Environmental Assessment

Establishment and Operation of a Helicopter Aerial Gunnery Range and Establishment of Special Use Airspace Restricted Area R-4601
Limestone Hills Training Area, Montana

Technical Study Volume 1
Air Quality, Airspace and Noise

2022

Prepared Under Contract with the
U.S. Army Corps of Engineers, Omaha District

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for the

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TECHNICAL STUDY VOLUME 1

1.1 AIR QUALITY

1.2 AIRSPACE ANALYSIS

1.3 NOISE MODEL OPERATIONAL DATA DOCUMENTATION

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1.1 AIR QUALITY

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AIR QUALITY TECHNICAL REPORT
FINAL
U.S. AIR FORCE ENVIRONMENTAL ASSESSMENT FOR THE ESTABLISHMENT AND OPERATION OF A HELICOPTER AERIAL GUNNERY RANGE AND SPECIAL USE AIRSPACE RESTRICTED AREA R-4601 AT THE LIMESTONE HILLS TRAINING AREA, MONTANA

USAF LHTA EA: Air Quality Technical Report

CONTENTS

Table of Tables

ABBREVIATIONS AND ACRONYMS

341 SFG – 341st Security Forces Group
40 HS – 40th Helicopter Squadron
ACAM – Air Conformity Applicability Model
AFB – Air Force Based
AFGSC – Air Force Global Strike Command
AFPD – Air Force Policy Directive
AGR – Aerial Gunnery Range
APU - Auxiliary Power Unit
AQCR – Air Quality Control Region
ARM – Administrative Rules of Montana
CAA – Clean Air Act
CEQ – Council of Environmental Quality
CFR – Code of Federal Regulations
CO – Carbon Monoxide
DoD – Department of Defense
EA – Environmental Assessment
EIAP – Environmental Impact Analysis Process
EPA – Environmental Protection Agency
FDP – Flight Duty Period
FONSI – Finding of No Significant Impact
HAPs – Hazardous Air Pollutants
LHTA – Limestone Hill Training Area
LTO – Landing and Takeoff Cycle
MT – Montana
MTARNG – Montana Army National Guard
MTR – Montana Rules
NAAQS – National Ambient Air Quality Standards
NEPA – National Environmental Policy Act
NESHAPs – National Emissions Standards for Hazardous Air Pollutants
NO_2 – Nitrogen Dioxide
NSPS – New Source Performance Standards
O_3 - Ozone
Pb – Lead
PM – Particulate Matter
RFDs -Reasonably Foreseeable Developments
SIP – State Implementation Plan
SO_2 – Sulfur Dioxide
SUA – Special Use Airspace
TIM – Time in Modes
USAF – U.S. Air Force
WDZ – Weapon Danger Zone

1.0 INTRODUCTION

This report provides technical support documentation for the Air Quality and Climate Change portion of the Environmental Assessment (EA) required under the National Environmental Policy Act (NEPA) for the proposed establishment and operation of a helicopter aerial gunnery range (AGR) and establishment of Special Use Airspace (SUA) Restricted Area R-4601 at the Limestone Hills Training Area (LHTA) by the U.S. Air Force (USAF). Air Force Global Strike Command (AFGSC) proposes to establish an AGR at the LHTA to fulfill training requirements of the 40th Helicopter Squadron (40 HS) and 341 Missile Wing Security Forces Group (341 MW SFG), which are based at the Malmstrom Air Force Base (AFB) in Cascade County, MT. After qualification, AFGSC helicopter aircrews are required to conduct training every 90 days to maintain proficiency, and the LHTA is the only existing federal facility within one Flight Duty Period (FDP) of the Malmstrom AFB with the possibility to support AFGSC aerial gunnery training requirements (USACE, 2022). The LHTA is an existing military training range in Broadwater County, Montana (MT) located approximately 75 nautical miles from Malmstrom AFB. Presently, the 40 HS temporarily relocates to the Utah Test and Training Range which is more than 480 miles from Malmstrom AFB (USACE, 2022). The Montana Army National Guard (MTARNG) currently operates the LHTA and also must travel to the UTTR and other training ranges in Utah to meet aerial gunnery training requirements. The proposed establishment of the SUA at the LHTA would enable the MTARNG to also perform aerial gunnery training at the LTHA.

Section 2 of this report describes relevant regulations and guidance for air quality, greenhouse gases (GHG) and climate change along with existing air quality and climate conditions at the LTHA in support of the Affected Environment section of the EA. This is followed by an air quality and climate change impact assessment for the Action Alternatives in support of the Environmental Consequences section of the EA (Section 3). References are provided in Section 4.

2.0 AIR QUALITY AND CLIMATE CHANGE TECHNICAL DOCUMENTATION FOR AFFECTED ENVIRONMENT

2.1 Definition of the Resource

2.1.1 Air Quality

Air quality is a measure of how suitable the atmosphere is to support life. Air quality is described in terms of the type and concentration of air pollutants present in the ambient atmosphere.[1] Air quality impacts of the Proposed Action would result from an increase in annual air pollutant emissions over current levels. This section summarizes the relevant federal and state air quality regulations that define the air pollutants of concern and the thresholds and criteria used for these pollutants to characterize ambient air quality and determine significance of air quality impacts.

Criteria Air Pollutants and National Ambient Air Quality Standards

Under the Clean Air Act (CAA), the Environmental Protection Agency (EPA) established the National Ambient Air Quality Standards (NAAQS) for six criteria air pollutants that are known to be harmful to public health and the environment: carbon monoxide (CO), lead (Pb), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter (PM). The NAAQS for PM are defined separately for particulate matter of 2.5 micrometers in diameter or less ($PM_{2.5}$) and particulate matter of 10 micrometers in diameter or less (PM_{10}). Emissions of volatile organic compounds (VOC) and nitrogen oxides (NOx) are often evaluated though they are not criteria air pollutants because they are precursors to O_3. O_3 is formed through reactions of NOx and VOC in the atmosphere. Similarly, ammonia (NH_3) and VOC are evaluated as precursors of $PM_{2.5}$. Also, emissions of sulfur oxides (SOx) are often estimated instead of SO_2 alone.

The NAAQS are meant to represent the maximum concentrations of these pollutants in the ambient atmosphere that are considered safe for public health and the environment. In Montana, EPA delegates the enforcement and maintenance of the NAAQS and other rules of the CAA to the Montana Department of Environmental Quality (MDEQ). The state of Montana has adopted air quality standards similar to the NAAQS known as the Montana Ambient Air Quality Standards (MAAQS) under the Administrative Rules of Montana (ARM) regulations 17.8.210 through 17.8.223 (Montana Rules [MTR], 2021).

The EPA and MDEQ oversee the designation of the air quality status of geographic areas of MT in relation to the NAAQS. Using ambient air monitoring data and other information, areas are designated as attainment, non-attainment, maintenance, or unclassified. Areas designated as attainment have demonstrated compliance with NAAQS, while areas designated as nonattainment exceed the NAAQS. Nonattainment areas are required to develop a State Implementation Plan (SIP) establishing emissions control measures and other strategies that will be implemented to attain and maintain compliance. Maintenance areas are those that were previously designated nonattainment but are now in compliance with the NAAQS and are subject to a maintenance plan to ensure that compliance is maintained. An area is designated as unclassified if there is insufficient information for a compliance determination.

Conformity Rules

[1] Ambient atmosphere or ambient air is defined by 40 Code of Federal Regulations (CFR) 50.1 as "the portion of the atmosphere, external to buildings, to which the general public has access"

Conformity Rules apply to federal actions in nonattainment and maintenance areas to ensure that the action meets the requirements of the SIP and to prevent the action from causing or contributing to a violation of the NAAQS. There are two types of Conformity Rules: Transportation Conformity and General Conformity. Transportation Conformity (40 CFR 93 Subpart A) applies to Federal Highway Administration or Federal Transit Administration projects, while General Conformity (40 CFR 93 Subpart B) applies to all Federal actions. The Proposed Action does not meet the definition of a Federal Highway Administration or Federal Transit Administration project and thus is not subject to the Transportation Conformity Rule. The General Conformity Rule also does not apply because the LHTA is in Broadwater County, which is designated as attainment for all NAAQS (see Section 2.2.1). However, the General Conformity de minimis emission thresholds are used as significance indicators for the emissions generated by the Action Alternatives consistent with USAF guidance as described below.

New Source Performance Standards, National Emission Standards for Hazardous Air Pollutants

The CAA also establishes New Source Performance Standards (NSPS) and National Emissions Standards for Hazardous Air Pollutants (NESHAP) for specific stationary source categories. Standards and compliance requirements are listed in Title 40 Code of Federal Regulations (CFR) Part 60, 61, and 63 and establish stationary source emissions limits and emissions control requirements based on the best available technology. NESHAP includes stationary source standards for 187 hazard air pollutants which the EPA identified as having potential to cause cancer and other serious adverse health effects on humans. The activities of the Action Alternatives do not meet the definition of any of the regulated source categories or activities, and thus are not subject to NSPS or NESHAP.

Prevention of Significant Deterioration

The Prevention of Significant Deterioration (PSD) rule of the CAA applies to new major stationary sources or major modifications of existing sources in areas designated as attainment or unclassifiable with the NAAQS (EPA, 2020a). It sets emission limitations based on the best available control technology and requires an air quality analysis to demonstrate that new emissions will not cause or contribute to a violation of the NAAQS or exceed defined PSD increments. The rule provides special protections for specific national parks or wilderness areas, known as Mandatory Federal Class I Areas (40 CFR Part 81). The nearest Mandatory Federal Class I Area to the LHTA is the Gates of the Mountains Wilderness located more than 35 miles to the north. All other Federal Class I areas are more than 50 miles away from the LHTA. As there are no major stationary sources at the LTHA or any associated with the Action Alternatives, PSD does not apply.

USAF Guidance for Technical Analysis

The Environmental Impact Analysis Process (EIAP; 32 CFR Part 989) is the USAF's implementation tool for NEPA and framework for complying with the requirements of NEPA and Council of Environmental Quality (CEQ). The USAF Air Quality EIAP Guide (USAF, 2019a) is a comprehensive guide to systematic procedures to assess and analyze the potential air quality impacts associated with USAF proposed actions in compliance with the CAA and General Conformity. The air quality EIAP process proceeds through three levels of assessment based on whether the air emissions exceed significance thresholds. First is the screening of Exempt Actions (Level I), which determines if a formal air quality assessment is required. If no air emissions will occur or if the proposed action is exempt (e.g., a Categorical Exclusion from NEPA), then no further analysis is required. Otherwise, a quantitative air quality assessment (Level II) is required to estimate the annual net total emissions of air pollutants and compare them to applicable thresholds.

In a Level II assessment, annual net total direct and indirect emissions of pollutants of concern (i.e., criteria air pollutants and GHG) are estimated using the methodologies in the USAF Air Quality EIAP Guide (USAF, 2019a) and the Air Conformity Applicability Model (ACAM, 2017). The following conditions must be met for a Level II assessment:

- The worst-case emissions scenario, which is described as the greatest annual emissions for each pollutant from the start of the action until emissions have reached steady state, should be the basis for the assessment
- Estimated emissions are "net", which means emissions added increase totals while emissions removed reduce the total
- Action phases, scheduling, and locations should be clearly laid out to indicate which years the Proposed Action and Action Alternatives are occurring

The estimated emissions are then compared to significance criteria to determine the potential severity of adverse impacts associated with a proposed action and whether further analysis is required. The Air Quality EIAP requires that General Conformity thresholds (i.e., de minimis emission levels) are used as significance criteria for Level II assessments.

2.1.2 Climate and Climate Change

Climate describes the long-term weather conditions of a region. Variations in average weather conditions that persist for multiple decades or longer are referred to as climate change (Department of Defense (DoD), 2021a). The GHGs such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) warm the earth by absorbing energy and trapping heat in the atmosphere. In general, GHGs are generated from both natural sources (e.g., volcanoes and biological processes) and through human (anthropogenic) activities such as the burning of fossil fuels and land use changes. Because emissions of CO_2, CH_4, N_2O and other GHGs result in different levels of warming, GHG emissions are often converted into carbon dioxide equivalent (CO_2e) emissions to account for differences in their global warming potential (GWP).

<u>Mandatory Greenhouse Gas Reporting Rule</u>

The Mandatory Greenhouse Gas Reporting Rule (40 CFR Part 98) requires that large GHG emissions sources (stationary sources with 25,000 metric tons of CO_2e per year), fuel and industrial gas providers, and CO_2 injection sites provide an annual GHG report to the EPA (EPA, 2020b). Stationary fuel combustion sources are the only USAF source category that are potentially subject to the rule (USAF, 2019b). The LHTA is not currently required to report its GHG emissions to the EPA, and the activities of the Proposed Action are limited to mobile sources and munitions usage that are not subject to GHG reporting. Malmstrom AFB reported annual GHG emissions from 2010 through 2015, but discontinued reporting after its total emission remained below 25,000 metric tons of CO_2e for 5 years.[2]

<u>Executive Orders 13990 and 14008</u>

President Biden signed Executive Order 13990 (86 FR 7037)[3] titled "Protecting Public Health and the Environment and Restoring Science To Tackle the Climate Crisis" on January 20th, 2021. Among other actions, the Order's fifth section, titled "Accounting for the Benefits of Reducing Climate Pollution," re-established the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG). The Order

[2] As reported in the EPA's Facility Level Information on Greenhouse Gases Tool (FLIGHT) at https://ghgdata.epa.gov/

[3] https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-protecting-public-health-and-environment-and-restoring-science-to-tackle-climate-crisis/

directed the IWG, among other things, to publish estimates of the social cost of carbon (SC-CO_2), social cost of methane (SC-CH_4), and social cost of nitrous oxide (SC-N_2O) that reflect the best available science and provide recommendations to the President regarding the areas of decision-making, budgeting, and procurement by the Federal government where the SC-CO_2, SC-CH_4 and SC-N_2O should be applied. The social costs represent the monetary value of the societal impacts associated with adding a ton of CO_2, CH_4, or N_2O to the atmosphere in a given year allowing agencies to understand the social benefits of reducing GHG emissions, or the social costs of increasing such emissions, in cost-benefit analyses of regulatory and other actions (IWG, 2021).

In February 2021, the IWG (2021) published the "Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990" that provides interim estimates of the SC-CO_2, SC-CH_4 and SC-N_2O. IWG (2021) states that, in principle, the social costs include the value of climate change impacts including but not limited to changes in net agricultural productivity, human health impacts, property damage from increased flood risk and natural disasters, disruption of energy systems, risk of conflict, environmental migration and the value of ecosystem services. The IWG uses discount rates[4] to convert future damages to the present-day values in the year when the emissions are released, and the interim social cost estimates are provided for average damages under three different discount rates: 2.5 percent, 3 percent and 5 percent. The IWG also provides a fourth value selected as the 95th percentile of estimates based on a 3 percent discount rate to account for potentially higher-than-expected economic impacts from climate change. Using a discount rate of 3%, the IWG (2021) estimates an average social costs in 2020 dollars of $51, $1,500, and $18,000 per metric ton of CO_2, CH_4, and N_2O emitted in 2020. They note that the interim social costs likely underestimate societal damages from GHG emissions due to limitations in the approaches used, but final estimates have not been published by the IWG (as of September 2022).

On January 27th, 2021, President Biden signed Executive Order 14008 (86 FR 7619),[5] titled "Tackling the Climate Crisis at Home and Abroad," in order to stimulate domestic action to avoid or mitigate climate change impacts. Among other things, the order establishes a National Climate Task Force that includes the Secretary of Defense to "facilitate the organization and deployment of a Government-wide approach to combat the climate crisis." In order to prioritize climate in national security, the order also requires the Department of Defense (DoD) to develop an analysis of the security implications of climate change (Climate Risk Analysis) and account for them in "developing the National Defense Strategy, Defense Planning Guidance, Chairman's Risk Assessment, and other relevant strategy, planning, and programming documents and processes."

The LHTA EA analysis was initiated prior to the signing of EO 13990 and EO 14008 and thus is not required to comply with the orders. Nonetheless the EOs are presented here for background information and the findings of the DoD Climate Risk Report prepared under EO 14008 are summarized in the following sections.

2.2 Existing Conditions

The proposed AGR and SUA would be established at the LHTA, which is an existing military training facility located entirely within Broadwater County, MT. The affected environment for air quality is Broadwater County.

[4] The discount rate converts future revenues or costs to present values. A lower discount rate assigns higher present value to future costs.

[5] https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/

2.2.1 Regional Air Quality

All of Broadwater County (including the LTHA) is designated as attainment with the NAAQS. Per 40 CFR 81.169, Broadwater County is located within the Helena Intrastate Air Quality Control Region (AQCR).[6] This AQCR is in attainment of the NAAQS with exception of the following maintenance areas:

- East Helena in Lewis and Clark County was previously designated as a nonattainment area for Pb and SO_2 (EPA, 2021), but the EPA approved maintenance plans and re-designation to attainment for both in 2019 [84 Federal Register (FR) 47895, 84 FR 47897]
- Butte in Silver Bow County was previously a moderate non-attainment area for the 1987 PM_{10} NAAQS. However, the EPA approved a Limited Maintenance Plan and re-designated the area to attainment in 2021 based upon air quality monitoring data from 2014 through 2018 (86 FR 33547).

All current nonattainment areas in MT are more than 100 miles away from the LHTA.

2.2.2 Existing Emissions

According to the LHTA Land Withdrawal Legislative EIS, existing activities at the LHTA are not major sources of air emissions as defined by the EPA or MDEQ, and air emissions sources are generally limited to minor point sources and mobile sources (MTARNG, 2008). Minor point sources at the LTHA include such things as personal heaters, cooking facilities, water heaters, and generators. Mobile sources at the LTHA include those used in and to support training activities, most of which are diesel powered. There are also fugitive emissions from fuel storage tanks. The total emissions at the LHTA from all regulated sources do not exceed the major source thresholds for any listed air pollutant, and thus the facility is not required to have an air permit for its operations (MTARNG, 2008).

2.2.3 Regional Climate

The LHTA is located in southwestern MT on the eastern slopes of the Limestone Hills. Based on meteorological monitoring data from the City of Townsend (National Climate Data Center Station No. USC00248324), which is located a few miles to the east of the LTHA, the region has an annual average temperature of 44.9 °F that ranges from 23.8 °F in January to 67.5 °F in July (NCEI, 2021). Total precipitation in the region averages 10.6 inches per year with highest monthly precipitation totals occurring in May (1.8 inches) and June (2.5 inches). The prevailing wind direction is from the west with an annual average wind speed of 7.7 miles per hour based on data for Helena from Western Regional Climate Center (2021).

