Noise Exposure Map Update

Pursuant to Title 14 of the Code of Federal Regulations Part 150

Patrick Leahy Burlington International Airport

HMMH Report No. 03-14010

PRELIMINARY DRAFT

October 2024

Prepared for:

City of Burlington, Vermont
1200 Airport Drive, #1
Burlington, VT 05403

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1200 Airport Drive, #1
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Executive Summary

The City of Burlington, Vermont (the City) is committed to being a good neighbor and a responsible operator of Patrick Leahy Burlington International Airport (BTV or "the Airport"). The City is updating the Noise Exposure Map for BTV in accordance with the Federal Aviation Administration's (FAA's) process codified under Title 14 of the Code of Federal Regulations Part 150 (14 CFR Part 150 or Part 150).

A Part 150 Study is a voluntary, federally funded and federally supervised formal process for airport operators to address aircraft noise in terms of land use compatibility. A Part 150 Study includes the following two principal elements:

- The **Noise Exposure Map** (NEM) element describes the airport layout and operation, aircraft-related noise exposure, land uses in the airport environs, and the resulting noise/land use compatibility. Part 150 requires that the documentation address aircraft operations during two time periods: the year of submission and a forecast year at least five years following the year of submission.
- The **Noise Compatibility Program** (NCP) element describes the actions the airport proprietor recommends to address existing and future land use incompatibilities with aircraft operations.

The Part 150 Study is similarly divided into two phases:

- **Phase 1** focuses on the development and submittal of the NEM to the FAA for acceptance as being completed in accordance with 14 CFR Part 150.
- **Phase 2** determines the Airport-recommended measures to minimize incompatible land uses from aircraft operations with the development and submittal of the NCP.

The City completed the previous NEM update for the Airport in 2018 with FAA acceptance in September 2019. In 2020, the FAA approved BTV's most recent NCP update.

This document includes all Phase 1 NEM documentation required for acceptance by the FAA, including quantifying noise exposure from aircraft operations, assessing compatibility of land uses near the Airport, and evaluating the existing NCP measures to determine their continued effectiveness in reducing incompatible land uses. The existing condition represents 2024, and the five-year forecast condition represents 2029. The Part 150 study area includes BTV and parts of the adjacent communities of South Burlington, Burlington, Winooski, Colchester, Essex, and Williston, all contained within Chittenden County.

Noise Exposure Maps

The 2024 and 2029 noise exposure contours are presented in **Figure ES-1** and **Figure ES-2** and in **Chapter 5** of this document.[1] The resulting land use compatibility analysis is summarized in **Table ES-1** and **Table ES-2**, including the population and housing units within the 65 decibel (dB) contour and noise sensitive parcels. The land use analysis shows that 2,440 residential units and 11 noise-sensitive parcels are potentially incompatible with noise from BTV aircraft operations in the 2029 Forecast Condition. The FAA considers all land uses compatible with aircraft noise less than 65 dB in terms of the Day-Night Average Sound Level (DNL) metric. Details of the land use analysis are provided in Section 5.2.

Table ES-1. Existing (2024) and Forecast (2029) Residential Land Use Compatibility
Source: HMMH and JPG, 2024

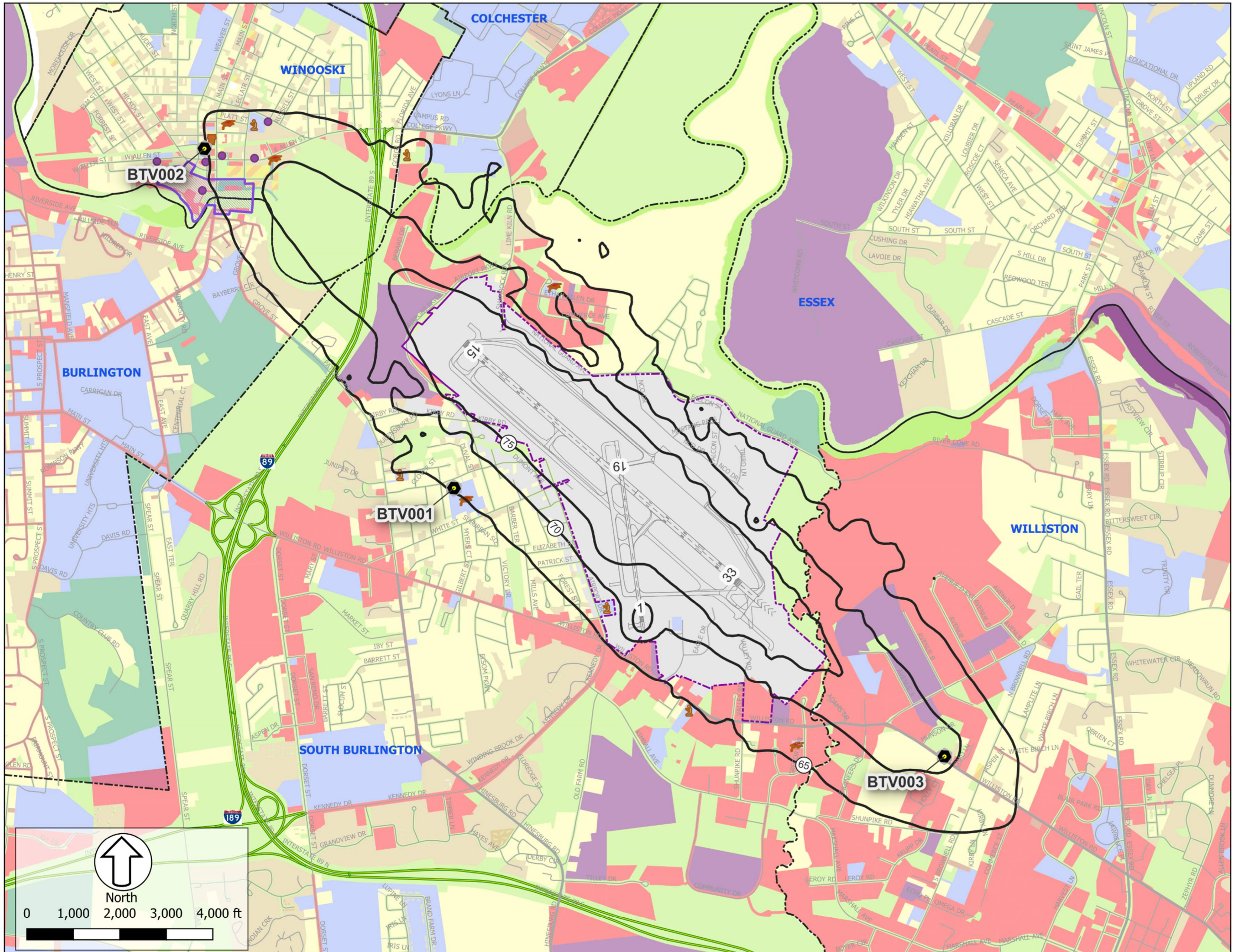
Contour Interval	Population Census 2020				Housing Units			
	Total		Compatible		Total		Compatible	
	2024	2029	2024	2029	2024	2029	2024	2029
65-70 DNL	4456	4628	7	7	1913	1985	3	3
70-75 DNL	1057	1057	25	25	454	454	11	11
>75 DNL	2	2	0	2	1	1	0	0
Total	**5515**	**5687**	**32**	**34**	**2368**	**2440**	**14**	**14**

Table ES-2. Existing (2024) and Forecast (2029) Inventory of Noise Sensitive Sites
Source: HMMH and JPG, 2024

Contour Interval	Schools		Places of Worship		Public Gathering	
	2024	2029	2024	2029	2024	2029
65-70 DNL	5	5	5	5	1	1
70-75 DNL	0	0	0	0	0	0
>75 DNL	0	0	0	0	0	0
Total	**5**	**5**	**5**	**5**	**1**	**1**

The 2024 and 2029 noise exposure contours cover less area than the Forecast Conditions (2023) DNL contours accepted by FAA on September 26, 2019. This is primarily because the local Vermont Air National Guard unit has been operating fewer F-35A operations than the volume that was previously forecasted and modeled. Section 5.3 provides a comparison of the updated NEM contours to the 2023 DNL contours.

[1] Large-scale versions of these figures showing the Official Noise Exposure Maps can be found in the back pocket of this document in print.



PATRICK LEAHY BURLINGTON INTERNATIONAL AIRPORT

PART 150 - NOISE EXPOSURE MAP UPDATE

Figure ES-1
2024 Noise Exposure Map

2024 DNL Contour (Existing Conditions)

Town Boundary
Airport Property Boundary
Historic Districts
Historic Sites
Local Roads
Major Roads
Highways
Education
Place of Worship
Public Gathering
Noise Monitor

2024 Land Use
Single Family Residential (1)
Multi Family Residential (1)
Other Residential (1)
Mixed Use (1)
Public Use (1)
Airport
Transportation (2)
Commercial (2)
Manufacturing & Production (2)
Recreational (2)
Open Space

(1) Potentially non-compatible within 65 dB DNL contour as discussed in Section 3.4.
(2) Potentially non-compatible within 70 dB DNL contour as discussed in Section 3.4.

Data Source:
Vermont Center for Geographic Information Inc. (VCGI), United States Census Bureau, National Register of Historic Places, Burlington Internationa Airport, Harris Miller Miller & Hanson Inc.

The Jones Payne Group, Inc.

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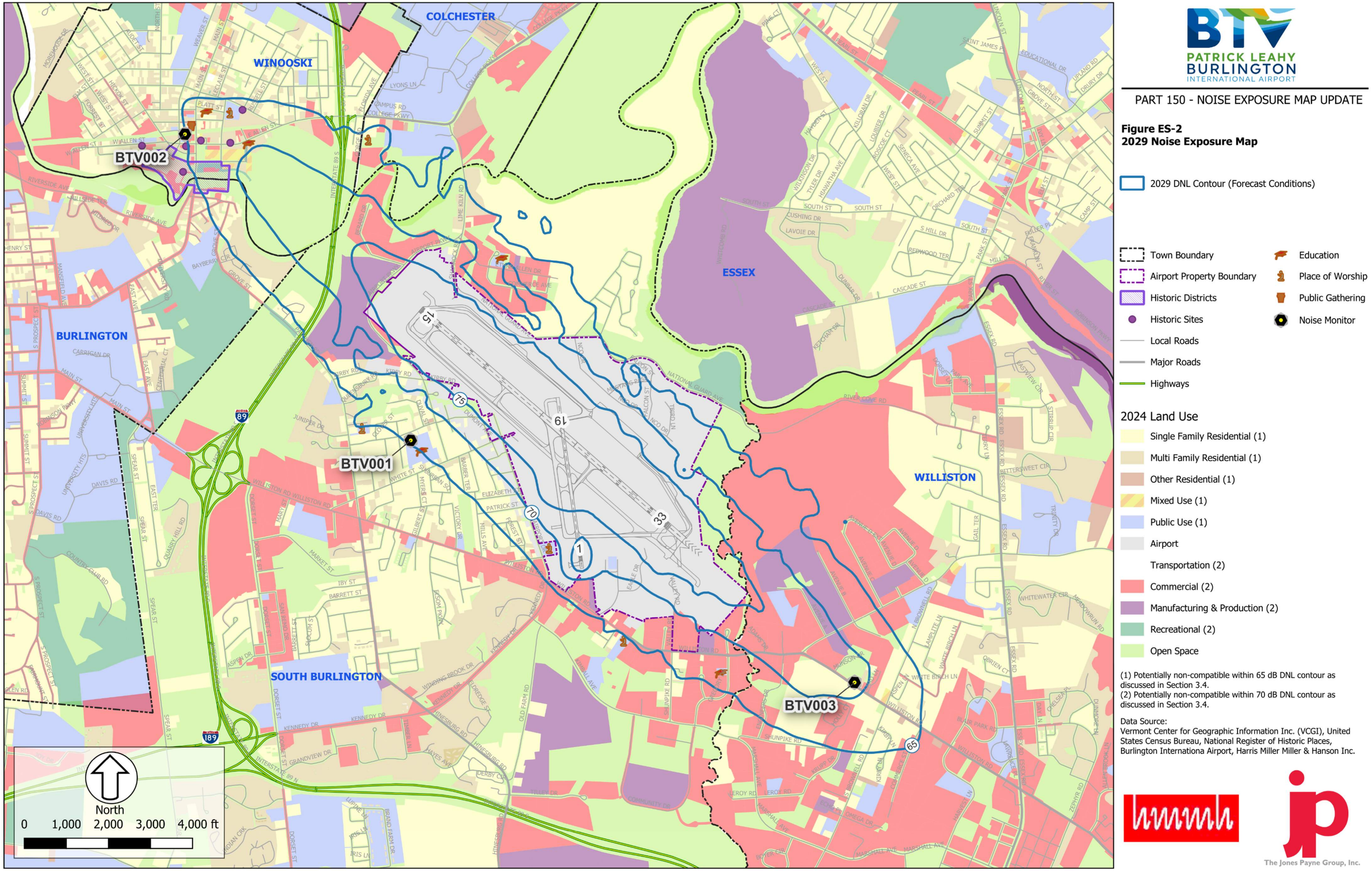
BTV
PATRICK LEAHY
BURLINGTON
INTERNATIONAL AIRPORT
PART 150 - NOISE EXPOSURE MAP UPDATE
Figure ES-2
2029 Noise Exposure Map
2029 DNL Contour (Forecast Conditions)
Town Boundary
Airport Property Boundary
Historic Districts
Historic Sites
Local Roads
Major Roads
Highways
Education
Place of Worship
Public Gathering
Noise Monitor
2024 Land Use
Single Family Residential (1)
Multi Family Residential (1)
Other Residential (1)
Mixed Use (1)
Public Use (1)
Airport
Transportation (2)
Commercial (2)
Manufacturing & Production (2)
Recreational (2)
Open Space
(1) Potentially non-compatible within 65 dB DNL contour as discussed in Section 3.4.
(2) Potentially non-compatible within 70 dB DNL contour as discussed in Section 3.4.
Data Source:
Vermont Center for Geographic Information Inc. (VCGI), United States Census Bureau, National Register of Historic Places, Burlington Internationa Airport, Harris Miller Miller & Hanson Inc.
hmmh
The Jones Payne Group, Inc.
COLCHESTER
WINOOSKI
ESSEX
BURLINGTON
WILLISTON
SOUTH BURLINGTON
BTV001
BTV002
BTV003
15
33
19
1
65
70
75
89
189
North
0
1,000
2,000
3,000
4,000 ft

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Sponsor's Certification

The City of Burlington has completed a comprehensive update of the Title 14 Code of Federal Regulations (CFR) Part 150 Noise Exposure Map for Burlington International Airport.

(1) The revised Noise Exposure Maps and associated documentation for the Patrick Leahy Burlington International Airport submitted in this volume to the Federal Aviation Administration under Federal Aviation Regulations Part 150, Subpart B, Section 150.21, are true and complete.

(2) Pursuant to Part 150, Subpart B, Section 150.21(b), all interested parties have been afforded adequate opportunity to submit their views, data, and comments concerning the correctness and adequacy of the draft noise exposure map, and of the descriptions of forecast aircraft operations.

(3) The "Existing Conditions (2024) Noise Exposure Map" (Figure 5-1 on page 5-3) accurately represents conditions for calendar year 2024.

(4) The "Five-Year Forecast Conditions (2029) Noise Exposure Map" (Figure 5-2 on page 5-5) accurately represents forecast conditions for calendar year 2029, which is the fifth calendar year after the date of this submission.

By: Nicolas Longo

____

Title: Director of Aviation

Date: ______________________________________

Airport Name: Patrick Leahy Burlington International Airport

Airport Owner/Operator: The City of Burlington, Vermont

Address: 1200 Airport Drive, #1, Burlington, VT 05403

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FAA Checklist

The FAA produced Advisory Circular 150/5020, "Airport Noise and Land Use Compatibility Planning," that includes a checklist for FAA's use in reviewing NEM submissions. The FAA prefers that the Part 150 documentation include a copy of the checklist with appropriate page numbers or other references and pertinent notes and comments to assist in the document's review, as presented in the table below.

Part 150 Noise Exposure Map Checklist

Source: FAA/APP, Washington, DC, March 1989; revised June 2005; reviewed for currency 12/2007

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
I. Submitting and Identifying The NEM:			
A. Submission is properly identified:			
1. 14 C.F.R. Part 150 NEM?	X		NEM Update
2. NEM and NCP together?		X	This document is an NEM Update only
3. Revision to NEMs FAA previously determined to be in compliance with Part 150	X		Section 1.2.1
B. Airport and Airport Operator's name are identified?	X		Sponsor Certification page xi and Section 1
C. NCP is transmitted by airport operator's dated cover letter, describing it as a Part 150 submittal and requesting appropriate FAA determination?		X	Cover letter will be included as part of the official FAA Submittal after public review of this draft
II. Consultation: [150.21(b), A150.105(a)]			
A. Is there a narrative description of the consultation accomplished, including opportunities for public review and comment during map development?			Sections 1.3 and 0 discuss roles and responsibilities and stakeholder engagement, respectively
B. Identification of consulted parties:			
1. Are the consulted parties identified?	X		Sections 1.3 and 0
2. Do they include all those required by 150.21(b) and A150.105(a)?	X		Sections 1.3 and 0
3. Agencies in 2, above, correspond to those indicated on the NEM?	X		Agencies identified on the NEM participated as part of the Technical Advisory Committee (TAC) Sections 1.3 and 0
C. Does the documentation include the airport operator's certification, and evidence to support it, that interested persons have been afforded adequate opportunity to submit their views, data, and comments during map development and in accordance with 150.21(b)?	X		Sponsor Certification page xi, Section 0, and Appendix E
D. Does the document indicate whether written comments were received during consultation and, if there were comments, that they are on file with the FAA regional airports division manager?	X		Section 6.3 discusses how comments were collected during the public consultation process. All written comments are included in Appendix F
III. General Requirements: [150.21]			
A. Are there two maps, each clearly labeled on the face with year (existing condition year and one that is at least 5 years into the future)?	X		Figure 5-1 and Figure 5-2 present maps with the 2024 Existing Conditions and the 2029 (future 5-year) Forecast Conditions, respectively

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
B. Map currency:			
1. Does the year on the face of the existing condition map graphic match the year on the airport operator's NEM submittal letter?	X		The Existing Conditions map (Figure 5-1) represents 2024, which is the year of submission of this document.
2. Is the forecast year map based on reasonable forecasts and other planning assumptions and is it for at least the fifth calendar year after the year of submission?	X		The Forecast year is 5 years after the year of submission (Figure 5-2). Section 4.2 describes the forecast methodology.
3. If the answer to 1 and 2 above is no, the airport operator must verify in writing that data in the documentation are representative of existing condition and at least 5 years' forecast conditions as of the date of submission?	N/A		Not Applicable – The Existing Conditions map year matches the year of submittal and the Forecast Conditions map is at least the fifth calendar year.
C. If the NEM and NCP are submitted together:	N/A		Not Applicable – NCP not submitted with this NEM
1. Has the airport operator indicated whether the forecast year map is based on either forecast conditions without the program or forecast conditions if the program is implemented?	N/A		Not Applicable – This is only an NEM Update.
2. If the forecast year map is based on program implementation:	N/A		Not Applicable – This is only an NEM Update.
a. Are the specific program measures that are reflected on the map identified?	N/A		Not Applicable – This is only an NEM Update.
b. Does the documentation specifically describe how these measures affect land use compatibilities depicted on the map?	N/A		Not Applicable – This is only an NEM Update.
3. If the forecast year NEM does not model program implementation, the airport operator must either submit a revised forecast NEM showing program implementation conditions [B150.3(b), 150.35(f)] or the sponsor must demonstrate the adopted forecast year NEM with approved NCP measures would not change by plus/minus 1.5 DNL? (150.21(d))	N/A		Not Applicable – This is only an NEM Update.
IV. Map Scale, Graphics, And Data Requirements: [A150.101, A150.103, A150.105, 150.21(a)]			
A. Are the maps of sufficient scale to be clear and readable (they must not be less than 1" to 2,000'), and is the scale indicated on the maps? (*Note (1) if the submittal uses separate graphics to depict flight tracks and/or noise monitoring sites, these must be of the same scale, because they are part of the documentation required for NEMs.*) (*Note (2) supplemental graphics that are not required by the regulation do not need to be at the 1" to 2,000' scale*)	X		Figure 5-1 and Figure 5-2 present maps with 2024 and 2029 conditions, respectively, at a scale of 1" = 2,000'. Noise monitoring locations are depicted on Figure 5-1 and Figure 5-2. The required supplemental flight track figures are included in Appendix D; in the print form of the document they are large folded maps at 1" = 2,000' scale
B. Is the quality of the graphics such that required information is clear and readable? (Refer to C. through G., below, for specific graphic depictions that must be clear and readable)	X		Figure 5-1 and Figure 5-2 and the supplemental flight track figures in Appendix D include the required elements and are clear and readable.
C. Depiction of the airport and its environs:			
1. Is the following graphically depicted to scale on both the existing condition and forecast year maps?			
a. Airport boundaries	X		Figure 5-1 and Figure 5-2 include airport boundaries

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
b. Runway configurations with runway end numbers	X		Figure 5-1 and Figure 5-2 include runways to scale with runway end numbering
2. Does the depiction of the off-airport data include?			
a. A land use base map depicting streets and other identifiable geographic features	X		Figure 5-1 and Figure 5-2 include streets and geographic features
b. The area within the DNL 65 dB (or beyond, at local discretion)	X		Figure 5-1 and Figure 5-2 include all land uses and area within the DNL 65 dB contour.
c. Clear delineation of geographic boundaries and the names of all jurisdictions with planning and land use control authority within the DNL 65 dB (or beyond, at local discretion)	X		Figure 5-1 and Figure 5-2 include jurisdictional boundaries and names
D. 1. Continuous contours for at least the DNL 65, 70, and 75 dB?	X		Figure 5-1 and Figure 5-2 include the DNL 65-, 70- and 75-dB contours.
2. Has the local land use jurisdiction(s) adopted a lower local standard and if so, has the sponsor depicted this on the NEMs?		X	Local jurisdictions have not adopted a lower standard
3. Based on current airport and operational data for the existing condition year NEM, and forecast data representative of the selected year for the forecast NEM?	X		The operational forecast is discussed in section 4.2 and Appendix C
E. Flight tracks for the existing condition and forecast year timeframes (these may be on supplemental graphics which must use the same land use base map and scale as the existing condition and forecast year NEM), which are numbered to correspond to accompanying narrative?	X		The required supplemental flight track figures are included in Appendix D; in the print form of the document, they are large folded maps at 1" = 2,000' scale. Additional flight track graphics are included in Section 4.5 with narrative discussing the contour development.
F. Locations of any noise monitoring sites (these may be on supplemental graphics which must use the same land use base map and scale as the official NEMs)	X		Figure 5-1 and Figure 5-2 include the locations of the three noise monitoring sites
G. Non-compatible land use identification:			
1. Are non-compatible land uses within at least the DNL 65 dB noise contour depicted on the map graphics?	X		Figure 5-1 and Figure 5-2 include land use color coding
2. Are noise sensitive public buildings and historic properties identified? (Note: If none are within the depicted NEM noise contours, this should be stated in the accompanying narrative text.)	X		Figure 5-1 and Figure 5-2 identify noise sensitive sites within the DNL 65 contours
3. Are the non-compatible uses and noise sensitive public buildings readily identifiable and explained on the map legend?	X		Figure 5-1 and Figure 5-2 identify noise sensitive sites on the map legend
4. Are compatible land uses, which would normally be considered non-compatible, explained in the accompanying narrative?	X		Figure 5-1 and Figure 5-2 identifies compatible land uses (sound-insulated residential units) which would normally be considered non-compatible; these are
V. Narrative Support Of Map Data: [150.21(a), A150.1, A150.101, A150.103]			
A. 1. Are the technical data and data sources on which the NEMs are based adequately described in the narrative?	X		See Section 4 Development of Noise Exposure Contours

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
2. Are the underlying technical data and planning assumptions reasonable?	X		The City carefully vetted all assumptions. The modeling inputs in Section 4 were discussed at TAC meeting #3 Section 4.2 provides aircraft operations information. Appendix C contains correspondence with the FAA
B. Calculation of Noise Contours:			
1. Is the methodology indicated?	X		See Section 4 for details on the modeling methodology.
a. Is it FAA approved?	X		Appendix C contains correspondence with the FAA on the modeling approach
b. Was the same model used for both maps? (Note: The same model also must be used for NCP submittals associated with NEM determinations already issued by FAA where the NCP is submitted later, unless the airport sponsor submits a combined NEM/NCP submittal as a replacement, in which case the model used must be the most recent version at the time the update was started.)	X		Both maps were produced using the same methodology, using the latest version of FAA's Aviation Environmental Design Tool (AEDT) available at the time the NEMs were prepared, i.e., "Version 3f." for civil operations and using NOISEMAP version 7.3 for military operations.
c. Has AEE approval been obtained for use of a model other than those that have previous blanket FAA approval?	X		Use of the NOISEMAP model for military aircraft is documented in the nonstandard modeling memo to FAA, included in Appendix C, together with FAA's written approval of the modeling approach.
2. Correct use of noise models:			
a. Does the documentation indicate, or is there evidence, the airport operator (or its consultant) has adjusted or calibrated FAA-approved noise models or substituted one aircraft type for another that was not included on the FAA's pre-approved list of aircraft substitutions?	X		Aircraft substitutions are identified in Section 4.3.1 and in the nonstandard modeling memo to FAA, included in Appendix C. Other nonstandard data (flight profiles, taxi profiles) used in the model is discussed in Section 4.3 and included in nonstandard memos in Appendix C.
b. If so, does this have written approval from AEE, and is that written approval included in the submitted document?	X		FAA's written approval is included in Appendix C.
3. If noise monitoring was used, does the narrative indicate that Part 150 guidelines were followed?		X	Noise monitoring was not conducted for this study; however, annual average DNL values from the BTV noise monitoring system were computed and are reported in Section 5.1.
4. For noise contours below DNL 65 dB, does the supporting documentation include an explanation of local reasons? (Note: A narrative explanation, including evidence the local jurisdiction(s) have adopted a noise level less than DNL 65 dB as sensitive for the local community(ies), and including a table or other depiction of the differences from the Federal table, is highly desirable but not specifically required by the rule. However, if the airport sponsor submits NCP measures within the locally significant noise contour, an explanation must be included if it wants the FAA to consider the measure(s) for approval for purposes of eligibility for Federal aid.)	N/A		Not Applicable – No noise contours below DNL 65 dB are depicted on the maps
C. Non-compatible Land Use Information:			
1. Does the narrative (or map graphics) give estimates of the number of people residing in each of the contours	X		Section 5.2.2

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
(DNL 65, 70 and 75, at a minimum) for both the existing condition and forecast year maps?			
2. Does the documentation indicate whether the airport operator used Table 1 of Part 150?	X		Section 2.1
a. If a local variation to table 1 was used:			
(1) Does the narrative clearly indicate which adjustments were made and the local reasons for doing so?	N/A		Not Applicable – No adjustments were made
(2) Does the narrative include the airport operator's complete substitution for table 1?	N/A		Not Applicable – No adjustments were made
3. Does the narrative include information on self- generated or ambient noise where compatible or non-compatible land use identifications consider non-airport and non-aircraft noise sources?	N/A		Not Applicable – Non-airport / non-aircraft noise sources were not considered
4. Where normally non-compatible land uses are not depicted as such on the NEMs, does the narrative satisfactorily explain why, with reference to the specific geographic areas?	X		Section 0 discusses changes to land use compatibility.
5. Does the narrative describe how forecast aircraft operations, forecast airport layout changes, and forecast land use changes will affect land use compatibility in the future?	X		Section 5.2 discusses changes to land use compatibility.
VI. Map Certifications: [150.21(b), 150.21(e)][2]			
A. Has the operator certified in writing that interested persons have been afforded adequate opportunity to submit views, data, and comments concerning the correctness and adequacy of the draft maps and forecasts?	X		Sponsor Certification, page xi
B. Has the operator certified in writing that each map and description of consultation and opportunity for public comment are true and complete under penalty of 18 U.S.C. § 1001?	X		Sponsor Certification, page xi

[2] Sponsor Certification occurs after the Public Comment Period and upon submittal of the Final NEM to the FAA.

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Acronyms

Acronym	Definition
AC	Air Carrier
ADO	Airports District Office
AEDT	Aviation Environmental Design Tool
AEE	Office of Environment and Energy
ANP	Aircraft Noise and Performance
ASNA	Aviation Safety and Noise Abatement Act of 1979
AT	Air Taxi
ATCT	Airport Traffic Control Tower
BTV	Burlington International Airport
CFR	Code of Federal Regulations
dB	Decibel (A-weighted unless otherwise stated)
DNL	Day-Night Average Sound Level
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
GA	General Aviation
HMMH	Harris Miller Miller & Hanson Inc.
ML	Military
MSL	Mean Sea Level
NCP	Noise Compatibility Program
NEM	Noise Exposure Map
NEPA	National Environmental Policy Act of 1969
NLR	Noise Level Reduction
Part 150	Title 14 of the Code of Federal Regulations Part 150 “Airport Noise Compatibility Planning”
ROA	Record of Approval
SEL	Sound Exposure Level
SLUCM	Standard Land Use Coding Manual
TAC	Technical Advisory Committee
TAF	Terminal Area Forecast
USAF	United States Air Force
USGS	United States Geological Survey
VTANG	Vermont Air National Guard
VTARNG	Vermont Army National Guard

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Contents

Appendices

Figures

Tables

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1 Introduction to Noise Compatibility Planning

As the airport operator, the City of Burlington, Vermont (the City) is undertaking a Noise Compatibility Planning Study for Patrick Leahy Burlington International Airport (BTV or "the Airport") in accordance with Title 14 of the Code of Federal Regulation Part 150 (14 CFR Part 150, or Part 150; herein referred to as "Part 150 Study"). The purpose of this Part 150 Study is to:

- Develop an accurate Noise Exposure Map (NEM) that reflects current and future airport operations, including the Vermont Air National Guard (VTANG) operation of F-35A Lightning II aircraft.
- Communicate noise exposure levels and land use compatibility associated with BTV aircraft operations to the surrounding communities.

Part 150 "Airport Noise Compatibility Planning" is a voluntary program provided to airports and communities by the Federal Aviation Administration (FAA) to assess and mitigate aircraft noise around airports. The regulation describes a formal process for airport operators to address airport noise in terms of land use compatibility and it establishes thresholds for aircraft noise exposure for specific land use categories. Part 150 studies allow airports to apply for federal funds to implement FAA-approved measures recommended by the City to reduce or eliminate incompatible land use. One of the principal reasons for preparation of this update is the City's interest in continuing implementation of federally supported noise mitigation at BTV. The NEM prepared under this Part 150 Study will be subject to Federal Aviation Administration (FAA) acceptance.

1.1 Part 150 Process

In 1968, Congress responded to widespread community concern with aircraft noise resulting from the dawn of the jet age by passing the Aircraft Noise and Sonic Boom Act, which set standards for measurement of aircraft noise and established noise abatement regulations associated with the certification of aircraft. The FAA's emphasis on the relationship between aircraft noise and land use compatibility planning began with the passage of the Aviation Safety and Noise Abatement Act of 1979 (ASNA). This act gives the FAA the authority to issue regulations on noise compatibility planning. The Airport and Airway Improvement Act of 1982 provides a means for federal funding of projects to improve land use compatibility around airports. In response to ASNA, the FAA developed implementing regulations as currently codified in 14 CFR Part 150, "Airport Noise Compatibility Planning."[3]

These voluntary Part 150 regulations set forth standards for airport operators to use when documenting noise exposure around airports and for establishing programs to minimize aircraft noise-related land use incompatibilities. By regulation, a Part 150 Study includes the following two principal elements (described in **Sections 1.1.1** and **1.1.2**):

[3] U.S. Government Publishing Office. Electronic Code of Federal Regulations, Title 14 CFR Part 150 – Airport Noise Compatibility Planning. Accessed at https://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title14/14cfr150_main_02.tpl on 12/07/2022.

1. Noise Exposure Map (NEM)
2. Noise Compatibility Program (NCP)

Acceptance of an NEM by the FAA is a prerequisite to their subsequent review and approval of measures recommended in an NCP**. Figure 1-1** provides an overview of the FAA Part 150 process.

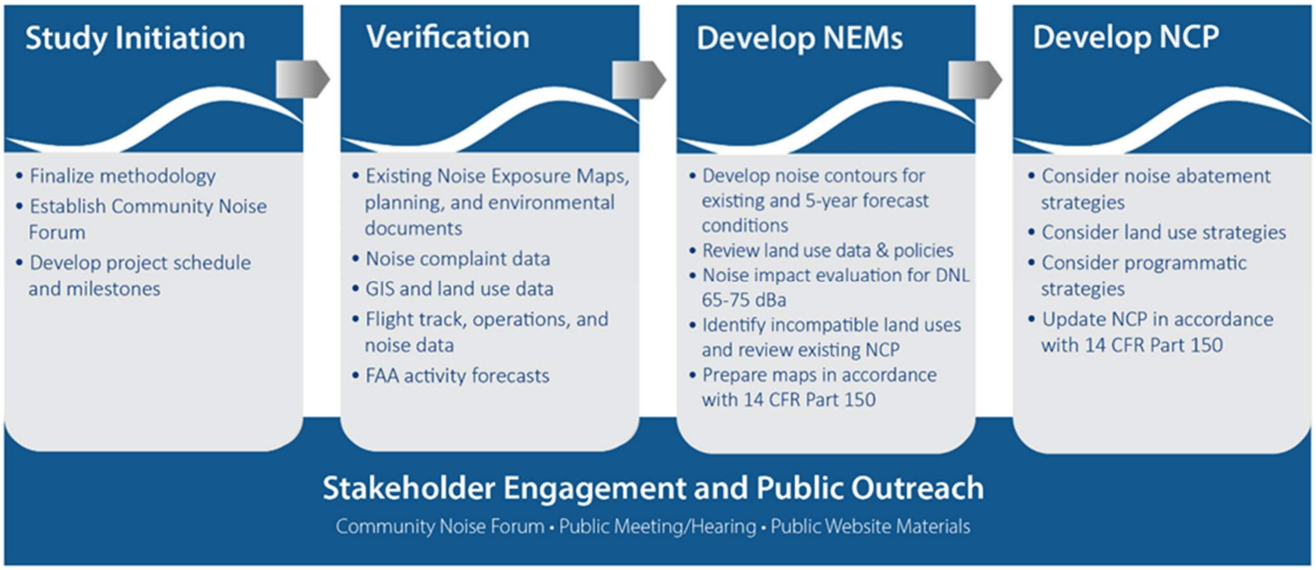

Figure 1-1. Overview of the FAA Part 150 Process
Source: HMMH

1.1.1 Noise Exposure Map

The NEM document describes the airport layout and operation, aircraft-related noise exposure, land uses in the airport environs, and the resulting noise/land use compatibility. The NEM documentation must address two timeframes:

1. The year of submission (the "Existing Condition") and
2. A forecast year that is at least five years following the year of submission (the "Forecast Condition").

This NEM update contains an Existing Condition map for calendar year 2024, and a five-year Forecast Condition map for calendar year 2029, presented in **Chapter 5.** The FAA maintains an NEM document checklist (see page xiii) to ensure the documents include all the requirements contained in the Part 150 regulation, including tabulated data and results, and clear descriptions of the data collection and analysis undertaken in the development of the NEM.

1.1.2 Noise Compatibility Program

An NCP is a list of actions an airport proprietor recommends for addressing existing and future land use incompatibilities resulting from the noise of aircraft operations. The FAA also maintains an NCP checklist to ensure the documents include all the requirements of Part 150, such as:

- The development of the program
- Each measure the airport sponsor considered
- The reasons the airport sponsor elected to recommend or exclude each measure
- The entities responsible for implementing each recommended measure
- Implementation and funding mechanisms
- The predicted effectiveness of both the individual measures and the overall program

The FAA reviews and approves specific measures based on information contained in the NCP. Airports may apply for grant funding for implementation of FAA-approved measures. An airport-recommended and FAA-approved measure does not require implementation of the measure but merely demonstrates that the measure is in compliance with Part 150. Additionally, if a measure requires subsequent FAA action, its implementation may require environmental study under the National Environmental Policy Act of 1969 (NEPA).

Chapter 3 presents a summary of the current BTV NCP, approved in 2020.

1.2 Burlington International Airport Part 150 Program Participation

The City began this Part 150 Update in late 2023 and expects to submit the final NEM document to FAA by December 2024 for their acceptance that the document is in accordance with 14 CFR Part 150 requirements. A public workshop will be held in October 2024 to present the updated NEM document to the community and to answer questions from the public. **Chapter 5** provides the official Noise Exposure Maps for the Existing Conditions (2024) and the five-year Forecast Conditions (2029). The predominant change in the noise model inputs from the Existing to the Forecast Conditions is an overall 3.6 percent growth in civilian operations. The City will hold a 30-day public comment period in fall 2024 to answer questions related to the NEM document.

The City is not updating the BTV NCP at this time; the NCP measures currently in place will continue. The land use measures, which are based on the DNL contours, will adopt the updated NEM in their ongoing implementation.

1.2.1 History of Noise Compatibility Planning at BTV

For over 35 years, the City of Burlington has been committed to participating in the FAA-sponsored Part 150 program. The City completed its first Part 150 Study for BTV in 1989. The NEM was accepted by the FAA and NCP measures were approved by the FAA in 1990. The NEM was updated in 1997, 2006, 2015, and 2018, and the NCP was updated in 2008 and 2020. **Figure 1-2** provides a timeline for BTV's Part 150 program participation over the years.

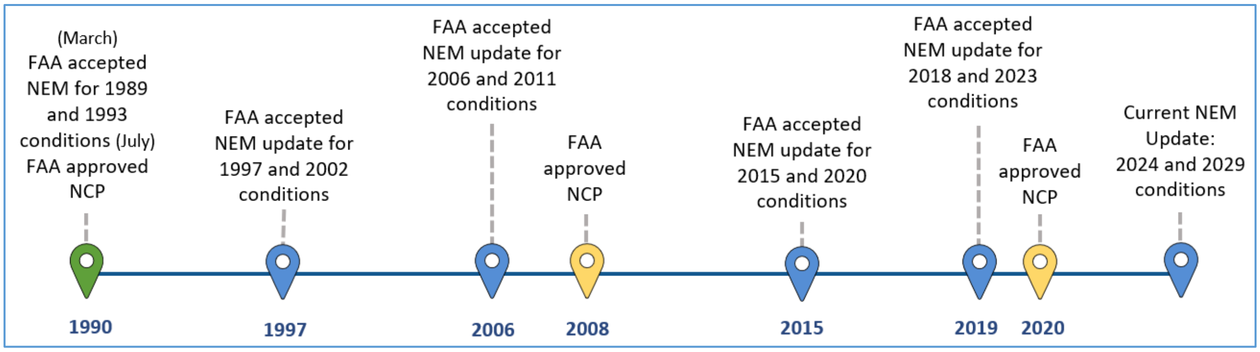

Figure 1-2. Timeline of BTV participation in Part 150 Program

Source: HMMH

The City completed the most recent NEM and NCP updates in 2019 and 2020, respectively. The FAA found the NEM in compliance with Part 150 requirements on September 26, 2019 with NEM contours for 2018 existing and 2023 forecast conditions. The contour maps are referred to as the "2018 NEM" and "2023 NEM", respectively, in this document.[4] That NEM update contains the most recent aircraft noise contours used for FAA-funded noise mitigation efforts at BTV. The FAA provided a Record of Approval (ROA) for the NCP on October 16, 2020 (see **Appendix B**).[5] A review of the current NCP is provided in **Chapter 3** of this document, along with implementation status of each recommended measure.

1.2.2 BTV Airport Facilities

BTV is a joint-use civil-military airport serving Vermont's most populous city, Burlington, and its metropolitan area. The airport is located mainly in South Burlington, approximately three miles east of Burlington's central business district. With roots dating back to the 1920s, BTV is by far the busiest airport in Vermont. Current commercial passenger service is provided by five airlines. Airside facilities at BTV currently include two runways, a taxiway system, and ramp areas that support general aviation (GA), air carrier, military, and air cargo services.

The Airport makes a significant contribution to the local economy. In addition to commercial airline services, BTV hosts BETA Technologies research and development facility and the Vermont Flight Academy (VFA), a non-profit flight school offering pilot certifications and ratings. The airport also services Healthnet helicopter ambulance, operated in collaboration between Dartmouth-Hitchcock Hospital and the University of Vermont (UVM).

[4] FAA provided notice of its acceptance in the Federal Register on October 10, 2019 https://www.federalregister.gov/documents/2019/10/10/2019-22221/noise-exposure-map-notice-burlington-international-airport-south-burlington-vermont

[5] https://www.btvsound.com/wp-content/uploads/sites/4/2020/10/Burlington-Vermont-NCP-Record-of-Approval-REVISED-signed-002.pdf

1.2.3 BTV Military Operations

BTV hosts two military installations: the Vermont Air National Guard (VTANG) and the Vermont Army National Guard (VTARNG). The VTANG 158th Fighter Wing operated the F-16C aircraft for over 30 years and currently flies the F-35 Lightning II. The United States Air Force (USAF) prepared the F-35A Operational Basing Final Environmental Impact Statement (EIS)[6] in 2013 and later issued a Record of Decision.[7] The unit received the F-35 Lightning II Aircraft in 2019, and they were declared operational in early 2022[8]. The previous NEM update, prepared while the VTANG was still operating the F-16C aircraft, included F-35 aircraft in its five-year forecast to represent projected 2023 conditions.

The VTARNG operates an Army Aviation Support Facility at BTV where the 1st Battalion, 103d Aviation Regiment and the 86th Medical Company (Air Ambulance) is based. At BTV, the VTARNG operates helicopters and C-12 turboprop aircraft.

1.3 Part 150 Roles and Responsibilities

Several groups are involved in the preparation of the BTV Part 150 Study and have provided important information that has been incorporated into this NEM document, including:

- The City of Burlington, including its staff and consultants (the Study Team),
- The 158th Fighter Wing of the VTANG,
- The VTARNG,
- The Technical Advisory Committee (TAC),
- The FAA, and
- The public.

1.3.1 The City of Burlington

As the airport operator, the City of Burlington submits the NEM document, recommends NCP measures, pursues implementation of the adopted NCP measures, and manages the Study Team. The City also leads public engagement efforts related to the Part 150 Study.

1.3.2 158th Fighter Wing of the VTANG

The VTANG's 158th Fighter Wing has both a state and federal mission to carry out. The USAF selected the 158th Fighter Wing to host the F-35A mission and the unit received a new fleet of F-35A Lightning II aircraft in 2019. The Study Team consulted with the 158th Fighter Wing to understand their procedures for operation of F-35A aircraft and to obtain flight track and flight profile information for noise modeling. Personnel from the 158th Fighter Wing reviewed the developed data for military noise model inputs and provided concurrence on data accuracy.

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[6] Final United States Air Force F-35A Operational Basing Environmental Impact Statement, September 2013 https://vt.public.ng.mil/Portals/19/Documents/Volume1, https://vt.public.ng.mil/Portals/19/Documents/Volume2
[7] Record of Decision issued October 4, 2013 https://vt.public.ng.mil/Portals/19/Documents/F-35A
[8] https://www.158fw.ang.af.mil/NEWS/Article-Display/Article/3138190/vtang-completes-a-historic-first-for-air-national-guard/

1.3.3 The Vermont Army National Guard (VTARNG)

Administered by the National Guard Bureau (a joint bureau of the departments of the U.S. Army and USAF), the VTARNG has both a federal and state mission. The dual mission, a provision of the U.S. Constitution and the U.S. Code of Laws, results in each soldier holding membership in both the National Guard of their state and in the U.S. Army. The VTARNG mainly operates H-60M and UH-72 helicopters at BTV, as well as infrequent flights by C-12 turboprop aircraft. The Study Team obtained concurrence from the 86th Troop Command for VTARNG military noise model inputs.

1.3.4 The Technical Advisory Committee (TAC)

The TAC is comprised of designated representatives from a broad spectrum of entities, including the Airport Commission, Airport management staff, local jurisdictions, school districts, FAA, fixed-base operator (FBO), VTANG and VTARNG. All TAC meetings are open to the public.

The TAC represents the core advisory group consulted throughout this NEM update process. The members review and provide input on Study content and materials, representing their constituents' interests. The TAC also provides a forum for discussion of complex topics, allowing members to share their differing perspectives on aircraft noise concerns. **Chapter 0** discusses the public participation process, including the TAC's role, during the development of the NEM Update for BTV.

1.3.5 Federal Aviation Administration

For the NEM update, the FAA reviews the operational forecast for consistency with their Terminal Area Forecast (TAF) and approves any non-standard noise modeling requests. The FAA reviews the Part 150 submission to determine whether the technical work, consultation, and documentation comply with Part 150 requirements. The FAA provides acceptance of the NEM if the review indicates compliance. The FAA also provides federal funding to complete the NEM update.

For an NCP, the FAA evaluates recommended measures individually with respect to a criteria framework and determines whether each measure merits approval, disapproval, or further review for the purposes of Part 150. In addition, the FAA reviews the details of the technical documentation for broader issues of safety and ensures consistency of recommended noise abatement measures with applicable federal law. Finally, the FAA issues the ROA for the recommended measures in the NCP. FAA involvement includes participation by staff from at least three parts of the agency:

- The Office of Environment and Energy
- The Air Traffic Organization
- The Office of Airports

The **Office of Environment and Energy** (AEE), located in FAA headquarters, reviews complex technical, regulatory, and legal matters of national environmental policy significance. The Office of Environment and Energy Noise Division (AEE-100) reviews and approves (or disapproves) of non-standard data inputs to the FAA's Aviation Environmental Design Tool (AEDT).

The **Air Traffic Organization** includes the Air Traffic Controllers and support staff. BTV's Air Traffic Control Tower (ATCT) personnel provide input on operational data, judgment regarding safety and capacity effects of alternative noise abatement measures, and input on implementation requirements for noise abatement measures.

Two groups in the **Office of Airports** are involved. The New England Regional Airports District Office (ADO) is the main point of contact for reviews, compliance, and direction as the Part 150 Update study progresses, including the approval of the aviation forecast, and determining if the documentation satisfies all Part 150 requirements. Headquarters ensures consistency with Part 150 regulations and reviews of national importance.

Prior to acceptance of the NEM/NCP documentation and approval of the airport-recommended NCP measures, the FAA conducts a Lines-of-Business review, which includes Air Traffic, Flight Standards, Legal, Special Programs, Planning and Requirements, Flight Procedures, and Regional Review.

1.3.6 Public

Members of the public are given opportunities to follow the Study's progress and provide input. The public could stay abreast of progress by visiting the BTV Sound website[9], participating in the public information meetings, and submitting comments on the draft NEM document. At regularly scheduled monthly Airport Commission meetings, the City provides information on the BTV noise monitors and noise comments as well as updating the status of the residential sound insulation program and the airport's Part 150 program. **Chapter 0** contains more information regarding stakeholder engagement.

1.4 Introduction to Noise Terminology

Information presented in this NEM document relies upon a reader's understanding of the characteristics of noise (unwanted sound), the effects noise has on persons and communities, and the metrics or descriptors commonly used to quantify noise. The properties, measurement, and presentation of noise involve specialized terminology. This section presents a brief overview; **Appendix A** contains more detailed information on noise metrics.

Sound is a physical phenomenon consisting of minute vibrations (waveforms) that travel through a medium such as air or water. **Noise** is sound that is unwelcome.

Noise metrics may be thought of as measures of noise 'dose'. There are two main types, describing (1) single noise events (single-event noise metrics) and (2) total noise experienced over longer time periods (cumulative noise metrics). Single-event metrics indicate the intrusiveness, loudness, or noisiness of individual aircraft events. Cumulative metrics consider the frequency of noise events as well as the time of day in which they occur. Unless otherwise noted, all noise metrics presented in Part 150 documentation are reported in terms of the A-weighted decibel (abbreviated as dBA or simply as dB where the A-weighting is understood).

Noise sensitivity is greater at night because background (ambient) sound levels tend to be lower at night and people tend to be sleeping. DNL represents noise as it occurs over a 24-hour period, treating noise

[9] https://www.btvsound.com/

events occurring at night (10 p.m. to 7 a.m.) with a 10 dB weighting.[10] This 10 dB weighting is applied to account for greater sensitivity to nighttime noise and the fact that events at night are often perceived to be more intrusive than daytime. **Figure 1-3** illustrates the weighting concept. An alternative way of describing this adjustment is that each event occurring during the nighttime period is calculated as if it were equivalent to ten daytime events. For purposes of Part 150, DNL is normally calculated through use of aircraft operations data averaged over a longer period, such as a year, to smooth out fluctuations occurring in day-to-day operations. The DNL depicted by an NEM is often referred to as the annual average daily DNL.

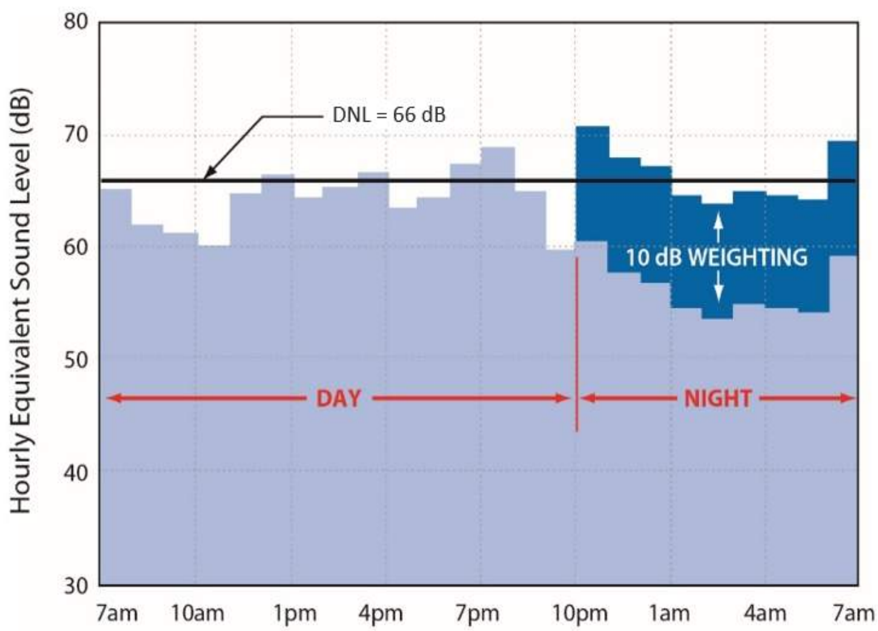

Figure 1-3. Graphic Example of a Day-Night Average Sound Level Calculation
Source: HMMH

[10] For the regulatory definition of DNL see 14CFR Part 150 §150.7 Definitions. http://www.ecfr.gov/cgi-bin/text-idx?SID=f8e6df268e3dad2edb848f61b9a0fb51&mc=true&node=pt14.3.150&rgn=div5; Accessed on 12/07/2022.

1.5 Navigating This Document

This document and the Part 150 Study it represents were undertaken in accordance with the requirements of the Part 150 regulation in Title 14 of the Code of Federal Regulations. The FAA-maintained NEM checklist (provided on page xiii) enumerates specific FAA requirements and identifies the associated location of the supporting text in this document and its appendices.

This document is organized as follows:

- The Airport Sponsor's certification and the FAA NEM checklist are provided in the front of the document, immediately following the Executive Summary
- **Chapter 1** introduces Part 150, includes the history of noise compatibility planning at BTV, and describes the roles and responsibilities of groups involved in the Study.
- **Chapter 2** presents FAA's land use compatibility guidelines and discusses land use in the BTV Part 150 Study area.
- **Chapter 3** describes the existing BTV Noise Compatibility Program and reports the implementation status for each measure.
- **Chapter 4** discusses the development of the aircraft noise exposure contours, including the noise modeling methodology and inputs.
- **Chapter 5** resents the official 2024 and 2029 Noise Exposure Maps and resulting land use compatibility data.
- **Chapter 6** reports on the stakeholder engagement efforts undertaken during the Part 150 process to date.
- Appendices provide supporting documentation as follows:
    - Appendix A: Noise Terminology
    - Appendix B: Existing Noise Compatibility Program Record of Approval
    - Appendix C: Noise Modeling Preparation Correspondence
    - Appendix D: Model Flight Tack Maps (with Same Scale and Base Map as NEMs)
    - Appendix E: Stakeholder Consultation
    - Appendix F: Public Comments

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2 Land Use

Part 150 requires the review of land uses located in the airport vicinity to understand the relationship between those land uses and the noise exposure associated with aircraft operations. This includes delineation of land uses within the DNL 65 dB and higher aircraft noise exposure contours and identification of noise sensitive uses. Identification of a noise sensitive use within the DNL 65 contour does not necessarily mean that the use is either considered incompatible or that it is eligible for mitigation. Rather, identification merely indicates that the use may be considered incompatible and requires further investigation.

This chapter provides an overview of the municipal jurisdictions with authority to regulate land use in the vicinity of BTV, a description of recommended land uses that are deemed generally compatible under Appendix A of Part 150, the land use data collection and verification process, and an overview of existing land uses classifications in the vicinity of the Airport.

2.1 Land Use Compatibility Guidelines

The objective of airport noise compatibility planning is to promote compatible land use in communities surrounding airports. Part 150 requires the review of existing land uses surrounding an airport to determine land use compatibility associated with aircraft activity at the Airport.

The FAA has published land use compatibility designations, as set forth in Part 150, Appendix A, Table 1 (reproduced here as **Table 2-1**). As **Table 2-1** indicates, the FAA generally considers all land uses to be compatible with aircraft-related noise exposure in terms of DNL below 65 dB, including residential parcels, hotels, retirement homes, intermediate care facilities, hospitals, nursing homes, schools, preschools, and libraries. These categories will be referenced throughout the Part 150 process.

Table 2-1. Part 150 Airport Noise / Land Use Compatibility Guidelines

Source: Part 150, Appendix A, Table 1, 2007

Land Use	Yearly Day-Night Average Sound Level [DNL] in Decibels					
	<65	65-70	70-75	75-80	80-85	>85
Residential Use						
Residential other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home park	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail--building materials, hardware and farm equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade—general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

Key and Notes to this table are on the following page

Key to Table 2-1

SLUCM: Standard Land Use Coding Manual
Y(Yes): Land use and related structures compatible without restrictions.
N(No): Land use and related structures are not compatible and should be prohibited.
NLR: Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, or 35: Land use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 A-weighted decibels (dB) must be incorporated into design and construction of structure.

Notes for Table 2-1

The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often started as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year-round. However, the use of NLR criteria will not eliminate outdoor noise problems.
2) Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
4) Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
5) Land use compatible provided special sound reinforcement systems are installed.
6) Residential buildings require an NLR of 25.
7) Residential buildings require an NLR of 30.
8) Residential buildings not permitted.

2.2 Local Land Use

Local municipalities have primary authority over land use decisions in the vicinity of the Airport. BTV is located in South Burlington, Vermont approximately three miles east of Burlington's central business district. The Part 150 study area is centered on the airport and includes parts of the adjacent communities of South Burlington, Burlington, Winooski, Colchester, Essex, and Williston, all contained within Chittenden County. **Figure 2-1** displays the study area, defined to meet the regulatory requirements[11] of Part 150.

Chittenden County has a regional planning council which includes planning department personnel from each of the cities and towns in the county. Representatives from each jurisdiction are invited to serve on the Part 150 Study's TAC and to provide the Study Team with feedback on the land use data used in the Noise Exposure Maps.

[11] Extending to at least 30,000' (approximately 5 nautical miles) from each runway end.

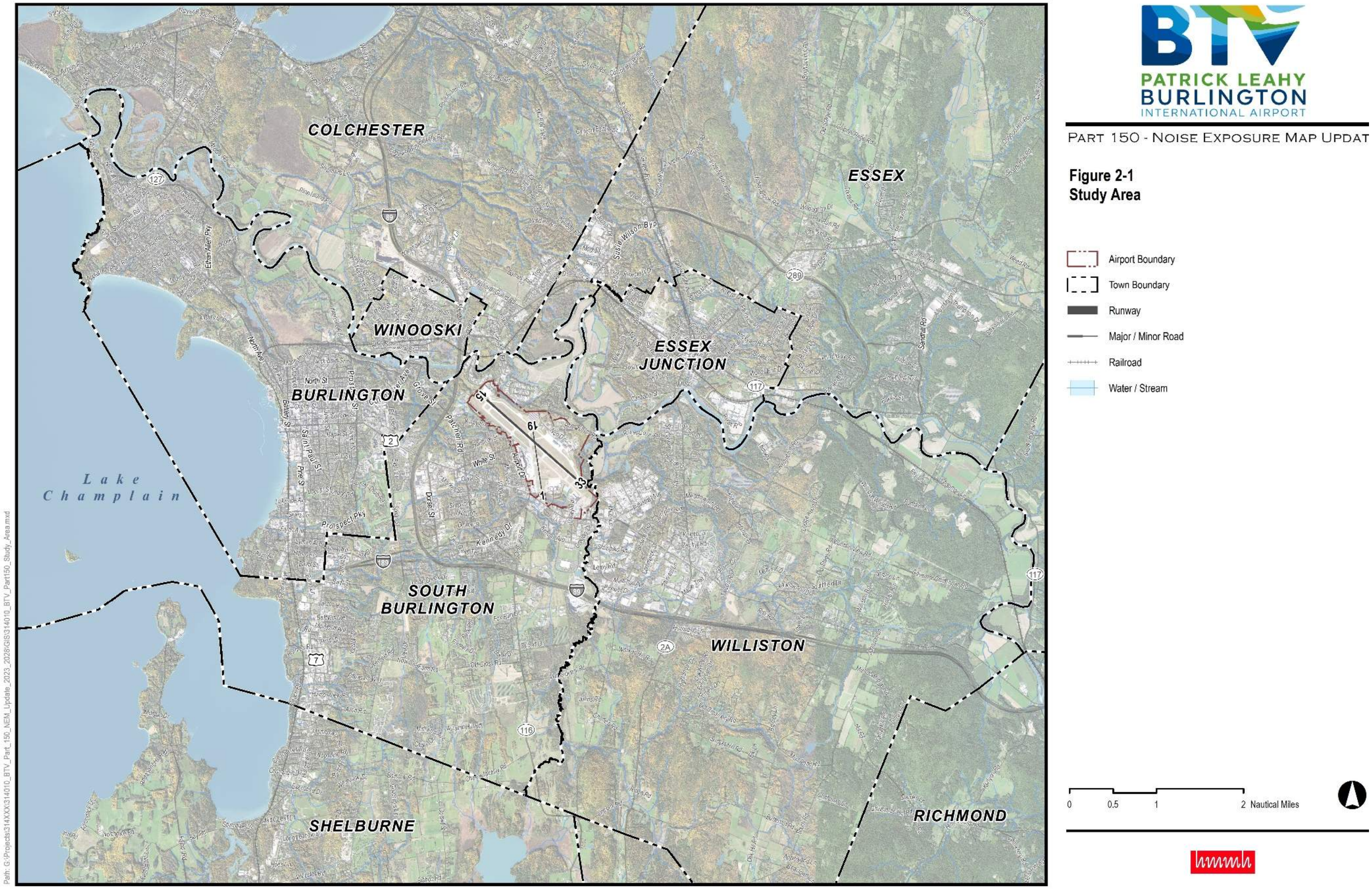

Figure 2-1. Study Area

2.3 Land Use Data Collection and Verification

The Study Team collected detailed land use information from municipalities throughout the study area. Land use data collection and verification focused on the area expected to be within the DNL 65 dB contour, based on prior NEM contours. The jurisdictions determined to potentially have land within the DNL 65 or higher aircraft noise exposure areas were consulted to verify existing land uses, and to discuss local land use controls and/or policies. The collected land use and zoning information were summarized according to the Part 150 land use categories. Noise sensitive land use parcels, categorized by type (residential, school, etc.) were identified and the Study Team conducted a “windshield survey” to verify land uses within the study area. Error! Reference source not found. presents the existing land use data.

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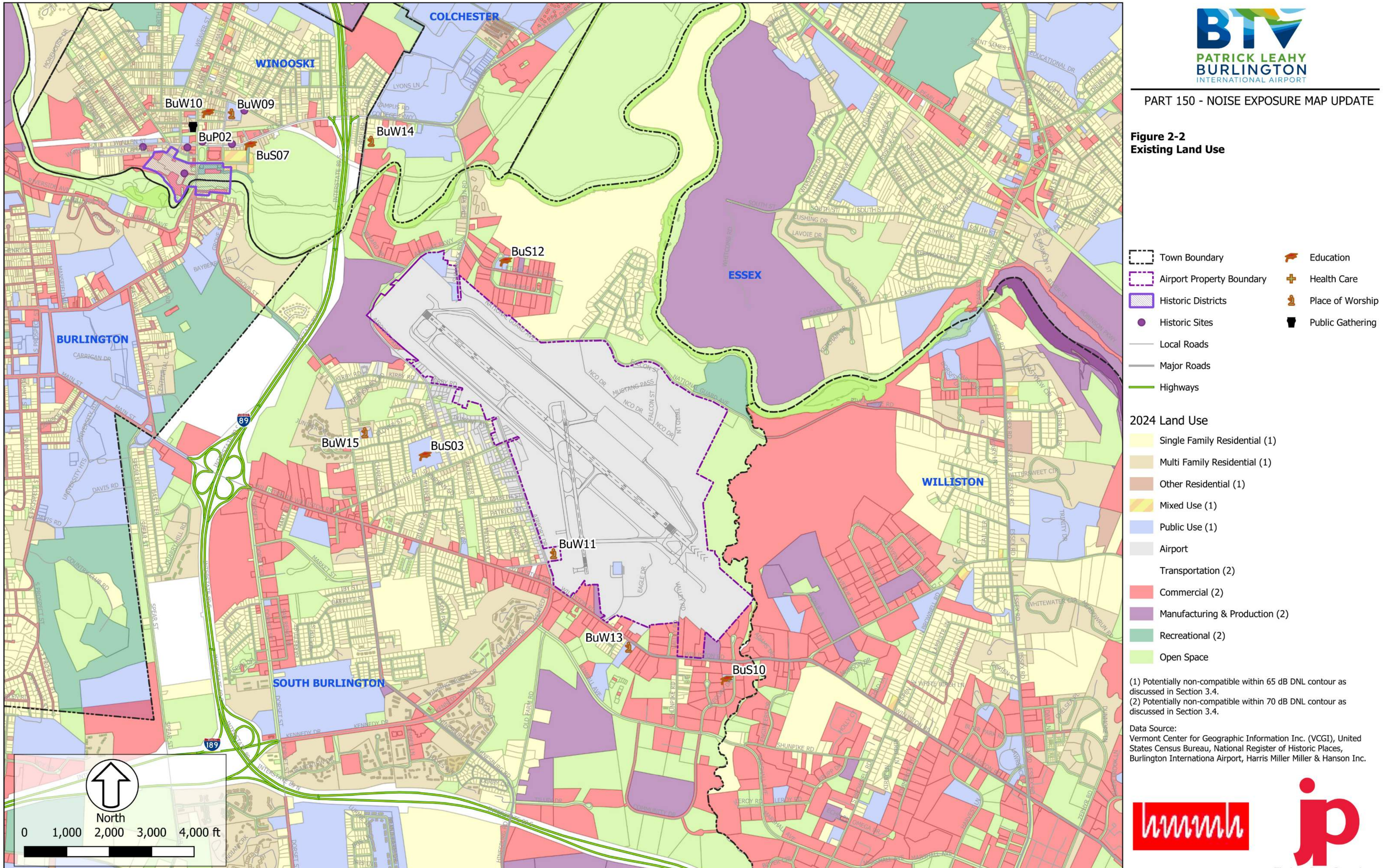
BTV
PATRICK LEAHY BURLINGTON INTERNATIONAL AIRPORT
PART 150 - NOISE EXPOSURE MAP UPDATE
Figure 2-2
Existing Land Use
COLCHESTER
WINOOSKI
ESSEX
BURLINGTON
WILLISTON
SOUTH BURLINGTON
BuW10
BuW09
BuP02
BuS07
BuW14
BuS12
BuW15
BuS03
BuW11
BuW13
BuS10
89
189
North
0 1,000 2,000 3,000 4,000 ft
Town Boundary
Airport Property Boundary
Historic Districts
Historic Sites
Local Roads
Major Roads
Highways
Education
Health Care
Place of Worship
Public Gathering
2024 Land Use
Single Family Residential (1)
Multi Family Residential (1)
Other Residential (1)
Mixed Use (1)
Public Use (1)
Airport
Transportation (2)
Commercial (2)
Manufacturing & Production (2)
Recreational (2)
Open Space
(1) Potentially non-compatible within 65 dB DNL contour as discussed in Section 3.4.
(2) Potentially non-compatible within 70 dB DNL contour as discussed in Section 3.4.
Data Source:
Vermont Center for Geographic Information Inc. (VCGI), United States Census Bureau, National Register of Historic Places, Burlington Internationa Airport, Harris Miller Miller & Hanson Inc.
hmmh
jp
The Jones Payne Group, Inc.

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3 Existing Noise Compatibility Program

BTV's existing Noise Compatibility Program (NCP) includes 14 FAA-approved measures which are a combination of measures approved in 2008 and 2020. Copies of the 2008 and 2020 FAA ROA documents are included in **Appendix B.** The 2020 NCP focused on updating the land use and programmatic measures to address the increased noise anticipated with the Vermont Air National Guard (VTANG) 158th Fighter Wing conversion of fighter aircraft from the F-16C to the F-35A, as well as addressing the City's and adjoining jurisdictions' preference for the local surrounding residential areas to remain a source of affordable housing.

There are seven operational measures (from the 2008 NCP ROA), five land use measures, and two programmatic measures in the current NCP. When the City decides to update the NCP, a review of all measures will be revisited for applicability. **Table 3-1** summarizes the individual measures, the FAA action and the City's implementation status. Detailed descriptions of each measure are provided in the following sections.

Table 3-1. Noise Compatibility Program Status

Sources: FAA ROA documents, BTV, Jones Payne Group, 2024

Number	Measure Description	Implementation Status
Operational Measures (2008 Record of Approval)		
O-1	Extension of Taxiway G	Completed
O-2	Terminal Power Installation & APU/GPU Restrictions	Implemented
O-3	Nighttime Bi-direction Runway Use	Unable to Implement
O-4	Noise Abatement Flight Paths for Runway 15 & 33 Departures and 15 Arrivals	Implemented
O-5	Voluntary Limits on Military C-5A Training	Implemented
O-6	Voluntary Minimization of F-16 Multiple Aircraft Flights	No Longer Applicable
O-7	Voluntary Army Guard Helicopter Training Controls	Not Implemented
Land Use Measures (2020 Record of Approval)		
L-1	Land Acquisition and Relocation	Implemented
L-2	Sound Insulation of Residential Structures	Implemented
L-3	Sound Insulation of Noise Sensitive Buildings	Implemented
L-4	Purchase Assurance for Single Family Parcels	Available for Implementation
L-5	Sales Assistance for Single Family Parcels	Available for Implementation
Programmatic Measures (2020 Record of Approval)		
P-1	Ongoing Monitoring and Review of Noise Exposure Map (NEM) and Noise Compatibility Program (NCP) Status	Ongoing
P-2	Noise and Flight Track Monitoring	Ongoing

3.1 Operational Measures

Operational measures, sometimes called noise abatement measures, are those that control noise at the source; such measures include airport layout modifications, noise barriers, flight path changes, preferential runway use, and arrival and departure procedures. The intention of operational measures in the NCP is to reduce the number of people and noise-sensitive properties exposed to aircraft noise of DNL 65 or greater by changing the size or shape of the DNL contours.

The following operational measures were contained in the 2008 NCP ROA but were not addressed by the 2020 ROA. An update on the status of each measure is provided for reference. The City will be revisiting these measures during the next NCP update.

3.1.1 O-1: Extension of Taxiway G

Original statement of recommendation*: Taxiway G would be extended from the existing intersection with Taxiway A to Taxiway C, remaining parallel with Runway 15/33 in order to reduce noise levels for residents along Airport Drive.*

Implementation Status: Completed. The extension of taxiway G was completed in 2023.

3.1.2 O-2: Terminal Power Installation and APU/GUP Restrictions

Original statement of recommendation: *Installation of terminal power hookups for aircraft would reduce the need for aircraft to use internal auxiliary power units (APU) or ground power units (GPU). Following the installation, a rule prohibiting the use of APUs or GPUs between 10:00 p.m. and 7:00 a.m. would be put in place (2008 ROA Measure 2).*

Implementation Status: Implemented. The Airport terminal now has “aircraft ground power” at all Passenger Boarding Bridges. The City will not be implementing the GPU/APU rule between 10:00 p.m. and 7:00 a.m., as too many flights arrive and depart during those hours. However, use of ground power is required for all aircraft in proximity to an available hookup.

3.1.3 O-3: Nighttime Bi-direction Runway Use

Original statement of recommendation: *To minimize late-night operations over the City of Winooski, the air traffic control tower would use Runway 15 for departure and Runway 33 for arrivals, traffic conditions permitting (2008 ROA Measure 3).*

Implementation Status: Unable to implement. The BTV Air Traffic Control Tower (ATCT) is closed from midnight until 5:30 a.m., which makes implementation of this measure infeasible during these hours. The ATCT has not implemented the procedure during the remaining DNL “nighttime” hours, i.e., from 5:30 to 7:30 a.m.

3.1.4 O-4: Noise Abatement Flight Paths for Runway 15 & 33 Departures and 15 Arrivals

Original statement of recommendation*: New procedures would have civil aircraft fly over less populated areas. Runway 33 departures would turn to a heading of 310 degrees. Runway 15 departures would turn to a heading of 180 degrees.*

Implementation Status: Implemented.

3.1.5 O-5: Voluntary Limits on Military C-5A Training

Original statement of recommendation*: An informal agreement with the military limits C-5A operations to only necessary takeoffs and landings.*

Implementation status: Implemented. An agreement is not currently in place, however (1) BTV operations strongly discourage C-5A training at the airport, because the runways are only 150 feet wide and wake turbulence from C-5A operations tears up the runway-edge lighting, (2) historically the military has always coordinated the arrival of a C-5A with BTV Operations because of the constraints on the airfield, and (3) all transient military aircraft are limited to two practice approaches.

3.1.6 O-6: Voluntary Minimization of F-16 Multiple Aircraft Flights

Original statement of recommendation*: Military personnel will schedule as many single-aircraft, as opposed to multiple-aircraft, flights as possible.*

Implementation Status: No longer applicable. The VTANG fighter wing changed from the F-16 aircraft to the F-35A in 2020. The city will relook at the intent of this measure during the next NCP update.

