Lexington and Concord on April 19, 1775, and a site where colonial militia munitions were stored.

10.9.3 Park Environs and Landscape Features

The MMNHP landscapes and habitats are dominated by forests that cover approximately 500 acres, including about 200 acres of forested wetlands. Non-forested wetlands, including several ponds, constitute approximately 180 acres within the park. Open meadows and fields cover an additional 250 acres, including approximately 100 acres that are farmed under the park's agricultural leasing program. Shrublands characterize the interface of fields and forests. The remainder of the park contains developed areas, including roads, parking lots, and buildings.

The park today is generally characterized by low-density residential development set in a landscape of open pastures, interspersed with woodland and marshes. However, as noted in the updated National Register nomination dated 2001, areas within the present-day park underwent significant change between 1775 and 1959. The area remained agricultural well into the nineteenth century, but intensive residential development occurred as the area became part of Boston's commuting community during the early and mid-twentieth century. The improvement of existing roads, such as Route 2 and Route 2A for the automobile in the 1920s and 1930s and also the creation of Route 128/I-95 regional highway in the 1950s, supported local growth. This suburbanization trend continues today around the park. Within the park, as part of its mission to preserve and interpret individual resources that contribute to understanding the site’s historical events, the NPS removed approximately 200 structures and nearly 100 percent of commercial development. These reclaimed open spaces provide a backdrop for the remaining historical resources.

10.9.4 Historic and Archaeological Resources in MMNHP

Included in the MMNHP boundaries are numerous historic buildings, structures, sites, and landscapes. Many of the key historic resources and areas within the park are shown on Figures 10-5 and 10-6 and are summarized in Table 10-13. The NPS completed a comprehensive inventory of all resources in MMNHP as part of an updated National Register nomination.[166] The NPS inventory identified approximately 106 resources that contribute to the historic significance of the park, as well as 24 resources that do not contribute, primarily due to their recent age. The complete NPS inventory for the park is included in Appendix G. The NPS is in the process of updating the MMNHP National Register resource list and documentation.

Extant historic farming fields in the park are dominantly clustered at the west end of the Battle Road Unit between the Farwell Jones and the Olive Stow houses and Meriam's Corner in Concord. Smaller fields also remain at the Trainor field and Fiske Hill fields in Lexington, and at fields near Bloody Angle and the Hartwell Tavern in Lincoln. An archaeological overview and assesment of MMNHP, with emphasis on the Battle Road Unit, was completed in 2005.[167] This study reports that MMNHP contains documented archaeological resources that date from approximately 9,000 years before present to the early twentieth century. More than 100 prehistoric and historic period archaeological sites have been identified within the park, and there is a high probability of additional sites being present in most areas.

10.10 MMNHP General Management Plan

The 1989 General Management Plan (GMP) for MMNHP has largely been implemented. In 2012 and in 2017, the NPS was in an ongoing planning process to develop a new General Management Plan (GMP) to replace the existing 1989 GMP. Several projects have been completed in the park since the *2012 ESPR*.

Table 10-13 Key Resources in the Minute Man National Historical Park

Town	MHC #	2005 Noise Label	Street Address	Name	Style-Date	NR/SR Status[1]
BATTLE ROAD UNIT						
Concord, Lexington, Lincoln	N/A2	Multiple	Along and off Massachusetts Avenue and Lexington Road	Battle Road	18th-20th centuries	Contributing
Concord, Lexington, Lincoln	N/A	Multiple	Off Massachusetts Avenue and Lexington Road	Battle Road Trail	1996-2001	Non-Contributing
Concord	N/A	MM-10	Off Route 2A	Historic Farming Fields	18th-20th centuries	Contributing

[166] Harrington et al. (PAL), Minute Man National Historical Park National Register of Historic Places Documentation, Concord, Lexington, and Lincoln, Massachusetts, 2001. The National Park Service is currently updating this documentation.
[167] Herbster (PAL), Archeological Overview and Assessment, Minute Man National Historical Park, Concord, Lexington, and Lincoln, Massachusetts, 2005.

Town	MHC #	2005 Noise Label	Street Address	Name	Style-Date	NR/SR Status[1]
Concord	CON.9015	MM-8	Old Bedford Road	Meriam's Corner Monument	1885	Contributing
Concord	CON.350	MM-9	34 Old Bedford Road	Meriam House	ca. 1705, ca. 1725	Contributing
Concord	CON.357	MM-11	965 Lexington Road	Olive Stow House /Farwell Jones House /Carty Barn	Colonial - ca. 1760	Contributing
Concord	CON.358	MM-12	1175 Lexington Road	Samuel Brooks House	ca. 1692-1728	Contributing
Lexington	LEX.929	MM-28	Old Massachusetts Avenue and Wood Street	Bluff Monument	1885	Contributing
Lexington	N/A	MM-30	Old Massachusetts Avenue and Wood Street	Ebenezer Fiske House Foundation	ca. 1729-late 19th century	Contributing
Lexington	N/A	MM-29	Off Route 2A	Historic Farming Fields	18th-20th centuries	Contributing
Lexington	LEX.618 LEX.1536	MM-27	21 Marrett Street	Jacob Whittemore House /John Muzzey House and Hargrove /Whittemore Barn	Georgian- 1745 (Barn-1850)	Contributing
Lexington	N/A	MM-26	Massachusetts Avenue	Minute Man Visitors Center	Modern- 1976	Non-Contributing
Lexington	N/A	MM-25	Off Massachusetts Avenue, Fiske Hill and Concord Hill	Parkers Revenge	1775	Contributing
Lincoln	N/A	MM-16	Off Lexington Road	Bloody Angle	1775	Contributing
Lincoln	LIN.70	MM-19	Virginia Road	Captain William Smith House	Colonial-ca. 1750	Contributing
Lincoln	LIN.66	MM-17	Virginia Road	Ephraim Hartwell Tavern	Colonial-1733	Contributing
Lincoln	N/A	MM-21	Off Route 2A	Historic Farming Fields	18th-20th centuries	Contributing
Lincoln	N/A	MM-14	North Great Road	Job Brooks House	Colonial-1740	Contributing

Town	MHC #	2005 Noise Label	Street Address	Name	Style-Date	NR/SR Status[1]
Lincoln	LIN.170 LIN.171	MM-22	200 Massachusetts Avenue	John Nelson House and Barn	Federal-1808, 1810	Contributing
Lincoln	LIN.65	MM-15	37 North Great Road	Joshua Brooks, Jr. House	Federal-1780	Contributing
Lincoln	LIN.929	MM-23	Nelson Road	Josiah Nelson, Jr. House Foundation	ca. 1775	Contributing
Lincoln	LIN.64	MM-13	33 North Great Road	Noah Brooks Tavern (and Carriage House)	Federal- ca. 1798	Contributing
Lincoln	LIN.940	MM-20	Massachusetts Avenue	Paul Revere Capture Site and Marker	pre 1902	Contributing
Lincoln	LIN.69	MM-18	Virginia Road	Sgt. Samuel Hartwell House Site	1693-1716; burned 1968; shelter 1986	Contributing
Lincoln	LIN.941	MM-24	Nelson Road	Thomas Nelson, Jr. House Foundation	1700-1750	Contributing
NORTH BRIDGE UNIT						
Concord	CON.343	MM-1	231Liberty Street	Major John Buttrick House	ca. 1715; 19th century alterations	Contributing
Concord	CON.941	MM-4	Liberty Street	The Minuteman (Statue)	1875	Contributing
Concord	CON.940	MM-5	Monument Street	North Bridge	1956	Contributing
Concord	N/A	MM-3	Monument Street	North Bridge Comfort Station	No Style-1984	Non-Contributing
Concord	CON.347	MM-6	269 Monument Street	Old Manse 3	Colonial-1769-1770	Contributing

Town	MHC #	2005 Noise Label	Street Address	Name	Style-Date	NR/SR Status[1]
Concord	CON.344	MM-2	174 Liberty Street	Steadman Buttrick House (NPS Headquarters and Visitor Center)	Colonial Revival-1911	Contributing
WAYSIDE UNIT						
Concord	CON.171	MM-7	455 Lexington Road	The Wayside 3 (Samuel Whitney House)	Colonial/ Victorian Eclectic-1716-17; altered mid-1840s; 1860/70	Contributing
BARRETT FARM UNIT						
Concord	CON.256	--	448 Barrett's Mill Road	Col. James Barrett Farm	Colonial-1705	Contributing

Notes:
1. NR – National Register of Historic Places; SR – State Register of Historic Places.
2. N/A – Not Applicable
3. Old Manse and The Wayside are individually listed National Historic Landmarks that are also located within MMNHP.

The NPS has indicated to Massport for the *2017 ESPR* that annual visitations at MMNHP are slightly increasing with current levels of about 1.1 – 1.2 million, up from 1.0 million people since the *2012 ESPR*. Little, if any, expansion of park boundaries or buildings is planned. Individual programs at various sites within the park continue to be advertised to attract audiences, but short-term general promotions to encourage large increases in total attendance are not part of the current or future management plans. The NPS is starting to plan for the 250th anniversary of MMNHP in 2025, including programming for the Barrett Farm Unit to open it to the public.

10.10.1 MMNHP Soundscape

The NPS issued Director's Order 47 (DO47) "Soundscape Preservation and Noise Management" in December 2000. This was the NPS headquarters generic modeling document that would provide a nationwide approach to identifying desired noise criteria in national parks. Park Managers would use the guidance in developing their own Soundscape Management Plans, each tailored to the unique activities, land uses and environmental needs of their individual parks.,

Nationally, the NPS explored the issue of aircraft overflights in the 1994 Report on Effects of Aircraft Overflights on the National Park System, which recommended the continuation of the federal interagency working group.. Sound monitoring was conducted in 2008-09 at MMNHP by the NPS Natural Sounds Division with volunteer staff assisting, and is included in the internal draft plan. The NPS indicated that an internal final draft of the Acoustic Management Environmental Assessment report was completed in 2014, and held public review meetings. Development of the soundscape plan is ongoing.Thirty-one locations within MMNHP were evaluated as noise analysis locations for the *2017 ESPR*. The analysis of 2017 conditions indicates that noise exposure levels created by aircraft flying over MMNHP ranged from 45 dB to 55 dB. The highest level (55.0 dB) occurred at the Noah Brooks Tavern (and Carriage House) (MM-13); this location had a 51.4 dB level in 2012. No areas of the MMNHP were within the 65 dB DNL contour in 2005, 2012 or 2017.

Approximately 55 acres of the MMNHP were within the 55 dB DNL contour in 2017 as compared to no areas in 2012. TA65 values ranged from 1 to 10.5 minutes at the 31 noise analysis locations, with the highest levels occurring at Samuel Brooks House (MM-12), the Noah Brooks Tavern (and Carriage House) (MM-13), and the Job Brooks House (MM-14). In 2012, the Noah Brooks Tavern (and Carriage House) (MM-13), and the Job Brooks House (MM-14), and Bloody Angle (MM-16) had the highest TA65 values. TA55 values ranged from 18 to 65 minutes, with the highest levels occurring at the Historic Farming Fields (MM-10) in the Bedford Levels.

10.11 Environmental Effects in MMNHP

One site in MMNHP experienced a DNL of 55 dB in 2017 due to higher than typical use of Runway 5/23 during a closure of Runway 11/29 for repaving. This was a unique, construction-phase change; none of the sites in the MMNHP would be expected to experience a DNL greater than 55 dB for 2017 or any future scenario in 2025 or 2035.

No portion of MMNHP is located in the 65 DNL contour in 2017 or in the 2025 and 2035 planning scenarios. Under current 2017 conditions, approximately 55 acres of MMNHP are within the 55 DNL noise contour, and the planning scenarios forecast that will be reduced to 30 acres in the 2025 and 26 acres in the the 2035 (see Table 10-1). The 55 DNL noise contour for 2017 is significantly larger in the south central area when compared to the 2012 conditions (see Figure 7-15). The noise contour only overlaps a very small area of the Massport property that falls within the MMNHP Congressional boundary.

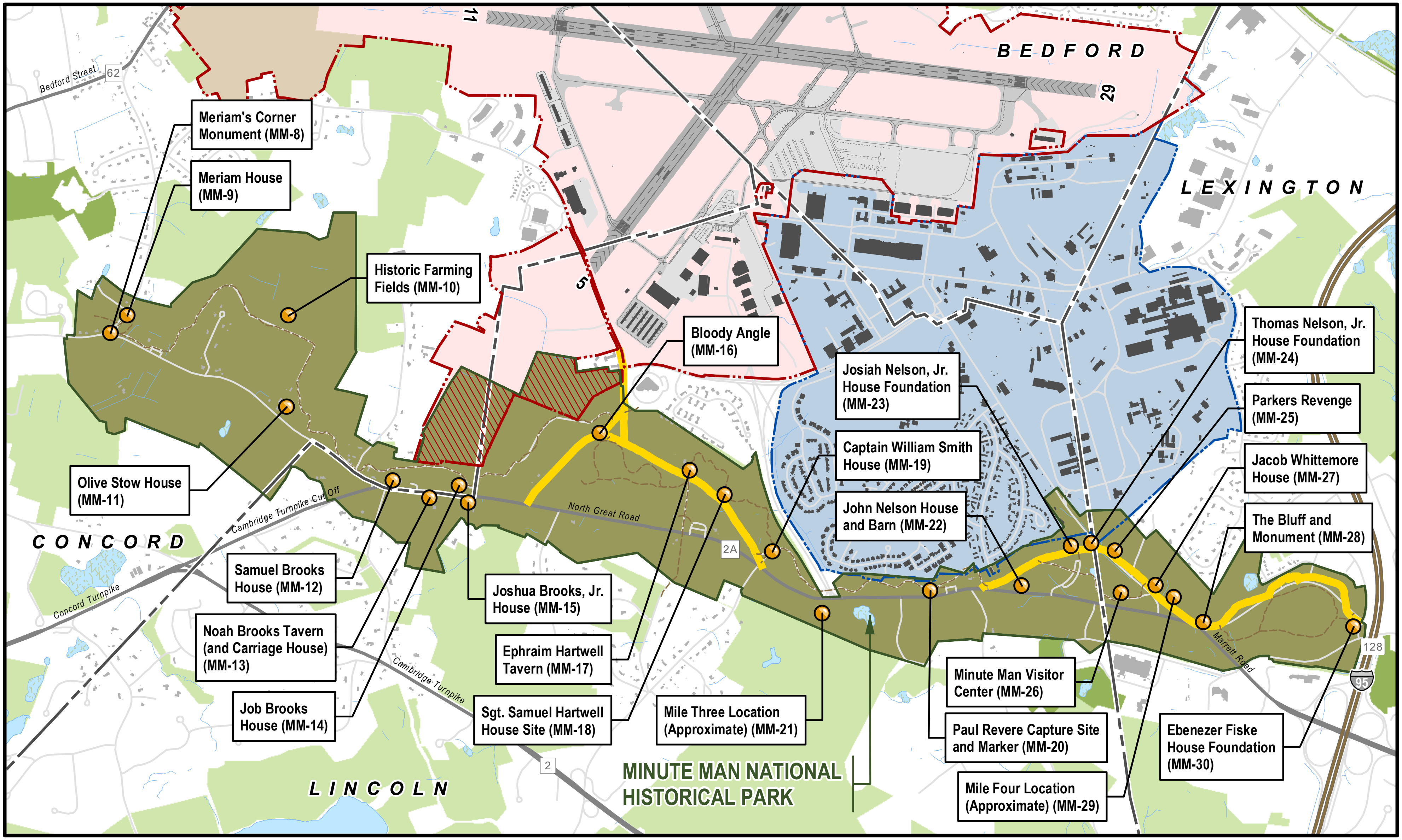
In 2017, Hanscom Field traffic represented approximately two percent of the peak hour traffic on Route 2A. Only one of the studied intersections in the MMNHP (Route 2A/Hanscom Drive) meets the threshold for 10 percent or more of the traffic movements associated with Hanscom Field.

As described in Chapter 8, all air pollutant concentrations are safely in compliance with health-based air quality standards. Therefore, this analysis concluded that no adverse air quality effects to historic resources including MMNHP are anticipated now or in future analysis years from activities at Hanscom Field.

10.11.1 Battle Road (Interpretive) Trail

The Battle Road Trail is an interpretive, multi-use trail within MMNHP that provides cycling, walking, and wheelchair access to the MMNHP's historical and natural resource areas. The route of the Battle Road Trail is shown on Figure 10-5 and Figure 10-6. The stone-dust trail extends five and one-half miles from Fiske Hill in Lexington, through Lincoln, to Meriam's Corner in Concord. The trail contains 25-foot wide portions of the historic Battle Road from April 19, 1775 that are restored and linked together by seven-foot wide sections of trail that traverse landscapes that evoke the past. Other portions of the historic Battle Road Trail follow the route of today's Route 2A.

The DNL, TA65 and TA55 values at noise analysis locations along the Battle Road Trail were plotted in Figures 10-7 through 10-9. None of the Battle Road Trail fell within either the 65 DNL or 55 DNL contours for 2017. Figures 10-7 through 10-9 indicate that DNL and Time Above values are highest to the west of the Hartwell Tavern, reflecting the proximity of this area to runways at Hanscom Field. It should be noted that a visitor to the Battle Road portion of the park is also affected by the background noise of road traffic from Route 128/I-95 and Route 2A throughout most of the day, and that Hanscom Field-related vehicular traffic contributes approximately two percent to the traffic volumes on Route 2A.