2.2.4 Climate Change

The Intergovernmental Panel on Climate Change (IPCC, 2021) has concluded that "human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years," and that climate change is already affecting every inhabited region across the globe. This includes increases in the frequency and intensity of heatwaves, heavy precipitation events, and droughts in many regions (IPCC 2021). In Montana, temperatures have risen by nearly 1.4 ^{o}C (2.5 ^{o}F) since the beginning of the 20th century, which is higher than the warming of the contiguous United States as a whole, and this warming is projected to continue (NOAA, 2022).

The DoD published a Climate Risk Analysis in October 2021 in response to EO 14008 (DoD 2021a). It reports that increasing temperatures, changing precipitation patterns and more frequent and intense extreme weather events as a result of climate change are exacerbating existing risks and creating new

[6] The Helena Intrastate Air Quality Control Region includes Beaverhead County, Broadwater County, Deer Lodge County, Gallatin County, Granite County, Jefferson County, Lewis and Clark County, Madison County, Meagher County, Park County, Powell County, Silver Bow County

security challenges (DoD, 2021a). While an analysis of regional risks are not provided in the publicly available (redacted) document, the report provides many examples of climate risks that are relevant to the Action Alternatives including reduction in rotary wing payload capacity, range and loiter time due to increased temperatures, cancellations of exercises and effects on readiness due to extreme weather, climate-related delays, disruption and/or degradation of DoD's ability to produce, package, repair, and distribute materiel and ammunition, and loss of range or accuracy due to wildfire and extreme weather conditions (DoD, 2021b). The DoD (2021b) also prepared a Climate Adaptation Plan that meets the requirements of EO 14008 and aims to ensure that the Department "maintains the ability to operating under changing climate conditions while preserving operational capability and protecting systems essential to our success."

3.0 AIR QUALITY AND CLIMATE CHANGE TECHNICAL DOCUMENTATION FOR ENVIRONMENTAL CONSEQUENCES

This section describes the technical documentation for the environmental consequences of the Proposed Action and Action Alternatives. There are three alternatives being evaluated by AFGSC in the EA: Alternative 1, Alternative 2, and the No Action Alternative. Both action alternatives include helicopter air-to-surface gunnery training at the proposed AGR, helicopter surface-to-surface weapon familiarization and firing from existing concrete helicopter landing pads, an annual integrated helicopter and convoy training without live firing of weapons, and establishment of the SUA from the surface to 10,000 ft above mean sea level over the LHTA. The alternatives only differ with respect to the location of the proposed integrated helicopter-convoy dry-fire training (USACE, 2022). Under Alternative 1, the helicopter-convoy dry-fire training would occur along and adjacent to Blue Route Road, while under Alternative 2 this would occur along and adjacent to a 0.75-mile section of Old Woman's Grave Road. Both locations are within in the LHTA, and the total distance traveled by the convoy would be similar. As differences in distance traveled would be small relative to the overall convoy length and the same number of ground vehicles and aircraft would be used, the alternatives are effectively the same with respect to the air quality impact analysis. For this reason, the emissions and potential impacts discussed below apply to both Alternative 1 and Alternative 2. Under the No Action Alternative, no AGR and SUA would be established, and the 40 HS and MTARNG would continue to use out-of-state military training ranges for the aerial gunnery training (USACE, 2022).

The potential air quality impacts from the Proposed Action were determined in accordance with the guidance of the Air Quality EIAP (USAF, 2019a). As described previously (Section 2.1), a Level II assessment was determined to be appropriate for the Proposed Action. Aircraft and personnel emissions were quantified using the latest version of ACAM (v5.0.17b). Emissions from munitions usage and on-road vehicles from the integrated helicopter-convoy training were estimated using EPA emission factors as these source types are not within ACAM. Aircraft and other activity information used to quantify emissions was obtained from the description of the alternatives in the EA (USACE, 2022) and data provided by USAF and MTARNG in response to a data request.[7] In absence of other data, ACAM defaults were used. A detailed description of the methods and input data used is provided in the following sections. The available data indicates that the activity in the Proposed Action would not vary between years, and that there will be no construction or other development required. Thus, steady state conditions were assumed in ACAM and the estimated annual emissions are the same across all years (i.e., all years from 2022 onwards are representative of the 'worst-case' year). None of the activities in Alternative 1 and Alternative 2 would occur under the No Action Alternative, and thus all of the emissions are 'added' and none are 'removed' in the calculation of net emissions, as described in the Air Quality EIAP guide (USAF, 2019a).

The total emissions from the Proposed Action were then compared to significance criteria. In areas that are in full attainment for the NAAQS, the Air Quality EIAP guidance only addresses NEPA requirements (and not General Conformity), however there are no NEPA thresholds for a Level II assessment, so the General Conformity Thresholds (de minimis emission thresholds) are to be used as significance indicators (USAF, 2019a). The de minimis emission thresholds used are provided in Table 1. As described previously, there are no significance criteria for GHGs, and instead the EIAP requires a relative comparison of GHG emissions across alternatives. In this case, the potential GHG emissions in

[7] Data request spreadsheets from the USAF and MTARNG ('USAF_LHTA_DataNeeds_Ramboll_AirResources_edits 7feb21 Maj Skarstedt.xlsx' and 'USAF_LHTA_DataNeeds_Ramboll_AirResources_MTARNG response (1).xlsx' were provided to Ramboll by AEM via email on June 10, 2021.

Alternative 1 and Alternative 2 are the same and were compared to the No Action Alternative, in which there would be no GHG emissions.

Table 1. General Conformity de minimis emission thresholds used as significance indicators

Criteria Air Pollutant	Emitted Pollutant	De Minimis Level (tons/yr)[a]
Ozone (O_3)	Volatile organic compounds (VOC) or Nitrogen Oxides (NOx)	100*
Carbon Monoxide (CO)	CO	100
Sulfur Dioxide (SO_2)	SO_2	100
Nitrogen Dioxide (NO_2)	NO_2	100
Particulate Matter 10 micrometers and smaller (PM_{10})	PM_{10}	100*
Particulate Matter 2.5 micrometers and smaller ($PM_{2.5}$)	$PM_{2.5}$, SO_2, NOx, VOC, or NH_3	100*
Lead (Pb)	Pb	25

[a] https://www.epa.gov/general-conformity/de-minimis-tables
* General Conformity provides different de minimis levels for maintenance and nonattainment areas; the de minimis emission level for maintenance areas were used as the analysis area for air quality is in attainment of all NAAQS.

3.1 Establishment and Operation of the Proposed Helicopter Gunnery Range

3.1.1 Construction

The proposed aerial gunnery range would be located entirely within the existing main dudded impact area associated with training ranges at the LHTA. The overall amount of land required for the AGR includes the physical range footprint area and the weapon danger zone (WDZ). The physical range footprint consists of firing positions, targets, and any necessary support structure. The WDZ encompasses the ground and airspace for lateral and vertical containment of weapons, munitions, projectiles, fragments, components, and debris resulting from the gunnery training. As described in the EA (USACE, 2022), the establishment of the AGR would require no new construction. Therefore, there would be no increase in air emissions and no impacts to air quality relative to the No Action Alternative from construction.

3.1.2 Operations and Maintenance

Range operation and fire suppression support would be required for all scheduled helicopter gunnery training at the proposed AGR. To support range operations, up to fourteen (14) active-duty personnel would travel by vehicles from Malmstrom AFB to the AGR. Personnel would be expected to be onsite for each of the 100 training events that would occur annually at the LHTA. ACAM was used to quantify emissions associated with these support personnel. Emission factors for personnel are based on the default on-road vehicle mix and associated default vehicle emission factors in ACAM. The model was run using fourteen (14) active-duty personnel travelling 260 round-trip miles per event consistent with the description of alternatives in the EA (USACE, 2022). It was assumed that personnel would be present nine (9) days per month. This was estimated by splitting the 100 training events per year into twelve months and rounding up to a whole day. As noted in the EA, sometimes two helicopter gunnery training events would occur during the same 24-hour period (one during the day and one at night), and so the 9 day per month personnel work schedule assumed in ACAM is conservative (i.e., higher) than what is expected under the Proposed Action. The resulting emissions from ACAM are shown in Table 2 below, and the model report from ACAM is provided as Appendix A. Note that GHG emissions are presented in CO_2e.

Table 2. Emissions from support personnel at the AGR as estimated by ACAM (tons/year)

NO_x	CO	VOC	SO_x	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2e
0.16	2.03	0.18	<0.01	<0.01	<0.01	0.00	0.01	160.5

Maintenance of the proposed AGR includes range clearance activities in accordance with existing procedures within the dudded impact area. Per the EA, the proposed AGR is located entirely within an existing training range and there will be no change in the frequency of current range clearance activities associated with aerial gunnery operations (USACE, 2022). Similarly, aircrews will fire weapons at existing ground targets within the dudded impact area, and there is no expected increase in the frequency of target replacement due to activity of the Proposed Action (USACE, 2022).

Therefore, there is no expected increase in air emissions associated with range clearance activities or target replacement and no impacts to air quality relative to the No Action Alternative.

3.2 Helicopter Gunnery Training

The Proposed Action would result in long-term increases in helicopter aerial gunnery training activity within the LHTA. Per Table 2-2 of the EA (USACE, 2022), the Proposed Action would include up to 100 new training events per year (60 events by Malmstrom AFB and 40 by MTARNG). Air emissions sources during these training activities would include fuel combustion in aircraft, transport of ground personnel for safety operations (described above in section 3.1.2), and emissions from ammunition usage. The emissions calculation methodology and estimated emissions from aircraft and munitions are described below.

3.2.1 Aircraft

The proposed helicopter aerial gunnery range training includes up to 100 new training events per year at the AGR requiring two (2) helicopters during each training event. During each training event aircraft would complete multiple landing and take-off cycles (LTOs) at different points in their flight paths. All helicopters would land at the LHTA to perform surface-to-surface weapons familiarization while on the ground with engines off at the Multi-Purpose Training Range before performing the air-to-surface gunnery training at the AGR. The number of annual LTOs for each aircraft differs based on the AGR user.

The Malmstrom AFB aerial gunnery training would include either three LTOs per training event (i.e., an outbound leg in a southerly direction from Malmstrom AFB to the LHTA for gunnery training, northwest to Helena Regional Airport to refuel, then an inbound leg from Helena back to Malmstrom AFB) or four LTOs per two training events (i.e., day and night in same 24-hour period where an additional LTO occurs from LHTA northwest to Helena Regional Airport to refuel back to the LHTA for nighttime gunnery training). Three LTOs per training event was assumed in ACAM for Malmstrom AFB for a total of 180 LTOs per aircraft per year (3 LTOs x 60 training events) as this resulted in higher emissions per year than if 2 training events per day with 4 total LTOs was assumed. The EA (USACE, 2022) does not specify the number of Malmstrom AFB training events for the UH-1N and MH-139 separately (only the total is provided), and so an even split between the aircraft was used in ACAM (i.e., 30 training events per year for each aircraft).

The MTARNG aerial gunnery training would involve two LTOs per training event using the same flight path to and from the LHTA (i.e., from their base at the Army Aviation Support Facility, located at the Helena Regional Airport, to the LHTA and returning along the same flight path after training). This results in 40 LTOs per year (2 LTOs x 20 training events) for each MTARNG helicopter (i.e., the UH-60 and CH-47).

Emissions associated with aircraft during the Proposed Action were estimated using ACAM v5.0.17b. ACAM does not include helicopters so a surrogate for each aircraft type, engine type, and auxiliary power unit (APU) was chosen based on available aircraft and engine types with similar characteristics. The aircraft, engine, and APU surrogates that were used are discussed as follows.

- The EA (USACE, 2022) states that the Malmstrom AFB will use the UH-1N and MH-139 aircraft at the proposed helicopter gunnery range. Based on the USAF Air Emissions Guide for Air Force Mobile Sources (AFCEC, 2020), the UH-1N and MH-139 have two T400-CP-400 and PT6C-67C engines, respectively, and no APU. To model the emissions associated with these helicopters, the surrogate aircraft and engines applied in the ACAM modeling of the Malmstrom UH-1N Replacement Beddown Environmental Assessment (Malmstrom AFB, 2019) were used: the C-12C aircraft with two PT6A-41 engines for the UH-1N and the C-23B aircraft with two PT6A-65AR engines for the MH-139.
- The EA (USACE, 2022) states that the MTARNG will use the UH-60 and CH-47 helicopters at the proposed gunnery range. The USAF Air Emissions Guide (AFCEC, 2020) lists three models of UH-60 (i.e., UH-60A, UH-60C, and UH-60Q) and all are reported to have two turboshaft T700-GE-700 engines. However, only the UH-60A is listed as having an APU (one T-62T-40-1). The MTARNG did not indicate which model of the UH-60 they operate, so we conservatively assumed that the UH-60 used at the LTHA has one APU (T-62T-40-1 APU). In response to the data request, the MTARNG indicated that the CH-47 has two Honeywell T55-715 engines and one T62-T-2B APU. An existing study in which ACAM was used to model emissions could not be identified, and instead surrogates were identified based on the available aircraft and engine types in the ACAM model. For the UH-60, the C-12J aircraft was used as a surrogate in ACAM as it is similar to the surrogate used for the UH-1N but with a turboshaft engine. The APU associated with the UH-60 (T-62T-40-1) is available in ACAM and was used directly in the model. For the CH-47, the aircraft engines in ACAM were screened for available turboshaft engines similar to the engine type of the CH-47 (T55-715). The available turboshaft engines in ACAM primarily consist of two engine families: PT6A which is associated with general aircraft and T406 which is associated with transportation Ospreys. Based on aircraft size and function, the CV-22A (T406-AD-400) was selected for the CH-47. The T-62T-27 APU was selected as a surrogate for the CH-47 (T-62T-2B) based on a similar APU family name.

Aircraft types and activities were input into ACAM for each of the four representative aircraft types associated with helicopter gunnery training in the Proposed Action. The flight operations time in modes (TIMs) were adjusted in the model using TIMs estimates for military helicopters from the USAF Air Emissions Guide for Air Force Mobile Sources (AFCEC, 2020). Emission factors used in aircraft emission calculations were the defaults from ACAM model based on the respective aircraft or surrogate type described above. The resulting aircraft emissions from ACAM are shown in Table 3 below, and the detailed model report from ACAM showing emission factors, inputs, and outputs from the model run is provided as Appendix A.

Table 3. Aerial gunnery range training aircraft emissions as estimated in ACAM (tons/year)[1]

User	Aircraft	ACAM Surrogate	NO_x	CO	VOC	SO_x	PM_{10}	$PM_{2.5}$	CO_2e
Malmstrom AFB	UH-1N	C-12C	0.12	1.02	0.94	0.02	0.01	0.01	71.40
Malmstrom AFB	MH-139	C-23B	0.13	1.20	0.35	0.03	0.02	0.01	80.60
MTARNG	UH-60	C-12J	0.21	1.11	0.27	0.04	0.02	0.02	133.00

User	Aircraft	ACAM Surrogate	NO_x	CO	VOC	SO_x	PM_{10}	$PM_{2.5}$	CO_2e
MTARNG	CH-47	CV-22A	0.85	0.37	0.03	0.08	0.12	0.11	257.00

1. Estimated emissions of Pb and NH_3 from ACAM were zero

3.2.2 Ammunition Usage

An estimated 780,000 rounds of ammunition would be expended during the proposed helicopter gunnery training on an annual basis (Table 2-3 of the EA). The Malmstrom AFB aircrew includes four gunners per aircraft, each of whom would fire 1,000 rounds totaling 4,000 rounds per individual aircraft training event. The MTARNG aircrew includes two (UH-60) to three (CH-47) gunners, each of whom would fire 1,500 rounds totaling up to 3,000 to 4,500 rounds per training event depending on the aircraft. Emissions associated with ammunition usage during the Proposed Action were estimated using emission factors from EPA AP-42 (EPA, 2011a) for M118 7.62mm ammunition in pounds of pollutant per round (Table 4). The resulting emissions are shown below in Table 5.

Table 4. Emission factors for ammunition usage (lb/round)[1]

Emission Factors (lb per round)					
NOx	CO	PM_{10}	$PM_{2.5}$	Pb	CO_2e[2]
4.10E-05	3.00E-03	6.20E-05	4.70E-05	6.20E-06	2.18E-03

Source: EPA, 2011a, Table 15.1.14-1
1. AP-42 does not provide emission factors for SO_2, VOC, and N_2O for ammunition usage
2. The emission factor for CO_2e was calculated using the emission factors for CO_2 and CH_4 with a global warming potential of 25 for CH_4 from the Intergovernmental Panel on Climate Change's Fourth Assessment report consistent with ACAM

Table 5. Emissions from ammunition usage in the aerial gunnery range training (tons/year)[1]

User	Aircraft	Annual Rounds	NOx	CO	PM_{10}	$PM_{2.5}$	Pb	CO_2e
Malmstrom AFB	UH-1N, MH-139	480,000	9.8E-03	7.2E-01	1.5E-02	1.1E-02	1.5E-03	5.2E-01
MTARNG	UH-60	120,000	2.5E-03	1.8E-01	3.7E-03	2.8E-03	3.7E-04	1.3E-01
MTARNG	CH-47	180,000	3.7E-03	2.7E-01	5.6E-03	4.2E-03	5.6E-04	2.0E-01

1. SO_2 and VOC emissions from ammunition usage were not calculated as no emission factors were available

3.3 Annual Integrated Helicopter-Convoy Training

The proposed integrated helicopter-convoy training by Malmstrom AFB would occur once annually with up to 15 vehicles (mix of Humvees, Bearcats, and general-purpose vehicles) between the Malmstrom AFB and the LHTA at a distance of 260 miles round trip (USACE, 2022). A fuel efficiency of four miles per gallon was assumed to calculate fuel usage. This was used along with emission factors from EPA AP-42 Chapter 3 (EPA, 2011b) for uncontrolled diesel fuel industrial engines (Table 6) to calculate the on-road vehicle exhaust emissions.[8]

On-road fugitive dust emissions were calculated using paved road emission factors from EPA AP-42 Chapter 13 (EPA, 2011c). The emission factor calculation assumed the same average vehicle weight on the highway (25.84 tons) and silt content (0.2 g/m^2) as used in the Draft Environmental Assessment for Construction of a New U.S. Air Force Helicopter Aerial Gunnery Range and Training at

[8] Conversion factor of 0.137381 MMBtu per gallon of diesel fuel was used from https://www.eia.gov/energyexplained/units-and-calculators/british-thermal-units.php

Camp Guernsey North Training Area (USAF, 2020). On-road fugitive dust emissions were then calculated using the emission factors and total vehicle miles travelled by the convoy.

