Boise Airport

14 CFR Part 150 Study Update

Updated Noise Exposure Maps and Noise Compatibility Program

VOLUME 1 OF 2

December 2015

Prepared for:
City of Boise, Idaho

Prepared by:
HNTB Corporation

AIP No. 3-16-0003-060-2014
Contract No. DOT-FA14NM-2068

Boise Airport

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and

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STATEMENT OF CERTIFICATION

This is to certify the following:

The Noise Exposure Maps and accompanying documentation for Boise Airport, submitted in accordance with 14 CFR Part 150 with the best available information are hereby certified as true and complete to the best of my knowledge and belief.

All interested persons have been afforded adequate opportunity to submit their views, data and comments concerning the correctness and adequacy of the draft noise exposure map and forecast operations. The record and description of consultation and opportunity for public comment as provided are hereby certified as true and complete to the best of my knowledge and belief.

By: Rebecca L. Hupp

Rebecca Hupp
Airport Director
Boise Airport

Date: December 21, 2015

Airport Name: Boise Airport

Airport Operator: City of Boise, Idaho

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APPENDICES

Acronyms and Abbreviations

AAD	Average Annual Day
AC	Advisory Circular
ADO	Airport District Office
AEDT	Aviation Environmental Design Tool
AEE	Office of Environment and Energy
AIA	Airport Influence Area
AIP	Airport Improvement Program
ANGB	Air National Guard Base
AOCI	Area of City Impact
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
BOI	Boise Airport
BRRC	Blue Ride Research and Consulting, LLC
CAGR	Compounded annual growth rate
CBP	U.S. Customs and Border Protection
CFR	Code of Federal Regulations
COMPASS	Community Planning Association of Southwest Idaho
CP	Continuing Program
dB	decibel
DNL	Day-Night Average Sound Level
DOT	Department of Transportation
DPs	Departure Procedures
FAA	Federal Aviation Administration
FBO	Fixed-based operations
FMS	Flight Management System
GA	General Aviation
GIS	Geographic Information System
HUD	Department of Housing and Development
IDANG (Idaho ANG)	124th Wing of the Idaho Air National Guard
IFR	Instrument Flight Rules
INM	Integrated Noise Model
LFPR	Lynda Friesz Public Relations
LU	Land Use
MPO	Metropolitan Planning Organization
MSL	Mean sea level
NA	Noise Abatement
NADP	Noise Abatement Departure Profile
NBAA	National Business Aviation Association
NCP	Noise Compatibility Program
NEM	Noise Exposure Map
NEPA	National Environmental Policy Act
NOTAM	Notice to Airmen
NPIAS	National Plan of Integrated Airport Systems

OPSNET	Operations Network
PBN	Performance Based Navigation
PC	Planned Community
RNAV	Area Navigation
RNP	Required Navigation Performance
ROA	Record of Approval
RP	Rural Preservation
RR	Rural Residential
RUT	Rural-Urban Transition
STARs	Standard Terminal Arrival Routes
TAF	Terminal Area Forecast
TFMSC	Traffic Flow Management Systems Counts
TRACON	Terminal Radar Approach Control
VFR	Visual Flight Rules

Boise Airport 14 CFR Part 150 Study Update

NOISE EXPOSURE MAP CHECKLIST – PART I

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?		✓	
2. NEM and NCP together?	✓		Letter of Transmittal, Sponsor Certification
3. Revision to NEMs FAA previously determined to be in compliance with Part 150?	✓		Chapter 1, Section 1.1
B. Airport and Airport Operator's name are identified?	✓		Letter of Transmittal, Sponsor Certification, Chapter 1, Section 1.4
C. NCP is transmitted by airport operator’s dated cover letter, describing it as a Part 150 submittal and requesting appropriate FAA determination?	✓		Letter of Transmittal
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?	✓		Section 1.4.6, Chapter 9, Appendix D
B. Identification of consulted parties:			
1. Are the consulted parties identified?	✓		Section 1.4.6, Chapter 9
2. Do they include all those required by 150.21(b) and A150.105(a)?	✓		Chapter 9
3. Agencies in 2, above, correspond to those indicated on the NEM?	✓		Chapter 9
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)?	✓		Sponsor Certification, Chapter 9 and Appendix D
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?	✓		Chapter 9, Appendix D

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
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)?	✓		Figures 5-1 and 5-2
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?	✓		Sponsor Certification, Figure 5-1
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?	✓		Sponsor Certification, Figure 5-2
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
C. If the NEM and NCP are submitted together:			
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?	✓		Chapter 5, all noise abatement measures are carried forward from the previous NCP, there is no change to forecast conditions with the NCP
2. If the forecast year map is based on program implementation:			
a. Are the specific program measures that are reflected on the map identified?	✓		Chapter 7
b. Does the documentation specifically describe how these measures affect land use compatibilities depicted on the map?	✓		Chapter 7
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

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
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)*	✓		5-1, 5-2
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)	✓		5-1, 5-2
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	✓		5-1, 5-2
b. Runway configurations with runway end numbers	✓		5-1, 5-2
2. Does the depiction of the off-airport data include?			
a. A land use base map depicting streets and other identifiable geographic features	✓		5-1, 5-2
b. The area within the DNL[1] 65 dB (or beyond, at local discretion)	✓		5-1, 5-2
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)	✓		5-1, 5-2
D. 1.Continuous contours for at least the DNL 65, 70, and 75 dB?	✓		5-1, 5-2,
2. Has the local land use jurisdiction(s) adopted a lower local standard and if so, has the sponsor depicted this on the NEMs?		✓	Note that DNL 60 extends beyond the graphical border on Figure 5-2 however the contours is informational only

PROGRAM REQUIREMENT	**YES**	**NO**	**SUPPORTING PAGES/REVIEW COMMENTS**
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?	✓		5-1, 5-2, Chapter 2, Chapter 3
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?	✓		Figures 3-2 and 3-3
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)*			N/A
G. Noncompatible land use identification:			
1. Are noncompatible land uses within at least the DNL 65 dB noise contour depicted on the map graphics?	✓		5-1, 5-2
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.)	✓		Chapter 5, Sections 5.1.1, 5.1.2 and 5.1.3
3. Are the noncompatible uses and noise sensitive public buildings readily identifiable and explained on the map legend?	✓		5-1, 5-2
4. Are compatible land uses, which would normally be considered noncompatible, explained in the accompanying narrative?		✓	N/A
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?	✓		Chapter 2, Chapter 3, Chapter 4, Chapter 5
2. Are the underlying technical data and planning assumptions reasonable?	✓		Sponsor Certification
B. Calculation of Noise Contours:			
1. Is the methodology indicated?	✓		Chapter 3
a. Is it FAA approved?	✓		Section 3.1

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
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.)*	✓		Section 3.1.1
c. Has AEE approval been obtained for use of a model other than those that have previous blanket FAA approval?	✓		NoiseMap was used for military operations, use of NoiseMap was requested in correspondence with AEE on January 28, 2015
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?	✓		Section 3.1.1, Appendix C
b. If so, does this have written approval from AEE, and is that written approval included in the submitted document?	✓		Appendix C
3. If noise monitoring was used, does the narrative indicate that Part 150 guidelines were followed?			N/A
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, DNL 60 dB contours are shown on Figures 5-1 and 5-2 for informational purposes only

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
C. Noncompatible Land Use Information:			
1. Does the narrative (or map graphics) give estimates of the number of people residing in each of the contours (DNL 65, 70 and 75, at a minimum) for both the existing condition and forecast year maps?	✓		Chapter 5, Sections 5.1.2 and 5.1.3
2. Does the documentation indicate whether the airport operator used Table 1 of Part 150?	✓		Chapter 4
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
(2) Does the narrative include the airport operator's complete substitution for table 1?			N/A
3. Does the narrative include information on self- generated or ambient noise where compatible or noncompatible land use identifications consider non-airport and non-aircraft noise sources?			N/A
4. Where normally noncompatible land uses are not depicted as such on the NEMs, does the narrative satisfactorily explain why, with reference to the specific geographic areas?			N/A
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?	✓		Chapter 5, Section 5.1.3
VI. Map Certifications: [150.21(b), 150.21(e)]			
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?	✓		Sponsor Certification
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?	✓		Sponsor Certification

Boise Airport 14 CFR Part 150 Study Update

NOISE COMPATIBILITY PROGRAM CHECKLIST – PART I

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
I. Submitting And Identifying The NCP:			
A. Submission is properly identified:			
1. 14 C.F.R. Part 150 NCP?		✓	Letter of Transmittal, Sponsor Certification
2. NEM and NCP together?	✓		Letter of Transmittal, Sponsor Certification
3. Program revision? (To what extent has it been revised?)	✓		Letter of Transmittal, Chapter 8, Section 8.2
B. Airport and Airport sponsor's name are identified?	✓		Letter of Transmittal, Sponsor Certification, Chapter 1, Section 1.4
C. NCP is transmitted by airport sponsor's cover letter?	✓		Letter of Transmittal
II. Consultation: (including public participation): [150.23]			
A. Documentation includes narrative of public participation and consultation process?	✓		Section 1.4.6, Chapter 9, Appendices D and E
B. Identification of consulted parties:			
1. All parties in 150.23(c) consulted?	✓		Chapters 8 and 9
2. Public and planning agencies identified?	✓		Chapters 8 and 9
3. Agencies in 2, above, correspond to those affected by the NEM noise contours?	✓		Chapters 8 and 9
C. Satisfies 150.23(d) requirements by:			
1. Documentation shows active and direct participation of parties in B., above?	✓		Chapters 6, 7, 8, 9, Appendices D and E
2. Active and direct participation of general public and opportunity to submit their views, data, and comments on the formulation and adequacy of the NCP?	✓		Chapter 9, Appendices D and E
3. Participation was prior to and during development of NCP and prior to submittal to FAA?	✓		Chapter 9, Appendices D and E
4. Indicates adequate opportunity afforded to all consulted parties to submit views, data, etc.?	✓		Chapter 9, Appendices D and E
D. Evidence is included there was notice and opportunity for a public hearing on the final NCP?	✓		Chapter 9, Appendices D and E

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
E. Documentation of comments:	✓		Chapter 9, Appendices D and E
1. Includes summary of public hearing comments, if hearing was held?	✓		Chapter 9, Appendix E
2. Includes copy of all written material submitted to operator?	✓		Chapter 9, Appendix D
3. Includes operator's responses/disposition of written and verbal comments?	✓		Chapter 9, Appendices D and E
F. Is there written evidence from the appropriate office within the FAA that the sponsor received informal agreement to carry out proposed flight procedures?			N/A
III. Noise Exposure Maps: [150.23, B150.3; 150.35(f)] *(This section of the checklist is not a substitute for the Noise Exposure Map checklist. It deals with maps in the context of the Noise Compatibility Program submission.)*			
A. Inclusion of NEMs and supporting documentation:			
1. Map documentation either included or incorporated by reference?	✓		Chapter 5
2. Maps previously found in compliance by FAA?			NEMs submitted with NCP
3. FAA's compliance determination still valid?			
a. Existing condition NEM represents conditions at the airport at the time of submittal of the NCP for FAA approval?	✓		Letter of Transmittal, 5-1, Chapter 5
b. Forecast condition NEM represents conditions at the airport at least 5 years into the future from the date of submittal of the NCP to the FAA for approval?	✓		Letter of Transmittal, 5-2, Chapter 5
c. Sponsor letter confirming elements (a) and (b), above, if date of submission is either different than the year of submittal of the previously approved NEMs or over 12 months from the date shown on the face of the NEM?			N/A
d. If (a) through (c) cannot be validated, the NEMs must be redone and resubmitted as per 150.21.			N/A
4. Does 180-day period have to wait for map compliance finding?	✓		

PROGRAM REQUIREMENT	**YES**	**NO**	**SUPPORTING PAGES/REVIEW COMMENTS**
B. Revised NEMs submitted with program: (Review using NEM checklist if map revisions included in NCP submittal. Report the applicable findings in the spaces below after a full review using the NEM checklist and narrative.)			
1. Revised NEMs included with program?		✓	No changes in DNL with NCP
2. Has airport sponsor requested in writing that FAA make a determination on the NEM(s), showing NCP measures in place, when NCP approval is made?		✓	
C. If program analysis uses noise modeling:			
1. INM, HNM, or FAA-approved equivalent?	✓		Chapter 3
2. Monitoring in accordance with A150.5?			N/A
D. One existing condition and one forecast-year map clearly identified as the official NEMs?	✓		5-1, 5-2
IV. Consideration of Alternatives: [B150.7, 150.23(e)(2)]			
A. At a minimum, were the alternatives below considered, or if they were rejected was the reason for rejection reasonable and based on accurate technical information and local circumstances?			
1. Land acquisition and interests therein, including air rights, easements, and development rights?	✓		Chapter 7
2. Barriers, acoustical shielding, public building soundproofing	✓		Chapter 6
3. Preferential runway system	✓		Chapter 6
4. Voluntary flight procedures	✓		Chapter 6
5. Restrictions described in B 150.7 (taking into account Part 161 requirements)	✓		Chapter 6
6. Other actions with beneficial impact not listed in the regulation	✓		Chapters 6, 7 and 8
7. Other FAA recommendations (see D, below)		✓	Chapter 8
B. Responsible implementing authority identified for each considered alternative?	✓		Chapters 6, 7 and 8
C. Analysis of alternative measures:			
1. Measures clearly described?	✓		Chapters 6, 7 and 8
2. Measures adequately analyzed?	✓		Chapters 6, 7 and 8
3. Adequate reasoning for rejecting alternatives?	✓		Chapters 6, 7 and 8

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
D. Other actions recommended by the FAA: As the FAA staff person familiar with the local airport circumstances, determine whether other actions should be added? *(List separately, or on back, actions and describe discussions with airport sponsor to have them included prior to the start of the 180-day cycle. New measures recommended by the airport sponsor must meet applicable public participation and consultation with officials before they can be submitted to the FAA for action. See E., below.)*			N/A
V. Alternatives Recommended for Implementation: [150.23(e), B150.7(c); 150.35(b), B150.5]			
A. Document clearly indicates:			
1. Alternatives that are recommended for implementation?	✓		Chapter 8
2. Final recommendations are airport sponsor's, not those of consultant or third party?	✓		Letter of Transmittal, Chapter 8
B. Do all program recommendations:			
1. Relate directly or indirectly to reduction of noise and noncompatible land uses? *(Note: All program recommendations, regardless of whether previously approved by the FAA in an earlier Part 150 study, must demonstrate a noise benefit if the airport sponsor wants FAA to consider the measure for approval in a program update. See E., below.)*	✓		Chapter 8
2. Contain description of each measure's relative contribution to overall effectiveness of program?	✓		Chapter 8
3. Noise/land use benefits quantified to extent possible to be quantified? *(Note: some program management measures cannot be readily quantified and should be described in other terms to show their implementation contributes to overall effectiveness of the program.)*	✓		Chapter 8

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
4. Does each alternative include actual/anticipated effect on reducing noise exposure within noncompatible area shown on NEM?	✓		Section 6.4
5. Effects based on relevant and reasonable expressed assumptions?	✓		Chapters 6 and 7
6. Does the document have adequate supporting data that the measure contributes to noise/land use compatibility?	✓		Chapters 6, 7 and 8
C. Analysis appears to support program standards set forth in 150.35(b) and B150.5?	✓		Chapters 6, 7 and 8
D. When use restrictions are recommended for approval by the FAA:			
1. Does (or could) the restriction affect Stage 2 or Stage 3 aircraft operations *(regardless of whether they presently operate at the airport)*? *(If the restriction affects Stage 2 helicopters, Part 161 also applies.)*			N/A
2. If the answer to D.1 is yes, has the airport sponsor completed the Part 161 process and received FAA Part 161 approval for a restriction affecting Stage 3 aircraft? Is the FAA's approval documented? For restrictions affecting only Stage 2 aircraft, has the airport sponsor successfully completed the Stage 2 analysis and consultation process required by Part 161 and met the regulatory requirements, and is there evidenced by letter from FAA stating this fact?			N/A
3. Are non-restrictive alternatives with potentially significant noise/compatible land use benefits thoroughly analyzed so that appropriate comparisons and conclusions among all alternatives can be made?			N/A
4. Did the FAA regional or ADO reviewer coordinate the use restriction with APP-400 prior to making determination on start of 180-days?			N/A

PROGRAM REQUIREMENT	YES	NO	SUPPORTING PAGES/REVIEW COMMENTS
E. Do the following also meet Part 150 analytical standards?			
1. Recommendations that continue existing practices and that are submitted for FAA re-approval? *(Note: An airport sponsor does not have to request FAA re-approval if noise compatibility measures are in place from previously approved Part 150 studies. If the airport has implemented the measures as approved in the previous NCP, the measures may be reported and modeled as baseline conditions at the airport.)*			N/A
2. New recommendations or changes proposed at the end of the Part 150 process?	✓		
F. Documentation indicates how recommendations may change previously adopted noise compatibility plans, programs, or measures?	✓		Chapter 8
G. Documentation also:			
1. Identifies agencies that are responsible for implementing each recommendation?	✓		Chapters 6, 7 and 8
2. Indicates whether those agencies have agreed to implement?	✓		Chapter 8
3. Indicates essential government actions necessary to implement recommendations?	✓		Chapter 8
H. Timeframe:			
1. Includes agreed-upon schedule to implement alternatives?	✓		Chapter 8
2. Indicates period covered by the program?	✓		Chapter 8
I. Funding/Costs:			
1. Includes costs to implement alternatives?	✓		Chapters 7 and 8
2. Includes anticipated funding sources?	✓		Chapters 7 and 8

PROGRAM REQUIREMENT	**YES**	**NO**	**SUPPORTING PAGES/REVIEW COMMENTS**
VI. Program Revision: [150.23(e)(9)] Supporting documentation includes provision for revision? *(Note: Revision should occur when it is likely a change has taken place at the airport that will cause a significant increase or decrease in the DNL noise contour of 1.5 dB or greater over noncompatible land uses. See §150.21(d))*	✓		Letter of Transmittal

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Chapter One
INTRODUCTION

Title 14 of the Code of Federal Regulations (CFR) Part 150, “Airport Noise Compatibility Planning,” sets forth standards for airport operators to use in documenting noise exposure in airport environs and establishing programs to minimize aircraft noise and land use non-compatibilities. FAA Advisory Circular 150/5020-1, “Noise Control and Compatibility Planning,” establishes the framework for conducting Part 150 studies, and notes that the goal of the study process is “to develop a balanced and cost-effective program to minimize and/or mitigate the airport’s noise impact on local communities.”

This chapter provides an introduction to the 14 CFR Part 150 regulations. 14 CFR Part 150 (typically referred to as Part 150 within this Study) prescribes specific standards for the following:

- Measuring aircraft noise,
- Estimating cumulative aircraft noise exposure using computer models,
- Describing aircraft noise exposure (including instantaneous, single event and cumulative levels),
- Coordinating Noise Compatibility Program (NCP) development with local land use officials and other interested parties,
- Documenting the analytical process and development of the compatibility program,
- Submitting documentation to FAA,
- FAA and public review processes, and
- FAA approval or disapproval of the submission.

A full Part 150 submission to FAA consists of two elements: Noise Exposure Maps (NEM) and an NCP. Section 1.1 and 1.2 of this chapter describe the NEM and NCP requirements. Section 1.3 discusses the study goals, Section 1.4 discusses the organizations that had major roles and responsibilities in the study update process, and Section 1.5 discusses the report organization.

Chapter Two presents the existing and forecast operations data used in determining the noise environment around Boise Airport (BOI). Chapter Three discusses existing and forecast flight operations. Chapter Four outlines local and federal land use guidelines, as well as existing and future land uses. Chapter Five presents the NEMs. Chapter Six describes the development of an NCP, and then evaluates the existing noise abatement measures. Chapter Seven presents land use measure status, modifications and recommendations for existing and potential new measures. Chapter Eight includes continuing program measures, the recommended NCP and implementation factors. Finally, Chapter Nine provides the record of public consultation. Appendices A through D provide supporting information, as outlined in the Table of Contents.

1.1 NEM Requirements

The FAA uses a checklist in reviewing NEM submittals, which must be completed prior to submission of the final NEM. The checklist, which precedes this chapter, details the specific requirements for approval of NEMs, and includes page and section references indicating the document location where those requirements are addressed.

Each NEM shows the airport layout and operation, aircraft-related noise exposure, land uses in the airport environs, and the resulting aircraft noise and land use compatibility status. The NEM also includes maps of existing and future noise exposure resulting from aircraft operations and of land uses in the airport environs. As required, the NEMs must show existing noise conditions, and provide a projection of noise exposure five years into the future. The study documentation must describe the data collection and analysis undertaken in its development.

The forecasts developed for this study include 2015 as the year of submission ("existing condition") and a Future (2020) NEM representing the 5-year forecast noise exposure. Upon acceptance by the FAA, the NEMs replace previously accepted maps from BOI's 2006 14 CFR Part 150 Study Update.

1.2 NCP Requirements

The NCP is essentially a list of the actions the airport proprietor, airport users, local governments, and FAA propose to undertake to minimize existing and future aircraft noise and land use incompatibility. The NCP documentation must recount the development of the program, including a description of all measures considered, the reasons that individual measures were accepted or rejected, how measures will be implemented and funded, and the predicted effectiveness of individual measures and the overall program.

The development of an NCP begins with an evaluation of all reasonable, feasible actions that could reduce potential land use incompatibilities identified in the NEMs. Part 150 specifies the range of alternatives that must be considered, including land acquisition, sound barriers, soundproofing of public buildings, preferential runway use, flight procedures, restrictions on the type/class of aircraft, and other actions or FAA recommendations that may provide benefits. Although Part 150 requires that these types of measures must be evaluated, it does not mandate adoption or implementation of the measures. Previous Part 150 Studies for BOI have considered all of these alternatives and included applicable measures that were found to be reasonable and feasible.

There are three categories of NCP measures:

<u>Noise abatement measures</u> seek changes to operational flight procedures to reduce the size or change the shape of the noise contours so as to minimize incompatibilities. Noise abatement alternatives consider changes to runway use, flight track use, and other operational procedures that determine where aircraft fly in the immediate vicinity of the Airport. No additional noise mitigation measures were considered as part of this NCP.

<u>Land use measures</u> address areas of existing and potential future land use incompatibility that remain, presuming implementation of the noise abatement measures. The land use measures are

intended to correct existing incompatible land uses and prevent future incompatibilities.

Continuing program measures serve to enhance community and airport dialogue regarding aviation noise, improve public understanding of aviation noise, and provide for ongoing evaluation of noise generated from aircraft flight operations.

The measures described in the NCP presented in this document reflect the airport operator's recommendations for the NCP. The proposed NCP measures are presented prior to FAA's review for approval or disapproval and as such do not represent the opinions or decisions of FAA.

Official FAA acceptance of the Part 150 Study submission and approval of the NCP does not eliminate requirements for the submittal of environmental documentation of any proposed actions pursuant to requirements of the National Environmental Policy Act (NEPA). However, acceptance of the submission is a prerequisite to apply for Federal funding for implementation of any proposed measures.

1.3 Study Goals

The objective of the noise compatibility planning process at BOI is to improve compatibility between aircraft operations and noise-sensitive land uses in the vicinity of the Airport, while allowing the Airport to continue to serve its role in the community, state, and nation. BOI initiated the first Part 150 program in 1986, and subsequently conducted Part 150 Study updates in 1996 and 2004, with Record of Approvals received in 1997 and 2006, respectively. The FAA's Record of Approval of the NCP from the 2006 study is shown in ***Appendix A, Record of Approval for the 2006 NCP***.

The previous Part 150 Study Update, approved in 2006, forecast noise exposure in the year 2009. Since there was limited non-compatible development within the 2009 NEM, the focus of the NCP process in that study was on preventing future non-compatible development, while also addressing existing non-compatibilities. The resulting 2006 NCP for BOI included 32 measures: nine noise abatement measures, 18 land use measures, and five continuing program measures.

Four goals have been identified to guide the development of the current Part 150 Study for BOI:

- Minimize new non-compatible land uses and mitigate existing non-compatible land uses in the Airport surroundings;
- Continue to collaborate on measures and methods to maintain and enhance land use compatibility related to aviation noise;
- Develop an understanding of probable future noise levels; and
- Develop realistic mitigation plans within the context of Federal regulations and eligibility criteria, financial feasibility, and fairness to aviation and non-aviation interests.

1.4 Project Roles and Responsibilities

The major contributors to the Part 150 process for BOI are highlighted in the subsections below.

1.4.1 City of Boise

The City of Boise is the owner and operator of BOI. Therefore, the City has responsibility over the entire Part 150 Study, including ultimate responsibility for determining what elements will be included in the NCP submitted to the FAA for review. The City of Boise is also responsible for pursuing the implementation of some of the measures, if approved by the FAA.

The City of Boise Planning and Development Services Department (PDSD) plays a role in the development of the Part 150 Study. The City is responsible for adopting land use initiatives that protect avigation and land use planning within the Boise Airport Influence Area (AIA), and is also responsible for implementing the NCP's recommended land use measures as they relate to the property within the AIA in the City of Boise. Staff with the PDSD assisted in updating the implementation status of the previous Part 150 land use measures, provided information on the City's current development trends, and provided comments on the proposed Part 150 land use measures during the development of the Study. The City also reviewed the land use base mapping for this Part 150 Study.

1.4.2 Ada County

Ada County has jurisdiction within the BOI AIA, and has therefore adopted land use initiatives that protect avigation and land use planning within the AIA. Ada County has worked with BOI and the City of Boise in the development of the Airport's Part 150 studies and is responsible for the implementation of recommended land use measures that impact Ada County as part of the NCP. Ada County Development Services provided information regarding the County's current land use planning and development trends, provided comments on the proposed Part 150 land use measures during the development of the Study, and reviewed the land use base mapping for this Part 150 Study.

1.4.3 Idaho Air National Guard

The 124th Wing of the Idaho Air National Guard (IDANG or Idaho ANG) is located at the Gowen Field Air National Guard Base (ANGB) on the south side of BOI. The IDANG property encompasses approximately 546.8 acres along the southern half of BOI, and operates as a joint civilian/military facility adjacent to the Idaho Army National Guard. The land on which the Gowen Field ANGB is located is owned by the City of Boise and is secured for military use through a lease agreement with the City and the Federal government. For the Part 150 Study, the IDANG reviewed the noise modeling and existing flight track assumptions, and also provided input related to potential future operating conditions associated with the IDANG at Gowen Field ANGB.

1.4.4 COMPASS

The Community Planning Association of Southwest Idaho (COMPASS) serves as the metropolitan planning organization (MPO) for Ada and Canyon counties in Idaho. COMPASS provided information for the Part 150 Study related to Ada County's overall development trends and planning in the region as it relates to transportation and land use.

1.4.5 Consulting Team

The City of Boise retained a consultant team to conduct the technical work required to fulfill the Part 150 analyses and documentation requirements. HNTB has overall project management responsibility for the Part 150 Study, including development of the existing and future

NEMs, land use and zoning analyses, and development and evaluation of the measures that comprise the recommended NCP. Blue Ridge Research and Consulting, LLC (BRRC) performed noise analysis for operations associated with the IDANG and other existing and potential military users at the Airport. Lynda Friesz Public Relations, Inc. (LFPR) assisted in the coordination of public outreach efforts associated with the study.

1.4.6 General Public

Members of the general public were invited to attend three public open houses to provide input and feedback on the study findings. Each included a PowerPoint presentation, study handout, and display boards, and provided an opportunity for the public to offer comment on the study content. The first public open house was held on June 3, 2015, and highlighted the draft existing and future NEMs. The second public open house following release of the draft document was held on September 2, 2015, which provided an overview of the Airport's NCP and highlighted the potential modifications to the recommended land use measures. The third public open house was held on October 6, 2015, following several requests for additional public input.

Part 150 Study status updates, as well as the highlighted measures of the proposed NCP were also provided to the Boise Airport Commission during their scheduled monthly meetings on June 4 and September 3, 2015. The Commission meetings are open to the general public.

The Draft Part 150 Study Update was made available for public review and comment on August 26, 2015, followed by an extended comment period. The document was made available at Airport offices, the Boise Downtown Library, and on the Airport's website. Comments were accepted until November 13, 2015.

A public hearing to accept final comments related to the Draft Part 150 Noise Study was held on December 9, 2015.

1.4.7 Federal Aviation Administration

The FAA has ultimate review authority over the NEMs submitted under Part 150. FAA review includes an assessment of both the adequacy of the technical documentation and the broader issues related to satisfying the Part 150 process requirements. FAA involvement includes participation by staff from the local, regional, and national levels of the agency, as follows:

- The BOI Air Traffic Control Tower (ATCT) provides significant input into existing and future operational procedures and trends.
- When the Airport submits the Part 150 documentation to the FAA for review, the FAA's Helena Airport District Office (ADO) will conduct an initial, local review to determine if it satisfies all NEM checklist requirements. The ADO is responsible for the final review of the NEM documentation for adequacy in satisfying technical and legal requirements.
- FAA's Washington, D.C. Headquarters will receive a copy of the NEM documentation.
- FAA will issue a Record of Approval noting its approval or disapproval of the actions recommended in the NCP.

Chapter Two
AIRCRAFT ACTIVITY AND FORECAST

2.1 Introduction

In order to evaluate existing and future noise exposure, it is necessary to understand the level of airport activity (operations) and types of aircraft operating at an airport. As noted in the previous chapter, the Part 150 Study process requires consideration of existing (2015) noise levels, and the prediction of noise five years into the future. Therefore, this Part 150 forecast provides aircraft operations by aircraft type at BOI for the years 2015 and 2020. The assumptions inherent in the Part 150 forecast are based on input from the FAA's 2014 Terminal Area Forecast (TAF), federal and local sources, airport users, and professional experience.

Per FAA requirements, the BOI Part 150 Study Update uses Annual Average Day (AAD) operations to compute existing and future aircraft noise exposure. The AAD operations are representative of all aircraft operations that occur over the course of a year. As such, the total existing and future annual operations are divided by 365 days to determine the AAD operations. The forecast must specify the number of operations by specific aircraft types, arrival or departure, time of day (e.g., daytime or nighttime), and departure travel distance. For the purposes of the Day-Night Average Sound Level (DNL) metric used in Part 150 studies, daytime is defined as 7:00 a.m. to 9:59 p.m. while nighttime is defined as 10:00 p.m. to 6:59 a.m.

This chapter describes the data sources and methodologies applied to develop existing and future fleet mixes and operations at BOI. The most current FAA databases and forecast at the time this study was initiated, including the 2014 TAF[1], Traffic Flow Management Systems Counts (TFMSC)[2], Operations Network (OPSNET)[3] and Distributed OPSNET[4], in addition to information provided by the Airport, were used in the analysis. The FAA 2014 TAF forecast was used as the primary source of future (2020) activity projections.

This chapter first reviews historical aviation activities at the Airport. The methodology applied to develop the existing and future conditions fleet mixes and operations is then discussed. Data sources, assumptions, as well as existing and future conditions fleet mixes and operations are discussed in detail in this section. The chapter concludes with a summary of fleet mixes and operations development and forecast results.

2.2 Boise Airport Users and Activity Summary

BOI is classified by the FAA in the National Plan of Integrated Airport Systems (NPIAS) as both a primary airport and small hub facility. The "primary" status indicates that BOI is a public airport that has scheduled air carrier service of at least 10,000 passengers a year, while the small hub classification indicates that BOI is an airport that enplanes between 0.05 percent and 0.25 percent of total U.S. passenger enplanements. The types of aircraft activity at BOI include carrier activity (passenger aircraft), cargo operators, charter airlines, general aviation (GA) activity and military operations. Passenger airlines in operation at BOI in 2014 include Alaska (operated by Horizon Air and Skywest), Delta Air Lines (operated by Skywest), Southwest Airlines, United Airlines (operated by Skywest and GoJet), US Airways, and Allegiant Air. A number of charter operators provide scheduled or on-demand flight options including Gem Air, Mountain Aviation, Jackson Jet Center, Turbo Air, McCall Aviation, and Western Aircraft. FedEx and United Parcel Service are the primary air cargo servicers at BOI.

GA activity is supported by four fixed-based operators (FBO) and U.S. Customs and Border Protection (CBP). GA operations include those flown by aircraft based at BOI and those based elsewhere arriving to and departing from BOI. The Airport maintains a number of aircraft tie-down positions and T-hangars to store aircraft.

Military activity includes aircraft operated by the 124th Fighter Wing, which primarily flies the A-10 Thunderbolt II and the Army National Guard, which includes various helicopter flight activity. Transient military aircraft also fly into and from BOI.

Table 2.1 presents a summary of historic aviation activity by categories at the Airport for Fiscal Years 2005 through 2014. Itinerant operations include those aircraft that leave the immediate BOI airspace and arrive from or depart to another airport, while local operations are generally considered to be training flights. Activity is presented for air carriers, air taxi, GA, and military operations. For the time period reviewed, the number of annual operations peaked at 185,090 in 2007. However, starting from 2008 and most markedly in 2009, the number of passengers and operations dropped again due to the Great Recession and high fuel prices, as well as other factors such as airline consolidation. Aircraft activity in 2014 indicates that air traffic is rebounding and has reached levels last seen in the 2009/2010 time frame.

Table 2.1

Historic Aircraft Operations, Fiscal Years 2005 - 2014

Fiscal Year	Itinerant				Local		Total
	Air Carrier	Air Taxi	General Aviation	Military	General Aviation	Military	
2005	39,765	31,390	55,930	8,743	31,495	4,574	171,897
2006	40,450	34,052	59,135	8,574	26,520	3,709	172,440
2007	42,444	31,868	63,660	8,777	34,914	3,427	185,090
2008	44,923	25,768	52,552	9,333	20,897	3,030	156,503
2009	40,711	15,769	41,208	8,664	18,566	4,252	129,170
2010	38,493	15,366	38,044	8,720	20,827	3,105	124,555
2011	34,935	17,454	36,495	8,789	19,928	3,179	120,780
2012	32,351	14,755	38,127	7,890	19,726	2,196	115,045
2013	32,461	13,027	38,907	8,545	17,399	2,009	112,348
2014*	33,864	12,804	39,367	9,378	24,927	5,072	125,412

Note: * 2014 Activity is projected.

Source: FAA 2014 TAF.

2.3 Methodology

The development of the existing fleet mix and forecast fleet mix employed various sources of aircraft and operational data, including a sample of radar data, input provided by the Airport and airport users, and data provided by the FAA. This section describes the data sources and methodologies used to estimate the existing and future conditions fleet mixes. A description of the data sources follows:

- FAA TAF: The TAF provides forecast operations by user class, including itinerant air carrier, air taxi, itinerant GA, itinerant military, local GA, and local military by fiscal year. The TAF for Fiscal Year 2014 was used as the primary source of forecast aircraft operations.
- Operations Network (OPSNET): The FAA OPSNET database contains the official air traffic operation counts available for public release. It provides operation counts by category, such as air carrier, air taxi, GA, and military. Operation counts are available for such facilities as airports, air traffic control towers, and Terminal Radar Approach Control (TRACON) facilities. It also includes Instrument Flight Rules (IFR), Visual Flight Rules (VFR), and local and itinerant flight breakdowns. FAA OPSNET data was collected from February 2014 to January 2015.
- Traffic Flow Management Systems Counts (TFMSC)[5]: The FAA TFMSC is comprised of the number of IFR operations by individual aircraft. It is the primary data source used to identify fleet composition for the Airport. It also provides operation categories including air carrier, air taxi, freight, GA, military, and other. TFMSC data was collected from August 2013 to July 2014.
- Distributed Operations Network (Distributed OPSNET)[6]: The FAA Distributed OPSNET database records the hourly IFR distribution of air traffic handled by various facilities. It provides essential information on day and night operations required for noise impact analysis.
- FAA Aerospace Forecast (Fiscal Years 2014 - 2034): The FAA publishes the Aerospace Forecast each year. It includes a series of national and industry projections for a 20-year period. Two forecasts from this document were used in this study including GA flight hours by equipment category and load factor projections.
- US DOT T100: The US DOT T100 database, also known as the Air Carrier Statistics database, contains domestic and international airline market and segment data. It was used to calculate existing condition load factor and enplanements by aircraft and airline in this study. T100 data was collected from August 2013 to July 2014.
- Radar data: A sample of radar data covering portions of 2013 and 2014 provided flight trajectory data with additional flight details such as airline, aircraft, origin, destination, and time. Radar data was used to develop and adjust flight tracks, calculate day/night split, and estimate stage length.

- Passenger Traffic Reports 2013 and 2014: BOI provided commercial airline operations and passenger counts in 2013 and 2014, which were used for commercial fleet mix calibration and projection.

The following assumptions were incorporated into the development of the existing and forecast fleet mix:

- IFR operations are those which fly under instrument flight rules and for which the most detailed data is available. This study assumed that the TFMSC database included all IFR operations at BOI.
- Civilian local operations were defined as operations within the airport pattern, and were presumed to be performed only by piston aircraft. All civilian local operations were presumed to be touch-and-go operations. Further, since precise operations and aircraft types representing local traffic was not available, the number of local touch-and-go flights was assumed to be proportional to the number of operations reported in the TFMSC.
- VFR Itinerant operations, those aircraft that fly outside of the local airport pattern, were presumed be conducted by piston aircraft, and the number of VFR itinerant operations was presumed to be proportional to the number of IFR itinerant operations by piston aircraft, for which more detailed data was available.
- The 2020 forecast presented in this study is unconstrained, which assumes future aviation activity will not be constrained by limits to airport infrastructure and capacity.

2.4 Existing Conditions (2015) Fleet Mix and Operations

Table 2.2 shows annual aircraft operations as reported by the FAA by aircraft group between February 2014 and January 2015. A total of 128,546 annual operations occurred, comprised of 66,266 GA operations (51.5%), 35,110 air carrier operations (27.3%), 15,037 military operations (11.7%) and 12,133 air taxi operations (9.4%). For the purposes of the Part 150 Study, this number of operations represents the existing conditions.

The OPSNET reports the combined annual air carrier and air taxi operations to be 47,243. Passenger Traffic Reports provided by BOI recorded a total of 39,026 air carrier operations. The difference between the combined OPSNET air carrier and air taxi operations and Passenger Traffic Reports were assumed to be unscheduled air taxi operations.

Table 2.2

Operations by Aircraft Category, February 2014 – January 2015

	Air Carrier	Air Taxi	General	Military	Total
IFR Itinerant	35,093	9,315	15,522	3,185	63,115
VFR Itinerant	17	2,818	24,428	5,584	32,847
Local	--	--	26,316	6,268	32,584
Total	**35,110**	**12,133**	**66,266**	**15,037**	**128,546**

Source: FAA OPSNET, February 2014 through January 2015.

2.4.1 Passenger (Air Carrier and Air Taxi) and All-Cargo Operations

This section presents the development of the fleet mix for passenger carriers (air carrier and air taxi operations) and all-cargo carriers. While Table 2.2 provides the actual number of aircraft operations as provided by the FAA, it does not provide information regarding the specific fleet mix, the time of day of operations, distances flown, and other information needed to develop a detailed fleet mix and existing and forecast noise contours.

The existing condition fleet mix was obtained from the FAA TFMSC, which includes itinerant IFR flight information including aircraft type. For the purposes of identifying the most commonly flown aircraft at the Airport, the range of aircraft representing 99% of the total number of TFMSC operations was included in the existing condition fleet mix.

Passenger Traffic Reports provided by BOI for 2013 and 2014 were used to inform the distribution of air carrier activity, and included landings by passenger and all-cargo carriers. In some cases, the airlines that operate at an airport change during the course of a study, however, the overall fleet mix is anticipated to be consistent with the assumptions in this document. **Table 2.3** shows the number of landings reported in the fiscal year 2014 (October 2013 – September 2014). Table 2.3 shows that the predominant carrier at BOI at the time of study initiation was Horizon Air, followed by United Express, Southwest, and Delta Air Lines.

The Passenger Traffic Reports do not include aircraft information. Therefore the US DOT T100 database, which includes both air carrier and aircraft information, was used to obtain operations by air carrier and aircraft. **Table 2.4** shows the number of operations by aircraft and airline for passenger carriers and all-cargo carriers. In Table 2.4, the number of operations reported in the T100 database was scaled to match the total number of operations by air carrier in the passenger traffic report. The result was applied to the fleet mix to develop air carrier fleet mix and operations.

Annual passenger aircraft operations are composed of three major aircraft equipment categories: mainline jets, regional jets (RJ), and turboprops. The table shows that the most common passenger aircraft in use at BOI is the De Havilland Dash 8-400, a twin-engine turboprop aircraft. Mainline jets most frequently used at BOI include the Airbus A319, A320, Boeing 737-300, 737-700 and 737-800. Regional jets include the Canadair CRJ-200, -700,-900, and Embraer 170/175, with the CRJ-200 comprising the majority of RJ flights. A majority of cargo operations at the Airport are flown by the Airbus A300-600 series aircraft.

2.4.2 General Aviation Operations

General aviation (GA) refers to multiple aircraft operations, including flight training, aeromedical helicopter operations, private transport via business jets, and other operations that do not fit into air carrier, cargo, or military aircraft groups.

The itinerant GA fleet and operations was obtained from the FAA TFMSC and OPSNET data. Itinerant VFR operations were assumed to be performed by piston aircraft. Local GA operations were assumed to be touch-and-go operations performed by piston aircraft. The number of itinerant VFR and local operations by an aircraft was assumed to be proportional to the number of itinerant IFR operations by the same aircraft. The number of itinerant IFR, itinerant VFR, and local operations were scaled to match the FAA OPSNET itinerant IFR, itinerant VFR, and local operations.

2.4.3 Military Operations

Military operations at Gowen Field include based A-10A aircraft associated with the Idaho ANG, helicopter operations associated with the Army National Guard, and numerous transient aircraft not based at BOI but that use the facility as a fuel stop or to practice approaches. Military operations reported by the FAA via the OPSNET database for the period February 2014 through January 2015 included 15,037 military operations, which equates to approximately 41 operations on an average annual day. For this time period, military operations accounted for approximately 11.7% of all operations.

The fleet mix for military operations was derived from the FAA TFMSC, Distributed OPSNET and coordination with the Idaho ANG and ATCT. A sample of TFMSC data, which identifies aircraft with filed flight plans, yielded over 70 different types of aircraft that operate at the Airport. Representative aircraft were selected to include operation categories such as Air Force fighter, Navy fighter, based attack fighter, propeller, small jet, large transporter/ refueler, and helicopter. The distribution of operations by day and night was based on the Distributed OPSNET and operation details provided by the Idaho ANG. **Table 2.5** presents the military fleet mix and operations, classified by type and time of day. The table shows that the based aircraft and helicopters associated with the Idaho ANG (the A-10A) and the Army National Guard (UH-60 and AH-64) account for a majority (71.4%) of military operations.

Table 2.3

2015 Passenger and All-Cargo Carriers Operations

Airlines	Annual Operations	AAD Operations
Passenger Carrier		
Alaska (Horizon Air)	13,490	37.0
United Express (Skywest & GoJet)	7,998	21.9
Southwest Airlines	6,468	17.7
Delta Air Lines	5,346	14.6
US Airways	1,638	4.5
United Airlines	1,570	4.3
Allegiant Air	268	0.7
Total	*36,778*	*100.8*
All-Cargo Carrier		
Federal Express	1,682	4.6
United Parcel Service	566	1.6
Total	*2,248*	*6.2*
Grand Total	***39,026***	***106.9***
Note: Numbers may not sum to total due to rounding.		

Sources: BOI Passenger Traffic Report, 2013-2014 and HNTB Analysis, 2015.

Table 2.4

2015 Passenger and All-Cargo Carriers Operations by Aircraft and Airline

Aircraft	Aircraft ID	Carrier	Annual Operations	AAD Operations
Passenger Airlines Operations				
AIRBUS A320-100/200	A320	Delta Air Lines	2,095	5.7
		United Airlines	431	1.2
		US Airways	104	0.3
AIRBUS A319	A319	Delta Air Lines	820	2.2
		United Airlines	283	0.8
		US Airways	1,534	4.2
BOEING 737-300	B733	Southwest Airlines	1,272	3.5
BOEING 737-700/LR	B737	United Airlines	43	0.1
		Southwest Airlines	5,196	14.2
BOEING 737-800	B738	Delta Air Lines	936	2.6
		United Airlines	534	1.5
BOEING 737-900	B739	United Airlines	280	0.8
BOEING 757-200	B752	Delta Air Lines	247	0.7
		Allegiant Air	120	0.3
CANADAIR RJ-200ER/RJ440	CRJ2	Skywest Airlines	4,405	12.1
CANADAIR RJ 900	CRJ9	Endeavor Air	142	0.4
		Skywest Airlines	507	1.4
CANADAIR RJ-700	CRJ7	Skywest Airlines	2,341	6.4
		GoJet	746	2.0
DEHAVILLAND DHC8-400 -8	DH8D	Horizon Air	13,490	37.0
EMBRAER 170	E170	Compass Air	55	0.2
		Shuttle America	166	0.5
EMBRAER-175	E175	Skywest Airlines	598	1.6
MCDONNELL MD-80,1,2,3,8	MD83	Allegiant Air	123	0.3
	MD88	Allegiant Air	24	0.1
MCDONNELL D-90	MD90	Delta Air Lines	286	0.8
Passenger Carrier Total			***36,778***	***100.8***
All-Cargo Airlines Operations				
BOEING 757-200	B752	Federal Express	292	0.8
		United Parcel Service	37	0.1
AIRBUS A300-600/R/CF/R	A306	Federal Express	1,048	2.9
		United Parcel Service	496	1.4
AIRBUS A310-200C/F	A310	Federal Express	321	0.9
DOUGLAS DC-10-10	DC10	Federal Express	22	0.1
BOEING 767-300/ER	B763	United Parcel Service	33	0.1
All-Cargo Carrier Total			***2,248***	***6.2***
Grand Total			***39,026***	***106.9***

Note: Numbers may not sum to total due to rounding.

Sources: US DOT T100, BOI Passenger Traffic Report, 2013-2014, and HNTB Analysis, 2015.

Table 2.5
2015 Military Operations by Aircraft Type

Type	Aircraft	Arrivals		Departures		Local Pattern		Total
		Day	Night	Day	Night	Day	Night	
Based	A-10	1,770	93	1,863	0	745	0	4,471
	UH-60	143	48	143	48	2,063	687	3,132
	AH-64	143	48	143	48	2,063	687	3,132
Transient	F-15	300	0	300	0	100	0	700
	F-18	100	0	100	0	0	0	200
	T-6	300	0	300	0	0	0	600
	C-130	600	0	600	0	0	0	1,200
	C-21	200	0	200	0	0	0	400
	KC-135	200	0	200	0	0	0	400
	UH-60	400	0	400	0	0	0	800
Total		**4,156**	**189**	**4,249**	**96**	**4,971**	**1,374**	**15,035**

Sources: FAA, Idaho ANG, BRRC and HNTB Analysis, 2015.

2.4.4 Stage Length

Part 150 studies use the concept of stage length to assess typical aircraft takeoff weights and resulting takeoff performance. The FAA's Integrated Noise Model (INM), which is used to compute noise exposure, contains at least one departure profile for each aircraft type in its database. Most large transport-category aircraft have multiple departure profiles that reflect several takeoff weights. However, accurate takeoff weight data by aircraft type is not normally available, especially on an annual average basis. Therefore, standard noise modeling methodology assumes that aircraft takeoff weights and resulting aircraft performance can be approximated based upon stage (or trip) length, a factor much more readily obtainable from airline schedules. Thus, the distribution of departure profiles assigned to an aircraft type is based on the distribution of stage lengths flown by that aircraft type. Longer distance (high stage length) flights are assumed to require more fuel and thus to have higher takeoff weights. This increases takeoff distance and lowers the aircraft's climb rate, as compared to lighter (short trip) flights. Accordingly, information on aircraft stage lengths is incorporated into the Part 150 forecast.

Air carrier aircraft serve approximately 15 non-stop destinations from BOI, including but not limited to Chicago, Denver, Las Vegas, Oakland, Phoenix, San Diego, and San Francisco. Cargo carriers, including FedEx and UPS, typically fly to and from cargo hubs including Salt Lake City and Memphis, with nearly all flights less than 2,000 miles from BOI. The majority of itinerant GA flights generally range less than 500 nautical miles, as flights longer than that are not feasible due to the fuel capacity of the aircraft.

Distances flown by commercial aircraft was determined through an analysis of T100 data. Origin and destination airport locations were obtained from the FAA Airport Master Record (Form 5010)[7]. Distances between airports were calculated as point-to-point great circle distances from origin airports to destination airports. As the T100 database does not provide information on GA activity, radar data for three months in 2014 was used to determine stage length. **Table 2.6** shows the stage length definition and departure stage length distribution at the Airport for air carrier, air taxi and GA operations. Nearly 89% of all operations fly to or from destinations closer than 500 nautical miles.

2.4.5 Day/Night Distribution of Operations

The DNL noise metric takes into consideration the time of day of aircraft operations, and penalizes operations that occur between 10:00 p.m. and 6:59 a.m. to account for the added intrusiveness of aircraft noise during nighttime hours. Information needed to determine the distribution of operations was obtained from the FAA Distributed OPSNET database and by a sample of radar data. Using radar data time stamps, operations that occurred during the daytime or nighttime were identified. In addition, the FAA Distributed OPSNET database provided the number of operations by hour for air carrier, air taxi, GA, and military flights. For aircraft recorded in the radar data, daytime and nighttime operations were derived. For aircraft not in the radar data, the FAA OPSNET was applied based on the operation category. **Table 2.7** shows the civilian day/night operation distribution by operation category.

2.4.6 Existing Condition (2015) Fleet Mix Summary

Table 2.8 shows the aircraft type, operation type, day/night split, stage length, and operations for the existing condition, representative of aircraft operations in 2015. 2015 AAD operations total 352.2, consisting of 88.3% civilian operations and 11.7% military operations. Approximately 89.3% of operations occur during daytime while 10.7% of operations occur during nighttime. Approximately 88.9% of departures travel less than 500 nautical miles (stage length 1) while 11.1% of departures travel more than 500 nautical miles (stage length > 1).

Figure 2-1 shows the 2015 fleet composition and the number of operations by each category. For the existing condition, jet operations account for approximately 31.2% of the total operations. Single engine piston aircraft account for approximately 30.4% of the total operations and multi-engine piston aircraft comprise approximately 14.3%. In total, piston aircraft account for slightly less than 45% of the total operations. Turboprop aircraft and helicopters constitute the remaining 24% of total operations.

Table 2.6

Stage Length Definition and Departure Stage Length Distribution

Stage Length	Range (Nautical Miles)	Percent of Departures
1	0 - 500	88.9%
2	501 - 1,000	8.4%
3	1,001 - 1,500	2.6%
4	1,501 - 2,500	0.1%
5	2,501 - 3,500	0.0%
6	3,501 - 4,500	0.0%
7	4,501 - 5,500	0.0%
8	5,501 - 6,500	0.0%
9	> 6,500	0.0%
Total		**100%**

Note: Numbers may not sum to total due to rounding.

Sources: HNTB Analysis, 2015.

Table 2.7

Day/Night Distribution of Operations by Category

Operation Type	Operation Category	Day Percent	Night Percent
Arrival	Commercial	79.6%	20.4%
	General Aviation	94.6%	5.4%
	Military	95.7%	4.3%
Departure	Commercial	91.2%	8.8%
	General Aviation	96.2%	3.8%
	Military	97.8%	2.2%
Touch-and-Go	General Aviation	87.2%	12.8%
	Military	78.4%	21.6%

Note: Numbers may not sum to total due to rounding.

Sources: FAA OPSNET, HNTB Analysis, 2015.

Table 2.8

Existing Condition Fleet Mix and Operations (2015)

Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total Operations
			Day	Night	Day	Night	Day	Night	
Civilian Fleet Mix and Operations									
Airbus A300 B4-600	A306	1	1.11	1.01	1.05	-	-	-	3.16
Airbus A300 B4-600	A306	2	-	-	0.01	-	-	-	0.01
Airbus A300 B4-600	A306	3	-	-	1.06	-	-	-	1.06
Airbus A310 All Series	A310	1	0.26	0.18	0.40	-	-	-	0.84
Airbus A310 All Series	A310	3	-	-	0.05	-	-	-	0.05
Airbus A319	A319	1	2.49	1.13	0.40	0.03	-	-	4.05
Airbus A319	A319	2	-	-	2.75	0.20	-	-	2.95
Airbus A319	A319	3	-	-	0.23	0.02	-	-	0.24
Airbus A320 All Series	A320	1	3.20	0.44	1.72	0.35	-	-	5.71
Airbus A320 All Series	A320	2	-	-	1.21	0.24	-	-	1.46
Airbus A320 All Series	A320	3	-	-	0.08	0.02	-	-	0.09
Airbus A320 All Series	A320	4	-	-	0.02	0.00	-	-	0.02
Gulfstream Commander	AC90	1	0.22	0.07	0.20	0.09	-	-	0.57
Piper Aero Star	AEST	1	0.44	0.08	0.45	0.07	0.91	0.13	2.07
Dassault-Bréguet/Dornier Alpha Jet	AJET	1	0.03	0.01	0.04	-	-	-	0.07
IAI Astra 1125	ASTR	1	0.10	-	0.10	-	-	-	0.20
Beech Super King Air 350	B350	1	0.10	-	0.10	-	-	-	0.21
Boeing 737-200/VC96	B732	1	0.18	-	0.10	-	-	-	0.27
Boeing 737-200/VC96	B732	2	-	-	0.05	-	-	-	0.05
Boeing 737-200/VC96	B732	3	-	-	0.01	-	-	-	0.01
Boeing 737-200/VC96	B732	4	-	-	0.02	-	-	-	0.02
Boeing 737-300	B733	1	1.52	0.22	1.43	0.03	-	-	3.20
Boeing 737-300	B733	2	-	-	0.27	0.01	-	-	0.27
Boeing 737-300	B733	3	-	-	0.01	0.00	-	-	0.01

Table 2.8

Existing Condition Fleet Mix and Operations (2015)

Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total Operations
			Day	Night	Day	Night	Day	Night	
Boeing 737-700	B737	1	5.58	1.60	4.54	0.13	-	-	11.84
Boeing 737-700	B737	2	-	-	2.27	0.06	-	-	2.33
Boeing 737-700	B737	3	-	-	0.17	0.00	-	-	0.18
Boeing 737-800	B738	1	1.10	0.93	0.54	0.51	-	-	3.08
Boeing 737-800	B738	2	-	-	0.47	0.44	-	-	0.92
Boeing 737-800	B738	3	-	-	0.03	0.03	-	-	0.06
Boeing 737-900	B739	1	0.35	0.03	-	-	-	-	0.38
Boeing 737-900	B739	2	-	-	0.24	0.13	-	-	0.37
Boeing 737-900	B739	3	-	-	0.01	0.01	-	-	0.01
Boeing 757-200	B752	1	0.81	0.14	0.72	0.09	-	-	1.77
Boeing 757-200	B752	4	-	-	0.13	0.02	-	-	0.14
Boeing 767-300	B763	1	0.05	-	-	-	-	-	0.05
Boeing 767-300	B763	3	-	-	0.05	-	-	-	0.05
Beech King Air 100 A/B	BE10	1	0.04	0.01	0.04	0.01	-	-	0.09
Beech 200 Super King	BE20	1	2.87	0.70	3.29	0.27	-	-	7.14
Raytheon 300 Super King Air	BE30	1	0.07	-	0.07	-	-	-	0.15
Beech Bonanza 35	BE35	1	1.48	-	1.48	-	2.59	0.38	5.92
Beech Bonanza 36	BE36	1	1.23	-	1.23	-	2.16	0.32	4.94
Raytheon/Beech Beechjet 400/T-1	BE40	1	0.18	0.02	0.18	0.02	-	-	0.40
Beech Baron 55	BE55	1	0.62	-	0.62	-	1.08	0.16	2.47
Beech 58	BE58	1	0.84	-	0.84	-	1.47	0.22	3.36
Beech 60 Duke	BE60	1	0.59	-	0.59	-	1.03	0.15	2.37
Beech Airliner 99	BE99	1	0.59	-	0.59	-	-	-	1.18
Beech King Air 90	BE9L	1	1.07	0.03	1.05	0.04	-	-	2.19
Beech F90 King Air	BE9T	1	0.09	0.04	0.13	-	-	-	0.26

Table 2.8

Existing Condition Fleet Mix and Operations (2015)

Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total Operations
			Day	Night	Day	Night	Day	Night	
Cessna Skyhawk 172/Cutlass	C172	1	3.13	-	3.13	-	5.48	0.80	12.54
Cessna 177 Cardinal	C177	1	0.57	-	0.57	-	0.99	0.15	2.27
Cessna Skylane 182	C182	1	4.13	-	4.13	-	7.11	1.05	16.41
Cessna 206 Stationair	C206	1	1.24	0.22	1.27	0.19	2.46	0.36	5.73
Cessna 208 Caravan	C208	1	0.02	0.00	0.03	-	-	-	0.05
Cessna 210 Centurion	C210	1	2.98	0.33	3.31	-	5.09	0.75	12.46
Cessna Citation CJ2	C25A	1	0.52	0.02	0.52	0.02	-	-	1.08
Cessna Citation CJ3	C25B	1	0.46	-	0.43	0.03	-	-	0.91
Cessna Citation CJ4	C25C	1	0.12	-	0.12	-	-	-	0.25
Cessna 340	C340	1	1.56	-	1.56	-	2.37	0.35	5.85
Cessna 401/402	C402	1	0.16	0.85	1.01	-	0.09	0.01	2.12
Cessna Chancellor 414	C414	1	3.18	-	3.18	-	5.56	0.82	12.74
Cessna Golden Eagle 421	C421	1	0.86	-	0.61	0.25	1.25	0.18	3.16
Cessna 425 Corsair	C425	1	0.23	0.03	0.25	0.01	-	-	0.52
Cessna Conquest	C441	1	0.19	-	0.19	-	-	-	0.38
Cessna I/SP	C501	1	0.04	-	0.04	-	-	-	0.08
Cessna Citation Mustang	C510	1	0.52	-	0.44	0.09	-	-	1.05
Cessna CitationJet/CJ1	C525	1	0.96	0.19	1.07	0.07	-	-	2.29
Cessna Citation II/Bravo	C550	1	0.60	0.10	0.63	0.07	-	-	1.40
Cessna Citation II/SP	C551	1	0.04	0.01	0.04	0.01	-	-	0.09
Cessna Citation V/Ultra/Encore	C560	1	1.12	0.09	1.17	0.04	-	-	2.42
Cessna Excel/XLS	C56X	1	0.46	-	0.46	-	-	-	0.91
Cessna III/VI/VII	C650	1	0.53	0.06	0.51	0.08	-	-	1.18
Cessna Citation Sovereign	C680	1	0.43	-	0.43	-	-	-	0.85
Cessna Citation X	C750	1	0.18	-	0.18	-	-	-	0.36

Table 2.8

Existing Condition Fleet Mix and Operations (2015)

Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total Operations
			Day	Night	Day	Night	Day	Night	
Bombardier (Canadair) Challenger 300	CL30	1	0.40	0.04	0.40	0.03	-	-	0.88
Bombardier Challenger 600/601/604	CL60	1	0.19	-	0.19	-	-	-	0.38
Lancair LC-41 Columbia 400	COL4	1	0.44	-	0.44	-	0.78	0.11	1.78
Bombardier CRJ-200	CRJ2	1	5.35	0.69	5.75	0.29	-	-	12.08
Bombardier CRJ-700	CRJ7	1	3.47	0.76	1.86	0.21	-	-	6.30
Bombardier CRJ-700	CRJ7	2	-	-	1.17	0.13	-	-	1.30
Bombardier CRJ-700	CRJ7	3	-	-	0.78	0.09	-	-	0.86
Bombardier CRJ-900	CRJ9	1	0.43	0.45	0.09	0.13	-	-	1.10
Bombardier CRJ-900	CRJ9	2	-	-	0.28	0.38	-	-	0.66
Diamond Star DA40	DA40	1	0.86	-	0.86	-	1.51	0.22	3.46
Boeing (Douglas) DC 10-10/30/40	DC10	1	0.02	0.00	0.02	0.00	-	-	0.06
Bombardier Q-400	DH8D	1	16.14	2.34	16.90	1.58	-	-	36.96
Embraer ERJ 135/140/Legacy	E135	1	0.02	-	0.02	-	-	-	0.05
Embraer E170	E170	1	0.25	0.03	0.04	-	-	-	0.32
Embraer E170	E170	2	-	-	0.06	-	-	-	0.06
Embraer E170	E170	3	-	-	0.19	-	-	-	0.19
Embraer E175	E175	1	0.67	0.10	0.09	0.02	-	-	0.88
Embraer E175	E175	2	-	-	0.13	0.03	-	-	0.15
Embraer E175	E175	3	-	-	0.42	0.09	-	-	0.50
Embraer Phenom 100	E50P	1	0.25	-	0.25	-	-	-	0.49
Embraer Phenom 300	E55P	1	0.07	-	0.07	-	-	-	0.14
Eclipse 500	EA50	1	0.10	-	0.08	-	-	-	0.18
Eclipse 500	EA50	2	-	-	0.03	-	-	-	0.03
Eurocopter EC-145	EC45	1	0.00	0.00	0.00	0.00	-	-	0.01
Dassault Falcon 2000	F2TH	1	0.11	0.01	0.12	-	-	-	0.25

Table 2.8

Existing Condition Fleet Mix and Operations (2015)

Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total Operations
			Day	Night	Day	Night	Day	Night	
Dassault Falcon 900	F900	1	0.20	-	0.13	0.01	-	-	0.35
Dassault Falcon 900	F900	2	-	-	0.01	0.00	-	-	0.02
Dassault Falcon 900	F900	3	-	-	0.04	0.00	-	-	0.05
Dassault Falcon/Mystère 20	FA20	1	0.03	0.01	0.03	0.01	-	-	0.08
Dassault Falcon/Mystère 50	FA50	1	0.14	-	0.06	-	-	-	0.20
Dassault Falcon/Mystère 50	FA50	2	-	-	0.06	-	-	-	0.06
Dassault Falcon/Mystère 50	FA50	3	-	-	0.02	-	-	-	0.02
Dassault Falcon F7X	FA7X	1	0.06	-	0.06	-	-	-	0.11
Gulfstream G150	G150	1	0.10	-	0.10	-	-	-	0.19
IAI 1126 Galaxy/Gulfstream G200	GALX	1	0.39	-	0.31	0.08	-	-	0.77
Bombardier BD-700 Global 5000	GL5T	1	0.18	-	0.18	-	-	-	0.36
Bombardier BD-700 Global Express	GLEX	1	0.02	-	0.02	-	-	-	0.05
Gulfstream IV/G400	GLF4	1	0.10	-	0.08	0.01	-	-	0.19
Gulfstream V/G500	GLF5	1	0.09	-	0.09	-	-	-	0.19
BAe HS 125/700-800/Hawker 800	H25B	1	0.49	0.04	0.53	-	-	-	1.07
Quest Kodiak	KODI	1	0.02	-	0.02	-	-	-	0.04
Bombardier Learjet 31/A/B	LJ31	1	0.09	-	0.09	-	-	-	0.18
Bombardier Learjet 35/36	LJ35	1	0.18	-	0.13	0.05	-	-	0.36
Learjet 40; Gates Learjet	LJ40	1	0.03	-	0.03	-	-	-	0.06
Bombardier Learjet 45	LJ45	1	0.96	0.01	0.91	0.05	-	-	1.93
Bombardier Learjet 55	LJ55	1	0.01	0.01	0.02	-	-	-	0.05
Bombardier Learjet 60	LJ60	1	0.14	0.02	0.16	-	-	-	0.32
Mooney M-20C Ranger	M20P	1	0.99	-	0.99	-	1.72	0.25	3.95
Turbo Mooney M20K	M20T	1	0.42	0.07	0.43	0.06	0.86	0.13	1.97
Boeing (Douglas) MD 83	MD83	1	0.17	-	0.17	-	-	-	0.34

Table 2.8

Existing Condition Fleet Mix and Operations (2015)

Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total Operations
			Day	Night	Day	Night	Day	Night	
Boeing (Douglas) MD 88	MD88	1	0.03	-	0.03	-	-	-	0.07
Boeing (Douglas) MD 90	MD90	1	0.21	0.18	-	-	-	-	0.40
Boeing (Douglas) MD 90	MD90	2	-	-	0.25	0.14	-	-	0.40
Mitsubishi Marquise/Solitaire	MU2	1	0.02	0.00	0.02	0.00	-	-	0.04
Piaggio P-180 Avanti	P180	1	0.08	0.01	0.08	0.02	-	-	0.18
Riley Super P210	P210	1	0.91	-	0.91	-	1.60	0.23	3.65
Piper Cherokee	P28A	1	2.09	-	2.09	-	3.66	0.54	8.39
Cherokee Arrow/Turbo	P28R	1	0.29	0.23	0.51	-	0.86	0.13	2.02
Piper Malibu Meridian	P46T	1	0.19	0.03	0.21	-	-	-	0.43
Piper Cherokee	PA28	1	0.29	0.05	0.30	0.04	0.60	0.09	1.38
Piper Navajo PA-31	PA31	1	3.50	1.13	4.63	-	0.95	0.14	10.35
Piper PA-34 Seneca	PA34	1	0.67	-	0.67	-	1.16	0.17	2.67
Piper Seminole	PA44	1	0.81	-	0.81	-	1.42	0.21	3.26
Piper Malibu	PA46	1	1.82	-	1.82	-	3.19	0.47	7.31
Piper Cheyenne 1	PAY1	1	0.03	-	0.03	-	-	-	0.06
Piper Cheyenne 2	PAY2	1	0.05	0.01	0.05	0.01	-	-	0.12
Piper PA-42-720 Cheyenne 3	PAY3	1	0.17	0.03	0.17	0.03	-	-	0.40
Piper Cheyenne 400	PAY4	1	0.06	0.02	0.08	-	-	-	0.16
Pilatus PC-12	PC12	1	3.50	0.56	3.40	0.66	-	-	8.12
Raytheon Premier 1/390 Premier 1	PRM1	1	0.12	-	0.11	0.01	-	-	0.24
Saab 2000	SB20	1	0.04	0.01	0.04	0.01	-	-	0.09
North American Rockwell Sabre 40/60	SBR1	1	0.03	-	0.03	-	-	-	0.05
Cirrus SR 22	SR22	1	2.83	-	2.83	-	4.91	0.72	11.30
Fairchild Swearingen SA-226T/TB Merlin 3	SW3	1	0.13	0.02	0.15	-	-	-	0.31
Swearingen Merlin 4/4A Metro2	SW4	1	0.15	0.75	0.88	0.02	-	-	1.81

Table 2.8

Existing Condition Fleet Mix and Operations (2015)

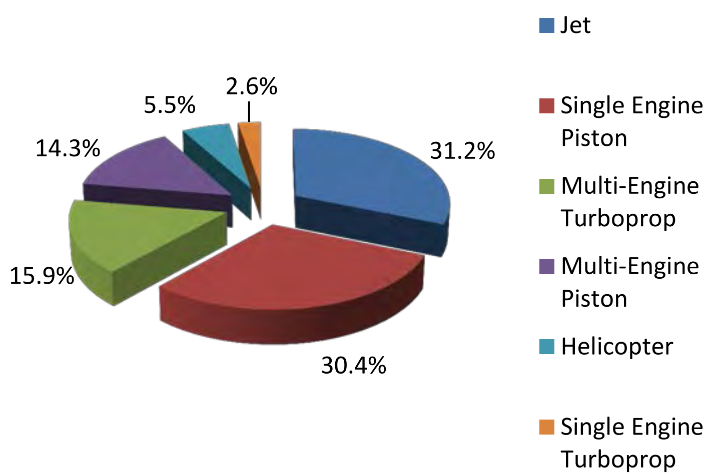
Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total Operations
			Day	Night	Day	Night	Day	Night	
Socata TBM-7	TBM7	1	0.06	-	0.06	-	-	-	0.11
Socata TBM-850	TBM8	1	0.20	-	0.20	-	-	-	0.41
Civilian Total			**103.30**	**16.14**	**111.61**	**7.84**	**62.86**	**9.24**	**310.98**
Military Fleet Mix and Operations									
Thunderbolt II	A10	1	4.85	0.25	5.10	-	2.04	-	12.25
Black Hawk Helicopter	UH60	1	1.49	0.13	1.49	0.13	5.65	1.88	10.77
Apache Helicopter	AH64	1	0.39	0.13	0.39	0.13	5.65	1.88	8.58
Eagle Fighter	F15	1	0.82	-	0.82	-	0.27	-	1.92
Hornet Fighter	F18	1	0.27	-	0.27	-	-	-	0.55
Texan II	T6	1	0.82	-	0.82	-	-	-	1.64
Hercules	C130	1	1.64	-	1.64	-	-	-	3.29
Huron	C21	1	0.55	-	0.55	-	-	-	1.10
Stratolifter/Stratotanker	KC35	1	0.55	-	0.55	-	-	-	1.10
Military Total			**11.39**	**0.52**	**11.64**	**0.26**	**13.62**	**3.76**	**41.19**
Grand Total			**114.69**	**16.66**	**123.25**	**8.10**	**76.48**	**13.00**	**352.18**

Note: Numbers may not sum to total due to rounding.

Sources: FAA, US DOT T100, BOI, Radar Data and HNTB Analysis, 2015.

Figure 2-1

Existing Condition Operations by Aircraft Category



2.5 Future (2020) Fleet Mix and Operations

As stated in Section 1.1, 14 CFR Part 150 requires the use of a forecast condition dated five years from the date of the submission. As such, operations were forecast for the year 2020 and include assumptions developed for air carrier, cargo, air taxi, GA and military operations. The assumptions inherent in the Part 150 forecast are based on input from the FAA 2014 TAF, federal and local sources, and professional experience. The following sections provide details on the development of the future forecast and fleet mix.

2.5.1 FAA 2014 TAF

As stated in Section 2.3, the FAA 2014 TAF was used as the primary source of forecast aircraft operations. According to the FAA TAF, operations are forecast to increase to over 138,000 by 2020. The total number of operations provided in the TAF was adjusted to address the following factors:

- A conversion from Fiscal Year operations to Calendar Year operations;
- An adjustment to the number of 2015 operations provided by the OPSNET database; and
- Adjustments made to the commercial and military fleet mix.

After considering all adjustments, the total number of operations is projected to increase from 128,546 in the existing condition to 138,204 in the forecast condition, as shown in **Table 2.9**. The total number of air carrier and air taxi operations is projected to increase at a compounded annual growth rate (CAGR) of 3.0% from 2015 to 2020. GA operations are projected to increase slightly at a CAGR of 0.8% for the same period. Military operations, however, are expected to decrease at an annual rate of 0.8%. The total number of operations at the Airport is projected to increase at an annual rate of 1.5%.

Table 2.9

Adjustments to FAA TAF Forecast

Year	Itinerant				Local		Total
	Air Carrier	Air Taxi	GA	Military	GA	Military	
TAF (Fiscal Year)							
2015	37,410	12,202	38,830	9,378	28,852	5,072	131,744
2020	44,432	10,487	39,922	9,378	29,228	5,072	138,519
After Fiscal Year to Calendar Year Adjustment							
2015	36,524	12,353	38,964	9,378	27,871	5,072	130,161
2020	44,042	10,623	39,867	9,378	29,209	5,072	138,190
After OPSNET Adjustment							
2015	35,110	12,133	39,950	8,769	26,316	6,268	128,546
2020	44,042	10,623	39,867	9,378	29,209	5,072	138,190
After Commercial Flight Adjustment							
2015	39,026	8,217	39,950	8,769	26,316	6,268	128,546
2020	47,059	7,605	39,867	9,378	29,209	5,072	138,190
After Military Flight Adjustment							
2015	39,026	8,217	39,950	8,769	26,316	6,268	128,546
2020	47,059	7,605	39,867	7,964	29,209	6,500	138,204
CAGR	3.81%	-1.54%	-0.04%	-1.91%	2.11%	0.73%	1.46%

Note: Numbers may not sum to total due to rounding.

Sources: FAA 2014 TAF, ATADS, and HNTB Analysis, 2015.

2.5.2 Future Fleet Mix and Operations Projections

The adjusted TAF shown in Table 2.9 was used to determine the total number of future civilian operations in each category. Following the adjustments made to the TAF, the forecast 2020 operations are anticipated to be 138,204, or approximately 378.6 AAD operations. Commercial flights were projected by both air carrier and aircraft type. GA operations were forecasted using GA aircraft manufacturer data and the FAA forecast on flight hours by category. Military fleet and operations were projected based on the FAA TAF and potential operation changes associated with the mission of the Idaho ANG.

The existing stage length and day/night distribution of operations was carried forward by aircraft type. The following sections describe future commercial, GA, and military operations in further detail.

2.5.2.1 Commercial Flights Projection

The future condition fleet mix and operations were based on the TAF enplanements (passengers) projection, adjusted TAF operations projection, US DOT T100, the Passenger Traffic Report, FAA Aerospace Forecast and individual airline fleet retirement plans.

The air carrier operations growth factor projected by the FAA TAF was used as the air carrier and air taxi operations growth factor. Meanwhile, the TAF enplanements growth factor was also used to estimate growth in scheduled seat departures. The seat departure projection, combined with the air carrier and air taxi operations projections, were used to estimate future air carrier aircraft size and guide the fleet mix projections. The existing fleet service age information was obtained from airfleets.net and the JP airline fleets database. Each airline's existing (at the initiation of this study) and projected fleet mix was analyzed, and the following trends and assumptions were incorporated into the forecast 2020 fleet mix.

- Allegiant Air currently operates Boeing (formerly McDonnell Douglas) MD-80s and B757-200s at the Airport. The average service age of their Boeing MD-80s is approximately 24 years and their B757-200s is 21 years. Allegiant's Airbus fleet has had a shorter service period, with A319s at 10 years and A320s at 14 years, and is therefore expected to have a longer future operational life. The forecast assumes that the Airbus fleet would partially replace the Boeing fleet in 2020, due to the eventual retirement of the older Boeing aircraft.

- At the initiation of this study, Compass Airlines and Skywest Airlines operated Embraer E170 and E175 aircraft at the Airport on behalf of Delta Air Lines. The fleet is relatively new (approximately 6 years) and these aircraft are expected to continue service at BOI.

- Delta Air Lines currently operates Airbus A319, A320, Boeing B737-800, B757-200, MD-88 and MD-90 aircraft at BOI. The McDonnell Douglas aircraft, including MD-88s and MD-90s, represent the oldest aircraft in the Delta fleet, with an average service age of approximately 24 years for MD-88s and 18 years for MD-90 aircraft. The forecast assumes that MD-88s and MD-90s would be replaced by Boeing B737-900ER aircraft.

- Endeavor Air, a wholly owned subsidiary of Delta Air Lines operating under the umbrella of Delta Connection, utilizes Canadair CRJ-900 aircraft at BOI. Since the CRJ-900 fleet is relatively new, it was expected that the aircraft would continue to serve the Airport.

- Horizon Air operates the Bombardier Q400 for Alaska Airlines, with a relatively new fleet age (approximately 7 years) and a recent firm purchase order of additional Q400s[8], and is forecast to continue use of these aircraft.

- Skywest currently operates Canadair CRJ-200, CRJ-700, and CRJ-900 aircraft at the Airport. This forecast assumes that the 50-seat CRJ-200 would be replaced by 70-seat CRJ-700 in the future, consistent with the industry trend of replacing 50-seat regional aircraft with 70-seat regional aircraft. Since initiation of this study, Skywest has begun flight service for Delta Air Lines, and also provides service for Alaska Airlines.

- Shuttle America operates the Embraer E170 aircraft at BOI, with a fleet age of approximately 8 years, and is forecast to continue to serve BOI with these aircraft.

- Southwest serves BOI using Boeing B737-300 and B737-700 aircraft. The Boeing B737-300 belongs to the B737 Classic series and is expected to be retired between 2016 and 2020, while the Boeing B737-700 belongs to the B737 New Generation series and is designed to replace aircraft in the Classic series. Therefore the forecast assumes the B737-300 will be replaced by the B737-700 in 2020.
- With the merger of US Airways and American Airlines, the forecast anticipates that the current US Airways fleet would be blended with the current American Airlines fleet. The current US Airways fleet includes Airbus A319, A320, and A321 aircraft. It was assumed that the future American Airlines fleet would include US Airways Airbus A319, A320, and A321 aircraft, as well as maintaining American's current MD-80 and Boeing 737-800 aircraft.
- In addition to passenger carriers, two major all-cargo carriers (UPS and FedEx), operate at BOI. Both airlines fly Boeing 757-200, Boeing 767-300, and Airbus A300-600 aircraft, while UPS also operates Airbus A310-200/300F aircraft. UPS and FedEx were assumed to continue operations using these aircraft.

Using the aircraft replacement assumptions above, the future air carrier fleet mix was projected. The FAA 2014 TAF forecasts for air carrier operations, as adjusted, were used as the projected total number of commercial operations, while the enplanement forecast was used to ensure that the combination of future average aircraft size and operations would not over-serve or under-serve the projected passenger growth in the future.

Table 2.10 shows the projected commercial air carrier fleet mix.

2.5.2.2 GA Fleet and Operations Projection

The GA fleet and operations were projected using an HNTB proprietary GA aircraft forecasting model and the FAA Aerospace Forecast (Fiscal Years 2014-2034). The GA aircraft forecasting model considers the manufacturing period and average production rate for a particular GA aircraft to project the number in service in the future. The model estimates aircraft growth by individual equipment type. The FAA Aerospace Forecast provides an estimate of the total number of flying hours by aircraft category (jet, turboprop, etc.) in the future. The individual aircraft projections from the GA aircraft forecasting model in each category were adjusted proportionately to sum to the FAA projections growth within that category. The resultant number of operations in each category was then scaled to match the total number of GA operations in the 2014 TAF.

In September 2013, the FAA published a ruling that prohibits Stage 2 jet airplanes with a maximum weight of 75,000 pounds or less operating in the United States unless they meet Stage 3 noise levels.[9] There are two Stage 2 jet aircraft types currently operating at BOI, the Dassault Falcon 20 and the Rockwell Sabre 40/60, both of which would be prohibited from flying unless they could be modified to be Stage 3 compliant. There is no information indicating that modifications are available to make either aircraft Stage 3 compliant, and as such, the forecast assumes these aircraft would be replaced by other business jets.

Table 2.10

2020 Passenger and All-Cargo Air Carrier Operations

Existing Condition Equipment	Carrier	2020 Equipment	2020 AAD Operations	Annual Operations
Passenger Carrier				
AIRB A320-100/200	Delta Air Lines	AIRB A320-100/200	2.60	949
		Boeing B717	3.90	1,423
	United Airlines	AIRB A320-100/200	1.32	482
	American Airlines	AIRB A320-100/200	0.13	47
		MCDON MD-80,1,2,3,8	0.06	23
		BOEING 737-800	0.13	47
AIRBUS A319	Delta Air Lines	AIRBUS A319	2.54	928
	United Airlines	AIRBUS A319	0.87	316
	American Airlines	AIRBUS A319	1.88	686
		MCDON MD-80,1,2,3,8	0.94	343
		BOEING 737-800	1.88	686
BOEING 737-300	Southwest Airlines	BOEING 737-700/LR	3.90	1,424
BOEING 737-700/LR	United Airlines	BOEING 737-700/LR	0.13	48
	Southwest Airlines	BOEING 737-700/LR	15.92	5,810
BOEING 737-800	Delta Air Lines	BOEING 737-800	2.90	1,060
	United Airlines	BOEING 737-800	1.64	597
BOEING 737-900	United Airlines	BOEING 737-900	0.86	313
BOEING 757-200	Delta Air Lines	BOEING 757-200	0.77	280
	Allegiant Air	BOEING 757-200	0.37	135
CANAD RJ-200ER/RJ440	Skywest	CANAD RJ-200ER/RJ440	0.00	-
		CANADAIR RJ-700	13.51	4,932
CANADAIR RJ 900	Endeavor Air	CANADAIR RJ 900	0.43	158
	Skywest	CANADAIR RJ 900	1.53	558
CANADAIR RJ-700	Skywest	CANADAIR RJ-700	7.18	2,620
	GoJet	CANADAIR RJ-700	2.29	835

Table 2.10

2020 Passenger and All-Cargo Air Carrier Operations

Existing Condition Equipment	Carrier	2020 Equipment	2020 AAD Operations	Annual Operations
		Passenger Carrier		
DEHAV DHC8-400 -8	Horizon Air	DEHAV DHC8-400 -8	41.34	15,088
EMBRAER 170	Compass Air	EMBRAER 170	0.16	58
	Shuttle America	EMBRAER 170	0.48	174
EMBRAER-175	Skywest Airlines	EMBRAER-175	1.71	626
MCDON MD-80,1,2,3,8	Allegiant Air	MCDON MD-80,1,2,3,8	0.08	28
		AIRBUS A319	0.15	55
		AIRB A320-100/200	0.15	55
	Allegiant Air	MCDON MD-80,1,2,3,8	0.01	5
		AIRBUS A319	0.03	11
		AIRB A320-100/200	0.03	11
MCDONNELL D-90	Delta Air Lines	MCDONNELL D-90	0.89	324
Passenger Carrier Total			***112.69***	***41,134***
		All-Cargo Carrier		
BOEING 757-200	Federal Express	BOEING 757-200	0.89	325
	United Parcel Service	BOEING 757-200	0.11	40
AIRB A300-600/R/CF/R	Federal Express	AIRB A300-600/R/CF/R	3.21	1,173
	United Parcel Service	AIRB A300-600/R/CF/R	1.52	556
AIRB A310-200C/F	Federal Express	AIRB A310-200C/F	0.98	359
DOUGLAS DC-10-10	Federal Express	BOEING 767-300/ER	0.07	24
BOEING 767-300/ER	United Parcel Service	BOEING 767-300/ER	0.10	37
All-Cargo Carrier Total			***6.89***	***2,515***
Grand Total			**119.59**	**43,649**

Note: Numbers may not sum to total due to rounding.

Sources: FAA TAF, US DOT T100, BOI Passenger Traffic Report, and HNTB Analysis, 2015.

2.5.2.3 Military Fleet and Operations Projection

The future military fleet mix and operations were developed based on the existing condition fleet mix and potential changes in the Idaho ANG mission. The US Air Force has considered various alternatives that would result in the A-10A being removed from service, which would impact the flying mission of the Idaho ANG. Although no final course of action has been decided as of August 2015, this forecast assumes that the A-10A will be removed from service and the Idaho ANG will assume a flying mission consisting of an approximate equal number of F-15 Eagle (F-15E) aircraft by 2020. Although there are no definite plans for this transition, Gowen Field provides a number of advantages for based F-15E aircraft, including the proximity to Mountain Home Air Force Base (which currently operates F-15E aircraft) and the facilities necessary for F-15E operations at BOI already exist. The Idaho ANG and Boise Airport strongly support a continued flying mission at BOI.

No changes to the number of transient aircraft or helicopter operations associated with the Idaho ANG are anticipated. Based on the information provided by the Idaho ANG, the number of forecast military operations was adjusted slightly from the 2014 TAF. **Table 2.11** shows the military fleet mix and operations.

2.5.3 Forecast Summary

The air carrier, air taxi, and GA operations, after adjustments, were used as the total number of operations for the future condition (2020). The number of air carrier and air taxi operations is projected to increase at an annual rate of 2.96%. Itinerant GA operations are projected to decrease slightly at an annual rate of 0.04% while local GA operations increase at an annual rate of 2.11%. The total number of operations was projected to increase at an annual rate of 1.46%.

Figure 2-2 shows the future condition fleet composition and the number of operations by each category. The share of jet operations increases from 31.2% in the existing condition to 34.8% in the future condition. Single engine piston aircraft operations account for 27.6% of the total airport operations, a decrease of 2.8% compared to the existing condition. The percentage of operations by multi-engine piston aircraft is also projected to decrease by 1.5% from the existing condition to 12.8%. In total, piston aircraft are projected to account for slightly more than 40% of the total operations. Turboprop aircraft and helicopters constitute the remaining 24.7% of the total operations.

The future condition fleet mix and AAD operations are shown in **Table 2.12**. The total number of operations for the future condition is 138,204, equivalent to 378.6 AAD operations.

Table 2.11
2020 Military Fleet Mix and Operations

Type	Aircraft	Arrivals		Departures		Local Pattern		Total
		Day	Night	Day	Night	Day	Night	
Based	F-15	3.90	0.21	4.11	-	2.47	-	10.68
	UH-60	0.39	0.13	0.39	0.13	5.65	1.88	8.58
	AH-64	0.39	0.13	0.39	0.13	5.65	1.88	8.58
Transient	F-15	0.82	-	0.82	-	0.27	-	1.92
	F-18	0.27	-	0.27	-	-	-	0.55
	T-6	0.82	-	0.82	-	-	-	1.64
	C-130	1.64	-	1.64	-	-	-	3.29
	C-21	0.55	-	0.55	-	-	-	1.10
	KC-135	0.55	-	0.55	-	-	-	1.10
	UH-60	1.10	-	1.10	-	-	-	2.19
Total		**10.44**	**0.47**	**10.65**	**0.26**	**14.04**	**3.76**	**39.63**

Note: Numbers may not sum to total due to rounding.

Sources: FAA, Idaho ANG, BBRC, and HNTB Analysis, 2015.