North

0 1,000 2,000 Feet

Minute Man National Historical Park Resource

Hanscom Field Property Boundary

Massport Property within MMNHP Congressional Boundary

Hanscom AFB Property Boundary

Municipal Boundary

Historic Battle Road

Battle Road Trail

Interstate

Highway

Road

MMNHP Boundary

Open Space Non-protected

Open Space Protected in Perpetuity

Open Water

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

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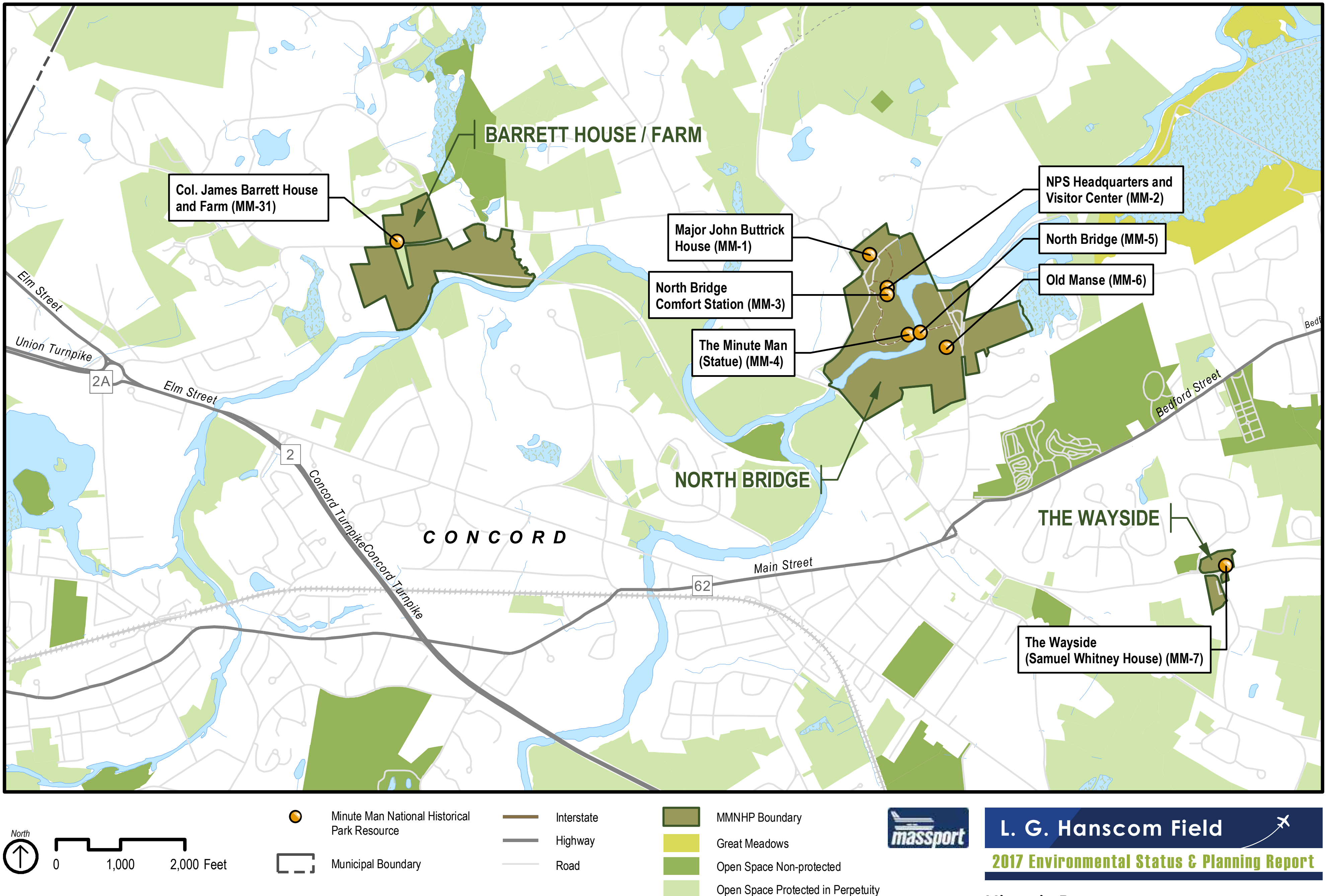
Historic Resources
MMNHP Battle Road Unit

Figure **10-5**



Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

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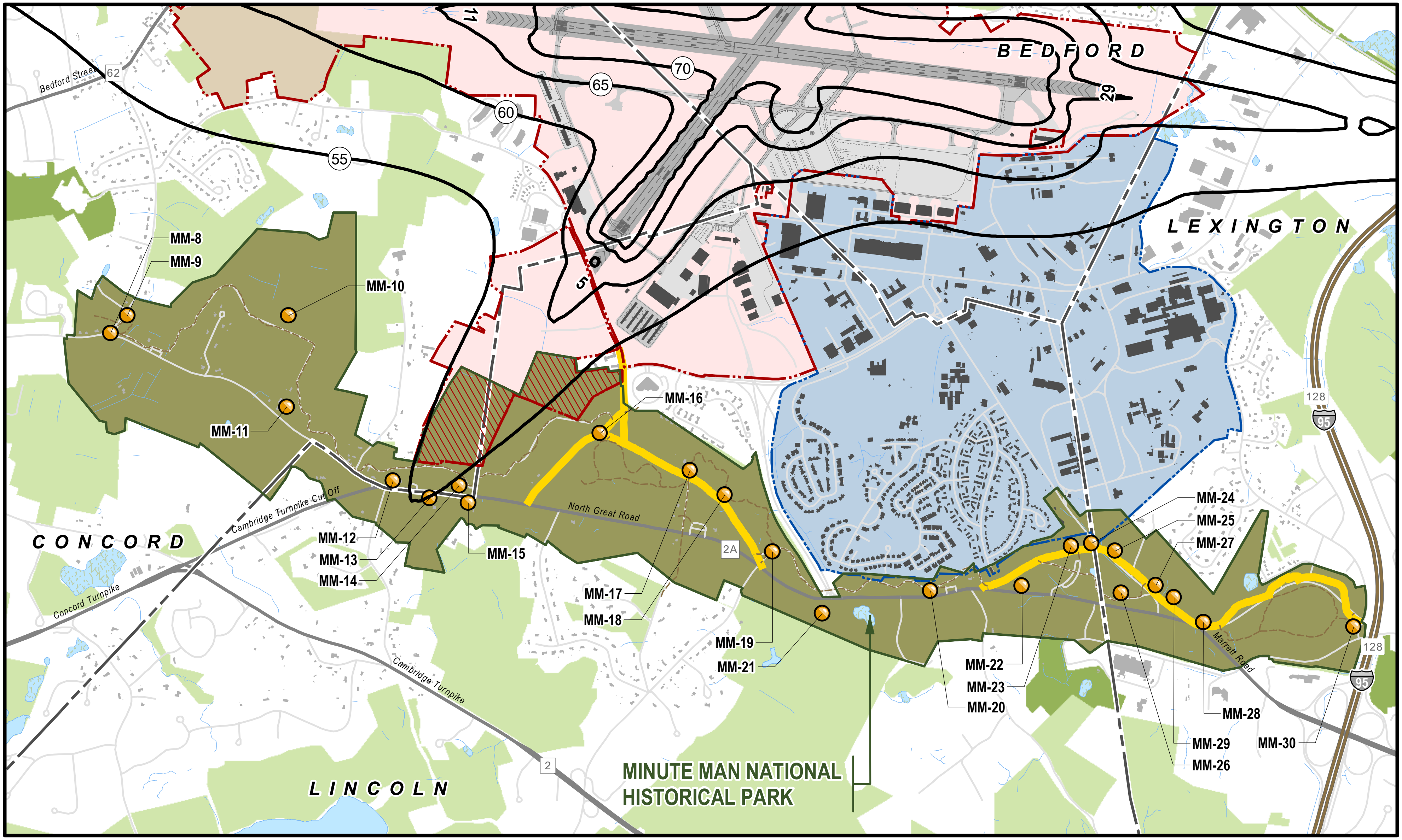
2017 Environmental Status & Planning Report

Historic Resources
MMNHP North Bridge and Barrett Farm

Figure **10-6**



North

0 1,000 2,000 Feet

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

- 2017 DNL Noise Contour
- Minute Man National Historical Park Resource
- Hanscom Field Property Boundary
- Massport Property within MMNHP Congressional Boundary
- Hanscom AFB Property Boundary
- Municipal Boundary
- Historic Battle Road
- Battle Road Trail
- Interstate
- Highway
- Road
- MMNHP Boundary
- Open Space Non-protected
- Open Space Protected in Perpetuity
- Open Water

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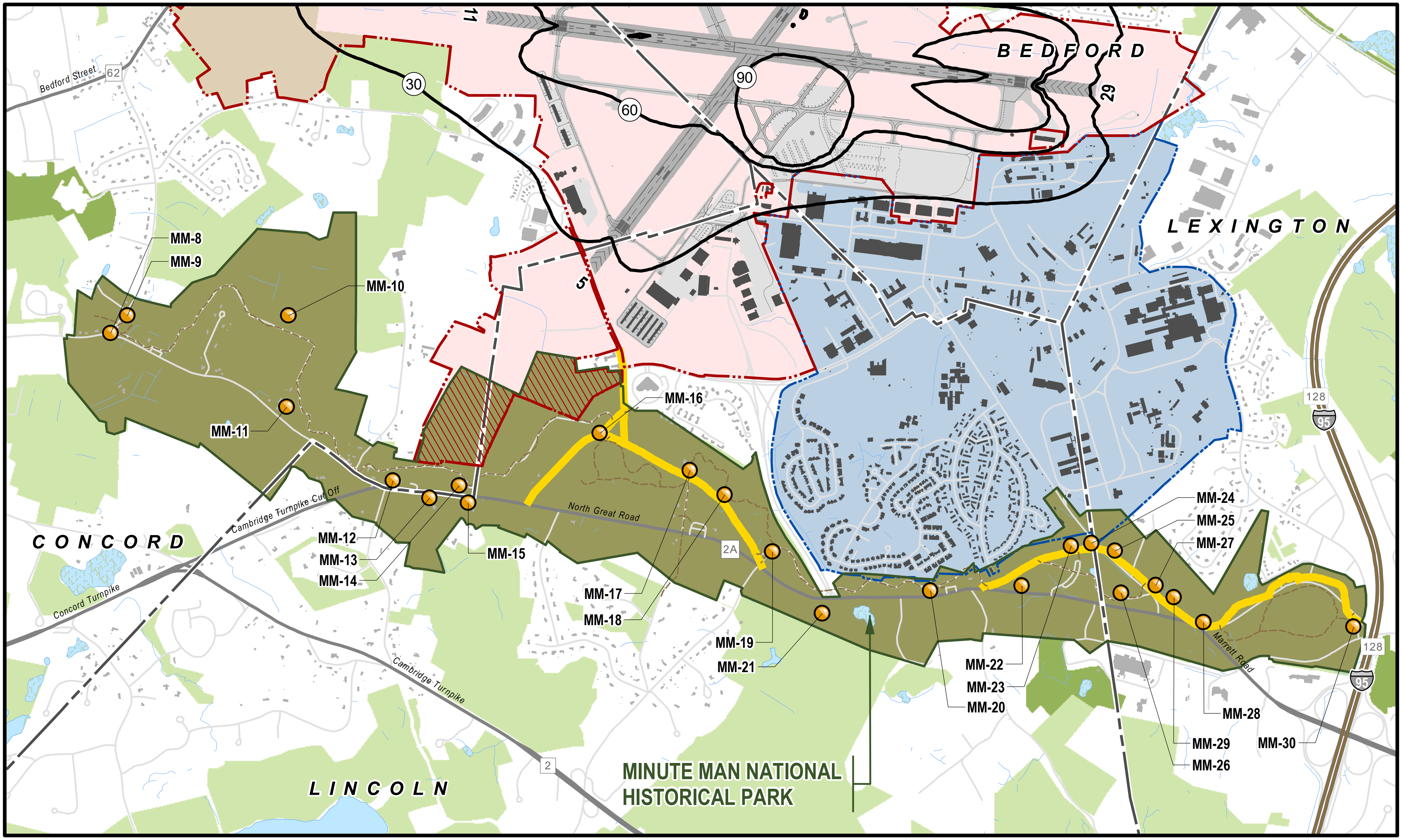
2017 DNL at MMNHP Battle Road Unit

Figure 10-7



North

0 1,000 2,000 Feet

2017 Time Above 65 dBA Contours (Minutes)
Minute Man National Historical Park Resource
Hanscom Field Property Boundary
Massport Property within MMNHP Congressional Boundary
Hanscom AFB Property Boundary
Municipal Boundary
Historic Battle Road
Battle Road Trail
Interstate
Highway
Road
MMNHP Boundary
Open Space Non-protected
Open Space Protected in Perpetuity
Open Water

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

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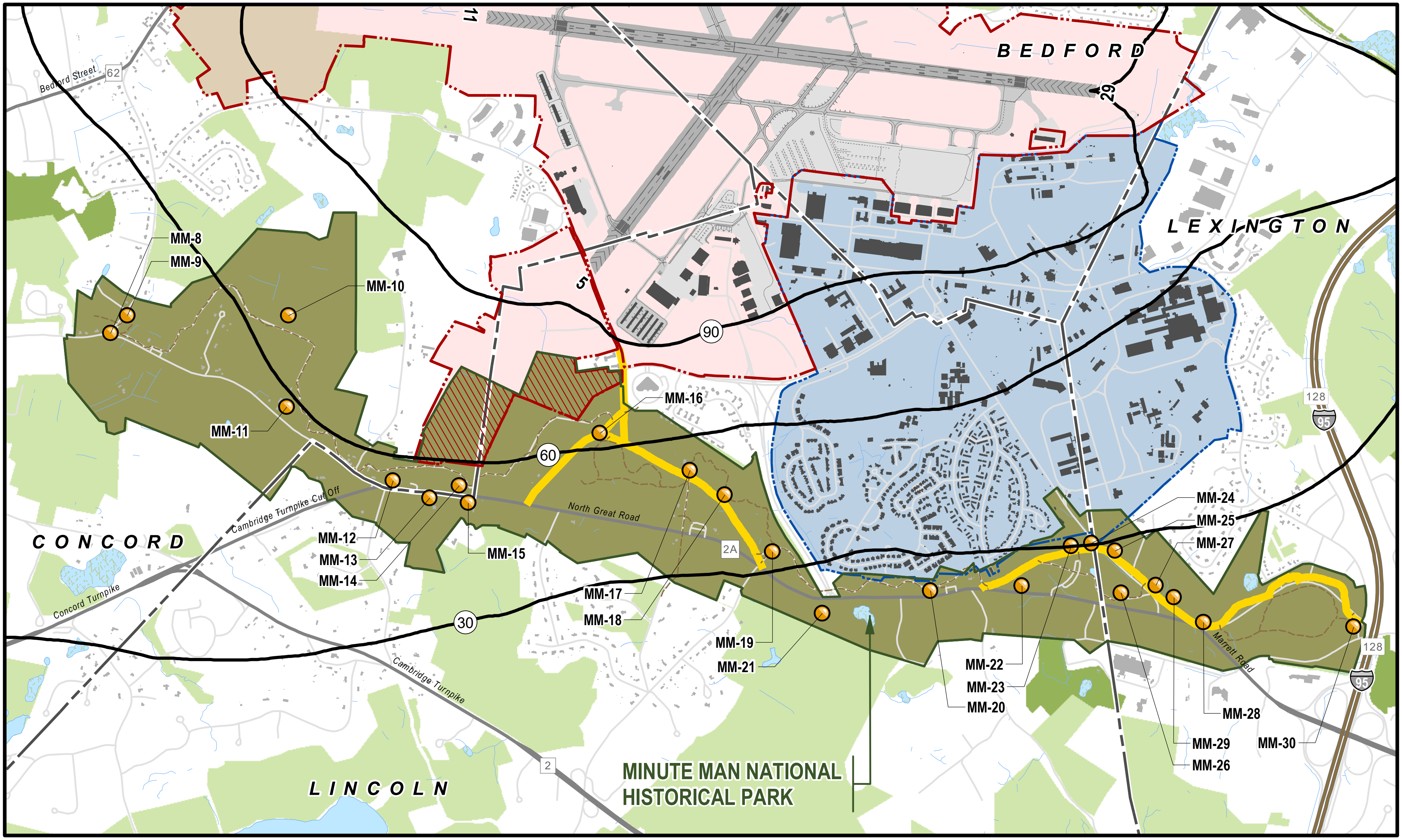
2017 Time Above 65 dBA at MMNHP Battle Road Unit

Figure 10-8



North

0 1,000 2,000 Feet

2017 Time Above 55 dBA Contours (Minutes)
Minute Man National Historical Park Resource
Hanscom Field Property Boundary
Massport Property within MMNHP Congressional Boundary
Hanscom AFB Property Boundary
Municipal Boundary
Historic Battle Road
Battle Road Trail
Interstate
Highway
Road
MMNHP Boundary
Open Space Non-protected
Open Space Protected in Perpetuity
Open Water

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

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2017 Time Above 55 dBA at MMNHP Battle Road Unit

Figure 10-9

10.11.2 MMNHP Current Status and Future Concerns

At the July 2018 coordination meeting for the *2017 ESPR*, the MMNHP Superintendent indicated ongoing concerns regarding how noise from aircraft affects park programming. NPS is particularly concerned about noise levels at North Bridge, including at locations outside the 55 DNL contour, such as Parker's Revenge (noise receptor MM-25). The Park noted the site is more open than it was during the preparation of the 2012 ESPR. Noise studies in Chapter 7 show the site has decreased in noise from 47.0 dB in 2012 to 46.8 db in 2017. The Park staff have also noted a perceived increase in air traffic.