Table 6. Emission factors for the on-road vehicles of the annual integrated helicopter-convoy training[1]

Emission Source	Unit	NO_x	CO	VOC	SO_x	PM_{10}	$PM_{2.5}$	CO_2
On-road vehicle exhaust	lb/MMBtu	4.41	0.95	0.36	0.29	0.31	0.31	164
Fugitive Dust	lb/VMT	-	-	-	-	0.014	0.003	-

Sources: EPA, 2011b; EPA, 2011c
1. AP-42 does not provide an emission factor for Pb, CH_4, and N_2O. CO_2e specified = CO_2
2. Emission factors for CH_4 and N_2O were not available for the on-road vehicle exhaust, and thus CO_2e was not estimated

In addition to the on-road vehicles, the convoy would include two helicopters for overhead support. Emissions from these aircraft were calculated using the ACAM model in a similar manner to the aerial gunnery training (Section 3.2.1). Since the type of aircraft that would be used was not specified in the EA, the MH-139 was used as a conservative surrogate, being the higher emitting aircraft proposed to be used by Malmstrom AFB.

The emissions from the annual integrated helicopter-convoy training are shown below in Table 7. The location of the proposed integrated helicopter-convoy dry-fire training within the LHTA differs by alternative. In Alternative 1, the convoy training location is along and adjacent to Blue Route Road, while in Alternative 2 the training would occur along and adjacent to a 0.75-mile section of the Old Woman's Grave Road. While the locations of the dry-fire training would be different, the overall distance traveled would be similar under both alternatives. Thus, the magnitude of emissions would be similar. The emissions shown in Table 7 are representative of both Alternative 1 and Alternative 2.

Table 7. On-road vehicle and aircraft emissions from the annual integrated helicopter-convoy training (tons/year)

Emission Source	NO_x	CO	VOC	SO_x	PM_{10}	$PM_{2.5}$	CO_2e
On-road vehicle exhaust	0.30	0.06	0.02	0.02	0.02	0.03	11.00
Fugitive Dust	0.00	0.00	0.00	0.00	0.03	<0.01	0.00
Aircraft	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.90

3.4 Summary

Under the No Action Alternative, the establishment and operation of the AGR and SUA and the annual integrated convoy training would not occur, and therefore, there would be no emissions and no impacts to air quality or GHGs at the LHTA. The emissions estimated for the Proposed Action are shown in Table 8 by activity and the total across all activities. As discussed previously, the air emissions are expected to be same in Alternative 1 and Alternative 2. The total emissions from the Proposed Action would be long-term but are well below the de minimis thresholds for all NAAQS (shown in Table 1) In conclusion, emissions modeling performed with ACAM following the USAF Air Quality Guidance shows that emissions of all pollutants under both action alternatives (Alternative 1 and 2) would be below relevant thresholds (and similar in the two alternatives) and therefore, no significant impacts to air quality would occur due to the Proposed Action. Since the LHTA is in an attainment area for all pollutants, these emissions would not result in any exceedances of ambient air quality standards.

The total GHG emissions associated with the Proposed Action were estimated to be 715 tons per year of CO_2e at the LHTA in either action alternative, while the No Action alternative would not result in any GHG emissions. For comparison, the total GHG emissions due to fossil fuel combustion in Montana in 2018 was approximately 30.7 million metric tons per year;[9] thus, the GHG emissions from the Proposed Action at the LHTA are less than 0.0001% of the total state GHG emissions. While the state total GHG emissions are expected to be decrease with time, the Proposed Action's emissions would continue to represent a negligible fraction of the total.

GHG emissions from the project would incrementally contribute to climate change and the associated impacts and social costs discussed in Section 2.2.4. The impacts and social costs from these emissions would be relatively small, though not zero, because of the relatively small scale of projected emissions. The two action alternatives would have the same impacts on climate change because the projected emissions are the same for each scenario.

The DoD (2021b) Climate Adaptation Plan outlines the Department's plans to both enhance resilience to the effects of climate change and also reduce GHG emissions. It includes five lines of effort associated with priority adaptation actions (i.e., implement climate-informed decision making, train and equip a climate-ready force, achieve resilient built and natural installation infrastructure, build supply chain resilience and innovation, and enhance adaptation and resilience through collaboration) that will be enabled by four activities (i.e., continuous monitoring and data analytics, aligning incentives to reward innovation, increasing climate literacy, and addressing environment justice) Implementation of these priority adaptation actions is intended to ensure that DoD to can operate under changing climate conditions.

Table 8. Summary of the emissions from the Proposed Action (tons/year)

Source	**User**	**Emissions in either Action Alternative (tons/year)**							
		NO_x	**CO**	**VOC**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**Pb**	**CO_2e**
Aircraft - UH-1N	Malmstrom AFB	0.12	1.02	0.94	0.02	0.01	0.01	0.00	71.40
Aircraft - MH-139	Malmstrom AFB	0.13	1.20	0.35	0.03	0.02	0.01	0.00	80.60
Aircraft - UH-60	MTARNG	0.21	1.11	0.27	0.04	0.02	0.02	0.00	133.00
Aircraft - CH-47	MTARNG	0.85	0.37	0.03	0.08	0.12	0.11	0.00	257.00
Personnel	All	0.16	2.03	0.18	<0.01	0.01	<0.01	0.01	160.50
Ammunition Usage	Malmstrom AFB	0.01	0.72	0.00	0.00	0.01	0.01	<0.01	0.52
Ammunition Usage	MTARNG	0.01	0.45	0.00	0.00	0.01	0.01	<0.01	0.33
Convoy – On-road vehicles	Malmstrom AFB	0.30	0.06	0.02	0.02	0.04	0.03	0.00	11.00
Convoy - Aircraft	Malmstrom AFB	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.00	0.90
Total	**Malmstrom AFB**	**0.63**	**4.03**	**1.41**	**0.07**	**0.09**	**0.06**	**0.01**	**244.66**
Total	**MTARNG**	**1.15**	**2.94**	**0.40**	**0.13**	**0.15**	**0.13**	**0.01**	**470.58**
Total	**All**	**1.78**	**6.97**	**1.80**	**0.20**	**0.24**	**0.19**	**0.01**	**715.23**
Threshold		**100**	**100**	**100**	**100**	**100**	**100**	**25**	**None**

a

[9] https://www.eia.gov/environment/emissions/state/

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APPENDIX A. Detailed Air Conformity Applicability Model (ACAM) Report

1. General Information

- Action Location
Base: MALMSTROM AFB
State: Montana
County(s): Broadwater
Regulatory Area(s): NOT IN A REGULATORY AREA

- Action Title: Establishment and Operation of a Helicopter Aerial Gunnery Range and Establishment of a Special Use Airspace Restricted Area R-4601 at the Limestone Hills Training Area, Montana

- Project Number/s (if applicable):

- Projected Action Start Date: 10 / 2021

- Action Purpose and Need:
Draft

- Action Description:
The Proposed Action addressed includes the establishment and operation of a AFGSC helicopter aerial gunnery training range at the Limestone Hills Training Area (LHTA) and the establishment of SUA restricted area to authorize that type of training within one FDP of Malmstrom AFB. Through the alternative development and screening process, AFGSC identified that the only reasonable alternative would be to implement the Proposed Action at the LHTA. There are two alternative locations at the LHTA for the integrated helicopter and convoy training without live fire – Blue Route Road (Alternative 1) and OWG Road (Alternative 2). Section 2 of the EA further describes the Proposed Action and alternatives.
There will be no ground preparation, demolition, or major construction under either Action Alternative. Therefore, a single ACAM model run will adequately support analyses for Action Alternatives 1 and 2.

- Point of Contact
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Title: Consultant
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- Activity List:

Activity Type		Activity Title
2.	Aircraft	Aerial Gunnery Range Training (CH-47)
3.	Aircraft	Aerial Gunnery Range Training (UH-60)
4.	Aircraft	Aerial Gunnery Range Training (UH-1N)
5.	Aircraft	Aerial Gunnery Range Training (MH-139)
6.	Personnel	Aerial Gunnery Training Personnel for Operations and Fire Suppression Duties
7.	Aircraft	Convoy Training Aircraft Support (MH-139)

Emission factors and air emission estimating methods come from the United States Air Force's Air Emissions Guide for Air Force Stationary Sources, Air Emissions Guide for Air Force Mobile Sources, and Air Emissions Guide for Air Force Transitory Sources.

2. Aircraft

2.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Broadwater
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Aerial Gunnery Range Training (CH-47)

- Activity Description:

- Activity Start Date
Start Month: 10
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)	Pollutant	Emissions Per Year (TONs)
VOC	0.033991	PM 2.5	0.106860
SO_x	0.084846	Pb	0.000000
NO_x	0.853073	NH_3	0.000000
CO	0.366549	CO_2e	257.0
PM 10	0.118901		

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)	Pollutant	Emissions Per Year (TONs)
VOC	0.033991	PM 2.5	0.106860
SO_x	0.084846	Pb	0.000000
NO_x	0.853073	NH_3	0.000000
CO	0.366549	CO_2e	257.0
PM 10	0.118901		

2.2 Aircraft & Engines

2.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: CV-22A
Engine Model: T406-AD-400
Primary Function: Transport - Bomber
Aircraft has After burn: No
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? Yes
Original Aircraft Name: CH-47
Original Engine Name: T55-715

2.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	362.00	0.10	1.07	4.15	8.35	1.58	1.42	3234
Approach	663.00	0.02	1.07	6.05	3.47	1.58	1.42	3234
Intermediate	948.00	0.02	1.07	7.87	1.82	1.58	1.42	3234
Military	2507.00	0.01	1.07	18.03	0.29	1.58	1.42	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

2.3 Flight Operations

2.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft: 2
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 80
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 24

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins): 8
Takeoff [Military] (mins): 2.27
Takeoff [After Burn] (mins): 2.27
Climb Out [Intermediate] (mins): 4.53
Approach [Approach] (mins): 6.8
Taxi/Idle In [Idle] (mins): 7

Per the Air Emissions Guide for Air Force Mobile Sources, the defaults values for military aircraft equipped with after burner for takeoff is 50% military power and 50% afterburner. (Exception made for F-35 where KARNES 3.2 flight profile was used)

- Trim Test

Idle (mins): 12
Approach (mins): 27
Intermediate (mins): 9
Military (mins): 12
AfterBurn (mins): 0

2.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year

AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for LTOs per Year

$AE_{LTO} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{LTO}: Aircraft Emissions (TONs)
AEM_{IDLE_IN}: Aircraft Emissions for Idle-In Mode (TONs)
AEM_{IDLE_OUT}: Aircraft Emissions for Idle-Out Mode (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for TGOs per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * TGO / 2000$

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
TGO: Number of Touch-and-Go Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for TGOs per Year
$AE_{TGO} = AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{TGO}: Aircraft Emissions (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for Trim per Year
$AEPS_{POL} = (TD / 60) * (FC / 1000) * EF * NE * NA * NTT / 2000$

$AEPS_{POL}$: Aircraft Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
NA: Number of Aircraft
NTT: Number of Trim Test
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Trim per Year
$AE_{TRIM} = AEPS_{IDLE} + AEPS_{APPROACH} + AEPS_{INTERMEDIATE} + AEPS_{MILITARY} + AEPS_{AFTERBURN}$

AE_{TRIM}: Aircraft Emissions (TONs)
$AEPS_{IDLE}$: Aircraft Emissions for Idle Power Setting (TONs)
$AEPS_{APPROACH}$: Aircraft Emissions for Approach Power Setting (TONs)
$AEPS_{INTERMEDIATE}$: Aircraft Emissions for Intermediate Power Setting (TONs)
$AEPS_{MILITARY}$: Aircraft Emissions for Military Power Setting (TONs)
$AEPS_{AFTERBURN}$: Aircraft Emissions for After Burner Power Setting (TONs)

2.4 Auxiliary Power Unit (APU)

2.4.1 Auxiliary Power Unit (APU) Assumptions

- Default Settings Used: No

- Auxiliary Power Unit (APU)

Number of APU per Aircraft	Operation Hours for Each LTO	Exempt Source?	Designation	Manufacturer
1	1	No	T-62T-27	United Technologies Corporation

2.4.2 Auxiliary Power Unit (APU) Emission Factor(s)

- Auxiliary Power Unit (APU) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
T-62T-27	102.0	0.795	0.108	0.402	4.363	-1.000	-1.000	341.1

2.4.3 Auxiliary Power Unit (APU) Formula(s)

- Auxiliary Power Unit (APU) Emissions per Year

$APU_{POL} = APU * OH * LTO * EF_{POL} / 2000$

APU_{POL}: Auxiliary Power Unit (APU) Emissions per Pollutant (TONs)
APU: Number of Auxiliary Power Units
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

3. Aircraft

3.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Broadwater
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Aerial Gunnery Range Training (UH-60)

- Activity Description:

- Activity Start Date
Start Month: 10
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.272647
SO_x	0.043511
NO_x	0.210966
CO	1.108880
PM 10	0.021991

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.016588
Pb	0.000000
NH_3	0.000000
CO_2e	133.0

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.272647
SO_x	0.043511
NO_x	0.210966
CO	1.108880
PM 10	0.021991

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.016588
Pb	0.000000
NH_3	0.000000
CO_2e	133.0

3.2 Aircraft & Engines

3.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
- **Aircraft Designation:** C-12J
- **Engine Model:** PT6A-65B
- **Primary Function:** General - Turboprop
- **Aircraft has After burn:** No
- **Number of Engines:** 2

- Aircraft & Engine Surrogate
- **Is Aircraft & Engine a Surrogate?** Yes
- **Original Aircraft Name:** UH-60
- **Original Engine Name:** T700-GE-700

3.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	131.43	53.66	1.07	1.89	166.43	1.23	1.11	3234
Approach	339.89	3.31	1.07	4.59	20.86	0.74	0.67	3234
Intermediate	570.64	0.72	1.07	6.69	6.72	0.29	0.26	3234
Military	633.06	0.53	1.07	7.08	5.36	0.26	0.23	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

3.3 Flight Operations

3.3.1 Flight Operations Assumptions

- Flight Operations
- **Number of Aircraft:** 2
- **Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft:** 80
- **Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft:** 0
- **Number of Annual Trim Test(s) per Aircraft:** 24

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins): 8
Takeoff [Military] (mins): 2.27
Takeoff [After Burn] (mins): 2.27
Climb Out [Intermediate] (mins): 4.53
Approach [Approach] (mins): 6.8
Taxi/Idle In [Idle] (mins): 7

Per the Air Emissions Guide for Air Force Mobile Sources, the defaults values for military aircraft equipped with after burner for takeoff is 50% military power and 50% afterburner. (Exception made for F-35 where KARNES 3.2 flight profile was used)

- Trim Test
Idle (mins): 12
Approach (mins): 27
Intermediate (mins): 9
Military (mins): 12
AfterBurn (mins): 0

3.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for LTOs per Year
$AE_{LTO} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{LTO}: Aircraft Emissions (TONs)
AEM_{IDLE_IN}: Aircraft Emissions for Idle-In Mode (TONs)
AEM_{IDLE_OUT}: Aircraft Emissions for Idle-Out Mode (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for TGOs per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * TGO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
TGO: Number of Touch-and-Go Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for TGOs per Year

$AE_{TGO} = AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{TGO}: Aircraft Emissions (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for Trim per Year

$AEPS_{POL}$ = (TD / 60) * (FC / 1000) * EF * NE * NA * NTT / 2000

$AEPS_{POL}$: Aircraft Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
NA: Number of Aircraft
NTT: Number of Trim Test
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Trim per Year

$AE_{TRIM} = AEPS_{IDLE} + AEPS_{APPROACH} + AEPS_{INTERMEDIATE} + AEPS_{MILITARY} + AEPS_{AFTERBURN}$

AE_{TRIM}: Aircraft Emissions (TONs)
$AEPS_{IDLE}$: Aircraft Emissions for Idle Power Setting (TONs)
$AEPS_{APPROACH}$: Aircraft Emissions for Approach Power Setting (TONs)
$AEPS_{INTERMEDIATE}$: Aircraft Emissions for Intermediate Power Setting (TONs)
$AEPS_{MILITARY}$: Aircraft Emissions for Military Power Setting (TONs)
$AEPS_{AFTERBURN}$: Aircraft Emissions for After Burner Power Setting (TONs)

3.4 Auxiliary Power Unit (APU)

3.4.1 Auxiliary Power Unit (APU) Assumptions

- Default Settings Used: No

- Auxiliary Power Unit (APU)

Number of APU per Aircraft	Operation Hours for Each LTO	Exempt Source?	Designation	Manufacturer
1	1	No	T-62T-40-1	

3.4.2 Auxiliary Power Unit (APU) Emission Factor(s)

- Auxiliary Power Unit (APU) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
T-62T-40-1	272.6	0.493	0.289	1.216	3.759	0.131	0.037	910.8

3.4.3 Auxiliary Power Unit (APU) Formula(s)

- Auxiliary Power Unit (APU) Emissions per Year

$APU_{POL} = APU * OH * LTO * EF_{POL} / 2000$

APU_{POL}: Auxiliary Power Unit (APU) Emissions per Pollutant (TONs)
APU: Number of Auxiliary Power Units
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

4. Aircraft

4.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Broadwater
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Aerial Gunnery Range Training (UH-1N)

- Activity Description:

- Activity Start Date
Start Month: 10
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.940613
SO_x	0.023631
NO_x	0.115304
CO	1.016015
PM 10	0.006305

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.005721
Pb	0.000000
NH_3	0.000000
CO_2e	71.4

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.940613
SO_x	0.023631
NO_x	0.115304
CO	1.016015
PM 10	0.006305

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.005721
Pb	0.000000
NH_3	0.000000
CO_2e	71.4

4.2 Aircraft & Engines

4.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: C-12C

Engine Model: PT6A-41
Primary Function: General - Turboprop
Aircraft has After burn: No
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? Yes
Original Aircraft Name: UH-1N
Original Engine Name: T400-CP-400

4.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	147.00	116.88	1.07	1.97	115.31	0.50	0.45	3234
Approach	273.00	26.12	1.07	4.65	34.80	0.10	0.09	3234
Intermediate	473.00	2.34	1.07	7.57	6.49	0.25	0.23	3234
Military	510.00	2.01	1.07	7.98	5.10	0.24	0.22	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

4.3 Flight Operations

4.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 2
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 180
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi/Idle Out [Idle] (mins): 8
Takeoff [Military] (mins): 2.27
Takeoff [After Burn] (mins): 2.27
Climb Out [Intermediate] (mins): 4.53
Approach [Approach] (mins): 6.8
Taxi/Idle In [Idle] (mins): 7

Per the Air Emissions Guide for Air Force Mobile Sources, the defaults values for military aircraft equipped with after burner for takeoff is 50% military power and 50% afterburner. (Exception made for F-35 where KARNES 3.2 flight profile was used)

- Trim Test
Idle (mins): 12
Approach (mins): 27
Intermediate (mins): 9
Military (mins): 12
AfterBurn (mins): 0