3.1.7 O-7: Voluntary Army Guard Helicopter Training Controls

Original statement of recommendation*: The National Guard helicopter training operations will be conducted away from the Airport when conditions permit. In terms of long-range planning, the Guard should consider consolidating operations at Camp Johnson.*

Implementation Status: Not implemented. The Vermont Army National Guard has continued training operations at BTV.

3.2 Land Use Measures

Land use measures are also intended to reduce the number of people and noise-sensitive properties exposed to aircraft noise of DNL 65 or greater, but they do so by addressing the noise/land use incompatibilities identified by the Noise Exposure Maps. The City's Noise Mitigation Program is comprised of several programs which were initially centered around land acquisition/relocation, but which, since 2020, are now focused on sound insulation.

The NCP Update which the City completed in 2000 examined all of the pre-existing land use measures and recommended five to be carried forward. The current Noise Mitigation Program uses the five-year forecast 2023 NEM contours accepted by FAA on September 26, 2019, as the basis for implementation of these programs. When a new NEM is accepted by FAA, the updated five-year forecast DNL contours will become the new basis for the land use measures. **Figure 3-1** shows the extents of the noise mitigation program as of April 2024, mapped with the 2023 Forecast DNL contours.

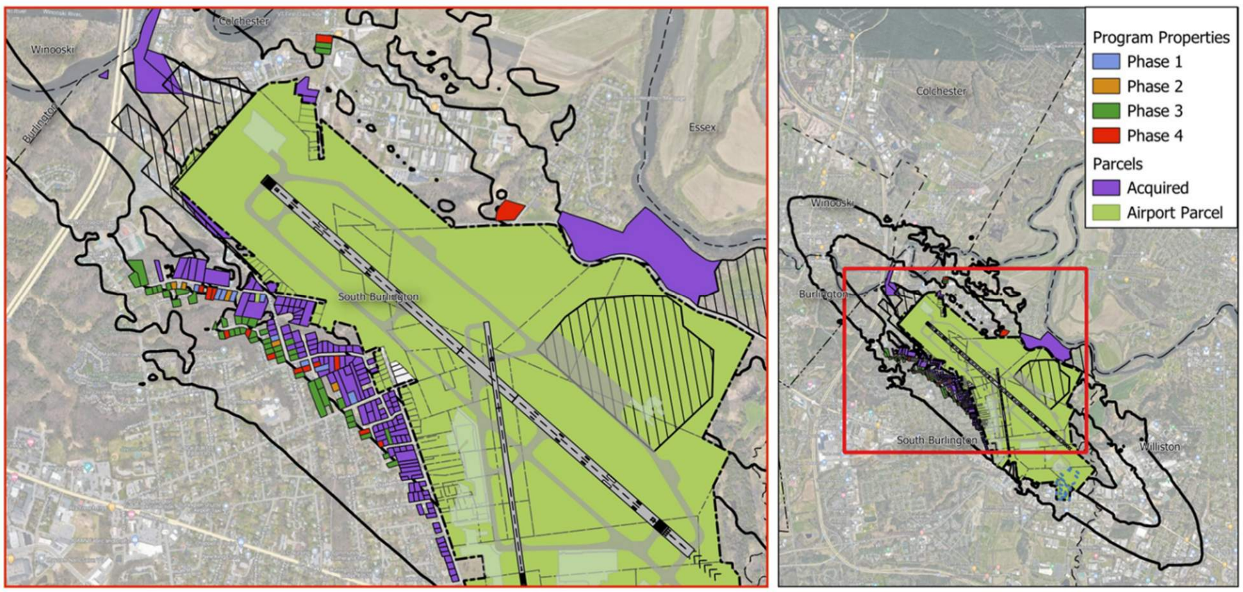


Figure 3-1. Noise Mitigation Program Extents, as of April 2024, with 2023 DNL Contours
Source: Jones Payne Group, 2024

3.2.1 L-1: Land Acquisition and Relocation

Original statement of recommendation*: The City of Burlington, Vermont (the "City") proposes to modify the existing Land Acquisition and Relocation Program to limit the eligibility to parcels where the majority of the non-compatible parcel is located within the 75 dB DNL contour.*

As with the current NCP, this program is voluntary. Eligible property owners will be paid for their property at Fair Market Value, and provided relocation assistance in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (the "Uniform Act") and implementing Department of Transportation (DOT) regulation.

The City proposes to modify the existing Land Acquisition and Relocation Program to limit eligibility to parcels where the majority of the non-compatible parcel is located within the 75 dB DNL contour. This is to preserve neighborhood continuity where terrain modeling resulted in small 75 DNL "pockets". The City recognizes that future NEM updates may shift these 75 DNL "pockets" to other areas in the neighborhood.

This will be a revision to the 2008 ROA Land Use measure #10, which included mobile homes within the 65 DNL contour and residence within the 70 DNL contour. The City, along with input from the City of South Burlington, has requested this measure be modified to apply only to the 75 DNL and higher contours.

The Land Acquisition and Relocation program was modified in the 2020 ROA to limit eligibility to parcels located within the DNL 75 dB contour. Previously, acquisition and relocation was the preferred method of mitigation for homes located within the DNL 65 dB and higher contours.

There are 10 properties identified as touching the 2023 NEM DNL 75 dB contour, as shown in **Figure 3-2**. Five of the properties were included in a 2016 AIP grant for land acquisition and each owner rejected the City's offer to purchase. The other five properties classified as being in the 2023 NEM DNL 75 dB contour were located in small, isolated areas (pockets) of DNL 75 dB within the DNL 70 dB contour that resulted from high-resolution terrain elevation data used in the noise modeling process. Four of the properties, located along Kirby Rd, are contiguous to each other and slightly touch the edge of one of the DNL 75 dB pockets on the 2023 NEM. The fifth property is located north of the Airport on a very large parcel which touches the 2023 DNL 75 dB contour while the residential building itself is not located near the 2023 DNL 75 dB contour.

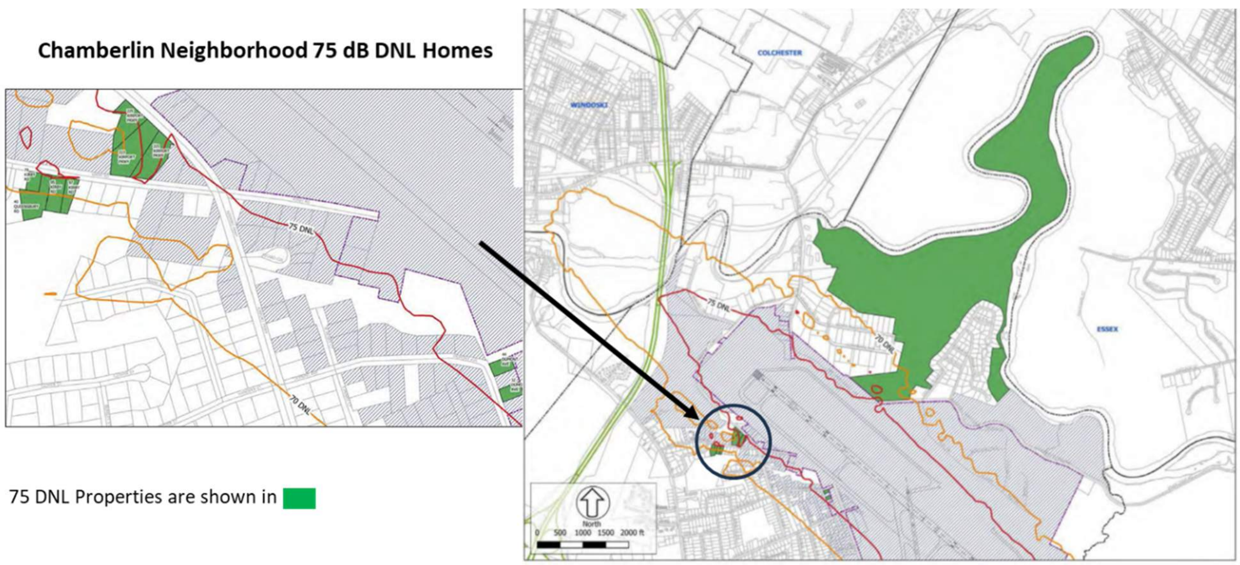


Figure 3-2. Locations of Homes Identified Under Measure L-1
Source: Jones Payne Group, 2024

Implementation Status:

The program is an approved measure under the Noise Compatibility Program. As of October 2024, no homeowners have requested the purchase of their property.

There is one residential property located in 2029 NEM DNL 65 dB DNL and higher contours.

3.2.2 L-2: Sound Insulation of Residential Structures

Original statement of recommendation*: Qualified incompatible residential land uses within the 65 and up to the 75 dB DNL contours, and residential land use located partially within the 75 dB DNL noise contours where a majority of the parcel is located outside the 75 dB DNL contour, would be included in a sound insulation program. For qualified properties, the City will provide an acoustical treatment package designed to reduce interior noise levels to 45 DNL and provide a minimum reduction of 5 dB from the existing interior noise level in accordance with FAA guidelines.[12] These types of parcels will be treated as 70 DNL. Sound insulation is the preferred method of noise mitigation for residences.*

Implementation Status:

There are approximately 2,440 residential units (622 single family units and 1,818 multi-family units) located within the 2029 NEM DNL 65 dB DNL and higher contours.

The Residential Sound Insulation Program has been implemented and is ongoing. The Program began in 2021 and the City has completed construction on 14 homes. There are 68 homes for which sound insulation has been designed and which are awaiting construction. Based on available FAA AIP funding, the City will continue the sound insulation program to design and construct sound insulation treatments for approximately 50 homes per year.

3.2.3 L-3: Sound Insulation of Noise Sensitive Buildings

Original statement of recommendation*: Qualified incompatible non-residential land uses within the 65 and up to the 75 dB DNL contours would be included in a sound insulation program. For qualified properties, the City will provide an acoustical treatment package designed to reduce interior noise levels to 45 DNL and provide a minimum reduction of 5 dB from the existing interior noise level in accordance with FAA guidelines.*

Implementation Status:

There are approximately 11 non-residential land uses (schools, places of worship, learning centers and public gathering places) within the 2029 Forecast Condition DNL 65 dB and greater contours which may be eligible for the sound insulation program.

The Gertrude E. Chamberlin Elementary School, located in South Burlington, VT, is in the DNL 65-70 dB contour interval. At the request of the South Burlington School District, the City applied for federal funds to undertake testing to determine if the school would be eligible for acoustic treatment. The testing determined that the existing interior noise level was below DNL 45 dB and thus the school did not qualify for a full sound insulation treatment package. However, because the school would need to keep the windows and doors closed during classroom hours to maintain that low interior noise level, the building qualified for a positive ventilation system. The City received a second grant to design and construct the positive ventilation system, which was installed during 2021.

[12] FAA Order 5100.38D "Airport Improvement Program Handbook", Appendix R "Noise Compatibility Planning/Projects", Change 1, effective date February 26, 2019

Each year, the City selects potentially eligible properties for sound insulation through the FAA AIP grant program. Properties are selected by noise level contour, starting with the highest contour and working outward, for both residential and non-residential properties within the project area based on available funding.

3.2.4 L-4: Purchase Assurance for Single Family Parcels

Original statement of recommendation*: Qualified incompatible owner-occupied single-family parcels within the 65 DNL up to the 75 DNL contours would be included in a purchase assurance program. The City would acquire the home in exchange for an avigation easement, provide sound insulation and resell the home on the open market for fair market value. Proceeds from the sale of the home would be utilized to fund further noise mitigation programs. This measure pertains to eligible properties within the 65 dB DNL noise level or higher for which the land use is considered non-compatible. (49 USC § 47502, as implemented by Table 1 of Appendix A in 14 CFR part 150). An avigation easement will be required.*

Those properties that are <u>owner-occupied</u> are eligible for this program.

Implementation Status:
There are 622 single family parcels located within the 2029 Forecast Condition DNL 65 dB and greater contours. Those properties that are <u>owner-occupied</u> are eligible for this program.

Available for Implementation. The program has not been requested by eligible homeowners. The City will apply for AIP grant funds should a homeowner wish to participate in the program.

3.2.5 L-5: Sales Assistance for Single Family Parcels

Original statement of recommendation*: Qualified incompatible owner-occupied single-family parcels within the 65 DNL up to the 75 DNL contours and not eligible for sound insulation would be included in a sales assistance program. In exchange for an avigation easement, the City would provide an incentive to assure homeowners receive fair market value for the sale of their home on the open market. Land use includes eligible properties within the 65 dB DNL noise level or higher for which the land use is not considered to be compatible (49 USC § 47502, as implemented by Table 1 of Appendix A in 14 CFR part 150). An avigation easement will be required.*

Those properties that are <u>owner-occupied and are not eligible for sound insulation</u> may be eligible for this program. The incentive package will be tailored to each home to assist in the sale if there are no fair market value offers.

Implementation Status:

There are 622 single family parcels located within the 2029 Forecast Condition DNL 65 dB and greater contours Those properties that are <u>owner-occupied and are not eligible for sound insulation</u> may be eligible for this program. The incentive package will be tailored to each home to assist in the sale if there are no fair market value offers.

Available for implementation. This program has not been requested by eligible homeowners. The City will apply for AIP grant funds should a homeowner wish to participate in the program.

3.3 Programmatic Measures

Programmatic measures enable the City to monitor the implementation and compliance of the recommended operational and land use management measures, as well as enhance stakeholders' understanding of aircraft noise. Programmatic measures are critical to the success of the NCP implementation.

3.3.1 P-1: Ongoing Monitoring and Review of Noise Exposure Map (NEM) and Noise Compatibility Program (NCP) Status

Original statement of recommendation*: This measure provides for revision of the NEM and NCP, citing three examples: changes in airport layout, unanticipated changes in the level of airport activity, and noncompliance with the NCP.*

In the 2008 NCP, this measure also included the recommendation for the Technical Advisory Committee to serve as a Noise Abatement Committee and for the purchase of a permanent noise monitoring system (2008 ROA measure #8).

Implementation Status: Ongoing. The City is undertaking this current NEM Update to assess the noise impacts of the VTANG use of the F-35A aircraft. The permanent noise monitoring system (2008 ROA measure #8) was recommended as a separate new measure in the 2020 NCP update. The Airport currently has a Technical Advisory Committee for the NEM Update and has a standing noise abatement committee (Sound Committee) that meets as directed by the Airport.

3.3.2 P-2: Noise and Flight Track Monitoring

Original statement of recommendation*: This measure recommends the implementation of a system to perform noise monitoring and flight track analysis on an ongoing basis.*

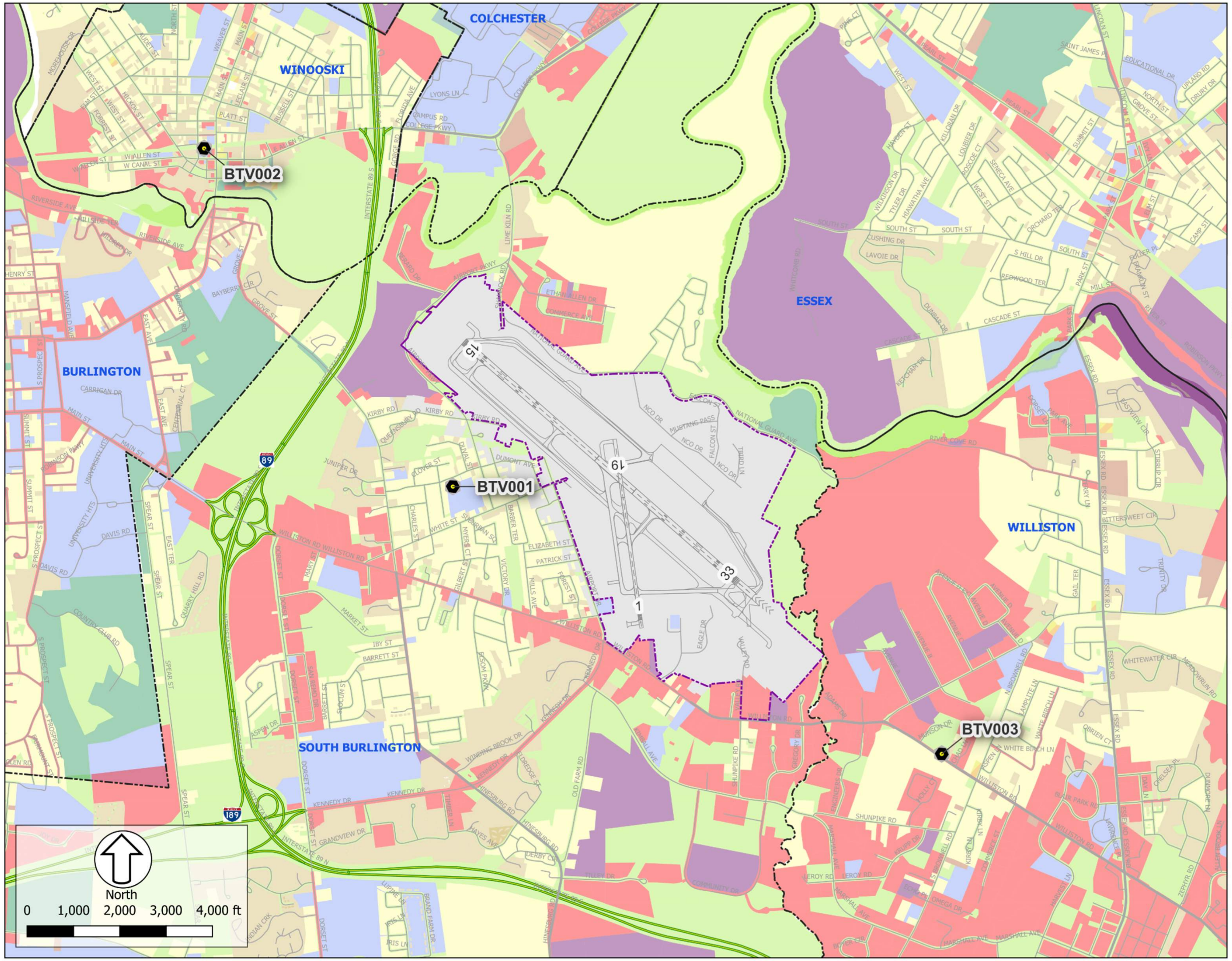
A similar measure was included in the 2008 NCP. The 2020 NCP updated the wording to more clearly indicate that the system should include both noise and flight track monitoring. The system is designed to make the information available to the general public.

Implementation Status:

The City installed a noise and flight tracking system in 2021. The system includes 3 noise monitors and a public website[13] or the community to view flight operations and the associated noise levels. BTV staff report monthly to the Airport Commission on the status of the system. **Figure 3-3** depicts the locations of the City's permanent noise monitors, labeled as shown in the public portal: BTV001 is at the

[13] https://www.btvsound.com/

Chamberlin School, BTV002 is at the Winooski City Hall and BTV003 is on Williston Rd near Chad Lane in Williston.



PATRICK LEAHY BURLINGTON INTERNATIONAL AIRPORT

PART 150 - NOISE EXPOSURE MAP UPDATE

Figure 3-3
Noise Monitor Sites

- Noise Monitor
- Town Boundary
- Airport Property Boundary
- Local Roads
- Major Roads
- Highways

2024 Land Use

- Single Family Residential (1)
- Multi Family Residential (1)
- Other Residential (1)
- Mixed Use (1)
- Public Use (1)
- Airport
- Transportation (2)
- Commercial (2)
- Manufacturing & Production (2)
- Recreational (2)
- Open Space

(1) Potentially non-compatible within 65 dB DNL contour as discussed in Section 3.4.
(2) Potentially non-compatible within 70 dB DNL contour as discussed in Section 3.4.

Data Source:
Vermont Center for Geographic Information Inc. (VCGI), United States Census Bureau, National Register of Historic Places, Burlington Internationa Airport, Harris Miller Miller & Hanson Inc.

The Jones Payne Group, Inc.

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4 Development of Noise Exposure Contours

Part 150 requires that the aircraft noise exposure contours for an NEM be prepared using the most recent release of the FAA's Aviation Environmental Design Tool (AEDT) that was available at the outset of the study, in this case, Version 3e. AEDT is a software system developed by the FAA that models aircraft performance in space and time to estimate fuel consumption, emissions, noise and air quality consequences.[14] AEDT is the FAA-approved tool for determining the cumulative effect of aircraft noise exposure around airports. Statutory requirements for AEDT use are defined in Part 150, "Airport Noise Compatibility Planning."

The noise exposure from the VTANG and VTARNG's aircraft operations were primarily computed[15] with the Department of Defense's NOISEMAP (NMap) software, Version 7.3. Data for the NMap modeling of F-35A and military helicopter (UH-60M and UH-72A) operations was based on the NMap modeling in the previous NEM Update, revised using current information provided by the Air National Guard and Army National Guard. The noise grid output of the NMap model was combined with the AEDT output to generate contours for the average annual daily DNL contours. In accordance with the definition of the DNL metric (described in section 1.4), daytime is from 7 a.m. to 10 p.m. and nighttime is from 10 p.m. to 7 a.m. These day and night definitions are used through this NEM unless specified otherwise.

Sections 4.1 through 4.8 describe the required AEDT and NMap inputs, which include:

- Physical description of the airport layout (Section 4.1)
- Aircraft operations (Section 4.2)
- Aircraft noise and performance characteristics (Section 4.3)
- Runway use (Section 4.4)
- Flight track geometry and usage (Section 4.5)
- Ground noise inputs (Section 4.6)
- Meteorological Data (Section 4.7)
- Terrain Data (Section 4.8)

4.1 Physical Description of the Airport Layout

BTV has two operational runways: Runway 15/33 and Runway 1/19. The primary runway, Runway 15/33, is 8,319 feet long and 150 feet wide. Runway 1/19 is 4,112 feet long and 75 feet wide. The published airport elevation is 335 feet above mean sea level. **Figure 4-1** shows the current airport diagram.

[14] https://aedt.faa.gov/; Accessed on 0/08/2024.

[15] The VTARNG's C-12 is modeled as a Beechcraft 1900D in AEDT and military transient P-8 operations are represented as Boeing 737-800s in AEDT. All other military aircraft are modeled with NMap.

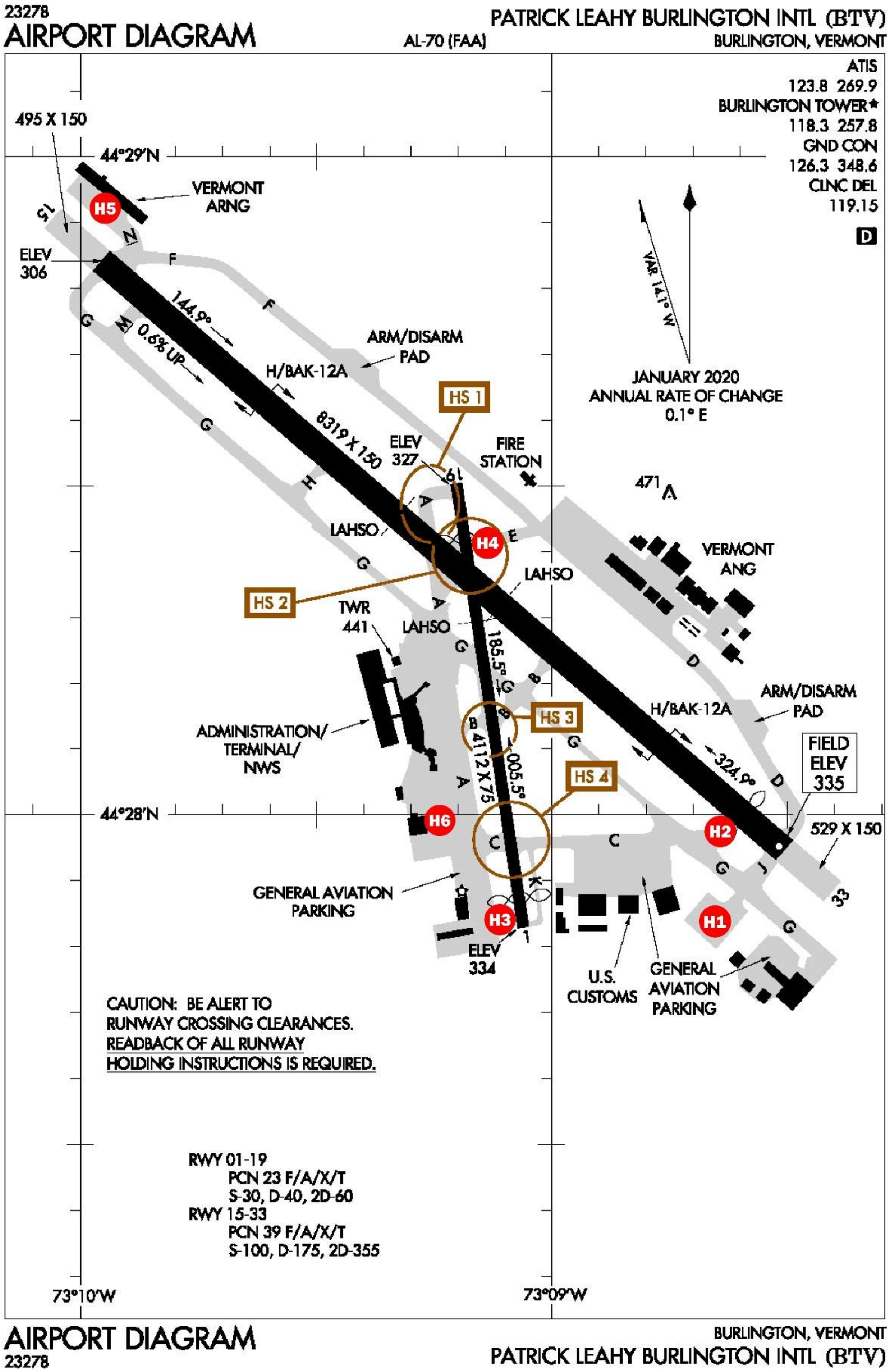

Figure 4-1. BTV Airport Diagram

Source: FAA, accessed in October 2023, HMMH addition of helipad locations

Multiple locations on the airfield serve as helicopter departure and landing points, even if they are not formally designated as helipads. For noise modeling purposes, six such locations (indicated by the red dots labeled H1 through H6 on **Figure 4-1**) are identified. **Table 4-1** provides the airport layout information used in modeling the 2024 Existing and 2029 Forecast conditions. In calculating noise, AEDT uses the following data:

- departure thresholds (i.e. where aircraft begin their take-off roll)
- arrival threshold (a location marked on the runway)
- arrival threshold crossing height (TCH) (the height that arriving aircraft cross the arrival threshold)
- runway gradient (i.e. is the runway slightly uphill or downhill)
- runway location
- runway direction

Runway length, runway width, instrumentation, and declared distances affect which runway an aircraft will use and under what conditions, and therefore, those factors, together with weather constraints, determine runway usage proportions for each category of operations.

Table 4-1. Current Airport Layout Data

Sources: FAA 5010, BTV staff, and pilot interviews, 2023

Runway End or Helipad	Latitude	Longitude	Elevation (ft MSL)	Length (ft)	Approach Angle (degrees)	Displaced Threshold (ft)
15	44.480674	-73.165879	306	8,319	3.0	0
33	44.465758	-73.141763	335	8,319	3.2	500
19	44.474978	-73.153352	327	4,112	3.5	500
01	44.463826	-73.151003	334	4,112	4.0	225
H1	44.464083	-73.144222	320	N/A	N/A	N/A
H2	44.466368	-73.143932	333	N/A	N/A	N/A
H3	44.464046	-73.151502	332	N/A	N/A	N/A
H4	44.473678	-73.152465	328	N/A	N/A	N/A
H5	44.482399	-73.166001	300	N/A	N/A	N/A
H6	44.466413	-73.154174	323	N/A	N/A	N/A

MSL = mean sea level
A helicopter can approach and land anywhere on the airfield if authorized by ATCT. The locations H1 through H6 are modeled as helicopter arrival and/or departure points but are not officially designated as helipads.

Civilian helicopters use helipads H1, H3, and H6. H1 is located between the two GA parking areas south of Runway 15/33, H3 is adjacent to the south end of Runway 1/19, and H6 is just south of the airport terminal at the north end of the GA ramp. The VTARNG operates a helipad northeast of Runway 15/33 (H5) on their ramp and they also use taxiways E (H4), C (H2), and L (H3) for helicopter takeoffs and landings.

4.2 Aircraft Operations

Civilian and transient military annual-average daily aircraft operations are based on an 18-month data sample obtained from the BTV noise and operations monitoring system[16] (NOMS), covering the period of January 1, 2022, through June 30, 2023. For each FAA category (Air Carrier, Air Taxi and GA). The Study Team used the NOMS data to determine day-night split of operations and fleet mix as required to prepare aircraft noise exposure DNL contours.

The Study Team compared the FAA ATCT counts for July 1, 2022, through June 30, 2023, to the published FAA TAF operations levels. That analysis suggested that the tower counts should be used as a basis for forecasting 2024 and 2029, rather than scaling to the TAF as was done in BTV's previous NEM update[17]. NOMS flight records for the midnight to 5:30 a.m. time frame (when the air traffic control tower is closed) provided a means for calculating a tower-closed scaling factor to apply to FAA tower counts data. Growth rates from the February 2023 issue of the FAA's TAF were applied to the scaled tower counts to project aircraft category totals for modeling the NEM Existing (2024) and Forecast (2029) conditions.

The Study Team met with representatives from Vermont Flight Academy, University of Vermont Health Network (Med-flight), and Beta Technologies to discuss their respective current aircraft fleets and projected operations levels for 2024 and 2029. Incorporating that information, 2022/2023 NOMS data fleet mix, and recently announced scheduled commercial service changes, the Study Team developed a detailed operational forecast for 2024. Additional expected civilian fleet changes and service-level changes are incorporated in the 2029 detailed forecast. The Study Team developed military operations forecasts in consultation with personnel from the US Air National Guard 134th Fighter Squadron (also referred to as the Vermont Air National Guard or VTANG) and personnel from the Army National Guard 86th Troop Command (also referred to as the Vermont Army National Guard or VTARNG).

Table 4-2 and **Table 4-3** provide summaries of annual aircraft operations to be modeled for the BTV NEM Existing and Forecast years. The operations are condensed into categories[18]; namely Air Carrier (AC), Air Taxi (AT), General Aviation (GA), and military (ML). AC and AT are commercial categories distinguished by aircraft capacity, while GA includes all non-commercial, non-military operations. The tables list operations as either itinerant (meaning arrivals and departures) or local (meaning aircraft that remain in the BTV airspace). For the 2029 forecast year, there are 300 more departures than arrivals. This is due to the inclusion of an estimated 300 new BETA Technologies ALIA aircraft departing the BTV on-site factory for finishing at nearby Plattsburg airport before final delivery to nationwide clients. For the purposes of noise modeling, all local operations will be modeled as closed oval-shaped patterns, which include touch-and-go operations and other practice flights.

The military operations data account for the fact that the air traffic control tower may consider multiple military aircraft flying in formation as a single count. This practice is documented in FAA Order 7210.3Y at Chapter 12, Section 12-2-1 (April 3, 2014) and verified with FAA staff. Typically, 2 or more aircraft take off in formation (single count) and then return individually (2 or more counts). As a result, total

[16] Supplied by Vector Airport Systems, LLC
[17] The tower count methodology is the more conservative option for noise modeling, resulting in totals that are 8 to 9 percent higher than TAF operations.
[18] Specified by FAA Order 7210.3 "Facility Operation and Administration"

modeled military aircraft operations numbers exceed those reported in the tower counts. A detailed discussion of the development of current and future levels of flight operations is provided in the forecast memo included in **Appendix C**. FAA reviewed the forecast memo and worked through several rounds of refinements with the study team from April to July, 2024, until all concerns were resolved.

Table 4-2. BTV Annual Aircraft Operations Summary for Existing Year 2024

Sources: FAA, 2023; HMMH, 2023; USAF 134th Fighter Squadron, 2023; BTV NOMS data, 2023

Category		Itinerant Operations				Local Operations		Totals
		Arrivals		Departures		Closed Patterns		
		Day	Night	Day	Night	Day	Night	
Civilian	Air Carrier	5,918	2,442	5,664	2,696	0	0	**16,720**
	Air Taxi	2,804	203	2,898	109	0	0	**6,013**
	GA	20,365	514	20,065	814	43,936	1,322	**87,015**
Military	VTANG	2,075	0	2,075	0	60	0	**4,210**
	VTARNG	500	31	491	40	0	0	**1,062**
	Transient	81	0	81	0	46	0	**208**
Civilian Total		**29,087**	**3,158**	**28,626**	**3,619**	**43,936**	**1,322**	**109,747**
Military Total		**2,656**	**31**	**2,647**	**40**	**106**	**0**	**5,480**
Combined Totals		**31,743**	**3,189**	**31,273**	**3,659**	**44,042**	**1,322**	**115,227**

Table 4-3. BTV Annual Aircraft Operations Summary for Forecast Year 2029

Sources: FAA, 2023; HMMH, 2023; USAF 134th Fighter Squadron, 2023; BTV NOMS data, 2023

Category		Itinerant Operations				Local Operations		Totals
		Arrivals		Departures		Closed Patterns		
		Day	Night	Day	Night	Day	Night	
Civilian	Air Carrier	6,453	2,663	6,177	2,940	0	0	**18,233**
	Air Taxi	2,976	203	3,070	109	0	0	**6,358**
	GA	20,868	514	20,868	814	44,909	1,354	**89,327**
Military	VTANG	2,069	0	2,069	0	60	0	**4,198**
	VTARNG	500	35	498	37	0	0	**1,070**
	Transient	73	0	73	0	46	0	**192**
Civilian Total		**30,298**	**3,379**	**30,115**	**3,862**	**44,909**	**1,354**	**113,917**
Military Total		**2,642**	**35**	**2,640**	**37**	**106**	**0**	**5,460**
Combined Totals		**32,940**	**3,414**	**32,755**	**3,899**	**45,015**	**1,354**	**119,377**

Table 4-4 and **Table 4-5** provide detailed operations data for each modeled aircraft type within the civilian and military aircraft categories. The specific aircraft types listed indicate the aircraft noise and performance (ANP) data accessed by the AEDT or NMap program in the noise calculation. The small numbers of transient military aircraft operations are grouped together in this table as fighter jets or transport aircraft. All fighter jets will be modeled in NMap.

Table 4-4. BTV Annual Flight Operations for Existing Year 2024

Sources: FAA, 2023; HMMH, 2023; USAF 134th Fighter Squadron, 2023; BTV NOMS data, 2023

Category		ANP type	Arrivals		Departures		Closed Patterns		Totals
			Day	Night	Day	Night	Day	Night	
Air Carrier	Jet	757RR	160	-	155	5	-	-	**321**
		757PW	118	-	118	-	-	-	**236**
		A319-131	328	256	283	301	-	-	**1,168**
		A320-232	256	-	251	5	-	-	**512**
		717200	-	257	-	257	-	-	**515**
		737700	276	40	275	41	-	-	**632**
		737800	333	189	44	479	-	-	**1,045**
		7378MAX	51	261	-	312	-	-	**625**
		CRJ9-ER	2,764	1,435	2,912	1,287	-	-	**8,398**
		EMB170	521	-	521	-	-	-	**1,042**
		EMB175	1,110	3	1,105	8	-	-	**2,227**
Air Taxi & GA	Jet	CNA560XL	904	-	889	15	-	-	**1,808**
		CNA680	419	29	423	25	-	-	**897**
		CL600	279	21	299	-	-	-	**599**
		CNA55B	831	47	797	81	39	9	**1,803**
	Piston	GASEPF	2,169	-	2,169	-	6,876	-	**11,213**
		CNA172	10,253	216	10,039	431	23,525	1,023	**45,487**
		CNA182	1,300	-	1,300	-	293	-	**2,894**
		GASEPV	1,506	14	1,497	23	5,072	102	**8,213**
		COMSEP	1,054	6	1,048	11	162	-	**2,281**
	Turboprop	CNA208	1,217	178	1,280	115	61	-	**2,852**
		DHC6	785	-	785	-	-	-	**1,571**
	Helicopter	R22	1,660	19	1,646	34	7,759	180	**11,299**
		SA350D	158	3	150	11	88	-	**409**
		EC130	634	183	640	176	60	9	**1,701**
VTANG	Jet	F-35A	2,075	-	2,075	-	60	-	**4,210**
VTARNG	Helicopter	H-60M	149	19	156	12	-	-	**336**
		UH-72	301	12	287	26	-	-	**626**
	Turboprop	C-12	50	-	48	2	-	-	**100**
Transient	Jet	Fighters	42	-	42	-	-	-	**84**
	Jet	Transport	29	-	29	-	6	-	**64**
	Turboprop	Transport	10	-	10	-	40	-	**60**
Totals			**31,733**	**3,189**	**31,263**	**3,659**	**44,002**	**1,322**	**115,227**

Notes: Military Transients include fighters (F16C, F18E/F, F-35A, and F-22) and various transport aircraft (jet KC46 and turboprop C130J), all of which will be modeled in NMap, except the P-8 (which will be represented by 737800 in AEDT). The VTARNG C-12 will be modeled as a Beechcraft 1900D in AEDT. Military helicopters will be modeled in NMap.

Table 4-5. BTV Annual Flight Operations for Forecast Year 2029

Sources: FAA, 2023; HMMH, 2023; USAF 134th Fighter Squadron, 2023; BTV NOMS data, 2023

Category		ANP type	Arrivals		Departures		Closed Patterns		Totals
			Day	Night	Day	Night	Day	Night	
Air Carrier	Jet	757RR	175	-	170	5	-	-	**349**
		757PW	129	-	129	-	-	-	**258**
		A319-131	357	279	309	328	-	-	**1,273**
		A320-232	279	-	274	5	-	-	**558**
		737800	364	487	48	803	-	-	**1,701**
		737700	301	44	300	45	-	-	**690**
		7378MAX	56	285	-	341	-	-	**681**
		CRJ9-ER	3,014	1,565	3,175	1,404	-	-	**9,158**
		EMB170	568	-	568	-	-	-	**1,136**
		EMB175	1,211	3	1,205	9	-	-	**2,428**
Air Taxi & GA	Jet	CNA560XL	926	-	911	15	-	-	**1,852**
		CNA680	445	29	449	25	-	-	**949**
		CL600	296	21	317	-	-	-	**633**
		CNA55B	858	47	824	81	39	9	**1,858**
	Piston	GASEPF	2,201	-	2,201	-	6,999	-	**11,402**
		CNA172	9,239	195	9,037	397	19,070	893	**38,832**
		CNA182	1,349	-	1,349	-	308	-	**3,007**
		GASEPV	2,816	35	2,794	56	9,967	254	**15,923**
		COMSEP	1,069	6	1,064	11	164	-	**2,313**
	Turboprop	CNA208	1,269	178	1,331	115	62	-	**2,956**
		DHC6	825	-	825	-	-	-	**1,649**
	Helicopter	R22	1,744	19	1,730	34	8,147	189	**11,864**
		SA350D	166	3	158	11	92	-	**429**
		EC130	642	183	648	176	60	9	**1,718**
	Electric	GASEPV	-	-	300	-	-	-	**300**
VTANG	Jet	F-35A	2,069	-	2,069	-	60	-	**4,198**
VTARNG	Helicopter	H-60M	150	20	150	20	-	-	**340**
		UH-72	300	15	300	15	-	-	**630**
	Turboprop	C-12	50	-	48	2	-	-	**100**
Transient	Jet	Fighters	34	-	34	-	-	-	**68**
	jet	Transport	29	-	29	-	6	-	**64**
	Turboprop	Transport	10	-	10	-	40	-	**60**
Totals			**32,940**	**3,414**	**32,755**	**3,899**	**45,015**	**1,354**	**119,377**

Notes: Military Transients include fighters (F16C, F18E/F, F-35A, and F-22) and various transport aircraft (jet KC46 and turboprop C130J), all of which will be modeled in NMap, except the P-8 (which will be represented by 737800 in AEDT). The VTARNG C-12 will be modeled as a Beechcraft 1900D in AEDT. Military helicopters will be modeled in NMap.

4.3 Aircraft Noise and Performance Characteristics

AEDT and NMap require the use of specific noise and performance data for each aircraft type operating at the Airport. Noise data is in the form of Sound Exposure Level (SEL) at a range of distances (from 200 feet to 25,000 feet) from a particular aircraft with engines at a range of thrust levels. Performance data 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 types, most of which are civilian aircraft. NMap includes noise data for various military aircraft types, though unlike AEDT, NMap does not contain inbuilt aircraft performance data. Performance data for modeling of aircraft in NMap is developed based on information obtained through interviews with aircraft operators. Collectively, the aircraft data in both models is referred to as aircraft noise and performance (ANP) data.

Within the AEDT database, aircraft takeoff (departure) profiles are defined by a range of trip distances identified as “stage lengths.” Higher stage lengths (longer trip distances) are associated with a heavier aircraft due to the increase in fuel requirements for the flight. For this study, stage lengths are derived using the city-pairs information in the 2022/2023 NOMS data, determined by the distance from the originating airport (BTV) to the planned arrival city.

The Study Team used STANDARD profiles for all fixed-wing civilian aircraft types in the existing condition. For military aircraft types modeled in NMap, the Study Team used interviews with on-base pilots to develop locally accurate representative flight profiles that are indicative of how the fighter jets operate at BTV.

Additional modeling inputs for this study were developed and submitted to the FAA for approval. The details of these inputs are included in the Study Team’s correspondence with FAA in **Appendix C**. In summary, these changes include the following topics:

- Non-standard substitutions for selection of representative AEDT aircraft types
- Modeling of aircraft taxi activity
- Non-standard flight profiles for medical helicopters between BTV and a nearby hospital

4.3.1 Non-Standard Substitutions

Not all aircraft types identified as operating at BTV have specific AEDT aircraft types or pre-approved substitutions. For those aircraft types not in the AEDT standard database, the following FAA-approved substitutions were used:

- Guimbal G-2 Cabri helicopter (substitution with ANP type R22)
- Tecnam P-Mentor (SIRA) single-engine aircraft (substitution with GASEPV)
- Piper 16 Clipper (PA16) single-engine aircraft (substitution with GASEPF)
- Pipistrel Velis Electro (PIVE) single-engine aircraft (substitution with GASEPF)
- Beta Technologies ALIA electric aircraft (substitution with GASEPV)

4.3.2 Aircraft Taxi Modeling

Taxiway noise is associated with aircraft taxiing to and from the runways to their respective parking areas or gates on the ramp. The taxiing may also include a queue time, where the aircraft is stationary, awaiting clearance to proceed, and the engines are at idle. Non-standard modeling inputs were prepared so that AEDT could represent taxiway operations. **Appendix C** provides additional details.

4.3.3 Medical Center Helicopter Operations

The local hospital, University of Vermont Medical Center, has a helipad to facilitate patient transportation by helicopter. The helipad, designated in FAA's records as 67VT, is located approximately 2 miles west of BTV. The helicopters, mainly Eurocopter EC 135 (modeled as AEDT ANP type EC130), are serviced, maintained, and stored at FBO facilities on the east side of BTV. The helicopters fly the 2 miles between the FBO and the helipad 67VT, within the 30,000-foot radius study area requirement in 14 CFR Part 150.[19] The average altitude of the helicopters is approximately 465 feet above field elevation. **Appendix C** provides additional details on the development of the helicopter flight profiles for AEDT input.

4.3.4 Military Aircraft Flight Profile Development

The Study Team used the Department of Defense's NOISEMAP software for modeling the noise exposure of the VTANG F-35A aircraft operations at BTV, as well as for the transient military fighter jet and the VTARNG helicopter activity. The team updated the 2018 NEM F-35A modeling data with multiple iterations of input development and refinement with the VTANG to reflect current and projected future F-35A flying operations.

The Study Team developed flight profiles for transient aircraft by using the standard profiles included with NMap and adapting them for BTV as appropriate.

[19] 14 CFR Part 150 Appendix-A-to-Part-150(b)(1)

4.4 Runway Use

The primary factor affecting runway use at airports is weather; specifically, the wind direction and speed. Additional factors that may affect runway use include the position of airport facilities, including passenger terminals, GA ramps, fixed based operators, and other unique factors related to an airport's configuration relative to the position and direction of the runways.

Civilian runway utilization percentages input to the noise model are based on the most recent 12 months of data obtained from the BTV NOMS. The data provide counts of operations using each runway by category (Air Carrier, Air Taxi, or General Aviation) and aircraft category (Jet, turboprop, piston, or helicopter). There are no known changes to the airport configuration or any known changes to aircraft flight procedures expected during the five-year forecast period of this Part 150 Study, and as such, the same runway utilization rates are used for both 2024 and 2029.

Table 4-6, **Table 4-7**, and **Table 4-8** provide the modeled runway use percentages for arrivals, departures, and closed patterns, respectively. The VTANG provided the Study Team with all military runway use. The transient military category includes military fighter jets and military transport aircraft.

Table 4-6. BTV Arrival Runway Use, Fixed Wing Aircraft

Sources: USAF 134th Fighter Squadron, 2023; HMMH analysis of BTV NOMS data, 2023

Aircraft Category	Day Usage Percent By Runway End					Night Usage Percent By Runway End				
	15	33	1	19	Total	15	33	1	19	Total
Air Carrier Jet	54.4%	45.6%	--	--	**100%**	60.7%	39.3%	--	--	**100%**
Air Taxi/GA Jet	53.0%	47.0%	--	--	**100%**	58.2%	41.8%	--	--	**100%**
Civilian Non-Jet	28.5%	31.3%	16.1%	24.1%	**100%**	53.9%	29.2%	7.8%	9.1%	**100%**
VTANG Jet (F-35As)	50.0%	50.0%	--	--	**100%**	--	--	--	--	
VTARNG Turboprop	53.0%	47.0%	--	--	**100%**	--	--	--	--	
Transient Military	53.0%	47.0%	--	--	**100%**	--	--	--	--	

Notes: Totals may not appear to add to 100% due to rounding.

No military arrivals were modeled in the night time frame (10 p.m.. to 7 a.m.)

Table 4-7. BTV Departure Runway Use, Fixed Wing Aircraft

Sources: USAF 134th Fighter Squadron, 2023; HMMH analysis of BTV NOMS data, 2023

Aircraft Category	Day Usage By Runway End					Night Usage By Runway End				
	15	33	1	19	Total	15	33	1	19	Total
Air Carrier Jet	50.9%	49.1%	--	--	**100%**	64.8%	35.2%	--	--	**100%**
Air Taxi/GA Jet	51.6%	48.4%	--	--	**100%**	42.7%	57.3%	--	--	**100%**
Civilian Non-Jet	21.4%	28.0%	18.2	32.4	**100%**	24.8%	32.2%	18.9%	24.1	**100%**
VTANG Jet (F-35As)	50.0%	50.0%	--	--	**100%**	--	--	--	--	
VTARNG Turboprop	44.0%	56.0%	--	--	**100%**	44.0%	56.0%	--	--	**100%**
Transient Military	44.0%	56.0%	--	--	**100%**	--	--	--	--	

Notes: Totals may not appear to add to 100% due to rounding.

The rare military departures modeled in the night time frame (10 p.m. to 7 a.m.) are VTARNG C-12s

Table 4-8. BTV Closed Pattern Runway Use

Sources: USAF 134th Fighter Squadron, 2023; HMMH analysis of BTV NOMS data, 2023

Aircraft Category	Day Usage By Runway End					Night Usage By Runway End				
	15	33	1	19	Total	15	33	1	19	Total
GA Fixed Wing Aircraft	12.6%	26.3%	20.8	40.4	**100%**	18.7%	23.9%	15.9%	41.5	**100%**
GA Helicopters	4.0%	2.9%	28.1	65.0	**100%**	9.1%	0.0%	29.5%	61.4	**100%**
VTANG Jet (F-35As)	50.0%	50.0%	--	--	**100%**	--	--	--	--	
Transient Military	44.0%	56.0%	--	--	**100%**	--	--	--	--	

Notes: Totals may not appear to add to 100% due to rounding.

Military pattern operations are only conducted in the day period (7 a.m. to 10 p.m.)

Civilian helicopter patterns are modeled using the runway ends instead of the helipads; military helicopters do not fly pattern operations at BTV

Arrow diagrams provide the same modeled runway use data in a graphical format for the most important aircraft categories[20]. Figure 4-2 and Figure 4-3 depict the modeled civilian and military jet runway use, respectively. Figure 4-4 and Figure 4-5 show the modeled runway use for the civilian non-jet fixed wing arrivals/departures and closed pattern flights, respectively.

Table 4-9 provides helipad use at BTV, with the helipad numbering[21] as shown on **Figure 4-1**. Civilian helicopters arrive and depart from helipads H1, H3, and H6, with most arrivals and departures occurring on H1 and H3. The civilian helipad usage was derived from the NOMS data. Based military helicopters arrive and depart from helipads H2, H3, H4, and H5, with most arrivals and departures occurring to or from H5 (the VTARNG ramp). The VTARNG provided the Study Team with the helipad usage for modeling.

Table 4-9. BTV Helipad Usage

Sources: VTARNG, BTV staff; HMMH analysis of BTV NOMS data, 2024

Helipad Designation	Military Helicopters Arrivals & Departures		Civilian Helicopters Arrivals		Civilian Helicopters Departures	
	Day	Night	Day	Night	Day	Night
H1	-	-	42.8%	20.6%	29.5%	21.8%
H2	30%	30%	-	-	-	-
H3	4%	4%	50.2%	77.5%	51.9%	74.4%
H4	10%	10%	-	-	-	-
H5	56%	56%	-	-	-	-
H6	-	-	7.0%	2.0%	18.6%	3.8%
Totals	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Note: Totals may not appear to add to 100% due to rounding.

[20] From a noise perspective, the most important aircraft categories at BTV are the based VTANG Jets (F-35As) and the civilian jets, due to their noise levels, and the civilian non-jets, due to their frequency of operation.

[21] The helipad numbering was applied for noise modeling purposes only; these are not official airport designations

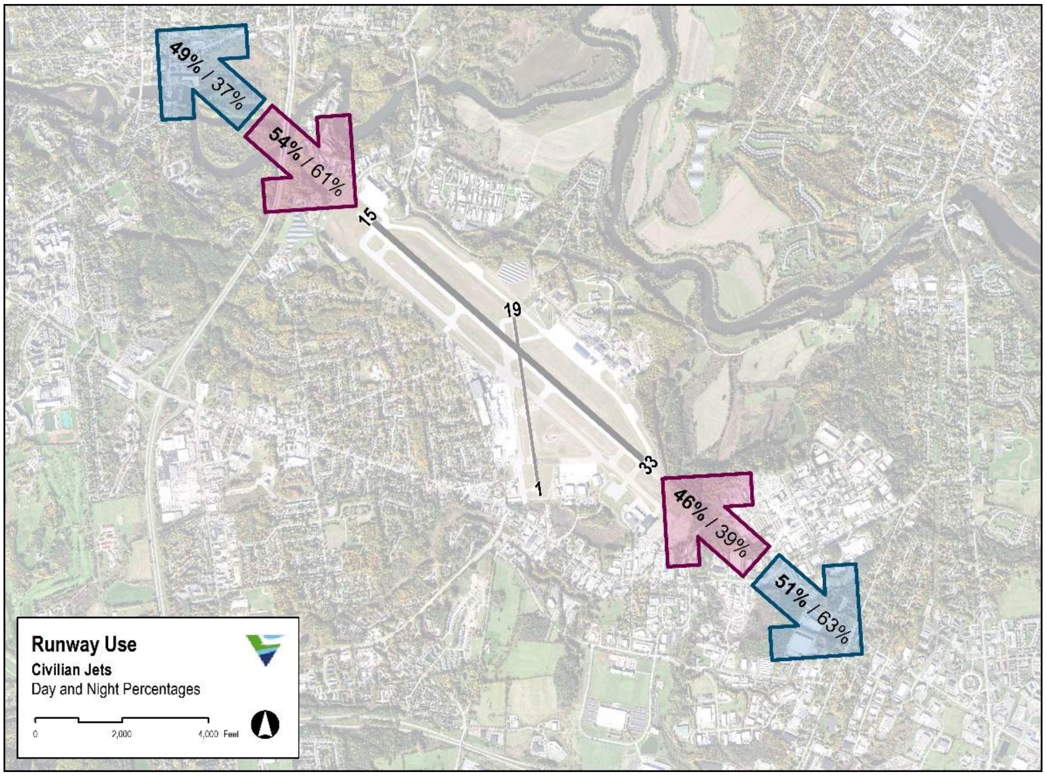

Figure 4-2. Civilian Jets Runway Use

Source: HMMH analysis of BTV NOMS data, 2024

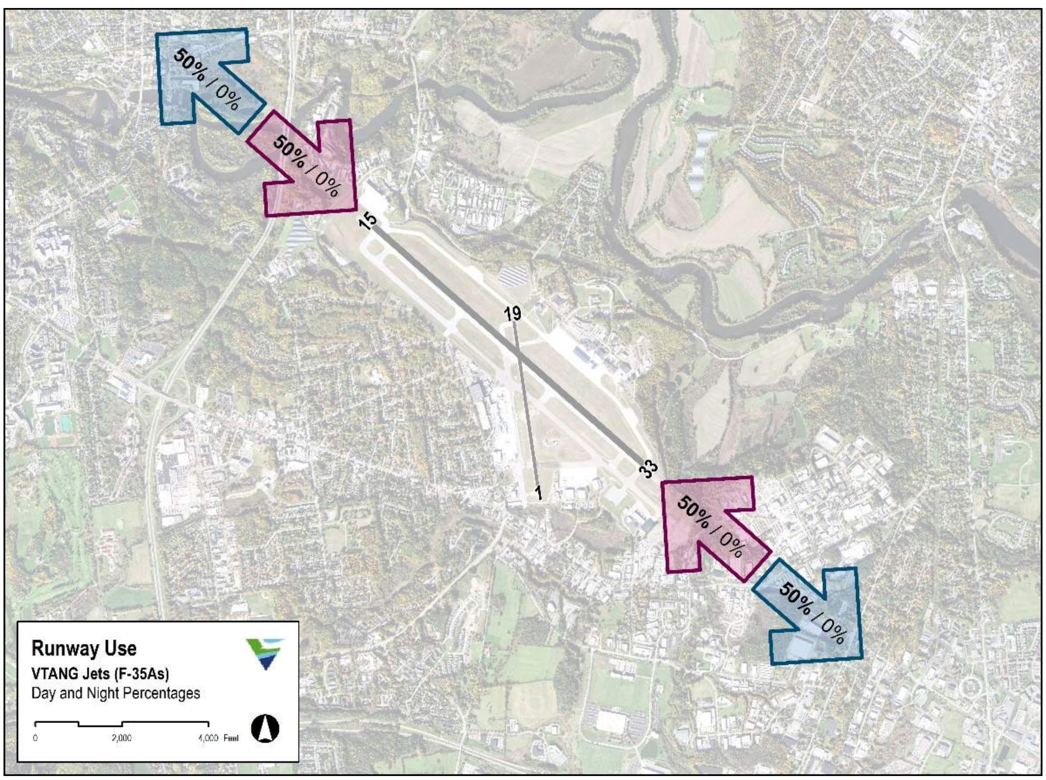

Figure 4-3. Military Jets Runway Use

Source: VTARNG, 2024

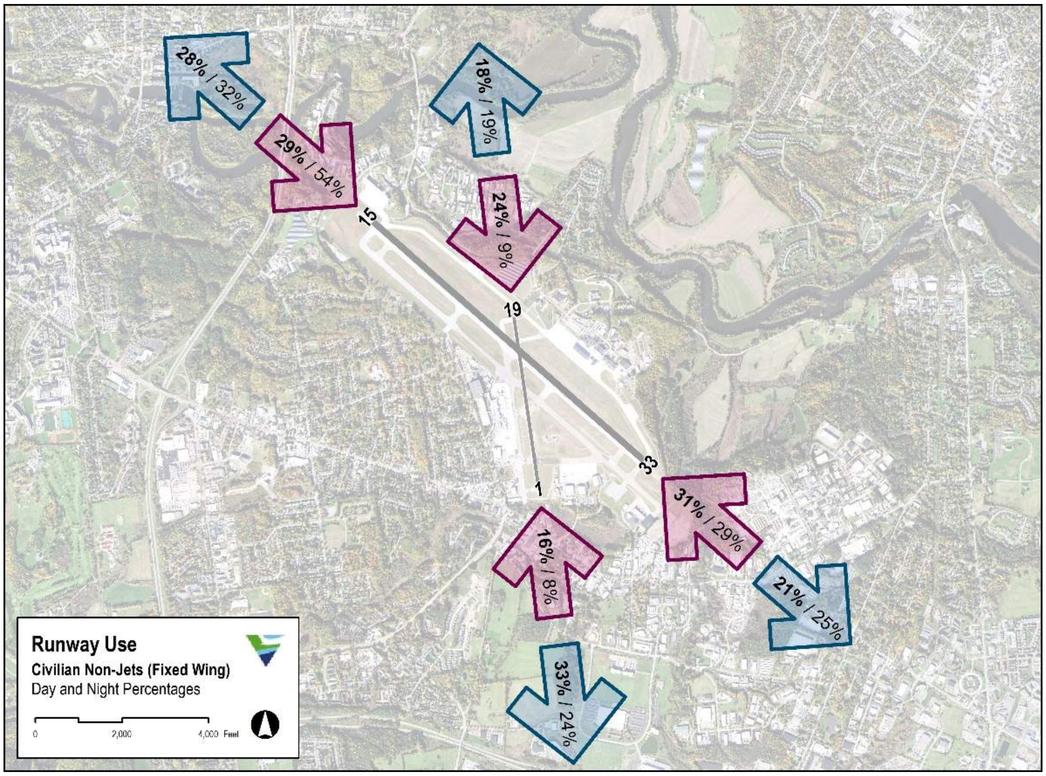

Figure 4-4. Civilian Non-Jets Runway Use, Arrivals and Departures

Source: HMMH analysis of BTV NOMS data, 2024

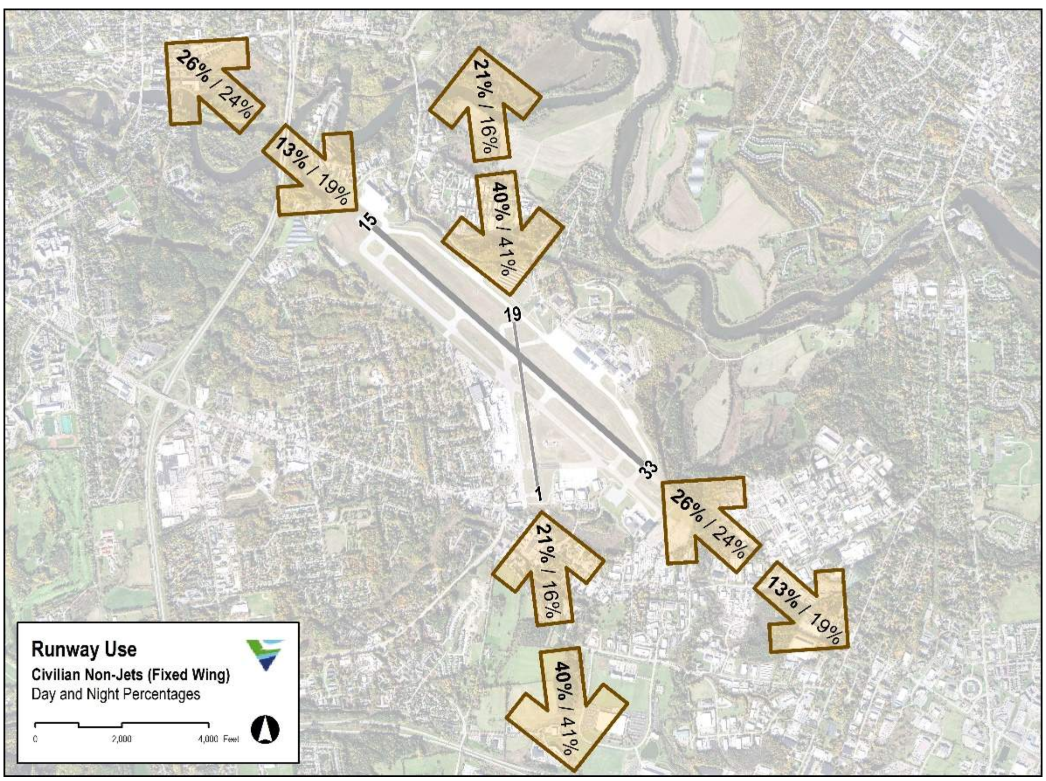

Figure 4-5. Civilian Non-Jets Runway Use, Closed Patterns

Source: HMMH analysis of BTV NOMS data, 2024

4.5 Flight Track Geometry and Usage

AEDT requires flight tracks for each runway and type of operation. Flight tracks are defined in the model as the ground path that the aircraft flies; assigned flight track utilization defines how often that track is flown by each category of aircraft. All flight track utilization rates for this study are defined relative to the runway end. The number of operations modeled on any given track is determined by multiplying the operations (presented in Section 4.2) by the runway use (presented in Section 4.4) and finally by the track usage for each individual aircraft type.

The Study Team examined actual flight tracks from the BTV NOMS and built representative model flight tracks for each grouping of similar tracks. The development process separates flight tracks by operation type (e.g., arrival or departure), runway end, and engine category (jet, propeller, helicopter). Next, flight track groups are "bundled" according to flight path direction and similarity of geometry for each set of operations. Each bundle is then used to create a "backbone" model flight track with an equal number of dispersion sub-tracks on either side of the backbone track. **Figure 4-6** provides an example for one grouping of flight tracks, specifically those for jet aircraft arriving from the northwest to Runway 15.

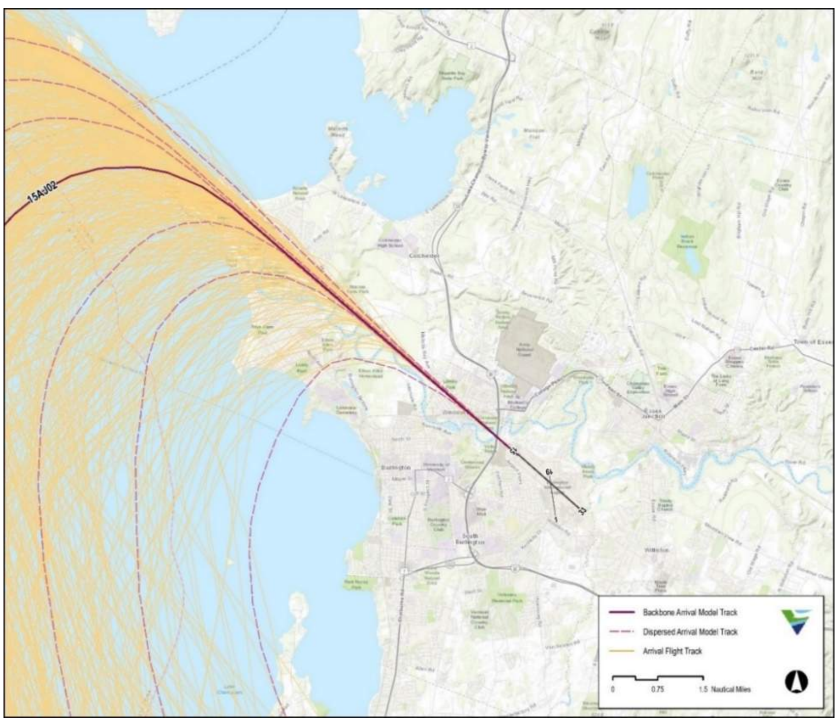

Figure 4-6. Example Model Track (15AJ02) with Sub-tracks
Sources: BTV NOMS, HMMH analysis, 2023

The software calculated the geometric mean of the group to form model track 15AJ02. The flight track naming convention uses the runway as the first two characters, then A, D, or C (for arrival, departure, or closed pattern), followed by J, N, or H (for jet, non-jet, or helicopter), with a final two-digit number for distinction. The dispersion around a backbone track is represented by a set of sub-tracks, distanced from the backbone according to the distribution of the original flight track data. Operations are assigned to the tracks in each bundle using percentages from a mathematical bell curve. **Figure 4-6** shows the backbone track as a solid line, the distribution sub-tracks as dashed lines, and the actual flight tracks from the BTV NOMS plotted under the modeled tracks in orange.

4.5.1 Civilian Aircraft Flight Tracks

Figure 4-7 through **Figure 4-15** present the full set of civilian model flight tracks overlaid on the corresponding actual flight tracks for each group of civilian aircraft operations**. Table 4-10** through **Table 4-15** provide the flight track usage; the track names in the tables match the labels on the Figures.

- Civilian jet operations: **Figure 4-7**, **Figure 4-8** and **Table 4-10**
- Civilian non-jets arrivals and departures: **Figure 4-9**, **Figure 4-10**, **Table 4-11** and **Table 4-12**
- Civilian non-jet closed patterns: **Figure 4-11** and **Table 4-13**.
- Civilian helicopter operations: **Figure 4-12** through **Figure 4-15**, **Table 4-14** and **Table 4-15**.

Civilian helicopters perform short-hop operations between the helipads at BTV and the helipad at the University of Vermont (UVM) Medical Center, which is located about a mile west of the Airport. These operations and the corresponding model flight tracks are shown in **Figure 4-15**.

The Part 150 regulation specifies that flight tracks for the existing condition and forecast year timeframes may be on supplemental graphics but must use the same land use base map and scale as the existing condition and forecast year NEM. These flight track maps are provided in **Appendix D**.