Massport's Fly Friendly program was instituted in 2009. The program aims to decrease noise over Hartwell Tavern, where Park leaders indicated to Massport that a large number of interpretive talks are held. The program vigourously promotes fly friendly technigues as well as voluntary measures for pilots to avoid Hartwell Tavern (noise receptor MM-17) while performing touch and go training operations. Since the inception of the program in 2009, air traffic over Hartwell Tavern has decreased by 22%. Further discussion of noise levels at MMNHP locations is detailed in Chapter 7.

10.12 Analysis of Future Scenarios

This section analyzes the potential effects of the 2025 and 2035 scenarios on cultural and historical resources within and in the vicinity of Hanscom Field. The environmental analysis focuses on noise and traffic effects of the 2025 and 2035 planning scenarios. The air quality assessment, discussed in Chapter 8, concludes that even maximum air concentrations for the 2025 and 2035 scenarios comply with all health-based air quality standards and therefore will result in no adverse air quality effects to historic resources including MMNHP.

The analyses of cultural and historical resources use information on future aviation operations activity levels presented in Chapter 3 Airport Activity Levels, and potential new facilities described in Chapter 4 Airport Planning. Data is also derived from the evaluation of traffic volumes and intersection operations that are described in Chapter 6 Ground Transportation, and noise analyses for DNL and TA measurements that are presented in Chapter 7.

Any future project at Hanscom Field will undergo a project-specific environmental review process in the event that MEPA, NEPA, or other applicable environmental review thresholds are met. The historic resources and archaeological reconnaissance surveys (included in Appendix G), will provide baseline data for these assessments. Additional cultural and historical properties may be identified through more detailed surveys in that process and will be addressed at that time.

As described in Chapter 6 Ground Transportation, the *2017 ESPR* reflects Massport's commitment to traffic management approaches to address future Hanscom Field-related traffic volumes, rather than physical modifications to intersections to add capacity. The traffic analysis focuses on predicted traffic volume changes on Route 2A in the MMNHP.

As stated in Chapter 7, any significant changes in noise exposure are assessed based on both the absolute value of the projected DNL, as well as the magnitude of the change. Noise analysis considers as significant changes in DNL on the order of 1.5 dB or more for areas within the 65 dB DNL noise contour and changes of 3.0 or more decibels between 60 and 65 dB DNL.[168] Noise impact criteria are used to determine areas for further analysis and possible mitigation when completing environmental documentation for a specific project at an airport. Though the *2017 ESPR* is not an environmental permitting document for a project, the use of these criteria help to highlight notable changes in the noise environment at Hanscom Field.

Chapter 7 presents 2025 and 2035 noise exposure levels at noise analysis locations including those that are cultural and historic resources. The 65 dB DNL noise contour was used as a guideline for determining potential land use incompatibilities, in accordance with FAA guidelines. The Secretary directed Massport to evaluate the extent of the 55 dB DNL noise contour in the *2017 ESPR*.

10.13 Future Scenarios: Historic Resources

This section assesses potential effects to historic resources that could result from the 2025 and 2035 future planning scenarios. Assessment of future noise effects to historic resources focuses on the National and State Registers-listed properties and the MHC Inventory and MACRIS-listed resources. The noise analysis, as presented in Chapter 7, includes 24-hour noise and time above exposure values. Information about the environmental effects to MMNHP is contained in a separate section below.

10.13.1 National and State Registers Properties

Figures 10-10 and 10-11 illustrate the location of historic National and State Registers properties in the vicinity of Hanscom Field generally, and the MMNHP Battle Road Unit specifically, relative to the noise contours for the 2025 and 2035 growth scenarios. The figure includes the contours for 2012 and 2017 as well for comparing future noise forecasts with that experienced in recent years. Table 10-14 presents DNL values for the 2025 and 2035 scenarios at the 12 locations with the highest DNL values in 2017. No historic properties fall within the 65 dB DNL noise contour or experience increased exposure of 3.0 dB or more at DNL levels between 60 and 65 dB. As compared to the 2012 DNL values, the increases in DNL values for

[168] U.S. Department of Transportation, Federal Aviation Administration, Office of Environment and Energy, Environmental Impacts: Policies and Procedures, FAA order 1050.1E CHG1, Washington, DC.

most National and State Registers sites are less than one decibel and they have DNL values below 55 dB in the 2025 and 2035 scenarios.

Table 10-14 DNL Values for Historic Architectural Properties Listed in the National and State Registers of Historic Places

MHC #	Name[1]	Street Address	Town	Noise Label	2005	2012	2017	2025	2035
CON.177	Deacon John Wheeler-Captain Jonas Minot Farmhouse (aka Thoreau Birthplace)	341 Virginia Rd.	Concord	NC-18	60.4	58.4	57.8	58.6	59.0
CON.178	Wheeler-Meriam House	477 Virginia Rd.	Concord	NC-19	59.9	58.1	57.7	58.4	58.8
LEX.413	Simonds Tavern	331 Bedford St.	Lexington	NLX-1	55.5	53.0	54.5	55.3	55.9
BED.V	Bedford Depot Park Historic District	80 Loomis St. and 120 South Rd.	Bedford	NB-5	53.7	49.8	52.0	51.6	52.1
CON.170	Orchard House	399 Lexington Rd.	Concord	NC-17	53.8	50.2	50.0	50.8	51.3
CON.317	Ralph Waldo Emerson House	28 Cambridge Tpk.	Concord	NC-15	52.9	49.1	49.1	49.9	50.4
CON.802 (CON.DY)	Sleepy Hollow Cemetery	24 Court Ln.	Concord	NC-12	52.2	49.0	49.0	49.9	50.4
CON.DS	American Mile Historic District	Lexington Road	Concord	NC-13	51.7	48.5	48.6	49.5	49.9
CON.329	Wright Tavern	Lexington Rd. & Main St.	Concord	NC-11	51.0	48.2	48.4	49.2	49.6
CON.DV	North Bridge-Monument Square Historic District	Monument St., Liberty St., and Lowell St.	Concord	NC-10	50.5	48.2	48.4	49.2	49.6
CON.A	Concord Monument Square- Lexington Road Historic District	Monument Sq. and Lexington Rd.	Concord	NC-14	50.9	48.1	48.3	49.1	49.6
CON.DU	Main Street Historic District	Main St. between Monument Sq. and Wood St.	Concord	NC-9	50.8	48.0	48.3	49.1	49.5

Notes:
1. The historic districts and properties with the 12 highest DNL values in 2017 are listed in order of their DNL value.
2. MMNHP sites are included in Table 10-17.

10.13.2 2025 Scenario

Two historic National Register-listed properties in Concord that are located on Virginia Road next to Hanscom Field would have DNL values between 55 and 60 dB DNL in the 2025 scenarios see Figure 10-10):

- Deacon John Wheeler/Capt. Joseph Minot Farmhouse (NC-18) in Concord is forecast at 58.6 dBA in the 2025 scenario (compared to 57.8 dBA in 2017); and
- Wheeler-Meriam House (NC-19) in Concord is forecast at 58.4 dBA in the 2025 scenario (compared to 57.7 dBA in 2017).

The next highest predicted level for a historic National Register-listed resource, Simonds Tavern (NLX-1) in Lexington, would have a DNL value of 55.3 dBA in the 2025 scenario (compared to 54.5 dBA in 2017). All other sites would have a DNL value below 55 dBA in both the 2025 and 2035 scenarios. The highest predicted TA65 level occurs at the Wheeler-Meriam House for the 2025 scenario, which increases from 27.6 minutes a day in 2017 to 31.3 minutes a day minutes a day in the 2025 scenario (see Figure 10-12).

The highest 2025 TA55 level also occurs at Wheeler-Meriam House, which increases from 121.7 minutes a day in 2017 to 128.4 minutes a day in the 2025 scenario (see Figure 10-13). In both the 2017 and 2025 scenarios, the TA65 is lower than in 2012 at this site. Each of the 18 historic districts listed in Table 10-15 is outside the 65 dBA DNL contour for the 2017 existing conditions and the 2025 and 2035 scenarios.

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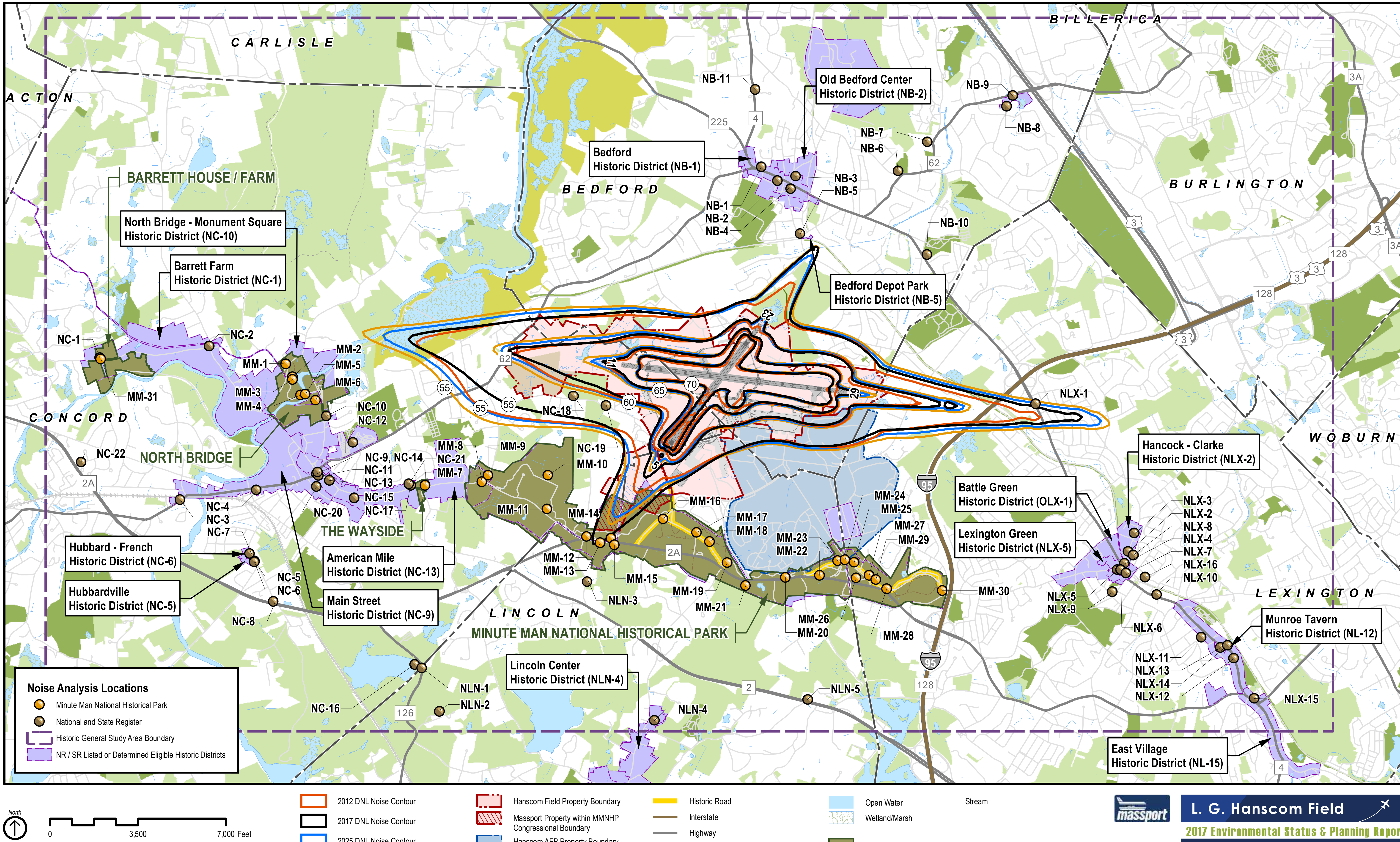

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

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Historic Resources within the 2012, 2017, 2025 and 2035 DNL Noise Contours

Figure 10-10

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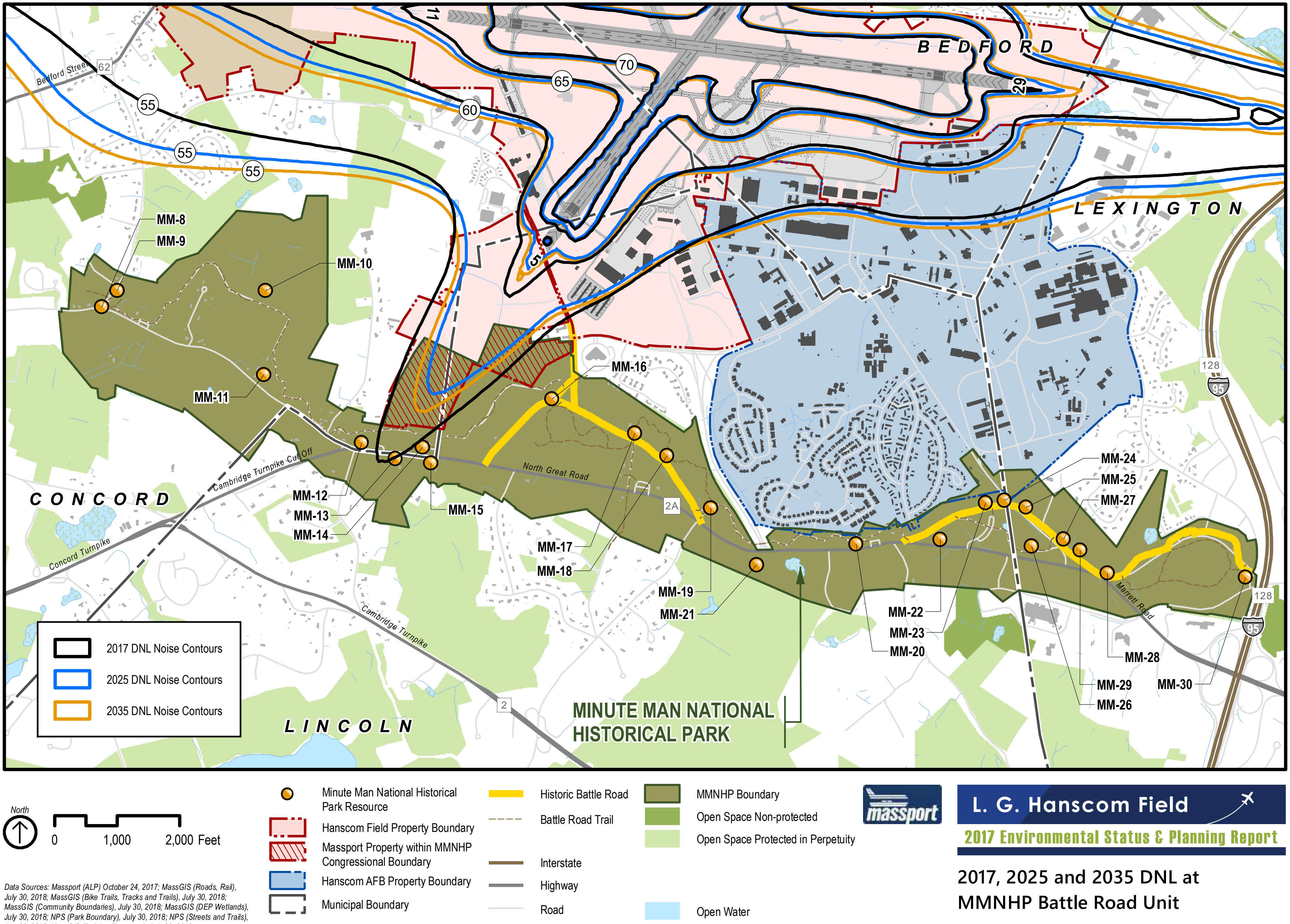