4.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for LTOs per Year
$AE_{LTO} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{LTO}: Aircraft Emissions (TONs)
AEM_{IDLE_IN}: Aircraft Emissions for Idle-In Mode (TONs)
AEM_{IDLE_OUT}: Aircraft Emissions for Idle-Out Mode (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for TGOs per Year
$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * TGO / 2000$

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
TGO: Number of Touch-and-Go Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for TGOs per Year
$AE_{TGO} = AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{TGO}: Aircraft Emissions (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for Trim per Year
$AEPS_{POL} = (TD / 60) * (FC / 1000) * EF * NE * NA * NTT / 2000$

$AEPS_{POL}$: Aircraft Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
NA: Number of Aircraft
NTT: Number of Trim Test
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Trim per Year
$AE_{TRIM} = AEPS_{IDLE} + AEPS_{APPROACH} + AEPS_{INTERMEDIATE} + AEPS_{MILITARY} + AEPS_{AFTERBURN}$

AE_{TRIM}: Aircraft Emissions (TONs)
$AEPS_{IDLE}$: Aircraft Emissions for Idle Power Setting (TONs)
$AEPS_{APPROACH}$: Aircraft Emissions for Approach Power Setting (TONs)
$AEPS_{INTERMEDIATE}$: Aircraft Emissions for Intermediate Power Setting (TONs)
$AEPS_{MILITARY}$: Aircraft Emissions for Military Power Setting (TONs)
$AEPS_{AFTERBURN}$: Aircraft Emissions for After Burner Power Setting (TONs)

4.4 Auxiliary Power Unit (APU)

4.4.1 Auxiliary Power Unit (APU) Assumptions

- Default Settings Used: No

- Auxiliary Power Unit (APU)

Number of APU per Aircraft	Operation Hours for Each LTO	Exempt Source?	Designation	Manufacturer

4.4.2 Auxiliary Power Unit (APU) Emission Factor(s)

- Auxiliary Power Unit (APU) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e

4.4.3 Auxiliary Power Unit (APU) Formula(s)

- Auxiliary Power Unit (APU) Emissions per Year
$APU_{POL} = APU * OH * LTO * EF_{POL} / 2000$

APU_{POL}: Auxiliary Power Unit (APU) Emissions per Pollutant (TONs)
APU: Number of Auxiliary Power Units
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

5. Aircraft

5.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Broadwater
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Aerial Gunnery Range Training (MH-139)

- Activity Description:

- Activity Start Date
Start Month: 10
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.348183
SO_x	0.026658
NO_x	0.125408
CO	1.204185
PM 10	0.015775

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.014218
Pb	0.000000
NH_3	0.000000
CO_2e	80.6

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.348183
SO_x	0.026658
NO_x	0.125408
CO	1.204185
PM 10	0.015775

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.014218
Pb	0.000000
NH_3	0.000000
CO_2e	80.6

5.2 Aircraft & Engines

5.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: C-23B
Engine Model: PT6A-65AR
Primary Function: General - Turboprop
Aircraft has After burn: No
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? Yes
Original Aircraft Name: MH-139
Original Engine Name: PT6C-67C

5.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	131.43	53.66	1.07	1.89	166.43	1.23	1.11	3234
Approach	339.89	3.31	1.07	4.59	20.86	0.74	0.67	3234
Intermediate	570.64	0.72	1.07	6.69	6.72	0.29	0.26	3234
Military	633.06	0.53	1.07	7.08	5.36	0.26	0.23	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

5.3 Flight Operations

5.3.1 Flight Operations Assumptions

- Flight Operations

Number of Aircraft:	2
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft:	180
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft:	0
Number of Annual Trim Test(s) per Aircraft:	0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)

Taxi/Idle Out [Idle] (mins):	8
Takeoff [Military] (mins):	2.27
Takeoff [After Burn] (mins):	2.27
Climb Out [Intermediate] (mins):	4.53
Approach [Approach] (mins):	6.8
Taxi/Idle In [Idle] (mins):	7

Per the Air Emissions Guide for Air Force Mobile Sources, the defaults values for military aircraft equipped with after burner for takeoff is 50% military power and 50% afterburner. (Exception made for F-35 where KARNES 3.2 flight profile was used)

- Trim Test

Idle (mins):	12
Approach (mins):	27
Intermediate (mins):	9
Military (mins):	12
AfterBurn (mins):	0

5.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000$

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for LTOs per Year

$AE_{LTO} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{LTO}: Aircraft Emissions (TONs)
AEM_{IDLE_IN}: Aircraft Emissions for Idle-In Mode (TONs)
AEM_{IDLE_OUT}: Aircraft Emissions for Idle-Out Mode (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for TGOs per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * TGO / 2000$

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)

TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
TGO: Number of Touch-and-Go Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for TGOs per Year
$AE_{TGO} = AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{TGO}: Aircraft Emissions (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for Trim per Year
$AEPS_{POL} = (TD / 60) * (FC / 1000) * EF * NE * NA * NTT / 2000$

$AEPS_{POL}$: Aircraft Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
NA: Number of Aircraft
NTT: Number of Trim Test
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Trim per Year
$AE_{TRIM} = AEPS_{IDLE} + AEPS_{APPROACH} + AEPS_{INTERMEDIATE} + AEPS_{MILITARY} + AEPS_{AFTERBURN}$

AE_{TRIM}: Aircraft Emissions (TONs)
$AEPS_{IDLE}$: Aircraft Emissions for Idle Power Setting (TONs)
$AEPS_{APPROACH}$: Aircraft Emissions for Approach Power Setting (TONs)
$AEPS_{INTERMEDIATE}$: Aircraft Emissions for Intermediate Power Setting (TONs)
$AEPS_{MILITARY}$: Aircraft Emissions for Military Power Setting (TONs)
$AEPS_{AFTERBURN}$: Aircraft Emissions for After Burner Power Setting (TONs)

5.4 Auxiliary Power Unit (APU)

5.4.1 Auxiliary Power Unit (APU) Assumptions

- Default Settings Used: No

- Auxiliary Power Unit (APU)

Number of APU per Aircraft	Operation Hours for Each LTO	Exempt Source?	Designation	Manufacturer

5.4.2 Auxiliary Power Unit (APU) Emission Factor(s)

- Auxiliary Power Unit (APU) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e

5.4.3 Auxiliary Power Unit (APU) Formula(s)

- Auxiliary Power Unit (APU) Emissions per Year
APU_{POL} = APU * OH * LTO * EF_{POL} / 2000

APU_{POL}: Auxiliary Power Unit (APU) Emissions per Pollutant (TONs)
APU: Number of Auxiliary Power Units
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

6. Personnel

6.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Broadwater
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Aerial Gunnery Training Personnel for Operations and Fire Suppression Duties

- Activity Description:

- Activity Start Date
Start Month: 10
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.179145
SO_x	0.001138
NO_x	0.162850
CO	2.025190
PM 10	0.005002

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.004552
Pb	0.000000
NH_3	0.010316
CO_2e	160.5

6.2 Personnel Assumptions

- Number of Personnel
Active Duty Personnel: 14
Civilian Personnel: 0
Support Contractor Personnel: 0
Air National Guard (ANG) Personnel: 0

Reserve Personnel: 0

- Default Settings Used: No

- Average Personnel Round Trip Commute (mile): 260

- Personnel Work Schedule

Active Duty Personnel: 9 Days Per Month
Civilian Personnel: 5 Days Per Week
Support Contractor Personnel: 5 Days Per Week
Air National Guard (ANG) Personnel: 4 Days Per Week
Reserve Personnel: 4 Days Per Month

6.3 Personnel On Road Vehicle Mixture

- On Road Vehicle Mixture (%)

	LDGV	LDGT	HDGV	LDDV	LDDT	HDDV	MC
POVs	37.55	60.32	0	0.03	0.2	0	1.9
GOVs	54.49	37.73	4.67	0	0	3.11	0

6.4 Personnel Emission Factor(s)

- On Road Vehicle Emission Factors (grams/mile)

	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	Pb	NH_3	CO_2e
LDGV	000.343	000.002	000.257	003.756	000.010	000.009		000.022	00313.875
LDGT	000.400	000.003	000.434	004.961	000.012	000.011		000.024	00404.284
HDGV	000.657	000.005	001.065	014.900	000.026	000.023		000.044	00740.723
LDDV	000.141	000.003	000.139	002.353	000.004	000.004		000.008	00301.516
LDDT	000.270	000.004	000.389	003.971	000.007	000.006		000.008	00428.585
HDDV	000.614	000.013	005.915	001.983	000.169	000.155		000.030	01487.496
MC	002.246	000.003	000.875	013.744	000.028	000.025		000.055	00398.991

6.5 Personnel Formula(s)

- Personnel Vehicle Miles Travel for Work Days per Year

$VMT_P = NP * WD * AC$

VMT_P: Personnel Vehicle Miles Travel (miles/year)
NP: Number of Personnel
WD: Work Days per Year
AC: Average Commute (miles)

- Total Vehicle Miles Travel per Year

$VMT_{Total} = VMT_{AD} + VMT_C + VMT_{SC} + VMT_{ANG} + VMT_{AFRC}$

VMT_{Total}: Total Vehicle Miles Travel (miles)
VMT_{AD}: Active Duty Personnel Vehicle Miles Travel (miles)
VMT_C: Civilian Personnel Vehicle Miles Travel (miles)
VMT_{SC}: Support Contractor Personnel Vehicle Miles Travel (miles)
VMT_{ANG}: Air National Guard Personnel Vehicle Miles Travel (miles)
VMT_{AFRC}: Reserve Personnel Vehicle Miles Travel (miles)

- Vehicle Emissions per Year

$V_{POL} = (VMT_{Total} * 0.002205 * EF_{POL} * VM) / 2000$

V_{POL}: Vehicle Emissions (TONs)
VMT_{Total}: Total Vehicle Miles Travel (miles)
0.002205: Conversion Factor grams to pounds
EF_{POL}: Emission Factor for Pollutant (grams/mile)
VM: Personnel On Road Vehicle Mixture (%)
2000: Conversion Factor pounds to tons

7. Aircraft

7.1 General Information & Timeline Assumptions

- Add or Remove Activity from Baseline? Add

- Activity Location
County: Broadwater
Regulatory Area(s): NOT IN A REGULATORY AREA

- Activity Title: Convoy Training Aircraft Support (MH-139)

- Activity Description:

- Activity Start Date
Start Month: 10
Start Year: 2021

- Activity End Date
Indefinite: Yes
End Month: N/A
End Year: N/A

- Activity Emissions:

Pollutant	Emissions Per Year (TONs)
VOC	0.003869
SO_x	0.000296
NO_x	0.001393
CO	0.013380
PM 10	0.000175

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000158
Pb	0.000000
NH_3	0.000000
CO_2e	0.9

- Activity Emissions [Flight Operations (includes Trim Test & APU) part]:

Pollutant	Emissions Per Year (TONs)
VOC	0.003869
SO_x	0.000296
NO_x	0.001393
CO	0.013380
PM 10	0.000175

Pollutant	Emissions Per Year (TONs)
PM 2.5	0.000158
Pb	0.000000
NH_3	0.000000
CO_2e	0.9

7.2 Aircraft & Engines

7.2.1 Aircraft & Engines Assumptions

- Aircraft & Engine
Aircraft Designation: C-23B
Engine Model: PT6A-65AR

Primary Function: General - Turboprop
Aircraft has After burn: No
Number of Engines: 2

- Aircraft & Engine Surrogate
Is Aircraft & Engine a Surrogate? Yes
Original Aircraft Name: M-139
Original Engine Name: PT6C-67C

7.2.2 Aircraft & Engines Emission Factor(s)

- Aircraft & Engine Emissions Factors (lb/1000lb fuel)

	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e
Idle	131.43	53.66	1.07	1.89	166.43	1.23	1.11	3234
Approach	339.89	3.31	1.07	4.59	20.86	0.74	0.67	3234
Intermediate	570.64	0.72	1.07	6.69	6.72	0.29	0.26	3234
Military	633.06	0.53	1.07	7.08	5.36	0.26	0.23	3234
After Burn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3234

7.3 Flight Operations

7.3.1 Flight Operations Assumptions

- Flight Operations
Number of Aircraft: 2
Number of Annual LTOs (Landing and Take-off) cycles for all Aircraft: 2
Number of Annual TGOs (Touch-and-Go) cycles for all Aircraft: 0
Number of Annual Trim Test(s) per Aircraft: 0

- Default Settings Used: No

- Flight Operations TIMs (Time In Mode)
Taxi/Idle Out [Idle] (mins): 8
Takeoff [Military] (mins): 2.27
Takeoff [After Burn] (mins): 2.27
Climb Out [Intermediate] (mins): 4.53
Approach [Approach] (mins): 6.8
Taxi/Idle In [Idle] (mins): 7

Per the Air Emissions Guide for Air Force Mobile Sources, the defaults values for military aircraft equipped with after burner for takeoff is 50% military power and 50% afterburner. (Exception made for F-35 where KARNES 3.2 flight profile was used)

- Trim Test
Idle (mins): 12
Approach (mins): 27
Intermediate (mins): 9
Military (mins): 12
AfterBurn (mins): 0

7.3.2 Flight Operations Formula(s)

- Aircraft Emissions per Mode for LTOs per Year
AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * LTO / 2000

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
LTO: Number of Landing and Take-off Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for LTOs per Year

$AE_{LTO} = AEM_{IDLE\_IN} + AEM_{IDLE\_OUT} + AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{LTO}: Aircraft Emissions (TONs)
AEM_{IDLE_IN}: Aircraft Emissions for Idle-In Mode (TONs)
AEM_{IDLE_OUT}: Aircraft Emissions for Idle-Out Mode (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for TGOs per Year

$AEM_{POL} = (TIM / 60) * (FC / 1000) * EF * NE * TGO / 2000$

AEM_{POL}: Aircraft Emissions per Pollutant & Mode (TONs)
TIM: Time in Mode (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
TGO: Number of Touch-and-Go Cycles (for all aircraft)
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for TGOs per Year

$AE_{TGO} = AEM_{APPROACH} + AEM_{CLIMBOUT} + AEM_{TAKEOFF}$

AE_{TGO}: Aircraft Emissions (TONs)
$AEM_{APPROACH}$: Aircraft Emissions for Approach Mode (TONs)
$AEM_{CLIMBOUT}$: Aircraft Emissions for Climb-Out Mode (TONs)
$AEM_{TAKEOFF}$: Aircraft Emissions for Take-Off Mode (TONs)

- Aircraft Emissions per Mode for Trim per Year

$AEPS_{POL} = (TD / 60) * (FC / 1000) * EF * NE * NA * NTT / 2000$

$AEPS_{POL}$: Aircraft Emissions per Pollutant & Power Setting (TONs)
TD: Test Duration (min)
60: Conversion Factor minutes to hours
FC: Fuel Flow Rate (lb/hr)
1000: Conversion Factor pounds to 1000pounds
EF: Emission Factor (lb/1000lb fuel)
NE: Number of Engines
NA: Number of Aircraft
NTT: Number of Trim Test
2000: Conversion Factor pounds to TONs

- Aircraft Emissions for Trim per Year

$AE_{TRIM} = AEPS_{IDLE} + AEPS_{APPROACH} + AEPS_{INTERMEDIATE} + AEPS_{MILITARY} + AEPS_{AFTERBURN}$

AE_{TRIM}: Aircraft Emissions (TONs)
$AEPS_{IDLE}$: Aircraft Emissions for Idle Power Setting (TONs)
$AEPS_{APPROACH}$: Aircraft Emissions for Approach Power Setting (TONs)
$AEPS_{INTERMEDIATE}$: Aircraft Emissions for Intermediate Power Setting (TONs)
$AEPS_{MILITARY}$: Aircraft Emissions for Military Power Setting (TONs)
$AEPS_{AFTERBURN}$: Aircraft Emissions for After Burner Power Setting (TONs)

7.4 Auxiliary Power Unit (APU)

7.4.1 Auxiliary Power Unit (APU) Assumptions

- Default Settings Used: No

- Auxiliary Power Unit (APU)

Number of APU per Aircraft	Operation Hours for Each LTO	Exempt Source?	Designation	Manufacturer

7.4.2 Auxiliary Power Unit (APU) Emission Factor(s)

- Auxiliary Power Unit (APU) Emission Factor (lb/hr)

Designation	Fuel Flow	VOC	SO_x	NO_x	CO	PM 10	PM 2.5	CO_2e

7.4.3 Auxiliary Power Unit (APU) Formula(s)

- Auxiliary Power Unit (APU) Emissions per Year

$APU_{POL} = APU * OH * LTO * EF_{POL} / 2000$

APU_{POL}: Auxiliary Power Unit (APU) Emissions per Pollutant (TONs)
APU: Number of Auxiliary Power Units
OH: Operation Hours for Each LTO (hour)
LTO: Number of LTOs
EF_{POL}: Emission Factor for Pollutant (lb/hr)
2000: Conversion Factor pounds to tons

1.2 AIRSPACE ANALYSIS

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Environmental Assessment for Establishment and Operation of a Helicopter Aerial Gunnery Range and Establishment of Restricted Airspace at the Limestone Hills Training Area

Airspace Analysis

HMMH Project No. 309640.001

September 28, 2022

Prepared for:

AEM Group Environmental Services
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Prepared by:
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Contents

Figures

Tables

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1 Introduction

This technical study was prepared by Harris Miller Miller & Hanson Inc. (HMMH) to support the preparation of the Environmental Assessment (EA) for the Establishment and Operation of a Helicopter Aerial Gunnery Range and Special Use Airspace (SUA) Restricted Area R-4601 at the Limestone Hills Training Area, Montana.[1]

The United States Air Force's 341st Missile Wing (341 MW), based at Malmstrom Air Force Base (AFB) near Great Falls, MT, is one of three units that maintains and operates the nation's Minuteman III Intercontinental Ballistic Missile (ICBM) system under the purview of the Air Force Global Strike Command (AFGSC). The Department of Defense (DoD), Air Force, and the United States Strategic Command require that the AFGSC provide armed helicopter support for ICBM operations in the missile fields. The AFGSC's 582nd Helicopter Group, specifically the 40th Helicopter Squadron (40 HS), provides this support for the 341 MW. Additionally, 40 HS provides aerial surveillance for DoD strategic weapons convoys and emergency security forces responses; executes search and rescue missions to support the Joint Chiefs of Staff Search and Rescue Plan and emergency response plans for federal, state, and local agencies; and supports emergency war order tasking, priority personnel, and cargo airlifts.[1]

Although based at Malmstrom AFB in MT, the 40 HS aircrew currently train and qualify at the Utah Test and Training Range (UTTR), which is the nearest aerial gunnery range facility to Malmstrom. As noted in the EA,[1] the UTTR is the United States' largest combined restricted airspace and land training area. Its capabilities and facilities mean that it is in high demand and supports over 22,000 training sorties and 1,000 test sorties for the Air Force, US Army, and US Marine Corps. The UTTR is also located nearly 500 miles from Malmstrom AFB, requiring the 40 HS to temporarily relocate to the UTTR for approximately two weeks every 90 days to maintain proficiency and currency for their aerial gunnery qualifications. The combination of the training frequency and the distance to the UTTR means that the 40 HS spends significant time traveling and on temporary deployments to meet their training requirements.