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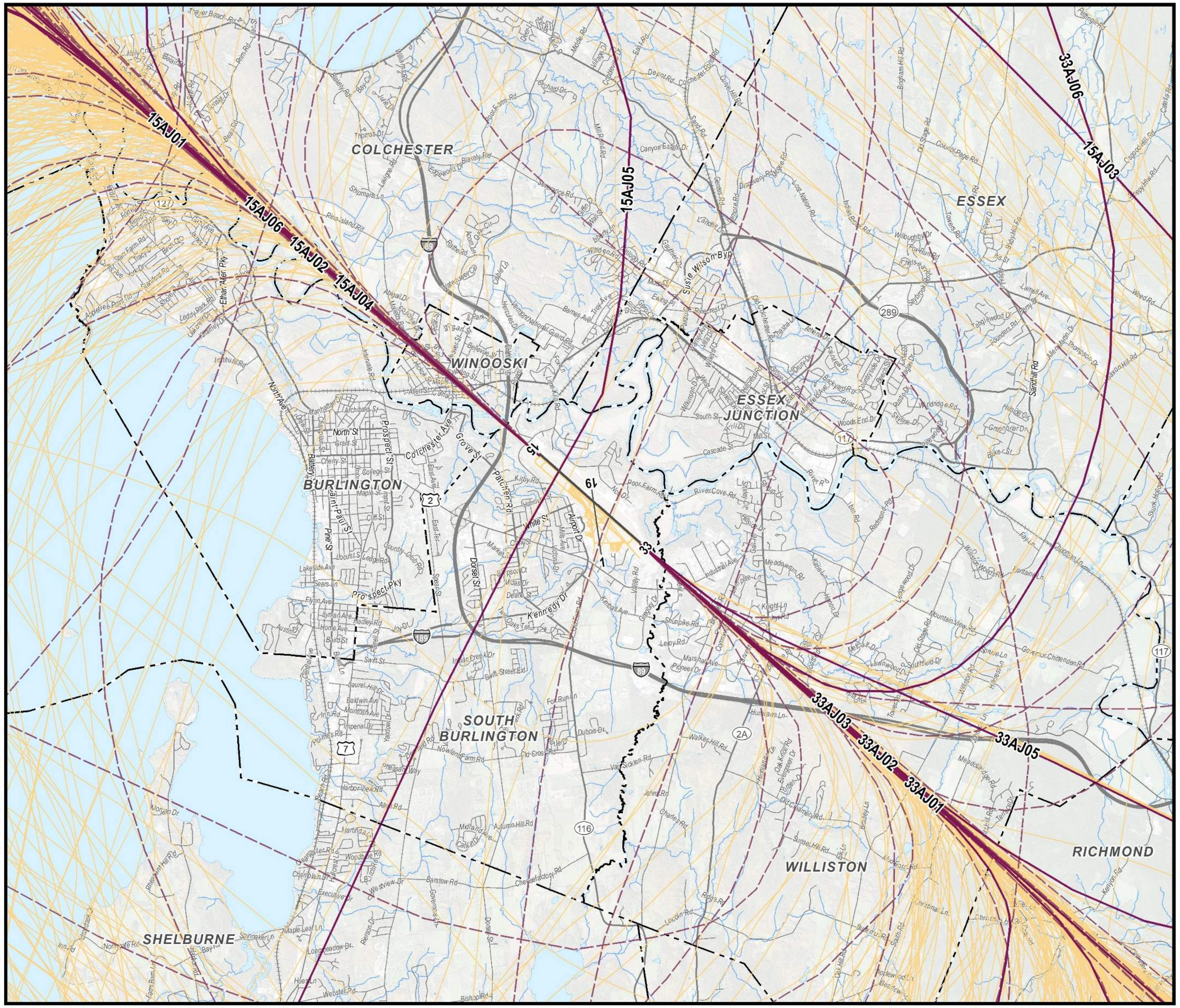

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PART 150 - NOISE EXPOSURE MAP UPDATE

Figure 4-7
Model Flight Tracks - Civilian Jet Arrivals

- Backbone Arrival Model Track
- Dispersed Arrival Model Track
- Arrival Flight Track
- Runway
- Helicopter Pad
- Town Boundary
- Major / Minor Road
- Railroad
- Water / Stream

0 0.5 1 2 Nautical Miles

hmmh

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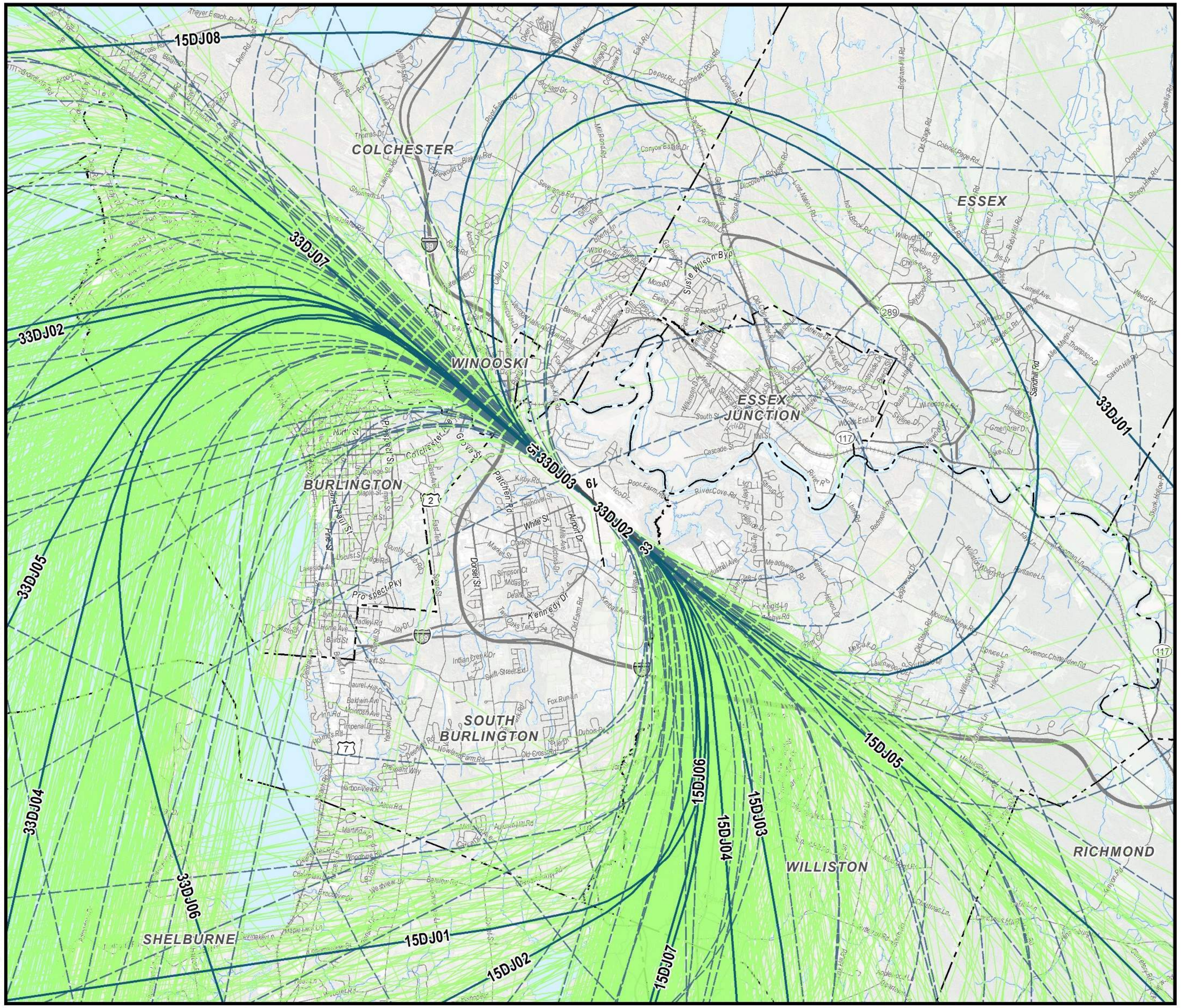

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PART 150 - NOISE EXPOSURE MAP UPDATE

Figure 4-8
Model Flight Tracks - Civilian Jet Departures

Backbone Departure Model Track
Dispersed Departure Model Track
Departure Flight Track
Runway
Helicopter Pad
Town Boundary
Major / Minor Road
Railroad
Water / Stream

0 0.5 1 2 Nautical Miles

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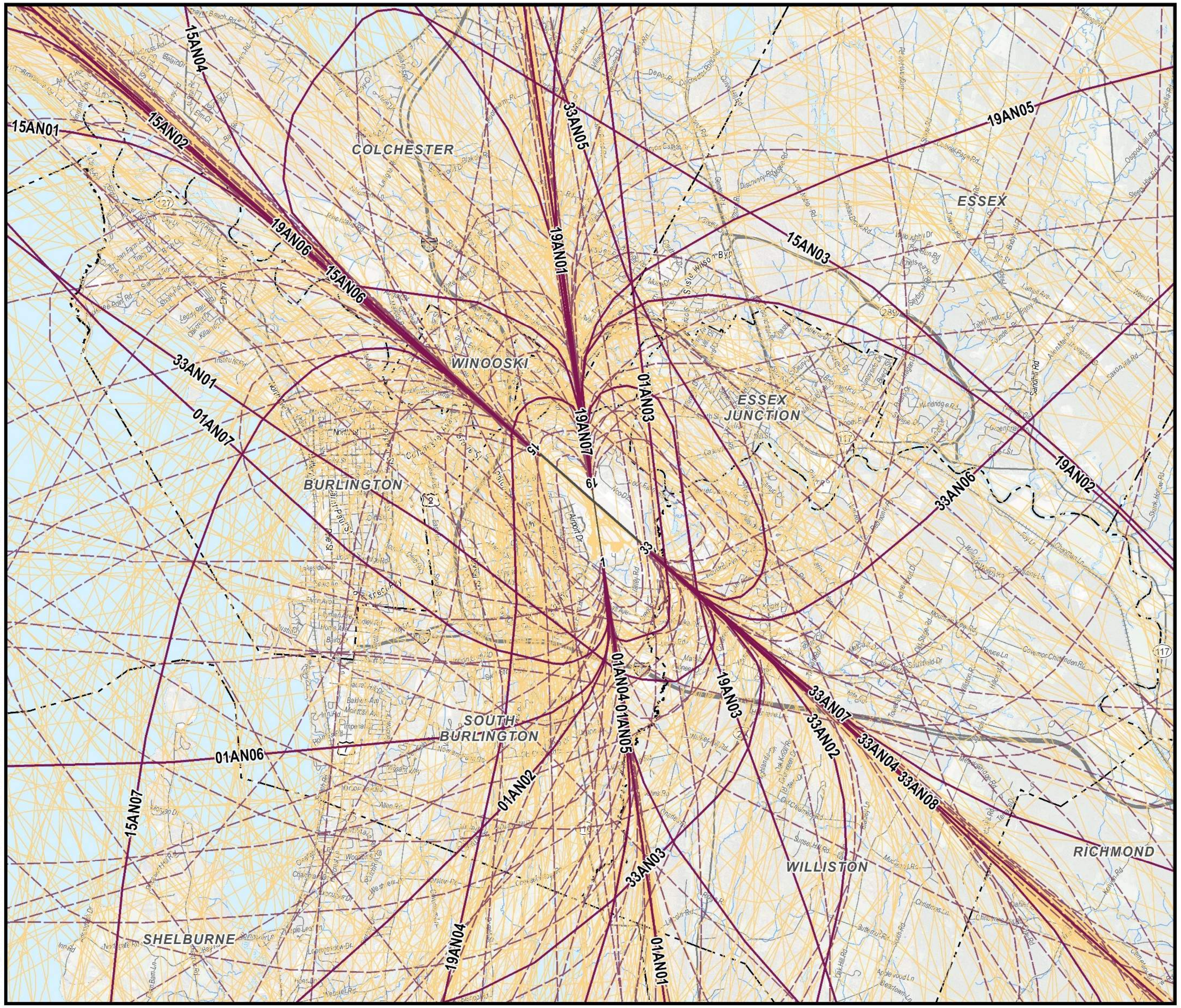

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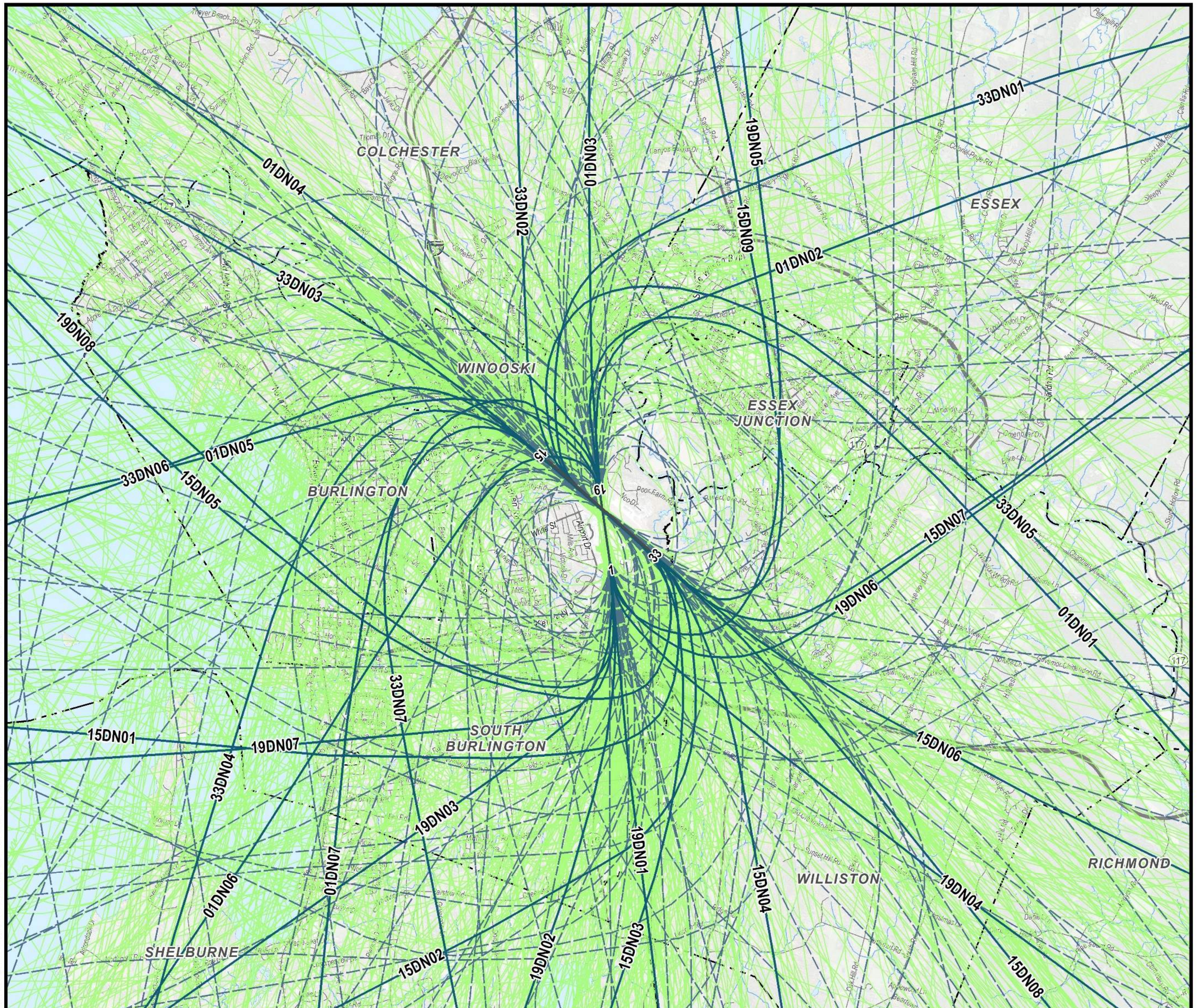
Figure 4-9
Model Flight Tracks - Civilian Non-Jet Arrivals

Backbone Arrival Model Track
Dispersed Arrival Model Track
Arrival Flight Track
Runway
Helicopter Pad
Town Boundary
Major / Minor Road
Railroad
Water / Stream

0 0.5 1 2 Nautical Miles

hmmh



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PART 150 - NOISE EXPOSURE MAP UPDATE

Figure 4-10
Model Flight Tracks - Civilian Non-Jet Departures

Backbone Departure Model Track
Dispersed Departure Model Track
Departure Flight Track
Runway
Helicopter Pad
Town Boundary
Major / Minor Road
Railroad
Water / Stream

0 0.5 1 2 Nautical Miles

hmmh

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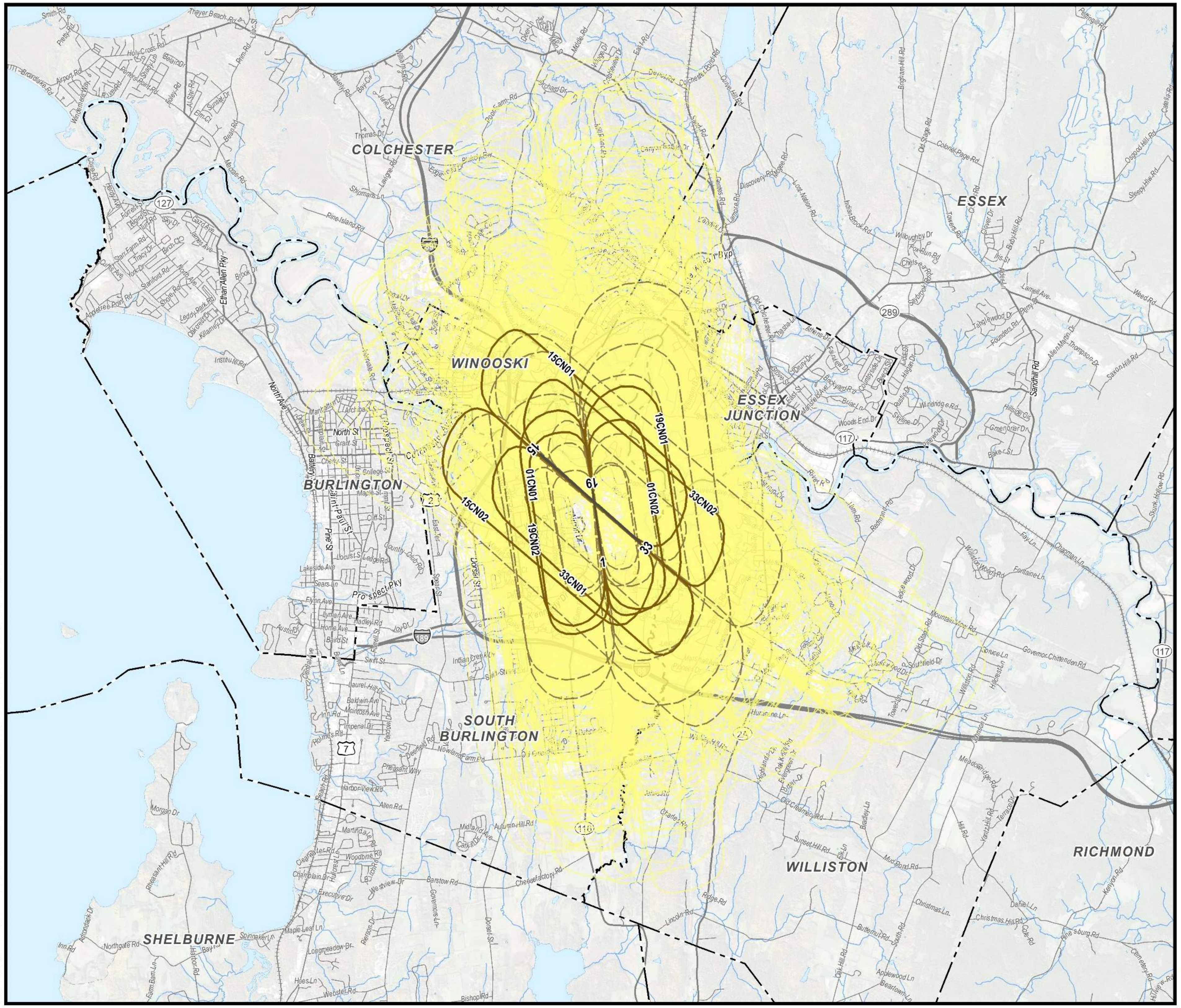

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PART 150 - NOISE EXPOSURE MAP UPDATE

Figure 4-11
Model Flight Tracks - Civilian Non-Jet Closed Patterns

Backbone Circuit Model Track
Dispersed Circuit Model Track
Circuit Flight Track
Runway
Helicopter Pad
Town Boundary
Major / Minor Road
Railroad
Water / Stream

0 0.5 1 2 Nautical Miles

hmmh

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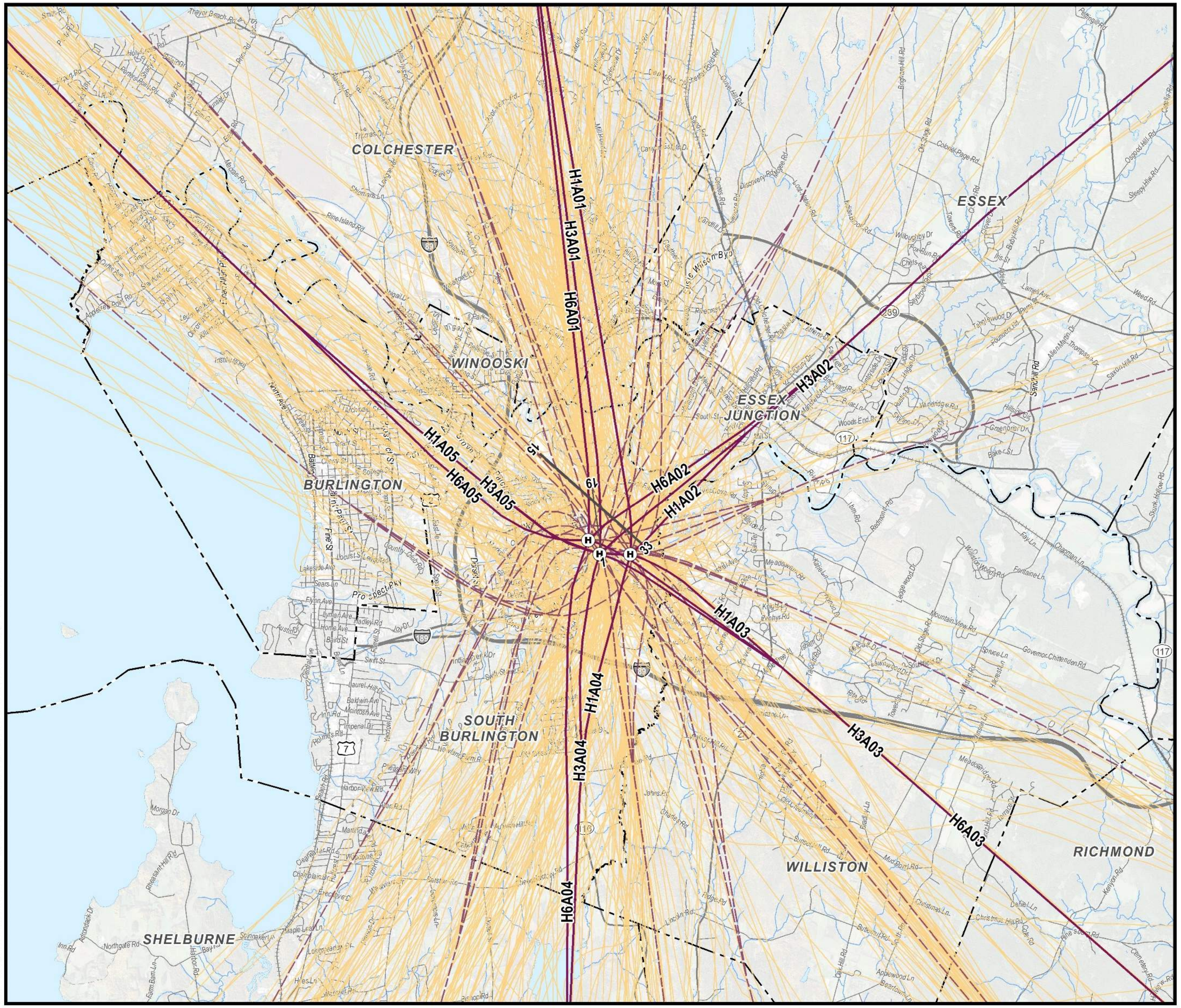

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PART 150 - NOISE EXPOSURE MAP UPDATE

Figure 4-12
Model Flight Tracks - Civilian Helicopter Arrivals

Backbone Arrival Model Track
Dispersed Arrival Model Track
Arrival Flight Track
Runway
Helicopter Pad
Town Boundary
Major / Minor Road
Railroad
Water / Stream

0 0.5 1 2 Nautical Miles

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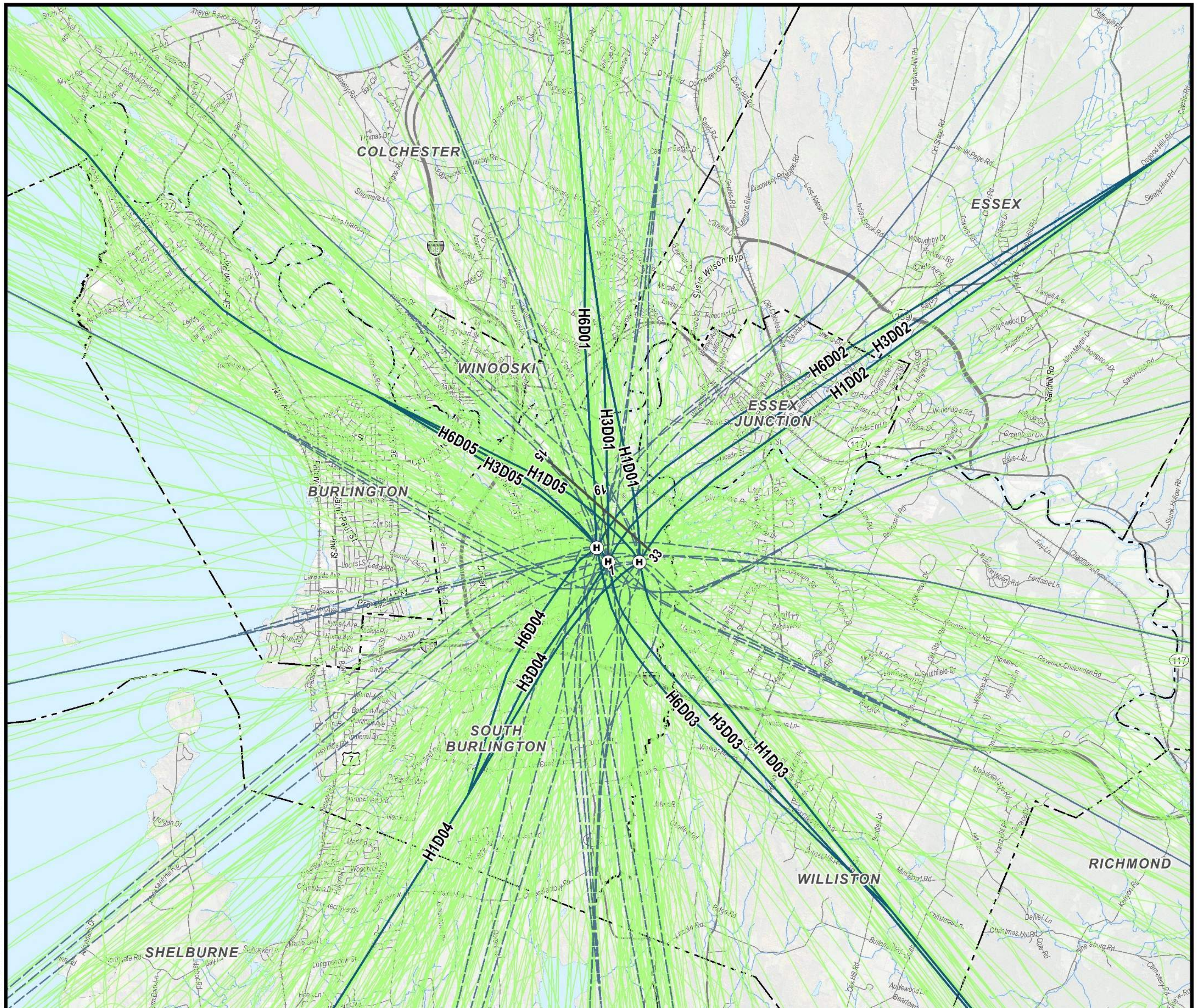

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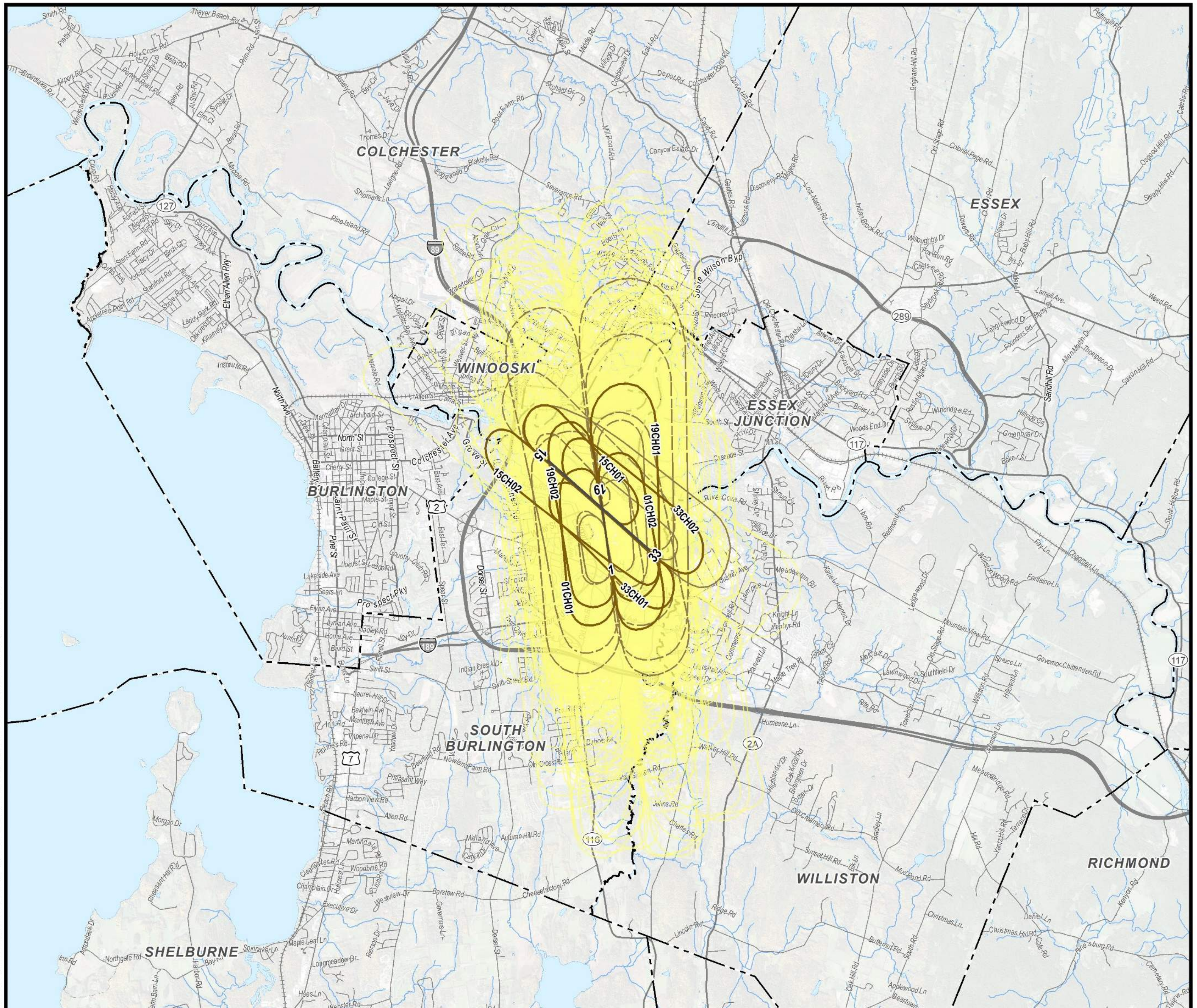
PART 150 - NOISE EXPOSURE MAP UPDATE

Figure 4-13
Model Flight Tracks - Civilian Helicopter Departures

- Backbone Departure Model Track
- Dispersed Departure Model Track
- Departure Flight Track
- Runway
- Helicopter Pad
- Town Boundary
- Major / Minor Road
- Railroad
- Water / Stream

0 0.5 1 2 Nautical Miles

hmmh



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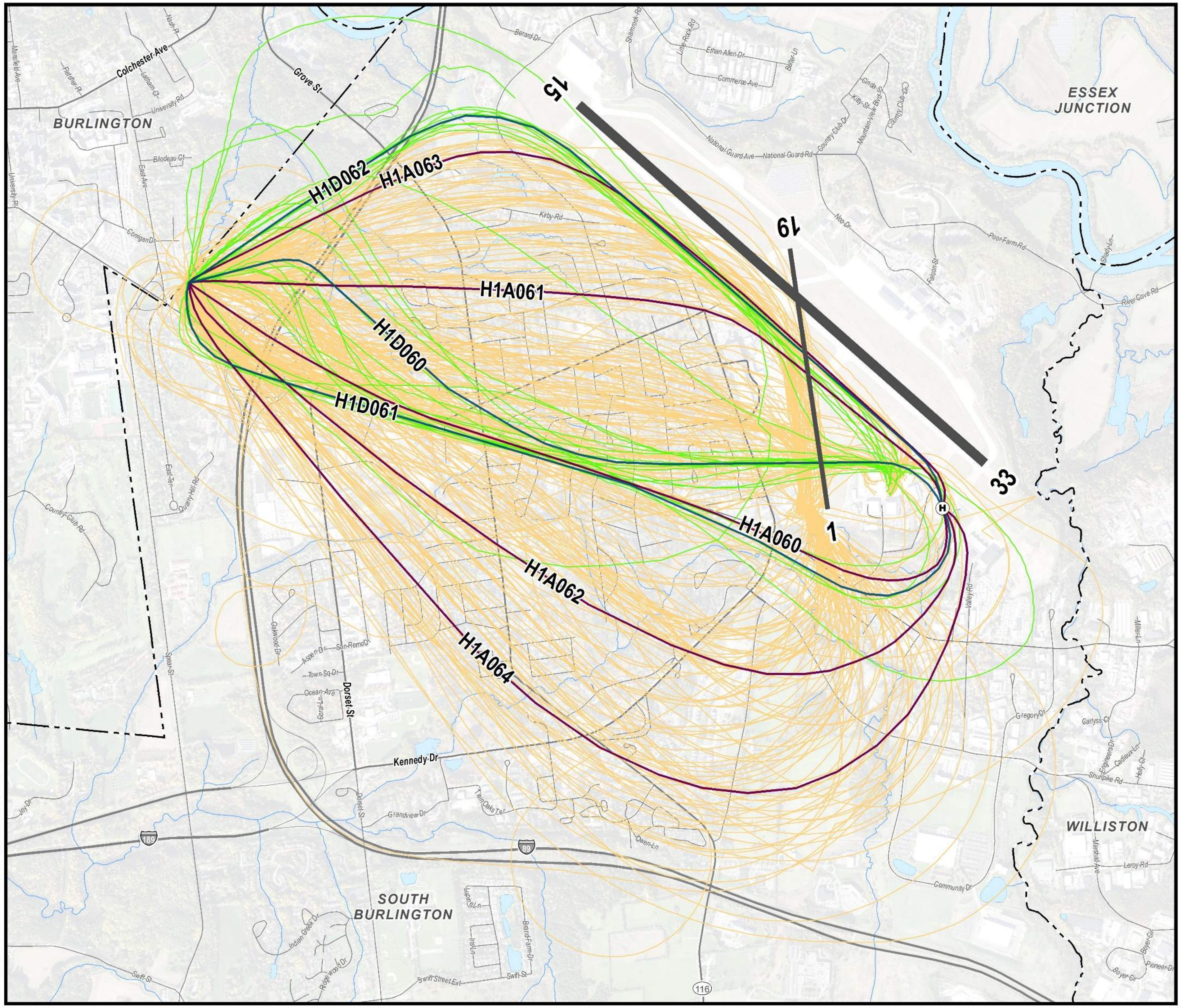
PART 150 - NOISE EXPOSURE MAP UPDATE

Figure 4-14
Model Flight Tracks - Civilian Helicopter Circuits

- Backbone Circuit Model Track
- Dispersed Circuit Model Track
- Circuit Flight Track
- Runway
- Helicopter Pad
- Town Boundary
- Major / Minor Road
- Railroad
- Water / Stream

0 0.5 1 2 Nautical Miles

hmmh



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PART 150 - NOISE EXPOSURE MAP UPDATE

Figure 4-15
Model Flight Tracks - Civilian Helicopter Traffic between BTV and UVM Helipad

- Departure Model Track
- Departure Flight Track
- Arrival Model Track
- Arrival Flight Track
- Runway
- Helicopter Pad
- Town Boundary
- Major / Minor Road
- Railroad
- Water / Stream

0 0.25 0.5 Nautical Miles

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Table 4-10. Civilian Jet Aircraft Flight Track Use

Sources: HMMH, 2023; BTV NOMS data, 2023

Track Name	Air Carrier		Air Taxi		GA	
	Day	Night	Day	Night	Day	Night
Arrivals						
Runway 15						
15AJ01	16.1%	6.7%	13.6%	11.7%	16.6%	22.0%
15AJ02	65.5%	52.0%	57.9%	37.9%	53.4%	44.1%
15AJ03	0.7%	0.2%	7.5%	1.0%	10.5%	2.5%
15AJ04	0.0%	0.0%	4.4%	0.0%	3.9%	0.0%
15AJ05	0.6%	0.8%	0.8%	0.0%	0.9%	1.7%
15AJ06	17.0%	40.3%	15.8%	49.5%	14.8%	29.7%
Runway 33						
33AJ01	49.6%	2.5%	50.2%	7.5%	37.3%	7.2%
33AJ02	47.5%	96.1%	41.7%	90.0%	53.4%	89.2%
33AJ03	0.1%	0.0%	0.6%	0.0%	1.0%	0.0%
33AJ04	1.9%	0.1%	4.3%	1.3%	4.1%	2.4%
33AJ05	0.9%	1.4%	0.4%	1.3%	0.3%	0.0%
33AJ06	0.1%	0.0%	2.7%	0.0%	3.9%	1.2%
Departures						
Runway 15						
15DJ01	6.5%	8.4%	10.8%	2.3%	10.0%	15.4%
15DJ02	12.1%	5.4%	7.9%	4.5%	8.8%	5.1%
15DJ03	1.9%	0.4%	1.9%	1.1%	2.2%	2.6%
15DJ04	32.4%	17.9%	38.1%	46.6%	33.0%	23.1%
15DJ05	2.7%	1.3%	10.0%	8.0%	14.7%	15.4%
15DJ06	0.2%	0.0%	1.6%	2.3%	4.2%	0.0%
15DJ07	43.7%	66.6%	28.9%	35.2%	25.4%	35.9%
15DJ08	0.5%	0.0%	0.7%	0.0%	1.7%	2.6%
Runway 33						
33DJ01	0.0%	0.2%	6.5%	10.4%	12.1%	12.1%
33DJ02	10.1%	10.0%	9.3%	10.4%	11.5%	15.2%
33DJ03	17.6%	4.7%	9.2%	7.8%	12.7%	10.6%
33DJ04	61.9%	77.9%	47.3%	35.1%	36.8%	45.5%
33DJ05	8.8%	6.6%	16.1%	28.6%	9.4%	3.0%
33DJ06	1.1%	0.5%	6.0%	5.2%	6.9%	3.0%
33DJ07	0.5%	0.2%	3.6%	0.0%	6.5%	7.6%
33DJ08	0.1%	0.0%	2.0%	2.6%	4.2%	3.0%

Table 4-11. Civilian Non-jet Aircraft Arrival Flight Track Use

Sources: HMMH, 2023; BTV NOMS data, 2023

	Turboprops				Pistons			
	Air Taxi		GA		Air Taxi		GA	
Track Name	Day	Night	Day	Night	Day	Night	Day	Night
Runway 15								
15AN01	2.0%	1.0%	8.7%	20.7%	7.1%	11.1%	12.8%	19.6%
15AN02	32.2%	29.2%	20.2%	20.7%	33.3%	22.2%	16.3%	15.5%
15AN03	41.3%	1.0%	12.8%	6.9%	14.3%	11.1%	9.2%	18.6%
15AN04	1.0%	0.0%	5.3%	0.0%	7.1%	0.0%	12.6%	1.0%
15AN06	9.5%	1.0%	27.9%	24.1%	9.5%	33.3%	24.9%	10.3%
15AN07	14.0%	67.7%	25.1%	27.6%	28.6%	22.2%	24.2%	35.1%
Runway 33								
33AN01	6.6%	0.0%	15.2%	12.0%	2.1%	0.0%	14.5%	2.3%
33AN02	11.6%	49.1%	20.0%	12.0%	29.8%	0.0%	20.0%	30.2%
33AN03	1.8%	0.0%	12.1%	12.0%	0.0%	16.7%	6.4%	18.6%
33AN04	57.5%	47.4%	31.1%	44.0%	46.8%	66.7%	16.5%	23.3%
33AN05	2.9%	0.0%	12.4%	4.0%	4.3%	0.0%	23.1%	2.3%
33AN06	0.3%	0.0%	2.3%	4.0%	0.0%	0.0%	6.0%	2.3%
33AN07	4.5%	1.8%	1.7%	0.0%	2.1%	0.0%	8.5%	16.3%
33AN08	14.8%	1.8%	5.1%	12.0%	14.9%	16.7%	5.0%	4.7%
Runway 01								
01AN01	23.3%	0.0%	70.8%	50.0%	52.4%	0.0%	27.2%	22.2%
01AN02	0.0%	0.0%	0.0%	0.0%	9.5%	0.0%	11.4%	13.9%
01AN03	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.8%	0.0%
01AN04	0.0%	0.0%	0.0%	0.0%	14.3%	0.0%	3.2%	2.8%
01AN05	6.7%	100.0%	16.7%	50.0%	14.3%	0.0%	24.3%	38.9%
01AN06	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.2%	2.8%
01AN07	70.0%	0.0%	12.5%	0.0%	9.5%	0.0%	23.8%	19.4%
Runway 19								
19AN01	0.0%	0.0%	3.6%	0.0%	3.7%	0.0%	6.5%	0.0%
19AN02	86.0%	0.0%	32.1%	0.0%	33.3%	50.0%	14.8%	32.4%
19AN03	6.5%	100.0%	0.0%	0.0%	18.5%	0.0%	4.6%	16.2%
19AN04	2.7%	0.0%	46.4%	100.0%	18.5%	0.0%	32.4%	32.4%
19AN05	4.3%	0.0%	17.9%	0.0%	0.0%	0.0%	5.5%	5.4%
19AN06	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	7.4%	5.4%
19AN07	0.0%	0.0%	0.0%	0.0%	14.8%	0.0%	19.7%	8.1%
19AN08	0.5%	0.0%	0.0%	0.0%	11.1%	0.0%	9.1%	0.0%

Table 4-12. Civilian Non-Jet Aircraft Departure Flight Track Use

Sources: HMMH, 2023; BTV NOMS data, 2023

Track Name	Turboprops				Pistons			
	Air Taxi		GA		Air Taxi		GA	
	Day	Night	Day	Night	Day	Night	Day	Night
Runway 15								
15DN01	0.6%	0.0%	7.9%	15.6%	0.0%	0.0%	5.1%	6.3%
15DN02	4.3%	9.1%	15.4%	12.5%	2.6%	12.5%	5.6%	3.2%
15DN03	20.0%	86.4%	27.9%	40.6%	25.6%	0.0%	18.1%	31.7%
15DN04	13.4%	0.0%	12.9%	6.3%	12.8%	12.5%	11.4%	6.3%
15DN05	1.6%	0.0%	9.8%	15.6%	0.0%	0.0%	9.9%	7.9%
15DN06	11.9%	0.0%	7.9%	0.0%	7.7%	12.5%	16.4%	9.5%
15DN07	2.7%	0.0%	4.0%	6.3%	0.0%	0.0%	7.2%	9.5%
15DN08	44.3%	4.5%	9.4%	3.1%	41.0%	50.0%	9.2%	12.7%
15DN09	1.1%	0.0%	4.8%	0.0%	10.3%	12.5%	17.1%	12.7%
Runway 33								
33DN01	4.8%	0.0%	6.0%	0.0%	6.2%	0.0%	6.1%	4.4%
33DN02	0.2%	0.0%	3.1%	2.1%	9.2%	0.0%	10.2%	4.4%
33DN03	2.8%	0.0%	21.5%	39.6%	4.6%	5.0%	13.3%	10.3%
33DN04	38.7%	82.5%	30.9%	25.0%	27.7%	0.0%	29.1%	35.3%
33DN05	35.4%	5.0%	14.6%	4.2%	26.2%	75.0%	14.7%	23.5%
33DN06	7.4%	5.0%	18.3%	22.9%	6.2%	0.0%	10.1%	8.8%
33DN07	10.5%	7.5%	5.6%	6.3%	20.0%	20.0%	16.4%	13.2%
Runway 01								
01DN01	79.0%	0.0%	21.3%	0.0%	60.0%	100.0%	13.8%	20.5%
01DN02	0.9%	0.0%	2.2%	25.0%	0.0%	0.0%	5.6%	8.4%
01DN03	0.0%	0.0%	6.7%	0.0%	20.0%	0.0%	11.9%	8.4%
01DN04	11.3%	0.0%	48.3%	50.0%	0.0%	0.0%	30.4%	27.7%
01DN05	0.9%	0.0%	10.1%	0.0%	0.0%	0.0%	5.9%	9.6%
01DN06	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.0%	3.6%
01DN07	7.8%	100.0%	11.2%	25.0%	20.0%	0.0%	23.5%	21.7%
Runway 19								
19DN01	27.8%	0.0%	15.4%	0.0%	21.9%	11.1%	17.1%	17.0%
19DN02	13.2%	66.7%	18.9%	18.2%	25.0%	0.0%	21.4%	22.0%
19DN03	0.7%	33.3%	12.4%	27.3%	1.6%	0.0%	7.6%	4.0%
19DN04	21.2%	0.0%	13.0%	9.1%	21.9%	77.8%	12.9%	22.0%
19DN05	0.7%	0.0%	6.5%	0.0%	7.8%	0.0%	8.8%	5.0%
19DN06	0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	2.9%	0.0%
19DN07	0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	4.4%	3.0%
19DN08	36.4%	0.0%	33.7%	45.5%	18.8%	11.1%	24.8%	27.0%

Table 4-13. Civilian Fixed Wing (Non-Jet) Closed Pattern Track Use

Sources: HMMH, 2023, BTV NOMS data, 2023

Track Name	Fixed Wing Aircraft	
	Day	Night
Runway 01		
01CN01	83.5%	55.6%
01CN02	16.5%	44.4%
Runway 15		
15CN01	91.2%	100.0%
15CN02	8.8%	0.0%
Runway 19		
19CN01	92.3%	67.6%
19CN02	7.7%	32.4%
Runway 33		
33CN01	76.4%	58.3%
33CN02	23.6%	41.7%

Table 4-14. Civilian Helicopter Flight Track Use, Arrivals and Departures

Sources: HMMH, 2023; BTV NOMS data, 2023

Track Name	H1		H3		H6	
	Day	Night	Day	Night	Day	Night
Arrivals						
H*A01	20.7%	0.3%	35.9%	2.4%	35.9%	2.4%
H*A02	2.8%	0.5%	4.8%	3.7%	4.8%	3.7%
H*A03	7.7%	6.7%	13.3%	51.2%	13.3%	51.2%
H*A04	16.5%	2.5%	28.6%	19.5%	28.6%	19.5%
H*A05	10.1%	3.0%	17.4%	23.2%	17.4%	23.2%
H*A06*	42.4%	87.0%	0.0%	0.0%	0.0%	0.0%
Departures						
H*D01	15.0%	3.2%	16.6%	4.4%	16.6%	4.4%
H*D02	6.3%	7.5%	7.0%	10.4%	7.0%	10.4%
H*D03	24.5%	26.6%	27.0%	36.6%	27.0%	36.6%
H*D04	27.0%	12.7%	29.8%	17.5%	29.8%	17.5%
H*D05	17.9%	22.6%	19.7%	31.1%	19.7%	31.1%
H*D06*	9.2%	27.3%	0.0%	0.0%	0.0%	0.0%
Note: The H1A06* and H1D06* tracks are "short hops" between BTV and UVM, shown on Figure 4-15; all other helicopter arrival and departure tracks are shown in Figure 4-12 and Figure 4-13						

Table 4-15. Civilian Helicopter Circuit Track Use

Sources: HMMH, 2023, BTV NOMS data, 2023

Track Name	Helicopters	
	Day	Night
Runway 01		
01CH01	79.0%	85.7%
01CH02	21.0%	14.3%
Runway 15		
15CH01	83.3%	100.0%
15CH02	16.7%	0.0%
Runway 19		
19CH01	77.3%	54.5%
19CH02	22.7%	45.5%
Runway 33		
33CH01	48.5%	100.0%
33CH02	51.5%	0.0%

4.5.2 Military Aircraft Flight Tracks

Military flight track data was not available in the BTV NOMS. Military fighter jet and transient fixed wing aircraft flight tracks were derived through several meetings and data package revisions between HMMH and VTANG personnel; these are presented in **Figure 4-16** through **Figure 4-18**. **Table 4-16** provides the corresponding flight track usage. The flight tracks are named by the runway ends and types of operation. The numbers are non-sequential because the track names used in prior NEM modeling efforts were retained for consistency where tracks were re-used.

Military helicopter flight tracks were developed through meetings with the VTARNG. The helicopter flights will be modeled following the same ground tracks for both arrivals and departures, as shown in **Figure 4-19**. **Table 4-17** provides the corresponding track usage. Military helicopter flight tracks names include a 2-letter identifier of AG for “Army Guard”, an A or D to indicate arrival or departure, and a final letter for differentiation.

The model flight track maps required by the Part 150 regulation must use the same land use base map and scale as the existing condition and forecast year NEM. These are provided in **Appendix D**, with **Figure D-4** collectively portraying all modeled military flight tracks.

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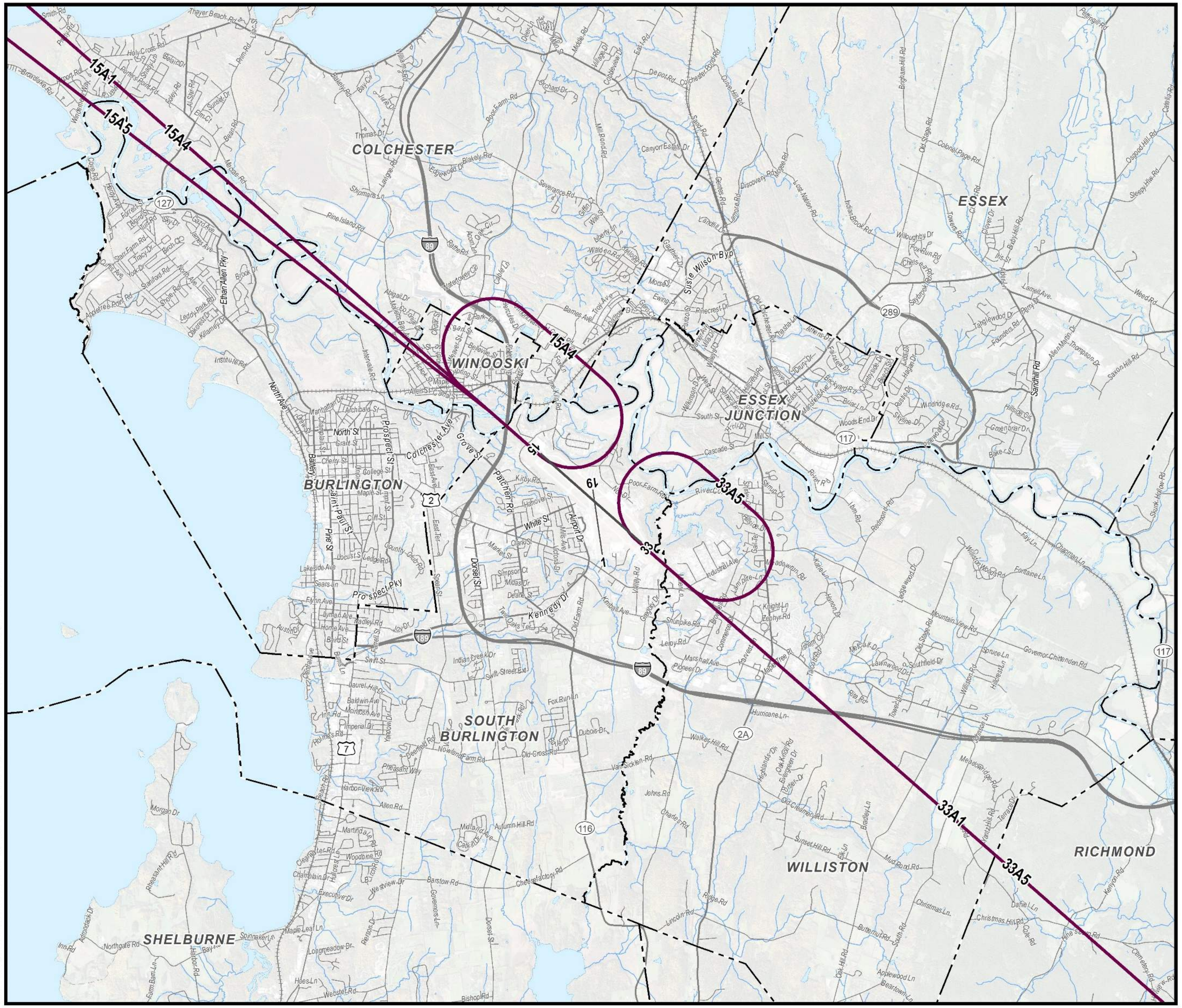

PATRICK LEAHY BURLINGTON INTERNATIONAL AIRPORT

PART 150 - NOISE EXPOSURE MAP UPDATE

Figure 4-16
Model Flight Tracks - Military Fixed Wing Aircraft Arrivals

Arrival Model Track

Runway
Helicopter Pad
Town Boundary
Major / Minor Road
Railroad
Water / Stream

0 0.5 1 2 Nautical Miles

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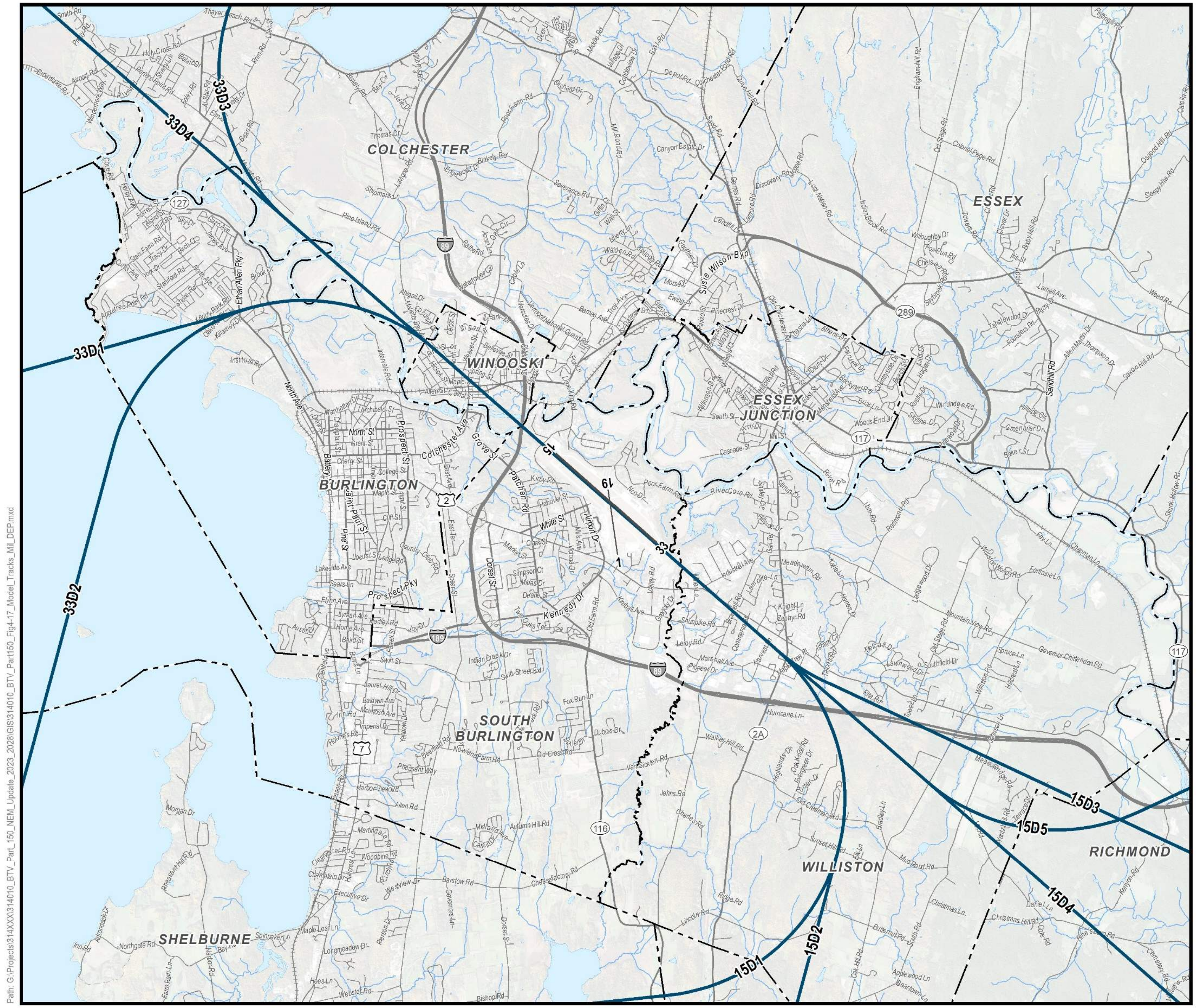


PATRICK LEAHY BURLINGTON INTERNATIONAL AIRPORT

PART 150 - NOISE EXPOSURE MAP UPDATE

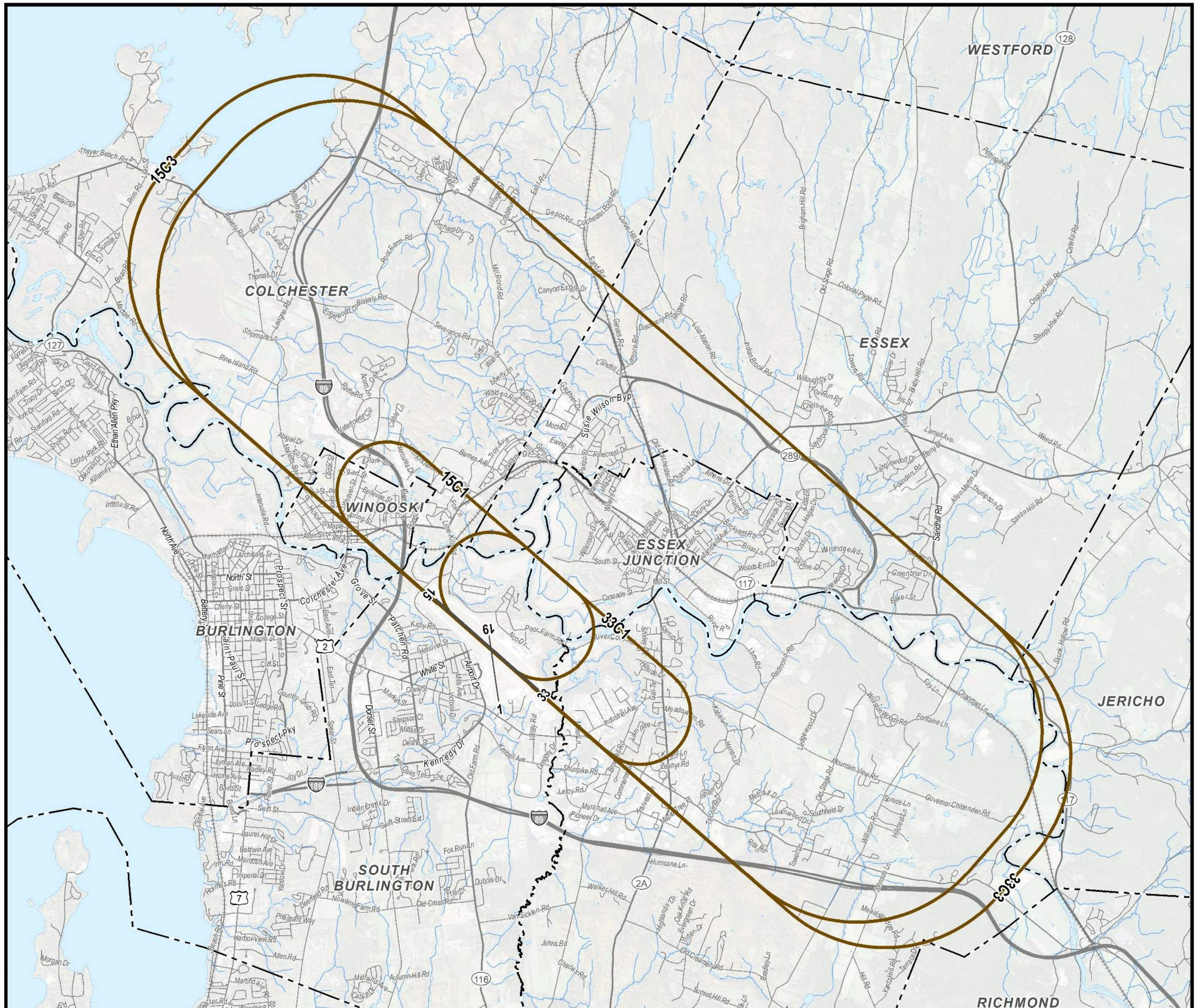
Figure 4-17
Model Flight Tracks - Military Fixed Wing Aircraft Departures

Departure Model Track

Runway
Helicopter Pad
Town Boundary
Major / Minor Road
Railroad
Water / Stream

0 0.5 1 2 Nautical Miles

hmmh



PATRICK LEAHY BURLINGTON INTERNATIONAL AIRPORT

PART 150 - NOISE EXPOSURE MAP UPDATE

Figure 4-18
Model Flight Tracks - Military Fixed Wing Aircraft Closed Patterns

Circuit Model Track

Runway
Helicopter Pad
Town Boundary
Major / Minor Road
Railroad
Water / Stream

0 0.5 1 2 Nautical Miles

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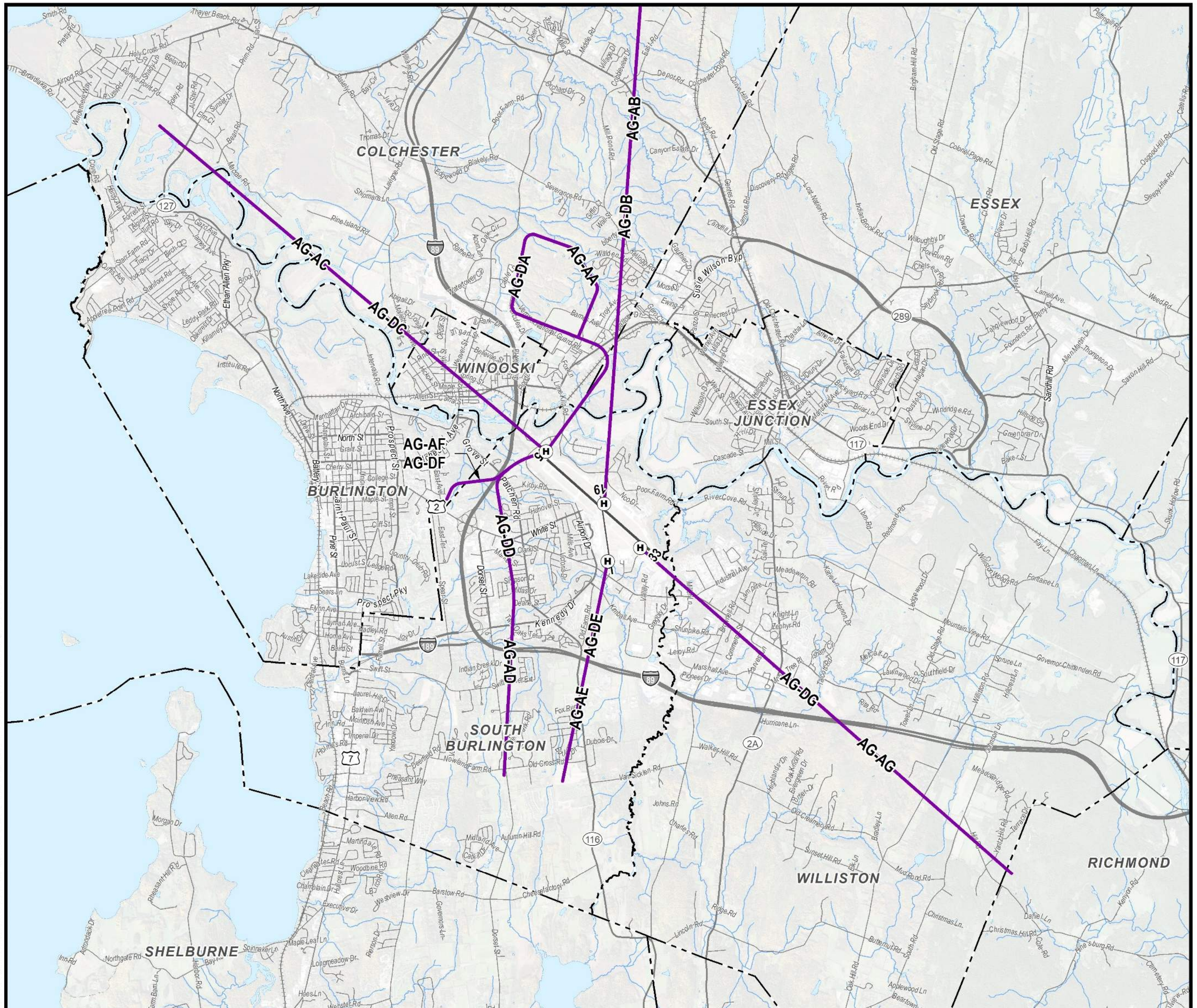

PATRICK LEAHY BURLINGTON INTERNATIONAL AIRPORT

PART 150 - NOISE EXPOSURE MAP UPDATE

Figure 4-19
Model Flight Tracks - Military Helicopter Flight Tracks

- Helicopter Model Track
- Runway
- Helicopter Pad
- Town Boundary
- Major / Minor Road
- Railroad
- Water / Stream

0 0.5 1 2 Nautical Miles

hmmh

Table 4-16. Military Fixed-Wing Aircraft Flight Track Use

Sources: HMMH, 2023; USAF 134th Fighter Squadron, 2023

Flight Track	Based		Transient			
	F-35A		Fighter		Transport	
	Day	Night	Day	Night	Day	Night
Arrivals						
Runway 15						
15A1	35.7%	35.7%	14.3%	14.3%	100.0%	100.0%
15A4	63.9%	63.9%	85.7%	85.7%	0.0%	0.0%
15A5	0.5%	0.5%	0.0%	0.0%	0.0%	0.0%
Runway 33						
33A1	35.8%	35.8%	14.3%	14.3%	100.0%	100.0%
33A5	64.2%	64.2%	85.7%	85.7%	0.0%	0.0%
Departures						
Runway 15						
15D1	95%	95%	0.0%	0.0%	0.0%	0.0%
15D3	1%	1%	0.0%	0.0%	0.0%	0.0%
15D4	3%	3%	100.0%	100.0%	100.0%	100.0%
15D5	1%	1%	0.0%	0.0%	0.0%	0.0%
Runway 33						
33D1	95%	95%	0.0%	0.0%	0.0%	0.0%
33D2	1%	1%	0.0%	0.0%	0.0%	0.0%
33D3	3%	3%	100.0%	100.0%	100.0%	100.0%
33D4	1%	1%	0.0%	0.0%	0.0%	0.0%
Closed Patterns						
Runway 15						
15C1	100%	100%	0.00%	0.00%	0.00%	0.00%
15C3	0%	0%	0.00%	0.00%	100.00%	100.00%
Runway 33						
33C1	100%	100%	0.00%	0.00%	0.00%	0.00%
33C3	0%	0%	0.00%	0.00%	100.00%	100.00%

Table 4-17. Military Helicopter Flight Track Use

Sources: HMMH, 2023; USAF 134th Fighter Squadron, 2023; VTARNG 2023

Flight Track	Day	Night	Flight Track	Day	Night
Arrivals			**Departures**		
VTARNG Ramp (H5)					
AG-AA	20%	20%	AG-DA	20%	20%
AG-AC	15%	15%	AG-DC	15%	15%
AG-AD	20%	20%	AG-DD	20%	20%
AG-AF	1%	1%	AG-DF	1%	1%
Taxiway E (H4)					
AG-AB	10%	10%	AG-DB	10%	10%
Taxiway C (H2)					
AG-AG	30%	30%	AG-DG	30%	30%
Taxiway L (H3)					
AG-AE	4%	4%	AG-DE	4%	4%

4.6 Ground Noise Modeling Inputs

The 2024 BTV NEM includes noise from aircraft engine ground run-up operations that aircraft perform as part of pre-flight and regular maintenance. The NEM also includes noise from aircraft taxiing to and from the runways.

4.6.1 Aircraft Run-ups

NMap flight profiles include a pre-flight run-up to represent the noise at the beginning of an aircraft's takeoff roll. F-35A aircraft at BTV perform pre-flight runups at the runway ends; prior to departure, pilots will hold the aircraft at Mil power for approximately 1 second before brake release.

Single engine propeller-drive civilian aircraft perform pre-flight runups immediately prior to each departure flight. For modeling purposes, the AEDT inputs include single engine aircraft runups at 100 percent power for one minute at the hold-short points on the taxiways, which are represented by yellow dots marked with the prefix "HS-" and runway end on **Figure 4-20**. The aircraft heading iduring the runup is modeled as parallel to the runway it will depart from.

Table 4-18 summarizes the modeled maintenance runup operations. **Figure 4-20** shows the runup locations for military aircraft as blue dots, corresponding with the data in the table. Military maintenance runups are performed by VTANG F-35A aircraft at the locations marked R1, R2, and R3 on the diagram. Civilian maintenance runups in the model consist of Cessna 680 civilian jets, on Taxiway G near the Pratt & Whitney engine repair facility, and, less often, at another location south of the Pratt & Whitney facility. These locations are shown as green dots in **Figure 4-20**.

The same number and type of maintenance runups were assumed to occur under the Forecast Condition as for the Existing Condition.

Table 4-18. F-35A Maintenance Runups at BTV

Sources: HMMH, 2023; USAF 134th Fighter Squadron, 2023; BTV staff, 2023

Aircraft Type	Engines Running	Power	Minutes per Year at Power	Runup Pad	Aircraft Heading (degrees)	% of Time at Runup Pad
F-35A	1	10%	3,888	R1	192	33%
				R2	192	33%
				R3	90	34%
		31%	100	R1	192	33%
				R2	192	33%
				R3	90	34%
Cessna 680	2	4495 LB	1,850	Txy_G	270	100%
		4259 LB	1,850	Txy_G	270	100%
		4022 LB	1,850	Txy_G	270	100%
		4732 LB	370	Txy_G	270	100%
		100 LB	1,850	Txy_G	270	100%
		208 LB	1,850	Txy_G	270	100%
		623 LB	1,850	Txy_G	270	100%
		3786 LB	1,850	Txy_G	270	100%
		3549 LB	1,850	Txy_G	270	100%
		706 LB	1,850	Txy_G	270	100%
		208 LB	1,850	VW_1	270	100%

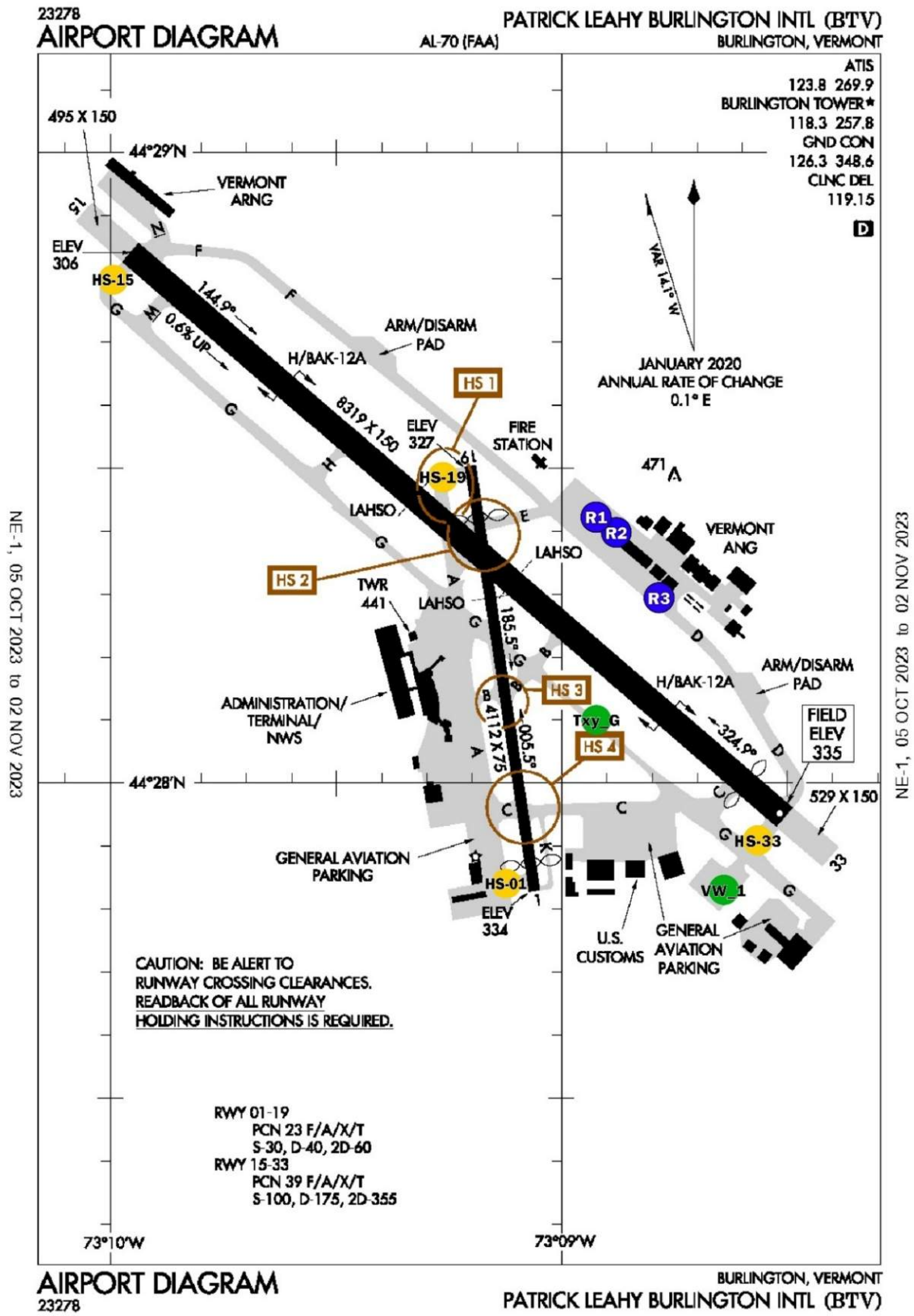

Figure 4-20. Model Runup Locations

Source: FAA, accessed in October 2023, HMMH addition of runup locations

4.6.2 Aircraft Taxi Operations

Aircraft taxiing has historically been included in noise modeling at BTV due to the proximity of several homes to the BTV taxiways and consequent community interest. The taxi noise analysis methodology for this NEM update is similar to what was performed for the prior three NEM updates. The modeled taxi paths are shown on the current airport layout in **Figure 4-21**. Taxi operations for the Existing Conditions and Forecast Conditions correspond to the flight operations data provided in section 4.2.