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

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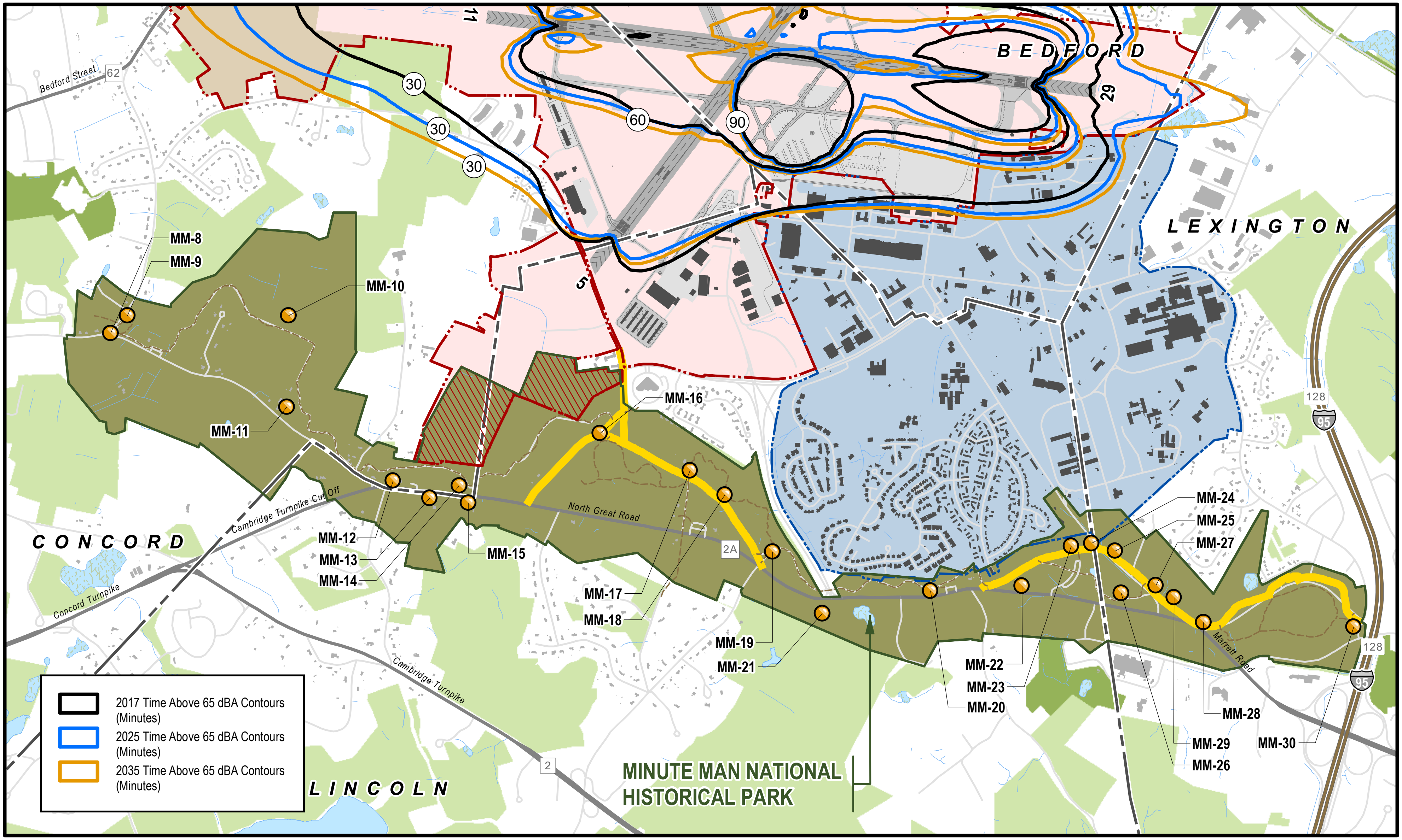
2017, 2025 and 2035 DNL at MMNHP Battle Road Unit

Figure **10-11**

Table 10-15 Area of National and State Registers Historic Districts within the 55 dBA DNL Contour

MHC Number	Name[1]	Acreage	2017	2025	2035
BEDFORD					
BED.V	Bedford Depot Park Historic District	6.8 acres	0 acres	0 acres	0 acres
BED.A	Bedford Historic District	42 acres	0 acres	0 acres	0 acres
BED.C	Old Bedford Center Historic District	79 acres	0 acres	0 acres	0 acres
BED.K	Old Burlington Road- Wilson Mill Area	2.7 acres	0 acres	0 acres	0 acres
CONCORD					
CON.DS	American Mile Historic District	133 acres	0 acres	0 acres	0 acres
CON.DT	Barrett Farm Historic District	221 acres	0 acres	0 acres	0 acres
CON.A	Concord Monument Sq.- Lexington Rd Historic District	42 acres	0 acres	0 acres	0 acres
CON.EA	Hubbard-French Historic District	2.6 acres	0 acres	0 acres	0 acres
CON.DZ	Hubbardville Historic District	6.6 acres	0 acres	0 acres	0 acres
CON.DU	Main Street Historic District	74 acres	0 acres	0 acres	0 acres
CON.DV	North Bridge- Monument Square Historic District	89 acres	0 acres	0 acres	0 acres
LEXINGTON					
LEX.B	Battle Green Historic District	110 acres	0 acres	0 acres	0 acres
LEX.E	East Village Historic District	56 acres	0 acres	0 acres	0 acres
LEX.C	Hancock-Clarke Historic District	34 acres	0 acres	0 acres	0 acres
LEX.AC	Lexington Green Historic District	17 acres	0 acres	0 acres	0 acres
LEX.D	Munroe Tavern Historic District	70 acres	0 acres	0 acres	0 acres
LEX.AZ	Richard Gleason Tower Estate	10.3 acres	0 acres	0 acres	0 acres
LINCOLN					
LIN.A LIN.D	Lincoln Center Historic District	187 acres	0 acres	0 acres	0 acres

Note:
1. All districts are outside the 65 dBA DNL contours for 2017 and the 2025 and 2035 scenarios. MMNHP is discussed separately.



North

0 1,000 2,000 Feet

- 2017 Time Above 65 dBA Contours (Minutes)
- Minute Man National Historical Park Resource
- Hanscom Field Property Boundary
- Massport Property within MMNHP Congressional Boundary
- Hanscom AFB Property Boundary
- Municipal Boundary
- Historic Battle Road
- Battle Road Trail
- Interstate
- Highway
- Road
- MMNHP Boundary
- Open Space Non-protected
- Open Space Protected in Perpetuity
- Open Water

Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

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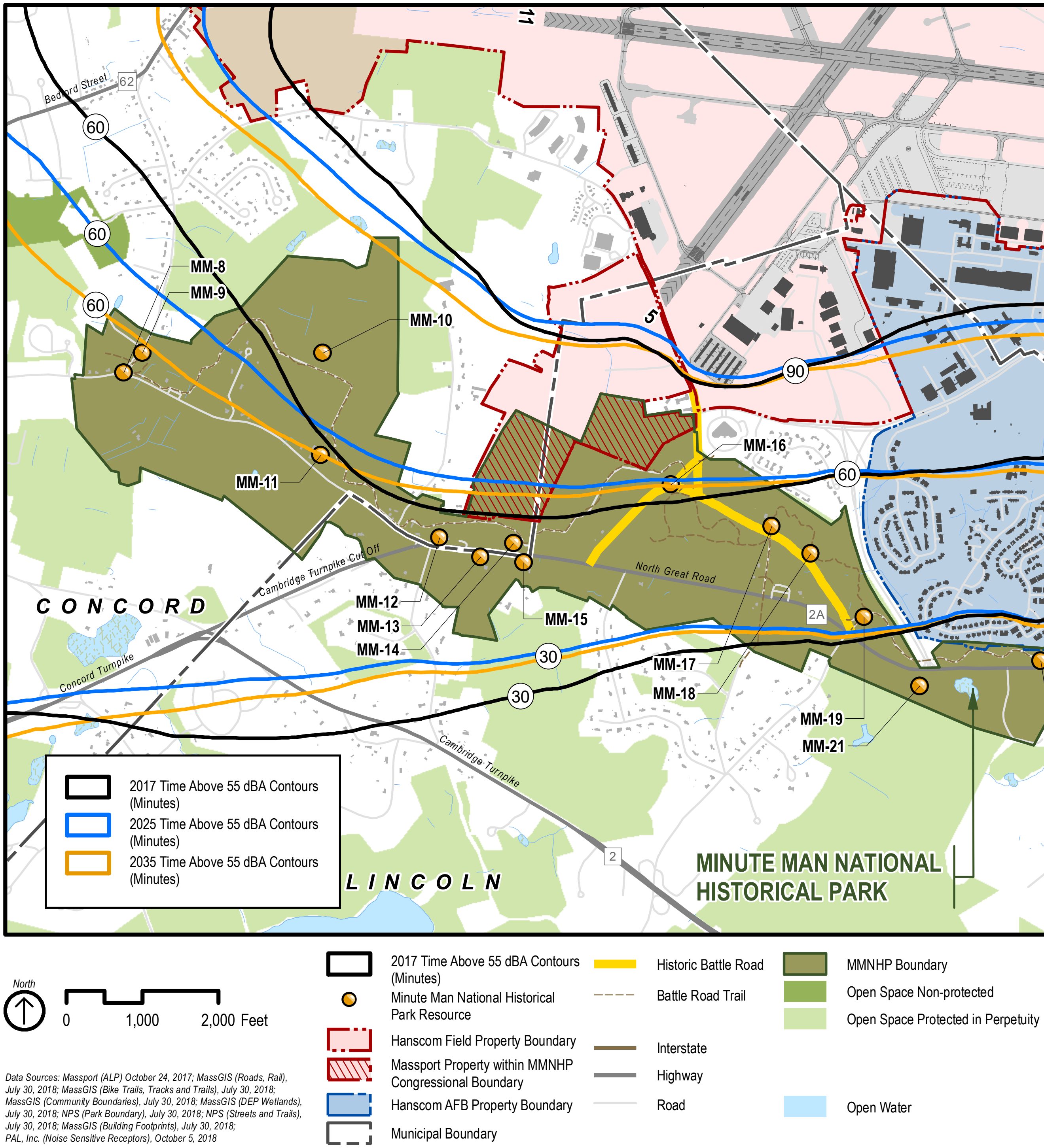
2017, 2025 and 2035 Time Above 65 dBA at MMNHP Battle Road Unit

Figure 10-12



Data Sources: Massport (ALP) October 24, 2017; MassGIS (Roads, Rail), July 30, 2018; MassGIS (Bike Trails, Tracks and Trails), July 30, 2018; MassGIS (Community Boundaries), July 30, 2018; MassGIS (DEP Wetlands), July 30, 2018; NPS (Park Boundary), July 30, 2018; NPS (Streets and Trails), July 30, 2018; MassGIS (Building Footprints), July 30, 2018; PAL, Inc. (Noise Sensitive Receptors), October 5, 2018

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2017, 2025 and 2035 Time Above 55 dBA at MMNHP Battle Road Unit

Figure 10-13

10.13.3 2035 Scenario

No historic sites would be exposed to DNL values greater than 65 dB in the 2035 scenario (see Figure 10-11). Increases are projected to be between 0.5 dB and 1.5 dB. Three properties are expected to have noise levels between 55 and 65 dB:

- Deacon John Wheeler/Capt. Jonas Minot Farmhouse (NC-18) in Concord is forecast at 59.0 dBA in the 2035 scenario (compared to 57.8 dBA in 2017).
- Wheeler-Meriam House (NC-19) in Concord is forecast at 58.8 dBA in the 2035 scenario (compared to 57.7 in 2017).
- Simonds Tavern (NLX-1) in Lexington is forecast at 55.9 dBA in the 2035 scenario (compared to 54.5 in 2017).

None of the other properties would experience noise levels that exceed 55 dBA. The highest predicted TA65 level would occur at the Wheeler-Meriam House in the 2035 scenario; the TA65 would increase from 27.6 minutes a day in 2017 to 33.9 minutes a day in 2035 (see Figure 10-12). The highest predicted TA55 would also occur at the Wheeler-Meriam House in the 2035 scenario; the TA65 would increase from 121.7 minutes a day in 2017 to 135.8 minutes a day (see Figure 10-12 and Figure 10-13).

Table 10-16 Historic Resources in the MHC Inventory and MACRIS within the 65 dBA and 55 dBA DNL Contours for the 2025 and 2035 Scenarios

Location[1]	2017 MHC Inventory[2]	2017[3]		2025[3]		2035[3]	
		65 dBA	55 dBA	65 dBA	55dBA	65 dBA	55 dBA
AREAS							
Bedford	2	-	2	-	2	-	2
Concord	8	-	6	-	6	-	8
Lexington	2	-	2	-	2	-	2
Lincoln	2	-	-	-	2	-	2
Total	14	0	10	0	12	0	14
INDIVIDUAL PROPERTIES							
Bedford	14	-	12	-	14	-	14
Concord	25	-	15	-	20	-	25
Lexington	137	-	55	-	107	-	137
Lincoln	-	-	-	-	-	-	-
Total	176	0	82	0	141	0	176

Notes:
1. Based on research for *2017 ESPR*.
2. Appendix G lists these historic resources.
3. The number of areas listed are fully or partially within the 55 dBA DNL contour.

10.13.4 MHC Inventory and Information from Historic Commissions

None of the historic resources in the MHC Inventory and MACRIS would be within the 65 dB DNL contour for the 2025 or 2035 scenarios. Table 10-16 summarizes by town the number of historic resources in the MHC Inventory and MACRIS that would be within the 55 dB DNL contour for the 2025 and 2035 scenarios.

- 2025 Scenario - In the 2025 growth scenario, 12 survey areas and 141 individual historic resources listed in the MHC Inventory and MACRIS would be within the 55 dB DNL contour.
- 2035 Scenario – In the 2035 growth scenario, 14 survey areas and 176 individual historic resources listed in the MHC Inventory and MACRIS would be within the 55 dB DNL contour.

10.14 Future Scenarios: Archaeological Resources

Massport encourages new development in areas with existing impervious surfaces that take advantage of existing infrastructure. Any physical changes proposed near recorded archaeological sites and/or in undisturbed portions of the airport, have the potential to affect archaeological resources. These areas would be studied, as appropriate, if a project were proposed that affected a relevant area. Ground disturbance is not contemplated near traffic study intersections, since no physical modifications are proposed by Massport for these locations. The following is an assessment of the potential impacts from possible development to archaeological resources and/or sensitivity areas from the planning areas reviewed for 2025 and 2035 and described in Chapter 4. The five planning areas are the North Airfield, Northeast Airfield, East Ramp, West Ramp and Pine Hill. The impacts assessment is based on the information in the archaeological reconnaissance survey update for the *2017 ESPR*.

10.14.1 2025 Scenario

Development in the 2025 scenario is evaluated for four of the five planning areas described in Chapter 4. No development is considered in the 2025 scenario for the Northeast Airfield parcel. All development evaluated for the East Ramp will occur on existing impervious ramp and apron and are entirely within areas assessed as having a low archaeological sensitivity. These potential development sites are unlikely to affect potentially significant archaeological resources.

New development is also evaluated for some areas of the North Airfield and Pine Hill planning areas. The sites in these two areas are entirely within areas assessed as having a low archaeological sensitivity, and they are unlikely to affect potentially significant archaeological resources.

New development evaluated for the West Ramp planning area includes three possible areas of development. Two are located in low sensitivity areas, but one small area in the southeastern section is within an area of moderate/high archaeological sensitivity.

While the majority of the new development concepts for the 2025 scenario would be sited on existing impervious and previously disturbed areas, one potential West Ramp development area is located within an area that is presently vegetated and pervious. Additional archaeological investigation within this area would be appropriate if this concept moved forward to planning and design, and belowground impacts are proposed.

10.14.2 2035 Scenario

The development concepts considered for the 2035 scenario augment those discussed above in the 2025 scenario and the potential effects on archaeological sensitive areas would be similar in most areas. Construction activity in the East Ramp, North Airfield, and Pine Hill areas would continue to be confined to existing impervious areas previously disturbed with low archaeological sensitivity.

In the West Ramp area, potential development could occur within areas that are presently vegetated and pervious and are within areas of moderate/high archaeological sensitivity. Additional archaeological investigation within these this areas would be appropriate if any of these concepts moved forward to planning and design, and belowground impacts are proposed.

10.15 Future Scenarios: Minute Man National Historical Park

This section assesses potential noise and traffic effects of the 2025 and 2035 scenarios on MMNHP. Specific areas of focus include the NPS’s goals of physical protection and restoration of Battle Road; road traffic, public safety, and access to park facilities, particularly regarding speed and traffic congestion; management of air traffic to protect the visitor's experience in the park; and the future of Hanscom AFB. Noise level analyses identified DNL and TA values at contributing resources within the park and estimates of acreage of park within the 55 dB DNL contour for the 2025 and 2035 scenarios. Table 10-17 presents the sites with the ten highest DNL values in the Park.

Table 10-17 DNL Values of Sites in the Minute Man National Historical Park (in dB)

Label[1]	Name[2]	Unit/Town[3]	2005	2012	2017	2025	2035
MM-13	Noah Brooks Tavern (and Carriage House)	Battle Road Unit/Lincoln	53.4	51.4	55.0	53.6	54.0
MM-14	Job Brooks House	Battle Road Unit/Lincoln	53.0	51.5	54.6	53.3	53.7
MM-12	Samuel Brooks House	Battle Road Unit/Concord	52.5	50.8	54.4	53.2	53.6
MM-15	Joshua Brooks, Jr. House	Battle Road Unit/Lincoln	51.7	50.7	53.6	52.4	52.8
MM-16	Bloody Angle	Barrett Farm Unit/Concord	50.1	50.9	51.7	51.0	51.3
MM-10	Historic Farming Fields	Battle Road Unit/Concord	51.4	50.7	50.9	51.1	51.5
MM-11	Olive Stow House/Farwell Jones House/ Carty Barn	Battle Road Unit/Concord	50.5	49.2	50.6	50.3	50.6
MM-9	Meriam House	Battle Road Unit/Concord	52.1	50.6	50.5	51.2	51.6
MM-8	Meriam's Corner Monument	Battle Road Unit/Concord	51.9	50.3	50.3	50.9	51.3
MM-7	The Wayside (Samuel Whitney House) *	Wayside Unit/Concord	53.6	50.3	50.1	50.9	51.4
MM-1	Major John Buttrick House	North Bridge Unit/Concord	51.2	48.7	48.9	49.6	50.1
MM-2	NPS Headquarters and Visitor Center at 174 Liberty St. (Stedman Buttrick Residence)	North Bridge Unit/Concord	50.5	48.3	48.4	49.1	49.6

Notes:
1. The MMNHP is a National Historic Landmark district. All sites are in the National Register of Historic Places. The sites with the ten highest DNL values in 2017 are listed in order of their 2017 DNL value.
2. Sites within MMNHP are marked with an asterisk (*) if they are individually listed in the National Register of Historic Places.
3. Sites in the Battle Road Unit are located on the Battle Road Interpretive Trail.