The AFGSC proposes to establish a new aerial gunnery range at the Limestone Hills Training Area (LHTA), MT to increase the efficiency and effective maintenance of the 40 HS's and 341 MW Security Forces Group (SFG)'s readiness posture and attainment of mission training requirements. The LHTA is located approximately 75 nautical miles (NM) from Malmstrom AFB, which would allow for aerial gunnery training within one flight duty period (12-hour period). The Montana Army National Guard (MTARNG) operates the LHTA and ground-based gunnery, air drop, and helicopter training without aerial gunnery is conducted in accordance with a Letter of Authorization from the Federal Aviation Administration (FAA) granting the using agency (MTARNG) the authority to operate a Controlled Firing Area (CFA) at the LHTA. A CFA does not authorize aerial gunnery training.

Fort Harrison, located west of Helena, MT, is the primary training site for the MTARNG. It provides a range of training terrain and opportunities, including simulated urban combat, firing ranges, helicopter drop zones, and tank courses. The LHTA supplements these training facilities with its tank and heavy vehicle training facilities, mortar ranges, helicopter training areas, and sniper training opportunities.

[1] USACE 2022. Environmental Assessment for the Establishment and Operation of a Helicopter Aerial Gunnery Range and Establishment of Special Use Airspace Restricted Area R-4601 at the Limestone Hills Training Area, Montana.

Units training at the LHTA often plan and prepare for these operations at Fort Harrison before training at the LHTA.[2]

To support the AFGSC's Proposed Action, MTARNG seeks FAA approval to establish a joint-use SUA restricted area, called R-4601, to permit aerial gunnery training. MTARNG's 1-189th General Support Aviation Battalion, based at the Helena Regional Airport (HLN), has a similar training requirement to conduct live fire gunnery training. Currently, they satisfy requirements by traveling to the UTTR and other training ranges in Utah. The proposed establishment of Restricted Area R-4601 at the LHTA would enable the MTARNG to also perform aerial gunnery training at the LHTA.

This airspace analysis characterizes the current airspace setting and flight operations at the LHTA. It identifies potential impacts to existing airspace procedures and air traffic routes, as well as notional modifications to existing instrument flight procedures (IFPs) and supporting airspace to accommodate the proposed Restricted Area at the LHTA for consideration. These proposed modifications are recommendations only and represent one of many potential options to reroute traffic to avoid the proposed Restricted Area. As the steward of airspace, which is a finite national resource, and as the agency charged by Congress with managing and resolving competing demands for its use and management, the FAA has the final authority to develop, review, assess, or implement any airspace revisions.

Section 2 describes the airspace environment that exists in the vicinity of the LHTA, including airports, airspace, airways, and users of these resources. This section also identifies the regulatory environment within which these resources exist and defines the Region of Influence (ROI) for this airspace analysis. Section 3 describes the anticipated consequences that would be associated with the establishment and ongoing use of a Restricted Area (the Proposed Action) and with the No Action scenario, and Section 4 summarizes the findings of this analysis.

[2] *Fort William H. Harrison and Limestone Hills Training Area Joint Land Use Summary*, December 2014

2 Affected Environment: Airspace

The Limestone Hills Training Area (LHTA) is located to the west of the City of Townsend, in Broadwater County, MT. It includes approximately 21,295 acres, primarily owned by the Bureau of Land Management, and managed by the Department of the Army. The LHTA is a supplemental training area associated with Fort Harrison, providing support and training facilities for annual and inactive duty training for MTARNG, as well as for some active components of the Armed Forces and other governmental and civilian organizations.[2] It is approximately 75 NM from Malmstrom AFB and 30 NM from Fort Harrison.

Geographical Features

In general, topography is varied in the LHTA, with elevations ranging between 3,800 and 6,000 feet (ft) above Mean Sea Level (MSL).[3,4] The Little Hogback Ridge runs through the western portion of the LHTA in a northeast-southwest direction, paralleling Old Woman's Grave Road. Its peaks are approximately 5,500 ft MSL. To the east of Old Woman's Grave Road, the terrain is lower, with hills reaching elevations of approximately 5,000 ft MSL.[5]

The Elkhorn Mountains lie to the west of the LHTA in the Helena National Forest and are surrounded by the cities of Helena, Townsend, Montana City, Whitehall, and Boulder. Its highest peaks, Crow Peak (9,414 ft MSL) and Elkhorn Peak (9,381 ft MSL), are approximately 12 miles west of the western border of the proposed Restricted Area.

Canyon Ferry Lake, approximately three miles northeast of the proposed Restricted Area, is the third largest body of water in Montana. It provides irrigation to local farms and recreational activities, such as fishing, swimming, boating, and camping, to the region. The City of Townsend is located approximately three miles south of the lake and directly to the east of the LHTA; Townsend Airport (8U8) is approximately two miles northeast of the city and Canyon Ferry Airport (8U9) is approximately 6.5 miles northwest of the city.

2.1 Resource Definition and Regulatory Setting

The FAA regulates aeronautical activities and operates the air traffic control (ATC) system in the United States. Its regulatory activities include certification of aircraft and their operators and providing and managing standards for operator training, aircraft operation, and equipment manufacturing. The FAA also creates, manages, and operates a system of navigational aids that allow aircraft operations to occur without visual reference to the ground.

The FAA has primary jurisdiction over management of airspace. The National Airspace System (NAS) is a collective term referring to the common network of U.S. airspace, incorporating all facets of navigable airspace, including terrestrial and satellite-based navigation facilities, equipment, and services; airports or landing areas; aeronautical charts, information, and services; rules, regulations, and procedures;

[3] *Montana Army National Guard Installation Compatible Use Zone Study*, January 2021

[4] Altitudes measured in MSL are referenced against a universally accepted value of the sea level to establish a consistent reference point for altitude throughout the world. Altitudes or heights measured in reference to Above Ground Level (AGL) are measured with reference to the local terrain. Thus, a height of 1,500 ft AGL in a coastal area is different than 1,500 AGL in a mountainous area.

[5] United States Geological Service, Townsend, MT. https://store.usgs.gov/map-locator. Accessed August 3, 2021.

technical information, manpower, and material. System components shared jointly with the military are also included in the NAS.

The FAA operates the national ATC system. This system and its personnel provide guidance to pilots, separating aircraft within defined sectors of airspace under the control of air traffic controllers. During all phases of flight, an aircraft operates within the NAS in either controlled or uncontrolled airspace. While in controlled airspace, ATC provides safe and adequate separation among aircraft, depending upon the type of operation (Instrument Flight Rules [IFR] or Visual Flight Rules [VFR])[6] and the kind of controlled airspace. ATC does not provide separation in uncontrolled airspace since it lacks regulatory jurisdiction and therefore cannot provide separation if it is not able to control the airspace.

Navigable airspace is airspace above the minimum altitudes of flight prescribed by regulations under Title 49 of the United States Code of Federal Regulations (CFR), Subtitle VII, Part A, and includes airspace needed to ensure safety in the takeoff and landing of aircraft, as defined in 14 CFR, Part 77. Navigable airspace is a limited natural resource that Congress has charged the FAA to administer in the public interest as necessary to ensure the safety of aircraft and its efficient use. The FAA must balance the potentially competing needs and interests of many users, including the military, air carriers, and general aviation (GA).

FAA Joint Order (JO) 7400.2N, *Procedures for Handling Airspace Matters (2021)* and 14 CFR Parts 71 and 73 provide guidance on the definition and uses of airspace. The DoD and the service branches manage airspace delegated by the FAA to them in accordance with the processes and procedures outlined in DoD Directive 5030.19 *DoD Responsibilities on Federal Aviation and National Airspace System Matters,* Army Regulation 95-2 *Airspace, Airfields/Heliports, Flight Activities, Air Traffic Control, and Navigation Aids,* and Air Force Instruction 13-201 and its supplement, both named *Airspace Management*. The DoD and the service branches collaborate with the FAA to ascertain the minimum requirement for airspace, while also evaluating the environmental consequences of proposed airspace designations in compliance with both the FAA and the DoD's regulations associated with the implementation of the National Environmental Policy Act (NEPA). These agencies thus serve as prudent stewards of a limited common national resource.

When examining airspace use and management, it is useful to first categorize it based upon whether the FAA provides ATC separation services within it or not; that is, whether the airspace is *controlled airspace* versus *uncontrolled airspace*. A second tier of classification hinges upon those circumstances when the FAA removes a defined volume of airspace from the public domain, placing other users on notice that it has been allocated for the benefit of a particular category of user, such as the military. The use may be exclusive, limiting non-participating (i.e., non-military) users, or it may be advisory, indicating to non-participating users of the airspace that military operations are occurring in certain areas or along defined routes and thus require an extra measure of vigilance by non-participating users. This second

[6] Under VFR a pilot operates an aircraft through visual references to other aircraft, the ground, and other obstacles. The pilot is responsible for maintaining safe separation from these entities. Additionally, specific weather conditions apply so that visual separation is maintained; these conditions are known as Visual Meteorological Conditions (VMC).

Flight under IFR places the responsibility for separation of the aircraft from other aircraft, terrain, and obstacles on air traffic controllers. Detailed procedural rules, along with surveillance (via radar or other means) of aircraft in flight, enable safe operations during those times a pilot may not be able to maintain visual separation. This requires the pilot to control the aircraft by reference to cockpit flight instruments instead of visual references (e.g., while in clouds or during periods of low visibility). Flight during Instrument Meteorological Conditions (IMC) must be conducted under IFR; however, aircraft operating under IFR may be in VMC. During such times, the pilot also retains responsibility for aircraft separation.

tier of classification – removal from the public domain or notice to non-participating users – is commonly referred to as SUA, or Special Use Airspace.

Restricted Areas are a form of SUA and are established via 14 CFR Part 74 via a public rulemaking process. Flight within these areas is not entirely prohibited but is subject to restrictions on non-participating aircraft since operations occurring in these areas can be hazardous to non-participating aircraft. The airspace in the Proposed Action for the LHTA is such an area.

2.2 Existing Training at LHTA

Training at the LHTA primarily consists of tank and Bradley Fighting Vehicle maneuvers and weapons firing, including mortar training, sub-caliber artillery firing, aerial navigation, and aerial gunnery. Helicopter operations also occur at the LHTA, including air-to-ground drop zones, low-level hovering and flight, insertion and extraction exercises, traffic patterns, and external load operations. The LHTA is currently used for military training approximately 140 days of the year between May and November due to the need to minimize disturbances to wintering big game wildlife.[2]

Currently, all surface live-fire weapons familiarization and training at the LHTA occurs within a CFA that covers the majority of LHTA and extends slightly to the east and west. CFAs contain activities that could be hazardous to non-participating aircraft if they are not conducted in a controlled setting. According to the FAA's Aeronautical Informational Manual (AIM), activities in a CFA are suspended as soon as surveillance facilities such as spotter aircraft, radar, or ground observers indicate non-participating aircraft are approaching the area. Though included in the AIM as a type of SUA, this type of airspace is not charted and is not defined through the rulemaking process required for other types of airspace, nor do non-participating aircraft need to change their flight paths to avoid CFAs.[7] As a result, non-participating operators may not be aware of CFAs.

Daily usage for the LHTA CFA may be scheduled over a 22-hour period (8:00 a.m. to 6:00 a.m. local), and the maximum height of projectiles for all surface-fired weapon systems is within 4,000 ft Above Ground Level (AGL). MTARNG has a range tower in place for safety observers to control operations and cease fire in case any non-participating aircraft approach the CFA during operations. Weapons system use follows all safety precautions and procedures specified for the operation of the CFA and in the FAA's JO 7400.2N, *Procedures for Handling Airspace Matters*. Aircraft involvement in any training is controlled through constant contact with the range tower, coordination, regulation, standard operation procedures, safety briefings, and inspections. Aircraft may be utilized for transport of equipment and personnel to and from the ranges; however, no aerial gunnery activities (i.e., air-to-ground expenditure of ammunition) are allowed within a CFA.

2.3 Region of Influence

The Proposed Action and the No Action Alternative involve aircraft operations in Class E and G airspace during en route operations. The proposed Restricted Area is located approximately 50 miles northwest of Bozeman Yellowstone International Airport (BZN), 27 miles southeast of Helena Regional Airport (HLN), and five miles west of Townsend Airport (8U8). The proposed airspace would be approximately 7

[7] FAA aeronautical Information Manual, Chapter 3, Section 4, Special Use Airspace. https://www.faa.gov/air_traffic/publications/atpubs/aim_html/chap3_section_4.html. Accessed August 17, 2021.

NM along its longest north-south axis and 5.5 NM along its longest east-west axis, with an area of approximately 33.3 square statute miles.

The regional airspace volume most likely to be affected by the Proposed Action and for which potential consequences are examined is known as its ROI. It includes the airspace contained by a circle with radius 30 NM from the Townsend Airport. This ROI or study area was derived to include both the proposed Restricted Area and those airways and instrument flight procedures potentially affected by the Proposed Action. The rationale for an ROI of this size is to include all potentially affected airspace and procedures that air carrier, military, and GA flights would transit and use. Figure 2-1 illustrates the proposed Restricted Area and the ROI associated with this Proposed Action.

The remainder of this section discusses the airfields, airspace, and existing flight operations potentially impacted by the Proposed Action.

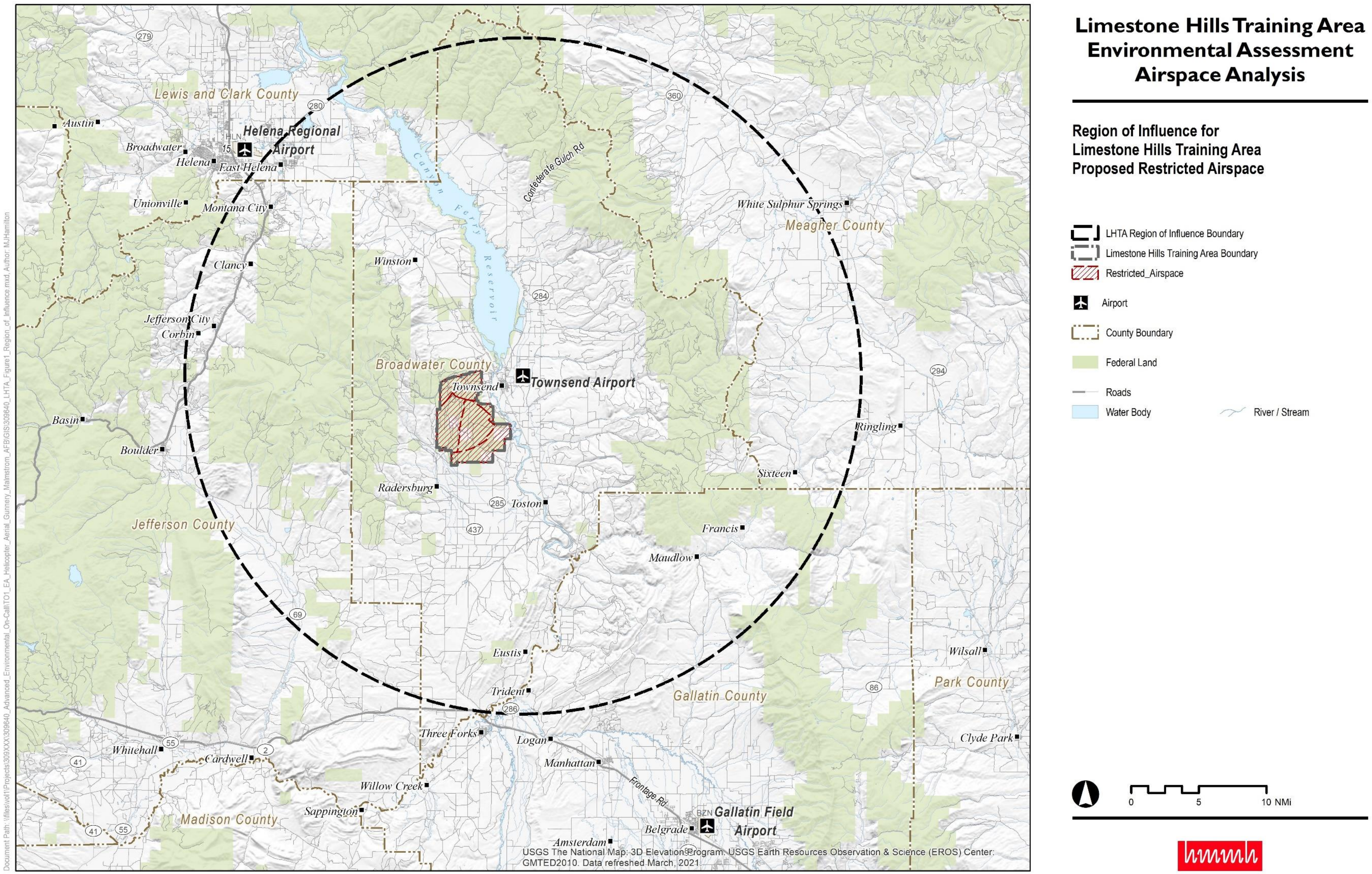

Figure 2-1: Region of Influence for LHTA Proposed Restricted Airspace

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2.3.1 Airfields and Airports

Two airfields, Townsend Airport (8U8) and Canyon Ferry Airport (8U9), exist within the ROI for the proposed Restricted Area. An additional two airfields, Helena Regional Airport (HLN) and Bozeman Yellowstone International Airport (BZN), lie outside the ROI but are included in this section since air traffic to and from these airports transits through the ROI and the proposed Restricted Area. The following sections discuss the operational characteristics and specifications of these airports.

2.3.1.1 Townsend Airport (8U8)

Townsend Airport (8U8) is a public use, non-towered airport jointly owned by Broadwater County and the City of Townsend. It lies two miles east of Townsend, MT, in Broadwater County at an elevation of 3,897 ft MSL and covers 125 acres of land. 8U8 has one paved runway, Runway 17/35, that is 4,000 ft long and 60 ft wide. Sixteen single-engine aircraft and one helicopter are based at 8U8.[8] Townsend Airport is primarily used for GA operations, as noted in Table 2-1. The MTARNG also conducts some helicopter operations at 8U8.[9]

Table 2-1 provides operational counts, or the total number of arrivals and departures, at 8U8 for each of the aircraft categories tracked by FAA Air Traffic Control Towers (ATCT). Air Carrier operations, in this context, are commercial flight operations with more than 60 seats or payload of more than 18,000 pounds, while Air Taxi operations are commercial operations with 60 or fewer seats or a payload of 18,000 pounds or less. Local GA operations refer to civil, non-commercial flight operations that remain within approximately 20 miles of the airport, while Itinerant GA operations arrive from and depart to areas farther than approximately 20 miles of the airport. Military operations include all flights conducted by military aircraft. In the remainder of this document, civilian traffic refers to all flight operations that are non-military (Air Carrier, Air Taxi, GA).