Using AEDT to represent taxi operations constitutes nonstandard modeling and thus requires FAA approval[22], which has been granted for previous NEM updates at BTV. Full details of the taxiway modeling assumptions and AEDT modeling inputs are documented in the non-standard modeling request submitted to FAA, reproduced in **Appendix C**.

The outline of the method is as follows[23]:

- An overflight operational profile is used, with an altitude of 10 ft to account for engine height.
- All taxiing occurs at a speed of 10 knots.
- The locations at which an aircraft is stationary and holding for clearance (hold points) are represented by very slow-moving aircraft. These stationary segments include:
    - Two-minute idle warm-up
    - Five-and-a-half-minute taxi hold/queue[24]
    - One-minute hold for crossing Runway 1/19
- Idle power is used for the aircraft at hold points
    - A setting of 30% maximum static thrust is used to briefly to accelerate from hold points up to the taxiing speed of 10 knots.

Taxi noise modeling for this NEM update excludes taxiing of VTANG F-35A aircraft along Taxiways F and D. Taxiway modeling of the F-35A aircraft is not currently possible in NMap or AEDT and has not been included in any NEM update at BTV. Other military aircraft average less than 1 operation per day, so their taxi activities are not modeled for simplicity. In addition, there are no noise-sensitive receptors in close proximity to the east taxiways.

[22] Non-standard modeling approval requested in memorandum submitted to FAA from HMMH on June 12, 2024. Approval provided from FAA Office of Environment and Energy to FAA Region Environmental Protection Specialist on June 25, 2024

[23] These assumptions are consistent with the 2019 BTV NEM taxiway modeling unless otherwise noted.

[24] Based on data provided by US Department of Transportation, Bureau of Transportation Statistics for 2022 and 2023. The database is titled "Airline On-Time Performance Data, Marketing Carrier On-Time Performance (Beginning January 2018)" and is available at https://www.transtats.bts.gov.

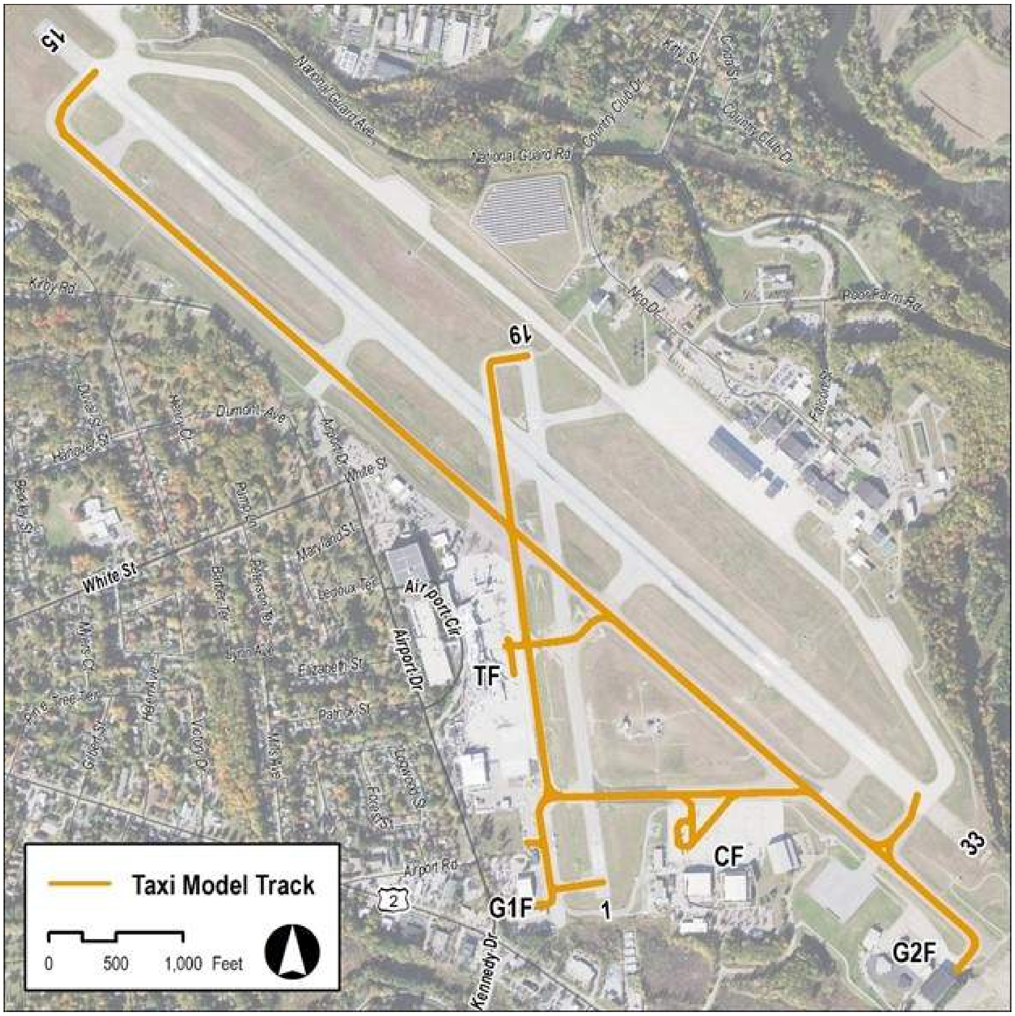

Figure 4-21. BTV Taxiways and Aircraft Taxiing Paths
Sources: HMMH, 2023; BTV NOMS data, 2023

4.7 Meteorological Conditions

The AEDT and NMap have several settings that affect aircraft performance profiles and sound propagation based on meteorological data. Meteorological settings include average annual temperature, barometric pressure, and relative humidity at the Airport. The Study Team applied the 10-year average data from the National Climatic Data Center (NCDC), which are provided in the AEDT database, to the noise modeling:

- Temperature: 47.0° F
- Sea-level Pressure: 1002.6 millibars
- Relative Humidity 65.9%
- Dew Point: 36.2° F
- Wind Speed: 6.7 knots

4.8 Terrain Data

Terrain data describes the elevation of the ground surrounding the airport and on airport property. The AEDT uses terrain data to adjust the ground level under the flight paths. The terrain data does not change the aircraft's performance or noise levels in AEDT, but it alters the vertical distance between the aircraft and a "receiver" on the ground. NMap does the same, and NMap also incorporates ground impedance data into its noise calculations as well as using terrain elevation data to account for the effect of varying topography along propagation paths from a source to a receiver. The NMap model requires the user to specify areas of land as acoustically "soft" or "hard" surfaces, based on data from the United States National Land Cover Database.

Both the AEDT and Nmap models used the terrain data from the National Elevation Dataset (NED), obtained via the United States Geological Survey (USGS) National Map Viewer.[25] The noise models accept Digital Elevation Model (DEM) data[26]. Typical input is the USGS 1 arc-second or 1/3 arc-second DEM grid data[27], with elevation data available at 1-meter vertical resolution. The latest USGS data was initially published in 2019[28]. USGS makes use of multiple available data sources, one of which is LiDAR[29], to develop the data.

At the suggestion of a TAC member during the NEM update process, the Study Team investigated an alternative terrain data source, in the form of Vermont Center for Geographic Information (VCGI)[30] data, published in 2014.[31] The VCGI DEM data is a raster grid[32] with a 0.7-meter lateral cell size and 1 cm vertical precision that is based solely on LiDAR[33]. A comparison of the USGS data to the VCGI data showed that, in most areas, the USGS and VCGI data agree when placed in the format and resolution expected by the noise models. In a few isolated locations in the NEM study area, the two data sources appeared to differ by 3 meters (approximately 10 feet) or more.

The Study Team decided to run the noise analysis with the USGS 1/3 arc second data, as is standard procedure. During the quality control review of the draft DNL contours, the noise results were compared to both the USGS and VCGI data, looking for instances in which a disagreement between the two data sources may have affected the DNL results. No obvious discrepancies were found.

[25] https://viewer.nationalmap.gov/basic/

[26] Elevation data given as bare earth, devoid of structures. https://www.usgs.gov/faqs/what-difference-between-lidar-data-and-digital-elevation-model-dem

[27] At a latitude of 44.4 degrees, where BTV is, an arc second is about 22 meters (about 72 feet). Correspondingly, 1/3 arc second data would be in a grid with points spaced about 7.3 meters or 24 feet apart.

[28] USGS 1/3 DEM metadata: thor-f5.er.usgs.gov/ngtoc/metadata/waf/elevation/1-3_arc-second/undefined/USGS_13_n45w074_20190416.xml

29 LiDAR stands for Light Detection and Ranging. It is a remote sensing method that uses light in the form of a pulsed laser to measure variable distances to the Earth

[30] https://vcgi.vermont.gov/

[31] VCGI metadata: https://maps.vcgi.vermont.gov/gisdata/metadata/ElevationDEM_DEMHE0p7M2014.htm

[32] A raster is a matrix of cells (or pixels) organized into rows and columns (or a grid) where each cell contains a value representing information

[33] More information on VCGI LiDAR data here: https://vcgi.vermont.gov/resources/frequently-asked-questions/lidar-program-faqs

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5 2024 and 2029 Noise Exposure Maps

This chapter presents the BTV modeled aircraft noise exposure contours for calendar year 2024 (the Existing Condition) and 2029 (the five-year Forecast Condition) and the associated land use compatibility.

Modeled noise exposure contours are the fundamental elements and the key outcome of an NEM Update process. The noise contours display 5-decibel increments using the DNL metric for both Existing and Forecast conditions. The contours are presented over land use maps depicting the airport layout, local land-use control jurisdictions, major land-use categories, discrete non-residential noise-sensitive sites, and other information as required by Part 150.

5.1 Noise Exposure Map Figures

Figure 5-1 and **Figure 5-2** represent the formal NEMs as submitted herein for FAA acceptance as compliant with Part 150 pursuant to §150.21. As noted in item IV.D of the Part 150 Noise Exposure Maps Checklist, the regulation requires that Noise Exposure Maps depict the DNL 65, 70, and 75 noise contours at a scale of 1 inch to 2,000 feet. **Figure 5-1** and **Figure 5-2** contain all graphical elements that Part 150 requires on NEMs, with the exception of flight tracks, which Part 150 permits airports to submit in supplemental graphics[34].

As noted on the NEM Checklist, the formal NEM figures include the locations of noise monitoring sites. Using data from the system, the study team calculated the average daily DNL values for each site for the 12-month period from July 1, 2022, through June 30, 2023. The measured DNL includes all sound sources, not just aircraft noise.

- BTV001: Chamberlain Elementary School - 63.4 dB
- BTV002: Winooski City Hall - 68.2 dB
- BTV003: Williston Rd & Chad Ln - 73.5 dB

Figure 5-3 shows both sets of NEM contours over the land use base map for easy comparison between the Existing and Forecast Conditions contour sets. The modeling assumptions for each of the contour sets are documented in Chapter 4 of this document. Many of the input categories do not change between the 2024 and 2029 scenarios. The main differences are in the level and mix of aircraft operations for each year, which change very little; there is an overall increase of 3.6 percent in operations from 2024 to 2029. The contour comparison figure shows minor noise increases in noise, as evidenced by the slightly larger area covered by the 2029 contours.

[34] Large-scale flight track figures (printed at 1 inch to 2,000 feet) using the same land use base map as the DNL contours are provided as folded maps in pockets in Appendix D of the printed copies of this document, to meet FAA requirements.

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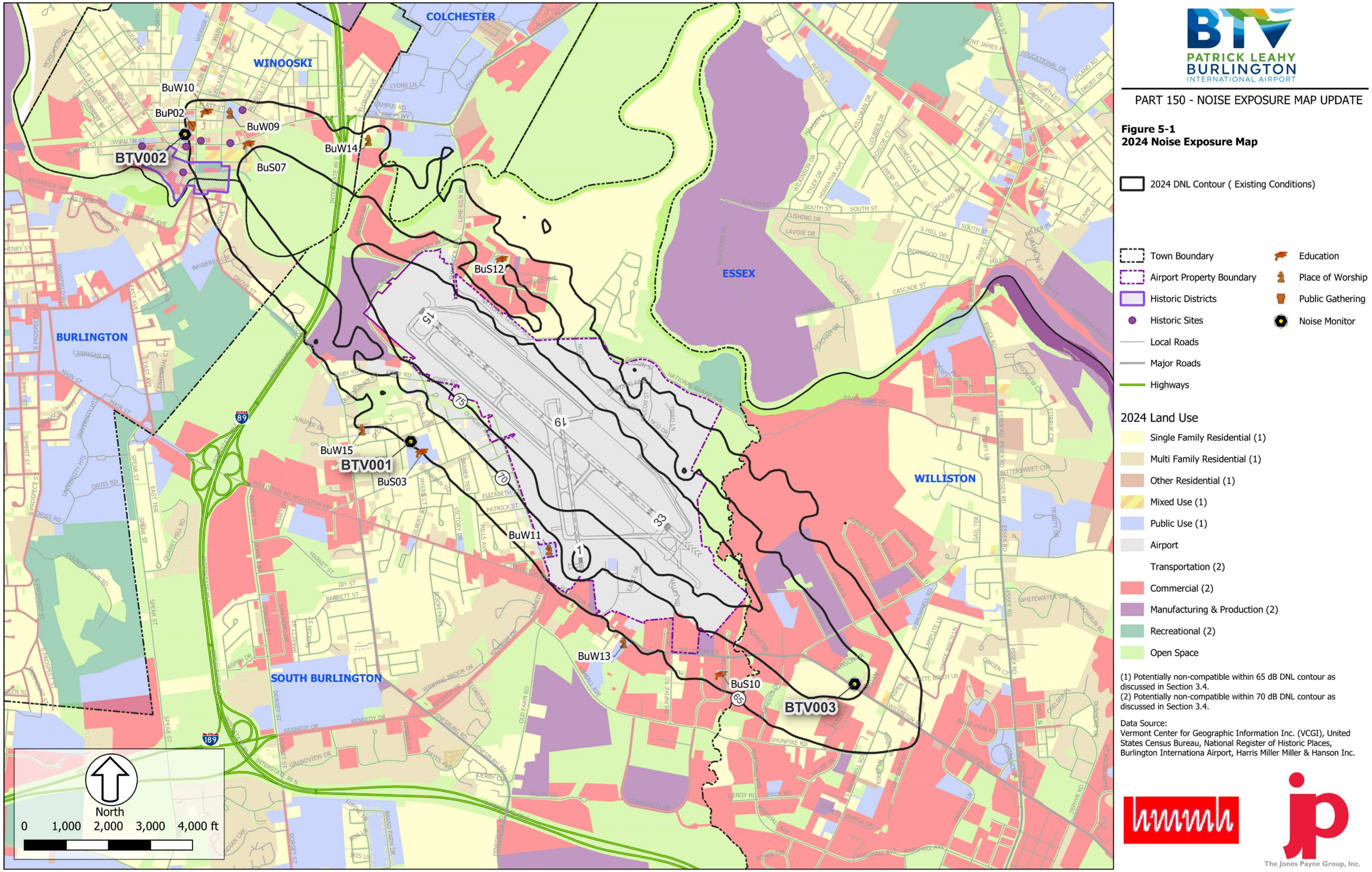

Figure 5-1
2024 Noise Exposure Map

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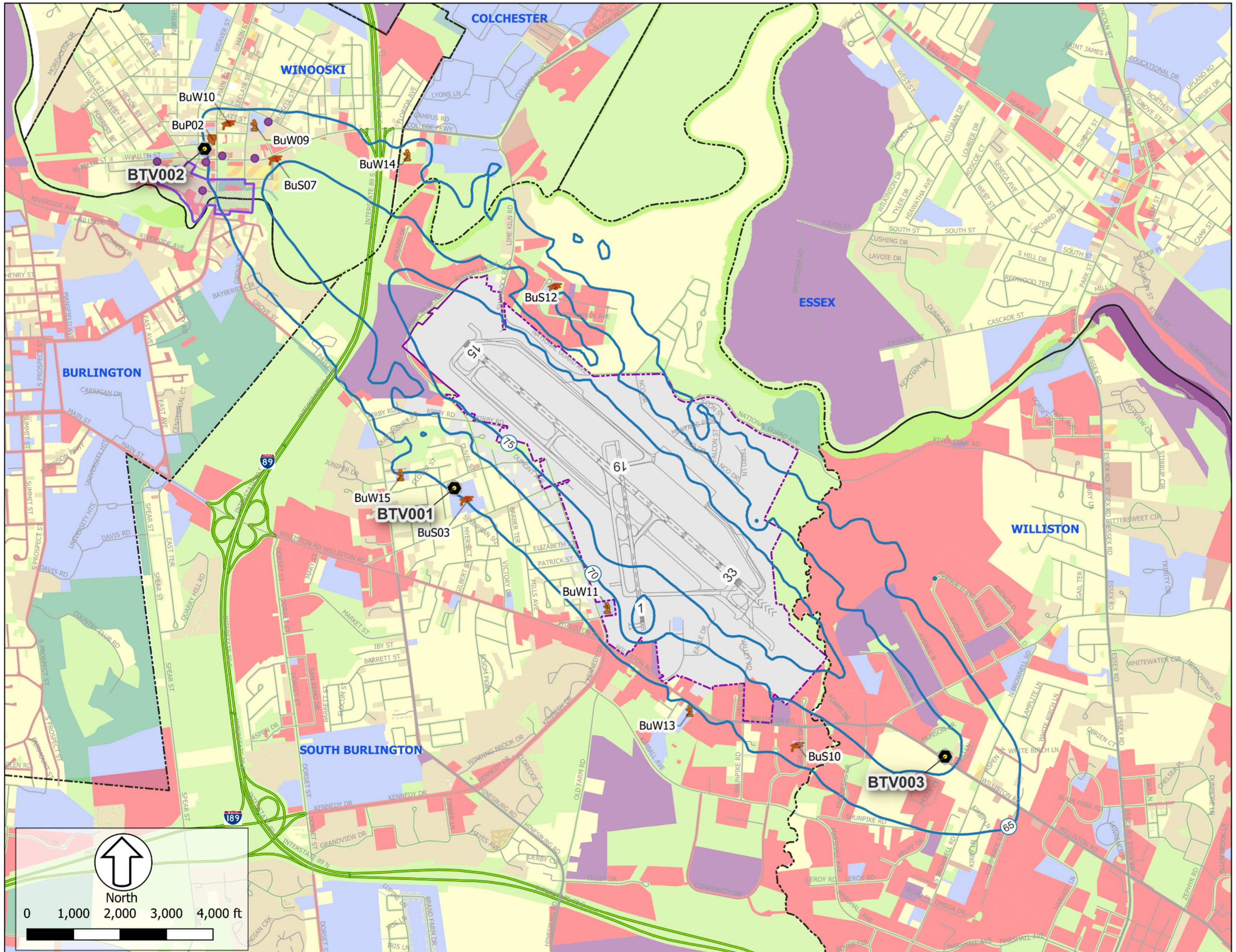

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Figure 5-2
2029 Noise Exposure Map

2029 DNL Contour (Forecast Conditions)

Town Boundary
Airport Property Boundary
Historic Districts
Historic Sites
Local Roads
Major Roads
Highways
Education
Place of Worship
Public Gathering
Noise Monitor

2024 Land Use

Single Family Residential (1)
Multi Family Residential (1)
Other Residential (1)
Mixed Use (1)
Public Use (1)
Airport
Transportation (2)
Commercial (2)
Manufacturing & Production (2)
Recreational (2)
Open Space

(1) Potentially non-compatible within 65 dB DNL contour as discussed in Section 3.4.
(2) Potentially non-compatible within 70 dB DNL contour as discussed in Section 3.4.

Data Source:
Vermont Center for Geographic Information Inc. (VCGI), United States Census Bureau, National Register of Historic Places, Burlington Internationa Airport, Harris Miller Miller & Hanson Inc.

The Jones Payne Group, Inc.

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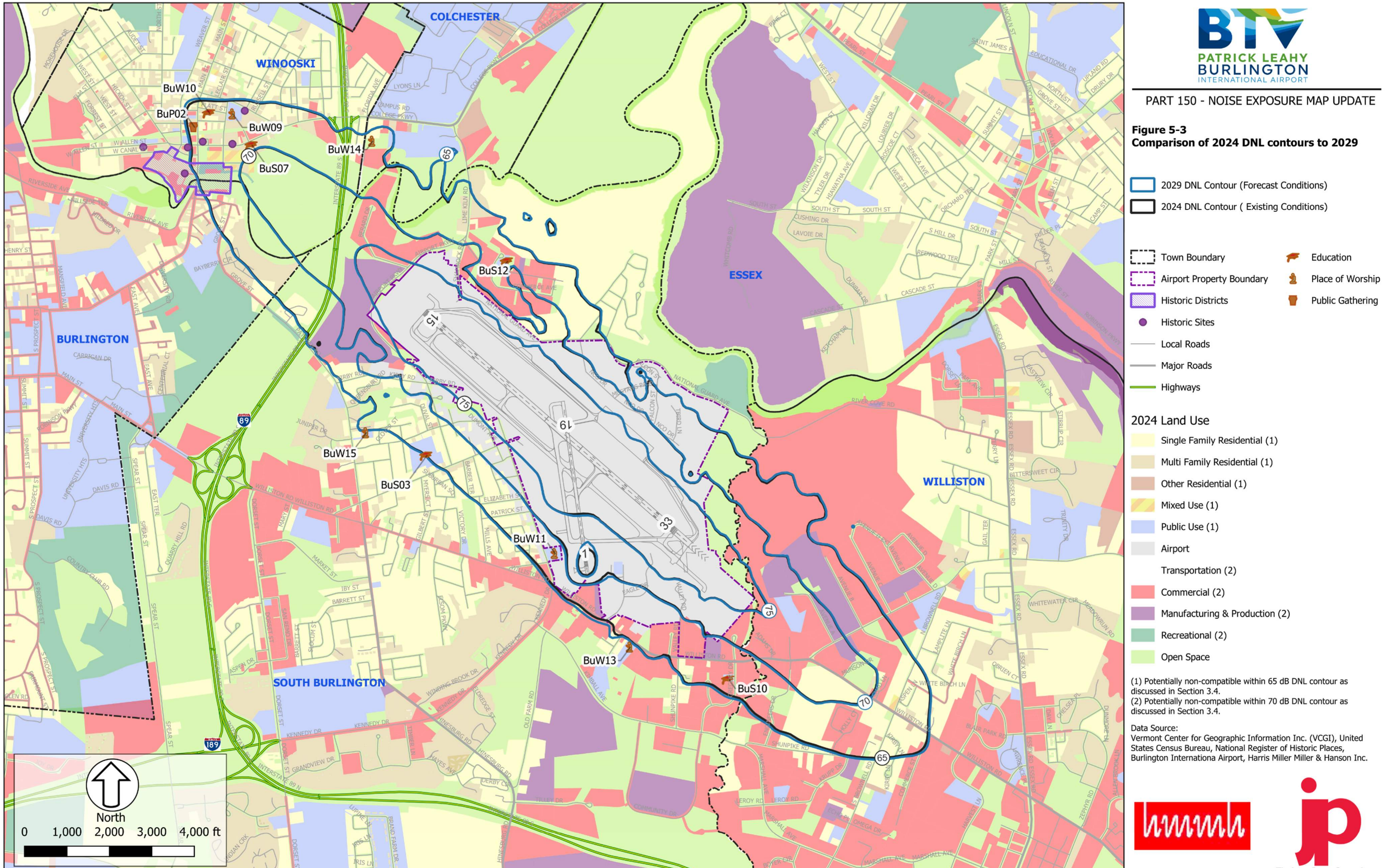

Figure 5-3
Comparison of 2024 DNL contours to 2029

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5.2 Land Use Compatibility within the 2024 and 2029 Noise Exposure Maps

Based on the FAA's land use compatibility guidelines presented in **Table 2-1**, the following land uses are *potentially* incompatible with aircraft noise exposure, within the DNL 65 dB contours.[35]

- Residential land use within the DNL 65 dB and higher contours (shown in various shades of yellow or beige in the figures. This includes residential elements of areas shown as "Mixed Use").
- Residential homes on agricultural land within 65 dB and higher contours.
- Public and private schools within 65 dB and higher contours.
- Places of worship within 65 dB and higher contours.
- Auditoriums, concert halls, and public meeting areas within 65 dB and higher contours.
- Government service, Manufacturing and Wholesale Trade, General Sales and Services, Transportation, Communication, and Utilities buildings within the 70 dB and higher contours.

These potential incompatible land uses fall into two principal categories: (1) discrete noise sensitive receptors (e.g., educational facilities and houses of worship), and (2) residential units.

The local municipalities (land use control jurisdictions) within the 2023 65 dB DNL NEM contour include:

- Town of Williston
- City of South Burlington
- City of Burlington
- City of Winooski
- Town of Colchester

All of these municipalities are within Chittenden County. Some non-contiguous DNL 65 dB contour areas and irregular finger-shaped projections are present on the 2024 and 2029 NEMs, but to a lesser extent than for the previous NEM update.

A key element of the FAA-approved NCP for BTV in 2008 was voluntary property acquisitions and associated relocation. BTV pursued that program with FAA funding support until the NCP update in 2020. The affected local municipalities expressed interest in ending the voluntary acquisition program and in transitioning to other mitigation options. The City would like to continue acquisitions to the extent the homeowner, land use jurisdiction, the FAA and the Airport/City are in agreement, but starting in 2020, the City's preference has been to implement sound insulation as the primary mitigation measure. Comparison of the 2024 and 2029 contours, as depicted in **Figure 5-3**, shows that the area within the DNL 65 dB contours is expected to increase very slightly for the 2029 forecast year, resulting in only small increases to incompatible land uses.

[35] As indicated in the notes to Table 2-1, the ultimate compatibility determination depends on the amount of outdoor to indoor "Noise Level Reduction" incorporated into the building, or for some land uses, certain portions of the building.

5.2.1 Discrete Sensitive Receptors and National Register of Historic Places within the Noise Contours

The NEMs also show the locations of the identified potentially noise sensitive non-residential receptors with noise levels of DNL 65 dB or greater for either of the NEM conditions. **Table 5-1** provides a summary of the sites. **Table 5-2** lists each of the identified facilities and the calculated DNL interval on the 2024 NEM and the 2029 NEM are noted. None of these locations is currently listed on the National Register of Historic Places. **Figure 5-1** and **Figure 5-2** indicate each of the locations, labeled with the IDs designated in **Table 5-2**.

The identified noise sensitive locations could be compatible or incompatible with the aircraft noise level, depending on the building's outdoor-to-indoor Noise Level Reduction (NLR). The appropriate NLR for each activity is specified in the FAA's Land Use Compatibility table provided for reference in **Chapter 2**. The facilities identified in **Table 5-2** which are all in the DNL 65-70 dB contour interval would require a NLR of 25 dB. The NLR provided by the building is only beneficial for activities within the facilities' structure and does not provide benefit for outdoor activities.

Table 5-1. Existing (2024) and Forecast (2029) Inventory of Noise Sensitive Sites

Sources: HMMH and JPG, 2024

Contour Interval	Schools		Places of Worship		Public Gathering	
	2024	2029	2024	2029	2024	2029
65-70 DNL	5	5	5	5	1	1
70-75 DNL	0	0	0	0	0	0
>75 DNL	0	0	0	0	0	0
Total	**5**	**5**	**5**	**5**	**1**	**1**

Table 5-2. Discrete Noise Sensitive Locations within, the DNL 65 dB Contours for 2024 and 2029

Sources: HMMH and JPG, 2024

City/Town	Type	Facility Name	2024 Contour Interval	2029 Contour Interval	ID on NEMs
Winooski	Place of Worship	Saint Stephen Church	65-70	65-70	BuW09
South Burlington	Place of Worship	Eldredge Cemetery	65-70	65-70	BuW11
South Burlington	Place of Worship	Vibrant Church	65-70	65-70	BuW13
Winooski	Place of Worship	St Stephens Cemetery	65-70	65-70	BuW14
South Burlington	Place of Worship	Ahavat Gerim Cemetery	65-70	65-70	BuW15
Winooski	Public Gathering	Veterans of Foreign Wars	65-70	65-70	BuP02
South Burlington	Education	Chamberlin Elementary School	65-70	65-70	BuS03
South Burlington	Education	Union Training Center, IBEW Local 300	65-70	65-70	BuS10
South Burlington	Education	Kid Logic Learning	65-70	65-70	BuS12
Winooski	Education	Heartworks Child Care Center	65-70	65-70	BuW10
Winooski	Education	Community College of Vermont	65-70	65-70	BuS07

Notes: Facility designators are the same as in the US Air Force's Final Environmental Impact Statement (2013) and the 2018 NEM where appropriate. The site ID for Heartworks Child Care Center (previously named Loveworks Child Care Center) contains a W because the building was once a place of worship.

5.2.2 Residential Population within the Noise Contours

Table 5-3 presents estimates of the land use within the 2024 and 2029 DNL contours, based on data compiled from multiple sources, including the Vermont Center for Geographic Information, airport staff, aerial photography, and street view. Each jurisdiction provided zoning information and building point data that further refined the current land use database. In the analysis, if a parcel is intersected by a contour, all dwelling units within that parcel are counted within the higher interval level. The estimated residential population is developed by multiplying the number of dwelling units within each DNL contour band by the average number of residents per dwelling unit. Based on 2020 Census data, the average household size for units within the Census blocks encompassed by the 2024 and 2029 DNL 65 dB contours is 2.33 residents.

The 2029 NEM contour will be utilized by the City for future land-use planning, much as the 2023 forecast contour from the previous NEM update has been used to implement the City's Residential Sound Insulation Program to date. As noted in Section 3.2.2, the City has completed sound insulation construction on 14 homes. **Table 5-3** lists those properties and the associated population estimates within the DNL 65 contour that are classified as compatible with the aircraft noise as a result of the sound insulation.

Table 5-3. Existing (2024) and Forecast (2029) Land Use Compatibility

Sources: US Census (2020), HMMH and JPG, 2024

Contour Interval	Potentially Incompatible[1]		Compatible[2]		Total	
	2024	2029	2024	2029	2024	2029
Off-Airport Acreage[3]						
65-70 DNL	249	261	1	1	250	262
70-75 DNL	317	317	3	3	320	320
>75 DNL	< 1	< 1	0	0	< 1	< 1
Total	**566**	**578**	**4**	**4**	**570**	**582**
Housing Units						
65-70 DNL	1,910	1,982	3	3	1,913	1,985
70-75 DNL	443	443	11	11	454	454
>75 DNL	1	1	0	0	1	1
Total	**2,354**	**2,426**	**14**	**14**	**2,368**	**2,440**
Population (Census 2020)						
65-70 DNL	4,449	4,621	7	7	4,456	4,628
70-75 DNL	1,032	1,032	25	25	1,057	1,057
>75 DNL	2	2	0	0	2	2
Total	**5,483**	**5,655**	**32**	**32**	**5,515**	**5,687**

Notes: Acreage is calculated using the GIS parcel data obtained from the cites which may differ from the deeded acres.
1. "Potentially Incompatible" includes residential and other noise-sensitive land uses; compatibility can depend on the building's outdoor-to-indoor Noise Level Reduction (NLR)
2. "Compatible" quantities in this table refer to residential units made compatible by sound insulation.
3. Acreage does not include airport owned property.

Table 5-4 presents the number of residential dwelling units and the associated population in each DNL contour interval by city or town, categorized as single family land parcels or multi-family/mixed use.

Table 5-4 Estimated Residential Population and Dwelling Units within the DNL 65 dB Contours

Sources: US Census (2020), HMMH and JPG, 2024

DNL Contour Interval	Residential Analysis	Burlington		Colchester		South Burlington		Williston		Winooski		TOTAL	
		2024	2029	2024	2029	2024	2029	2024	2029	2024	2029	2024	2029
Single Family Parcels													
65-70 dB	Dwelling Units	96	97	6	6	309	317	77	84	74	84	**562**	**586**
	Population	224	226	14	14	720	739	179	196	172	196	**1,309**	**1,366**
70-75 dB	Dwelling Units	0	0	0	0	34	34	1	0	0	0	**35**	**35**
	Population	0	0	0	0	79	79	2	0	0	0	**81**	**81**
75 dB +	Dwelling Units	0	0	0	0	1	1	0	0	0	0	**1**	**1**
	Population	0	0	0	0	2	2	0	0	0	0	**2**	**2**
Total 65 dB +	Dwelling Units	**96**	**97**	**6**	**6**	**334**	**352**	**78**	**84**	**74**	**84**	**598**	**622**
	Population	**224**	**226**	**14**	**14**	**801**	**820**	**181**	**196**	**172**	**196**	**1,392**	**1,449**
Multi-Family & Mixed Use Parcels													
65-70 dB	Dwelling Units	156	160	3	3	261	266	6	6	925	964	**1,351**	**1,399**
	Population	363	373	7	7	608	620	14	14	2,155	2,248	**3,147**	**3,262**
70-75 dB	Dwelling Units	84	84	0	0	0	0	1	1	334	334	**419**	**419**
	Population	196	196	0	0	0	0	2	2	778	778	**976**	**976**
75 dB +	Dwelling Units	0	0	0	0	0	0	0	0	0	0	**0**	**0**
	Population	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Total 65 dB +	Dwelling Units	**240**	**244**	**3**	**3**	**261**	**7**	**7**	**7**	**1,259**	**1,298**	**1,770**	**1,818**
	Population	**559**	**569**	**7**	**7**	**608**	**16**	**16**	**16**	**2,933**	**3,026**	**4,123**	**4,238**
Estimated Totals - All Parcel Types													
65-70 dB	Dwelling Units	252	257	9	9	570	583	83	88	999	1,048	**1,913**	**1,985**
	Population	587	599	21	21	1,328	1,359	193	205	2,327	2,444	**4,456**	**4,628**
70-75 dB	Dwelling Units	84	84	0	0	34	34	2	2	334	334	**454**	**454**
	Population	196	196	0	0	79	79	4	4	778	778	**1,057**	**1,057**
75 dB +	Dwelling Units	0	0	0	0	1	1	0	0	0	0	**1**	**1**
	Population	0	0	0	0	2	2	0	0	0	0	**2**	**2**
Total 65 dB +	Dwelling Units	**336**	**341**	**9**	**9**	**605**	**618**	**85**	**90**	**1,333**	**1,382**	**2,368**	**2,440**
	Population	**783**	**795**	**21**	**21**	**1,409**	**1440**	**197**	**209**	**3,105**	**3,222**	**5,515**	**5,687**

5.3 Comparison of Updated DNL Contours to Previous NEM

Figure 5-4 compares the 2024 Existing Conditions DNL contours to the 2023 forecast contour that the FAA accepted on September 26, 2019. For both of these contour sets, the F-35A aircraft are the dominant noise source. In 2019, the VTANG was transitioning from F-16C aircraft to F-35A aircraft at BTV and the 2023 forecast contour was based on modeled projections of expected VTANG F-35A operations levels with flight profile data from F-35A squadrons operating elsewhere. In contrast, the 2024 Existing Conditions modeling is based on data from VTANG representing their current operating procedures and flight volume.

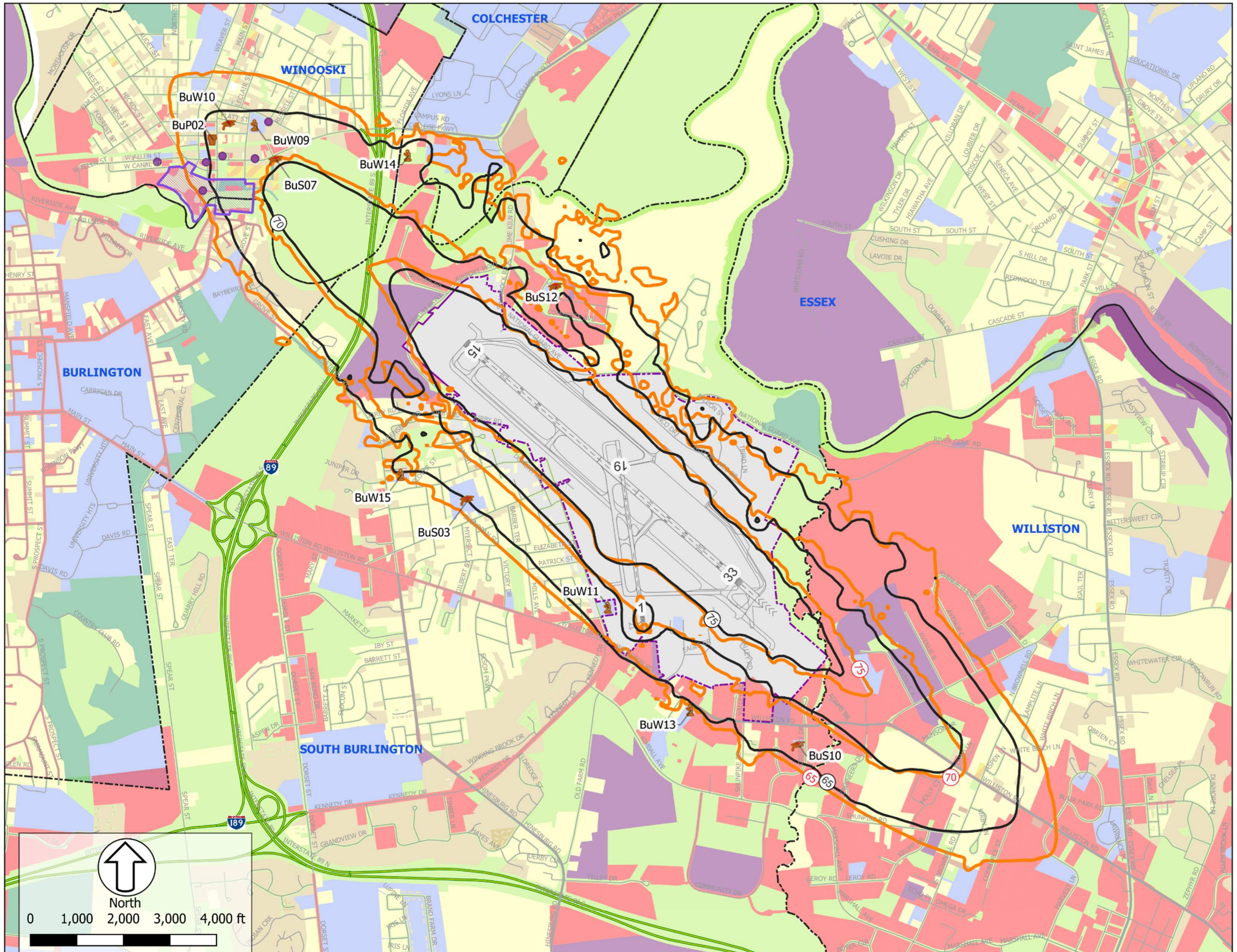

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Figure 5-4
Comparison of 2024 DNL contours to previous NEM's Forecast 2023

- 2024 DNL Contour (Existing Conditions)
- 2023 DNL Contour
- Town Boundary
- Airport Property Boundary
- Historic Districts
- Historic Sites
- Local Roads
- Major Roads
- Highways
- Education
- Place of Worship
- Public Gathering

2024 Land Use

- Single Family Residential (1)
- Multi Family Residential (1)
- Other Residential (1)
- Mixed Use (1)
- Public Use (1)
- Airport
- Transportation (2)
- Commercial (2)
- Manufacturing & Production (2)
- Recreational (2)
- Open Space

(1) Potentially non-compatible within 65 dB DNL contour as discussed in Section 3.4.
(2) Potentially non-compatible within 70 dB DNL contour as discussed in Section 3.4.

Data Source:
Vermont Center for Geographic Information Inc. (VCGI), United States Census Bureau, National Register of Historic Places, Burlington Internationa Airport, Harris Miller Miller & Hanson Inc.

hmmh

The Jones Payne Group, Inc.

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Table 5-5 compares the number of residential dwelling units and the associated population identified as being exposed to DNL 65 dB or greater for forecast year 2023 in the previous NEM Update to the corresponding data for 2024 and 2029. As shown in **Figure 5-4**, the 2023 forecast contour covered more area, with each contour line (65, 70, and 75 DNL) generally outside of the area enclosed by the equivalent noise level contour for the 2024 Existing Conditions. Accordingly, the number of dwelling units potentially incompatible with the aircraft noise levels was greater in that earlier analysis.

Table 5-5. Comparison Estimated Residential Population and Dwelling Units to Previous NEM

Sources: 2023 Forecast NEM data as published in Burlington International Airport 14 CFR Part 150 Update 2018 and 2023 Noise Exposure Maps, September 2019, US Census (2020), HMMH and JPG, 2024

	Dwelling Units			Population		
	2023	2024	2029	2023	2024	2029
Single Family Parcels	890	598	622	2,065	1,392	1,449
Multi-Family & Mixed Use Parcels	1,750	1,770	1,818	4,060	4,123	4,238
Estimated Totals - All Parcel Types	**2,640**	**2,368**	**2,440**	**6,125**	**5,515**	**5,687**

Note: Residential land use analysis completed in 2019 for the 2023 Forecast Conditions accessed 2010 US Census data; the current analysis for the 2024 Existing Conditions and 2029 Forecast Conditions use 2020 US Census data.

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6 Stakeholder Engagement

A Part 150 study represents a unique opportunity for the study sponsor to engage with stakeholders on aircraft noise and to share information related to land use compatibility around the airport. This chapter describes outreach efforts conducted throughout the development of the NEM to engage airport stakeholders, including the public. Stakeholders and those interested in aircraft noise compatibility planning were afforded an ongoing opportunity to learn about the Part 150 Study and provide comments. This occurred through various mechanisms as described in the following subsections.

6.1 Technical Advisory Committee

The Technical Advisory Committee (TAC) is the core advisory group consulted throughout this NEM update process. The members reviewed and provided input on study content and materials, representing their constituents' interests. Four TAC meetings took place over the course of the study and the committee was kept apprised of study progress throughout. At key points in the study process, the Study Team presented information related to the NEM update and solicited input from members.

Major topics discussed at each of the TAC meetings are presented in **Table 6-1.** Copies of the TAC meeting presentations are included in **Appendix E**.

Table 6-1. Technical Advisory Committee Meetings for 2024 BTV NEM Update

Sources: Jones Pyne Group, HMMH, 2024

Date	Topics covered
October 12, 2023	• Part 150 Overview • Existing NEM and NCP • Land Use Compatibility Guidelines • Noise Terminology and Noise Modeling Overview • NEM Update Study Schedule
November 30, 2023	• Noise Modeling Overview • Proposed Noise Modeling Inputs
April 11, 2024	• Review of Existing BTV Noise Compatibility Program • Responses to Questions from Previous Meeting
October 23, 2024	• Noise Modeling Results • Presentation of the Noise Exposure Map Document • Public Review Process

6.2 Project Website

Members of the public were given opportunities to follow the Study's progress and provide input. The public was encouraged to stay abreast of progress by visiting the Part 150 Study website at www.btvsound.com. All Study-related information and resources are posted on this site, including the slides presented at each of the TAC meetings.

6.3 Public Participation

As the noise modeling process progressed and this document was being developed and refined, the City and airport management offered the public opportunities to learn about the NEM and its findings and to provide input.

- Airport staff will hold meetings with officials from Burlington, South Burlington and Winooski, and verbally brief them about the draft NEM.
- A 30-day period will be provided for public review and comment of the draft Noise Exposure Map, starting on October 23, 2024 and ending on November 22, 2024
- The draft NEM document will be made available for review through the Burlington International Airport's sound Mitigation Program website, http://www.btvsound.com. A copy of the draft document will also be available for public review at the airport offices 1200 Airport Rd, Suite 1, South Burlington, VT, 05403. Please contact Larry Lackey at lackey@btv.aero to view the document.
- The draft Noise Exposure Map will be presented at public workshops from 6:30 p.m. to 8:00 p.m. on October 23, 2024 at the Chamberlin Elementary School in South Burlington and on October 24, 2024 at the Winooski High School in Winooski.
- The public workshops will be advertised in print material including newspapers published in communities surrounding the airport, and in some social media.
- Staff from BTV, and the consultant team (The Jones Payne Group, and HMMH) will be present at the public workshops to answer questions about the study and explain information shown on the presentation boards describing the study process and results.
- Copies of the draft Noise Exposure Map will be available for attendees to review at the workshop.
- Comment sheets will be provided for individuals to fill out and submit to BTV at the public workshops or at any time during the public comment period by mail or email.

6.4 Public Comments on the Draft NEM Report

During the comment period, a total of ___ written comments were submitted by members of the public, elected officials, and representatives of municipal organizations. **Appendix F** presents copies of all comments received at the Airport's offices or website by date, 2024. In the spirit of Part 150 requirements, copies of any additional "written comments received during consultation" will be filed with the FAA, including comments received after the deadline.

Table 6-2 lists, and provides summary descriptions of, the ten most frequent categories of comments received prior to the closing of the 30-day public comment period on November 22, 2024. In descending order from most to least frequent, these ten categories account for approximately 90 percent of comments received; the remaining comments fall into dispersed categories.

Table 6-2. Top Ten Most Frequent Public Comments Received

Source: City of Burlington, Jones Payne Group, and HMMH, 2024

Comment Category	Description

Appendix F includes a table that lists all the comments received. Scanned copies of each of the written comments received are also contained in **Appendix F**. The following items were entered into the table for each comment:

- First and last name (and title, if applicable)
- Affiliation/organization, if applicable
- Address (city only)
- The medium in which the comment originated – Comment Form, electronic mail, letter
- Comment identification number (including sub-identification number for comments addressing multiple topics)
- Comment topic (general categories addressed in each comment)

As review of **Table 6-2 and Appendix F** indicates, the comments ……….

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Appendix A: Noise Terminology

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A.1 Aircraft Noise Terminology

Noise is a complex physical quantity. The properties, measurement, and presentation of noise involve specialized terminology that can be difficult to understand. To provide a basic reference on these technical issues, this section introduces fundamentals of noise terminology, the effects of noise on human activity, and noise propagation.

A.1.1 Introduction to Noise Terminology

Analyses of potential impacts from changes in aircraft noise levels rely largely on a measure of cumulative noise exposure over an entire calendar year, expressed in terms of a metric called the day-night average sound level (DNL). However, DNL does not provide an adequate description of noise for many purposes. A variety of measures, which are further described in subsequent subsections, are available to address essentially any issue of concern, including:

- Sound Pressure Level (SPL) and the decibel (dB)
- A-Weighted Decibel (dBA)
- Maximum A-Weighted Sound Level (L_{max})
- Time Above (TA)
- Sound Exposure Level (SEL)
- Equivalent A-Weighted Sound Level (L_{eq})
- Day-Night Average Sound Level (DNL)

A.1.2 Sound Pressure Level, SPL, and the Decibel, dB

All sounds come from a sound source—a musical instrument, a voice speaking, an airplane passing overhead. It takes energy to produce sound. The sound energy produced by any sound source travels through the air in sound waves—tiny, quick oscillations of pressure just above and just below atmospheric pressure. The ear senses these pressure variations and, with much processing in our brain, translates them into “sound.”

Our ears are sensitive to a wide range of sound pressures. The loudest sounds that we can hear without pain contain about one million times more energy than the quietest sounds we can detect. To allow us to perceive sound over this very wide range, our ear/brain “auditory system” compresses our response in a complex manner, represented by a term called sound pressure level (SPL), which we express in units called decibels (dB).

Mathematically, SPL is a logarithmic quantity based on the ratio of two sound pressures, the numerator being the pressure of the sound source of interest (P_{source}), and the denominator being a reference pressure ($P_{reference}$).[1]

$$\textit{Sound Pressure Level (SPL)} = 20 * Log\left(\frac{P_{source}}{P_{reference}}\right) dB$$

[1] The reference pressure is approximately the quietest sound that a healthy young adult can hear.

The logarithmic conversion of sound pressure to SPL means that the quietest sound that we can hear (the reference pressure) has a sound pressure level of about 0 dB, while the loudest sounds that we hear without pain have sound pressure levels of about 120 dB. Most sounds in our day-to-day environment have sound pressure levels from about 40 to 100 dB[2].

Because decibels are logarithmic quantities, we cannot use common arithmetic to combine them. For example, if two sound sources each produce 100 dB operating individually, when they operate simultaneously, they produce 103 dB, not the 200 dB we might expect. Increasing to four equal sources operating simultaneously will add another 3 dB of noise, resulting in a total SPL of 106 dB. For every doubling of the number of equal sources, the SPL goes up another 3 dB.

If one noise source is much louder than another is, the louder source "masks" the quieter one and the two sources together produce virtually the same SPL as the louder source alone. For example, a 100 dB and 80 dB sources produce approximately 100 dB of noise when operating together.

Two useful “rules of thumb” related to SPL are worth noting: (1) humans generally perceive a six to 10 dB increase in SPL to be about a doubling of loudness,[3] and (2) changes in SPL of less than about 3 dB for any particular sound are not readily detectable outside of a laboratory environment.

A.1.3 A-Weighted Decibel

An important characteristic of sound is its frequency, or "pitch.” This is the per-second oscillation rate of the sound pressure variation at our ear, expressed in units known as Hertz (Hz).

When analyzing the total noise of any source, acousticians often break the noise into frequency components (or bands) to consider the “low,” “medium,” and “high” frequency components. This breakdown is important for two reasons:

- Our ear is better equipped to hear mid and high frequencies and is least sensitive to lower frequencies. Thus, we find mid- and high-frequency noise more annoying.
- Engineering solutions to noise problems differ with frequency content. Low-frequency noise is generally harder to control.

The normal frequency range of hearing for most people extends from a low of about 20 Hz to a high of about 10,000 to 15,000 Hz. Most people respond to sound most readily when the predominant frequency is in the range of normal conversation, typically around 1,000 to 2,000 Hz. The acoustical community has defined several “filters,” which approximate this sensitivity of our ear and thus, help us to judge the relative loudness of various sounds made up of many different frequencies.

The so-called "A" filter (“A weighting”) generally does the best job of matching human response to most environmental noise sources, including natural sounds and sound from common transportation sources. A-weighted decibels are abbreviated dBA. Because of the correlation with our hearing, the U. S. Environmental Protection Agency (EPA) and nearly every other federal and state agency have adopted

[2] The logarithmic ratio used in its calculation means that SPL changes relatively quickly at low sound pressures and more slowly at high pressures. This relationship matches human detection of changes in pressure. We are much more sensitive to changes in level when the SPL is low (for example, hearing a baby crying in a distant bedroom), than we are to changes in level when the SPL is high (for example, when listening to highly amplified music).

[3] A “10 dB per doubling” rule of thumb is the most often used approximation.

A-weighted decibels as the metric for use in describing environmental and transportation noise. **Figure A-1** depicts A-weighting adjustments to sound from approximately 20 Hz to 10,000 Hz.

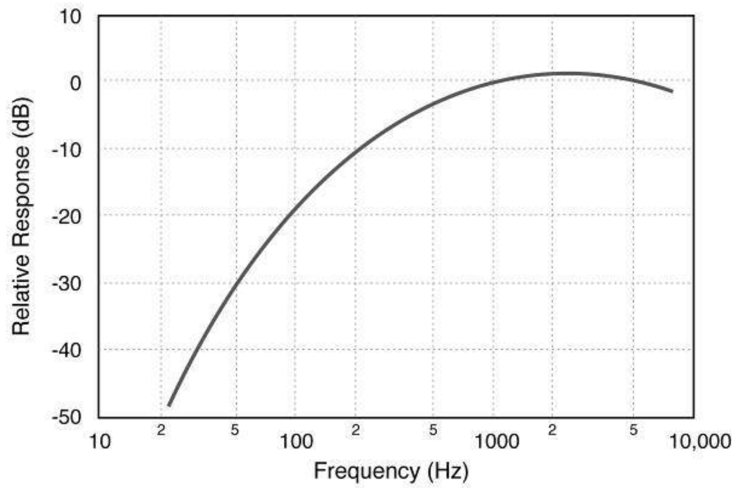

Figure A-1. A-Weighting Frequency Response

Source: Extract from Harris, Cyril M., Editor, "Handbook of Acoustical Measurements and Control," McGraw-Hill, Inc., 1991, pg. 5.13; HMMH

As the figure shows, A-weighting significantly de-emphasizes noise content at lower and higher frequencies where we do not hear as well, and has little effect, or is nearly "flat," in for mid-range frequencies between 1,000 and 5,000 Hz. All sound pressure levels presented in this document are A-weighted unless otherwise specified.

Figure A-2 shows representative A-weighted levels for many common sounds**.**

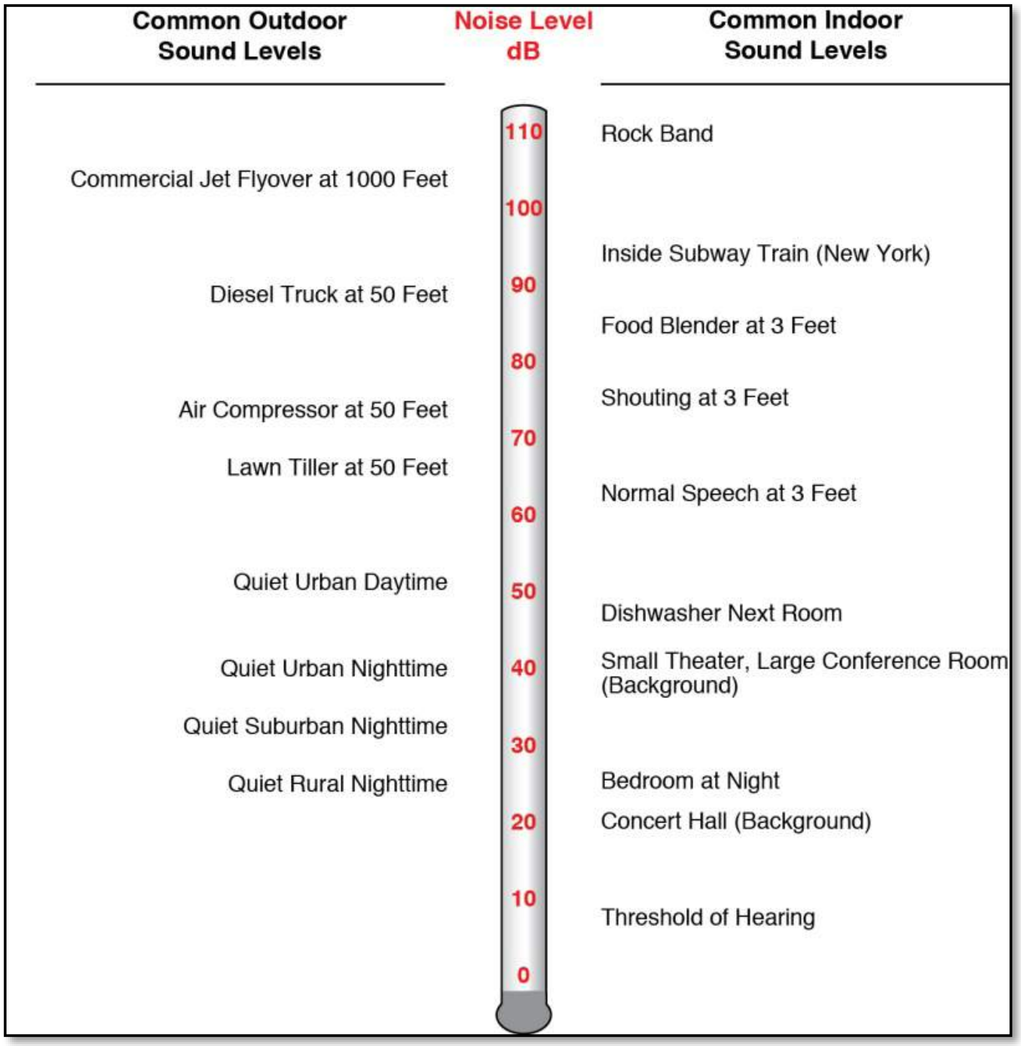

Figure A-2. A-Weighted Sound Levels for Common Sounds
Source: HMMH

A.1.4 Maximum A-Weighted Sound Level, L_{max}

An additional dimension to environmental noise is that A-weighted levels vary with time. For example, the sound level increases as a car or aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance. The background or "ambient" level continues to vary in the absence of a distinctive source, for example due to birds chirping, insects buzzing, leaves rustling, etc. It is often convenient to describe a particular noise "event" (such as a vehicle passing by, a dog barking, etc.) by its maximum sound level, abbreviated as L_{max}.

Figure A-3 depicts this general concept, for a hypothetical noise event with an L_{max} of approximately 102 dB.

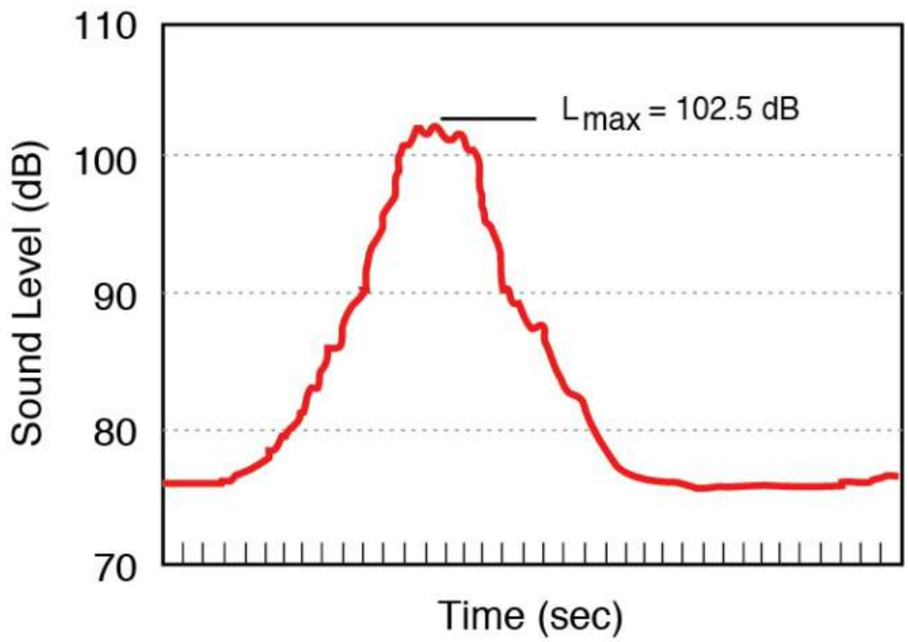

Figure A-3. Variation in A-Weighted Sound Level over Time and Maximum Noise Level

Source: HMMH

While the maximum level is easy to understand, it suffers from a serious drawback when used to describe the relative “noisiness” of an event such as an aircraft flyover; i.e., it describes only one dimension of the event and provides no information on the event’s overall, or cumulative, noise exposure. In fact, two events with identical maximum levels may produce very different total exposures. One may be of very short duration, while the other may continue for an extended period and be judged much more annoying.

The next section introduces a measure that accounts for this concept of a noise "dose," or the cumulative exposure associated with an individual “noise event” such as an aircraft flyover.

A.1.5 Sound Exposure Level, SEL

The most commonly used measure of cumulative noise exposure for an individual noise event, such as an aircraft flyover, is the Sound Exposure Level, (SEL). SEL is a summation of the A-weighted sound energy over the entire duration of a noise event. SEL expresses the accumulated energy in terms of the one-second-long steady-state sound level that would contain the same amount of energy as the actual time-varying level.

SEL provides a basis for comparing noise events that generally match our impression of their overall “noisiness,” including the effects of both duration and level. The higher the SEL, the more annoying a noise event is likely to be. In simple terms, SEL “compresses” the energy for the noise event into a single second. **Figure A-4** depicts this compression, for the same hypothetical event shown in **Figure A-3**. Note that the SEL is higher than the L_{max}.

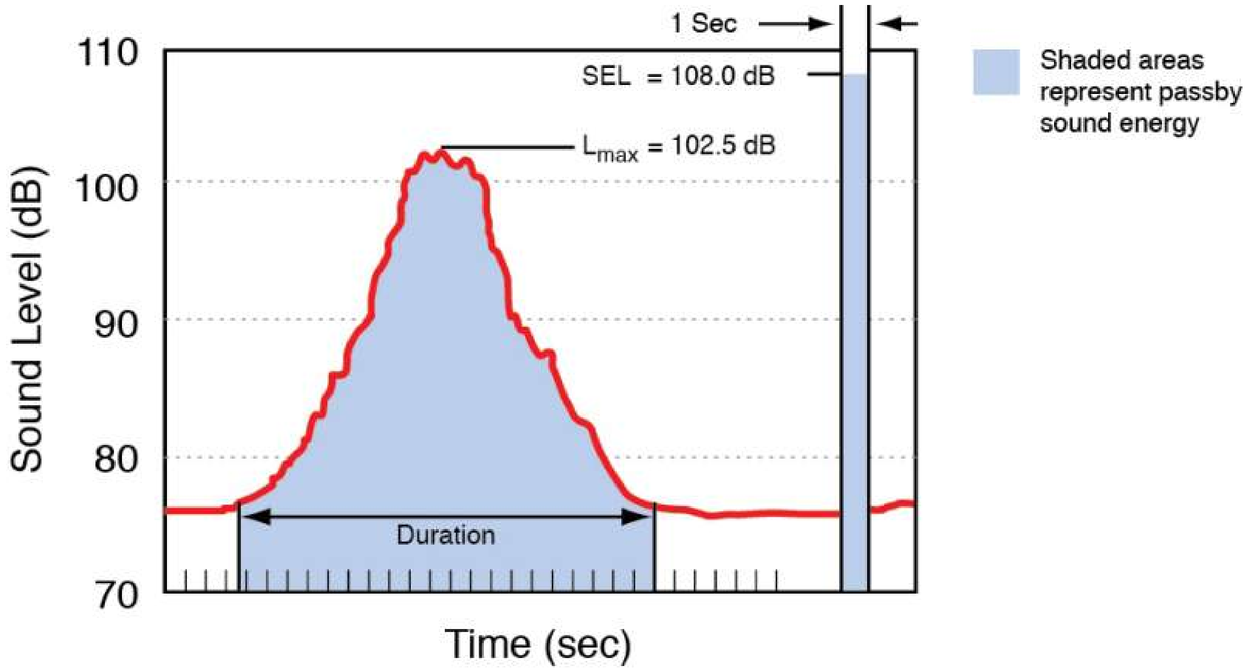

Figure A-4. Graphical Depiction of Sound Exposure Level

Source: HMMH

The "compression" of energy into one second means that a given noise event's SEL will be a higher numerical value than its L_{max} if the event lasts longer than one second. For most aircraft flyovers, SEL is roughly five to 12 dB higher than L_{max}. Adjustment for duration means that relatively slow and quiet propeller aircraft can have the same or higher SEL than faster, louder jets, which produce shorter duration events.

A.1.6 Equivalent A-Weighted Sound Level, L_{eq}

The Equivalent Sound Level, abbreviated L_{eq}, is a measure of the exposure resulting from the accumulation of sound levels over a particular period of interest; e.g., one hour, an eight-hour school day, nighttime, or a full 24-hour day. L_{eq} plots for consecutive hours can help illustrate how the noise dose rises and falls over a day or how a few loud aircraft significantly affect some hours.

L_{eq} may be thought of as the constant sound level over the period of interest that would contain as much sound energy as the actual varying level. It is a way of assigning a single number to a time-varying sound level. **Figure A-5** illustrates this concept for the same hypothetical event shown in **Figure A-3** and **Figure A-4**. Note that the L_{eq} is lower than either the L_{max} or SEL.

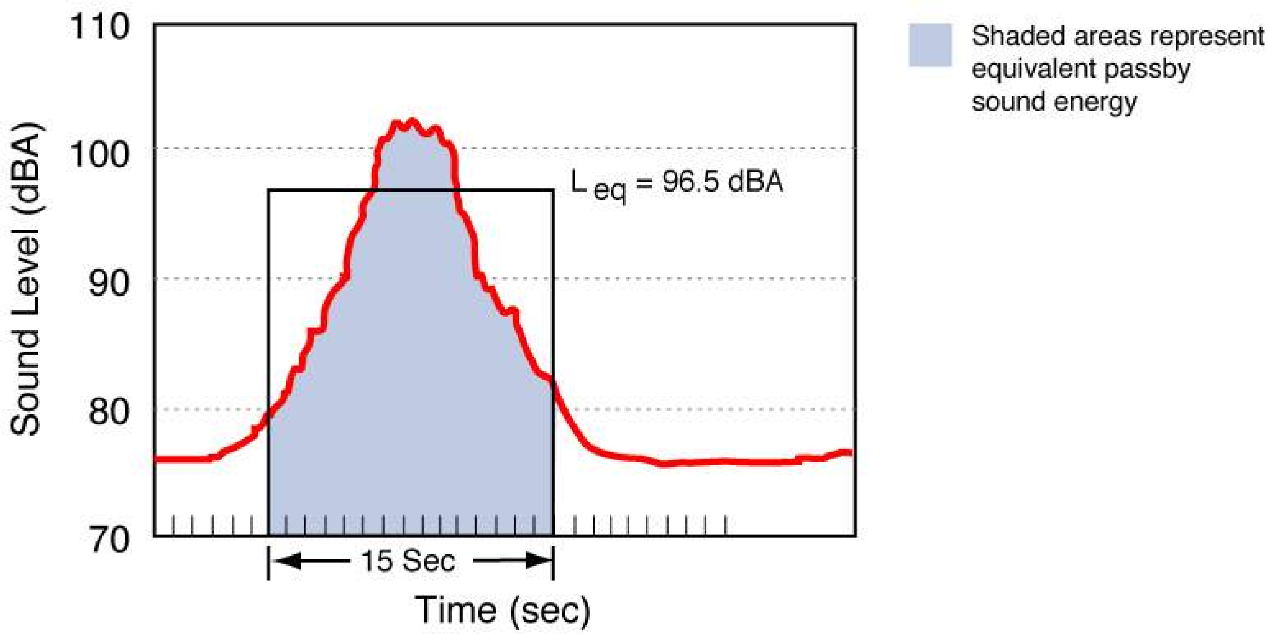

Figure A-5. Example of a 15-Second Equivalent Sound Level

Source: HMMH

A.1.7 Day-Night Average Sound Level, DNL or L_{dn}

The FAA requires that airports use a measure of noise exposure that is slightly more complicated than L_{eq} to describe cumulative noise exposure: the day-night average sound level (DNL).

The EPA identified DNL as the most appropriate means of evaluating airport noise based on the following considerations:[4]

- The measure should be applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods.
- 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 principle, 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.

[4] "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, March 1974.

- The measure should lend itself to small, simple monitors, which can be left unattended in public areas for long periods.

Most federal agencies dealing with noise have formally adopted DNL. The Federal Interagency Committee on Noise (FICON) 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.”

In 2015, the FAA began a multi-year effort to update the scientific evidence on the relationship between aircraft noise exposure and its effects on communities around airports.[5] This was the most comprehensive study using a single noise survey ever undertaken in the United States, polling communities surrounding 20 airports nationwide. The FAA Reauthorization Act of 2018 under Section 188 and 173, required FAA to complete the evaluation of alternative metrics to the DNL standard within one year. The Section 188 and 173 Report to Congress was delivered on April 14, 2020[6] and concluded that while no single noise metric can cover all situations, DNL provides the most comprehensive way to consider the range of factors influencing exposure to aircraft noise. In addition, use of supplemental metrics is both encouraged and supported to further disclose and aid in the public understanding of community noise impacts. The full study supporting these reports was released in January 2021. If changes are warranted in the use of DNL, which DNL level to assess or the use of supplemental metrics, FAA will propose revised policy and related guidance and regulations, subject to interagency coordination, as well as public review and comment.

In simple terms, DNL is the 24-hour L_{eq} with one adjustment; all noises occurring at night (defined as 10 p.m. through 7 a.m.) are increased by 10 dB, to reflect the added intrusiveness of nighttime noise events when background noise levels decrease. In calculating aircraft exposure, this 10 dB increase is mathematically identical to counting each nighttime aircraft noise event ten times.

DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for limited numbers of points, and, in the absence of a permanently installed monitoring system, only for relatively short periods. Most airport noise studies use computer-generated DNL estimates depicted as equal-exposure noise contours (much as topographic maps have contours of equal elevation).

The annual DNL is mathematically identical to the DNL for the average annual day, i.e., a day on which the number of operations is equal to the annual total divided by 365 (366 in a leap year). **Figure A-6** graphically depicts the manner in which the nighttime adjustment applies in calculating DNL. **Figure A-7** presents representative outdoor DNL values measured at various U.S. locations.