Figure 2-2
Future Condition Operations by Aircraft Category

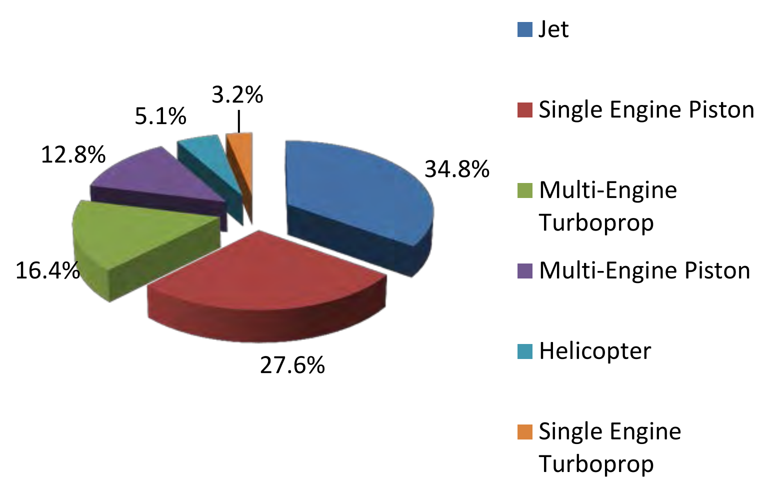


Table 2.12
2020 Fleet Mix and Operations

Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total
			Day	Night	Day	Night	Day	Night	Operations
Civilian Fleet Mix and Operations									
Airbus A300 B4-600	A306	1	1.24	1.12	1.17	-	-	-	3.53
Airbus A300 B4-600	A306	2	-	-	0.01	-	-	-	0.01
Airbus A300 B4-600	A306	3	-	-	1.18	-	-	-	1.18
Airbus A310 All Series	A310	1	0.30	0.20	0.44	-	-	-	0.93
Airbus A310 All Series	A310	3	-	-	0.05	-	-	-	0.05
Airbus A319	A319	1	2.77	1.26	0.45	0.03	-	-	4.51
Airbus A319	A319	2	-	-	3.07	0.22	-	-	3.29
Airbus A319	A319	3	-	-	0.25	0.02	-	-	0.27
Airbus A320 All Series	A320	1	3.54	0.48	1.90	0.38	-	-	6.31
Airbus A320 All Series	A320	2	-	-	1.34	0.27	-	-	1.61
Airbus A320 All Series	A320	3	-	-	0.09	0.02	-	-	0.10
Airbus A320 All Series	A320	4	-	-	0.02	0.00	-	-	0.02
Gulfstream Commander	AC90	1	0.18	0.06	0.16	0.07	-	-	0.47
Piper Aero Star	AEST	1	0.32	0.06	0.33	0.05	0.90	0.13	1.79
Dassault-Bréguet/Dornier Alpha Jet	AJET	1	0.04	0.01	0.04	-	-	-	0.09
IAI Astra 1125	ASTR	1	0.12	-	0.12	-	-	-	0.23
Beech Super King Air 350	B350	1	0.14	-	0.14	-	-	-	0.27
Boeing 737-300	B733	1	1.70	0.25	1.60	0.03	-	-	3.58
Boeing 737-300	B733	2	-	-	0.30	0.01	-	-	0.31
Boeing 737-300	B733	3	-	-	0.01	0.00	-	-	0.01
Boeing 737-700	B737	1	6.24	1.79	5.08	0.14	-	-	13.25
Boeing 737-700	B737	2	-	-	2.54	0.07	-	-	2.61
Boeing 737-700	B737	3	-	-	0.19	0.01	-	-	0.20
Boeing 737-800	B738	1	1.22	1.03	0.60	0.56	-	-	3.41
Boeing 737-800	B738	2	-	-	0.53	0.49	-	-	1.02
Boeing 737-800	B738	3	-	-	0.04	0.03	-	-	0.07

Table 2.12
2020 Fleet Mix and Operations

Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total
			Day	Night	Day	Night	Day	Night	Operations
Boeing 737-900	B739	1	0.39	0.04	-	-	-	-	0.43
Boeing 737-900	B739	2	-	-	0.27	0.15	-	-	0.41
Boeing 737-900	B739	3	-	-	0.01	0.01	-	-	0.02
Boeing 757-200	B752	1	0.90	0.16	0.80	0.10	-	-	1.97
Boeing 757-200	B752	4	-	-	0.14	0.02	-	-	0.16
Boeing 767-300	B763	1	0.09	-	-	-	-	-	0.09
Boeing 767-300	B763	3	-	-	0.09	-	-	-	0.09
Beech King Air 100 A/B	BE10	1	0.03	0.01	0.03	0.00	-	-	0.07
Beech 200 Super King	BE20	1	3.49	0.86	4.01	0.33	-	-	8.69
Raytheon 300 Super King Air	BE30	1	0.05	-	0.05	-	-	-	0.09
Beech Bonanza 35	BE35	1	1.06	-	1.06	-	2.53	0.37	5.03
Beech Bonanza 36	BE36	1	0.67	-	0.67	-	1.59	0.23	3.15
Raytheon/Beech Beechjet 400/T-1	BE40	1	0.30	0.03	0.30	0.03	-	-	0.67
Beech Baron 55	BE55	1	0.45	-	0.45	-	1.07	0.16	2.13
Beech 58	BE58	1	0.81	-	0.81	-	1.94	0.28	3.84
Beech 60 Duke	BE60	1	0.43	-	0.43	-	1.03	0.15	2.04
Beech Airliner 99	BE99	1	0.70	-	0.70	-	-	-	1.41
Beech King Air 90	BE9L	1	1.06	0.03	1.04	0.04	-	-	2.17
Beech F90 King Air	BE9T	1	0.10	0.04	0.14	-	-	-	0.28
Cessna Skyhawk 172/Cutlass	C172	1	2.25	-	2.25	-	5.36	0.79	10.65
Cessna 177 Cardinal	C177	1	0.41	-	0.41	-	0.97	0.14	1.93
Cessna Skylane 182	C182	1	2.47	-	2.47	-	5.76	0.85	11.55
Cessna 206 Stationair	C206	1	1.10	0.19	1.13	0.17	2.93	0.43	5.95
Cessna 208 Caravan	C208	1	0.03	0.01	0.04	-	-	-	0.07
Cessna 210 Centurion	C210	1	2.27	0.25	2.52	-	4.98	0.73	10.76
Cessna Citation CJ2	C25A	1	0.90	0.03	0.90	0.04	-	-	1.87
Cessna Citation CJ3	C25B	1	0.94	-	0.88	0.06	-	-	1.89

Table 2.12
2020 Fleet Mix and Operations

Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total
			Day	Night	Day	Night	Day	Night	Operations
Cessna Citation CJ4	C25C	1	0.87	-	0.87	-	-	-	1.74
Cessna 340	C340	1	1.21	-	1.21	-	2.35	0.35	5.13
Cessna 401/402	C402	1	0.16	0.90	1.07	-	0.09	0.01	2.24
Cessna Chancellor 414	C414	1	2.32	-	2.32	-	5.52	0.81	10.97
Cessna Golden Eagle 421	C421	1	0.68	-	0.48	0.19	1.24	0.18	2.78
Cessna 425 Corsair	C425	1	0.19	0.02	0.20	0.01	-	-	0.42
Cessna Conquest	C441	1	0.15	-	0.15	-	-	-	0.30
Cessna I/SP	C501	1	0.04	-	0.04	-	-	-	0.08
Cessna Citation Mustang	C510	1	1.56	-	1.30	0.26	-	-	3.13
Cessna CitationJet/CJ1	C525	1	1.37	0.27	1.54	0.10	-	-	3.29
Cessna Citation II/Bravo	C550	1	0.62	0.11	0.66	0.07	-	-	1.46
Cessna Citation II/SP	C551	1	0.04	0.01	0.04	0.01	-	-	0.09
Cessna Citation V/Ultra/Encore	C560	1	1.55	0.12	1.61	0.06	-	-	3.34
Cessna Excel/XLS	C56X	1	0.78	-	0.78	-	-	-	1.56
Cessna III/VI/VII	C650	1	0.70	0.08	0.67	0.10	-	-	1.55
Cessna Citation Sovereign	C680	1	0.93	-	0.93	-	-	-	1.86
Cessna Citation X	C750	1	0.35	-	0.35	-	-	-	0.71
Bombardier (Canadair) Challenger 300	CL30	1	0.96	0.08	0.96	0.08	-	-	2.09
Bombardier Challenger 600/601/604	CL60	1	0.29	-	0.29	-	-	-	0.57
Lancair LC-41 Columbia 400	COL4	1	0.69	-	0.69	-	1.65	0.24	3.28
Bombardier CRJ-200	CRJ2	1	5.98	0.77	6.42	0.33	-	-	13.50
Bombardier CRJ-700	CRJ7	1	3.88	0.85	2.08	0.23	-	-	7.04
Bombardier CRJ-700	CRJ7	2	-	-	1.31	0.14	-	-	1.45
Bombardier CRJ-700	CRJ7	3	-	-	0.87	0.10	-	-	0.97
Bombardier CRJ-900	CRJ9	1	0.49	0.51	0.11	0.14	-	-	1.24
Bombardier CRJ-900	CRJ9	2	-	-	0.32	0.43	-	-	0.74

Table 2.12
2020 Fleet Mix and Operations

Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total
			Day	Night	Day	Night	Day	Night	Operations
Diamond Star DA40	DA40	1	1.10	-	1.10	-	2.63	0.39	5.22
Bombardier Q-400	DH8D	1	18.05	2.62	18.90	1.77	-	-	41.34
Embraer E170	E170	1	0.30	0.04	0.05	-	-	-	0.39
Embraer E170	E170	2	-	-	0.07	-	-	-	0.07
Embraer E170	E170	3	-	-	0.23	-	-	-	0.23
Embraer E175	E175	1	0.81	0.12	0.11	0.02	-	-	1.06
Embraer E175	E175	2	-	-	0.15	0.03	-	-	0.19
Embraer E175	E175	3	-	-	0.51	0.10	-	-	0.61
Embraer Phenom 100	E50P	1	0.29	-	0.29	-	-	-	0.58
Embraer Phenom 300	E55P	1	0.09	-	0.09	-	-	-	0.19
Eclipse 500	EA50	1	0.10	-	0.08	-	-	-	0.18
Eclipse 500	EA50	2	-	-	0.03	-	-	-	0.03
Eurocopter EC-145	EC45	1	0.00	0.00	0.00	0.00	-	-	0.01
Dassault Falcon 2000	F2TH	1	0.17	0.02	0.20	-	-	-	0.39
Dassault Falcon 900	F900	1	0.30	-	0.20	0.01	-	-	0.51
Dassault Falcon 900	F900	2	-	-	0.02	0.00	-	-	0.02
Dassault Falcon 900	F900	3	-	-	0.07	0.00	-	-	0.07
Dassault Falcon/Mystère 50	FA50	1	0.14	-	0.06	-	-	-	0.21
Dassault Falcon/Mystère 50	FA50	2	-	-	0.06	-	-	-	0.06
Dassault Falcon/Mystère 50	FA50	3	-	-	0.02	-	-	-	0.02
Dassault Falcon F7X	FA7X	1	0.16	-	0.16	-	-	-	0.33
Gulfstream G150	G150	1	0.25	-	0.25	-	-	-	0.51
Galaxy/Gulfstream G200	GALX	1	0.80	-	0.64	0.16	-	-	1.60
Bombardier BD-700 Global 5000	GL5T	1	0.34	-	0.34	-	-	-	0.68
Bombardier BD-700 Global Express	GLEX	1	0.03	-	0.03	-	-	-	0.07
Gulfstream IV/G400	GLF4	1	0.12	-	0.10	0.01	-	-	0.24
Gulfstream V/G500	GLF5	1	0.15	-	0.15	-	-	-	0.30

Table 2.12

2020 Fleet Mix and Operations

Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total
			Day	Night	Day	Night	Day	Night	Operations
BAe HS 125/700-800/Hawker 800	H25B	1	0.69	0.05	0.74	-	-	-	1.49
Quest Kodiak	KODI	1	0.02	-	0.02	-	-	-	0.04
Bombardier Learjet 31/A/B	LJ31	1	0.09	-	0.09	-	-	-	0.19
Bombardier Learjet 35/36	LJ35	1	0.21	-	0.15	0.06	-	-	0.42
Learjet 40; Gates Learjet	LJ40	1	0.08	-	0.08	-	-	-	0.15
Bombardier Learjet 45	LJ45	1	1.51	0.02	1.44	0.08	-	-	3.04
Bombardier Learjet 55	LJ55	1	0.01	0.01	0.03	-	-	-	0.05
Bombardier Learjet 60	LJ60	1	0.18	0.03	0.20	-	-	-	0.40
Mooney M-20C Ranger	M20P	1	0.71	-	0.71	-	1.69	0.25	3.35
Turbo Mooney M20K	M20T	1	0.81	0.14	0.82	0.12	2.26	0.33	4.49
Boeing (Douglas) MD 83	MD83	1	0.19	-	0.19	-	-	-	0.38
Boeing (Douglas) MD 88	MD88	1	0.04	-	0.04	-	-	-	0.07
Boeing (Douglas) MD 90	MD90	1	0.24	0.20	-	-	-	-	0.44
Boeing (Douglas) MD 90	MD90	2	-	-	0.28	0.16	-	-	0.44
Mitsubishi Marquise/Solitaire	MU2	1	0.02	0.00	0.02	0.00	-	-	0.04
Piaggio P-180 Avanti	P180	1	0.13	0.02	0.13	0.03	-	-	0.31
Riley Super P210	P210	1	0.66	-	0.66	-	1.56	0.23	3.10
Piper Cherokee	P28A	1	1.69	-	1.69	-	4.02	0.59	7.98
Cherokee Arrow/Turbo	P28R	1	0.28	0.22	0.50	-	1.11	0.16	2.27
Piper Malibu Meridian	P46T	1	0.27	0.04	0.31	-	-	-	0.62
Piper Cherokee	PA28	1	0.24	0.04	0.24	0.04	0.66	0.10	1.31
Piper Navajo PA-31	PA31	1	3.63	1.17	4.79	-	0.94	0.14	10.67
Piper PA-34 Seneca	PA34	1	0.65	-	0.65	-	1.54	0.23	3.06
Piper Seminole	PA44	1	0.81	-	0.81	-	1.94	0.29	3.85
Piper Malibu	PA46	1	1.11	-	1.11	-	2.65	0.39	5.26
Piper Cheyenne 1	PAY1	1	0.02	-	0.02	-	-	-	0.05
Piper Cheyenne 2	PAY2	1	0.03	0.01	0.03	0.00	-	-	0.07

Table 2.12
2020 Fleet Mix and Operations

Aircraft Name	Aircraft ID	Stage Length	Arrivals		Departures		Touch-and-Go		Total
			Day	Night	Day	Night	Day	Night	Operations
Piper PA-42-720 Cheyenne 3	PAY3	1	0.10	0.02	0.11	0.02	-	-	0.24
Piper Cheyenne 400	PAY4	1	0.04	0.01	0.05	-	-	-	0.11
Pilatus PC-12	PC12	1	4.45	0.71	4.33	0.84	-	-	10.33
Raytheon Premier 1/390 Premier 1	PRM1	1	0.20	-	0.19	0.02	-	-	0.41
Saab 2000	SB20	1	0.05	0.01	0.04	0.01	-	-	0.10
Cirrus SR 22	SR22	1	3.77	-	3.77	-	8.87	1.30	17.71
Fairchild Swearingen SA-226T/TB Merlin 3	SW3	1	0.12	0.02	0.15	-	-	-	0.29
Swearingen Merlin 4/4A Metro2	SW4	1	0.18	0.89	1.04	0.02	-	-	2.13
Socata TBM-7	TBM7	1	0.05	-	0.05	-	-	-	0.11
Socata TBM-850	TBM8	1	0.44	-	0.44	-	-	-	0.88
Civilian Total			111.47	18.03	120.36	9.13	69.77	10.26	339.01
Military Fleet Mix and Operations									
Strike Eagle Fighter	F15	1	4.73	0.21	4.93	-	2.74	0	12.60
Black Hawk Helicopter	UH60	1	1.49	0.13	1.49	0.13	5.65	1.88	10.77
Apache Helicopter	AH64	1	0.39	0.13	0.39	0.13	5.65	1.88	8.58
Hornet Fighter	F18	1	0.27	-	0.27	-	-	-	0.55
Texan II	T6	1	0.82	-	0.82	-	-	-	1.64
Hercules	C130	1	1.64	-	1.64	-	-	-	3.29
Huron	C21	1	0.55	-	0.55	-	-	-	1.10
Stratolifter/Stratotanker	KC35	1	0.55	-	0.55	-	-	-	1.10
Military Total			10.44	0.47	10.65	0.19	14.04	3.76	39.63
Grand Total			121.91	18.50	131.01	9.32	83.81	14.02	378.64

Note: Numbers may not sum to total due to rounding.

Sources: FAA, USDOT, BOI, Radar Data, BBRC and HNTB Analysis, 2015.

References

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[2] Traffic Flow Management Systems Counts (TFMS-C), FAA, https://aspm.faa.gov/etms/sys/main.asp.

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[4] Distributed Operations Network, (Distributed OPSNET), FAA, https://aspm.faa.gov/etms/sys/OPSNET.asp.

[5] Traffic Flow Management Systems Counts (TFMSC), FAA, https://aspm.faa.gov/etms/sys/main.asp.

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[9] 14 CFR Part 91, RIN 2120-AK25, Adoption of Statutory Prohibition on the Operations of Jets Weighing 75,000 Pounds or Less That Are Not Stage 3 Noise Compliant, FAA, September 2013.

Chapter Three
EXISTING FLIGHT OPERATIONS

3.1 Introduction

This chapter describes the existing and future aircraft flight operations at BOI, and the related inputs and assumptions needed to generate noise contours for the 2015 and 2020 NEMs.

The Aviation Safety and Noise Abatement Act of 1979 required the FAA to establish a consistent measurement of airport noise exposure. In developing the Part 150 study process, the FAA adopted the use of the Day Night Average Sound Level (DNL) metric as the primary measurement of aircraft noise exposure, and in cooperation with other federal agencies, identified land use compatibility guidelines using the DNL metric. Therefore, the noise model computes the overall annual average daily noise exposure (e.g., DNL) at points on the ground around BOI. From the grid of points, contours of equal daily sound level are drawn by the noise model for overlay onto land use maps.

3.1.1 Noise Models

The FAA requires the analyses of subsonic aircraft noise exposure around airports to be accomplished using the Integrated Noise Model (INM), a computer program distributed by the FAA. The most recent version of INM (version 7.0d) was used for this study to model civilian aircraft and helicopter operations. In should be noted that on May 29, 2015, the FAA released the Aviation Environmental Design Tool (AEDT) Version 2b to replace the INM as the FAA-required noise model for use in a Part 150 Study. Because this Study commenced prior to May 29, INM is approved for use in this Part 150 Study. The Department of Defense (DoD) maintains a noise modeling tool similar to INM (NOISEMAP) which the FAA accepts for the modeling of military aircraft and helicopter operations. The output from each noise model is combined to present DNL noise contours.

INM and NOISEMAP contain reference noise and performance data on nearly all aircraft types that operate at BOI, including military aircraft. The noise reference data is populated in the model based on information provided by aircraft manufacturers such as Boeing and Airbus to the FAA, as outlined by 14 CFR Part 36 (Noise Standards: Aircraft Type And Airworthiness Certification) and the corresponding Advisory Circular (AC 36-4C). The AC promotes uniformity of implementation of the noise certification requirements by presenting test, analysis, and documentation procedures.

The resulting data is used to model an individual aircraft's departure and arrival flight profiles, and when combined with local conditions (runway layout, fleet mix, weather conditions, etc.) is used to ultimately develop and identify cumulative noise exposure from aircraft operations. Aircraft that are not specifically included in the database (such as those with unique engine combinations or not yet in service) are modeled using appropriate substitution aircraft and criteria per the FAA's pre-approved substitution list. Those without an appropriate substitution are reviewed with the FAA's Office of Environment and Energy (AEE) to determine a suitable noise model aircraft type. Coordination undertaken with AEE for this study is included and shown as Attachment 1 in ***Appendix B, Noise and Its Effect on People***.

3.1.2 Annual Average Day

Both models use representative samples of actual data to develop noise exposure. Annual Average Day (AAD) operations are representative of all aircraft operations that occur over the course of a year, and represent annual operations divided by 365 days. Runway and flight track use is also averaged over the same time period. AAD operations consist of departures and arrivals, by daytime and nighttime. Runway use, flight track location and use, and aircraft profiles define the paths that aircraft use as they fly to and from the Airport.

3.1.3 Day Night Average Sound Level Metric

Aircraft operations consist of departures and arrivals categorized by acoustical daytime and nighttime. As stated in Chapter Two, for the purposes of noise modeling, acoustical daytime is defined as 7:00 a.m. to 9:59 p.m., and nighttime is defined as 10:00 p.m. to 6:59 a.m. The DNL metric applies a 10-decibel (dB) penalty to nighttime flights due to the added intrusiveness of nighttime operations. The noise models compute noise exposure (i.e., DNL) at points on the ground around the Airport. From the grid of points generated by the models, contours of equal sound level are drawn and overlaid onto land use maps.

The use of computer-based noise modeling allows for the projection of future forecasted noise exposure, which could not be accomplished with noise monitoring that can only assess existing noise exposure at a limited number of locations. When the calculations are made in a consistent manner, noise models are most accurate for comparing "before-and-after" noise effects resulting from forecast changes or potential alternatives. The noise models allow noise predictions for such forecast change actions without the need for noise monitoring over an extended period of time, or actual implementation of any forecast changes. The noise models allow for the evaluation of aircraft noise exposure at many more points, thus permitting development of DNL contours. *Appendix B* provides additional details related to noise, the metrics used to define it, and its effect on people.

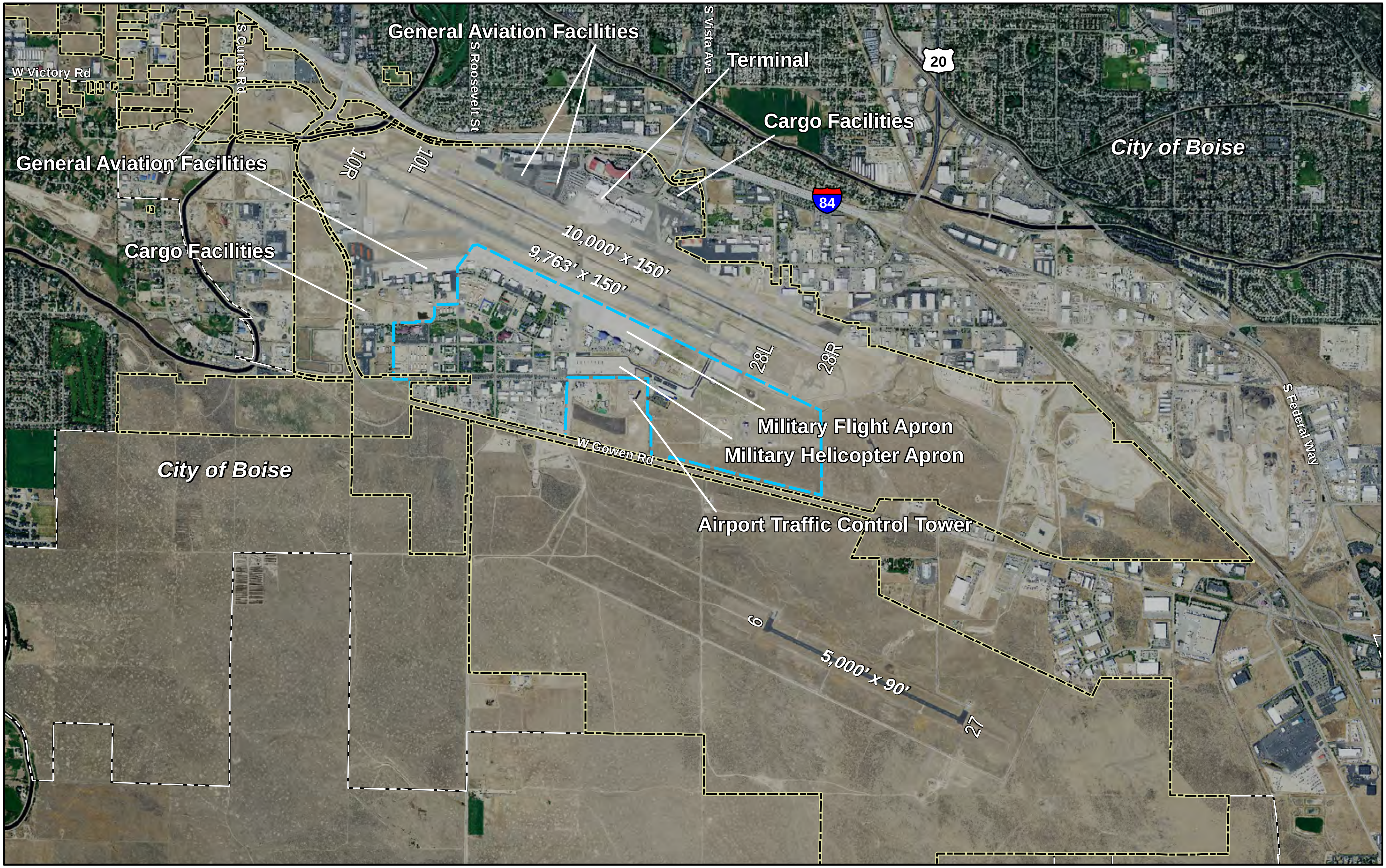
3.2 Airport Location and Layout

3.2.1 Airport Facilities

BOI is located approximately three miles south of downtown Boise, Idaho, within the limits of the City of Boise but including a portion of the southern boundary with Ada County. The elevation of BOI is 2,871 feet above Mean Sea Level (MSL). The City of Boise, as well as the Airport, is located on a broad, flat plain. To the northeast, the topography changes to foothills and mountainous terrain. The current magnetic declination (the difference between magnetic north and true geographic north) is 13.67 degrees east as of March 2015. Air Traffic Control (ATC) and pilots use magnetic headings to direct and fly aircraft.

The following paragraphs describe key airport facilities that influence both the type of aircraft that can operate at BOI and the way in which they operate. **Figure 3-1** presents an illustration of these aviation facilities, including the location of airport users, runways, the Airport Traffic Control Tower (ATCT) and other key aviation facilities.

Part 150 Study Update



Legend

- Airport Property
- City of Boise Limits
- Gowen Field Air National Guard Base

N

0 750 1,500 3,000 Feet

Figure 3-1
Airport Layout

Sources: City of Boise, Ada County, HNTB 2015

The ATCT is the FAA facility that provides air traffic control services to aircraft arriving at or departing from the Airport, or to aircraft that are traversing through the immediate area. In 2013, the FAA opened a new 268-foot tall ATCT located to the southeast of the parallel runways. The ATCT building also houses the Boise Terminal Radar Approach Control (TRACON) facility, which is responsible for controlling aircraft transitioning between the arrival/departure and enroute environments.

The Airport currently has three active runways. Runways 10L/28R and 10R/28L are oriented in an east-west direction and have lengths of 10,000 and 9,763 feet, respectively. They serve as the Airport's primary arrival and departure runways and handle all of BOI's arrival and departure operations. Runway 9/27 is paved but has no taxiways or connection to the remainder of the Airport. Runway 9/27, constructed in 2002, is located to the southeast of the Airport center across Gowen Road and was constructed initially to serve as a training field for military C130 operations; however following the departure of that aircraft from BOI it is mainly used as a training area for military helicopters.

3.2.2 Weather, Climate and Terrain

Weather has a significant impact on noise exposure and propagation. Runway use and the operational characteristics of aircraft are heavily influenced by weather.

Temperature is an important factor in aircraft performance. As temperature increases, air density decreases, reducing wing lift and engine thrust which results in increased takeoff distance and a lower climb rate; departing aircraft are thus at a lower altitude and noise exposure thereby generally increases. Conversely, noise exposure is decreased on cold days when aircraft have improved performance capabilities. An average temperature of 52.6 degrees Fahrenheit was used in the noise model to represent 2015 conditions.[1] Future 2020 conditions were modeled using a 20-year average (1994-2014) temperature of 53.1 degrees Fahrenheit.

Humidity does not have a significant impact on aircraft performance. In conjunction with temperature, however, it does impact the propagation of noise through the air. In general, sound travels farther in more humid conditions. Relative humidity is highest at night and gradually drops during the day. It is generally at its lowest point in the afternoon. An average humidity of 55.9% was used in the noise model to represent existing conditions, while a 20-year average of 54.5% was used to represent 2020 conditions.[2]

Wind speed and direction primarily determine runway selection and operational flow. Aircraft generally takeoff and land into the wind (known as a headwind) whenever possible, and prevailing winds (both direction and speed) dictate which runways can be used for aircraft arrivals and departures. Headwinds reduce an aircraft's takeoff and landing distance and increase climb rate. Aircraft can operate with considerable crosswinds (a wind blowing at the side of the aircraft)—up to about 20 knots for a typical air carrier jet aircraft. Aircraft can operate with limited tailwinds (a wind blowing on the rear of the aircraft)—up to five to seven knots for a typical air carrier aircraft. Tailwinds increase takeoff and landing distance. Winds in excess of crosswind and tailwind limits generally force aircraft to use a different runway. The winds at BOI are generally out of the northwest and southeast and favor operations on the existing runways, which are aligned accordingly. In general, the predominant wind patterns dictate that departures and arrivals operate to the east in the morning and to the west in the afternoon.

Terrain data for the Boise area at 10-foot intervals is included in the noise model. This data improves the calculation of noise exposure, as the noise model can more accurately compute the distance between airborne aircraft and points on the ground. For elevations higher than the Airport, the terrain data improves the accuracy of the noise exposure calculation because it reflects the reduced distance between source and receiver.

3.3 Modeled Aircraft Operations

This section describes noise model operational inputs, including flight operations, runway use, and flight track location and use for both the existing 2015 and forecast 2020 conditions. The noise models (INM and NOISEMAP) use these inputs to compute noise exposure on the ground. The data in this section provides an overview of the aircraft operations included in the noise model.

3.3.1 2015 Fleet Mix

In the 12-month period that represents the base year of 2015, approximately 128,546 annual operations, or about 352.2 AAD operations, occurred at BOI. A majority of overall aircraft operations at BOI are flown by GA aircraft, followed by commercial service (passenger and cargo operations) and military. On an AAD, approximately 10.7% of all operations occur during the hours that the DNL metric defines as nighttime (10:00 p.m. to 6:59 a.m.). Table 2.8 in Chapter Two presents the AAD flight operations forecast for BOI representing existing conditions in 2015.

In 2015, GA operations accounted for approximately 51% of all operations at BOI. GA encompasses a majority of aircraft operations in the US, and can generally be thought of as all civil aircraft activity that does not include scheduled air services or for-hire air transportation operations. GA activity includes recreational pilots, flight schools, aircraft operations in support of agriculture, and manufacturing and maintenance activity. The FBOs referenced in Chapter Two and the US Customs and Border Protection provide services to GA users. GA aircraft can include small single- and multi-engine propeller, business jets and helicopters, as well as gliders. Some of the most commonly flown GA aircraft types at BOI include the Cessna Skylane 182, Cessna 414, Cessna 210, Cirrus SR 22, and Piper Navajo PA-31. As shown in Table 2.7, GA activity occurs mostly during the daytime, with approximately 5% of arrivals, 4% of departures, and 13% of touch-and-go activity occurring during nighttime hours.

Passenger (which includes air carrier and air taxi operators) and cargo operations account for 47,243 operations in 2015, or 36.7% of all operations at BOI. These aircraft include passenger jet and propeller aircraft of various sizes, as well as aircraft that haul cargo rather than transporting passengers. Most aircraft in this category operate on a fixed schedule, however some air taxi operations are provided on demand. The most common aircraft in this category at BOI include the Bombardier Q-400 (a twin-engine turboprop), Bombardier CRJ-200 (a 50-seat regional jet) and the Boeing 737-700 series (a narrowbody jet). Approximately 20% of arrivals and 9% of departures occur during nighttime hours.

Military operations at Gowen Field include based A-10A aircraft associated with the Idaho ANG, helicopter operations associated with the Army National Guard, and numerous transient aircraft not based at BOI but that use the facility as a fuel stop or to practice approaches. In 2015, military activity accounts for 15,037 total operations, or 11.7% of all operations. Approximately 4% of overall military arrivals and 2% of military departures are forecast to occur during nighttime.

3.3.2 2020 Fleet Mix

Section 2.5 presented the assumptions used to develop the future (2020) forecast and fleet mix used to represent the 2020 NEM. The 2020 condition includes a forecast of operations, changes to the aircraft fleet mix, and a change in mission associated with the Idaho ANG as discussed in Chapter Two. The total number of operations at BOI is projected to increase from 128,546 in the existing condition to 138,204 in the forecast condition in 2020 (approximately 378.6 operations are forecast to occur on an AAD). Overall, the total number of operations at the Airport represents a 7% increase from operations in 2015.

The most notable change in the future fleet mix, which has the most potential to change noise exposure patterns, occurs with the potential change in flying mission by the Idaho ANG. This study assumes that an F-15E mission would be located at Gowen Field to replace the A-10A mission. The noise emitted from F-15E aircraft is louder than an A-10A aircraft, and notably, to be consistent with standard F-15E operating procedures, all future F-15E departures are modeled using afterburners. For the F-15 mission, total operations on an AAD are forecast to be 12.6, or approximately 4,600 annual operations, compared with 12.2 AAD A-10A operations or 4,472 annual A-10A operations.

3.3.3 Aircraft Flight Profiles

Flight profiles model the vertical paths of aircraft during departure and arrival to determine the altitude, speed, and engine thrust of an aircraft at any point along a flight track. The noise models use this information to calculate noise exposure on the ground. Profiles are unique to each aircraft type and are based on airline operating procedures, temperature and aircraft operating weight. Detailed information on aircraft flight profiles, under varying conditions, is stored in the INM aircraft database for civilian operations. Information related to the profiles flown by military aircraft is collected and input directly into the NOISEMAP model.

The climb rate and flight profile of departing aircraft can vary considerably. New, modern aircraft have higher thrust engines and improved wing designs which results in an increased climb rate as compared to older aircraft. Modern jet engines are also much quieter than their predecessors, even though they can produce more thrust. Temperature, takeoff weight and airline operating procedures are also important factors that affect climb rate.

Pilots use their respective airline's operating procedures to maneuver an aircraft during takeoff. The procedures are unique to each aircraft type. Airlines develop their own procedures with aircraft manufacturer and FAA approval. As a result, operating procedures among most airlines are essentially similar. Standard INM departure profiles, which approximate Distant Noise Abatement Departure Profile (NADP)/ICAO-B profiles as published in FAA AC 91-53A, were used in this study to represent civilian operations.

As discussed in Section 2.4.4, the INM uses the concept of stage length to account for the varying distances flown by aircraft, and includes multiple departure profiles that reflect several takeoff weights. INM assumes aircraft weight increases with stage, or trip length, due to the need for more fuel and that each aircraft type's takeoff distance and climb performance is different for each stage length. High-weight (long trip, high stage length) aircraft have increased takeoff distances and lower climb rates than lighter (short trip) aircraft, for a given aircraft type. Based on the information collected, aircraft departures were assigned stage lengths which correspond to flight profiles in the model, as shown in Table 2.6. Note that arrival operations are generally flown using a three-degree approach path, and their altitude varies more based on ATC instruction to maintain adequate horizontal and vertical separation. As such, arriving aircraft do not use stage lengths.

Flight profiles associated with military operations were developed in close coordination with the Idaho ANG, including interviews with pilots that fly both the A-10A and the F-15E aircraft. The interviews yielded specific information related to the flight path, engine thrust settings, speed and altitude, and this information was incorporated into the noise model.

Flight profiles are not anticipated to change between 2015 and 2020, with exception of those associated with the A-10A (which is forecast to be removed from the fleet) and the F-15E aircraft (which is forecast to replace the A-10A at BOI).

3.3.4 Runway Use

Runway use is determined by several factors including safety, wind, weather, traffic demand, runway capacity, direction of flight, and prescribed runway use procedures. The ATCT assigns runway use with consideration to all of these factors. Noise model runway use input represents AAD runway use based on typical operations over the course of the entire year.

For the 2015 and 2020 conditions, AAD runway use was determined through an analysis of radar data and consultation with the Boise ATCT and Idaho ANG. Two months of radar data was evaluated to determine the predominant flow of operations; however due to the closely spaced parallel runways and the availability of radar data coverage, the fidelity of the radar was not suitable to provide information on specific runway uses (i.e. whether an aircraft departure used Runway 10L or 10R). Additional consultation with the ATCT and Idaho ANG informed the determination of runway use. Further, runways are periodically closed to aircraft operations for maintenance activity; in 2014, Runway 10L/28R (the north parallel runway) was closed between May and October for resurfacing. The resulting AAD runway use reflects the predominant runway use patterns when all runways are operational.

In general, passenger jet operations favor arrivals and departures on the north runway (Runway 10L/28R). This is a function of the distance between the terminal and aircraft gates, which are located in closer proximity to Runway 10L/28R. Business jet aircraft use the south runway (Runway 10R/28L) more frequently than the north. Military aircraft and helicopters primarily use Runway 10R/28L, which is located closer to the Idaho ANG facilities on the south side of the Airport. **Table 3.1** shows AAD runway use for the 2015 NEM by day and night. Table 3.1 also applies to the Future (2020) NEM.

Table 3.1

Average Annual Day Runway Use by Aircraft Category

Operation Type	Time of Day	Operational Category	Runway						
			10L	10R	28L	28R	9	27	Total
Arrival	Daytime	Cargo Jet	25%	30%	15%	30%	-	-	100%
		GA Jet	26%	26%	22%	26%	-	-	100%
		GA Prop	20%	38%	26%	16%	-	-	100%
		Mil Helicopter	-	90%	10%	-	-	-	100%
		Mil Jet	5%	55%	38%	2%	-	-	100%
		Mil Prop	3%	57%	38%	2%	-	-	100%
		Passenger Jet	40%	23%	7%	30%	-	-	100%
		Regional Jet	40%	23%	7%	30%	-	-	100%
		Regional Prop	40%	30%	2%	28%	-	-	100%
		Overall	**26%**	**35%**	**19%**	**21%**	**-**	**-**	**100%**
	Nighttime	Cargo Jet	30%	20%	20%	30%	-	-	100%
		GA Jet	25%	25%	25%	25%	-	-	100%
		GA Prop	15%	35%	35%	15%	-	-	100%
		Mil Helicopter	-	90%	10%	-	-	-	100%
		Mil Jet	3%	57%	38%	2%	-	-	100%
		Mil Prop	-	-	-	-	-	-	-
		Passenger Jet	28%	12%	10%	50%	-	-	100%
		Regional Jet	28%	12%	10%	50%	-	-	100%
		Regional Prop	20%	20%	1%	59%	-	-	100%
		Overall	**22%**	**23%**	**18%**	**36%**	**-**	**-**	**100%**
	Arrival Overall		**26%**	**33%**	**19%**	**23%**	**-**	**-**	**100%**
Departure	Daytime	Cargo Jet	25%	5%	20%	50%	-	-	100%
		GA Jet	26%	32%	20%	22%	-	-	100%
		GA Prop	19%	31%	31%	19%	-	-	100%
		Mil Helicopter	-	90%	10%	-	-	-	100%
		Mil Jet	3%	57%	38%	2%	-	-	100%
		Mil Prop	3%	57%	38%	2%	-	-	100%
		Passenger Jet	49%	1%	1%	49%	-	-	100%
		Regional Jet	49%	1%	1%	49%	-	-	100%
		Regional Prop	49%	1%	1%	49%	-	-	100%
		Overall	**28.6%**	**23.3%**	**19.4%**	**28.7%**	**-**	**-**	**100%**

Table 3.1

Average Annual Day Runway Use by Aircraft Category

Operation Type	Time of Day	Operational Category	Runway						
			10L	10R	28L	28R	9	27	Total
Departure	Nighttime	Cargo Jet	-	-	-	-	-	-	-
		GA Jet	40%	40%	10%	10%	-	-	100%
		GA Prop	20%	30%	30%	20%	-	-	100%
		Mil Helicopter	-	90%	10%	-	-	-	100%
		Mil Jet	-	-	-	-	-	-	-
		Mil Prop	-	-	-	-	-	-	-
		Passenger Jet	60%	3%	2%	35%	-	-	100%
		Regional Jet	60%	3%	2%	35%	-	-	100%
		Regional Prop	60%	3%	2%	35%	-	-	100%
		Overall	**47.6%**	**14.8%**	**9.1%**	**28.5%**			**100%**
	Departure Overall		**29.7%**	**22.8%**	**18.8%**	**28.7%**	**-**	**-**	**100%**
Touch-and-Go (Closed Pattern)	Daytime	Cargo Jet	-	-	-	-	-	-	-
		GA Jet	-	-	-	-	-	-	-
		GA Prop	5.1%	45.9%	44.1%	4.9%	-	-	100%
		Mil Helicopter	-	-	-	-	60%	40%	100%
		Mil Jet	-	60%	40%	-	-	-	100%
		Mil Prop	-	-	-	-	-	-	-
		Passenger Jet	-	-	-	-	-	-	-
		Regional Jet	-	-	-	-	-	-	-
		Regional Prop	-	-	-	-	-	-	-
		Overall	**4.6%**	**42.4%**	**40.5%**	**4.4%**	**4.9%**	**3.2%**	**100%**
	Nighttime	Cargo Jet	-	-	-	-	-	-	-
		GA Jet	-	-	-	-	-	-	-
		GA Prop	10%	40%	40%	10%	-	-	100%
		Mil Helicopter	-	-	-	-	60%	40%	100%
		Mil Jet	-	-	-	-	-	-	-
		Mil Prop	-	-	-	-	-	-	-
		Passenger Jet	-	-	-	-	-	-	-
		Regional Jet	-	-	-	-	-	-	-
		Regional Prop	-	-	-	-	-	-	-
		Overall	**8.3%**	**33.1%**	**33.1%**	**8.3%**	**10.3%**	**6.9%**	**100%**
	Touch-and-Go Overall		**5.1%**	**41.1%**	**39.5%**	**4.9%**	**5.6%**	**3.7%**	**100%**

Note: Totals may not equal 100-percent due to rounding.

Sources: BOI ATCT, Idaho ANG, HNTB Analysis 2015.

3.3.5 Flight Track Layout and Use

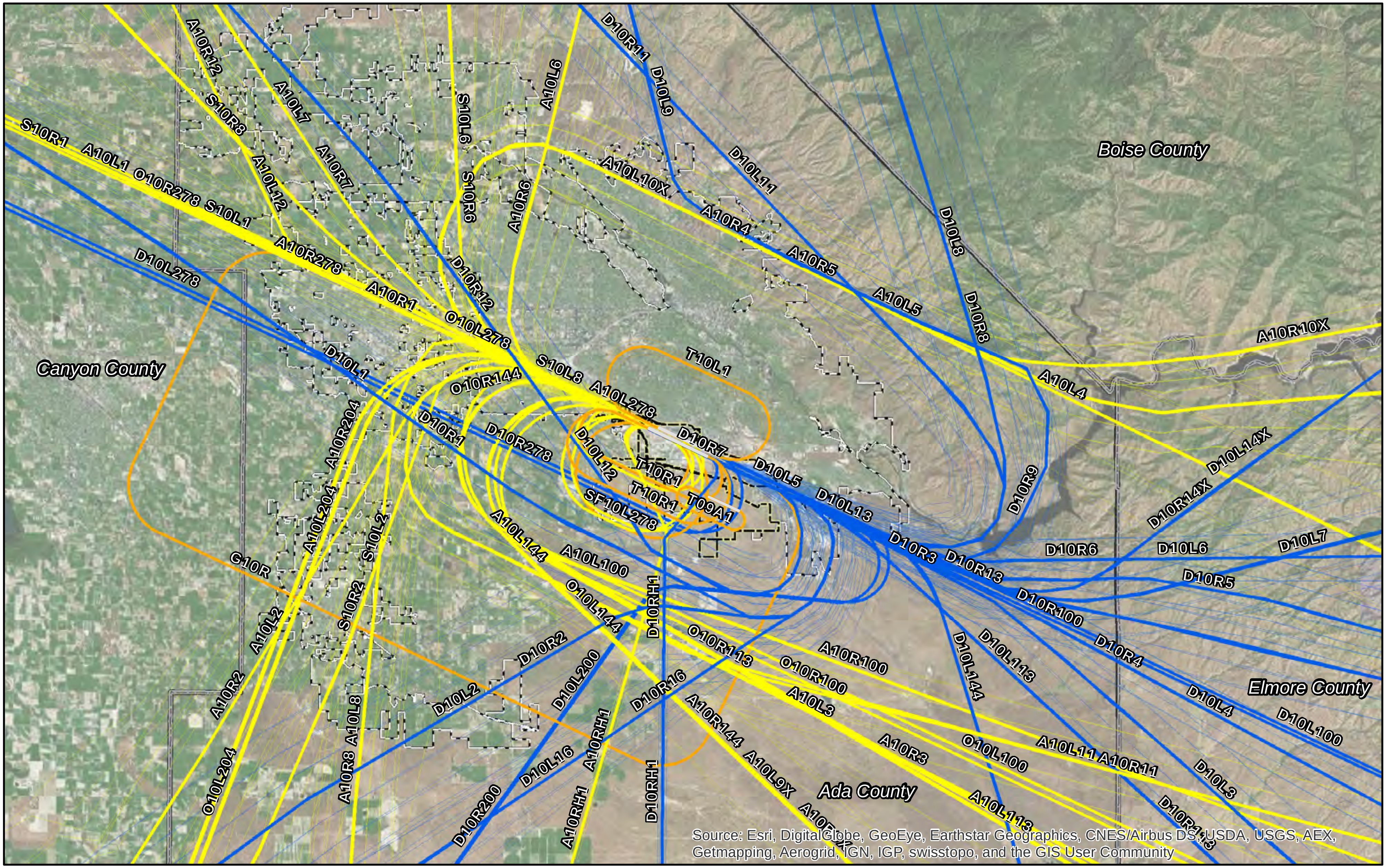
Modeled flight tracks depict the approximate paths, or ground tracks, that aircraft use as they travel to and from an airport. Flight tracks are intended to be representative of typical aircraft operations at BOI. As with runway use, flight track use reflects the percentage of annual operations that use a specific flight route, grouped by arrival or departure and daytime or nighttime.

To account for the fact that all aircraft do not follow a single precise track to and from an airport, the noise models use primary (e.g., backbone) and dispersed flight tracks to model actual arrival and departure flight tracks. Since aircraft fly through a moving air mass, a given heading will result in different paths over the ground under different wind conditions. Weather, traffic levels, pilot technique and differing aircraft performance capabilities make an infinite number of ground tracks possible. The primary flight track is the mean, or average, track for a specific heading or route; multiple dispersed flight tracks reflect the dispersion that occurs to either side of the primary track. Deviation from typical flight tracks will occur due to safety requirements, emergencies, weather, traffic demand, capacity, and aircraft performance.

Flight track location and use for Runways 10L/28R and 10R/28L was derived from analysis of a sample of radar data and consultation with the ATCT and the Idaho ANG. Flight track location and use for Runway 9/27 associated with military helicopter use, was developed through discussions with the Idaho ANG. Flight tracks are developed to represent aircraft arrivals, departures, and closed pattern (or touch-and-go or circuit) operations. Arrival and departure paths to and from an airport are a function of the larger airspace, and are coordinated by ATC to maintain adequate vertical and horizontal separation. Pilots (both GA and military) fly multiple pattern operations without stopping the aircraft as part of pilot training. A typical touch-and-go operation flown by a GA aircraft is represented by the aircraft departing, flying an elongated circle parallel to the runway, followed by a landing without a complete stop. Military aircraft fly similar patterns both with and without ATCT support.

For the 2020 NEM, there are some differences in the flight tracks flown by forecast military aircraft (specifically the F-15). Flight track locations were developed in consultation with Idaho ANG and optimized to reduce potential noise impacts. Further, the flight track traffic pattern altitudes for the F-15 changed from 1,500’ AGL to 2,200’ AGL, an increase of 700’, based on U.S. Air Force standard operating procedures.

Figure 3-2 shows the modeled departure, arrival, and touch-and-go flight tracks for Runways 9, 10L, and 10R for both the 2015 and 2020 conditions. **Figure 3-3** shows the same information for Runways 27, 28L, and 28R. Arrival and departure flight track use is shown in **Table 3.2** by runway, and touch-and-go/closed pattern flight track use is shown in **Table 3.3**.



Legend

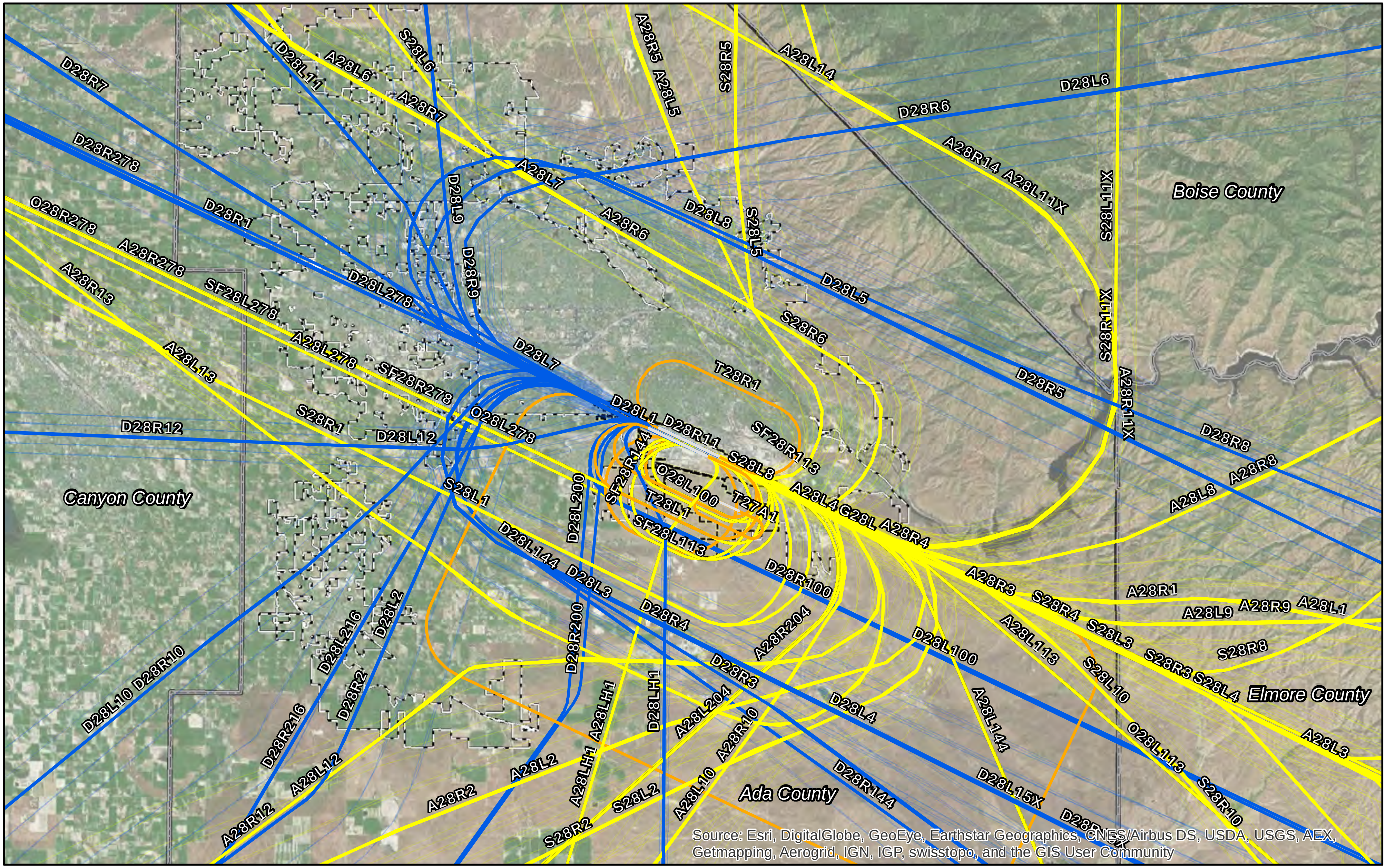
- Airport Property
- City of Boise Limits
- Backbone Arrival Flight Track
- Dispersed Arrival Flight Track
- Backbone Departure Flight Track
- Dispersed Departure Flight Track
- Backbone Touch and Go Flight Track
- Dispersed Touch and Go Track

Figure 3-2
Modeled Flight Tracks for Runways 9, 10L and 10R

N

0 5,000 10,000 20,000 Feet

Sources: City of Boise, Ada County, HNTB 2015



Legend

- Airport Property
- City of Boise Limits
- Backbone Arrival Flight Track
- Dispersed Arrival Flight Track
- Backbone Departure Flight Track
- Dispersed Departure Flight Track
- Backbone Touch and Go Flight Track
- Dispersed Touch and Go Track

Figure 3-3
Modeled Flight Tracks for Runways 27, 28L and 28R

N

0 5,000 10,000 20,000 Feet

Sources: City of Boise, Ada County, HNTB 2015

Table 3.2
Flight Track Use by Runway

Runway	Arrivals			Departures		
	Track Name	**Percent of Day Ops**	**Percent of Night Ops**	**Track Name**	**Percent of Day Ops**	**Percent of Night Ops**
10L	A10L1	8.9%	5.8%	D10L1	9.4%	8.4%
	A10L100	0.5%	0.0%	D10L100	0.4%	0.0%
	A10L10X	3.7%	5.4%	D10L11	6.3%	6.7%
	A10L11	2.1%	3.6%	D10L113	0.1%	0.0%
	A10L12	3.3%	2.0%	D10L12	8.7%	7.7%
	A10L144	0.3%	0.1%	D10L13	1.1%	0.0%
	A10L2	12.0%	10.6%	D10L144	0.3%	0.0%
	A10L204	0.1%	0.0%	D10L14X	3.5%	3.1%
	A10L278	0.3%	0.0%	D10L16	12.4%	15.3%
	A10L3	20.3%	26.1%	D10L2	6.2%	6.0%
	A10L4	2.4%	7.4%	D10L278	0.3%	0.0%
	A10L5	5.5%	2.7%	D10L3	15.8%	13.6%
	A10L6	4.7%	1.7%	D10L4	8.4%	9.6%
	A10L7	9.4%	5.1%	D10L5	10.5%	12.4%
	A10L8	1.6%	1.8%	D10L6	2.1%	0.9%
	A10L9X	2.7%	3.7%	D10L7	4.5%	6.7%
	O10L100	0.0%	0.0%	D10L8	7.7%	7.3%
	O10L144	0.1%	0.0%	D10L9	2.2%	2.5%
	O10L204	0.0%	0.0%			
	O10L278	0.0%	0.0%			
	S10L1	9.4%	14.0%			
	S10L2	4.4%	4.6%			
	S10L6	5.1%	4.3%			
	S10L8	3.1%	1.1%			
10L Total		**100.0%**	**100.0%**		**100.0%**	**100.0%**

Table 3.2
Flight Track Use by Runway

Runway	Arrivals			Departures		
	Track Name	Percent of Day Ops	Percent of Night Ops	Track Name	Percent of Day Ops	Percent of Night Ops
10R	A10R1	5.1%	4.8%	D10R1	7.3%	8.5%
	A10R100	5.7%	3.6%	D10R100	7.4%	7.9%
	A10R10X	1.8%	2.3%	D10R11	1.2%	2.9%
	A10R11	0.9%	1.4%	D10R113	2.9%	0.0%
	A10R113	0.5%	0.3%	D10R12	5.3%	5.4%
	A10R12	1.9%	1.8%	D10R13	0.3%	0.0%
	A10R144	2.4%	1.3%	D10R144	7.5%	0.0%
	A10R2	9.6%	7.4%	D10R14X	4.6%	4.2%
	A10R204	1.8%	1.0%	D10R16	6.0%	8.3%
	A10R278	2.4%	0.1%	D10R2	3.6%	3.7%
	A10R3	14.7%	15.4%	D10R278	3.6%	0.0%
	A10R4	1.4%	4.0%	D10R3	18.9%	12.6%
	A10R5	6.9%	3.9%	D10R4	5.0%	6.2%
	A10R6	6.5%	3.5%	D10R5	7.4%	8.6%
	A10R7	7.1%	5.7%	D10R6	3.8%	3.6%
	A10R8	0.7%	0.7%	D10R7	0.1%	1.1%
	A10R9X	1.4%	1.7%	D10R8	8.6%	10.3%
	A10RH1	1.7%	2.4%	D10R9	2.7%	4.9%
	O10R100	0.6%	0.0%	D10RH1	3.7%	11.8%
	O10R113	0.2%	0.1%			
	O10R144	1.0%	0.6%			
	O10R204	0.8%	0.4%			
	O10R278	0.5%	0.0%			
	S10R1	13.2%	29.5%			
	S10R2	2.3%	2.3%			
	S10R6	4.6%	3.4%			
	S10R8	4.3%	2.3%			
10R Total		**100.0%**	**100.0%**		**100.0%**	**100.0%**
10RH	A10RH1	100.0%	100.0%	D10RH1	100.0%	100.0%
10RH Total		**100.0%**	**100.0%**		**100.0%**	**100.0%**

Table 3.2
Flight Track Use by Runway

Runway	Arrivals			Departures		
	Track Name	**Percent of Day Ops**	**Percent of Night Ops**	**Track Name**	**Percent of Day Ops**	**Percent of Night Ops**
28L	A28L1	0.5%	0.2%	D28L1	2.9%	3.3%
	A28L10	0.4%	0.7%	D28L10	9.2%	12.2%
	A28L100	4.4%	0.3%	D28L100	5.1%	1.4%
	A28L113	2.0%	0.7%	D28L11	14.4%	16.7%
	A28L11X	0.2%	0.2%	D28L12	3.4%	1.3%
	A28L12	6.6%	4.1%	D28L144	3.9%	0.0%
	A28L13	0.1%	0.0%	D28L15X	0.5%	0.0%
	A28L14	0.1%	0.0%	D28L2	0.1%	0.7%
	A28L144	2.4%	0.9%	D28L216	4.1%	0.0%
	A28L2	1.6%	2.5%	D28L278	3.4%	0.0%
	A28L204	1.6%	0.6%	D28L3	6.4%	9.3%
	A28L278	2.9%	0.1%	D28L4	12.2%	10.7%
	A28L3	0.5%	1.6%	D28L5	0.1%	1.2%
	A28L4	3.0%	3.7%	D28L6	7.7%	9.1%
	A28L5	1.7%	1.4%	D28L7	2.3%	2.5%
	A28L6	0.4%	0.2%	D28L8	5.9%	7.5%
	A28L7	0.3%	0.1%	D28L9	17.8%	21.9%
	A28L8	1.2%	2.4%	D28LH1	0.5%	2.1%
	A28L9	9.1%	7.5%			
	A28LH1	0.5%	0.5%			
	O28L100	0.8%	0.0%			
	O28L113	0.8%	0.3%			
	O28L144	1.0%	0.4%			
	O28L204	0.7%	0.3%			
	O28L278	0.6%	0.0%			
	S28L1	5.8%	7.5%			
	S28L10	19.2%	38.2%			
	S28L11X	0.3%	0.3%			
	S28L2	6.5%	4.3%			
	S28L3	3.0%	4.4%			
	S28L4	1.9%	5.3%			
	S28L5	11.6%	6.2%			
	S28L6	7.3%	3.9%			
	S28L8	1.1%	1.0%			
28L Total		**100.0%**	**100.0%**		**100.0%**	**100.0%**
28LH	A28LH1	100.0%	100.0%	D28LH1	100.0%	100.0%
28LH Total		**100.0%**	**100.0%**		**100.0%**	**100.0%**

Table 3.2
Flight Track Use by Runway

Runway	Arrivals			Departures		
	Track Name	Percent of Day Ops	Percent of Night Ops	Track Name	Percent of Day Ops	Percent of Night Ops
28R	A28R1	0.6%	0.1%	D28R1	13.8%	14.1%
	A28R10	1.5%	1.9%	D28R10	12.4%	14.0%
	A28R100	0.2%	0.0%	D28R100	0.6%	0.0%
	A28R113	0.1%	0.0%	D28R11	5.9%	3.6%
	A28R11X	0.4%	0.5%	D28R12	2.0%	1.0%
	A28R12	5.1%	2.9%	D28R144	0.1%	0.0%
	A28R13	1.2%	1.5%	D28R15X	0.8%	0.0%
	A28R14	1.0%	1.2%	D28R2	3.7%	4.0%
	A28R144	0.1%	0.0%	D28R216	0.1%	0.0%
	A28R2	6.6%	8.3%	D28R278	0.4%	0.0%
	A28R204	0.1%	0.0%	D28R3	9.9%	13.1%
	A28R278	0.1%	0.0%	D28R4	12.5%	11.4%
	A28R3	2.1%	4.0%	D28R5	4.5%	6.8%
	A28R4	5.8%	7.5%	D28R6	10.1%	10.3%
	A28R5	3.9%	4.1%	D28R7	2.5%	2.0%
	A28R6	4.6%	5.4%	D28R8	4.5%	4.9%
	A28R7	0.3%	0.1%	D28R9	16.1%	14.9%
	A28R8	3.3%	5.7%			
	A28R9	5.6%	3.2%			
	O28R100	0.0%	0.0%			
	O28R113	0.0%	0.0%			
	O28R144	0.0%	0.0%			
	O28R204	0.0%	0.0%			
	O28R278	0.0%	0.0%			
	S28R1	8.4%	8.2%			
	S28R10	16.4%	19.0%			
	S28R11X	0.8%	0.9%			
	S28R2	7.0%	6.0%			
	S28R3	5.9%	6.1%			
	S28R4	5.2%	8.1%			
	S28R5	7.4%	2.5%			
	S28R6	4.2%	0.9%			
	S28R8	2.0%	1.8%			
28R Total		**100.0%**	**100.0%**		**100.0%**	**100.0%**

Source: HNTB 2015.

Table 3.3
Closed Pattern/Touch-and-Go Flight Track Use by Runway

Runway	Track Name	Percent of Day Ops	Percent of Night Ops
09A	T09A1	100%	100%
Total		**100%**	**100%**
10L	T10L1	100%	100%
Total		**100%**	**100%**
10R	G10R	3%	0%
	T10R1	97%	100%
Total		**100%**	**100%**
27A	T27A1	100%	100%
Total		**100%**	**100%**
28L	G28L	2%	0%
28L	T28L1	98%	100%
Total		**100%**	**100%**
28R	T28R1	100%	100%
Total		**100%**	**100%**

Source: HNTB 2015.

3.3.6 Maintenance Run-Up Activity

Aircraft perform engine run-ups for multiple reasons, including pre- and post-flight engine testing, as well as for maintenance activity. The noise models provide the capability to model engine run-ups.

For 2015, engine run-ups were modeled for the A-10A aircraft, which is based at BOI. Under existing conditions, the A-10A performs various types of engine run-ups on an average of 11 times per day. A majority of these run-ups are pre- and post-flight run-ups located on the ramp with engines at idle thrust. High power maintenance run-ups occur much less frequently, and are performed less than 50 times per year, generally located on the ramp near the south end of the Runway 28L end. Engine maintenance activity for civilian occurs at the FBOs located around the Airport and in designated areas on the airfield, but do not occur with sufficient frequency to influence the size or shape of the noise contours.

The 2020 NEM includes modeled assumptions for engine run-up operations. The potential change in mission flown by the Idaho ANG will result in engine maintenance activity associated with the F-15E. For civilian aircraft, a new maintenance facility along Gowen Road is expected to be open by 2020, which will provide a larger hangar area and will result in the potential for increased engine maintenance run-ups for some jet aircraft (such as the Embraer 175).

3.4 Summary of Noise Model Input

The number of aircraft modeled on any given flight track can be derived by multiplying the AAD flight operations by the runway use percentages, and then by the flight track use percentages. Note that this is representative of an AAD only; in reality, the actual number of operations that use a specific flight track can vary significantly due to wind and operational factors.

The data discussed in this chapter is integrated into INM and NOISEMAP to generate the DNL contours shown on the 2015 and 2020 NEMs, as presented in Chapter Five.

References

[1] Weather obtained for Station ID BOI via Weather Underground, HNTB 2015.
[2] Ibid.

Chapter Four
LAND USE GUIDELINES AND COMPATIBILITY

This chapter reviews the Federal and local land use guidelines related to compatibility with aircraft noise exposure and aeronautical uses, and the development of land use data needed for the analyses required in 14 CFR Part 150.

4.1 Federal Guidelines

The degree of annoyance that people experience from aircraft noise varies, depending on their activities at any given time. For example, people are usually less disturbed by aircraft noise when they are shopping, working, or driving than when they are at home. Transient hotel and motel residents seldom express as much concern with aircraft noise as do permanent residents of an area. The concept of "land use compatibility" has arisen from this systematic variation in community reaction to noise.

In a Part 150 Study, DNL noise values have the following two principal uses:

- Provide a quantitative basis for identifying potential noise impacts; and
- Provide a basis for comparing existing noise conditions to the effects of noise abatement procedures and/or forecast changes in airport activity.

Both of these functions require the application of objective criteria for evaluating noise impacts. **Table 4.1** reproduces the FAA's recommended guidelines for noise and land use compatibility evaluation as provided in 14 CFR Part 150. As explained in Chapter Three, the Aviation Safety and Noise Abatement Act of 1979 required the FAA to select a single measure for evaluating airport noise. FAA, through the Part 150 Study process, adopted the DNL metric and guidelines for compatibility of various land uses with various intensities of DNL, as shown in the table.

The FAA's guidelines represent a compilation of the results of scientific research into noise-related activity interference and attitudinal response. However, reviewers of DNL contours should recognize the highly subjective nature of an individual's response to noise, and that special circumstances can affect individual tolerances. For example, a high, non-aircraft background noise level can reduce the significance of aircraft noise, such as in areas constantly exposed to relatively high levels of vehicular traffic noise. Alternatively, residents of areas with unusually low background noise levels may find relatively low levels of aircraft noise annoying.

Response may also be affected by expectation and experience. People may become accustomed to a level of exposure that guidelines typically indicate may be unacceptable. Conversely, minor changes in exposure may generate a response that is far greater than that which the guidelines suggest.

Table 4.1

14 CFR Part 150 Noise/Land Use Compatibility Guidelines

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(a)	N(a)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(a)	N(a)	N(a)	N	N
Public Use						
Schools	Y	N(a)	N(a)	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(b)	Y(c)	Y(d)	Y(d)
Parking	Y	Y	Y(b)	Y(c)	Y(d)	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(b)	Y(c)	Y(d)	N
Retail trade--general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(b)	Y(c)	Y(d)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y(b)	Y(c)	Y(d)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(f)	Y(g)	Y(h)	Y(h)	Y(h)
Livestock farming and breeding	Y	Y(f)	Y(g)	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(e)	Y(e)	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

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 dB must be incorporated into design and construction of structure.

See following page for Table Notes.

Notes for Table 4.1

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.

(a) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor 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 stated 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.
(b) 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.
(c) 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.
(d) 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.
(e) Land use compatible provided special sound reinforcement systems are installed.
(f) Residential buildings require an NLR of 25.
(g) Residential buildings require an NLR of 30.
(h) Residential buildings not permitted.

Source: Table 1 of 14 CFR Part 150.

The cumulative nature of DNL means that the same level of noise exposure can be achieved in an infinite number of ways. For example, a reduction in a small number of relatively noisy operations may be counterbalanced by an increase in relatively quiet flights, with no net change in DNL. Residents of the area may be highly annoyed by the increased frequency of operations, despite the seeming maintenance of the noise status quo.

With these cautions in mind, the Part 150 land use compatibility guidelines can be applied to the DNL contours to identify the potential types, degrees, and locations of incompatibility. Measurement of the land areas involved can provide a quantitative measure of impact that allows a comparison of at least the gross effects of existing and future aircraft operations.

As listed in Table 4.1, Part 150 guidelines specify that all uses are normally compatible with aircraft noise exposure levels at or below DNL 65 dB. This limit is supported formally by standards adopted by the Department of Housing and Urban Development (HUD). HUD standards address whether sites are eligible for Federal funding support. These standards, set forth in 24 CFR Part 51, define areas with DNL exposure not exceeding 65 dB as acceptable for funding. Areas exposed to noise levels between DNL 65 and 75 dB are “normally unacceptable,” and require special abatement measures and review. Those areas at DNL 75 dB and above are “unacceptable” unless special approval is received.[1]

According to Part 150, the Federal land use guidelines are to be used unless local land use authorities have adopted alternative land use compatibility guidelines. Section 4.2 notes that while local land use guidelines have been adopted by the City of Boise and Ada County, they are consistent with the Federal guidelines. This Part 150 Study therefore uses the Federal Part 150 and local guidelines to assist in identifying potential land use incompatibilities in the BOI environs.

4.2 Local Land Use Guidelines

BOI is located near the southern extent of the City of Boise in Ada County. The City of Boise extends north and west of the Airport, while unincorporated Ada County surrounds the remaining area. The City of Boise and Ada County both have jurisdiction within the BOI Airport Influence Area (AIA). In the State of Idaho, counties and municipalities each have individual control to amend their municipal zoning ordinances and comprehensive plans.

Land use regulations provide the primary means of preventing incompatible new development. A number of different controls are normally available to local governments to prevent incompatible development. The City and the County have both adopted land use initiatives that protect airport operations and land use planning within the AIA, as discussed in Section 4.2.1.

4.2.1 Airport Influence Area

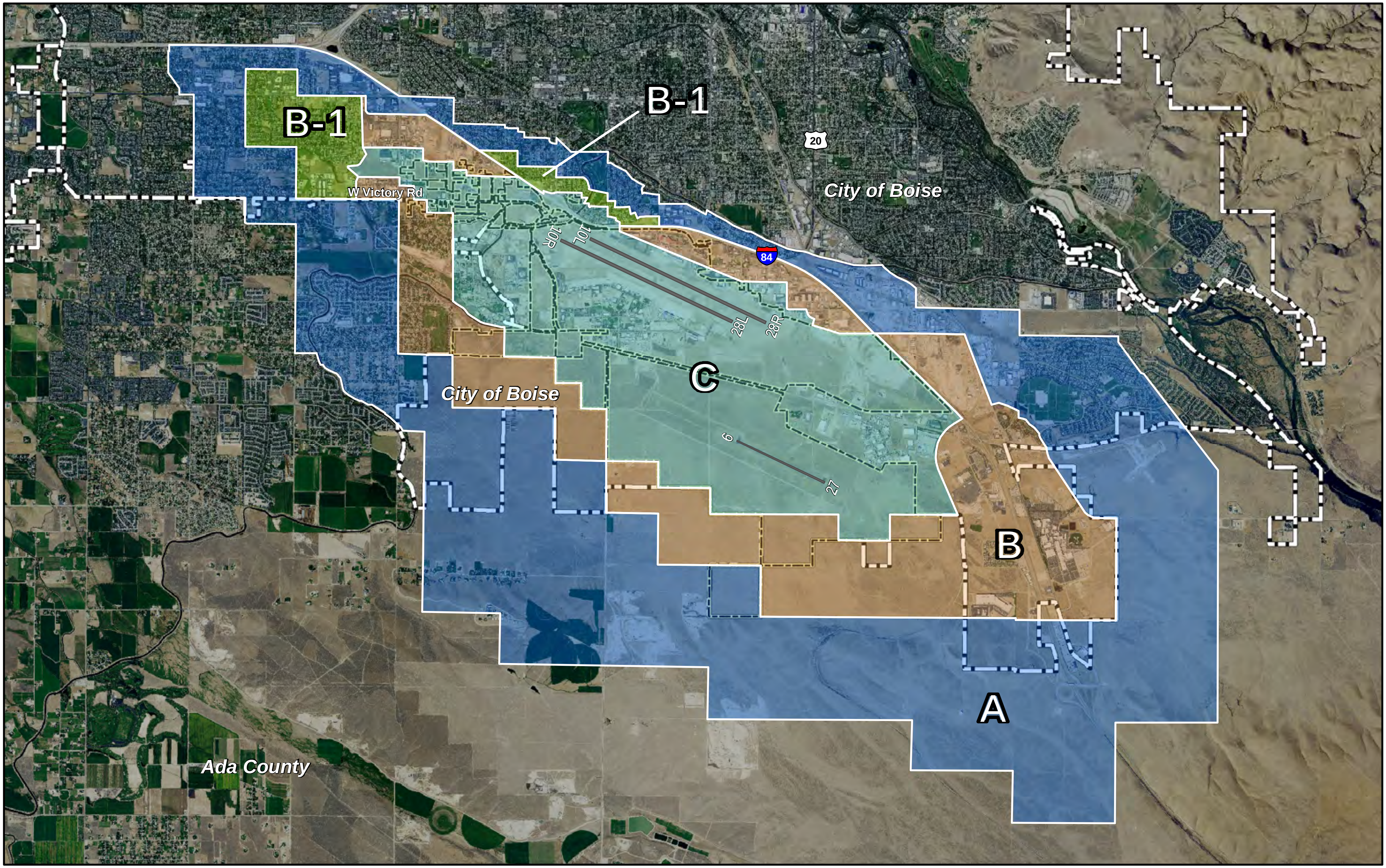
The AIA was developed with the 1996 NCP as a depiction of potential future noise exposure as a scenario in which BOI would be operating at maximum capacity. When established as an overlay zone, the AIA can assist the City of Boise and Ada County in determining if an impending land use is potentially incompatible with existing and future aircraft operations. **Figure 4-1** illustrates the AIA.

The AIA has four (4) sub-districts; A, B, B-1 and C. Influence Area, or “Zone” A represents the outer perimeter potentially affected by future average noise exposure levels in the DNL 60-65 dB; Areas B-1 and B represent the land area between A and C that could be potentially affected by future DNLs of 65-70 dB. Zone C represents the inner core, potentially affected by future DNLs greater than 70 dB. This area includes the Airport and land immediately adjacent to the Airport and is therefore the most restrictive in terms of land use. The majority of land area within Zone C is within Boise City limits.

Both Ada County and the City of Boise currently have procedures in place to ensure that avigation easements are obtained for new subdivision development within the AIA.

The AIA planning standards in the City of Boise and Ada County both require the dedication of avigation easements for all permitted uses. An avigation easement is the right to the use of real property for the purpose of aircraft overflights and related noise, vibrations, and other effects caused by aircraft operations, and is a permanent encumbrance on the land. Although the use of navigable airspace by aircraft is a federal prerogative, an avigation easement provides an additional mechanism of right-of-way and disclosure.

The AIA is used by the City of Boise and Ada County for planning purposes and to enact and enforce their respective zoning regulations; however the jurisdictions do not necessarily coordinate or synchronize their specific requirements with each other.



Legend

- Airport Property
- City of Boise Limits

Figure 4-1
Airport Influence Area

N

0 1,700 3,400 6,800 Feet

Sources: City of Boise, Ada County, HNTB 2015

4.2.2 City of Boise

BOI and the majority of the AIA are within City of Boise limits. The amount of land surrounding the Airport that is within the City's jurisdiction has increased in recent years as the City and County have worked together to identify unincorporated areas of the County that are appropriate for City annexation. The City's land use planning tools in support of land use compatibility surrounding BOI include a comprehensive planning process, zoning and various development regulations.

4.2.2.1 Comprehensive Plan

Adopted in 2011, *Blueprint Boise* is the City's Comprehensive Plan, intended to serve as a "comprehensive guide to managing growth for the next 20 years."[2] The plan contains multiple principles, goals and policies specific to the Airport area. *Blueprint Boise* Chapter 2 – *Citywide Policies* goals includes the adoption of the land use, zoning, and subdivision standards necessary to prevent the establishment of uses that are noise-sensitive or conflict with safe operations of the airport.[3]

The AIA boundaries and description are included in *Blueprint Boise* Chapter 3 – *Community Structure and Design*, along with a description of uses, design principles and zoning districts that are appropriate in the AIA.[4] The principles in the *Blueprint Boise* chapter are consistent with guidelines set forth in the 1996 NCP and continued in the 2006 NCP and support limiting the expansion of existing noise-sensitive land uses. The principles also address soundproofing and compatible uses for the zones of the AIA and support limiting new development within AIA C (70+ DNL) to non-residential uses (residential uses are prohibited). The principles also state that all new development and existing structures within the AIA must comply with the development specifications and provide sound insulation in noise sensitive areas, consistent with the zone specifications established by the 1996 and 2006 NCPs.

Blueprint Boise Chapter 4 – *Planning Area Policies* presents the City's Planning Area Policies for eleven subdistricts within the City, one of which is the Airport Planning Area. The Airport Planning Area boundary does not coincide with the AIA, however the Airport Policies in *Blueprint Boise* reinforce the role of the Airport area as one of the City's major employment centers and promote development that is compatible with airport operations, such as industrial and airport-related development. The airport policies promote compatible industrial and airport-related development and discourage encroachment from non-compatible uses, such as residential, to protect BOI operations and minimize future conflicts.

Additionally, the City is planning the "East Columbia" area, a 6,000-acre planned community intended to house 40,000 new residents. This planning area will be located east of I-84 and south of Gowen Road. The City of Boise has engaged a project management team as well as a stakeholder group and has held several meetings with key stakeholders.[5]

4.2.2.2 Boise City Code

Although the City's Comprehensive Plan references the AIA, the City of Boise Zoning Ordinance[6] offers no specific guidelines pertaining to the AIA or a delineation of AIA boundaries. Section 11-05-07 – Special Purpose Overlay Districts of the zoning ordinance, specifies an "Airport Overlay Zone District" as a reserved section, but does not include the purpose, scope and land use controls of the district, nor is the AIA illustrated on the Zoning Map. Therefore, protection of airport operations has fallen to staff diligence regarding the implementation of the Comprehensive Plan and the past Part 150 studies.

Title 12 – Boise Air Terminal (Gowen Field) Ordinance in the Boise City Code defines the Airport District and the legal implementation of the continued comprehensive planning process. While Title 12 provides specifications to limit land uses in the defined FAA Part 77 airspace, the specifications do not support the AIA Land Use Compatibility Standards for Noise Sensitive and Recreational Uses established by the 1996 NCP and continued by the 2006 NCP. The description of the established zones differ from those of the Comprehensive Plan and impose limitations within each zone such as height restrictions, conforming and non-conforming uses and general land use limitations.

Title 12 illustrates and designates airport Zones A through J (note that there is no “Zone D”), listed in **Table 4.2**.

4.2.2.3 Development Regulations

As noted in Section 4.2.1, the City of Boise requires the dedication of avigation easements for new subdivision development within the AIA, however there are no established guidelines or requirements as part of the City’s building permit application process that would require the applicant to execute an avigation easement. The City of Boise submits development proposals within the AIA to BOI for staff review. At that time, the Airport typically takes the opportunity to place an easement on the property if one does not already exist.

4.2.3 Ada County

The BOI AIA includes unincorporated areas of Ada County. The County therefore maintains policies and regulations to support land use compatibility with airport operations. The County’s comprehensive plan, zoning ordinance and various development regulations serve as guides for land use decisions in the AIA.

Table 4.2

Description of Boise Air Terminal Airport Zones

Zone	Description
Zone A	The primary surface comprising the landing strip and overrun area
Zone B	Instrument Runway Inner Approach Zones (Agriculture, Rural Residential, Sand and Gravel pits, and Sanitary Landfills)
Zone C	Instrument Runway Outer Approach Zones (no use permitted)
Zone E	Approach Zone Transition Zone (no use permitted)
Zone F	Horizontal Zone (no use permitted)
Zone G	Conical Zone
Zone H	Airport Noise Transition Zone (Residential, Industrial and Commercial)
Zone I	Landing Strip Transition (Primary Surface) Zone
Zone J	Outer Area Limitation Zone

Source: Boise Municipal Code, Chapter 12-05, http://cityclerk.cityofboise.org/city-code/.

4.2.3.1 Comprehensive Plan

Ada County's 2007 Comprehensive Plan guides land use and decision-making in the County, and provides the policy basis for the Ada County Zoning Ordinance, which conveys the specific standards and requirements for making land use and development decisions. Note that the County is currently (2015) undergoing a strategic comprehensive plan amendment to the existing 2007 plan.

Chapter 5 – Land Use in the 2007 Comprehensive Plan discusses the Airport AIA and sets goals (Goal 5.12) and policies to "provide for land uses that are compatible with aircraft noise, approach zones, and operation activities and protect the health, safety, and welfare of the general public." The 2001 Boise Airport Master Plan is referenced as a guide for land use decisions in the AIA and aviation (avigation) easements are encouraged for all permitted uses. Goals in other chapters of the Comprehensive Plan, including *Chapter 3 – School Facilities and Transportation* and *Chapter 8 – Transportation* also encourage land use compatibility, as well as updating of County zoning regulations and standards as needed to ensure future compatibility with the airport and any potential expansion areas.

The *Ada County Comprehensive Plan* also identifies Areas of City Impact (or future city planning areas). Land within the impact area includes unincorporated areas of Ada County where future development, annexation or incorporation is anticipated to occur by the City of Boise. Ada County has an agreement with each of the cities (including Boise) that any new development within an Area of City Impact (AOCI) is subject to (1) the comprehensive plans as negotiated pursuant to the Local Land Use Planning Act; and (2) Ada County zoning, subdivision and development regulations, with the understanding that city ordinances and/or jointly developed city/county ordinances may be applied in some Areas of Impact in the future.[7] The City of Boise and Ada County coordinate and consult with each other on development proposals and land use changes within the impact area.

As is the case with each of the cities in Ada County, the County has adopted Boise's Comprehensive Plan *(Blueprint Boise)* for use within the AOCI boundaries applicable to the City of Boise.[8]

4.2.3.2 Ada County Code

Title 8 of the Ada County Code consists of the Ada County Zoning Ordinance. *Chapter 3 – Overlay Districts* of the zoning ordinance includes *Article A – Boise Air Terminal Airport Influence Area Overlay District*, which sets forth the purpose, applicability and standards for the overlay district and references the Boise Air Terminal Airport Influence Areas map. Table 8-3A-1 of this section lists the standards by use according to zones (influence area) and is consistent with the land use compatibility standards established for the AIA in the 1996 and 2006 NCPs. The AIA overlay district is divided into four zones including Zones "A" (65 DNL), "B-1" (70 DNL), "B" (70 DNL), and "C" (75+ DNL), establishing land use restrictions and noise attenuation standards for those areas. These regulations apply to new subdivisions and new construction, alterations, a use change of residential, commercial or industrial structures within the airport overlay district and as identified on the BOI AIA maps.

Zone A establishes use restrictions and noise attenuation standards for uses subject to noise levels up to 65 dB. Uses generally considered noise-sensitive, including residential development, places of public assembly such as schools, hospitals, day care centers, theaters, nursing homes and churches, are all permitted within Zone A with evidence that a minimum noise level reduction of 25 dB is provided by the builder.

Zone B-1 establishes use restrictions and noise attenuation standards for uses subject to noise levels up to 70 dB, while acknowledging existing residential uses. Some noise sensitive uses are prohibited within Zone B-1, however most residential uses, overnight lodging facilities and hospitals are permitted, provided that a minimum noise level reduction of 30 dB is provided. Also, residential density is not to exceed three dwelling units per acre in this area. Other commercial and industrial uses are typically allowed, provided that a noise level reduction of 25 to 30 dB or greater is incorporated into the design and construction of any noise sensitive areas. Due to City annexation of property around the Airport in recent years, no Ada County land is within Zone B-1.

Zone B establishes use restrictions and noise attenuation standards for uses subject to noise levels up to 70 DNL. Many noise-sensitive uses including schools, hospitals, temporary lodging and the majority of residential development are prohibited in Zone B, however single family detached dwellings are permitted, provided a noise level reduction of 35 dB is provided. New dwellings and/or new residential subdivisions are prohibited within Zone “B” unless the subject property is designated for a residential land use in the Comprehensive Plan and increases in residential density are not permitted. Many commercial and industrial uses are permitted provided that a noise level reduction of 25 dB or greater is incorporated into the design and construction of any noise sensitive areas.

Zone C establishes use restrictions and noise attenuation standards for uses subject to noise levels up to 75 DNL. This area includes and borders the Airport, and is therefore the most restrictive, with no residential uses, hospitals, schools or other places of public assembly permitted. Non-lodging commercial and industrial uses are generally permitted in Zone C, provided a noise level reduction of 25 dB is provided. Any principal permitted use within Zone C must receive conditional use approval with the exception of agriculture and non-accessory uses. Avigation easements are required for all permitted uses. Open spaces such as greenways, parks, agriculture and recreation are considered compatible uses within the AIA. Prior to issuance of a zoning certificate, an applicant must provide written documentation that the applicant has filed an avigation easement with BOI. Approximately 220 acres of Zone C remain within Ada County.

4.2.3.3 Development Regulations

Ada County has procedures in place to ensure that avigation easements are obtained for new development within the AIA. The Ada County Code requires avigation easements be filed prior to issuance of zoning certificates. Ada County requires that all building permit applications receive a Zoning Certificate of Compliance. All permit applications filed are reviewed for not only the AIA, but also for property encumbrances with an avigation easement. If a permit application does not have a recorded avigation easement, it is returned to the permit holder with the requirement of meeting with Airport staff to obtain an easement on the property.

4.3 Land Use Mapping

This section describes the development of land use data, and the existing and forecast land use and zoning conditions in the vicinity of the BOI noise environment. Chapter Five presents the residential population and housing unit counts, and noise-sensitive counts, for each NEM and DNL contour interval for the existing and future land use.

The analysis of potential noise impacts relative to existing and future land uses and estimated population were conducted using a Geographic Information System (GIS). DNL noise contours, when superimposed on the land use base maps, allow assessment of land use compatibility for existing and future noise exposure conditions at the Airport. GIS was used to delineate non-compatible land uses, including residential housing units, as discussed in Chapter Five.

4.3.1 Land Use

The land uses near BOI, including land historically located within the noise contours, fall within the political jurisdictions of Ada County and the City of Boise. Neither the City of Boise nor Ada County maintains an existing land use database, therefore existing generalized land use data was developed using multiple sources, including the 2006 Part 150 Study Update land use data, aerial photography interpolation, targeted field verification, and input from the City and County. The location of noise-sensitive buildings such as schools, places of worship, and hospitals was determined through land use data and was cross-referenced with Google Maps (2015)/ Aerial photography (2013) or through field survey.

Future land use data for the area around the Airport, including some unincorporated areas of Ada County, was provided by *Blueprint Boise*. The land use map in Boise's Comprehensive Plan is intended to serve as a guide for future development over the next 10 to 20 years; future zoning changes should generally adhere to the land use categories depicted on the map.[9]

4.3.1.1 Existing Land Use

Figure 4-2 depicts generalized existing land use in the vicinity of the Airport. Land use categories include single-family and multi-family residential, commercial, industrial, public facility/institutional, open space, airport land uses, parks, schools and places of worship. The area north and northwest of the Airport is fully developed and consists of residential, commercial and industrial land uses. The area to the west of the Airport is partially developed and consists primarily of industrial land uses. Several schools and places of worship are located beyond the industrial development to the west of the Airport.

The area to the east of the Airport is partially developed and consists primarily of industrial land uses with areas of open space. There are pockets of commercial and multi-family residential land uses to the east of the Airport, along the I-84 corridor. Land to the south of the Airport is sparsely developed, and is identified as open space with pockets of industrial land use.

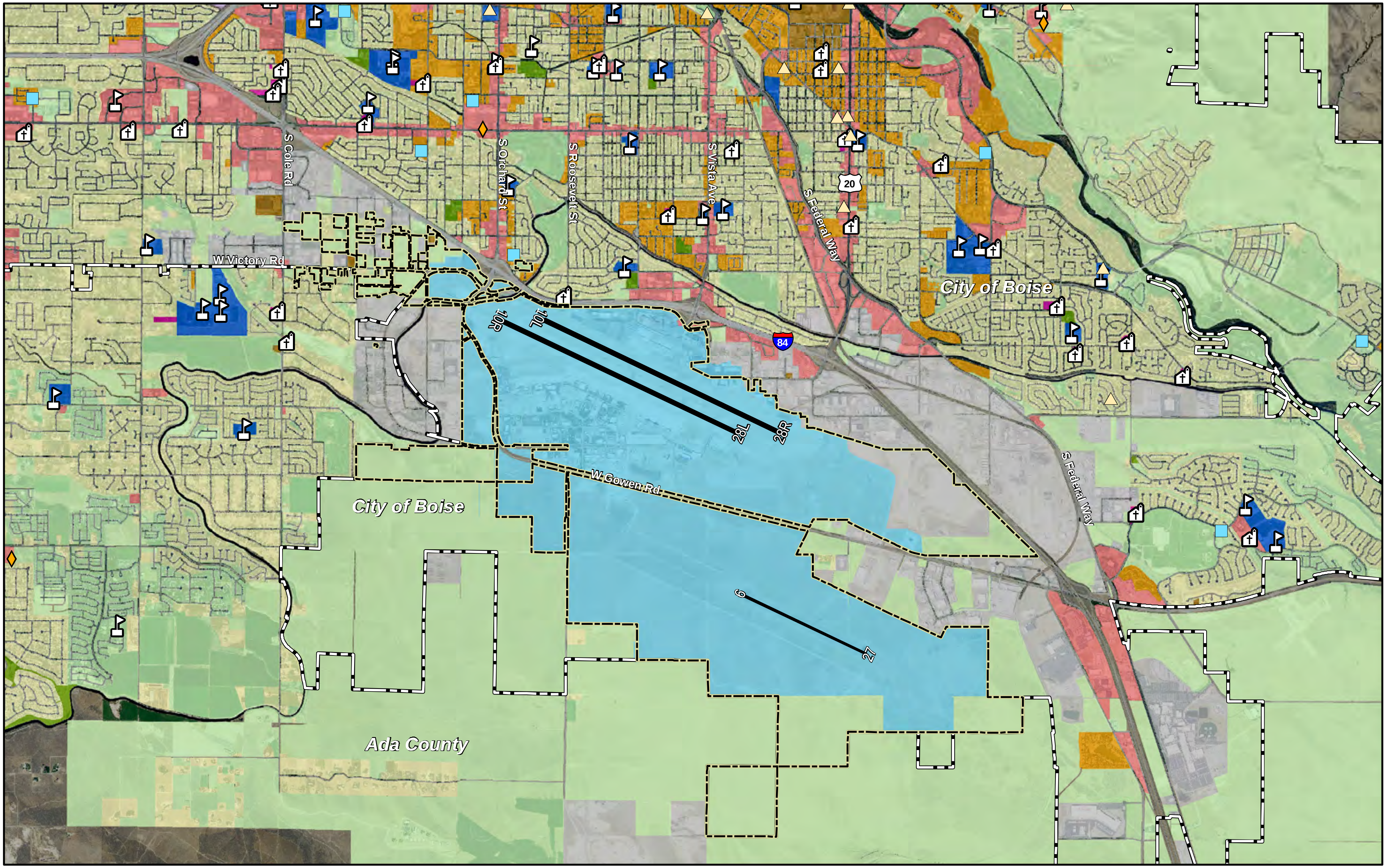
4.3.1.2 Future Land Use

Figure 4-3 shows planned future land uses, as identified in *Blueprint Boise* and Ada County's 2011 Future Land Use Map. As shown on Figure 4-3, BOI property is designated primarily as Airport in the future, with some areas along the perimeter of the main Airport property and within Airport

BOI Boise Airport

Part 150 Study Update

HNTB



Legend

- Airport Property
- City of Boise Limits
- Place of Worship
- Nursing Home
- School
- Library
- National Historic Place

Generalized Land Use (2015)

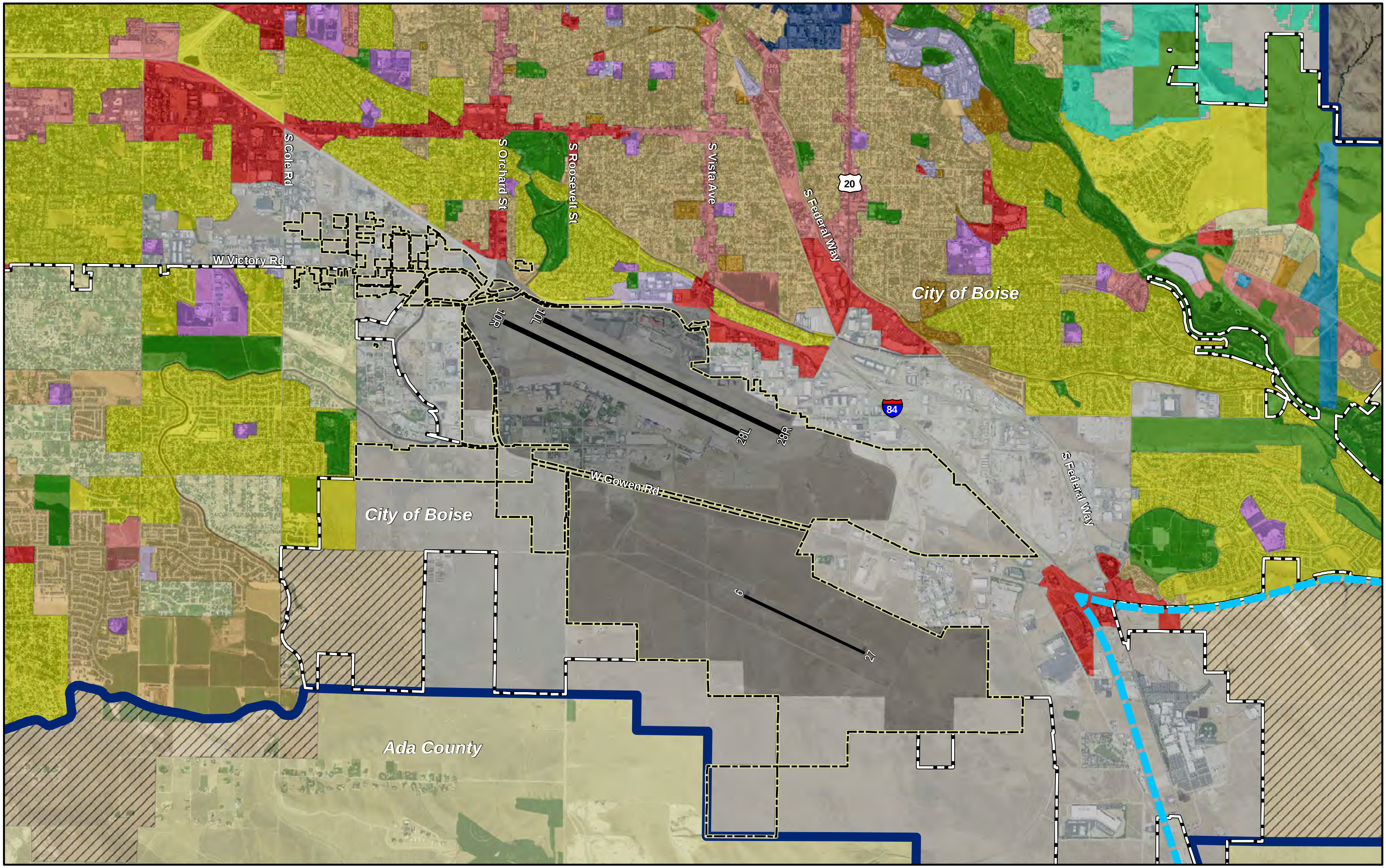
- Single Family Residential
- Multi-Family Residential
- Commercial
- Industrial
- Public Facility/Institutional
- Open Space
- Airport Land Use
- Park
- School
- Place of Worship

N

0 1,250 2,500 5,000 Feet

Figure 4-2
Existing Land Use

Sources: City of Boise, Ada County, HNTB 2015



Legend

Airport Property	
City of Boise Limits	
Area of City Impact	
East Columbia Boundary	

Future Land Use

Airport	High Density	Parks/Open Space
BSU Master Plan	Industrial	Public/Quasi-Public
Buildable	Large Lot/Rural	Education
Commercial	Mixed Use	Slope Protection
Compact	Office	Suburban
Downtown Mixed Use	Planned Community	

N

0 1,250 2,500 5,000 Feet

Figure 4-3
Future Land Use

Sources: City of Boise, Ada County, *Blueprint Boise*, 2011, HNTB 2015 property to the west designated as Industrial land use. Several noncontiguous parcels identified as Airport property farther west and north of the industrial area are undeveloped and designated for large lot/rural land use and compact neighborhood.

Future land use to the north of the airport is identified primarily as industrial, commercial, suburban neighborhoods, compact neighborhoods and office development. Pockets of land use are identified for parks/open space or schools. Future land uses adjacent to the Airport to the west, south and east are all designated as Industrial land uses. The commercial land uses to the east of the Airport along the I-84 corridor remain commercial in the future.

In addition to future land use, Figure 4-3 also shows the Boise AOCI (or future city planning areas), as discussed in Section 4.2.3.1, as well as the City's East Columbia planning area.

4.3.2 Zoning

Illustrated on **Figure 4-4**, zoning data in the vicinity of the Airport was provided by the City of Boise in October 2014 for both the City and Ada County. Zoning in the vicinity of the Airport is under the authority of the City of Boise or Ada County, depending on locational jurisdiction. The City has zoning authority to the north of the Airport, and the areas to the east, west and south of the Airport contain areas zoned by both the City and the County.

The Airport itself, within the City, is zoned C-3 Service Commercial in the northern section (north of Runway 10R-28L), M-1 Limited Industrial to the south of Runway 10R-28L toward and across Gowen Road, and is zoned A-1 Open Land and M-1 Limited Industrial in the southern area of the Airport.