Table 2-1: Townsend Airport Operations through April 2019

Tower Category	Operations
Air Carrier	0
Air Taxi	0
Local GA	1,500
Itinerant GA	3,000
Military	10
Total	***4,510***

Source: FAA OPSNET, Airport Operations, 8U8

2.3.1.2 Canyon Ferry Airport (8U9)

Canyon Ferry Airport (8U9) is a public use, non-towered airport owned by Broadwater County. It covers 39 acres of land and lies seven miles northwest of Townsend, MT. It is located at an elevation of 3,840 ft MSL. 8U9 has one gravel runway, Runway 16/34, that is 3,200 ft long and 75 ft wide. One single-engine

[8] FAA Form 5010, Airport Master Record, 8U8, FAA Site 12531.*A. Accessed June 10, 2021.
[9] Fort William H. Harrison and Limestone Hills Training Area Joint Land Use Summary, December 2014

aircraft and one ultra-light aircraft are based at 8U9.[10] It mainly supports GA operations, as noted in Table 2-2, as well as MTARNG helicopter operations.[2]

Table 2-2: Canyon Ferry Operations through January 2018

Tower Category	Operations
Air Carrier	0
Air Taxi	0
Local GA	50
Itinerant GA	600
Military	650
Total	***1,300***

Source: FAA OPSNET, Airport Operations, 8U9

2.3.1.3 Helena Regional Airport (HLN)

Helena Regional Airport (HLN), owned and operated by the Helena Regional Airport Authority, is a towered, public-use airport. Its air traffic activity levels warrant an ATCT with associated Class D airspace. It is located on 1,224 acres approximately two miles northeast of the city of Helena, MT, in Lewis and Clark County. The National Plan of Integrated Airport Systems (NPIAS)[11] categorizes it as a primary commercial service non-hub airport.[12] It provides regional and national commercial services as well as GA services.

Helena Regional has three paved runways and one grass runway as listed in Table 2-3. Runways 05/23 and 17/35 are unavailable to air carrier aircraft with more than 30 passenger seats. The turf runway, Runway 10/28, is usually available between March and September when weather permits.[13]

Table 2-3: Helena Regional Runway Characteristics

Runway	Orientation	Surface	Length (ft)	Width (ft)	Elevation (ft MSL)
05/23	NE-SW	Asphalt	4,644	75	3,877/3,819
09/27	E-W	Asphalt	9,000	150	3,864/3,845
10/28	E-W	Turf	1,584	75	3,856/3,851
17/35	N-S	Asphalt	2,989	75	3,812/3,862

Source: FAA 5010, HLN

Additionally, the MTARNG's Army Aviation Support Facility (AASF) is located at HLN and supports aircraft including the UH-60 Blackhawk, the CH-47 Chinook, and the UH-72 Lakota.[2] In addition to these helicopters, C-12, C-17, C-130, and C-5 aircraft can and do operate at the airfield.[14]

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[10] FAA Form 5010, Airport Master Record, 8U9, FAA Site 12531.1*A. Accessed June 10, 2021.

[11] The National Plan of Integrated Airport Systems (NPIAS) identifies public-use airports that are important to the national air transportation system and illustrates the role that an airport plays within the regional and national contexts of the National Airspace System. Inclusion in the NPIAS makes an airport eligible for federal funding through the Airport Improvement Plan, based on metrics such as commercial service levels, based aircraft, and proximity to other facilities. FAA Order 5090.3C provides guidance, policies, and procedures for the formulation, maintenance, and publication of the NPIAS.

[12] FAA NPIAS, https://www.faa.gov/airports/planning_capacity/npias/current/media/NPIAS-2021-2025-Appendix-A.pdf. Accessed June 14, 2021.

[13] Helena Regional Airport Authority, Turf Landing Strip. https://helenaairport.com/turf-landing-strip/. Accessed June 14, 2021.

[14] Helena Regional Airport Authority, Military. https://helenaairport.com/military/. Accessed June 14, 2021.

The United States Forest Service's Fire Tanker Base is also located at Helena Regional and can handle all air tankers in operation, including the 747 Super Tanker and the DC-10 tanker.[15]

Table 2-4 summarizes the operations at HLN for calendar year 2019.

Table 2-4: Helena Regional Operations, 2019

Tower Category	Operations
Air Carrier	3,421
Air Taxi	4,728
Local GA	22,483
Itinerant GA	15,410
Military	5,306
Total	***51,348***

Source: FAA OPSNET, Airport Operations, HLN

A total of 237 aircraft are based at Helena Regional: 157 single engine aircraft, 27 multi-engine aircraft, 6 jets, 22 helicopters, 2 ultralight aircraft, and 23 military aircraft.[16] Helena Regional supports several types of operations, including scheduled domestic air carrier and cargo service; GA, including on-demand air taxi and privately owned/operated aircraft; and military flights. The Vetter Aviation flight school provides flight instruction[17] and the Sleeping Giant Flight Club operates out of Helena Regional. Sleeping Giant owns and bases five GA aircraft at the airport.[18]

Helena Regional has several IFPs: ten Standard Instrument Approach Procedures (SIAPs), three Standard Instrument Departures (SIDs), and an Obstacle Departure Procedure (ODP).[19] Of these procedures, two SIAPs, the Area Navigation procedures with Required Navigation Performance (RNAV RNP) Y and RNAV (RNP) Z procedures for Runway 27, would traverse the northwesternmost corner of the proposed Restricted Area. RNAV procedures allow aircraft to operate on any flight path within a network of ground-based or space-based navigational aids, rather than navigating specifically between land-based navigational aids.[20] RNAV not only allows for increased accuracy and precision in identifying aircraft position when compared to land-based navigational aids, but also allows the use of routes that use space-based navigation points in addition to land-based navigational aids, which provides greater flexibility and efficiency in flight routing.

2.3.1.4 Bozeman Yellowstone International Airport (BZN)

Bozeman Yellowstone International Airport (BZN), owned by the Gallatin Airport Authority, is a towered, public use airport. Its air traffic activity levels warrant an ATCT with associated Class D airspace. The airport contains 2,481 acres and is located about seven miles northwest of Bozeman, MT, at an elevation of 4,473 ft MSL. The NPIAS classifies Bozeman Yellowstone as a small hub, primary commercial

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[15] Helena Regional Airport Authority, USFS Tanker Base. https://helenaairport.com/usfs-tanker-base/. Accessed June 14, 2021.
[16] FAA Form 5010, Airport Master Record, HLN, FAA Site 12402.*A. Accessed June 9, 2021.
[17] https://www.flyvetter.com/. Accessed June 14, 2021.
[18] https://sleepinggiantflyingclub.weebly.com/. Accessed June 14, 2021.
[19] Departure Procedures begin at and are tied to specific runway ends on an airfield and may be either a Standard Instrument Departure (SID) or an Obstacle Departure Procedure (ODP). The former is developed primarily for standardization of traffic flows and other ATC purposes in addition to providing clearance from terrain and obstructions. The latter is developed only for obstruction avoidance.
[20] FAA Joint Order 7400.2N, Chapter 20 Area Navigation (RNAV) Routes. https://www.faa.gov/air_traffic/publications/atpubs/pham_html/chap20_section_5.html. Accessed July 12, 2021.

service airport.[17] The airport hosts domestic and international scheduled air carrier, cargo, GA, including on-demand air taxi and private aircraft, and military operations.

Table 2-5: BZN Runway Characteristics

Runway	Orientation	Surface	Length (ft)	Width (ft)	Elevation (ft MSL)
03/21	NE-SW	Asphalt	2,650	75	4,473/4,455
11/29	E-W	Asphalt	5,050	75	4,442/4,461
11G/29G	E-W	Grass	2,802	80	4,444/4,453
12/30	NW-SE	Asphalt	8,994	150	4,425/4,462

Source: FAA 5010, BZN

Bozeman Yellowstone has three paved runways and one grass runway, as presented in Table 2-5. The grass runway, Runway 11G/29G, is parallel to and 240 ft to the south of the paved runway, Runway 11/29. Use of this runway is limited to when it is dry. Runway 12 is the primary runway for both arrivals and departures when the windspeed is less than ten knots.[21] A total of 344 aircraft are based at the airport: 245 single engine aircraft, 27 multi-engine aircraft, 43 jets, 20 helicopters, and 9 gliders.[22] Table 2-6 summarizes the operations at Bozeman Yellowstone for calendar year 2018.

Table 2-6: BZN Operations, 2018

Tower Category	Operations
Air Carrier	13,408
Air Taxi	10,238
Local GA	32,563
Itinerant GA	33,855
Military	444
Total	***90,508***

Source: FAA OPSNET, Airport Operations, BZN

Bozeman Yellowstone is home to two Fixed-Base Operators (FBOs): Jet Aviation and Yellowstone Jetcenter. Both provide fuel, hangars, tie-downs and parking, aircraft maintenance, catering, and other aviation services to GA and air taxi operations. FBOs also provide terminal buildings for embarking and disembarking passengers for these kinds of operations, as opposed to airline terminal buildings.

Two companies provide helicopter tours, survey and construction helicopter services, and other commercial helicopter support; in addition, one of these companies provides helicopter flight training. [23,24] An additional two companies provide flight training, aircraft management, aircraft sales, and charter services, and a third company provides charters, flight training, firefighting, and survey services.[25]

Bozeman Yellowstone has several IFPs: six SIAPs, two SIDs, and an ODP. None of these would transit the proposed Restricted Area. However, a transition segment of the RNAV procedure to Runway 30 would be 3.6 NM from the southeastern corner of the proposed Restricted Area at its closest point. This procedure segment as charted by the FAA specifies that any aircraft flying these procedures remain

[21] A unit of measuring speed, a knot is 1 nautical per hour or 1.15 miles per hour.
[22] FAA Form 5010, Airport Master Record, BZN, FAA Site 12278.*A. Accessed June 11, 2021.
[23] https://centralcopters.com/
[24] https://rockymountainrotors.com/
[25] https://www.northernwingsaviation.com/

within 0.5 NM of the centerline, so this procedure would not be impacted by the proposed Restricted Area.[26]

2.3.2 Airspace

Existing Air Traffic Control Airspace designated in the vicinity of the LHTA includes:

- Surface Class D airspace volumes surrounding Helena Regional and Bozeman Yellowstone, which support runway separation services to all aircraft, in-flight separation services to IFR aircraft, and sequencing services to all aircraft,
- Surface Class E extensions that support in-flight separation services to IFR aircraft conducting instrument approaches, and
- Overlying Class E shelves for Helena Regional and Bozeman Yellowstone from 700 ft AGL, which similarly support aircraft conducting instrument approaches.

Additionally, two air traffic system (ATS) routes, specifically Victor airways, are located to the east of the proposed Restricted Area and two instrument approach procedures to Helena Regional have segments that traverse the northwestern corner of the proposed Restricted Area. Lastly, radar flight track data indicate that three common flight routes (see Figure 2-3) transit the proposed Restricted Area. These routes are not documented airways or procedures but were used frequently enough to warrant discussion in this analysis.

The following sections include brief descriptions of the relevant airspace and airway characteristics. Additional background information on the types of airspace classifications is provided in Appendix A.

2.3.2.1 Controlled Airspace

Controlled versus uncontrolled airspace refers to the different classifications of airspace: Classes A, B, C, D, and E are controlled airspace, while Class G is uncontrolled airspace. Each airspace class has specific requirements that operators must meet to use that airspace; similarly, air traffic controllers provide defined services to flights operating in each class under IFR and VFR. During defined meteorological conditions falling below certain cloud ceiling and visibility minima, flight in controlled airspace must occur under IFR. In some cases, multiple airspace classes may overlap; when this occurs, the requirements associated with the more restrictive and active airspace class apply.

Over the lower 48 states, airspace above 1,200 ft AGL is generally designated as controlled airspace; in addition, controlled airspace may extend to the ground over and in the vicinity of busier airports. Near LHTA, ground elevation is approximately between 3,500 and 5,500 ft MSL; therefore, 1,200 ft AGL and the lower floor of controlled airspace correspond to approximately 4,700 to 6,700 ft MSL.

Bozeman Yellowstone and Helena Regional both lie within Class D airspace, which extends from the surface to 2,500 ft AGL. Class D airports with SIAPs may include Class D or Class E extensions to the main Class D airspace cylinder volume to provide separation and protection for aircraft conducting this type of operation. Operations within this airspace are authorized with active radio communication with the tower or by prior authorization or arrangement.

[26] RNAV (RNP) RWY 30, Bozeman Yellowstone Intl. https://skyvector.com/files/tpp/2108/pdf/00059RR30.PDF. Accessed August 17, 2021.

Both Bozeman Yellowstone and Helena Regional have such Class E extensions. Helena Regional has two Class E surface extensions, each extending nine NM both to the east and west along the extended centerline of Runway 9/27. Overlying Class E airspace beginning at 700 ft AGL covers a circle with a radius of nine NM from the center of the airport, as well as an additional extension out to 18 NM to the northwest along the centerline of Runway 9/27. Bozeman Yellowstone has a Class E surface extension extending 15.5 NM northwest along the extended centerline of Runway 12/30 and a Class E surface extension extending seven NM to the southwest. Overlying Class E airspace beginning at 700 ft AGL covers a circle with radius 13 NM from the center of the airport, as well as an additional extension out to 25 NM to the northwest along the centerline of Runway 12/30. As with surface extensions, the purpose of the 700 ft AGL shelf is for the protection of aircraft conducting SIAPs under IFR. The airspace in the vicinity of LHTA is depicted in Figure 2-2.

2.3.2.2 Air Traffic System (ATS) Routes and Airways

Victor airways are a form of ATS routes defined by radials bearings emanating from Very high frequency Omnidirectional Range (VOR) radio navigational aids. These airways are part of the Low En Route airspace structure, extending from 1,200 ft AGL (approximately 4,700 to 6,700 ft MSL near LHTA) to 17,999 ft MSL. These routes and their associated controlled airspace, normally Class E, exist to protect aircraft operating under IFR during Instrument Meteorological Conditions (IMC) by providing defined routes that protect users from obstacles and terrain and by facilitating separation among IFR traffic. They may also be used by aircraft operating under VFR. The routes are surveyed and analyzed for presence of terrain and man-made obstacles with minimum altitudes established so that aircraft flying in IMC (e.g., in a cloud) are provided separation from terrain in addition to being separated from other aircraft. The width of Victor airways typically extends four NM to either side of the centerline, covering a lateral distance of eight NM in total.

Two such airways, V-365 and V-536, exist within the LHTA ROI. V-365 follows the 103-degree radial from the HLN VOR to the SWEDD intersection over Canyon Ferry Lake, then proceeds southeast over 8U8 along the 140-degree radial from the BZN VOR. V-536 follows the 169-degree radial from the Great Falls VOR to the SWEDD intersection over Canyon Ferry Lake, where it is coincident with V-365 to the BZN VOR. Between SWEDD and Toston, MT (11 miles south of 8U8), the centerline of V-365 and V-536 lies 3.25 NM from the closest point of the perimeter of the proposed LHTA Restricted Area. Since Victor airways extend four NM to either side of the centerline, the proposed Restricted Area would partially extend into V-365 and V-536, as shown in Figure 2-2. The segment in question has a minimum en route altitude of 10,000 ft MSL and a minimum obstruction clearance altitude of 9,400 ft MSL. These altitudes are applicable to IFR aircraft and provide separation from terrain and obstacles, as well as allowing adequate identification of airway intersections.

2.3.2.3 Standard Instrument Approach Procedures

Instrument flight procedures (IFPs) are charted and textual descriptions of a course or route to be flown, minimum and maximum altitudes to be observed, and similar procedural information that, when followed by pilots, facilitates separation of aircraft from other aircraft and from terrain while operating under IFR. One of these procedures is the SIAP, which is a defined procedure that allows an aircraft under IFR to transition from the en route flight environment of airways and air routes to the initiation of landing procedures in the terminal environment. Such a procedure consists of defined maneuvers with reference to flight instruments that provide protection from obstacles, providing safe and predictable transition to a point where the runway can be visually acquired, and landing can be completed.

Two SIAPs lie within the ROI for the proposed Restricted Area. These two procedures that potentially could be affected are the RNAV RNP Y and the RNAV RNP Z approaches to Runway 27 at HLN.

The RNAV RNP Z and Y for Runway 27 at HLN follow the same flight path, with the primary differences between the procedures being the required precision of the RNAV system and the final altitude at which the crew must decide whether to land or to forego the landing and fly the missed approach procedure. This flight path would pass over the northwesternmost corner of the proposed Restricted Area between 9,000 and 10,000 ft MSL, as shown in Figure 2-2.

2.3.2.4 Observed Flight Routes

In addition to the known air traffic routes, examination of the radar data showed three common flight routes crossing the proposed Restricted Area overlying the LHTA. One, transiting the LHTA from the southeast to the northwest, is primarily used by flights destined for Glacier Park International Airport, in Kalispell, MT. A second route transits the middle of the LHTA along the east-west axis and is used by aircraft overflying the area, as is a third route that crosses the northernmost tip of the LHTA along a northwest-southeast direction. These routes are not published but appear to be used with enough frequency to warrant discussion regarding the potential effects of the proposed Restricted Area; these routes are shown in Figure 2-3.