[5] Federal Aviation Administration. Press Release – FAA To Re-Evaluate Method for Measuring Effects of Aircraft Noise. https://www.faa.gov/news/press_releases/news_story.cfm?newsId=18774

[6] Federal Aviation Administration. Report to Congress on an evaluation of alternative noise metrics. https://www.faa.gov/about/plans_reports/congress/media/Day-Night_Average_Sound_Levels_COMPLETED_report_w_letters.pdf

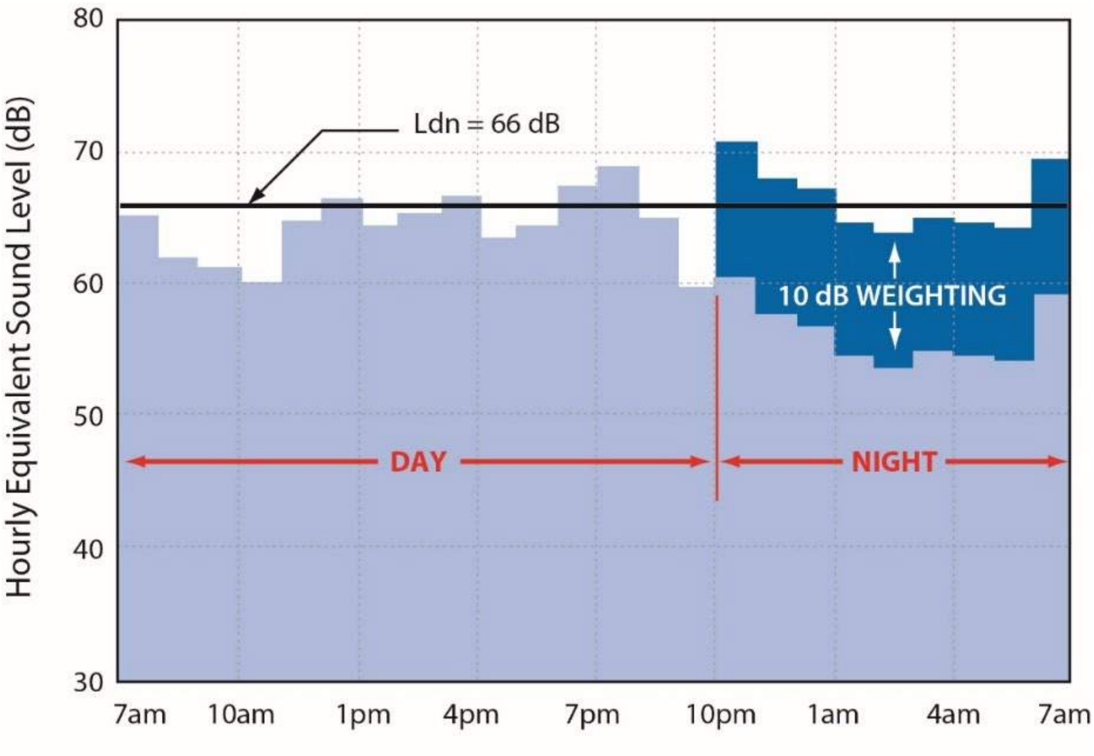

Figure A-6. Example of a Day-Night Average Sound Level Calculation

Source: HMMH

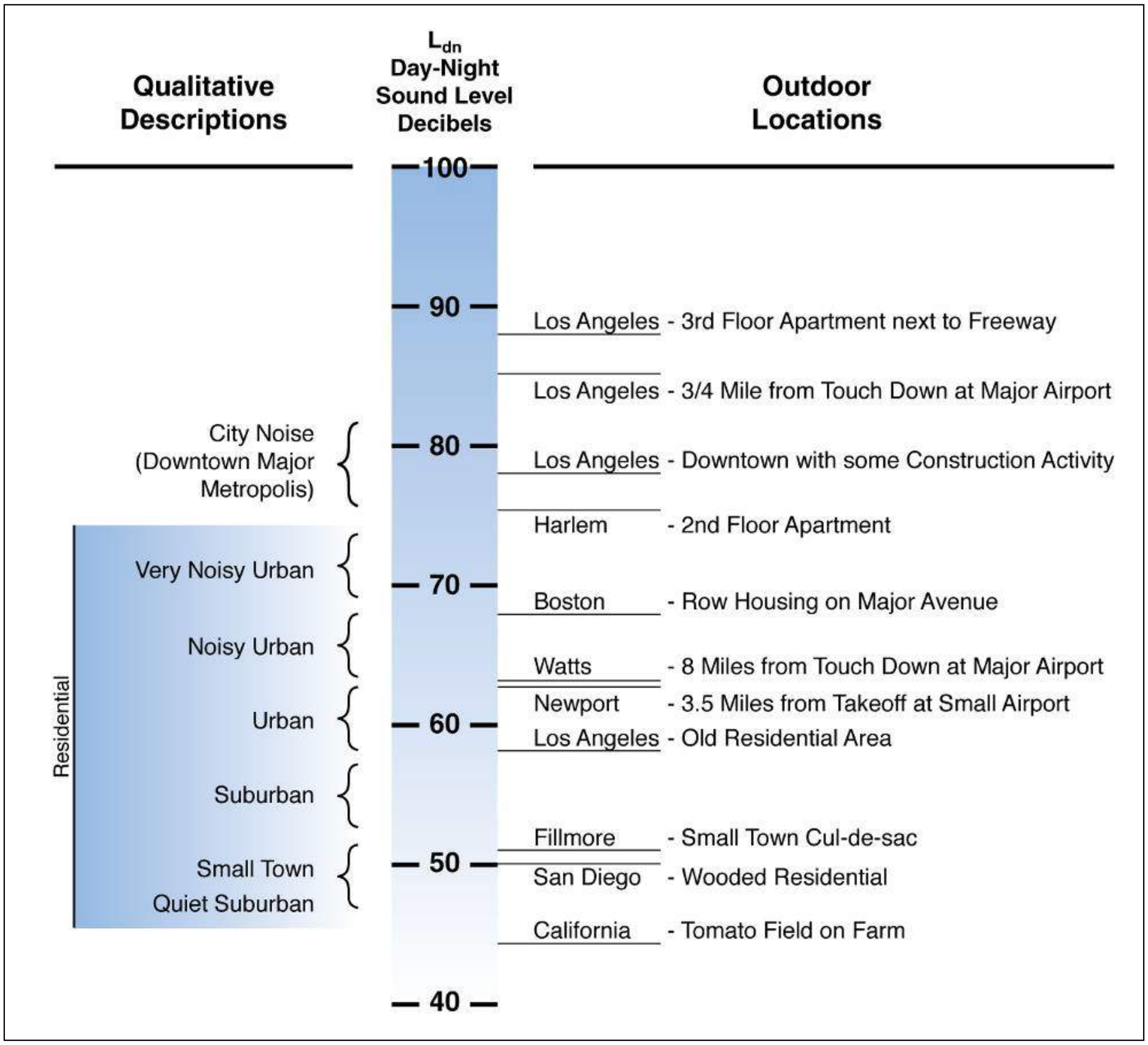

Figure A-7. Examples of Measured Day-Night Average Sound Levels, DNL

Source: U.S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," March 1974, p.14.

Appendix B: Existing Noise Compatibility Program Record of Approval

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Federal Aviation Administration

Memorandum

Date: June 19, 2008

From: Richard Doucette, Environmental Protection Specialist

To: LaVerne Reid, Airports Division Manager

John Donnelly, Regional Counsel's Office

Subject: Burlington International Airport, Part 150 Record of Approval

Attached is the Draft Record of Approval for the Noise Compatibility Program developed by Burlington International Airport. Only one new measure was under consideration. The prior Part 150 Noise Compatibility Program recommended acquisition of residences within the 70DNL contour. This new measure allows for land acquisition within the 65DNL contour.

No written comments were received during the FAA comment period.

In conformance with Regional and National procedures, AEE-1 has reviewed the draft Record of Approval and has no national policy concerns; and APP-400 has concurred with the draft Record of Approval. As soon as your concurrence is obtained, the Federal Register Notice on FAA's approval of the Noise Compatibility Program can be submitted.

John R. Donnelly — 6/23/08 — ✓

John Donnelly, Regional Counsel, ANE-7 — Date — Concur — Nonconcur

LaVerne F. Reid — 6/23/08 — ✓

LaVerne F. Reid, Airports Division Manager — Date — Approved — Disapproved

RECORD OF APPROVAL

Burlington International Airport, South Burlington VT

FAR Part 150 Noise Compatibility Program

INTRODUCTION

The Burlington International Airport sponsored an Airport Noise Compatibility Planning Study under a Federal Aviation Administration (FAA) grant, in compliance with Federal Aviation Regulation, Part 150. Burlington produced a report entitled "Burlington International Airport, 14 CFR Part 150 Update, Noise Compatibility Program Update". The Noise Compatibility Program (NCP) was submitted to FAA for review and approval on April 23, 2008. The Noise Exposure Maps were determined to be in compliance in November 2006. That determination was announced in the Federal Register on November 17, 2006.

The study focused on one administrative measure to improve compatibility between airport operations and community land use. This one measure under consideration is the acquisition of homes within the 65dB DNL contour. Burlington International Airport's most recent Noise Compatibility Program (approved September 21, 1990) recommended land acquisition within the 70dB DNL noise contour. This change will allow more incompatible land use to be converted to compatible land use, through voluntary land acquisition.

The approvals listed herein include approvals of actions that the airport recommends be taken. It should be noted that these approvals indicate only that the actions would, if implemented, be consistent with the purposes of Part 150. These approvals do not constitute decisions to implement the actions. Later decisions concerning possible implementation of these actions may be subject to applicable environmental or other procedures or requirements. Approval does not constitute a commitment by the FAA to financially assist in the implementation of the program nor a determination that all measures covered by the program are eligible for grant-in-aid funding from the FAA. Eligibility for federal funding of measures that are determined in this Record of Approval to meet the approval criteria of 150.33 will be determined at the time the FAA receives an application for funding, using the criteria in the most current version of FAA Order 5100.38, Airport Improvement Program Handbook.

The program measures below summarize as closely as possible the airport operator's recommendations in the noise compatibility program and are cross-referenced to the program with page numbers that follow the title of each measure. The statements contained within the summarized program measures and before the indicated FAA approval, disapproval, or other determination, do not represent the opinions or decisions of the FAA.

EXISTING NOISE COMPATIBILITY PROGRAM

The prior NCP, developed in the original (1987-1990) Part 150 study, includes a mix of operational, implementation, and land use elements. While this update addresses only a revision to a single NCP measure, this NCP and Record of Approval provide a summary of the entire program to provide context. All measures recommended for implementation in 1989 were approved in 1990 and remain in effect, with the one revision resulting from this Program Update.

Airport Operations Measures

1. Extension of Taxiway G (pg 13)
Taxiway G would be extended from the existing intersection with Taxiway A to Taxiway C, remaining parallel with Runway 15/33 in order to reduce noise levels for residents along Airport Drive.
Status: Not yet implemented. The FAA has approved the extended Taxiway G at the planning level and it is shown on the updated 2006 Airport Layout Plan; the City has scheduled it for completion sometime after the 2011 planning horizon of the accepted NEM.

2. Terminal Power Installation and APU/GPU Restrictions (pg 13)
Installation of terminal power hookups for aircraft would reduce the need for aircraft to use internal auxiliary power units (APU) or ground power units (GPU). Following the installation, a rule prohibiting the use of APUs or GPUs between 10:00 p.m. and 7:00 a.m., would be put in place.
Status: Not fully implemented. The Airport terminal has "aircraft ground power" (referred to as "terminal power hooks" in the ROA and the 1989 NCP document) capability at nine gate locations that have passenger boarding bridges. Eight of the passenger gates - 3, 4, 5, 6, 11, 12, 14, and 15 are airport owned and available to any aircraft that uses these gates. Gate 8 has ground power that is owned and operated by United Airlines.

3. Nighttime Bi-direction Runway Use (pg 13)
To minimize late-night operations over the City of Winooski, the air traffic control tower would use Runways 15 for departure and Runway 33 for arrivals, traffic conditions permitting.
Status: Not implemented. The BTV ATCT is closed from 10:00 PM until 5:00 AM, which makes implementation of this measure infeasible during these hours. The ATCT has not implemented the procedure during the remaining "nighttime" hours, from 5:00 to 7:00 AM.

4. Noise Abatement Flight Paths for Runway 15 and 33 Departures, and 15 Arrivals (pg 14)
New procedures would have civil aircraft fly over less populated areas. Runway 33 departures would turn to a heading of 310 degrees. Runway 15 departures would turn to a heading of 180 degrees.
Status: Not fully implemented. Current procedures involve assignments that result in: (1) most west-bound Runway 15 departures making initial turns to a heading of 190, (2) most west-bound Runway 33 departures maintaining runway heading until past the City of Winooski, and (3) most east-bound Runway 33 departures initiating right hand turns over Winooski.

5. Voluntary Limits of Military C-5A Training (pg 14)
An informal agreement with the military limits C-5A operations to only necessary takeoffs and landings.
Status: Implemented. This informal agreement continues in place. BTV Operations strongly discourages C-5 training at the airport, because the runways are only 150 feet wide and wake turbulence from C-5 operations tear up the runway-edge lighting.

6. Voluntary Minimization of F-16 Multiple Aircraft Flights (pg 14)
Military personnel will schedule as many single-aircraft, as opposed to multiple-aircraft, flights as possible.
Status: Not fully implemented. Based on observations during data collection for this study, F-16s in multiple aircraft flights typically operated with some distance between individual aircraft, so that the aircraft do not produce their maximum noise levels at the same locations at the same time; while aircraft are operating close in time, they are not simultaneous in most cases.

7. Voluntary Army Guard Helicopter Training Controls (pg14)
The National Guard helicopter training operations will be conducted away from the airport when conditions permit. In terms of long range planning, the Guard should consider consolidating operations at Camp Johnson.
Status: Not implemented. The National Guard has continued training operations at BTV.

Monitoring and Review Elements

8. Ongoing Monitoring and Review of Noise Exposure Map (NEM) and Noise Compatibility Program (NCP) Status (pg 14)
This measure provides for revision of the NEM and NCP, citing three examples: changes in airport layout, unanticipated changes in the level of airport activity, and non-compliance with the NCP. This measure also included the recommendation of the Technical Advisory Committee as a Noise Abatement Committee and purchase of a permanent noise monitoring system.
Status: Not implemented. The City of Burlington updated its NEM in 1997 and 2006. This documentation represents the first NCP update.

9. Flight Track Monitoring (pg 15)
Utilize an outside firm to perform flight track analysis of radar data on a temporal sampling basis.
Status: Not implemented. Flight tracks for the 2006 NEM were developed from information provided by the Air National Guard, the 1997 NEM update, and interviews with FAA ATCT staff.

Land Use Measures

The City will use the 2006 and 2011 NEM contours to the extent that the following land use measures require definition of eligibility and implementation areas. The City will continuously monitor conditions affecting NEM validity, to determine when and if the contours require revision to reflect changes in the adequacy of the NEM contours.

10. Land Acquisition and Relocation (pg 15)
Incompatible land use includes mobile homes within the 65 dB DNL contour and residences within the 70 dB DNL contour. A purchase and relocation program would be voluntary and comply with the Uniform Relocation Assistance and Real Property Acquisition Policies Act.
Status: Implemented. There are no mobile homes within the 65 dB DNL contour. The City has purchased some, and is in the process of purchasing additional, permanent residences in the 70 dB DNL contour. The City proposes to change this element to include residences in the 65 dB DNL contour, as described at the end of this document.

11. Sound Insulation (pg 15)
Qualified compatible residential and noise sensitive land uses within the 65 and 70 dB DNL contours, and qualified compatible non-residential land uses in the 75 dB DNL contour, would be included in a sound insulation program.
Status: Not implemented. As discussed in Section 3.3.1 of the NCP document, the City has chosen to apply available funding to land acquisition.

12. Easement Acquisition Related to Soundproofing (pg15)
The City would attempt to negotiate avigation easements within the 65 dB DNL contour, in return for sound attenuation assistance.

Status: Not implemented. The City has chosen to apply available funding to land acquisition within the 70 dB DNL contour interval prior to providing treatment to homes in the 65-70 dB DNL contour interval.

13. Airport Zoning Overlay District (pg15)
Land use measures that would restrict uses which are highly sensitive to noise and could also feature construction standards for sound insulation.
Status: Not implemented. Although a formal Airport Zoning Overlay District has not been adopted, the City of South Burlington has actively worked to consider airport noise when addressing land-use decisions around the airport.

14. Easement Acquisition for New Development (pg 16)
Easements above would be obtained for new development within the 65, 70 and 75 dB DNL contours.
Status: Not implemented.

15. Real Estate Disclosure (pg 16)
A real estate disclosure policy would be developed for land uses within the 65 dB DNL contour, and implemented through revisions to zoning ordinances.
Status: Not implemented. The Airport has not actively encouraged the use of Real Estate Disclosures for properties within the 65 dB DNL contour but will be working with the City of South Burlington and the City of Winooski in that regard.

RECOMMENDED NOISE COMPATIBILITY PROGRAM REVISION

This NCP update proposes modification of one existing NCP element, as described below.

Land Acquisition and Relocation (pg 17)
The City of Burlington proposes to modify the existing Land Acquisition and Relocation Program (Land Use measure #10) to expand eligibility to the 65 dB DNL contour. This program is voluntary. Eligible property owners will be paid fair market value for their property at its highest and best rate, and provided relocation assistance in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (the "Uniform Act") and implementing Department of Transportation (DOT) regulations. The City, in coordination with the applicable jurisdiction, will conduct studies to define program boundaries and to identify options for compatible reuse of the acquired properties.

The City, and the jurisdiction within which the program is implemented, will develop a land use plan for the area surrounding the airport that is impacted by noise. This effort will follow the guidance contained in the FAA document "Management of Acquired Noise Land: Inventory Reuse Disposal" dated January 30, 2008, or later superseding documents.

FAA Action: Approved.

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RECORD OF APPROVAL

Burlington International Airport, South Burlington VT

14 CFR Part 150 Noise Compatibility Program

INTRODUCTION

The Burlington International Airport sponsored an Airport Noise Compatibility Planning Study under a Federal Aviation Administration (FAA) grant, in compliance with Federal Aviation Regulation, Part 150. Burlington produced a report entitled "Burlington International Airport, 14 CFR Part 150 Update, Noise Compatibility Program Update". The Noise Compatibility Program (NCP) was submitted to FAA for review and approval on April 6, 2020. The Noise Exposure Maps were determined to be in compliance on September 26, 2019. That determination was announced in the Federal Register on October 10, 2019.

The study focused on addressing the increased noise of the F-35 aircraft now based at BTV. The 2012 Department of Defense EIS indicated the maximum noise level generated by the F-35 aircraft (115dBA Lmax at 1,000ft AGL) is approximately 21 decibels louder than the F-16 aircraft (94dBA Lmax at 1,000ft AGL). See Table BR3.2-1, EIS dated March 2012. This considerable increase in noise will triple the number of homes located in the 65DNL noise contour, to over 2,600 homes.

To address this noise increase, the City of Burlington proposes to shift from land acquisition to sound insulation as its primary noise mitigation measure. It will also offer Purchase Assurance and Sales Assistance programs, which will help homeowners in the affected area. Sound insulation does allow the available funding to address more homes, but it does not remove the homes (and relocate the residents) from the noise-affected areas. Sound insulation is not a panacea. It is only useful when residents are indoors, with the windows closed.

After acoustical testing of homes, many of these may be eligible for sound insulation, which could be funded by the FAA. FAA grants require a local share, in this case 10% of the total cost of each grant. As a small hub airport, it will be very difficult for Burlington International Airport to generate sufficient revenue to fund a program of this size. Federal budget rules do not currently allow the Department of Defense to provide any portion of the local share for an FAA grant. Understandably, the local municipalities are resistant to funding the local share. Due to the number of homes inside the 65DNL noise contour, it could take decades for all the eligible homes to be sound insulated by the City of Burlington.

The City of Burlington and the host community South Burlington, have chosen sound insulation over acquisition as their preferred noise mitigation measure. This was done to preserve the affordable housing around the airport. This creates an unfortunate conflict between two public interests: affordable housing and compatible land use. Based on federal standards, noise levels of 65DNL are not compatible with residential land use. Installation of sound insulation technically makes the homes "compatible" with these noise levels, but it does not meet the needs of all homeowners in all situations. The FAA can assist in balancing these two interests by funding eligible noise mitigation. But this conflict can only be lessened, it cannot be eliminated. The FAA continues to recommend acquisition, as opposed to sound insulation, for noise mitigation in areas of 70DNL noise and higher.

One source of noise mitigation funding that has yet to be tapped is local aviation fuel taxes collected by South Burlington, which now total over $180,000. We recommend South Burlington and Burlington work jointly to consider an appropriate use of this ongoing source of revenue. One possible use would be to help fund the annual operating cost of a noise monitoring system, which is now under consideration. The FAA is prohibited from funding ongoing operational costs.

The approvals listed herein include approvals of actions that the airport recommends be taken. It should be noted that these approvals indicate only that the actions would, if implemented, be consistent with the purposes of Part 150. These approvals do not constitute decisions to implement the actions. Later decisions concerning possible implementation of these actions may be subject to applicable environmental or other procedures or requirements. Approval does not constitute a commitment by the FAA to financially assist in the implementation of the program nor a determination that all measures covered by the program are eligible for grant-in-aid funding from the FAA. Eligibility for federal funding of measures that are determined in this Record of Approval to meet the approval criteria of 14 CFR Part 150 will be determined at the time the FAA receives an application for funding, using the criteria in the most current version of FAA Order 5100.38, Airport Improvement Program Handbook.

The program measures below summarize as closely as possible the airport operator's recommendations in the noise compatibility program and are cross-referenced to the program with page numbers that follow the title of each measure. The statements contained within the summarized program measures and before the indicated FAA approval, disapproval, or other determination, do not represent the opinions or decisions of the FAA.

EXISTING NOISE COMPATIBILITY PROGRAM

The prior NCP was developed in the original (1987-1990) Part 150 study and revised in 2008. It includes a mix of operational, implementation, and land use elements. This NCP and Record of Approval provide a summary of the entire program to provide context. All measures previously approved remain in effect, unless specifically modified by an NCP Update and subsequently approved by a Record of Approval (ROA).

Airport Operations Measures

Ongoing Monitoring and Review of Noise Exposure Map (NEM) and Noise Compatibility Program (NCP) Status

This measure provides for revision of the NEM and NCP, citing three examples: changes in airport layout, unanticipated changes in the level of airport activity, and non-compliance with the NCP (2008 ROA measure #8).

Flight Track Monitoring

Utilization of an outside firm to perform flight track analysis of radar data on a temporal sampling basis (2008 ROA measure #9).

Land Use Measures

Most of the following land use measures rely on an accurate Noise Exposure Map. The 2023 NEM is the preferred map for land use planning, as it reflects a full complement of F-35 aircraft.

Land Acquisition and Relocation

Non-compatible land use includes residences within the 65 dB DNL contour in the 1997, 2006, and 2015 NEM. Eligible property owners will be paid fair market value for their property, and provided relocation assistance in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (the “Uniform Act”) and implementation of Department of Transportation (DOT) regulations. The City, in coordination with applicable jurisdiction, will conduct studies to define program boundaries and to identify options for compatible reuse of the acquired properties (2008 ROA measure 10).

Sound Insulation

Qualified incompatible residential and noise sensitive land uses within the 65 and 70 dB DNL contours, and qualified incompatible non-residential land uses in the 75 dB DNL contour, would be included in a sound insulation program (2008 ROA measure #11).

Easement Acquisition Related to Soundproofing

The City would attempt to negotiate avigation easements within the 65 dB DNL contour, in return for sound attenuation assistance (2008 ROA measure #12).

Airport Zoning Overlay District

Land use measure that would restrict uses which are highly sensitive to noise and could also feature construction standards for sound insulation (2008 ROA measure #13).

Easement Acquisition for New Development

Easements would be obtained for new development within the 65, 70 and 75 dB DNL contours (2008 ROA measure #14).

Real Estate Disclosure

A real estate disclosure policy would be developed for land uses within the 65 DNL contour, and implemented through revisions to zoning ordinances (2008 ROA measure #15).

RECOMMENDED NOISE COMPATIBILITY PROGRAM

This NCP update includes new mitigation measures, and modifications to existing measures. The City of Burlington, and the City of South Burlington, prefer the local surrounding residential areas to remain a source of affordable housing. This decision results in a shift in the NCP from land acquisition to sound insulation.

The approval of the 2020 NCP update by the FAA is not a commitment to fund or implement these measures. This information is provided here as a planning tool to assist in the implementation of the NCP. Implementation of the recommended measures is at the discretion of the City of Burlington and subject to available funding from both the FAA and the City.

Airport Operational Measures

1. Ongoing Monitoring and Review of Noise Exposure Map (NEM) and Noise Compatibility Program (NCP) Status

This measure provides for revision of the NEM and NCP, citing three examples: changes in airport layout, unanticipated changes in the level of airport activity, and non-compliance with the NCP. This measure also included the recommendation of the Technical Advisory Committee as a Noise Abatement Committee and purchase of a permanent noise monitoring system (2008 ROA measure #8).

Costs: The estimated cost for a future NEM/NCP update is $500,000 to $1,000,000.
Schedule: As required by existing regulations, the NEM and/or NCP documents are to be updated when necessitated by operational changes resulting in a change in noise levels. The Airport is committed with the Vermont Air National Guard to a joint NEM update 1-2 years after Full Operational Capability (FOC) of the F35A aircraft is attained. This update is anticipated to be funded in late 2021-2022.

FAA Action: Approved.

2. Noise and Flight Track Monitoring

This measure recommends the implementation of a system to perform noise monitoring and flight track analysis of radar data, on an ongoing basis. This was a measure contained in the 2008 ROA, Monitoring and Review Elements, measure #9. This measure has been updated to more clearly indicate it includes both noise monitoring and flight tracking. Previously, noise monitoring was included in measure #1. The system will be designed to make the information available to the general public.

Costs: The estimated cost for an extensive noise monitoring and flight tracking system is $500,000 to $1,000,000. A smaller system would cost less, and could be expanded over time. Annual operating costs are not eligible for FAA funding.
Schedule: The City can purchase and install the system upon approval of the measure and availability of funding.

FAA Action: Approved, as may be limited by Part 150 and FAA funding guidance.

Land Use Measures

3. Land Acquisition and Relocation

The City of Burlington, Vermont (the "City") proposes to modify the existing Land Acquisition and Relocation Program to limit the eligibility to parcels where the majority of the non-compatible parcel is located within the 75 dB DNL contour.

As with the current NCP, this program is voluntary. Eligible property owners will be paid for their property at Fair Market Value, and provided relocation assistance in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (the "Uniform Act") and implementing Department of Transportation (DOT) regulation.

The City proposes to modify the existing Land Acquisition and Relocation Program to limit eligibility to parcels where the majority of the non-compatible parcel is located within the 75 dB DNL contour. This is to preserve neighborhood continuity where terrain modeling resulted in small 75 DNL "pockets". The City recognizes that future NEM updates may shift these 75 DNL "pockets" to other areas in the neighborhood.

This will be a revision to the 2008 ROA Land Use measure #10, which included mobile homes within the 65 DNL contour and residence within the 70 DNL contour. The City, along with input from the City of South Burlington, has requested this measure be modified to apply only to the 75 DNL and higher contours.

Costs: There are 10 residential properties located within the 2023 75 DNL contour. There is an average cost of $339,000 per unit for acquisition and relocation; the total cost to implement this measure if all units participated would be $3,390,000.[1]
Schedule: This measure could be implemented upon approval and the availability of funding. It should be noted that five parcels have been included in prior phases of this program and the property owners have declined participation.

FAA Action: Approved, with the understanding that the FAA preference would be acquisition and relocation in areas experiencing noise levels 70DNL and above.

4. Sound Insulation of Residential Structures

Qualified incompatible residential land uses within the 65 and up to the 75 dB DNL contours, and residential land use located partially within the 75 dB DNL noise contours where a majority of the parcel (and all of the structure) is located outside the 75 dB DNL contour, would be included in a sound insulation program. For qualified properties, the City will provide an acoustical treatment package designed to reduce interior noise levels to 45 DNL and provide a minimum reduction of 5 dB from the existing interior noise level in accordance with FAA guidelines.[2]

This will be a revision to the 1990 ROA Land Use measure #11. The previous NCP contains an approval for "sound proofing" for residences in the 65 DNL and 70 DNL noise contour. This measure seeks to clarify that properties which touch the 75 DNL due to AEDT modeling settings would be treated as 70 DNL. The City recognizes these parcels are not contiguous to the

[1] Estimated cost is based upon the average of the 2017 property purchases by Burlington International Airport.

[2] FAA Order 5100.38D "Airport Improvement Program Handbook", Appendix R "Noise Compatibility Planning/Projects", Change 1, effective date February 26, 2019.

existing acquisition area and acquisition could create an adverse impact on the surrounding neighborhood.

Costs: There are approximately 2,627 residential units that are located within the 2023 NEM 65 and 70 DNL contours. There are 878 single family units and 1,749 multi-family units. The estimated average cost to provide sound insulation is $45,000 per unit for single family homes located in the 65 to 70 DNL and $50,000 per unit for homes located in the 70 to 75 DNL. The estimate cost for multi-family buildings is $25,000 per unit for located in the 65 to 70 DNL and $30,000 per unit for homes located in the 70 to 75 DNL. The total cost to implement this measure if all units participated would be $84,650,000.[3]
Schedule: This measure could be implemented upon approval and the availability of funding.

FAA Action: Approved, with the understanding that sound insulation is more difficult and expensive at these higher noise levels.

5. Sound Insulation of Noise Sensitive Buildings

Qualified incompatible non-residential land uses (schools, hospitals, places of worship) within the 65 and up to the 75 dB DNL contours would be included in a sound insulation program. For qualified properties, the City will provide an acoustical treatment package designed to reduce interior noise levels to 45 DNL and provide a minimum reduction of 5 dB from the existing interior noise level in accordance with FAA guidelines. This measure was included in the 1990 ROA, Land Use measure #11.

Costs: There are approximately 24 noise sensitive buildings, including places of worship, learning centers, and care centers, located within the 65 and 70 DNL contours. Costs for these parcels have not been developed.
Schedule: This measure could be implemented upon approval and the availability of funding.

FAA Action: Approved.

6. Purchase Assurance for Single Family Parcels

Qualified incompatible owner occupied single family parcels within the 65 DNL up to the 75 DNL contours would be included in a purchase assurance program. The City would acquire the home (with their own funds) in exchange for an avigation easement, provide sound insulation and resell the home on the open market for fair market value. Proceeds from the sale of the home would be utilized to fund further noise mitigation programs. This measure pertains to eligible properties within the 65 dB DNL noise level or higher for which the land use is considered non-compatible. (49 USC § 47502, as implemented by Table 1 of Appendix A in 14 CFR part 150). An avigation easement will be required.

Costs: There are 878 single family units located within the 65 DNL up to the 75 DNL contours. The estimated average cost is $341,000 per parcel. (This includes $296,000 to acquire a single family home plus $45,000 for an acoustical treatment package). The total cost to implement this measure if all units participated would be approximately $60,000,000.[4]
Schedule: This measure could be implemented upon approval and the availability of funding.

FAA Action: Approved. Income from this program would, for FAA compliance purposes, be considered "program income" and be used to offset program costs.

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[3] Estimated cost is based upon 2017 costs from other New England Region sound insulation programs.

[4] Estimated cost is based upon 2017 costs from other New England Region sound insulation program.

7. Sales Assistance for Single Family Parcels

Qualified incompatible owner occupied single family parcels within the 65 DNL up to the 75 DNL contours and not eligible for sound insulation would be included in a sales assistance program. In exchange for an avigation easement, the City would provide an incentive to assure homeowners receive fair market value for the sale of their home on the open market. Land use includes eligible properties within the 65 dB DNL noise level or higher for which the land use is not considered to be compatible[5] (49 USC § 47502, as implemented by Table 1 of Appendix A in 14 CFR part 150). An avigation easement will be required.

Costs: There are 878 single family units located within the 65 and 70 DNL contours. The estimated maximum differential payment would be 5% of the average home cost for a single family home would be $14,800[6]. The total cost to implement this measure if all units participated would be $12,994,400.[7]

FAA Action: Approved, with the understanding that FAA participation is intended to help offset the difference between fair market value and the sale price of noise-affected properties on the open market. This is not expected to exceed the cost of avigation easements on eligible properties.

8. Purchase of Avigation Easement for Noise – Measure to be Removed

The acquisition of an avigation easement for new development within the 65, 70 and 75 DNL contours. This was a measure contained in the 1990 ROA, Land Use measure #14.

FAA Action: Approved for removal.

9. Noise Barrier Analysis – Measure Not Recommended for Implementation

Physical barriers can be effective means of reducing noise exposure in certain situations. Barriers are commonly used along roadways and near stationary noise sources to minimize the propagation of noise to adjacent communities.

A significant constraint limiting the effectiveness of barriers at airports is the requirement to limit the height of obstacle. This limits the ability to build a barrier both high enough and close enough to the runway that is effective in blocking takeoff roll and landing roll noise. If a barrier cannot be placed close to the noise source, its effectiveness will be greatest if it can be placed close to the receiver location. This means a high wall built adjacent to residences, providing acoustic blockage, which may result in visual or aesthetic intrusion to these residents.

In accordance with Appendix R “Noise Compatibility Planning/Projects” of the Federal Aviation Administration (FAA) Order 5100.38D Airport Improvement Program Handbook[8] (AIP Handbook), a noise barrier must be able to reduce aircraft noise levels by at least 5 dB.[9] If construction of a noise barrier is funded through the Part 150 program, any residences receiving a 5 dB reduction in DNL would be considered mitigated and would not maintain eligibility for

[5] FAA Order 5100.38D “Airport Improvement Program Handbook”, Appendix R “Noise Compatibility Planning/Projects”, Change 1, effective date February 26, 2019.
[6] Estimated cost is based upon the average single family residence purchased by Burlington International Airport is $296,000.
[7] Estimated cost is based upon 2017 costs from other New England Region sound insulation programs.
[8] FAA Order 5100.38D “Airport Improvement Program Handbook”, Appendix R “Noise Compatibility Planning/Projects”, effective date February 26, 2019.
[9] FAA Order 5100.38D Appendix R, Table R-6 “Noise Compatibility Planning/Project Requirements”, m. “Noise Mitigation Measures – On-airport Noise Barriers” Paragraph (4): “The project must reduce noise to a land use noncompatible with aircraft noise by at least 5 dB.”

other mitigation measures such as sound insulation or acquisition. This was a measure analyzed in the 2008 NCP Update and not recommended for implementation.

FAA Action: Approved for removal.

Julie Seltsam, Deputy Director, ANE-600
Airports Division, New England Region

Appendix C: Noise Modeling Supporting Information

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Operational Forecast Documents:

Non-Standard Modeling Documents:

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HMMH
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TECHNICAL MEMORANDUM

To:	Diane Carter and Brianna Whiteman
	The Jones Payne Group
From:	David Crandall, Principal Consultant Kate Larson, Senior Managing Consultant
Date:	July 12, 2024
Subject:	Flight Operations Forecast for BTV Operations in Calendar Years 2024 and 2029
Reference:	HMMH Project Number 03-14010

The City of Burlington, Vermont (the City) has retained Jones Payne Group (JPG) and Harris Miller Miller & Hanson Inc. (HMMH) to prepare an update to its Noise Exposure Map (NEM) and associated documentation for Burlington International Airport (BTV) in accordance with Federal Aviation Administration regulations published at Title 14 of the Code of Federal Regulations (CFR) Part 150. This effort is referred to as the "BTV NEM Update". This memorandum presents the base year and forecast operational assumptions for review and comment.

The City plans to submit the BTV NEM Update to Federal Aviation Administration (FAA) in calendar year 2024. Therefore, the NEM year of submission will be 2024 and the forecast year NEM will be 2029.

This memorandum includes the following four appendices:

1. Appendix A provides the FAA OPSNET data (Tower Counts) for BTV from July 1, 2022 through June 30, 2023
2. Appendix B provides the most recent FAA Terminal Area Forecast (TAF) operations data for BTV, issued January 2024.
3. Appendix C presents the detailed 2024 civilian operations forecast, revised March 2024 with current airline schedules
4. Appendix D presents the detailed 2029 civilian operations forecast, revised March 2024 based on updates to 2024 forecast

1. 2024 Noise Exposure Map Forecast

The purpose of this forecast is to prepare aircraft operations for use in the NEM preparation for BTV that represent calendar year 2024 and 2029 activity levels. The forecast needs to include the full variety of aircraft types that are expected to operate in those years. HMMH identified representative aircraft types for each category from various sources for input into the Aviation Environmental Design Tool (AEDT) model. Operations must be identified as daytime (7:00 AM to 10:00 PM local time) or nighttime (10 PM to 7 AM local time) for use in calculating Day-Night Average Sound Level (DNL).

In its June 2008 document entitled "Review and Approval of Aviation Forecasts",[1] the FAA describes its guidelines for comparing locally-prepared forecasts to the FAA's TAF. For all classes of airports, forecasts for total enplanements, based aircraft, and total operations are considered consistent with the TAF if they meet the following criterion:

Forecasts differ by less than 10 percent in the 5-year forecast period and 15 percent in the 10-year period.

For the BTV NEM Update, HMMH proposes to use the growth rates from the January 2024 issue of the FAA's TAF (Appendix B of this memorandum) as the basis for forecasting aircraft operational activity levels, with adjustments reflecting recent operational changes, nighttime tower closures, and FAA's practice of counting military aircraft flying in formation as a single operation. HMMH met with military personnel and representatives from Vermont

[1] https://www.faa.gov/sites/faa.gov/files/airports/planning_capacity/approval_local_forecasts_2008.pdf

Flight Academy and from Beta Technologies[2] to discuss their current aircraft fleets and projected operations levels for 2024 and 2029.

The total proposed modeled aircraft operations are presented below:

- 115,227 annual aircraft operations in 2024
  - The modeled operations correspond to 113,897 projected tower count activity levels
  - The TAF issued in January 2024 shows 104,896 operations (Appendix b)
  - Additional details are presented in **Section 2**
- 119,139 annual aircraft operations in 2029
  - The modeled operations correspond to 117,737 projected tower count activity levels
  - The TAF issued in January 2024 shows 108,165 operations (Appendix B)
  - Additional details are presented in **Section 3**

The TAF is based on historical "Tower Count" data reported by FAA OPSNET. FAA Air Traffic Controllers provide the counts to OPSNET in accordance with FAA Order 7210.3. In general, each aircraft arrival or departure is counted as a single "itinerant" operation. Practice touch-and-go operations (where the pilot practices a landing on a runway, then proceeds to take off again instead of stopping) are counted as two operations, and generally classified as "local" operations.

For reference, the TAF reports aircraft operational activity levels in one of four categories listed below.

- Air Carrier – Operations by aircraft capable of holding 60 seats or more and which use three-letter company designators. At BTV, most air carrier operations are scheduled passenger operations; about 3 percent are cargo jet aircraft operations.
- Air Taxi – Operations by aircraft with less than 60 seats and which use three-letter company designators, the prefix "T" (TANGO), or the prefix "L" (MEDEVAC). At BTV, most air taxi operations in recent years have been charter and corporate aircraft, followed by scheduled passenger operations and regular cargo operations.
- Military – All classes of military operations. At BTV, this includes operations of both the Vermont Air National Guard (VTANG) and the Vermont Army National Guard (VTARNG). Additional military operations include transient aircraft which are operated by a branch of the armed services that are traveling through the area, training with the local units, and/or carrying dignitaries.
- General Aviation (GA) – Civil (non-military) aircraft operations not otherwise classified under air carrier or air taxi. At BTV, a large number of GA operations are associated with flight training conducted by Beta Technologies and Vermont Flight Academy.

HMMH considered two particular features of OPSNET reporting when preparing the NEM forecasts. First, operations are only counted when the local air traffic control facility is staffed. At BTV, the local air traffic control facilities are closed from midnight to 5:30 AM and therefore operations during that period are not reported to OPSNET.[3] Second, multiple aircraft flying in a single formation are counted as a single operation because the aircraft traffic control facility communicates only with the lead aircraft[4]. At BTV, military aircraft frequently operate in formations of two to six aircraft, and in such cases are only counted once in OPSNET. Both of these features result in the OPSNET data somewhat under-reporting total activity levels. To compensate, HMMH estimated operations counts occurring while the tower is closed, as explained in Section 2. HMMH developed military operations data in consultation with US Air National Guard 134th Fighter Squadron personnel; FAA OPSNET military counts only provided supplementary information.

[2] HMMH discussion with Vermont Flight Academy on October 12, 2023, and Beta Technologies on October 19, 2023

[3] Aircraft operations needing air traffic control services at such times contact the Boston Center, which maintains its own separate OPSNET counts.

[4] The practice is documented in FAA Order 7210.3DD [4] FAA Order 7210.3DD, section 9-1-4a: https://www.faa.gov/air_traffic/publications/atpubs/foa_html/chap9_section_1.html

For the noise exposure map, all physical aircraft operations should be represented. Therefore, there are some differences between the proposed operations for noise model input and the tower counts that would be reported by OPSNET. The OPSNET data are more directly comparable to the TAF.

2. Existing Operations

Civilian 2024 existing conditions operations were developed from a combination of Vector Airport System (Vector) Noise and Operations Management System (NOMS) data, FAA tower counts (as reported by OPSNET), FAA forecast (TAF), and information from BTV airport staff. Flight information and radar track data for civilian aircraft operations for July 1, 2022 through June 30, 2023 were adjusted to represent annual 2024 conditions by considering recent activity, historical growth at the airport, and recent changes in commercial operations. Operations counts were also adjusted to account for the FAA Air Traffic Control Tower (ATCT) being closed midnight through 5:30 AM daily.

Table 1 presents the FAA-reported tower counts for a 12-month sample period. The adjustment for the estimated operations occurring while the tower was closed was derived from the Vector NOMS data for the same time frame.

Table 1. July 2022 to June 2023 FAA OPSNET Tower Counts and Estimated Operations During Tower Closure

FAA Aircraft Categories		FAA-Reported Tower Counts	Estimated Operations Midnight to 5:30 AM	Total Estimated Operations	Percent Difference
Itinerant	Air Carrier	17,366	654	18,020	3.63%
	Air Taxi and Commuter	6,833	72	6,905	1.04%
	General Aviation	39,458	512	39,970	1.28%
	Military	3,777	0	3,777	0.00%
Local	General Aviation	42,419	121	42,540	0.28%
	Military	725	0	725	0.00%
Totals[1]		**110,578**	**1,359**	**111,937**	**1.21%**

Sources: FAA OPSNET, 2023; BTV Vector® data, 2023; HMMH, 2023.

The 2024 forecast incorporates announced scheduled commercial service changes current as of March 2024. These changes include the elimination of jetBlue's 2 daily round-trip flights to New York's John F. Kennedy (JFK) airport starting in 2024[5], resulting in a reduction of 1,460 aircraft operations. Delta Airlines schedule changes (reducing service to JFK and New York LaGuardia Airport but adding service to Detroit and Minneapolis/St. Paul) has been taken into account as well as American Airlines alterations to their Philadelphia service and United Airlines commencement of service to Denver. Also, an increase in Breeze Airways flights to Florida has been included in the projections. In addition to the commercial airline schedule changes, HMMH incorporated the growth expected in the next few months at Beta Technologies[6] and Vermont Flight Academy, which provides pilot training services.

The proposed 2024 existing conditions modeled operations are based on the total estimated operations shown in **Table 1**, with the known modifications applied. **Table 2** presents a summary of the 2024 existing conditions

[5] jetBlue Announcement: https://vtdigger.org/2023/10/25/jetblue-to-end-burlington-new-york-route-delta-to-scale-back-flights/

[6] Beta Technologies is an aircraft design and manufacturing firm for the ALIA aircraft, which uses electric propulsion resulting in zero emissions expected from operating such aircraft.

operations proposed for modeling, provided in terms of both annual operations as well as average annual day (AAD) operations. The 2024 TAF data and calendar year 2023 operations counts are provided in the last two columns for comparison.

Table 2. Comparison of Proposed Operations for the 2024 NEM Modeling to TAF Operations and 2023 OPSNET

FAA Categories		Proposed 2024 Operations for NEM Modeling		Adjustment for tower closed hours	Expected 2024 Tower Counts[2]	FY 2024 TAF[3] Issued Jan 2024	CY 2023 OPSNET[4]
		Annual	AAD				
Itinerant	Air Carrier	16,720	42.1	-3.63%	16,113	14,172	16,887
	Air Taxi and Commuter	6,013	19.1	-1.04%	5,950	8,725	7,383
	General Aviation	41,758	114.1	-1.28%	41,223	39,314	37,279
	Military[1]	5,374	14.3	0.00%	5,374	3,620	3,424
Local	General Aviation	45,258	123.7	-0.28%	45,131	38,518	35,262
	Military	106	0.2	0.00%	106	547	366
Totals		**115,227**	**314.8**		**113,897**	**104,896**	**100,601**

Notes:
1 Military operations were developed through conversations and interviews with the VTANG and VTARNG.
2 Expected 2024 tower counts associated with the operations modeled for the 2024 NEM are comparable to OPSNET and to the TAF; they include adjustments to reflect that the tower is closed between midnight and 5:30 AM daily.
3 FAA's Terminal Area Forecast (TAF) https://taf.faa.gov/: data issued January 2024 is provided in Appendix B.
4 Calendar year 2023 OPSNET counts are presented for comparison purposes. https://aspm.faa.gov/opsnet/sys/Airport.asp
Sources: FAA, 2023, 2024; HMMH, 2023; USAF 134th Fighter Squadron, 2023; BTV Vector® data, 2023.

Applying adjustment factors to remove the operations which might be expected to occur while the tower is closed results in the expected tower counts for 2024. That total, 113,897 operations, is 8.6 percent higher than the 2024 total in the most recent TAF. The air carrier and air taxi operations in the expected 2024 tower counts and the actual 2023 tower counts (CY 2023 OPSNET) match fairly well to the most recent TAF. The primary differences come from the expected 2024 general aviation operations, which are predominantly associated with Beta Technologies and Vermont Flight Academy.

The table of proposed detailed civilian operations to be modeled for the 2024 Existing Conditions NEM is included as Appendix C.

3. Forecast Assumptions

The detailed forecast for 2029 relies on several general assumptions concerning changes to the fleet mix (the specific type and number of aircraft operating at BTV) within the forecasting period. These changes would be made relative to the 2024 fleet. **Table 3** presents a summary of the 2029 forecast operations.

Table 3. Comparison of Proposed Operations for the 2029 NEM Modeling to TAF Operations

FAA Categories		Proposed 2029 Operations for NEM Modeling		Adjustment for tower closed hours	Expected 2029 Tower Counts[2]	FY 2029 TAF[3] Issued Jan 2024
		Annual	AAD			
Itinerant	Air Carrier	18,071	49.4	-3.63%	17,415	17,036
	Air Taxi and Commuter	6,282	17.2	-1.04%	6,217	8,532
	General Aviation	43,064	117.7	-1.28%	42,513	39,709
	Military[1]	5,354	14.6	0.00%	5,354	3,620
Local	General Aviation	46,263	126.4	-0.28%	46,133	38,721
	Military	106	0.3	0.00%	106	547
Totals		**119,139**	**325.5**		**117,737**	**108,165**

Notes:

1 Military operations were developed through conversations and interviews with the VTANG and VTARNG.

2 Expected 2029 tower counts associated with the operations modeled for the 2029 NEM are comparable to the TAF; they include adjustments to reflect that the tower is closed between midnight and 5:30 AM daily.

3 FAA's Terminal Area Forecast (TAF): data issued January 2024 is provided in Appendix B.

Sources: FAA, 2023; HMMH, 2023; USAF 134th Fighter Squadron, 2023; Vector® Data, 2023.

In preparing the 2029 forecast, HMMH applied the following assumptions:

- 2024 modeled operations are scaled by the TAF average annual compound growth rate (AACGR) from 2026 through 2030 by operational category to create the 2029 forecast. Those years were chosen because the TAF echoes the significant changes in commercial operations occurring in the early 2020's due to the COVID pandemic but then settles into steady modest growth predictions. The 2026 through 2030 period encompasses the Noise Exposure Map forecast year; it portrays a reasonable AACGR of 1.57 percent for air carrier and 0.88 percent for air taxi / commuter aircraft operations.
- The day/night ratio and departure stage length distribution will remain the same as the 2024 base year for each aircraft type.
- Adjustments have been made for the following:
  - Beta Technologies expects current aircraft activity to increase five percent from 2024 to 2029.
  - Beta Technologies is operating an electric aircraft manufacturing plant which was officially opened in October 2023. At this time, we assume that in 2029 the plant will be operating at the full 300 manufactured aircraft per year capacity, producing a mix of the company's CX300 electric conventional-takeoff-and-landing and the A250 electric vertical-takeoff-and-landing (eVTOL) aircraft. These aircraft will depart BTV after assembly, go to Plattsburgh for painting, and from there be delivered to customers. These aircraft are not expected to conduct additional flight operations at BTV.

As shown in **Table 3**, the proposed operations annual total for 2029 corresponds to expected tower counts of 117,737 operations, which is 8.8 percent higher than the 2029 total in the most recent TAF. The table of detailed civilian operations to be modeled for the 2029 Forecast Conditions is included as Appendix D.

4. Existing and Future Fleet Mix

The existing and future detailed fleet mixes, with operations listed by aircraft type, by day/night time periods and by representative stage length are provided in Appendix C and Appendix D.

The existing conditions fleet mix is based on the same data used for the existing conditions aircraft operations levels discussed in Section 2. The future fleet mix is developed from the existing airline fleet mix and information regarding near term fleet changes, including the retirement of older aircraft and purchase of new aircraft as passenger demands warrant. General aviation aircraft fleet mix is usually more static, and changes occur more gradually. Military fleet mix changes based on the needs of the US military, with development and deployment of a new air frame taking many years.

The following assumptions were included in the development of the future fleet mix:

- Delta Air Lines has announced that it will retire its Boeing 717-200 by December 2025.[7] Delta is the only operator of this aircraft type in the 2024 operations. The 2029 forecast assumes that the 717-200 operations will be replaced with Boeing 737 aircraft and that Delta will replace BTV 717-200 operations on a one-for-one basis with the 737-800. Any additional Delta operations occurring due to the forecasted growth of air carrier operations at BTV assume a corresponding increase in use of the 737-800.
- Vermont Flight Academy (VFA) anticipates replacing some of its fleet with Tecnam P-Mentor aircraft, beginning in 2024 and continuing throughout the 2024-2029 time frame. As the replacement schedule is uncertain, the 2024 modeled operations assume a VFA fleet largely composed of Cessna 172 aircraft and the 2029 VFA operations would be modeled with 50 percent Tecnam P-Mentors.

[7] Securities and Exchange Commission 8-K filing 9/25/2020 under Item 2.06 Material Impairments. Available at https://www.sec.gov/ix?doc=/Archives/edgar/data/27904/000168316820003281/delta_i8k.htm

APPENDIX A. FAA TOWER COUNTS

11/6/23, 10:34 AM OPSNET Report

OPSNET : Airport Operations : Standard Report

From 07/2022 To 06/2023 | Facility=BTV

	Itinerant					Local			
Date	Air Carrier	Air Taxi	General Aviation	Military	Total	Civil	Military	Total	Total Operations
07/2022	1,638	592	3,977	368	6,575	2,820	65	2,885	9,460
08/2022	1,643	647	4,258	363	6,911	3,726	128	3,854	10,765
09/2022	1,607	534	3,847	339	6,327	3,580	47	3,627	9,954
10/2022	1,647	584	4,383	401	7,015	4,148	73	4,221	11,236
11/2022	1,409	435	2,565	327	4,736	3,150	77	3,227	7,963
12/2022	1,266	530	2,409	269	4,474	2,838	82	2,920	7,394
01/2023	1,223	638	2,110	229	4,200	3,544	52	3,596	7,796
02/2023	1,154	639	2,388	245	4,426	2,574	24	2,598	7,024
03/2023	1,284	614	2,919	342	5,159	3,589	7	3,596	8,755
04/2023	1,442	430	3,135	314	5,321	3,859	71	3,930	9,251
05/2023	1,538	567	3,886	309	6,300	4,465	63	4,528	10,828
06/2023	1,515	623	3,581	271	5,990	4,126	36	4,162	10,152
Total:	**17,366**	**6,833**	**39,458**	**3,777**	**67,434**	**42,419**	**725**	**43,144**	**110,578**

Report created on Mon Nov 6 10:34:06 EST 2023
Sources: The Operations Network (OPSNET)

APPENDIX B. FAA TERMINAL AREA FORECAST (TAF) FOR BTV ISSUED JANUARY 2024

	Itinerant Operations					Local Operations			
Fiscal Year	Air Carrier	Air Taxi & Commuter	GA	Military	Total	Civil	Military	Total	Total Ops
1990	11,616	28,379	32,630	7,401	80,026	26,792	4,734	31,526	111,552
1991	14,042	36,305	34,987	7,799	93,133	26,246	5,450	31,696	124,829
1992	12,614	36,203	32,670	7,936	89,423	25,895	5,811	31,706	121,129
1993	9,369	38,192	31,220	7,863	86,644	26,321	5,320	31,641	118,285
1994	7,909	39,505	28,553	6,474	82,441	21,215	4,613	25,828	108,269
1995	7,972	42,531	31,504	6,681	88,688	22,062	4,577	26,639	115,327
1996	7,591	44,849	26,385	7,582	86,407	17,152	7,087	24,239	110,646
1997	6,995	44,078	28,565	5,491	85,129	21,081	5,099	26,180	111,309
1998	6,991	42,954	29,228	6,219	85,392	22,733	7,023	29,756	115,148
1999	6,921	39,865	32,464	5,602	84,852	28,262	6,396	34,658	119,510
2000	6,769	37,796	30,738	5,383	80,686	31,323	5,821	37,144	117,830
2001	8,416	41,211	27,844	5,820	83,291	30,928	5,227	36,155	119,446
2002	7,806	31,123	28,694	6,616	74,239	30,985	5,551	36,536	110,775
2003	5,300	32,205	26,573	6,007	70,085	25,325	5,692	31,017	101,102
2004	5,400	35,418	26,982	6,000	73,800	27,306	5,342	32,648	106,448
2005	7,064	37,062	25,812	7,215	77,153	26,620	6,051	32,671	109,824
2006	9,819	31,523	23,609	5,002	69,953	20,862	4,297	25,159	95,112
2007	9,524	30,404	24,280	4,824	69,032	23,241	4,704	27,945	96,977
2008	12,397	25,871	22,406	5,435	66,109	24,720	4,381	29,101	95,210
2009	13,107	19,353	17,042	4,436	53,938	17,381	4,526	21,907	75,845
2010	10,771	18,581	18,156	2,854	50,362	16,299	2,638	18,937	69,299
2011	12,337	17,029	18,914	3,563	51,843	22,996	2,172	25,168	77,011
2012	13,586	14,353	19,102	4,231	51,272	23,151	2,552	25,703	76,975
2013	12,083	14,183	18,204	4,243	48,713	22,317	2,820	25,137	73,850
2014	13,541	13,239	20,948	4,441	52,169	19,382	2,523	21,905	74,074
2015	12,843	11,936	19,746	4,038	48,563	19,607	1,950	21,557	70,120
2016	11,948	14,342	21,862	4,499	52,651	20,971	1,799	22,770	75,421
2017	11,266	15,411	22,148	3,357	52,182	11,838	1,789	13,627	65,809
2018	13,135	15,182	23,351	2,882	54,550	13,614	978	14,592	69,142
2019	14,049	14,170	25,052	3,013	56,284	16,351	894	17,245	73,529
2020	9,069	9,737	23,218	3,068	45,092	13,408	1,110	14,518	59,610
2021	7,673	8,925	30,756	4,471	51,825	28,245	1,719	29,964	81,789
2022	16,205	8,108	35,845	4,031	64,189	30,524	1,254	31,778	95,967
2023*	17,121	7,153	39,236	3,620	67,130	38,477	547	39,024	106,154
2024*	14,172	8,725	39,314	3,620	65,831	38,518	547	39,065	104,896
2025*	15,446	8,670	39,393	3,620	67,129	38,558	547	39,105	106,234
2026*	16,234	8,322	39,472	3,620	67,648	38,599	547	39,146	106,794
2027*	16,542	8,358	39,551	3,620	68,071	38,639	547	39,186	107,257
2028*	16,796	8,445	39,630	3,620	68,491	38,680	547	39,227	107,718

	Itinerant Operations					Local Operations			
Fiscal Year	Air Carrier	Air Taxi & Commuter	GA	Military	Total	Civil	Military	Total	Total Ops
2029*	17,036	8,532	39,709	3,620	68,897	38,721	547	39,268	108,165
2030*	17,275	8,619	39,789	3,620	69,303	38,762	547	39,309	108,612
2031*	17,506	8,707	39,868	3,620	69,701	38,802	547	39,349	109,050
2032*	17,741	8,796	39,948	3,620	70,105	38,843	547	39,390	109,495
2033*	17,975	8,886	40,028	3,620	70,509	38,884	547	39,431	109,940
2034*	18,208	8,978	40,108	3,620	70,914	38,925	547	39,472	110,386
2035*	18,455	9,071	40,188	3,620	71,334	38,966	547	39,513	110,847
2036*	18,712	9,166	40,268	3,620	71,766	39,007	547	39,554	111,320
2037*	18,969	9,262	40,349	3,620	72,200	39,048	547	39,595	111,795
2038*	19,222	9,359	40,430	3,620	72,631	39,090	547	39,637	112,268
2039*	19,483	9,458	40,511	3,620	73,072	39,131	547	39,678	112,750
2040*	19,754	9,559	40,592	3,620	73,525	39,172	547	39,719	113,244
2041*	20,015	9,661	40,673	3,620	73,969	39,213	547	39,760	113,729
2042*	20,292	9,765	40,754	3,620	74,431	39,254	547	39,801	114,232
2043*	20,571	9,871	40,836	3,620	74,898	39,296	547	39,843	114,741
2044*	20,848	9,978	40,917	3,620	75,363	39,337	547	39,884	115,247
2045*	21,123	10,087	40,999	3,620	75,829	39,379	547	39,926	115,755
2046*	21,400	10,198	41,081	3,620	76,299	39,420	547	39,967	116,266
2047*	21,682	10,311	41,163	3,620	76,776	39,462	547	40,009	116,785
2048*	21,965	10,426	41,246	3,620	77,257	39,503	547	40,050	117,307
2049*	22,259	10,544	41,328	3,620	77,751	39,545	547	40,092	117,843
2050*	22,562	10,664	41,411	3,620	78,257	39,587	547	40,134	118,391

* Indicates forecast year

APO TERMINAL AREA FORECAST DETAIL REPORT
Forecast Issued January 2024
REGION:ANE STATE:VT LOCID:BTV CITY:BURLINGTON AIRPORT:BURLINGTON INTL

APPENDIX C. DETAILED 2024 OPERATIONS FOR INPUT TO AEDT

2024 BTV Civilian Operations for modeling — 109,747 Total

Category	Market	Type	Aircrafttype	AEDT 3e Equip ID	AEDT ANP_TYPE	AEDT Airframe	AEDT Engines	ARR_DAY	ARR_NIGHT	DEP_DAY	DEP_NIGHT	TGO_DAY	TGO_NIGHT	Total Ops	Average Annual Day	Number of Annual Ops by Departure Stagelength: Day 1	Day 2	Day 3	Day 4	Night 1	Night 2	Night 3	Night 4
AC	Cargo	J	B752	3917	757RR	Boeing 757-200 Series Freighter	2 RB211-535E4	160	-	155	5	-	-	321	0.9	63	92	-	-	2	3	-	-
AC	Cargo	J	B752	4089	757PW	Boeing 757-200 Series Freighter	2 PW2040	118	-	118	-	-	-	236	0.6	48	70	-	-	-	-	-	-
AC	Passenger	J	A319	957	A319-131	Airbus A319-100 Series	2 V2522-A5	328	256	283	301	-	-	1,168	3.2	283	-	-	-	290	11	-	-
AC	Passenger	J	A320	1019	A320-232	Airbus A320-200 Series	2 V2527-A5	256	-	251	5	-	-	512	1.4	6	-	245	-	-	5	-	-
AC	Passenger	J	B712	83	717200	Boeing 717-200 Series	2 BR700-715A1-30	-	257	-	257	-	-	515	1.4	-	-	-	-	-	257	-	-
AC	Passenger	J	B737	178	737700	Boeing 737-700 Series	2 CFM56-7B24	14	40	13	41			109	0.3	6	7	-	-	40	1	-	-
AC	Passenger	J	BCS3	6634	737700	Airbus A220-300	2 PW1521G	262	-	262	-			523	1.4	-	-	262	-	-	-	-	-
AC	Passenger	J	B739	2417	737800	Boeing 737-900-ER	2 CFM56-7B27E	1	70	-	71			143	0.4	-	-	-	-	70	1	-	-
AC	Passenger	J	B738	2499	737800	Boeing 737-800 Series	2 CFM56-7B26	332	118	44	407			902	2.5	-	44	-	-	-	407	-	-
AC	Passenger	J	B39M	6406	7378MAX	Boeing 737-9	2 LEAP-1B28/28B1/28B2/28B3	-	50	-	50			101	0.3	-	-	-	-	50	-	-	-
AC	Passenger	J	B38M	6472	7378MAX	Boeing 737-8	2 LEAP-1B28/28B1/28B2/28B3	51	210	-	262	-	-	524	1.4	-	-	-	-	212	49	-	-
AC	Passenger	J	CRJ7	1253	CRJ9-ER	Bombardier CRJ-700	2 CF34-8C1	748	-	701	46	-	-	1,495	4.1	701	-	-	-	46	-	-	-
AC	Passenger	J	CRJ9	2547	CRJ9-ER	Bombardier CRJ-900	2 CF34-8C5	2,016	1,435	2,210	1,241	-	-	6,903	18.9	1,965	245	-	-	875	366	-	-
AC	Passenger	J	E170	2559	EMB170	Embraer ERJ170	2 CF34-8E5	521	-	521	-	-	-	1,042	2.8	486	35	-	-	-	-	-	-
AC	Passenger	J	E75L	3071	EMB175	Embraer ERJ175-LR	2 CF34-8E5	889	-	888	1	-	-	1,778	4.9	564	324	-	-	1	-	-	-
AC	Passenger	J	E75S	3816	EMB175	Embraer ERJ175	2 CF34-8E5	221	3	217	7	-	-	449	1.2	217	-	-	-	7	-	-	-
	Air Carrier Total							**5,918**	**2,442**	**5,664**	**2,696**	-	-	**16,720**	**45.7**	**4,340**	**817**	**507**	-	**1,595**	**1,101**	-	-
											16,720												
AT	Other/Miscellaneous	J	C56X	6065	CNA560XL	Cessna 560 Citation Excel	2 PW530	269	-	254	15	-	-	539	1.5	151	68	35	-	9	4	2	-
AT	Other/Miscellaneous	J	C680	3047	CNA680	Cessna 680 Citation Sovereign	2 PW306B	419	29	423	25	-	-	897	2.5	341	40	43	-	20	2	2	-
AT	Other/Miscellaneous	J	CL35	5345	CL600	Bombardier Challenger 350	2 AS907-2-1A (HTF7350)	279	21	299	-	-	-	599	1.6	270	29	-	-	-	-	-	-
AT	Other/Miscellaneous	J	E55P	4917	CNA55B	Embraer Phenom 300 (EMB-505)	2 PW530	346	-	346	-	-	-	691	1.9	255	59	32	-	-	-	-	-
AT	Other/Miscellaneous	P	C172	1267	CNA172	Cessna 172 Skyhawk	1 O-320	445	11	447	9	-	-	912	2.5	447	-	-	-	9	-	-	-
AT	Other/Miscellaneous	T	BE99	3258	DHC6	Raytheon Beech 99	2 PT6A-28	361	-	361	-	-	-	723	2.0	361	-	-	-	-	-	-	-
AT	Other/Miscellaneous	T	C208	2106	CNA208	Cessna 208 Caravan	1 PT6A-114	51	142	134	59	-	-	386	1.1	134	-	-	-	59	-	-	-
AT	Other/Miscellaneous	T	DHC6	6190	DHC6	DeHavilland DHC-6-100 Twin Otter	2 PT6A-65R	301	-	301	-	-	-	602	1.6	301	-	-	-	-	-	-	-
AT	Other/Miscellaneous	T	PC12	3122	CNA208	Pilatus PC-12	1 PT6A-67	332	-	332	-	-	-	665	1.8	332	-	-	-	-	-	-	-
	Air Taxi Total							**2,804**	**203**	**2,898**	**109**	-	-	**6,013**	**16.4**	**2,592**	**196**	**110**	-	**98**	**6**	**5**	-
											6,013												
GA		HP	G2CA	4105	_NS_G2CA R22	NON STANDARD 4105 _NS_G2CA u:	1 IO-320-D1AD	1,660	19	1,646	34	7,759	180	11,299	30.9	1,646	-	-	-	34	-	-	-
GA		HT	AS50	3810	SA350D	Aerospatiale SA-350D Astar (AS-350)	1 TPE331-3	158	3	150	11	88	-	409	1.1	150	-	-	-	11	-	-	-
GA		HT	EC35	4097	EC130	Eurocopter EC-T2 (CPDS)	1 TPE331-3	634	183	640	176	60	9	1,701	4.6	640	-	-	-	176	-	-	-
GA		J	C56X	6070	CNA560XL	Cessna 560 Citation XLS	2 PW530	635	-	635	-	-	-	1,270	3.5	370	159	106	-	-	-	-	-
GA		J	E55P	4917	CNA55B	Embraer Phenom 300 (EMB-505)	2 PW530	485	47	451	81	39	9	1,112	3.0	229	184	38	-	23	58	-	-
GA		P	C150	1882	GASEPF	Cessna 150 Series	1 O-200	344	-	344	-	893	-	1,580	4.3	344	-	-	-	-	-	-	-
GA		P	C152	1882	GASEPF	Cessna 150 Series	1 O-200	267	-	267	-	1,075	-	1,608	4.4	267	-	-	-	-	-	-	-
GA		P	C172	1267	CNA172	Cessna 172 Skyhawk	1 O-320	9,007	206	8,791	422	21,982	1,023	41,430	113.2	8,791	-	-	-	422	-	-	-
GA		P	C182	1262	CNA182	Cessna 182	1 IO-360-B	1,300	-	1,300	-	293	-	2,894	7.9	1,300	-	-	-	-	-	-	-
GA		P	CH7B	6242	CNA172	American Champion Cibrata (FAS)	1 O-320	69	-	69	-	538	-	676	1.8	69	-	-	-	-	-	-	-
GA		P	DA40	6286	GASEPV	Diamond DA40	1 IO-360-B	371	-	371	-	695	-	1,436	3.9	371	-	-	-	-	-	-	-
GA		P	SIRA	1904	_NS_SIRA GASEPV	NON STANDARD 1904 _NS_SIRA usi	1 O-360	1,135	14	1,127	23	4,376	102	6,777	18.5	1,127	-	-	-	23	-	-	-
GA		P	HUSK	1260	CNA172	Aviat Husky A1B	1 IO-360-B	732	-	732	-	1,006	-	2,470	6.7	732	-	-	-	-	-	-	-
GA		P	J3	6311	GASEPF	Piper J-3 Cub (FAS)	1 O-200	372	-	372	-	2,035	-	2,778	7.6	372	-	-	-	-	-	-	-
GA		P	P28A	1887	GASEPF	Piper PA-28 Cherokee Series	1 O-320	710	-	710	-	1,878	-	3,298	9.0	710	-	-	-	-	-	-	-
GA		P	P28R	1887	GASEPF	Piper PA-28 Cherokee Series	1 O-320	231	-	231	-	319	-	780	2.1	231	-	-	-	-	-	-	-
GA		P	PA16	6241	_NS_PA16 GASEPF	NON STANDARD 6241 _NS_PA16 us	1 O-320	130	-	130	-	420	-	680	1.9	130	-	-	-	-	-	-	-
GA		P	PIVE	6248	_NS_PIVE GASEPF	NON STANDARD 6248 _NS_PIVE usi	1 O-320	116	-	116	-	256	-	488	1.3	116	-	-	-	-	-	-	-
GA		P	SR22	6281	COMSEP	Cirrus SR22 Turbo (FAS)	1 TIO-540-J2B2	1,054	6	1,048	11	162	-	2,281	6.2	980	69	-	-	11	-	-	-
GA		T	C208	4784	CNA208	Cessna 208 Caravan	1 TPE331-12B	170	-	170	-	16	-	356	1.0	170	-	-	-	-	-	-	-
GA		T	DHC6	6190	DHC6	DeHavilland DHC-6-100 Twin Otter	2 PT6A-65R	123	-	123	-	-	-	246	0.7	123	-	-	-	-	-	-	-
GA		T	PC12	3122	CNA208	Pilatus PC-12	1 PT6A-67	382	36	363	56	-	-	838	2.3	279	83	-	-	56	-	-	-
GA		T	TBM9	4677	CNA208	DAHER TBM 900/930	1 PT6A-66	281	-	281	-	45	-	608	1.7	220	61	-	-	-	-	-	-
	General Aviation Total							**20,365**	**514**	**20,065**	**814**	**43,936**	**1,322**	**87,015**	**237.7**	**19,365**	**556**	**144**	-	**756**	**58**	-	-
											41,758		**45,258**										

APPENDIX D. DETAILED 2029 OPERATIONS FOR INPUT TO AEDT

2029 BTV Civilian Operations for modeling — 113,679 Total

Category	Market	Type	Aircrafttype	AEDT 3e Equip ID	AEDT ANP_TYPE	AEDT Airframe	AEDT Engines	ARR_DAY	ARR_NIGHT	DEP_DAY	DEP_NIGHT	TGO_DAY	TGO_NIGHT	Total Ops	Average Annual Day	Number of Annual Ops by Departure Stagelength: Day 1	Day 2	Day 3	Day 4	Night 1	Night 2	Night 3	Night 4
AC	Cargo	J	B752	3917	757RR	Boeing 757-200 Series Freighter	2 RB211-535E4	173	-	168	5	-	-	346	0.9	68	99	-	-	2	3	-	-
AC	Cargo	J	B752	4089	757PW	Boeing 757-200 Series Freighter	2 PW2040	128	-	128	-	-	-	255	0.7	52	76	-	-	-	-	-	-
AC	Passenger	J	A319	957	A319-131	Airbus A319-100 Series	2 V2522-A5	354	277	306	325	-	-	1,262	3.5	306	-	-	-	313	12	-	-
AC	Passenger	J	A320	1019	A320-232	Airbus A320-200 Series	2 V2527-A5	277	-	271	5	-	-	553	1.5	6	-	265	-	-	5	-	-
AC	Passenger	J	B738	2499	737800	Boeing 737-800 Series	2 CFM56-7B26	-	278	-	278	-	-	556	1.5	-	-	-	-	-	278	-	-
AC	Passenger	J	B737	178	737700	Boeing 737-700 Series	2 CFM56-7B24	15	44	14	45			118	0.3	6	8	-	-	44	1	-	-
AC	Passenger	J	BCS3	6634	737700	Airbus A220-300	2 PW1521G	283	-	283	-			566	1.5	-	-	283	-	-	-	-	-
AC	Passenger	J	B739	2417	737800	Boeing 737-900-ER	2 CFM56-7B27E	1	76	-	77			155	0.4	-	-	-	-	76	1	-	-
AC	Passenger	J	B738	2499	737800	Boeing 737-800 Series	2 CFM56-7B26	359	128	47	440			974	2.7	-	47	-	-	-	440	-	-
AC	Passenger	J	B39M	6406	7378MAX	Boeing 737-9	2 LEAP-1B28/28B1/28B2/28B3	-	55	-	55			109	0.3	-	-	-	-	55	-	-	-
AC	Passenger	J	B38M	6472	7378MAX	Boeing 737-8	2 LEAP-1B28/28B1/28B2/28B3	56	227	-	283	-	-	566	1.6	-	-	-	-	230	53	-	-
AC	Passenger	J	CRJ7	1253	CRJ9-ER	Bombardier CRJ-700	2 CF34-8C1	748	-	701	46	-	-	1,495	4.1	701	-	-	-	46	-	-	-
AC	Passenger	J	CRJ9	2547	CRJ9-ER	Bombardier CRJ-900	2 CF34-8C5	2,016	1,435	2,210	1,241	-	-	6,903	18.9	1,965	245	-	-	875	366	-	-
AC	Passenger	J	E170	2559	EMB170	Embraer ERJ170	2 CF34-8E5	521	-	521	-	-	-	1,042	2.9	486	35	-	-	-	-	-	-
AC	Passenger	J	E75L	3071	EMB175	Embraer ERJ175-LR	2 CF34-8E5	1,226	116	1,237	105	-	-	2,684	7.4	864	373	-	-	76	30	-	-
AC	Passenger	J	E75S	3816	EMB175	Embraer ERJ175	2 CF34-8E5	239	3	235	8	-	-	485	1.3	235	-	-	-	8	-	-	-
	Air Carrier Total							**6,396**	**2,639**	**6,121**	**2,914**	-	-	**18,071**	**49.5**	**4,691**	**883**	**548**	-	**1,724**	**1,190**	-	-
											18,071												
AT	Other/Miscellaneous	J	C56X	6065	CNA560XL	Cessna 560 Citation Excel	2 PW530	281	-	265	16	-	-	563	1.5	158	71	37	-	10	4	2	-
AT	Other/Miscellaneous	J	C680	3047	CNA680	Cessna 680 Citation Sovereign	2 PW306B	438	31	442	26	-	-	937	2.6	356	42	44	-	21	2	3	-
AT	Other/Miscellaneous	J	CL35	5345	CL600	Bombardier Challenger 350	2 AS907-2-1A (HTF7350)	291	22	313	-	-	-	626	1.7	282	30	-	-	-	-	-	-
AT	Other/Miscellaneous	J	E55P	4917	CNA55B	Embraer Phenom 300 (EMB-505)	2 PW530	361	-	361	-	-	-	722	2.0	266	61	34	-	-	-	-	-
AT	Other/Miscellaneous	P	C172	1267	CNA172	Cessna 172 Skyhawk	1 O-320	465	11	467	9	-	-	953	2.6	467	-	-	-	9	-	-	-
AT	Other/Miscellaneous	T	BE99	3258	DHC6	Raytheon Beech 99	2 PT6A-28	378	-	378	-	-	-	755	2.1	378	-	-	-	-	-	-	-
AT	Other/Miscellaneous	T	C208	2106	CNA208	Cessna 208 Caravan	1 PT6A-114	54	148	140	62	-	-	403	1.1	140	-	-	-	62	-	-	-
AT	Other/Miscellaneous	T	DHC6	6190	DHC6	DeHavilland DHC-6-100 Twin Otter	2 PT6A-65R	314	-	314	-	-	-	629	1.7	314	-	-	-	-	-	-	-
AT	Other/Miscellaneous	T	PC12	3122	CNA208	Pilatus PC-12	1 PT6A-67	347	-	347	-	-	-	694	1.9	347	-	-	-	-	-	-	-
	Air Taxi Total							**2,929**	**212**	**3,027**	**114**	-	-	**6,282**	**17.2**	**2,708**	**204**	**115**	-	**102**	**7**	**5**	-
											6,282												
GA		HP	G2CA	4105 _NS_G2CA	R22	NON STANDARD 4105 _NS_G2CA us	1 IO-320-D1AD	1,744	19	1,730	34	8,147	189	11,864	32.5	1,730	-	-	-	34	-	-	-
GA		HT	AS50	3810	SA350D	Aerospatiale SA-350D Astar (AS-350)	1 TPE331-3	166	3	158	11	92	-	429	1.2	158	-	-	-	11	-	-	-
GA		HT	EC35	4097	EC130	Eurocopter EC-T2 (CPDS)	1 TPE331-3	372	56	613	158	60	9	1,268	3.5	648	-	-	-	176	-	-	-
GA	UVM flights	HT	EC35	4097	EC130	Eurocopter EC-T2 (CPDS)	1 TPE331-3	270	127	35	18			450	1.2	648	-	-	-	176	-	-	-
GA		J	C56X	6070	CNA560XL	Cessna 560 Citation XLS	2 PW530	641	-	641	-	-	-	1,282	3.5	374	160	107	-	-	-	-	-
GA		J	E55P	4917	CNA55B	Embraer Phenom 300 (EMB-505)	2 PW530	493	47	458	81	39	9	1,127	3.1	233	186	39	-	23	58	-	-
GA		P	C150	1882	GASEPF	Cessna 150 Series	1 O-200	347	-	347	-	897	-	1,592	4.4	347	-	-	-	-	-	-	-
GA		P	C152	1882	GASEPF	Cessna 150 Series	1 O-200	267	-	267	-	1,075	-	1,608	4.4	267	-	-	-	-	-	-	-
GA		P	C172	1267	CNA172	Cessna 172 Skyhawk	1 O-320	7,930	185	7,726	388	17,476	893	34,599	94.8	7,726	-	-	-	388	-	-	-
GA		P	C182	1262	CNA182	Cessna 182	1 IO-360-B	1,349	-	1,349	-	308	-	3,007	8.2	1,349	-	-	-	-	-	-	-
GA		P	CH7B	6242	CNA172	American Champion Cibrata (FAS)	1 O-320	69	-	69	-	538	-	676	1.9	69	-	-	-	-	-	-	-
GA		P	DA40	6286	GASEPV	Diamond DA40	1 IO-360-B	374	-	374	-	699	-	1,447	4.0	374	-	-	-	-	-	-	-
GA		P	SIRA	1904 _NS_SIRA	GASEPV	NON STANDARD 1904 _NS_SIRA usi	1 O-360	2,442	35	2,420	56	9,268	254	14,475	39.7	2,420	-	-	-	56	-	-	-
GA		P	HUSK	1260	CNA172	Aviat Husky A1B	1 IO-360-B	769	-	769	-	1,056	-	2,593	7.1	769	-	-	-	-	-	-	-
GA		P	J3	6311	GASEPF	Piper J-3 Cub (FAS)	1 O-200	390	-	390	-	2,136	-	2,917	8.0	390	-	-	-	-	-	-	-
GA		P	P28A	1887	GASEPF	Piper PA-28 Cherokee Series	1 O-320	714	-	714	-	1,880	-	3,308	9.1	714	-	-	-	-	-	-	-
GA		P	P28R	1887	GASEPF	Piper PA-28 Cherokee Series	1 O-320	231	-	231	-	319	-	780	2.1	231	-	-	-	-	-	-	-
GA		P	PA16	6241 _NS_PA16	GASEPF	NON STANDARD 6241 _NS_PA16 us	1 O-320	131	-	131	-	422	-	685	1.9	131	-	-	-	-	-	-	-
GA		P	PIVE	6248 _NS_PIVE	GASEPF	NON STANDARD 6248 _NS_PIVE usi	1 O-320	122	-	122	-	269	-	512	1.4	122	-	-	-	-	-	-	-
GA		P	SR22	6281	COMSEP	Cirrus SR22 Turbo (FAS)	1 TIO-540-J2B2	1,069	6	1,064	11	164	-	2,313	6.3	994	70	-	-	11	-	-	-
GA		T	C208	4784	CNA208	Cessna 208 Caravan	1 TPE331-12B	179	-	179	-	17	-	374	1.0	179	-	-	-	-	-	-	-
GA		T	DHC6	6190	DHC6	DeHavilland DHC-6-100 Twin Otter	2 PT6A-65R	124	-	124	-	-	-	248	0.7	124	-	-	-	-	-	-	-
GA		T	PC12	3122	CNA208	Pilatus PC-12	1 PT6A-67	392	36	373	56	-	-	858	2.3	287	86	-	-	56	-	-	-
GA		T	TBM9	4677	CNA208	DAHER TBM 900/930	1 PT6A-66	284	-	284	-	45	-	614	1.7	222	62	-	-	-	-	-	-
GA		E	ALIA	6334 _NS_ALIA	GASEPF	NON STANDARD 6334 _NS_ALIA usi	1 O-320	-	-	300	-	-	-	300	0.8	300							
	General Aviation Total							**20,868**	**514**	**20,868**	**814**	**44,909**	**1,354**	**89,327**	**244.7**	**20,806**	**564**	**146**	-	**932**	**58**	-	-
											43,064		**46,263**										

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TECHNICAL MEMORANDUM

To:	Cheryl Quaine, Environmental Protection Specialist, FAA
From:	David Crandall, Principal Consultant Kate Larson, Managing Consultant
Date:	June 12, 2024
Subject:	Patrick Leahy Burlington International Airport 2024/2029 Noise Exposure Map Request for Non-standard AEDT Modeling Approval
Reference:	HMMH Project Number 03-14010

The City of Burlington, Vermont has contracted Jones Payne Group (JPG) and HMMH to prepare a Noise Exposure Map (NEM) as part of the Title 14 Code of Federal Regulations (CFR) Part 150 Airport Noise Compatibility Study (Part 150) for Patrick Leahy Burlington International Airport (BTV). This Part 150 Update will include NEM documentation for 2024, the anticipated year of submission to the Federal Aviation Administration (FAA), and 2029, the fifth year from the anticipated year of submission.[1] The NEM documentation will include Day-Night Average Sound Level (DNL) contours prepared using the FAA's Aviation Environmental Design Tool (AEDT), Version 3e.[2]

As was done in the previous NEM updates for BTV, HMMH will model military operations performed by based units of the Vermont Air National Guard (VTANG) and Vermont Army National Guard (VTARNG) with the Department of Defense aircraft noise model NOISEMAP. The NOISEMAP result grids will be imported into AEDT and combined with AEDT results for civilian and transient military aircraft to generate the final DNL contours for the NEM. This memo focuses on the AEDT modeling.