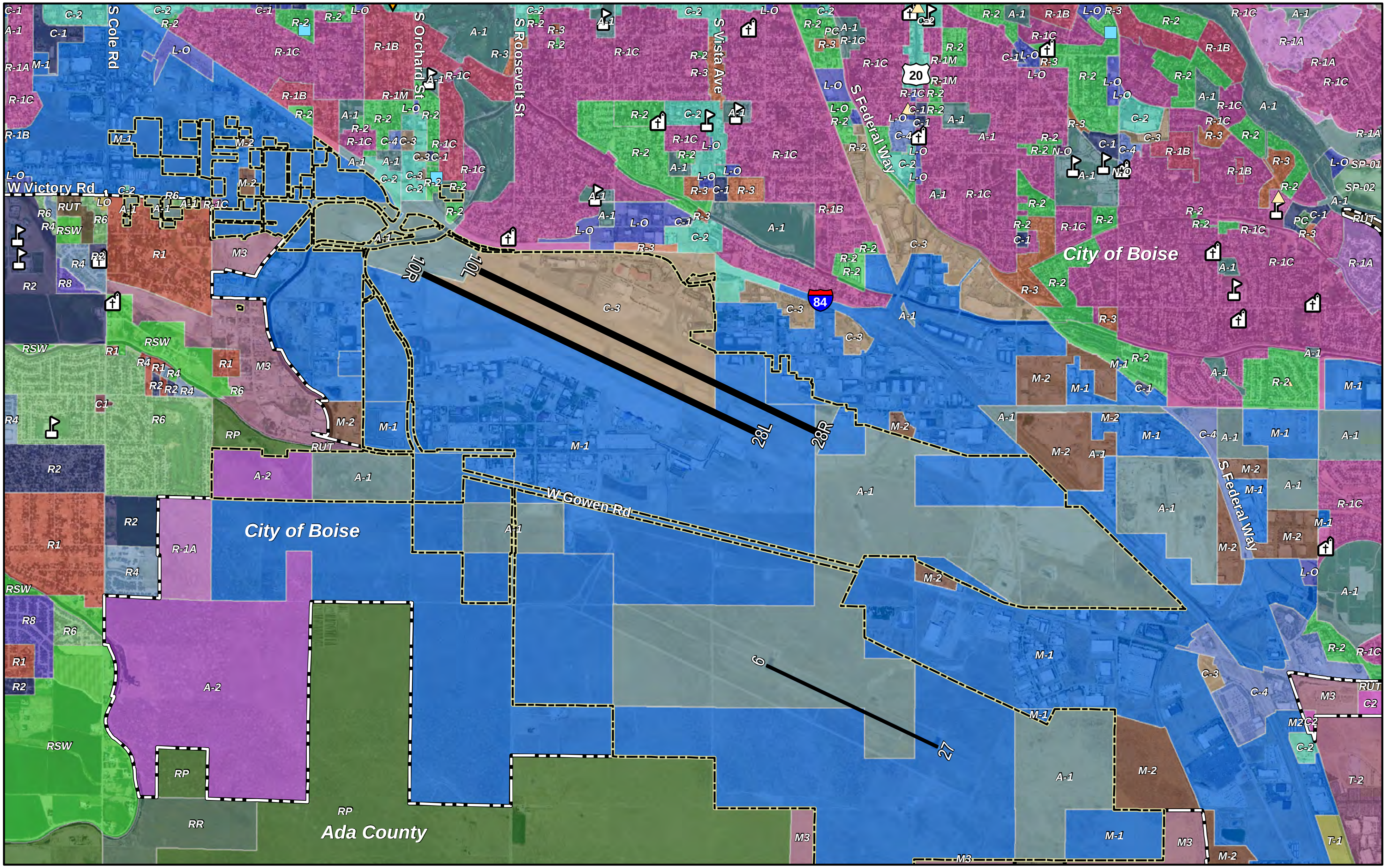
The area north of the Airport is zoned for L-O, Limited Office, C-1 Neighborhood Commercial, C-2 General Commercial, C-3 Service Commercial, and for R-1 Single Family, R-2 Combined and R-3 Multifamily Residential.

Land to the east of the Airport is primarily zoned for A-1 Open Land and M-1 Limited Industrial, with interspersed industrial and commercial areas. Land to the west of the Airport is zoned M-1 Limited Industrial, M3 Airport Industrial (Ada County), A-1 Open Land, with pockets of commercial and residential areas slightly further west. South of the Airport is zoned M-1 Limited Industrial, A-1 Open Land, and RP Rural Preservation (Ada County).

4.3.2.1 Airport Overlay Zone

Ada County's zoning ordinance includes several Special Overlay Districts. Overlay zoning districts are a distinct zone overlaying an existing zoning district that includes an additional set of regulations that is applied to the property within the overlay zone in addition to the requirements of the underlying or base zoning district. Ada County includes the "Boise Air Terminal Airport Influence Areas Overlay" as a Special Overlay District in the County's zoning ordinance. The overlay district coincides with the AIA zones established as part of the 1996 NCP. For Ada County, the additional use restrictions and standards designated by the overlay zone (Zone A, B-1, B, or C) are applied in addition to the base zoning district.

Although the City of Boise includes a section for "Airport Overlay Zone District" as a reserved section in the zoning ordinance,



Legend

- Airport Property
- City of Boise Limits
- Place of Worship
- Nursing Home
- School
- National Historic Place

City of Boise Zoning

A-1, A-2, C-1, C-2, C-3, C-4, L-O, M-1, M-2, N-O, PC, R-1A, R-1B, R-1C, R-1M, R-2, R-3, SP-01, SP-02, T-1, T-2

Ada County Zoning

C1, C2, LO, M2, M3, R1, R2, R4, R6, R8, RP, RR, RSW, RUT

N

0 875 1,750 3,500 Feet

Figure 4-4
Zoning in the Vicinity of the Airport

Sources: City of Boise, Ada County, HNTB 2015

the section remains vacant and no reference is made to the AIA. Therefore the City has no legal authority to ensure enforcement of the recommended use restrictions and standards of the AIA. Currently, AIA guidelines are enforced through Conditions of Approval in the City.

References

[1] Department of Housing and Urban Development (HUD), 24 CFR, Part 51 – Environmental Criteria and Standards, Subpart B – Noise Abatement and Control, 44 FR 40861, July 12, 1979, as amended at 49 FR 12214, Mar. 29, 1984.

[2] City of Boise Planning and Development, *Blueprint Boise*, http://pds.cityofboise.org/planning/comp/blueprint-boise/, accessed 4/8/2015.

[3] City of Boise, *Blueprint Boise* (Comprehensive Plan), adopted November 2011, p. 2-51.

[4] City of Boise, *Blueprint Boise* (Comprehensive Plan), adopted November 2011, p. 3-41.

[5] S. Beecham, Associate Comprehensive Planner (City of Boise), personal communication, August 19, 2015.

[6] City of Boise, Boise City Code Title 11, March 2013.

[7] Ada County, *Ada County Comprehensive Plan*, 2007, p. 5-7.

[8] Ada County, "Comprehensive Plans," https://adacounty.id.gov/Development-Services/Planning-Zoning-Division/Comprehensive-Plans, accessed 4/14/15.

[9] City of Boise, *Blueprint Boise* (Comprehensive Plan), adopted November 2011, pp. 3-1 to 3-2.

Chapter Five
NOISE EXPOSURE MAPS

The BOI NEMs are presented in this chapter. The NEMs represent existing (2015) and five-year forecast (2020) noise exposure at the Airport. The NEMs were developed with the information discussed in Chapters Three and Four. This chapter also provides an overview of the development of the estimated population and housing unit counts for the 2015 and 2020 NEMs. This data is used in support of the existing and future land use compatibility assessment.

5.1 Noise Exposure Maps

The BOI NEMs were developed in accordance with the provisions of 14 CFR Part 150, Airport Noise Compatibility Planning. The certification page at the front of this document and on the NEMs addresses Part 150 requirements regarding the accuracy of the maps and the opportunities provided for public review and input.

5.1.1 Methodology

The FAA requires that the NEMs show existing and projected land uses. Section 4.3 describes the development of land use data displayed on the NEMs. The analysis of potential noise impacts relative to existing and future land uses and estimated population were conducted using GIS. DNL noise contours, when superimposed on the land use base maps, allow assessment of land use compatibility for existing and future noise exposure conditions at the Airport. GIS was used to delineate non-compatible land uses, including residential housing units, noise-sensitive public buildings, and historic sites, if applicable.

The estimated residential population, housing unit counts, and noise-sensitive locations were estimated for each NEM by DNL contour interval for the existing and future land use. The housing counts within the DNL 65+ dB noise contours of the NEMs were estimated through a combination of residential land use data, parcel data, targeted field and aerial (2013) verification, and BOI staff review. City of Boise land use data was used to identify residential areas within the contours. The number of housing units within residential land uses was then estimated based on land use classification (e.g., single family or multifamily), City of Boise parcel data, and through aerial photography verification. Additionally, BOI staff provided input on known properties and several areas were field verified.

To estimate residential population, the 2010 U.S. Census Bureau average household size for the associated Census block was multiplied by the number of houses within that block.

Although it is difficult to estimate the future number of dwellings and people that are likely to live in the area predicted to be exposed to forecast aircraft noise, the projected data are useful in gauging the potential future impacts from aviation operations. Future land use, as identified in *Blueprint Boise*[1] was applied to the future NEM, and the estimated parcels and housing units within the DNL 65+ dB were determined. To estimate future residential population, the 2010 U.S. Census Bureau average household size for the associated Census block was multiplied by the number of housing units within that block.

5.1.2 Year 2015 NEM

Figure 5-1 represents the 2015 NEM. This is the NEM for existing conditions for the year of submission (2015), incorporating the existing land use, operational procedures, airport layout, flight operations and fleet mix, and other noise modeling considerations described in Chapter Three.

As discussed in Section 4.1, the Federal standard for noise compatibility for most noise-sensitive land uses is the DNL 65 dB noise contour. As shown in **Table 5.1**, there are an estimated 237 people and 82 housing units within the DNL 65-69 dB contour of the 2015 NEM. Within the DNL 70-74 dB contour, there are an estimated 23 people and seven housing units in the 2015 NEM.

There is one place of worship (Jehovah's Witness Kingdom Hall) within the DNL 65-69 dB contour of the 2015 NEM. There are no other non-residential noise sensitive public buildings (schools, hospitals, etc.) or historic properties within the DNL 65+ dB contour of the 2015 NEM.

5.1.3 Year 2020 NEM

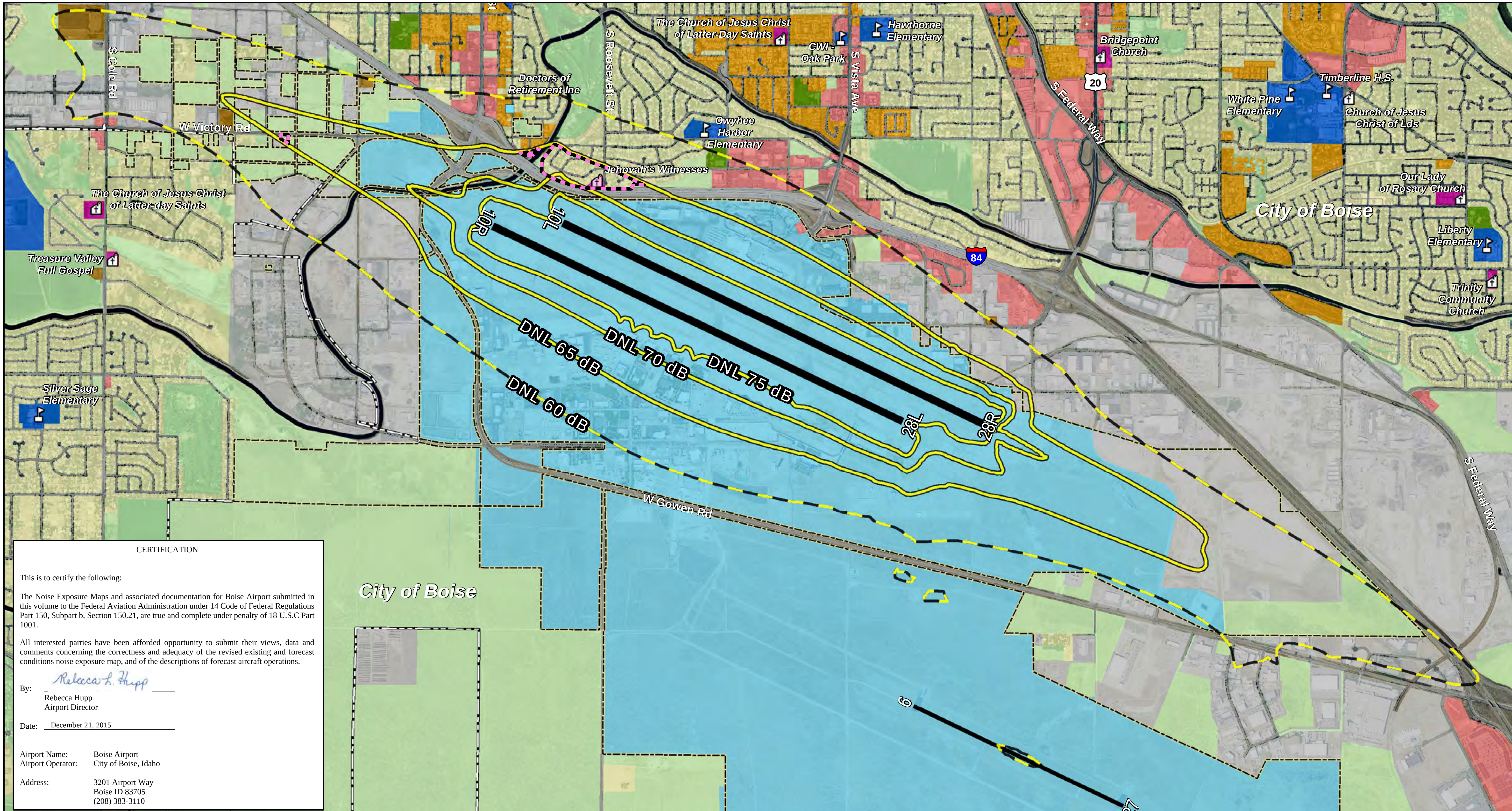
Figures 5-2 and 5-3 represent the NEMs for forecast conditions for the fifth year following the year of submission (2020), on existing and future land use, respectively, reflecting the noise model input data as described in Chapter Three. Figure 5-2 is referred to as the 2020 NEM.

As shown in Table 5.1, the DNL 65-69 dB contour of the 2020 NEM contains an estimated 828 people and 343 housing units relative to the existing land use. Within the DNL 70-74 dB contour, there are an estimated 222 people and 76 housing units. There are approximately 790 more people and 330 more housing units in the 2020 NEM than in the 2015 NEM within the DNL 65+ dB contour, due to the increase in forecasted flight operations and change in fleet mix discussed in Chapters Two and Three.

Non-residential noise-sensitive land uses within the DNL 65-69 dB noise contour of the 2020 NEM include a nursing home (Doctors of Retirement, Inc.) and part of a park (Owyhee Park), both located north of BOI. No historic properties are located within the DNL 65+ dB contour. One place of worship (Jehovah's Witness Kingdom Hall), also north of BOI, is located within the DNL 70-74 dB contour of the 2020 NEM. No noise-sensitive land uses are located within the DNL 75+ dB contour. No other noise-sensitive public buildings are located within the DNL 65+ dB of the 2020 NEM.

Year 2020 NEM with Future Land Use

Within the DNL 65+ dB contour using future land use, there are an estimated 837 people and 327 housing units. Note that the reduction of people and housing units with the future land use, as compared to the existing land use, is related to a reduced amount of residential future land uses north and northwest of the Airport.



CERTIFICATION

This is to certify the following:

The Noise Exposure Maps and associated documentation for Boise Airport submitted in this volume to the Federal Aviation Administration under 14 Code of Federal Regulations Part 150, Subpart b, Section 150.21, are true and complete under penalty of 18 U.S.C Part 1001.

All interested parties have been afforded opportunity to submit their views, data and comments concerning the correctness and adequacy of the revised existing and forecast conditions noise exposure map, and of the descriptions of forecast aircraft operations.

By: Rebecca L. Hupp
Rebecca Hupp
Airport Director

Date: December 21, 2015

Airport Name: Boise Airport
Airport Operator: City of Boise, Idaho

Address: 3201 Airport Way
Boise ID 83705
(208) 383-3110

Legend

- 2015 DNL Noise Contour
- 2015 DNL Noise Contour (60 DNL)
- Airport Property
- City of Boise Limits
- Place of Worship
- Place of Worship (Noncompatible)
- Nursing Home
- National Historic Place
- School

Generalized Land Use (2015)

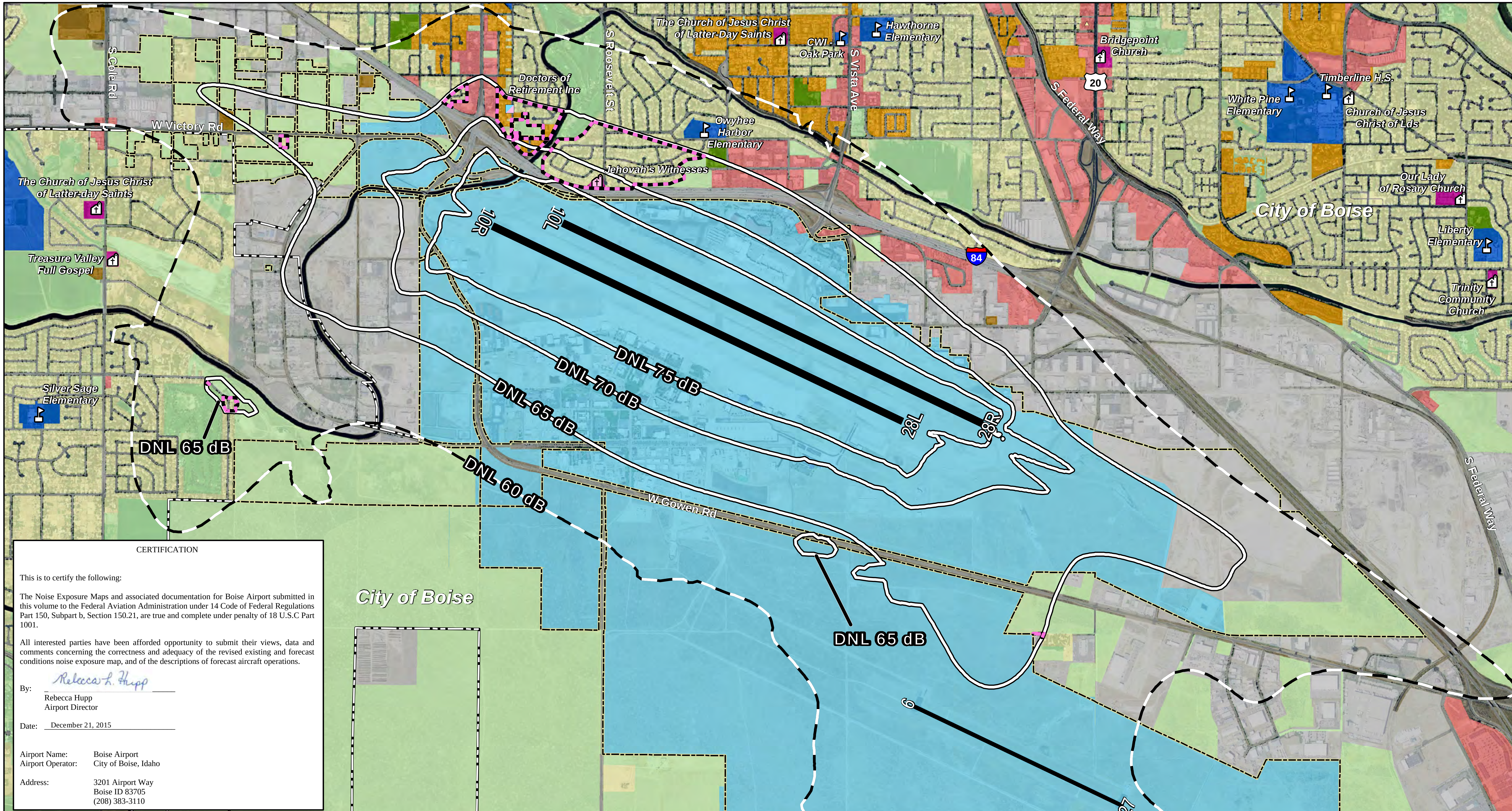
- Single Family Residential
- Multi-Family Residential
- Commercial
- Industrial
- Public Facility/Institutional
- Open Space
- Airport Land Use
- Park
- School
- Place of Worship
- Noncompatible Land Use

N

0 500 1,000 2,000 Feet

Figure 5-1
2015 Noise Exposure Map

Sources: City of Boise, Ada County, HNTB 2015



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- Place of Worship (Noncompatible)
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Generalized Land Use (2015)

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- Multi-Family Residential
- Commercial
- Industrial
- Public Facility/Institutional
- Open Space
- Airport Land Use
- Park
- School
- Place of Worship
- Noncompatible Land Use

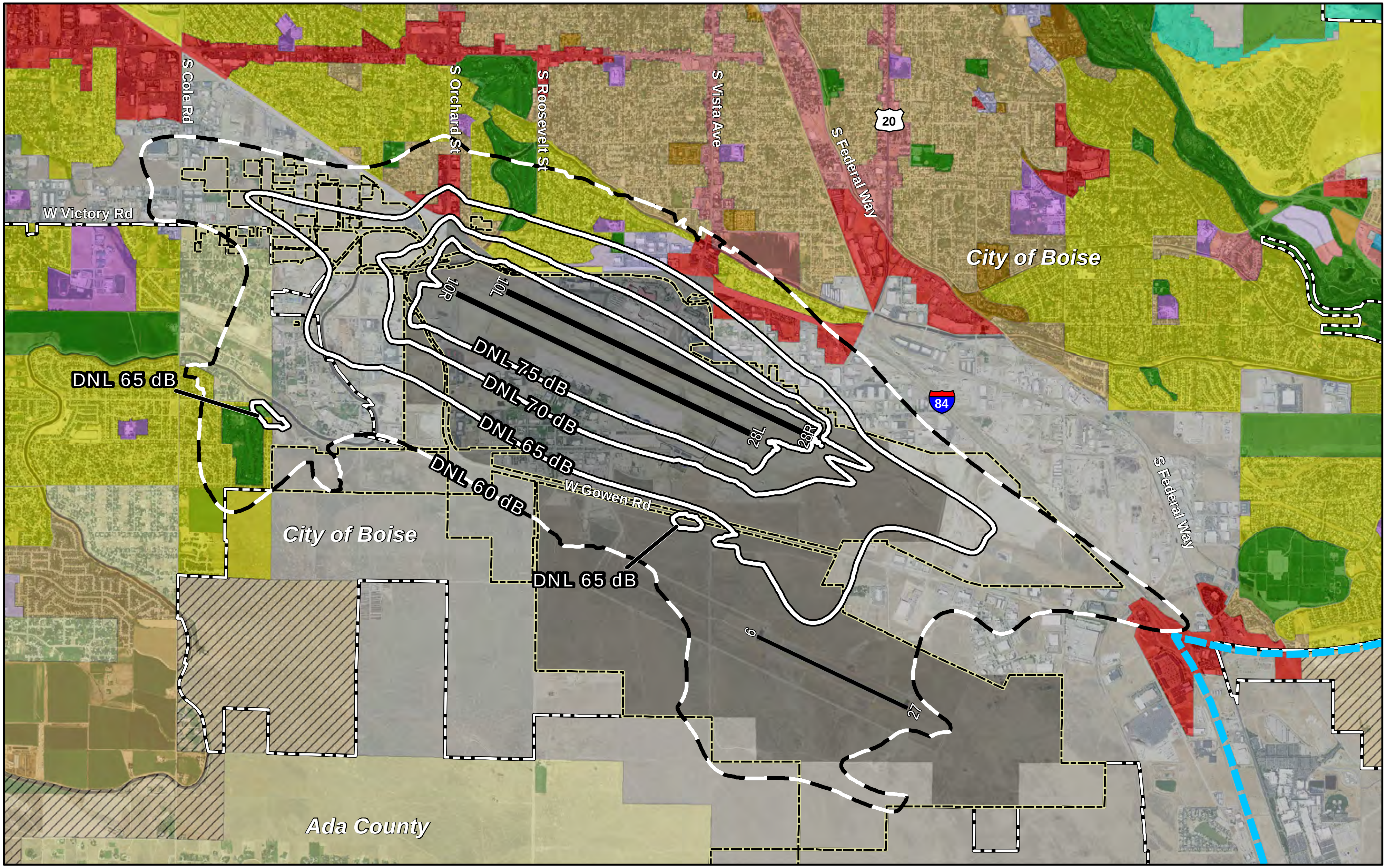
N

0 500 1,000 2,000 Feet

Figure 5-2
2020 Noise Exposure Map

Sources: City of Boise, Ada County, HNTB 2015

Part 150 Study Update



Legend

- Airport Property
- City of Boise Limits
- 2020 DNL Noise Contour
- East Columbia Boundary

Future Land Use

Airport	High Density	Parks/Open Space
BSU Master Plan	Industrial	Public/Quasi-Public
Buildable	Large Lot/Rural	Education
Commercial	Mixed Use	Slope Protection
Compact	Office	Suburban
Downtown Mixed Use	Planned Community	

N

0 1,000 2,000 4,000 Feet

Figure 5-3
2020 Noise Exposure Map on Future Land Use

Sources: City of Boise, Ada County, *Blueprint Boise*, 2011, HNTB 2015

Table 5.1

Summary of Non-Compatible Land Use within Noise Exposure Maps

Noise Exposure Map	DNL 65-69 dB		DNL 70-74 dB		Within DNL 75 dB		Total	
	Estimated Population	Housing Units	Estimated Population	Housing Units	Estimated Population	Housing Units	Estimated Population	Housing Units
Existing Land Use								
2015 NEM	237	82	23	7	0	0	**260**	**89**
2020 NEM	828	343	222	76	0	0	**1,050**	**419**
Future Land Use								
2020 NEM	642	264	195	63	0	0	**837**	**327**

Note: Population data rounded to the nearest whole number, except for values less than one which are rounded up.

Source: U.S. Census Bureau, 2010, HNTB analysis, 2015.

References

[1] The future land uses are meant to illustrate the projected future uses as envisioned by the comprehensive planning process completed by the City of Boise. *Blueprint Boise,* http://pds.cityofboise.org/media/151849/boise_future_lu11_11_final.pdf, accessed 6/25/15.

Chapter Six
NOISE ABATEMENT MEASURES

This chapter discusses the status of the existing noise abatement flight procedures that are part of BOI's previously recommended Noise Compatibility Program (NCP) to reduce noise exposure to communities surrounding the Airport, and revisits the full range of noise abatement measures considered in a Part 150 Study. An analysis of noise abatement measures considers changes to runway use, flight track use, and other operational procedures that determine where aircraft fly in the immediate vicinity of the Airport. The objective of the noise compatibility planning process at BOI has been to improve the compatibility between aircraft operations and noise-sensitive land uses in the vicinity of the Airport (primarily within the DNL 65 dB noise contour), while allowing the Airport to continue to serve its role in the community, state, and nation.

As described in Chapter Five, the forecast 2020 NEM projects an increase in the area and estimated population within the noise contours. However that increase is primarily due to the possible change in mission of the Idaho ANG, from A-10A aircraft to a potential mission flying F-15E aircraft. During the development of the input assumptions of the 2020 NEM, viable methods for reducing the impact of F-15 operations were considered. It is important to note that prior to a change in mission with the Idaho ANG, requirements set forth under the National Environmental Policy Act (NEPA) must be met, which include an analysis and disclosure of the potential increase in noise that would result. Because the F-15 is not yet operational at BOI, and the types of noise abatement measures will depend on the flying mission of the F-15 aircraft, *no new noise abatement measures that would potentially further reduce the number of persons within the DNL 65 dB noise contour were considered in this study*. BOI and the City of Boise plan to work collaboratively with the Department of Defense, the Idaho ANG, and the ATCT should the F-15s (or another flying mission) relocate to BOI.

In summary, the existing noise abatement measures provide the maximum benefit possible within the DNL 65 dB noise contour, with exception of potential future F-15E operations. Noise abatement measures for the F-15E are anticipated to be considered under future NEPA analysis and could be the subject of future Part 150 studies.

In this chapter, Section 6.1 discusses the general elements of an NCP and provides the framework for Chapters Six, Seven and Eight. Section 6.2 reviews the specific noise abatement measures of the previous 2006 NCP, Section 6.3 provides a brief overview of the range of typical measures and strategies and updates their applicability to BOI, and Section 6.4 summarizes the recommended changes to the Airport's NCP for the existing noise abatement measures.

6.1 General Elements of the Noise Compatibility Program

The development of an NCP begins with an evaluation of all reasonable, feasible actions that could reduce potential land use non-compatibilities identified in the NEMs. Part 150 specifies the range of alternatives that must be considered, which fall into three principal categories:

- Noise abatement measures seek changes to operational flight procedures to reduce the size or change the shape of the noise contours so as to minimize non-compatibilities (discussed in this Chapter).
- Land use measures are intended to correct existing non-compatible land uses and prevent future non-compatibilities (discussed in Chapter Seven).
- Continuing program measures are useful for implementing and evaluating the recommended noise abatement and land use measures, and to enhance community and airport dialogue regarding aviation noise, improve public understanding of aviation noise, and provide of ongoing evaluation of noise generated from aircraft flight operations (discussed in Chapter Eight).

The analysis of noise abatement measures considers changes to runway use, flight track use, and other operational procedures that determine where aircraft fly in the immediate vicinity of the Airport. A typical NCP evaluates measures that fall within the following categories, shown in **Table 6.1**.

Table 6.1

Categories of Noise Compatibility Planning Measures

Category	Description	Measure Type
1	Land acquisition and interests therein	Land Use
2	Barriers, shielding, public building soundproofing	Land Use and Noise Abatement
3	Preferential runway use system	Noise Abatement
4	Flight procedures	Noise Abatement
5	Restrictions on type/class of aircraft	Noise Abatement
6	Other actions with beneficial impact	Miscellaneous, Land Use, or Noise Abatement
7	Other FAA recommendations	Miscellaneous, Land Use, or Noise Abatement

Source: 14 CFR Part 150, paragraphs B150.7 (b) (1) through (7); BOI Part 150 Study, 2006.

6.2 Review of Noise Abatement Elements in 2006 NCP

The 2006 Part 150 Study considered a range of NCP measures, including beneficial actions suggested by the Airport, FAA, other study participants and the public. They include measures such as land acquisition, construction of noise barriers, shielding, and sound insulation, a preferential runway use system, flight procedures, and restrictions associated with the type or class of aircraft. Following an analysis of the potential benefits of each of the measures, a final recommended set of noise abatement measures was identified in the 2006 NCP. The recommended noise abatement measures would continue existing operational procedures at BOI that provide benefit to neighboring communities and maintain the Airport's small number of impacted residents within the DNL 65+ dB noise contours.

Noise abatement measures can be either formal or informal procedures. Informal procedures are typically implemented on a voluntary basis, in cooperation with the airport, aircraft operators, and ATC. Formal procedures require letters of agreement between the airport, aircraft operators, and ATC, and have historically been more difficult to coordinate, implement, and enforce. As a result, many noise abatement measures are implemented on a voluntary basis. The City of Boise, as airport operator, must initiate the implementation of all noise abatement measures. Clearly, however, the FAA and ATC have key roles in the implementation of aircraft operational measures. Since the FAA is responsible for air traffic control, it must develop and provide instructions to pilots related to preferred runway use and noise abatement flight tracks. Both air carriers and pilots have supporting roles in the implementation of aircraft operational measures, as they must support and comply with noise abatement procedures, consistent with the safe operation of aircraft.

Since there was limited non-compatible development within the 2009 NEM, the focus of the 2006 NCP was on preventing future non-compatible development, while also addressing existing non-compatibilities. A total of 12 noise abatement measures were evaluated in detail in the previous study, nine of which were included in the recommended NCP. FAA approval of noise abatement measures under the Part 150 program is contingent upon a benefit within the DNL 65 dB noise exposure contour, and depends on a number of factors. FAA approval does not necessarily imply that a measure will be or has been implemented.

The previous Part 150 Study provided a detailed evaluation of each of the recommended measures. The range of evaluation criteria included the following: description of the measure, potential noise impacts, ATC and operational feasibility, and safety considerations, effects on airport operations and impact on airport users, regional economic impacts, quality of service impacts, costs and anticipated funding sources, ease of implementation and enforcement, legal factors, and the responsible parties for implementation. The following sections provide an overview of each of the recommended measures; the current implementation status of each measure is included in Section 6.2.7, Implementation Status.

6.2.1 Measure NA-1 - Preferential Runway Use

This measure designated Runways 10L and 10R as the preferential flow for departing aircraft and Runways 28L and 28R as the preferential flow for arriving aircraft, per the discretion of the Boise ATCT. During either east or west flow, the north parallel runway (10R/28L) would be designated as the primary arrival runway, and the south parallel (10L/28R) as the primary departure runway.

The aim of this measure is twofold – 1) to maximize the use of more compatible land uses to the east/southeast of BOI, and 2) to identify preferred runways that minimize noise exposure close to the Airport. The 2006 measure was a modification of the 1996 measure which included the identification of Runways 10L and 10R as the preferential runways. The 2006 NCP updated this measure to include designation of a preferential arrival flow, and designation of the north and south parallel runways as preferential for arrivals and departures, respectively.

Aircraft operate most efficiently into the wind (headwind) as opposed to with the wind (tailwind). At BOI, to avoid airspace conflicts, the runways are operated in either east flow or west flow, such that arrivals and departures are separated. During east flow, all arrivals are routed to approach from the northwest (and land on either Runway 10L or 10R), while all departures are initially directed to the southeast (from Runway 10L or 10R). During west flow, the Airport is operated in reverse, and arrivals approach from the southeast (landing on Runways 28L or 28R) and departures are initially routed to the northwest (departing from Runways 28L or 28R). The primary determination for how the Airport operates at a given time is the predominant direction of winds. The previous Part 150 evaluated the noise benefit of maximizing both east and west flows and concluded that to minimize noise impacts within the DNL 65 dB noise contour, louder departing aircraft would be directed to less-populated areas east of the Airport and when feasible, arrivals would also approach from the southeast.

To address ground noise, a second element of this preferential runway use measure evaluated the designation of the north parallel runway to be favored for arrivals and the south parallel runway to be favored for departures. As a result, these preferences could provide a benefit in ground noise reductions (especially during the nighttime when vehicular noise is also reduced) to the neighborhood bordering the airport to the north along I-84.

As a voluntary measure, the Boise ATCT has the authority to operate a preferential runway use measure in a manner that ensures the safety of aircraft operations. Factors such as weather, aircraft separation, runway crossings, and capacity are important and dominant considerations in runway selection. This measure is primarily intended to give ATC and pilots guidance on noise sensitive runway selection as operational conditions permit. As a voluntary measure, aircraft operators could continue to request the most convenient runway end given their direction of flight during calm wind conditions. The measure was approved as voluntary by the FAA as air traffic, weather and airspace safety and efficiency permit.

6.2.2 Measures NA-2 through NA-5 – Departure Turn Altitudes

Existing measures NA-2, NA-3, NA-4, and NA-5 specify recommended altitudes for which aircraft are to begin their turns to assigned flight tracks out of BOI. Each of these measures were included in the Airport's previous NCPs and were recommended with modifications (for Measure NA-2 only) in the 2006 NCP.

In general, the turn altitudes recommended in these measures occur at distances from the runways that are near or outside the DNL 60 dB contour of the 2009 NEM. The measures are a practical mechanism to encourage aircraft to climb-out over generally compatible land uses before beginning their turns to assigned headings. Moreover, the different climb gradients of departing aircraft results in aircraft reaching the altitude for turns at varying distances from the Airport, which disperses noise exposure and avoids repeated impacts to specific, localized areas. The continued use of these procedures was not anticipated to change the population within the contours, but would provide benefits in terms of single-event noise levels.

Measure NA-2 directed jet departures from Runways 28L and 28R to maintain runway heading until reaching 5,000' MSL before turning north or south. This measure was originally included in the 1996 NCP and included a higher altitude (6,000' MSL) for the military F-4 aircraft in operation at the time. It was modified in the 2006 NCP to remove the F-4 aircraft and to include departures to the south, as considerable development had begun to occur southwest of BOI. The intent of the measure was to direct larger aircraft south of a concentrated residential neighborhood before turning north in order to prevent low overflight of dense residential areas by aircraft with high single event noise levels.

For smaller non-jet departures, Measure NA-3 directed non-jet aircraft over 12,500 pounds with destination headings to the north to fly runway heading to an altitude of 4,500' feet MSL before turning. Like Measure NA-2, the measure served as a practical mechanism to encourage aircraft to climb-out over generally compatible land uses before beginning their turns to assigned headings.

Measure NA-4 directs aircraft departures flying under Visual Flight Rules (VFR) with destination headings to the north to fly runway heading to the end of the runway before turning. All aircraft flying to or from an airport are operating under either VFR or Instrument Flight Rules (IFR). Visual conditions occur when a pilot is able to safely use visual references to navigate an aircraft; operation of the aircraft is thus governed by VFR – also commonly referenced as "see and avoid" flying. When meteorological conditions do not meet certain minimum requirements, aircraft must operate under Instrument Flight Rules (IFR), which relies on navigation by onboard instrumentation and separation from other air traffic provided by ATC. The intent of this measure is to maximize the altitude of aircraft by overflying the runway for the longest extent possible prior to turning and overflying potentially non-compatible land uses to the north and northwest.

Measure NA-5 would continue to direct north and northwest bound turbojet departures from Runways 10L and 10R to fly runway heading to 5,000 feet MSL before turning north. Like the previous measures, maximizing the altitude of the aircraft while still aligned with the runway heading can increase the altitude of the aircraft when overflying potentially non-compatible land uses to the north.

Because the measures are voluntary, the BOI ATCT has the authority to designate flight procedures that ensure the safety of aircraft operations. ATC and aircraft use of the turn altitudes is dependent upon weather, wind, aircraft performance, and traffic demand. As the measures are already in use, and due to their voluntary nature, there are no significant ATC constraints to continued use.

6.2.3 Measure NA-6 – Downwind Arrival Flight Tracks

Measure NA-6 was included as a recommendation in the 2006 NCP but was disapproved by the FAA. The measure prescribed that, primarily during nighttime hours, aircraft would be voluntarily re-routed to use arrival flight tracks with downwind legs to the south of BOI. A downwind leg describes the segment of an aircraft arrival where an aircraft flies a level flight path parallel to the landing runway, but in the opposite direction. The downwind leg precedes the base leg (the turn to align with the landing runway) and the final approach. This was a new measure in the 2006 NCP recommended by BOI staff, with the goal of reducing overflight noise to the densely populated residential areas in the City of Boise that are north of the Airport.

Most of the flight tracks in use at BOI are routed to expediently serve aircraft flying to or from a specific destination. This measure evaluated the potential for rerouting aircraft at some distance (40 miles or so) from the Airport, so that they would use downwind arrival legs to the south of the Airport, rather than north of the Airport. Any potential noise benefits would be anticipated to occur well beyond BOI's noise contours and not positively or negatively impact the estimated population within. However, the procedure had the potential to reduce overflight noise, especially at night, for communities outside the DNL contours.

The measure included a number of drawbacks: it would impose considerable additional flight costs on aircraft operators as aircraft would not fly the most expedient route to the Airport and it would not be feasible during times of peak operations use, due to the need to separate and sequence aircraft for arrival. Thus, its use would be limited to nighttime hours.

6.2.4 Measure NA-7 – FMS/GPS Flight Procedures for I-84 Corridor

Measure NA-7 evaluated the use of precision arrival and departure flight tracks to and from BOI using satellite based navigation technology to maximize the overflight of compatible land uses. Use of Global Positioning System (GPS) and Flight Management Systems (FMS) allows air traffic to fly with relative precision over specific points on the ground, rather than traditional ground-based navigation. Specifically, Measure NA-7, a new measure in the 2006 NCP, would have established Departure Procedures (DPs) and Standard Terminal Arrival Routes (STARs) along the I-84 corridor to the east of the Airport.

The previous Part 150 Study evaluated in detail a range of potential procedures. The use of STARs and DPs for the existing flight tracks at the time would have increased population within the DNL contours and were not recommended. To the west, there were no apparent corridors with compatible land use; therefore no beneficial flight routes were developed. However, use of the

I-84 corridor to the east of BOI (for arrivals to Runways 28L and 28R, and departures from Runways 10L and 10R) would direct aircraft over mostly compatible land uses. Although the procedure would not have reduced population within the DNL 65+ dB contour, establishment of the procedure would have encouraged aircraft noise and land use compatibility as development occurs along the corridor. As such, the measure recommended that BOI pursue implementation of precision flight tracks along the I-84 corridor. Any potential modified flight tracks would have also required further environmental review under NEPA.

The FAA disapproved this measure in the 2006 ROA, due to a lack of demonstrable benefit within the DNL 65 dB noise contour, even with 100% compliance (based on both ATCT usage and navigation equipment in every aircraft). The FAA concluded in the ROA that these recommendations are more appropriate to pursue outside of the Part 150 process to determine local feasibility and possible inclusion in future updates.

6.2.5 Measure NA-8 – Distant Noise Abatement Departure Profile

Measure NA-8 specified the specific Noise Abatement Departure Profile (NADP) to be used on each runway end at BOI. The purpose of this measure is to determine the appropriate NADP that exposes the fewest people to aircraft noise. FAA Advisory Circular (AC) 91-53A, published in 1993, establishes guidelines for NADPs. The AC defines guidelines and minimum operating parameters for airlines to use in developing operating procedures, and prescribes two types of procedures: A Close-In NADP, which provides a slight reduction in noise exposure for homes in the immediate vicinity of the Airport, generally within 3 miles, and a Distant NADP, which provides a slight reduction in noise for homes that are not in the immediate vicinity of the Airport.

The FAA does not allow airports to develop their own unique procedures due to safety concerns. AC 91-53A establishes a standardized system so that an aircraft type will use the same generalized operating procedures throughout the nation. Airports are permitted to select the appropriate NADP to use on each runway end. Unless otherwise instructed, airlines typically use the Distant NADP. Each airline develops their specific NADPs, which are approved by the FAA. For business jets, the National Business Aviation Association (NBAA) has developed noise abatement procedures that are recommended as a standard for all operations in the absence of a procedure developed specifically by the aircraft manufacturers.

The previous Part 150 Study evaluated the use of both the close-in and distant NADP, and found through an analysis of single event aircraft levels that the use of the close-in procedure resulted in increased noise exposure for most areas around BOI. As such, Measure NA-8 proposed designation of the Distant NADP as the preferred departure profile. This measure applies to jet aircraft with a maximum takeoff weight greater than 75,000 pounds. For lighter jet aircraft, the continued use of the NBAA noise abatement departure procedures is encouraged.

This was a new measure in the 2006 NCP and in the ROA, the FAA approved it as voluntary and noted that the sponsor's role is to coordinate with aircraft users to highlight the use of the distant procedure.

6.2.6 Measure NA-9 – Visual Approach Arrival Altitudes

Measure NA-9 encouraged the ATCT to voluntarily route aircraft on the visual approach to Runways 28L and 28R at 5,000' MSL until the aircraft begins the final approach. This was a new measure in the 2006 NCP driven by the concerns of residents located in areas east of the Airport at elevations several hundred feet higher than the elevation of the runways at BOI. Under the existing procedure, aircraft arriving to Runways 28L and 28R from the east are directed by the Boise ATCT to maintain an altitude of 4,500' MSL until beginning their final approach. The Final Approach Fix is the fix from which the final approach (under IFR) to an airport is executed and which identifies the beginning of the final approach segment.

Operationally, increasing the altitude of arriving aircraft by 500' could only be used primarily during periods of low traffic demand when the ATCT has increased flexibility in directing air traffic. At other times, such as during peak operations, the current procedure of routing aircraft at 4,500' MSL would be used. This change would not impact BOI's DNL noise contours, but would have reduced single-event noise levels for these residents. During the development of the 2006 NCP, the Boise ATCT indicated support for the measure as a voluntary mechanism. BOI would request the ATCT to update their standard operations procedures and tower order to include the revised measures. The FAA approved this measure as voluntary. According to the ATCT, jet aircraft arriving from the north are to remain at or above 4,500' MSL until final until established on final approach.

6.2.7 Implementation Status of Noise Abatement Elements

<u>NA-1 – Preferential Runway Use</u>: This measure is considered partially implemented. Consultation with the ATCT regarding wind and weather conditions indicates that in the morning hours, winds typically originate from the east, and shift to originate from the west in the afternoon hours. Due to the efficiency gained from operating into the wind, the direction or flow in which the Airport operates generally shifts in the midday hours. Thus, the Airport typically operates using Runways 10L and 10R (east flow) in the morning and shifts to use Runways 28L and 28R in the afternoon (west flow). According to the ATCT, there are limited opportunities to operate solely to the east, in addition to the added complications associated with separating aircraft. Chapter Three provides additional detail regarding average annual day runway use. Overall, runway use indicates that Runways 10L and 10R account for approximately 59% of all arrivals and 52.5% of all departures, respectively.

The analysis in Chapter Three also presents general trends in runway use by aircraft category. Generally, ATCT accommodates a pilot's request to land on a specific runway (for example, either Runway 10L or 10R); these requests are made to maximize the efficiency of ground operations based on the location of airport facilities and to maximize the efficiency of the airfield. Generally, passenger jets arrive on the north runway (10L/28R); non-passenger flights use both runways more evenly. Nearly all passenger jet departures use the north runway (10L/28R), while general aviation jets tend to be more evenly split. These patterns are driven by the location of ground facilities – for example, the location of the passenger terminal north of both runways means that an aircraft would spend less time taxiing and not have to cross an active runway when using the north runway. In general, the recommendation to use the north runway primarily for arrivals and the south runway primarily for departures could be increased with further coordination between BOI and the ATCT by further publicizing this noise abatement procedure.

<u>NA-2 through NA-5 – Departure Turn Altitudes:</u> Each of these measures was approved as voluntary measures by the FAA and represents standard operations at BOI. The measures are already in use and are followed by a majority of aircraft. The continued use of these procedures would not change the population within the contours, but would provide benefits in terms of single-event noise. In order to further publicize the measures and maximize their use, BOI can request that the ATCT to update their standard operations procedures and tower order.

<u>NA-6 – Downwind Arrival Flight Tracks:</u> Because this measure was disapproved by the FAA, no further action was taken. According to the FAA, the measure offered no demonstrable noise benefit if implemented on a voluntary basis. Further, the FAA indicated that directing aircraft to south downwind would create operational issues, requiring aircraft to be blended with south traffic and to be kept clear of departing traffic. The net result would be increased workload, risk of error, and increased flying time and cost for users. As such, this measure has not been implemented.

<u>NA-7 – FMS/GPS Flight Procedures for I-84 Corridor:</u> This measure has not been implemented. As part of the FAA's NextGen endeavor, airspace around the country is undergoing a transformation from ground-based to satellite based technology. Performance Based Navigation (PBN), comprised of Area Navigation (RNAV) and Required Navigation Performance (RNP), describe an aircraft's capability to navigate using performance standards. In September 2014, FAA implemented seven new RNAV arrivals and a series of new departure waypoints (designed to provide separation from the RNAV arrivals). The RNAV arrivals incorporate a continuous descent profile to the airport, which eliminates procedural separation for arriving aircraft. BOI now has seven RNAV STAR arrival procedures that allow aircraft to utilize satellite-based technology to transition from the en-route environment to the local airspace.

Further, in addition to the Airport's Instrument Landing System and other published approaches, BOI has ten RNAV (both RNP and GPS) instrument approach procedures in place. The procedures specify both the vertical and horizontal position of the aircraft and are designed to be repeatable and automated, such that all aircraft which are capable of flying the procedure fly in the same fashion. Although the Airport now has RNAV and RNP procedures for some aircraft, these procedures do not yet take full advantage of compatible land use corridors.

<u>NA-8 – Distant Noise Abatement Departure Profile:</u> The distant procedure remains the standard departure procedure in use at BOI, and therefore this measure has been implemented.

<u>NA-9 – Visual Approach Arrival Altitudes:</u> This measure, which keeps aircraft higher than the normal procedure during nighttime hours, has not been implemented.

6.3 Measures Considered but Not Carried Forward in the 2006 Part 150 Study

The previous Part 150 Study considered a number of additional potential measures which for various reasons were not included as recommended measures, which are summarized and evaluated for their current applicability in the following sections.

6.3.1 Military Aircraft

The Airport hosts both civilian operations and operations flown by the military, including based aircraft operated by the Idaho ANG and transient aircraft which use BOI for refueling. Although they can be a source of noise complaints, military operations are essentially beyond the scope of a Part 150 Study. As a result, the Part 150 Study process does not specifically address abatement measures for military aircraft. The representatives of the Idaho ANG have publicly committed to consider noise abatement in their flight operations, to the extent possible. Examples of military noise abatement procedures include the provision that fighter jets are to remain at 5,000’ MSL on the overhead arrival until turning base leg; military departures are not permitted to use afterburner past the end of the runway, and military aircraft are to climb quickly to 5,000’ MSL and then maintain a standard climb. In 2014, the ATCT issued an updated Notice to Airmen (NOTAM) for military aircraft indicating that all practice approaches are prohibited from 1900 to 0800, that all arrival break operations are to be performed to the south (unless otherwise directed by ATCT) to maximize the overflight of less populated areas, that carrier breaks are prohibited, and that limits the use of afterburner takeoffs (unless operationally required). Further, the Idaho ANG tracks noise complaints and works proactively with the Department of Defense, ATCT and users to minimize noise exposure.

6.3.2 Noise Abatement Arrival Profiles

The evaluation of this potential measure focused on the potential to modify the arrival profile of aircraft to reduce the impact of arrival noise, as no changes to arrival flight tracks would provide noise benefit within the DNL 65 dB noise contour. Typical jet aircraft arrive to the runways at BOI while descending on a 3-degree approach slope, which is the standard approach slope used nationwide for both visual and instrument landing system approaches. With noise abatement arrival profiles, aircraft would use a combination of steeper approaches and reduced thrust settings, flap settings, and delayed land gear deployment to reduce noise exposure to the ground. At the time of the previous Part 150 Study, the FAA, with the support of UPS, was undertaking flight tests using a continuous descent approach. The modified approach was shown to reduce arrival noise in areas further from the airport.

With existing policy, the FAA will not approve a steeper approach slope unless needed for terrain or obstruction clearance. Steeper approach slopes are not implemented for noise factors, due to safety concerns over non-standard operating procedures and airspeeds. At present, there are no standardized procedures for implementing noise abatement arrival profiles. Until standards are approved by the FAA, it would not be possible to implement a revised arrival procedure at BOI.

However, BOI could track the development of noise abatement arrival profiles, and investigate the procedures once standards are issued. The 2006 Part 150 Study concluded with the recommendation that the Airport should investigate the use of noise abatement profiles when standards from the FAA become available. Accordingly, the measure was not recommended for the NCP. As indicated in Section 6.2.5, the RNAV arrival procedures currently in place at BOI provide for more consistent arrival approaches that allow the reduction in the number of level-off segments that traditionally occur to maintain aircraft separation.

6.3.3 Airport Use Restrictions

Airport use restrictions include curfews and restrictions on certain users or aircraft at an airport, typically the noisiest aircraft. Restrictive measures have the potential to reduce noise exposure impacts as they would restrict operations by especially noisy aircraft and nighttime operations, which in general are a significant source of noise and annoyance for the community. Although airport use restrictions are required to be evaluated per Part 150, their adoption and implementation is strictly regulated by other laws and regulations that generally prohibit airports from restricting traffic out of concerns for impacts to interstate commerce.

The Airport Noise and Capacity Act of 1990 established a national aviation noise policy that mandated the phase-out of the oldest and noisiest jet aircraft in the U.S. air carrier fleet. Aircraft such as the DC8, Boeing 727, and DC9 that were certified as “Stage 2” per 14 CFR Part 36 and have a maximum takeoff weight greater than 75,000 pounds were prohibited from operating in the U.S. after 1999. While some of these aircraft were retired, many were retrofitted with hushkits and recertificated as Stage 3 aircraft. Many of the noisier hushkitted aircraft have been retired due to their higher operating and maintenance costs in comparison to modern and fuel-efficient aircraft, such as the Boeing 737s and Airbus A320s. In addition to improved economics, these aircraft that are manufactured to the more stringent Stage 3 noise standards have improved climb-out performance and are quieter. Consequently, the DNL contours at many airports, including BOI, have shrunk as older and noisier aircraft have gradually left the fleet and been replaced with quieter aircraft.

In addition and in exchange for the mandated phase-out of Stage 2 aircraft, the Airport Noise and Capacity Act of 1990 directed the FAA to establish a national program to review and approve local airport use restrictions. This program was enacted through FAA’s 14 CFR Part 161 regulation, which governs noise and access restrictions. With Part 161, airport operators must demonstrate that the noise benefits of restricting noisy aircraft operations outweigh the economic impacts of denying access.

The FAA has generally opposed efforts to enact aircraft use restrictions at airports, and has threatened removal of grant funds at airport that have proposed to restrict Stage 2 operations. In addition, the courts have held that mandatory use restrictions must be reasonable, non-arbitrary, and non-discriminatory. Essentially, the legal and regulatory environment establishes a difficult and high standard from which to develop a workable airport use restriction.

As part of the FAA Modernization and Reform Act of 2012, the FAA issued a final rule that affects jet airplanes with a maximum weight of 75,000 pounds or less operating in the United States. Aircraft under 75,000 pounds will no longer be able to operate in the contiguous United States after December 31, 2015, unless they meet Stage 3 noise levels.

The 2006 Part 150 evaluated potential restrictions for 24-hour and nighttime (10:00 p.m. to 7:00 a.m.) restrictions on both Stage 2 aircraft weighing less than 75,000 pounds and hushkitted Stage 3 aircraft. An evaluation of noise exposure contours found that these restrictions would have a beneficial impact on the estimated population within the DNL 65 dB noise contour of the 2009 NEM. However, there were (and remain) significant economic and legal constraints that essentially preclude the adoption of use restrictions. As such, measures to restrict aircraft operations were not recommended for inclusion in the 2006 NCP. Further, due to the continued retirement of older hushkitted aircraft and the pending phase out of Stage 2 aircraft weighing less than 75,000 pounds, the potential for reduced noise exposure has continued to decrease.

6.3.4 Noise Barriers

Aircraft operations on the ground can be a source of noise, including the noise produced during the ground roll portions of takeoffs and landings (particularly start-of-takeoff-roll and reverse-thrust noise), noise from aircraft ground movements on taxiways and aprons, engine idle noise, auxiliary or ground power units, and engine maintenance run-up noise. A noise barrier has the potential to reduce the transmission of ground-based aircraft noise to noise-sensitive locations in the immediate vicinity of the Airport.

To be most effective, a noise barrier would need to be located close to the noise receivers (the noise affected residences). Most of the land bordering the Airport is used for compatible uses, including industrial and commercial use. The only residential area bordering the Airport, along West St. Andrews Drive, also borders I-84. This measure was not recommended for inclusion in the 2006 NCP. At the time of the previous noise study, residents in the neighborhood had stated that they were more concerned with highway noise. Since that time, noise barriers along I-84 have been constructed. These barriers block the line-of-sight of the nearest residential areas to the airport and do provide some measure of noise attenuation for ground-based noise.

6.4 Summary of Noise Abatement Measures

Table 6.2 provides a summary of the previously recommended noise abatement measures in the 2006 NCP, their current status, and the City of Boise's recommendation for inclusion or withdrawal from the updated NCP.

In general, the noise abatement measures of the NCP are recommended to remain unchanged, with exception of removal of the two measures that were disapproved by the FAA in the 2006 NCP. As stated in Section 6.2, BOI is in the fortunate position of having a small number of impacted residents within the DNL 65+ dB contours. The noise abatement evaluation conducted for the 2006 NCP did not identify measures that would eliminate these people from impact. However, the NCP did identify current favorable trends in the operational procedures at BOI that are recommended for continued use. BOI will continue to proactively work to reduce noise exposure through the measures identified in this NCP, through consultation with the ATCT and airport users including the Idaho ANG, and through other means as available.

Table 6.2

Status and Recommendation of Noise Abatement Measures

	Measure	FAA Determination/ Implementation	Recommendation
NA-1	Designate Runways 10L and 10R as the preferential flow for departing aircraft; Runways 28L and 28R as the preferential flow for arriving aircraft, per the discretion of the BOI ATCT. The north parallel runway (10R/28L) would be designated as the primary arrival runway, and the south parallel runway (10L/28R) as the primary departure runway.	Approved as Voluntary / Partially implemented	Include unchanged; increase awareness with Airport users and ATCT.
NA-2	Continue directing jet departures from Runways 28L/R to maintain runway heading until reaching 5,000' MSL before turning north. This directs the larger aircraft south of a concentrated residential neighborhood before turning north. This procedure prevents low overflight of dense residential areas by aircraft with high single event noise levels.	Approved as Voluntary / Partially implemented	Include unchanged; increase awareness with Airport users and ATCT.
NA-3	Continue directing non-jet aircraft over 12,500 pounds with destination headings to the north to fly runway heading 4,500' MSL before turning. This procedure helps prevent propeller aircraft over 12,500 pounds from overflight of dense residential areas.	Approved as Voluntary / Partially implemented	Include unchanged; increase awareness with Airport users and ATCT.
NA-4	Continue directing VFR departures with destination headings to the north to fly runway heading to the end of the runway before turning.	Approved as Voluntary / Partially implemented	Include unchanged; increase awareness with Airport users and ATCT.
NA-5	Direct north and northwest bound turbojet departures from Runways 10L/R to fly runway heading to 5,000' MSL before turning north.	Approved as Voluntary / Partially implemented	Include unchanged; increase awareness with Airport users and ATCT.
NA-6	During nighttime hours, reroute aircraft to voluntarily use arrival flight tracks with downwind legs to the south of BOI. This would route aircraft over relatively low-density residential and vacant land uses.	Disapproved / Not implemented	Remove
NA-7	Establish departure procedures and standard arrival routes along the I-84 corridor to the east of the airport. Use of the I-84 corridor to the east of BOI (for arrivals to Runways 28L and 28R, and departures to Runways 10L and 10R) would direct aircraft over mostly	Disapproved / Not implemented	Remove

Table 6.2

Status and Recommendation of Noise Abatement Measures

	compatible land uses.		
NA-8	Establish the Distant NADP as the recommended NADP for all runway ends (applicable to jet aircraft with a maximum takeoff weight greater than 75,000 pounds; lighter jet aircraft would continue use of the National Business Aviation Association noise abatement departure procedures).	Approved as Voluntary / Implemented	Include unchanged; increase awareness with Airport users and ATCT.
NA-9	Encourage ATCT to voluntarily route aircraft on the visual approach to runways 28L and 28R at 5,000 feet MSL until the aircraft begins final approach.	Approved as Voluntary / Not Implemented	Include unchanged; increase awareness with Airport users and ATCT.

Source: FAA Record of Approval, 2006, BOI ATCT, HNTB 2015.

Chapter Seven
LAND USE MEASURES

This chapter provides a review of the land use measures recommended in the 2006 NCP, including the implementation status of each of the measures, and an evaluation of the continued benefit of these measures to the current recommended NCP. The existing measures are then re-evaluated and revised as necessary for their potential continued benefit. Potential new land use measures to further reduce and prevent non-compatibility are then considered for addition to the NCP.

BOI, in cooperation with the City of Boise and Ada County, has worked proactively to minimize new non-compatible land uses and to mitigate existing non-compatible land uses in the Airport surroundings. The jurisdictions have cooperatively prepared and implemented land use regulations, as discussed in Chapter Four, which have proven to be effective in limiting new non-compatible development. Similar to trends seen around the Country, noise exposure surrounding BOI has decreased since the Part 150 program initiation in 1986 due to technological improvements in aircraft and changes in Airport operations. Due to the relatively small population impacted by aircraft noise around BOI, per FAA standards, and the limited non-compatible development within the noise exposure contours, the focus of the BOI Part 150 program has historically been on preventing future non-compatible development, while also addressing existing non-compatibilities.

Currently, an estimated 89 housing units and 260 people are estimated to reside within the DNL 65+ dB contours of the 2015 NEM. An estimated 419 housing units and 1,050 people are projected to fall within the DNL 65+ dB noise contour in the 2020 NEM based on existing land use.

Although the Part 150 Study is a Federal program, it is important to note that the FAA (Federal government) has no authority to control local land use; implementation of the recommended land use measures is considered to be within the authority of the local jurisdictions. Because the land within the established influence areas of BOI encompasses both the City of Boise and Ada County, land use, planning, zoning, and building department authority are the responsibility of both City of Boise and Ada County, depending on the project location.

BOI is one of nine departments within the City of Boise management structure under direct supervision of the City Mayor. The Airport remains a recommending department with regard to land planning and building department matters, and has at times offered assistance in the oversight of rules and regulations required by the FAA regarding safety in airport operations.

Through mutual agreement, Airport staff is offered an opportunity to comment and review development applications for the City and the County; the applications are forwarded to BOI as part of a routing/review process. Airport staff is generally a recommending entity only and does not have any land use or building regulation authority.

The City of Boise owns land within the AIA, including that utilized exclusively for airport operations. The matter of maintaining the condition and safety of the land within the airport operations zones or "airport property" has been and will continue to be part of BOI operations. The requirement to maintain safe airport operations remains part of the staff and operations budget. Land purchased by the Airport as recommended in the previous Part 150 Study is currently maintained by airport operations, even though it remains outside of the immediate "airport property" that is used for airport operations.

7.1 Implementation Status of Land Use Measures in 2006 NCP

This section reviews the land use measures contained in the 2006 NCP according to the category of overall purpose (e.g., AIA, Zoning, etc.); the current implementation status of each measure is included in *Section 7.1.7, Implementation Status*. All of the *preventive* land use measures from the 1996 Part 150 Study NCP were carried through (some revised) to the 2006 NCP. Two (2) of the *corrective* measures were carried through as revised; one corrective measure was not continued (sound insulation).

Since there was limited non-compatible development within the 2009 NEM DNL 65+ dB contour, the focus of the 2006 NCP was on preventing future non-compatible development, while also addressing existing non-compatibilities.

The 2006 NCP for BOI recommended three corrective and 15 preventive land use measures. *Corrective* land use measures are efforts to address existing non-compatible land uses within the DNL 65+ dB contour of the NEM. *Preventive* land use measures seek to prevent the introduction of new non-compatible land uses within the AIA. For the purposes of this study, noise-sensitive uses such as residential development, schools, and places of worship within the DNL 65+ dB contour are considered to be non-compatible. Additional information on non-compatible uses per the Part 150 guidelines is shown in Table 4.1.

The measures fall into one of six categories of overall purpose, discussed in Sections 7.1.1 through 7.1.6: Airport Influence Area and Comprehensive Planning (LU-1 and LU-2); Airport Zoning (LU-3, LU-4, LU-5, LU-6, LU-7, LU-8, LU-11, **LU-18**); Avigation Easements (LU-9 and **LU-15**); Building Codes / Noise Level Reduction Construction Standards (LU-10 and **LU-16**); Disclosure (LU-12 and **LU-17**); Land Acquisition and Relocation (LU-13 and LU-14). Land use measures that were new in the 2006 NCP are identified in **bold.** The implementation status of each land use measure and a summary of all the measures are included in Sections 7.1.7 and 7.1.8, respectively.

7.1.1 Airport Influence Area and Comprehensive Planning

The 2006 NCP carried forward Land Use (LU) measures LU-1 and LU-2 from the 1996 NCP related to the AIA and comprehensive planning. The measures address the issue of aircraft noise and compatibility on existing and proposed land uses as identified by the Part 150 guidelines. Specifically, the 2006 NCP recommended the following measures: **LU-1**, the Boise Airport Commission should recommend to the City and County to maintain the current AIA boundaries until such time that noise levels require their expansion; and **LU-2**, refine the land use compatibility standards for the four sub-districts within the AIA.

7.1.2 Airport Zoning

The 2006 NCP recommended several zoning measures for areas within the AIA in an effort to prevent the development of non-compatible land uses. The Study recommended the following measures: **LU-3**, that both City of Boise and Ada County maintain existing commercial and industrial zoning within the AIA; **LU-4**, rezone airport property and land southeast of the Airport and east of Apple Street from residential to industrial; **LU-5**, rezone land southeast of the Airport, east of I-84 and south of East Gowen Road; **LU-6**, encourage clustered residential development southeast of the Airport within the AIA, away from the runway centerline and outside the DNL 60 dB contour; **LU-7**, to maintain existing large lot residential zoning within the AIA; **LU-8**, to maintain existing Rural Preservation (RP) zoning within the AIA; and **LU-11**, adopt project review guidelines for rezoning, special use, conditional use, planned development and variance applications.

LU-18 was a new measure included in the 2006 NCP that recommended that an airport staff liaison be designated for the Planning and Zoning and Building Departments of both the City of Boise and Ada County.

7.1.3 Avigation Easements

Provisions for avigation easements and disclosure requirements have been included in the NCP for many years in the AIA planning standards in the City of Boise and Ada County. Avigation easements ensure the Airport's right to use navigable airspace, to generate noise associated with aircraft operations, and to prohibit future airspace obstructions. Recommendations were made in the 2006 NCP for **LU-9** to amend subdivision regulations and building permit applications to require avigation easements for new subdivision development in the AIA and mandate that avigation easements be required for all (residential and commercial) development within the AIA as part of the building permit application. A new corrective measure in the 2006 NCP, **LU-15**, recommended that BOI acquire avigation easements from property owners for existing residential and non-residential noise sensitive properties within the DNL 65+ dB contours.

7.1.4 Building Codes / Noise Level Reduction Construction Standards

The 2006 NCP continued a 1996 recommendation, **LU-10**, to adopt local building code amendments setting sound insulation construction standards (also known as noise level reduction standards) for noise sensitive residential and non-residential construction within the AIA.

LU-16, a new measure in the 2006 NCP, recommended amending building permit applications to document and require compliance with applicable noise level reduction construction standards.

7.1.5 Disclosure

Measure **LU-12** recommended fair disclosure of noise impacts in the AIA through the promotion of both formal and informal mechanisms. This would be in addition to the disclosure requirements of the avigation easements in LU-9. **LU-17**, a new measure in the 2006 NCP, recommended that the City of Boise refine its application process to improve awareness of the AIA at a time of application submittal rather than at the time of comment review.

7.1.6 Land Acquisition and Relocation

These measures were recommended to eliminate non-compatible residential land uses in the areas subject to the DNL 70-75 dB of the 2009 NEM. The study recommended **LU-13**, to offer voluntary acquisition of 40 homes within the DNL 65+ dB of the 2009 NEM; and **LU-14**, to acquire undeveloped land with potential to be developed non-compatibly within the DNL 65 dB contour of the 2009 NEM.

7.1.7 Implementation Status

<u>LU-1 – Airport Influence Area</u>: The AIA includes portions of both Ada County and the City of Boise. There have been no modifications to the AIA boundaries since the 2006 NCP in either Boise or Ada County. The City of Boise references the AIA in its 2011 Comprehensive Plan (*Blueprint Boise*) and it is part of the City of Boise Code, while Ada County includes the AIA as a special overlay district in its zoning ordinance and in the 2007 *Ada County Comprehensive Plan*.

<u>LU-2 – Land Use Compatibility Standards in AIA</u>: No changes to the land use compatibility standards in the subareas have occurred since the previous study and there are no scheduled amendments associated with either the City or County planning documents regarding working toward more consistent land use designations and zoning classifications. No aviation task force has been established to date, as recommended in the 2006 NCP that would re-evaluate current designated land planning uses within Boise and Ada County.

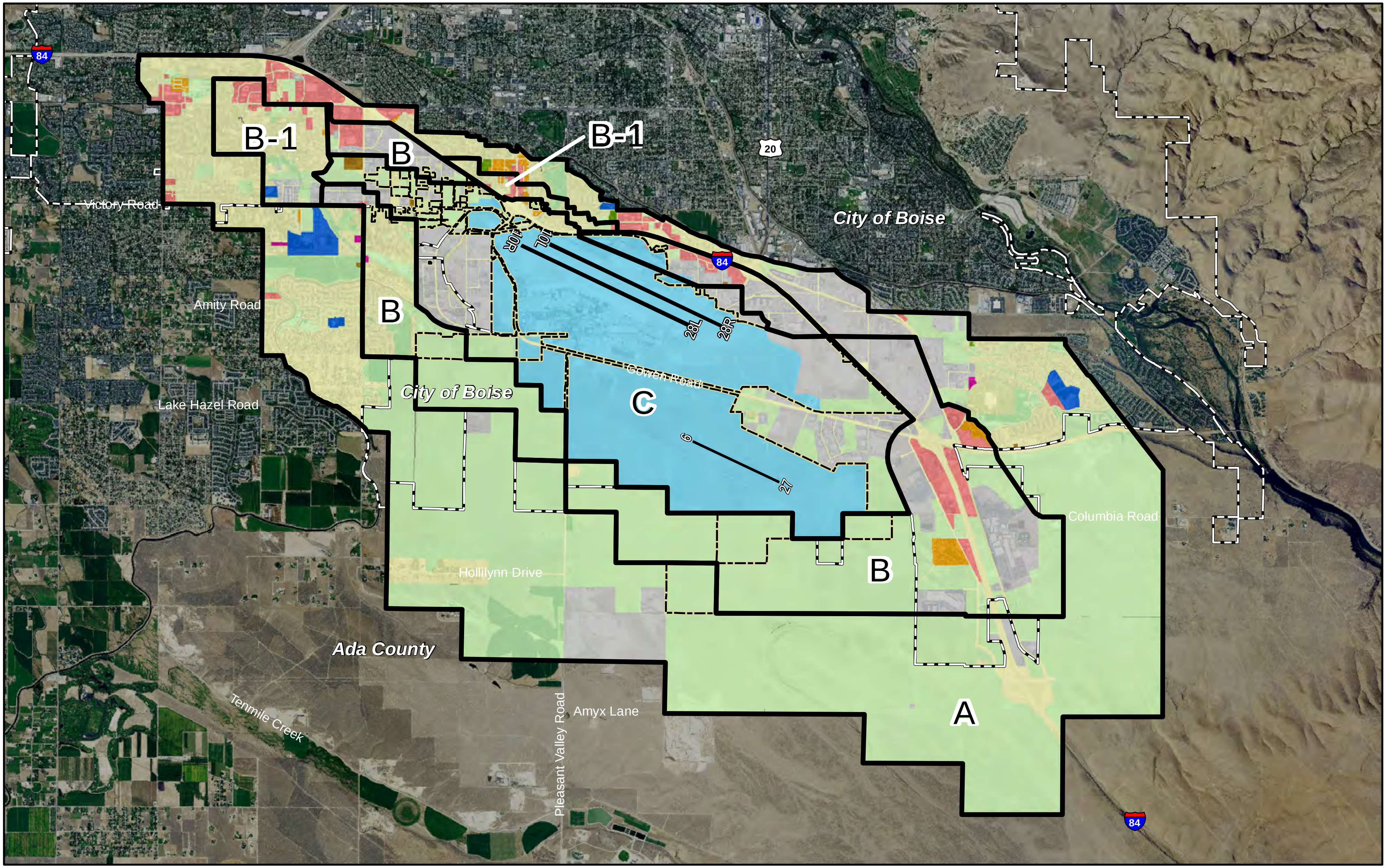
Figures 7-1 and **7-2** show the AIA as defined by Ada County and the City of Boise, on existing and future land use, respectively.

<u>LU-3 – Commercial and Industrial Zoning in AIA</u>: Rezoning approvals are guided by the Comprehensive Plan future land use maps of the City and County. The City and County have continued to work with Airport staff to maintain existing zoning for commercial and industrial development within the AIA; future land uses shown do not call for the conversion of any industrial or commercial uses within the AIA to residential use. The location of Ruschman Sand & Gravel along South Pleasant Valley Road, south of the Airport (in Ada County, AIA Zone A) is an Industrial land use on the Existing Land Use Map (See Figure 7-1); this area is identified as Large Lot/Rural on the *Blueprint Boise* future land use map (See Figure 7-2), but is already zoned RP, which permits large lot residential. The surrounding future land use in the vicinity of this area is also identified as Large Lot/Rural on the future land use map.

Unless the City and County have made exceptions (rezoning approvals or conditional use permits) that are inconsistent with the Comprehensive Plan or AIA guidelines, the compatible uses permitted within each zone of the AIA continue to guide rezoning decisions and therefore would discourage conversion of commercial or industrial to non-compatible uses.

Ada County adopted the *Blueprint Boise* future land use map in early 2015 with the exception of a residential area west of the Airport in the Wright, Raymond, and Elder

Part 150 Study Update



Legend

- Airport Property
- City of Boise Limits
- Airport Influence Area

Generalized Land Use (2015)

- Single Family Residential
- Multi-Family Residential
- Commercial
- Industrial
- Public Facility/Institutional
- Open Space
- Airport Land Use
- Park
- School
- Place of Worship

Figure 7-1
Airport Influence Area on Existing Land Use

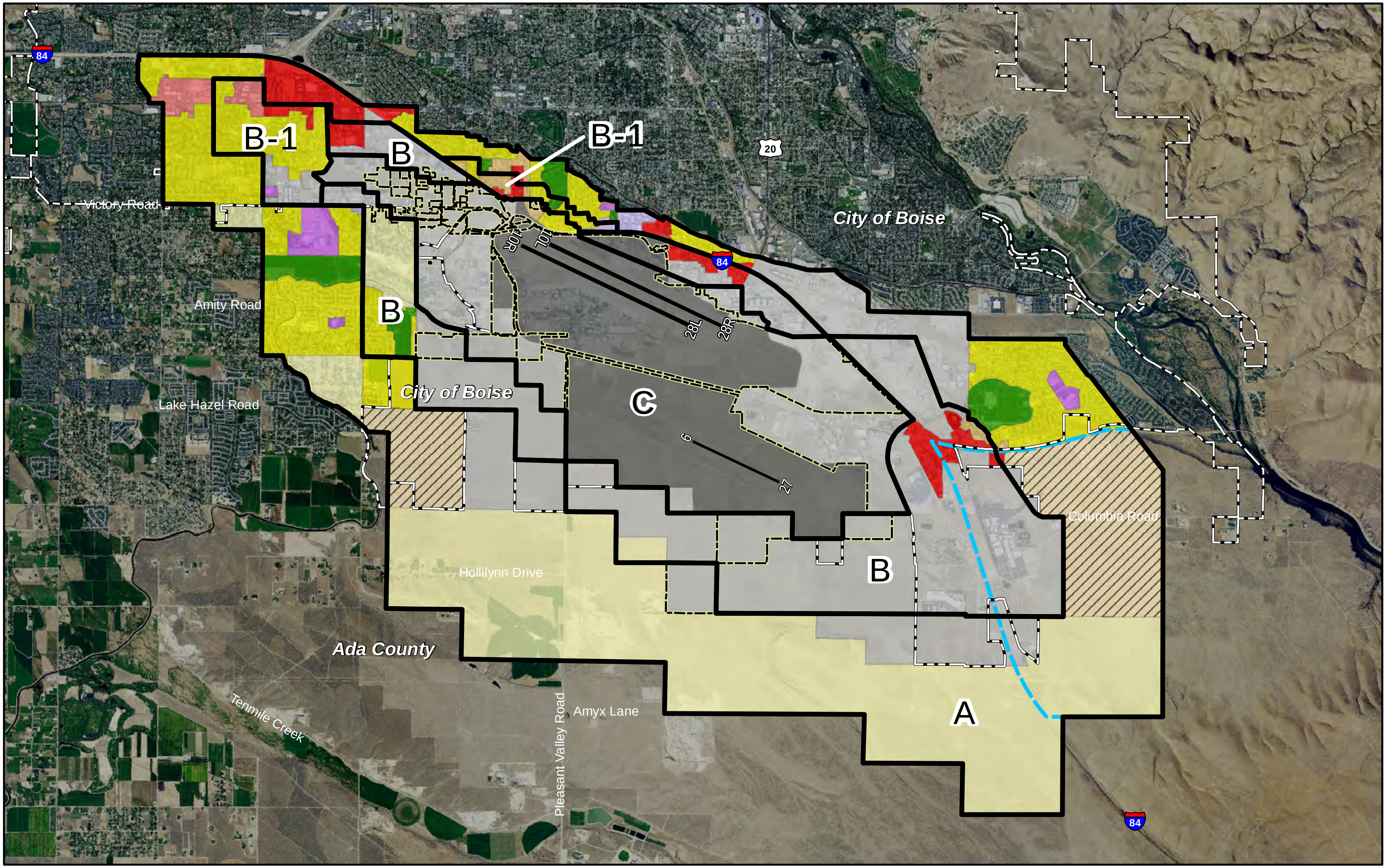
N

0 1,750 3,500 7,000 Feet

Sources: City of Boise, Ada County, HNTB 2015

Part 150 Study Update

HNTB



Legend

- Airport Property
- City of Boise Limits
- Airport Influence Area
- East Columbia Boundary

Future Land Use

- Airport
- BSU Master Plan
- Buildable
- Commercial
- Compact
- Downtown Mixed Use
- High Density
- Industrial
- Large Lot/Rural
- Mixed Use
- Office
- Planned Community
- Parks/Open Space
- Public/Quasi-Public
- Education
- Slope Protection
- Suburban

Figure 7-2
Airport Influence Area on Future Land Use

N

0 1,750 3,500 7,000 Feet

Sources: City of Boise, Ada County, HNTB 2015

Street neighborhoods that the City identifies as Industrial on the future land use map; Ada County intends to retain this area as Residential on the Ada County future land use map.

LU-4 – Zone for Compatible Use in Apple Street Area: The area remains undeveloped and the current City of Boise Zoning Ordinance zoning for this property is still A-1, which allows for residential land uses. The future land use identified in *Blueprint Boise*, however, identifies this area as Industrial. Therefore, the City's plan is to transition this area to compatible industrial uses. Implementation of this change is largely based on rezoning requests.

LU-5 – Zone for Compatible Use in Gowen Road Area: The portion of this property located within the City of Boise city limits has been developed compatibly as light industrial (T-1, Technological Industrial Park) and is no longer at risk of non-compatible development. The portion of the area in Ada County remains undeveloped and zoned Rural-Urban Transition (RUT), which would permit residential land uses within the parameters of the AIA Zone A designation, permitting residential use with the inclusion of an avigation easement and sound insulation.

The Ada County area within the LU-5 boundaries is within the Boise Area of City Impact (AOCI)[1], which means that the intent is for the City of Boise to annex this property from the County. It is identified as Planned Community (PC) in the *Blueprint Boise* future land use map and is also in the City of Boise's East Columbia planning area, a 6,000-acre planned community intended to house 40,000 new residents. East Columbia will be located east of I-84 and south of Gowen Road. Also, the area near the intersection of Gowen Road, I-84 and Federal Highway is designated as Regional Activity Center in the *Blueprint Boise* future land use map. As with other Regional Activity Centers, this area would likely include employment and retail uses, high-density residential, and mixed-use development. [2]

LU-6 – Encourage Clustered Residential Development: The area recommended for clustered residential development in LU-6 is included in the Columbia Village subdivision, and is currently in various stages of residential development. The eastern portion of the property has been developed and the western portion has been subdivided and platted. The area is zoned single-family residential and is not developed as clustered development.

LU-7 – Maintain Large Lot Residential Zoning: The portion that falls within the City of Boise limits north of East Gowen Road is now developed or subdivided as low density residential and zoned as R-1C, which provides for predominantly single family residential uses within the urban community. The area south of East Gowen Road in Ada County is primarily undeveloped and is zoned RUT and RP, which both allow for residential uses.

The northern portion of this area, south of East Gowen Road (zoned RUT), is within the Boise AOCI and is part of the East Columbia planning area. The southern portion of the LU-7 area (zoned RP) is in unincorporated Ada County and is not within the AOCI, however this area is within the East Columbia planning area and the City intends to add this area to the AOCI. As discussed in LU-5, East Columbia is intended to house approximately 40,000 new residents and land use density is expected to increase. This area is currently shown as Rural on Ada County's future land use map (2011).[3]

LU-8 – Maintain Rural Preservation Zoning: Land within Ada County in LU-8 has primarily been maintained as RP zoning, which requires a 40-acre minimum residential lot. The area zoned as rural residential (RR) located at the western edge of the LU-8 area, requires a 10-acre minimum. There is a small area in the northwest corner of the LU-8 area zoned R4, which permits four dwellings per acre. The County does not currently have plans to allow higher density residential development in this area. Any higher density development would require a Comprehensive Plan change.

The City has annexed approximately 1,571 acres of the approximately 7,908 total acres of land in this area since the previous Part 150 Study. The annexed area includes Zone A-2 (Open Land, which is intended for permanent open space, however single family dwellings, golf courses and public park are permitted), Zone R-1A (Single Family Residential), M-1 (Limited Industrial), and T-2 (Technological Manufacturing Park). The area zoned A-2 in Boise, as well as Boise AOCI property just northeast of the Ten Mile Creek Area is identified as Suburban and "Planned Community" on the City's Comprehensive Plan, which is "generally suited for urban development and has been considered by Boise City for inclusion in a future AOCI expansion."[4]

The area currently in Ada County but within the AOCI in the LU-8 area, however, is unlikely to be developed until it is annexed by the City due to infrastructure (e.g., sewer) limitations.

In summary, unincorporated areas of the County continue to be maintained as rural development. Although the land within City limits and the AOCI is currently zoned for rural uses, the City plans to develop the southwest portion of LU-8, near Ten Mile Creek as Planned Community which promotes a more urban environment.

LU-9 – Amend Subdivision Regulations and Building Permit Applications to Require Avigation Easements: Ada County and the City of Boise continue to require avigation easements for new development or when there are changes to development within the AIA.

In Ada County, all permit applications filed are reviewed not only for their location in the AIA, but also for property encumbrances with an avigation easement. This applies to all new subdivisions, new construction or change of use within the overlay district. If a permit application does not have a recorded avigation easement, it is returned to the permit holder with the requirement of meeting with Airport staff to obtain an easement on the property. Ada County requires that all building permit applications receive a Zoning Certificate of Compliance.

The City of Boise requires avigation easements with subdivision approval, however there are no established guidelines or requirements as part of the City's building permit application process that would require the applicant to execute an avigation easement. However, Ada County and the City of Boise both submit development proposals within the AIA to BOI for staff review. At that time, the Airport typically takes the opportunity to place an easement on the property if one does not already exist. The City of Boise therefore requires avigation easements as part of the approval process, but does not include them as part of the application process.

An illustration of the properties that currently have avigation easements is provided on **Figure 7-3**.

<u>LU-10 – Adopt Local Building Code Amendments for NLR Construction the AIA</u>: Ada County and the City of Boise use versions of the *International Building Code* and *International Energy Conservation Code* to guide development. Ada County has adopted an informal policy that if a structure meets the requirements for the *International Energy Conservation Code* (which regulates the thermal envelope of the building), it provides adequate sound transmission loss through the building envelope. Neither of these documents addresses specific noise level reduction goals. Neither jurisdiction has taken formal action to modify building codes to include supplemental information with specific techniques and guidance on noise level reduction construction techniques. Because neither jurisdiction has adopted a formal method of setting sound insulation standards, this measure has not been implemented.

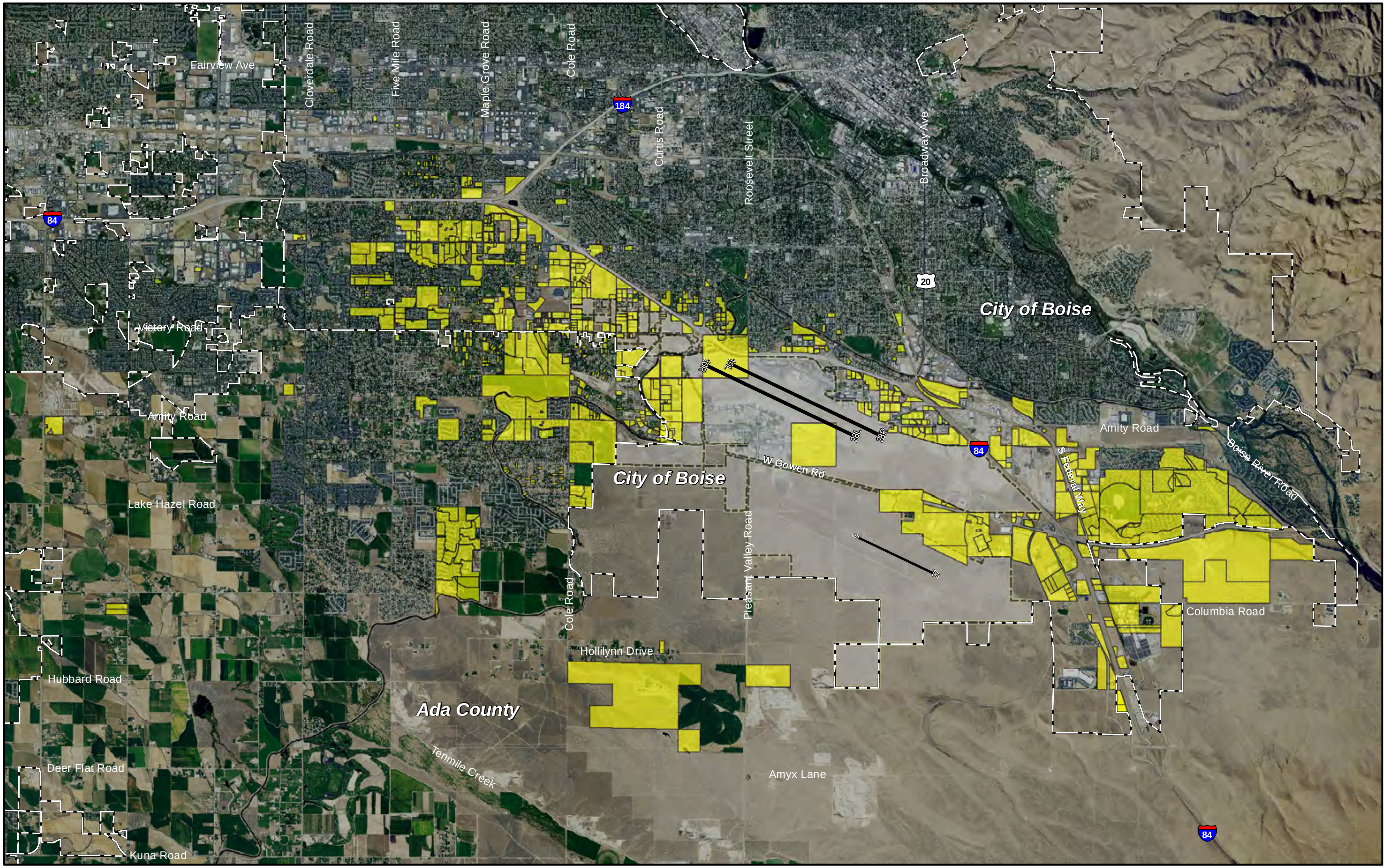
<u>LU-11 – Adoption of Project Review Guidelines for the City of Boise and Ada County</u>: The local jurisdictions have not developed additional project review criteria or procedures for staff at the City and County planning departments to help guide future land use deliberations. The Airport has a designated staff member to review and comment on development applications submitted to the City of Boise or Ada County that are within the AIA. The Airport staff member/reviewer provides a memorandum with information related to where the project is located in relation to the AIA and any restrictions or specifications involved with the location, to include sound attenuation requirements, easements, lighting requirements, etc. Any objections or recommended changes to the proposal are formally documented as part of this process.

<u>LU-12 – Fair Disclosure of Noise Impacts in the AIA</u>: No formal disclosure of noise impact or AIA limits is required during the sale of property within the AIA. Without State legislation, this is typically a difficult mandate to implement. Record of an avigation easement, however, is required during real estate transactions if one exists on the property. The Airport continues to make the NEM and AIA boundaries readily available to the public and to advertise any changes to the boundaries.

The Airport has not implemented any informal mechanisms for fair disclosure of noise impacts through selling of property within the AIA. The Airport staff advises local real estate agents, potential buyers and current owners about property when they are contacted, however no brochures or specific presentations are available to the real estate community at this time.

<u>LU-13 – Residential Property Acquisition within DNL 65+ dB Noise Contour</u>: The 2006 NCP recommended offering voluntary acquisition to approximately 40 homes within the DNL 65+ dB of the 2009 NEM.[5] The Airport has not initiated the voluntary acquisition program in these areas, and therefore the 40 parcels have not been offered acquisition and relocation to date. However, since July 1, 2004 (the month of the previous BOI Part 150 Study Update completion), the Airport has acquired six residential parcels (six homes) outside of the 2009 DNL 65+ dB limits as the properties have become available,

Part 150 Study Update



Legend

- Airport Property
- City of Boise Limits
- Avigation Easement

Figure 7-3
Existing Avigation Easements

N

0 2,000 4,000 8,000 Feet

Sources: City of Boise, Ada County, HNTB 2015

particularly in the area to the northwest of the Airport and south of I-84 as shown on **Figure 7-4**. Although these properties are not within the DNL 65+ dB of the 2009 NEM, they are in areas that have historically been within the BOI noise contours or were contiguous to other Airport-owned property. Acquisition of these properties through the voluntary sale by the property owner allows for removal of residences and consolidation of contiguous parcels. Residential property acquired by the Airport through a voluntary sale by the owner is converted to a compatible use, which typically includes demolition of the existing residential structure(s). The only remaining unmitigated residential land uses within the DNL 65+ dB of the 2009 NEM are in the residential neighborhood to the north of I-84.

In addition to the residential parcels acquired through the voluntary sale by the owner since July 1, 2004, two adjacent industrial parcels (2181 Commerce Avenue), also shown on Figure 7-4, were acquired by the Airport for future hangar development. The Airport has therefore acquired residential parcels through voluntary acquisition, however the parcels have not been within the DNL 65+ dB contour of the 2009 NEM.

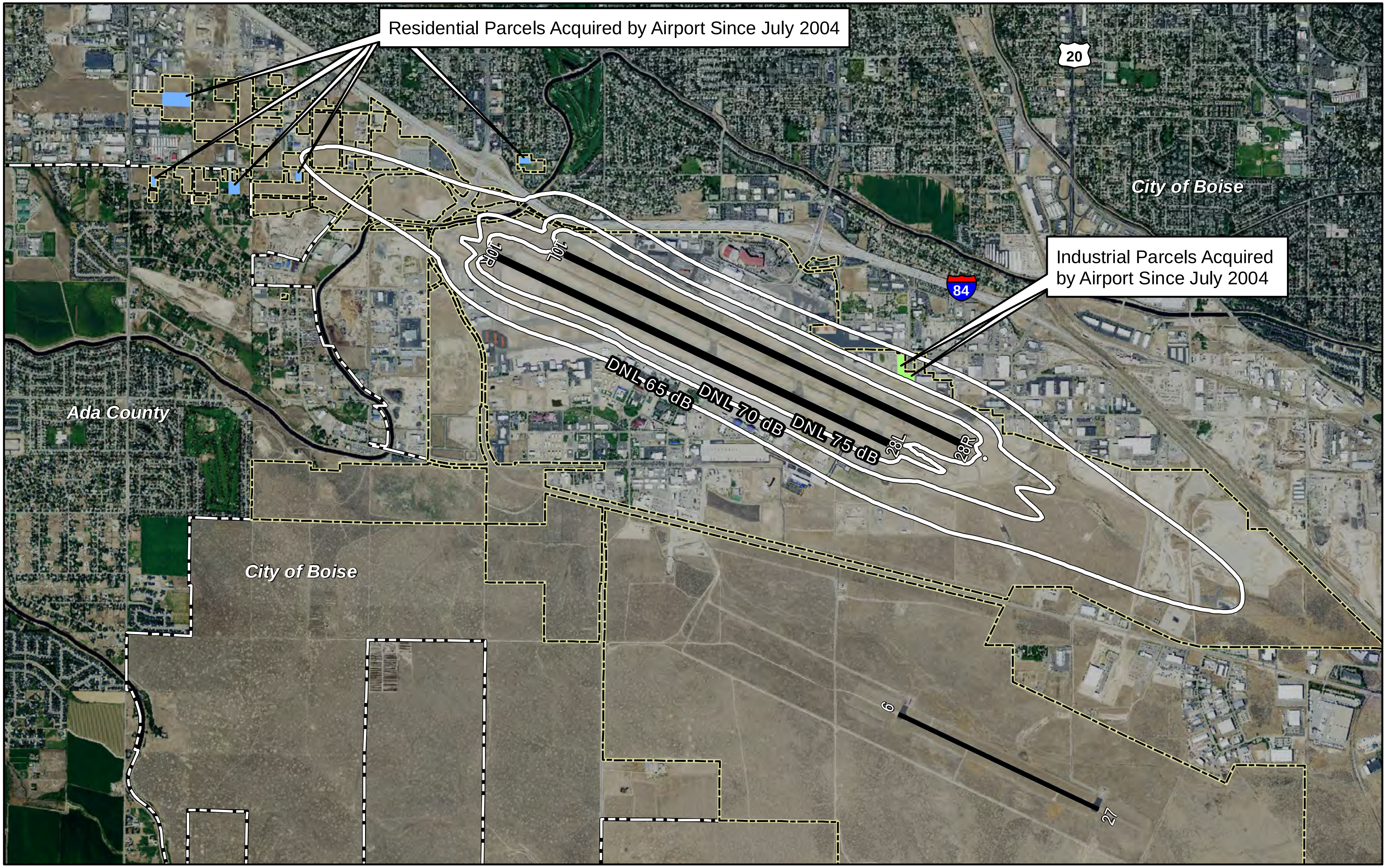
<u>LU-14 – Undeveloped Property Acquisition within DNL 65+ dB Noise Contour</u>: No vacant or undeveloped parcels have been acquired by BOI since July 1, 2004. BOI continues to promote vacant land purchases within the AIA or areas historically in the DNL 65+ dB noise contour as property becomes available. There are currently 30 vacant /open space parcels within or adjacent to the 2009 NEM DNL 65+ dB contour. In addition, BOI would evaluate the potential purchase of vacant property if it becomes available for sale by the owner to prevent future non-compatible land uses.