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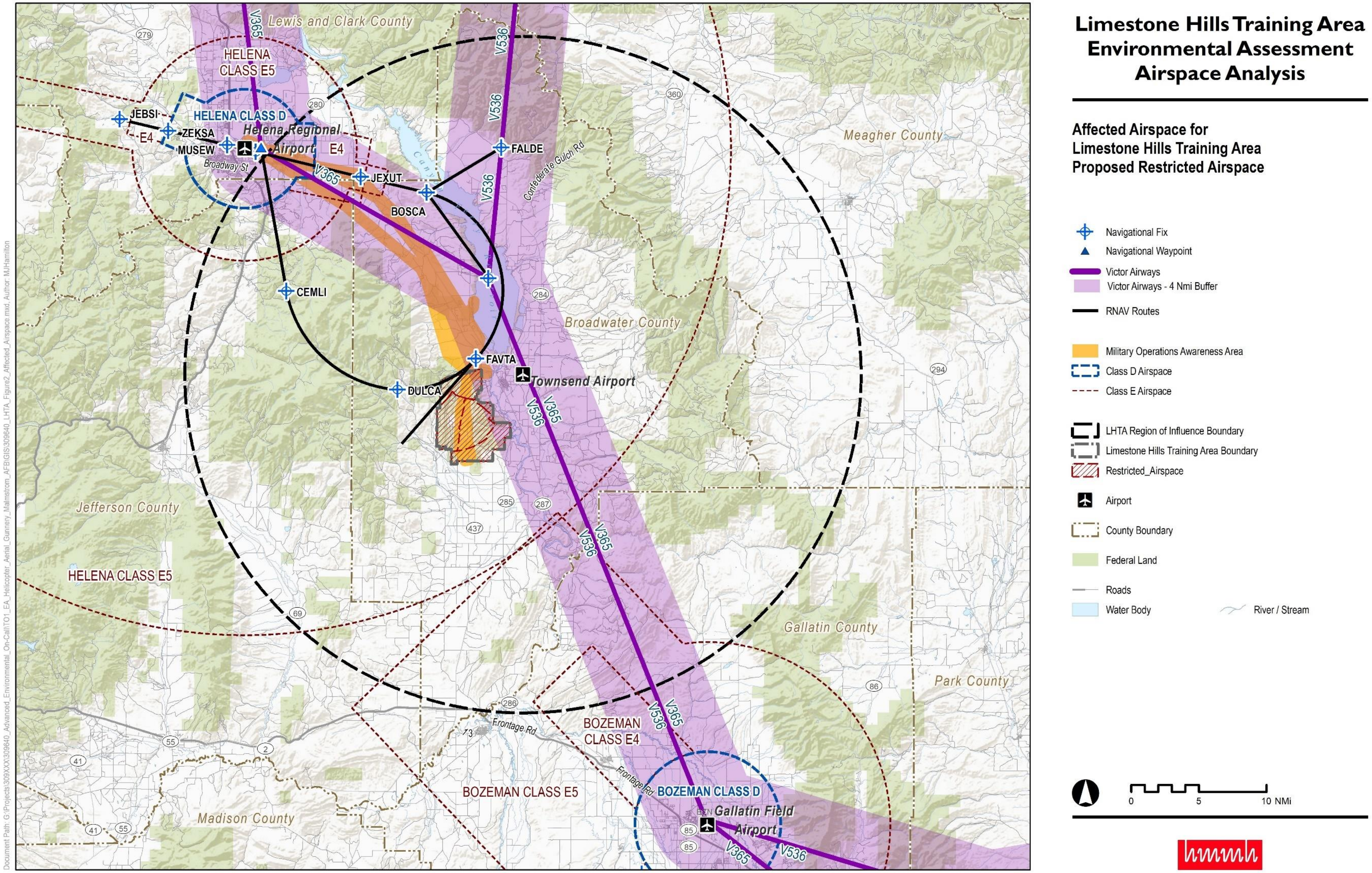

Figure 2-2: Airways and Instrument Flight Procedures Potentially Affected by the Proposed Restricted Area at LHTA

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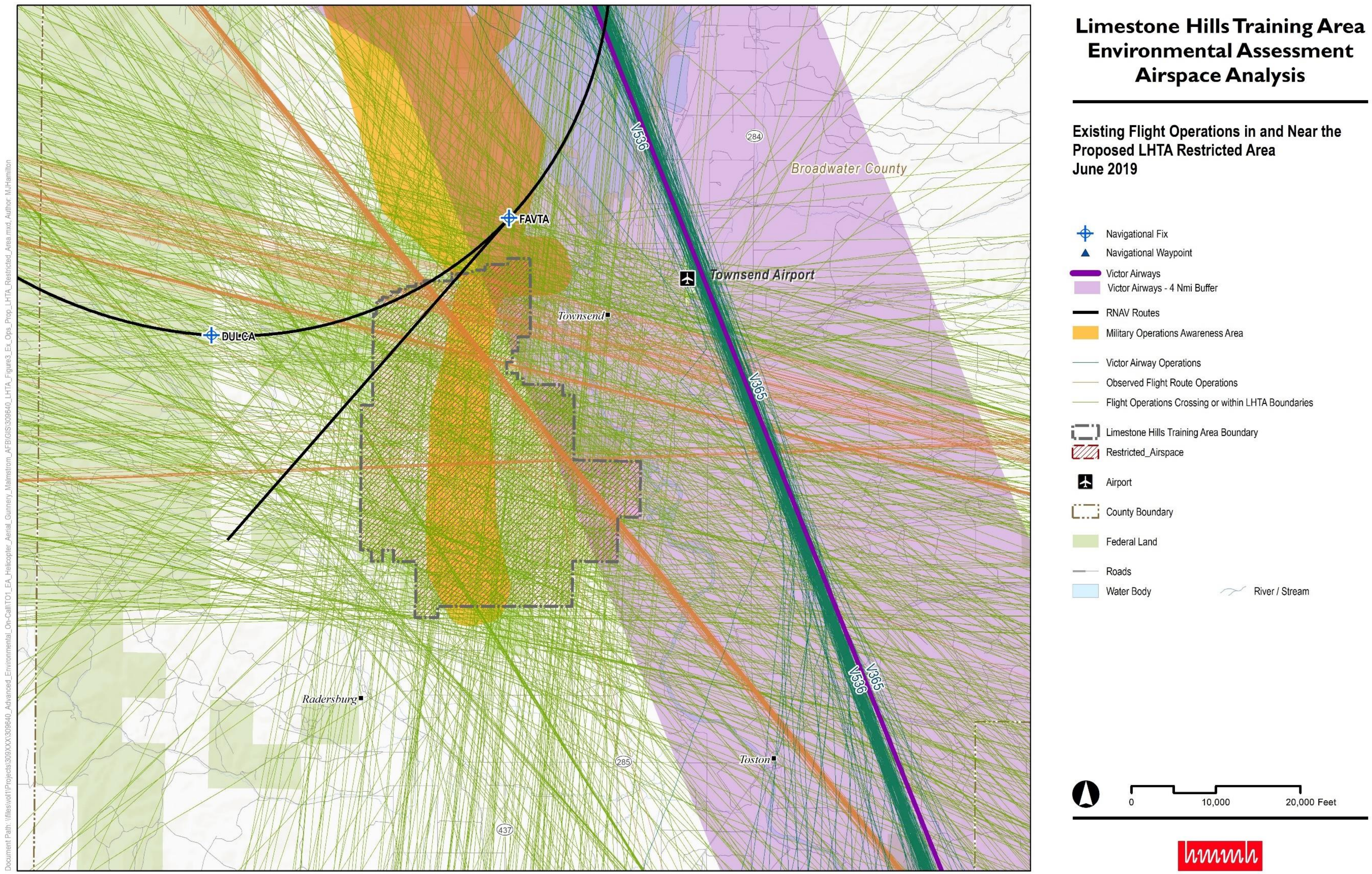

Figure 2-3: Existing Flight Operations in and near the Proposed LHTA Restricted Area, 2019

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2.4 Existing Civilian Flight Operations

A sample of radar data was obtained from the FAA's Performance Data Analysis and Reporting Systems (PDARS) for the month of June 2019, which is the busiest air traffic month for the region for the calendar year 2019.[27] This one month can be extrapolated to provide a worst-case estimate of air traffic for the calendar year 2019; this estimate represents an upper limit of air traffic that may be affected by the proposed Restricted Area at LHTA. The radar data were processed using HMMH's flight track visualization tools to identify operations on Victor airways, SIAPs, and informal flight tracks in the vicinity of the LHTA. Analysts then used database queries to identify and classify the operations occurring within the LHTA and on these procedures and airways.

This data sample includes 11,022 flight operations for June 2019 and captures operations for an area within a circle with radius of 30 NM from the Townsend Airport. This area includes traffic to and from Helena Regional and Bozeman Yellowstone that overflies the LHTA. PDARS data captures the same categories as described in Section 2.3.1.1; in some cases, operations were not classified specifically as Air Carrier, Air Taxi, Military, or GA; these aircraft are categorized as Other operations.

As shown in Table 2-7, most of these operations (70%) are military traffic. Air taxi operations form 13% of the data sample and 17% are GA operations. Air carrier operations represent 1% of the data sample. Scaling the data sample to represent a calendar year results in a worst-case scenario of 132,264 operations within 30 NM of the LHTA.

In the June 2019 data sample, 745 flight operations directly overfly the LHTA; only one (0.13%) of these operations occurred within the proposed Restricted Area airspace (surface to 9,000 ft MSL), while the remainder of the operations overflying LHTA occur above 9,000 ft MSL. These overflights included 169 operations seen on the observed flight routes discussed in Section 2.3.2.4.

Additionally, 180 operations occurred on the nearby Victor airways V-365 and V-536; four (2.3%) of these flights were at or below 9,000 ft in the vicinity of the proposed Restricted Area and could be affected by the proposed Restricted Area. The remaining operations occurred above 9,000 ft.

Table 2-7 provides operational counts for the June 2019 data sample and estimated counts for the 2019 calendar year for the entire sample area and for the proposed Restricted Area and nearby Victor airways. Figure 2-3 shows the flight operations that operate in and above the proposed Restricted Area and on the Victor airways.

[27] FAA Air Traffic Activity System, Airport Operations, HLN, BZN. Accessed February 10, 2021.

Table 2-7: Flight Operations Data for the LHTA Proposed Restricted Area

	June 2019 Data					CY 2019 Estimate				
	All Data	In Proposed RA (≤ 9,000 ft MSL)	Above Proposed RA		Victor Airways	All Data	In Proposed RA (≤ 9,000 ft MSL)	Above Proposed RA		Victor Airways
			Observed Flight Routes	Other				Observed Flight Routes	Other	
Air Carrier	126	0	126	314	19	1,512	0	1,512	3,768	228
Air Taxi	1,401	0	34	162	153	16,812	0	408	1,944	1,836
GA	1,846	1	9	86	5	22,152	12	108	1,032	48
Military	7,613	0	0	13	1	91,356	0	0	156	12
Other	36	0	0	0	0	432	0	0	0	0
Total	***11,022***	***2***	***169***	***575***	***180***	***132,264***	***12***	***2,028***	***6,900***	***2,160***

Source: FAA PDARS data, June 2019; HMMH

3 Environmental Consequences: Airspace

Impacts to airspace use and management would occur if the Proposed Action would:

- restrict movement of other air traffic in the vicinity of the proposed Restricted Area,
- create conflicts with regional air traffic control,
- change operations within already-designated airspace within the region,
- result in a need to designate new controlled airspace or reclassify airspace to a more restrictive classification, or
- result in a need to designate new, additional SUA.

3.1 Proposed Action: Establishment of Restricted Area R-4601

The Proposed Action would establish the Restricted Area R-4601 over the boundaries of the entirety of the LHTA, extending from the surface to 9,000 ft MSL to authorize helicopter aerial gunnery training. Its time of use would be from 7 a.m. to midnight, local time, and it would be controlled by the FAA, specifically the Salt Lake City Air Route Traffic Control Center. The MTARNG would be responsible for scheduling and reporting use of the proposed R-4601.[1] Currently, flight operations within the LHTA occur within a CFA, as described in Section 2.2; as noted there, a CFA is one of the least-restrictive forms of SUA and does not require non-participating aircraft to alter their flight paths. Restricted Areas, such as R-4601, are one of the more restricted types of SUAs; as such, the proposed R-4601 would, when active, entirely remove the defined airspace from use by non-participating aircraft.

The Proposed Action would retain the use of the CFA for ground-based gunnery and helicopter training without gunnery; it would be active for up to 140 days per year between 8 a.m. and 6 a.m., local time, when the proposed R-4601 is inactive.

3.1.1 Range Flight Operations

In 2019, MTARNG conducted approximately 833 flight hours in the LHTA, approximately 85% (708 hours) of which occurred during the day. These operations involved the CH-47, UH-60, and UH-72 helicopters.[28] These training operations are the baseline flight training operations conducted in the LHTA and are expected to continue within the LHTA CFA.[1] Table 3-1 summarizes the flight hours for 2019.

[28] *Montana Army National Guard Installation Compatible Use Zone Study*, January 2021

Table 3-1: LHTA Flight Hours, 2019

Aircraft Type	Day Flight Hours (0700 – 2200)	Night Flight Hours (2200 – 0700)
UH-72 Lakota	53	9
CH-47 Chinook	179	32
H-60 Blackhawk	476	84
Total	***708***	***125***

Source: MTARNG ICUZ, January 2021

Per the EA, the Proposed Action would not result in substantial changes to existing helicopter training sorties. However, an additional 200 sorties would result from aerial gunnery training, half of which would occur during daytime hours. According to the EA, up to 100 aerial gunnery training events would be scheduled annually by the 40 HS and by the MTARNG. These events would each last two to three hours and would be split between day and night events. Each event would include two helicopters, resulting in up to 200 sorties per year. These events would generally be scheduled between May and November to avoid disturbances to big game wildlife; if such training is required during the December through April timeframe, it would be restricted to January 16 through March 15.

The 40 HS would schedule up to 60 aerial gunnery training events annually. These events are estimated to be split evenly between night and day operations. Due to range scheduling limitations, more training operations may occur at night if needed, since the greater difficulty associated with nighttime operations can count towards daytime training requirements. The MTARNG estimates an additional 40 training events, also nominally evenly split between day and nighttime events, annually. These training events are expected to include two helicopters each, resulting in approximately 200 helicopter flights in the proposed Restricted Area per year.[1] Table 3-2 summarizes the projected additional annual flight sorties for the proposed Restricted Area.

Table 3-2: Projected Additional Aerial Gunnery Flight Use for Proposed LHTA Restricted Area

Airspace User	Range Use		Aircraft per Event	Total Annual Sorties	Total Estimated Annual Hours	Aircraft Types
	Days	Nights				
Malmstrom AFB 40 HS	30	30	2	120	120 – 180	UH-IN, MH-139
MTARNG	20	20	2	80	80 – 120	CH-47, UH-60
Total	***50***	***50***	***2***	***200***	***200 – 300***	

Source: EA, 2022

In general, helicopters transiting between the training areas and their based location would use predetermined paths and altitudes to reduce disturbances, per the EA for this action. Routes between Malmstrom AFB and LHTA would follow the “Malm” and “Helena” routes shown in Figure 3-1. Such altitudes are usually 500 ft AGL or higher. Over sensitive sites such as residential areas, they would fly at higher altitudes. When transiting between Helena Regional and the LHTA, flight paths would be expected to be contained within the existing Military Overflight Awareness Area (MOAA) that overlies the typical flight routes that currently exist between Helena Regional and the LHTA, though some variation may occur due to weather conditions.[1] This MOAA is shown in Figure 2-2.

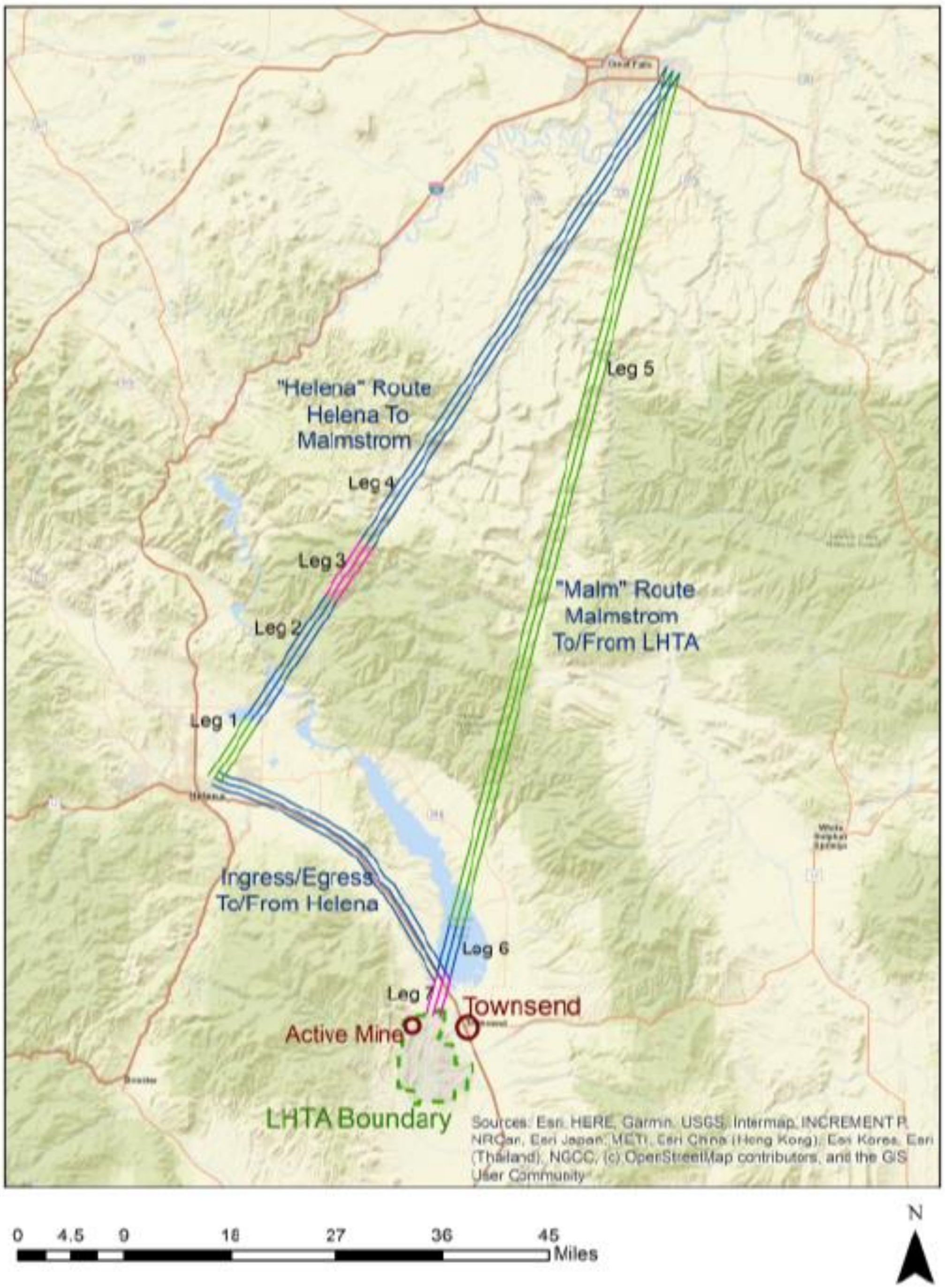

Figure 3-1: Proposed Ingress/Egress Routes for LHTA

Live fire exercises would be conducted between 50 to 1,500 ft AGL along the western edge of the LHTA. Pilots would fly range clearing maneuvers between 50 and 1,000 ft AGL prior to beginning aerial gunnery training. The actual gunnery operations would entail helicopters loitering between 50 and 100 ft AGL or 1,000 to 1,500 ft AGL, depending on the type of training, followed by live fire occurring with the helicopter at 300 ft AGL. All firing would occur to the east of the firing axis. Egress from the firing axis would occur at 50 to 100 ft AGL.