This request reflects FAA's comments to earlier editions, dated March 14, 2024 and May 24, 2024.[3] It describes the need and seeks approval for the following non-standard AEDT modeling components for the BTV NEM:

1. ***Aircraft Substitutions***: During review of existing and forecasted operations at BTV, HMMH found aircraft types that are not explicitly included in the AEDT default database or pre-approved aircraft substitution list.
2. ***Aircraft Taxi Modeling***: The noise modeling methodology used for the prior BTV NEM included aircraft taxi activity, which will be included in the updated NEM for consistency.
3. ***UVM Medical Center Helicopter Operations***: Analysis of flight track data (not available at the time of the previous NEM) revealed a significant number of helicopter flights between BTV and a nearby hospital which will require customized flight profile data to accurately model these helicopter operations.

HMMH has prepared this technical memorandum in accordance with Section 5 of FAA's document titled "Guidance on Using the Aviation Environmental Design Tool (AEDT) to Conduct Environmental Modeling for FAA Actions Subject to NEPA" dated October 27, 2017.[4] This particular request falls under this Section 5.2.2 "Analysis methods/data that require AEE review and approval," which includes:

- "Aircraft that do not exist in AEDT default data."
- "User-defined aircraft profiles (including modifications to standard profiles) developed by methods other than AEDT's FAA-accepted methodology."

[1] For consistency with §150.21(a) and §150.21(a)(1)

[2] https://aedt.faa.gov/ Development of modeling inputs for this study started before the release of AEDT 3f. Our review of the AEDT 3f release notes indicates that the newer AEDT version does preclude the need for the requests presented in this memorandum.

[3] FAA's comments considered in this document were provided in various meetings between April 17, 2024 and June 7, 2024.

[4] https://aedt.faa.gov/Documents/guidance_aedt_nepa.pdf

HMMH believes that this request should be routed in accordance with Section 5.1 of that AEDT guidance document. After review at FAA headquarters, we would expect a document from the Office of Environment and Energy (AEE) responding to the methods presented in this memorandum. That AEE response will be included in the NEM's technical documentation supporting the noise analysis. This memorandum describes and requests approval for three categories of nonstandard inputs and/or techniques in the AEDT modeling for the 2024 NEM update for BTV. These categories are:

- Nonstandard aircraft noise and performance data substitutions for aircraft that do not exist in AEDT default data
- Taxiway modeling with user-defined aircraft profiles
- Helicopter user-defined profiles for short flights

1.0 Aircraft Substitutions

HMMH developed civilian baseline operations from a combination of Vector Airport System (Vector) Noise and Operations Management System (NOMS) data, FAA tower counts [as reported by FAA Operations Network (OPSNET)], FAA Terminal Area Forecast (TAF), and information from BTV airport staff. Flight track and aircraft identification data for the 12-month period from July 1, 2022 through June 30, 2023 form the basis of the inputs data, with adjustments to represent annual 2024 and 2029 civil aircraft operations conditions.

Table 1 shows aircraft type designators in the BTV operations data that do not appear in AEDT's FltActypeToUniqueEquipMap table in the AEDT 3e FLEET database.[5] FAA Approval is requested for the use of the Aircraft Noise Performance (ANP) types and AEDT equipment IDs shown in the table, based on the considerations in the following subsections.

Table 1. Summary of Requested Nonstandard AEDT Aircraft Substitutions

Aircraft Information			Proposed AEDT 3e Assignment Data				
Aircraft Designator	Aircraft Description	Engine Type	AEDT Equipment ID	AEDT Airframe	AEDT Engine Model	AEDT ANP Type	AEDT BADA_ID
G2CA	Guimbal G-2 Cabri	Helicopter, 1 piston engine	4105	Robinson R22 Mariner	IO-320-D1AD	R22	P28A
SIRA	Tecnam P-Mentor (SIRA)	Light Sport Aircraft, 1 piston engine	1904	EADS Socata TB-10 Tobago	IO-360	GASEPV	TB21
PA16	Piper 16 Clipper	Fixed wing, 1 piston engine	6241	Aeronca 15 Sedan (FAS)	O-200	GASEPF	C172
PIVE	Pipistrel Velis Electro	Fixed wing, 1 electric motor	6263	Cessna 162 (FAS)	O-200	GASEPF	C172
ALIA	Beta ALIA	Electric aircraft In development	1900	Spencer S-12 Air Car	TIO-540-J2B2	GASEPV	P28A

1.1 G2CA – Guimbal G-2 Cabri

The Guimbal G-2 Cabri (G2CA) is a two-seat helicopter powered by a single Lycoming O360 piston engine driving a 23.6-foot diameter main rotor with three blades.[6] The maximum weight is listed as 700 kilograms /1,543 pounds and landing skids (i.e. no wheels). Three of these helicopters are based at BTV and are used extensively for flight

[5] The recently released AEDT 3f also does not include noise modeling data or substitutions for any of these aircraft.
[6] https://www.guimbal.com/cabri-g2/ FAA Type Certificate Data Sheet (TCDS) R00005RD, Rev2 https://drs.faa.gov/browse/excelExternalWindow/F762C243A2A7316286258717006F2294.0001

training. As such, the aircraft depart, make multiple practice approaches and departures, and then land. Our draft existing operations and draft forecast have on the order of 11,000 to 12,000 annual operations of the G2CA.

We propose to represent the G2CA with ANP type R22 and AEDT equipment ID 4105. ANP type R22 is the only two-seat, piston powered helicopter in the AEDT 3e database. AEDT 3e equipment ID 4105 is associated with ANP type R22, airframe "Robinson R22 Mariner," an IO-320 engine, and BADA3 ID P28A. We do not expect to use AEDT equipment ID 4105 for any other reason on this project, which allows the G2CA operations to be identifiable throughout the modeling and reporting process.

1.2 SIRA – Tecnam P-Mentor

The Tecnam P-Mentor (SIRA) is a two-seat low-wing fixed-wing with a maximum take-off weight of 1,587 pounds[7]. The aircraft is powered by a single Rotax 912 engine with approximately 100 horsepower driving a constant speed MTV-21 propellor[8]. A flight school operating at BTV currently has several SIRA aircraft on order with delivery anticipated in the next few months. These aircraft are anticipated to be used for flight training, requiring arrival, departure, and touch-and-go profiles. Our draft forecast has on the order of 6,000 to 15,000 annual operations of the SIRA.

We propose to represent the SIRA with ANP type GASEPV, which represents a generic variable-pitch, single-engine aircraft, using AEDT equipment ID 1904 associated with airframe "EADS Socata TB-10 Tobago", with an IO-360 engine and BADA3 ID TB21. AEDT 3e equipment ID 1904 is not expected to represent any other operations on this project, which allows the SIRA operations to be identifiable throughout the modeling and reporting process.

1.3 PA16 – Piper 16 Clipper

The Piper 16 Clipper (PA16) is a high-wing, fixed-wing aircraft that can seat three to four people. It is powered by one Lycoming O-235 piston engine and has a maximum take-off weight in the range of 1,650 pounds to 1,738 pounds and appears to have a fixed-pitch propellor (or at least ground selectable pitch).[9] The aircraft appears to have been derived by enlarging the J-3 Cub family. Our draft existing operations and draft forecast have on the order of 700 annual operations of the PA16.

We propose to represent the PA16 with ANP type GASEPF, which represents a generic fixed-pitch, single-engine aircraft, using AEDT equipment ID 6241 associated with airframe "Aeronca 15 Sedan (FAS)," an O-200 engine, and BADA3 ID C172, which are the same characteristics for AEDT 3e's Piper J-3 Cub represented by AEDT equipment ID 6311. AEDT 3e equipment ID 6241 is not expected to represent any other operations on this project, which allows the PA16 operations to be identifiable throughout the modeling and reporting process.

1.4 PIVE – Pipistrel Velis Electro

The Pipistrel Velis Electro (PIVE) is a high-wing, single-engine electric-powered aircraft with a maximum take-off weight of 1,320 pounds.[10] The electric motor is rated at 57.6 kW MTOP, which is approximately equivalent output to 77 horsepower. The propellor is fixed pitch. Our draft existing operations and draft forecast have on the order of 500 annual operations of the PIVE.

There are no electric-powered aircraft represented directly in the AEDT database. We propose to represent the PIVE with ANP type GASEPF, which represents a generic fixed-pitch, single-engine aircraft, using AEDT equipment ID 6263 associated with airframe "Cessna 162 (FAS)," an O200 engine and BADA3 ID C172. AEDT 3e equipment ID 6263 is not expected to represent any other operations on this project, which allows the PIVE operations to be identifiable throughout the modeling and reporting process.

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[7] https://tecnam.com/aircraft/pmentor/
[8] Information on the MTV-21 is available on the manufacturer's website https://www.mt-propeller.com
[9] FAA Type Certificate Data Sheet (TCDS) 1A1, Rev 13 https://drs.faa.gov
[10] https://www.pipistrel-aircraft.com/products/velis-electro/

1.5 ALIA – Beta ALIA

Beta Technologies recently completed a manufacturing building at BTV for its ALIA electric fixed-wing/conventional take-off and landing (CTOL) and vertical take-off and landing (VTOL) aircraft variants.[11] Our recent interviews with Beta indicate that aircraft manufactured at BTV will depart when completed and fly to nearby Plattsburgh for painting and preparation for passenger delivery. Therefore, we expect approximately 300 departure operations (no arrival operations) as included in the draft forecast to correspond with their published production plans.

There are no electric-powered aircraft represented directly in the AEDT database. The ALIA aircraft are forecasted to reflect a small portion of the overall flight operations although they are publicly anticipated. We are assuming all ALIA aircraft, regardless of variant, will perform their respective departures in a manner similar to conventional take-off, especially for the flight portion off-airport.

We propose to represent the ALIA with ANP type GASEPV, which represents a generic variable-pitch, single-engine aircraft, using AEDT equipment ID 1900 associated with airframe "Spencer S-12 Air Car", a TIO-540-J2B2 engine, and BADA3 ID P28A. The Spencer Air Car shares some general layout characteristics with the ALIA such as a high wing powered by a single Hartzell pusher propeller located behind the fuselage.[12] AEDT 3e equipment ID 1900 is not expected to represent any other operations on this project, which allows the ALIA operations to be identifiable throughout the modeling and reporting process.

2.0 Aircraft Taxi Modeling

BTV has expressed the desire to include aircraft taxi operations in the aircraft noise modeling for the NEM update due to the relative close proximity of the taxiways to noise-sensitive properties and in response to community interest.[13] Although aircraft taxiway operations modeling is not a built-in feature of AEDT, HMMH has developed methodology to implement taxiing activity in AEDT, consistent with the guidance outlined in the Integrated Noise Model (INM) 7.0 User's Guide, Section 9.8.7. This methodology has been used with FAA approval for previous BTV NEM updates in 2006, 2015 and 2019, as well as for the 2014 NEM for Portsmouth International Airport. HMMH requests approval of this methodology for the current study.

Taxi tracks have been constructed which connect four aircraft parking locations to the four runway ends. The four parking areas are: the ramp associated passenger terminal (labeled TF); the ramp associated with cargo operations and the fixed base operator (FBO) (labeled CF); a general aviation ramp on the west side of Runway 1/19 (labeled G1F); and general aviation ramp at the southwest corner of the airfield, just south of the Runway 33 departure end (labeled G2F). These tracks reflect the current taxiway configuration, which includes the 2020 shifting of Taxiway G 100 feet further away from residences.[14] The overall taxi track layout is shown in **Figure 1**. Section 2.3 provides more details of the various taxi paths and respective operations.

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[11] https://vtdigger.org/2023/10/02/beta-unveils-its-electric-aircraft-production-facility-in-south-burlington/
https://www.beta.team/aircraft/

[12] AEE has advised using GASEPV (variable pitch propellor) instead of GASEPF (fixed pitch), citing the ALIA take-off's weight of approximately 6,000 lb. and its use of a 5-bladed Hartzell pusher-propellor. While many of the other of characteristics listed (propellor placement or low-wing vs high-wing) are not identified in AEDT and are not used in the noise calculations, prior discussions with AEE have indicated a preference to use substitutions with a similar general layout as the actual aircraft.
https://hartzellprop.com/blog-beta-technologies-updates-hartzell/
https://www.seabee.info/spencer.htm
https://www.si.edu/object/republic-rc-3-seabee%3Anasm_A19840676000
https://en.wikipedia.org/wiki/Spencer_Air_Car

[13] Taxiway noise has been a concern at BTV since the airport's first 14 CFR Part 150 project in 1989/1990. Taxiway G, located on the northwest of the airfield between Runway 15/33 and a residential neighborhood, was mentioned specifically in FAA's 1990 Noise Compatibility Plan (NCP) Records of Approval (ROA) for BTV and FAA's 2008 NCP ROA for BTV. Both documents are available at https://www.faa.gov/airports/environmental/airport_noise/part_150/states/vt

[14] The Taxiway G reconstruction was funded by FAA grants and opened December 2020. https://vermontbiz.com/news

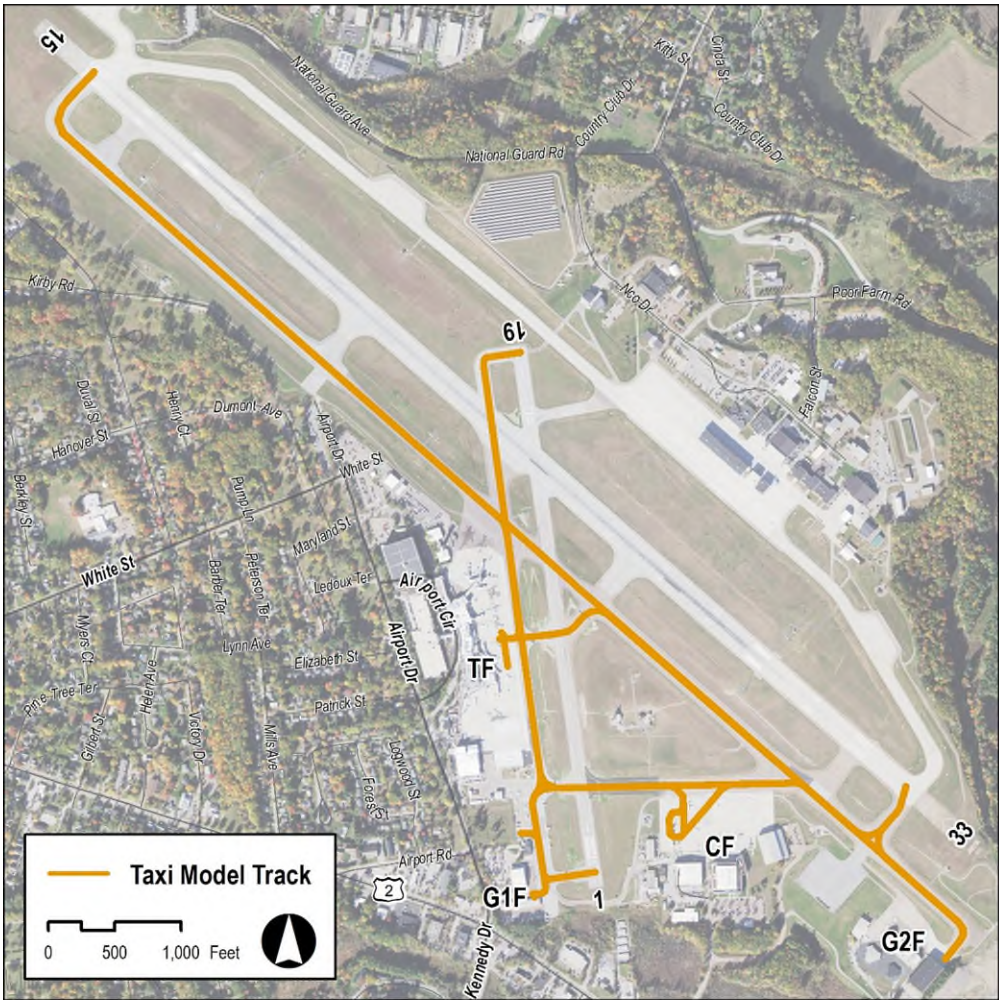

Figure 1. BTV Taxiways and Represenitive Taxiway Model Tracks

Several AEDT overflight profiles are used to represent the operations for the taxiways in this project, all of which are described below. These profiles include various stationary segments, where appropriate, and include the following:[15]

- Two-minute idle warm-up
- Five-and-a-half-minute taxi hold/queue based on data provided by U.S. Department of Transportation, Bureau of Transportation Statistics for 2022 and 2023, modeled near the end of the taxi-paths, typically just before hold lines.[16]
- One-minute hold for crossing Runway 1/19 (based on HMMH experience)

[15] These assumptions are consistent with the 2019 BTV NEM taxiway modeling unless otherwise noted.
[16] The database is titled "Airline On-Time Performance Data, Marketing Carrier On-Time Performance (Beginning January 2018)" (DOT On-Time) and is available at https://www.transtats.bts.gov. Interviews during the 2006 NEM preparation with airport staff and FAA indicated that aircraft turn off their engines if they queue for more than 10 minutes. Estimates indicate that without queuing, aircraft need approximately seven minutes for idle warm-up and taxi from the terminal to the departure threshold. Therefore, the analysis used individual "TaxiOut" times provided in the DOT On-Time database between seven minutes (taxi out, no queue) and seventeen minutes (taxi out, maximum duration queue with engines on) and then averaged. Data used was the 5,812 individual operations listed in the DOT On-Time data from 07/01/2022 through 06/30/2023 that did not have DepTime = NULL.

As per the INM 7.0 User's Guide, the stationary positions are modeled as slow-moving aircraft through the area. This slow movement representation is used because the AEDT overflight profiles cannot model 0 velocity profile segments, and the slow movement area represents multiple "average annual" positions at which individual aircraft may actually stop.

Each ANP aircraft type used in this study has up to 24 unique proposed overflight profiles, which correspond to the correct length and speeds of the particular taxiway ground track and the parameters for the particular aircraft (although not all ANP aircraft will use all of the profiles). Therefore, the following profile description uses variables to describe several of the parameters.

In summary, all of the taxi profiles use an overflight operation type and an altitude of 10 feet. The moving portion of the profile will be modeled at a constant speed (10 knots) at an idle power setting defined later in Section 2.1.2. The stationary positions are represented with several profile points entered in the FLT_ANP_PROFILE_POINTS table, provided in **Table 2**. The points represent the deceleration from 10 knots to "0 knots" over 50 feet, slow movement at speed "AS" over a specified distance to represent the desired stationary time and aircraft movement through that same area, and then acceleration from "0 knots" to 10 knots. The acceleration portions include segments at a higher thrust/power setting, referred to in this memorandum as "acceleration power" and abbreviated "ACL". Section 2.1 discusses the development of the ACL value for entry into AEDT. **Table 3** presents the profile points for taxi after arrival. These profiles are much simpler, with only two points. The aircraft taxi with a constant speed of 10 knots and idle thrust for the full length of the profile.

The representation of aircraft which are stopped, waiting for clearance across a runway, is done in the same manner for any arrival or departure profile that crosses a runway. In such cases, six points are added to represent the deceleration (2 points), slow taxi representing the stopped aircraft for one minute (2 points) just before the respective hold line, and then acceleration back to 10 knots (2 points). Section 2.3 provides more details of the various taxi paths and respective operations.

Table 2. Profile Points for Taxi to Departure

OP_TYPE	PROF_ID1	PROF_ID2	PT_NUM	DISTANCE (ft)	ALTITUDE (ft)	SPEED (Knots)	THR_SET	OP_MODE
V	[TX]	[TX2]	1	0	10	0.2	[IDLE]	A
V	[TX]	[TX2]	2	41	10	0.2	[IDLE]	A
V	[TX]	[TX2]	3	47	10	2.4	[ACL]	A
V	[TX]	[TX2]	4	97	10	10.0	[ACL]	A
V	[TX]	[TX2]	5	107	10	10.0	[IDLE]	A
V	[TX]	[TX2]	6	[START]-50	10	10.0	[IDLE]	A
V	[TX]	[TX2]	7	[START]	10	[AS]	[IDLE]	A
V	[TX]	[TX2]	8	[END]-10	10	[AS]	[IDLE]	A
V	[TX]	[TX2]	9	[END]	10	2.4	[ACL]	A
V	[TX]	[TX2]	10	[END]+50	10	10.0	[ACL]	A
V	[TX]	[TX2]	11	[END]+60	10	10.0	[IDLE]	A
V	[TX]	[TX2]	12	[S]	10	10.0	[IDLE]	A

Notes:
[ACL] = Accelerating thrust for taxi, 0 to 10 knots in 50 ft. Section 2.1 discusses development of this value.
[AS] = Adjust speed – speed that will provide the desired stationary time in the stationary area and the necessary time to taxi through the area.
[END] = Profile distance to end of stationary area (ft)
[IDLE] = Idle thrust setting Section 2.1 discusses development of this value.
[S] = The length of the taxiway track.
[START] = Profile distance to beginning of stationary area (ft)
[TX] = Name of the taxiway track
[TX2] = Name of the taxiway track, PROF_ID2 indicator
Settings for points (PT_NUM) 1-5 and 9 revised June 2024 in response to FAA comments. The current settings come close to the desired two-minute warm-up followed by an increase to acceleration thrust [ACL] over an approximately 3 second period, followed by acceleration to 10 knots over the course of 50 ft, and then a brief thrust reduction to idle power [IDLE].

Table 3. Profile Points for Taxi from Arrival

OP_TYPE	PROF_ID1	PROF_ID2	PT_NUM	DISTANCE (ft)	ALTITUDE (ft)	SPEED (Knots)	THR_SET	OP_MODE
V	[TX]	[TX2]	1	0	10	10.0	[IDLE]	A
V	[TX]	[TX2]	2	[S]	10	10.0	[IDLE]	A

Notes:
[IDLE] = Idle thrust setting Section 2.1 discusses development of this value.
[S] = The length of the taxiway track.
[TX] = Name of the taxiway track
[TX2] = Name of the taxiway track, PROF_ID2 indicator

2.1 Development of AEDT idle and accelerating power entries

AEDT's underlying database stores noise levels in a series of Noise-Power-Distance (NPD) curves. The "Power" of the NPD curves is usually entered in units of pounds thrust, although it can also be in units of horsepower or engine rotations-per -minute (RPMs).

2.1.1 Derivation of Taxiing Acceleration Thrust

The derivation of acceleration thrust uses basic physics and some simplifying assumptions. This analysis assumes that aerodynamic drag and wheel friction are negligible, that the aircraft is on a level surface, and the only force (thrust) required is to accelerate the mass of the aircraft to the desired speed within the desired distance. This analysis also assumes that an aircraft's maximum static thrust is approximately 30 percent of the aircraft weight.[17] The result of the analysis is that approximately 30 percent static thrust is required to accelerate the aircraft from 0 to 10 knots (16.88 feet per second) within 50 feet.

Equation 1 represents one of the equations of motion and relates acceleration and distance to a change in velocity. **Equation 2** uses Equation 1 and expresses the acceleration required to change velocity from 0 to 10 knots (16.88 ft/s) within 50 feet. This is the desired acceleration. **Equation 3** represents the relationship between force, mass and acceleration (Newton's Second Law of Motion). **Equation 4** relates the weight of the aircraft to its mass based on Equation 3 and the acceleration of gravity (32.17 ft/s^2). **Equation 5** is based on Equation 3 and relates the desired thrust to the desired acceleration. **Equation 6** replaces the mass in Equation 5 with the relationship presented in Equation 4. **Equation 7** presents the observed relationship between the static thrust and aircraft weight, based on comparison of relevant aircraft in the AEDT fleet database. **Equation 8** replaces the weight in Equation 6 with the function of static thrust given in Equation 7, yielding the final relationship between the desired thrust and static thrust.

$$\text{Velocity}_{\text{Final}}^2 = \text{Velocity}_{\text{Initial}}^2 + 2 * \text{Acceleration} * \text{Distance} \quad (1)$$

$$\text{Acceleration}_{\text{Desired}} = (16.88 \text{ ft/s})^2/(2 * 50 \text{ ft}) = 2.85 \text{ ft/s}^2 \quad (2)$$

$$\text{Force} = \text{Mass} * \text{Acceleration} \quad (3)$$

$$\text{Weight} = \text{Mass} * 32.17 \text{ ft/s}^2 \quad (4)$$

$$\text{Thrust}_{\text{Desired}} = \text{Mass} * \text{Acceleration}_{\text{Desired}} \quad (5)$$

$$\text{Thrust}_{\text{Desired}} = (\text{Weight}/32.17 \text{ ft/s}^2) * \text{Acceleration}_{\text{Desired}} \quad (6)$$

$$\text{Thrust}_{\text{Static}} = 0.30 * \text{Weight} \quad (7)$$

$$\text{Thrust}_{\text{Desired}} = ((\text{Thrust}_{\text{Static}}/0.30)/32.17 \text{ ft/s}^2) * \text{Acceleration}_{\text{Desired}} \quad (8)$$

$$\text{Thrust}_{\text{Desired}} = ((\text{Thrust}_{\text{Static}}/0.30)/32.17 \text{ ft/s}^2) * 2.85 \text{ ft/s}^2$$

$$\text{Thrust}_{\text{Desired}} = 0.30 * \text{Thrust}_{\text{Static}}$$

2.1.2 AEDT data entries

The AEDT power entries, listed in **Table 2** and **Table 3** in the field THR_SET, must be in the same units as the NPD curves. Therefore,

- For an AEDT ANP type with NPD curves defined in terms of thrust (`FLT_ANP_AIRPLANE_NOISE_GROUPS, THRUST_SET_TYPE = L`), the idle entry is 10% of the maximum static thrust associated with the ANP type (AEDT table FLT_ANP_AIRPLANES, field THR_STATIC). The accelerating value is entry is 30% of the maximum static thrust associated with the ANP type.
- For AEDT ANP types that have NPD curves defined in terms of engine RPMs (`FLT_ANP_AIRPLANE_NOISE_GROUPS, THRUST_SET_TYPE = X`), discussions with AEE-100 indicates that 20% of RPMs should be appropriate for idle and 40% of maximum RPMs should be appropriate for acceleration power.
- For all other AEDT ANP types (in which the NPD curves are not expressed in terms of thrust or RPMs) the highest value in the respective ANP's departure NPD curve set is assumed to be the ANP maximum power value for this method (AEDT table FLT_ANP_AIRPLANE_NPD_CURVES, field THR_SET where OP_MODE=D). The AEDT value associated with [IDLE] is 10% of the ANP maximum power value and the AEDT value associated with [ACL] 30% of the ANP maximum power value.

[17] Estimated by comparison of static thrust and maximum take-off weights for various ANP types used in this study, as provided in the AEDT fleet database.

2.2 Omission of F-35A Aircraft/other Military Aircraft from Taxiway Modeling

Aircraft noise modeling for the 2024 BTV NEM update excludes taxiway modeling for VTANG F-35A aircraft along Taxiways D and F. Taxiway modeling of the F-35A aircraft is not currently possible as AEDT 3e does not contain noise data for the F-35A aircraft. The prior NEM[18] did not include VTANG F-35A taxiway modeling for the same reason (i.e., lack of data in the AEDT 2d). In addition, there are no noise-sensitive receptors in close proximity on that side of the Airport. Other military aircraft average less than 1 operation per day, so their taxi activities are not modeled for simplicity.

2.3 Operations and Profiles

This section presents the results of combining all the individual profiles, apron use, and track use for this study using draft operations. The following figures and tables show the various taxi paths with indications if the aircraft are taxiing at 10 knots, holding, accelerating, or decelerating. The tables that follow indicate the names of the taxiway tracks within the AEDT study and the most common ANP type using the taxi path.

In most cases, there is a single taxi path between an apron and runway end or a runway end and an apron. Two taxiway profiles from each apron area have been developed to serve Runway 15 departures. One of the Runway 15 departure profiles, and the most commonly used, places the five-minute queue just before the hold line to Runway 15. The second profile, used about five percent of the time, places the five-minute queue just before the hold line associated with the Instrument Landing System (ILS) critical area, which is approximately 900 ft further southeast.[19]

Figures 2 through 9 depict the taxi path profiles. Each figure is followed by a table describing the profile(s) used on each path.

[18] Accepted by FAA in 2019, depicting 2018 and forecast 2023 conditions

[19] Interviews and observations indicate that the ILS critical area hold line is only used in adverse weather conditions. This reported use at BTV is consistent with FAA Order 7110.65AA, Section 3-7-5. The use of two profiles will allow us to adjust the use of the respective hold lines as model inputs are reviewed and refined during the course of the project. Within AEDT, PROF_ID2 = 1 is used to denote the profiles using the runway hold line while PROF_ID2 = 2 is used to denote the profiles that use the ILS hold line.

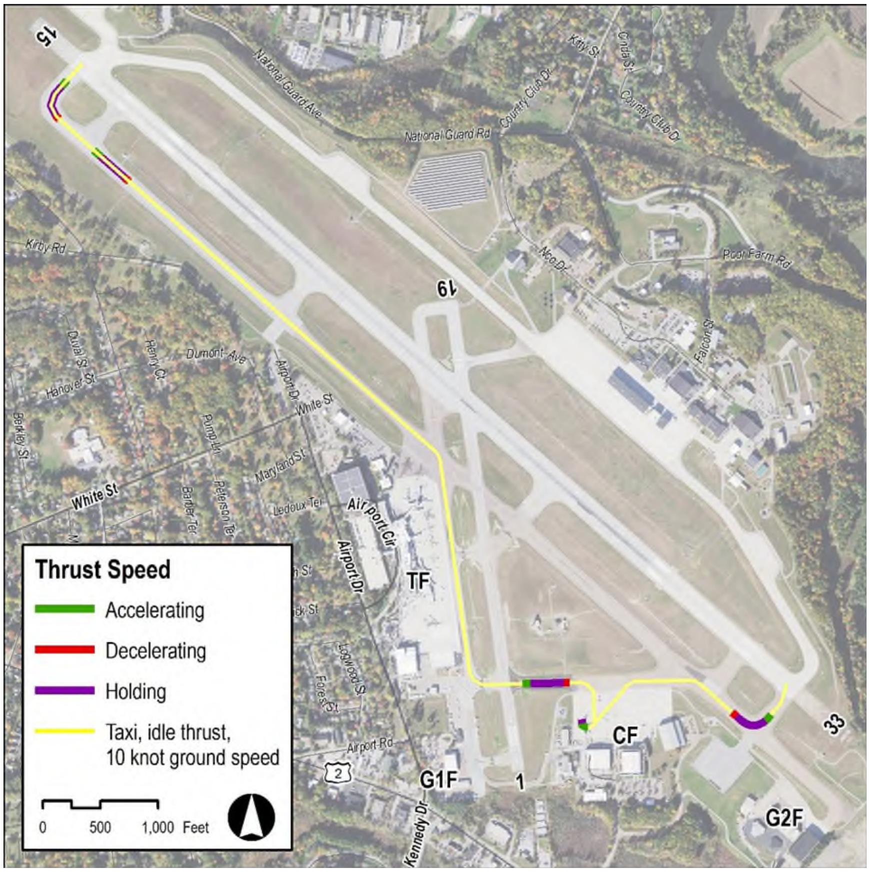

Figure 2. Taxi paths for departing aircraft from apron CF

Table 4. Taxi profiles for departing aircraft from apron CF

OP_TYPE	TRK_ID1 PROF_ID1	PROF_ID2	Taxi Path Notes	Ending at Runway	Most common ANP type
V	TD15_CF	1	Start heading west, Hold before crossing Runway 1-19 Hold at Runway 15 departure end	15	CNA208
V	TD15_CF	2	Start heading west, Hold before crossing Runway 1-19 Hold at ILS critical area (instead of at Runway 15 departure end)	15	CNA208
V	TD33_CF	1	Start heading east, then turns right to southeast Hold at Runway 33 departure end	33	CNA208

Notes:
All of the above departure entries start with a two-minute hold representing engine warm-up
All entries have TRK_ID2 = 1

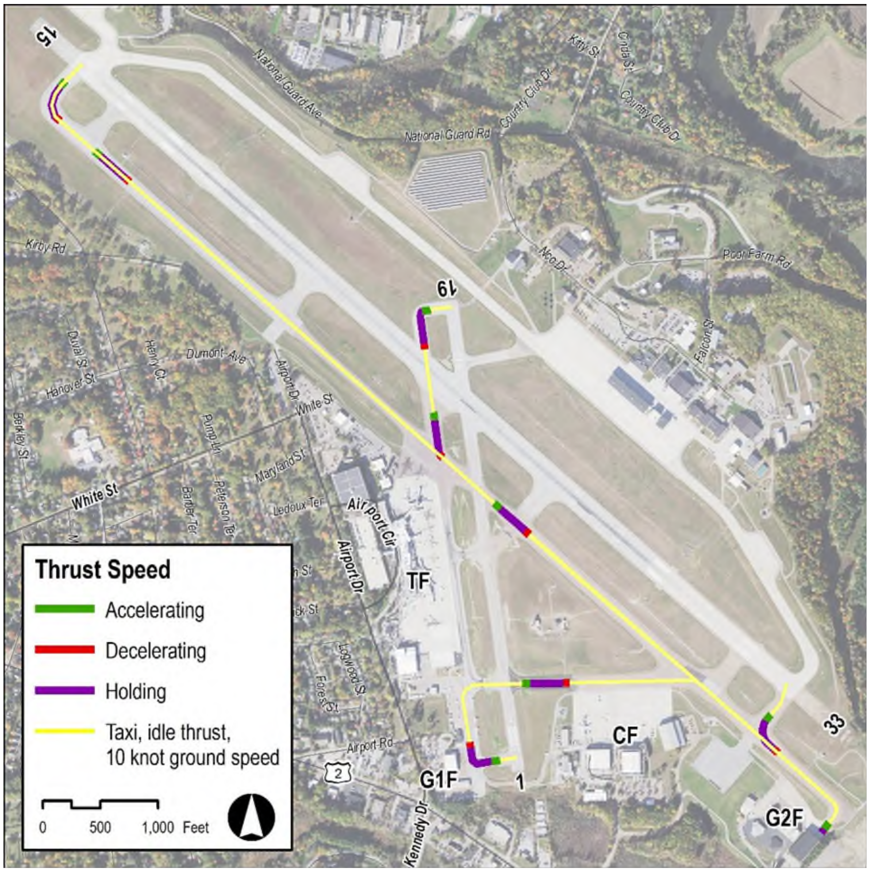

Figure 3. Taxi paths for departing aircraft from apron G2F

Table 5. Taxi profiles for departing aircraft from apron G2F

OP_TYPE	TRK_ID1 PROF_ID1	PROF_ID2	Taxi Path Notes	Ending at Runway	Most common ANP type
V	TWD01_G2	1	Start heading northwest, then turns left and pass Apron CF Hold before crossing Runway 1-19 Cross Runway and turn left, passing Apron G1F Hold at Runway 1 departure end	1	CNA172
V	TD15_G2F	1	Start heading northwest Hold before crossing Runway 1-19 Hold at Runway 15 departure end	15	CNA172
V	TD15_G2F	2	Start heading northwest, Hold before crossing Runway 1-19 Hold at ILS critical area (instead of at Runway 15 departure end)	15	CNA172
V	TWD19_G2	1	Start heading northwest Hold before crossing Runway 1-19 Turn right, Hold before crossing Runway 15-33 Hold at Runway 19 departure end	19	CNA172
V	TD33_G2F	1	Start heading northwest, then turns right Hold at Runway 33 departure end	33	CNA172

Notes:
All of the above departure entries start with a two-minute hold representing engine warm-up
All entries have TRK_ID2 = 1

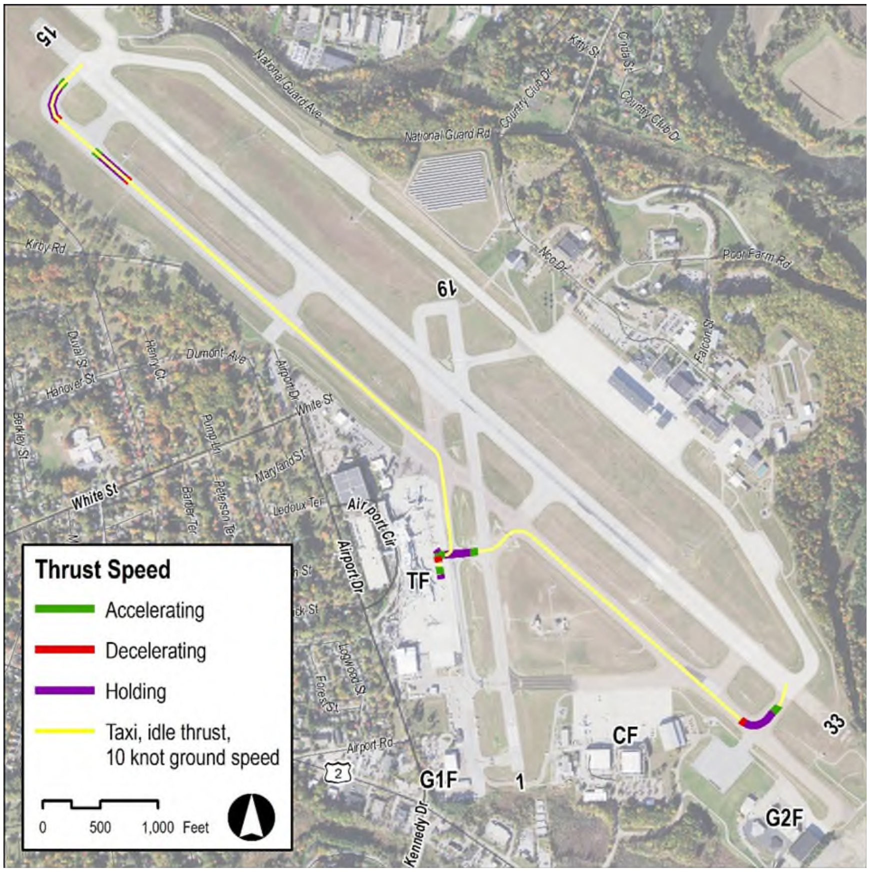

Figure 4. Taxi paths for departing aircraft from apron TF

Table 6. Taxi profiles for departing aircraft from apron TF

OP_TYPE	TRK_ID1 PROF_ID1	PROF_ID2	Taxi Path Notes	Ending at Runway	Most common ANP type
V	TD15_TF	1	Start heading north, then turn left to northwest Hold at Runway 15 departure end	15	CRJ9-ER
V	TD15_TF	2	Start heading north, then turn left to northwest Hold at ILS critical area (instead of at Runway 15 departure end)	15	CRJ9-ER
V	TD33_TF	1	Start heading east Hold before crossing Runway 1-19 cross runway, then turn right to southeast Hold at Runway 33 departure end	33	CRJ9-ER

Notes:
All of the above departure entries start with a two-minute hold representing engine warm-up.
All entries have TRK_ID2 = 1.

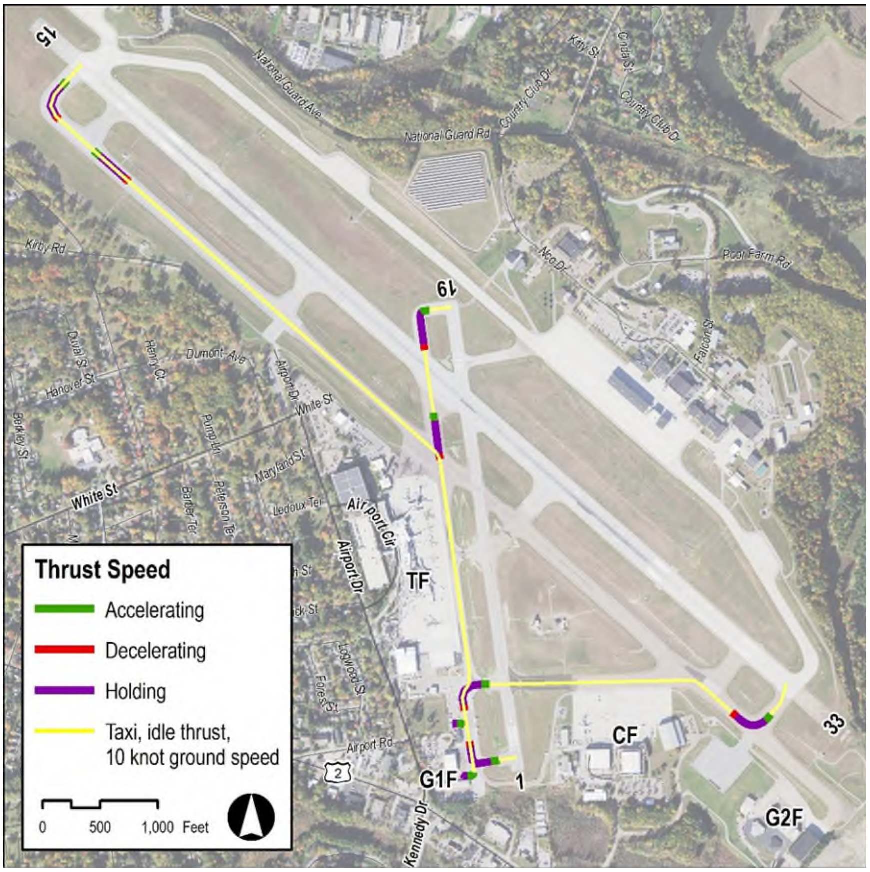

Figure 5. Taxi paths for departing aircraft from apron G1F

Table 7. Taxi profiles for departing aircraft from apron G1F

OP_TYPE	TRK_ID1 PROF_ID1	PROF_ID2	Taxi Path Notes	Ending at Runway	Most common ANP type
V	TWD01_G1	1	Hold at Runway 1 departure end	1	GASEPF
V	TWD19_G1	1	Start heading north and pass apron TF Hold before crossing Runway 15-33 Hold at Runway 19 departure end	19	GASEPF
V	TD15_G1F	1	Start heading north and pass apron TF, then turn left to northwest Hold at Runway 15 departure end	15	GASEPF
V	TD15_G1F	1	Start heading north and pass apron TF, then turn left to northwest Hold at ILS critical area (instead of at Runway 15 departure end)	15	GASEPF
V	TD33_G1F	1	Hold before crossing Runway 1-19 Cross Runway heading east, passing Apron CF then turn right to southeast Hold at Runway 33 departure end	33	GASEPF

Notes:
All of the above departure entries start with a two-minute hold representing engine warm-up
All entries have TRK_ID2 = 1.

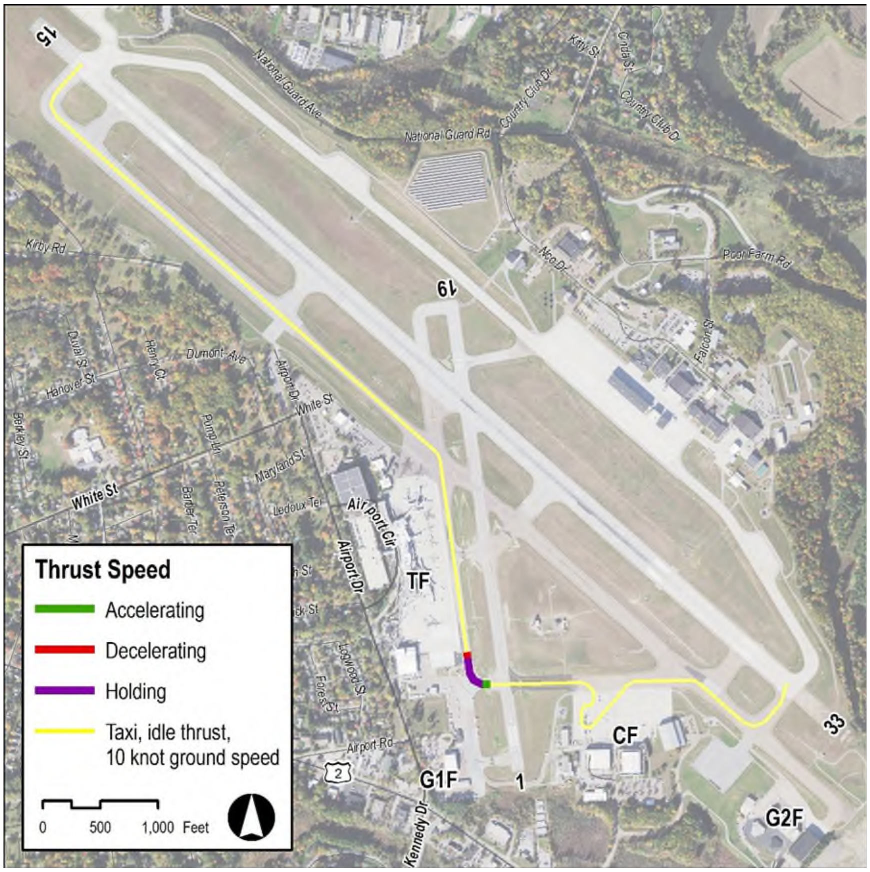

Figure 6. Taxi paths for aircraft arriving to apron CF

Table 8. Taxi profiles for aircraft arriving to apron CF

OP_TYPE	TRK_ID1 PROF_ID1	PROF_ID2	Taxi from arrival on Runway	Taxi Path Notes	Most common ANP type
V	TA15_CF	1	15	Aircraft starts at southeast end of runway, Then turns right, towards southwest, then northwest, then turns to west Taxi directly to apron	CNA208
V	TA33_CF	1	33	Aircraft starts at northwest end of runway, then turns left, towards southwest, then southeast then turns to right to south, passing Apron TF Hold before crossing Runway 1-19	CNA208

Notes:
All entries have TRK_ID2 = 1.

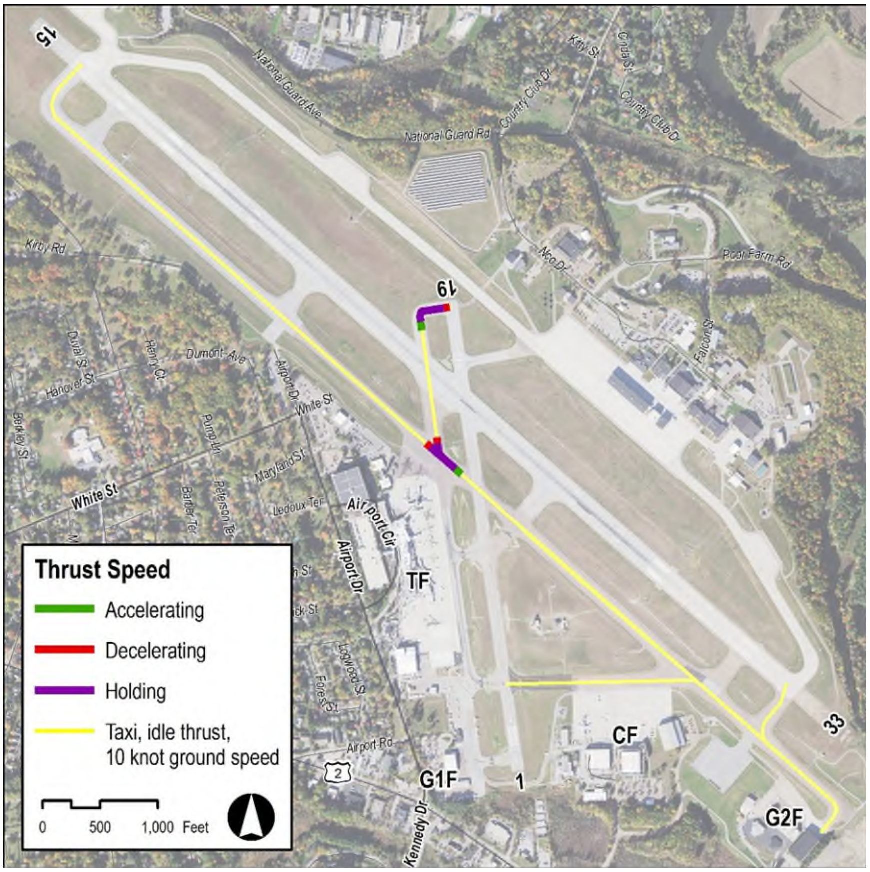

Figure 7. Taxi paths for aircraft arriving to apron G2F

Table 9. Taxi profiles for aircraft arriving to apron G2F

OP_TYPE	TRK_ID1 PROF_ID1	PROF_ID2	Taxi from arrival on Runway	Taxi Path Notes	Most common ANP type
V	TWA01_G2	1	1	Aircraft starts at north end of runway then turns left to west Hold before crossing Runway 15-33 then turns left and hold before Runway 1-19 Continue southeast to apron	CNA172
V	TA15_G2F	1	15	Aircraft starts at southeast end of runway, then turns right, towards southwest then turns left to southeast Taxi directly to apron	CNA172
V	TWA19_G2	1	19	Aircraft leaves runway before reaching southern end then turns left to east, passing Apron CF then turns right to southeast	CNA172
V	TA33_G2F	1	33	Aircraft starts at northwest end of runway, then turns left, towards southwest, then southeast Hold before crossing Runway 1-19	CNA172

Notes:
All entries have TRK_ID2 = 1.

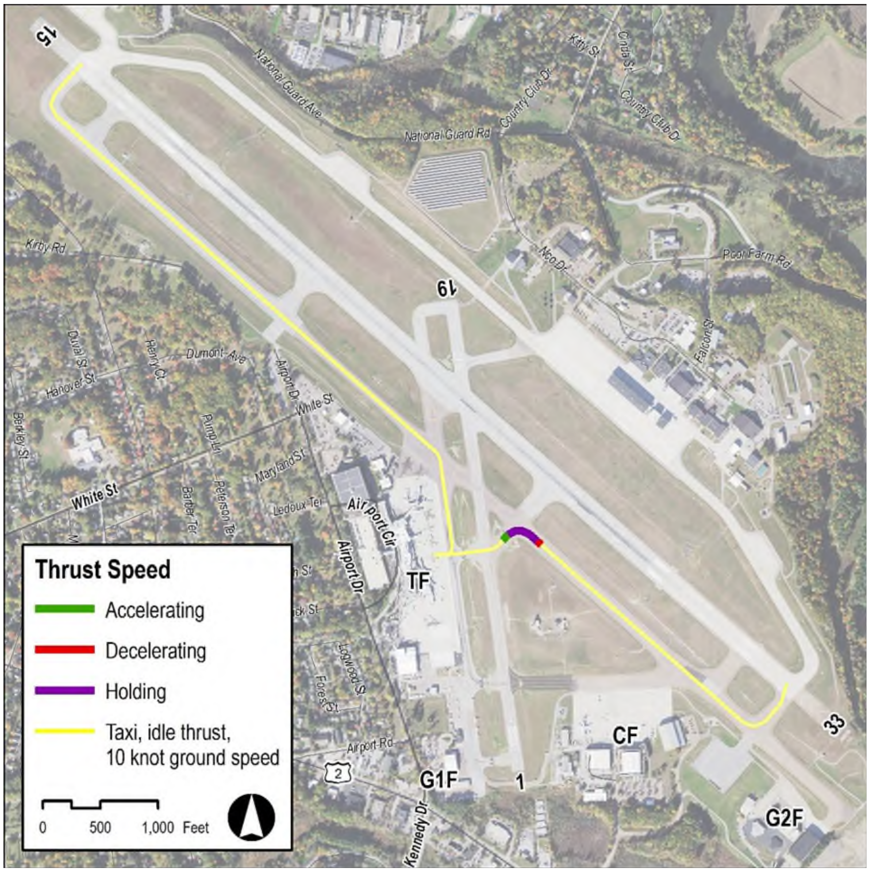

Figure 8. Taxi paths for aircraft arriving to apron TF

Table 10. Taxi profiles for aircraft arriving to apron TF

OP_TYPE	TRK_ID1 PROF_ID1	PROF_ID2	Taxi from arrival on Runway	Taxi Path Notes	Most common ANP type
V	TA15_TF	1	15	Aircraft starts at southeast end of runway, then turns right, towards southwest, then turns right northwest Hold before crossing Runway 1-19	CRJ9-ER
V	TA33_TF	1	33	Aircraft starts at northwest end of runway, then turns left, towards southwest, then turns right southeast turns to right to south	CRJ9-ER

Notes:
All entries have TRK_ID2 = 1.

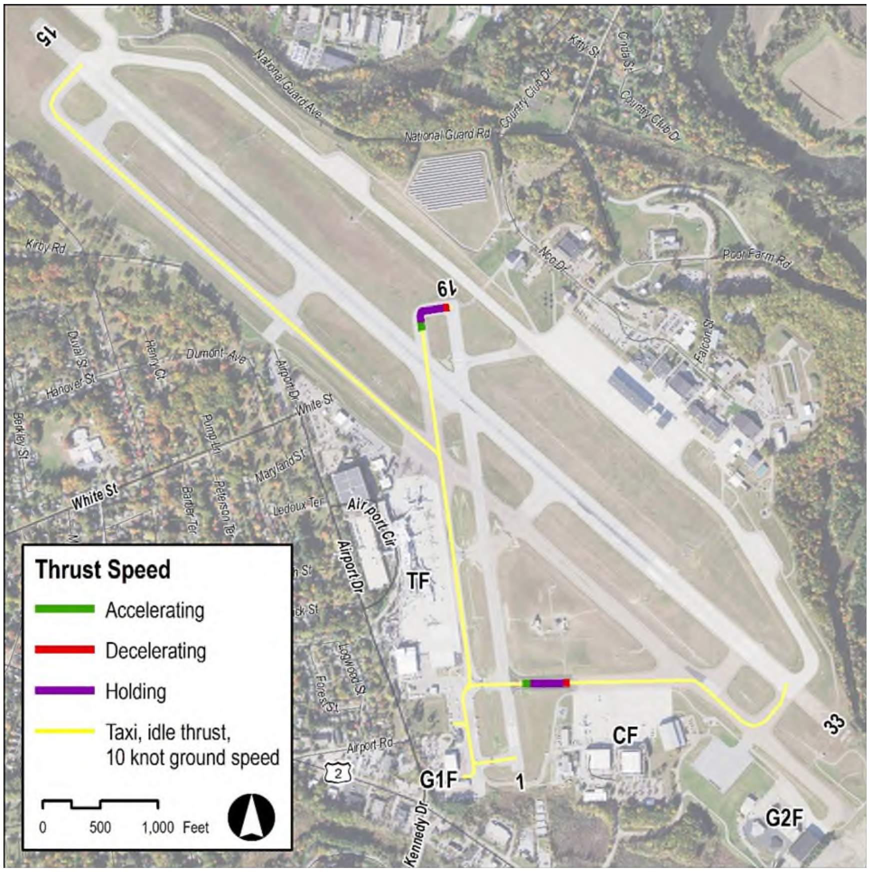

Figure 9. Taxi paths for aircraft arriving to apron G1F

Table 11. Taxi profiles for aircraft arriving to apron G1F

OP_TYPE	TRK_ID1 PROF_ID1	PROF_ID2	Taxi from arrival on Runway	Taxi Path Notes	Most common ANP type
V	TWA01_G1	1	1	Aircraft starts at north end of runway Turns left to west Hold before crossing Runway 15-33 Taxi south, passing Apron TF	GASEPF
V	TA15_G1F	1	15	Aircraft starts at southeast end of runway, Turns right, towards southwest, then northwest, turns to west passing Apron CF Hold before crossing Runway 1-19 Cross Runway and turn left to south	GASEPF
V	TWA19_G1	1	19	Aircraft starts at south end of runway Taxi directly to apron	GASEPF
V	TA33_G1F	1	33	Aircraft starts at northwest end of runway, Turns left, towards southwest, then southeast turns to right to south, passing Apron TF	GASEPF

Notes:
All entries have TRK_ID2 = 1.

The AEDT performance report for the draft operations is available in Excel format upon request. The Excel file was used in preparing the preceding figures to verify that AEDT is producing the expected results with the inputs described above. It should be noted that AEDT sub-segmented the profiles further. We reviewed and found most of the duration variations are approximately one to two seconds and the distance variations are on the order 10 feet or less. Therefore, we do not believe these adversely affect the overall results.

2.4 Draft Results in Day-Night Average Sound Level

Figure 10 presents the DNL 65 dB and DNL 70 dB contours using the draft year 2024 operations, draft runway use, the taxiway tracks presented in **Figure 1**, and the proposed taxiway profiles defined above, applied to the appropriate ANP types. The DNL 65 dB contour generated from these taxiway operations does extend slightly outside of airfield property on the northwest side. Although not shown in this memorandum, the shape and extent of the 65 dB DNL contour is similar to a prior BTV taxiway modeling submission.[20] The residential area within the DNL 65 dB contour shown in **Figure 10** has been an area of noise mitigation efforts in accordance with the airport's FAA approved Noise Compatibility Program (which is financially supported by several sources, including FAA Airport Improvement Program grants). The taxi operations around ramp areas G1F and G2F do not produce noise levels of 65 dB DNL.

[20] Document "Burlington International Airport Noise Exposure Map Update – Requested Review and Approval of Integrated Noise Model Non-Standard Inputs" prepared for Richard Doucette, FAA; Prepared by David Crandall; September 11, 2014, HMMH Job #305660. Attachment B, Page B-8, Figure 3-5.
Reviewed and approved by FAA AEE-100 via letter dated December 9, 2014 addressed to Richard Doucette, signed by Rebecca Cointin, Manager AEE/Noise Division
Both of the above documents are included in Appendix B of the BTV 2015 and 2020 Noise Exposure Maps.

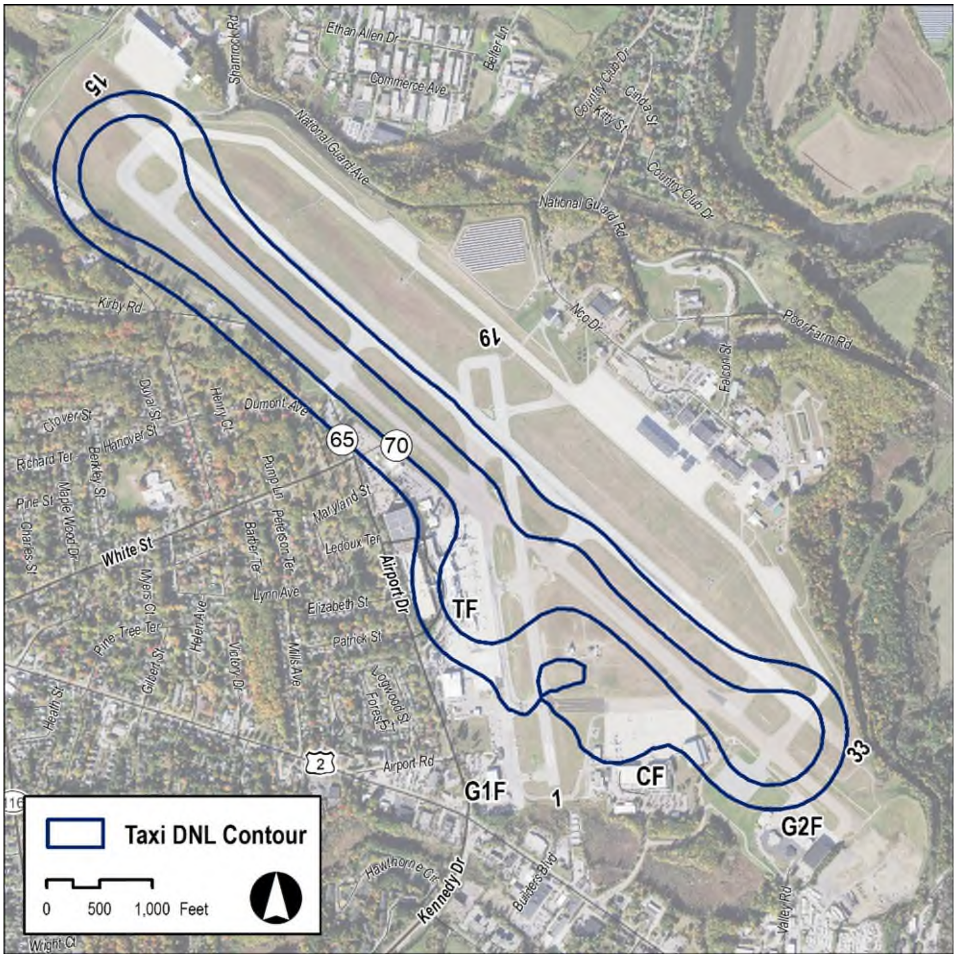

Figure 10. Draft 65 dB and 70 dB DNL Contours associated with Taxiing Aircraft

3.0 UVM Medical Center Helicopter Operations

The local hospital, University of Vermont Medical Center, has a helipad to facilitate patient transportation by helicopter. The helipad, designated in FAA's records as 67VT, is located approximately 2 miles west of BTV.[21] The helicopters, mainly Eurocopter EC 135 (modeled as AEDT ANP type EC130), are serviced, maintained, and stored at FBO facilities on the east side of BTV. The helicopters fly the 2 miles between the FBO and the helipad 67VT either over or around residential areas near BTV, within the 30,000-foot radius study area requirement in 14 CFR Part 150.[22] Our draft existing and forecast operations data have on the order of 1,700 annual EC130 operations of which approximately 450 fly between BTV and 67VT. Approximately one third of the 450 annual operations occur during the DNL metric's 10 PM to 7 AM nighttime period.

Figure 11 shows the actual flight tracks (green tracks depict arrivals to BTV and orange tracks depict departures from BTV) and the representative model tracks associated with these operations. Flight track analysis indicates that the transit time, on average, is four minutes, which results in an average ground speed of 38 knots.[23] Flight track analysis also indicates that the average altitude of the helicopters is approximately 800 feet mean sea level

[21] FAA's Airport Data and Information Portal has information at https://adip.faa.gov/agis/public/#/simpleAirportMap/67VT
[22] 14 CFR Part 150 Appendix-A-to-Part-150(b)(1)
[23] Measured between BTV Taxiway and a straight line approximating the helicopters crossing of Interstate 89.

(MSL), or 465 feet above field elevation (AFE). The representative helipad selected for these profiles was chosen with consideration of the other on-airport helipads within the model and stakeholder input (Technical Advisory Committee).