The evaluation of traffic identifies potential changes in Route 2A traffic volumes that are attributable to Hanscom Field. Chapter 6, Ground Transportation, describes Massport's support for Transportation Demand Management strategies to reduce its contribution to traffic on area roadways and potential traffic management strategies that do not require physical modification to intersections. As described in Chapter 8, there are no adverse effects attributable to air quality in 2017 or the 2025 and 2035 scenarios.

10.15.1 2025 Scenario

The environmental effects of traffic and noise on MMNHP from Hanscom planning concepts in the 2025 scenario are presented below.

Noise

In the 2025 scenario, none of the 31 noise analysis locations within, and no part of, MMNHP would be within the 65 dB DNL contour. The area of the park within the 55 dB DNL contour is projected to decrease in 2025 relative to the area in 2017. The DNL values at MMNHP sites would range from 45.5 dB to 53.6 dB. The highest level (53.6 dB) would occur at Noah Brooks Tavern (and Carriage House) (MM-13).

None of the 4.9-mile Battle Road Trail would be within the 65 dB DNL or 55 DNL contour in the 2025 scenario. It should be noted that a visitor to the Battle Road portion of the park is affected by the background noise of road traffic from Route 128/I-95 and Route 2A throughout most of the day.

Modeled DNL, TA65 and TA55 values at noise analysis locations along the Battle Road Trail indicate that predicted DNL and Time Above values along the trail are highest west of the Hartwell Tavern, reflecting the proximity of these sites to runways at Hanscom Field.

TA65 values ranged from 1.7 to 8.1 minutes at the 31 noise analysis locations with the highest levels occurring at Historic Farming Fields (MM-10 on Figure 10-12) in the Bedford Levels with value of 8.1 minutes in the 2025 scenario. TA55 values ranged from 18.8 to 66.8 minutes with the highest levels occurring at the Historic Farming Fields (MM-10) in the Bedford Levels in the 2025 scenario (Figure 10-13).

Traffic

Hanscom Field traffic remains a very small percentage of the overall volumes on the roadway in the 2025 scenarios. As discussed earlier in this chapter in 2018 Hanscom Field represented twp percent of peak hour traffic on Route 2A. Hanscom Field traffic is forecasted to remain stead at these levels in both the 2025 and 2035 scenarios. Hanscom AFB and other local and regional traffic sources account for the rest of the traffic volumes.

In both the 2025 and 2035 scenarios, Hanscom Field traffic would exceed ten percent of a single traffic movement at only one intersection on Route 2A in the MMNHP (#6) Route 2A/Hanscom Drive in Lincoln.

10.15.2 2035 Scenario

The environmental effects of traffic and noise on MMNHP from Hanscom planning concepts in the 2035 scenario are presented below.

Noise

In the 2035 scenario, none of the 31 noise analysis locations at MMNHP would be within the 65 dB DNL contour. The area of the park within the 55 dB DNL contour is projected to decrease in 2035 relative to the area in 2017. The predicted DNL values at MMNHP sites would range from 45.9 dB to 54.0 dB. The highest predicted level (54.0 dB) would occur at the Noah Brooks Tavern (and Carriage House) (MM-13). In the 2035 scenario, 0.4 acres of the MMNHP would be within the 55 dB DNL contour up from 0 acres in the 2025 scenario.

None of the 4.9-mile Battle Road Trail would lie within the 55 or 65 dB DNL contour in the 2035 scenario.

TA65 values would range from 1.9 to 8.7 minutes at the 31 noise analysis locations, with the highest levels occurring at Historic Farming Fields (MM-10) in the Bedford Levels in the 2035 scenario (Figure 10-12). TA55 values would range from 20.5 to 71.1 minutes, with the highest predicted levels occurring at the Historic Farming Fields (MM-10) in the Bedford Levels (Figure 10-12). Similar to the 2025 scenario, DNL and Time Above values, along the trail would be highest west of the Hartwell Tavern.

10.16 Environmentally Beneficial Measures

This section presents a summary of possible environmentally beneficial measures that have been identified to address the predicted effects of Hanscom Field on historical and cultural resources in the 2025 and 2035 scenarios. The development and implementation of these improvements would occur in the future in response to actual conditions and anticipated environmental effects. More discussion of potential strategies is presented in Chapter 11 Sustainability and Environmental Management.

Historic Resources

The inclusion of several tiered categories of updated information about historic resources in the *2017 ESPR* provides a comprehensive basis for future analyses in the event that a specific project is developed for implementation. These include the up-to-date compilation of National and State Registers-listed historic resources, the data on current MHC Inventory and MACRIS resources; and the results of the historic resources reconnaissance survey completed to capture other historic resources that are 50 years old or older in the *2012 ESPR* and updated in the *2017 ESPR*. Traffic measures discussed in Chapter 6 focus on improvements that do not require physical changes to the roadways, as Massport has limited operational impact on the ground transportation network in the area of Hanscom Field for the scenarios analyzed (existing, 2025 forecast, and 2035 forecast). Possible noise mitigation measures could include operational measures of a voluntary nature such as those reported in Chapters 7 and 11.

Archaeological Resources

Any disturbance in areas of archaeological sensitivity or near known archaeological sites has the potential to impact archaeological resources. The reconnaissance survey for the *2012 ESPR* and the *2017 ESPR* update will guide future studies to identify and evaluate these areas in the event that a specific project is contemplated. Possible measures, if they are needed, may include project design approaches to avoid an archaeological site or sensitive area, site protection during construction, or data recovery excavations if a site cannot be avoided.

Minute Man National Historical Park

Possible noise mitigation strategies to reduce effects on historical sites could include continued operational measures of a voluntary nature such as those reported in Chapters 7 and 11. The federal interagency working group that was formed to review impacts on MMNHP may provide specific recommendations in the future that should be considered. Future noise recommendations may also be derived from the NPS soundscape plan for MMNHP.

11 Sustainability & Environmental Management

Massport recognizes the importance of sustainability and seeks to incorporate and encourage sustainable practices as an integral component of the agency's general operating and development philosophy. Massport takes a holistic approach, managing its facilities to ensure economic viability, operational efficiency, natural resource conservation, and social responsibility. The organization's primary responsibility at Hanscom Field is to maintain a safe, secure, and efficient regional airport while minimizing the environmental impact of its operations. Massport's sustainability vision also includes a Resiliency Program, which exists to improve the ability of their infrastructure and operations to withstand disruptive events and recover within a reasonable timeframe.

This chapter provides a high-level overview of sustainable management concepts, the current state of practice in the airport industry, and specific sustainability initiatives in place at Hanscom Field. The chapter also includes Massport's approach to addressing climate change and increasing the resiliency of infrastructure and operations at Hanscom Field. Finally, the chapter covers Massport's Environmental Management System (EMS), and an update to the current, ongoing and planned environmentally beneficial measures.

11.1 Key Findings Since 2012

Massport is a leader among Massachusetts agencies in the promotion and implementation of sustainable design and operations. In 2015, Massport developed a Sustainability Management Plan (SMP) for Logan Airport and the following year, Massport published its first Boston Logan International Airport Annual Sustainability Report to document the progress and challenges of its sustainability initiatives included in the SMP. In 2018, Massport expanded the scope of the Sustainability and Resiliency Report[169] to include all of its facilities, including Hanscom Field. This report includes an added focus on resiliency efforts and climate change adaptation planning, reflecting Massport's commitment to strengthening facility operations, infrastructure, and workforce in the face of climate change. The addition highlights the fact that sustainability and resilience are interrelated concepts and both must be addressed to ensure the longevity of Massport facilities and investments. Massport's increased emphasis on resiliency also aligns with Massachusetts state-level guidance to address climate change through adaptation, risk mitigation, and increased resilience, as discussed in Section 11.3.

Massport continues to build on its efforts and commitments to sustainable development. Massport encourages that all new development, including development at Hanscom and by its tenants, meet the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) Silver certification requirements. [170] LEED certification is achieved through the incorporation of sustainability commitments in building design and operation, including energy efficiency, water efficiency, use of environmentally friendly building materials and products, reuse and recycling, and renewable energy.

Massport and Hanscom tenants are committed to reducing the environmental impact of their facilities and operations at Hanscom. Examples include:

- 222 solar photovoltaic (PV) panels on Massport's Hanscom Civil Air Terminal provide onsite renewable energy, reducing the facility's demand for power from offsite electricity sources. The 51 kW capacity solar installation currently supplies 4 percent of the Civil Air Terminal building's annual energy needs;
- Construction on Massport's permanent Airport Rescue & Firefighting (ARFF) and United States Customs and Border Protection (USCBP) facility broke ground in June 2018. The facility is designed to LEED Gold standards, including use of sustainable construction practices utilizing locally sourced building materials that were extracted, harvested or recovered, as well as manufactured within a 500 mile radius of the building site;

[169] Massport. 2018. *Sustainable Massport, Annual Sustainability & Resiliency Report.* http://www.massport.com/media/2774/massport-annual-sustainability-and-resiliency-report-2018_lr.pdf
[170] The U.S. Green Building Council LEED Green Building Rating System is a global framework to guide the development of sustainable, energy-efficient buildings.

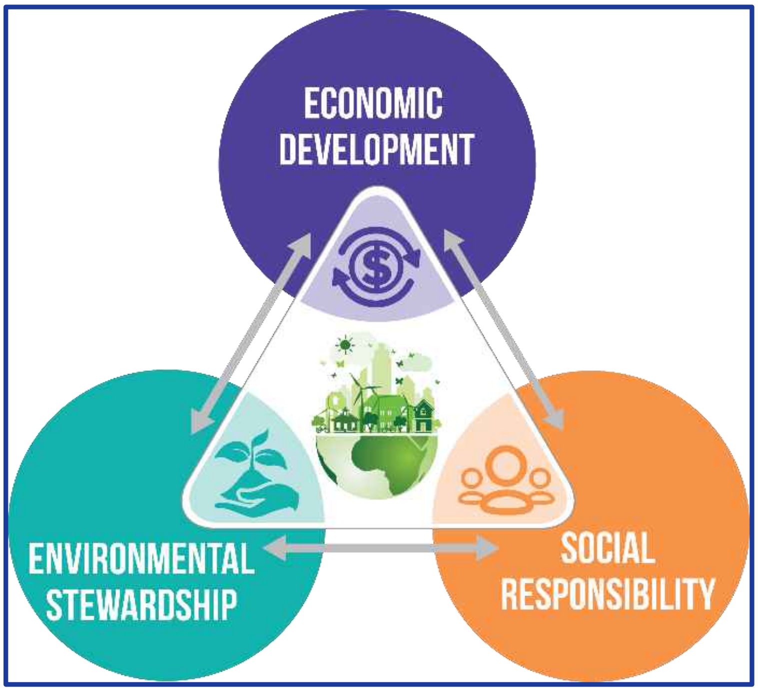
- Jet Aviation recently constructed a new hangar and fixed-base operator (FBO) facility which is built to LEED Silver standards, incorporating sustainable design elements such as high efficiency condensing boilers and LED lighting;
- A 200 kW rooftop solar PV system installed on Boston MedFlight's recently constructed hangar and corporate headquarters facility is designed to supply all facility electricity needs. The facility is also designed to LEED Silver standards; and
- All major tenants at Hanscom have a recycling program to redirect a portion of their facility waste from landfills.

11.2 Concept of Sustainability

The concept of sustainability acknowledges the inter-relationships among economic, environmental, and societal needs. One of the first widely accepted definitions of sustainability was developed by the World Commission on Environment and Development in 1987, and states that sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[171]

A sustainable approach to planning, design, construction, and operations considers three elements: 1) the economy, 2) the environment, and 3) society. Also called the "triple bottom line", this approach to sustainability is characterized by considering the balance and interconnectedness among the three elements. Balancing economic development, environmental stewardship, and social responsibility facets is a challenge for every organization to consider regarding sustainable development projects and sustainability initiatives.

Figure 11-1 Triple Bottom Line Concept (Economic, Environmental and Social)



[171] World Commission on Environment and Development (WCED). 1987. *Our Common Future*, the Report of the Brundtland Commission, published by Oxford University Press.

Finally, sustainability as a concept encourages the identification of and engagement with relevant stakeholders, as well as the tracking and reporting on key metrics in order to facilitate continuous improvement. While individual organizations can develop sustainability plans specific to their needs, there are some common guiding principles[172], including:

- Reduce reliance upon non-renewable resources such as fossil fuels, metals, and minerals;
- Reduce consumption of chemicals and other synthetic compounds that are not easily assimilated by biological systems;
- Reduce or reverse the progressive degradation of natural systems resulting from development and other human activities; and
- Help people meet their hierarchy of economic and social needs in fair and efficient ways.

As described further in Section 11.4, the airport industry has also added operational efficiency as a fourth element, or consideration, to the concept of sustainability, which reflects the specific needs of airports.

11.3 Regulations, Monitoring, & Reporting

Massport looks to voluntary guidance from the Commonwealth of Massachusetts concerning various sustainability, energy, and climate adaptation and resilience topics, in addition to complying with all mandatory regulations.

Operations and facility development at Hanscom are governed by both state and federal environmental regulations, which require monitoring and reporting to ensure compliance. Section 11.3.1 contains information concerning air quality, water quality, and hazardous waste regulations and guidance.

Massport has voluntarily adopted several proactive policies and programs to assist in monitoring environmental performance and to identify opportunities to improve Massport's environmental programs. These include an Environmental Management System (EMS) (refer to Section 11.5.1) and various reporting initiatives. As part of the EMS, an annual performance review is conducted, including a regulatory compliance audit, peer review and a third party ISO 14001 certification audit, which becomes the basis for selecting new objectives and targets for continuous improvement. The annual review evaluates environmental performance for a number of parameters, including energy efficiency and watershed protection.

[172] The Natural Step. 2018. *Approach and Sustainability Principles*. https://thenaturalstep.org/approach/

Since the development of its Sustainability Management Plan in 2015, Massport voluntarily publishes an Annual Sustainability and Resiliency Report that describes sustainability initiatives at all of their facilities, including projects implemented at Hanscom.

Non-mandatory state-level guidance that Massport considers:

- Executive Order 385 Planning for Growth (1996);
- Executive Order 438 State Sustainability Program;
- Executive Order 484 Leading by Example – Clean Energy and Efficient Buildings (2007);
- Global Warming Solutions Act (2008);
- Executive Order 569 Establishing an Integrated Climate Change Strategy for the Commonwealth (2016);
- State Hazard Mitigation and Climate Adaptation Plan (2018);
- Massachusetts Comprehensive Energy Plan (CEP);
- Statewide Resilience Master Plan (SRMP); and
- Massachusetts Department of Transportation (MassDOT) Statewide Climate Change Adaptation Plan.

Ongoing monitoring and reporting practices at Hanscom include:

- Use of the EMS to track, manage, and improve environmental compliance and performance;
- Annual *State of Hanscom* report;
- Annual Massport-wide Sustainability and Resiliency reports;
- Periodic Environmental Status & Planning Reports (ESPRs);
- Quarterly inspection of Massport facilities by a third-party to ensure environmental compliance,;
- Requirement for tenants to conduct an annual third-party environmental compliance audit for their operations at Hanscom; and
- All required reporting related to implementation of the Clean Water Act, described under Section 11.3.1, Water Quality.

Massport has voluntarily adopted several proactive policies and programs to assist in monitoring environmental performance and to identify opportunities to improve Massport's environmental programs. These include an Environmental Management System (EMS) (refer to Section

In addition, every year Massport prepares *The State of Hanscom* report which is presented to the Hanscom Field Advisory Commission (HFAC), a legislatively created body comprised of representatives from the surrounding residential areas, organizations, and members of the aviation community. The presentation to the HFAC provides stakeholders with an opportunity to discuss the role of Hanscom Field in the regional transportation system and Massport's objectives for the airport, including environmental and sustainability activities. The report notes that Massport meets its environmental commitments using a series of programs that include monitoring and auditing activities at Hanscom to ensure compliance with environmental regulations and the use of pollution prevention practices.

11.3.1 Required Environmental Regulations

Massport complies with a number of environmental regulations that are applicable at Hanscom. Compliance with state and federal regulations is handled through monitoring and reporting initiatives, which are further explained in the following sections.

Air Quality

The Federal Clean Air Act (CAA) requires that states meet and maintain National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter ≤10 microns (PM_{10}) and ≤ 2.5 microns ($PM_{2.5}$), lead (Pb), and nitrogen dioxide (NO_2). The U.S. Environmental Protection Agency (EPA) sets NAAQS at levels intended to protect public health and the environment. The Massachusetts Department of Environmental Protection (MassDEP) is the state agency responsible for monitoring outdoor air quality in Massachusetts and developing plans and regulatory programs to reduce emissions of pollutants that adversely affect public health, welfare, and the environment. The Greater Boston area, including the Hanscom Field communities, is currently in attainment with all Massachusetts and National Ambient Air Quality Standards (NAAQS). Refer to Chapter 8 for further information regarding air quality terminology, standards, and conditions.