<u>LU-15 – Purchase of Avigation Easements</u>: The Airport has not pursued avigation easements from property owners of existing residential or non-residential noise sensitive properties within the DNL 65+ dB contour unless the property owner has submitted a request for development or rezoning approval within the AIA, therefore this measure has not been implemented.

<u>LU-16 – Building Permit Applications to Document and Require Compliance with Noise Level Reduction Construction Standards</u>: No changes to the building codes of Ada County or City of Boise have been made to incorporate this measure, nor have any changes to the building permit application process been made to specifically address interior noise level goals for noise sensitive development within the AIA. The 2006 NCP notes that builders associated with the Building Contractors of Southwest Idaho (a dues membership association) have previously supported across the board sound insulation of 25 dB through compliance with the *International Energy Code*.

<u>LU-17 – Improve City of Boise Application Process to Promote Early Recognition of AIA within All Application Processes</u>: No changes have been made to the application process at the City of Boise to disclose the AIA when the application is submitted. The Airport has designated a staff member to review proposals to the Boise City Planning and Development Services; however this occurs after the application is submitted and as part of the review process.

<u>LU-18 – Designate Airport Staff Liaison for Planning and Zoning Building Departments of both City of Boise and Ada County</u>: The Airport has a designated staff person that serves as liaison with the planning and zoning and building departments of the City



Legend

- Airport Property
- City of Boise Limits
- 2009 DNL Noise Contour
- Industrial Parcels Acquired by Airport Since July 1, 2004
- Residential Parcels Acquired by Airport Since July 1, 2004

N

0 750 1,500 3,000 Feet

Figure 7-4
Residential and Industrial Property Acquired by Airport (Since July 1, 2004) with 2009 NEM

Sources: City of Boise, Ada County, HNTB 2015

of Boise and Ada County. As noted in LU-11, through mutual agreement with the City and County, Airport staff is offered an opportunity to comment and review applications for development (both planning and building); applications are forwarded to BOI as part of a routing/review process.

7.1.8 Summary of 2006 NCP Land Use Measures

BOI continues to work with the City of Boise and Ada County in the development and implementation of effective land use measures that help to prevent and to correct non-compatible land uses in the areas surrounding the Airport. The process is ongoing as airport operations at BOI fluctuate and development pressures in the surrounding area continue.

Ensuring appropriate land uses within the AIA and the use of the City's and County's comprehensive plans as guides have furthered noise and land use compatibility efforts. The continued acquisition of avigation easements and non-compatible properties as they become available has also been particularly effective.

Table 7.1 summarizes each of the 18 land use measures of the 2006 NCP and identifies their current implementation status.

Table 7.1

Summary of 2006 NCP Land Use Measures

Land Use Measure		Description	Implementation Status
1	Airport Influence Area (AIA)	Maintain the current AIA boundaries until such time that noise levels require their expansion.	The AIA boundaries have not changed since the 2006 NCP in either Boise or Ada County. City of Boise uses the AIA as a land use planning tool through *Blueprint Boise*. Ada County includes AIA as a special zoning overlay district in zoning ordinance.
2	Land Use Compatibility Standards in AIA	Refine land use compatibility standards for the four sub-districts within the AIA.	No changes to the subareas have occurred since the 2006 NCP and no Aviation Task Force has been created to work toward consistent land use designation and/or zoning classifications.
3	Commercial and Industrial Zoning in AIA	Maintain existing commercial and industrial zoning within the AIA.	Rezoning approvals are guided by the future land use maps in the City and County, which do not call for the conversion of any industrial or commercial uses within the AIA to residential.
4	Zone for Compatible Use in Apple Street Area	Rezone property and land southeast of the airport and east of Apple Street from residential to industrial.	The area remains undeveloped and the current City of Boise zoning allows for residential land uses to be built. Future land use identified in *Blueprint Boise*, which guides zoning decisions designates this area as Industrial land use.
5	Zone for Compatible Use in Gowen Road Area	Rezone land southeast of the airport, east of I-84 and south of East Gowen Road from residential to industrial use.	The majority of this area is currently in Ada County but is within the Boise AOCI and is designated in *Blueprint Boise's* future land use map as Planned Community. This area is also in the East Columbia planning area, a 6,000-acre planned community intended to house 40,000 new residents.

Table 7.1

Summary of 2006 NCP Land Use Measures

Land Use Measure		Description	Implementation Status
6	Encourage Clustered Residential Development	Encourage clustered residential development southeast of the airport within the AIA.	This is included in the Columbia Village subdivision, and is currently in various stages of residential development, however is not being developed as clustered development. The eastern portion of the property has been developed and the western portion has been subdivided and platted.
7	Maintain Large Lot Residential Zoning	Maintain existing large lot residential zoning within AIA.	The part within the City of Boise north of East Gowen Road is developed as low density residential. The area south of East Gowen Road in Ada County is undeveloped, zoned for RUT and RP, which both allow for residential uses. The RUT-zoned part is in the Boise AOCI and is in the East Columbia planning area. The RP-zoned part in the south is currently identified as Rural on Ada County's future land use map (2011), however this area is within the East Columbia planning area boundaries and the City intends to add this area to the AOCI.
8	Maintain Rural Preservation Zoning	Maintain existing Rural Preservation zoning within the AIA.	The City has annexed land in this area and rezoned to A-2, R-1A, R-4, M-1, A-2 and T-2. Although the land within City limits and the AOCI is currently zoned for rural uses, the City plans to develop the southwest portion of LU-8, near Ten Mile Creek as Planned Community. The Ada County zoning classifications include RP and RR; the County's future land use map maintains this area as Rural.
9	Amend Subdivision Regulations and Building Permit Applications to Require Avigation Easements	Amend subdivision regulations and building permit application process (residential and commercial) to require dedication of avigation easements.	The City and County continue to require avigation easements for new development or when there are applications for changes to development within the AIA. Ada County also requires avigation easements as part of the building permit application process.
10	Adopt Local Building Code Amendments for NLR Construction the AIA	Amend building codes for areas within AIA to require NLR construction in AIA.	Building codes have not been modified to include specific techniques and guidance on NLR construction techniques.
11	Adoption of Project Review Guidelines for the City of Boise and Ada County	Adopt project review guidelines for rezoning special use, conditional use, planned development and variance applications.	The local jurisdictions have not developed additional project review criteria or procedures for staff at the City and County planning departments to help guide future land use deliberations.
12	Fair Disclosure of Noise Impacts in the AIA	Promote fair disclosure of potential noise impacts in AIA through formal and informal means.	No formal or informal disclosure of noise impact or AIA limits is required during the sale of property within the AIA. Record of an avigation easement is required during real estate transactions.

Table 7.1

Summary of 2006 NCP Land Use Measures

Land Use Measure		Description	Implementation Status
13	Residential Property Acquisition within DNL 65+ dB Noise Contour	Acquire 40 existing homes within the DNL 65+ dB noise contour of the 2009 NEM.	The mitigation program as identified in LU-13 has not been implemented; the 40 homes identified have not been offered voluntary acquisition. However, since July 1, 2004, the Airport has acquired six residential parcels northwest of BOI, historically within noise-impacted areas, as the properties have become available for purchase.
14	Undeveloped Property Acquisition within DNL 65+ dB Noise Contour	Acquire undeveloped land with potential to be developed non-compatibly within DNL 65+ dB noise contour of 2009 NEM.	No vacant or undeveloped parcels within the 2009 NEM DNL 65+ dB contour have been acquired by BOI since July 1, 2004.
15	Purchase of Avigation Easements	Acquire avigation easement from property owners of existing residential and non-residential noise sensitive properties within the 65+ DNL contour.	The Airport has not pursued avigation easements from property owners of existing residential or non-residential noise sensitive properties within the DNL 65+ dB contour unless the property owner has submitted a request for development or rezoning approval within the AIA.
16	Amend Building Permit Applications to Document and Require Compliance with Noise Level Reduction Construction Standards	Amend building codes and refine application process to require applicant to indicate compliance with proposed standards for NLR construction techniques for noise sensitive construction areas within AIA.	No changes to the building codes of Ada County or City of Boise have been made to incorporate this measure, nor have any changes to the building permit application process been made to specifically address interior noise level goals for noise sensitive construction areas within the AIA.
17	Improve City of Boise Application Process to Promote Early Recognition of AIA within All Application Processes	Improve awareness of AIA at time of application submittal rather than at first comment review.	No changes have been made to the application process at the City of Boise to disclose the AIA when the application is submitted.
18	Designate Airport Staff Liaison for Planning and Zoning Building Departments of both City of Boise and Ada County	Airport to play a greater role in reviewing and participating in the development approval process inside the boundaries of the AIA.	The Airport has a designated staff person that serves as liaison with the planning and zoning and building departments of the City of Boise and Ada County. Airport staff is offered an opportunity to comment and review applications for development (both planning and building).

7.2 Evaluation of Existing Land Use Measures

This section evaluates changes to the land use element of the existing NCP. The evaluation reflects the following developments since the adoption of the current program:

1. Implementation of the previously recommended measures, which greatly reduces the scope of such measures in the future.
2. Changes in local government policy that encourage more density in land uses due to the need to accommodate expected future growth primarily within the City limits and the Boise AOCI.
3. Recognition of potential noise and overflight concerns associated with future residential development identified in the Comprehensive Plans for the City of Boise and Ada County.

7.2.1 Evaluation Criteria

For a land use measure to be recommended in the NCP, its anticipated benefits must be evaluated and compared to costs and effects on existing land uses. Legal constraints and political acceptability must also be considered.

An overview of the six categories that the land use measures fall into is briefly discussed, followed by an evaluation of each land use measure. A summary table follows each land use measure evaluation. **Table 7.2** shows the qualitative and quantitative criteria that are used in the evaluation of the existing and potential new land use measures. Much of the evaluation conducted in this chapter is organized in the form of tables. This is done to provide structure and consistency for comparison and thus enhance the readability of the evaluation.

In order to maintain the LU “number” (e.g., LU-1, LU-2) historically associated with each measure in previous NCPs, the measures are provided in sequential order rather than according to category (e.g., Airport Influence Area, Avigation Easements, etc.). **Table 7.3** provides a reference key.

7.2.2 Land Use Measure Evaluation

LU-1: Airport Influence Area

Measure LU-1 addresses the AIA that was initially developed as part of the 1996 NCP as a depiction of potential future noise exposure as a scenario in which BOI would be operating at maximum capacity. The AIA assists the City of Boise and Ada County in determining if a potential land use is potentially non-compatible with existing and future aircraft operations. Thus, the intent of the AIA as a preventive measure has been to guard against the development of future non-compatible land uses that could encroach upon future operations and development of the Airport.

Specifically, the measure in the 2006 NCP called for the Boise Airport Commission to recommend to the City of Boise and Ada County to maintain the AIA boundaries until such time that noise levels require their expansion. The previous 1996 NCP had included a recommendation to adjust the AIA boundaries; therefore the measure in the 2006 NCP was revised to recommend maintaining the AIA boundaries.

The 2020 NEM DNL 65+ dB contours continue to be smaller than (within) the area covered by the AIA. For this update to the NCP, the AIA is recommended to continue without change to its borders. The planning community appears to be satisfied with the effectiveness of the AIA boundaries and guidelines. For this reason, as well as the 2020 NEM remaining within the AIA boundaries, LU-1 is recommended for inclusion as is in the current NCP. **Table 7.4** provides an evaluation of the measure.

Table 7.2

Evaluation Criteria for Land Use Measures

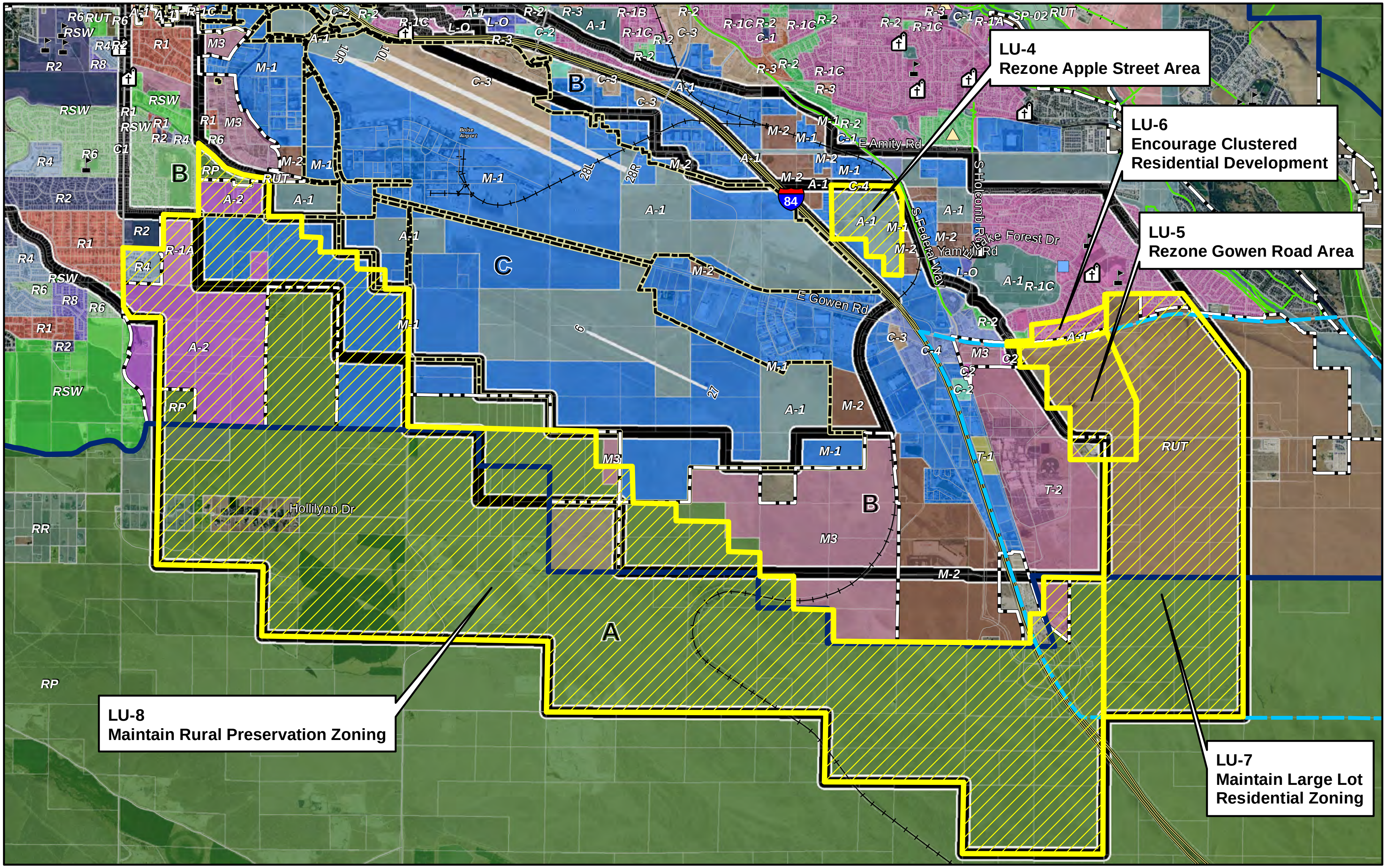
Criterion	Description
Area to which measure would be applied	This factor defines the DNL contour intervals within which the measure would be applied and/or the types of land uses within the applicable contour intervals that would be addressed.
Anticipated Benefits	Assessment of potential benefit of measure in terms of land use compatibility with noise exposure from aircraft operations. Specifically, potential to promote compatibility with: physical features; existing or future needs of the Airport; community development goals; and airport design and airspace criteria. Potential benefits could be of a direct nature (restricting additional residential development in areas impacted by airport noise), indirect nature (permitting informed decisions by potential buyers), or remedial nature (providing acceptable interior noise levels).
Costs and Anticipated Funding Sources	Costs and funding sources, as can be reasonably estimated, that would be needed to implement a measure. Funding availability is also considered, especially in regard to federal funds.
Effect on Existing Land Uses	Assessment of existing, non-compatible land uses and zoning affected by the measure, and a means to transition, if possible, such areas to compatible land uses.
Effect on Property Values and Tax Base	Qualitative assessment of measure's potential impact on affected real property values and tax base.
Legal Factors	Legal constraints to implementation of a measure.
Political Acceptability	Input and recommendations from the public at large, local jurisdictions and their planning agencies, advisory committee, and Airport staff. This factor also describes the interests that may be adversely affected by the potential measure. Such interests could include existing landowners concerned about potential impacts on property values or developers opposed to limitations or conditions that might be placed on the development of land.
Implementation Factors	Steps needed to implement the measure.
Responsible Parties	This factor identifies the federal, state and local agencies and/or jurisdictions responsible for the implementation of a proposed measure.
Conclusion	Positive or negative recommendation on inclusion of measure in NCP.

Table 7.3

Land Use Measures Key

Land Use Element / Category	Applicable Land Use Measures	Description
Airport Influence Area and Comprehensive Planning	LU-1, LU-2	The measures described in this section serve to define the area of existing and potential future noise exposure, and also to define the standards which are used to determine if a land use within the noise exposure area is compatible or non-compatible with noise generated by aircraft operations at BOI.
Zoning Measures	LU-3, LU-4, LU-5, LU-6, LU-7, LU-8, LU-11, **LU-18**	These measures encourage amendments to existing zoning maps and zoning regulations for areas within the AIA. The zoning amendments would typically discourage new non-compatible development and other noise sensitive structures from being constructed within certain areas of the AIA, while supporting favorable trends in other areas to enhance compatibility with future aircraft operations. The locations of the zoning measures evaluated showing existing zoning are illustrated on **Figure 7-5**. The zoning measures shown with future land use are illustrated on **Figure 7-6**.
Avigation Easements	LU-9, **LU-15**	Although the use of navigable airspace by aircraft is a federal prerogative, an avigation easement provides an additional mechanism of right-of-way and disclosure. The avigation easement measures encourage the continued use/purchase of avigation easements by BOI on properties within the AIA that do not currently have them. An illustration of the properties that currently have avigation easements is provided on Figure 7-3.
Building Codes / Noise Level Reduction Construction Standards	LU-10, **LU-16**	These regulatory measures are intended to amend building codes and building code application procedures to require residential and non-residential noise-sensitive buildings to be constructed to achieve an interior noise level at or below 45 dBA. This interior noise level would meet the EPA guideline for avoiding sleep and speech interference due to aircraft noise.
Disclosure	LU-12, **LU-17**	These preventive land use measures encourage disclosure of noise exposure to prospective homebuyers and also to improve public awareness of the guidelines and restrictions associated with purchasing, developing, or making modifications to property within the AIA.
Land Acquisition and Relocation	LU-13, LU-14	Both of the land acquisition measures in the 2006 NCP provide mechanisms for BOI to acquire developed and undeveloped lands within the DNL 65+ dB contour. For this update to the NCP, the measures are recommended to be revised to include acquisition of non-compatible residential dwellings within and adjacent to the DNL 65+ dB contour of the 2015 NEM as part of a defined program area. Due to the uncertain nature of future Idaho ANG operations, which greatly influences the NEM contours, BOI recommends the use of 2015 NEM as a basis for voluntary acquisition rather than the 2020 NEM for this NCP.

Note: Land use measures newly identified/recommended in 2006 NCP are identified in **bold.**



Legend

- Airport Property
- City of Boise Limits
- Area Affected by Zoning Measures
- Airport Influence Area
- Area of City Impact
- East Columbia Boundary
- Parcel Boundary
- School
- Nursing Home
- Place of Worship
- Railroad
- National Historic Place
- Trail

City of Boise Zoning

A-1, A-2, C-1, C-2, C-3, C-4, L-O, M-1, M-2, R-1A, R-1C, R-2, SP-01, T-1, T-2

Ada County Zoning

C1, C2, M2, M3, R1, R2, R4, R6, R8, RP, RR, RSW, RUT

Figure 7-5

2006 NCP Zoning Measures Evaluated

N

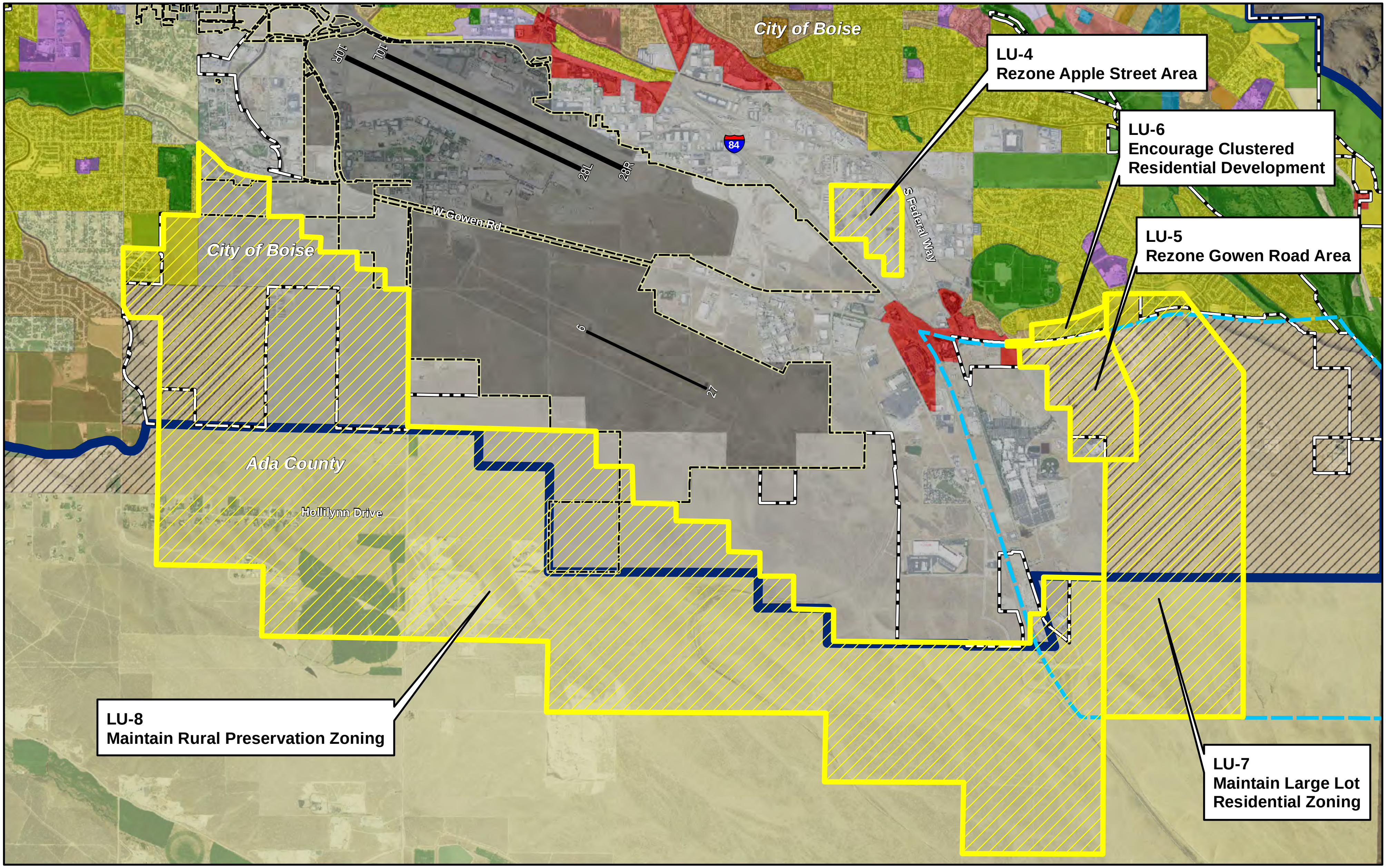
0 1,250 2,500 5,000 Feet

Sources: City of Boise, Ada County, NPS, USDA

Boise Airport

Part 150 Study Update

HNTB



Legend

- Airport Property
- City of Boise Limits
- Area of City Impact
- Area Affected by Zoning Measures
- East Columbia Boundary

Future Land Use

Airport	High Density	Parks/Open Space	
BSU Master Plan	Industrial	Public/Quasi-Public	
Buildable	Large Lot/Rural	Education	
Commercial	Mixed Use	Slope Protection	
Compact	Office	Suburban	
Downtown Mixed Use	Planned Community		

Figure 7-6

2006 NCP Zoning Measures Evaluated with Future Land Use

N

0 1,250 2,500 5,000 Feet

Sources: City of Boise, Ada County, HNTB 2015

Table 7.4

Evaluation of Measure LU-1: Airport Influence Area

Description	The Boise Airport Commission should recommend to the City of Boise and Ada County to maintain the current AIA boundaries until such time that noise levels require their expansion.
Area to which measure would be applied	The AIA has four (4) sub-districts: A, B, B-1 and C. Influence Area A represents the outer perimeter potentially affected by future average noise exposure levels in the DNL 60-65 dB, while C represents the inner core potentially affected by future DNLs greater than 70 dB. Areas B-1 and B represent the land area between A and C that could be potentially affected by future DNLs 65-70 dB.
Anticipated Benefits	When established as an overlay zone, the AIA can assist the City of Boise and Ada County in determining if an impending land use is potentially non-compatible with existing and future aircraft operations. Also, the AIA establishes a recorded jurisdictional boundary for Airport staff to review and comment on proposed planning and zoning actions as well as building development within City of Boise and Ada County.
Costs and Anticipated Funding Sources	This measure would involve only relatively small administrative expenses from operation budgets as needed for ongoing implementation of the measure.
Effect on Existing Land Uses	No effect on existing land uses.
Effect on Property Values and Tax Base	Possible impact on market value of properties involved, although experience with appraisals within the AIA indicates that this effect is minimal. Avigation easements are required within the AIA. Noise level reduction construction techniques would be required on new development over existing properties that are located within the appropriate DNL contours in the AIA.
Legal Factors	No impact to local governing agencies, as this measure recommends continuation of the existing boundaries/zones.
Political Acceptability	Developers and/or property owners may oppose the measure due to the perceived potential for reducing marketability. However, public education of the property owners within the AIA should dispel much of that opposition.
Implementation Factors	The City of Boise and Ada County would maintain the current AIA in their Comprehensive Plans and Municipal Code Ordinances.
Responsible Parties	The City of Boise and Ada County.
Conclusion	This measure is recommended for continued inclusion in the NCP.

LU-2: Land Use Compatibility Standards in Airport Influence Area

The land use compatibility standards establish the criteria used to determine if a land use within the AIA is compatible or non-compatible with the noise generated by aircraft operations. Currently, the AIA has four (4) sub-districts; A, B, B-1 and C, as discussed in Chapter 4.[6] As the 2020 NEM does not extend to the DNL levels estimated in the AIA, the intent of LU-2 is to guard against future expansion of the contours and resultant noise non-compatibility by requiring that noise-sensitive development meet noise level reduction construction goals. Note that none of the land within Zone B-1 of the AIA remains within Ada County, and only approximately 220 acres of Zone C remain in Ada County due to City annexation of property around the Airport.

Although the AIA is used by the City of Boise and Ada County for planning purposes and to enact and enforce their respective zoning regulations, the jurisdictions do not necessarily coordinate or synchronize their specific requirements with each other. In Ada County, the AIA compatibility standards are enforced through an AIA Zoning Overlay District ("Boise Air Terminal Airport Influence Areas Overlay"). To date, the City of Boise has not adopted the AIA as part of the zoning ordinance; AIA compatibility standards are enforced through Conditions of Approval. The AIA is part of the City of Boise Code and is referenced in the City's Comprehensive Plan as a land use planning tool.

This preventive measure would have the City and County work jointly to refine land use compatibility standards for the four sub-districts within the AIA. As part of the coordination for implementing this measure, BOI staff along with the City of Boise and Ada County Planners and Building Officials, should consider creating an Aviation Task Force to re-evaluate current designated land planning uses within both Boise and Ada County. In addition, the task force should determine appropriate and consistent land use designations and zoning classifications that create consistency within the comprehensive planning and zoning ordinance guidelines of both jurisdictions.

The 2006 NCP also identified a potential change to the land use compatibility standards based on feedback from public meetings. New residential development is prohibited within Zone B[7] but permitted in Zone B-1 of the AIA. According to residents during public meetings for the 2006 NCP, the Zone B designation makes remodeling or expansion activities of existing developed areas non-compliant. Therefore a boundary change to the AIA designation from B to B-1 was included as part of the recommended measure to avoid the inconvenience of prohibiting remodeling or expansion. However, changing the boundary to B-1 would also potentially permit existing undeveloped land that was zoned commercial to be subdivided into residential development. Therefore the current NCP is not carrying forward that part of the recommendation. The current NCP, however, includes a proposed change to the land use compatibility standards for Zone B to permit the expansion of any existing primary residential structure, which must then achieve a NLR of 30 dBA.

This NCP therefore recommends that the City and County jointly revisit the land use compatibility standards to ensure that they are appropriate *and* consistent with one another. It also recommends a change to the land use compatibility standards for Zone B to permit the expansion of any existing primary residential structure, which must then achieve a NLR of 30 dBA. **Table 7.5** defines the land uses permitted within each zone of the AIA, and has been updated (Table Note 9) to permit the expansion of a primary residential structure, with the stipulation that the expansion achieves a noise level reduction of 30 dBA. New residential development in Zone B would continue to be prohibited. **Table 7.6** provides an evaluation of this measure.

LU-3: Commercial and Industrial Zoning in Airport Influence Area

Measure LU-3 encourages the City of Boise and Ada County to maintain commercial and industrial-zoned areas within the AIA as such. The primary intent of this measure is to preserve this land for compatible future development and to avoid rezoning of these areas for residential uses. Since commercial and industrial land uses are compatible with aircraft overflights, their use within the AIA is encouraged and promotes compatible land use development.

Measures such as this discourage new non-compatible residential development and other noise-sensitive structures from being constructed within certain areas of the AIA, while supporting favorable trends in other areas to enhance compatibility with future aircraft operations. **Table 7.7** provides an evaluation of this measure.

Table 7.5

Land Use Compatibility Standards for Noise Sensitive and Recreational Uses in Airport Influence Area

SLUCM No.	Land Use Name	Zone & Influence Areas/DNL Levels[1]			
		A 60-65	**B-1 65-70**	**B 65-70**	**C 70+**
10	**Residential**				
11	Household Units	Y[2]	Y[3,6]	N[3,9]	N
11.11	Single Units – detached	Y[2]	Y[3,6]	N[3,9]	N
11.12	Single Units – semi-detached	Y[2]	Y[3,6]	N[3,9]	N
11.13	Single Units – attached row	Y[2]	Y[3,6]	N[3,9]	N
11.21	Two Units – side by side	Y[2,7]	Y[3,7]	N[3,9]	N
11.22	Two Units – one above another	Y[2,7]	Y[3,7]	N[3,9]	N
11.31	Apartments – walk up	Y[2]	N	N	N
11.32	Apartments – elevator	Y[2]	N	N	N
12	Group Quarters	Y[2]	N	N	N
13	Residential Hotels	Y	N	N	N
14	Mobile Home Park or Courts	N	N	N	N
15	Transient Lodging	Y	N	N	N
16	Other Residential	Y[2,7]	Y[3,6,7]	N	N
60	**Services**				
65.1	Hospitals, nursing homes	Y	N	Y[5]	Y[4]
65.2	Other medical facilities	Y	Y[4]	Y[5]	Y[5]
68	Educational services	Y[2]	N	N	N
70	**Cultural, Entertainment, and Recreational**				
71	Cultural activities (including churches)	Y	Y[4]	N	N
71.2	Nature exhibits	Y	Y[4]	Y[5]	N
72	Public Assembly	Y	Y[4]	N	N
72.1	Auditoriums, concert halls	Y	Y[4]	N	N
72.11	Outdoor music shells, amphitheaters	N	N	N	N
72.2	Outdoor sports arenas, spectator sports	Y[8]	N	N	N
73	Amusements	Y	N	N	N
74	Recreational activities (including golf courses, riding stables, water recreation)	Y	Y[4]	Y[5]	Y[5]
75	Resorts and group camps	Y	N	N	N
76	Parks	Y	Y	Y[5]	N
79	Other cultural, entertainment	Y	Y[4]	Y[5]	N

Table 7.5

Land Use Compatibility Standards for Noise Sensitive and Recreational Uses in Airport Influence Area

SLUCM No.	Land Use Name	Zone & Influence Areas/DNL Levels[1]			
		A 60-65	B-1 65-70	B 65-70	C 70+

Notes

1 Avigation easements shall be dedicated to the City of Boise and fair disclosure covenants shall be recorded for all permitted uses in Airport Influence Area.

2 Sound attenuation measures to achieve an NLR of 25 dBA are required.

3 Sound attenuation measures to achieve an NLR of 30 dBA are required.

4 Measures to achieve NLR of 25 dBA must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, sleeping areas, and other noise sensitive areas.

5 Measures to achieve NLR of 30 dBA must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, sleeping areas, and other noise sensitive areas.

6 New residential development (maximum density) limited to three (3) residential units per acre.

7 Existing land planning base zoning (R-2) standards would be maintained in City of Boise to allow duplex residential development complying with bulk setback and planning standards. No conditional uses, variances or rezones would be permitted that intensify current zoning.

8 Land use is compatible provided special sound reinforcement systems are installed.

9 Expansion or remodel of existing single-family or two-family residential structures (constructed and occupied at the time of this document publication) shall be permitted under the standards established for note 3.

Key

SLUCM	Standard Land Use Coding Manual, (U.S. Urban Renewal Administration and Bureau of Public Roads, 1965, 1977).
Y (Yes)	Land Use and related structures are compatible without restrictions, unless otherwise noted.
N (No)	Land Use and related structures are not compatible and shall be prohibited, unless otherwise noted.
NLR (Noise level reduction)	Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

Source: BOI Part 150 Study NCP, 2006.

Table 7.6

Evaluation of Measure LU-2: Land Use Compatibility Standards in Airport Influence Area

Description	BOI, the City of Boise and Ada County should identify an Aviation Task Force to revisit and refine their land use compatibility standards and the way in which they are implemented. Zone B would permit the expansion of an existing residential structure with a noise level reduction of 30 dBA.
Area to which measure would be applied	The AIA sub-districts; A, B, B-1 and C. Zone A represents the outer perimeter affected by average sound levels in the DNL 60-65 dB noise contour and C represents the inner core affected by average sound levels greater than DNL 70 dB. Areas B-1 and B represent the land area between A and C. Recommended change to allow expansions of primary residential structure with NLR would affect Zone B within the AIA of both the City and County. The City of Boise has approximately 89 residential acres within Zone B; Ada County has approximately 283 residential acres within Zone B.
Anticipated Benefits	The adoption of a model ordinance that both the City of Boise and Ada County can enforce in unison with local builders and developers. This would avoid the appearance of one jurisdiction having more power over the other by imposing different standards upon the public.
Costs and Anticipated Funding Sources	This measure would require administrative expenses from City and County operating budgets as needed for refinement and ongoing implementation.
Effect on Existing Land Uses	The standards would ensure that new development would be designed to promote compatibility with the Airport.
Effect on Property Values and Tax Base	Possible impact on market value of properties involved, although experience with appraisals within the Airport Influence Area indicates that this effect is slight.
Legal Factors	It will be necessary for local planning and zoning officials, attorneys and governing bodies to consult in refining and accepting a final ordinance and to amend Zone B in existing ordinances/codes.
Political Acceptability	Developers and/or property owners may oppose the measure due to the perceived potential for reducing marketability. However, public education of the property owners within the Airport Influence Area should dispel much of that opposition.
Implementation Factors	The City of Boise and Ada County would refine land use compatibility standards within the AIA, per their respective Comprehensive Plans and Municipal Code Ordinances.
Responsible Parties	City of Boise and Ada County
Conclusion	This measure is recommended for continued inclusion in the NCP, with revision to emphasize an Aviation Task Force to determine if refinement to standards is needed. This measure does not continue the recommendation to revise the boundaries of Zone B-1.

Table 7.7

Evaluation of LU-3: Commercial & Industrial Zoning in Airport Influence Area

Description	Maintain existing commercial and industrial zoning within the AIA. This land should be preserved for compatible future development and to avoid rezoning of these areas for residential use.
Area to which measure would be applied	Current commercial and industrial property zoning within the AIA. Thus, no changes in the use would occur. This land use recommendation would ensure that these areas remain as compatible land uses.
Anticipated Benefits	Preservation of existing zoning for compatible land uses within the AIA and to avoid new non-compatible development.
Costs and Anticipated Funding Sources	The measure may require small administrative expenses from operating budgets within the City of Boise and Ada County as needed for ongoing implementation of the measure.
Effect on Existing Land Uses	No effect on existing land uses.
Effect on Property Values and Tax Base	Possible impact on market value of properties involved, although experience with appraisals within the Airport Influence Area indicates that this effect is minimal.
Legal Factors	No impact on local governing agencies.
Political Acceptability	Surrounding residents may support decreased development potential.
Implementation Factors	The City of Boise and Ada County maintain existing zoning requirements for commercial and industrial development within the AIA, as outlined in their respective Comprehensive Plans and Municipal Code Ordinances.
Responsible Parties	The City of Boise and Ada County.
Conclusion	This measure is recommended for inclusion in the NCP.

<u>LU-4</u>: Zone for Compatible Use in Apple Street Area

This preventive zoning measure encourages the City of Boise to rezone the Apple Street area northeast of the Airport within the AIA from residential to industrial. The area is zoned A-1, which allows low density residential uses requiring larger areas for development such as parks, schools, golf courses and agriculture. This area is within the City of Boise limits and is located in AIA Zone B and includes a number of parcels under separate ownership. The AIA Zone B area indicates that new residential development is not permitted.[8]

Consistency with Blueprint Boise: The *Blueprint Boise* future land use map identifies this area as industrial, therefore future compatibility of this land with the Airport is further supported by the Comprehensive Plan.

This land use measures is evaluated in **Table 7.8** and illustrated on **Figure 7-7**.

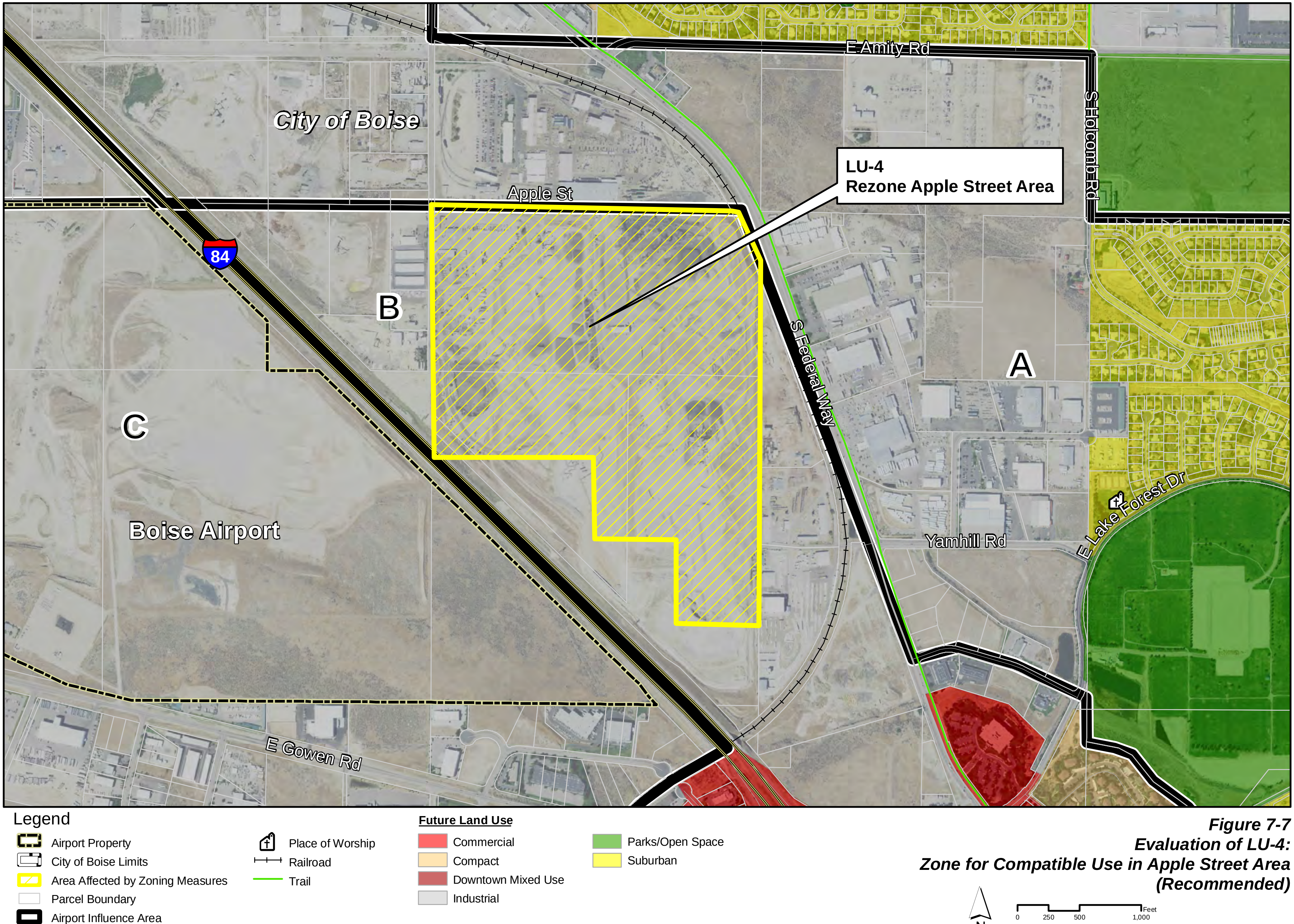


Figure 7-7
Evaluation of LU-4:
Zone for Compatible Use in Apple Street Area (Recommended)

Sources: City of Boise, USDA

Table 7.8

Evaluation of LU-4: Zone for Compatible Use in Apple Street Area

Description	Rezone private property in the area near Apple Street southeast of BOI that is within the AIA from residential (A-1) to industrial use (M-1, M-2 or M-4).
Area to which measure would be applied	Large tract of land (approx. 120 acres) east of the Airport, north of I-84 and east of Apple Street that remains zoned as A-1 and is within AIA Zone B.
Anticipated Benefits	This measure would decrease the potential for non-compatible development in the AIA.
Costs and Anticipated Funding Sources	Minor administrative expenses from the City of Boise's operating budget.
Effect on Existing Land Uses	Rezoning or authorizing conditional uses for any new residential development in the AIA is prevented.
Effect on Property Values and Tax Base	Possible impact on market value of properties involved, although experience with appraisals within the AIA indicates that this effect is slight.
Legal Factors	It will be necessary for local planning and zoning officials and attorneys to consult in the event the remaining land zoned RUT, is proposed for residential or non-compatible development.
Political Acceptability	Developers and/or property owners may oppose the measure due to the potential for reducing marketability. Surrounding residents may support decreased development potential.
Implementation Factors	This area is identified as Industrial on the *Boise Blueprint* Land Use Map. Rezoning requests for industrial use would be supported by the City's future land use plans in this area.
Responsible Parties	City of Boise
Conclusion	This measure is recommended for inclusion in the NCP. The remaining portion of the Apple Street area should be rezoned for industrial use.

<u>LU-5</u>: Zone for Compatible Use in Gowen Road Area

The goal of this preventive measure would be to encourage the rezoning of an area southeast of the Airport, east of I-84 and south of East Gowen Road, from residential to industrial use. This land is located off the extended runway centerlines east of I-84 and south of East Gowen Road and is bordered by industrial zoning to the east, which is the location of Micron Technology. The property is located in AIA Zone A primarily in Ada County and includes a number of parcels under separate ownership.

A small portion of the area is located within the City of Boise and is zoned T-1 (Technological Industrial Park) and has been developed as a compatible land use (industrial), therefore this measure is no longer applicable to that part of the property.

The majority of the area is located in Ada County, is currently undeveloped and has a zoning designation of RUT which allows agriculture and rural residential uses until urban public facilities are extended to this area.

***Consistency with Blueprint Boise**:* This area is within the Boise AOCI, identified as an area to be annexed by the City.

Specifically, the area is designated Planned Community (PC) on the *Blueprint Boise* future land use map, and it is also located within the East Columbia planning area. East Columbia will encourage mixed use and higher density development, including future residential uses. Therefore this measure is not consistent with *Blueprint Boise.*

Because this area has been studied and promoted by the City for planned community development, and given that this area is outside of the DNL 65+ dB in the 2020 NEM and within AIA Zone A, which permits residential uses contingent on noise level reduction, this measure is not recommended to be carried forward in this NCP.

This land use measure is evaluated in **Table 7.9** and illustrated on **Figure 7-8.**

<u>LU-6</u>: Encourage Clustered Residential Development

This measure seeks to encourage clustered residential development away from the extended runway centerlines for the area east of the airport, just north of Gowen Road, now referred to as Columbia Village. The eastern portion of the property has been developed and the western portion has been subdivided and platted. The area is zoned R-1C within AIA Zone A, which does permit residential uses with sound attenuation. Because the area is developed, the measure no longer applies and is not recommended for inclusion in the NCP.

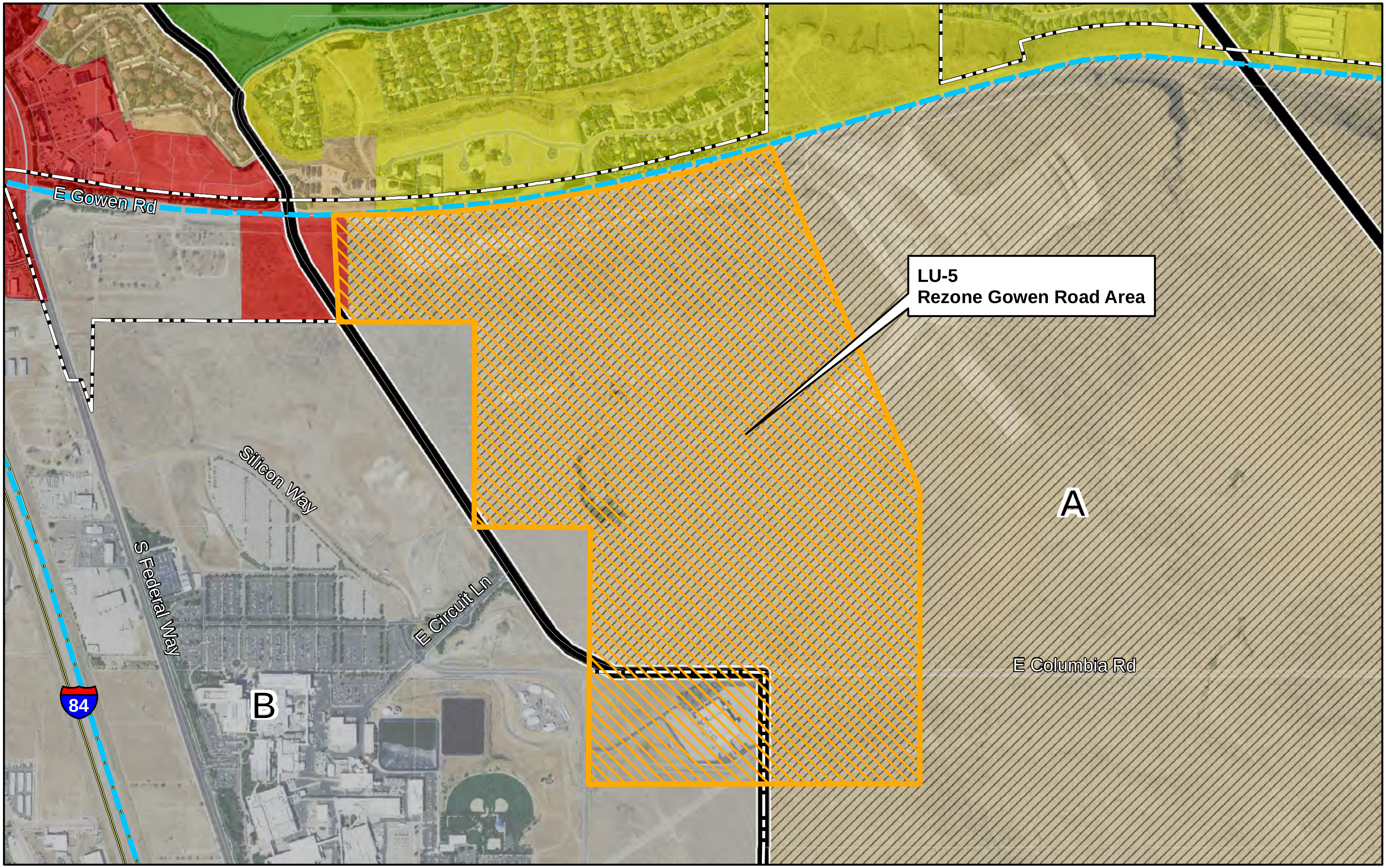
Consistency with Blueprint Boise*:* This area is identified as Suburban on the *Blueprint Boise* future land use map and is therefore not consistent with the Comprehensive Plan.

This land use measures is evaluated in **Table 7.10** and illustrated on **Figure 7-9**.

<u>LU-7</u>: Maintain Large Lot Residential Zoning

This measure is intended to encourage the continued use of low-density residential development within the AIA, southeast of the Airport, in a large area that spans both the City and the County. The northern part of the area is located in Ada County, is currently undeveloped and has a zoning designation of RUT which allows agriculture and rural residential uses until urban public facilities are extended to this area. This area is within the Boise AOCI, however, and is in the East Columbia planning area. The southern part of this area, zoned RP, is in unincorporated Ada County and within the East Columbia planning area, however is not within the Boise AOCI at this time.

Consistency with Blueprint Boise and Ada County Future Land Use*:* The northern part of this area (currently zoned RUT) is identified as PC on the *Blueprint Boise* future land use map and is within the Boise AOCI. Ada County identifies future land use in the southern part of this area (zoned RP) as Rural, which is consistent with the current use. However this area is within the East Columbia planning boundary and the AOCI will likely be expanded to include this area in the future. Because the LU-7 area is located in the future East Columbia area being planned by the City, and given that this area is outside of the DNL 65+ dB in the 2020 NEM and lies within Zone A, which permits residential uses contingent on noise level reduction, this measure is not recommended to be carried forward in this NCP. This land use measures is evaluated in **Table 7.11** and illustrated on **Figure 7-10**.



Legend

- Airport Property
- City of Boise Limits
- Area Affected by Zoning Measures
- East Columbia Boundary
- Airport Influence Area
- Area of City Impact
- Parcel Boundary
- Railroad

Future Land Use

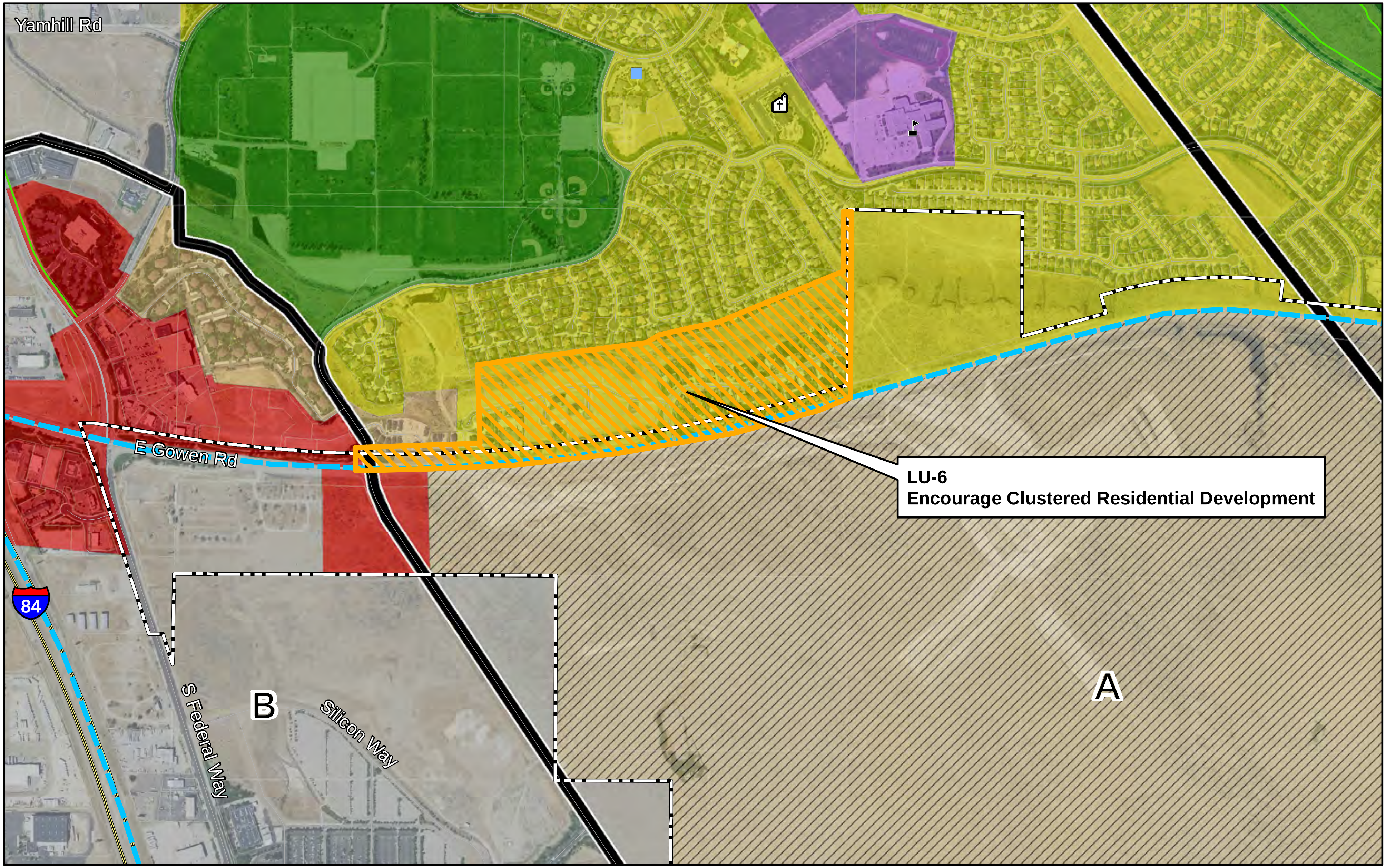
- Commercial
- Compact
- Industrial
- Planned Community
- Parks/Open Space
- Suburban

N

0 250 500 1,000 Feet

Figure 7-8
Evaluation of LU-5:
Zone for Compatible Use in Gowen Road Area
(Not Recommended)

Sources: City of Boise, USDA



Legend
- Airport Property
- City of Boise Limits
- Area Affected by Zoning Measures
- East Columbia Boundary
- Airport Influence Area
- Area of City Impact
- Parcel Boundary
- School
- Nursing Home
- Place of Worship
- Railroad
- Trail

Future Land Use
- Commercial
- Compact
- Industrial
- Large Lot/Rural
- Planned Community
- Parks/Open Space
- Education
- Suburban

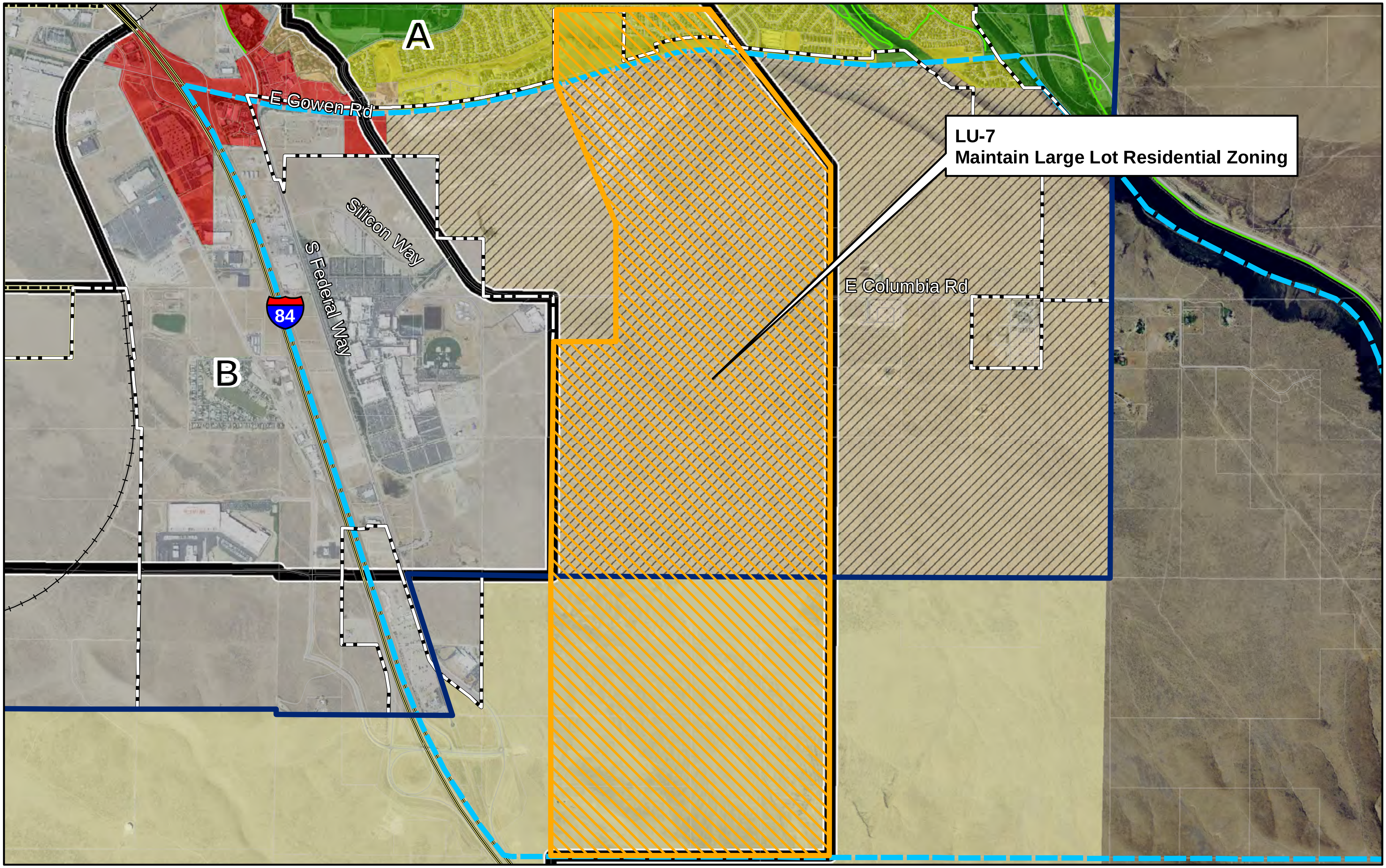
N

0 250 500 1,000 Feet

Figure 7-9
Evaluation of LU-6:
Encourage Clustered Residential Development
(Not Recommended)

Sources: City of Boise, Ada County, USDA

Part 150 Study Update



Legend

- Airport Property
- City of Boise Limits
- Area Affected by Zoning Measures
- East Columbia Boundary
- Airport Influence Area
- Area of City Impact
- Parcel Boundary
- Railroad
- Trail

Future Land Use

- Commercial
- Compact
- Industrial
- Large Lot/Rural
- Planned Community
- Parks/Open Space
- Suburban

N

0 625 1,250 2,500 Feet

Figure 7-10
Evaluation of LU-7: Maintain Large Lot Residential Zoning (Not Recommended)

Sources: City of Boise, Ada County, USDA

Table 7.9

Evaluation of LU-5: Zone for Compatible Use in Gowen Road Area

Description	Rezone a large tract of land from residential to industrial within the AIA.
Area to which measure would be applied	Land located off the extended runway centerlines east of I-84 and south of East Gowen Road. An Industrial Zoning District currently borders the property to the east. This area is currently in Ada County, but is within the Boise Area of City Impact.
Anticipated Benefits	This measure would decrease the amount of noise sensitive land use within the AIA.
Costs and Anticipated Funding Sources	This measure would involve modest administrative expenses from operation budgets for drafting the amending ordinance and notification through a public hearing, as well as mapping preparation for neighborhood presentation and platting.
Effect on Existing Land Uses	Currently comprehensive planning documents recommend planned community development within this particular property area. It is not likely that planning commission would support rezone of property to industrial given plans for East Columbia in this area.
Effect on Property Values and Tax Base	Area has remained undeveloped since the 2006 NCP.
Legal Factors	If industrial zoning classification is pursued, BOI staff would need to lobby planning agencies, property owners, city council, and county commissioners to support amendment to the comprehensive plan.
Political Acceptability	City/county staff, developers and/or property owners may oppose the measure due to the potential for reducing marketability.
Implementation Factors	This area has remained undeveloped and has a zoning classification of RUT and RP. Future plans for this area include increasing density and allowing residential uses. It is within the City of Boise Area of City Impact and East Columbia planning area. Changing the land use to industrial would require a Comprehensive Plan/future land use map change by the City of Boise.
Responsible Parties	The City of Boise and Ada County.
Conclusion	This measure is not supported by *Blueprint Boise* and is outside of the DNL 65+ dB noise contour of the 2020 NEM. While BOI would prefer to maintain this beneficial noise tolerant corridor, the City's need to accommodate future growth, and the planning currently underway for that growth, are considered. This measure is not recommended for inclusion in the NCP.

Table 7.10

Evaluation of LU-6: Encourage Clustered Residential Development

Description	This measure addresses land to be considered for clustered residential development within a current residential zone inside the AIA. The homes would be clustered away from the runway centerline.
Area to which measure would be applied	Land southeast of the airport and north of East Gowen Road, in the area now known as the Columbia Village Subdivision.
Anticipated Benefits	This measure would reduce the number of future residential homes along the runway centerline and thus homes exposed to noise.
Costs and Anticipated Funding Sources	This measure would require limited administrative expenses from the jurisdiction's operating budget.
Effect on Existing Land Uses	No effect on existing land uses.
Effect on Property Values and Tax Base	No effect on present property values.
Legal Factors	Initiation of this measure is at the discretion of the developer. The local governing agencies cannot mandate this process.
Political Acceptability	Developers and/or property owners may oppose the measure due to the potential for reducing marketability. Surrounding residents may support decreased development potential.
Implementation Factors	Development in this area is part of the Columbia Village Subdivision master plan. There are several housing components of the development that offer "clustered" housing as well as high-density housing. The land remains under residential zoning classification.
Responsible Parties	The City of Boise and Ada County.
Conclusion	As this area has already been subdivided and partially developed, this measure is no longer applicable and is not recommended for inclusion in the NCP.

Table 7.11

Evaluation of LU-7: Maintain Large Lot Residential Zoning

Description	This measure would maintain the large lot, low-density residential development in the AIA to discourage intensive residential development in areas that could be affected by future growth at BOI.
Area to which measure would be applied	Land currently zoned for residential development northwest and south of the AIA in the City of Boise and Ada County. Property includes minimum lot sizes of one acre or more.
Anticipated Benefits	To reduce or minimize future numbers of people residing in potential noise exposure areas.
Costs and Anticipated Funding Sources	This measure would require only relatively small administrative expenses from current operating budgets as needed for continued implementation of the measure.
Effect on Existing Land Uses	No effect on existing land uses.
Effect on Property Values and Tax Base	No effect on present property values.
Legal Factors	No impact on local governing agencies.
Political Acceptability	Developers and/or property owners may oppose the measure due to the potential for reducing marketability. Surrounding residents may support decreased development potential.
Implementation Factors	The City of Boise and Ada County would establish this policy by amending their Comprehensive Plans or by adopting a resolution into the Municipal Code Ordinances. The NCP or relevant parts could be adopted as part of an airport vicinity land use plan.
Responsible Parties	The City of Boise and Ada County.
Conclusion	This measure is not supported by *Blueprint Boise* and is not within the DNL 65+ dB noise contour of the 2020 NEM. While BOI would prefer to maintain this beneficial noise tolerant corridor, the City's need to accommodate future growth, and the planning currently underway for that growth, are considered. This measure is not recommended for inclusion in the NCP.

LU-8: Maintain Rural Preservation Zoning

As with LU-7, this measure is intended to encourage continued use of low-density residential development south of the Airport, primarily in unincorporated Ada County. The measure is intended to discourage intensive residential development that could be affected by the long-term expansion of the Airport. This area falls within AIA Zones A and B. The majority of land within LU-8 is in unincorporated Ada County and remains undeveloped, zoned RP. The northern part of LU-8 is within the Boise AOCI and is zoned for residential development (R-1A, R4, A2).

Consistency with Blueprint Boise and Ada County Future Land Use*:* The northwest area of the LU-8 area is within the Boise AOCI, as are several other areas toward the north of the area. *Blueprint Boise* identifies the northwest corner of the LU-8 area as PC and the area just east of this, immediately adjacent to Airport property, as Industrial in the future. The southern part of LU-8 in Ada County, not within the AOCI, is designated by Ada County on the future land use map as Rural. The ability to maintain the rural nature of the area south of the Airport in unincorporated Ada County will continue to be encouraged.

The boundaries of LU-8 are revised as part of the current NCP to maintain RP zoning in Ada County in the areas outside of the Boise AOCI. The residential development along Hollilynn Drive is currently zoned RR in Ada County, so it has also been excluded from the LU-8 boundary.

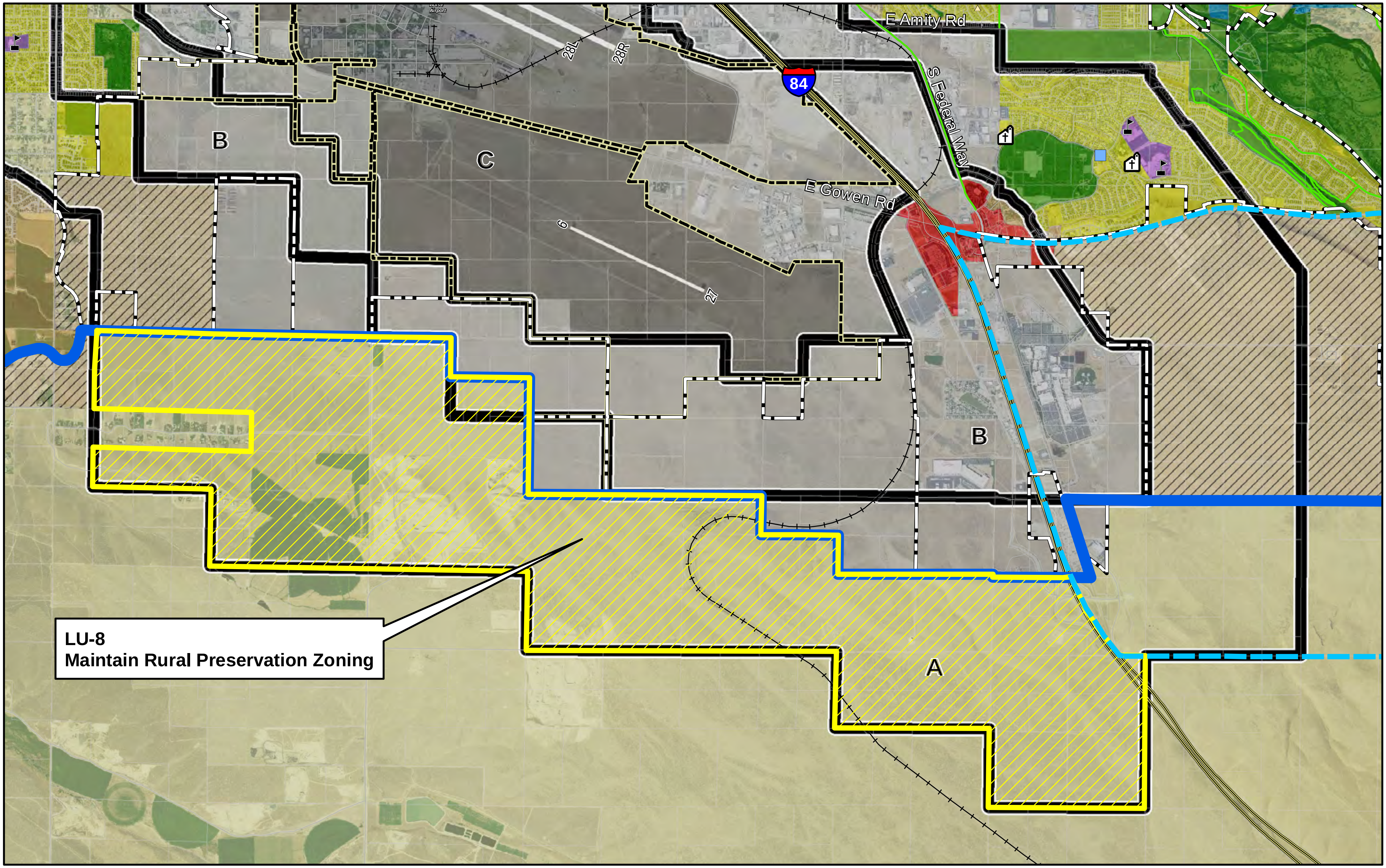
The LU-8 boundaries for the current NCP are also revised to exclude the Industrial area identified in the *Blueprint Boise* future land use map (within the AOCI), as this type of use would be compatible with airport land uses, as well as the area identified as PC in the *Blueprint Boise* future land use map. LU-8 to the east of I-84 is within the East Columbia planning area boundary and has also been removed from the extents of Measure LU-8. Finally, the northern perimeter of LU-8 has also been modified to align with the Boise AOCI, as this area is designated as industrial use in the future, which would be compatible with airport operations.

These areas excluded from the LU-8 area are not proximate to the DNL 65+ dB of the 2020 NEM and are primarily in AIA Zone A, which permits residential development with the inclusion of an avigation easement and sound insulation. The area within AIA Zone B, which prohibits new residential development, has been removed from this land use measure. This land use measure is evaluated in **Table 7.12** and the revised boundaries of LU-8 are illustrated on **Figure 7-11**.

LU-9: Amend Building Permit Applications to Require Avigation Easements

Measure LU-9 suggested that Ada County and the City of Boise subdivision regulations be amended to require dedication of avigation easements. This measure was carried forward in the 2006 NCP to also include dedication of avigation easements as part of the building permit application process as well.

Ada County and the City of Boise both submit development proposals within the AIA to Boise Airport for staff review. At that time, the Airport typically takes the opportunity to place an easement on the property if one does not already exist. The Ada County Code requires avigation easements are filed prior to issuance of zoning certificates and is therefore required



Legend

- Airport Property
- City of Boise Limits
- Area Affected by Zoning Measures
- East Columbia Boundary
- Airport Influence Area
- Area of City Impact
- Parcel Boundary
- School
- Nursing Home
- Place of Worship
- Railroad
- Trail

Future Land Use

- Airport
- Commercial
- Compact
- Industrial
- Large Lot/Rural
- Planned Community
- Parks/Open Space
- Public/Quasi-Public
- Education
- Suburban

N

0 1,125 2,250 4,500 Feet

Figure 7-11
Evaluation of LU-8
Maintain Rural Preservation Zoning
(Recommended as Revised)

Sources: City of Boise, Ada County, USDA

as part of the zoning review/approval process, which occurs prior to the building development process. The City currently has procedures in place to ensure that avigation easements are obtained for new development, rezoning, or changes to development within the AIA, however the process is not necessarily regulated formally by the Boise Municipal Code. An evaluation of this preventive measure is contained in **Table 7.13**. See Figure 7-3 for properties that currently have avigation easements.

Table 7.12

Evaluation of LU-8: Maintain Rural Preservation Zoning

Description	To maintain unincorporated land currently zoned for Rural Preservation within the AIA to ensure that such lands do not become more intensively residentially developed.
Area to which measure would be applied	Land is located in the southern part of the AIA (Zone A and B) in Ada County and City of Boise. Most of this area is undeveloped, although some of it has been rezoned, is within the AOCI, and/or the East Columbia planning boundary. Ada County zoning includes R4 (permits 4 dwelling units/acre), RR (permits 1 unit/10 acres) and RP (permits 1 unit/40 acres). The City's zoning includes Industrial, A-2 (permits 1 unit/40 acres) and R-1A (permits 2 units/acre).
Anticipated Benefits	Current zoning district limits the amount of housing and other urban uses that can be developed. This would thus reduce or minimize future numbers of people residing in potential noise exposure areas in Ada County.
Costs and Anticipated Funding Sources	This measure would require only relative small administrative expenses from current operating budgets as needed for continued implementation of the measure.
Effect on Existing Land Uses	No effect on existing land uses.
Effect on Property Values and Tax Base	No effect on present property values.
Legal Factors	No impact on local governing agencies.
Political Acceptability	Developers and/or property owners may oppose the measure due to the potential for reducing marketability. Surrounding residents may support decreased development potential.
Implementation Factors	The City of Boise and Ada County would establish this policy by amending their Comprehensive Plans or by adopting a resolution into the municipal code ordinances. The NCP or relevant parts could be adopted as part of an airport vicinity land use plan.
Responsible Parties	The City of Boise and Ada County.
Conclusion	For the areas that remain "rural" in nature in unincorporated Ada County, this measure is valid in that it would encourage continuation of low-density development south of the Airport. The northern part of this area within the Boise AOCI and identified as Industrial and PC in the future are not consistent with this measure. The measure would be preventive in nature and would maintain the rural nature of the County south of the Airport and protect against future non-compatible land uses with expanded noise contours. As a result, the measure is recommended, as revised, for inclusion in the NCP.

Table 7.13

Evaluation of LU-9: Amend Building Permit Applications to Require Avigation Easements

Description	The AIA planning standards in the City of Boise and Ada County require the dedication of avigation easements for all permitted uses. This practice has been in place for many years, and it is recommended to be continued. At this time, Ada County Code requires avigation easements be filed prior to issuance of zoning certificates, and as part of all zoning reviews/approvals; however the City of Boise Code does not.
Area to which measure would be applied	Current and future permitted residential subdivision uses and new development requiring building permits within the AIA.
Anticipated Benefits	Would empower local planning, zoning and building officials to ensure that easement and disclosure requirements were met at time of a property being subdivided or when a building permit is issued. The avigation easement would grant to the Airport unabridged right to airspace above the property and the right to make noise inherent in the operation of aircraft.
Costs and Anticipated Funding Sources	This measure would require administrative expenses from the jurisdictions operating budgets as needed for revision and continued implementation.
Effect on Existing Land Uses	No effect on existing land uses since the measure is already in place and only needs enhanced implementation by the City.
Effect on Property Values and Tax Base	Possible impact on market value of properties involved.
Legal Factors	It will be necessary for local planning and zoning officials and attorneys to consult in refining the existing City ordinance.
Political Acceptability	Developers, real estate brokers, and/or property owners may oppose the measure due to the potential for reducing marketability.
Implementation Factors	The City of Boise and Ada County have established requirements for new subdivisions such that if a permit application is located within the AIA and without a recorded Avigation Easement, the application is returned to the permit holder until an easement for the property is obtained.
Responsible Parties	The City of Boise.
Conclusion	Currently, the City follows procedures that ensure avigation easements are obtained within the AIA; however the procedures should be formalized. This measure is recommended for inclusion, as revised, to formalize the inclusion of avigation easements as part of zoning certificate approval or as part of the building permit application process in the City of Boise within the AIA.

LU-10: Adopt Local Building Code Amendments for NLR Construction in the AIA

This measure was included in the 2006 NCP and has not yet been implemented. Currently, both the City of Boise and Ada County rely on the *International Building Code* and the *International Energy Conservation Code* to ensure that new development meets a minimum level of noise level reduction through energy efficiency. However, the codes do not specifically address noise reduction technologies, and the noise level reduction requirements for some permitted development in the AIA is well in excess of the noise level reduction provided by standard construction methods. As such, there is currently no requirement or methodology to ensure that the adequate level of noise level reduction is provided in new construction in the AIA.

In the previous Part 150 Study, BOI developed a report entitled the *Noise Level Reduction Construction Technical Report*. The report included an Acoustical Design Guide for Residences which provides recommendations for the design of dwellings in the vicinity of the airport that may be constructed in the future. In the guidelines, construction guidelines are presented for noise level reductions of 25, 30, and 35 decibels. The guide also provides recommendations for the renovation of existing homes to provide sound insulation in accordance with FAA guidelines. The guidelines are being updated as part of this Part 150 Update study. Information related to the previous guidelines is provided in ***Appendix C, 2004 Noise Level Reduction Construction Technical Report***. This measure is evaluated in **Table 7.14**.

LU-11: Adoption of Project Review Guidelines for the City of Boise and Ada County

Measure LU-11 is intended to establish project review guidelines to assist local planners, commissions and governing boards when addressing airport land use compatibility standards and in assessing the potential compatibility of future development projects with aircraft noise. The measure recommended that the City of Boise and Ada County adopt project review criteria specifically for rezoning, special use, conditional use, planned development and variance applications within the AIA. The 2006 NCP updated this measure, with modifications to help control new residential development under heavily used departure and arrival corridors as part of the AIA.

Several of the recommendations in the 2006 NCP have been informally implemented. For example, the local land use authorities now notify Airport staff of proposed noise sensitive land development, and the locations of that development within the AIA through the development review process that is now part of the application process. With this step in the process, approval of rezoning, conditional uses and variances which introduce noise-sensitive development into areas impacted by 60 DNL or above within the AIA are discouraged. Therefore this measure is recommended, as revised, to include the components that have not yet been formally implemented, as summarized in **Table 7.15**.

Table 7.14

Evaluation of LU-10: Adopt Local Building Code Amendments for NLR Construction in the AIA

Description	The AIA planning standards in the City of Boise and Ada County have required the use of noise level reduction construction techniques for noise-sensitive uses for all permitted development for many years. Both the City and County have lacked specific guidance for implementing this requirement and should adopt noise level reduction standards to supplement their building codes.
Area to which measure would be applied	All permitted uses within the AIA of the City of Boise and Ada County.
Anticipated Benefits	Achieve the EPA recommendation of an interior noise level at or below 45 dBA.
Costs and Anticipated Funding Sources	Costs for ensuring that new construction meets NLR requirements depends on the means and methods established by the City of Boise and/or Ada County. There would be initial administrative costs to develop and adopt modifications or supplements to the respective buildings codes. The cost of training local building officials is estimated to be around $10,000. If physical testing is required, costs could range from $20,000 to $50,000 but depend greatly on the type of construction and the methods used. Methods to certify buildings for noise level reduction should be evaluated.
Effect on Existing Land Uses	This measure would apply mostly to new construction, but would also ensure that additions to or expansions of previously developed properties meet NLR requirements.
Effect on Property Values and Tax Base	No effect to present property values. This measure could increase property values for new construction.
Legal Factors	It will be necessary for local building officials and attorneys to consult in refining the existing building code ordinances.
Political Acceptability	Potential opposition may be presented by developers or property owners due to increased costs of compliance.
Implementation Factors	The City of Boise and Ada County have the authority to implement this measure.
Responsible Parties	The City of Boise and Ada County.
Conclusion	Both the City and the County require adherence to the *International Energy Code*, and operate under the assumption that structures that meet energy code requirements provide sufficient amounts of noise level reduction (approximately 25 dB). As such, no further demonstration of NLR measures is required by the City or County. Further pursuit of this measure is anticipated to be met with opposition from developers and would result in additional costs by each jurisdiction. The Airport supports each jurisdiction's ongoing efforts to encourage compatible development, and if needed, the City or the County may implement these recommendations outside of the Airport's recommended NCP. As such, this measure is not recommended for inclusion in the NCP.

Table 7.15

Evaluation of LU-11: Adoption of Project Review Guidelines for the City of Boise and Ada County

Description	The adoption of special project review criteria specifically addressing airport land use compatibility standards and continued enforcement in future land use deliberations. Specifically, new project review guidelines should include: 1. Locate noise-sensitive development within the DNL 65 dB contour that must be permitted in areas away from the extended runway centerlines; and 2. Consideration of heavily used departure and arrival corridors when considering new residential development within the AIA, even when outside of the DNL 65 dB noise contour. Additionally, a Letter of Agreement is recommended to formalize recommending authority of the Airport, already informally in place.
Area to which measure would be applied	Project review criteria would be included in local comprehensive plans or as checklists for local planners, commissions and governing boards. Criteria would be specifically suggested for use in the review of planned development, rezoning, conditional use and variance applications within the AIA. Letter of Agreement between BOI and both the City and County to formalize Airport review procedures.
Anticipated Benefits	To determine whether a projected land use is potentially non-compatible in reference to the NEMs and AIA. Letter of Agreement would support Airport's role as reviewer to further promote noise and land use compatibility.
Costs and Anticipated Funding Sources	This measure would require minor administrative expenses from the jurisdiction's operating budgets.
Effect on Existing Land Uses	Projected land uses within the AIA could potentially be discouraged upon reference to the project review guidelines.
Effect on Property Values and Tax Base	Possible impact on market value of properties involved, although experience with appraisals within the AIA, indicates that this effect is minimal.
Legal Factors	It will be necessary for local planning and zoning officials and attorneys to consult in refining the existing ordinance.
Political Acceptability	Developers and/or property owners may oppose the measure due to the potential for reducing marketability.
Implementation Factors	Airport staff would need to become familiar with heavily used departure and arrival corridors and flight track information would need to be readily available to the public with statement that new noise-sensitive uses within that corridor are discouraged.
Responsible Parties	The City of Boise and Ada County.
Conclusion	Although the AIA guidelines provide permitted and non-permitted uses within the AIA, the planning departments would benefit from supplemental criteria to use when evaluating proposed development projects. This measure is recommended for inclusion in the NCP, as revised, to include applicable guidelines and to formalize the Airport's role as a reviewing authority.

LU-12: Fair Disclosure of Noise Impacts in the Airport Influence Area

This preventive measure would inform potential buyers that the property they are purchasing is located within the BOI NEMs and/or AIA, and therefore subject to aircraft noise exposure. This measure would permit buyers to make an informed decision about the property. This measure is in addition to the disclosure requirements per avigation easements included in measure LU-9.

Property owners and their agents with noise-sensitive properties within the AIA would be requested to disclose aircraft noise levels in sales and leasing agreements. Existing properties would be subject to the disclosure requirements upon the sale and purchase of those properties. Although more formal methods of noise disclosure would be desirable from the Airport's perspective, there is little apparent viability for implementing formal procedures.

In a formal program, aircraft noise exposure information would be included in a property's real estate listing, sales contract, and sales documents. By including noise disclosure information in the real estate listing and sales contract, the buyer would be made aware of aircraft noise exposure levels well in advance of the time of closing. This would also help to ensure that the buyer does not overlook noise disclosure at closing. In addition, the buyer would be required to sign an affidavit at the time of closing acknowledging that they are aware that the property being purchased is in an area potentially subjected to aircraft noise exposure of DNL 60 dB or greater. Similarly, lease agreements would contain a provision notifying the leaser that the property is potentially subject to aircraft noise exposure of DNL 60 dB or greater.

Note that this disclosure policy would not relinquish any of the buyers legal rights; it would only serve as a means to ensure that buyers are aware of potential aircraft noise exposure levels before purchasing or leasing the property. In concert with measure LU-10, the disclosure documents could also indicate the noise level reduction and interior noise level provided by the building, if known.

As a related effort, BOI could pursue an aggressive public education program directed towards notifying potential homebuyers of potential aircraft noise exposure levels. This program could include both printed and online pamphlets and maps. This measure is described in further detail in Chapter Eight. **Table 7.16** provides an evaluation of this measure.

LU-13: Voluntary Residential Property Acquisition Within or Adjacent to DNL 65+ dB Noise Exposure Contour

This corrective measure would include the voluntary acquisition of residential dwellings within and adjacent to the 2015 DNL 65+ dB contour within a proposed program area boundary. This measure would apply to areas within the DNL 65+ dB contour, as FAA guidelines define noise sensitive uses within the DNL 65+ dB contour as non-compatible. Due to the uncertain nature of future Idaho ANG operations, which greatly influences the NEM contours, the 2015 NEM is used as the basis for the voluntary acquisition program rather than the 2020 NEM for this NCP.

Properties would be acquired through the voluntary sale by the owner only. Although BOI already has the option of pursuing acquisition of developed land without this measure, the inclusion of this measure in the NCP would permit the Airport to seek federal grant funds to aid in the acquisition cost. Voluntary acquisition programs are subject to the provisions set forth in the *Uniform Relocation Assistance and Real Property Acquisition Policies Act* (49 CFR Part 24). Participation in the program as offered in this NCP would be voluntary, and participation in the program would qualify the homeowner for the benefits outlined in 49 CFR Part 24.

The proposed area includes 105 residential parcels to the north of the Airport in the South Hillcrest subdivision, as shown on **Figure 7-12**. Because the DNL 65+ dB contour only impacts a portion of the neighborhood, a potential program area has been identified to include nearby residential uses for the purpose of establishing a contiguous area for future re-purposing of the land compatibly. Seven parcels are located within the DNL 70 dB contour, which would be the priority to offer voluntary acquisition. Seventy-five (75) residential parcels are within the DNL 65-69 dB contour, and 23 residential parcels are contiguous and are therefore included in the proposed program area. The multi-family residences on West Victory Road within the DNL 65+ dB contour are not included in the potential program area boundaries due to the Airport staff's historic recommendation to not approve this development due to its proximity to the Airport.

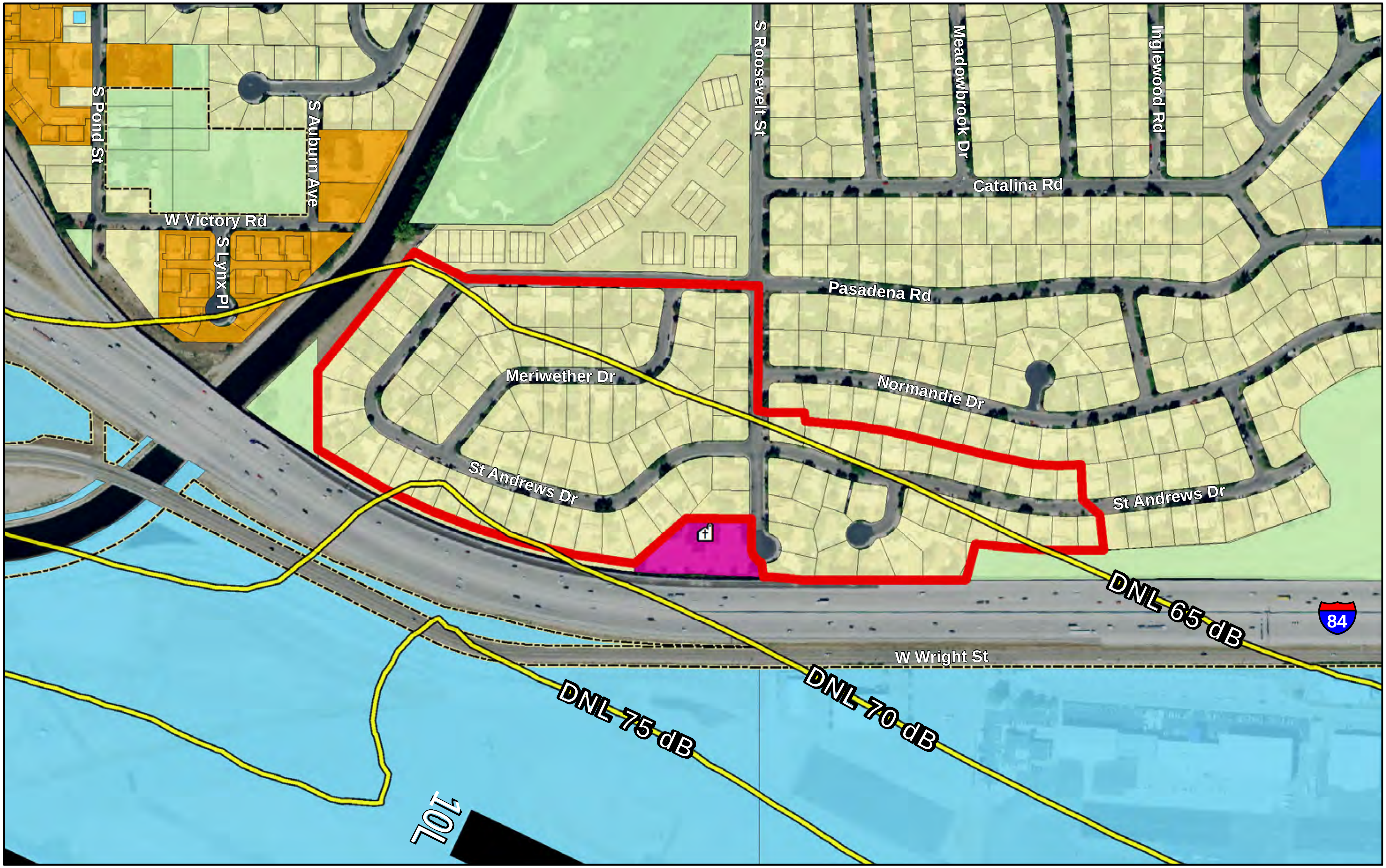
Costs associated with the voluntary acquisition program include costs of appraisals, relocation and moving expenses, demolition costs, and administrative expenses. While some of these costs are fixed, the value of the properties varies, so the overall program cost of this measure is an estimate. The Ada County tax assessor website[9] was used to conduct an initial analysis of assessed value. Currently, homes in this area range from $70,600 to just under $300,000, with an average assessed value of approximately $156,000. If acquisition costs are approximately $236,000 per home, with a 25% participation rate in the program, the cost of the program would be approximately $6.2 million. The program's estimated costs are included in **Table 7.17**. These costs are estimates only and are preliminary in nature. Prior to implementation of the proposed program, more detailed costs should be developed and evaluated. An evaluation of this measure is included in **Table 7.18**.

<u>LU-14</u>: Undeveloped Property Acquisition within DNL 65+ dB Contour

With this corrective measure, BOI could acquire any remaining undeveloped parcels of undeveloped land within the DNL 65+ dB contour of the 2015 NEMs. This measure is similar to LU-13, except that it applies to undeveloped property instead of already developed property. This would be done for the purpose of maintaining the land as vacant, selling the property for development into compatible uses with deed restrictions, or developing the property for a compatible public use.

This measure would apply to undeveloped areas within the DNL 65+ dB contour with the risk of non-compatible development. Properties would primarily be acquired through the voluntary sale of the owner. Although BOI already has the option of pursing acquisition of developed land without this measure, the inclusion of this measure in the NCP would permit the airport to seek federal grant funds to aid in the acquisition cost.