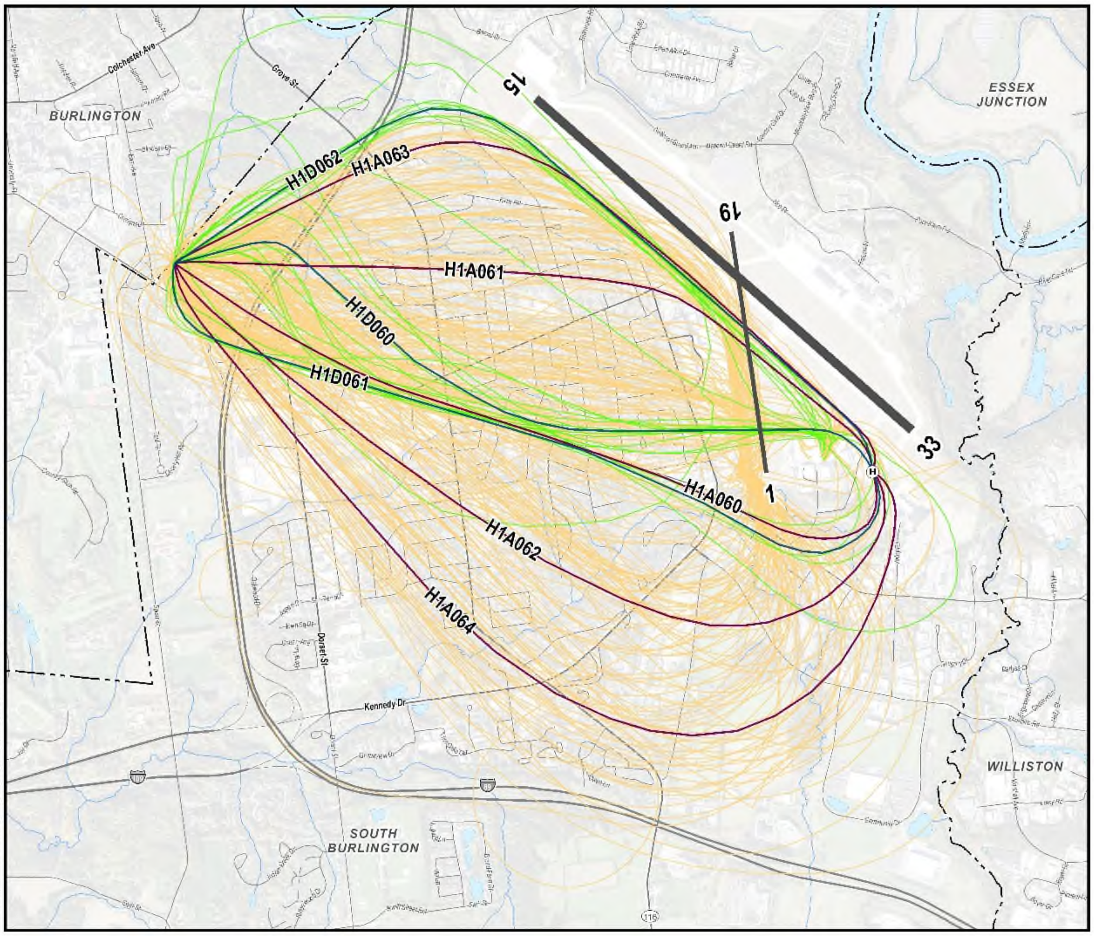

Figure 11. Actual and Representative Tracks for Proposed Profiles
Note: Green/blue = arrivals to BTV; Orange/red = departures from BTV

Figure 11 also presents the eight proposed representative model tracks. Red tracks are BTV departures, leading from the modeled helipad at the FBO on BTV property to the UVM helipad. Blue tracks are BTV arrivals, leading from UVM to the FBO. This methodology allows the operations to be modeled as arrivals/departures to/from BTV. Each departure or arrival profile is set to the respective track length.

3.1 Proposed Arrival Profiles

Table 12 presents the proposed user-defined arrival profile representing an EC130 starting in the air over helipad 67VT, flying to BTV, and landing on the BTV airfield. The profile is shown as it would be entered to AEDT's table FLT_ANP_HELICOPTER_PROCEDURES, and the step types (and interpretation of the respective duration, distance, altitude and speed values) are those defined in the AEDT 3e User Manual Appendix M and AEDT 3e Technical Manual 11.2.3.3.[24] All attributes not presented for the proposed profile are the same as the EC130 AEDT default profile.

[24] Both the User Manual and the Technical Manual were last updated May 9, 2022 and are available at https://aedt.faa.gov/3e_information.aspx

Table 12. Proposed Profile EC130 Approach U_fm_UVM_H1A061

Step Number	Step Type	DURATION (see note)	DISTANCE (feet)	ALTITUDE (feet)	SPEED (knots)	STANDARD profile attributes and notes (if different)
1	S Start altitude at constant speed	-	-	**465**	**38**	ALTITUDE =1,000; SPEED = 113.4
2	L Level flight at constant speed	-	**9,638***	-	-	DISTANCE = 87,250
3	B Approach with horizontal deceleration	-	**316**	-	**30**	DISTANCE = 5000 SPEED = 65 Maintain** deceleration
4	A Approach at constant speed	-	**624**	**400**	-	DISTANCE = 4800 ALTITUDE =500 Maintain** descent angle
5	C Approach with descending deceleration	-	**2,263**	15	0	DISTANCE = 2850 Maintain** descent angle
6	Y Vertical descent in ground effect	3	-	0	-	
7	H Flight idle	30	-	-	-	
8	G Ground idle	30	-	-	-	
	Total track distance		**12,841***			

Notes:
* These distances are adjusted in other profiles associated with other respective ground tracks.
** Distance values are selected so that the proposed profiles maintain the same descent angle and/or deceleration rate associated the respective STANDARD profile segment. In the example of Step 3, the deceleration rate is developed via a form of Equation 1 where acceleration/deceleration is equal to $(Vf^2 – Vi^2)/(2*d)$. The standard profile's deceleration rate works out to about 2.5 ft/s^2. That 2.5 ft/s^2 deceleration rate was then applied to the proposed profile's starting speed of 38 knots (Vi), and interim speed of 30 knots (Vf) to come up with the step distance of 316 feet (rounded). In the example of Step 4, the descent angle is set by the standard profile's ratio between the difference in the altitude (1,000 ft AFE – 500 ft AFE = 500 ft) and segment distance (4,800 ft) which is approximately 5.9 degrees. To match the standard profiles descent angle, Step 4 of the a proposed profile has a distance of 624 feet based on an altitude change of 465 ft AFE to 400 ft AFE (65 feet).
The DURATION, DISTANCE, ALTITUDE and SPEED fields are used only by particular Step Types. Values presented here are as entered into AEDT's FLT_ANP_HELICOPTER_PROCEDURES table with the exception that entries shown as "-" are unused parameters and actually entered into the table as 0. This proposed user-defined profile does not have any changes to the DURATION field compared to the AEDT STANDARD profile. For most step types, the actual representative segment duration can be calculated using the appropriate distance and the appropriate speed. Please see AEDT documentation for further details.

Figure 12 presents a graphical representation of the proposed profile altitude relative to the distance from the helipad (as shown in **Table 12**) compared to AEDT default "standard" profile. Steps 1 through 4 are at a lower altitude (465 ft above airfield elevation) for the proposed profile; the standard profile has the same steps between 1,000 ft AFE and 500 ft. Distances in steps 2 through 5 are adjusted based on the total track distances to maintain the same descent angle and/or deceleration rate compared to the AEDT default profile. Steps 6 through 8 are identical in both profiles and occur during the last minute of flight, representing the last 15 feet of altitude, before touching down and stopping. **Figure 13** graphs the profile's speed relative to the distance from the helipad.

Figure 14, **Figure 15**, and **Figure 16** compare the proposed arrival profile's resulting SEL contour (in red) to the AEDT standard EC130 profile's resulting SEL (in blue) on each of the five representative tracks. The five figures each display the 85 dB, 90 dB and 95 dB SEL contours associated with a single operation on the indicated track. In general, the proposed profile is about 5 dB louder than the standard profiles during the transit. Some of the difference can be accounted for by the lower altitude of the proposed profile (465 feet AFE compared to 1,000 feet

AFE). The rest of the difference is attributable to the slower speed of the proposed profile (38 knots compared to 113.4 knots).

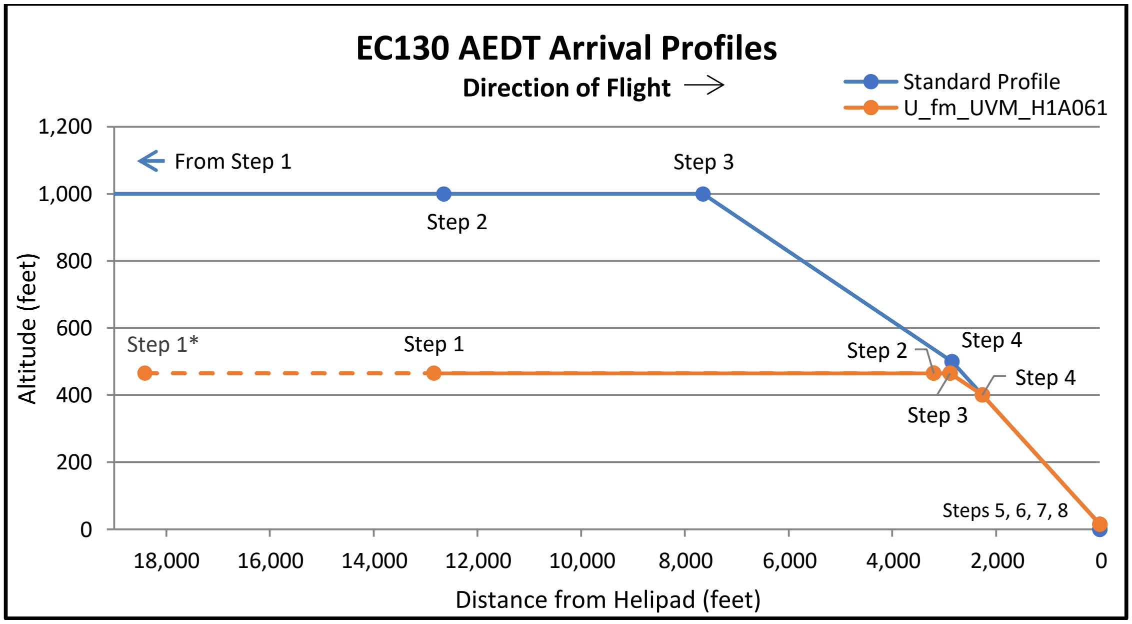

Figure 12. Comparison of EC130 AEDT Standard and Proposed Arrival Altitude versus Distance Profiles
*Note: *Total distance for the longest proposed arrival profile (U_fm_UVM_H1A064) is 18,411 feet*

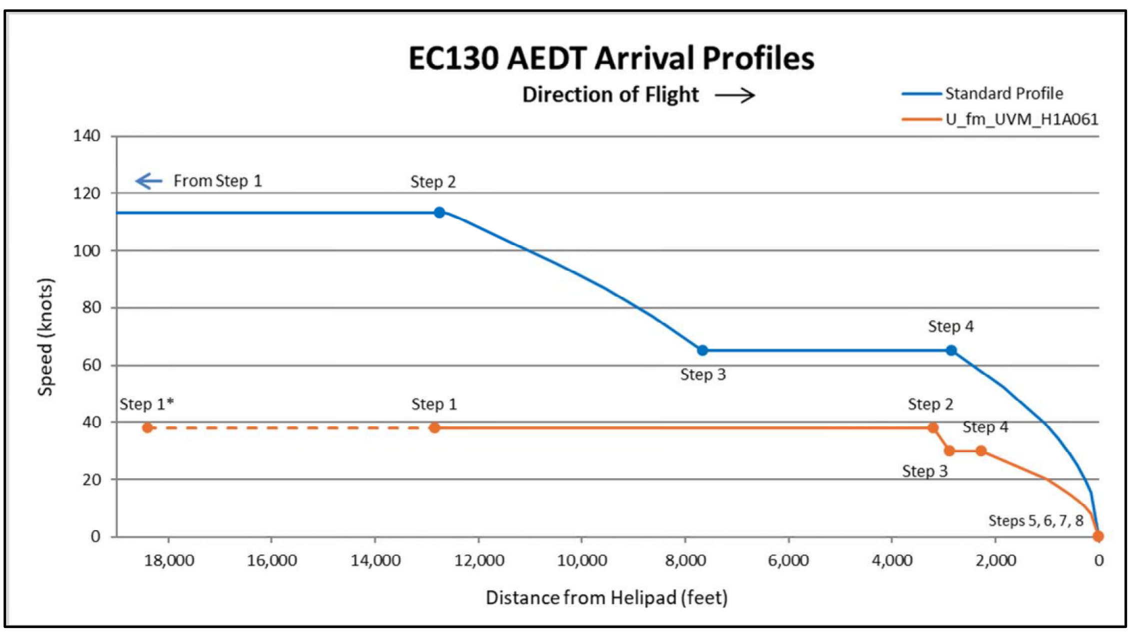

Figure 13. Comparison of EC130 AEDT Standard and Proposed Arrival Speed versus Distance Profiles
*Note: *Total distance for the longest proposed arrival profile (U_fm_UVM_H1A064) is 18,411 feet*

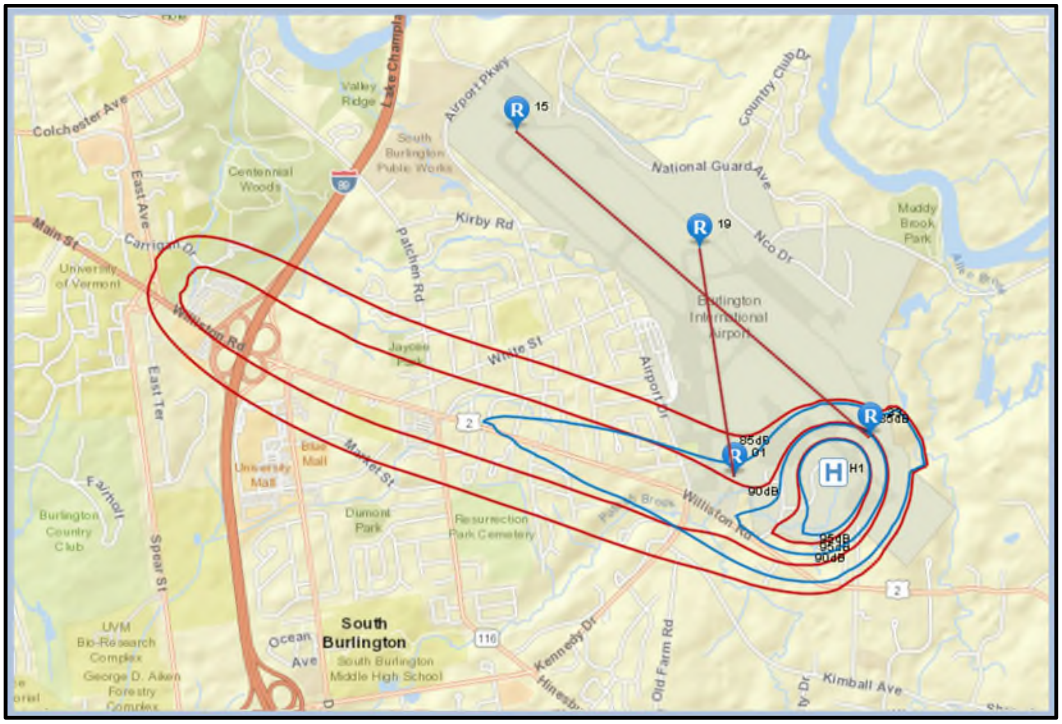

Figure 14. Comparison SEL Contours Arrival Track H1A060 from UVM (west) to AEDT Helipad (east)

H1A060 Attributes: Total distance is 13,484 feet; Step 2 distance is 10,281 feet

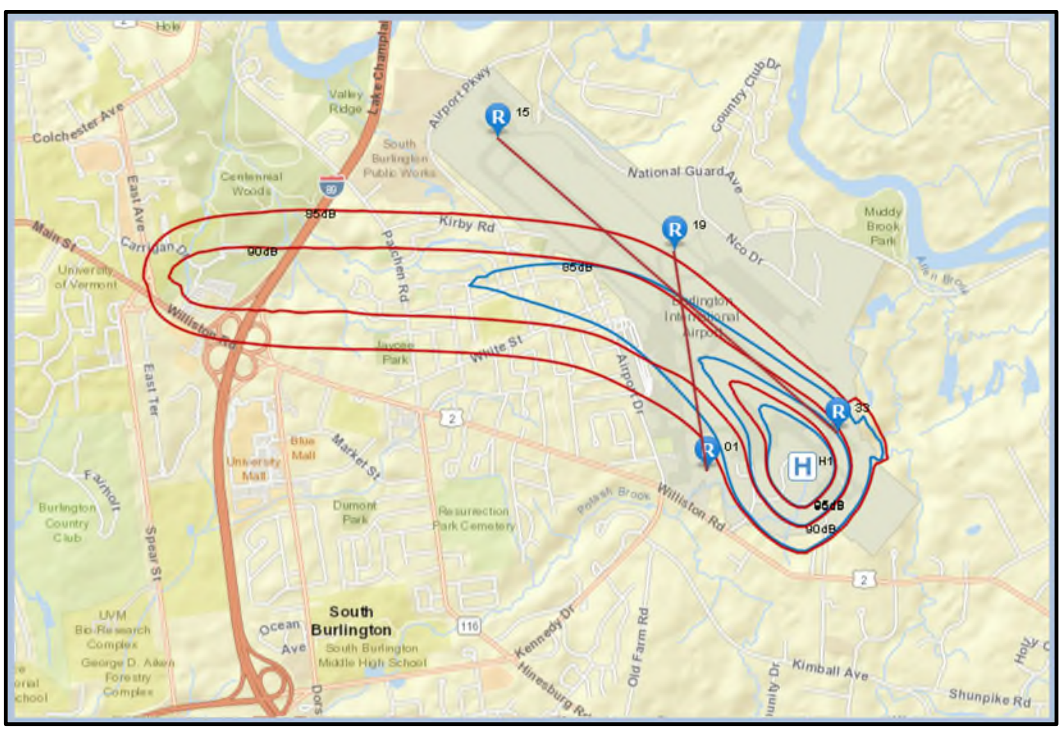

Figure 15. Comparison SEL Contours Arrival Track H1A061 from UVM (west) to AEDT Helipad (east))

H1A061 Attributes: Total distance is 12,841 feet; Step 2 distance is 9,638 feet

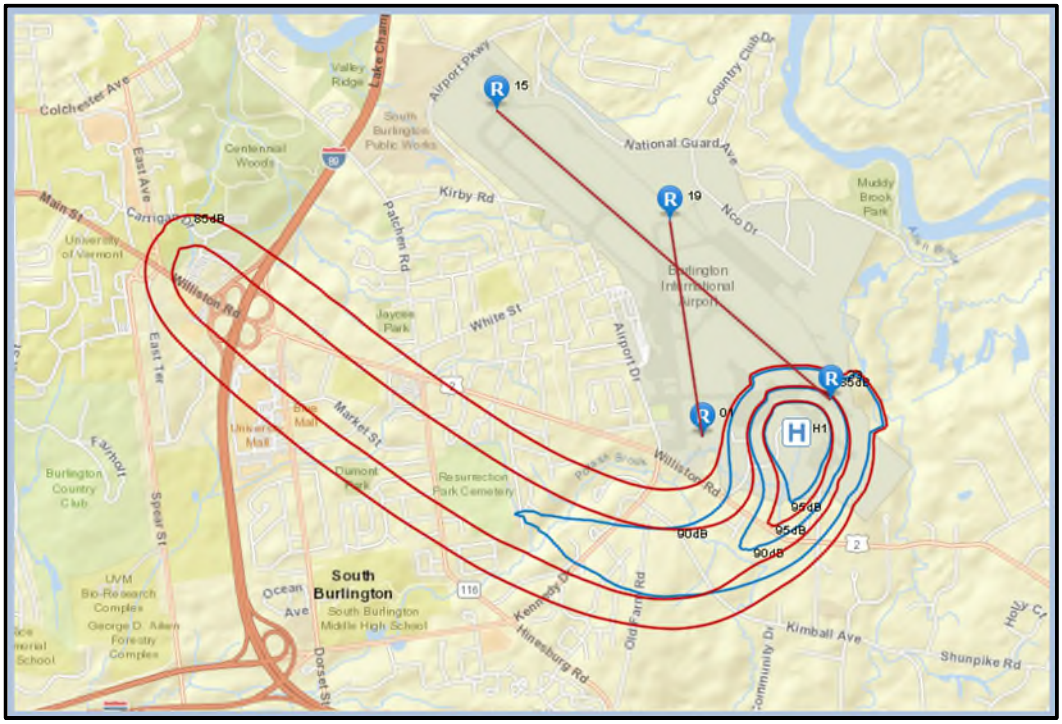

Figure 16. Comparison SEL Contours Arrival Track H1A062 from UVM (west) to AEDT Helipad (east)
H1A062 Attributes: Total distance is 15,408 feet; Step 2 distance is 12,205 feet

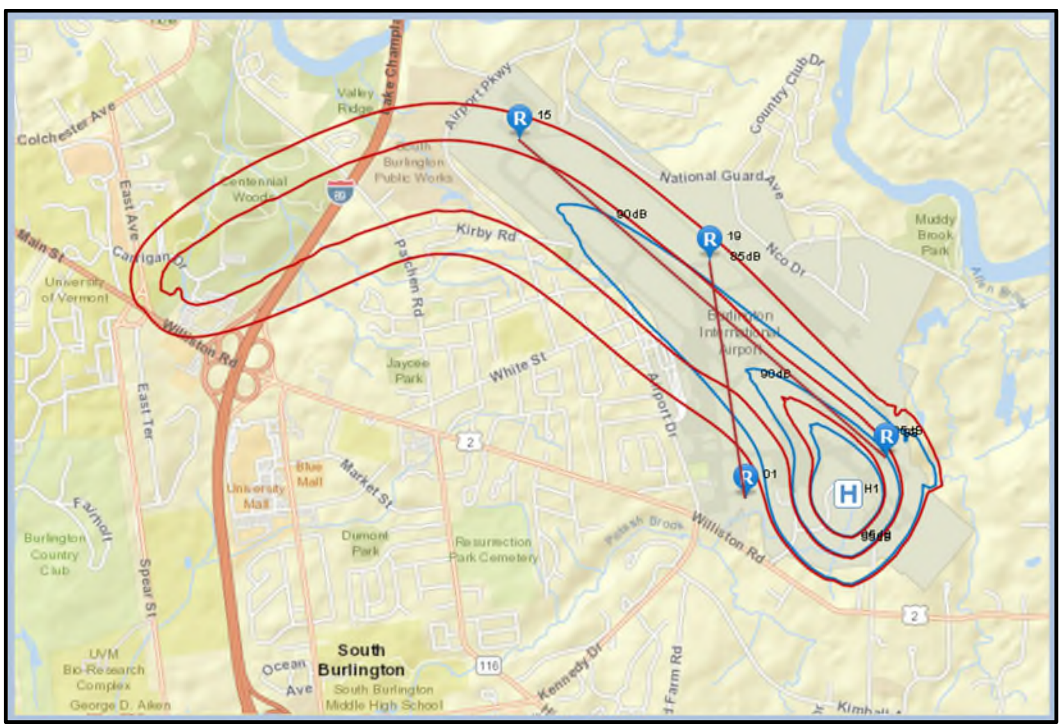

Figure 17. Comparison SEL Contours Arrival Track H1A063 from UVM (west) to AEDT Helipad (east)
H1A063 Attributes: Total distance is 14,308 feet; Step 2 distance is 11,105 feet

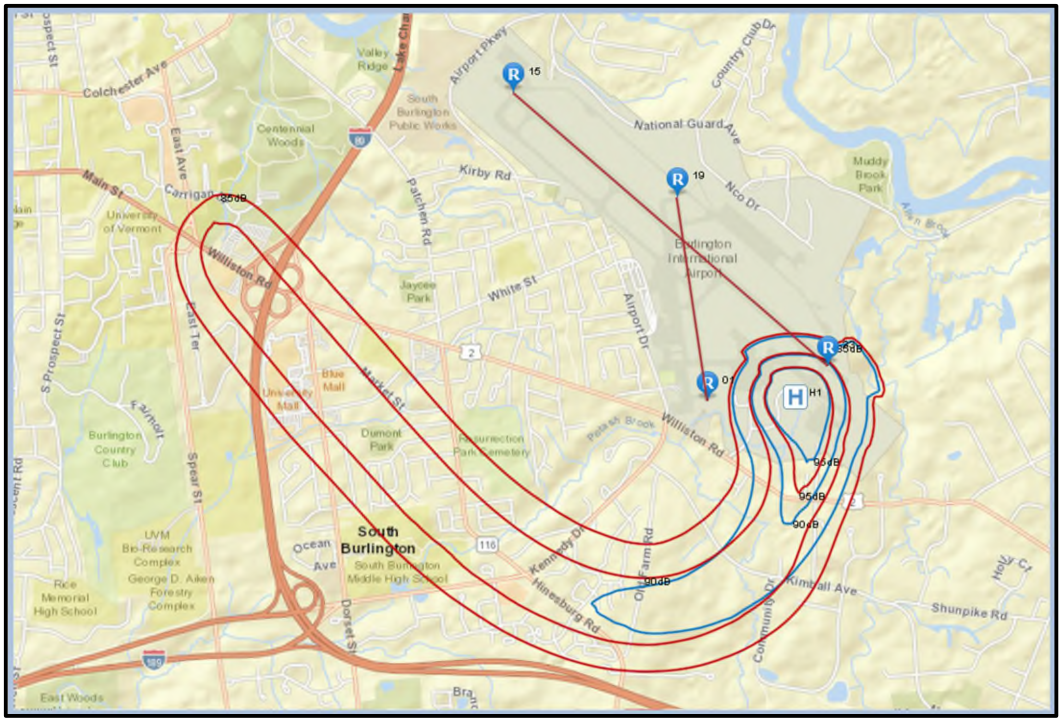

Figure 18. Comparison SEL Contours Arrival Track H1A064 from UVM (west) to AEDT Helipad (east)
H1A064 Attributes: Total distance is 18,411 feet; Step 2 distance is 15,208 feet

3.2 Proposed Departure Profile

Table 13 presents the proposed user-defined departure profile representing an EC130 departing a helipad on the BTV airfield, flying towards 67VT, and entering a level flight with the profile ending where the track ends, over 67VT. The profile is presented as it would be entered into AEDT's table FLT_ANP_HELICOPTER_PROCEDURES, and the step types (and interpretation of the respective duration, distance, altitude and speed values) are those defined in the AEDT 3e User Manual Appendix M and AEDT 3e Technical Manual 11.2.3.3. All attributes not presented for the proposed profile are the same as the EC130 AEDT default profile.

Table 13. Proposed Profile EC130 Departure U_to_UVM_H1D060

Step Number	Step Type	DURATION	DISTANCE (feet)	ALTITUDE (feet)	SPEED (knots)	STANDARD profile attributes (if different)
1	G Ground idle	30	-	-	-	
2	H Flight idle	30	-	-	-	
3	V Vertical ascent in ground effect	3	-	15	-	
4	E Depart with horizontal acceleration	-	100	-	30	
5	F Depart with climbing acceleration	-	**39**	30	**34**	DISTANCE = 500 SPEED = 65 Maintain** acceleration
6	D Departure at constant speed	-	**1,570**	**465**	-	DISTANCE = 3,500 ALTITUDE =1,000 Maintain** climb angle
7	E Depart with horizontal acceleration	-	**94**	-	**38**	DISTANCE = 2,800 SPEED = 113.4 Maintain** acceleration
8	L Level flight at constant speed	-	**11,145***	-	-	DISTANCE = 93,100
	Total track distance		**12,948***			

Notes:
* These distances are adjusted in other profiles associated with other respective ground tracks.
** Distance values are selected so that the proposed profiles maintain the same climb angle and/or acceleration rate associated the respective STANDARD profile segment. See notes to **Table 12** for further details and examples of this process.
The DURATION, DISTANCE, ALTITUDE and SPEED fields are used only by particular Step Types. Values presented here are as entered into AEDT's FLT_ANP_HELICOPTER_PROCEDURES table with the exception that entries shown as "-" are unused parameters and actually entered into the table as 0.
This proposed user-defined profile does not have any changes to the DURATION field compared to the AEDT STANDARD profile. For most step types, the actual representative segment duration can be calculated using the appropriate distance and the appropriate speed. Please see AEDT documentation for further details.

Figure 19 presents a graphical representation of the proposed profile altitude relative to the distance from the helipad (as shown in **Table 13**) compared to AEDT default "standard" profile. Steps 1 through 4 represent the start of the departure and are unchanged compared to the AEDT default profile. Steps 5, 6, and 7 are modified to represent the lower aircraft altitude and slower speed. Distances are adjusted based on the total track distances to maintain the same climb angle and/or acceleration rate compared to the AEDT default profile. Step 8 is simply shortened relative to the default profile. **Figure 20** graphs the profile's speed relative to the distance from the helipad.

Figure 21, **Figure 22**, and **Figure 23** compare the proposed departure profile's resulting SEL contour (in red) to AEDT standard profile's resulting SEL (in blue) on the three representative tracks. The three figures each display the 85 dB, 90 dB and 95 dB SEL contours associated with a single operation on the indicated track.

In general, the proposed profile is about 5 dB louder than the standard profiles during the transit. Some of this can be accounted for by the lower altitude of the proposed profile at 465 feet above field elevation (AFE) compared to the standard profile's altitude of 1,000 feet AFE. Some can be accounted for by the slower speed of the proposed profile at 38 knots compared to the standard profile's speed of 113.4 knots.

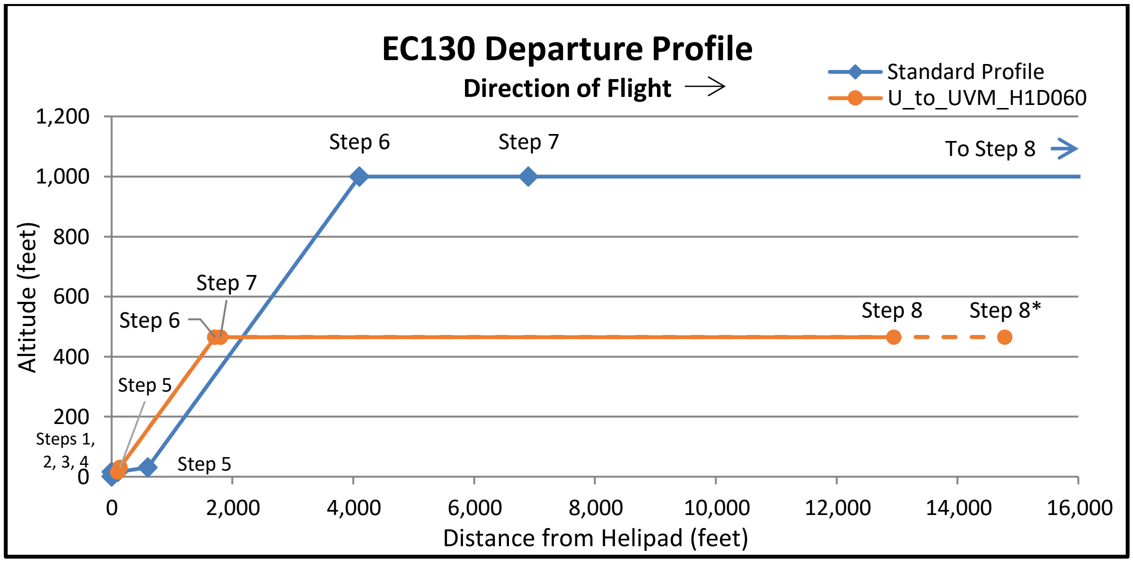

Figure 19. Comparison of EC130 AEDT Standard and Proposed Departure Altitude versus Distance Profiles

*Note: *Total distance for the longest proposed departure profile (U_to_UVM_H1D062) is 14,781 feet*

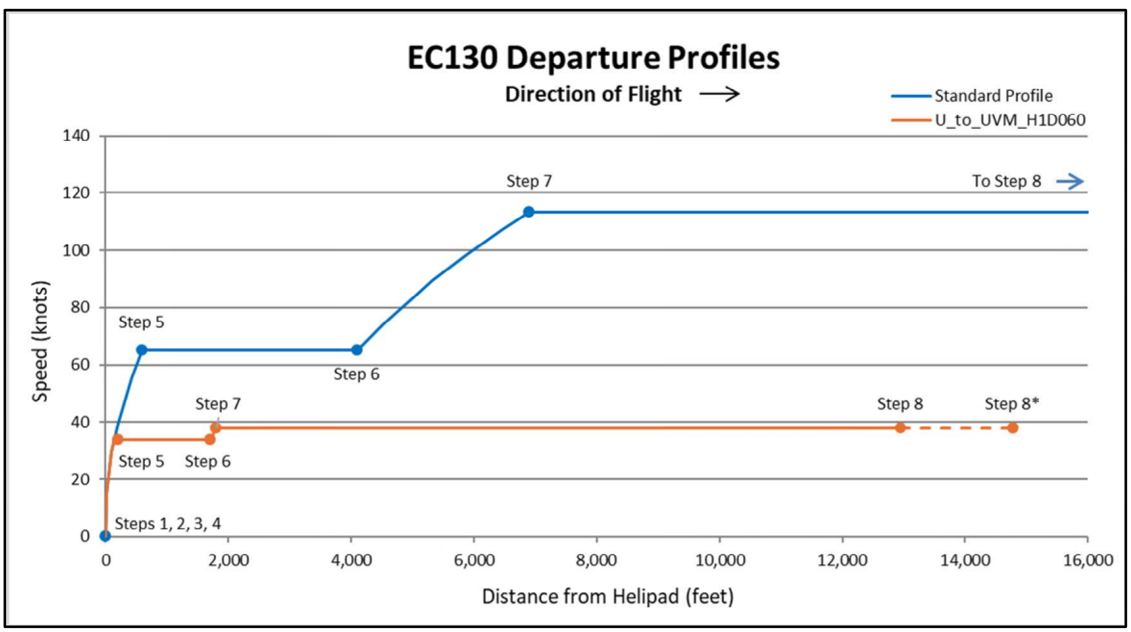

Figure 20. Comparison of EC130 AEDT Standard and Proposed Departure Speed versus Distance Profiles

*Note: *Total distance for the longest proposed departure profile (U_to_UVM_H1D062) is 14,781 feet*

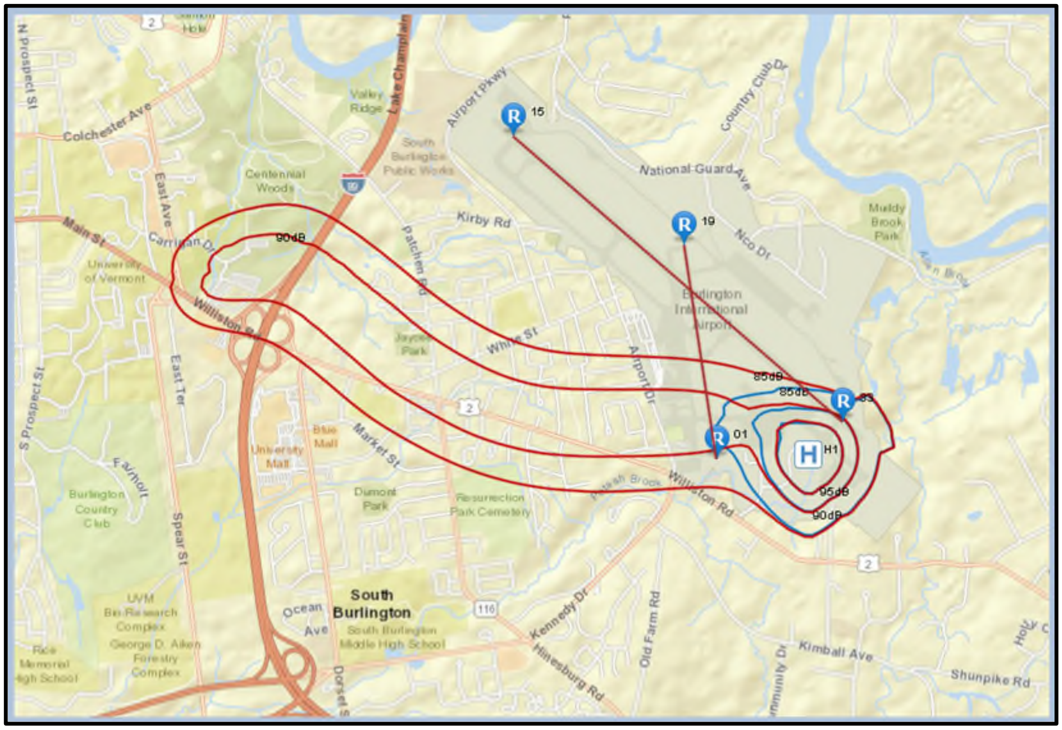

Figure 21. Comparison SEL Contours for Departure Track H1D060 from AEDT Helipad (east) to UVM (west)
H1D060 Attributes: Total distance is 12,948 feet; Step 2 distance is 11,145 feet

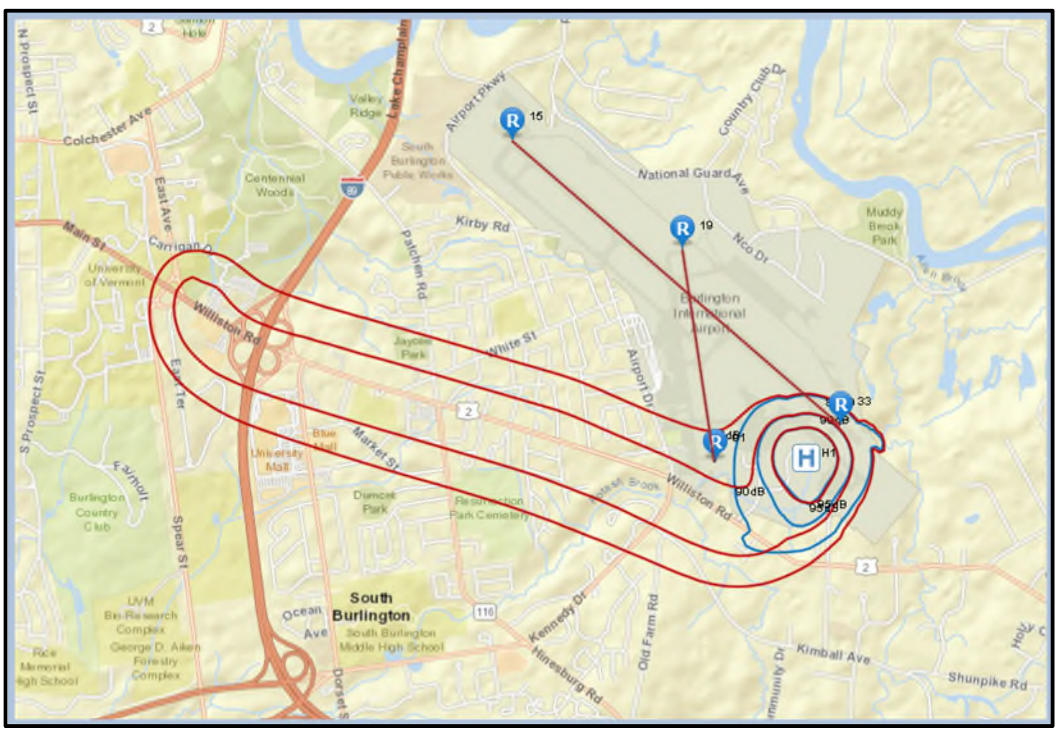

Figure 22. Comparison SEL Contours for Departure Track H1D061 from AEDT Helipad (east) to UVM (west)
H1D061 Attributes: Total distance is 14,208 feet; Step 2 distance is 12,405 feet

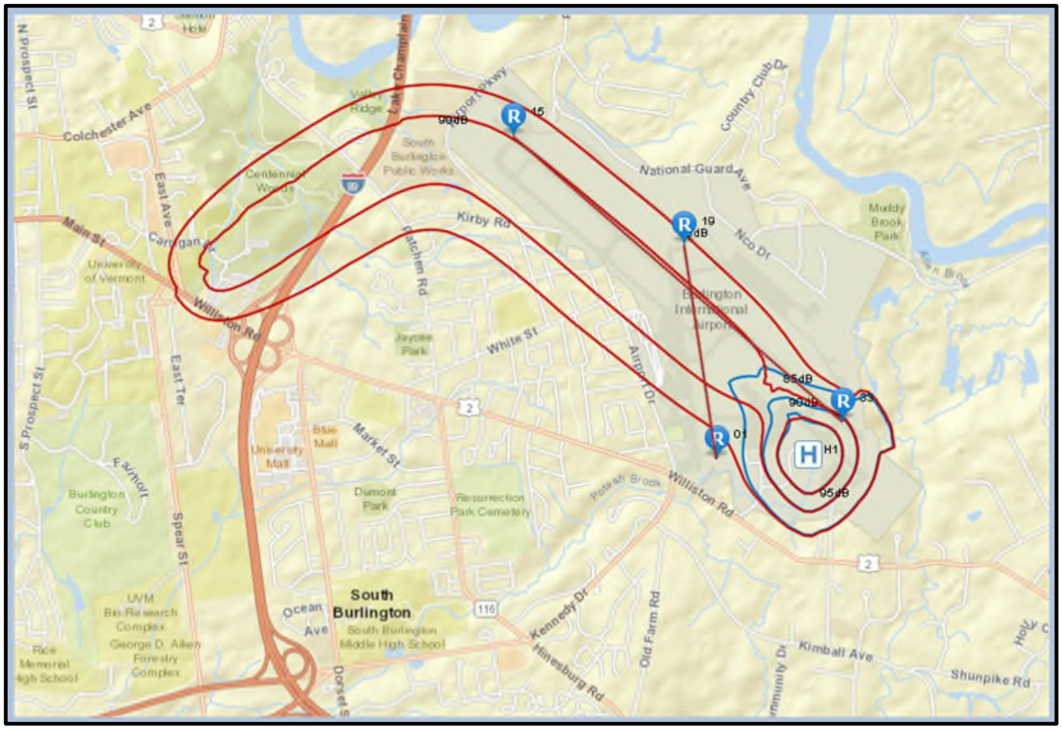

Figure 23. Comparison SEL Contours for Departure Track H1D062 from AEDT Helipad (east) to UVM (west)
H1D062 Attributes: Total distance is 14,781 feet; Step 2 distance is 12,978 feet

3.3 Discussion of Proposed EC130 Profiles with respect to Project DNL

The preceding figures presented SEL contours for individual operations. As mentioned previously, the research done so far for this project indicates that there are approximately 450 operations total between BTV and 67VT in both directions, with one-third at night. Those same operations would be approximately five equivalent average annual day operations when modeled with the DNL metric, after applying the nighttime adjustment. Therefore, at the expected level of operations, the 95 dB SEL contour would be representative of 53 dB DNL, the 90 dB SEL contour would be representative of 48 dB DNL and the 85 dB SEL contours would be representative of 43 dB DNL, absent any other aircraft activity, with the assumption that all operations fly only one of the eight tracks presented. As the figures indicate, the 95 dB SEL levels occur completely on airport property. Therefore, we do not expect the proposed profiles and associated operations by themselves to cause noticeable lobes in the overall project's 65 dB DNL contours.

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U.S. Department of Transportation
Federal Aviation Administration

Office of Environment and Energy

800 Independence Ave., S.W.
Washington, D.C. 20591

6/25/2024

Cheryl Quaine
Environmental Protection Specialist
New England Region
Federal Aviation Administration
1200 District Ave.
Burlington, MA 01803-5299

Dear Cheryl Quaine,

The Office of Environment and Energy Noise Division (AEE-100) has received the memo from HMMH dated June 12, 2024, on behalf of the City of Burlington, Vermont referencing the Title 14 CFR Part 150 Airport Noise and Land Use Compatibility Study (Part 150), Noise Exposure Map (NEM) update for the Patrick Leahy Burlington International Airport (BTV). In the memo, HMMH requested the approval of multiple non-standard AEDT aircraft and helicopter substitutions, approval of a non-standard methodology for modeling taxiway operations at BTV, and approval of a non-standard methodology to develop user-defined helicopter profiles for the modeling of Eurocopter EC-135 operations between BTV and the nearby hospital helipad at the University of Vermont Medical Center (67VT) in AEDT 3e.

Non-Standard AEDT Aircraft and Helicopter Substitutions

AEE approves the proposed substitutions for the Guimbal G2CA helicopter and Tencam SIRA, Piper PA16, Pipistrel PIVE and, Beta ALIA aircraft types as detailed in Table 1.

Table 1. Aircraft and Helicopters Not Present in the AEDT 3e Database

HMMH Proposed and FAA AEE Approved Substitutions						
Aircraft Code	Represented Aircraft	AEDT EQUIP_ID	AEDT Airframe	AEDT Engine	AEDT ANP_ID	AEDT BADA_ID
G2CA	Guimbal G-2 Cabri	4105	Robinson R22 Mariner	IO-320-D1AD	R22	P28A
SIRA	Tecnam P-Mentor (SIRA)	1904	EADS Socata TB-10 Tobago	IO-360	GASEPV	TB21
PA16	Piper 16 Clipper	6241	Aeronca 15 Sedan (FAS)	O-200	GASEPF	C172

HMMH Proposed and FAA AEE Approved Substitutions						
Aircraft Code	Represented Aircraft	AEDT EQUIP_ID	AEDT Airframe	AEDT Engine	AEDT ANP_ID	AEDT BADA_ID
PIVE	Pipistrel Velis Electro	6263	Cessna 162 (FAS)	O-200	GASEPF	C172
ALIA	Beta ALIA	1900	Spencer S-12 Air Car	TIO-540-J2B2	GASEPV	P28A

Non-Standard AEDT Taxiway Modeling Methodology

AEE approves the aircraft taxiway modeling methodology outlined in the June 12, 2024 request memo but defers to APP-400, and the New England Region ADO for a justification of need for the utilization of this methodology including the requested omission of F-35A and other military aircraft taxi noise as described in Section 2.2.

Non-Standard AEDT EC-135 User-Defined Helicopter Arrival and Departure Profiles

The standard helicopter arrival and departure profiles in AEDT 3e for the Eurocopter EC-135 do not reflect the typical cruising altitude of 465 feet above Mean Sea Level (MSL), distances, or cruise speed of 38 knots needed to reflect the profiles of helicopter operations to and from the Fixed Base Operator (FBO) helipad at BTV and hospital helipad at 67VT. Therefore, HMMH is seeking approval for adjustment of these standard helicopter profiles for the Eurocopter EC-135 to accurately reflect the typical range of cruising altitudes, distances, and speeds utilizing non-standard user-defined profiles.

The proposed revised methodology for developing non-standard user-defined helicopter profiles in AEDT 3e for the Eurocopter EC-135 between the BTV FBO helipad and 67VT helipad appear to be adequate for this analysis; therefore, AEE approves use of the methodology proposed for this project.

Please understand that these approvals are limited to this particular Part 150 NEM update for BTV and for use with AEDT 3e only. Further non-standard AEDT inputs or methodologies for additional projects at this or any other site will require separate approval.

Sincerely,

Donald Scata
Manager
AEE-100/Noise Division

cc: ARP Contacts (Susan Staehle, APP-400)

Appendix D: Model Flight Tracks (with Same Scale and Base Map as NEMs)

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PATRICK LEAHY BURLINGTON INTERNATIONAL AIRPORT

PART 150 - NOISE EXPOSURE MAP UPDATE

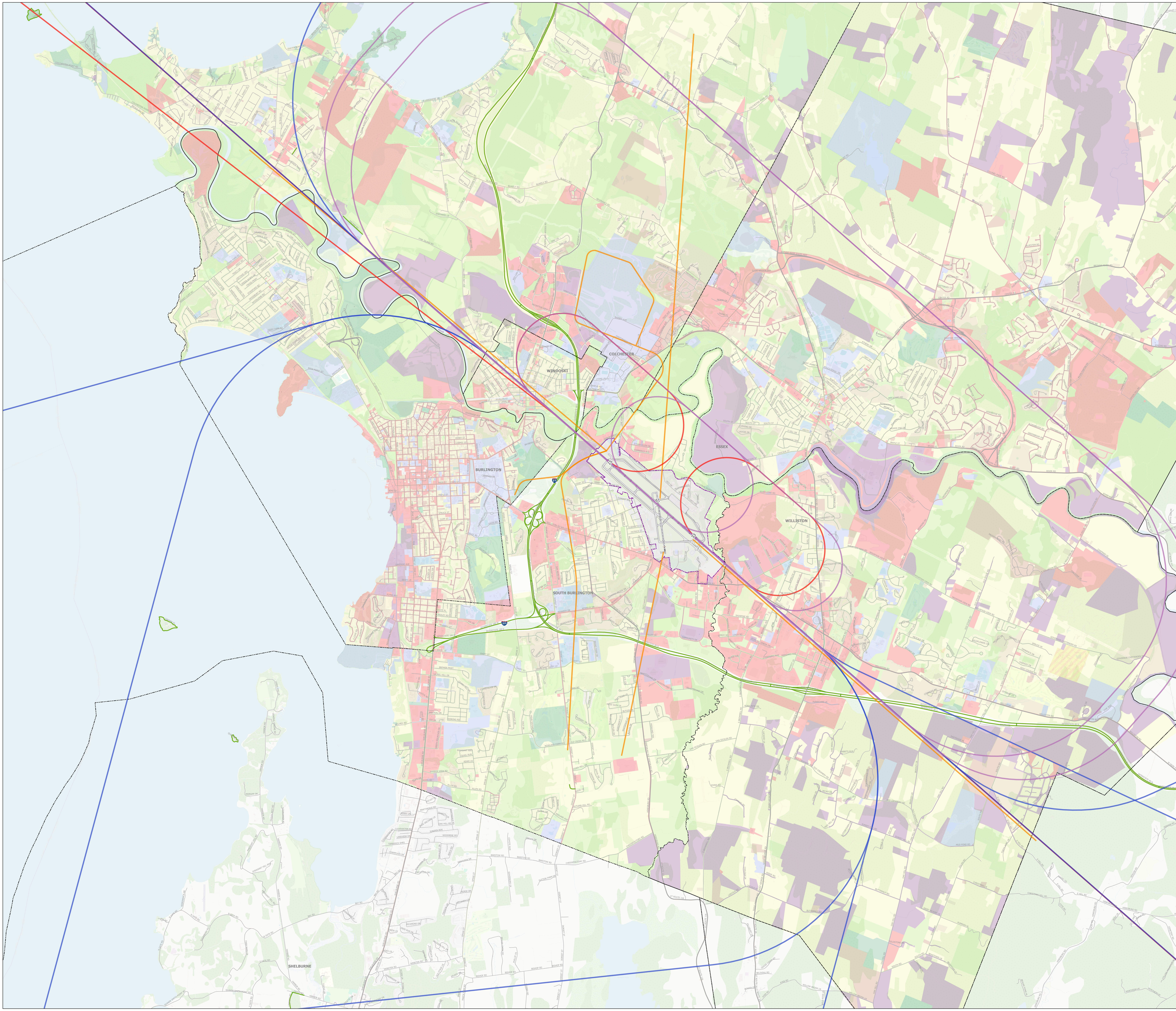
Appendix D-1
Civilian Arrivals

(1) Potentially non-compatible within 65 dB DNL contour as discussed in Section 3.4.
(2) Potentially non-compatible within 70 dB DNL contour as discussed in Section 3.4.

Data Source:
Vermont Center for Geographic Information Inc. (VCGI), United States Census Bureau, National Register of Historic Places, Burlington Internationa Airport, Harris Miller Miller & Hanson Inc.

PATRICK LEAHY
BURLINGTON
INTERNATIONAL AIRPORT
PART 150 - NOISE EXPOSURE MAP UPDATE
Appendix D-2
Civilian Departures
Model Tracks
Civilian Jet Departure Model Tracks
Civilian NonJet Departure Model Tracks
Civilian Helo Departure Model Tracks
The Jones Payne Group, Inc.
Town Boundary
Airport Property Boundary
Local Roads
Major Roads
Highways
2024 Land Use
Single Family Residential (1)
Multi Family Residential (1)
Other Residential (1)
Mixed Use (1)
Public Use (1)
Airport
Transportation (2)
Commercial (2)
Manufacturing & Production (2)
Recreational (2)
Open Space
(1) Potentially non-compatible within 65 dB DNL contour as discussed in Section 3.4.
(2) Potentially non-compatible within 70 dB DNL contour as discussed in Section 3.4.
Data Source:
Vermont Center for Geographic Information Inc. (VCGI), United States Census Bureau, National Register of Historic Places, Burlington Internationa Airport, Harris Miller Miller & Hanson Inc.
North
2,000
0
2,000
4,000 ft
WINOOSKI
COLCHESTER
ESSEX
BURLINGTON
WILLISTON
SOUTH BURLINGTON
SHELBURNE
RICHMOND


PATRICK LEAHY BURLINGTON INTERNATIONAL AIRPORT
PART 150 - NOISE EXPOSURE MAP UPDATE
Appendix D-3
Civilian Circuits
Including the helicopter tracks between BTV & UVM together with the Closed Patterns
Model Tracks
Civilian NonJet Circuit Model Tracks
Civilian Helo Circuit Model Tracks
UVM Model Tracks
Civilian Helo UVM Model Tracks
Civilian Helo UVM Model Tracks pt1
Civilian Helo UVM Model Tracks pt2
The Jones Payne Group, Inc.
Town Boundary
Airport Property Boundary
Local Roads
Major Roads
Highways
2024 Land Use
Single Family Residential (1)
Multi Family Residential (1)
Other Residential (1)
Mixed Use (1)
Public Use (1)
Airport
Transportation (2)
Commercial (2)
Manufacturing & Production (2)
Recreational (2)
Open Space
(1) Potentially non-compatible within 65 dB DNL contour as discussed in Section 3.4.
(2) Potentially non-compatible within 70 dB DNL contour as discussed in Section 3.4.
Data Source:
Vermont Center for Geographic Information Inc. (VCGI), United States Census Bureau, National Register of Historic Places, Burlington Internationa Airport, Harris Miller Miller & Hanson Inc.
North
2,000
0
2,000
4,000 ft
COLCHESTER
WINOOSKI
BURLINGTON
ESSEX
WILLISTON
SOUTH BURLINGTON
SHELBURNE
RICHMOND



PATRICK LEAHY BURLINGTON INTERNATIONAL AIRPORT

PART 150 - NOISE EXPOSURE MAP UPDATE

Appendix D-4
All Military

Model Tracks
- Military Jet Circuit Model Tracks
- Military Jet Departure Model Tracks
- Military Jet Arrival Model Tracks
- Military Helo Model Tracks

The Jones Payne Group, Inc.

- Town Boundary
- Airport Property Boundary
- Local Roads
- Major Roads
- Highways

2024 Land Use
- Single Family Residential (1)
- Multi Family Residential (1)
- Other Residential (1)
- Mixed Use (1)
- Public Use (1)
- Airport
- Transportation (2)
- Commercial (2)
- Manufacturing & Production (2)
- Recreational (2)
- Open Space

(1) Potentially non-compatible within 65 dB DNL contour as discussed in Section 3.4.
(2) Potentially non-compatible within 70 dB DNL contour as discussed in Section 3.4.

Data Source:
Vermont Center for Geographic Information Inc. (VCGI), United States Census Bureau, National Register of Historic Places, Burlington Internationa Airport, Harris Miller Miller & Hanson Inc.

North

2,000 0 2,000 4,000 ft

Appendix E: Stakeholder Consultation

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Patrick Leahy International Airport

BTV
BURLINGTON
INTERNATIONAL AIRPORT

BTV Noise Exposure Map Update
Technical Advisory Committee Meeting #1

October 12, 2023

1

Agenda

- Introductions
- Public Comment
- Part 150 Overview
- Existing Noise Exposure Map (NEM)
- Land Use Compatibility Guidelines
- Existing Noise Compatibility Program (NCP)

2

Consultant Team

THE JONES PAYNE GROUP

Diane Carter | Principal-in-Charge
Brianna Whiteman | Assistant Project Manager

Responsible for:
- Overall Project Management/Client/Agency Coordination
- Community Outreach

hmmh

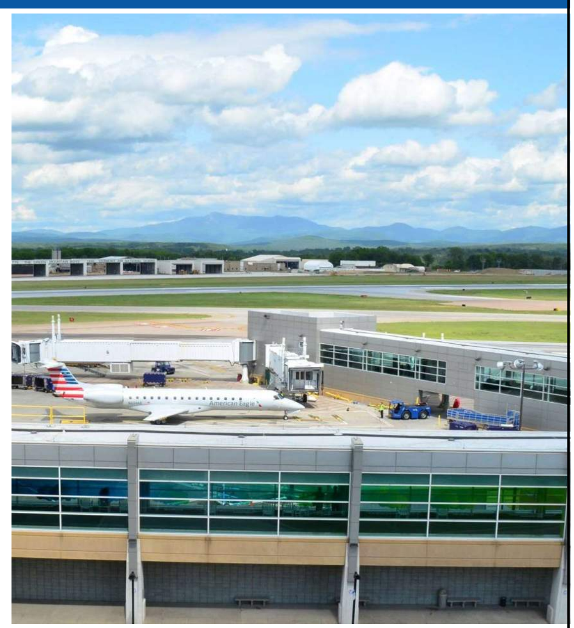
Gene Reindel | Principal-in-Charge
Kate Larson | Project Manager
Paul Krusell | Assistant Project Manager
David Crandall | Technical Advisor

Responsible for:
- Noise Modeling
- Compliance with Federal Regulations

3

TAC Membership

- **Vermont National Army Guard**
- **Burlington Airport Commission**
- **Burlington International Airport**
- **Chittenden County Regional Planning Commission (CCRPC)**
- **City of South Burlington**
- **City of Winooski**
- **Community College of Vermont**
- **FAA (Air Traffic Manager)**
- **FAA (New England Regional Office) – Advisory**
- **Heritage Aviation (FBO)**
- **South Burlington School District**
- **Town of Williston**
- **Vermont National Air Guard (VTANG)**
- **Williston School District**
- **Winooski School District**



4

Roles and Responsibilities

City of Burlington
- As airport owner and operator, the City is responsible for conducting the Noise Exposure Map (NEM) analysis and submitting the study for acceptance
- Consulting team is retained to conduct technical work and prepare documentation related to the NEM process

Federal Aviation Administration (FAA)
- Determines whether the NEM process has met Part 150 requirements and approves individual noise mitigation measures

Technical Advisory Committee (TAC)
- Provides representation for stakeholder organizations, including local jurisdictions, airlines, local business interests

5

Part 150 Overview

The Federal Aviation Administration (FAA) developed the Part 150 Program in response to the federal Aviation Safety and Noise Abatement Act of 1979 ("ASNA")
- Codified under Title 14 of the Code of Federal Regulations (CFR) Part 150
- Formal citation is "14 CFR Part 150," informal is "Part 150"
- Formal title is "Airport Noise Compatibility Planning"

Voluntary FAA-defined process for airport noise studies
- 250+ airports have participated

***Why do airports participate*? Primary reasons include:**
- Access to FAA funding of some approved measures
- Process is comprehensive, well-established, and understood

6

Part 150 Overview

Part 150 prescribes standards and systems for:

- Measuring noise
- Estimating cumulative noise exposure using computer modeling
- Describing noise exposure
- Coordinating with local land use agencies
- Documenting the analytical process
- Submitting the documentation to FAA
- FAA and public review processes
- FAA approval or disapproval process

7

Part 150 Overview

Consultation required with:

- All local, state, and federal entities with control over land use
- FAA regional officials
- Regular aeronautical users of the airport
- All parties interested in reviewing and commenting on the draft reports

Two primary elements:

- Noise Exposure Map (NEM)
  - ***Focus of this study***
- Noise Compatibility Program (NCP)
  - Current NCP approved in 2020
  - ***Not updating currently***

Detailed FAA guidance at:
www.faa.gov/airports/environmental/airport_noise/

8

Part 150 NEM Overview

FAA "accepts" NEM as compliant with Part 150 standards
NEM must include detailed description of:

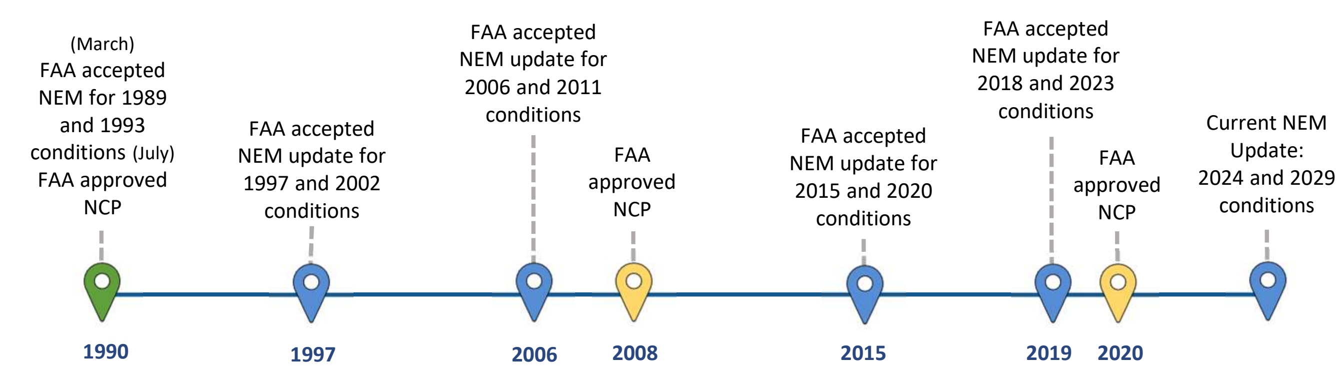
- Airport layout, aircraft operations, and other inputs to noise model
- Aircraft noise exposure in terms of Day-Night Average Sound Level (DNL)
- Land use compatibility assessment

NEM must address two calendar years

- Year of submission
- Forecast (at least five years from year of submission)

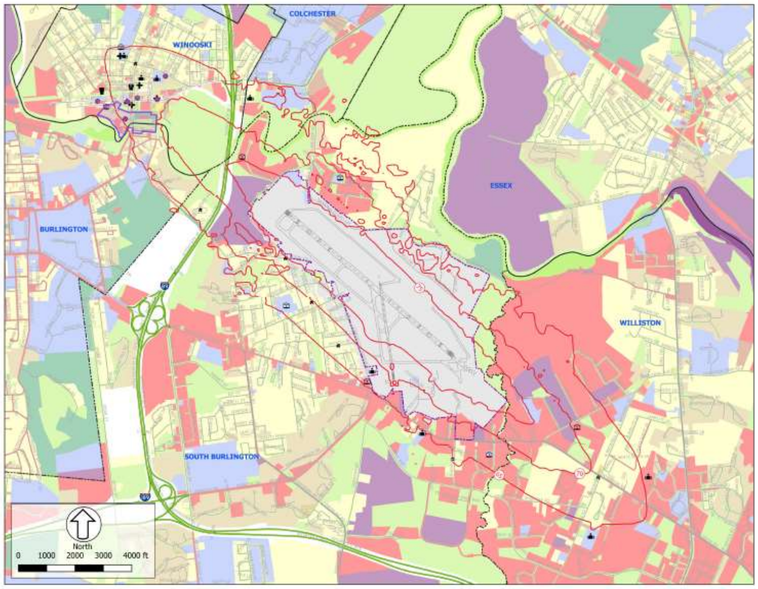
9

Prior BTV NEM Efforts



10

EXISTING 2023 BTV NEM



Estimated Residential Population for 2018 and 2023 Contours

Day-Night Average Sound Level (DNL) Contour Interval	Estimated Dwelling Units and Population	Burlington 2018	Burlington 2023	Colchester 2018	Colchester 2023	Essex 2018	Essex 2023	South Burlington 2018	South Burlington 2023	Williston 2018	Williston 2023	Winooski 2018	Winooski 2023	Total 2018	Total 2023
Single Family Parcels															
65-70 dB	Dwelling Units	-	51	-	9	-	-	126	356	-	105	-	260	126	781
	Population	-	118	-	21	-	-	292	826	-	244	-	603	292	1,812
70-75 dB	Dwelling Units	-	-	-	-	-	-	8	96	-	1	-	-	8	97
	Population	-	-	-	-	-	-	19	223	-	2	-	-	19	225
75 dB +	Dwelling Units	-	-	-	-	-	-	-	12	-	-	-	-	-	12
	Population	-	-	-	-	-	-	-	28	-	-	-	-	-	28
Total 65 dB +	Dwelling Units	-	51	-	9	-	-	134	464	-	106	-	260	134	890
	Population	-	118	-	21	-	-	311	1,076	-	246	-	603	311	2,065
Multi-Family & Mixed Use Parcels															
65-70 dB	Dwelling Units	-	209	-	13	-	-	30	344 [1]	-	4	-	993 [2]	30	1,563
	Population	-	485	-	30	-	-	70	798 [1]	-	9	-	2,304 [2]	70	3,626
70-75 dB	Dwelling Units	-	81 [3]	-	-	-	-	-	14	-	2	-	89 [4,5]	-	186
	Population	-	188 [3]	-	-	-	-	-	32	-	5	-	206 [4,5]	-	432
75 dB +	Dwelling Units	-	-	-	-	-	-	-	1	-	-	-	-	-	1
	Population	-	-	-	-	-	-	-	2	-	-	-	-	-	2
Total 65 dB +	Dwelling Units	-	290	-	13	-	-	30	359	-	6	-	1,082	30	1,750
	Population	-	673	-	30	-	-	70	833	-	14	-	2,510	70	4,060
Estimated Totals - All Parcel Types															
65-70 dB	Dwelling Units	-	260	-	22	-	-	156	700	-	109	-	1,253	156	2,344
	Population	-	603	-	51	-	-	362	1,624	-	253	-	2,907	362	5,438
70-75 dB	Dwelling Units	-	81	-	-	-	-	8	110	-	3	-	89	8	283
	Population	-	188	-	-	-	-	19	255	-	7	-	206	19	657
75 dB +	Dwelling Units	-	-	-	-	-	-	-	13	-	-	-	-	-	13
	Population	-	-	-	-	-	-	-	30	-	-	-	-	-	30
Total 65 dB +	Dwelling Units	-	341	-	22	-	-	164	823	-	112	-	1,342	164	2,640
	Population	-	791	-	51	-	-	380	1,909	-	260	-	3,113	380	6,125

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Land Use Compatibility Guidelines

Land Use	DNL <65 dB	DNL 65-70 dB	DNL 70-75 dB	DNL > 75 dB
Residential	Compatible	Incompatible (1)	Incompatible (1)	Incompatible
Mobile home park	Compatible	Incompatible	Incompatible	Incompatible
Transient lodgings	Compatible	Incompatible (2)	Incompatible (2)	Incompatible (2)
Schools	Compatible	Incompatible (3)	Incompatible (3)	Incompatible
Hospitals and nursing homes	Compatible	25(4)	30(4)	Incompatible
Churches, auditoriums and concert halls	Compatible	25(4)	30(4)	Incompatible

(1) Measures are required to achieve 25 to 30 dB of noise level reduction for aircraft noise from outside to inside.
(2)"Transient lodgings" include, but are not limited to, hotels and motels.
(3)Measures are required to achieve 25 to 30 dB of noise level reduction for aircraft noise from outside to inside.
(4) The measures to achieve NLR of 25 or 30 dB must be incorporated into design and construction of structure.