At Hanscom, measures are taken to mitigate air quality impacts from facilities and operation, such as:

- **Utilizing the holding area at the head of Runway 23 to reduce minor aircraft delays and prevent associated emissions from engine idling;**
- **Using ultra low sulfur diesel fuel in Massport fleet vehicles;**
- **Encouraging FBOs to minimize aircraft auxiliary power unit use;**
- **Promoting the purchase of alternatively fueled ground service equipment for tenants, where appropriate;**
- **Considering alternative fuel vehicles for any new Massport vehicle purchase.**

Water Quality

The federal Clean Water Act (CWA) requires permits for pollutant discharges into United States waters from a point source and for stormwater discharges associated with industrial activities. Permits are issued under the Federal EPA's National Pollutant Discharge Elimination System (NPDES) Program. Presently, Massport holds a NPDES Multi-Sector General Permit for stormwater discharges at Hanscom. Massport requires that all development and facility operations conform to the requirements of the 2015 NPDES permit for Hanscom Field. All activities are also required to meet applicable standards for stormwater management required for site development or redevelopment by MassDEP.

Massport collaborates with MassDEP and the U.S. Air Force (USAF) to take actions to reduce impacts of Hanscom area activities on the Shawsheen River Watershed. Cooperatively, the agencies have assessed current impacts of stormwater through modeling of discharges in the drainage area. Massport continues to evaluate stormwater controls and BMPs for reducing peak runoff rates and increasing stormwater infiltration.

A major component of Massport's water pollution prevention program is the development and implementation of a comprehensive stormwater pollution prevention plan (SWPPP). Massport published its most recent Storm Water Pollution Prevention Plan (SWPPP) for Hanscom in October 2015, with subsequent updates to reflect changes in the facility and tenants, which integrates both stormwater management and monitoring components. As described in the plan, Massport and its tenants have implemented a number of programs and management practices to reduce the potential for pollutants to be released into the storm drainage system. Many of the ongoing practices are focused on education and implementation of pollution source reduction techniques, and improved handling practices. Best management practices (BMPs) for stormwater control include good housekeeping practices, preventative maintenance, material compatibility and system inventory, spill prevention and response, and employee training.

Massport will continue to reduce or eliminate potential water quality impacts from Hanscom Field in the future by:

- Tracking the progress of the Installation Restoration Program (for environmental cleanup) and the USAF's progress toward site closure as described in Chapter 9 Wetlands, Wildlife and Water Resources;
- Performing regular visual inspections of water quality at Hanscom Field stormwater outfalls in accordance with its SWPPP and the NPDES permit;
- Enforcing MassDEP’s policy requiring that stormwater runoff for new projects does not increase peak runoff rates;
- Implementing Hanscom Field's Spill Prevention Control and Countermeasure (SPCC) Plan to ensure that all of Massport operated storage tanks are in compliance with current regulations and to monitor the age, condition, and regulatory compliance status of these tanks on an ongoing basis through the Tank Management Program;
- Requiring that tenants conduct annual environmental audits to document compliance with tank regulations;
- Employing pollution prevention measures as they apply to site drainage, material storage, material transfer, truck unloading operations, and site security as part of the SPCC Plan;
- Providing annual spill, stormwater, and hazardous waste management training for Massport employees;
- Directing new development to areas with existing impervious surfaces and stormwater infrastructure;
- Identifying and removing existing impervious surfaces where feasible to increase infiltration;

- Installing weirs to reduce peak flows; and
- Placing floating booms at outfalls.

Hazardous Materials/Toxics

Hanscom Field is a Very Small Quantity generator (< 220 lbs. /month) of Resource Conservation and Recovery Act (RCRA) regulated hazardous waste and a Small Quantity generator (< 2,200 lbs. /month) of Massachusetts regulated hazardous waste.[173] Massport is committed to reducing the potential for the discharge and release of toxic materials, and pollution prevention is part of Massport's Storm Water Pollution Prevention Plan (SWPPP). Less toxic and non-toxic alternatives are evaluated and implemented where applicable. Massport and its tenants also adhere to Spill Prevention Control and Countermeasure (SPCC) Plans, ensuring that hazardous materials storage tanks are in compliance with regulations and monitoring them to maintain compliance.

Through Hanscom's EMS, Massport periodically looks for ways to reduce the use of toxic materials including evaluation of products for replacements with non-toxic alternatives. For example, solid-form sodium formate was selected for deicing at Hanscom after a careful evaluation of other options that were both FAA-approved and that met Clean Water Act receiving water standards.

Massport conducts a comprehensive annual audit, which began in 2016, to inventory chemicals in use and storage at Hanscom Field. In addition, improved tracking methods were employed to identify opportunities for reducing and eliminating the amount of hazardous materials on site. Massport initiated improved housekeeping strategies to consistently label and store hazardous chemicals and waste. Massport plans to further improve purchasing practices in order to eliminate duplicative product purchases. Reduction of toxic materials means that less hazardous waste is produced, thereby minimizing impacts to the environment and saving costs associated with waste disposal. In keeping with this goal, potential sources of spills or contamination are also carefully managed.

Massport also works with its tenants to identify ways to reduce the amount and toxicity of certain products used at Hanscom Field. Massport involves the tenants in achieving environmental compliance and pollution prevention, including providing ongoing technical assistance to tenants regarding new regulations and means for compliance through an inspection program conducted by the Environmental Management Unit. In addition, educational materials, including notices of upcoming regulatory requirements, are distributed on pollution prevention, stormwater best management practices, spill prevention and response procedures, and other topics.

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[173] MassDEP. November 2018. *List of Massachusetts Hazardous Waste Generators, November 13, 2018.* https://www.mass.gov/guides/hazardous-waste-generation-generators#generator-status-storage-limits

11.4 State of Practice in the Airport Industry

As noted previously, many airports have voluntarily adopted an approach to sustainability that accounts for the triple bottom line plus operations, or "EONS" (Economic vitality, Operational efficiency, Natural resources, and Social responsibility). The EONS approach emphasizes operational efficiency, which is a critical consideration of all airport sustainability initiatives. Due to an increased focus on the EONS approach to sustainability, many North American airports have begun or continue to issue regular environmental and/or sustainability reports, or develop formal Sustainability Management Plans (SMP).[174] There is also an increased focus on sustainable design and construction, and operations and maintenance of airport facilities. As of October 2017, there were LEED airport projects registered in almost all 50 U.S. states and over 40 foreign countries and territories.[175] Massport continues to stay abreast of these advancements and participates actively in many sustainability initiatives.

Figure 11-2 Airport Industry Concept of Sustainability (EONS)

Table 11-1 displays some resources available to agencies operating airports that have been developed or enhanced since 2012. These include resources from: Airports Council International (ACI) and its North American region (ACI-NA), Sustainable Aviation Guidance Alliance (SAGA), the National Academy of Sciences' Airport Cooperative Research Program (ACRP), and the Federal Aviation Administration (FAA).

[174] Airports Council International-North America (ACI-NA). September 2016. *2016 Environmental Benchmarking Survey*. https://www.aci-na.org/sites/default/files/envirobenchmarkingsurvey.pdf

[175] USGBC. October 2017. *USGBC Releases LEED in Motion: Transportation Report (Press Release)*. https://www.usgbc.org/articles/usgbc-releases-leed-motion-transportation-report

Table 11-1: Key sustainability resources developed or enhanced since 2012, for reference by agencies operating airports

Agency/ Organization	Resource/ Effort	Purpose
Airport Cooperative Research Program	ACRP conducts a variety of research to benefit airports	Publications cover many topics in the environmental field, including various aspects of sustainability as related to airports.[1]
ACI-NA	Environmental Affairs Committee, Sustainability Working Group[2]	Provides guidance and industry best practices on environmental management, sustainability, regulations and policies applicable to airports and their tenants.
	Environmental Goals	Updated goals in 2015, including specific actions airports may consider to meet the goals based on the unique requirements of their individual facilities.[3]
	Environmental Benchmarking Survey	Provides insight into industry environmental management activities and collective progress on sustainability initiatives.
ACI World	World Environmental Standing Committee	Provides guidance and industry best practices on environmental management and sustainability initiatives applicable to airports and their tenants. ACI also developed the Airport Carbon Emissions Reporting Tool, a framework to develop greenhouse gas emissions inventories for airports.[4]
FAA	Airport Improvement Program (AIP) Grants	Assist airports in sustainability planning, energy efficiency, and renewable energy projects.
	Sustainable Master / Management Plan Guidance	FAA developed lessons learned guidance from the Airport Sustainable Master / Management Plan pilot program.[5]
	Solar and Recycling Guidance	FAA published a memo in 2014, "Guidance on Airport Recycling, Reuse and Waste Reduction Plans".[6] and updated the "Technical Guidance for Evaluating Selected Solar Technologies at Airports".
SAGA	Sustainable Aviation Guidance Alliance Database	Comprehensive list of sustainability strategies, practices, projects and technologies at airports, serves as free resource to airport operators.[7]

Notes:
1. Airport Cooperative Research Program, http://www.trb.org/ACRP/ACRP.aspx .
2. Massport is a member of ACI-NA, and staff serve on the Environmental Affairs Committee.
3. Airports Council International-North America (ACI-NA). 2018. *ACI-NA Environmental Goals*. www.aci-na.org
4. ACI World. *Airport Carbon Emissions Reporting Tool (ACERT)*. https://aci.aero/About-ACI/Priorities/Environment/ACERT/
5. FAA Airport Sustainability website, https://www.faa.gov/airports/environmental/sustainability/.
6. FAA Recycling Guidance, https://www.faa.gov/airports/environmental/media/airport-recycling-reuse-waste-reduction-plans-guidance.pdf
7. Sustainable Aviation Guidance Alliance (SAGA) database. http://www.airportsustainability.org/

Massport is committed to minimizing the impact of its operations on both the natural and human environments through a wide array of initiatives and programs. These include:

- Environmental Management System;
- Sustainable Planning, Design, and Construction;
- Sustainable Operations and Maintenance;
- Climate Adaptation and Resiliency;
- Regional Economic Contributions; and
- Social Sustainability initiatives.

11.5 Sustainability at Hanscom Field

This section provides details of Massport's current and planned sustainability practices at Hanscom Field which fall into the categories above.

11.5.1 Environmental Management System

The International Organization for Standardization (ISO) 14000 series of international standards address environmental management issues associated with the activities, products, or services provided by an organization. The standards are designed to be applicable to organizations of any type and size. The voluntary program involves creating an Environmental Management System (EMS), to include a corporate environmental policy, environmental performance evaluation, and comprehensive system auditing. This process allows for continual evaluation and improvement in environmental performance.

In November 2000, the Massport Board approved an Environmental Management Policy that states, "Massachusetts Port Authority (Massport) is committed to operate all its facilities in an environmentally sound and responsible manner. Massport will strive to minimize the impact of its operations on the environment through the continuous improvement of its environmental performance and the implementation of pollution prevention measures, both to the extent feasible and practicable in a manner that is consistent with Massport's mission and goals."

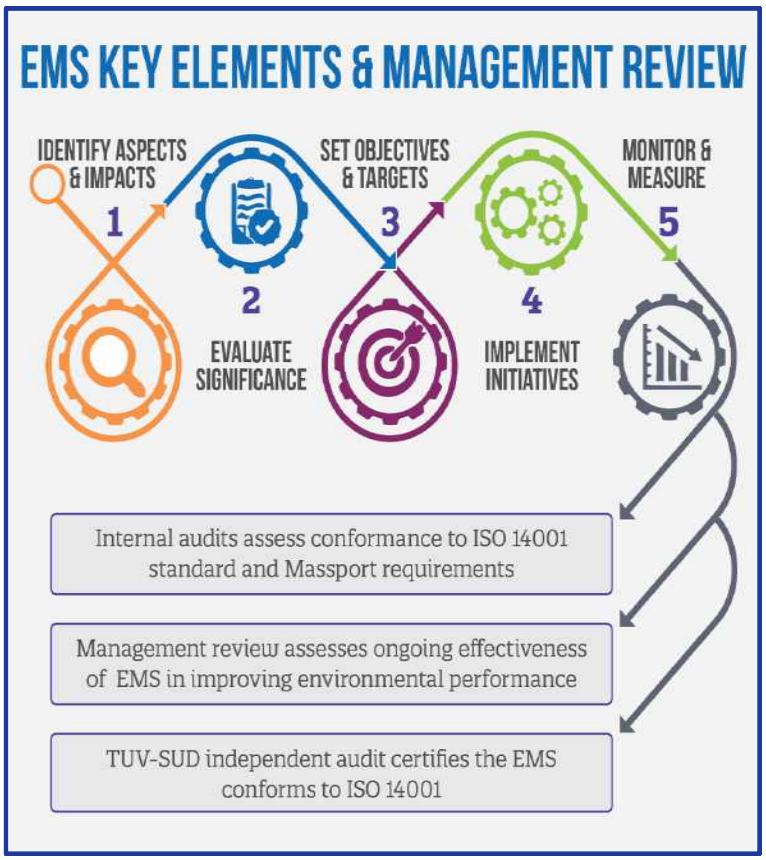
In order to successfully implement its environmental management policy, Massport is committed to developing and maintaining management systems designed to:

- Ensure that the environmental management policy is available to staff, tenants, customers and the general public;
- Ensure compliance with all applicable laws and regulations;
- Ensure that environmental considerations are included in the business, financial, operational, and programmatic decisions, including feasible and practicable options for potentially exceeding compliance with applicable regulatory requirements;

- Define and apply sustainable design principles in the planning, design, operation and decommissioning of its facilities;
- Define and establish environmental objectives, targets, and best management practices and monitor performance;
- Provide training to and communication with staff and affected tenants regarding environmental goals, objectives, and targets and their respective roles and responsibilities in fulfilling them;
- Incorporate monitoring of Massport and Massport tenants' environmental activities;
- Include the preparation of an annual environmental performance report, which will be made available to staff, tenants, customers and the public.

In May 2001, Hanscom Field became the first airport in the U.S. to receive ISO 14001 certification through the development and implementation of its Environmental Management System (EMS). The EMS provides a mechanism for systematic identification and prioritization of risks and opportunities for improvement by setting objectives and targets that are evaluated at regular intervals.

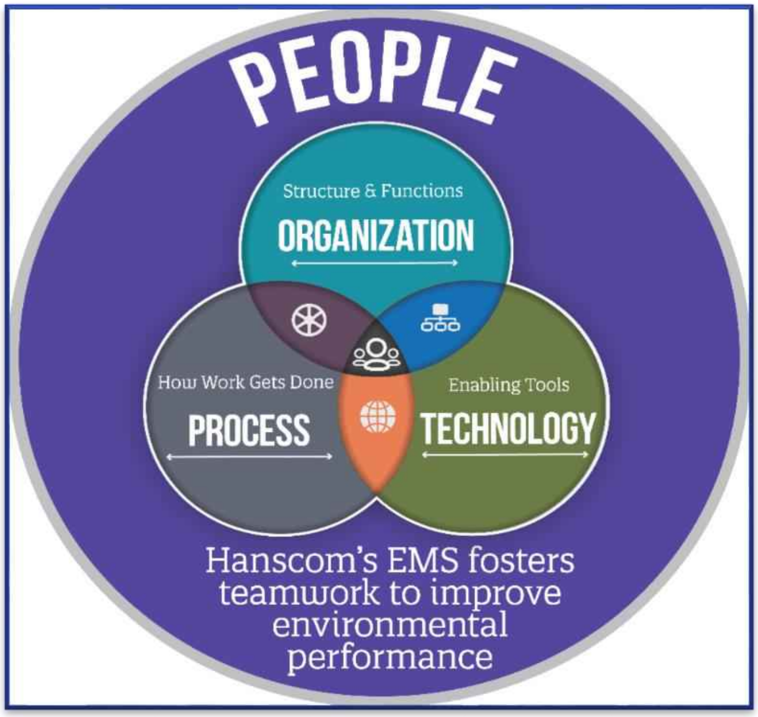
Figure 11-3 EMS Key Elements & Management Review



Massport's ISO 14001 certification requires regular third party audits to ensure that it demonstrates continued improvement. These are performed by an internal auditor annually and then by a third-party auditor every three years. At Hanscom, key EMS objectives include: reducing energy use, reducing hazardous material use, reducing the amount of contaminants entering storm water systems, increasing tenant solid-waste recycling, improving housekeeping methods to safely store and label hazardous materials, and ensuring employee and tenant training initiatives are completed. Hanscom Field's most recent EMS ISO re-certification audit was conducted in May 2018.

Hansom's EMS fosters teamwork to improve environmental performance. The EMS provides a framework to improve the structure and functions of the organization, enhance processes for getting work done, and incorporate technologies that enable continuous improvement. Hanscom leadership engages in efforts to focus on their "people" who support the EMS efforts by working toward greater staff engagement, enhancing information flows, and maintaining effective documentation. In this regard, management review is a key element to the EMS at Hanscom Field. Senior managers regularly review the EMS, ensure adequate resources are available, and determine next steps. A management review meeting is held annually to review the results of periodic audits and to determine if changes to the system are required.

Figure 11-4 Massport Environmental Management System Concept



In addition, Massport employees are regularly trained to ensure awareness of risks to the environment associated with facility operations, to support continued ISO 14001 certification, and to facilitate continuous improvement. Training topics include compliance requirements such as the management of hazardous materials and waste, stormwater pollution prevention, and spill prevention and response.

11.5.2 Sustainable Planning, Design, and Construction

Massport provides regular updates on its development activities and project updates at Hanscom Field through monthly Hanscom Field Advisory Commission (HFAC) meetings and the annual *State of Hanscom* reports. Public outreach and information sharing is facilitated with local stakeholders including the towns of Bedford, Concord, Lexington, and Lincoln, as well as the Hanscom AFB and the Minute Man National Historical Park.