Part 150 Study Update



Legend

- Airport Property
- City of Boise Limits
- 2015 DNL Noise Contour
- Potential Program Area Boundaries
- Place of Worship
- Nursing Home

Generalized Land Use (2015)

- Single Family Residential
- Multi-Family Residential
- Commercial
- Industrial
- Public Facility/Institutional
- Open Space
- Airport Land Use
- Park
- School
- Place of Worship

Figure 7-12
Potential Residential Voluntary Acquisition Program Area

N

0 100 200 400 Feet

Sources: City of Boise, HNTB 2015

As shown on **Figure 7-13**, there are 36 parcels of vacant land/open space within the DNL 65+ dB contours of the 2015 NEM, therefore this measure is recommended to be continued. An evaluation of this measure is included in **Table 7.19**.

Table 7.16

Evaluation of LU-12: Fair Disclosure of Noise Impacts in the Airport Influence Area

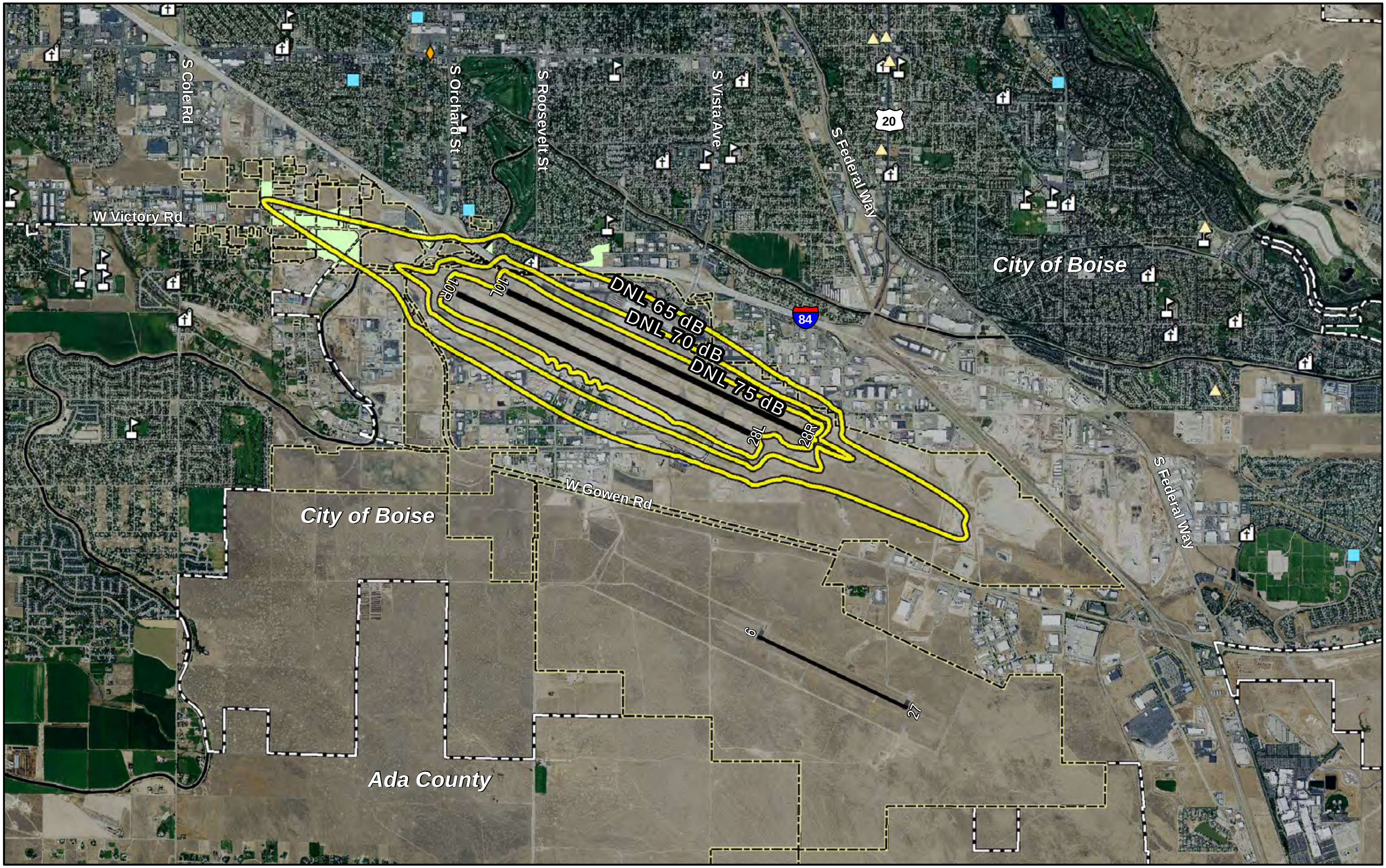
Description	Informal means of ensuring fair disclosures for both new and existing properties of the potential noise impacts to buyers within the AIA. Additional collaboration with the local Board of Realtors to develop voluntary ways of disclosing airport impacts to buyers before they are committed to purchasing that property.
Area to which measure would be applied	Residential, noise sensitive and commercial properties located within the AIA.
Anticipated Benefits	Provide accurate, balanced information for property buyers considering the purchasing of property within the influence area to make informed decisions.
Costs and Anticipated Funding Sources	City administrative costs for the development of informational materials and the posting of signage, estimated to be in the range of $20,000.
Effect on Existing Land Uses	Potential reduced marketability with disclosure procedures.
Effect on Property Values and Tax Base	Possible impact on market value of properties involved, although experience with appraisals within the AIA indicates that this effect is slight.
Legal Factors	Minor impacts on local governing agencies to revise current disclosure forms.
Political Acceptability	Homeowners and developers may oppose measure due to potential negative effect on marketing residential units.
Implementation Factors	Formal disclosure programs have proven difficult to implement. Additional promotion of the disclosure process should be examined through the preparation of informal brochures and presentations to local real estate agents and the public on an ongoing basis.
Responsible Parties	Ada County and the City of Boise, with coordination from BOI.
Conclusion	This measure is recommended for inclusion in the NCP.

Table 7.17

Preliminary Costs of Proposed Voluntary Acquisition Program

Acquisition Type	Eligible Dwellings	Tax Assessor Value	Relocation Estimate	Demolition Estimate	Administrative Fees Estimate	Total
Per Dwelling	-	$156,000	$25,000	$40,000	$15,000	$236,000
25% participation	26	$4,095,000	$656,250	$1,050,000	$393,750	$6,195,000

Source: HNTB, 2015.



Legend

- Airport Property
- City of Boise Limits
- 2015 DNL Noise Contour
- Vacant/Open Space Parcels Within or Adjacent to 2015 NEM DNL 65+ dB Contour
- Place of Worship
- Nursing Home
- School
- Library
- National Historic Place

Figure 7-13
Vacant/Open Space Parcels Within or Adjacent to 2015 NEM DNL 65+ dB Contour

N

0 1,000 2,000 4,000 Feet

Sources: City of Boise, Ada County, HNTB 2015

Table 7.18

Evaluation of LU-13: Voluntary Residential Property Acquisition Within or Adjacent to DNL 65+ dB Noise Exposure Contour

Description	As owners within the proposed program area sell their residential property, BOI would seek to acquire selected parcels of developed non-compatible residential land within or adjacent to properties impacted by the DNL 65+ dB contours of the 2015 NEMs for the purpose of leasing or converting the properties into compatible uses with deed restrictions and easements.
Area to which measure would be applied	Residential parcels within and adjacent to the DNL 65+ dB contour, primarily to the north of the Airport and north of I-84. Per FAA policy, the program would apply only to existing non-compatible properties within the DNL 65+ dB contour of the 2015 NEM that were constructed and occupied before October 1, 1998.
Anticipated Benefits	The measure would seek to eliminate non-compatible land uses within the DNL 65+ dB contour. The program would result in the compatible reuse of residences located within the DNL 65+ dB contour; land uses would be considered compatible with airport operations.
Costs and Anticipated Funding Sources	BOI may incur program administration and land acquisition costs. Cost of home and related property at 25% participation is estimated to be $6.2 million with an average cost of $156,000 per home. Average cost for demolition, moving and relocation per home is $25,000, which includes a 25% contingency factor. A portion of the acquisition costs may be eligible for federal funding if this measure is part of an approved Part 150 NCP, although actual funding would be dependent upon availability. The balance of funding could be provided through the airport capital budget. BOI may seek to purchase eligible homes and then apply for Federal reimbursement through the grant process.
Effect on Existing Land Uses	Homes purchased as they are available for sale through this program could be razed or converted into compatible uses with deed restrictions and easements. Fair market value would be offered for the voluntary acquisitions. It is not expected that more than 25% participation in the program would occur; therefore neighborhood cohesiveness could be affected as some parcels would become vacant. The Airport would be responsible for the maintenance of the purchased property; however the ability to re-use individual residential properties until a contiguous area is created would need to be considered. The reuse plan of parcels in this area would be included in the Airport's next Noise and Land Reuse Plan Update. The development of a transition plan or redevelopment plan may also be appropriate.
Effect on Property Values and Tax Base	Participation in the voluntary acquisition program would result in the removal of those properties from the local tax base. Properties resold for compatible use would be returned to the tax base.
Legal Factors	There are no significant legal constraints, as properties would typically be acquired through the voluntary sale of the owner. Regional FAA offices prefer that the airport sponsor secure title to or at a minimum obtain an option on the property before a grant for Federal assistance is issued.
Political Acceptability	Since the program would be voluntary and property owners would receive fair market value for their properties, little opposition would be anticipated from affected property owners; however residents that remain in the neighborhood may oppose the measure due to potential that vacant properties could remain in the neighborhood until they are converted to a compatible land use. The

Table 7.18

Evaluation of LU-13: Voluntary Residential Property Acquisition Within or Adjacent to DNL 65+ dB Noise Exposure Contour

	reuse plan of parcels in this area should be considered during the Airport's ongoing updates to its Noise and Land Reuse Plan Update. The development of a transition plan or redevelopment plan may also be appropriate.
Implementation Factors	BOI would coordinate with property owners to determine the fair market value of the selected properties and to acquire the property. BOI would pursue federal funding support. The local jurisdiction would also be consulted on the acquisition. In the past, BOI staff created a "Buy-out" program that offered appraisal, purchase and relocation expenses for interested homeowners.
Responsible Parties	BOI would be responsible for purchase and disposition of developed properties eligible for acquisition.
Conclusion	This measure is recommended for inclusion in the revised NCP, with revision to include developed residential property within and adjacent to the DNL 65+ dB contour of the 2015 NEM as defined by the proposed program area boundaries in Figure 7-12. All 105 homes would be offered participation in the voluntary acquisition program.

Table 7.19

Evaluation of LU-14: Undeveloped Property Acquisition Within or Adjacent to DNL 65+ dB Contour

Description	BOI may seek to acquire selected parcels of undeveloped land within or adjacent to the DNL 65+ dB contour of the 2015 NEM for the purpose of: • Maintaining the land as vacant; • Selling the property for development into compatible uses with deed restrictions; or • Developing the property for a compatible public use. Undeveloped land acquired would have the potential for future non-compatible use, such as residential or other noise-sensitive use.
Area to which measure would be applied	Vacant parcels with the potential for noise-sensitive development within or adjacent to the DNL 65+ dB contour of the 2015 NEM may be considered for acquisition.
Anticipated Benefits	This measure would aid in the prevention of new non-compatible development within the NEMs.
Costs and Anticipated Funding Sources	BOI may incur program administration and land acquisition costs. A portion of the acquisition costs may be eligible for federal funding if this measure is part of an approved Part 150 NCP, although actual funding would be dependent upon availability. BOI may seek to purchase eligible properties and then apply for Federal reimbursement through the grant process.
Effect on Existing Land Uses	None. Only vacant parcels would be acquired. Any vacant parcels acquired in this area should be considered during the Airport's ongoing updates to its Noise and Land Reuse Plan Update.
Effect on Property Values and Tax Base	This measure would not affect property values. Although acquired lands would be removed from the corresponding jurisdiction's tax base, only a few properties would be expected to be acquired by BOI. Also, properties resold for compatible use would be returned to the tax base.
Legal Factors	There are no significant legal constraints, as parcels would typically be acquired through the voluntary sale of the owner.
Political Acceptability	Since the program would be voluntary and property owners would receive fair market value and relocation assistance for their properties, little opposition would be anticipated from affected property owners.
Implementation Factors	BOI would coordinate with property owners to determine the fair market value of the selected parcels and to acquire the property. BOI would pursue federal funding support. The corresponding local jurisdiction would also be consulted on the acquisition.
Responsible Parties	BOI would be responsible for purchase and disposition of undeveloped properties selected for acquisition, and for maintenance of the property while under the control of BOI. Disposition of any property purchased by BOI would need to be coordinated with City of Boise purchasing staff to ensure legal guidelines (public auction, minimum bidding, etc.) are met.
Conclusion	The measure is recommended for inclusion in the NCP. This measure would continue to provide a mechanism to seek federal funds to support the acquisition of vacant parcels.

<u>LU-15</u>: Purchase of Avigation Easements

Measure LU-15 was a new measure in the 2006 NCP that would seek the purchase of easements for properties without an avigation easement. Whereas Measure LU-9 would seek to obtain easements for new construction; this new measure would seek the purchase of easements for existing properties without an avigation easement. Under this measure, for existing non-compatible properties within the DNL 65+ dB contour, BOI would seek to acquire an avigation easement from the property owner. Primarily, the intent of this measure would be to provide an alternative form of mitigation should the property owner decline to participate in the voluntary acquisition program outlined in Measure LU-13. This measure previously applied to the DNL 65+ dB of the 2009 NEM. This measure is recommended to be carried forward, as revised, to include the existing non-compatible properties of the DNL 65+ dB of the 2015 NEM, as well as the contiguous properties of the program area proposed as part of Measure LU-13, which includes several contiguous parcels in the South Hillcrest subdivision.

In the past, avigation easements have been viewed by the FAA as a means of compensating property owners for the effects of noise. The present FAA policy regarding valuation of avigation easements bases the easement value on the effect of the easement on the value of the property. In other words, the cost of the easement is intended to compensate the property owner for the additional difficulty of selling property having an avigation easement, not for the effect of noise on property. To illustrate this concept, the value of an easement could be assessed by comparing the property values for two similar properties experiencing the same level of noise aircraft; one with and one without an avigation easement. The value of the easement would be equal to the difference in property values due to the effects of the easement alone. Although there has been limited experience in the application of this policy at Boise, the value of avigation easements on existing development obtained under this policy have ranged from $500 to $1000 per residential property. This measure is evaluated in **Table 7.20**.

<u>LU-16</u>: Amend Building Permit Applications to Document and Require Compliance with Noise Level Reduction Construction Standards

This measure further supports Measure LU-10 by amending the building permit applications for Ada County and the City of Boise to require the applicant to indicate compliance with an interior noise level goal of at or below 45 dBA for noise sensitive construction areas within the AIA. This measure is not recommended for continuation. An evaluation of this measure is contained in **Table 7.21**.

Table 7.20

Evaluation of LU-15: Purchase of Avigation Easements

Description	For existing non-compatible properties within the DNL 65+ dB contours and the proposed program area (see LU-13), BOI would seek to acquire an avigation easement from the property owner. However, homes within the DNL 65+ dB contour or program area boundary of the FAA-accepted NEMs (from the 1996 study) that were constructed and first occupied after October 1, 1998, are not eligible for federal funding support.
Area to which measure would be applied	Noise-sensitive uses within the DNL 65+ dB contour of the 2015 NEM and proposed program area boundary established as part of LU-13.
Anticipated Benefits	The easements would notify property owners of the aircraft noise exposure levels and the right of aircraft overflight. The easement would also release local jurisdictions, aircraft operators, and the airport owner and operator for the effect of aircraft operations on noise-sensitive properties.
Costs and Anticipated Funding Sources	BOI would incur program administration and easement acquisition costs. Easement acquisition costs would be determined by an independent appraisal. A portion of the acquisition costs may be eligible for federal funding if this measure is part of an approved Part 150 NCP, although actual funding would be dependent upon availability. At $1000 per easement, the cost of the program for 105 homes (82 homes in DNL 65+ dB, plus 23 contiguous parcels in the proposed program area) would be $105,000. However, many residential and non-residential properties have existing avigation easements.
Effect on Existing Land Uses	This measure could apply to the homes in the DNL 65+ dB and the contiguous homes in the proposed program area if the owner is unwilling to sell their property per LU-13.
Effect on Property Values and Tax Base	An avigation easement purchased for an existing home could reduce its property value slightly.
Legal Factors	None significant. The homeowner would voluntarily agree to accept the easement in return for compensation.
Political Acceptability	Some homeowners may oppose the measure due to the potential for reduced marketability.
Implementation Factors	For existing noise sensitive properties within the DNL 65+ dB contours, BOI would coordinate with property owners to determine the appropriate purchase price for the avigation easements. BOI would pursue federal funding support.
Responsible Parties	BOI would be responsible for purchasing avigation easements for existing noise sensitive properties within the DNL 65+ dB contours.
Conclusion	This measure is recommended to be carried forward, as revised, to include existing non-compatible properties of the DNL 65+ dB of the 2015 NEM, as well as the program area proposed as part of LU-13, which includes several contiguous parcels in the South Hillcrest subdivision.

Table 7.21

Evaluation of LU-16: Amend Building Permit Applications

Description	The City of Boise and Ada County should refine their application process to require the applicant to indicate compliance with an interior noise level goal of at or below 45 dBA for noise sensitive construction areas within the AIA. This measure would help to ensure compliance with LU-10.
Area to which measure would be applied	Varying degrees of noise level reduction in correlation with the subdistricts in the AIA. Noise level reductions would vary from 25 to 35 decibels.
Anticipated Benefits	Compatibility of development within the AIA.
Costs and Anticipated Funding Sources	Adoption of this measure would require additional administrative expenses from operation budgets of Development Services within both the City of Boise and Ada County. Published standards would be required as part of the application process.
Effect on Existing Land Uses	The Standards would ensure that new development is designed to promote compatibility with the Airport. Noise level reduction measures would be required when improvements of existing properties that are located within the appropriate AIA subareas are brought before agency for permit approval.
Effect on Property Values and Tax Base	Additional construction costs needed to comply would increase assessed building value at an insignificant level, offering no significant effect on either property value or tax base.
Legal Factors	It will be necessary for local building officials to seek certification by permit holders that compliance was achieved prior to final permit sign-off by the authority having jurisdiction.
Political Acceptability	Construction of single-family residences in either the City of Boise or Ada County does not require either design professional or builder to certify home construction. Builders associated with the Building Contractors of Southwest Idaho (a dues membership association) have previously supported across the board sound insulation of 25 dB through compliance with *International Energy Code*.
Implementation Factors	The City of Boise and Ada County would need to amend their code ordinances. Public process would offer resistance from building contractors.
Responsible Parties	City of Boise, Ada County, and BOI.
Conclusion	Additional noise level reduction construction techniques have historically been defeated due to builders concerns regarding increases costs and would present a challenge to implementing this measure. However, the existing procedures that rely on the *International Energy Conservation Code* do not address noise level reduction standards, and although the code likely provides NLR values of 25 dB, it may not be sufficient for higher NLR values. Without the implementation of Measure LU-10, this measure is not applicable. However, the City or the County may implement these recommendations outside of the Airport's recommended NCP if deemed necessary. This measure is not recommended for inclusion in the NCP.

LU-17: Continue to Promote Early Recognition of AIA within All Application Processes

Measure LU-17 in the 2006 NCP was intended to improve awareness of the AIA at the time of application submittal to the City of Boise rather than at the time of the first comment review. By disclosing the AIA at the time of application submittal (earlier in the process), Measure LU-17 would reduce the administrative time involved in the application review process for the City, the County and the applicant. The current application system processes in place at the City and the County both provide sufficient review and ensure that the AIA is disclosed to the applicant. However, Measure LU-17 is revised as part of this NCP to recommend the formal notification/ disclosure (via signature or similar method) of the AIA at the time of submittal (earlier in the process) rather than at the time of the first comment review. This measure would continue to build upon measure LU-11, which establishes project review criteria, and would encourage the City of Boise to promote acknowledgement of the AIA early in the application process for new development. Applicants that are required to submit to either Boise City Planning or Building departments would benefit with early notification of encumbrances that would be required of development within the AIA. **Table 7.22** provides an evaluation of this measure.

LU-18: Maintain Airport Staff Liaison for Planning and Zoning Building Departments of both City of Boise and Ada County

This 2006 NCP measure recommended that Airport staff play a greater role in reviewing and participating in the development approval process for projects within the AIA. This measure would result in the establishment and identification of a specific airport staff position(s) responsible for communication between the Airport management and local planning agencies.

The Airport staff liaison would provide recommendations only, and would not serve as an authoritative entity. This type of position would require the Airport to reassign existing staff or retain additional staff to accommodate this measure.

Airport staff is afforded the opportunity to review development proposals and rezoning requests within the AIA of the City and the County. This measure has been implemented, and is therefore revised to maintain an airport staff liaison and to formalize the Airport staff as a recommending authority through a Letter of Agreement. A summary of this measure is provided in **Table 7.23**.

Table 7.22

Evaluation of LU-17: Continue to Promote Early Recognition of AIA within All Application Processes

Description	The City of Boise and Ada County would require formal disclosure (via signature or similar method) of the AIA at the time of application submittal to improve awareness of the AIA at time of application submittal rather than at time of first comment review.
Area to which measure would be applied	Applicants that are required to submit to either Boise City Planning or Building departments would benefit with early notification of encumbrances that would be required of development within the Airport Influence Area.
Anticipated Benefits	Improved land use compatibility.
Costs and Anticipated Funding Sources	Adoption of this measure would require administrative expenses from city and county operating budgets.
Effect on Existing Land Uses	The current process for permit submittal does offer the chance for development to occur without notification of airport authority for review. Formalization of notification/disclosure at time of permit submittal would improve that process.
Effect on Property Values and Tax Base	None.
Legal Factors	It will be necessary for local planning and zoning officials and attorneys to consult in refining ordinance and application processes.
Political Acceptability	Substantial opposition to this measure would not be expected.
Implementation Factors	The City of Boise and Ada County would need to amend their application forms, application software, and procedures on a limited basis.
Responsible Parties	City of Boise and Ada County.
Conclusion	This measure is recommended, as revised to include both the City and County to formalize notification of AIA procedures early in the application process, for inclusion in the NCP.

Table 7.23

LU-18: Maintain Airport Staff Liaison for Planning and Zoning Building Departments of Both City of Boise and Ada County

Description	Airport staff would continue to review and participate in the development approval process inside the boundaries of the AIA.
Area to which measure would be applied	Development review within designated influence areas.
Anticipated Benefits	Continued cooperation between airport staff and surrounding development staff from land use authorities.
Costs and Anticipated Funding Sources	Continuation of this measure would require administrative expenses from the Airport.
Effect on Existing Land Uses	None.
Effect on Property Values and Tax Base	None.
Legal Factors	This measure would continue to identify the airport as a recommending and not authoritative entity.
Political Acceptability	Active participation of airport staff in land planning actions would offer little conflict and has proven beneficial to the approval process.
Implementation Factors	BOI would continue to accommodate this measure.
Responsible Parties	Airport staff, City of Boise and Ada County.
Conclusion	This measure has been implemented and should be continued. It is therefore recommended for inclusion, as revised, in the NCP to maintain an Airport staff liaison and formalize the liaison as a recommending authority through a Letter of Agreement.

7.3 Evaluation of Potential New Land Use Measures

This section evaluates three new measures to determine if they would be a valuable addition to the existing land use measures currently in place at BOI. If recommended, the intent of these measures would be to enhance the overall effectiveness of the NCP.

7.3.1 Amend City of Boise Zoning Ordinance to Include Airport Influence Area Overlay District

This measure would establish a zoning overlay district to provide a formal means of implementing the AIA standards for each of the subareas. The City of Boise Zoning Ordinance[11] offers no specific guidelines pertaining to the AIA or a delineation of AIA boundaries. Section 11-05-07 – Special Purpose Overlay Districts of the zoning ordinance, specifies an “Airport Overlay Zone District” as a reserved section, but does not include the purpose, scope and land use controls of the district, nor is the AIA illustrated on the Zoning Map. Therefore, protection of airport operations has fallen to staff diligence regarding the implementation of the Comprehensive Plan and the past Part 150 studies. As Ada County has done, it is recommended that the City formally enact a zoning overlay district that would legally enforce the implementation of the AIA zones. This measure is evaluated in **Table 7.24**.

7.3.2 Part 150 Sound Insulation Program

This measure would consider the installation of sound insulation to provide noise level reduction in existing homes that are impacted by aircraft noise. The goal of this corrective measure is to alleviate the impact of aircraft noise to residents in their homes by providing indoor environments where normal activities can be enjoyed without interruption by aviation noise. The sound insulation program would fund structural modifications to residential dwellings and public buildings that would reduce the amount of noise entering the interior from the outside. Sound insulation and improvements would be made to existing homes to achieve the required 25 to 35 decibels of noise level reduction.

Primarily, the intent of this measure would be to provide an alternative form of mitigation should the property owner decline to participate in the voluntary acquisition program outlined in Measure LU-13. This measure is recommended to include the properties within the existing non-compatible properties of the DNL 65+ dB of the 2015 NEM, as well as the program area proposed as part of Measure LU-13, which includes several contiguous parcels in the South Hillcrest subdivision.

Per FAA policy under Part 150, the program would apply only to existing non-compatible properties within the DNL 65+ contours of the 2015 NEMs that were constructed and occupied before October 1998. Additionally, in accordance with FAA Order 5100.3D, *Airport Improvement Program Handbook*, a noise-impacted non-compatible structure must also have existing interior noise levels that are 45 dB or greater with the windows closed to be considered eligible for Airport Improvement Program (AIP) funding.[12] Specifically, homes that currently achieve the EPA recommendation of a maximum 45 dBA interior noise level may not be eligible, as they are already considered to provide adequate insulation from aviation noise. It should also be noted that any costs associated with bringing existing buildings up to local building codes would not be eligible for AIP funding; only the costs directly associated with sound insulation are eligible.

Additionally, eligible residential properties would be requested to accept an avigation easement in order to participate in the program. This measure is evaluated in **Table 7.25**.

7.3.3 Noise Monitoring System

BOI proposes to initiate a permanent noise monitoring system that would monitor noise levels at critical locations around the Airport. The data could be analyzed to better understand long-term trends and to identify locations or residents unusually exposed to aviation noise. The use of noise monitors may also be used to verify the existing noise exposure levels which could be determined by comparing monitoring results with present time noise exposure modeled using the noise model currently approved by the FAA.

The primary focus of the program could be to monitor commercial and military aircraft operations in noise-sensitive areas, as these aircraft represent the largest component of noise at the Airport. The noise monitoring program would track aircraft operations and allow BOI aviation staff to provide information on specific aircraft activity if complaints are registered.

Although the FAA has established criteria that must be adhered to for determining noise exposure and land use compatibility around Airports when requesting federal funding for mitigation support, a noise monitoring program would assist the Airport in identifying noise patterns or trends that could subsequently be addressed via alternate mechanisms. If this measure is approved, the Airport would be eligible to request federal funding assistance in the solicitation of a noise monitoring system. This measure is evaluated in **Table 7.26**.

Table 7.24

Evaluation of Potential Measure: Amend City of Boise Zoning Ordinance to Include Airport Influence Area Overlay Zoning District

Description	The City of Boise should amend its zoning ordinance to include an overlay zoning district that would enforce the guidelines in each of the subareas of the AIA.
Area to which measure would be applied	Current land within the AIA boundary zones in the City of Boise.
Anticipated Benefits	When established as an overlay district, the AIA standards will be legally enforceable.
Costs and Anticipated Funding Sources	This measure would require administrative expenses from the City's operating budget to draft the amended ordinance and notify the public through a public hearing, as well as mapping preparation for City presentation and final platting.
Effect on Existing Land Uses	The overlay district would ensure that new development or changes to existing development would be in compliance with the guidelines of the AIA subareas. These requirements are already implemented through Conditions of Approval by the City; however this measure would formalize the use of these guidelines.
Effect on Property Values and Tax Base	Possible impact on market value of properties in AIA, although experience with appraisals within the AIA indicates that this effect is slight.
Legal Factors	It will be necessary for local planning and zoning officials, attorneys and governing bodies to consult in developing and accepting a revised zoning ordinance.
Political Acceptability	Developers and/or property owners may oppose the measure due to the perceived potential for reducing marketability. However, public education of the property owners within the AIA should dispel much of that opposition.
Implementation Factors	The City of Boise would establish this policy by amending its zoning ordinance. The AIA, NCP or relevant parts could be adopted as part of the ordinance.
Responsible Parties	City of Boise.
Conclusion	This measure is recommended for inclusion in the NCP. This measure provides a viable mechanism for ensuring the legal enforcement of the AIA guidelines.

Table 7.25

Evaluation of Potential Measure: Part 150 Sound Insulation Program

Description	As a corrective measure, the sound insulation program would fund structural modifications to homes and noise-sensitive public buildings that would reduce the amount of noise entering the interior from the outside. The program would seek to reduce interior noise levels by utilizing a combination of structural modifications including replacement of exterior windows and doors, additional insulation, baffles, and other measures. Homes that currently achieve a maximum 45 dBA interior noise level would not be eligible.
Area to which measure would be applied	Residential dwellings and noise-sensitive public buildings located within the DNL 65+ dB of the 2015 NEM and proposed program area boundary established as part of LU-13. Per FAA policy, the program would apply only to existing non-compatible properties within the DNL 65+ contours of the 1994 NEM that were constructed and occupied before October 1, 1998. AIP eligibility is also contingent upon interior noise level being at or above 45 dB, in accordance with FAA Order 5100.38D AIP eligibility standards.
Anticipated Benefits	The measure would reduce interior noise levels and thus improve the compatibility of residential dwellings and public buildings within the DNL 65+ dB.
Costs and Anticipated Funding Sources	BOI would incur program administration and construction costs. A portion of the acquisition costs may be eligible for federal funding if this measure is part of an approved Part 150 NCP, although actual funding would be dependent upon availability. The program would include the existing non-compatible properties of the DNL 65+ dB of the 2015 NEM, as well as the contiguous properties included in the program area proposed in Measure LU-13, which includes several contiguous parcels in the South Hillcrest subdivision. Therefore approximately 112 residential dwellings are estimated to be potentially eligible for the program and one public building. At an estimated cost of $38,900 per dwelling in 2015 dollars, total program cost would approach $4.4 million. A pilot program would be needed to establish exact costs. The program would likely require involvement from a consultant with expertise in FAA approved sound insulation programs.
Effect on Existing Land Uses	There are approximately 112 homes in the 2015 NEM DNL 65+ dB and contiguous parcels of the proposed program area (LU-13) and one noise-sensitive facility (place of worship).
Effect on Property Values and Tax Base	Property values or residential properties could increase slightly due to the noise attenuation that would be provided by the program.
Legal Factors	No significant legal constraints would be expected.
Political Acceptability	When this type of program was proposed in the 1996 NCP, property owners showed little to no interest in participation of the program, as there were greater concerns over the I-84 roadway noise at the time. The program was not carried forward to the 2006 NCP. Given the current resident concerns over aviation noise, political leaders may revisit the feasibility of this type of program.
Implementation Factors	BOI would determine program guidelines and the eligibility of homes for the program. BOI would pursue federal funding support. The actual implementation of the sound insulation program could be conducted under contract with a management company.

Responsible Parties	BOI would be responsible for establishing, funding, and managing the sound insulation program.
Conclusion	This measure is recommended for inclusion in the NCP. This measure provides a viable mechanism for alleviating aircraft noise to residents within the DNL 65+ dB and proposed program boundary.

Table 7.26

Evaluation of Potential Measure: Permanent Noise Monitoring Program

Description	A noise monitoring program would continuously monitor noise levels at critical locations around the Airport. The data could be analyzed to better understand long-term noise issues and to identify locations or residents unusually exposed to repetitive or intrusive aircraft activity.
Area to which measure would be applied	Noise sensitive areas to be determined at a later date once the program is initiated.
Anticipated Benefits	A noise monitoring program would help to identify areas outside of the DNL 65+ dB contour unusually exposed to aviation noise. Once identified, BOI would work to implement effective voluntary noise abatement procedures for arriving and departing aircraft, and would work with the City and County to establish land use strategies that encourage compatible development in these areas. The monitoring system would also provide more frequent updates to noise conditions, although not in the form of DNL contours.
Costs and Anticipated Funding Sources	BOI would incur program administration costs. A portion of the program costs may be eligible for federal funding if this measure is part of an approved Part 150 NCP, although actual funding would be dependent upon availability.
Effect on Existing Land Uses	None.
Effect on Property Values and Tax Base	None.
Legal Factors	No significant legal constraints would be expected.
Political Acceptability	Depending on the number of monitors included in the proposed program a noise monitoring program could be costly for the City unless AIP funding is available. However, the ability to respond to residents about a particular noise event and the potential to provide regular noise monitoring reports may justify the costs.
Implementation Factors	The funding for the program would need to be approved by City Council. BOI would need to solicit for a consultant or vendor to develop a noise monitoring program and maintenance of the program. Once under contract, the consultant or vendor would have to research and identify the most appropriate areas for noise monitors, types of noise monitors, timing of noise monitors, etc.
Responsible Parties	BOI would be responsible for establishing, funding, and managing the noise monitoring program.
Conclusion	This measure is recommended for inclusion in the NCP.

7.4 Summary of Recommended Land Use Measures

The recommended land use element of the NCP reflects a refinement of the existing land use measures contained in the current NCP and inclusion of additional measures. The updated land use element of the NCP would contain a total of 16 measures, if accepted by the FAA. Reflecting the focus of this study on preventing future non-compatible development, while also addressing existing non-compatibilities, there are 12 preventive measures and four corrective measures.

Table 7.27 provides a summary of the recommended land use measures. Note that the table renumbers the recommended measures, as several of the zoning measures in the 2006 NCP are not recommended for inclusion in the NCP.

Preventive Measures: Measures LU-1 and LU-2 would seek to define an AIA and appropriate noise compatibility standards to prevent the development of future non-compatible land uses that could encroach upon future operations and development of the Airport. The zoning and planning measures in LU-3 through LU-5 would seek to encourage favorable trends in promoting aircraft noise and land use compatibility within the AIA. LU-7 and LU-13 would provide additional guidance to City and County staff in the implementation of zoning and planning measures.

Disclosure of aircraft noise to potential homebuyers is addressed as part of LU-9 and LU-14. Measure LU-11 encourages the acquisition of vacant property within the DNL 65+ dB contour of the 2015 NEM with the potential for non-compatible development to ensure that the property is used compatibly in the future.

The new measure LU-14 (Table 7.27) to amend the City of Boise Zoning Ordinance to include an AIA Overlay District, would enhance legal protection for the guidelines established in the AIA. New measure LU-16 (Table 7.25) would establish a noise monitoring program to continuously monitor noise levels around the airport to better understand long-term noise issues.

Corrective Measures: Measure LU-10 would encourage the acquisition of existing non-compatible development within and adjacent to the DNL 65+ dB contour of the 2015 NEM. Measures related to avigation easements contained in LU-6 and LU-11 would seek to use this mechanism as a means of disclosure and an additional mechanism of right-of-way.

New measure LU-15 (Table 7.27) would be a corrective measure if implemented, established to make structural modifications to eligible properties in order to reduce interior noise.

Overall, the recommended land use measures for the revised NCP will enable the BOI and local jurisdictions to continue to advance the goal of aircraft noise and land use compatibility.

Table 7.27

Land Use Measures Recommended for Inclusion in the NCP

Land Use Measure		Description	Action Needed or Implementation Status	NCP Update Recommendation
1	**Airport Influence Area**	The Boise Airport Commission should recommend to the City of Boise and Ada County to maintain the current Airport Influence Area boundaries until such time that noise levels require their expansion.	The AIA boundaries have not changed since the 2006 NCP in either Boise or Ada County. The City of Boise and Ada County would maintain the current AIA in their Comprehensive Plans and Municipal Codes.	This measure is recommended for inclusion in the NCP.
2	**Land Use Compatibility Standards in Airport Influence Area**	BOI, the City of Boise and Ada County should identify an Aviation Task Force to revisit and refine their land use compatibility standards and the way in which they are implemented.	The City of Boise and Ada County would work together (potentially set up a Task Force) to refine land use compatibility standards within the AIA, particularly Zone B if needed, and to work toward consistent land use designation and/or zoning classifications.	This measure is recommended for inclusion in the NCP.
3	**Commercial & Industrial Zoning in Airport Influence Area**	The City of Boise and Ada County should maintain existing commercial and industrial zoning within the Airport Influence Area.	The City of Boise and Ada County continue to work with the Airport to maintain existing zoning requirements for commercial and industrial construction within the Airport Influence Area.	This measure is recommended for inclusion in the NCP.
4	**Zone for Compatible Use in Apple Street Area**	Rezone property and land southeast of the Airport and east of Apple Street from residential to industrial.	The area remains undeveloped and the current City of Boise zoning allows for residential land uses to be built. Future land use identified in *Blueprint Boise* identifies this area as Industrial, which guides rezoning decisions.	This measure is recommended for inclusion in the NCP.
-	**Zone for Compatible Use in Gowen Road Area**	Rezone land southeast of the Airport, east of I-84 and south of East Gowen Road.	This East Columbia planned community is being planned near this area (to the east), which will encourage mixed uses, including future residential uses.	Remove from consideration.
-	**Encourage Clustered Residential Development**	Encourage clustered residential development southeast of the airport within the Airport Influence Area.	This area has been developed or subdivided as residential housing, however it is not developed as clustered.	Remove from consideration.
-	**Maintain Large Lot Residential Zoning**	Maintain existing large lot residential zoning within the Airport Influence Area.	This East Columbia planned community is being planned near this area (to the east), which will encourage mixed uses, including future residential uses.	Remove from consideration.
5	**Maintain Rural Preservation Zoning**	Maintain existing Rural Preservation (RP) zoning within the Airport Influence Area.	Maintain existing zoning for low-density development in unincorporated Ada County outside of City of Boise planning areas.	This measure is recommended, as revised, for inclusion in the NCP.

Table 7.27

Land Use Measures Recommended for Inclusion in the NCP

Land Use Measure		Description	Action Needed or Implementation Status	NCP Update Recommendation
6	**Amend Building Permit Application Process to Require Avigation Easements**	Amend building permit application process (residential and commercial) to require dedication of avigation easements.	Currently avigation easements are requested if they do not already exist during staff review of development proposals in the AIA. Process should be formalized to include dedication of avigation easements in the building permit application process.	This measure is recommended, as revised, for inclusion in the NCP.
-	**Adopt Local Building Code Amendments for NLR Construction the AIA**	Amend building codes for areas within AIA to require NLR construction in AIA.	Building codes have not been modified to include specific techniques and guidance on NLR construction techniques.	Remove from consideration.
7	**Adoption of Project Review Guidelines for the City of Boise and Ada County**	Adopt project review guidelines for rezoning special use, conditional use, planned development and variance applications.	Most land planning applications for both Ada County and City of Boise include opportunity for airport staff review. However, additional project review criteria, checklists or procedures for staff at the City and County planning departments would help guide future land use.	This measure is recommended, as revised, for inclusion in the NCP.
8	**Fair Disclosure of Noise Impacts in the AIA**	Promote fair disclosure of potential noise impacts in AIA through formal and informal means.	No formal disclosure of noise impact or AIA limits is required during the sale of property within the AIA. Informal methods of disclosure are not actively promoted. Airport would continue to work with local and state government/ real estate community to require fair disclosure statement as part of sale within AIA.	This measure is recommended for inclusion in the NCP.
9	**Voluntary Residential Property Acquisition Within and Adjacent to DNL 65+ dB Noise Exposure Contour**	As owners within the proposed program area (105 homes) want to sell their residential property, BOI would seek to acquire this non-compatible residential land within or adjacent to properties impacted by the DNL 65+ dB contours of the 2015 NEMs.	BOI would coordinate with property owners to determine the fair market value of the selected properties in the program area and to acquire the property. BOI would pursue federal funding support.	This measure is recommended, as revised, for inclusion in the NCP.
10	**Undeveloped Property Acquisition within DNL 65+ dB Contour**	Acquire undeveloped land with potential to be developed non-compatibly within DNL 65+ dB contour of 2015 NEM.	BOI would coordinate with property owners to determine the fair market value of the selected parcels and to acquire the property. BOI would pursue federal funding support.	This measure is recommended, as revised, for inclusion in the NCP.

Table 7.27

Land Use Measures Recommended for Inclusion in the NCP

Land Use Measure		Description	Action Needed or Implementation Status	NCP Update Recommendation
11	**Purchase of Avigation Easements**	Acquire avigation easement from property owners of existing residential and non-residential noise sensitive properties within the DNL 65+ dB contour.	Many homes within the AIA have existing easements; BOI would coordinate with property owners without existing easements, within the AIA, to acquire easement as a form of disclosure.	This measure is recommended, as revised, for inclusion in the NCP.
-	**Amend Building Permit Applications to Document and Require Compliance with Noise Level Reduction Construction Standards**	Amend building codes and refine application process to require applicant to indicate compliance with proposed standards for NLR construction techniques for noise sensitive construction areas within AIA.	The City of Boise and Ada County would need to amend their code ordinances. Public process would offer resistance from building contractors.	Remove from consideration.
12	**Continue to Promote Early Recognition of AIA within All Application Processes**	Improve awareness of AIA at time of application submittal rather than at first comment review.	The City of Boise and Ada County would need to amend their application forms, application software, and procedures on a limited basis.	This measure is recommended, as revised, for inclusion in the NCP.
13	**Maintain Airport Staff Liaison for Planning and Zoning Building Departments of both City of Boise and Ada County**	Airport to play a greater role in reviewing and participating in the development approval process inside the boundaries of the AIA.	BOI has implemented this measure and would continue to accommodate this staff liaison position.	This measure is recommended, as revised, for inclusion in the NCP.
14	**Amend City of Boise Zoning Ordinance to Include Airport Influence Area Overlay District**	The City of Boise should amend its zoning ordinance to include an overlay zoning district that would enforce the guidelines in each of the subareas of the AIA.	The City of Boise would establish this policy by amending its zoning ordinance. The AIA, NCP or relevant parts could be adopted as part of the ordinance.	New measure, recommended for inclusion in the NCP.
15	**Implement a Sound Insulation Program**	Implement a program to fund structural modifications to homes and noise-sensitive public buildings that would reduce the amount of noise entering the interior from the outside.	If approved by FAA, City Council would have to approve funding for the program. BOI would determine program guidelines and eligibility and pursue federal funding support. Actual implementation could be conducted under contract with a management company.	New measure, recommended for inclusion in the NCP.
16	**Initiate a Noise Monitoring System**	Initiate the development of a system to monitor noise levels at critical locations around the Airport to analyze and understand long-term noise issues.	If approved by FAA, City Council would have to approve funding for the program. BOI would likely need to solicit for a consultant or vendor to establish and manage the noise monitoring program.	New measure, recommended for inclusion in the NCP.

Endnotes

[1] Areas of City Impact (or future city planning areas) are the unincorporated areas surrounding existing cities where future development, annexation or incorporation is anticipated to occur. Impact boundary adjustments are made by mutual agreement between the affected jurisdiction and the County.

[2] City of Boise, *Blueprint Boise*, 2011, p. 3-2.

[3] Ada County Comprehensive Plan Future Land Use Map, https://adacounty.id.gov/Portals/0/DVS/PLN/Doc/Comprehensive%20Plan%20Map.pdf, April 2012.

[4] City of Boise, *Blueprint Boise,* 2011, p. 3-53.

[5] 40 homes was calculated through analysis of residential acreage within the DNL 65+ dB contour of the 2009 NEM, divided by the average number of housing units per acre in the 2000 U.S. Census.

[6] None of the land within Zone B-1 of the AIA remains within Ada County, and only approximately 220 acres of Zone C remain in Ada County due to City annexation of property around the Airport.

[7] New dwellings and/or new residential subdivisions are prohibited within Zone "B" unless the subject property is designated for a residential land use in the Comprehensive Plan and increases in residential density are not permitted.

[8] New dwellings and/or new residential subdivisions are prohibited within Zone "B" unless the subject property is designated for a residential land use in the Comprehensive Plan and increases in residential density are not permitted.

[9] Ada County Assessor, http://www.adacountyassessor.org/adamaps/, accessed 6/30/15.

[11] City of Boise, Boise City Code Title 11, March 2013.

[12] Federal Aviation Administration, Order 5100.38D, *Airport Improvement Program Handbook*, September 30, 2014, http://www.faa.gov/airports/aip/aip_handbook/media/AIP-Handbook-Order-5100-38D.pdf (accessed 10/9/15).

Chapter Eight
NOISE COMPATIBILITY PROGRAM

This chapter summarizes the measures recommended for inclusion in the NCP. Section 8.1 introduces continuing program measures that could serve to enhance the recommended noise abatement and land use measures. Section 8.2 reviews the cumulative recommended NCP and implementation procedures.

8.1 Continuing Program Measures

Continuing program measures may be useful for implementing and evaluating the recommended noise abatement and land use measures. They can also serve to enhance community and airport dialogue regarding aviation noise, improve public understanding of aviation noise, and provide ongoing evaluation of noise generated from aircraft flight operations. **Table 8.1** discusses and evaluates the continuing program measures considered at BOI. All of the continuing program measures are recommended for inclusion in the NCP. Note that the program management measures included in the 2006 NCP are integrated into the proposed continuing program measures; as such, the program management measures are not specifically re-evaluated in this study.

8.2 Recommended Noise Compatibility Program

As discussed in Section 1.4, the City of Boise had overall responsibility for the conduct of the Part 150 Study Update, including ultimate responsibility for the recommendation of measures for inclusion in the NCP. *All of the final NCP measures that this document proposes for implementation are recommendations of the Boise Airport (BOI), as a department of the City of Boise.* The land use measures and continuing program measures from the 2006 NCP were re-evaluated for applicability, and removed, revised or carried forward as appropriate. Three new potential measures were also evaluated and recommended. No new noise abatement measures were considered in this study.

Section 8.2.1 summarizes the noise abatement, land use and continuing program measures that the BOI proposes for inclusion in the NCP. Section 8.2.2 summarizes NCP implementation and related requirements.

8.2.1 Recommended Measures

The recommended noise abatement measures would continue existing operational procedures at BOI that provide benefit to neighboring communities and maintain the Airport's limited number of impacted residents within the DNL 65+ dB noise contours. The proposed land use element includes corrective measures to address currently non-compatible land uses, while the preventive measures will serve to deter future non-compatibility. The NCP for BOI includes 28 measures: seven (7) noise abatement measures, 16 land use measures, and five (5) continuing program measures. Chapters Six and Seven present the analyses that led to the selection of the noise abatement and land use measures, respectively.

Table 8.1

Continuing Program (CP) Measures

Measure	Description	Costs and Implementation Responsibility
CP-1. Noise Complaint System	BOI would continue to maintain an appropriate system for receiving and responding to noise complaints. Complaints should continue to be recorded on forms designed for that purpose. A summary report should be compiled as needed and provided to the Airport Commission at least annually.	Administrative costs are the responsibility of BOI.
CP-2. Public Information Program	Develop and maintain a program to increase public awareness of aircraft noise exposure issues and provide input concerning the implementation of the NCP. The program would potentially include a NCP website, quarterly newsletters, and public meetings as needed.	Administrative costs are the responsibility of BOI.
CP-3. Airport Noise Committee	As an extension of the public information program, regular (e.g., semi-annually or quarterly) meetings between Airport staff and representatives of local governments, citizen groups, neighborhood associations, aeronautical users, etc. would serve to enhance communication between the airport and neighboring communities.	Administrative costs are the responsibility of BOI.
CP-4. Aircraft Noise Relations Staff	BOI would continue to designate one or multiple staff positions with the responsibilities of monitoring aircraft noise and land use compatibility issues. Responsibilities of these staff positions would continue to include coordination of the implementation of the recommended NCP measures, especially the implementation of the land use measures with the local jurisdictions; coordination with airport users and the ATCT to ensure that the noise abatement measures are adequately noticed and followed to the extent practical; coordination of and response to community concerns regarding aircraft noise and noise complaints (as identified in CP-1 and CP-2), including coordination with other airport users such as the FBOs and Idaho ANG; and ongoing monitoring and management of the continuing program measures (including CP- 5).	Staffing costs and implementation is responsibility of BOI.
CP-5. Periodic Evaluation of Noise Exposure	BOI would analyze aircraft operations on a periodic basis (e.g. yearly) to determine if significant changes in operations at BOI have occurred, and if the NEMs would need to be updated accordingly.	Costs for updating the NEMs would be eligible for federal funds; costs not eligible for federal funding would be the responsibility of BOI.

8.2.1.1 Recommended Noise Abatement Measures

Noise Abatement Measure 1 – Designate Runways 10L and 10R as the preferential flow for departing aircraft; Runways 28L and 28R as the preferential flow for arriving aircraft, per the discretion of the BOI ATCT. Designate Runway 10R/28L as the primary arrival runway, and Runway 10L/28R as the primary departure runway. *[No change to the existing measure.]*

Noise Abatement Measure 2 – Continue directing jet departures from Runways 28L/28R to maintain runway heading until reaching 5,000' MSL before turning north. This directs the larger aircraft south of a concentrated residential neighborhood before turning north and minimizes low overflight of dense residential areas. *[No change to the existing measure.]*

Noise Abatement Measure 3 – Continue directing non-jet aircraft over 12,500 pounds with destination headings to the north to fly runway heading 4,500' MSL before turning. This procedure helps prevent propeller aircraft over 12,500 pounds from overflight of dense residential areas. *[No change to the existing measure.]*

Noise Abatement Measure 4 – Continue directing VFR departures with destination headings to the north to fly runway heading to the end of the runway before turning. This procedure helps prevent aircraft from overflying dense residential development close to the runway. *[No change to the existing measure.]*

Noise Abatement Measure 5 – Direct north and northwest bound turbojet departures from Runways 10L/R to fly runway heading to 5,000' MSL before turning north. This procedure helps prevent turbojet aircraft from overflying dense residential development. *[No change to the existing measure.]*

Noise Abatement Measure 6 – Establish the Distant NADP as the recommended NADP for all runway ends. This measure applies to jet aircraft with a maximum takeoff weight greater than 75,000 pounds. For lighter jet aircraft, the continued use of the NBAA noise abatement departure procedures is encouraged. *[No change to the existing measure.]*

Noise Abatement Measure 7 – Encourage ATCT to voluntarily route aircraft on the visual approach to Runways 28L and 28R at 5,000' MSL until the aircraft begins final approach. This increase in the altitude of some arriving aircraft by 500' could provide single-event noise level reduction during periods of low traffic demand when the ATCT has increased flexibility in directing air traffic. *[No change to the existing measure.]*

8.2.1.2 Recommended Land Use Measures

Land Use Measure 1 – Airport Influence Area: The Boise Airport Commission should recommend to the City of Boise and Ada County to maintain the current AIA boundaries until such time that noise levels require their expansion. *[No change to the existing measure.]*

Land Use Measure 2 – Land Use Compatibility Standards in AIA: This measure would refine land use compatibility standards within the AIA. *[The proposed measure revises the existing measure to emphasize development of an Aviation Task Force to determine if refinement is needed, and excludes proposed revisions to the Zone B-1 boundary.]*

Land Use Measure 3 – Commercial & Industrial Zoning in AIA: The City of Boise and Ada County maintain existing commercial and industrial zoning within the Airport Influence Area. *[No change to the existing measure.]*

Land Use Measure 4 – Zone for Compatible Use in Apple Street Area: Rezone property and land southeast of the airport and east of Apple Street from residential to industrial. *[No change to the existing measure.]*

Land Use Measure 5 – Maintain Rural Preservation Zoning: Maintain existing Rural Preservation zoning within the AIA. *[The proposed measure revises the boundary of the 2006 NCP measure to include primarily areas zoned RP in Ada County; the proposed measure removes the northern part of the measure in the Boise AOCI, intended for Industrial and Planned Community in the Blueprint Boise future land use map.]*

Land Use Measure 6 – Amend Building Permit Application Process to Require Avigation Easements: Amend current building permit regulations in the City of Boise to require dedication of avigation easements within the AIA. *[The proposed measure would revise the existing measure to formalize the inclusion of avigation easements in the building permit application process in the City of Boise.]*

Land Use Measure 7 – Adoption of Project Review Guidelines for the City of Boise and Ada County: Adopt project review guidelines for rezoning, special use, conditional use, planned development and variance applications. *[The proposed measure is revised to include applicable guidelines and to formalize the Airport's role as a reviewing authority.]*

Land Use Measure 8 – Fair Disclosure of Noise Impacts in the AIA: Promote means of providing the fair disclosure of potential noise impacts in the Airport Influence Area. *[No change to existing measure.]*

Land Use Measure 9 – Voluntary Residential Property Acquisition Within and Adjacent to DNL 65+ dB Contour: Acquire 105 existing homes within the DNL 65+ dB contour of the 2015 NEM. *[The proposed measure would revise the existing measure per the 2015 NEM to include 105 homes to be offered voluntary participation as part of a recommended Program Area].*

Land Use Measure 10 – Undeveloped Property Acquisition within DNL 65+ dB Contour: Acquire undeveloped land with potential for non-compatible development within the DNL 65+ dB contour of the 2015 NEM. *[The proposed measure revises the existing measure to include the DNL 65+ dB contour from the 2015 NEM.]*

Land Use Measure 11 – Purchase of Avigation Easements: For selected developed non-compatible properties within the DNL 65+ dB contour of the 2015 NEM, the airport could pursue acquisition of avigation easements. *[The proposed measure revises the existing measure to include the DNL 65+ dB contour from the 2015 NEM.]*

Land Use Measure 12 – Continue to Promote Early Recognition of AIA within All Application Processes: The City of Boise could improve awareness of Airport influence areas at time of application submittal rather than at time of first comment review. *[The proposed measure is revised to include both the City and County to formalize notification of AIA procedures early in the application process.]*

Land Use Measure 13 – Maintain Airport Staff Liaison for Planning and Zoning and Building Departments of both City of Boise and Ada County: Airport staff role should be maintained in reviewing and participating in the development approval process inside the boundaries of the Airport Influence Area. *[The proposed measure is revised to maintain an Airport staff liaison and formalize the liaison as a recommending authority through a Letter of Agreement.]*

Land Use Measure 14 – Amend City of Boise Zoning Ordinance to Include AIA Overlay Zoning District: The City of Boise should amend its zoning ordinance to include an overlay zoning district that would enforce the guidelines in each of the subareas of the AIA. *[New measure.]*

Land Use Measure 15 – Implement a Sound Insulation Program: BOI would initiate a program to fund structural modifications to residential dwellings and public buildings within the DNL 65+ dB and proposed program area that would reduce the amount of noise entering the interior from the outside. *[New measure.]*

Land Use Measure 16 – Initiate a Noise Monitoring System: BOI would initiate a program to continuously monitor noise levels at critical locations around the Airport to help identify locations or residents with unusual exposure to aviation noise. *[New measure.]*

8.2.1.3 Continuing Program Measures

Continuing Program Measure 1 – Noise Complaint System: BOI would maintain a system for recording and disseminating information on noise complaints. *[No change to the existing measure.]*

Continuing Program Measure 2 – Public Information Program: This measure would establish a program to enhance public awareness of aircraft noise issues and the NCP. *[No change to the existing measure.]*

Continuing Program Measure 3 – Airport Noise Committee: This measure would establish a standing committee to encourage dialogue between community representatives, aeronautical users, and BOI. *[No change to the existing measure.]*

Continuing Program Measure 4 – Airport Noise Relations Staff: BOI would continue to designate one or multiple staff positions with responsibility for implementation of the NCP measures, coordination with the City of Boise and Ada County, and communication with neighboring communities. *[The proposed measure is revised to maintain or expand the staff positions with responsibilities of monitoring aircraft noise and land use compatibility issues.]*

Continuing Program Measure 5 – Periodic Evaluation of Noise Exposure: This evaluation would serve to update the NEMs. *[No change to the existing measure.]*

8.2.2 NCP Implementation

Part 150 details extensive requirements related to NCP implementation, including:

- Identification of the time period covered by the program.
- Identification of parties responsible for implementation of each program element.
- Indication that responsible parties have agreed to implement the measure.
- Schedule for implementation of the program.

- Essential government actions.
- Anticipated funding sources.

Table 8.2 summarizes implementation details for each proposed element of the NCP.

8.2.2.1 Time Period Covered by the Noise Exposure Maps

In the absence of unanticipated changes in forecast conditions, the NEMs would typically cover a period of five years from the date of submission. The NCP would remain valid until revised in a subsequent NCP update.

8.2.2.2 Implementation Responsibility

Part 150 requires that the NCP clearly identify the agency(-ies) responsible for implementing each recommended element.

According to the FAA's definition of implementation responsibility[1], the City of Boise, as airport operator, must initiate the implementation of all noise abatement measures. Clearly, however, the FAA and ATC have key roles in the implementation of aircraft operational measures. Since the FAA is responsible for air traffic control, it must develop and provide instructions to pilots related to preferred runway use and noise abatement flight tracks. Both air carriers and pilots have supporting roles in the implementation of aircraft operational measures, as they must support and comply with noise abatement procedures, consistent with the safe operation of aircraft.

BOI and local governments share responsibility for the implementation of land use measures. BOI will seek assistance from local governments in the publicity and administration of land use measures. Local jurisdictions are responsible for the implementation and enforcement of land use controls. The FAA is involved in the implementation of land use measures through program approval and funding assistance.

BOI has the lead responsibility for continuing program measures. The FAA may assist by providing funding and in ongoing program review.

Local governments would assist in ongoing program review.

8.2.2.3 Indication of Agreement to Implement

As the lead agency in the implementation of all measures, BOI agrees to its responsibilities. Through airport staff, the consulting team members have discussed the proposed NCP elements with the FAA and local government representatives.

8.2.2.4 Further Environmental Review

Federal or local regulations may require environmental review prior to the implementation of some NCP measures (e.g., implementation of a Federal action and/or potential for environmental impacts). BOI will not initiate the implementation of any measure until it, the FAA, or other responsible agency has satisfied any such requirements.

In particular, the FAA may approve some noise abatement measures "subject to environmental review" per the National Environmental Policy Act, as described in FAA Order 1050.1E Policies and Procedures for Considering Environmental Impacts. The FAA will determine environmental review requirements when an official FAA "action" is contemplated.

Table 8.2

Implementation Summary of NCP

Proposed Measure	Implementation Actions and Responsible Parties	Anticipated Costs and Funding Sources	Anticipated Schedule
Noise Abatement Measures			
NA-1: Preferential Runway Use	BOI would request amendment of ATCT standard operating procedures to include alternative flight procedures. FAA reviews, approves, and implements.	BOI and FAA administrative costs.	Currently in place.
NA-2: Departure Turn Altitudes	BOI would request amendment of ATCT standard operating procedures to include alternative flight procedures. FAA reviews, approves, and implements.	BOI and FAA administrative costs.	Currently in place.
NA-3: Departure Turn Altitudes	BOI to coordinate with ATCT on the continued use of the measure.	BOI and FAA administrative costs.	Currently in place.
NA-4: Departure Turn Altitudes	BOI to coordinate with ATCT on the continued use of the measure.	BOI and FAA administrative costs.	Currently in place.
NA-5: Departure Turn Altitudes	BOI to coordinate with ATCT on the continued use of the measure.	BOI and FAA administrative costs.	Currently in place.
NA-6: Distant Noise Abatement Departure Profile	BOI coordinates with airlines to ensure implementation of the Distant NADP.	BOI administrative costs.	Distant NADP already in use at BOI.
NA-7: Visual Approach Arrival Altitudes	BOI would request amendment of ATCT standard operating procedures to include alternative flight procedures. FAA reviews, approves, and implements.	BOI and FAA administrative costs.	Promote use when conditions allow.

Table 8.2

Implementation Summary of NCP

Proposed Measure	Implementation Actions and Responsible Parties	Anticipated Costs and Funding Sources	Anticipated Schedule
Land Use Measures			
LU-1: Airport Influence Area	The City of Boise and Ada County would be responsible for maintaining the current Airport Influence Area boundaries, with support from the BOI Commission.	Jurisdiction administrative costs.	Currently in place.
LU-2: Land Use Compatibility Standards in Airport Influence Area	The City of Boise and Ada County would be responsible for determining if task force is needed and establishing the task force, with BOI support.	Jurisdiction administrative costs.	Upon local approval.
LU-3: Commercial & Industrial Zoning in Airport Influence Area	The City of Boise and Ada County would be responsible for maintaining existing zoning.	Jurisdiction administrative costs.	Upon local approval.
LU-4: Zone for Compatible Use in Apple Street Area	The City of Boise would be responsible for the zoning amendments.	Jurisdiction administrative costs.	Upon local approval.
LU-5: Maintain Rural Preservation Zoning	Ada County would be responsible for maintaining existing zoning in the County (excluding areas in AOCI and East Columbia planning boundary).	Jurisdiction administrative costs.	Upon local approval.
LU-6: Amend Building Permit Application Process to Require Avigation Easements	Ada County already has measure in place. The City of Boise would need to formalize the building permit process to include dedication of avigation easements.	Jurisdiction administrative costs.	Upon local approval.

Table 8.2

Implementation Summary of NCP

Proposed Measure	Implementation Actions and Responsible Parties	Anticipated Costs and Funding Sources	Anticipated Schedule
LU-7: Adoption of Project Review Guidelines for the City of Boise and Ada County	The City of Boise and Ada County would be responsible for ensuring use of project review guidelines and enhancing processes where possible, and coordinating with BOI.	Jurisdiction administrative costs.	Upon local approval.
LU-8: Fair Disclosure of Noise Impacts in the AIA	Ada County and the City of Boise, with coordination from the BOI and the local Board of Realtors.	Jurisdiction administrative costs.	Upon local approval.
LU-9: Voluntary Residential Property Acquisition Within and Adjacent to DNL 65+ dB Noise Exposure Contour	BOI in consultation with local jurisdictions.	FAA AIP and BOI funds.	Process initiated after NCP approval.
LU-10: Undeveloped Property Acquisition within 65+ DNL Contour	BOI in consultation with local jurisdictions.	FAA AIP and BOI funds.	Process initiated after NCP approval
LU-11: Purchase of Avigation Easements	BOI in consultation with local jurisdictions.	FAA AIP and BOI funds.	Process initiated after NCP approval.
LU-12: Continue to Promote Early Recognition of AIA within All Application Processes	The City of Boise would be responsible for amending project application process.	Jurisdiction administrative costs.	Upon local approval.
LU-13: Maintain Airport Staff Liaison for Planning and Zoning Building Departments of both City of Boise and Ada County	BOI would be responsible for maintaining a staff liaison.	Boise administrative costs.	Currently in place.
LU-14: Amend City of Boise Zoning Ordinance to Include Airport Influence Area Overlay District	The City of Boise and Ada County would be responsible for amending their zoning ordinance.	Jurisdiction administrative costs.	Upon local approval.
LU-15: Implement a Sound Insulation	BOI would determine program guidelines and	FAA AIP and BOI	Upon local approval.

Table 8.2

Implementation Summary of NCP

Proposed Measure	Implementation Actions and Responsible Parties	Anticipated Costs and Funding Sources	Anticipated Schedule
Program	program eligibility. Implementation of the program could be conducted under contract with a management company.	funds.	
LU-16: Initiate a Noise Monitoring System	BOI would solicit a consultant or vendor to establish and manage the program. Once under contract, locations of monitors would be determined.	FAA AIP and BOI funds.	Upon local approval.
Continuing Program Measures			
CP-1: Noise Complaint System	BOI would implement measure.	BOI administrative costs.	Currently in place.
CP-2: Public Information Program	BOI would implement measure.	BOI administrative costs.	Initiate following NCP approval.
CP-3: Airport Noise Committee	BOI would implement measure.	BOI administrative costs.	Initiate following NCP approval.
CP-4: Aircraft Noise Relations Staff	BOI would implement measure.	BOI administrative costs.	Currently in place.
CP-5: Periodic Evaluation of Noise Exposure	BOI would implement measure.	FAA grant and BOI funds.	Initiate process following NCP approval at such time that operations or procedures significantly change at BOI.

References

[1] As set forth in FAA Advisory Circular (AC) 150/5020-1, “Noise Control and Compatibility Planning for Airports”, August 5, 1982.

Chapter Nine
RECORD OF CONSULTATION

The public consultation program for the Boise Airport (BOI) Part 150 Study Update was developed in accordance with the public consultation requirements contained in 14 CFR Part 150 Subpart B, Development of Noise Exposure Maps (NEMs) and Noise Compatibility Programs (NCPs). The opportunity for comment on the NEMs and NCP was afforded through availability of the draft study online at the Boise Airport website and via the availability of hard copies at the BOI Offices (3201 Airport Way, Suite 1000) and the Boise Downtown Library (715 S. Capitol Blvd.). Written comments on the draft study were requested and are included in ***Appendix D, Record of Consultation***. This chapter summarizes the public consultation process undertaken for this study, including a summary of the comments received on the study.

9.1 Local Jurisdictions

City of Boise Planning and Development Services

The Part 150 Study Team coordinated with planners from the City of Boise Planning and Development Services Department (PDSD) on several occasions, including in-person meetings and phone and email communication.

The Part 150 Study Team met with PDSD staff on November 18, 2014 and June 3, 2015, and corresponded via email and phone during the development of the Draft Study.

The planning staff provided land use and other GIS data, reviewed and commented on the existing land use mapping for the study, helped to identify development trends in the City of Boise, and provided input regarding the implementation status of the 2006 NCP land use measures.

During the initial meeting with the PDSD, the planning staff provided input regarding the existing and future land use map development, as well as input regarding development trends, small area plans, and other future development planning ongoing in the City. The City provided input related to the existing and future plans for areas of the City as they relate to the current land use measures, particularly the zoning measures. Additionally, PDSD staff was provided with a draft Generalized Existing Land Use Map in early 2015 prior to the development of the draft NEMs to ensure general accuracy of land uses identified on the map

The PDSD was also provided the opportunity to review the recommended land use measures in the NCP in order to provide comments. The input received was incorporated into the development of the Draft Part 150 Study Update document. For example, the Planning and Development Services Department provided additional information and the planning boundaries for the East Columbia planning area to assist in discussion of the relevant land use measures included in the NCP.

Ada County Development Services

The Part 150 Study Team also coordinated with the Ada County Development Services Department on several occasions, including in-person meetings and phone and email communication. The County provided assistance in the discussion of the status of implementation, as well as current and future development trends in the County.

The County also reviewed a draft Existing Generalized Land Use Map to ensure general accuracy of the map in early 2015 prior to the development of the draft NEMs. The County was also provided the opportunity to review the recommended land use measures in the NCP in order to provide comments. Comments received regarding the proposed land use measures were incorporated into the development of the Draft Part 150 Study Update document.

Meetings were held with the Ada County Development Services staff on November 18, 2014 and June 3, 2015, and email communication regarding the land use measures included in the Part 150 Study occurred prior to the publication of the Draft Study.

9.2 Public Open Houses

Three public open houses were held for the Part 150 Study Update. The first public open house provided an update on the study and provided an opportunity to comment on the draft NEMs; the subsequent public open house was held following the publication of the Draft Part 150 Study in order to allow the opportunity for comment on the study findings and recommendations. The third Open House focused on resident concerns related to the potential future noise impacts if the F-15E aircraft replaces the A-10 fleet at Gowen Field when it is retired.

Each open house included a PowerPoint presentation, study handout, and display boards, and provided an opportunity for the public to discuss the project with the Airport staff and Part 150 Study Team.

Open House Notification

Notification for the open houses included newspaper ads in the weeks prior to the open houses. For the first two open houses, a legal notice in the *Idaho Statesman* was advertised one week prior to each meeting, and a general ad in the "News" section of the *Idaho Statesman* was advertised two weeks prior to each meeting. Email notifications were also sent with notice of the open houses and publication of the Draft Part 150 Study Update to stakeholders including City, County and State officials, airport users, agencies, nearby neighborhood associations, previous public meeting attendees, and the media.

The third open house was advertised through a legal ad and display ad in the *Idaho Statesman* and via multiple media outlets, including social media, the Airport website, and multiple news and radio stations. Notification materials are included in *Appendix D*.

Open House #1, June 3, 2015 – The first public open house was held at Boise Airport in the Boise River Conference Room on June 3, 2015 from 4:00 p.m. to 6:00 p.m., in order to provide the public the opportunity to discuss the draft NEMs and NCP with project team members and provides comments. The open house project materials and presentation provided an overview of the existing (2015) and potential future (2020) NEMs and provided an overview of the Part 150 Study Update process. The public had the opportunity to review the draft NEMs with Airport staff and the Study Team. Attendees were also encouraged to provide written comments related to the study and/or the draft NEMs.

The Part 150 Study Team members staffed stations with information and displays on the study. According to the sign-in list, 11 people attended the first open house. One person submitted written comments via email following the first open house and request for comments. *Appendix D* contains a description of the comments received.

Open House #2, September 2, 2015 – The second public open house was held September 2, 2015 from 4:00 p.m. to 6:00 p.m. at Boise Airport to discuss the Draft Part 150 Study Update document, including the recommended NCP. The open house project materials and presentation focused primarily on identification of previously approved noise abatement measures and updated land use and continuing program measures necessary to maintain or enhance compatible land use in the areas and communities surrounding BOI. The public had the opportunity to review the display board information, including the NEMs and NCP, with Airport staff and the Study Team. Prior to the meeting, the draft document was made available for public comment on August 26. Attendees were encouraged to provide written comments related to the Draft Study findings, including the NEMs and NCP. Thirteen (13) members of the public attended the second open house.

Open House #3, October 6, 2015 – The third public open house was held October 6, 2015 from 5:00 p.m. to 7:00 p.m. at Boise Airport to discuss the Draft Study; this open house focused on resident concerns with the potential future noise exposure related to the F-15E fleet that is modeled in the 2020 NEM. The public had the opportunity to review the display board information with Airport staff. Eighty-five (85) residents attended the Open House. Attendees were encouraged to provide written comments.

Local news station KBOI News Channel 2 provided local news coverage of all of the open houses and provided a link to the Part 150 Study information on the KBOI News Channel 2 website.

9.3 Publication of the Draft Part 150 Study Update

The Draft Part 150 Study Update was made available for public comment on August 26, 2015 on the Boise Airport website (www.iflyboise.com) and in hard copy at the Boise Airport offices and the Downtown Library through September 28, 2015. The comment period was extended through November 13, 2015, in response to requests received from the public.

9.4 Airport Commission

The status and findings of the ongoing Part 150 Study Update were provided to the Boise Airport Commission at their monthly Commission Meeting on June 4, 2015. The Commission was provided an opportunity to comment on the study, as well as review the Draft 2015 and 2020 NEMs. The same materials were provided to the Commission as were available at the June 3, 2015 Public Open House. The Airport Commission was briefed on the Study a second time at their monthly Commission Meeting on September 3, 2015. Discussion items included a brief overview of the project status and NCP, a review of the previously presented NEMs, and highlighted the recommended land use measures for the NCP. The abbreviated PowerPoint presentation provided to the Commission is included in *Appendix D*. The Commission meetings are open to the public.

9.5 Airport Stakeholders

As indicated in Chapters Two and Three, the draft NEMs reflect information collected from the FAA and Airport stakeholders. Because of the key role that the Idaho Air National Guard provides, and the close coordination between the Part 150 Study Team and the Idaho ANG in the development of the NEMs, the Part 150 Study Team presented study findings to Idaho ANG leadership on June 4, 2015.

9.6 Additional Coordination

School Districts

In addition to the public open houses and availability of the draft study for review and comment, scoping letters were sent to the local public school districts (West Ada School District and Boise Independent School District) to inform them of the study, to request any feedback they may have about the existing (2015) and future (2020) NEMs, and inform them of the second open house. Copies of the distributed materials are included in *Appendix D*.

COMPASS

The Community Planning Association of Southwest Idaho (COMPASS), the metropolitan planning organization (MPO) for Ada and Canyon counties in Idaho, met with the Part 150 Study Team on November 17, 2014. COMPASS planners provided information for the Part 150 Study related to Ada County's overall development trends and planning in the region as it relates to transportation and land use.

9.7 Summary of Written Comments

Eighty-five (85) written comments were received following the publication of the Draft Part 150 Study Update. Appendix D contains the comments received, along with responses to the individual comments. Most of the comments included more than one topic. One comment included multiple signatures with request to change their subdivision's future land use designation; one comment included a petition with 40 signatures opposing F-15's and F-35's coming to BOI; and one comment included a resident-generated survey.

The majority of comments were related to opposition to military jets, particularly F-15's or F-35's coming to Boise Airport.

A breakdown of the comment topics is provided in **Table 9.1**. Individual responses to comments received on the Draft Part 150 Study are included in *Appendix D*.

Table 9.1
Comment Summary

Comment Topic	No. of Comments on Topic
Oppose military jets coming to BOI	53
Public Outreach Efforts	29
Methodology	23
Jets should be located at Mountain Home AFB	20
Temporary F-15 Noise in August	13
Land Use Questions or Request for Changes	12
Property Values	10
In favor / No issue with military jets	5
Environmental Concerns (e.g., wildlife, schools)	5
Voluntary Acquisition Program	3
Other	7

**Note that the table includes the number of comments on each particular topic, and therefore does not equal the number of commenters (85).*

9.8 Public Hearing

A public hearing was held on Wednesday, December 9, 2015 at Boise Airport in the Salmon River Conference Room from 5:30 to 7:30 p.m. to formally accept verbal comments regarding study recommendations. All comments from the public hearing were transcribed and are included, along with notice of the public hearing, in ***Appendix E, Public Hearing***. Written comments received at the public hearing are also included in Appendix E, along with responses to the comments.

Comments received at the public hearing are similar in nature to the comments received during the Draft Part 150 Study comment period. The majority of comments were related to opposition to military jets coming to Boise Airport, and request to analyze a new third runway in the Part 150 Study.

APPENDIX A

Record of Approval for the 2006 NCP

RECORD OF APPROVAL

FEDERAL AVIATION REGULATION PART 150
NOISE COMPATIBILITY PROGRAM

BOISE AIRPORT
BOISE, IDAHO

INTRODUCTION

The Noise Compatibility Program (NCP) for Boise Airport (BOI) includes measures to abate aircraft noise, control land development, mitigate the impact of noise on non-compatible land uses, and implement and update the program. Federal Aviation Regulation (FAR) Part 150 requires that the Noise Exposure Map (NEM) contour apply to a period of no less than five years into the future, although it may apply to a longer period if the sponsor so desires. The airport sponsor has requested that the program measures be applied to the 2009 NEM (Figure 5-2) because it covers a larger area for potential mitigation.

The objective of the noise compatibility planning process has been to improve the compatibility between aircraft operations and noise-sensitive land uses in the area, while allowing the airport to continue to serve its role in the community, state, and nation. The approval actions listed herein include all those that the airport sponsor recommends be taken by the Federal Aviation Administration (FAA). It should be noted that the 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. Subsequent decisions concerning possible implementation of these actions may be subject to applicable environmental procedures or aeronautical study requirements.

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

The Airport sponsor has certified that the existing conditions shown in the 2003 NEM and the future 2008 NEM that were presented at the public hearing are representative of the 2004 and 2009 NEMs included in the submittal. At the time the FAA initiated its review of the NCP (mid-2005), we reaffirmed the NEMs continued to be representative of conditions at the airport for the existing and forecast year timeframes.

PROGRAM ELEMENTS A complete summary of the recommended program elements can be found in Chapter Eight of the Part 150 Update. Many of the program elements from the existing 1996 NCP were reevaluated for inclusion in this NCP update. The 1996 NCP was approved in 1997. Some of the existing measures have been slightly modified and are so noted. For reference, the complete 1997 Record of Approval for the existing program is in Appendix A of the document.

NOISE ABATEMENT MEASURES

Noise Abatement Measure 1 – Preferential Runway Use: . *[This measure would revise the existing measure to include designation of preferential arrival flow, and designation of north and south parallel runways as preferential for arrivals and departures, respectively.]* This measure would designate Runways 10L and 10R as the preferential flow for departing aircraft; Runways 28L and 28R as the preferential flow for arriving aircraft, per the discretion of the Boise Air Traffic Control Tower (ATCT). During either the east or west flow, the north parallel runway (10R/28L) would be designated as the primary arrival runway, and the south parallel runway (10L/28R) as the primary departure runway, 6-5 through 6-9, including Table 6.5 and Figures 6-1, 6-2 and 6-3. Also included in Table 6.14.

FAA Determination: Approved as a voluntary measure only as air traffic, weather and airspace safety and efficiency permit. Publication in the standard operating procedures (SOP) must not be construed as a mandatory procedure for noise abatement purposes. The Tower can select runways and procedures that maximize the efficiency of air traffic flow at all times; noise abatement procedures are voluntary and may be used when operating conditions. permit

Noise Abatement Measure 2 – Departure Turn Altitudes: *[This measure would delete the provision that applies to F-4s as they are no longer operating at BOI. It also revises the existing measure to include southbound headings.] This* measure would continue directing jet departures from Runways 28L and 28R to maintain runway heading until reaching 5,000 feet MSL before turning north or south. Pages 6-9 through 6-11, including Table 6.6. Also included in Table 6.14.

FAA Determination: Approved as voluntary.

Noise Abatement Measure 3 – Departure Turn Altitudes: *[No change to existing procedure.]* This measure would continue directing non-jet aircraft over 12,500 pounds with destination headings to the north to fly runway heading to 4,500 feet MSL before turning. Pages 6-9 through 6-11, including Table 6.6. Also included in Table 6.14.

FAA Determination: Approved as voluntary.

Noise Abatement Measure 4 – Departure Turn Altitudes: *[No change to existing procedure.]* This measure would continue directing VFR departures with destination headings to the north to fly runway heading to the end of the runway before turning. Pages 6-9 through 6-11, including Table 6.6. Also included in Table 6.14.

FAA Determination: Approved as voluntary.

Noise Abatement Measure 5 – Departure Turn Altitudes: *[No change to existing procedure.]* This measure would continue to direct north and northwest bound turbojet departures from Runways 10L and 10R to fly runway heading to 5,000 feet MSL before turning north Pages 6-9 through 6-11, including Table 6.6. Also included in Table 6.14.

FAA Determination: Approved as voluntary.

Noise Abatement Measure 6 – Downwind Arrival Flight Tracks: *[New Measure.]* During nighttime hours, this measure would voluntarily reroute aircraft to use arrival flight tracks with downwind legs to the south of BOI. This would route aircraft over relatively low-density residential and vacant land uses. Pages 6-12 and 6-13. Tables 6.7 and 6.14. Figures 6-6 and 6-7.

FAA Determination: Disapproved. No demonstrable noise benefit would accrue if this measure were implemented on a voluntary basis. Vectoring aircraft to south downwind would create operational issues. The aircraft would have to be blended with south traffic and have to be kept clear of departing traffic. The net result would be increased workload, risk of error, and increased flying time and cost for users.

Noise Abatement Measure 7 – Flight Management System (FMS)/Global Positioning System (GPS) Flight Procedures for I-84 Corridor: *[New measure.]* This measure would establish departure procedures and standard arrival routes along the I-84 corridor to the east of the airport. There are no apparent corridors with compatible land use to the west of BOI; therefore it is not likely that a beneficial flight route could be developed without substantially impacting residents under that flight route. However, use of the I-84 corridor to the east of BOI (for arrivals to Runways 28L and 28R, and departures to Runways 10L and 10R) would direct aircraft over mostly compatible land uses. Although the procedure would not reduce populations within the 65+DNL contour, establishment of the procedure would encourage aircraft noise and land use compatibility as development occurs along the corridor. Pages 6-14 and 6-15. Table 6.8 and 6.14. Figures 6-8 and 6-9.

FAA Determination: Disapproved. The NCP does not demonstrate noise benefits, even assuming 100 percent compliance. Many aircraft presently are not equipped to carry out FMS/GPS procedures, so the compliance rate is unrealistic. Also, the FAA would still need to develop airport-specific procedures, which would take some time to study and determine their feasibility. This recommendation is more appropriate to pursue outside of the Part 150 process to determine local feasibility and possible inclusion in future updates.

Noise Abatement Measure 8 – Distant Noise Abatement Departure Profile (NADP): *[New measure.]* BOI would establish the Distant NADP as the recommended NADP for all runway ends. This measure would apply to jet aircraft with a maximum takeoff weight greater than 75,000 pounds. For lighter jet aircraft, the continued use of the National Business Aviation Association noise abatement departure procedures would be encouraged. Pages 6-16 and 6-17, including Table 6.9. Also included in Table 6.14. Figure 6-10.

FAA Determination: Approved as voluntary. The sponsor will coordinate with aircraft users to highlight use of the distant procedure.

Noise Abatement Measure 9 – Visual Approach Arrival Altitudes: *[New measure.]* This measure would encourage ATCT to voluntarily route aircraft on the visual approach to runways 28L and 28R at 5,000 feet MSL until the aircraft begins final approach. Page 6-19. Table 6.11 and 6.14.

FAA Determination: Approved as voluntary. The NCP states at table 6.9 that pilots are already using this procedure. This would include it in the official NCP for BOI.

LAND USE MEASURES

Land Use Measure 1 – Airport Influence Area: *[The proposed measure maintains current boundaries.]* The Boise Airport Commission should recommend to the City of Boise and Ada County to maintain the current Airport Influence Area boundaries until such time that noise levels require their expansion. Page 7-9. Figures 7-1 and 7-2. Table 7.3 and Table 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the City and County.

Land Use Measure 2 – Land Use Compatibility Standards in Airport Influence Area: *[No change to existing measure.]* This measure would have the City and County refine land use compatibility standards for the four sub-districts within the Airport Influence Area. Page 7-12 through 7-15, including Table 7.15. Also included in Table 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the City and County.

Land Use Measure 3 – Commercial & Industrial Zoning in Airport Influence Area: *[No change to existing measure.]* The City of Boise and Ada County maintain existing commercial and industrial zoning within the Airport Influence Area. Page 7-16 and 7-17, including Table 7.6. Also included in Table 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the City and County.

Land Use Measure 4 – Zone for Compatible Use in Apple Street Area: *[No change to existing measure.]* Rezone property and land southeast of the airport and east of Apple Street from residential to industrial. Page 7-18. Table 7.7. Figure 7-3. Table 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the responsible land use control body.

Land Use Measure 5 – Zone for Compatible Use in Gowen Road Area: *[No change to existing measure.]* Rezone land southeast of the airport, east of I-84 and south of East Gowen Road from residential to industrial use. Page 7-19. Table 7.8. Figure 7-3. Table 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the responsible land use control body.

Land Use Measure 6 – Encourage Clustered Residential Development: *[No change to existing measure.]* Encourage clustered residential development southeast of the airport within the Airport Influence Area. Page 7-20. Table 7.9. Figure 7-3. Table 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the responsible land use control body. The property is outside the DNL 65 dB noise contour, and the airport sponsor has adopted the Federal land use compatibility standard for this NCP. Federal guidelines state residential land uses within the DNL 65 dB noise contour are not compatible with airport operations.

The FAA's policy published in the Federal Register April 3, 1998, states that the FAA will not approve Federal Funding to mitigate noise-sensitive land uses constructed after October 1, 1998.

Land Use Measure 7 – Maintain Large Lot Residential Zoning: *[No change to existing measure.]* Maintain existing large lot residential zoning within the Airport Influence Area. Page 7-21. Table 7.10. Table 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the responsible land use control body. The property is outside the DNL 65 dB noise contour, and the airport sponsor has adopted the Federal land use compatibility standard for this NCP. Federal guidelines state residential land uses within the DNL 65 dB noise contour are not compatible with airport operations.

The FAA's policy published in the Federal Register April 3, 1998, states that the FAA will not approve Federal Funding to mitigate noise-sensitive land uses constructed after October 1, 1998.

Land Use Measure 8 – Maintain Rural Preservation Zoning: *[No change from existing measure.]* Maintain existing Rural Preservation zoning within the Airport Influence Area. Page 7-21. Table 7.11. Table 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the responsible land use control body. The property is outside the DNL 65 dB noise contour, and the airport sponsor has adopted the Federal land use compatibility standard for this NCP. Federal guidelines state residential land uses within the DNL 65 dB noise contour are not compatible with airport operations.

The FAA's policy published in the Federal Register April 3, 1998, states that the FAA will not approve Federal Funding to mitigate noise-sensitive land uses constructed after October 1, 1998.

Land Use Measure 9 – Amend Subdivision Regulations and Building Permit Applications to Require Avigation Easements: *[The proposed measure would revise the existing measure to include building permits.]* The Airport Influence Area planning standards in the City of Boise and Ada County require the dedication of avigation easements for all permitted uses. This practice has been in place for many years, and it is recommended to be continued. In addition, this measure would be required for all (residential and commercial) development within the Airport Influence Area as part of the building permit process. Amend current subdivision regulations to require dedication of avigation easements. Page 7-24. Tables 7.12 and 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the responsible land use control body.

Land Use Measure 10 – Adopt Local Building Code Amendments for Noise Level Reduction Construction in the Airport Influence Area: *[No change to existing measure.]* The Airport Influence Area planning standards in the City of Boise and Ada County have required the use of noise level reduction construction techniques for noise-sensitive uses for all permitted development for many years. Both the City and County have lacked specific guidance for implementing this requirement and should adopt noise level reduction standards to supplement their building codes. Pages 7-24 through 7-26, including Table 7.13. Also included in Table 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the responsible land use control body.

Land Use Measure 11 – Adoption of Project Review Guidelines for the City of Boise and Ada County: *[No change to existing measure.]* Adopt project review guidelines for rezoning special use, conditional use, planned development and variance applications. Page 7-26. Tables 7.14 and 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the responsible land use control body.

Land Use Measure 12 – Fair Disclosure of Noise Impacts in the Airport Influence Area: *[This proposed measure revises the existing measure to include the promotion of both formal and informal mechanisms.]* Promote means of providing the fair disclosure of potential noise impacts in the Airport Influence Area. Page 7-26. Tables 7.15 and 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the responsible land use control body.

Land Use Measure 13 – Residential Property Acquisition within 65+DNL Contour: *[Revised to include the 2009 NEM.]* Acquire 40 existing homes within the 65+ DNL contour of the 2009 NEM. Page 7-30. Tables 7.16 and 7.24.

FAA Determination: Approved. The FAA's policy published in the Federal Register April 3, 1998, states that the FAA will not approve Federal Funding to mitigate noise-sensitive land uses constructed after October 1, 1998.

Land Use Measure 14 – Undeveloped Property Acquisition within 65+DNL Contour: *[Revised to include the 2009 NEM.]* Acquire undeveloped land with potential to be developed noncompatibly within the 65+DNL contour of the 2009 NEM. Page 7-30. Tables 7.17 and 7.24.

FAA Determination: Approved. This measure would prevent the development of land available for non-compatible use, if land use preventive controls adopted elsewhere in this NCP are not effective. Acquisition of vacant land is justified as necessary to prevent new noncompatible development when new noncompatible development is highly likely and local land use controls will not prevent such development.

Land Use Measure 15 – Purchase of Avigation Easements: *[New measure.]* Avigation easements would convey the right to the use of real property for the purpose of aircraft overflights and related noise, vibrations, and other effects caused by aircraft operations. The easement would release the local jurisdiction, aircraft operators, and the airport owner and operator for the effect of aircraft operations on the property. For existing residential and non-residential noise sensitive properties within the 65+DNL contours, BOI would seek to acquire an avigation easement from the property owner. However, homes within the 65+DNL contours of the FAA-accepted (from the 1996 study) that were constructed after October 1, 1998, are not eligible for federal funding support. Page 7-37. Tables 7.20 and 7.24.

FAA Determination: Approved The FAA's policy published in the Federal Register April 3, 1998, states that the FAA will not approve Federal Funding to mitigate noise-sensitive land uses constructed after October 1, 1998.

Land Use Measure 16 – Amend Building Permit Applications to Document and Require Compliance with Noise Level Reduction Construction Standards: *[New measure.]* The City of Boise and Ada County should amend their building code and refine their application process to require the applicant to indicate compliance with proposed standards for noise level reduction construction techniques for noise sensitive construction areas within the Airport Influence Area. Airport funding in the form of a compliance rebate to cover the increase in home construction costs may offset the negative impacts of additional housing costs. Page 7-37. Tables 7.21 and 7.24.

FAA Determination: Approved in part, Disapproved in part Amendments to building codes and local application procedures is approved. The FAA believes that prevention of additional land uses within the DNL 65 dB contour is highly preferable over allowing such uses even with sound attenuation, revised building codes or avigation easements. If prevention of incompatible development is not feasible, the airport sponsor and local land use jurisdiction are urged to pursue all possible avenues to discourage new residential development within these levels of noise exposure.

Funding incentives for new construction outside the DNL 65 dB is **disapproved**. Section 189 of Public Law 108-176, Vision 100-Century Of Aviation Reauthorization Act, December 12, 2003, specifically prohibits FAA approval of Part 150 program measures that require AIP funding to mitigate aircraft noise outside DNL 65 (through Fiscal Year 2007). Section 189 does not preclude the use of airport revenue or PFC funding outside DNL 65 dB.

Land Use Measure 17 – Improve City of Boise Application Process To Promote Early Recognition of Airport Influence Area within all Application Processes: *[New measure.]* The City of Boise could improve awareness of Airport Influence Areas at time of application submittal rather than at time of first comment review. Page 7-37. Tables 7.22 and 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the responsible land use control body.

Land Use Measure 18 – Designate Airport Staff Liaison for Planning and Zoning Building Departments of both City of Boise and Ada County: *[New Measure.]* Airport staff should play a greater role in reviewing and participating in the development approval process inside the boundaries of the Airport Influence Area. Page 7-37. Tables 7.23 and 7.24.

FAA Determination: Approved. The Federal government has no authority to control local land use: implementation of this measure is considered to be within the authority of the responsible land use control body.

PROGRAM MEASURES

Continuing Program Measure 1 – Noise Complaint System: *[No change to existing measure.]* Boise Airport would maintain a system for recording and disseminating information on noise complaints. Pages 8-1, 8-5 and Table 8.1.

FAA Determination: Approved.

Continuing Program Measure 2 – Public Information Program: *[New measure.]* This measure would establish a program to enhance public awareness of aircraft noise issues and the Noise Compatibility Program. Pages 8-1, 8-5 and Table 8.1.

FAA Determination: Approved.

Continuing Program Measure 3 – Airport Noise Committee: *[New measure.]* This measure would establish a standing committee to encourage dialogue between community representatives, aeronautical users, and the Boise Airport. Pages 8-1, 8-5 and Table 8.1.

FAA Determination: Approved.

Continuing Program Measure 4 – Airport Noise Relations Staff: *[Revised measure.]* Boise Airport would designate a staff position with responsibility for aircraft noise and land use compatibility issues, in order to facilitate implementation of the NCP measures, coordination with the City of Boise and Ada County, and neighboring communities. Pages 8-1, 8-5 and Table 8.1.

FAA Determination: Approved.

Continuing Program Measure 5 – Periodic Evaluation of Noise Exposure Maps: *[New measure.]* This evaluation would serve to update the NEMs when needed to account for significant changes in the airport operations or procedures at the Boise Airport. Pages 8-1, 8-5 and Table 8.1. Note: The previous NCP committed the airport sponsor to updating the NCP as necessary.

FAA Determination: Approved.

APPENDIX B

Noise and Its Effect on People

APPENDIX B
Noise and Its Effect on People

Aircraft noise exposure in this document is primarily addressed using the Day-Night Average Sound Level (DNL) metric. This study also involves the use of supplemental noise metrics in addition to DNL to provide comprehensive analysis for quantifying a specific situation. To assist reviewers in interpreting complex noise metrics, this appendix presents an introduction to the relevant fundamentals of acoustics and noise terminology, and the effects of noise on human activity.

B.1 Noise and its Metrics

Noise, often defined as unwanted sound, is one of the most common environmental issues associated with aircraft operations. Of course, aircraft are not the only sources of noise in an urban or suburban surrounding, where interstate and local roadway traffic, rail, industrial and neighborhood sources may also intrude on the everyday quality of life. Nevertheless, aircraft are readily identifiable to those affected by their noise and are typically singled out for criticism. Consequently, aircraft noise problems often dominate analyses of environmental impacts.