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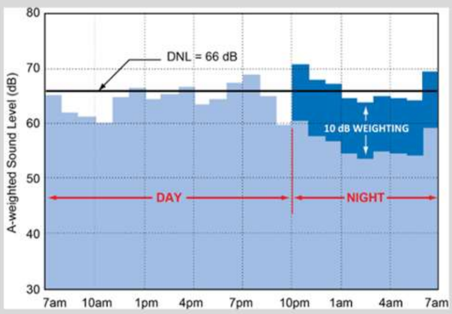
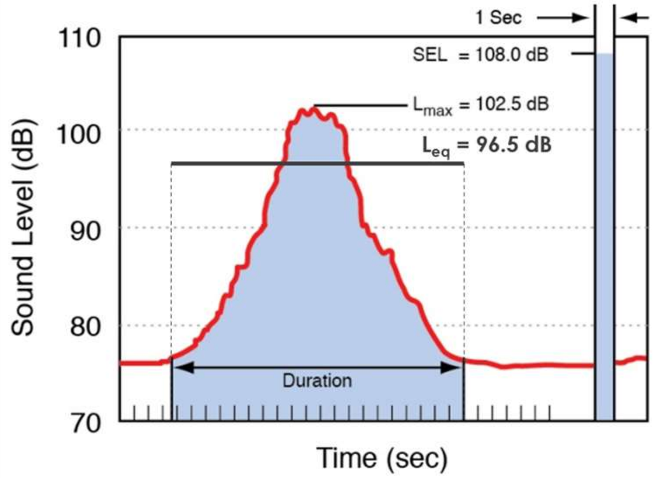
Noise Metrics

- Maximum Noise Level (L_{max})
- Sound Exposure Level (SEL)
- Equivalent Sound Level (L_{eq})
- Hourly Noise Level (HNL or L_{eq1h})
- Day Night Average Sound Level (DNL)





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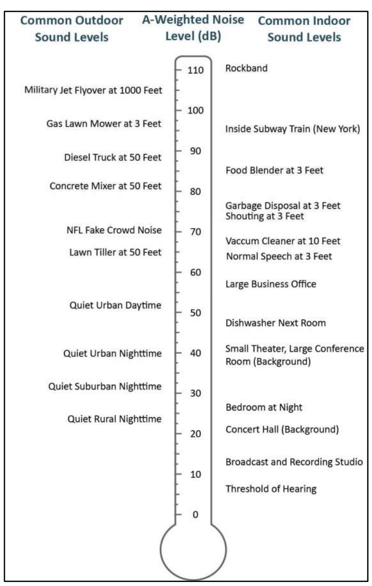
Noise Terminology

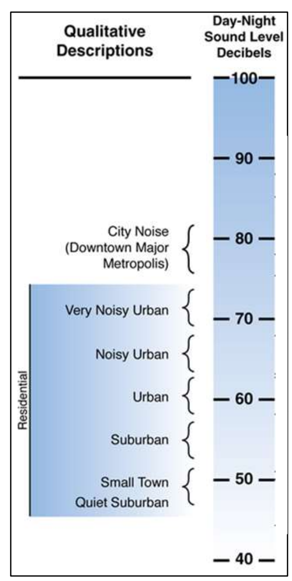


A-weighted decibel

- Reflects how we hear different pitches of sound in our normal environment
- Federal agencies have adopted use of A-weighted sound levels for environmental studies

Day–Night Average Sound Level (DNL or Ldn)

- 24-hour cumulative sound level
- Applies a 10-fold weighting to nighttime noise (from 10pm to 7am) as humans perceive sound levels at night being twice as loud as the same sound level during the day
- Part 150 requires use of DNL for land use compatibility assessments



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Noise Modeling Overview

- FAA requires use of their Aviation Environmental Design Tool (AEDT) for civilian aircraft operations
  - Version 3e is the most current version (at study's commencement)
  - https://aedt.faa.gov
- Military aircraft operations will be modeled with the Department of Defense noise model, NOISEMAP
- Military noise model results will be combined with AEDT results of the civilian aircraft operations

AEDT requires noise model input data in three categories:

1 Aircraft Noise and Performance Data

- Aircraft performance profiles
- Noise level vs. distance curves

2 Airport Physical Inputs

- Runway end coordinates
- Ground engine runup locations
- Weather data
- Terrain data

3 Aircraft Operational Inputs

- Number of aircraft operations
- Aircraft fleet mix
- Day-night split of operations
- Runway utilization
- Flight track geometry and utilization

15

NEM Update Process Summary

1. Collect data and information
2. Develop five-year forecast of aircraft operations
3. Prepare noise model inputs
4. Run the noise model and assess land use compatibility
5. Prepare draft Noise Exposure Map (NEM) documentation
6. Publish NEM documentation for public review and hold public workshop
7. Submit NEM to the FAA for review and acceptance

16

Existing BTV NCP

Airport Operations Measures
- Monitoring and Review of NEM and NCP Status
- Noise and Flight Track Monitoring

Land Use Measures:
- Land Acquisition & Relocation
- Sound Insulation of Residences
- Sound Insulation of Noise Sensitive Structures
- Purchase Assurance
- Sales Assistance

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NEM Project Schedule

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TAC Preliminary Topics and Schedule

TAC Meeting 2 — Thursday, November 30, 2023
- Forecasts, Military Operations, Noise Model Inputs

TAC Meeting 3 — Thursday, January 18, 2024
- Noise Compatibility Program Review

TAC Meeting 4 — Thursday, April 11, 2024
- Noise Modeling Results – Presentation of the Noise Exposure Maps

BW0

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TAC MEMBER DISCUSSION

Place holder for graphic

20

Patrick Leahy International Airport

BTV
PATRICK LEAHY
BURLINGTON
INTERNATIONAL AIRPORT

BTV Noise Exposure Map Update
Technical Advisory Committee Meeting #2

November 30, 2023

jp | hmmh

1

Agenda

- Introductions and Study Roles
- Part 150 Overview
- Noise Modeling Overview
- Proposed Noise Model Inputs
- Wrap up & Discussion

2

Consultant Team

THE JONES PAYNE GROUP

Diane Carter | Principal-in-Charge
Brianna Whiteman | Assistant Project Manager

Responsible for:
- Overall Project Management/Client/Agency Coordination
- Community Outreach

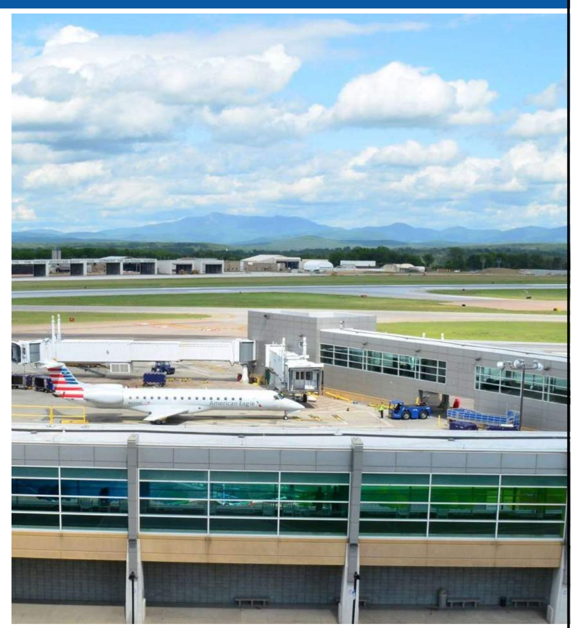
Gene Reindel | Principal-in-Charge
Kate Larson | Project Manager
Paul Krusell | Assistant Project Manager
David Crandall | Technical Advisor

Responsible for:
- Noise Modeling
- Compliance with Federal Regulations

3

TAC Membership

- **Vermont National Army Guard**
- **Burlington Airport Commission**
- **Burlington International Airport**
- **Chittenden County Regional Planning Commission (CCRPC)**
- **City of South Burlington**
- **City of Winooski**
- **Community College of Vermont**
- **FAA (Air Traffic Manager)**
- **FAA (New England Regional Office) – Advisory**
- **Heritage Aviation (FBO)**
- **South Burlington School District**
- **Town of Williston**
- **Vermont National Air Guard (VTANG)**
- **Williston School District**
- **Winooski School District**



4

Roles and Responsibilities

City of Burlington
- As airport owner and operator, the City is responsible for conducting the Noise Exposure Map (NEM) analysis and submitting the study for acceptance
- Consulting team is retained to conduct technical work and prepare documentation related to the NEM process

Federal Aviation Administration (FAA)
- Determines whether the NEM process has met Part 150 requirements and approves individual noise mitigation measures

Technical Advisory Committee (TAC)
- Provides representation for stakeholder organizations, including local jurisdictions, airlines, local business interests

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Part 150 NEM Overview

FAA "accepts" NEM as compliant with Part 150 standards
NEM must include detailed description of:
- Airport layout, aircraft operations, and other inputs to noise model
- Aircraft noise exposure in terms of Day-Night Average Sound Level (DNL)
- Land use compatibility assessment

NEM must address two calendar years
- Year of submission
- Forecast (at least five years from year of submission)

6

Noise Modeling Overview

- FAA requires use of their Aviation Environmental Design Tool (AEDT) for civilian aircraft operations
  - Version 3e is the most current version (at study's commencement)
  - https://aedt.faa.gov
- Military aircraft operations will be modeled with the Department of Defense noise model, NOISEMAP Version 7.3
- Military noise model results will be combined with AEDT results of the civilian aircraft operations

AEDT requires noise model input data in three categories:

1 Aircraft Noise and Performance Data
- Aircraft performance profiles
- Noise level vs. distance curves

2 Airport Physical Inputs
- Runway end coordinates
- Ground engine runup locations
- Weather data
- Terrain data

3 Aircraft Operational Inputs
- Number of aircraft operations
- Aircraft fleet mix
- Day-night split of operations
- Runway utilization
- Flight track geometry and utilization

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Proposed Noise Modeling Inputs

All materials presented on the following slides are draft and subject to:
- *TAC review*
- *Airport review, approval and/or change*
- *FAA review and approval.*

Model Input Category	Typical Data Source
Airport Layout	FAA 5010 data and airport
Aircraft noise and performance	Standard AEDT database, pilot interviews (NOISEMAP)
Aircraft operations	FAA ATADS, airport forecasts, FAA TAF, BTV NOMS, operator interviews
Aircraft runup operations	Airport staff/log
Runway use rates	BTV NOMS, ATCT personnel, Airport staff
Flight track geometry and use rates	BTV NOMS, ATCT personnel, observations
Meteorological conditions	Standard AEDT database
Terrain data	USGS National Map Viewer, National Land Cover Database

Note: "BTV NOMS" is the noise and operations monitoring system currently installed at BTV.

ATADS = Air Traffic Activity Data System

ATCT = Air Traffic Control Tower

NOMS = Noise and Operations Monitoring System

TAF = Terminal Area Forecast

USGS = United States Geological Survey

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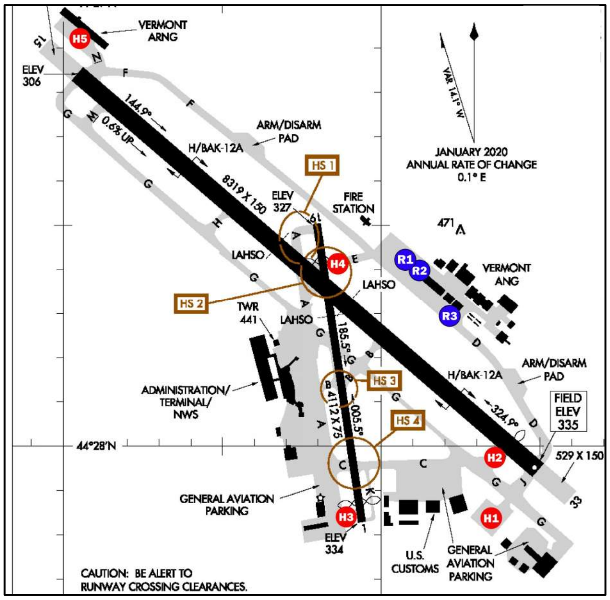
Physical Input Requirements



Sources: FAA 5010 and BTV staff

Airport layout

Runways:
- Runway 15/33 – primary
- Runway 1/19 – crosswind

Helipads:
- Civilian helipads at H1 and H3
- VTARNG uses 4 locations as helipads
  - H2, H3, H4 (taxiways E, C, and L)
  - H5 (VTARNG ramp)

Runups:
- Marked R1, R2, R3

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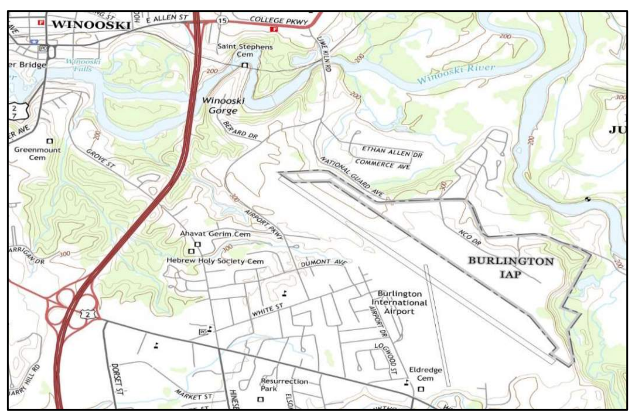
Physical Input Requirements

Airport elevation & surrounding terrain
- Data obtained from the United States Geological Survey (USGS) National Elevation Dataset

Airport weather
- The AEDT database includes recent 10-year averages:
  - Temperature* – 47.0°F
  - Station pressure* – 1002.6 mb
  - Relative humidity* – 65.9%
  - Dew point – 36.2°F
  - Wind speed – 6.7 knots
- *Applied to NOISEMAP modeling



Source: USGS; Nov 2023

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Operational Input Requirements

Annual-Average Day Operations
Existing year 2024
Forecast year 2029
Aircraft Type
Jet, Turboprop, Helicopter, Piston
AEDT or NOISEMAP Equipment Type
EMB175, CNA172, F-35A, etc.
for access to standard AEDT noise and performance database

Day-Night Split
Day: 7 AM – 10 PM
Night: 10 PM – 7 AM
Stage length
Surrogate for aircraft weight; determined by distance from departure to destination airport

Year	Air Carrier	Air Taxi	General Aviation	Military	Total
2024	15,419	6,983	87,015	5,312	114,729
2029	16,814	7,384	89,327	5,292	118,817

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Noise Modeling Process: Baseline Data Analysis

Commercial and General Aviation Operations

Based on 18 months of flight track and aircraft identification data:
January 1, 2022 through June 30, 2023

- Adjusted annual-average aircraft operations to the FAA tower counts:
  - Calculated additional nighttime operations not accounted for in the tower counts due to tower closures from midnight to 5:30 am daily
- Determined the following for each FAA category (Air Carrier, Air Taxi and GA):
  - Day-night split of operations
  - Fleet mix
- Determined the following for each aircraft type group (jets, non-jets and helicopters):
  - Model flight tracks and annual flight track use
  - Annual runway use

Data sources include: FAA ATADS, BTV NOMS, and operator interviews

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Noise Modeling Process: Baseline Data Analysis

Military Operations

Obtained from discussions with VTANG and VTARNG

- Three predominant military operators:
  - 158th Fighter Wing (VTANG): F-35A jet aircraft
  - 103rd Air Wing (VTARNG): HH-60M and UH-72 helicopters
  - Transient operators: fighter jets, freighter/tanker aircraft
- Numbers of arrival, departure, and closed pattern operations
- Flight profiles for each type of flight operation
- Runway usage
  (based on historical data)
- Flight track geometry
  (based on current operating procedures)

image source: https://www.dvidshub.net/image/6168204/vtang-maintains-f-35-readiness-during-covid-19-pandemic

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Noise Modeling Process: Input Data

Preparation of Existing (2024) and Forecast (2029) Conditions

- Commercial and general aviation operations prepared through:
  - Scaling baseline aircraft operations and updating aircraft fleet
    - Publicly available information; announce airline service changes
    - Interviews with airport tenants
  - Applying growth rates from FAA's Terminal Area Forecast (TAF)
  - Assuming no changes to flight tracks, flight track use and runway use
- Military operations obtained from VTANG and VTARNG:
  - Assuming no changes to flight tracks, flight track use and runway use

Baseline data	2024					2029

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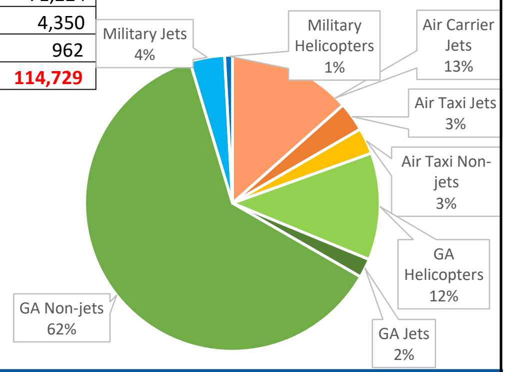
2024 Annual Aircraft Operations

2024 Existing Conditions		Arrivals		Departures		Closed Patterns		Total
Category	**Type**	**Day**	**Night**	**Day**	**Night**	**Day**	**Night**	**Operations**
Air Carrier	Jets	5,134	2,575	5,015	2,695	-	-	15,419
Air Taxi	Jets	1,711	137	1,750	98	-	-	3,696
	Non-jets	1,491	152	1,576	68	-	-	3,287
GA	Helicopters	2,452	205	2,435	221	7,907	189	13,409
	Jets	1,120	47	1,086	81	39	9	2,382
	Non-jets	16,793	262	16,543	512	35,990	1,125	71,224
Military	Jets*	2,145	-	2,145	-	60	-	4,350
	Helicopters	450	31	443	38	-	-	962
Totals		**31,296**	**3,410**	**30,992**	**3,713**	**43,996**	**1,322**	**114,729**

** Includes a small number of transient non-jet military aircraft*



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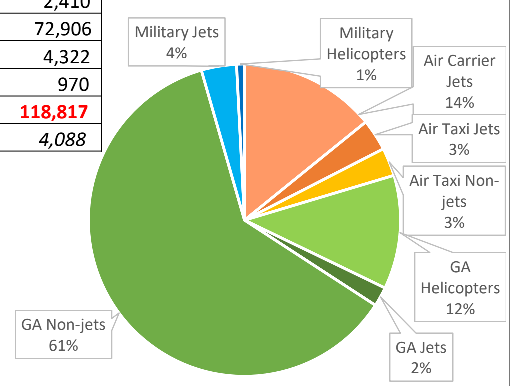
2029 Annual Aircraft Operations

2029 Forecast Conditions		Arrivals		Departures		Closed Patterns		Total
Category	**Type**	**Day**	**Night**	**Day**	**Night**	**Day**	**Night**	**Operations**
Air Carrier	Jets	5,823	2,584	5,682	2,725	-	-	16,814
Air Taxi	Jets	1,817	137	1,856	98	-	-	3,908
	Non-jets	1,586	152	1,670	68			3,476
GA	Helicopters	2,552	205	2,536	221	8,300	198	14,011
	Jets	1,134	47	1,100	81	39	9	2,410
	Non-jets*	17,182	262	17,233	512	36,570	1,148	72,906
Military	Jets **	2,131	-	2,131	-	60	-	4,322
	Helicopters	450	35	450	35	-	-	970
Totals		**32,675**	**3,422**	**32,656**	**3,741**	**44,969**	**1,354**	**118,817**
Increase from 2024		*1,379*	*12*	*1,664*	*28*	*973*	*32*	*4,088*

** Includes newly manufactured Beta electric aircraft*
*** Includes a small number of transient non-jet military aircraft*



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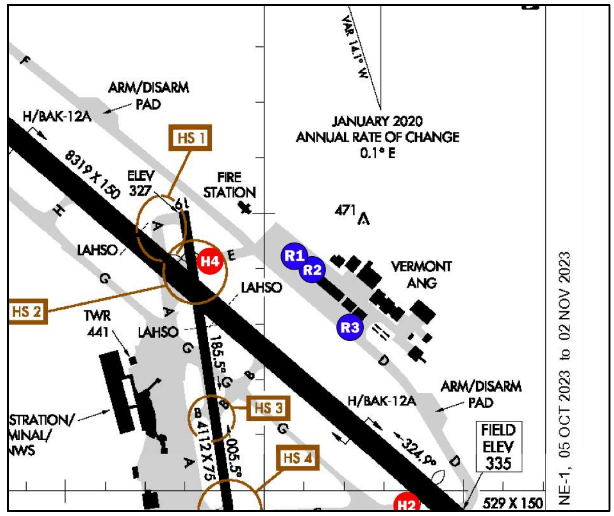
Additional Modeled Aircraft Operations

Engine Runups

Military runups on ANG Apron (restricted area)

Aircraft Type	% of Full Power	Minutes/ year	Location	Aircraft Heading	% of Time at Location
F-35A	10%	3,888	R1	192°	33%
			R2	192°	33%
			R3	90°	34%
	31%	100	R1	192°	33%
			R2	192°	33%
			R3	90°	34%



Sources: FAA 5010 and VTANG staff

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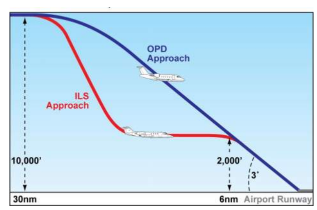
Flight Profiles

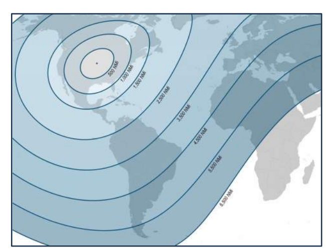
Arrivals

- AEDT database has standard arrival profiles
- NOISEMAP military aircraft flight profiles refined with VTANG input



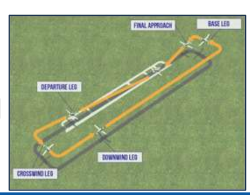
Departures

- AEDT database has departure profiles by stage length (a surrogate for weight)
  - Stage lengths determined from data city pairs; many small aircraft have a single departure profile
- NOISEMAP military aircraft flight profiles refined with VTANG/VTARNG input



Closed Pattern profiles

- Pattern width, length, and altitude derived from flight track data and VTANG input



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Runway Use

Runway Use

Time of Day	Day				Night			
Runway End	15	33	1	19	15	33	1	19
Arrivals								
Non-military Jets	53%	47%	0%	0%	61%	39%	0%	0%
Non-Jets	26%	33%	16%	25%	52%	28%	9%	10%
Military Fighters	73%	27%	0%	0%	73%	27%	0%	0%
Departures								
Non-military Jets	50%	50%	0%	0%	64%	36%	0%	0%
Non-Jets	21%	28%	18%	33%	25%	31%	19%	25%
Military Fighters	73%	27%	0%	0%	73%	27%	0%	0%
Closed Patterns								
Non-Jets	11%	25%	20%	43%	19%	24%	16%	41%

Sources: BTV NOMS, ATCT and BTV staff

Runway 15/33 – primary
- Handles all jet traffic

Runway 1/19 – crosswind
- Used only by GA propellor aircraft

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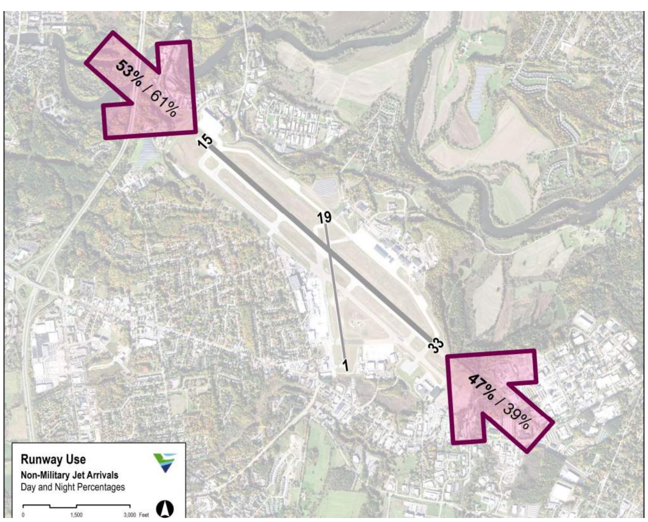
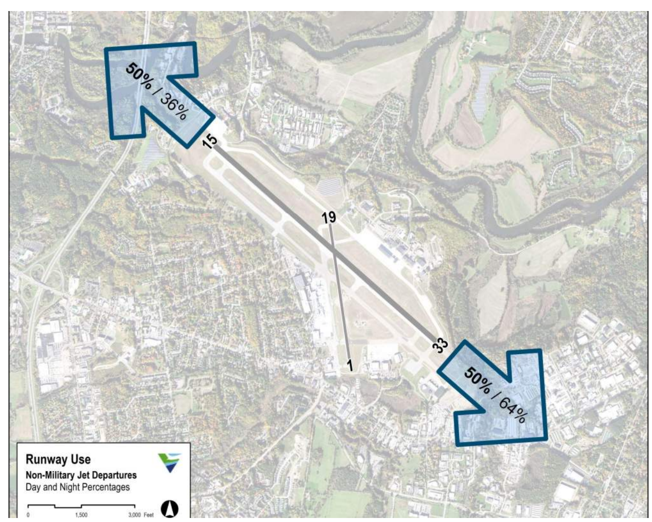
Commercial Jet Runway Use



Arrivals (day% / night%)



Departures (day% / night%)

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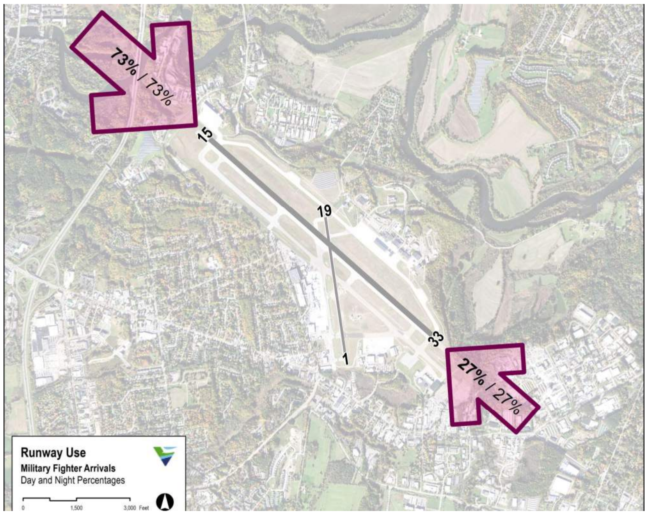
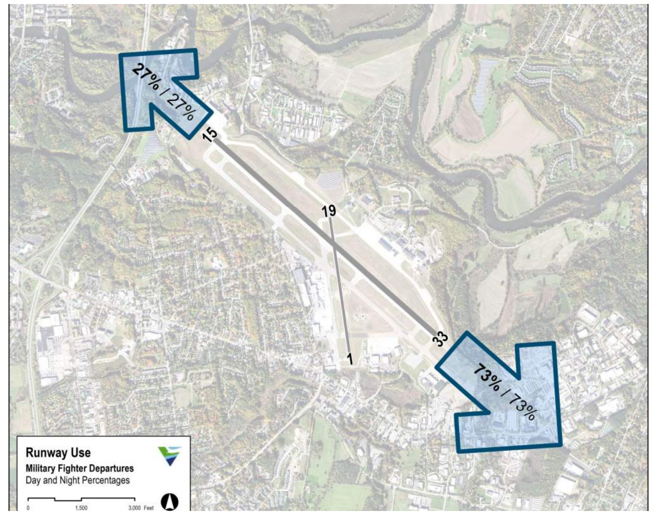
Military Jet Runway Use



Arrivals (day% / night%)



Departures (day% / night%)

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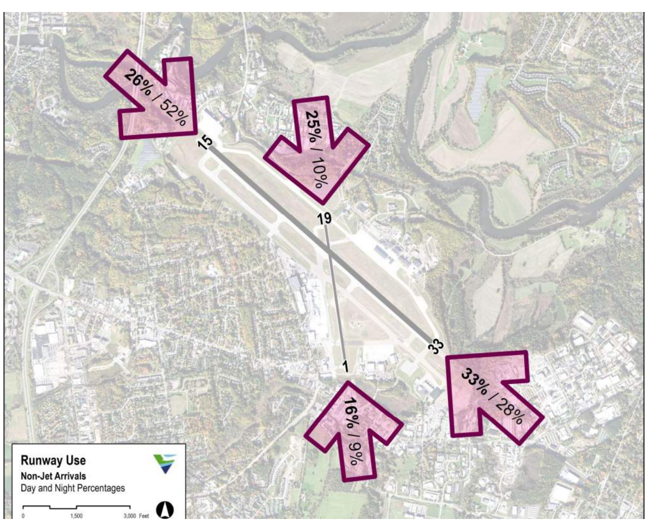
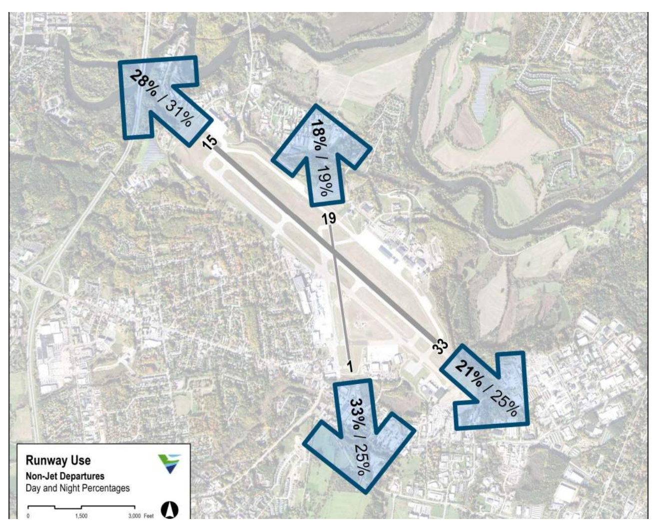
Non-Jet Runway Use



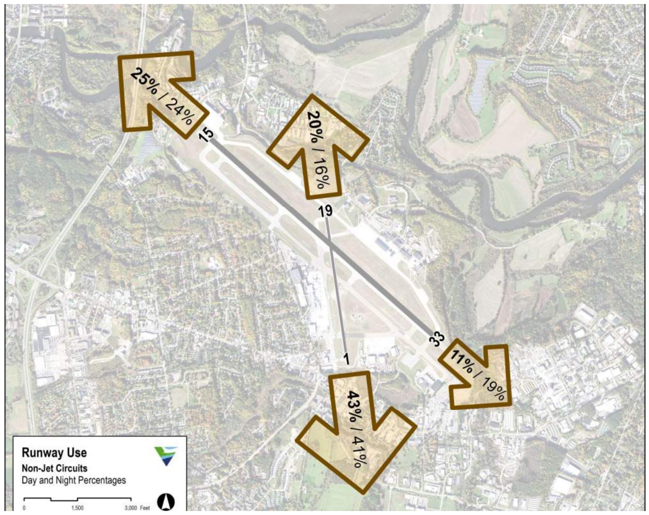
Arrivals (day% / night%)



Departures (day% / night%)

22

Non-Jet Runway Use



Closed Patterns (day% / night%)

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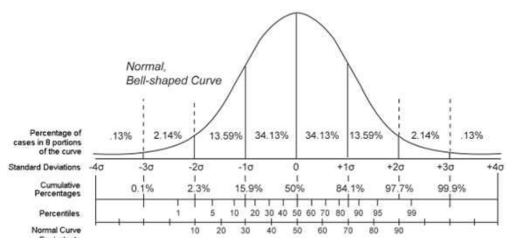
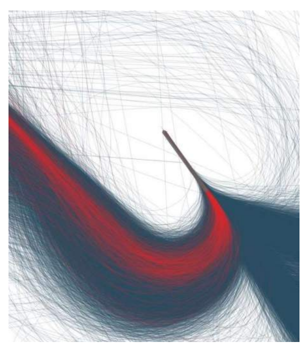
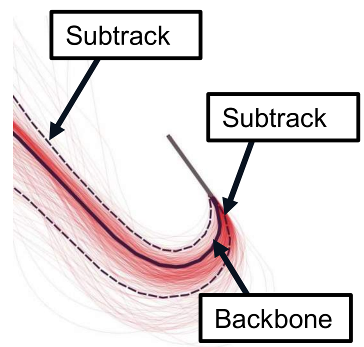
Development of AEDT Model Flight Tracks







- "Backbone tracks" represent statistical center of a distinct flight path corridor (122)
- "Subtracks" represent flight dispersion across the flight path corridors (390)

	Arrivals		Departures		Circuits	
Runway	Backbones	Subtracks	Backbones	Subtracks	Backbones	Subtracks
01	9	24	7	22	2	4
15	13	52	17	64	2	0
19	10	28	8	28	2	6
33	16	46	16	68	2	4
H1	6	14	12	30	0	0
Total	**54**	**164**	**60**	**212**	**8**	**14**

Sources: BTV NOMS, HMMH analysis

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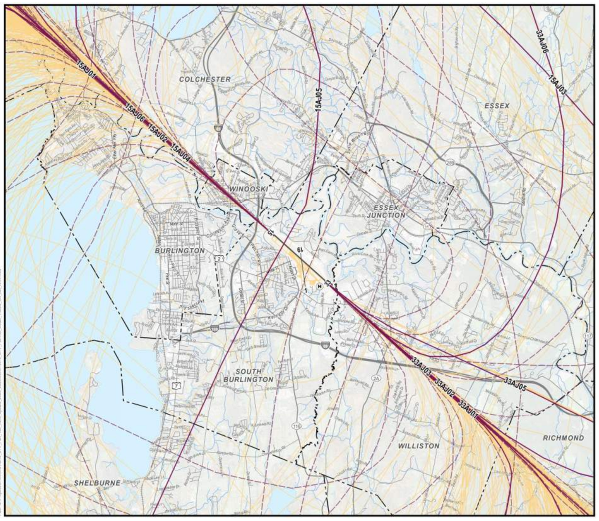
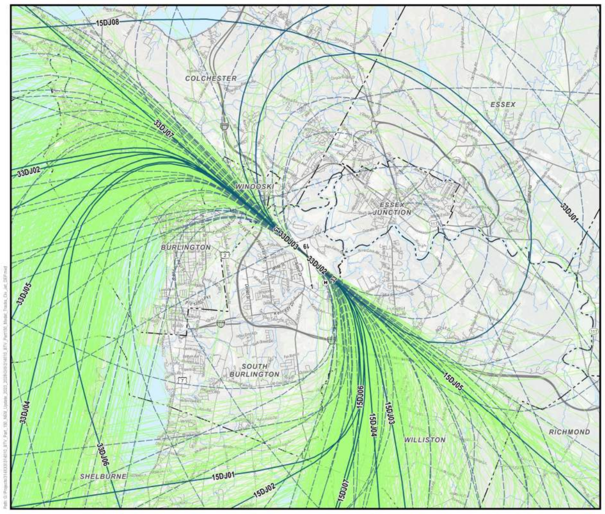
Flight Tracks: Commercial Jet Arrivals & Departures



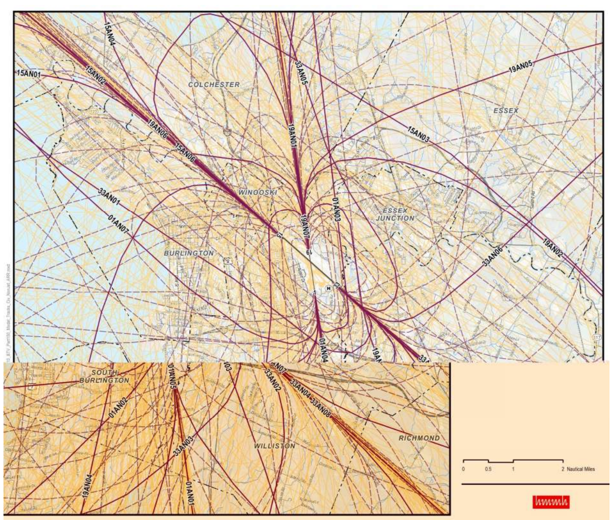
Arrivals



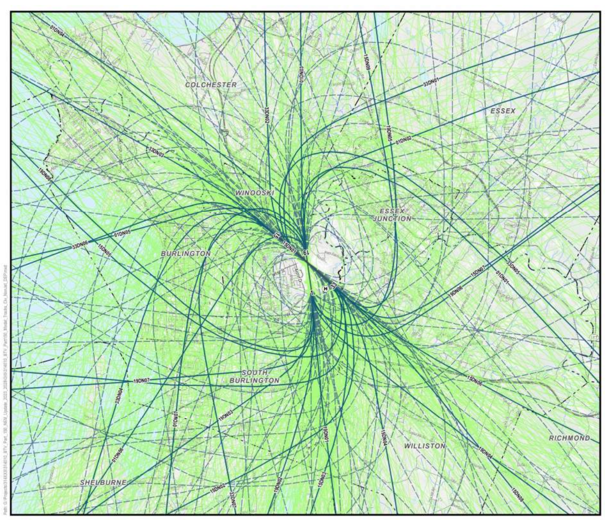
Departures

25

Flight Tracks: Commercial Non-Jet Arrivals & Departures



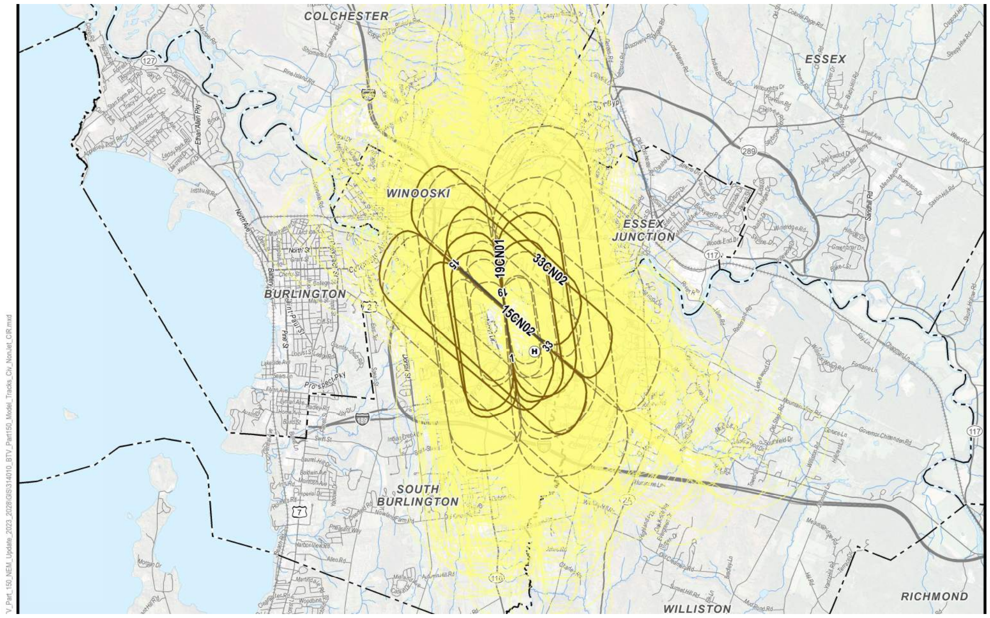
Arrivals



Departures

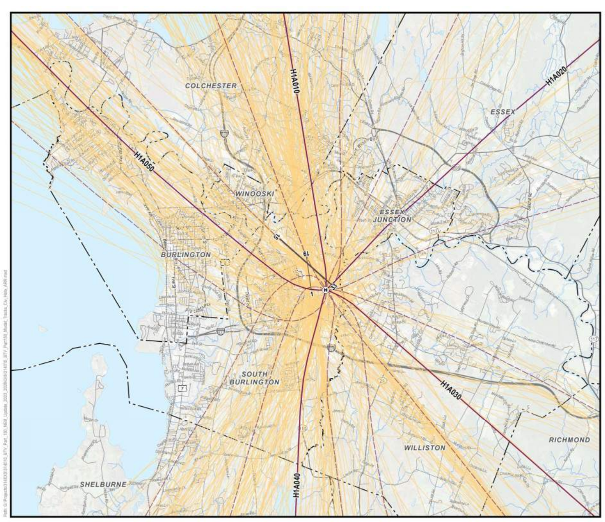
26

Flight Tracks: General Aviation Closed Patterns

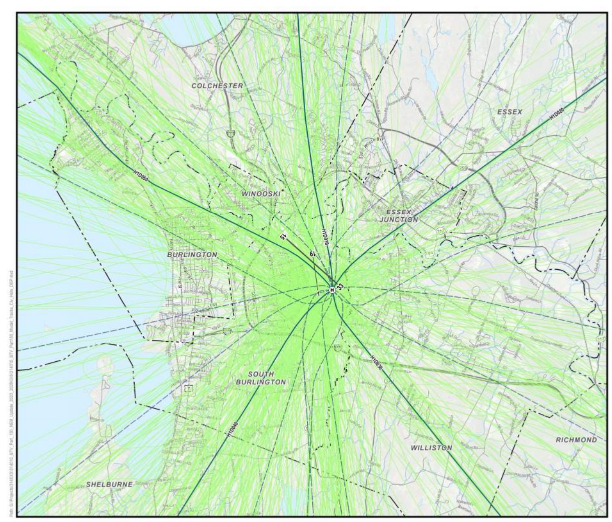


27

Flight Tracks: Helicopter Arrivals & Departures



Arrivals



Departures

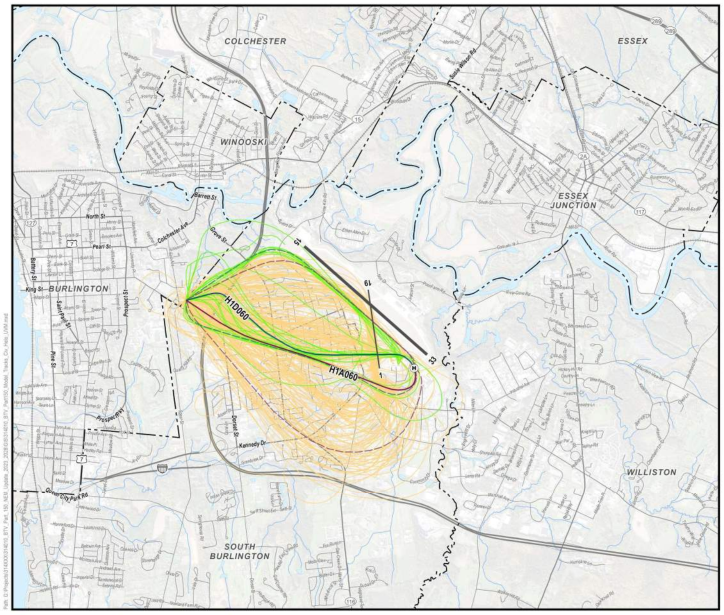
28

Flight Tracks: Helicopter Short Hops

Helicopter flights between BTV and UVM medical center

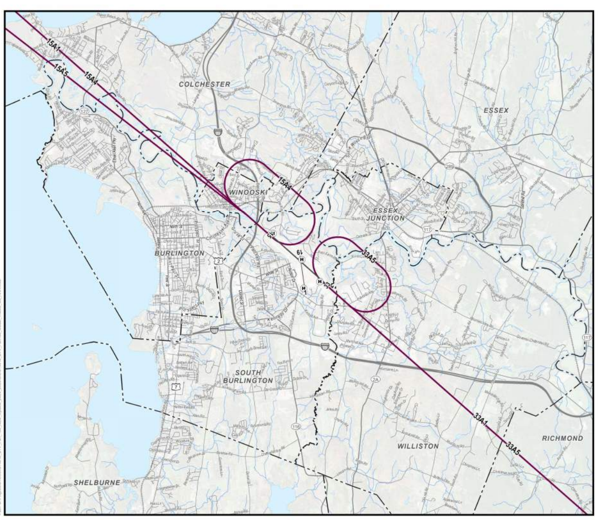
Color indicates direction:

- Green = arrivals
- Orange = departures

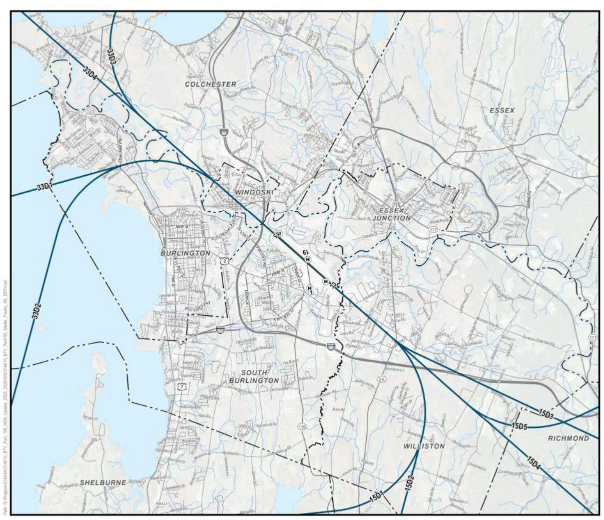


29

Flight Tracks: Military Jet Arrivals & Departures



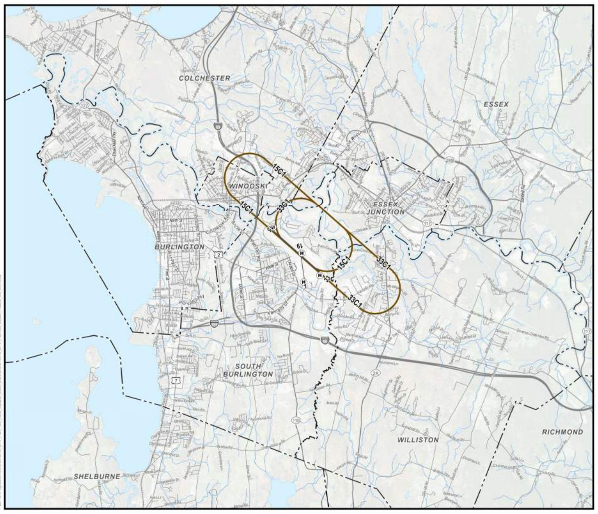
Arrivals



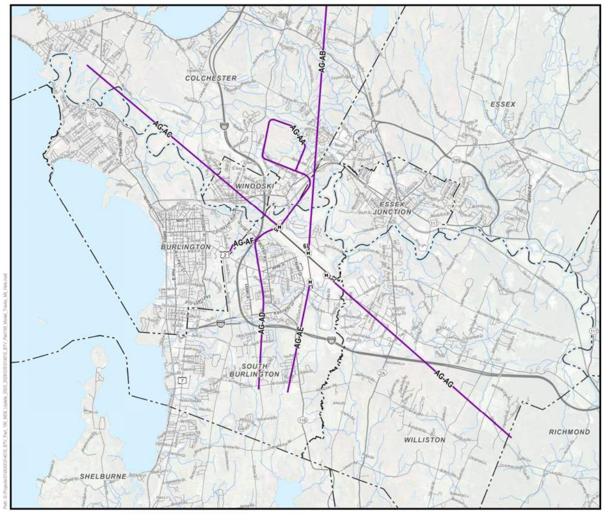
Departures

30

Flight Tracks: Military Circuits & Helicopters



Closed Patterns



Helicopters

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NEM Project Schedule

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TAC Preliminary Topics and Schedule

TAC Meeting 2	Thursday, November 30, 2023

- Noise Model Inputs

TAC Meeting 3	Thursday, January 18, 2024

- Noise Compatibility Program Review

TAC Meeting 4	Thursday, April 11, 2024

- Noise Modeling Results – Presentation of the Noise Exposure Maps

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TAC MEMBER DISCUSSION

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Patrick Leahy Burlington International Airport

BTV Noise Exposure Map Update 2024/2029
Technical Advisory Committee Meeting #3

April 11, 2024

1

Agenda

- Introductions
- Part 150 Overview
- Existing Noise Exposure Map (NEM)
- Existing Noise Compatibility Program (NCP)
- Responses to Questions from TAC Meeting #2
- Public Comment

2

INTRODUCTIONS

3

Consultant Team

THE JONES PAYNE GROUP

Diane Carter | Principal-in-Charge
Brianna Whiteman | Assistant Project Manager

Responsible for:
- Overall Project Management/Client/Agency Coordination
- Community Outreach

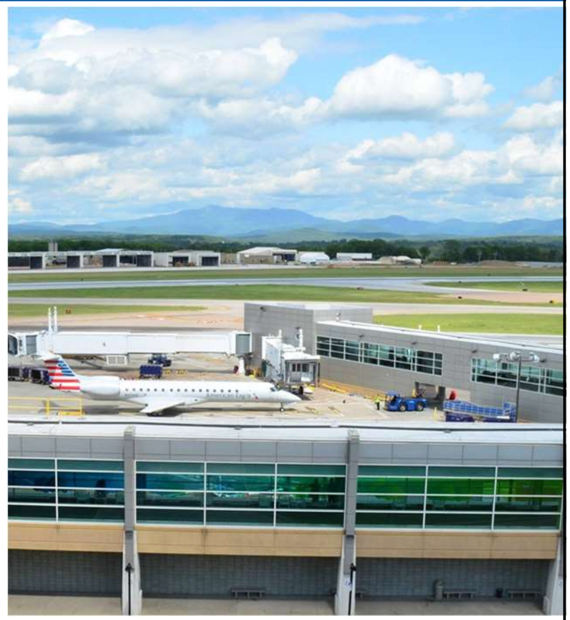
Gene Reindel | Principal-in-Charge
Kate Larson | Project Manager
Paul Krusell | Assistant Project Manager
David Crandall | Technical Advisor

Responsible for:
- Noise Modeling
- Compliance with Federal Regulations

4

TAC Membership

- Vermont National Army Guard
- Burlington Airport Commission
- Patrick Leahy Burlington International Airport
- Chittenden County Regional Planning Commission (CCRPC)
- City of South Burlington
- City of Winooski
- Community College of Vermont
- FAA (Air Traffic Manager)
- FAA (New England Regional Office) – Advisory
- Heritage Aviation (FBO)
- South Burlington School District
- Town of Williston
- Vermont National Air Guard (VTANG)
- Williston School District
- Winooski School District



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PART 150 OVERVIEW

6

Roles and Responsibilities

City of Burlington
- As airport owner and operator, the City is responsible for conducting the Noise Exposure Map (NEM) analysis and submitting the study for acceptance
- Consulting team is retained to conduct technical work and prepare documentation related to the NEM process

Federal Aviation Administration (FAA)
- Determines whether the NEM process has met Part 150 requirements and approves individual noise mitigation measures

Technical Advisory Committee (TAC)
- Provides representation for stakeholder organizations, including local jurisdictions, airlines, local business interests

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Part 150 NEM Overview

FAA "accepts" NEM as compliant with Part 150 standards
NEM must include detailed description of:
- Airport layout, aircraft operations, and other inputs to noise model
- Aircraft noise exposure in terms of Day-Night Average Sound Level (DNL)
- Land use compatibility assessment

NEM must address two calendar years
- Year of submission
- Forecast year (at least five years from year of submission)

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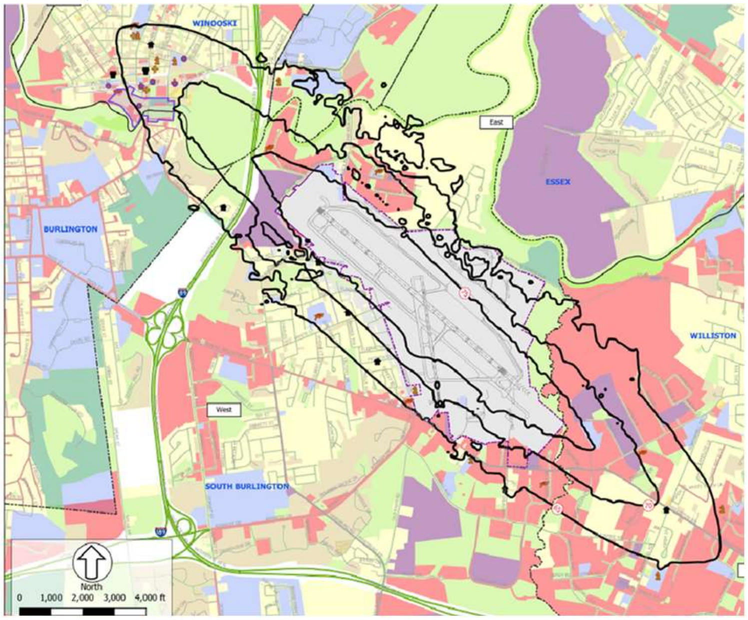
KL0

2023 NEM Contour



2023 NEM Est. Dwelling Units & Population

Day-Night Level (DNL)	Est. Dwelling Units and Population	Total
65-70 dB	Dwelling Units	2,344
	Population	5,438
70-75 dB	Dwelling Units	283
	Population	657
75 dB+	Dwelling Units	13
	Population	30
Total 65+ dB	Dwelling Units	2,640
	Population	6,125

Source: BTV 2018 and 2023 Noise Exposure Map, September 2019, Table 4

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Land Use Compatibility Guidelines

Land Use	DNL <65 dB	DNL 65-70 dB	DNL 70-75 dB	DNL > 75 dB
Residential	Compatible	Incompatible (1)	Incompatible (1)	Incompatible
Mobile home park	Compatible	Incompatible	Incompatible	Incompatible
Transient lodgings	Compatible	Incompatible (2)	Incompatible (2)	Incompatible (2)
Schools	Compatible	Incompatible (3)	Incompatible (3)	Incompatible
Hospitals and nursing homes	Compatible	25(4)	30(4)	Incompatible
Churches, auditoriums and concert halls	Compatible	25(4)	30(4)	Incompatible

(1) Measures are required to achieve 25 to 30 dB of noise level reduction for aircraft noise from outside to inside.
(2)"Transient lodgings" include, but are not limited to, hotels and motels.
(3)Measures are required to achieve 25 to 30 dB of noise level reduction for aircraft noise from outside to inside.
(4) The measures to achieve NLR of 25 or 30 dB must be incorporated into design and construction of structure.

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REVIEW OF EXISTING NCP

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2020 NCP Measures

#	TYPE OF MEASURE	BTV IMPLEMENTATION STATUS
	Operational Measures (2008 Record of Approval)	
O-1	Extension of Taxiway G	Completed
O-2	Terminal Power Installation & APU/GPU Restrictions	Implemented
O-3	Nighttime Bi-direction Runway Use	Unable to Implement
O-4	Noise Abatement Flight Paths for Runway 15 & 33 Departures and 15 Arrivals	Implemented
O-5	Voluntary Limits on Military C-5A Training	Implemented
O-6	Voluntary Minimization of F-16 Multiple Aircraft Flights	No Longer Applicable
O-7	Voluntary Army Guard Helicopter Training Controls	Not Implemented
	Land Use Measures (2020 Record of Approval)	
L-1	Land Acquisition and Relocation	Implemented
L-2	Sound Insulation of Residential Structures	Implemented
L-3	Sound Insulation of Noise Sensitive Buildings	Implemented
L-4	Purchase Assurance for Single Family Parcels	Available for Implementation
L-5	Sales Assistance for Single Family Parcels	Available for Implementation
	Programmatic Measures (2020 Record of Approval)	BW0
P-1	Ongoing Monitoring and Review of Noise Exposure Map (NEM) and Noise Compatibility Program (NCP) Status	Ongoing
P-2	Noise and Flight Track Monitoring	Ongoing

The Operational Measures were contained in the 2008 NCP Record of Approval (ROA). Many are outdated and no longer applicable. These measures will be reviewed during the next NCP Update. BW1

The Land Use & Programmatic Measures were contained in the 2020 NCP ROA. All measures are voluntary.

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OPERATIONAL MEASURES

2008 Record of Approval

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O-1: Extension of Taxiway G

Extend Taxiway G, which would be extended from the existing intersection with Taxiway A to Taxiway C, remaining parallel with Runway 15/33 in order to reduce noise levels for residents along Airport Drive.

Status: Completed

The extension of Taxiway G was completed in 2023.

14

O-2: Terminal Power Installation

Install terminal power hookups for aircraft, which would reduce the need for aircraft to use internal auxiliary power units (APU) or ground power units (GPU). Following the installation, a rule prohibiting the use of APUs or GPUs between 10:00 p.m. and 7:00 a.m. would be put in place.

Status: Implemented

The Airport terminal now has “aircraft ground power” capability at all Passenger Boarding Bridges. The City will not be implementing the GPU/APU rule between 10:00 p.m. and 7:00 a.m., as too many flights arrive/depart during those hours. However, use of ground power is required for all aircraft in proximity to an available hookup.

15

O-3: Nighttime Bi-direction Runway Use

In order to minimize late-night operations over the City of Winooski, the Air Traffic Control Tower (ATCT) would use Runway 15 for departures and Runway 33 for arrivals, traffic conditions permitting.

Implementation Status: Unable to Implement

The BTV ATCT is closed from midnight until 5:30 a.m., which makes implementation of this measure infeasible during these hours. The ATCT has not implemented the procedure during the remaining DNL “nighttime” hours, i.e., from 5:30 to 7:00 a.m.

16

O-4: Noise Abatement Flight Paths

Development of new flight procedures that would have civil aircraft fly over less populated areas. Runway 33 departures would turn to a heading of 310 degrees. Runway 15 departures would turn to a heading of 180 degrees.

Implementation Status: Implemented

17

O-5: Voluntary Limits on Military C-5A Training

Develop an informal agreement with the military that would limit C-5A operations to only necessary takeoffs and landings.

Implementation Status: Implemented

An agreement is not currently in place, however:

(1) BTV Operations strongly discourage C-5A training at the Airport, as the runways are only 150 feet wide and wake turbulence from C-5A operations tears up runway-edge lighting

(2) Historically, the military has always coordinated the arrival of a C-5A with BTV Operations because of the constraints on the airfield

(3) All transient military aircraft are limited to two practice approaches

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O-6: Minimization of F-16 Multiple Aircraft Flights

Voluntary minimization of F-16 multiple aircraft flights. Military personnel would schedule as many single-aircraft, as opposed to multiple-aircraft, flights as possible.

Implementation Status: No Longer Applicable

The VTANG fighter wing changed from the F-16 aircraft to the F-35A in 2020.

19

O-7: Voluntary Army Guard Helicopter Training Controls

The Army National Guard helicopter training operations be conducted away from the Airport when conditions permit. In terms of long-range planning, the Guard should consider consolidating operations at Camp Johnson.

Implementation Status: Not Implemented

The Vermont Army National Guard has continued training operations at BTV.

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BTV PATRICK LEAHY BURLINGTON INTERNATIONAL AIRPORT

LAND USE MEASURES

2020 Record of Approval

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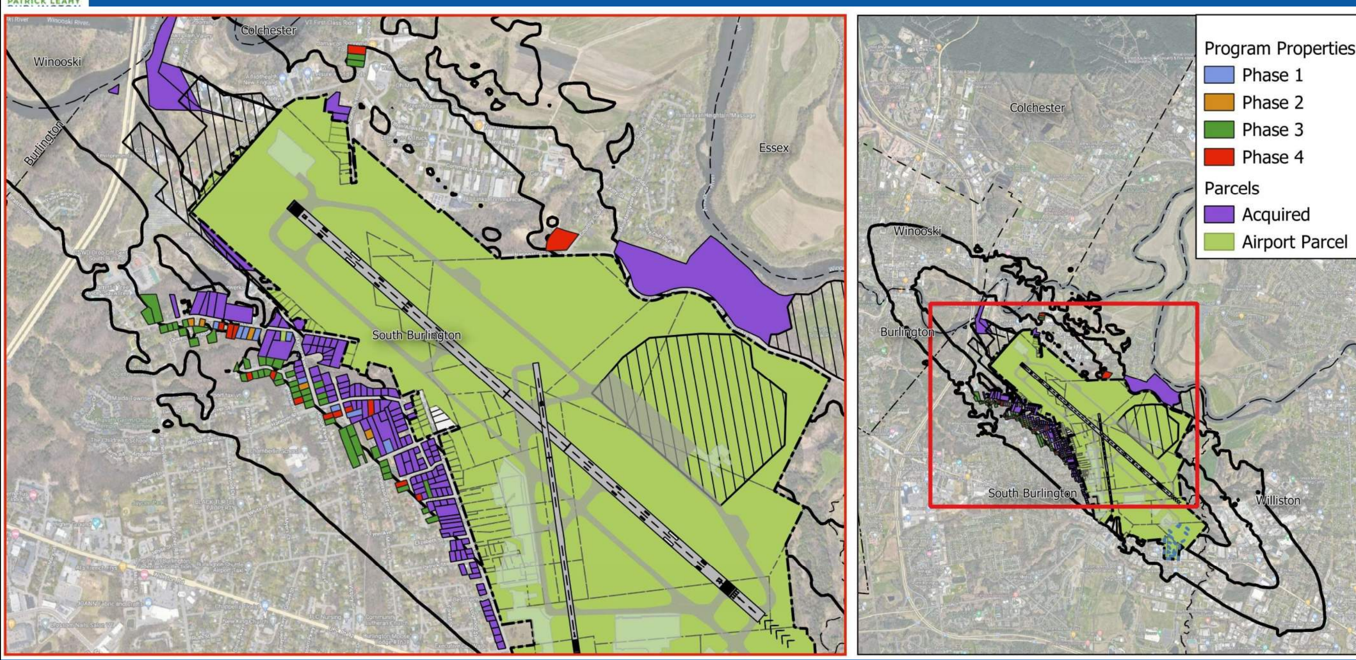
BTV PATRICK LEAHY

Noise Mitigation Program Status – April 2024



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L-1: Land Acquisition and Relocation

Land Acquisition and Relocation of parcels where the majority of the parcel is within the 75 dB DNL contour (to preserve neighborhood continuity).

The program is voluntary for eligible owners wishing to participate. Owners are paid fair market value and provided relocation assistance.

Status: Implemented – Available for the 5 homes located in the 75 dB DNL

Eligible homes have previously declined participation in this program.

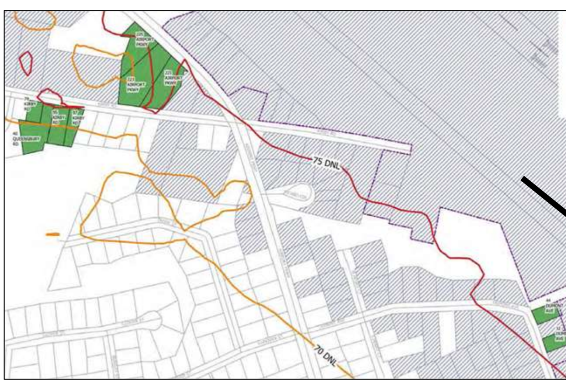
BW1

Since the start of federal Fiscal Year 2007 through September 2017, the FAA has issued 13 grants to the City of Burlington totaling approximately $48 million. BW2

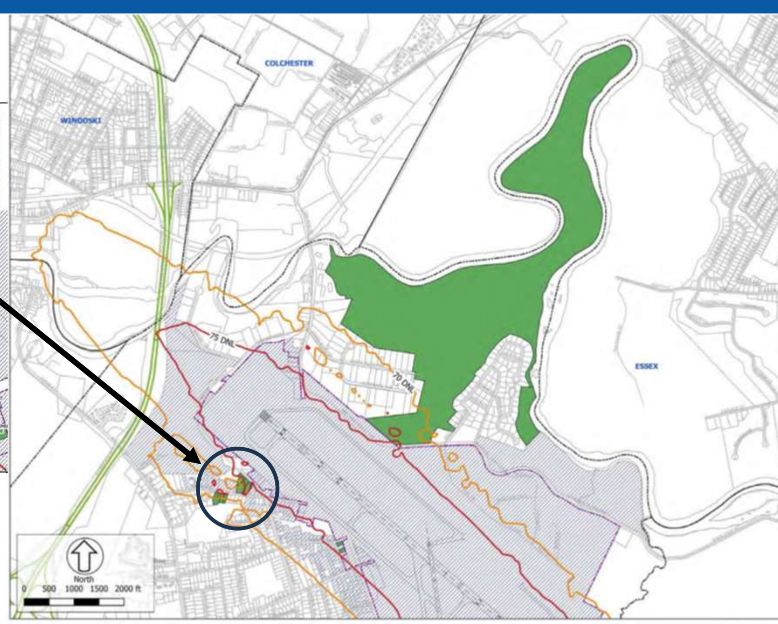
23

L-1: Land Acquisition and Relocation

Chamberlin Neighborhood 75 dB DNL Homes



75 DNL Properties are shown in



24

L-2: Sound Insulation of Residential Structures

Provide sound insulation for homes within the 65 dB and 70 dB DNL contours of the approved NEM. These qualified homes would receive an acoustical treatment package, in accordance with FAA guidelines, to:

- reduce interior noise levels to 45 DNL and
- provide a minimum reduction of 5 dB from the existing interior noise level

Status: Implemented and Ongoing

The City began the program in 2021. To date, 82 homes have been designed over 4 phases and construction has been completed on 14 homes. There are an additional 23 homes currently under design. The City plans to complete 50 homes per year based on available FAA funding.

25

L-3: Sound Insulation of Noise Sensitive Buildings

Provide sound insulation of qualified non-compatible non-residential land uses (schools, hospitals, places of worship) within the 65 dB and 70 dB DNL noise contour

Status: Implemented and Ongoing

There are 24 noise sensitive buildings located in the 65 dB and 70 dB DNL contours.

The Gertrude E. Chamberlin Elementary School, located within the DNL 65 dB contour received a positive ventilation system upgrade in 2021. Acoustical testing determined the existing interior noise level was below 45 dB DNL and did not qualify for a full treatment.

Annually, the City selects potentially eligible properties for sound insulation for the FAA AIP grant program. Properties are selected by noise level contour, starting with the highest contour and working outward, for both residential and non-residential properties within the project area.

26

L-4: Purchase Assurance for Single Family Parcels

A voluntary purchase assurance program would include any qualified non-compatible owner-occupied single-family parcels within the 65 dB DNL and 70 dB DNL contours.

Status: Available for Implementation

This program has not been requested by eligible homeowners.

The City would:

- Determine if the home is eligible for sound insulation (if not, home is eligible for sales assistance)
- Acquire the home (with FAA AIP grant funds) in exchange for an avigation easement
- Provide sound insulation treatment package
- Resell the home on the open market for fair market value
- Utilize the proceeds from the sale to fund further noise mitigation programs

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L-5: Sales Assistance for Single Family Parcels

A voluntary sales assistance program would include qualified owner-occupied single-family parcels that are not eligible for sound insulation within the 65 dB DNL and 70 dB DNL contours.

The City would provide an incentive to assure homeowners receive fair market value for the sale of their home on the open market in exchange for an avigation easement.

Status: Available for Implementation

This program has not been requested by eligible homeowners.

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PROGRAMMATIC MEASURES

2020 Record of Approval

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BW0

P-1: Ongoing Review of NEM and NCP Status

The City will update the NEM and NCP, when the following occurs:

- Changes in airport layout
- Unanticipated changes in airport activity
- Non-compliance with NCP

Status: Ongoing

The City continues to regularly assess the Airport's noise exposure. This NEM update is to assess the noise impacts of the VTANG use of the F-35A aircraft.

This measure also created a standing noise abatement committee (Sound Committee) which meets as directed by the Airport.

30

P-2: Noise and Flight Track Monitoring

Recommends the acquisition of an aircraft noise and flight track monitoring system. The system is intended to make the information accessible to the public.

Status: Ongoing

Installed in 2021, there are 3 noise monitors and a website for the community to view flight operations and their associated noise levels, and submit any noise complaints.

BTV staff report monthly to the Airport Commission on the status of the system and any complaints received.

Noise Monitoring Terminal Locations

#1 – Winooski City Hall
#2 – Chamberlin Elementary School
#3 – Town of Williston (Chad Ln.)

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NEM Project Schedule

	Project Phase	2023						2024													
		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB
1	Data Collection; approval of military aircraft modeling; development of operational forecasts																				
2	Development of draft contours; land use analysis																				
3	Draft NEM document for public review; public meeting; public comment period																				
4	Finalize and submit final NEM to FAA for approval																				

Consultant Task | Community Input | Agency Review

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Follow-up from TAC Meeting #2

The next three slides respond to two inquiries from the previous TAC meeting:

- Terrain data in the AEDT model
- How the 2024 and 2029 forecast aircraft operations data compares to the previous NEM Forecast Condition (for 2023)

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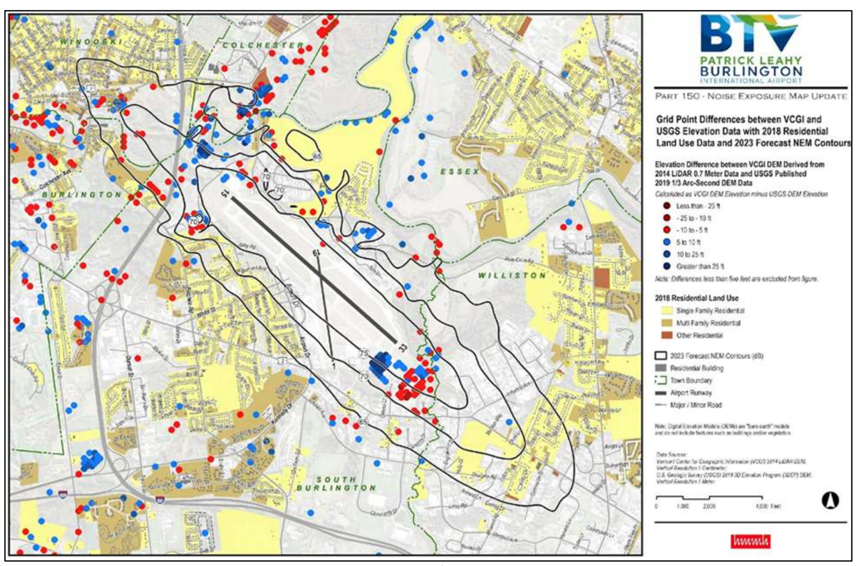
Noise Model Terrain Data Sources

- HMMH sampled the 1/3 arc-second USGS and 1m VCGI data at 100 ft intervals
- Found the elevation differences at these sampled points
  - Blue dots indicate VCGI elevation higher by 5 ft or more
  - Red dots indicate VCGI elevation lower by 5 ft or more
- Largest off-airport differences are around steep grades



Difference Grid Between 1/3 Arc-S and VT LIDAR DEM

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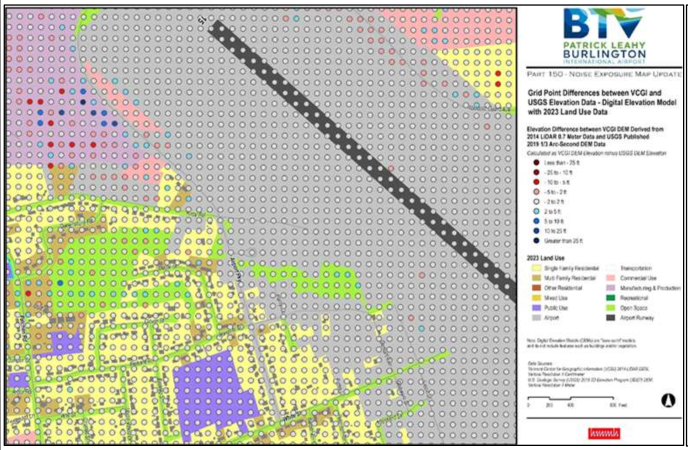
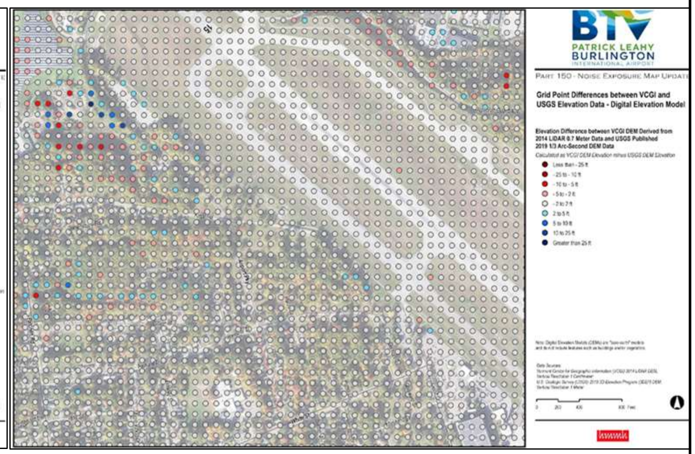
Noise Model Terrain Data Sources

Elevation Difference Grid Between 1/3 Arc-S and VT LIDAR DEM - Northwest of Airfield



Difference Grid with 2023 Land Use



Difference Grid with Aerial

Comparison of Aircraft Operations to Previous NEM

- 73% increase in total operations for Existing 2024 compared to previous forecast
- Most of the increase in operations are by GA aircraft, both local and itinerant
- Air carrier/air taxi operations together are essentially same
- Military operations are lower

Category		2023 Forecast (prior NEM)	Tower Counts CY2023	2024 Existing	% Difference between Forecast 2023 and Existing 2024	2029 Forecast
			Itinerant			
Civilian	Air Carrier	17,378	16,887	16,720	-4%	18,233
	Air Taxi	5,087	7,383	6,013	18%	6,358
	GA	22,636	37,279	41,758	84%	43,064
Military		6,846	3,424	5,374	-22%	5,354
	Total Itinerant	**51,947**	**64,973**	**69,864**	**34%**	**73,009**
			Local			
Civilian	GA	11,138	35,262	45,258	306%	46,263
Military		3,423	366	106	-97%	106
	Total Local	**14,561**	**35,628**	**45,364**	**212%**	**46,369**
	Grand Total	**66,508**	**100,601**	**115,227**	**73%**	**119,377**

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TAC Preliminary Topics and Schedule

TAC Meeting 3 Thursday, April 11, 2024

- Noise Compatibility Program Review

TAC Meeting 4 TBD, July 2024

- Noise Modeling Results – Presentation of the Noise Exposure Maps

Public Meeting TBD, Fall 2024

- Presentation of the draft NEM Document

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TAC MEMBER DISCUSSION

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PUBLIC COMMENT

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Appendix F: Public Comments

This appendix includes copies of all public comments received (*to be included in the Final NEM document*).

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