The *2017 ESPR* is intended to provide baseline conditions and a comprehensive review of the cumulative environmental effects of development and operations at Hanscom Field to inform the planning and review of future activities and projects. Individual environmental filings are required for any specific project that meets or exceeds the Massachusetts Environmental Policy Act (MEPA) or the National Environmental Policy Act (NEPA) regulatory threshold for review.

Massport encourages sustainable and resilient planning, design, and construction of all development at Hanscom through:

- Use of Massport's Sustainability and Resiliency Design Standards & Guidelines;
- Encouraging LEED certification (Silver or better);
- Locating new water, sewer and stormwater drainage systems within already developed areas when feasible;
- Implementing soil erosion and sediment control measures during construction;
- Designing facilities that require septic systems in accordance with Title 5 regulations;
- Using BMPs to ensure that relevant stormwater runoff rates are not increased both during construction and in future operating conditions;
- Minimizing impacts to undeveloped areas.

Under MEPA, proposed projects are subject to a project-specific environmental review process with opportunities for public comment. Many projects subject to NEPA also have opportunities for public comment.

Massport is not subject to local zoning; however, projects involving work within wetland resource areas or their buffer zones involve applications to the appropriate conservation commissions for permitting as required under the Massachusetts Wetlands Protection Act. Massport takes every precaution to avoid, minimize, and mitigate potential wetland impacts of development.

The opening of a renovated facility and related site upgrades by Jet Aviation, a long-time Hanscom tenant, is a prime example of a project designed and implemented using sustainable planning, design, and construction principles. In 2017, Jet Aviation opened a newly constructed 40,000 square foot hangar, office and commercial space, and Fixed Base Operator (FBO) facility. In addition, upgrades were made to its ramp, apron, entrance roadway, parking and utilities onsite.

The upgraded facilities are designed to improve safety and efficiency while decreasing the environmental impacts associated with the facility. It was designed and built in accordance with LEED Silver certification standards. Key sustainable design elements include energy efficient LED lighting, condensing boilers, radiant flooring, water conservation technologies related to landscaping and water reuse, and

Figure 11-5 Jet Aviation Hangar Built to LEED Standards

use of recycled materials for building construction. Jet Aviation is ISO 14001 and OHSAS 18001 certified, maintaining an EMS to foster continuous environmental improvement.

Sustainability and Resiliency Design Standards and Guidelines (SRDSG)

Massport adopted a comprehensive set of standards and guidelines for sustainable planning, design, and construction in 2009, followed by an updated version released in December of 2018.[176] The Sustainability and Resiliency Design Standards and Guidelines (SRDSG) are available electronically as a resource for architects, engineers, and planners working on Massport capital projects, as well as tenants and third-party developers of Massport properties.

The SRDSG includes general standards relating to project management, documentation, public involvement, systems commissioning, and operational and maintenance programs. It also includes guidance on project site design and project materials. The guidelines cover energy management and efficiency measures, air quality measures, water management and efficiency measures, and measures to improve indoor air quality and occupant comfort. Examples of technologies encouraged in the SRDSG include natural day-lighting, passive solar gain, natural cooling, energy-efficient HVAC equipment, environmentally beneficial building materials, and energy use monitoring.

LEED Certification

Massport encourages all development projects greater than 20,000 square feet in size strive to meet the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) Silver certification requirements or better. The LEED Green Building Rating System was established in 2000, as a third-party certification program for "the design, construction, and operation of high performance green buildings." The LEED rating system can be used to evaluate many project types, including new construction, renovations, retrofits, and the operation of existing buildings.

According to the USGBC and substantiated by many case studies, LEED buildings generally:

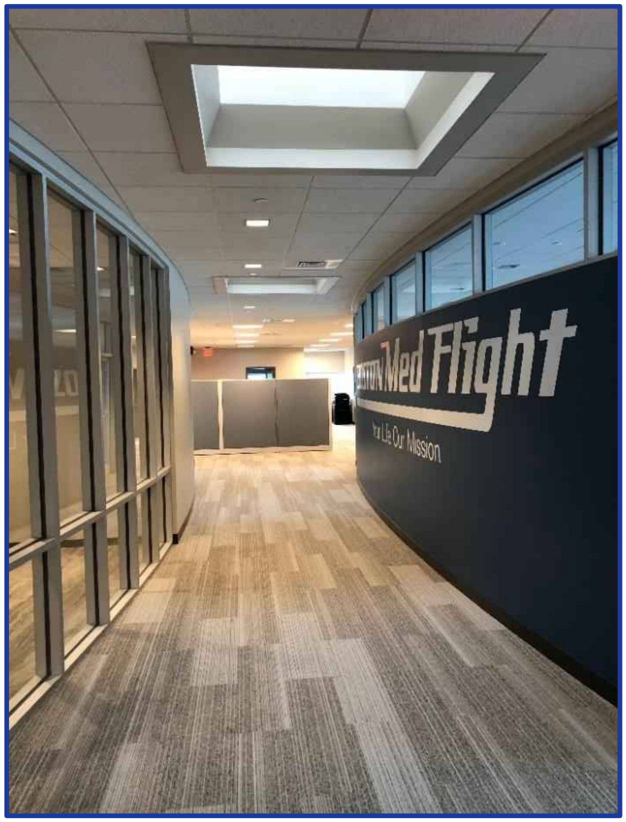
- **Cost less to operate and maintain;**
- **Generate higher energy and/or water-efficiencies;**
- **Demonstrate higher rent values than conventional buildings in their markets;**
- **Provide a healthier and safer indoor environment for occupants;**
- **And embody the environmental or sustainability values of the organizations that build, own, and occupy them.**

[176] Massachusetts Port Authority, *Sustainability and Resiliency Design Standards and Guidelines (SRDSG)*. December 2018. Available at: http://www.massport.com/media/3111/massport-sustainability-and-resiliency-design-standards-and-guidelines-dec2018.pdf

To obtain LEED certification, building designs must be registered with USGBC for review and verified through a third party. LEED provides the framework for a point-based rating system in which the number of points achieved across a number of "impact categories" are awarded based on the number of sustainable design elements incorporated.[177] The number of points achieved determines which of the four increasingly stringent levels of LEED certification a project is eligible to obtain (Certified, Silver, Gold, and Platinum). The USGBC also provides training and accreditation for design professionals.

In June 2018 Massport began constructing its permanent ARFF and United States Customs and Border Protection (USCBP) Building facility at Hanscom Field, which is designed to LEED Gold standards (and currently seeking certification). Sustainability considerations were incorporated throughout the buildings' planning, design, and construction phases. Innovative whole building energy simulation modeling was utilized by architects during the design process to optimize energy performance, projected to achieve 30 percent energy savings. Materials for the building were locally sourced within a 500 mile radius of the building site, to reduce emissions associated with transporting them. The building incorporates efficient plumbing fixtures and components which aim to reduce its operational water consumption by 45 percent. It also takes advantage of natural day lighting and windows to decrease energy use necessary for lighting purposes.

Figure 11-6 Boston Medflight Facility Utilizing Large Skylights for Day-lighting



At Hanscom Field, tenant facility designers are also encouraged to achieve higher levels of LEED certification through the incorporation of innovative sustainable design and operational elements. Rectrix achieved many credits toward LEED certification for its newly constructed hangar and fixed base operator facility. Boston MedFlight's new hangar and headquarters facility meets LEED Silver standards as well. Key green features incorporated into the design of these facilities include day-lighting, energy-efficient systems, and use of environmentally friendly and locally sourced building materials.

[177] U.S. Green Building Council. LEED Green Building Certification System, FAQ. https://www.usgbc.org/sites/default/files/Docs3330.pdf.

Hanscom AFB, although not a Massport facility or tenant, is in close proximity to Hanscom Field and continues to increase the efficiency and resiliency of facilities on their property, designing to LEED standards when possible. The Massachusetts National Guard, Joint Force Headquarters facility (located on the AFB and opened in 2013) is designed to LEED Gold standards, incorporating energy modeling design, regenerative elevator drives, point-of-use controls, and no-irrigation landscaping, among other sustainable design features. Hanscom Middle School is another example of a new facility located on the AFB (opened in 2016), which is designed to LEED Silver standards, incorporating sustainable features such as solar power, a green roof, stormwater capture systems and bio-treatment capability. In terms of increasing resilience, Hanscom AFB is one of two bases in the Air Force that is participating in the "Energy as a Service" pilot study intended to develop examples of viable strategies for partnering with industry to improve the capability of the Air Force to provide on-base electric utility systems[178], a component of which may eventually involve installation of a solar facility on-site at Hanscom AFB.

Energy Efficiency and Renewable Energy

Energy efficiency and renewable energy requirements are often stipulated in the environmental permitting documents and commitments as well as lease agreements. In addition to following the SRDSG and supporting the LEED credits for energy in new or rehabilitated buildings, Hanscom Field has invested a significant effort into post-construction energy-efficiency projects as well. For example, once in operation, Massport's new ARFF and USCBP facility is expected to obtain 70 percent of its electricity from off-site renewable energy sources over a 2-year period.

Massport invested in a roofing system on Hanscom's Civil Air Terminal which includes a 51-kilowatt capacity solar photovoltaic (PV) facility comprised of 222 solar panels. The solar panels are mounted on the roof and on the south facing wall of the structure and installation was

[178] Official United States Air Force Website. "Air Force seeks energy innovation ideas." July 21, 2017. https://www.safie.hq.af.mil/News/Article-Display/Article/1254551/air-force-seeks-energy-innovation-ideas/

completed in 2011. The system was modeled to produce over 57,233 kilowatt-hours (kWh) of electricity per year, or up to 10 percent of the total building electricity requirement.

Figure 11-7 Solar PV Panels on Hanscom Field Civil Air Terminal

In addition, Massport partnered with Hanscom AFB, MIT Lincoln Laboratory (MIT-LL), U.S. Air Force Office of Energy Assurance and Massachusetts Military Asset & Security Strategy Task Force on an application to the Massachusetts Clean Energy Center, Community Microgrids Program through which the Hanscom community received funding for a microgrid feasibility assessment. The program is intended to advance community microgrid projects through their early feasibility stages in order to set the stage for future investment. It intends to develop community microgrids in the state to improve efficiency, decrease GHGs, lower energy costs, and increase resilience. This specific microgrid would be intended to support the assets of the partner organizations and ensure Hanscom Field maintains power to serve as a reliever air field to Logan Airport during regional emergencies and natural disasters.[179]

Figure 11-8 Boston MedFlight's 200 kW Rooftop Solar PV Installation

Hanscom tenants have also taken on their own innovative projects to increase energy efficiency and embrace renewable energy options. Several tenants report replacing conventional lights with LED lighting in their buildings and hangars. Jet Aviation retrofitted its existing hangar with LEDs and reported a return on investment after four months. In addition, four tenants utilize radiant floor heating to reduce the energy needs of their facilities while maintaining occupant comfort.

Boston MedFlight's recently constructed hangar and corporate headquarters incorporates a rooftop 200 kW solar PV facility, designed and optimized to meet all electrical needs of the facility on a typical summer day. The facility

[179] Massachusetts Clean Energy Center. "Community Microgrids Program: Feasibility Assessment Award Summary." http://files.masscec.com/Community%20Microgrid%20Awardee%20Summary.pdf

was designed with three high-efficiency gas fired boilers to supply potable hot water. The boilers also supply water for the radiant heat system that heats the 19,000 square foot hangar floor, 10,000 square foot aircraft apron, and 3,000 square foot ambulance bay floor.

An innovative energy saving design feature of the facility is a translucent hangar door which allows natural light to enter the hangar during the day, minimizing the use of the photo-sensitive hangar lighting system. Skylights were also designed throughout the building to take advantage of day-lighting and minimize the need for supplemental lighting, although LEDs were installed as well to allow for efficient lighting (as shown in Figure 11-7).

Figure 11-9 Translucent Hangar Door Allows Natural Light to Enter Boston MedFlight's Hangar

Water Efficiency and Wastewater Reduction

In addition to encouraging sustainable and resilient design elements outlined in the SRDSG and supporting the LEED credits for water efficiency and wastewater reduction in new or rehabilitated buildings, Massport continuously seeks opportunities to manage water resources more sustainably at Hanscom Field. Massport has installed low-flow faucets that include automatic water shut-off throughout its facilities, as well as installation of low-flow toilets. Efficient plumbing fixtures and building components at the new ARFF and USCBP facility are expected to reduce water use by 45 percent.

Tenants at Hanscom have also made investments in technologies to improve efficiency of water use. Ross Aviation Rectrix reports utilization of low-flow fixtures in their facility to decrease water consumption. Another tenant incorporated rain sensor technology into the design of their landscape irrigation system, which results in decreased water consumption necessary for landscaping. Boston MedFlight has incorporated drought-tolerant landscaping to reduce water needs. They also designed water-saving plumbing fixtures into their facility, installing showers, bathroom faucets, kitchen sinks, water closets, and urinals that are more efficient than required by code.

Sustainable Construction Measures

Massport has established requirements for construction contractors that are aimed at minimizing environmental impacts, included in the *Massport Guide to Tenant Construction*. As part of its project approval process, Massport requires contractors to adhere to construction guidelines relating to:

- Construction debris and demolition waste recycling;
- Selection of high-efficiency space heating/cooling systems;
- Manage use of excess construction soil (Soil Management Plan); and
- The Clean Construction Initiative, which requires contractors to retrofit their heavy equipment with advanced pollution control devices during construction of all Massport projects.

In addition to enforcing the use of the construction guidelines, Massport actively seeks opportunities to employ environmentally friendly technologies.

Massport seeks to mitigate the impacts of construction projects at Hanscom Field as much as feasible, in order to limit the impact on surrounding communities and neighboring lands. Massport recognizes that construction projects may cause short-term impacts such as increased noise, increased emissions from the exhaust of construction equipment, and fugitive dust generated from earth moving activities. Contractors are recommended to retrofit heavy construction equipment such as front-end loaders, backhoes, cranes and excavators with advanced pollution control devices, such as oxidation catalysts and diesel particulate filters to mitigate emissions impact of construction projects.[180] These devices filter and break down emissions from diesel fuel burn, including hydrocarbons, particulate matters and carbon dioxide. Massachusetts state Anti-Idling law is also

Construction-Period Traffic Management Plans will include the following components:

- **General project information;**
- **Expected work hours;**
- **Delivery and construction truck routes;**
- **Worker access and parking plans;**
- **Track unloading and staging;**
- **Construction site signs;**
- **Protection of utilities; and**
- **Noise and dust control measures.**

[180] Massport Sustainability and Resiliency Design Standards and Guidelines, 2018.

applicable during construction; equipment is not authorized to idle for any longer than five minutes unless it is in active operation.

Control measures are undertaken to mitigate emissions impacts of fugitive dust generated during construction as a result of disturbing dry soil. Fugitive dust emissions are temporarily mitigated through the use of vehicle wash stations and the application of water to exposed soils. Some projects may require long- term mitigation strategies such as seeding or mulching to remove the chance of soil erosion as a result of dry or windy periods.

Prior to any temporary period of construction, Massport will develop a project specific Construction-Period Traffic Management Plan to be published and accessible prior to construction.

The Plans are intended to improve communication with neighboring communities regarding construction projects, in order to reduce impact as much as possible. Plans are provided to the HFAC prior to construction. When feasible, construction will occur on weekdays between 7:00 AM and 7:00 PM, or as consistent with local noise ordinances. In some circumstances, specialized construction activities may be warranted and require work outside this targeted period.

11.5.3 Sustainable Operations and Maintenance

Massport has several programs in place that contribute to the sustainable operation and maintenance of the airport and its facilities. These programs are described below.

Energy Efficiency

In addition to promoting energy efficiency in planning, design, and construction, Massport strives for continuous improvement in operational energy efficiency. At Hanscom Field, digital energy meters were installed to obtain more accurate energy consumption data. The digital energy metering systems provide data necessary for annual reporting and review through the Massport EMS. Hanscom will continue to consider opportunities to re-lamp facilities, airfields, and streetlights with LED systems. In addition, automatic, power-saver light switches will also be evaluated for installation.

Massport is upgrading electrical and fire protection infrastructure at various locations through the airfield as needed. Administrative offices were moved to pre-existing empty office space in the Civil Air Terminal, in order to consolidate resources and decrease the Massport administrative facility foot print.

Clean Fuel Vehicle Programs

As part of the Clean Fuel Vehicle Program, Massport has made progress in bringing alternative fuel vehicles (AFVs) into its fleet at Hanscom Field. At present, Massport owns fifteen fleet vehicles at Hanscom Field, two of which are electric. In addition, several tenants have switched to electric tugs for moving aircraft, resulting in reduced emissions at the airport. Jet Aviation uses six electric tugs; Signature uses one electric ground service equipment (eGSE) and North Star Facilities owns two electric vehicles. Rectrix maintains four eGSE and two electric fleet vehicles.

Massport will continue to consider AFVs for new vehicle purchase in the future, when appropriate. Any new conventional-fueled vehicle added to the Hanscom fleet in the future will have very low emissions and will automatically comply with the low emission goals of the federal Clean Fuel Fleet Program (40 Code of Federal Regulations Part 88). As part of these regulations, ultra-low-sulfur diesel fuel for on-road diesel vehicles was phased in starting in 2005.