A “metric” is defined as something “of, involving, or used in measurement.” As used in environmental noise analyses, a metric refers to the unit or quantity that quantitatively measures the effect of noise on the environment. Noise studies have typically involved a confusing proliferation of noise metrics used by individual researchers who have attempted to understand and represent the effects of noise. As a result, literature describing environmental noise or environmental noise abatement has included many different metrics.

Various federal agencies involved in environmental noise mitigation have agreed on common metrics for environmental impact analysis documents. Furthermore, the Federal Aviation Administration (FAA) has specified which metrics, such as DNL, should be used for federal aviation noise assessments.

This section discusses the following acoustic terms and metrics:

- Decibel (dB)
- A-Weighted Decibel (dBA)
- Maximum Sound Level (L_{max})
- Sound Exposure Level (SEL)
- Equivalent Sound Level (L_{eq})
- Day-Night Average Sound Level (DNL)
- Time-Above a Specified Level (TA)

B.1.1 The Decibel (dB)

All sounds come from a sound source—a musical instrument, a speaking voice, or an airplane passing overhead. It takes energy to produce sound. The sound energy produced by any sound source is transmitted through the air in sound waves—tiny, quick oscillations of pressure just above and just below atmospheric pressure. These oscillations, or sound pressures, impinge on the ear creating the sound we hear.

Our ears are sensitive to a wide range of sound pressures. The loudest sound that we hear without pain has about one trillion times more energy than the quietest sounds we hear. On a linear scale, this range is unwieldy. Therefore we compress the total range of sound pressures to a more meaningful range by introducing the concept of sound pressure level (SPL) and its logarithmic unit of decibel (dB).

SPL is a measure of the sound pressure of a given noise source relative to a standard reference value (typically the quietest sound that a young person with good hearing can detect). Decibels are logarithmic quantities—logarithms of the ratio of the two pressures, the numerator being the pressure of the sound source of interest, and the denominator being the reference pressure (the quietest sound we can hear).

The logarithmic conversion of sound pressure to SPL means that the quietest sound we can hear (the reference pressure) has a SPL of about zero decibels, while the loudest sounds we hear without pain have SPLs less than or equal to about 120 dB. Most sounds in our day-to-day environment have SPLs from 30 to 100 dB.

Because decibels are logarithmic quantities, they require logarithmic math and not simple (linear) addition and subtraction. For example, if two sound sources each produce 100 dB and are operated together, they produce only 103 dB—not 200 dB as might be expected. Four equal sources operating simultaneously result in a total SPL of 106 dB. In fact, for every doubling of the number of equal sources, the SPL (of all of the sources combined) increases another three decibels. A ten-fold increase in the number of sources makes the SPL increase by 10 dB. A hundredfold increase makes the level increase by 20 dB, and it takes a thousand equal sources to increase the level by 30 dB.

If one source is much louder than another, the two sources together will produce the same SPL (and sound to our ears) as if the louder source were operating alone. For example, a 100 dB source plus an 80 dB source produce 100 dB when operating together. The louder source “masks” the quieter one. But if the quieter source gets louder, it will have an increasing effect on the total SPL. When the two sources are equal, as described above, they produce a level 3 decibels above the sound level of either one by itself.

From these basic concepts, note that one hundred 80 dB sources will produce a combined level of 100 dB; if a single 100 dB source is added, the group will produce a total SPL of 103 dB. Clearly, the loudest source has the greatest effect on the total.

There are two useful rules of thumb to remember when comparing SPLs: (1) most of us perceive a 6 to 10 dB increase in the SPL to be an approximate doubling of loudness, and (2) changes in SPL of less than about 3 dB are not readily detectable outside of a laboratory environment.

B.1.2 A-Weighted Decibel (dBA)

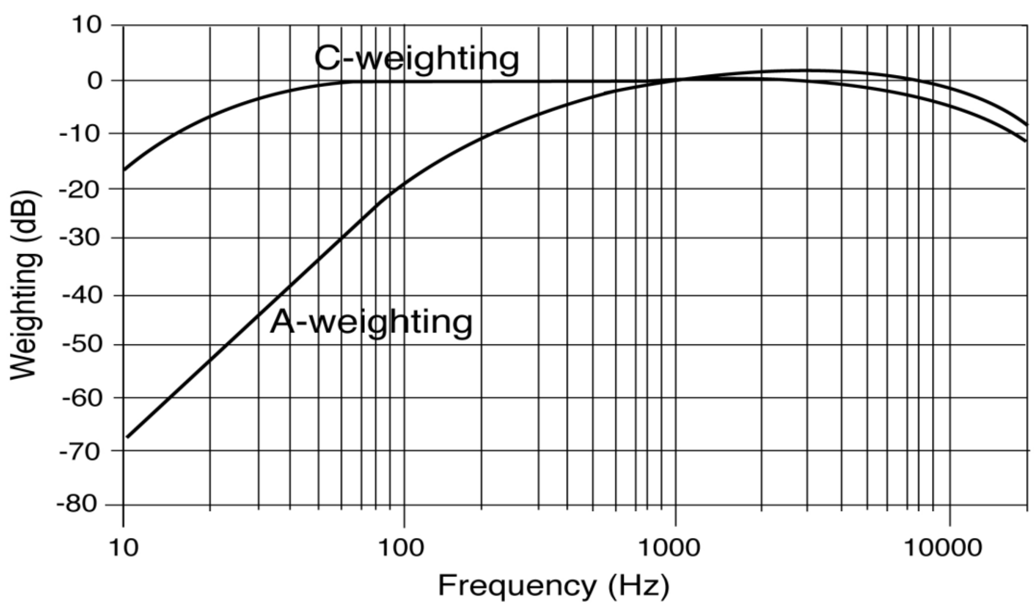
Another important characteristic of sound is its frequency, or “pitch.” This is the rate of repetition of the sound pressure oscillations as they reach our ear. Frequency can be expressed in units of cycles per second (cps) or Hertz (Hz). Although cps and Hz are equivalent, Hz is the preferred scientific unit and terminology.

A very good ear can hear sounds with frequencies from 16 Hz to 20,000 Hz. However, most people hear from approximately 20 Hz to approximately 10,000-15,000 Hz. People respond to sound most readily when the predominant frequency is in the range of normal conversation, around 1,000 to 4,000 Hz. Acousticians have developed and applied “filters” or “weightings” to SPLs to match our ears’ sensitivity to the pitch of sounds and to help us judge the relative loudness of sounds made up of different frequencies. Two such filters, “A” and “C,” are most applicable to environmental noises.

A-weighting significantly de-emphasizes noise at low and high frequencies (below approximately 500 Hz and above approximately 10,000 Hz) where we do not hear as well. The filter has little or no effect at intervening frequencies where our hearing is most efficient. **Figure B-1** shows a graph of the A-weighting as a function of frequency and its aforementioned characteristics. Because this filter generally matches our ears’ sensitivity, sounds having higher A-weighted sound levels are usually judged to be louder than those with lower A-weighted sound levels, a relationship which does not always hold true for unweighted levels. Therefore, A-weighted sound levels are normally used to evaluate environmental noise. SPLs measured through this filter are referred to as A-weighted decibels (dBA).

Figure B-1

Frequency Response Characteristics of Various Weighting Networks



Source: ANSI S1.4-1983 “Specification of Sound Level Meters.”

As shown in Figure B-1, C-weighting is nearly flat throughout the audible frequency range, hardly de-emphasizing the low frequency noise. C-weighted levels are not used as frequently as A-weighted levels, but they may be preferable in evaluating sounds whose low-frequency components are responsible for secondary effects such as the shaking of a building, window rattle, perceptible vibrations or other factors that can cause annoyance and complaints. Uses include the evaluation of blasting noise, artillery fire, sonic boom, and in some cases, aircraft noise inside buildings. SPLs measured through this filter are referred to as C-weighted decibels (dBC).

Other weighting networks have been developed to correspond to the sensitivity and perception of other types of sounds, such as the "B" and "D" filters. However, A-weighting has been adopted as the basic measure of community environmental noise by the U.S. Environmental Protection Agency (EPA) and nearly every other agency concerned with aircraft noise throughout the United States.

Figure B-2 presents typical A-weighted sound levels of several common environmental sources. Sound levels measured (or computed) using A-weighting are most properly called "A-weighted sound levels" while sound levels measured without any frequency weighting are most properly called "sound levels." However, since this document deals only with A-weighted sound levels, the adjective "A-weighted" will be hereafter omitted, with A-weighted sound levels referred to simply as sound levels. As long as the use of A-weighting is understood, there is no difference implied by the terms "sound level" and "A-weighted sound level" or by the dB or dBA units.

An additional dimension to environmental noise is that sound levels vary with time and typically have a limited duration, as shown in **Figure B-3**. For example, the sound level increases as an aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance (although even the background varies as birds chirp, the wind blows or a vehicle passes by). Sounds can be classified by their duration as continuous like a waterfall, impulsive like a firecracker or sonic boom or intermittent like an aircraft overflight or vehicle passby.

B.1.3 Maximum Sound Level (Lmax)

The variation in sound level over time often makes it convenient to describe a particular noise "event" by its maximum sound level, abbreviated as L_{max}. For the aircraft overflight event in Figure B-3, the L_{max} is approximately 67 dBA.

Figure B-4 shows L_{max} values for a variety of common aircraft from the FAA's Integrated Noise Model (INM) database. These L_{max} values for each aircraft type are for aircraft performing a maximum stage (trip) length departure on a day with standard atmospheric conditions at a reference distance of 3.5 nautical miles (NM) from their brake release point. Of the dozen aircraft types listed on the figure, the Concorde has the highest L_{max} and the Saab 340 (SF340) has the lowest L_{max}.

The maximum level describes only one dimension of an event; it provides no information on the cumulative noise exposure generated by a sound source. In fact, two events with identical maxima may produce very different total exposures. One may be of short duration, while the other may continue for an extended period. The metric, discussed later in this appendix, corrects for this deficiency.

Figure B-2

Sound Levels of Typical Noise Sources (dBA)

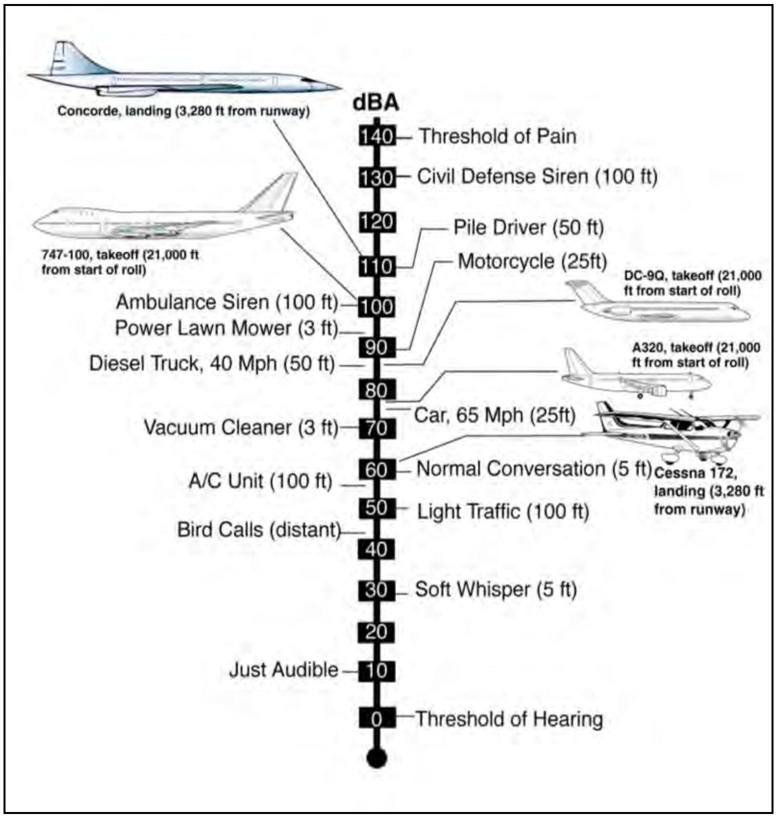
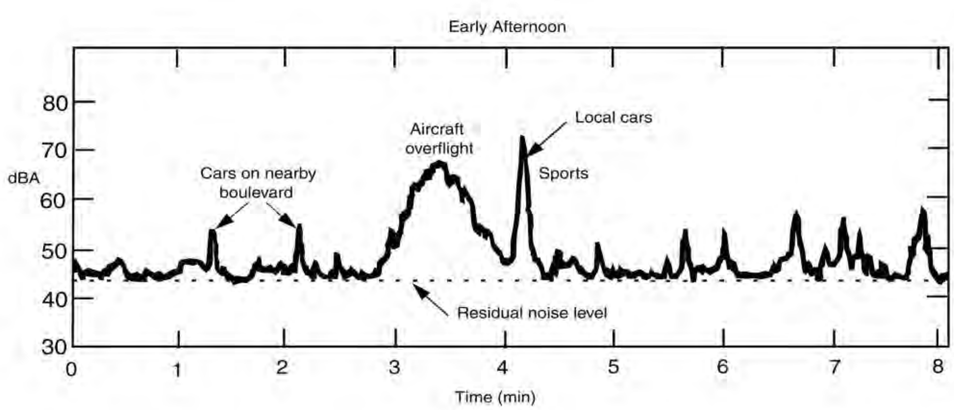


Figure B-3

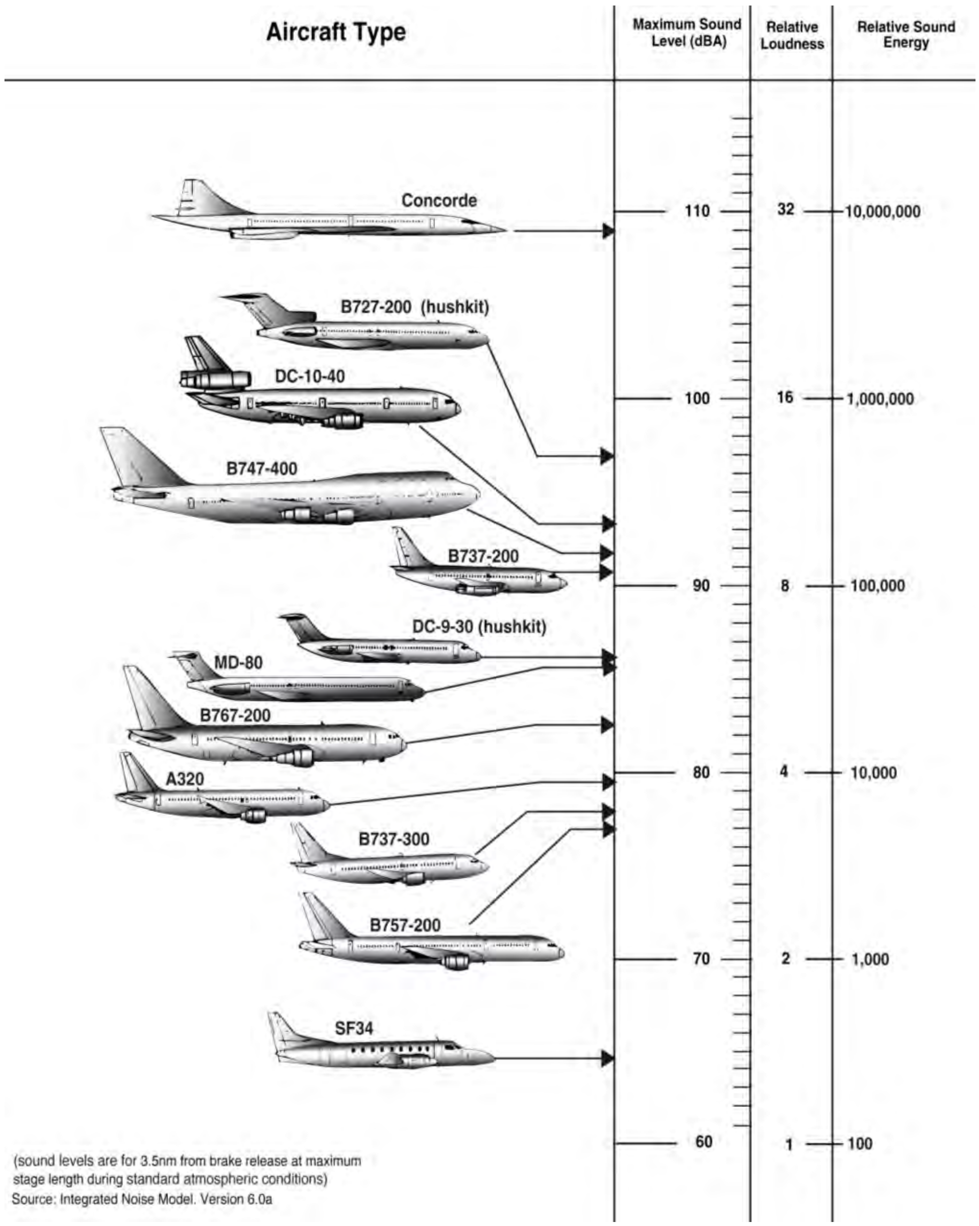
Variation of Community Noise in a Suburban Neighborhood



Source: "Community Noise," NTID 300.3 EPA, December 1971.

Figure B-4

Common Aircraft Departure Noise Levels



B.1.4 Sound Exposure Level (SEL)

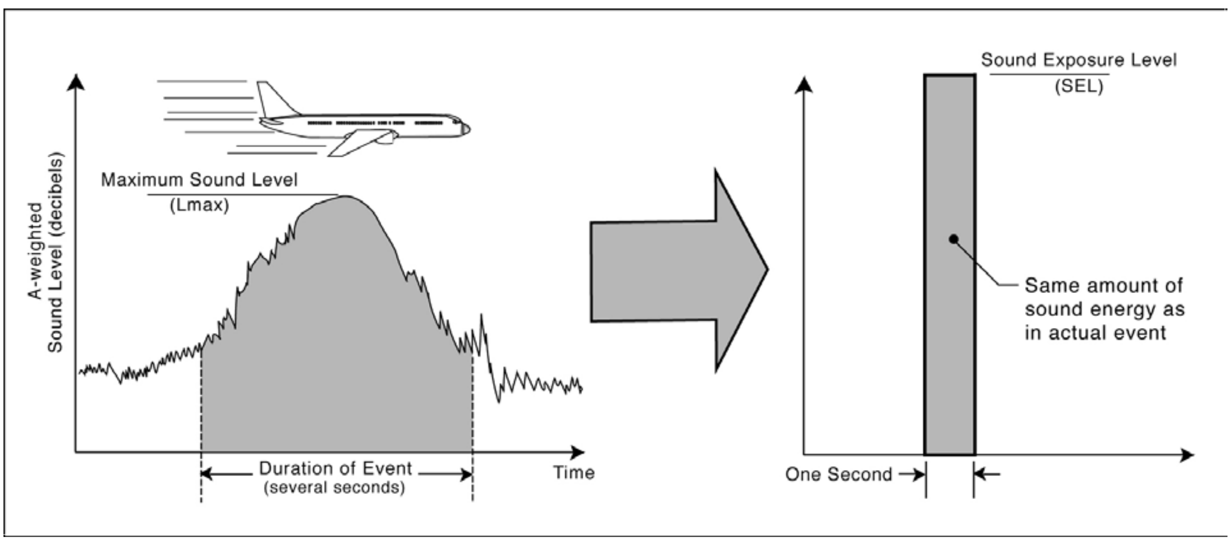
A frequently used metric of noise exposure for a single aircraft flyover is the Sound Exposure Level, or SEL. SEL may be considered an accumulation of the sound energy over the duration of an event. The shaded area in **Figure B-5** illustrates that portion of the sound energy (or "dose") included in an SEL computation. The dose is then normalized (standardized) to a duration of one second. This "revised" dose is the SEL, shown as the shaded rectangular area in Figure B-5. Mathematically, the SEL represents the sound level of the constant sound that would, in one second, generate the same acoustic energy as the actual time-varying noise event. For events that last more than one second, SEL does not directly represent the sound level heard at any given time, but rather provides a measure of the net impact of the entire acoustic event.

Note that, because the SEL is normalized to one second, it will always be larger in magnitude than the maximum A-weighted level for an event that lasts longer than one second. In fact, for most aircraft overflights, the SEL is on the order of 7 to 12 dBA higher than the L_{max}. The fact that it is a cumulative measure means that not only do louder flyovers have higher SELs than quieter ones (of the same duration), but longer flyovers also have greater SELs than shorter ones (of the same L_{max}).

It is the SEL's inclusion of both the intensity and duration of a sound source that makes SEL the metric of choice for comparing the single-event levels of varying duration and maximum sound level. This metric provides a comprehensive basis for modeling a noise event in determining overall noise exposure.

Figure B-5

Relationship Between Single Event Noise Metrics



This metric provides a comprehensive basis for modeling a noise event in determining overall noise exposure. In order to demonstrate a comparison of single-event noise levels at Boise Airport, a number of representative aircraft were selected to represent a range of aircraft sizes and frequency of operations at BOI. **Figures B-6** through **B-19** present SEL contour levels of 80 and 90 dB for one arrival and one departure, using Runway 10L.

The **Airbus A300**, shown on **Figure B-6,** (INM type A300-622R) represents a wide-body cargo jet. It is operated by FedEx and UPS at BOI, and accounts for approximately 4.24 operations on an average annual day in 2015 (approximately 1.5% of all operations).

Derived from the common MD-80 series aircraft, the **McDonnell Douglas MD-90,** shown on **Figure B-7** (INM type MD9025) is a narrow body passenger jet that was introduced into service in 1995. At BOI, the MD-90 flies less than one operation on an annual average day in 2015.

The **Airbus A320**, shown in **Figure B-8** (INM type A320-232) is a narrow-body passenger jet flown by many airlines, including Delta, United and US Airways at BOI. In the 2015 fleet, it flies approximately 7 operations on an annual average day and accounts for approximately 2.6% of all operations.

The Boeing 737-700, as shown on Figure B-9 (INM Type 737700), represents another narrow-body passenger jet that accounts for over 5% of BOI traffic and is commonly flown by United and Southwest.

The **Bombardier CRJ-200**, shown in **Figure B-10** (INM Type CLREGJ), represents the earlier generation of regional jets typically seating about 50 passengers. It represents approximately 4% of 2015 AAD operations.

The **Bombardier CRJ-700** (INM Type CRJ701), shown in **Figure B-11**, represents a common larger regional jet flown by Skywest, that accounts for approximately 3% of AAD operations in 2015.

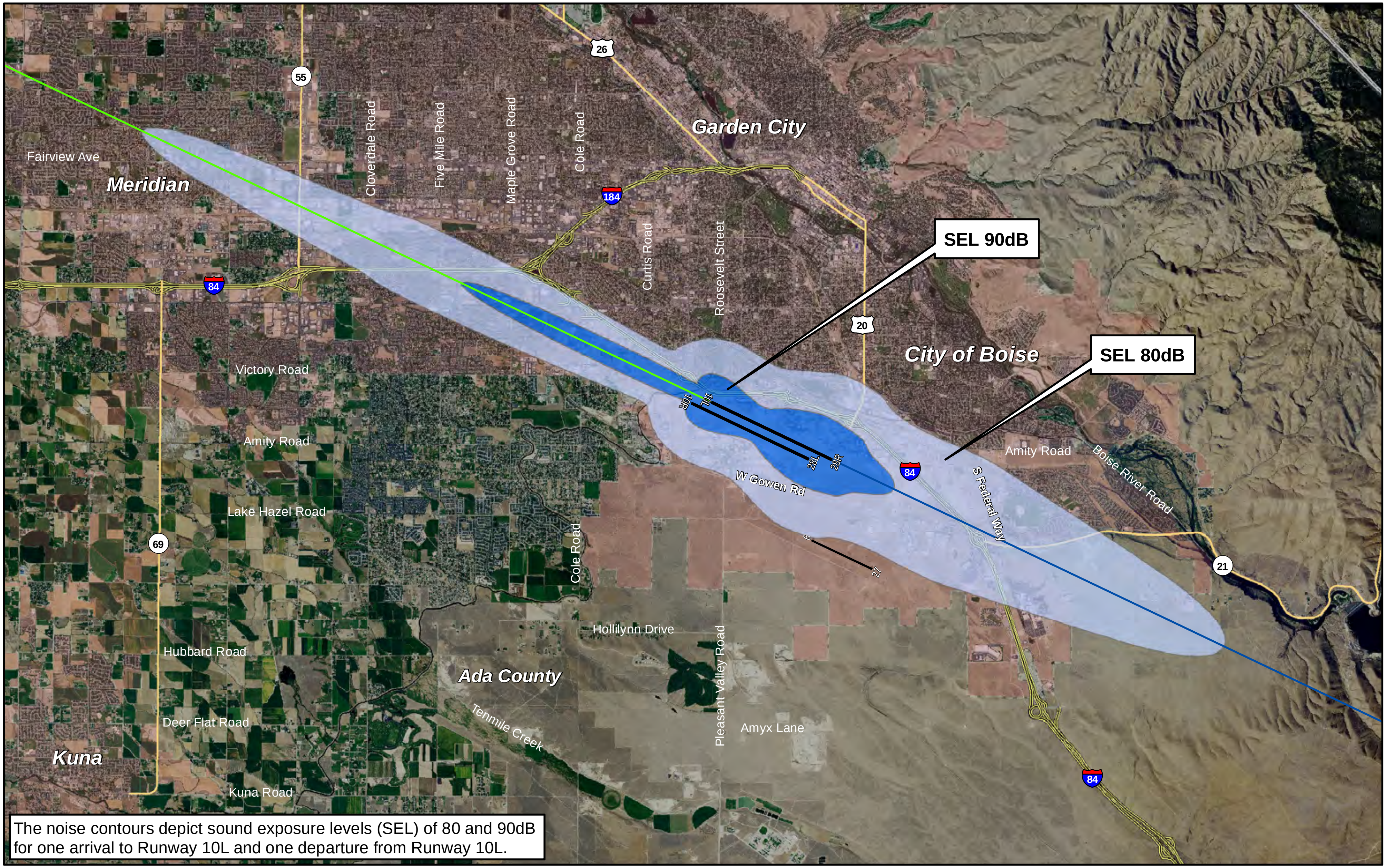
The **Dassault Falcon/Mystere 20**, shown in **Figure B-12** (INM Type FAL20), represents an older business jet that seats approximately 8-10 passengers. The Falcon 20 operates at BOI infrequently, and is one of a number of aircraft weighing less than 75,000 pounds that are required to either become compliant with Stage 3 noise standards or be removed from service after December 31, 2015.

A newer business jet that meets Stage 3 noise standards include those in the Cessna Citation family, represented by the **Cessna 560E** (INM Type CNA560E) shown in **Figure B-13**. These aircraft are the most heavily utilized business jets at BOI, although they account for slightly less than 1% of all operations.

The **Bombardier Q-400** (INM Type DHC830), shown in **Figure B-14**, is a twin-engine turboprop aircraft. Flown at BOI by Horizon Air, the Q-400 accounts for nearly 14% of all 2015 operations.

Single engine propeller aircraft, such as the **Cessna Skylane 182** shown in **Figure B-15** (INM Type CNA182), are some of the smallest and quietest aircraft in the fleet mix at BOI. The Cessna 182 accounts for approximately 4.5% of all 2015 operations at BOI.

Figure B-16 presents the A-10A aircraft, currently flown by the Idaho Air National



Legend
- City Limits
- 80 SEL dB
- 90 SEL dB
- Arrival Flight Track
- Departure Flight Track

Figure B-6
Airbus A300 Sound Exposure Level (80dB/90dB) Noise Contour

N

0 2,500 5,000 10,000 Feet

Sources: City of Boise, Ada County, USDA, HNTB 2015

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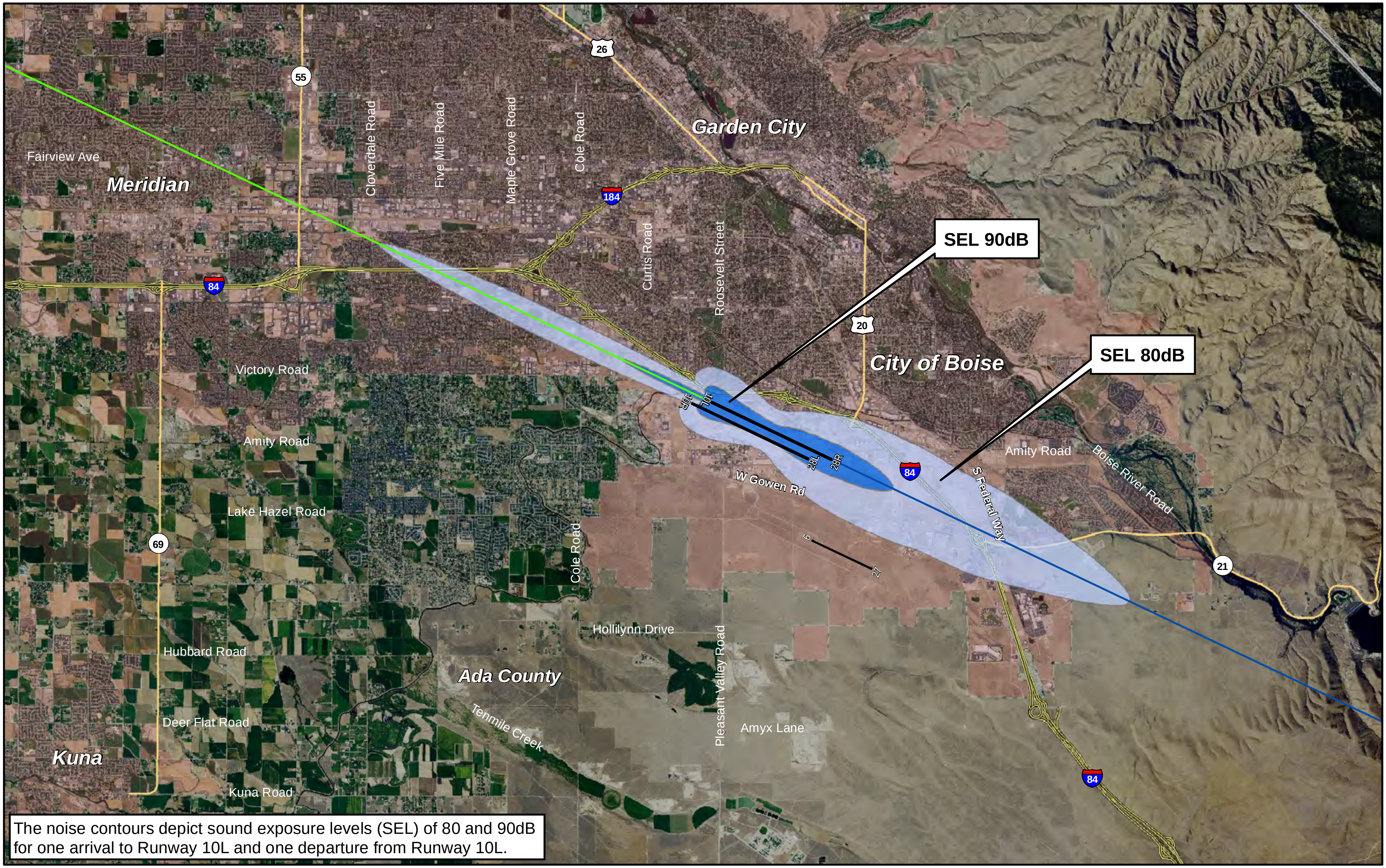


Legend

- City Limits
- 80 SEL dB
- 90 SEL dB
- Arrival Flight Track
- Departure Flight Track

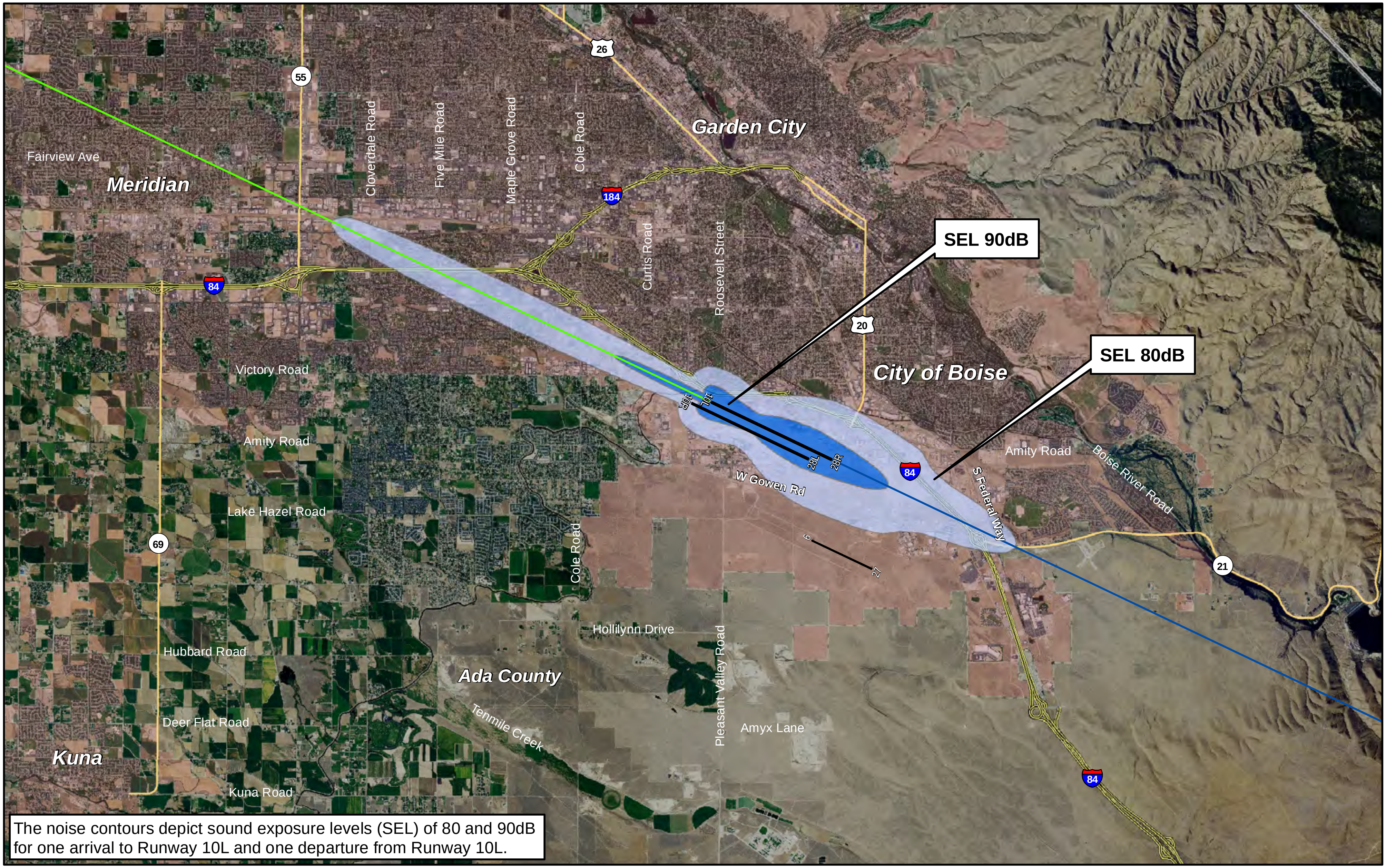
Figure B-7

McDonnell Douglas MD-90 Sound Exposure Level (80dB/90dB) Noise Contour

N

0 2,500 5,000 10,000 Feet

Sources: City of Boise, Ada County, USDA, HNTB 2015



The noise contours depict sound exposure levels (SEL) of 80 and 90dB for one arrival to Runway 10L and one departure from Runway 10L.

Legend

- City Limits
- 80 SEL dB
- 90 SEL dB
- Arrival Flight Track
- Departure Flight Track

Figure B-8
Airbus A320 Sound Exposure Level (80dB/90dB) Noise Contour

N

0 2,500 5,000 10,000 Feet

Sources: City of Boise, Ada County, USDA, HNTB 2015

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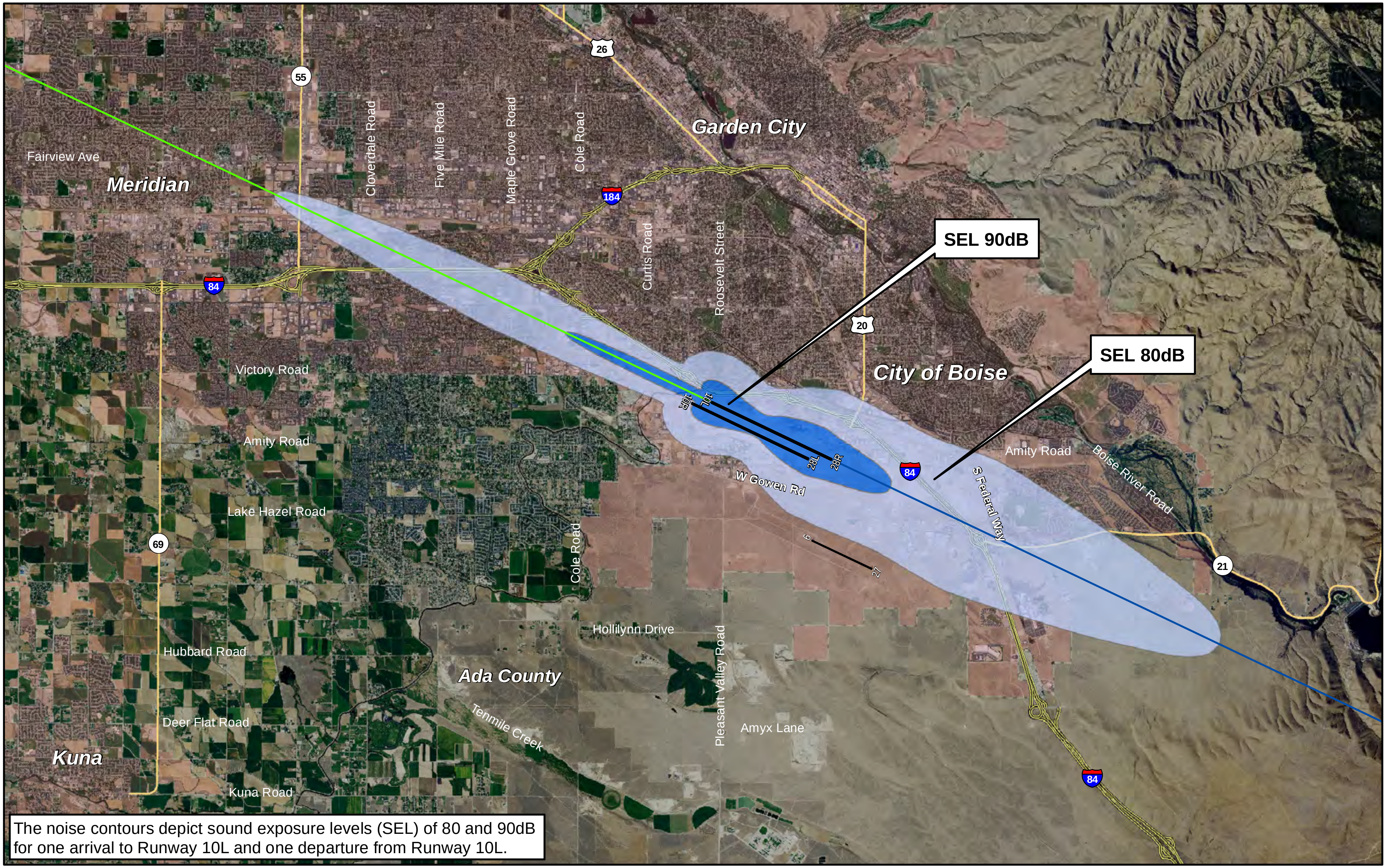


The noise contours depict sound exposure levels (SEL) of 80 and 90dB for one arrival to Runway 10L and one departure from Runway 10L.

Legend

- City Limits
- 80 SEL dB
- 90 SEL dB
- Arrival Flight Track
- Departure Flight Track

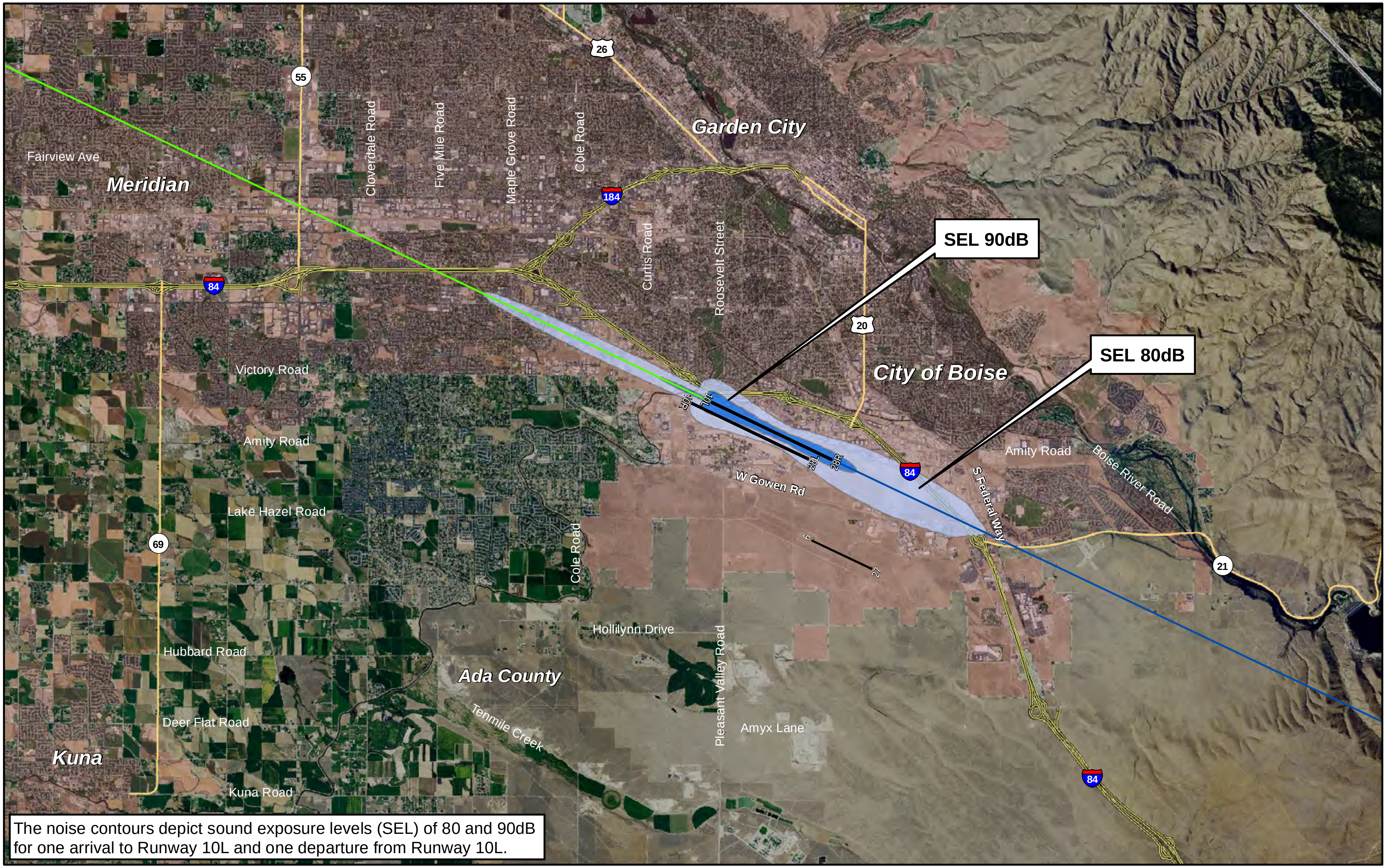
Figure B-9

Boeing 737-700 Sound Exposure Level (80dB/90dB) Noise Contour

N

0 2,500 5,000 10,000 Feet

Sources: City of Boise, Ada County, USDA, HNTB 2015



Legend

- City Limits
- 80 SEL dB
- 90 SEL dB
- Arrival Flight Track
- Departure Flight Track

Figure B-10
Bombardier CRJ-200 Sound Exposure Level (80dB/90dB) Noise Contour

N

0 2,500 5,000 10,000 Feet

Sources: City of Boise, Ada County, USDA, HNTB 2015

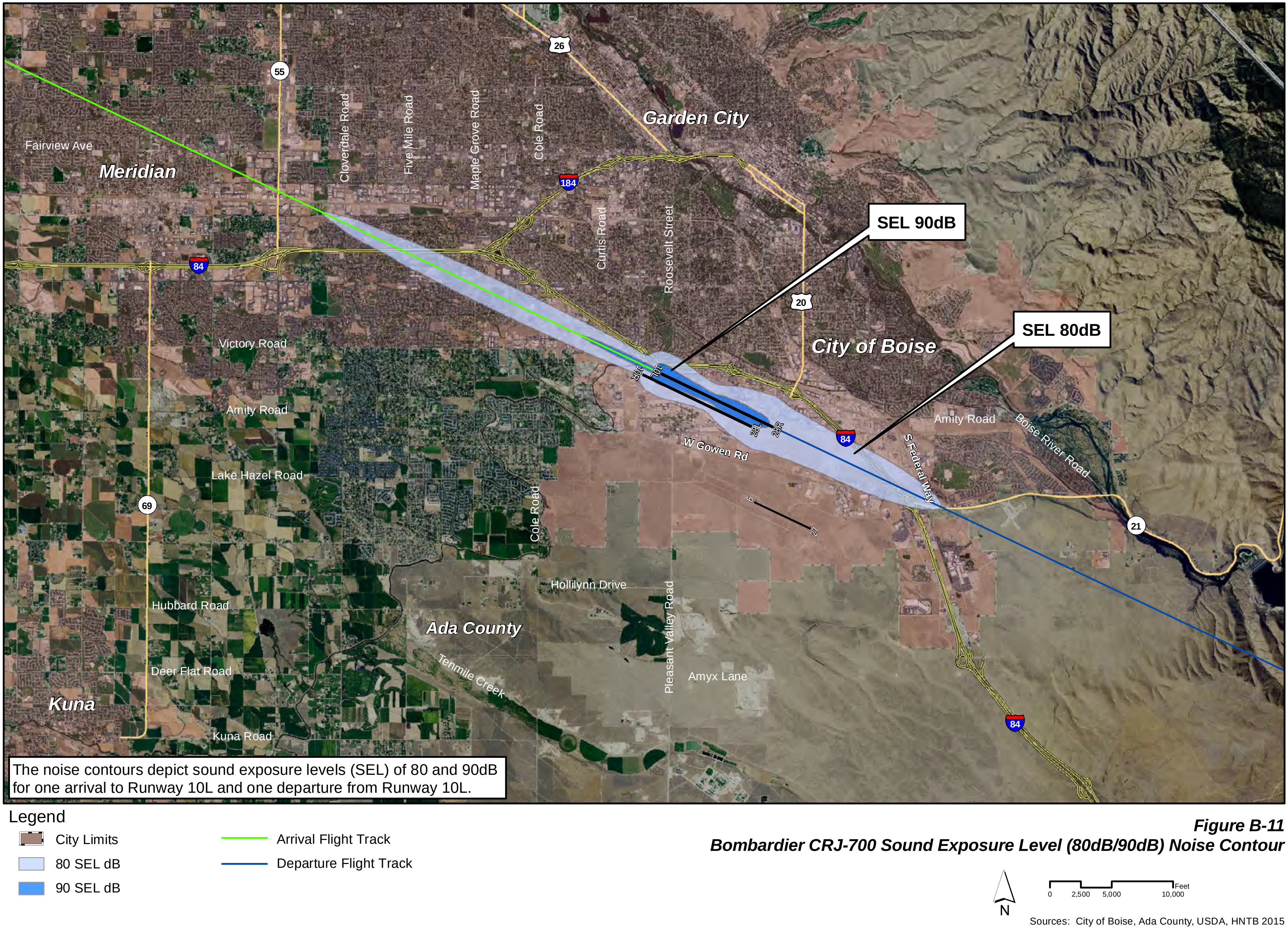


Figure B-11
Bombardier CRJ-700 Sound Exposure Level (80dB/90dB) Noise Contour

Sources: City of Boise, Ada County, USDA, HNTB 2015

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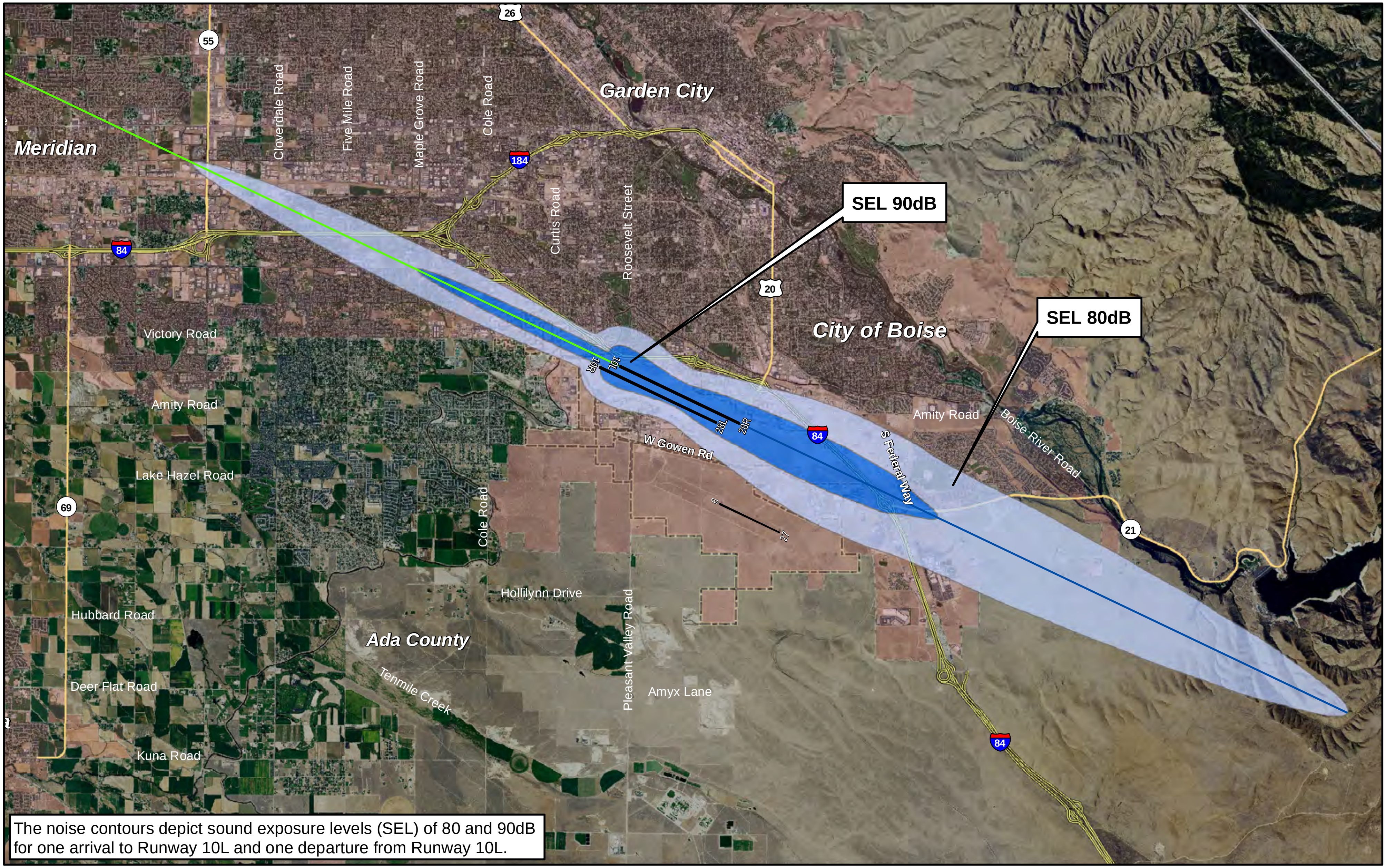

Legend

- City Limits
- 80 SEL dB
- 90 SEL dB
- Arrival Flight Track
- Departure Flight Track

Figure B-12
Falcon 20 Sound Exposure Level (80dB/90dB) Noise Contour

N

0 2,500 5,000 10,000 Feet

Sources: City of Boise, Ada County, USDA, HNTB 2015

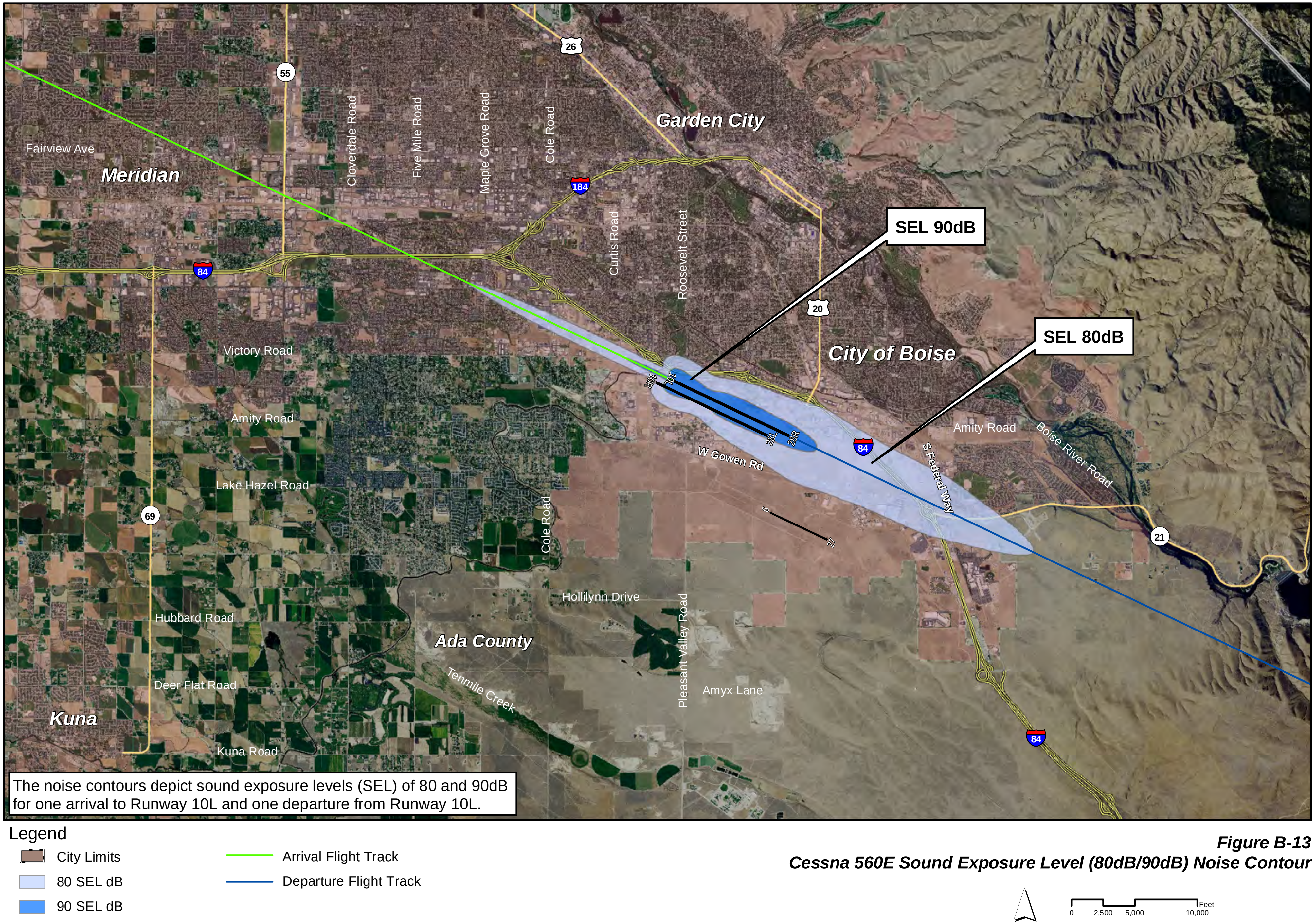

Figure B-13

Cessna 560E Sound Exposure Level (80dB/90dB) Noise Contour

Sources: City of Boise, Ada County, USDA, HNTB 2015

Boise Airport

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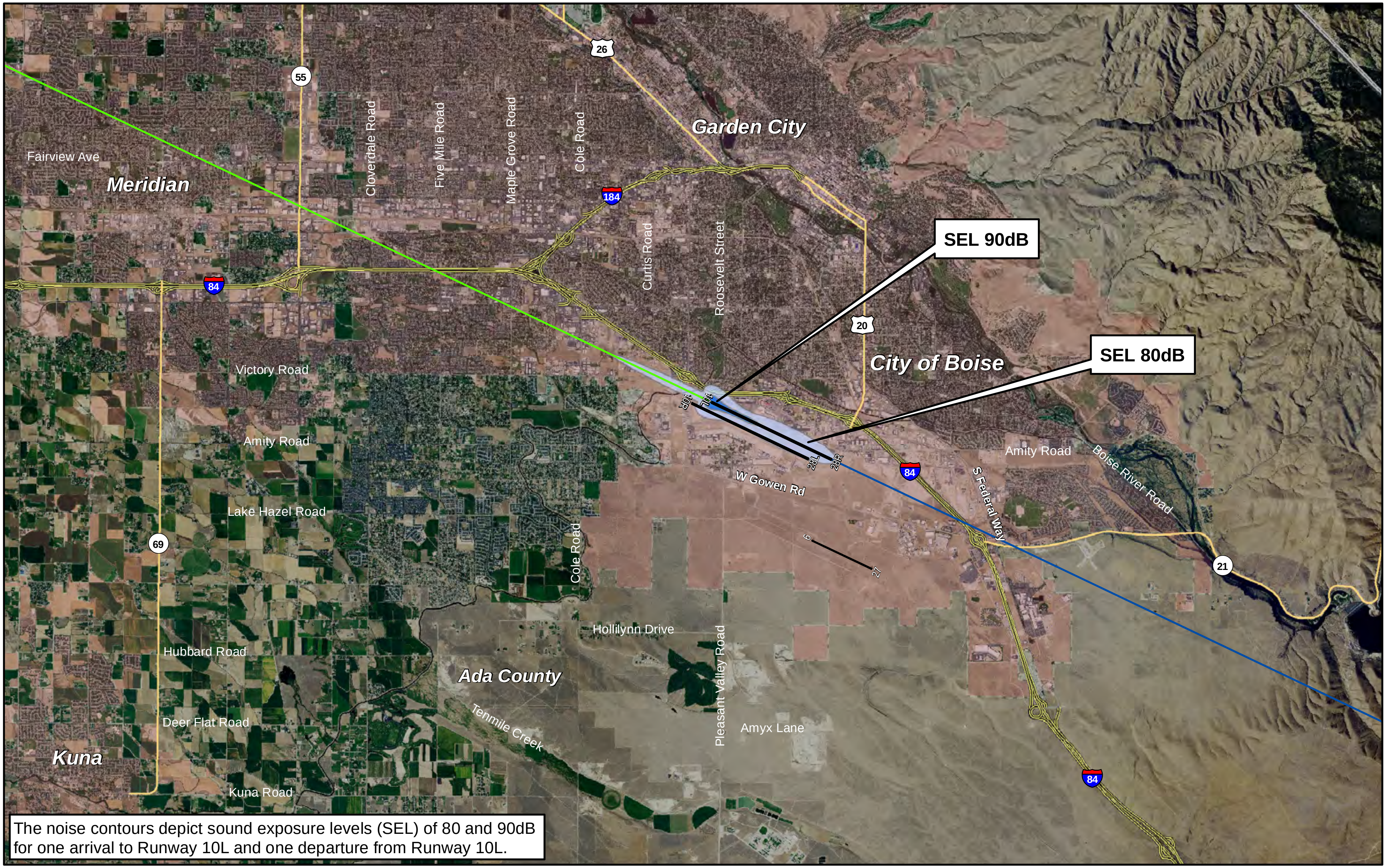
HNTB



The noise contours depict sound exposure levels (SEL) of 80 and 90dB for one arrival to Runway 10L and one departure from Runway 10L.

Legend

- City Limits
- 80 SEL dB
- 90 SEL dB
- Arrival Flight Track
- Departure Flight Track

Figure B-14

Bombardier Q-400 Sound Exposure Level (80dB/90dB) Noise Contour

N

0 2,500 5,000 10,000 Feet

Sources: City of Boise, Ada County, USDA, HNTB 2015

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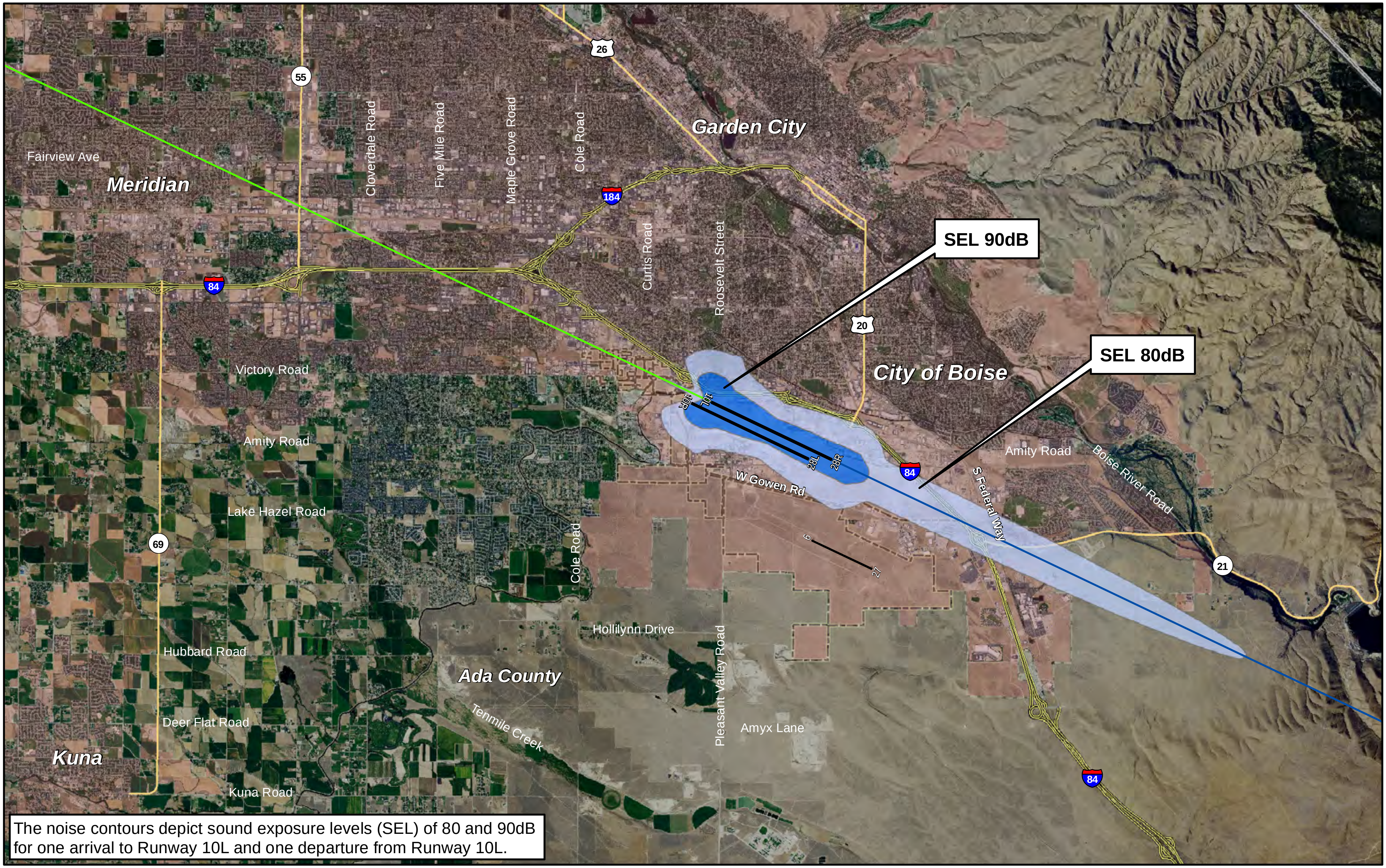


Legend

City Limits

80 SEL dB

90 SEL dB

Arrival Flight Track

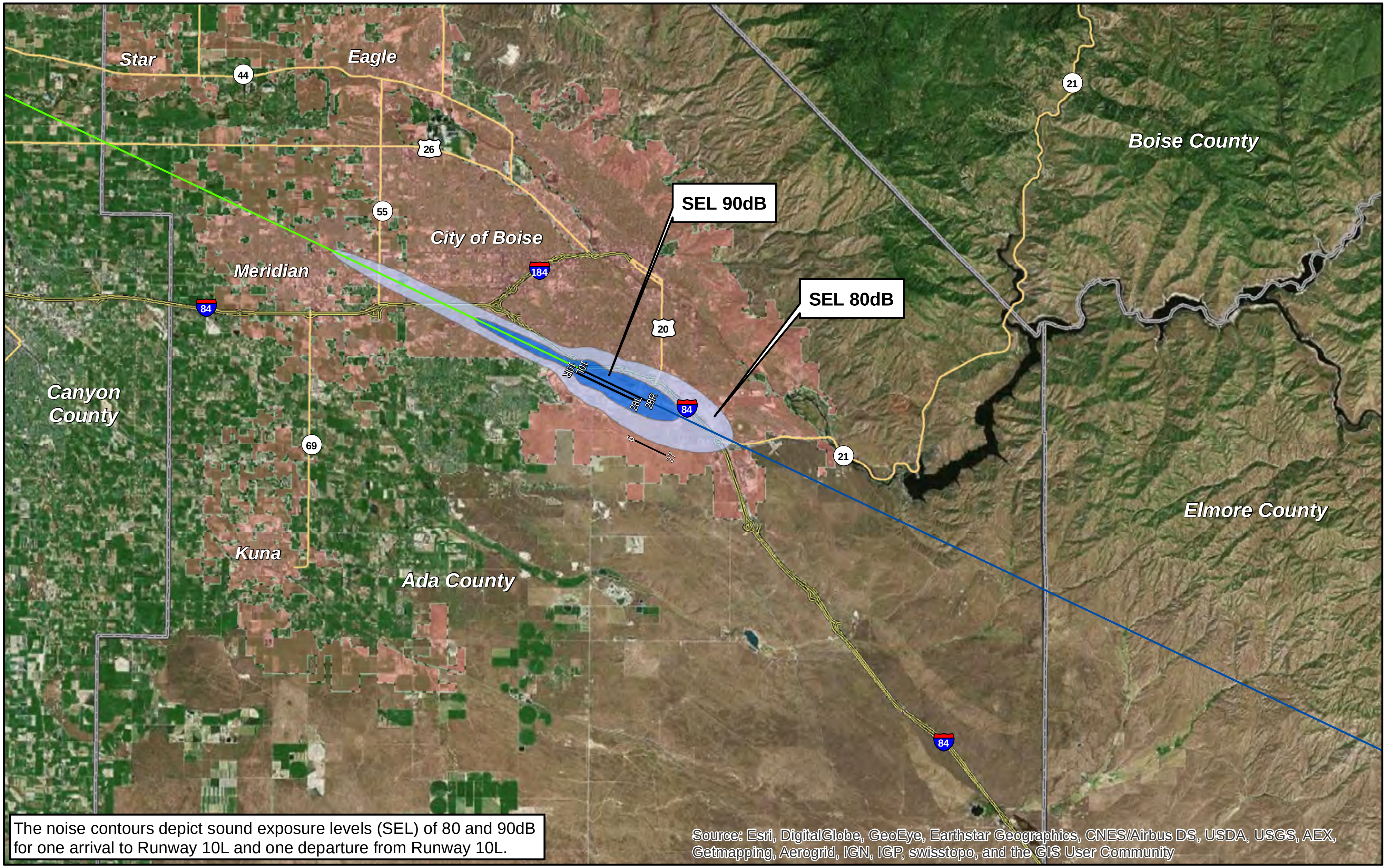
Departure Flight Track

Figure B-15
Cessna 182 Sound Exposure Level (80dB/90dB) Noise Contour

N

0 2,500 5,000 10,000 Feet

Sources: City of Boise, Ada County, USDA, HNTB 2015



Legend

- City Limits
- 80 SEL dB
- 90 SEL dB
- Arrival Flight Track
- Departure Flight Track

Figure B-16

A-10A Sound Exposure Level (80dB/90dB) Noise Contour

N

0 5,000 10,000 20,000 Feet

Sources: City of Boise, Ada County, HNTB 2015

Guard. **Figures B-17**, **B-18**, and **B-19** present other military jet fighter aircraft, including the F-15E, F-18 and F-35. BOI occasionally serves F-15E and F-18 aircraft, and may be a future location for based F-15E aircraft. The F-35 does not operate at BOI at this time.

These figures are useful for understanding the relative comparison between different aircraft in operation at BOI.

B.1.5 Equivalent Sound Level (L_{eq})

Maximum A-weighted level and SEL are used to measure the noise associated with individual events. The following metrics apply to longer-term cumulative noise exposure that often includes many events.

The first cumulative noise metric, the Equivalent Sound Level (abbreviated L_{eq}), is a measure of the exposure resulting from the accumulation of A-weighted sound levels over a particular period of interest (e.g., an hour, an 8-hour school day, nighttime or a full 24-hour day). However, because the length of the period can be different depending on the time frame of interest, the applicable period should always be identified or clearly understood when discussing the metric. Such durations are often identified through a subscript, for example $L_{eq(8)}$ or $L_{eq(24)}$.

As for its application to aircraft noise issues, L_{eq} is often presented for consecutive 1-hour periods to illustrate how the hourly noise dose rises and falls throughout a 24-hour period, as well as how certain hours are significantly affected by a few loud aircraft. Since the period of interest for this study is in a full 24-hour day, $L_{eq(24)}$ is the proper nomenclature.

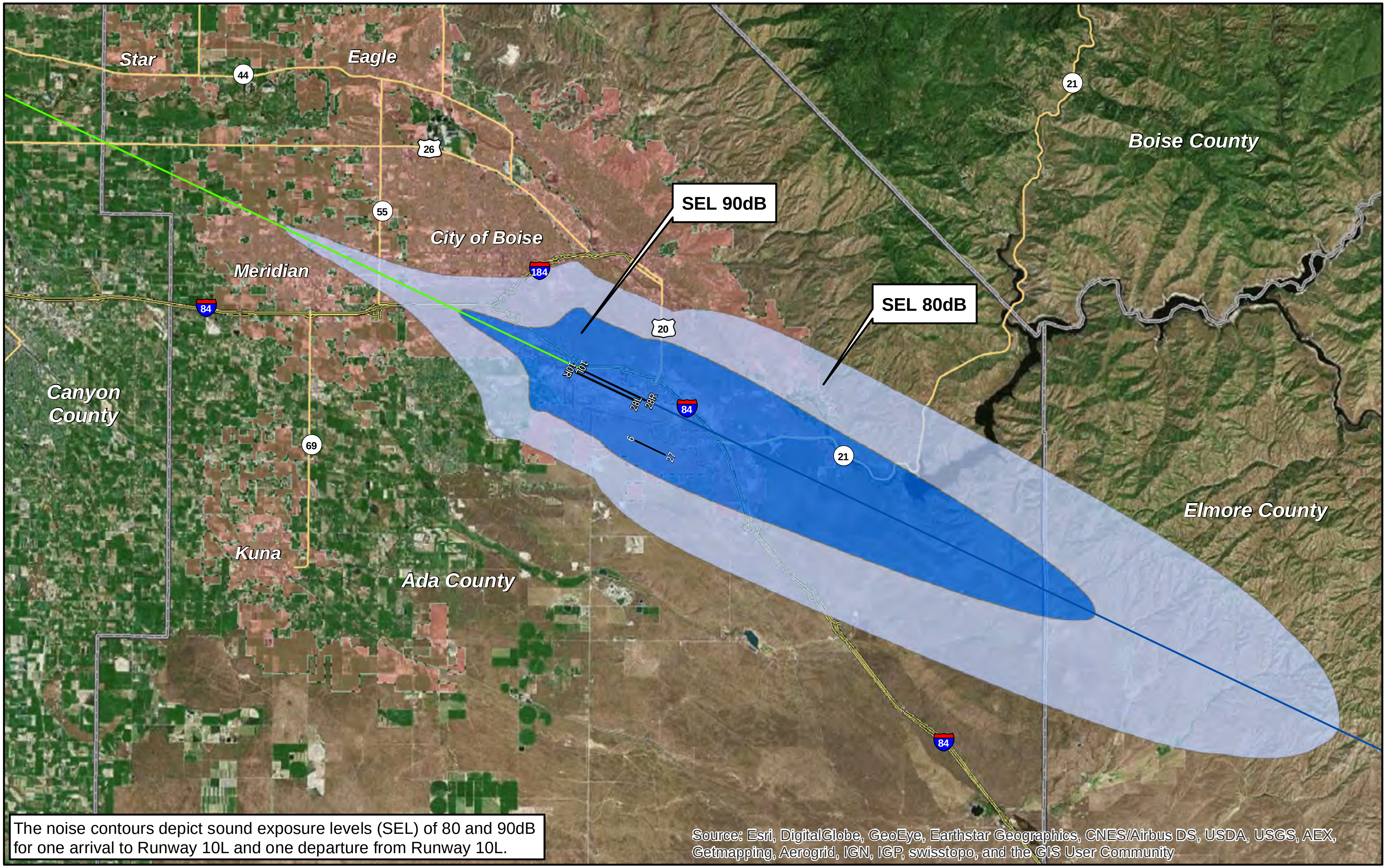
Conceptually, L_{eq} may be thought of as a constant sound level over the period of interest that contains as much sound energy as the actual time-varying sound level with its normal “peaks” and “valleys,” as illustrated in Figure B-3. In the context of noise from typical aircraft flight events and as noted earlier for SEL, L_{eq} does not represent the sound level heard at any particular time, but rather represents the total sound exposure for the period of interest. Also, it should be noted that the “average” sound level suggested by L_{eq} is not an arithmetic value, but a logarithmic, or “energy-averaged,” sound level. Thus, loud events tend to dominate the noise environment described by the L_{eq} metric.

B.1.6 Day-Night Average Sound Level (DNL)

DNL is the same as L_{eq} (an energy-average noise level over a 24-hour period) except that 10 dB is added to those noise events occurring at night (between 10 p.m. and 7 a.m.). This weighting reflects the added intrusiveness of nighttime noise events attributable to the fact that community background noise levels typically decrease by about 10 dB during those nighttime hours. DNL does not represent the sound level heard at any particular time, but rather represents the total (and partially weighted) sound exposure.

Typical DNL values for a variety of noise environments are shown in **Figure B-20** to indicate the range of noise exposure levels usually encountered.

Due to the DNL metric’s excellent correlation with the degree of community annoyance from aircraft noise, DNL has been formally adopted by most federal agencies for measuring and evaluating aircraft noise for land use planning and



Legend

- City Limits
- 80 SEL dB
- 90 SEL dB
- Arrival Flight Track
- Departure Flight Track

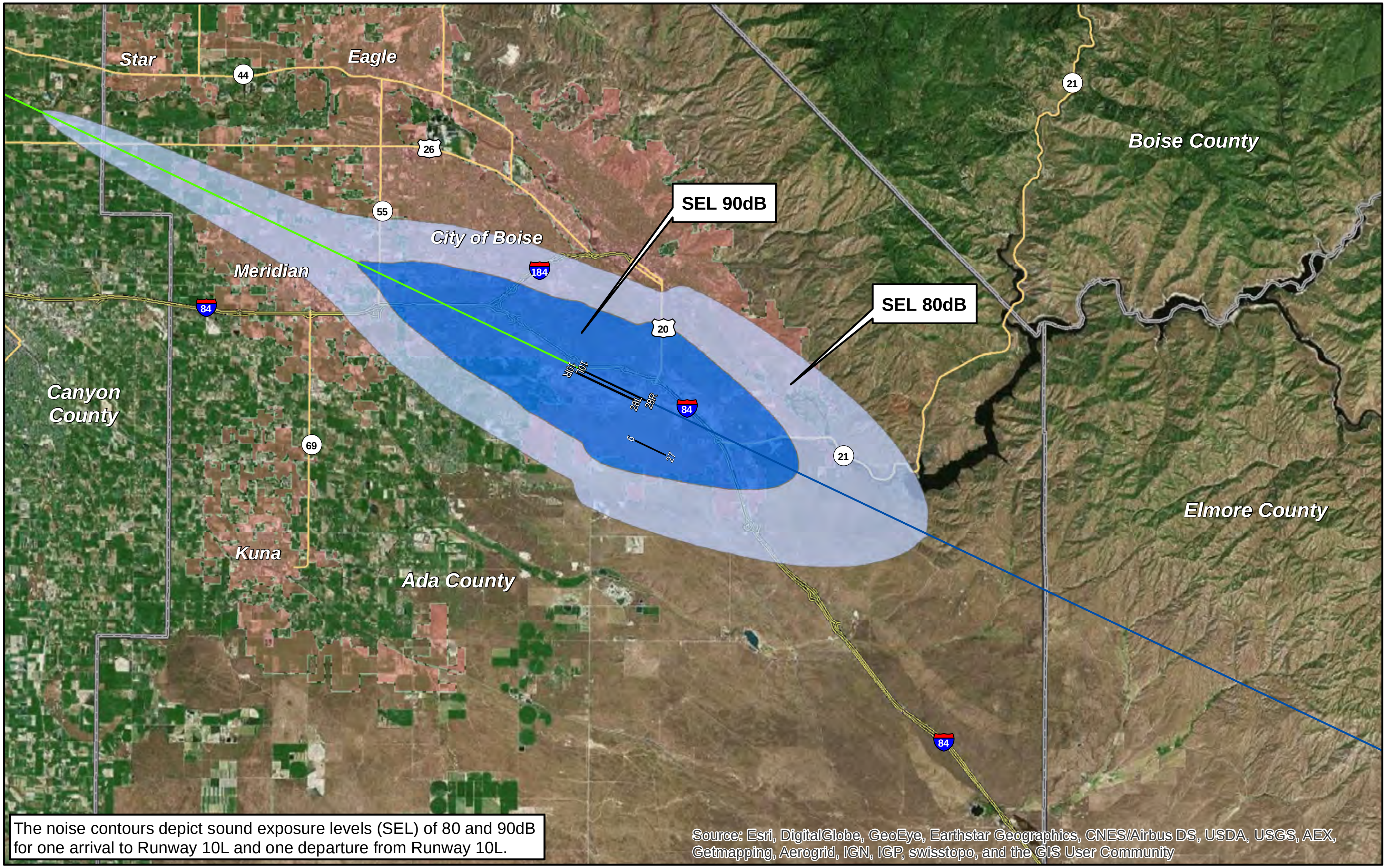
Figure B-17
F-15E Sound Exposure Level (80dB/90dB) Noise Contour

N

0 5,000 10,000 20,000 Feet

Sources: City of Boise, Ada County, HNTB 2015

Part 150 Study Update



Legend

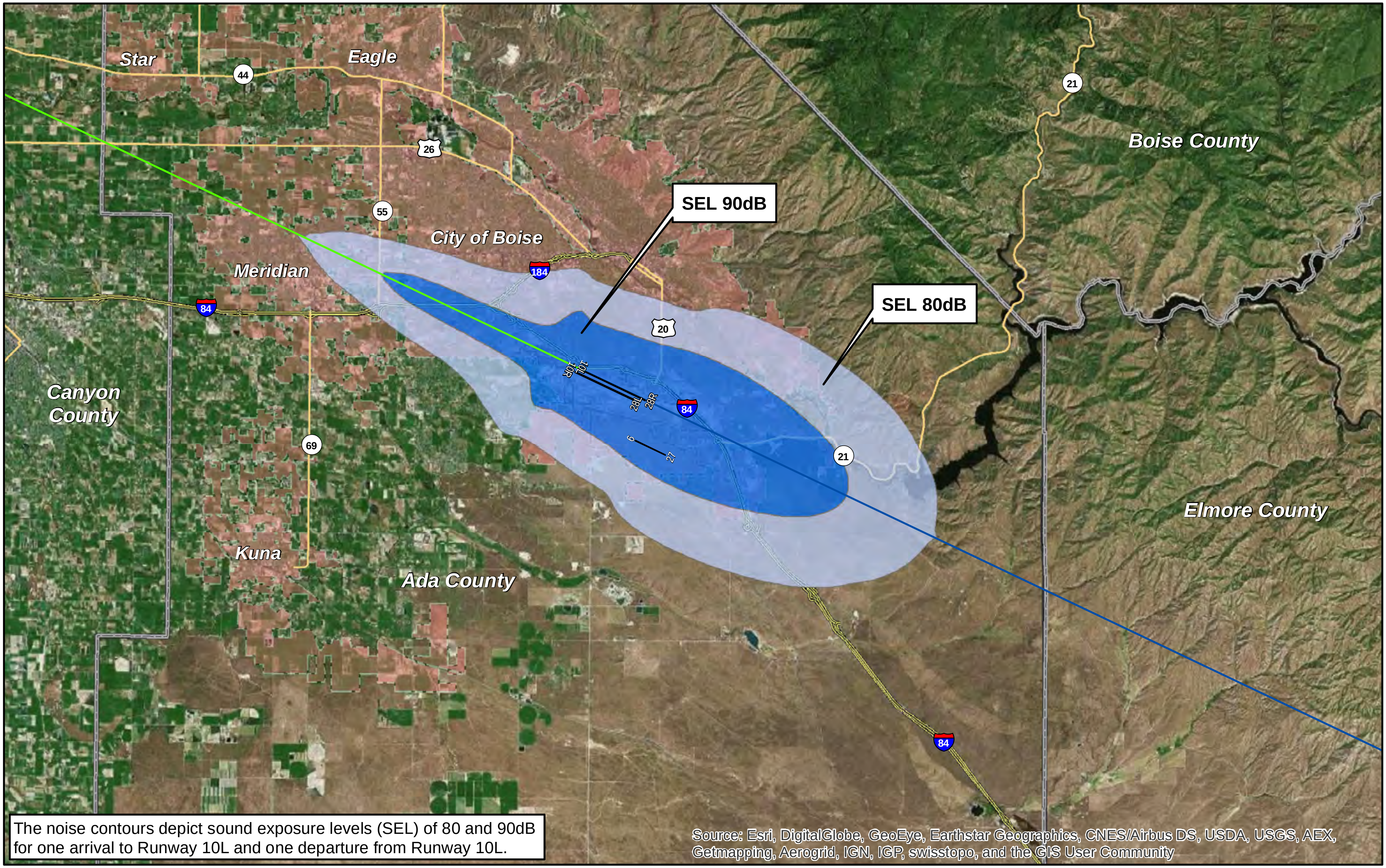
- City Limits
- 80 SEL dB
- 90 SEL dB
- Arrival Flight Track
- Departure Flight Track

Figure B-18
F-18 Sound Exposure Level (80dB/90dB) Noise Contour

N

0 5,000 10,000 20,000 Feet

Sources: City of Boise, Ada County, HNTB 2015



Legend
- City Limits
- 80 SEL dB
- 90 SEL dB
- Arrival Flight Track
- Departure Flight Track

Figure B-19
F-35 Sound Exposure Level (80dB/90dB) Noise Contour

N
0 5,000 10,000 20,000 Feet

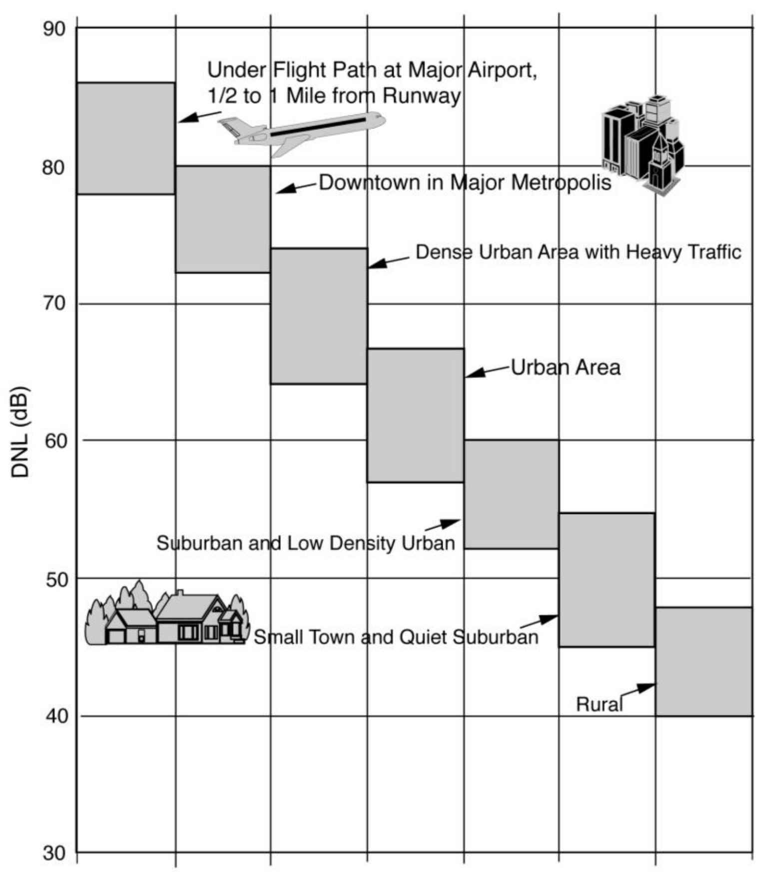
Sources: City of Boise, Ada County, HNTB 2015

noise impact assessment. Federal interagency committees such as the Federal Interagency Committee on Urban Noise (FICUN) and the Federal Interagency Committee on Noise (FICON) which include the EPA, FAA, Department of Defense, Department of Housing and Urban Development (HUD), and Veterans Administration, found DNL to be the best metric for land use planning. They also found no new cumulative sound descriptors or metrics of sufficient scientific standing to substitute for DNL. Other cumulative metrics could be used only to supplement, not replace DNL. Furthermore, FAA Order 1050.1E for environmental documents requires that DNL be used in describing cumulative noise exposure and in identifying aircraft noise/land use compatibility issues.[1 2 3 4 5]

Measurements of DNL are practical only for obtaining values for a relatively limited number of points. Instead, many noise studies, including this document, are based on estimates of DNL using an FAA-approved computer-based noise model.

Figure B-20

Typical Range of Outdoor Community Day-Night Average Sound Levels



Source: U.S. Department of Defense. Departments of the Air Force, the Army, and the Navy, 1978. *Planning in the Noise Environment.* AFM 19-10. TM 5-803-2, and NAVFAC P-970. Washington, D.C.: U.S. DoD.

B.1.7 Time-Above a Specified Level (TA)

The Time-Above a Specified Level (TA) metric describes the total number of minutes that instantaneous sound levels (usually from aircraft) are above a given threshold. For example, if 65 dB is the specified threshold, the metric would be referred to as "TA65." Like DNL, the TA metric is typically associated with a 24-hour annual average day or only for the DNL nighttime period of 10 p.m. to 7 a.m.

When the TA calculation is expressed as a percentage of the day it is referred to as "%TA." Although the threshold chosen for the TA calculation is arbitrary, it is usually the ambient level for the location of interest or 65 dB for comparison to a level of 65 dB DNL.

B.2 The Effects of Aircraft Noise on People

To many people, aircraft noise can be an annoyance and a nuisance. It can interfere with conversation and listening to television, disrupt classroom activities in schools and disrupt sleep. Relating these effects to specific noise metrics aids in the understanding of how and why people react to their environment. This section addresses three ways we are potentially affected by aircraft noise: annoyance, interference of speech and disturbance of sleep.

B.2.1 Community Annoyance

The primary potential effect of aircraft noise on exposed communities is one of annoyance. The U.S. EPA defines noise annoyance as any negative subjective reaction on the part of an individual or group.[1]

Scientific studies [1 2 3 6 7] and a large number of social/attitudinal surveys [8 9] have been conducted to appraise the U.S. and international community of annoyance due to all types of environmental noise, especially aircraft events. These studies and surveys have found the DNL to be the best measure of that annoyance.

This relation between community annoyance and time-average sound level has been confirmed, even for infrequent aircraft noise events.[10] For helicopter overflights occurring at a rate of 1 to 52 per day, the stated reactions of community individuals correlated with the daily time-average sound levels of the helicopter overflights.

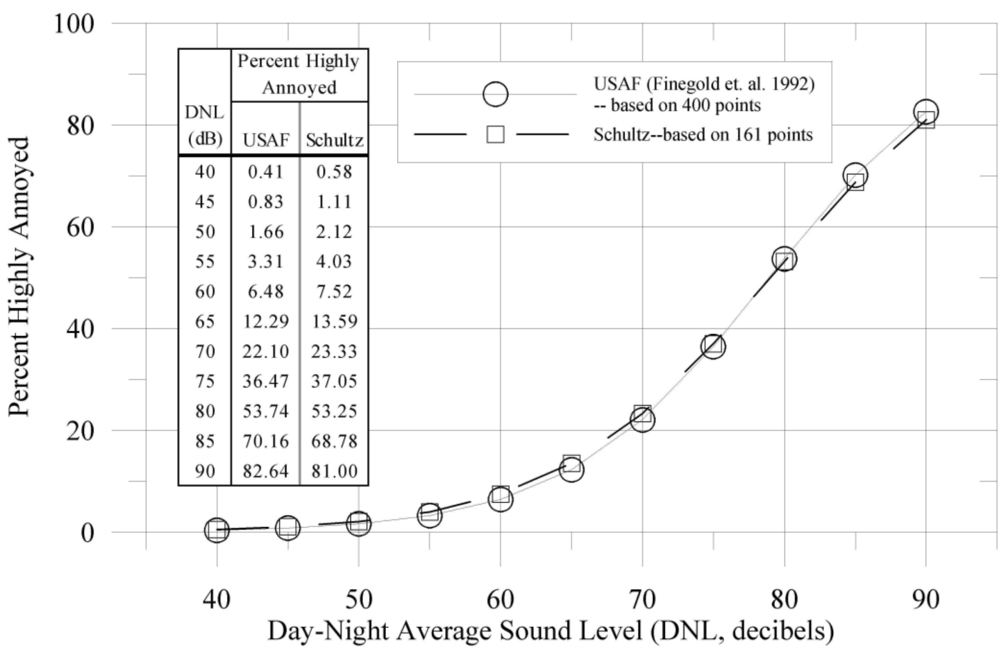
The relationship between annoyance and DNL that has been determined by the scientific community and endorsed by many federal agencies, including the FAA, is shown in **Figure B-21.** Two lines in Figure B-21 represent two large sets of social/ attitudinal surveys: one for a curve fit of 161 data points compiled by an individual researcher, Ted Schultz, in 1978[8] and one for a curve fit of 400 data points (which include Schultz's 161 points) compiled in 1992 by the U.S. Air Force.[11] The agreement of these two curves simply means that when one combines the more recent studies with the early landmark surveys in 1978, the results of the early surveys (i.e., the quantified effect of noise on annoyance) are confirmed.

Figure B-7 shows the percentage of people "highly annoyed" by a given DNL. For example, the two curves in the figure yield a value of about 13% for the percentage of people that would be highly annoyed by a DNL exposure of 65 dB. The figure also shows that at very low values of DNL, such as 45 dB or less, 1% or less of the exposed population would be highly annoyed. Furthermore, at very high values of DNL, such as 90 dB, more than 80% of the exposed population would be highly annoyed.

Recently, the use of DNL has been criticized as not accurately representing community annoyance and land-use compatibility with aircraft noise. One frequent criticism is based on the inherent feeling that people react more to single noise events and not as much to “meaningless” time-average sound levels. In fact, a time-average noise metric, such as DNL, takes into account both the noise levels of all individual events which occur during a 24-hour period and the number of times those events occur. As described briefly above, the logarithmic nature of the decibel unit causes the noise levels of the loudest events to control the 24-hour average.

Figure B-21

Relationship Between Annoyance and Day-Night Average Sound Level



DNL (dB)	Percent Highly Annoyed USAF	Schultz
40	0.41	0.58
45	0.83	1.11
50	1.66	2.12
55	3.31	4.03
60	6.48	7.52
65	12.29	13.59
70	22.10	23.33
75	36.47	37.05
80	53.74	53.25
85	70.16	68.78
90	82.64	81.00

Source: Federal Interagency Committee on Noise (FICON), "*Federal Agency Review of Selected Airport Noise Analysis Issues*", August 1992, p. 3-6, Figure 3.1

As a simple example of this characteristic, consider a case in which only one aircraft overflight occurs in daytime hours during a 24-hour period, creating a sound level of 100 dB for 30 seconds. During the remaining 23 hours 59 minutes and 30 seconds of the day, the ambient sound level is 50 dB. The DNL for this 24-hour period is 65.5 dB. As a second example, assume that 10 such 30-second overflights occur in daytime hours during the next 24-hour period, with the same ambient sound level of 50 dB during the remaining 23 hours and 55 minutes of the day. The DNL for this 24-hour period is 75.4 dB. Clearly, the averaging of noise over a 24-hour period does not ignore the louder single events and tends to emphasize both the sound levels and number of those events. This is the basic concept of a time-average sound metric, and, specifically, the DNL.

It is often suggested that a lower DNL, such as 60 or 55 dB, be adopted as the threshold of community noise annoyance for FAA environmental analysis documents. While there is no technical reason why a lower level cannot be measured or calculated for comparison purposes, a DNL of 65 dB:

- Provides a valid basis for comparing and assessing community noise effects.
- Represents a noise exposure level that is normally dominated by aircraft noise and not other community or nearby highway noise sources.
- Reflects the FAA's threshold for grant-in-aid funding of airport noise mitigation projects.
- HUD also established a DNL standard of 65 dB for eligibility for federally guaranteed home loans.

B.2.2 Speech Interference

A primary effect of aircraft noise is its tendency to drown out or "mask" speech, making it difficult to carry on a normal conversation.

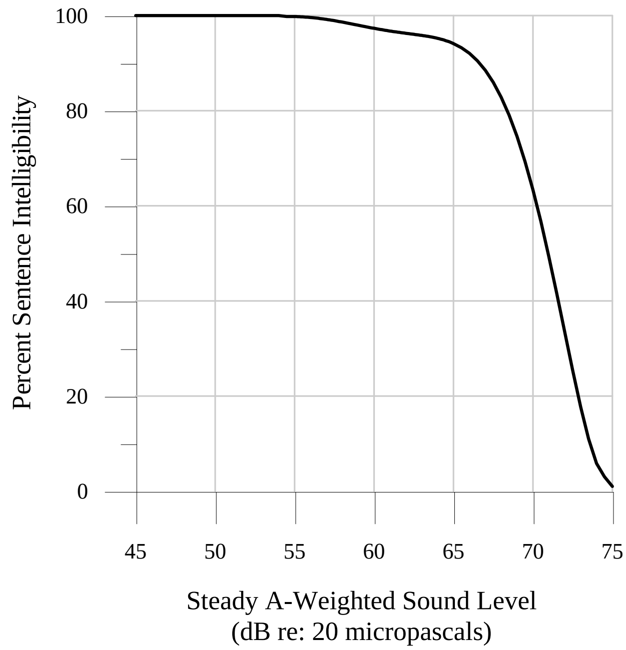
Speech interference associated with aircraft noise is a primary cause of annoyance to individuals on the ground. The disruption of routine activities, such as radio or television listening, telephone use or family conversation, causes frustration and aggravation. Research has shown that "whenever intrusive noise exceeds approximately 60 dB indoors, there will be interference with speech communication."[1]

Indoor speech interference can be expressed as a percentage of sentence intelligibility among two people speaking in relaxed conversation approximately one meter apart in a typical living room or bedroom.[1] The percentage of sentence intelligibility is a non-linear function of the (steady) indoor background sound level, as shown in **Figure B-22**. This curve was digitized and curve-fitted for the purposes of this document. Such a curve-fit yields 100 percent sentence intelligibility for background levels below 57 dB and yields less than 10 percent intelligibility for background levels above 73 dB. Note that the function is especially sensitive to changes in sound level between 65 dB and 75 dB. As an example of the sensitivity, a 1 dB increase in background sound level from 70 dB to 71 dB yields a 14 percent decrease in sentence intelligibility.

In the same document from which Figure B-22 was taken, the EPA established an indoor criterion of 45 dB DNL as requisite to protect against speech interference indoors.

Figure B-22

Percent Sentence Intelligibility



Source: EPA 1974

B.2.3 Sleep Disturbance

Sleep disturbance is another source of annoyance associated with aircraft noise. This is especially true because of the intermittent nature and content of aircraft noise, which is more disturbing than continuous noise of equal energy and neutral meaning.

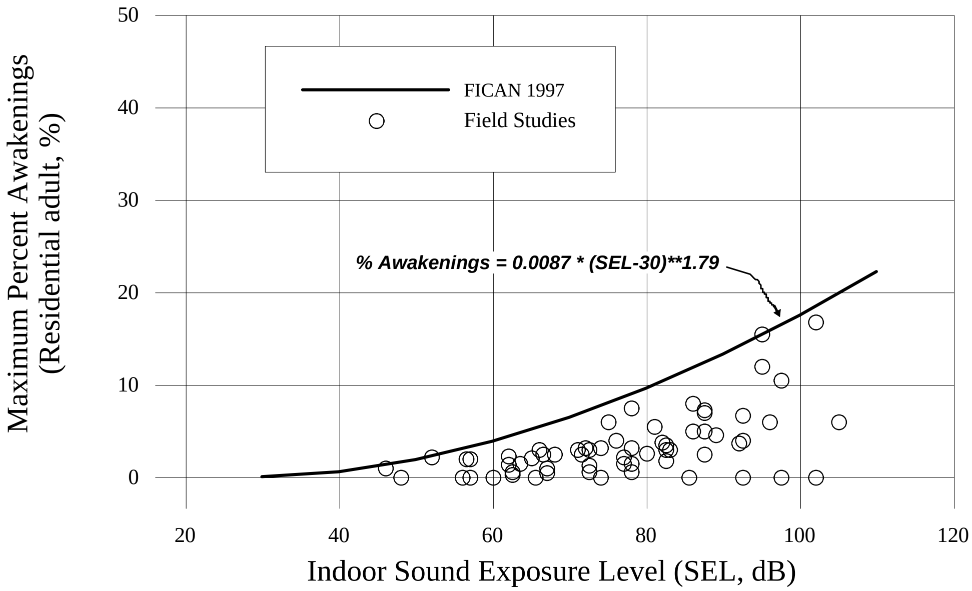
Sleep disturbance can be measured in one of two ways: "Arousal" represents awakening from sleep, while a change in "sleep stage" represents a shift from one of four sleep stages to another stage of lighter sleep without awakening. In general, arousal requires a higher noise level than does a change in sleep stage.

In terms of average daily noise levels, some guidance is available to judge sleep disturbance. The EPA identified an indoor DNL of 45 dB as necessary to protect against sleep interference.[1]

In June 1997, the Federal Interagency Committee on Aviation Noise (FICAN) reviewed the sleep disturbance issue and presented a sleep disturbance dose-response prediction curve.[12] FICAN based their curve on data from field studies[13 14 15 16] and recommends the curve as the tool for analysis of potential sleep disturbance for residential areas. **Figure B-23** shows this curve which, for an indoor SEL of 60 dB, predicts that a maximum of approximately 5 percent of the residential population exposed are expected to be behaviorally awakened. FICAN cautions that this curve should only be applied to long-term adult residents.

Figure B-23

Sleep Disturbance Dose-Response Relationship



Source: FICAN, 1997

Endnotes

[1] U.S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety," Report 550/9-74-004, March 1974.

[2] "Guidelines for Considering Noise in Land Use Planning and Control," Federal Interagency Committee on Urban Noise (FICUN), June 1980.

[3] "Federal Agency Review of Selected Airport Noise Analysis Issues," Federal Interagency Committee on Noise (FICON), August 1992.

[4] 14 CFR Part 150, Airport Noise Compatibility Planning, Amendment 150-3, Updated April 2012.

[5] FAA Order 1050.1E, Chg 1, Environmental Impacts: Policies and Procedures, Department of Transportation, Federal Aviation Administration, March 20, 2006.

[6] "Sound Level Descriptors for Determination of Compatible Land Use," American National Standards Institute Standard ANSI S3.23-1980.

[7] "Quantities and Procedures for Description and Measurement of Environmental Sound, Part I," American National Standards Institute Standard ANSI S21.9-1988.

[8] Schultz, T.J., "Synthesis of Social Surveys on Noise Annoyance," *J. Acoust. Soc. Am.,* 64, 377-405, August 1978.

[9] Fidell, S., Barger, D.S., Schultz, T.J., "Updating a Dosage-Effect Relationship for the Prevalence of Annoyance Due to General Transportation Noise." J. Acoust. Soc. Am., 89, 221-233, January 1991.

[10] "Community Reactions to Helicopter Noise: Results from an Experimental Study," *J. Acoust. Soc. Am.,* 479-492, August 1987.

[11] Finegold, L.S., C.S. Harris, H.E. VonGierke., "Applied Acoustical Report: Criteria for Assessment of Noise Impacts on People." *J. Acoust. Soc. Am.,* June 1992.

[12] Federal Interagency Committee on Aviation Noise (FICAN), "Effects of Aviation Noise on Awakenings from Sleep," June 1997.

[13] Pearson, K.S., Barber, D.S., Tabachnick, B.G., "Analyses of the Predictability of Noise-Induced Sleep Disturbance," USAF Report HSD-TR-89-029, October 1989.

[14] Ollerhead, J.B., Jones, C.J., Cadous, R.E., Woodley, A., Atkinson, B.J., Horne, J.A., Pankhurst, F., Reyner, L, Hume, K.I., Van, F., Watson, A., Diamond, I.D., Egger, P., Holmes, D., McKean, J., "Report of a Field Study of Aircraft Noise and Sleep Disturbance." London Department of Safety, Environment, and Engineering, 1992.

[15] Fidell, S., Pearsons, K., Howe, R., Tabachnick, B., Silvati, L., Barber, D.S. "Noise-Induced Sleep Disturbance in Residential Settings," AL/OH-TR-1994-0131, Wright Patterson AFB, OH, Armstrong Laboratory, Occupational and Environmental Health Division, 1994.

[16] Fidell, S., Howe, R., Tabachnick, B., Pearsons, K., Sneddon, M., "Noise-Induced Sleep Disturbance in Residences Near Two Civil Airports," Langley Research Center, 1995.

Attachment 1:

AEE Coordination

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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

April 20, 2015

Gary Gates
FAA Helena Airports District Office
Northwest Mountain Region
2725 Skyway Drive, Suite 2
Helena, MT 59602

Dear Mr. Gates,

The Office of Environment and Energy (AEE) has reviewed the proposed non-standard Integrated Noise Model (INM) aircraft substitutions for the Boise Airport (BOI) Noise Exposure Map (NEM) Update.

On behalf of the City of Boise, owner and operator of Boise Airport, HNTB is preparing an NEM Study to develop updated NEMs to define the noise exposure levels in and around the Airport. The noise analysis will be conducted for the years 2015 (existing condition) and 2020 (future condition) using the Integrated Noise Model (INM) – Version 7.0d. HNTB has proposed substitutions for 10 aircraft types that currently do not have standard substitutions in the INM version 7.0D aircraft database. The proposed substitutions and the corresponding AEE recommendations are summarized in the table below.

Aircraft	**HNTB Proposed Substitution**	**AEE Recommendation**
Embraer Phenom 100	CNA510	Concur
Piper Malibu Meridian	CNA208	Concur
Socata TBM-850	CNA208	Concur
Embraer Phenom 300	CNA560E	Concur
Dassault Falcon F7X	FAL900	Concur
Diamond Star DA40	GASEPV	Concur
Learjet 40	LEAR35	Concur
Lancair LC-41 Columbia 400	CNA206	Concur
Canadair CL-41 Tutor	**CL600**	**T37B**
Quest Kodiak	CNA208	Concur

AEE concurs with all but one of the proposed substitutions. The Canadair CL-41 Tutor jet trainer would be more appropriately modeled with INM type T37B military aircraft.

AEE approves the aircraft substitutions as listed in the table above under the heading "AEE Recommendation". Please understand that this approval is limited to this particular NEM Update Study at BOI. Any additional projects or non-standard INM input at BOI or any other site will require separate approval.

Sincerely,

Rebecca Cointin

Rebecca Cointin, Manager
AEE/Noise Division

cc: Jim Byers, APP-400

APPENDIX C

Noise Level Reduction
Construction Technical Report

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APPENDIX C
Noise Level Reduction Construction Technical Report

In the previous Part 150 Study, the Boise Airport prepared a design guide, an *Acoustical Design Guide for Residences (Wyle Laboratories, 2004)*, that provided recommendations for the design of dwellings in the vicinity of the Airport that may be constructed in the future. The design guide presents construction guidelines for achieving noise level reductions (NLRs) of 25, 30, and 35 decibels. Under this Part 150 Study Update, the Airport reviewed and updated the document. The updated (2015) design guide is attached as Appendix C of this Study.

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ACOUSTICAL DESIGN GUIDE FOR RESIDENCES

Prepared For

CITY OF BOISE

Part 150 Study Update

Prepared By

Gary Ehrlich

HNTB

September 2015

Table of Contents

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1.0 Introduction

1.1 Background

Residences located near airports experience many economic and transportation benefits of the facility, but are unfortunately exposed to significant amounts of aircraft noise. However, using proper construction techniques and materials can minimize the impact of aircraft noise and reduce interference with regular indoor activities. The City of Boise, Idaho, owner and operator of Boise Airport, initially developed an Acoustical Design Guide in support of the 2004 Noise Compatibility Study. The Acoustic Design Guide was compiled to assist builders, planning officials, building inspectors, and homeowners in incorporating specific noise level reduction features into the designs of homes. These features can help to ensure that homes in the airport vicinity provide an adequate noise level reduction to protect occupants from undesirable noise impacts.

For homes located in areas with high noise levels, standard building methods, even those that are designed for thermal efficiency (such as the International Energy Code), are normally inadequate to protect inhabitants from external noise. For this reason, building design and construction methods may have to be modified for noise-sensitive rooms such as bedrooms, living rooms, and family rooms. These spaces are referred to as the habitable rooms in a house. Standard design and construction methods can typically be used for non-habitable rooms, such as garages, mudrooms, and breezeways unless they open directly to habitable rooms without interior doors in between the rooms.

This Design Guide provides recommendations for the design of dwellings in the vicinity of the airport that may be constructed in the future. Construction guidelines are presented for the noise level reductions (NLRs) of 25, 30, and 35 decibels. This guide also provides recommendations for the renovation of existing homes to provide sound insulation in accordance with Federal Aviation Administration (FAA) guidelines.

1.2 How to Use this Guide

This guide has been developed to be used by a variety of different professionals, as well as by interested homeowners. This guide is recommended for the following people:

- Planning Officials
- Plan Reviewers
- Building Inspectors
- Builders
- Homebuyers/Homeowners

Sections 2 and 3

These sections include a brief overview of sound transmission paths into a home, a discussion of basic design principles, and subsections for each building element including walls, windows, doors, ceilings, attics, floors, basements, crawlspaces, and ventilation systems. The building element subsections include text, tables and design detail drawings to illustrate various options for noise control.

Section 4

Specific design modifications are presented in a selection chart. Designs that achieve noise level reductions (NLR) of 25, 30 and 35 dB are listed. The table in Section 4 presents the sound ratings of building materials that are needed to achieve specific NLR design goals.

Section 5

This section discusses the renovation of existing homes to provide sound insulation. The requirements for such projects are discussed, and sound insulation designs are presented for three typical homes found in the Airport Influence Area as adopted by the City of Boise and Ada County.

Appendix

Appendix A provides a summary of design and construction methods necessary to achieve NLRs of 25, 30, and 35 dB. Once the reader is familiar with this Guide, Appendix A can be used as a stand-alone reference in implementing the designs. Appendices B and C will be useful to builders, as they provide information on many acoustical product manufacturers and certified test laboratories. Appendix D is a glossary that will be useful to all parties. Appendix E contains the full results of a housing survey, completed as part of the previous study (2004), which was used in the development of sound insulation designs for new and existing houses.

This Guide seeks to provide clear, unambiguous direction that is practical and can be implemented with minimum additional cost. However, construction quality is especially important for maintaining the acoustical integrity of a design. For example, even a good window, if not installed properly, will allow a significant amount of noise into the building. High-quality construction standards are absolutely essential for these techniques to work effectively.

The design packages in Section 4, Section 5, and Appendix A address typical home sizes and styles. Information about new and existing home construction was provided by a representative housing survey performed in February 2004. The noise analysis used here makes assumptions about the number of exterior doors and the size of the windows with respect to the floor area. Unusual homes may require more specialized analysis to ensure compliance. For example, very small rooms with normal windows have a larger window-to-floor space ratio and may allow more noise intrusion than average sized rooms. Similarly, rooms with very large windows or a room with several windows and exterior doors may also allow more noise to enter. Unusually large windows would require better acoustical performance than is indicated in this report in order to meet the noise level reduction goals. *The use of cathedral ceilings is strongly discouraged for homes exposed to aircraft noise because the attic acts as a noise buffer*. Conversely, homes with large wrap- around porches may provide shielding from noise that the Guide will not anticipate. For these reasons, homes with unique features or with dimensions that differ significantly from the average may require the services of an acoustical consultant in order to ensure adequate noise reduction.

Individuals differ in their response to noise. In an aircraft noise-affected neighborhood, a number of residents are very annoyed by aircraft overflights, while quite a few others are not. If properly implemented, the recommendations in this Guide will reduce noise inside the home to levels that most people will find acceptable. The airplanes will still be discernible; sound insulation is not sound elimination. People will know that a plane is passing overhead but, with the techniques outlined in this Guide, the noise should not be so loud that it interferes with normal daily indoor activities. Those individuals, however, who are most sensitive to noise, may continue to be annoyed. Nevertheless, the number of people who perceive unacceptable indoor noise levels can be significantly reduced by the use of proper construction techniques.

2.0 Noise Control Basics

2.1 Units Used in Acoustics

A number of different metrics (measures) have been developed to express various aspects of acoustics. It is important to understand several of them in order to make the best use of this Guide.

Aircraft noise is generally expressed in terms of its A-weighted sound level, in units called "decibels." Strictly speaking, the decibel unit should be abbreviated only by "dB"; however, for clarity "dBA" and "dB(A)" are often used to highlight the fact that the sound level measurement has been A-weighted (this weighting system is described below).

The noise exposure in areas around airports is expressed in terms of the Day-Night Average Sound Level, which is abbreviated by "DNL" in text and "L_{dn}" in equations. DNL is a measure of the average A-weighted sound level of all aircraft flights occurring in a 24-hour period with nighttime operations being counted more heavily as described below. The unit of DNL is also the decibel.

The sound insulation properties of building construction materials are described by Sound Transmission Loss (TL) or Sound Transmission Class (STC). These measures of sound insulation are also described below.

A-Weighted Sound Level

The two most obvious characteristics of sound are level and frequency. Level is essentially a measure of loudness that refers to how much energy or power a sound has when we hear it. Frequency is essentially a measure of pitch. A deep-voiced baritone singer has a lower frequency (or pitch) than a soprano voice, though they may be equally loud. Hertz (abbreviated Hz) is the unit used to indicate frequency and is equal to the number of sound waves (cycles) per second. For reference, middle C on a piano has a frequency of exactly 256 Hz. The normal human ear can detect sound frequencies ranging from about 20 Hz to about 15,000 Hz. People do not hear all sounds over this wide range of frequencies equally well, however. The human ear is most sensitive to sounds in the 1000 to 6000 Hz range.

In order to reflect the differences in hearing sensitivity to different frequencies, sounds are usually described in terms of A-weighted sound levels. When a sound is A-weighted, sound levels measured in the 1000 to 6000 Hz frequency range are *increased* by a specified amount to account for the fact that the ear perceives them as louder compared to other frequencies. Similarly, sound levels measured at frequencies outside this range are *reduced* because the ear is less sensitive in those regions.

Day-Night Average Sound Level (DNL) and Noise Contours

Aircraft noise exposure in a community is usually described in terms of noise contour maps. These indicate bands or zones around airfields where the average noise level can be expected to fall within the ranges specified by the contour lines. The Federal Aviation Administration (FAA) states that areas with a noise exposure of DNL 65 dB and higher are "significantly" impacted by noise. Most noise contour maps show contour levels of DNL

65 dB and above in 5 dB increments.

The acoustic metric used is the Day-Night Average Sound Level (DNL or L_{dn}). This is a cumulative measure of the noise exposure during a 24-hour calendar day. A 10 dB penalty is added to noise events occurring between 10:00 p.m. and 7:00 a.m. to reflect their greater intrusiveness and potential for disturbing sleep. The DNL is the result of averaging the A-weighted sound pressure level over 24 hours for aircraft activities taking place on an average day. The average day is determined by analyzing flight activity over the period of one full year. This gives an indication of the year-round average noise exposure for the community.

Sound Transmission Loss (TL)[1]

This is the physical measure that describes the sound insulation value of a building element such as a window or wall. Values of TL are determined in acoustical laboratories under controlled testing methods prescribed by the American Society for Testing and Materials (ASTM). The TL is expressed in decibels (dB), and the greater the sound insulation, the higher the TL value and the less sound will be transmitted through the building material. TL values are determined for different frequency ranges and give an indication of how a building product responds differently to sounds at different frequencies.

Sound Transmission Class (STC)[2]

Since working with a series of TL measurements for different frequencies can be cumbersome, a single-number descriptor based on the TL values has been developed. This rating method is called the Sound Transmission Class (STC). As with the TL, the greater the STC rating for a construction method or component, the higher the sound insulation. Originally, STC ratings were developed as a single-number descriptor for the TL of interior office or apartment walls for typical office noise and speech spectra. Now, they are used for exterior building components as well. Most acoustical materials and components are commonly specified in terms of their STC ratings.

[1] Typical tests to determine TL are described in American Society of Testing and Materials (ASTM) Standard E90.
[2] STC is described in ASTM Standard E413.

2.2 Aircraft Noise

Interference With Activities

The problem of aircraft noise has been recognized and studied in this country since the 1950s. Opinion surveys indicate that interference with telephone usage, listening to television and radio, and conversations invoke the most complaints. However, after a home has been sound insulated, residents notice improvements in their ability to carry out these normal activities as well as to fall asleep and concentrate.

Fears of permanent hearing damage from flyovers have been shown to be unfounded. A large number of studies on the physical, mental, and emotional health effects of aircraft noise exposure have led to the general conclusion that residences near airports are not exposed to high enough sound levels to warrant concern. The principal effect of aircraft noise on airfield neighbors is annoyance, caused by interference with daily activities.

Aircraft Noise Characteristics

Noise intrusion from aircraft activities is perceived as more disturbing than other kinds of noise because of two primary characteristics. Unlike many other community noise sources, such as highway noise, which tend to be fairly constant, aircraft noise consists of sporadic individual noise events with a distinct rise and fall pattern. People do not, in general, respond to these events as just another component of the "background noise" of their day- to-day lives. Some people get used to the noise, but many others feel that each individual flyover event is recognizable and disturbing.

The noise level experienced at a particular dwelling will depend on its location relative to the aircraft flight paths and the mode of ongoing aircraft operations (arrivals or departures). For homes very near the airport, the second quality that makes aircraft noise more intrusive is its higher level, or loudness, than other types of community noise.

Aircraft Sound Spectrum

The noise produced by modern aircraft contains acoustical energy over a wide frequency range. The audible noise includes many sounds from a low-frequency "rumble" to a high-frequency "whine." The exact character depends on the aircraft type and the operation performed (takeoff, landing, or ground run-up). Low-frequency noise (below 500 Hz) penetrates walls, roofs, doors, and windows much more efficiently than does high-frequency noise. Higher frequencies (above 1000 Hz), however, are carried through cracks and vents better. Also, people hear higher frequency sound better, the human ear being more sensi- tive above 1000 Hz than below.

Since aircraft noise differs somewhat from other types of community noise, it is important to identify the characteristics of the noise that sound insulation is protecting against. Most materials and construction methods are more effective at insulating in one part of the frequency spectrum than in others. Knowing the noise characteristics helps in choosing the best materials for sound insulation. This Guide has been designed specifically to protect against aircraft noise rather than highway noise or some other problem.

Most of the sound energy from aircraft operations is found at lower frequencies. While this energy is below the most sensitive region of people's hearing range, it can be heard well enough to be annoying and it can cause disturbing structural vibration in a dwelling. Section 2.4 discusses the process by which sound is transmitted into a dwelling interior.

2.3 Sound Insulation to Reduce Noise

Total "soundproofing" of the dwelling, such that aircraft operations are not heard, is usually not practical or cost-effective. The goal for residential sound insulation is to *reduce* the dwelling interior noise levels due to aircraft operations to an acceptable level, that is, a level where it no longer interferes with daily activities.

Interior Noise Objectives

The Federal Aviation Administration (FAA) has established guidelines for the noise level reduction that a home must provide in order to be comfortable in the presence of aircraft noise. The FAA land-use compatibility table recommends that a home exposed to a DNL of 65 to 70 dB should provide at least 25 dB of NLR, and a home exposed to a DNL of 70 to 75 dB should provide at least 30 dB of NLR. The use of other NLR goals may be appropriate in many cases, especially if a noise metric other than DNL is used at that airport.

Room Variations

The noise level of different rooms in a house depends on the absorption within the room, as well as on the noise entering from outside. Upholstered furniture, drapes, and carpeting absorb sound while hard surfaces do not. The exterior sound level is transmitted through the outside walls (depending on their construction) and is further modified by the absorption inside the room (from the various furnishings) to determine what the interior noise level will be.

Expected Dwelling Noise Level Reduction

An acoustically well-insulated home with windows and doors kept closed can provide 30 to 35 dB of NLR whereas more typical, unmodified designs might provide 20 to 25 dB of NLR. Experience has proven that the objectives discussed here are reasonable when construction materials and methods follow the guidelines presented in Sections 3.0, 4.0, and 5.0. Providing more than 40 dB of noise level reduction is not usually practical for a typical residence. Of course, sound insulation will not have any effect on outdoor activities. The advantage of sound insulation is that it provides a refuge from external aircraft noise levels.

In general, it is more efficient and cost effective to take acoustic performance into account at the start when designing and building a home. Remodeling a pre-existing home is far more costly and time consuming than anticipating and building using good sound insulation techniques. This Guide was developed for new homes; different materials and techniques would be appropriate when renovating houses to achieve the NLR goals.

2.4 Basic Sound Insulation Concepts

Sound Transmission

In order to effectively examine noise control measures for dwellings it is helpful to understand how sound travels from the exterior to the interior of the house. This happens in one of two basic ways: through the solid structural elements and directly through the air. Figure 2-1 illustrates the sound transmission through a wall constructed with a brick exterior, stud framing, interior finish wall, and absorbent material in the cavity.

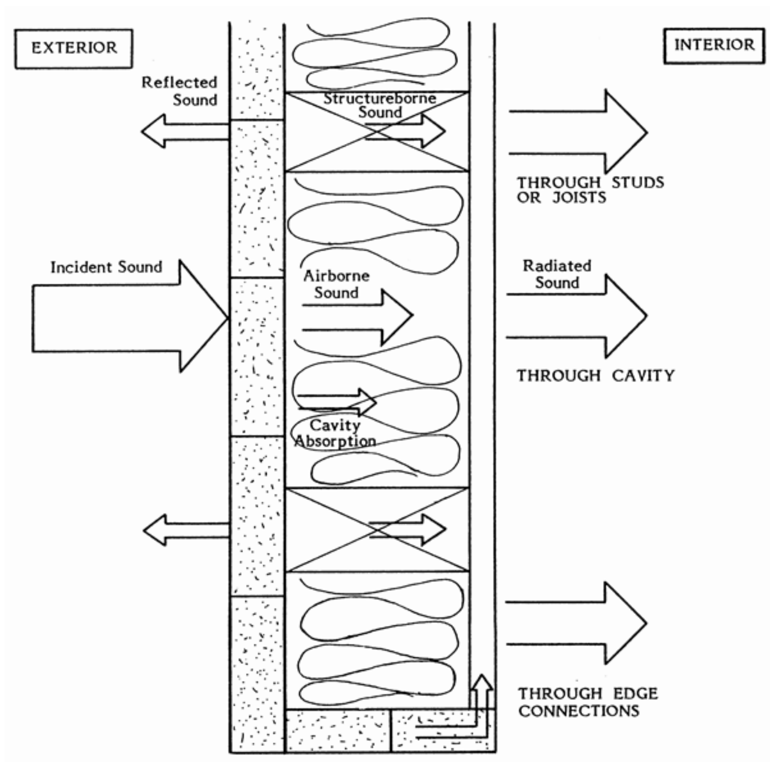


Figure 2-1. Pictorial Representation of Sound Transmission Through Built Construction

The sound transmission starts with noise at the wall exterior. Some of this sound energy will be reflected away and some will make the wall vibrate. The vibrating wall radiates sound into the airspace, which in turn sets the interior finish surface vibrating, with some energy lost in the airspace. This finish surface then radiates sound into the dwelling interior. As the figure shows, some vibrational energy also bypasses the air cavity by traveling through the studs and edge connections.

Openings in the dwelling, which provide air infiltration paths through windows, vents, and leaks, allow sound to travel directly into the interior. This is a very common, and often overlooked, source of noise intrusion. Basically, any way that air enters a home, sound will also enter.

Flanking is a similar concept and usually refers to sound passing around a wall. Examples of common flanking paths include: air ducts, open ceiling or attic plenums, continuous side walls and floors, joist and crawlspaces.

Figure 2-2 displays the three different major paths for noise transmission into a dwelling: air infiltration through gaps and cracks, secondary elements such as windows and doors, and primary building elements such as walls and the roof.

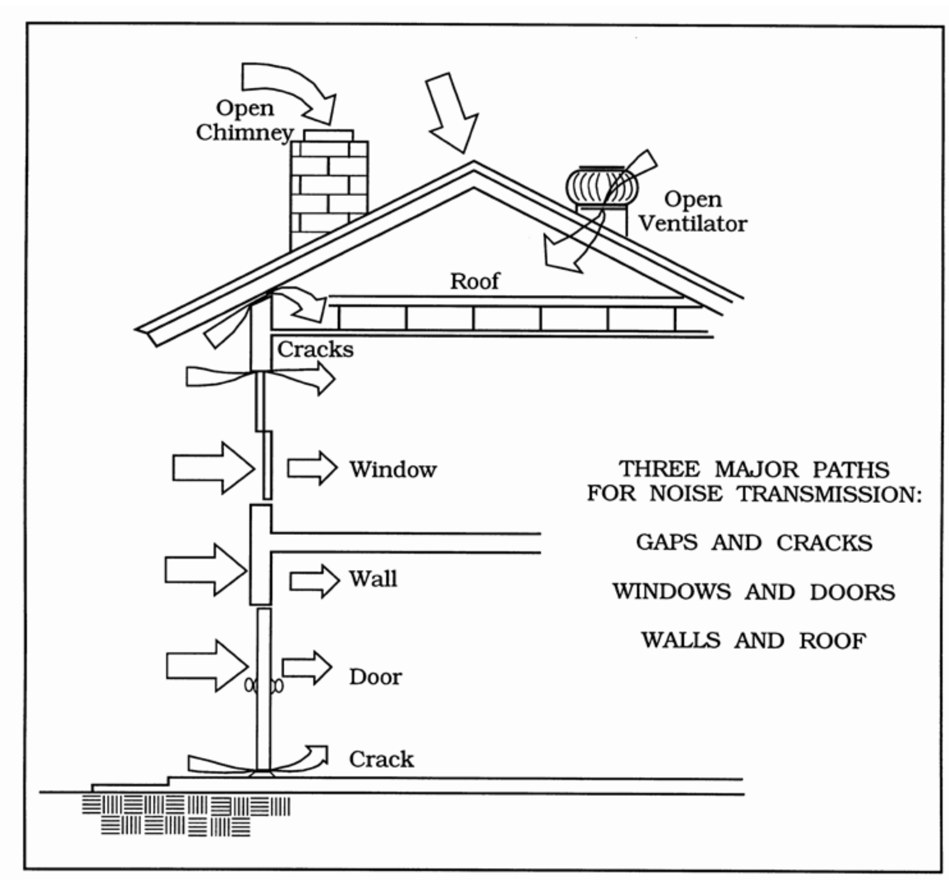


Figure 2-2. Sound Transmission Paths Into Dwelling Interiors

Low-frequency sound is most efficiently transmitted through solid structural elements such as walls, roofs, doors, and windows. High frequencies travel best through the air gaps.

Within these broad categories, different building materials have different responses based on the frequency of the incident sound and varying abilities to insulate against sound.

Reducing Transmitted Sound

The amount of sound energy transmitted through a wall, roof, or floor can be limited in several ways. First, all air infiltration gaps, openings, and possible flanking paths must be eliminated wherever possible. This is the single most important, but occasionally overlooked, step in noise level reduction. This includes keeping windows and doors closed and putting baffles on open-air vents. Some materials reflect more of the incident sound, converting less of it into vibrational energy. The mass of the exterior and interior panels influences how much sound will pass through them. The more mass a structural element has the more energy it takes to set it into vibration, so using heavier building elements generally blocks more noise. Then, absorption in the air cavity, resilient mounting of interior finish panels, and mounting the exterior and interior panels on different studs can further reduce the sound transmitted to the room. The primary approaches for improving sound isolation are:

1. Elimination of openings and flanking paths.
2. Using higher STC windows and doors.
3. Adding mass to walls or ceilings.
4. Isolation of panel elements through increasing their separation, mounting the interior and exterior panels on different studs, or resiliently mounting the interior panels.
5. Adding absorptive materials between the studs or joists.

Acoustical Design

The most important, or controlling, sound paths must be identified in order to know how to modify a dwelling design to meet a specified noise criterion. The ideal sound insulation design would focus on those elements that transmit the most acoustical energy into a room. This eliminates any weak links in the building's insulation envelope.

Windows generally allow more noise intrusion than walls; as more of the wall area is taken up with windows, the overall noise protection decreases. This effect is significant even for massive wall materials, such as brick. Intuition suggests that a brick wall would protect better against sound than siding and this is true when these materials alone are compared. But, putting a weak window or an especially large window into a brick wall will cause the overall construction to perform very poorly since noise enters through the weakest path. On the other hand, installing a high-STC window in a siding wall will give much better noise level reduction than building a weak window into a brick wall.

The STC rating, defined in Section 2.1, is a measure of the material's ability to insulate against sound; the higher the STC rating, the better the insulator. Proper use of STC ratings will be discussed in more detail in Section 3.1. Table 2-1 gives a brief list of typical STC ratings for common building elements. Much of the variability for walls and roofs is due to the type of interior finish, the type of studs or joists, and whether there is insulation in the stud or joist cavities. The ratings in Table 2-1 cannot be used directly to estimate noise level reduction because they do not account for the presence of other elements or the areas of each element.

In most cases, after making sure that openings remain sealed, the windows are the controlling sound paths. Using acoustical windows typically does more to improve the sound insulation performance than any other design modifications. Exterior doors typically require higher STC ratings. Depending on the NLR goal, other elements may become important in meeting specific noise level reduction goals. In some cases, ceilings and exterior walls may require special construction as well, particularly in the higher DNL noise zones. Treatments for these paths and others are discussed in Sections 3.2 through 3.8 of this Guide.

Table 2.1

Typical STC Ratings for Common Construction Elements

Large Elements		**STC (dB)[1]**
Exterior Walls		
	Wood, Vinyl, or Aluminum Siding	34-39
	Cement Board Siding	40
	Stucco	46
	Brick	54
Roofs		
	Venter Attic	45
Floors		
	Slab	60
	Vented Crawlspace	48
Small Elements		**STC (dB)[1]**
Windows[2]		
	Double-Strength Glazing	24-29
Doors[2]		
	Hollow Core (HC) wood	20
	Solid Core (SC) wood	23-29
	Steel or fiberglass	22-28
	Sliding Glass	25-29

Notes:
[1] A higher STC value indicates greater sound insulation.
[2] Food weatherstripping condition.

Problem Areas

Sound intrusion problems are commonly caused by:

1. Building construction components and configurations not providing sufficient sound insulation.

2. Building elements, such as windows, doors, walls, roofs, and floors chosen and combined in an unbalanced way so that some parts are much weaker sound insulators than others.

Unintended openings or sound-flanking paths caused by improper installation of construction elements.

Thermal Insulation

While homes that are well insulated thermally often perform well acoustically, thermal insulation is not always a good indicator of sound insulation. Many thermal windows provide little sound insulation when compared to walls or acoustical windows and are frequently the weak link in the building envelope. However, thermal treatments usually eliminate air infiltration and may serve to improve the acoustical performance of a dwelling for that reason. The presence of insulation in walls or ceilings is far more important than the type of the insulation.

Shielding

The last concept to consider is shielding. This refers to the fact that the side of the dwelling that faces away from the flight path and does not have an open line-of-sight to it will be protected somewhat from the noise. The shielding may be as much as 10 dB in some cases, though values on the order of 5 dB are more common. Sides of the house facing directly toward the flight path are unshielded. Sides that face the flight track at an angle may benefit from some minor shielding effects. Sometimes, however, *sound is reflected off nearby buildings and may counteract the shielding benefits.* Shielding must be examined on a case-by-case basis and the possibility of aircraft straying from the usual flight path must be taken into account before assuming a consistent shielding effect.

In general, a new dwelling should be oriented on the lot so that bedrooms and TV-viewing rooms face away from the flight track. This will eliminate the need to add extra sound insulation components to protect these noise-sensitive living areas.

3.0 Building Elements

This section provides specific guidelines for modifying standard construction designs and practices to meet the need for aircraft sound insulation in new homes. A general discussion of construction materials and methods is given in Section 3.1. Sections 3.2 through 3.8 address techniques for use with weatherstripping, windows, doors, walls and ceilings, attics, floors, HVAC systems, and other miscellaneous elements.

3.1 Evaluating Construction Materials and Methods

Informed Use of STC Ratings

STC ratings are the most common measures of acoustical performance given by manufacturers of building materials. For this reason, it is important to understand how to use STC ratings to evaluate construction materials and systems.

Two different construction methods or components may have identical STC ratings and yet may block aircraft noise differently because or their response at different frequencies. One method or component may perform better than another at some important frequencies. Selecting a construction method or component from a group only on the basis of the highest STC rating may not provide the intended sound insulation. This is because the STC rating does not take into account the strong low-frequency nature of aircraft noise. This guide has taken the ability of typical products to block aircraft noise into account. The recommended materials listed in Sections 4.0 and 5.0 (and their STC ratings) were evaluated for frequency response prior to formulating the design packages.

Combining Building Elements

As mentioned earlier, the acoustical performance of the building depends on the combined performances of each of the elements. The final result depends on the transmission loss (or STC) and the relative surface areas of the elements. If any of the components has poor insulation properties the overall performance can be seriously weakened. This is why it is important to focus on the weaker elements and to consider the relative areas of the components.

As a rule-of-thumb, if a weaker element will be included in the assembly, its size should be kept to a minimum. For example, very large windows degrade the noise level reduction of an otherwise effective brick wall. If a cathedral ceiling is included, it should be designed so that there is a larger-than-standard air space between the ceiling and the roofing system, and this space must be insulated. In addition, slightly higher STC ratings should be used for windows and doors than indicated in Sections 4.0 and 5.0. Sensible compromises can be made to preserve the noise level reduction of the home without sacrificing aesthetics, provided the principles explained in this Guide are employed.

3.2 Sealing and Weatherstripping

Good weatherstripping and caulking around windows and doors is crucial to effective sound insulation. The STC rating of the overall assembly can vary by as much as 2 to 4 dB, depending on perimeter infiltration. For these assemblies, any perimeter leakage will degrade the performance of the window or door and can be the controlling factor in the noise isolation. This is generally not an issue with new construction, but homeowners must understand the importance of maintaining weatherstripping in good condition.

For acoustical purposes, compressible neoprene weatherstripping is preferred over felt or other fibrous types. Neoprene is not as porous and compresses better against the window or doorframe. Also, felt and fibrous weatherstripping materials tend to deteriorate more quickly than neoprene and must be replaced more often.

3.3 Windows

Options Overview

The exterior windows are usually one of the weakest elements in the dwelling's sound insulation performance. Improving the acoustical properties of the windows is one of the simplest ways of lowering the overall sound transmission into the house. Design modification options include using thicker glass and wider airspaces between the panes of glass. Specialized acoustical windows provide maximum sound insulation, and should be used in the loudest environments, as specified in Sections 4.0 and 5.0.

Acoustical Performance

The thicker, high-quality insulated glass units should be ¾ inch to 1 inch thick and, for the best noise level reduction, should incorporate at least one lite (pane) of laminated glass, preferably ¼ inch thick. Laminated glass provides better transmission loss than standard, float glass. Tempered glass is also acoustically superior to standard glass, but is not nearly as effective as laminated glass. Off-the-shelf thermopane units are typically available with ratings ranging from STC 24 to 29, and upgraded acoustical units with thicker glass may provide ratings as high as STC 30 to 36. Figure 3-1 shows a typical window installation with the most important features highlighted.

Acoustical windows differ significantly from ordinary residential windows. The design of an acoustical window has a greater frame depth, the glass lites are heavier, and the weatherstripping and seals are more substantial. Most importantly, they have additional lites. The two most common types of acoustical windows are a double pane window with a storm unit attached, or an assembly of two double pane windows connected together. All of these measures are necessary to provide the high degree of sound insulation required for the window assembly. Figure 3-2 shows schematically the features of an acoustical window.

Proprietary windows with STC ratings of 39 to 48 are available in a variety of styles and finishes, including aluminum and vinyl. Information on specialized acoustical windows is available in Appendix A. They are considerably more expensive than typical residential windows.

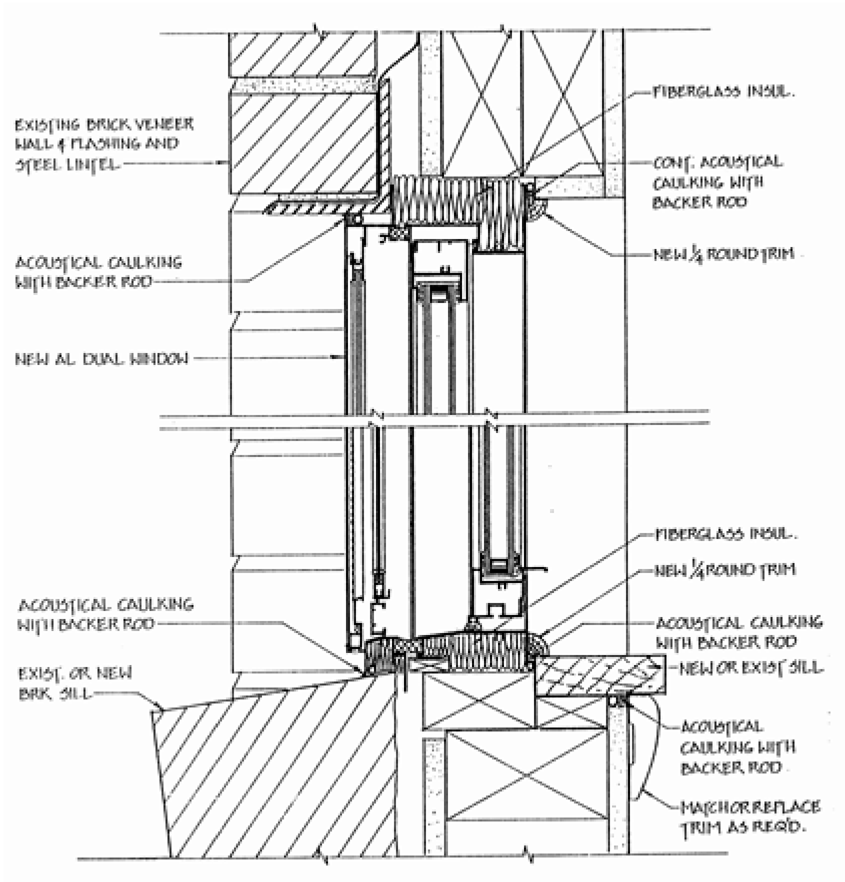


Figure 3-1. Typical Aluminum Dual Window Detail

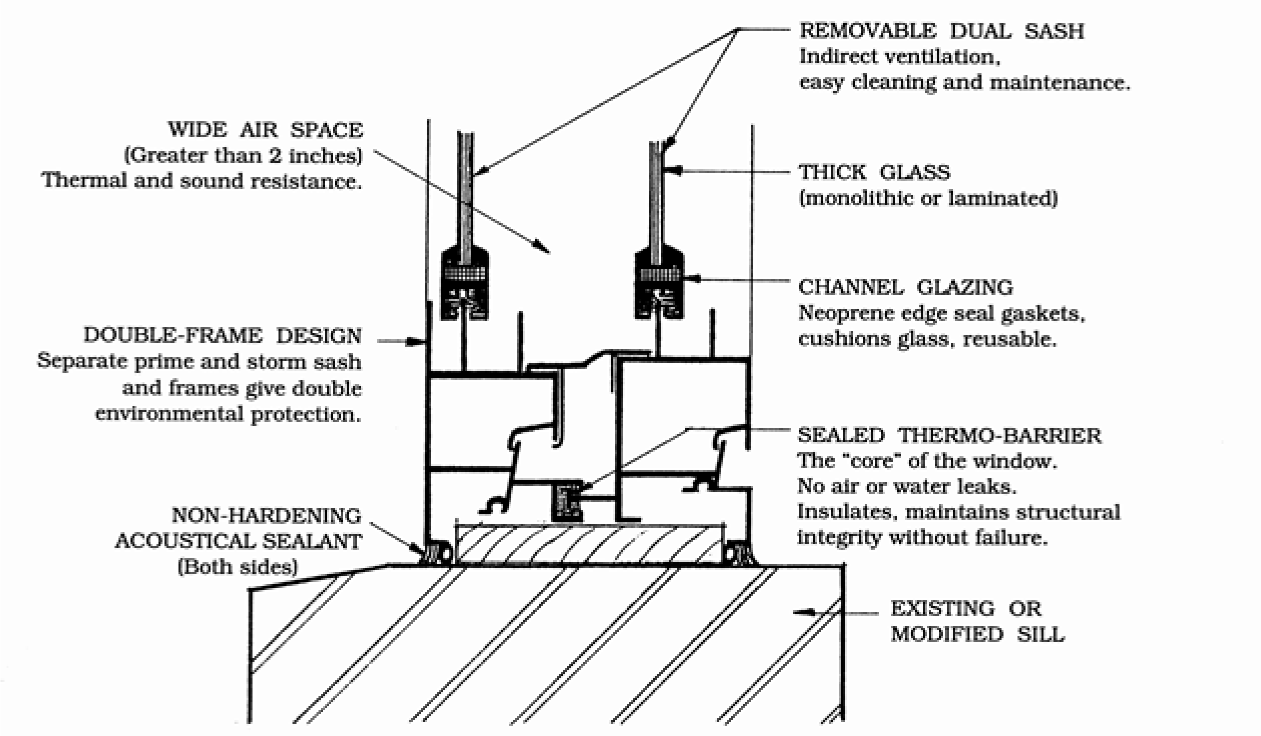


Figure 3-2 Construction Features of Acoustical Window

Thermal Performance

Insulated glass windows are recognized to block the transmission of heat (in winter or summer) much more effectively than single pane glazing. Increasing the thickness of the glass and the airspace, as recommended for noise level reduction, further improves their thermal performance.

Because of the above-mentioned design features, plus the common inclusion of thermal barriers at the frames, acoustical windows perform exceptionally well as thermal barriers. They allow approximately one-tenth the air infiltration of a typical 20-year-old double-hung wood window with single pane glass. The R-value (a measure of thermal resistance) for acoustical windows is R-4. For comparison, the R-values of most off-the-shelf single pane and double pane windows are R-1 and R-3, respectively.

Installation Considerations

For the windows to provide the required noise reduction they must remain tightly closed. Ways to maintain ventilation will be discussed in Section 3.8. It is important to note, however, that this requirement precludes the use of jalousie or louvered windows in a sound insulation design. Double-hung, single-hung, horizontal sliding, casement, fixed, and awning/hopper windows are all acceptable for noise reduction, provided they have the required STC rating.

Other considerations when preparing window specifications include maintainability, warranty, manufacturer's service, and proper installation. It is possible to install the best acoustical window improperly. If it does not fit tightly enough, air infiltration will significantly reduce the effectiveness. Starting with a too-small window unit and filling in the void around the window with a low-mass material such as fiberglass is unacceptable. Continuous wood blocking infill is, however, acceptable.

3.4 Doors

Options Overview

Doors are comparable to windows in the amount of sound they allow to enter the dwelling. Many typical residential doors require modification or substitution to provide the necessary protection from aircraft noise. As with windows, there are specialized acoustical units available, as well as acoustical storm doors. The following factors are important in evaluating doors for sound insulation:

- Door composition: hollow core wood, solid core wood, insulated metal or fiberglass, sliding glass; core material, additional internal insulation, etc.
- Door weight (can be estimated by pull-weight).
- Presence and type of fixed window panels.
- Quality of seals and weatherstripping and how tightly they seal.

The options for improving the noise level reduction of residential doors include:

- Installation of a tightly fitting storm door with thick (or laminated) glass; or use of a specialty acoustical storm door.
- Installation of a secondary French door.
- Use of thicker glass in sliding glass doors or specialty acoustical sliding glass doors.

Standard Doors

Standard entrance doors can be expected to have ratings of STC 21 to 27. STC requirements are outlined in Sections 4.0 and 5.0 for each type of door (swinging and sliding doors).

Thin glass panels in the primary door can reduce the sound insulation of the door, depending on the thickness of the glass, the surface area, and how well it is sealed. The thinner the glass and the larger the area it covers, the more it decreases the sound insulation of the door. When vision panels are required, it is best to keep them small or to use thick or insulated glass.

Swinging Storm Doors

External storm doors are common in many parts of the country and can improve the STC rating by 3 to 10 dB. In order for storm doors to be effective for sound insulation, they should incorporate thick glass (ideally 1/4-inch-thick laminated glass) and have a heavy core. Storm doors must be mounted year-round. Replacing the glass panel with a screen insert in the summer months will reduce the sound insulation of the home considerably but many homeowners may wish to exercise this option for periods when aircraft activity is light. A list of acoustical storm door suppliers is included in Appendix B.

Acoustical Swinging Doors

Acoustical doors, with a typical rating of STC 30 to 40, are similar in appearance to standard entrance doors. However, due to the high cost of acoustical doors, it is often preferable instead to use more typical residential doors with acoustical storm doors.

Because of their specialized construction and superior sealing design they provide a very noticeable improvement in noise reduction. While metal doors are available, wood doors are preferred by most homeowners since they are more like standard doors. Whether metal or wood, the internal construction of acoustical doors differs substantially from standard doors. Layering of materials, along with added absorption and mass, increases their weight to approximately 12 to 14 lbs per square foot.

To eliminate sound flanking between the closed door and the jamb, acoustic doors are designed with special fixed acoustical seals at the sides and top. A drop seal along the bottom activated by a cam rod when the door is closed is sometimes used to make tight contact with the threshold. In other cases, fixed bottom seals that contact a raised threshold or saddle are used. Also, because of their extra weight, acoustical doors usually require reinforcement of the door frame and heavy-duty mounting hardware and ball- bearing hinges. Manufacturers often provide customized frames with their acoustical doors.

Sliding Glass Doors

There are two options for improving the sound-insulating properties of sliding glass doors: using acoustical units, or using primary and secondary doors. The disadvantages of acoustical sliding glass doors are that they are very expensive, very heavy, and can have a high threshold. The disadvantages of using primary and secondary sliding glass doors have to open two doors to leave the building, and that the two frames would not fit in the width of a typical 2x4 stud wall. This same secondary door concept can be used with French doors. Of course, the installer must ensure that there is no conflict in the operation and opening hardware of the two door sets. Good weatherstripping should be installed on both doors.

Installing a secondary door generally requires building a second frame positioned to mount the door approximately 2 to 3 inches away from the primary door. This dual-door assembly has proven successful in that it raises the STC rating by 5 to 7 dB. Figure 3-3 shows a system of two sliding glass doors with the secondary door mounted outside of the typical door position.

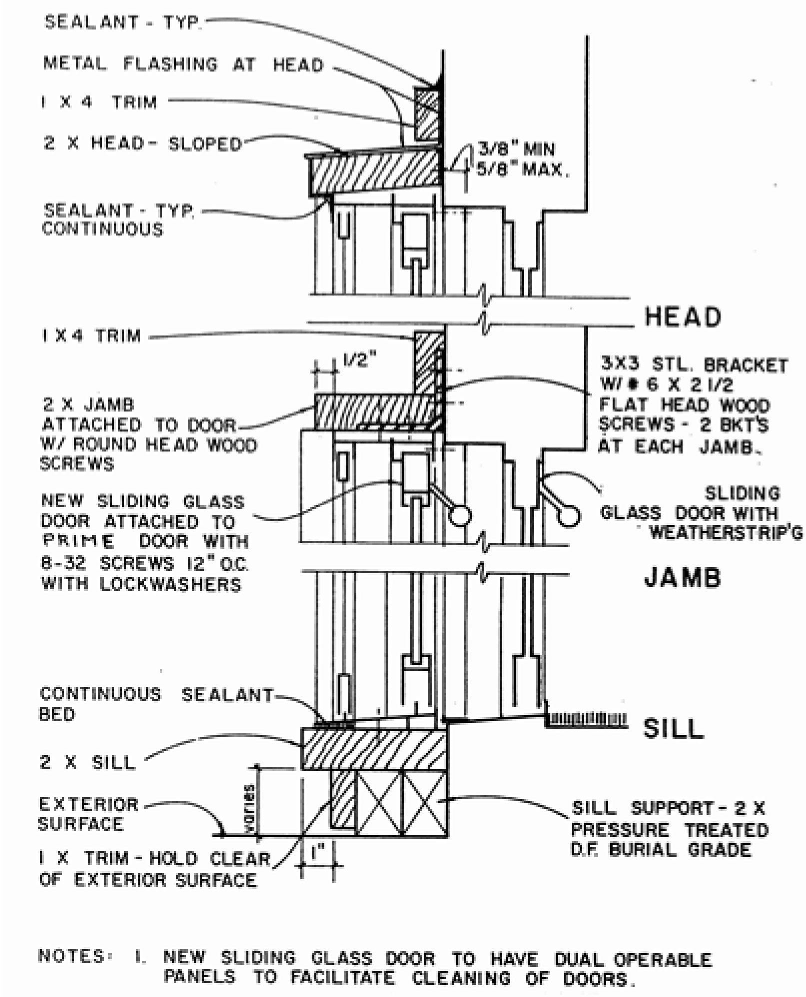


Figure 3-3 Sliding Glass Door Detail

Installation Considerations

As with windows, it is of critical importance to ensure that the door fits well, that all gaps and leaks are sealed, and that the door remains closed. High-quality weatherstripping is recommended to ensure the noise reduction of the door. Sound attenuation through standard doors can be improved by fitting them with special acoustical seals, including drop seals mounted to the back or fully mortised in the door's bottom rail. If the door does not fit squarely into the frame it will not seal properly and unnecessary noise infiltration will result. In all cases, avoid openings such as mail slots in doors or the use of pet doors.

3.5 Walls and Ceilings

Determining Wall and Ceiling Designs

Depending on the dwelling's exterior construction and materials, it may be necessary to use specialized designs for walls. Generally, dwellings that are of vinyl, aluminum, or wood siding exterior construction require improvements such as staggered studs or resilient channels in the highest noise impact zones. Dwellings which use brick, stucco, concrete masonry block, and other cementitious materials typically do not. Walls such as those with cement board siding (e.g., HardiPlank) or with Exterior Insulation and Finishing Systems (EIFS) perform somewhat better than those with regular (lightweight) siding, but to be conservative it is reasonable to treat these cases the same as lightweight siding.

For the purposes of this design guide, the following material definitions can be assumed:

- Brick or Brick Veneer Construction: At least 4½-inch-thick brick veneer over 7/16" OSB sheathing on 2x4 studs with at least 3" thick batt insulation, and 1/2" gypsumboard at interior. The entire exterior wall is constructed of brick.
- Stucco Construction: 7/8-inch stucco (not EIFS) over paper over 7/16" OSB sheathing on 2x4 studs with at least 3" thick batt insulation, and 1/2" gypsumboard at interior. Entire exterior wall is stucco, not partial siding or other material.
- Siding Construction: Non-cementitious siding including wood, MDF, aluminum, or vinyl. Construction includes siding on insulation board (e.g., Thermoply) or 7/16" OSB sheathing on 2x4 studs with at least 3" thick batt insulation, and 1/2" gypsumboard at interior.

Many buildings combine siding with other exterior construction materials such as brick, brick veneer, stone, or stucco. For the purposes of this Guide, the siding and siding-combination constructions are taken to have approximately the same sound insulation performance. Because noise penetrates through the weakest available element, unless the siding area is very limited, noise will penetrate through that part of the building envelope. Generally, if a particular wall is shielded from the flight track or is protected by a heavily roofed porch, the need for supplementary wall treatments is reduced.

Improved ceilings are sometimes necessary where there is an attic over habitable or noise-sensitive rooms such as bedrooms, living rooms, family rooms, etc. There is no need to modify the ceiling of any first-floor rooms where they are completely covered by a second story room. Non-habitable rooms, such as garages and mudrooms in breezeways, are generally not given improved ceilings unless they open directly to habitable rooms without interior doors in between the rooms.

Specific Interior Wall Designs

One technique for increasing the mass and resiliency of the wall or ceiling is to attach the gypsumboard to the studs with 1/2-inch, resilient, vibration-isolation channels ("resilient channels", or "RC"). This will provide an STC rating improvement of 7 dB over that for a typical wood frame/wallboard structure. The resilient-mounting channels should be attached to the studs so that they run horizontally for walls and perpendicular to the joists for ceilings. This minimizes the vibration transmission from the supporting studs to the channels and the wallboard. The screws used to attach the gypsum board to the channels must be short enough that they do not contact the studs. The common installation error of using too long screws allows vibration to travel from the stud to the gypsumboard, rendering the system ineffective.

A second technique involves using the resilient channels mentioned above, and changing the wall construction from 2 x 4 studs to 2 x 6 studs. This will increase the STC by 11 dB over the standard wall construction, and will allow space for R-19 insulation. However, this does involve changes to the framing design of the dwelling, and may not be desirable in some cases.

The third, and most effective, option is to construct the interior wall on a set of staggered studs so that the interior and exterior finish surfaces are not rigidly connected to each other except through the top and bottom plates. This system uses two rows of studs: one row of studs spaced 16" on center supporting the sheathing, and a second row spaced 16" on center supporting the interior wall finish. The end result is that there are studs each 8" on center. Figure 3-4 shows how to implement this construction. This modification provides acoustical decoupling and separation between the exterior and the interior of the room, resulting in a 13 dB increase in the STC rating over standard construction methods. A larger space between the interior and exterior panels will yield a greater STC improvement. Likewise, a greater spacing (24") between studs will provide a higher STC rating.

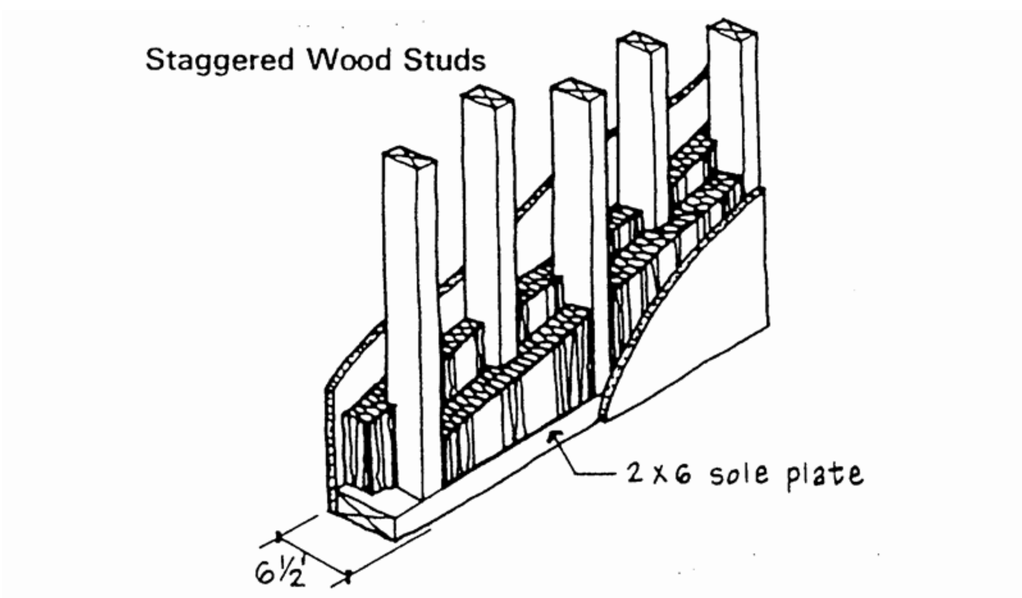


Figure 3-4 Staggered Wood Stud Construction

Two other options are presented in Table 3-1. Since these two options each provide the same STC rating as the staggered stud option discussed in the paragraph above they are listed as alternatives to it. They utilize different construction modifications such as double- layers of ½” gypsumboard (both of which are screwed into the studs), and the addition of 1” of rigid insulation on the exterior side.

Table 3.1
Wall Designs and STC Ratings

Label	Exterior Side	Studs	Interior Side	STC Rating
Siding on 2x4 studs	Siding, 7/16" OSB sheathing	2x4 16” O.C. with batt insulation	1 layer ½” Gypsum board	36-38
EIFS on 2x6 studs	6 mm EIFS, 1” rigid insulation, 7/16” OSB sheathing	2x6 16” O.C. with batt insulation	1 layer ½” Gypsum board	38
Cement Board Siding on 2x4 studs	Cement Board Siding, 7/16” OSB sheathing	2x4 16” O.C. with batt insulation	1 layer ½” Gypsum board	40
Resilient Channel on 2x4 studs	Siding, 7/16" OSB sheathing	2x4 16” O.C. with batt insulation	RC on studs, 1 layer ½” gypsum board	43
Resilient Channel on 2x6 studs	Siding, 7/16" OSB sheathing	2x6 16” O.C. with batt insulation	RC on studs, 1 layer ½” gypsum board	47
Staggered 2x4 on 2x6 base	Siding, 7/16" OSB sheathing	2x4 16” O.C. for each row (staggered on 2x6 base plate) with batt insulation	1 layer ½” gypsum board (attached only to interior-side studs)	49
Alternate to Staggered 2x4	Siding, 7/16" OSB sheathing	2x6 16” O.C. with batt insulation	RC on studs, 2 layers ½” Gypsum board	49
Alternate to Staggered 2x4	Siding, 1” rigid insulation, 7/16" OSB sheathing	2x4 16” O.C. with batt insulation	RC on studs, 2 layers ½” gypsum board	49

To absorb sound, fiberglass or mineral fiber batts are placed between the studs in the wall cavity. Thermal insulation at least 3” thick should be used to ensure a thick enough layer. Batts or blankets should be held firmly in place between studs, with fasteners if necessary, to prevent sagging; however, packing the insulation such that it is compressed may slightly *reduce* its acoustical (and thermal) performance. Blown-in insulation is not recommended in walls for acoustical purposes because of the tendency to compact over time.

Specific Interior Ceiling Modifications

The ceilings of top-floor rooms may need to be modified to provide increased noise protection. Some of the same methods that are used in wall constructions can be used for ceilings. The standard roof construction is assumed to be: asphalt shingles, 7/16" OSB sheathing, wood trusses, batt insulation, and 1/2" gypsumboard on the interior ceiling. This design has an STC 50 rating.

Section 4.0 references a design with resilient channels mounted perpendicular to the ceiling joists, on the bottom of the joists, with one layer of ½” gypsumboard attached to the channels. The addition of resilient channels to the ceiling assembly will increase the rating to approximately STC 56.

3.6 Attics and Roofs

Options Overview

Home designs incorporating unoccupied attic space over all living areas are recommended for dwellings exposed to aircraft noise. Skylights can be used if 1/4-inch-thick glazing or insulated thermopane glass is used at the bottom of the skylight well to supplement whatever glazing is used at the top of the well. In addition to these basic rules, it may be necessary to used improved roof, attic, or ceiling designs. Improvements could include baffles in the attic vents, extra insulation to absorb sound reverberating in the attic space, and an upgraded roof deck.

The use of cathedral ceilings is strongly discouraged for homes exposed to aircraft noise, particularly where the necessary NLR is 30 dB or higher. Rather than a true open-beam or cathedral ceiling, a mock-cathedral or vaulted ceiling with a small attic space above is recommended. Open-beam ceilings should never be used when the necessary NLR is 25 dB or higher.

Sound Transmission Paths

Sound enters through the roof in two paths: directly through vents and other leaks; and by vibrating the roof itself, thereby radiating acoustical energy into the air within the attic. If there is no attic the sound passes immediately into the living space under the roof. This is why homes with open-beam or cathedral ceilings often have very limited noise level reduction through the roof. Where there is an attic, the sound enters and reflects off of the attic surfaces, reverberating in the space. Since much of the sound energy has been dissipated, less sound passes through the finished ceiling to the room below.

Attic Vents

Attics typically have open-air vents at the ends (for a gabled roof) or under the eaves. The sound entering through these vents may be significant. Off-the-shelf acoustical louvers can be applied to baffle the sound passing through such openings. Most off-the-shelf noise control baffles are rectangular and this requires the use of rectangular vents in the dwelling design. Soffit vents under the eaves can be left unmodified when other measures are implemented, since they are somewhat shielded from direct exposure to the aircraft noise.

Any type of attic vent that opens directly through the roof toward the aircraft flight tracks is strongly discouraged. This includes gravity vents, ridge vents, and some active or positive ventilation systems. If these vents are used, built-in-place baffles can be used under them to reduce noise intrusion. Built-in-place baffles consist of pieces of 3/4" thick plywood covered with 1" thick rigid mineral fiber insulation; the plywood panels are oriented in such a way that noise (and air) must be reflected on at least one mineral fiber-lined surface before it can move into the attic. In general, acoustical louvers are preferred over built-in-place baffles due to the possibility that the built-in-place baffles may reduce ventilation through the attic. Figure 3-5 shows a typical built-in-place gable vent baffle design (although mineral fiber should be used instead of fiberglass lining).

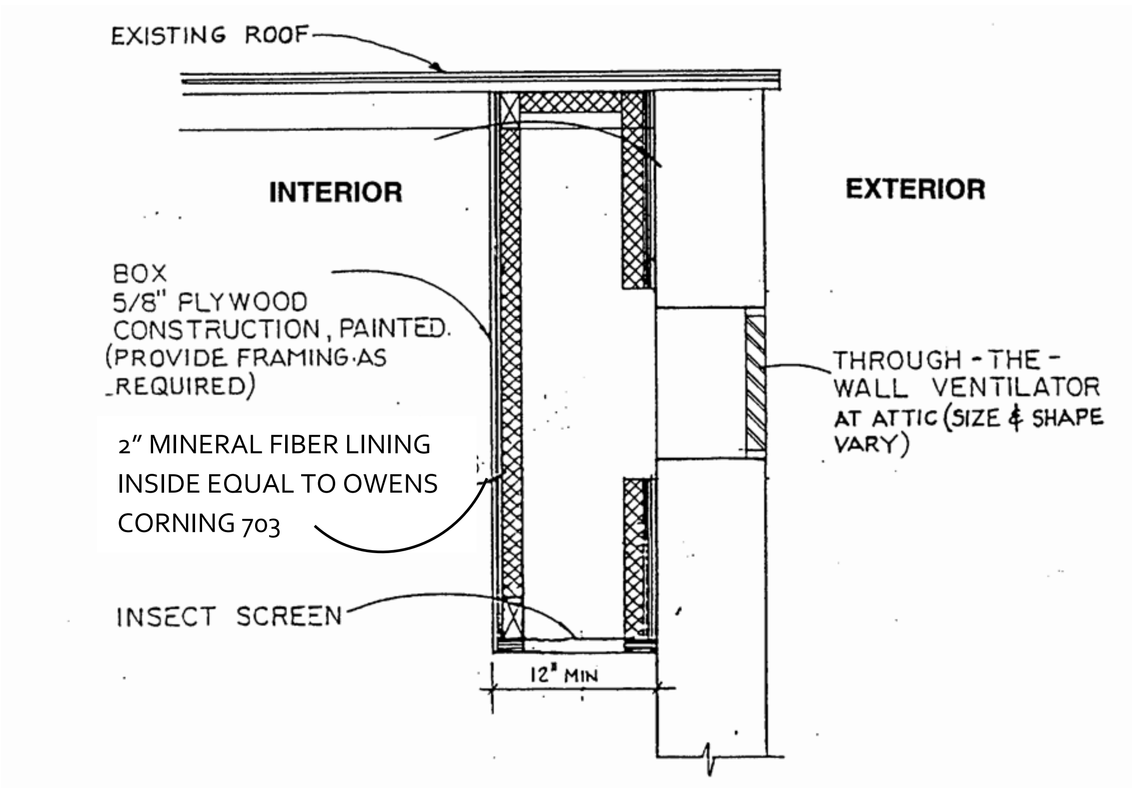


Figure 3-5 Built-in-place Gable Baffle

Attic Insulation

When considering the upgrade of thermal insulation to reduce noise levels it is important to understand what the insulation will do. Thermal insulation materials will act to absorb sound that is reverberating in the attic or in the space between flat panels. It does not prevent noise from entering the space. That is, it has no appreciable acoustic "insulating" properties but acts as an absorbent instead. To keep sound out, barriers must be used which increase the mass of the roof or ceiling. As a sound absorbent, fiberglass or mineral fiber batts and blown-in fiberglass or mineral fiber can be applied between the rafters, between the ceiling joists, or in conjunction with a plywood or gypsumboard barrier. Blown-in cellulose is not recommended since it compacts over time, reducing its effectiveness.

The absorption of a material should not be confused with noise level reduction (NLR). There is no direct relationship between a material's absorptive properties and the overall NLR.

A simple method for determining the proper thickness of sound-absorbent materials is to use the concept of the material's thermal rating (R-value). This R-rating is a commonly used and well-known rating for building products. The R-values and thickness for several common insulation materials are given in Table 3-2. The value of the sound absorption at lower frequencies depends on the thickness of the material. For noise sources with a significant low-frequency component, such as aircraft flyovers, the thickness is the most important parameter. Thicker materials provide better low-frequency sound absorption.

Table 3.2

Material Thickness and R-Value For Common Insulating Materials

Material	**Thickness, Inches**		
	R-11 to 15	**R-19**	**R-30**
Roll or Batt Fiberglass or Mineral Fiber (Vapor Barrier on One Side)	3.5	5.25	9
Blown-In Fiberglass or Mineral Fiber	5	8	13

3.7 Floors and Crawl Spaces

Options Overview

Dwellings in Boise will usually have one of these two types of floor systems at the ground level:

- Concrete slab
- Crawlspace

Since noise control measures are concerned with the external building envelope, floors between stories in a home are not addressed.

There are three stages of floor design improvements for sound insulation:

- Eliminating, sealing or baffling any openings.
- Installing insulation between the floor joists.
- Attaching a barrier panel to the underside of the floor joists or between the perimeter of the house and the ground (a skirt).

Concrete slabs require no treatment. Crawl spaces will be discussed below.

Crawl Spaces

One common floor system for new residences consists of wood plank and beam construction over a vented crawl space. Using insulation batts between joists is also very effective acoustically. The simplest way to improve the acoustical performance of a house that has a crawl space with masonry walls is to install off-the-shelf noise control louvers to the under-floor vents (see Appendix B); this is similar to the design discussed above for roof vents.

These louvers provide a noticeable quieting in the rest of the house. If crawl spaces do not have masonry walls, a massive barrier panel can be used as a skirt connecting the bottom of the walls to the ground. 2" thick precast concrete panels would be ideal. Alternatively, 2x4 pressure-treated wood studs with ¾" pressure-treated plywood on each side could be used, as long as the joints between the plywood are covered with batten strips.

3.8 Mechanical Systems and Building Penetrations

In order to maintain the noise reduction benefits of improving windows and doors and sealing leakage paths, it is important to keep these openings closed. While an acoustically well-insulated home can provide 30 to 35 dB of noise reduction, this figure drops to 15 dB whenever the windows and doors are open. Heating, ventilation, and air-conditioning (HVAC) systems do not directly affect the sound insulation performance, but they enable residents to keep the windows and doors shut year-round and benefit from the sound insulation modifications. The following information is not referenced in Sections 4.0 and 5.0 but the ventilation features discussed here are strongly recommended.

Fresh Air

New homes in Boise will most likely have central air-conditioning. Whether the air needs to be heated, cooled, dehumidified, or simply circulated and replenished depends on the season. Refreshing the air supply and moving it around is important for health and comfort no matter what the outside temperature. A fresh-air intake could be installed on an air- handling system to provide the required percentage of fresh makeup air combined with the recirculating air. However, when the system is not operating during mild weather no fresh air would be provided. Therefore, the system must, at a minimum, have a fresh-air intake and allow for ventilation alone when the residents do not want heating or cooling.

In order to ensure that fresh air is provided year-round, the preferred solution is to use active ventilators. Also, in cold climates we recommend using energy recovery ventilators (ERV) to minimize heat loss in winter. These devices are similar to heat recovery ventilators (HRV), except they exchange moisture as well as heat. An ERV system has four ducts: (1) a fresh air intake duct connecting the outdoors to a fan unit, (2) a fresh air supply duct connecting the fan unit to habitable areas of the home (typically connected to a central forced air duct system), (3) an exhaust air duct connecting bathrooms and/or kitchens to the fan unit, and (4) an exhaust duct connecting the fan unit to the outdoors.

The licensed professional designing the mechanical system must ensure that the building code requirements for fresh airflow volume are met.

Whatever ventilation system is used, penetrations of the building envelope must be minimized and located as far as possible from habitable areas of the house.

Combustion Air

All gas-fired furnaces and other combustion devices need oxygen to operate. If there is insufficient oxygen present harmful chemicals may be created. In order to prevent this, the building code sets forth requirements for airflow near combustion sources. The requirements are mostly related to how enclosed the furnace area is. When sound insulating a house against aircraft noise, the rate of air infiltration is reduced. This is beneficial in terms of energy consumption, but may adversely affect the presence of fresh air, as noted above. To compensate for this reduced air infiltration in the area of the furnace, it is recommended to provide a combustion air fan. This is a small fan that blows air to the furnace area.

Noise and Vibration Control

It is important to limit the amount of noise the HVAC system generates and the noise it carries in from the outside. Taking the steps outlined below will help to minimize the noise from fans, airflow, equipment vibration, and aircraft noise sources:

- Provide vibration isolation mounting for all equipment and locate the equipment far from noise-sensitive rooms so that the structure-borne sound and vibration are kept to a minimum.
- Use ducting materials appropriate to the location to minimize the sound transmitted through the system. Flexible ductwork should not be used in attics and crawl spaces; heavier sheet metal ducts will provide better sound insulation.
- Ducts to the outside, whether intake or exhaust, and all ducts in the attic or crawl space can be lined with 1-inch acoustical internal lining material, or have at least two 90-degree (right angle) elbows (turns) thereby breaking the line- of-sight to the outside as shown in Figure 3-6. It must be noted that there is concern than this fibrous acoustical lining material will affect air quality. Installing a duct sound attenuator (silencer) is an alternative to this technique; there are silencers available that do not contain fibrous lining. To prevent moisture and grease buildup exhaust fans (bathroom, dryer, kitchen, and range) must not have internal sound lining or silencers that use fibrous lining; the use of the 90-degree elbows and/or fiber-free silencers are appropriate in these cases. These measures ensure that the ventilation system is not bringing additional aircraft noise into the house.

- Do not use in-window, through-wall, or through-floor air-conditioners, ventilators, or heaters, i.e., units for which air ducts pass through the building envelope (windows, walls, or floors). On the other hand it is acceptable if only natural gas or refrigerant pipes pass through the building envelope, since these will not allow noise to enter the building. The preferred air-conditioning system is a split system utilizing an outdoor condensing unit.

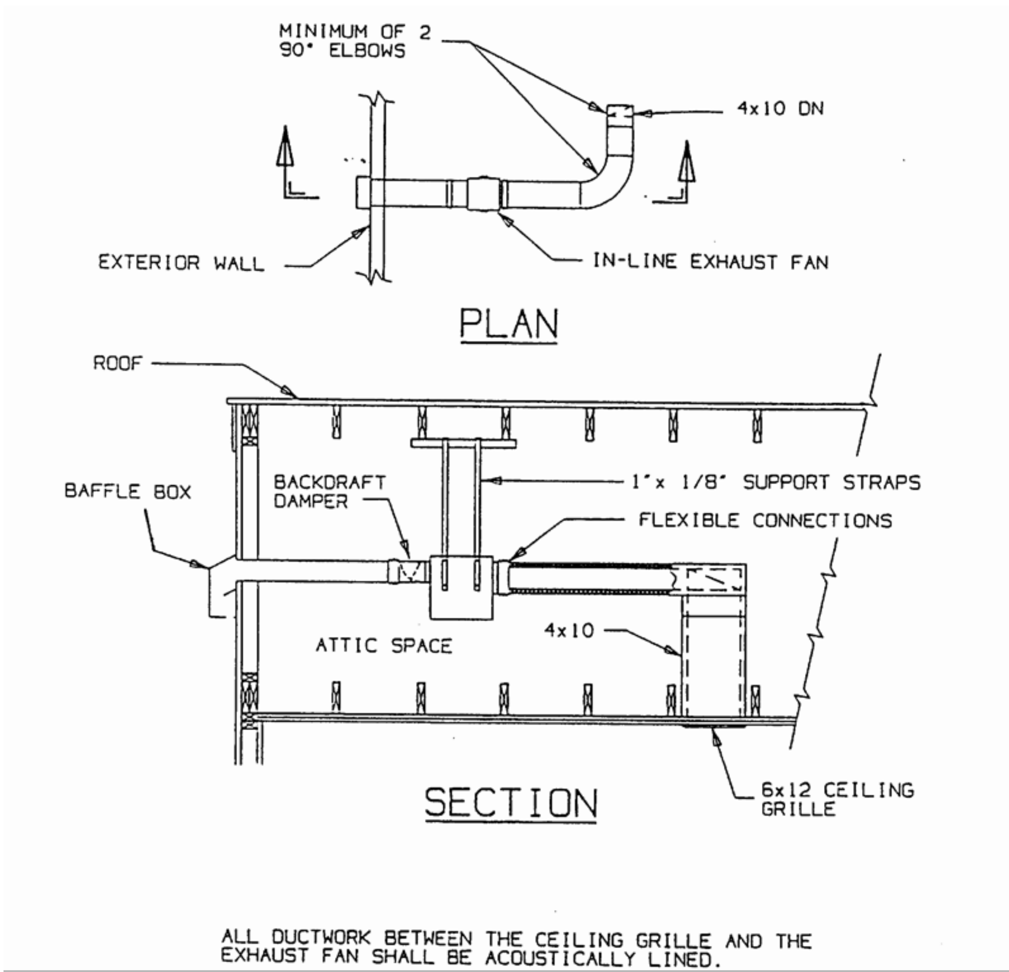


Figure 3-6 Controlling Noise Entering Through Ducts in Attic Space

Kitchen and Bath Fans

Most kitchen and bathroom designs for new homes already incorporate fans for ventilation purposes. If the kitchen and bathroom exhaust ventilators have ducts to the outside, they should be ducted through the attic as opposed to through a wall. A ducting scheme that incorporates at least one and preferably two right-angle turns is effective at reducing noise infiltration and there should be no direct line-of-sight through the duct from the outside to the inside. In other words, if the duct grilles or covers were removed, it should not be possible to see daylight through the duct. All ducts in the attic should be rigid metal and not flexible;

noise may pass through these elements to other rooms of the house. Ideally, the vents will be on the side of the roof facing away from the flight path. However, the length of the duct and the number of elbows must comply with local building codes as well as fan manufacturer requirements.

Fireplaces

Frequently, homes with fireplaces will require some of design modifications. This is especially true if the outside noise exposure is high, or the fireplace is in a room used for watching TV or sleeping. The treatment package consists of two parts: First, glass doors are mounted at the front of the fireplace. Second, the in-chimney damper must be installed so that all edges seal around the damper. Any air gaps or leaks will allow sound to pass through. The glass doors by themselves provide a noticeable improvement and these two treatments, in combination, have proven to be very effective at reducing the noise entering along this path. Chimney-top dampers have also been used successfully when tightly installed.

4.0 New Construction: Material Selection Chart

The following selection chart is to be used to determine the acoustical design needs of each noise-sensitive room of a dwelling. For each room, design recommendations are determined by following the chart from left to right. First, the required noise level reduction (NLR) must be determined for the dwelling based on its location in a certain noise contour zone. Second, the number of exterior walls of a room must be selected. Third, the total exterior façade area (including the gross wall/window/door area) of the room must be calculated, and classified as "typical" or "large" according to the requirements shown in the chart. The last four columns contain the minimum STC ratings of walls, windows, doors (of all types), and ceilings that must be used to achieve the desired noise level reduction.

See Table 2-1 and Section 3.5 for STC ratings of walls and ceilings. STC ratings for typical doors and windows are presented in Table 2-1.

Table 4.1

Material Selection Chart and Corresponding STC Ratings

NLR	Number of Exterior Walls	Room Exterior Wall Area (sq. ft.)	Minimum Recommended STC Rating			
			Wall	Window	Door	Ceiling[1]
25	1	Large (> 170)	36	33	24	50
		Typical (< 170)	36	27	24	50
	2	Large (> 300)	36	33	24	50
		Typical (< 300)	36	33	24	50
30	1	Large (> 170)	43	33	26	50
		Typical (< 170)	36	33	26	50
	2	Large (> 300)	43	40	33	56
		Typical (< 300)	43	33	26	50
35	1	Large (> 170)	47	40	38	50
		Typical (< 170)	43	40	38	50
	2	Large (> 300)	49	44	38	56
		Typical (< 300)	47	40	38	50

Note: [1]For rooms located on the top floor ONLY (with attic above).

4.1 Limitations

There are many variables affecting the acoustical performance of a room. The recommendations contained in this Guide are based on assumptions of typical parameters. If the actual building design and construction used don't match these assumptions the noise level reduction will be different. Due to the interrelationship between each of these variables there are no upper limits on individual parameters.

In developing recommendations, eight typical types of rooms were considered. Typical floor plans for new dwellings for single-family homes, townhomes, and condominiums have been used. They included:

1. Single-family home living room with 2 exterior walls with a gross area of 221 square feet (sq. ft.), window area of 50 sq. ft., and a floor area of 225 sq. ft.
2. Townhome living room with 1 exterior wall with a gross area of 171 sq. ft., window area of 47 sq. ft., door area of 21 sq. ft., and floor area of 456 sq. ft.
3. Condominium living room with 1 exterior wall with a gross area of 76 sq. ft., window area of 19 sq. ft., door area of 21 sq. ft., and floor area of 234 sq. ft.
4. Single-family home family room with 2 exterior walls with a gross area of 385 sq. ft., window area of 74 sq. ft., door area of 41 sq. ft. and a floor and ceiling area of 300 sq. ft.
5. Single-family home typical bedroom with 2 exterior walls with a gross area of 192 sq. ft., window area of 30 sq. ft., and a floor and ceiling area of 144 sq. ft.
6. Townhome typical bedroom with 1 exterior wall with a gross area of 76 sq. ft., window area of 30 sq. ft., and a floor and ceiling area of 90 sq. ft.
7. Condominium typical bedroom with 1 exterior wall with a gross area of 88 sq. ft., window area of 36 sq. ft., and a floor and ceiling area of 132 sq. ft.
8. Single-family home master bedroom with 2 exterior walls with a gross area of 372 sq. ft., window area of 79 sq. ft., and a floor and ceiling area of 451 sq. ft.

Conditions that would tend to ***reduce*** the acoustical performance include:

1. Using a greater area of windows or doors.
2. Having a greater area of exterior walls.
3. Using *smaller* rooms.
4. Adding wall penetrations such as through-wall air-conditioners, heaters, or fans.
5. Using hard room finishes such as ceramic tile or wood floors, and using few furnishings.

5.0 Existing Construction: Sound Insulation Renovation

In addition to designing new residences for sound insulation, existing structures may also be sound insulated via architectural renovation. Renovations include replacing doors and windows, increasing wall and ceiling thickness and mass, removing penetrations through exterior walls, and installing mechanical systems which circulate air.

This work can either be implemented by homeowners, by municipalities, or through a Federally-funded program. If Federal funds are used, the noise goals outlined below would apply.

5.1 Federally Mandated Noise Goals

Historically, airports implementing a federally-funded sound insulation program followed guidance issued in the *Airport Improvement Program (AIP) Handbook.* The AIP Handbook is a document published by the Federal Aviation Administration (FAA) to provide guidelines for sound insulation programs that receive federal funds. Chapter 8 of the handbook deals specifically with noise compatibility projects and the regulations that must be satisfied in order to have project funding reimbursed. Following is an excerpt from Chapter 8 "Noise Compatibility Projects" of FAA Order 5100.38B that was issued on May 31, 2002.

SECTION 2 NOISE COMPATIBILITY PROJECTS

Article 812 NOISE INSULATION PROJECTS

Division b. Residential Noise Insulation

(1) The design objective in a residential noise insulation project generally should be to achieve the requisite Noise Level Reduction (NLR) when the project is completed. (This is mathematically equivalent to achieving a DNL of 45 dB in all habitable rooms.) For residences located in areas where exterior noise exposure is DNL 65 dB, the requisite NLR provided by the structure should be at least 20 dB in major habitable rooms. The requisite NLR should be increased commensurate with any increase in exterior DNL above 65 dB. The project design should be based on exterior DNL and the existing NLR in the structure. The existing construction must provide less than the needed noise level reduction for the noise exposure level at the location of the residence. For example, a house having a 30 dB noise level reduction located at the DNL 68 dB is nominally compatible because the interior noise level would be approximately equivalent to 38 dB, well below the target 45 dB. Although such a dwelling is nominally compatible, some lesser level of noise insulation (replacement of depreciated windows, storm doors, caulking and weather stripping, etc.) may be provided to assure conformity of improvements and perceived equity of application in the project neighborhood.

(2) Since it takes an improvement of at least 5 dB in NLR to be perceptible to the average person, any residential noise insulation project should be designed to provide at least that increase in NLR as a marginal minimum.

(3) Examples.

(a) A residence located in an area where the DNL is 73 dB has existing NLR of 26 dB. The requisite NLR in that area is 28 dB (73 - 45). However, to meet the requirement for increasing the NLR by not less than 5 dB, a noise attenuation project for that residence should result in NLR of 31 dB (26 + 5).

(b) A residence located in an area where the DNL is 67 dB has existing NLR of 16 dB. The requisite NLR in that area is 22 dB (67 – 45). Therefore, the noise insulation project should be designed to increase the NLR by 6 dB (22 – 16).

In August 2012, the FAA issued Program Guidance Letter (PGL) 12-09, “AIP Eligibility and Justification Requirements for Noise Insulation Projects.” The PGL clarifies the FAA’s noise policy and reiterates a two-step eligibility process for sound insulation programs using AIP funding.

DNL is the metric that has been chosen by the FAA to determine a structure’s eligibility for inclusion in a federally supported sound insulation program. The FAA also uses DNL to define the minimum sound insulation that should be provided to a residential structure. It is important to note that, although the normal eligibility requirements are fixed (exterior DNL between 65 and 75 dB) the mandated NLR is a minimum requirement. Sound insulation, which increases the NLR of the structure, can be provided without violating the conditions of the AIP Handbook.

In general, DNL is an appropriate noise metric to use for identifying eligible houses for sound insulation because it correlates fairly well with the overall community reaction to environmental noise, and it is related to the total acoustic energy received. DNL takes into account both the sound level of typical flyover events and the number of events that occur. A structure experiencing a large number of overflights in a 24-hour period will have a higher DNL than a structure experiencing a small number of similar events in that period. Although DNL correlates well with a community’s reaction to noise, it does not necessarily correlate with any single individual’s reaction.

In summary, the criteria used in developing the acoustic insulation modification designs for the residences are as follows:

- In all major habitable rooms provide sufficient sound insulation such that an interior DNL of 45 dB is achieved.

- In all rooms that receive sound insulation modifications, increase the pre-modification NLR by at least 5 dB.

The Airports Cooperative Research Program (ACRP), funded through the Transportation Research Board, has published *ACRP Report 89: Guidelines for Airport Sound Insulation Programs*. The document provides guidelines for the sound insulation of residential (single- and multi-family) and other noise-sensitive buildings (such as schools, libraries and churches) with a focus primarily on meeting the requirements outlined in the AIP Handbook, PGL and relevant grant assurances for Federally-funded programs. The guidelines would serve as a beneficial resource for parties interested in the sound insulation of existing structures, including historic structures, and is available at http://onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_089.pdf.

5.2 Housing Survey

A housing survey was completed in February 2004. The survey included two parts. The first part was a general survey of housing in the Airport Influence Area, and the second part was a specific survey of nine houses located within the Airport Influence Area. At the time of the survey, the ages of these nine homes range from 1 to 44 years, and therefore provided useful information on existing homes eligible for sound insulation as well as new homes. The survey focused on the construction of the homes and the existing condition of the elements most crucial to noise infiltration, including doors, windows, walls, roofs, and wall penetrations.

The general survey gathered the following information:

1. The rough percentages of units that are: single family, duplex, townhome, apartment (multifamily), and mobile home.
2. For single family homes: the rough percentages of units that are 1, 1.5, 2, and 3 stories tall.
3. For single family homes: What are the most typical home sizes in terms of approximate square feet and approximate number of bedrooms?
4. What insulation R-value required/commonly used for roof?
5. Approximately how deep are roof trusses or joists?
6. Rough percentage of residences that are solid masonry vs. wood frame.
7. How common are brick, block, stone, and stucco? Are they commonly found only on the façade, or the whole house?
8. Are 2x4 or 2x6 studs more common?
9. What is the most common sheathing type for wood-framed houses: OSB or insulation board (e.g., Thermoply or Energy Brace).
10. How thick is typical drywall? Is plaster ever used?
11. Opinions on the feasibility of possible sound insulation wall treatments. For existing construction: additional layers of gypsum board? For new construction: Resilient channels? 2x6 studs? Staggered studs?

12. Opinions on ceiling treatments. For existing construction, additional layer of gypsum board? For new construction: resilient channels? Scissor trusses providing “false” vaulted ceilings (a sloped ceiling with insulated attic space above)?
13. Are storm Windows acceptable as a sound insulation modification?
14. Are skylights common in this area?
15. Is there an R-value requirement for windows/doors? Typical value?
16. What window style(s) are most common? Single hung, double hung, fixed, casement, slider, awning.
17. Are swinging storm doors typical?
18. Are slider or French doors typical?
19. Do exterior doors usually swing inward?
20. What are the rough percentages of home with: vinyl siding; aluminum siding; Handiplank; wood; EIFS; asbestos tiles?
21. Are full basements, crawl spaces, or slab foundations most common?
22. Are vaulted ceilings common?
23. Are there standards for fresh air/ventilation/circulation, aside from heat and air conditioning?
24. Is central air-conditioning common in existing homes? Do existing homes use window or thru-wall air conditioners?
25. Are forced hot air systems or radiators more common?
26. Are fireplaces common in this area?

The responses to the survey questions for the sample houses and general observations for the housing within the Airport Influence Area are presented in Appendix E. Since it was not possible to enter the homes, estimates were provided for the square footage, number of bedrooms, and other factors. Table 5-1 presents a summary of each house.