Recycling

Since the *2012 ESPR*, Massport has continued waste reduction efforts, focusing on single-stream recycling, which enables recycling of a wider range of materials than the previous system. Massport's recycling rate increased by 1.8 percent between 2012 and 2017. Massport also expanded their battery-recycling program in 2017 to include all facilities, recycling 1,250 lbs. of batteries that year alone. In addition, 40 tons of e-waste were recycled Authority-wide between 2012 and 2017.[181] Massport aims to increase the recycling rate to 60 percent by 2020.

At Hanscom facilities, scrap metal is recycled in addition to traditional paper, cardboard, metal, plastic and glass. Hanscom and tenant facilities are provided with recycling dumpsters from Massport.

All FBO tenants at Hanscom have a recycling program for some portion of their facility waste, as reported for the 2017 EMS audit. Jet Aviation recycled 68,000 pounds of single stream recycling in 2017. Rectrix recycles one hundred percent of their paper, plastics, cans, glass, and oils. Stream Enterprises collects waste oil, light bulbs, and batteries and recycles them annually. Signature Flight Support recycled over 52,000 pound of plastic, 574,000 pounds of paper, and 10,000 pounds of aluminum.

11.5.4 Climate Adaptation and Resiliency

Since 2012, Massport has increased their Authority-wide focus on climate adaptation and resilience, incorporating a Resiliency Program in 2014, which seeks to integrate resiliency principles, planning, and implementation into all of the authority's business strategies and operations.

Massport completed a climate change risk assessment for the entire organization in 2014 and issued a Floodproofing Design Guideline the next year, providing guidance to enhance the resiliency of critical assets through the use of measures such as temporary flood barriers, flood-

[181] Massport. 2018. *Sustainable Massport, Annual Sustainability & Resiliency Report*. http://www.massport.com/media/2774/massport-annual-sustainability-and-resiliency-report-2018_lr.pdf

resistant doors and hatches, and drainage collection systems or sump pumps. In 2017, Massport reviewed and improved its Flood Operations Plan. Authority-wide climate adaptation and resiliency efforts will be translated to Hanscom Field and other Massport facilities through the EMS framework.

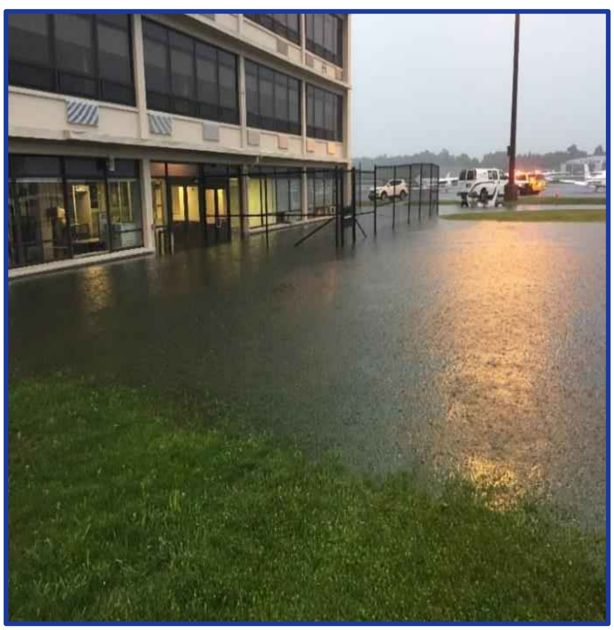
Massport Resiliency Application:

1. **Facilitates oversight of heavy precipitation and/or flooding events impacting Massport infrastructure;**
2. **Informs decision-making during a flood event where Massport flood operations plans may be or have been activated;**
3. **Enables real-time field updates via mobile devices regarding:**
   - ⇨ **Flood water encroachment;**
   - ⇨ **Barrier and resource deployments;**
   - ⇨ **Track unloading and staging;**
   - ⇨ **Equipment status or activity milestones Protection of utilities; and**
   - ⇨ **Site inspections.**

Additionally, Massport has developed a resiliency software application to help prepare for, respond to and recover from severe weather impacts, specifically flood-related damage due to tidal flooding, surge and/or heavy precipitation. The application was developed in response to several Nor'easters that impacted the Greater Boston region during the winter of 2017-2018. This application can be utilized at any Massport facility.

Massport recognizes that maintaining and improving facilities at Hanscom is critical to ensuring a viable regional transportation system and for emergency response. At Hanscom, examples of vulnerabilities have arisen including damage of T-hangars during a winter storm in 2014-2015, and flooding in the Civil Air Terminal due to heavy rain in 2017 (See Figure 11-10). The flash flooding resulted in 30 inches of water flooding the first floor of the building, causing $1.4

Figure 11-10 Flooding at the Civil Air Terminal Facility and Hanscom Field, 9/2017



million in damages. These events underscore the importance of Massport's efforts to evaluate and increase the resiliency of their facilities. Massport plans to develop a more robust resiliency plan for Hanscom in the near future.

Massport has undertaken initiatives to assess the vulnerability of Hanscom assets to climate change impacts, which has informed efforts to strengthen infrastructure at Hanscom. To address flooding risks to the Civil Air Terminal, Massport funded an evaluation of the facility's drainage system and flood proofing enhancements to the building. Recommendations were provided in order to decrease risks from flooding and improve stormwater management practices. Implementation of these recommendations has begun. For example, a new airfield lighting generator was installed in the fall of 2018 that complies with the Floodproofing Design Guidelines.

11.5.5 Regional Economic Contributions

Due to its unique location and facilities, Hanscom provides many economic benefits to its region. Hanscom serves as a vital link to domestic and international destinations for individual pilots, commuter airlines and local employers, including innovative technology corporations, research and development firms, and educational institutions. Businesses look for accessible air travel when deciding where to locate, and Hanscom provides them with easy access to corporate travel opportunities.

The Massachusetts Department of Transportation, Aeronautics Division conducts periodic airport economic impact studies every 3 to 5 years, which includes information concerning the economic impact of regional airports, including Hanscom Field. The most recent study was published in March 2019.[182] It was determined that Hanscom Field activity (excluding military impacts) results in 2,243 jobs. Annual wages for those workers whose employment is directly related to airport activity are nearly $134 million. Hanscom Field generated estimated economic benefits of approximately $679 million when direct, indirect, and induced economic benefits of the airport were aggregated. Estimated economic benefits described above do not include economic benefits generated by Hanscom AFB.

11.5.6 Social Sustainability Initiatives

In recognition of the triple bottom line, Massport undertakes a number of partnerships and joint efforts with and for external stakeholders. For Hanscom Field, social sustainability emphasizes good community relations, productive stakeholder engagement, charitable contributions, support for education and youth programs, and environmental efforts that create community benefits. Massport often coordinates efforts with the four towns surrounding Hanscom: Bedford, Concord, Lexington, and Lincoln.

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[182] Massachusetts Department of Transportation, *Massachusetts Statewide Airport Economic Impact Study Update*. March 2019. Available at: https://www.mass.gov/files/documents/2019/03/25/AeroEcon_ImpactStudy_January2019.pdf

Hanscom Field's social sustainability initiatives since 2012 include promoting a variety of initiatives focused on bringing benefit to a variety of Massport employees, tenants, and community members. Electronic-waste collection events were held in honor of Earth Day in both 2013 and 2015, providing a forum to prevent hazardous electronic waste from entering landfills. In addition, half of Hanscom's tenants report having an Employee Wellness Program in effect.

Massport invests in a variety of programs to benefit local organizations located in communities that host its facilities, including making charitable contributions and sponsoring scholarships, summer internships, and community summer jobs. The donations and training opportunities are intended to serve a diverse constituency and a support a wide variety of worthwhile purposes. For example, in 2017, Massport contributed over $7,000 to educational, scholarship, and youth programs in the Hanscom area. Additionally, Massport provided approximately $12,000 to sponsor summer internship positions at various municipal departments in the four towns surrounding Hanscom. They also invested in future leaders by spending over $14,000 to support the salaries of local college students that worked directly for Massport.

Massport is also focused on increasing public accessibility to the parks and open space near Hanscom. Massport maintains a 40-acre conservation area and local trail network. Massport worked closely with the towns of Bedford and Concord to develop the two-mile trail network and incorporate new trails into existing trail networks at the Mary Putnam Webber Wildlife Preserve and the Dellovo and Vanderhoof conservation areas in Bedford, as well as open space parcels in Concord. The trails allow community members to enjoy their natural surroundings and take advantage of Massport conservation efforts. Massport supports community gardening initiatives through its lease of MPA property to Gaining Ground. Gaining Ground is a non-profit organic farm that grows and donates fresh produce to support regional meal programs and food pantries. Massport also worked closely with the National Park Service to complete a noise outreach program.

In addition, Massport continues updates to its Vegetation Management Plan (VMP) in conjunction with the conservation commissions of the four surrounding towns. This plan ensures that vegetation which grows into Hanscom airspace is managed in an environmentally sensitive manner, with public input. In 2014, the most recent 2014-2018 VMP Update was approved. Obstructions on Hanscom's four runway ends have been mitigated following the recommendations included in the VMP. In 2017, preparation for the 2019-2023 VMP Update began and development continued throughout 2018. The Plan is expected in 2019.

11.6 Environmentally Beneficial Measures

Previous chapters of the *2017 ESPR* have assessed the environmental impacts of Hanscom Field operations for the baseline year of 2017, analyzed historic environmental trends using information from past reports, and considered the potential future effects of operations and development scenarios for future years 2025 and 2035. The *2017 ESPR* future scenarios are used to evaluate the potential cumulative environmental effects that could occur if Hanscom Field reaches the airport activity levels that that are described in Chapter 3 Airport Activity Levels.

The aviation activity forecasts that are described in Chapter 3 provide for a realistic and practical level of growth based on local and national aviation trends, including forecasts from the New England Regional Aviation System Plan. The 2025 and 2035 scenarios represent estimates of what could occur in the future, using certain planning assumptions, and are not considered recommended outcomes. This chapter summarizes the environmentally beneficial actions described in previous chapters that are in place at Hanscom Field, as well as additional measures that could be considered to avoid or minimize potential environmental effects.

In accordance with the EEA Scope Certificate, Table 11-2 presents environmentally beneficial measures in place at Hanscom, along with the responsible parties, implementation schedule, and the estimated cost (where applicable and data is available) for each measure. Additional details for each category of measures is described in proceeding subsections.

Table 11-2: Summary of existing and potential future Environmentally Beneficial Measures

Measure Detail	Responsible Party	Timetable	Cost to Implement (Estimate)
GROUND TRANSPORTATION			
Transportation information on Massport website	Massport	Complete	N/A
Transit information in Civil Air Terminal	Massport	Ongoing	Low cost [1]
Participation as a partner in MassRIDES Transportation Management Initiative program	Massport	To be determined	N/A
Information about transit and non-auto travel options in prominent locations throughout Hanscom Field	Massport	Complete	N/A
Bus stop with transit information	Massport	Complete	N/A
Exploration of working with local communities and stakeholders on a bikeshare network	Multiple parties including Massport	No longer active	N/A

Measure Detail	Responsible Party	Timetable	Cost to Implement (Estimate)
NOISE			
Modifications to the Fly Friendly Program using the flight tracking software to direct pilots conducting touch-and-go procedures to fly over the airport instead of neighboring lands or MMNHP, when possible.	Massport	Complete	N/A
Continued implementation of the Fly Friendly program	Massport	Ongoing	Low cost
Run-up procedures for use of the East Ramp	Massport	Ongoing	
Successful relocation of noise monitors based on input from ongoing community coordination process and implementation of updates to the Noise and Operations Monitoring System. Massport now has six monitors at Hanscom, including four in communities off of each runway end and two on the airfield.	Massport	Complete	N/A
Maintaining the interactive online "Airport Activity Monitor", which was released in 2016 and allows the public to research a noise event or flight, log a noise disturbance, and track correspondence related to a noise disturbance.	Massport	Ongoing	Moderate cost[2]
AIR QUALITY			
Continued encouragement of tenants to consider the purchase of alternatively fueled ground service equipment, where appropriate	Massport	Ongoing	Low cost
Encouragement of Fixed Base Operators to minimize Auxiliary Power Unit/Ground Power Unit use	Massport	Ongoing	Low cost
Use of Ultra Low Sulfur Diesel in Massport fleet vehicles	Massport	Ongoing	Low cost
Installation of a paved aircraft holding area at the head of Runway 23 to reduce minor aircraft delays and associated emissions from engine idling	Massport	Complete	N/A

Measure Detail	Responsible Party	Timetable	Cost to Implement (Estimate)
Continued consideration of Alternative Fuel Vehicles for any new Massport vehicle purchase	Massport	Ongoing	Cost varies depending on vehicle number and type
WATER QUALITY			
Support for Shawsheen Watershed Initiative to improve water quality and quantity flow in the Shawsheen River and its tributaries	Massport working with the MassDEP, USEPA, and Hanscom AFB	Ongoing	Moderate cost
Continuation of MassDEP Best Management Practices	Massport	Ongoing	Moderate cost
WILDLIFE			
Manage airfield in a manner that does not disrupt breeding season for grassland birds of which two species are listed under the Massachusetts Endangered Species Act, the Upland Sandpiper and the Grasshopper Sparrow	Massport	Ongoing	Low cost
Continue implementation of all aspects of Wildlife Hazard Management Plan.	Massport	Ongoing	Moderate cost
SUSTAINABLE DEVELOPMENT			
Maintenance of EMS procedures to control environmental effects	Massport	Ongoing	Moderate cost

Notes:
1. Low cost measures < $5,000
2. Moderate cost measures: $5,000 - $50,000
3. High cost measures: >$50,000

11.6.1 Ground Transportation

Measures to address ground transportation considerations in the 2025 and 2035 scenarios focus on traffic management and transportation demand management (TDM) approaches, as well as planning efforts to facilitate the development of non-auto modes of travel in the area.

Hanscom Field contributes a small percentage of traffic to Route 2A traffic volumes, just east of Hanscom Drive. The 2017 peak hour volumes represent a slight decrease compared to the 2012 volumes reported in the *2012 ESPR*.

Massport will continue to assess other potential TDM measures (as described in more detail in Chapter 6), such as promotion of ride-sharing and enhancing transit connections that may be appropriate for Hanscom Field. These would also include measures such as updates to Massport's website and other mechanisms to distribute information regarding transportation.

11.6.2 Noise Abatement

Massport has a long history of noise abatement commitments at Hanscom Field, which are based on the 1978 Master Plan and 1980 noise regulations. Massport restricts touch-and-go operations between 11:00 PM and 7:00 AM, the most noise-sensitive time of day, and imposes a fee on operations to discourage nighttime operations. The fee doubles for aircraft that conduct more than five night operations in a calendar year. This nighttime field use fee applies to all aircraft. Massport has added enhancements to implement the Fly Friendly Program, which includes encouraging operators to use noise abatement procedures.

The Hanscom Field Noise Workgroup has developed a number of recommendations which have guided noise abatement efforts at Hanscom Field (recommendations of the Workgroup and status of each are discussed in Chapter 7 Noise and the associated Noise Appendix D). Nearly ninety percent of the recommendations have been implemented or are in the process of implementation. Eight of the fourteen measures were included in the *2005 ESPR* and updated in the *2012 ESPR*. The remaining four recommendations are related to noise monitoring and the correlation of complaints with noise events. These were addressed through updates to the Noise and Operations Monitoring System.

Massport continues to enforce its nighttime run-up noise abatement procedures. Massport directs operators to the run-up pad located due south of Runway 11/29 and west of the intersection with Runway 5/23 during the day. There is a short "blast fence" on the east side of the pad, which deflects jet exhaust, prop wash, and debris. Massport also encourages Fixed Base Operators (FBOs) to minimize the use of auxiliary power units (APUs) and ground power units (GPUs) to minimize noise.

Massport has also worked cooperatively with the local community, aviation groups and the Minute Man National Historical Park (MMNHP) to implement a comprehensive noise abatement program known as "Fly Friendly", guided by the National Business Aircraft Association's (NBAA) published noise abatement guidelines and the Aircraft Owners and Pilots Association (AOPA) noise reduction recommendations. Pilots are encouraged to adhere to safe and quiet flying techniques, and to remain aware of noise issues at the airfield. Additionally, Massport developed recommended helicopter procedures and voluntary touch-and-go procedures that help reduce noise over the MMNHP.

Massport distributes handouts and posters describing noise abatement procedures to tenants, FBOs, and flight training schools. Additionally, all based pilots are required to watch the Massport recommended Fly Friendly procedures video when getting and renewing a security badge.

Massport was an active participant in Sound Initiative, a coalition that successfully supported the federal phase out of Stage 2 aircraft weighing less than 75,000 pounds. Stage 2 aircraft were manufactured before today's stringent noise standards were adopted for new airplanes. The use of Stage 2 aircraft weighing over 75,000 pounds was phased out nationally by 2000, but most of Hanscom's jets weigh less than 75,000 pounds. In 2012, Congress passed the FAA Modernization and Reform Act, which included the phase out of all non-stage 3 aircraft by December 31, 2015. Section 506 of the Act prohibits the operation, within the 48 contiguous states, of jets weighing 75,000 pounds or less that do not comply with Stage 3 noise levels. Military aircraft are exempt from the Stage 3 Rule.

Massport has also launched the interactive online "Airport Activity Monitor" which allows the public to research a noise event or flight, log a noise disturbance, and track correspondence related to a noise disturbance. The Airport Activity Monitor is continuously updated.