Table 5.1

Summary of Survey Houses

House Number	Year Built	Approx. Square Footage	Number of Bedrooms	Number of Floors	Windows
1	2000	2600	5	2	Double-Pane Vinyl
2	1994	2000	4	2	Double-Pane Vinyl
3	1960	1400	3	1	Single-Pane Metal
4	2003	1537	3	1	Double-Pane Vinyl
5	Unknown	1200	2 or 3	1	Single-Pane Metal
6	1998	1850	4	2	Double-Pane Vinyl
7	1977	2172	3	1	Single-Pane Metal

8	1983	2088	3	1	Double-Pane Vinyl
9	1973	2144	3	1	Single-Pane Metal

5.3 Prototypical Houses

The housing survey provided a representative sample of the housing stock in the Airport Influence Area. From the 9 homes in the survey, 3 were chosen to represent "prototypical" house types for the purpose of completing sound insulation modification designs. These designs will provide a sample of what types of modifications are required, and how they vary for houses of different sizes and ages, with different windows, doors, and other elements. Survey houses 2, 3, and 7 were chosen since they were built in different decades, have varying numbers of floors, and different wall and window constructions. Appendix E contains the complete survey information for each of these houses.

Existing mobile homes, such as survey house 5, are not usually sound insulated for several reasons. The light construction of the walls makes it difficult to add heavier, thicker acoustical windows. In addition, the cost of renovating a home for sound insulation approaches the total value of a typical mobile home, so it is more feasible to replace existing mobile homes. New mobile homes with heavier construction, double-glazed windows, and other selected modifications may be able to meet the AIP noise goals outlined above in some cases.

5.4 Sound Insulation Designs

The sound insulation designs were developed from a computer model of the 3 prototypical homes. Since floor plans were not available, the areas of the roofs, walls, windows, and doors for each room of each house were estimated based on the total square footage and number of bedrooms in each house, and the photographs provided in the housing survey.

Various architectural modifications were evaluated using this computer model. The assumed sound insulation properties of the existing construction and proposed modifications were based upon a combination of manufacturer test data, technical literature, and a comprehensive database from past projects. A collection of modifications was finally selected for each analyzed room that satisfied the acoustical design goals. The results for each room were compared for each house separately, and generalized sound insulation renovation designs were completed for each house.

Sound insulation designs were completed for two groups: houses located where the outdoor DNL is below 70 dB, and houses located where the DNL is between 70 and 75 dB. Homes located within the 75 DNL contour are not normally sound insulated using AIP funds. To meet the FAA requirements presented in Section 5.1, these designs provide a noise level reduction (NLR) of at least 25 dB for the first group, and at least 30 dB for the second group. In addition, the designs must increase the NLR by at least 5 dB in every room. In some instances, the existing NLR for a room was already above 25 dB. If such rooms were in houses exposes to a DNL below 70 dB, no modifications would be required to meet the 45 dB indoor goal. However, modifications would be required to increase the NLR by 5 dB, even though the indoor DNL was already below 45 dB.

The sound insulation designs are presented in Tables 5-2, 5-3 and 5-4. These tables show the existing construction elements and approximate Sound Transmission Class (STC) values, and the sound insulation designs for the two groups. The “ceiling” column applies *only* to rooms with an attic space above. Any room with finished rooms above will not need ceiling modifications. Rooms with a vaulted ceiling require special treatment noted below.

Table 5.2

Sound Insulation Designs for Survey House 2

Design	Exterior Wall	Window	Door	Ceiling	NLR (dB)
Existing	STC 36-38	STC 28	STC 25	STC 50[1]	21.5 - 30
DNL < 70	STC 43	STC 36	STC 31	STC 50	> 25
DNL 70 – 75	STC 43	STC 40	STC 37	STC 50	> 30

Note: [1] For vaulted ceilings, the existing rating is STC 45. Additional sound insulation modifications are required. See explanation below.

Table 5.3

Sound Insulation Designs for Survey House 3

Design	Exterior Wall	Window	Door	Ceiling	NLR (dB)
Existing	STC 36-38	STC 24	STC 25	STC 50	22.5 – 29.5
DNL < 70	STC 41	STC 36	STC 31	STC 50	> 25
DNL 70 – 75	STC 43	STC 40	STC 37	STC 50	> 30

Table 5.4

Sound Insulation Designs for Survey House 7

Design	Exterior Wall	Window	Door	Ceiling	NLR (dB)
Existing	STC 36-38	STC 24	STC 25	STC 50	19.8 – 28

DNL < 70	STC 41	STC 36	STC 31	STC 50	> 25
DNL 70 – 75	STC 43	STC 40	STC 37	STC 50	> 30

Replacement windows and doors may be obtained from the manufacturers listed in Appendix B. Installation methods specified by the manufacturer and described in Sections 3.2, 3.3, 3.4, and Appendix A must be followed.

To achieve the specified wall STC ratings, the following renovations are required. To achieve an STC 41 rating, one layer of 5/8" gypsum wall board must be added to the existing interior gypsum board or plaster walls. The new gypsum board must be screwed into the studs. In addition, if the wall is currently not insulated, blown-in insulation should be added to the wall cavity before installing the new gypsum board. To achieve an STC 43 rating, two layers of 5/8" gypsum board must be added to the existing interior walls (with blown-in insulation also added to walls that currently do not have insulation).

Masonry walls provide a rating of approximately STC 50. However, this only applies to walls that have an exterior constructed entirely of masonry or a masonry façade. A masonry accent or half-masonry, half-sided wall will still require additional gypsum board.

For rooms with vaulted ceilings, the existing roof construction will provide a rating of approximately STC 45. For rooms with vaulted ceilings in houses located where the DNL is below 70 dB, one layer of 5/8" gypsum board must be added to the existing interior gypsum board or plaster ceiling. For houses located where the DNL is between 70 and 75 dB, storm windows and storm doors must be added to rooms with vaulted ceilings, in addition to one layer of gypsum board on the ceiling. In this case, the prime and storm door combination must have a rating of STC 43, and the prime and storm window combination must have a rating of STC 44.

In some cases, walls and ceilings may not have a gypsum board or plaster finish. For walls with paneling installed directly on the studs, new gypsum board must be installed. Two new layers will achieve a rating of STC 41, and three new layers will achieve a rating of STC 43. Perhaps a more cost-effective solution to achieve STC 43 is to remove the existing wall finish, add resilient channels, and hang one layer of gypsumboard from the channels. Section 3.5 provides additional information on resilient channels. For flat ceilings with an attic above, suspended tile ceilings and tile ceilings installed directly on the joists are not acceptable. They must be replaced with a single layer of 5/8" gypsum board.

In addition to the modifications presented in Tables 5-1, 5-2, and 5-3, several other modifications are required to sound insulate an existing home. All wall penetrations must be removed, including thru-wall and window air-conditioners, mail slots, and exhaust fan duct openings. A home without central air conditioning is usually provided with such a system to allow the homeowner to keep the windows and doors shut in the summer. A ventilation system should be provided to ensure that air quality is good. For houses with a gas-fired furnace a combustion air fan should be provided. Attic vents must be fitted with acoustical baffles. Sections 3.8 and 3.9 provide further details on ventilation systems and the sound insulation of ventilation openings and fireplaces, and Section 3.6 provides details on attics.

5.5 Local Building Code Requirements

When renovating existing homes the local building codes must be followed. Local building code officials have addressed several important issues related to sound insulation modifications. They include:

1. Replacement windows must provide the same clear opening area as the existing windows, to provide an escape in the event of fire. Acoustical windows may have thicker frames than existing windows. In this case, the framing must be modified to allow for a replacement window that is larger than the existing window. This problem may also be encountered when the replacement window is of a different style (for example, replacing a slider with a double-hung window).
2. Exterior doors must provide a clear width of at least 32” and a clear height of at least 78”, and be readily openable from inside the dwelling without the use of a key.
3. Any doors connecting the inhabitable rooms of the house and the garage must have a 20-minute fire rating and equipped with a self-closing device. A 1-3/4” solid wood door would meet this requirement. Replacing such doors is a common sound insulation modification.
3. Porches and landings for exterior doors must have a length of at least 36 inches (measured in the direction of travel). This must be met for replacements doors, which may include storm doors.
4. Interior stairways must have a clear width of at least 36 inches. The addition of 1 or 2 layers of 5/8” gypsum board for sound insulation must not interfere with this requirement.
5. Interior ceiling height for habitable rooms must be at least 7 feet. The addition of gypsum board and/or new ductwork to the ceiling must not compromise this requirement.
6. The addition of new electrical appliances (i.e. central air conditioning) will not require the upgrading of wiring throughout the house. Only wiring related to the renovation project must be upgraded (unless there are substandard or unsafe conditions). This would include wiring for electrical outlets along exterior walls that would have to be reinstalled after new gypsum board layers are added. This may also include wiring on the same circuit as the new appliances. If the capacity of the existing electrical panel were to be exceeded, a new panel would have to be added.
7. Attic ventilation of 1 square foot per 150 square feet of attic floor area must be provided, with certain exceptions.
8. Renovation of basement rooms will not necessitate improving the existing window sizes to meet the minimum dimensions in the building code for emergency exits purposes. However, as mentioned above, window and doors clear opening areas must not be decreased from existing dimensions.

9. Installing glass doors on fireplaces to provide noise mitigation is allowed. However, combustion air must be allowed to flow into the chamber or flue, so this air must be allowed to enter from the outside.

Appendix A – New Construction: Noise Level Reduction (NLR) Design Guidance

SECTION 1: PURPOSE

Exterior noise having a significant impact on human activity, health and safety may be isolated and reduced in residences through construction techniques which selectively increase the insulating quality of the structures. The noise level reductions required are 25, 30, and 35 dB.

SECTION 2: GENERAL REQUIREMENTS

A. The NLR guidance specified herein may be achieved by any suitable combination of building designs, choices of building materials, and execution of construction details in accordance with established architectural and acoustical principles. The NLR guidance should be applied to all occupied rooms having one or more exterior walls or ceiling. The Sound Transmission Class (STC) ratings required for exterior walls, windows, doors, and ceilings are presented in Table 4-1.

B. Compliance with the construction standards herein are sufficient to comply with the NLR requirements specified in the various airport land use districts. These standards are applicable to plans and specifications for any proposed residence. If the plans and specifications do not indicate compliance with the construction standards herein, the local building code should be amended to require a written statement from a qualified acoustical consultant certifying that the construction of the building as indicated in the plans and specifications will result in an NLR for appropriate occupied rooms at least as great as the NLR value specified for the applicable airport use district.

C. Sound Transmission Class (STC) ratings for windows and doors are valid only if they are determined by laboratory tests performed by an independent laboratory for the product manufacturer. A rating estimated for glass alone is not an acceptable substitute for STC tests of windows. Likewise, ratings estimated for door leafs alone are not an acceptable substitute for STC ratings of doors. The installed products must have the same accessories such as storm panels, glazing thickness, glazing size, gaskets, bottom door seals, thresholds, etc., as the tested assembly.

D. In order to achieve the STC ratings specified below, special measures are necessary to install doors and windows. These include the use of non-hardening (acoustical) caulk at all hidden surfaces, flexible caulk at all exposed surfaces, and solid continuous blocking to fill all voids over 1/4” around windows and doors.

SECTION 3: BUILDING REQUIREMENTS FOR A MINIMUM NLR OF 25 dB

A. Exterior Walls

1. The interior surface of exterior walls shall be of gypsum board or plaster at least 1/2 inch thick.
2. Fiberglass or mineral fiber batt or blanket insulation shall be installed continuously and completely throughout the stud cavity. Batts or blankets should be held firmly in place between studs, with fasteners if necessary, to prevent sagging; however, packing the insulation such that it is compressed may slightly *reduce* its acoustical (and thermal) performance.

B. Windows

1. Windows other than as described in this section shall have a laboratory sound transmission class rating of at least STC-33.
2. Windows in any room with one exterior wall and a total exterior wall area below 170 square feet may have a laboratory sound transmission class rating of at least STC-27.

C. Doors

1. Exterior doors, other than as described in this section shall have a laboratory sound transmission class rating of at least STC-24.
2. Interior doors between occupied spaces and attached garages or unfinished attic spaces shall be solid-core wood or 20-gauge insulated metal at least 1-3/4 inches thick and shall be fully weatherstripped.

D. Roof-Ceiling Assembly

1. The standard roof construction is assumed to be shingles, 7/16" minimum OSB deck, and wood trusses or rafters spaced 16" or more O.C. forming an attic space over occupied rooms.
2. The use of cathedral ceilings is strongly discouraged for homes exposed to aircraft noise. A mock-cathedral ceiling with a small attic space above is recommended. If a cathedral ceiling is used, the gypsum board ceiling must be hung using resilient channels.
3. Skylights can be used if a secondary panel of 1/4-inch-thick safety glass or insulated thermopane glass is used at the bottom of the skylight well. Alternatively, skylights with an STC 38 rating can be used.
4. Gypsum board or plaster ceilings at least 1/2 inch thick shall be provided. Ceilings shall be substantially airtight with a minimum number of penetrations.

E. Floors, Foundations and Basements

1. The floor of the lowest occupied rooms shall be slab on fill, below grade, or over a fully enclosed basement or crawlspace. If the basement is used as a habitable living area (as a recreation area, study, or additional sleeping area, for example), the doors and windows shall conform to the requirements stated in this ordinance.
2. Concrete slabs require no treatment. Crawl spaces and basements are discussed below.
3. Crawl spaces with masonry walls must have noise control louvers at the under-floor vents (see Appendix B). If crawl spaces do not have masonry walls, a massive barrier panel must be used as a skirt connecting the bottom of the walls to the ground (see Section 3.7).
4. Dryer vents and other basement vents should be constructed of sheet metal to limit the amount of noise that will enter through them and then pass through the duct wall to the surrounding room.

F. Ventilation and Wall Penetrations

1. In-window, through-wall, or through-floor air-conditioning, ventilating, or heating units shall not be used.
2. Through-the-wall/door mailboxes or mail slots shall not be used.
3. A mechanical ventilation system should be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms, without the need to open any windows, doors, or other openings to the exterior.
4. Gravity vent openings in attics shall not exceed the code minimum in number and size.
5. If an attic fan is used for forced ventilation, the attic inlet and discharge openings shall be fitted with sheet metal transfer ducts of at least 20 gauge steel at least 5 feet long with at least one 90° bend.
6. All vent ducts connecting the interior space to the outdoors, excepting domestic range exhaust and bathroom exhaust ducts, shall contain at least two 90° bends.
7. Domestic range exhaust ducts connecting the interior space to the outdoors shall be at least 20 gauge steel and shall contain at least two 90° bends. Alternatively, unvented range exhaust fans may be used, if allowed by applicable codes.
8. Fireplaces, if present, shall be provided with glass doors and well-fitted dampers. Wood stoves shall not be used.
9. A combustion air fan is recommended if there is a gas-fired furnace.

SECTION 4: BUILDING REQUIREMENTS FOR A MINIMUM NLR OF 30 dB.

A. Exterior walls

1. Exterior walls other than as described below shall have a laboratory sound transmission class rating of at least STC-43. This rating can be achieved as follows. The gypsum board or plaster shall be fastened rigidly to the studs if the exterior is brick veneer. If the exterior is siding, the interior gypsum board or plaster

must be fastened to the studs using resilient channels. Resilient channels must be installed horizontally along the studs, and screws connecting the gypsum board or plaster to the channels must not contact the studs. Oriented Strand Board (OSB) at least 7/16 inches thick shall cover the exterior side of the wall studs.

2. Rooms that have one exterior wall and a total exterior wall area below 170 square feet need not meet the requirements of the paragraph above.
3. The interior surface of the exterior walls shall be of gypsum board or plaster at least 1/2 inch thick.
4. Fiberglass or mineral fiber batt or blanket insulation shall be installed continuously and completely throughout the stud cavity. Batts or blankets should be held firmly in place between studs, with fasteners if necessary, to prevent sagging; however, packing the insulation such that it is compressed may slightly *reduce* its acoustical (and thermal) performance.

B. Windows

1. Windows other than as described in this section shall have a laboratory sound transmission class rating of at least STC-33.
2. Windows in rooms with 2 exterior walls and a total exterior wall area greater than 300 square feet must have a laboratory sound transmission class rating of at least STC-40.

C. Doors

1. Exterior doors, or door/storm composite assemblies, other than as described in this section shall have a laboratory sound transmission class rating of at least STC-26. A typical door in combination with a typical storm door will achieve a rating of at least STC 26. Therefore, either a door tested to achieve an STC 26 rating may be used, or else a storm door can be added to an untested door. If a storm door is not used, all glass in the door shall be at least 3/16” thick.
2. Doors in rooms with 2 exterior walls and a total exterior wall area greater than 300 square feet must have a laboratory sound transmission class rating of at least STC-33. This rating may be achieved either by using a door tested to achieve an STC 33 rating, or a typical door in combination with a secondary/storm door tested to achieve an STC 29 rating, or a typical door in combination with a *full-view* secondary/storm door utilizing 1/4” thick laminated glass. If a storm door is not used, all glass in the door shall be at least 1/4” thick laminated glass.
3. Interior doors between occupied spaces and attached garages or unfinished attic spaces shall be solid-core wood or 20-gauge insulated metal at least 1-3/4 inches thick and shall be fully weather-stripped.
4. If a storm/secondary door is used, the airspace between the surfaces of the two doors shall be maximized.

D. Roof-Ceiling Assemblies

1. The standard roof construction is assumed to be shingles, 7/16" minimum OSB deck, and wood trusses or rafters spaced 16" or more O.C. forming an attic space over occupied rooms.
2. Roof-ceiling assemblies in top-floor rooms with 2 exterior walls and a total exterior wall area greater than 300 square feet must have a laboratory sound transmission class rating of at least STC-56. The required construction consists of resilient channels mounted perpendicular to the ceiling joists, on the bottom of the joists, with one layer of ½" gypsum-board attached to the channels. Resilient channels must be installed horizontally along the studs, and screws connecting the gypsum board or plaster to the channels must not contact the studs.
3. The use of cathedral ceilings is not allowed. A mock-cathedral ceiling with a small attic space above is acceptable.
4. Skylights can be used if a secondary panel of 1/4-inch-thick safety glass or insulated thermopane glass is used at the bottom of the skylight well. Alternatively, skylights with an STC 38 rating can be used.
5. Gypsum board or plaster ceilings at least 1/2 inch thick shall be provided. Ceilings shall be substantially airtight with a minimum number of penetrations.

E. Floors, Foundations and Basements

1. The floor of the lowest occupied rooms shall be slab on fill, below grade, or over a fully enclosed basement or crawlspace. If the basement is used as a habitable living area (as a recreation area, study, or additional sleeping area, for example), the doors and windows shall conform to the requirements stated in this ordinance.
2. Concrete slabs require no treatment. Crawl spaces and basements are discussed below.
3. Crawl spaces with masonry walls must have noise control louvers at the under-floor vents (see Appendix B). If crawl spaces do not have masonry walls, a massive barrier panel must be used as a skirt connecting the bottom of the walls to the ground (see Section 3.7).
4. Dryer vents and other basement vents should be constructed of sheet metal to limit the amount of noise that will enter through them and then pass through the duct wall to the surrounding room.

F. Ventilation and Wall Penetrations

1. In-window, through-wall, or through-floor air-conditioning, ventilating, or heating units shall not be used.
2. Through-the-wall/door mailboxes or mail slots shall not be used.
3. A mechanical ventilation system should be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms, without the need to open any windows, doors, or other openings to the exterior.

4. Gravity vent openings in attics shall not exceed the code minimum in number and size.
5. If an attic fan is used for forced ventilation, the attic inlet and discharge openings shall be fitted with sheet metal transfer ducts of at least 20 gauge steel at least 5 feet long with at least one 90° bend.
6. All vent ducts connecting the interior space to the outdoors, excepting domestic range exhaust and bathroom exhaust ducts, shall be at least 10 feet long and shall contain at least two 90° bends. It is recommended that in-line sound attenuators (silencers) be installed in fresh-air intake ducts larger than 3" in diameter.
7. Unvented range exhaust fans shall be used, if allowed by applicable codes. If unvented range exhaust fans are not allowed by applicable codes, range exhaust ducts connecting the interior space to the outdoors shall be at least 20 gauge steel and shall contain at least two 90° bends.
8. Operational vented fireplaces or wood stoves shall not be used.
9. A combustion air fan is recommended if there is a gas-fired furnace.

SECTION 5: BUILDING REQUIREMENTS FOR A MINIMUM NLR OF 35 dB

A. Exterior walls

1. Exterior walls other than as described below shall have a laboratory sound transmission class rating of at least STC-47. To achieve this rating, all exterior wall studs must have 2 x 6 studs, and the interior ½ inch gypsum board or plaster must be fastened to the studs using resilient channels. Resilient channels must be installed horizontally along the studs, and screws connecting the gypsum board or plaster to the channels must not contact the studs.
2. Exterior walls in any room with one exterior wall and a total exterior wall area below 170 square feet shall have a laboratory sound transmission class rating of at least STC-43. To achieve this rating, the interior ½ inch gypsum board or plaster must be fastened to the 2 x 4 studs using resilient channels. Resilient channels must be installed horizontally along the studs, and screws connecting the gypsum board or plaster to the channels must not contact the studs.
3. Exterior walls in any room with two exterior walls and a total exterior wall area greater than 300 square feet shall have a laboratory sound transmission class rating of at least STC-49. To achieve this rating, a staggered stud construction must be used for all exterior walls. This construction uses two rows of 2 x 4 studs on a 2x6 base plate: one row of studs spaced 16" on center supporting the sheathing, and a second row spaced 16" on center supporting the interior wall finish. The end result is that there are studs each 8" on center. ½ inch gypsum board or plaster must be used.
4. Oriented Strand Board (OSB) at least 7/16 inches thick shall cover the exterior side of the wall studs.
5. Fiberglass or mineral fiber batt or blanket insulation shall be installed continuously and completely throughout the stud cavity. Batts or blankets should be held firmly in place between studs, with fasteners if necessary, to prevent sagging; however, packing the

insulation such that it is compressed may slightly *reduce* its acoustical (and thermal) performance.

B. Windows

1. Windows other than as described in this section shall have a laboratory sound transmission class rating of at least STC-40.
2. Windows in rooms with 2 exterior walls and a total exterior wall area greater than 300 square feet must have a laboratory sound transmission class rating of at least STC-44.

C. Doors

1. Exterior doors, or door/storm composite assemblies, other than as described in this section shall have a laboratory sound transmission class rating of at least STC-38. Achieving this rating will require the use of specialty acoustical products.
2. Interior doors between occupied space and attached garage or unfinished attic spaces shall be solid-core wood or 20-gauge insulated metal at least 1-3/4 inches thick and shall be fully weather-stripped.
3. If a storm/secondary door is used, the airspace between the surfaces of the two doors shall be maximized.

D. Roof-Ceiling Assemblies

1. The standard roof construction is assumed to be shingles, 7/16" minimum OSB deck, and wood trusses or rafters spaced 16" or more O.C. forming an attic space over occupied rooms.
2. Roof-ceiling assemblies in top-floor rooms with 2 exterior walls and a total exterior wall area greater than 300 square feet must have a laboratory sound transmission class rating of at least STC-56. The required construction consists of resilient channels mounted perpendicular to the ceiling joists, on the bottom of the joists, with one layer of ½" gypsum-board attached to the channels. Resilient channels must be installed horizontally along the studs, and screws connecting the gypsum board or plaster to the channels must not contact the studs.
3. The use of cathedral ceilings is not allowed. A mock-cathedral ceiling with a small attic space above is acceptable.
4. Skylights shall not be used.
5. Gypsum board or plaster ceilings at least 1/2 inch thick shall be provided. Ceilings shall be substantially airtight with a minimum number of penetrations.

E. Floors, Foundations and Basements

1. The floor of the lowest occupied rooms shall be slab on fill, below grade, or over a fully enclosed basement or crawlspace. If the basement is used as a habitable living area (as a recreation area, study, or additional sleeping area, for example), the doors and windows shall conform to the requirements stated in this ordinance.

2. Concrete slabs require no treatment. Crawl spaces and basements are discussed below.
3. Crawl spaces with masonry walls must have noise control louvers at the under-floor vents (see Appendix B). If crawl spaces do not have masonry walls, a massive barrier panel must be used as a skirt connecting the bottom of the walls to the ground (see Section 3.7).
4. Dryer vents and other basement vents should be constructed of sheet metal to limit the amount of noise that will enter through them and then pass through the duct wall to the surrounding room.

F. Ventilation and Wall Penetrations

1. In-window, through-wall, or through-floor air-conditioning, ventilating, or heating units shall not be used.
2. Through-the-wall/door mailboxes or mail slots shall not be used.
3. A mechanical ventilation system should be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms, without the need to open any windows, doors, or other openings to the exterior.
4. Gravity vent openings in attics shall not exceed the code minimum in number and size.
5. If an attic fan is used for forced ventilation, the attic inlet and discharge openings shall be fitted with sheet metal transfer ducts of at least 20 gauge steel at least 10 feet long with at least one 90° bend.
6. All vent ducts connecting the interior space to the outdoors, excepting domestic range exhaust and bathroom exhaust ducts, shall be at least 10 feet long and shall contain at least two 90° bends. It is recommended that in-line sound attenuators (silencers) be installed in fresh-air intake ducts larger than 3” in diameter.
7. Unvented range exhaust fans shall be used, if allowed by applicable codes. If unvented range exhaust fans are not allowed by applicable codes, range exhaust ducts connecting the interior space to the outdoors shall be at least 20 gauge steel and shall contain at least two 90° bends.
8. Operational vented fireplaces or wood stoves shall not be used.
9. A combustion air fan is recommended if there is a gas-fired furnace.

Appendix B – Manufacturers of Acoustical Materials

This list represents a partial list of typical suppliers of specialty acoustical products. Other manufacturers not listed may have comparable products. The list below does not imply a product endorsement or recommendation.

INSULATION

Owens Corning Fiberglass Corp.
One Owens Corning Parkway
Toledo, Ohio 43659
800-GET PINK
http://www.owenscorning.com/

CertainTeed
(800) 233-8990
http://www.certainteed.com/

Roxul Inc.
8024 Esquesing Line
Multon, Ontario L9T 6W3
800-265-6878
http://www.roxul.com/

Knauf Insulation
One Knauf Drive
Shelbyville, IN 46176
317-398-4434
http://www.knaufinsulation.us

Johns Manville
P. O. Box 5108
Denver, Colorado 80217-5108
800-654-3103
http://www.jm.com/

DOORS

Algoma Hardwoods
1001 Perry Street
Algoma, Wisconsin 54201
800.678.8910
http://www.algomahardwoods.com/

Eggers Industries
164 North Lake Street
Neenah, WI 54957-1050
920-722-6444
http://www.eggersindustries.com/

Pioneer Industries
111 Kero Road
Carlstadt, New Jersey 07072
201-933-1900
http://www.pioneerindustries.com

Therma-Tru Doors
1750 Indian Wood Circle
Maumee, OH 43537
800-Thermatru
www.thermatru.com

Weyerhaeuser Architectural Doors
1401 East 4th Street
Marshfield, WI 54449-7780
800-869-3667
www.weyerhaeuser.com/

Soundproof Windows, Inc.
4673 Aircenter Circle
Reno, NV 89502
877-438-7843
www.soundproofwindows.com

Peerless Products, Inc.
2403 S. Main
Fort Scott, KS 66701
620-223-4610
http://www.peerlessproducts.com/

Mon-Ray, Inc.
7900 Excelsior Blvd., Suite 140
Minneapolis, MN 55343-3454
800-544-3646
http://www.monray.com/

DUCT ATTENUATORS AND NOISE CONTROL LOUVERS

Aeroacoustic Corp.
3300 Corporation Way
Darlington, SC 29532
843-398-1006
http://www.aeroacoustic.com/

United McGill Corporation
Duct Express Outlet (NC rep)
704-393-1056
http://www.mcgillairflow.com

Price Industries
2875 Shawnee Ridge Court
Suwanee, GA 30024
770-623-8050
http://www.priceindustries.com/

Industrial Acoustics Company
1776 Eastchester Road, Suite 210
Bronx, New York 10462
(718) 931 8000
http://www.iac-acoustics.com/us/

Vibro-Acoustics
355 Apple Creek Blvd
Markham, Ontario, L3R 9X7
416-291-7371
http://www.vibro-acoustics.com/

DOOR SEALS AND WEATHERSTRIPPING

Pemko Manufacturing Co.
5535 Distribution Drive
Memphis, TN 38141
800-824-3018
http://www.pemko.com/

National Guard Products, Inc.
4985 East Raines Rd
Memphis, TN 38118
800/647-7874
http://www.ngpinc.com/

Zero International, Inc.
415 Concord Avenue
Bronx, New York 10455-4898
718/585-3230
http://www.zerointernational.com/

SPECIALTY ACOUSTICAL WINDOW UNITS

Rehau Incorporated
4254 Green River Road
Corona, CA 92880-1669
800-944-1011
http://www.rehau.com/us-en

Peerless Products, Inc.
2403 S. Main
Fort Scott, KS 66701
620-223-4610
http://www.peerlessproducts.com/

Harvey Building Products
14000 Main Street
Waltham, MA 02451-1689
800-598-5400
www.harveybp.com

Graham Architectural Products Corp.
1551 Mt. Rose Avenue
York, PA 17403-2909
800-755-6274
http://www.grahamwindows.com/

Silver Line by Andersen
800-234-4228
http://www.silverlinewindows.com/

Jeld Wen Windows & Doors
800-535-3936
http://www.jeld-wen.com/

Wausau Window and Wall Systems
7800 International Drive
Wausau, WI 54401
877-678-2983
http://www.wausauwindow.com

Mon-Ray, Inc.
7900 Excelsior Blvd., Suite 140
Minneapolis, MN 55343-3454
800-544-3646
http://www.monray.com/

Milgard Windows and Doors
1010 54th Ave East
Takoma, WA 98424
800-Milgard
http://www.milgard.com/

Soundproof Windows, Inc.
4673 Aircenter Circle
Reno, NV 89502
877-438-7843
www.soundproofwindows.com

Chelsea Building Products
565 Cedar Way
Oakmont, PA 15139-2049
800-424-3573
http://www.chelseabuildingproducts.com/

Home-Kim
10103 Residency Rd
Manassas, VA 20110
703-330-3300
http://www.homekim.com/

Appendix C – Independent Certified Acoustical Testing Laboratories

This list represents a partial list of Certified Acoustical Testing Laboratories. The list below does not imply an endorsement or recommendation. The National Voluntary Laboratory Accreditation Program (NVLAP) maintains a Directory of Accredited Laboratories on their website:

https://www-s.nist.gov/niws/index.cfm?event=directory.results

Armstrong Acoustic Labs
2500 Columbia Avenue/PO Box 3001
Lancaster, PA 17604
717-396-6225

Western Electro-Acoustic Lab., Inc.
A division of Veneklasen Assoc., Inc.
25132 Rye Canyon Loop
Santa Clarita, CA 91355
310-738-4420
http://www.weal.com

NGC Testing Services
1650 Military Road
Buffalo, NY 14217-1198
716-873-9750
http://www.ngctestingservices.com

Intertek Testing Services NA Inc.
3933 U.S. Route 11
Cortland, NY 13045-0950
607-758-6316
http://www.intertek.com

Riverbank Acoustical Labs
(Alion Science & Technology)
1512 Batavia Avenue
Geneva, Illinois 60134
630-232-0104
http://riverbank.alionscience.com

Orfield Laboratories, Inc.
2709 E. 25th Street
Minneapolis, MN 55406
612-721-2455
http://www.orfieldlabs.com

USG Corporate Innovation Center
700 North US Highway 45
Libertyville, IL 60048-1296
847-970-5127
http://www.usg.com

Appendix D – Glossary

Absorption Coefficient The sound-absorbing ability of a material. Values of absorption coefficient are a function of the frequency of the incident sound. The values of sound absorption coefficients usually range from about 0.01 (for hard smooth surfaces) to about 1.0 (for thick absorptive fiberglass).

Acoustical Treatment Applying design principles in architectural acoustics to reduce noise or vibration and to correct acoustical problems.

Acoustics The science of sound, including the generation, transmission, and effects of sound waves, both audible and inaudible.

Airborne Sound Sound traveling through air rather than through solid materials or the structure of the building.

Ambient Noise Level Sometimes called the “background” noise, the level of noise that is all-encompassing within a given environment. It is usually made up of many different sounds, some originating near to and far from the receiver.

American National Standards Institute (ANSI) A voluntary federation of organizations concerned with developing standards covering a broad spectrum of topics.

American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) A professional organization which identifies and publishes specifications and standard practices relating to all aspects of heating, ventilation, refrigeration, and air conditioning.

American Society for Testing and Materials (ASTM) An organization which develops and publishes recommended practices and standards for a broad range of testing and material properties issues.

Architectural Acoustics The science of sound, including its production, transmission, control, and effects within buildings.

Attenuation The reduction of sound.

A-Weighted Sound Level A sound measure, in decibels, that reflects the heightened sensitivity of the human ear to sound frequencies between 1000 and 6000 Hz, and the relatively reduced sensitivity to sound below 1000 Hz or above 6000 Hz. The A-weighted sound level is used to predict the relative "noisiness" or "annoyance" of many common sounds.

Background Noise Ambient noise from all sources unrelated to any particular sound. Background noise may include airborne, structureborne, and instrument noise.

Balanced Design A noise control design in which all important noise paths transmit the same amount of acoustic energy into the space, avoiding any “weak links” so that the combined effect ensures an acceptable noise level.

Building Officials and Code Administrators International (BOCA) See International Building Code.

Dampen To cause a reduction, usually through dissipation, of the sound energy.

Day-Night Average Sound Level (DNL or L_{dn}) The day-night average sound level is a measure of the average noise environment over a 24-hour day. It is the 24-hour energy-averaged, A-weighted sound level with a 10 dB penalty applied to the nighttime levels which occur between10:00 p.m. to 7:00 a.m.

Decibel (dB) The term used to describe sound levels.

Design Criteria Design goals used in acoustical and noise control design of buildings. Design criteria may be stated either as the maximum allowable noise levels inside buildings or as noise reduction values (from outside to inside) required for certain types of buildings or rooms.

DNL See Day-Night Average Sound Level.

Environmental Noise Unwanted sound from various outdoor noise sources. Environmental noise sources include aircraft, cars, trucks, buses, railways, industrial plants, construction activities, lawnmowers, etc.

Frequency The number of oscillations per second of a vibrating object, measured in Hertz (Hz).

Hertz The unit used to designate frequency. Specifically, the number of cycles per second.

International Building Code (IBC) A comprehensive building code published by the International Code Council (ICC) covering the fire, life, and structural safety aspects of all buildings and related structures. As of January 2003, the three largest building code organizations in America merged. Building Officials and Code Administrators International (BOCA), Southern Building Code Congress International (SBCCI), and the International Conference of Building Officials (ICBO) integrated to form the International Code Council (ICC). Municipalities may still reference earlier versions of BOCA, UBC, and SBC (as well as IBC). Also, states typically have their own building codes that may incorporate all or part of these codes.

Loudness The attribute of a sound, on a scale extending from very soft to very loud. Loudness depends most on the sound pressure or energy of the source, but it also depends upon the frequency and wave form of the source (because the human ear is more sensitive to some frequencies and forms than others).

Masking The ability of one sound to block out the perception of another sound. For example, radio static may mask voices in a nearby room. Masking may involve the intentional use of an unobtrusive background noise to cover some other specific intruding sound.

Noise Any sound which is undesirable because it interferes with speech and hearing, or is intense enough to damage hearing, or is otherwise annoying.

Noise Contours Lines or "footprints" of noise level usually drawn around a noise source (such as an airport, industrial plant or highway). The lines are generally drawn in 5-decibel increments so that they resemble elevation contours found in topographic maps.

Noise Exposure The cumulative noise reaching the ear of a person over a specified period of time (e.g., a work shift, a day, a working life, or a lifetime).

Noise Level Reduction (NLR) The difference between A-weighted sound levels indoors and outdoors.

Noise Reduction (NR) The difference, in decibels, of the average sound levels in two adjacent areas or rooms. Noise reduction could be from outside to inside, or from one room to another. Noise reduction combines the effects of the building construction plus the effect of acoustic absorption present in the receiving room. By knowing the noise reduction values and the outdoor noise levels one can determine the Noise Level Reduction (NLR).

Octave The interval between two sound frequencies having a ratio of 2. For example, if the center frequency of one octave is 125 Hz, the next octave up will be centered at 250 Hz. and the octave above that will be at 500 Hz.

Octave Band A frequency range which is one octave wide. Standard octave bands are designed by their center frequency.

Octave Band Center Frequency The average of the upper and lower frequencies of the octave. Standard octave band center frequencies in the audible range are 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000, and 16,000 hertz.

One-Third Octave Band A frequency range which is one-third octave wide. Standard one-third octave bands are designed by their center frequency.

One-Third Octave Band Center Frequency The average of the upper and lower frequencies of the one-third octave bands. Standard one-third octave band center frequencies in the audible range are:

25.0	100	400	1600	6300
31.5	125	500	2000	8000
40.0	160	630	2500	10,000
50.0	200	800	3150	12,500
63.0	250	1000	4000	16,000
80.0	315	1250	5000	20,000

Receiver The listener who hears a sound or the measuring microphone which detects the sound transmitted by the source.

Reverberation The persistence of sound in an enclosed space, as a result of multiple reflections, after the sound source has stopped. The more absorptive the room is, the shorter the reverberation time will be. Generally, if the reverberation time is too short, people feel that the room is "dead" while if it is too long, there is confusion among sounds.

Shielding The ability of hills or structures to physically block sound or create shadow zones where sound levels are reduced.

Sound Absorption The ability of sound-absorbing materials to trap sound and convert it to heat or some other form of energy.

Sound Insulation Reducing the sound level inside a building through the use of specific building construction materials, and component assemblies which provide noise reduction.

Sound Transmission Class (STC) A single-number rating derived from measured values of transmission loss, in accordance with ASTM Classification E413, "Determination of Sound Transmission Class". It provides an evaluation of the sound-isolating properties of built construction against sounds of speech, radio, television, etc.

Sound Transmission Loss (TL) A measure of a built construction's ability to reduce sound passing through it, expressed in decibels.

Source The object which generates the sound.

Southern Building Code (SBC) See International Building Code.

Spectral Characteristics/Spectrum The frequency content of the noise produced by the source.

Structureborne Sound Sound energy transmitted through a solid medium such as the building structure.

Thermal Insulation A material or assembly of materials used primarily to provide resistance to heat flow.

TL See Sound Transmission Loss.

Uniform Building Code (UBC) See International Building Code.

Appendix E – 2004 Housing Survey

Appendix E-1. General Survey of Airport Influence Area

STUDY HOUSE NO. ***General Observation***	**ADDRESS:** ***Airport Influence Area***		**PARCEL NUMBER:**
1) Units that are: **Rough Percentage %**	***COMMENTS*:**		
a) Single Family	*79*	*By far, the lions share*	
b) Duplex	*5*	*Scattered throughout area*	
c) Townhome	*Less than 1*		
d) Apartment (Multifamily)	*5*		
e) Mobile Home	*10*	*Older homes, closer to Influence Area 'C'*	
2) Single Family Home **Rough Percentage %**	***COMMENTS*:**		
a) 1 story	*75*		
b) 1.5 story	*Less than 1*		
c) 2 story	*24*		
d) 3 story	*Less than 1*		
3) Single Family Home: What are the most typical home sizes?	***COMMENTS*:**		
a) Approximate square feet	*1800 - 2000*	*Larger houses are being developed further out from airport, around 2500 sf*	
b) Number of bedrooms	*3-4*		
4) What insulation R-value required/commonly used for roof?		***COMMENTS:*** *Typical now is an R-38 blown in product into the attic space of the roof truss. Older homes were probably 6-nch R-19 fiberglass batts.*	
5) What is the approximate depth of roof truss or joist?	*4:12 common* *4 to 6 feet*	***COMMENTS:*** *Older homes (Pre-1990) have lower slope, newer ones towards the 4: 12 to 6:12 slopes*	
6) Rough Percentage of residences that are Solid Masonry vs. Wood Frame	*99.5% Wood*	***COMMENTS:*** *An all masonry home is very unlikely*	
7) How Common?	***Façade Only***	***Whole House***	***COMMENTS:***
a) Brick	*Accent*	*Nil*	*Accent only, whole street façade is rare*
b) Block	*Not very*	*Nil*	
c) Stone (veneer)	*Accent*	*Nil*	*Accent only, whole street façade is rare*
d) Stucco	*Accent*	*Nil*	*Accent and whole street façade is 50/50 split*
8) More Common 2x4 or 2x6	*2 x 4*	***COMMENTS:*** *2 X 4 is about 90% of the stick built*	

Rough Percentage %		*homes.*
9) Sheathing Type for wood-framed houses? (OSB, Insulation Board i.e. thermoply or energy brace)	***COMMENTS***:	
a) Existing	*OSB*	*Roof and walls*
b) New	*OSB*	*Roof and walls, Thermoply becoming popular to replace OSB where not needed for seismic*
10) How thick is drywall?	*½-inch*	***COMMENTS****:*
a) Is plaster used in existing homes?		*Only in more historical or vintage locations. Too labor intensive.*
11) Your opinion on Sound Installation Treatments:	***COMMENTS:***	
a) For Existing Construction: Additional layers of gypsum board?		*Author believes few people would see benefit over inconvenience, even if they were not paying for it.*
b) For New Construction: Resilient Channels, 2x6 Studs or Staggered Studs?		*Not likely to meet acceptance by building contractors*

12) Opinions on Ceiling Treatments:	***COMMENTS***:	
a) For Existing Construction: Additional layers of gypsum board?		*Helpful, but few people will see the benefit*
b) For New Construction: Resilient Channels?		*Homebuilders will not support this additional effort*
c) "False": Vaulted ceilings (sloped ceiling with small attic space above)?		*Most roof trusses are pre-manufactured gang nail type with profiles as varies as the neighbors. Scissor trusses are common with a 3:13 interior slope and 5:12 or more on the exterior side.*
13) Are Storm Windows acceptable as a sound insulation modification?	*Not normal, see #18*	***COMMENTS:***
14) Are Skylights common in this area?	*Not typical*	***COMMENTS:***
15) R-value requirements	*Typical Value?*	***COMMENTS:***
a) Windows		*Extruded vinyl for the newer homes, extruded aluminum for the older ones*
b) Doors		*Solid wood doors for front are norm. Some have steel*

		wrap on front face.
16) What window styles are most common?	*Sliders and casements*	***COMMENTS:***
17) Storm doors for swinging doors typical?	*Not typical*	***COMMENTS****:*
18) Slider or French Doors Typical?	*Patio side or rear side*	
a) Your opinion on secondary French doors (storm doors)?	*Not Common*	***COMMENTS:*** *People like to leave there front doors closed, little need for front storm doors*
19) We assume that all swinging doors swing inward. Is this usually true?	*Yes*	***COMMENTS:***
20) Type of Siding Rough Percentage %	***COMMENTS****:*	
a) Vinyl	*Less than 1%*	
b) Aluminum	*Less than 1%*	
c) Handiplank	*Less than 1%*	
d) Wood	*95%*	*Molded or shaped MDF siding by far the norm.*
e) EIFS	*Accent*	*Street front accent or street façade only*
f) Asbestos	*Less than 1%*	
21) What is most common: Full basements, Crawl spaces or Slabs?	*Crawl Spaces*	***COMMENTS:*** *Most of the homes are built on a shallow crawl-space. Basements are rare. Older homes and newer patio homes are built slab on grade. Few patio homes are within the influence area.*
22) Are vaulted ceilings common in existing or new construction?		***COMMENTS:*** *Newer homes tend to have vaulted ceilings as part of the lower level living areas. Older homes typically did not contain vaulted ceilings. Many upper-end homes have vaulted ceilings on all stories.*
23) Are there standards for Fresh air, Ventilation, and Circulation aside from Heat and Air Conditioning?	*Yes*	***COMMENTS:*** *Only related to ventilation of attic or crawl spaces. Fixed louver venting of attic or crawlspace is 1 sf (net)/150 sf (attic or crawlspace area), mechanical venting is 0.2 cfm/sf.*
24) Is Central Air common in existing homes?	*Yes*	
a) Do existing homes use window or thru-wall air conditioners?	*Limited*	***COMMENTS:*** *Older homes have roof mounted swamp coolers, with few window or thru wall A/C units. Since say 1980, most homes have whole house A/C systems.*
25) Heat: Are forced hot air systems or radiators more common?	*Forced Air*	***COMMENTS:*** *Steam radiators or baseboard convectors not common I homes around the airport influence area.*
26) Fireplaces common in this area?	*Yes*	

a) Would the addition of a sound-insulating cap on a chimney be okay	*Yes See comments*	***COMMENTS:*** *Older homes were masonry chimneys wrapping both wood burning fireplace and furnace flues. Few had spark caps. Newer homes contain gas fireplaces, with lightweight flue pipe or chimney construction. Sound insulating cap would offer little, in writer's opinion*.

Appendix E-2. Survey of House 1

STUDY HOUSE NO.	***ADDRESS:***	***PARCEL NUMBER**:*
001	*3701 East Alta Ridge Court, Boise*	*R8224270050*

1) Units that are: Rough Percentage %	***COMMENTS:***		
f) Single Family	*X*	*Built 2000*	
g) Duplex			
h) Townhome			
i) Apartment (Multifamily)			
j) Mobile Home			
2) Single Family Home Rough Percentage %	***COMMENTS**:*		
e) 1 story			
f) 1.5 story			
g) 2 story	*X*		
h) 3 story			
3) Single Family Home: What are the most typical home sizes?	***COMMENTS:***		
c) Approximate square feet	*2600*		
d) Number of bedrooms	*5*		
4) What insulation R-value required/commonly used for roof?		***COMMENTS:*** *Cannot be verified, but presume an R-30 blown-in insulation between roof trusses.*	
5) What is the approximate depth of roof truss or joist?	*6-8 feet*	***COMMENTS:*** *Roof structure most likely pre-engineered, gang nailed roof trusses. Open air attic vents at gable ends.*	
6) Rough Percentage of residences that are Solid Masonry vs. Wood Frame	*Wood*	***COMMENTS:*** *Nearly 100% are wood framed.*	
7) How Common?	*Façade Only*	*Whole House*	***COMMENTS:***
e) Brick	*Less than 5%*		*Accent only*
f) Block			
g) Stone (veneer)			
h) Stucco			
8) More Common 2x4 or 2x6 Rough Percentage %	*2 x 4*	***COMMENTS**:*	
9) Sheathing Type for wood-framed houses? (OSB, Insulation Board i.e. thermoply or energy brace)	***COMMENTS:*** *Age of this house would promote use of OSB or Thermoply sheathing rather than plywood. Presume MDF lap siding over building paper (not “housewrap”) over sheathing attached to 2 x 4 framing.*		

c) Existing	*X*	*Asphalt Shingles over felt, over OSB*
d) New		
10) How thick is drywall?		***COMMENTS:*** *Assume ½-inch material*
b) Is plaster used in existing homes?		*Not likely*
11) Your opinion on Sound Installation Treatments:	***COMMENTS:***	
c) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
d) For New Construction: Resilient Channels, 2x6 Studs or Staggered Studs?		*N/A*
12) Opinions on Ceiling Treatments:	***COMMENTS:***	

d) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
e) For New Construction: Resilient Channels?		*N/A*
f) “False”: Vaulted ceilings (sloped ceiling with small attic space above)?		*N/A*
13) Are Storm Windows acceptable as a sound insulation modification?	*No Storm*	***COMMENTS:*** *Storm windows are not widely used here in BOI. Newer homes have insulated glazing within extruded vinyl frames.*
14) Are Skylights common in this area?	*No Skylites*	***COMMENTS:***
15) R-value requirements	*Typical Value?*	***COMMENTS:***
c) Windows		*Slider metal window, non insulated (R<1.0), Insulated Vinyl (R-20)*
d) Doors		*Solid wood in wood frame (R-2.5), Steel door in wood frame (R-6)*
16) What window styles are most common?	*Sliders*	***COMMENTS:*** *See storm windows.*
17) Storm doors for swinging doors typical?	*No Storm*	***COMMENTS****: Not typical*
18) Slider or French Doors	*Patio side*	

Typical?	*rear side*	
b) Your opinion on secondary French doors (storm doors)?		***COMMENTS:*** *Not typical*
19) We assume that all swinging doors swing inward. Is this usually true?	*Yes*	***COMMENTS:***
20) Type of Siding Rough Percentage %	***COMMENTS:***	
g) Vinyl		
h) Aluminum		
i) Handiplank		
j) Wood	*98%*	*Molded or shaped MDF siding*
k) EIFS		
l) Asbestos		
21) What is most common: Full basements, Crawl spaces or Slabs?	*Crawl Space*	***COMMENTS:***
22) Are vaulted ceilings common in existing or new construction?	*Yes*	***COMMENTS:*** *Part of first floor living*
23) Are there standards for Fresh air, Ventilation, and Circulation aside from Heat and Air Conditioning?	*Yes*	***COMMENTS:*** *Only related to ventilation of attic or crawl spaces. Fixed louver venting of attic or crawlspace is 1 sf (net)/150 sf (attic or crawlspace area), mechanical venting is 0.2 cfm/sf.*
24) Is Central Air common in existing homes?	*Yes*	
b) Do existing homes use window or thru-wall air conditioners?		***COMMENTS:***
25) Heat: Are forced hot air systems or radiators more common?	*Forced Air*	***COMMENTS:***
26) Fireplaces common in this area?	*Yes*	*One fireplace is reported in this house.*
b) Would the addition of a sound-insulating cap on a chimney be okay		***COMMENTS:*** *Presume a gas-fired unit. Newer construction would promote double wall insulated metal flue pipe with light construction surround.*

Appendix E-3. Survey of House 2

STUDY HOUSE NO.	*ADDRESS:*	*PARCEL NUMBER:*
002	*5569 South Fuchsia Place, Boise*	*R1525750640*

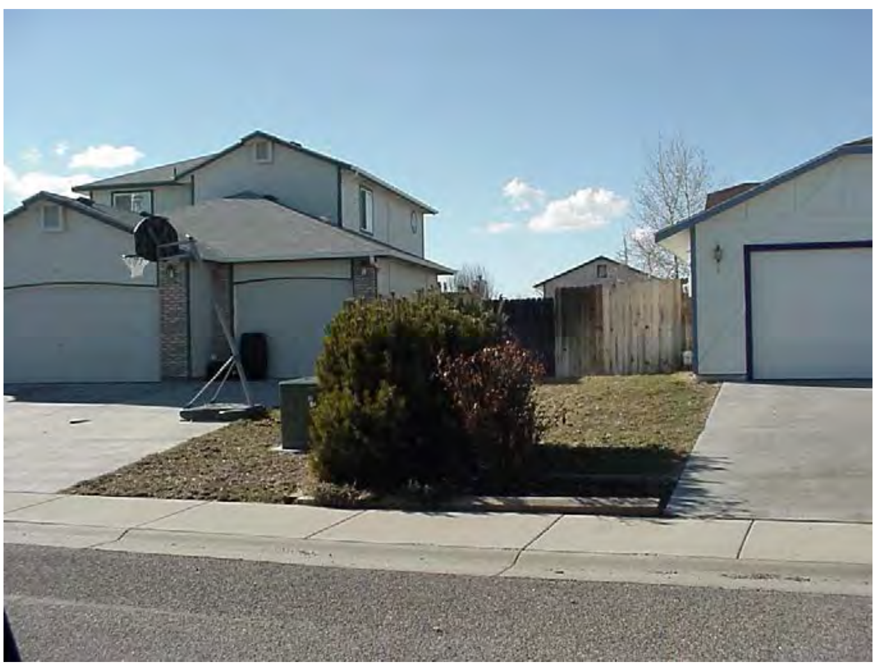
1) Units that are: **Rough Percentage %**	***COMMENTS:***		
k) Single Family	*X*	*Built 1994*	
l) Duplex			
m) Townhome			
n) Apartment (Multifamily)			
o) Mobile Home			
2) Single Family Home **Rough Percentage %**	***COMMENTS:***		
i) 1 story			
j) 1.5 story			
k) 2 story	*X*		
l) 3 story			
3) Single Family Home: What are the most typical home sizes?	***COMMENTS:***		
e) Approximate square feet	*2000*		
f) Number of bedrooms	*4*		
4) What insulation R-value required/commonly used for roof?		***COMMENTS:*** *Cannot be verified, but presume an R-30 blown-in insulation between roof trusses.*	
5) What is the approximate depth of roof truss or joist?	*5-6 feet*	***COMMENTS:*** *Roof structure most likely pre-engineered, gang nailed roof trusses. Open air attic vents at gable ends.*	
6) Rough Percentage of residences that are Solid Masonry vs. Wood Frame	*Wood*	***COMMENTS:*** *Nearly 100% are wood framed.*	
7) How Common?	*Façade Only*	*Whole House*	*COMMENTS:*
i) Brick	*Less than 5%*		*Accent only*
j) Block			
k) Stone (veneer)			
l) Stucco			
8) More Common 2x4 or 2x6 Rough Percentage %	*2 x 4*	***COMMENTS****:*	
9) Sheathing Type for wood-framed houses? (OSB, Insulation Board i.e. thermoply or energy brace)	***COMMENTS:*** *Age of this house would promote use of OSB or Thermoply sheathing rather than plywood. Presume MDF board siding over building paper (not "housewrap") over*		

	sheathing attached to 2 x 4 framing.	
e) Existing	*X*	*Composite Asphalt Shingles over sheathing*
f) New		
10) How thick is drywall?		***COMMENTS:*** *Assume ½-inch material*
c) Is plaster used in existing homes?		*Not likely*
11) Your opinion on Sound Installation Treatments:	***COMMENTS****:*	
e) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
f) For New Construction: Resilient Channels, 2x6 Studs or Staggered Studs?		*N/A*

12) Opinions on Ceiling Treatments:	***COMMENTS:***	
g) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
h) For New Construction: Resilient Channels?		*N/A*
i) "False": Vaulted ceilings (sloped ceiling with small attic space above)?		*N/A*
13) Are Storm Windows acceptable as a sound insulation modification?	*No Storm*	***COMMENTS:*** *Storm windows are not widely used here in BOI.* *This home has insulated glazing within extruded vinyl frames.*
14) Are Skylights common in this area?	*Skylights*	***COMMENTS:***
15) R-value requirements	*Typical Value?*	***COMMENTS:***
e) Windows		*Slider metal window, non insulated (R<1.0), Insulated Vinyl (R-20)*
f) Doors		*Solid wood in wood frame (R-2.5), Steel door in wood frame (R-6)*
16) What window styles are most common?	*Sliders*	***COMMENTS:*** *See storm windows.*
17) Storm doors for swinging doors typical?	*Storm Door*	***COMMENTS****:*
18) Slider or French Doors Typical?		
c) Your opinion on secondary French		***COMMENTS:*** *Not typical*

doors (storm doors)?		
19) We assume that all swinging doors swing inward. Is this usually true?	*Yes*	***COMMENTS****:*
20) Type of Siding Rough Percentage %	***COMMENTS****:*	
m) Vinyl		
n) Aluminum		
o) Handiplank		
p) Wood	*100%*	*Molded or shaped MDF siding*
q) EIFS		
r) Asbestos		
21) What is most common: **Full basements, Crawl spaces or Slabs?**	*Crawl Space*	***COMMENTS:***
22) Are vaulted ceilings common in existing or new construction?		***COMMENTS:*** *Part of first floor living*
23) Are there standards for Fresh air, Ventilation, and Circulation aside from Heat and Air Conditioning?	*Yes*	***COMMENTS:*** *Only related to ventilation of attic or crawl spaces. Fixed louver venting of attic or crawlspace is 1 sf (net)/150 sf (attic or crawlspace area), mechanical venting is 0.2 cfm/sf.*
24) Is Central Air common in existing homes?	*Yes*	
c) Do existing homes use window or thru-wall air conditioners?	*N/A*	***COMMENTS:***
25) Heat: Are forced hot air systems or radiators more common?	*Forced Air*	***COMMENTS:***
26) Fireplaces common in this area?	*Yes*	*One fireplace is reported in this house.*
c) Would the addition of a sound-insulating cap on a chimney be okay		***COMMENTS:*** *Presume this is a gas-fired type with light gage metal flue and cap.*


5569
5569



Appendix E-4. Survey of House 3

STUDY HOUSE NO.	*ADDRESS:*		*PARCEL NUMBER:*
003	*4006 West Normandie, Boise*		*R1580730270*

1) Units that are: Rough Percentage %	***COMMENTS:***		
p) Single Family	*X*	*Built 1960*	
q) Duplex			
r) Townhome			
s) Apartment (Multifamily)			
t) Mobile Home			
2) Single Family Home Rough Percentage %	***COMMENTS:***		
m) 1 story	*X*		
n) 1.5 story			
o) 2 story			
p) 3 story			
3) Single Family Home: What are the most typical home sizes?	***COMMENTS:***		
g) Approximate square feet	*1400*		
h) Number of bedrooms	*3*		
4) What insulation R-value required/commonly used for roof?		***COMMENTS:*** *Cannot be verified, but presume an R-19 batt blanket insulation between roof trusses.*	
5) What is the approximate depth of roof truss or joist?	*1-3 feet*	***COMMENTS:*** *Roof structure most likely pre-engineered, gang nailed roof trusses.*	
6) Rough Percentage of residences that are Solid Masonry vs. Wood Frame	*Wood*	***COMMENTS:*** *Nearly 100% are wood framed.*	
7) How Common?	***Façade Only***	***Whole House***	***COMMENTS:***
m) Brick			
n) Block			
o) Stone (veneer)			
p) Stucco			
8) More Common 2x4 or 2x6 Rough Percentage %	*2 x 4*	***COMMENTS:***	
9) Sheathing Type for wood-framed houses? (OSB, Insulation Board i.e. thermoply or energy brace)	***COMMENTS:*** *Age of this house would promote use of plywood sheathing rather than OSB or Thermoply. Presume plank siding over building paper over sheathing attached to 2 x 4 framing.*		
g) Existing	*Plywood*	*Composite asphalt Shingles over sheathing*	
h) New			

10) How thick is drywall?		***COMMENTS:*** *Assume ½-inch material*
d) Is plaster used in existing homes?		*Not likely*
11) Your opinion on Sound Installation Treatments:	***COMMENTS:***	
g) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
h) For New Construction: Resilient Channels, 2x6 Studs or Staggered Studs?		*N/A*

12) Opinions on Ceiling Treatments:	***COMMENTS:***	
j) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
k) For New Construction: Resilient Channels?		*N/A*
l) "False": Vaulted ceilings (sloped ceiling with small attic space above)?		*N/A*
13) Are Storm Windows acceptable as a sound insulation modification?	*No Storm Windows*	***COMMENTS:*** *Storm windows are not widely used here in BOI. Older homes have extruded metal-framed windows with single glazing, rather than wood. Newer homes are more likely to be insulated glazing within extruded vinyl frames.*
14) Are Skylights common in this area?	*No Skylights*	***COMMENTS:***
15) R-value requirements	*Typical Value?*	***COMMENTS:***
g) Windows		*Slider metal window, non insulated (R<1.0), Insulated Vinyl (R-20)*
h) Doors		*Solid wood in wood frame (R-2.5), Steel door in wood frame (R-6)*
16) What window styles are most common?	*Sliders*	***COMMENTS:*** *See storm windows.*
17) Storm doors for swinging doors typical?	*Storm Door*	***COMMENTS****: Older homes seem to have storm doors.*
18) Slider or French Doors Typical?		

d) Your opinion on secondary French doors (storm doors)?		***COMMENTS:*** *Not typical*
19) We assume that all swinging doors swing inward. Is this usually true?	*Yes*	***COMMENTS****:*
20) Type of Siding Rough Percentage %	***COMMENTS****:*	
s) Vinyl		
t) Aluminum		
u) Handiplank		
v) Wood	*100%*	*Lap or bevel wood siding planks fastened directly to sheathing*
w) EIFS		
x) Asbestos		
21) What is most common: Full basements, Crawl spaces or Slabs?	*Slab On Grade*	***COMMENTS****:*
22) Are vaulted ceilings common in existing or new construction?	*No*	***COMMENTS:***
23) Are there standards for Fresh air, Ventilation, and Circulation aside from Heat and Air Conditioning?	*Yes*	***COMMENTS:*** *Only related to ventilation of attic or crawl spaces. Fixed louver venting of attic or crawlspace is 1 sf (net)/150 sf (attic or crawlspace area), mechanical venting is 0.2 cfm/sf.*
24) Is Central Air common in existing homes?	*No*	
d) Do existing homes use window or thru-wall air conditioners?	*Not Visible*	***COMMENTS:***
25) Heat: Are forced hot air systems or radiators more common?	*Forced Air*	***COMMENTS:***
26) Fireplaces common in this area?	*Yes*	*2 fireplaces are reported in this house.*
d) Would the addition of a sound-insulating cap on a chimney be okay		***COMMENTS:*** *Date of construction would presume a masonry chimney shared with the furnace flue for primary. Also must have second fireplace by metal flue in back half of roof left side.*

Appendix E-5. Survey of House 4

STUDY HOUSE NO. *004*	***ADDRESS:*** *4679 West Garden Court, Boise*		***PARCEL NUMBER:*** *R05898870070*
1) Units that are: Rough Percentage %	***COMMENTS:***		
u) Single Family	*X*	*Built 2003*	
v) Duplex			
w) Townhome			
x) Apartment (Multifamily)			
y) Mobile Home			
2) Single Family Home Rough Percentage %	***COMMENTS:***		
q) 1 story	*X*		
r) 1.5 story			
s) 2 story			
t) 3 story			
3) Single Family Home: What are the most typical home sizes?	***COMMENTS:***		
i) Approximate square feet	*1537*		
j) Number of bedrooms	*3*		
4) What insulation R-value required/commonly used for roof?		***COMMENTS:*** *Cannot be verified, but presume an R-30 blown-in insulation between roof trusses.*	
5) What is the approximate depth of roof truss or joist?	*1-3 feet*	***COMMENTS:*** *Roof structure most likely pre-engineered, gang nailed roof trusses. Open air attic vents at gable ends.*	
6) Rough Percentage of residences that are Solid Masonry vs. Wood Frame	*Wood*	***COMMENTS:*** *Nearly 100% are wood framed.*	
7) How Common?	*Façade Only*	*Whole House*	***COMMENTS:***
q) Brick			
r) Block			
s) Stone (veneer)			
t) Stucco			
8) More Common 2x4 or 2x6 Rough Percentage %	*2 x 4*	***COMMENTS:***	
9) Sheathing Type for wood-framed houses? (OSB, Insulation Board i.e. thermoply	***COMMENTS:*** *Age of this house would promote use of OSB or Thermoply sheathing rather than plywood. Presume MDF lap siding over building paper (not "housewrap") over sheathing attached to 2 x*		

or energy brace)	*4 framing.*	
i) Existing	*OSB*	*Asphalt Shingles over felt, over OSB*
j) New		
10) How thick is drywall?		***COMMENTS:*** *Assume ½-inch material*
e) Is plaster used in existing homes?		*Not likely*
11) Your opinion on Sound Installation Treatments:	***COMMENTS****:*	
i) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
j) For New Construction: Resilient Channels, 2x6 Studs or Staggered Studs?		*N/A*

12) Opinions on Ceiling Treatments:	***COMMENTS****:*	
m) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
n) For New Construction: Resilient Channels?		*N/A*
o) “False”: Vaulted ceilings (sloped ceiling with small attic space above)?		*N/A*
13) Are Storm Windows acceptable as a sound insulation modification?	*No Storm Windows*	***COMMENTS:*** *Storm windows are not widely used here in BOI.Newer homes have insulated glazing within extruded vinyl frames.*
14) Are Skylights common in this area?	*No Skylights*	***COMMENTS****:*
15) R-value requirements	*Typical Value?*	***COMMENTS****:*
i) Windows		*Slider metal window, non insulated (R<1.0), Insulated Vinyl (R-20)*
j) Doors		*Solid wood in wood frame (R-2.5), Steel door in wood frame (R-6)*
16) What window styles are most common?	*Sliders and single hung*	***COMMENTS:*** *See storm windows.*
17) Storm doors for swinging doors typical?	*No Storm Door*	***COMMENTS****: Not typical*
18) Slider or French Doors Typical?		
e) Your opinion on secondary		***COMMENTS:*** *Not typical*

French doors (storm doors)?		
19) We assume that all swinging doors swing inward. Is this usually true?	*Yes*	***COMMENTS**:*
20) Type of Siding Rough Percentage %	***COMMENTS**:*	
y) Vinyl		
z) Aluminum		
aa) Handiplank		
bb) Wood	*100%*	*Molded or shaped MDF siding*
cc) EIFS		
dd) Asbestos		
21) What is most common: Full basements, Crawl spaces or Slabs?	*Crawl Space*	***COMMENTS**:*
22) Are vaulted ceilings common in existing or new construction?	*Yes*	***COMMENTS:** Vault probably in main living area street side*
23) Are there standards for Fresh air, Ventilation, and Circulation aside from Heat and Air Conditioning?	*Yes*	***COMMENTS**:* *Only related to ventilation of attic or crawl spaces. Fixed louver venting of attic or crawlspace is 1 sf (net)/150 sf (attic or crawlspace area), mechanical venting is 0.2 cfm/sf.*
24) Is Central Air common in existing homes?	*Yes*	
e) Do existing homes use window or thru-wall air conditioners?		***COMMENTS:***
25) Heat: Are forced hot air systems or radiators more common?	*Forced Air*	***COMMENTS:***
26) Fireplaces common in this area?	*Yes*	*One fireplace is reported in this house.*
e) Would the addition of a sound-insulating cap on a chimney be okay		***COMMENTS:** Newer construction would promote double wall insulated metal flue pipe with light construction surround.*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Appendix E-6. Survey of House 5

STUDY HOUSE NO. *005*	***ADDRESS:*** *2405 South Mobile Drive, Boise*		***PARCEL NUMBER:*** *R1539610035*
1) Units that are: **Rough Percentage %**	***COMMENTS:***		
z) Single Family	*X*	*Construction date Unknown*	
aa) Duplex			
bb) Townhome			
cc) Apartment (Multifamily)			
dd) Mobile Home			
2) Single Family Home **Rough Percentage %**	***COMMENTS**:*		
u) 1 story	*X*		
v) 1.5 story			
w) 2 story			
x) 3 story			
3) Single Family Home: What are the most typical home sizes?	***COMMENTS:***		
k) Approximate square feet	*1200 +/-*		
l) Number of bedrooms	*2 or 3*		
4) What insulation R-value required/commonly used for roof?		***COMMENTS:*** *Cannot be verified, but presume an R-19 batt blanket insulation between roof trusses.*	
5) What is the approximate depth of roof truss or joist?	*0.5 to 1.5 feet*	***COMMENTS:***	
6) Rough Percentage of residences that are Solid Masonry vs. Wood Frame	*Wood*	***COMMENTS:*** *Nearly 100% are wood framed.*	
7) How Common?	*Façade Only*	*Whole House*	***COMMENTS**:*
u) Brick			
v) Block			
w) Stone (veneer)			
x) Stucco			
8) More Common 2x4 or 2x6 **Rough Percentage %**	*2 x 4*	***COMMENTS:***	
9) Sheathing Type for wood-framed houses? (OSB, Insulation Board i.e. thermoply or energy brace)	***COMMENTS:*** *This house is a pre-manufactured unit, age unknown. Roof profile is very shallow. Presume insulation is fiberglass batt type between roof trusses*		
k) Existing		*Rolled roofing membrane over roof decking*	

l) New		
10) How thick is drywall?		***COMMENTS:*** *Assume ½-inch material*
f) Is plaster used in existing homes?		*Not likely*
11) Your opinion on Sound Installation Treatments:	***COMMENTS****:*	
k) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
l) For New Construction: Resilient Channels, 2x6 Studs or Staggered Studs?		*N/A*

12) Opinions on Ceiling Treatments:	***COMMENTS****:*	
p) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
q) For New Construction: Resilient Channels?		*N/A*
r) “False”: Vaulted ceilings (sloped ceiling with small attic space above)?		*N/A*
13) Are Storm Windows acceptable as a sound insulation modification?	*No Storm Windows*	***COMMENTS:*** *Storm windows are not widely used here in BOI. Older homes have extruded metal-framed windows with single glazing, rather than wood*
14) Are Skylights common in this area?	*No Skylights*	*COMMENTS:*
15) R-value requirements	*Typical Value?*	*COMMENTS:*
k) Windows		*Slider metal window, non insulated (R<1.0), Insulated Vinyl (R-20)*
l) Doors		*Solid wood in wood frame (R-2.5), Steel door in wood frame (R-6)*
16) What window styles are most common?	*Sliders and single hung*	***COMMENTS:*** *See storm windows*
17) Storm doors for swinging doors typical?	*No Storm Door*	***COMMENTS****: Not typical*
18) Slider or French Doors Typical?		
f) Your opinion on secondary		***COMMENTS:*** *Not typical*

French doors (storm doors)?		
19) We assume that all swinging doors swing inward. Is this usually true?	*Yes*	***COMMENTS**:*
20) Type of Siding Rough Percentage %	***COMMENTS**:*	
ee) Vinyl		
ff) Aluminum	*100 %*	
gg) Handiplank		
hh) Wood		
ii) EIFS		
jj) Asbestos		
21) What is most common: Full basements, Crawl spaces or Slabs?	*Skirt around structure*	***COMMENTS:** Presume that there is little insulation below the floor of this structure other than that required for perimeter construction.*
22) Are vaulted ceilings common in existing or new construction?	*No*	***COMMENTS:***
23) Are there standards for Fresh air, Ventilation, and Circulation aside from Heat and Air Conditioning?	*Yes*	***COMMENTS:*** *Only related to ventilation of attic or crawl spaces. Fixed louver venting of attic or crawlspace is 1 sf (net)/150 sf (attic or crawlspace area), mechanical venting is 0.2 cfm/sf.*
24) Is Central Air common in existing homes?	*No*	
f) Do existing homes use window or thru-wall air conditioners?	*Not visible*	***COMMENTS:***
25) Heat: Are forced hot air systems or radiators more common?	*Forced Air*	***COMMENTS:***
26) Fireplaces common in this area?	*No*	
f) Would the addition of a sound-insulating cap on a chimney be okay		***COMMENTS**:*

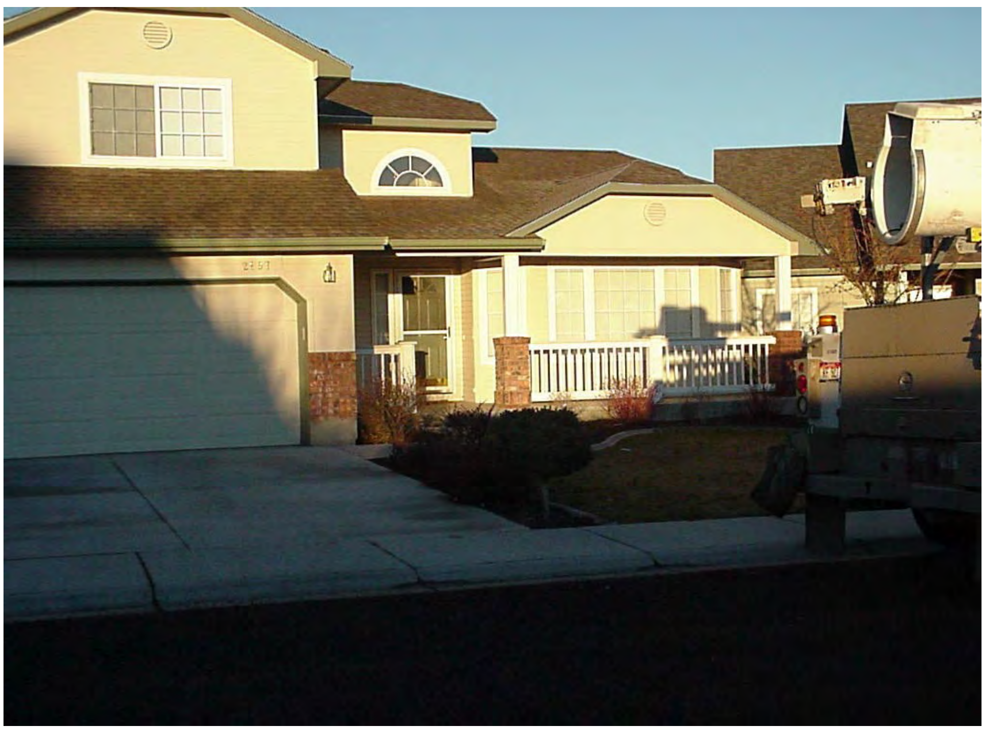
Appendix E-7. Survey of House 6

STUDY HOUSE NO.	*ADDRESS:*		*PARCEL NUMBER:*
006	*2897 South Merrimac Avenue, Boise*		*R1294350120*
1) Units that are: Rough Percentage %	***COMMENTS:***		
ee) Single Family	*X*	*Built 1998*	
ff) Duplex			
gg) Townhome			
hh) Apartment (Multifamily)			
ii) Mobile Home			
2) Single Family Home Rough Percentage %	***COMMENTS:***		
y) 1 story			
z) 1.5 story			
aa) 2 story	*X*		
bb) 3 story			
3) Single Family Home: What are the most typical home sizes?	***COMMENTS:***		
m) Approximate square feet	*1850*		
n) Number of bedrooms	*4*		
4) What insulation R-value required/commonly used for roof?		***COMMENTS:*** *Cannot be verified, but presume an R-30 blown-in fiber blanket insulation between roof trusses.*	
5) What is the approximate depth of roof truss or joist?	*2 - 4 feet*	***COMMENTS:*** *Roof structure most likely pre-engineered, gang nailed roof trusses.*	
6) Rough Percentage of residences that are Solid Masonry vs. Wood Frame	*Wood*	***COMMENTS:*** *Nearly 100% are wood framed.*	
7) How Common?	*Façade Only*	*Whole House*	***COMMENTS****:*
y) Brick	*X*		*Accent Only at Base*
z) Block			
aa) Stone (veneer)			
bb) Stucco			
8) More Common 2x4 or 2x6 Rough Percentage %	*2 x 4*	***COMMENTS****:*	
9) Sheathing Type for wood-framed houses? (OSB, Insulation Board i.e. thermoply or energy brace)	***COMMENTS:*** *Age of this house would promote use of OSB or Thermoply rather than plywood. Presume composite wood siding over building paper (not "house wrap") over sheathing attached to 2 x 4 framing.*		
m) Existing			

n) New	*OSB*	*Asphalt Shingles over roofing felt over OSB*
10) How thick is drywall?		***COMMENTS:*** *Assume ½-inch material*
g) Is plaster used in existing homes?		*Not likely*
11) Your opinion on Sound Installation Treatments:	***COMMENTS****:*	
m) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
n) For New Construction: Resilient Channels, 2x6 Studs or Staggered Studs?		*N/A*

12) Opinions on Ceiling Treatments:	***COMMENTS****:*	
s) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
t) For New Construction: Resilient Channels?	*Gyp. Bd. Secured to framing*	*N/A*
u) "False": Vaulted ceilings (sloped ceiling with small attic space above)?		*Limited to certain areas accent of house, presumed living room and master bedroom.*
13) Are Storm Windows acceptable as a sound insulation modification?	*No Storm Windows*	***COMMENTS:*** *Storm windows are not widely used here in BOI.This home contains insulated glazing within extruded vinyl frames.*
14) Are Skylights common in this area?	*No Skylights*	***COMMENTS:***
15) R-value requirements	*Typical Value?*	***COMMENTS:***
m) Windows		*Slider metal window, non insulated (R<1.0), Insulated Vinyl (R-20)*
n) Doors		*Solid wood in wood frame (R-2.5), Steel door in wood frame (R-6)*
16) What window styles are most common?	*Sliders*	***COMMENTS:*** *See Strom windows.*
17) Storm doors for swinging doors typical?	*Storm Door*	***COMMENTS****:*
18) Slider or French Doors Typical?		

g) Your opinion on secondary French doors (storm doors)?		***COMMENTS:*** *Not typical*
19) We assume that all swinging doors swing inward. Is this usually true?	*Yes*	***COMMENTS****:*
20) Type of Siding Rough Percentage %	***COMMENTS****:*	
kk) Vinyl		
ll) Aluminum		
mm)Handiplank		
nn) Wood	*90%*	
oo) EIFS		
pp) Asbestos		
21) What is most common: Full basements, Crawl spaces or Slabs?	*Crawlspace*	***COMMENTS****:*
22) Are vaulted ceilings common in existing or new construction?	*Yes*	***COMMENTS:*** *Probably part of entrance vestibule or main level living area.*
23) Are there standards for Fresh air, Ventilation, and Circulation aside from Heat and Air Conditioning?	*Yes*	***COMMENTS:*** *Only related to ventilation of attic or crawl spaces. Fixed louver venting of attic or crawlspace is 1 sf (net)/150 sf (attic or crawlspace area), mechanical venting is 0.2 cfm/sf.*
24) Is Central Air common in existing homes?	*Yes*	
g) Do existing homes use window or thru-wall air conditioners?		***COMMENTS:***
25) Heat: Are forced hot air systems or radiators more common?	*Forced Air*	***COMMENTS:***
26) Fireplaces common in this area?	*Yes*	*One fireplace is reported in this house.*
g) Would the addition of a sound-insulating cap on a chimney be okay		***COMMENTS:*** *Light-gage metal flue.*



Appendix E-8. Survey of House 7

STUDY HOUSE NO.	*ADDRESS:*		*PARCEL NUMBER:*
007	*3425 South Beverly Street, Boise*		*R8043270320*
1) Units that are: Rough Percentage %	***COMMENTS:***		
jj) Single Family	*X*	*Built 1977*	
kk) Duplex			
ll) Townhome			
mm) Apartment (Multifamily)			
nn) Mobile Home			
2) Single Family Home Rough Percentage %	***COMMENTS:***		
cc) 1 story	*X*		
dd) 1.5 story			
ee) 2 story			
ff) 3 story			
3) Single Family Home: What are the most typical home sizes?	***COMMENTS:***		
o) Approximate square feet	*2172*		
p) Number of bedrooms	*3*		
4) What insulation R-value required/commonly used for roof?		***COMMENTS:*** *Cannot be verified, but presume an R-19 batt blanket insulation between roof trusses.*	
5) What is the approximate depth of roof truss or joist?	*1 - 4 feet*	***COMMENTS:*** *Roof structure most likely pre-engineered, gang nailed roof trusses.*	
6) Rough Percentage of residences that are Solid Masonry vs. Wood Frame	*Wood*	***COMMENTS:*** *Nearly 100% are wood framed.*	
7) How Common?	***Façade Only***	***Whole House***	***COMMENTS:***
cc) Brick	*X*		*Sill to Soffit, Street side only*
dd) Block			
ee) Stone (veneer)			
ff) Stucco			
8) More Common 2x4 or 2x6 Rough Percentage %	*2 x 4*	***COMMENTS:***	
9) Sheathing Type for wood-framed houses? (OSB, Insulation Board i.e. thermoply or energy brace)	***COMMENTS:*** *Age of this house would promote use of plywood sheathing rather than OSB or Thermoply. Presume plank siding over building paper over sheathing attached to 2 x 4 framing.*		
o) Existing			
p) New		*Wood Shingles over lath strips between trusses*	
10) How thick is drywall?		***COMMENTS:*** *Assume ½-inch material*	
h) Is plaster used in existing homes?		*Not likely*	
11) Your opinion on Sound	***COMMENTS***:		

Installation Treatments:		
o) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
p) For New Construction: Resilient Channels, 2x6 Studs or Staggered Studs?		*N/A*

12) Opinions on Ceiling Treatments:	***COMMENTS**:*	
v) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
w) For New Construction: Resilient Channels?	*Gyp. Bd. Secured to framing*	*N/A*
x) "False": Vaulted ceilings (sloped ceiling with small attic space above)?		*N/A*
13) Are Storm Windows acceptable as a sound insulation modification?	*No Storm Windows*	***COMMENTS:** Storm windows are not widely used here in BOI. Older homes have extruded metal-framed windows with single glazing, rather than wood. Newer homes are more likely to be insulated glazing within extruded vinyl frames.*
14) Are Skylights common in this area?	*No Skylights*	***COMMENTS:***
15) R-value requirements	*Typical Value?*	***COMMENTS:***
o) Windows		*Slider metal window, non insulated (R<1.0), Insulated Vinyl (R-20)*
p) Doors		*Solid wood in wood frame (R-2.5), Steel door in wood frame (R-6)*
16) What window styles are most common?	*Sliders*	***COMMENTS:** See storm windows.*
17) Storm doors for swinging doors typical?	*Storm Door*	***COMMENTS**: Not typical*
18) Slider or French Doors Typical?		
h) Your opinion on secondary French doors (storm doors)?		***COMMENTS:** Not typical*
19) We assume that all swinging doors swing inward. Is this usually true?	*Yes*	***COMMENTS:***
20) Type of Siding Rough Percentage %	***COMMENTS**:*	
qq) Vinyl		
rr) Aluminum		
ss) Handiplank		
tt) Wood	*70%*	
uu) EIFS		

vv) Asbestos		
21) What is most common: Full basements, Crawl spaces or Slabs?	*Crawlspace*	***COMMENTS*:**
22) Are vaulted ceilings common in existing or new construction?	*No*	***COMMENTS:***
23) Are there standards for Fresh air, Ventilation, and Circulation aside from Heat and Air Conditioning?	*Yes*	***COMMENTS:*** *Only related to ventilation of attic or crawl spaces. Fixed louver venting of attic or crawlspace is 1 sf (net)/150 sf (attic or crawlspace area), mechanical venting is 0.2 cfm/sf.*
24) Is Central Air common in existing homes?	*Yes*	
h) Do existing homes use window or thru-wall air conditioners?	*Not visible*	***COMMENTS:***
25) Heat: Are forced hot air systems or radiators more common?	*Forced Air*	***COMMENTS:***
26) Fireplaces common in this area?	*Yes*	*One fireplace is reported in this house.*
h) Would the addition of a sound-insulating cap on a chimney be okay		***COMMENTS:*** *Wood burning with Furnace Flue in Masonry surround.*

Appendix E-9. Survey of House 8

STUDY HOUSE NO.	*ADDRESS:*	*PARCEL NUMBER:*
008	*5071 South Chinook Avenue, Boise*	*R4221320535*

1) Units that are: Rough Percentage %	***COMMENTS**:*		
oo) Single Family	*X*	*Built 1983*	
pp) Duplex			
qq) Townhome			
rr) Apartment (Multifamily)			
ss) Mobile Home			
2) Single Family Home Rough Percentage %	***COMMENTS:***		
gg) 1 story	*X*		
hh) 1.5 story			
ii) 2 story			
jj) 3 story			
3) Single Family Home: What are the most typical home sizes?	***COMMENTS:***		
q) Approximate square feet	*2088*		
r) Number of bedrooms	*3*		
4) What insulation R-value required/commonly used for roof?		***COMMENTS:*** *Cannot be verified, but presume an R-19 batt blanket insulation between roof trusses.*	
5) What is the approximate depth of roof truss or joist?	*1 - 4 feet*	***COMMENTS:*** *Roof structure most likely pre-engineered, gang nailed roof trusses.*	
6) Rough Percentage of residences that are Solid Masonry vs. Wood Frame	*Wood*	***COMMENTS:*** *Nearly 100% are wood framed.*	
7) How Common?	*Façade Only*	*Whole House*	*COMMENTS:*
gg) Brick	*X*		*Street side only*
hh) Block			
ii) Stone (veneer)			
jj) Stucco	*X*		*Sill plate to top plate, wood siding above at gables*
8) More Common 2x4 or 2x6 Rough Percentage %	*2 x 4*	***COMMENTS:***	
9) Sheathing Type for wood-framed houses? (OSB, Insulation Board i.e. thermoply or energy brace)	***COMMENTS**:*		
q) Existing	*X*	*Wood Shingles over lath strips between wood trusses*	
r) New	*N/A*		
10) How thick is drywall?		***COMMENTS:*** *Assume ½-inch material*	
i) Is plaster used in existing homes?		*Not likely*	

11) Your opinion on Sound Installation Treatments:	***COMMENTS:***	
q) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
r) For New Construction: Resilient Channels, 2x6 Studs or Staggered Studs?		*N/A*

12) Opinions on Ceiling Treatments:	***COMMENTS**:*	
y) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
z) For New Construction: Resilient Channels?		*N/A*
aa) "False": Vaulted ceilings (sloped ceiling with small attic space above)?		*N/A*
13) Are Storm Windows acceptable as a sound insulation modification?	*No Storm Windows*	***COMMENTS:*** *Storm windows are not widely used here in BOI. Older homes have extruded metal-framed windows with single glazing, rather than wood. Newer homes are more likely to be insulated glazing within extruded vinyl frames.*
14) Are Skylights common in this area?	*2 Skylights*	*COMMENTS:*
15) R-value requirements	*Typical Value?*	*COMMENTS:*
q) Windows		*Slider metal window, non insulated (R<1.0), Insulated Vinyl (R-20)*
r) Doors		*Solid wood in wood frame (R-2.5), Steel door in wood frame (R-6)*
16) What window styles are most common?	*Casements and Sliders*	***COMMENTS:*** *See storm windows.*
17) Storm doors for swinging doors typical?	*Storm Door*	***COMMENTS**: Not typical*
18) Slider or French Doors Typical?		
i) Your opinion on secondary French doors (storm doors)?		***COMMENTS:***
19) We assume that all swinging doors swing inward. Is this usually true?	*Yes*	***COMMENTS:***
20) Type of Siding Rough Percentage %	***COMMENTS**:*	
ww) Vinyl		
xx) Aluminum		
yy) Handiplank		

zz) Wood	*10%*	*Gable accents only*
aaa) EIFS		
bbb) Asbestos		
21) What is most common: Full basements, Crawl spaces or Slabs?	*Crawlspace*	***COMMENTS:***
22) Are vaulted ceilings common in existing or new construction?	*No*	***COMMENTS:***
23) Are there standards for Fresh air, Ventilation, and Circulation aside from Heat and Air Conditioning?	*Yes*	***COMMENTS****:* *Only related to ventilation of attic or crawl spaces. Fixed louver venting of attic or crawlspace is 1 sf (net)/150 sf (attic or crawlspace area), mechanical venting is 0.2 cfm/sf.*
24) Is Central Air common in existing homes?	*Yes*	
i) Do existing homes use window or thru-wall air conditioners?		***COMMENTS:***
25) Heat: Are forced hot air systems or radiators more common?	*Forced Air*	***COMMENTS:***
26) Fireplaces common in this area?	*Yes*	*One fireplace is reported in this house.*
i) Would the addition of a sound-insulating cap on a chimney be okay		***COMMENTS:*** *Location of fireplace uncertain in this house. Date of construction would presume a masonry chimney shared with the furnace for primary flue.*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Appendix E-10. Survey of House 9

STUDY HOUSE NO. *009*	***ADDRESS:*** *5580 South Tinker Street, Boise*	***PARCEL NUMBER:*** *R8223000375*

1) Units that are: Rough Percentage %	***COMMENTS:***		
tt) Single Family	*X*	*Built 1973*	
uu) Duplex			
vv) Townhome			
ww) Apartment (Multifamily)			
xx) Mobile Home			
2) Single Family Home Rough Percentage %	***COMMENTS:***		
kk) 1 story	*X*		
ll) 1.5 story			
mm) 2 story			
nn) 3 story			
3) Single Family Home: What are the most typical home sizes?	***COMMENTS:***		
s) Approximate square feet	*2144*		
t) Number of bedrooms	*3*		
4) What insulation R-value required/commonly used for roof?		***COMMENTS:*** *Cannot be verified, but presume an R-19 batt blanket insulation between roof trusses.*	
5) What is the approximate depth of roof truss or joist?	*1 - 4 feet*	***COMMENTS:*** *Roof structure most likely pre-engineered, gang nailed roof trusses.*	
6) Rough Percentage of residences that are Solid Masonry vs. Wood Frame	*Wood*	***COMMENTS:*** *Nearly 100% are wood framed.*	
7) How Common?	*Façade Only*	*Whole House*	***COMMENTS:***
kk) Brick			
ll) Block			
mm) Stone (veneer)			
nn) Stucco			
8) More Common 2x4 or 2x6 Rough Percentage %	*2 x 4*	***COMMENTS:***	
9) Sheathing Type for wood-framed houses? (OSB, Insulation Board i.e. thermoply or energy brace)	***COMMENTS:*** *Age of this house would promote use of plywood sheathing rather than OSB or Thermoply. Presume plank siding over building paper over sheathing attached to 2 x 4 framing.*		
s) Existing	*X*	*Composite Asphalt Shingles over sheathing*	
t) New			
10) How thick is drywall?		***COMMENTS:*** *Assume ½-inch material*	
j) Is plaster used in existing homes?		*Not likely*	
11) Your opinion on Sound	***COMMENTS:***		

Installation Treatments:		
s) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
t) For New Construction: Resilient Channels, 2x6 Studs or Staggered Studs?		*N/A*

12) Opinions on Ceiling Treatments:	***COMMENTS*:**	
bb) For Existing Construction: Additional layers of gypsum board?		*Doubtful that residents would support the inconvenience of the installation, however, that question has not been brought forth directly to the homeowners.*
cc) For New Construction: Resilient Channels?		*N/A*
dd) "False": Vaulted ceilings (sloped ceiling with small attic space above)?		*N/A*
13) Are Storm Windows acceptable as a sound insulation modification?	*No Storm Windows*	***COMMENTS:*** *Storm windows are not widely used here in BOI. Older homes have extruded metal-framed windows with single glazing, rather than wood. Newer homes are more likely to be insulated glazing within extruded vinyl frames.*
14) Are Skylights common in this area?	*No Skylights*	***COMMENTS:***
15) R-value requirements	*Typical Value?*	***COMMENTS:***
s) Windows		*Slider metal window, non insulated (R<1.0), Insulated Vinyl (R-20)*
t) Doors		*Solid wood in wood frame (R-2.5), Steel door in wood frame (R-6)*
16) What window styles are most common?	*Sliders*	***COMMENTS:*** *See storm windows.*
17) Storm doors for swinging doors typical?	*No Storm Door*	***COMMENTS****: Not typical*
18) Slider or French Doors Typical?		
j) Your opinion on secondary French doors (storm doors)?		***COMMENTS:*** *Not typical*
19) We assume that all swinging doors swing inward. Is this usually true?	*Yes*	***COMMENTS*:**
20) Type of Siding Rough Percentage %	***COMMENTS:***	
ccc) Vinyl		
ddd) Aluminum		
eee) Handiplank		
fff) Wood	*100%*	

ggg) EIFS		
hhh) Asbestos		
21) What is most common: Full basements, Crawl spaces or Slabs?	*Crawlspace*	***COMMENTS:***
22) Are vaulted ceilings common in existing or new construction?	*No*	***COMMENTS:***
23) Are there standards for Fresh air, Ventilation, and Circulation aside from Heat and Air Conditioning?	*Yes*	***COMMENTS:*** *Only related to ventilation of attic or crawl spaces. Fixed louver venting of attic or crawlspace is 1 sf (net)/150 sf (attic or crawlspace area), mechanical venting is 0.2 cfm/sf.*
24) Is Central Air common in existing homes?	*No*	
j) Do existing homes use window or thru-wall air conditioners?	*Not visible*	***COMMENTS:***
25) Heat: Are forced hot air systems or radiators more common?	*Forced Air*	***COMMENTS:***
26) Fireplaces common in this area?	*Yes*	*2 fireplaces are reported in this house.*
j) Would the addition of a sound-insulating cap on a chimney be okay		***COMMENTS:*** *Location of fireplace uncertain in this house. Date of construction would presume a masonry chimney shared with the furnace flue for primary and metal flue pipe for secondary flue.*

Appendix E-11. Housing Survey Map