Additionally, integrated helicopter and convoy training would occur once annually. This training would include two helicopters and up to 15 ground vehicles, with the helicopters providing overwatch and communications with ground personnel throughout the exercise. One helicopter would fly between 50 and 100 ft AGL and the second would fly between 1,000 and 1,500 ft AGL. This training event would require approximately two hours at the LHTA.

3.1.2 Impacts of the Proposed Action

The Proposed Action would result in the establishment and ongoing, periodic activation of the proposed Restricted Area R-4601 over the LHTA. This analysis assumes that the entirety of R-4601 would be active for all aerial gunnery exercises, and that the airspace occupied by the proposed Restricted Area would be unavailable to civilian and other non-participating air traffic during these times. Additionally, the CFA could be active during its stated hours of operation when R-4601 is inactive.

As part of the Proposed Action, an additional 100 helicopter training events would occur each year, nominally between May and November, within the MOAA between Helena Regional and the LHTA and within the LHTA airspace. These sorties would support aerial gunnery training and would be in addition to 800 to 900 annual helicopter training sorties that already occur within the CFA at LHTA. These 100 events would require activation of R-4601 for 200 to 300 hours per year, with the existing helicopter training sorties continuing to be conducted in the CFA. Convoy exercises would be conducted in the CFA, requiring its activation for approximately two hours per year. Within the LHTA SUA, these activities would occur between the surface and 1,500 ft AGL, which would approximately fall between 5,000 and 7,000 ft MSL, depending on the exact geographical location of the activities.

As a result of these proposed training activities, the proposed Restricted Area would be active for 200 to 300 hours per year for approximately 140 days in May through November, removing the airspace between the surface and 9,000 ft MSL from use by non-participating aircraft during this time. Assuming either 8,760 hours in a year for a 24-hour day, or 5,840 hours a year for a 16-hour day since aircraft operations generally are sparse during overnight hours, this represents an annual utilization rate of 3% and 5%, respectively.

The Proposed Action includes the retention of the CFA, which currently is used approximately 140 days per year between May and November from 8 a.m. to 6 a.m., which allows for 3,060 hours per year. Up to 300 of these hours would be associated with the activation of R-4601. Thus, a worst-case scenario of 2,780 to 2,860 hours per year would be associated with the activation of the CFA, including the 835 hours of convoy and helicopter training discussed above. This would result in a utilization rate of 35% for a 24-hour day for the LHTA SUA. The annual utilization rate for the CFA would be up to 33% for a 24-hour day and up to 3% for R-4601. Table 3-3 summarizes the overall annual hourly activation estimates for the LHTA SUA.

Table 3-3: Total Training Hours in the LHTA SUA

Airspace User	Activity	Existing / New	Airspace	Sorties	Annual Hourly Estimate
Malmstrom AFB 40 HS	Aerial Gunnery	New	R-4601	120	120 – 180
MTARNG	Aerial Gunnery	New	R-4601	80	80 – 120
Malmstrom AFB 40 HS and 341 SFG	Integrated Convoy	New	CFA	1	2
MTARNG	Helicopter Training	Existing	CFA	833	833
Total Scheduled Operations				***1,034***	***1,035 – 1,135***
Maximum Estimated Hours for Non-Scheduled CFA Activation					*2,780 – 2,860*
Total					***3,060***

Source: *EA*, 2022

Per the criteria stated in Section 3, the Proposed Action would change operations within the already-designated airspace of the Victor airways by removing them from civilian (i.e., non-military) use during the periods when the proposed Restricted Area would be active. Similarly, operations that transit the proposed Restricted Area would be required to modify their flight paths during these active times since this airspace would also be unavailable to civilian operations. However, the impact would not be expected to be significant due to the small number of civilian operations that would be expected to transit both areas, the expected utilization rate of the proposed Restricted Area, and the planned maximum altitude of the proposed Restricted Area.

3.1.2.1 Impacts to Operations within the Proposed Restricted Area

As shown in Table 3-4, in June 2019, only one operation (0.13%) crossed through the proposed Restricted Area airspace, which extends from the surface to 9,000 ft MSL. Since the Restricted Area nominally would be active for seven months of the year (May through November), an estimated seven flight operations would have been expected to transit the proposed Restricted Area during this active period for 2019. For the full calendar year, 12 operations would have been expected to transit the proposed Restricted Area. All these operations would be GA operations.

An additional 5,208 flight operations would have been estimated to pass above the proposed Restricted Area during the same May through November period at altitudes above 9,000 ft MSL, or 8,940 operations for the full calendar year. Table 3-4 provides counts for actual and estimated operations through and above the proposed Restricted Area for the entirety of 2019 and for the assumed months of use for 2019.

Table 3-4: Flight Operations Counts in and above the LHTA Proposed Restricted Area

ft MSL	Actual Operations			Estimated Operations					
	June 2019			CY 2019			May – Nov 2019		
	In R-4601	Above R-4601	Total	In R-4601	Above R-4601	Total	In R-4601	Above R-4601	Total
Air Carrier	0	440	440	0	5,280	5,280	0	3,080	3,080
Air Taxi	0	196	196	0	2,352	2,352	0	1,372	1,372
GA	1	95	96	12	1,140	1,152	7	665	672
Military	0	13	13	0	156	156	0	91	91
Total	***1***	***744***	***745***	***12***	***8,940***	***8,940***	***7***	***5,208***	***5,215***

Figure 3-2 shows flight operations in the proposed Restricted Area in red, as well as operations above the Restricted Area, for the June 2019 data sample.

3.1.2.2 Impacts to Operations on Nearby Victor Airways

In June 2019, 177 operations were seen on V-365/V-536; 4 of these (2.3%) occurred at or below 9,000 ft MSL. For the seven months during which the proposed Restricted Area is expected to be active, this would translate to 1,224 operations on the Victor airways near LHTA. Twenty-eight operations would be expected to occur in the same altitude block as the proposed Restricted Area. Table 3-5 summarizes the actual and estimated operations on these airways near the LHTA for 2019.

Table 3-5: Flight Operations Counts on V-365/V-536 near the LHTA Proposed Restricted Area

ft MSL	Actual Operations			Estimated Operations					
	June 2019			CY 2019			May – Nov 2019		
	In R-4601	Above R-4601	Total	In R-4601	Above R-4601	Total	In R-4601	Above R-4601	Total
Air Carrier	0	19	19	0	228	228	0	133	133
Air Taxi	1	152	153	12	1,824	1,836	7	1,064	1,071
GA	3	1	4	36	12	48	21	7	28
Military	0	1	1	0	12	12	0	7	7
Total	***4***	***173***	***177***	***84***	***2,076***	***2,124***	***28***	***1,211***	***1,239***

Additionally, though Victor airways extend four NM laterally to either side of the centerline, the operations on V-365/V-536 are clustered within one NM of the centerline in the vicinity of the proposed Restricted Area. Though the operations would not pass through the proposed Restricted Area, the airways could be unavailable for civilian use when the proposed Restricted Area is active since part of the Restricted Area would fall within the lateral bounds of the airways. Figure 3-2 shows the flight operations on the Victor airway segment as well as the lateral bounds of the Victor airways and the proposed Restricted Area.

3.1.2.3 Impacts to Operations on RNAV Approaches

In June 2019, no operations were identified as using the RNAV RNP approaches to Runway 27 at HLN. If any operations were to use either of these approach procedures, they would pass through the

Restricted Area at approximately 9,000 ft MSL. Operations on the curved portion of the approaches would transit the northwesternmost corner at 9,000 ft MSL, while operations on the straight segment transiting the proposed Restricted Area would be at 9,100 ft MSL. Although the data sample used for this analysis shows no effects to flight operations for these procedures, given the proximity of the procedures to the proposed Restricted Area, the procedures, either in full or in part, could be unavailable to non-participating aircraft when the Restricted Area is active.

3.2 No Action Alternative

The No Action Alternative would enact no changes to the airspace over the LHTA and would not increase flight operations in the LHTA airspace beyond the existing flight training operations identified in Table 3-4. Since the proposed Restricted Area would not exist, no civilian or non-participating aircraft would be restricted from using the airspace overlying the LHTA. No changes from the current operational level would occur at LHTA. The existing 833 sorties at LHTA would be expected to continue but they would continue to operate within the uncharted CFA airspace that covers the majority of the LHTA. The operational requirements and restrictions for the CFA are summarized in Section 2.2.

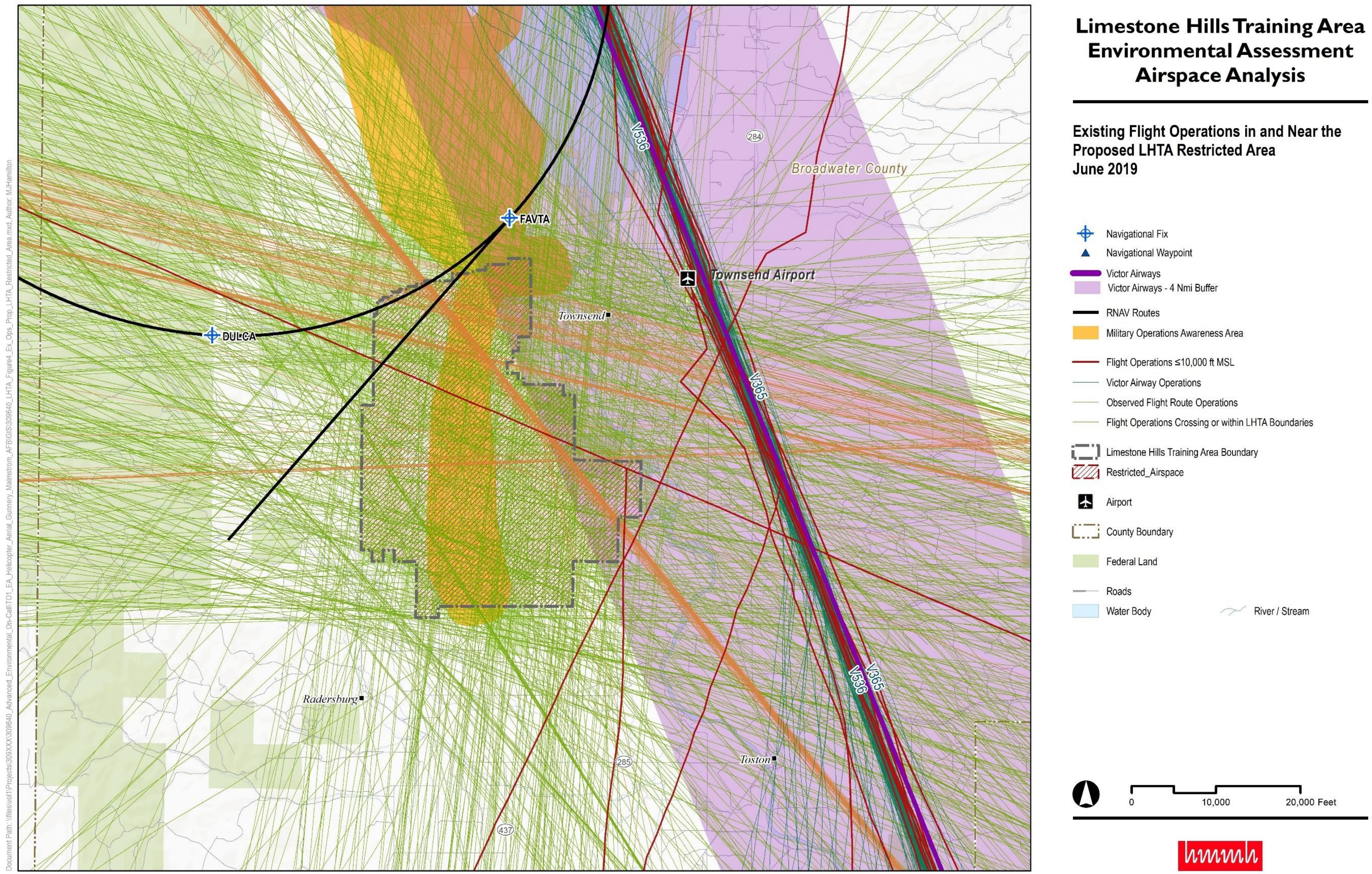

Figure 3-2: Flight Operations in the Proposed LHTA Restricted Area, 2019

4 Summary

This analysis of the aeronautical environment and available radar flight track data for the proposed R-4601 over the LHTA indicates that the activation of this proposed Restricted Area would not have a significant impact on civilian air traffic operations in the area. This proposed Restricted Area would be expected to be used primarily during the months of May through November. During this time in 2019, seven civilian flights would have been expected to transit the proposed Restricted Airspace, which covers the LHTA geographical footprint and extends from the surface to 9,000 ft MSL. Within the proposed Restricted Area, the proposed military flight operations would be expected to occur at or below altitudes of 1,500 ft AGL, or between 5,000 and 7,000 ft MSL. If the proposed Restricted Area would be used throughout the entire year, 12 civilian flights would have been expected to transit the airspace during 2019.

To the east of the proposed Restricted Area, 28 civilian flight operations would have been expected on the nearby Victor airways at or below 9,000 ft MSL during the May through November period, or 48 operations throughout the calendar year 2019. However, the proposed Restricted Airspace would overlap the westernmost portion of the Victor airways by approximately one NM. Therefore, during the times that the proposed R-4601 would be active, this segment of V-365 and V-536 could be unavailable to civilian operations. Although this segment of the airways does have a minimum en route altitude of 10,000 ft MSL and a minimum obstacle clearance altitude of 9,400 ft MSL, the June 2019 data sample showed aircraft operations at or below 9,000 ft MSL; these operations could be affected by the proposed Restricted Area.

The Proposed Action would result in the inability of civilian flights to use the airspace over the LHTA for an estimated 3,060 hours annually. Assuming 8,760 hours in a year, this represents an overall annual utilization rate of 35%, with the activation of the proposed R-4601 resulting in a 3% utilization annually. A total of 35 civilian operations would be expected to be affected for the May through November period, or 60 operations for the entirety of 2019; these flights represent 2.3% of the operations on the Victor airway segment and 0.1% of the operations transiting through the lateral bounds of the proposed Restricted Airspace. The remaining operations occur above 9,000 ft MSL.

Overall, the installation and activation of the proposed R-4601 at the LHTA would not be expected to adversely impact civil flight operations and airspace users in the region. Though the effects would be expected to be minimal, the Proposed Action would still restrict movement of other air traffic in the vicinity of the proposed Restricted Area and would change operations within already-designated airspace within the region by removing not only the airspace contained in the proposed R-4601 but also a segment of V-365 and V-536 from the public domain for up to 3% of the time. Civilian operations within the proposed R-4601 represent under one percent of flights in that area and would not be unduly affected. However, since the proposed Restricted Area would overlap the lateral bounds of V-365 and V-536, this segment of the airways would be unavailable for civilian use for an estimated 200 to 300 hours annually. Similarly, the RNAV (RNP) X and Y procedures to Runway 27 at HLN would be unavailable for the same amount of time. If this unavailability is not acceptable to the FAA or civilian users, the bounds of R-4601 may need to be redrawn or the Victor airways and RNAV (RNP) procedures relocated or modified, which would require an additional level of analysis and inquiry.

5 Acronyms

341 MW	341st Missile Wing
341 SFG	341st Security Forces Group
40 HS	AFGSC 40th Helicopter Squadron
8U8	Townsend Airport
8U9	Canyon Ferry Airport
AASF	Army Aviation Support Facility
AFB	Air Force Base
AFGSC	Air Force Global Strike Command
AGL	Above Ground Level
AIM	Aeronautical Information Manual
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
ATS	Air Traffic Systems
BZN	Bozeman Yellowstone International Airport
CFA	Controlled Firing Area
CFR	Code of Federal Regulations
DoD	Department of Defense
EA	Environmental Assessment
FAA	Federal Aviation Administration
FBO	Fixed Base Operator
ft	feet
GA	General Aviation
HLN	Helena Regional Airport
HMMH	Harris Miller Miller & Hanson Inc.
ICBM	Intercontinental Ballistic Missile
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
JO	Joint Order
LHTA	Limestone Hills Training Area
MOAA	Military Overflight Awareness Area
MSL	Mean Sea Level
MTARNG	Montana Army National Guard
NAS	National Airspace
NEPA	National Environmental Policy Act
NM	nautical mile
NPIAS	National Plan of Integrated Airport Systems
ODP	Obstacle Departure Procedure
PDARS	Performance Data Analysis and Reporting Systems
RNAV	Area Navigation
RNP	Required Navigational Performance
ROI	Region of Influence
SIAP	Standard Instrument Approach Procedure
SID	Standard Instrument Departure
SUA	Special Use Airspace

UTTR	Utah Test and Training Range
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VOR	Very high Omnidirectional Range

Appendix A Airspace and Air Traffic Control

The Federal Aviation Administration (FAA) both regulates aeronautical activities and operates the air traffic control (ATC) system in the United States. Its regulatory activities include licensing aircraft and their operators and providing and managing standards for operator training, aircraft operation, and equipment manufacturing. The FAA also creates, manages, and operates a system of navigational aids that allow aircraft operations to occur without visual reference to the ground.

The national ATC system is also operated by the FAA. This system and its operators provide guidance to aircraft operators by separating aircraft within defined sectors of airspace under the control of air traffic controllers. During all phases of flight, an aircraft operates within the National Airspace System (NAS) in controlled or uncontrolled airspace. When in controlled airspace, ATC provides safe and adequate separation between flight operations. ATC does not provide separation in uncontrolled airspace since it cannot provide separation if it is not able to control the airspace.

Separation services are provided via a combination of equipment, procedures, and personnel. Procedures are used to provide repeatable, standardized operations within the NAS. The equipment, including radio services, navigational aids, transponders, and surveillance equipment, enable the use of these procedures, and air traffic personnel provide directions and separation instructions to aircraft operators.

Prior to the advent of the ATC system, aircraft operators separated themselves from other aircraft and obstacles by visually identifying such impediments and altering course to avoid them. This method is known as see-and-avoid and forms the basis of Visual Flight Rules (VFR) separation. However, operations in clouds or in periods of limited visibility require Instrument Flight Rules (IFR) separation, which uses different separation techniques, relying on ATC personnel, procedures, and equipment to provide safe separation between aircraft. As operations increased, particularly around busy airports, IFR procedures were implemented to expedite operations and reduce workload for both operators and controllers when operating in controlled airspace. Operating under IFR requires an additional layer of training in addition to a basic pilot's or operator's license. Today, most commercial operations are IFR operations and are under the jurisdiction of ATC throughout all stages of flight.

A.1 Controlled Airspace

Controlled airspace refers to the different classifications of airspace (Classes A, B, C, D, and E) included as part of the NAS. Each airspace class has specific requirements that operators must meet to use that airspace; similarly, air traffic controllers provide defined services to flights operating in each class under instrument and visual meteorological conditions. In some cases, multiple airspace classes may overlap; when this occurs, the regulations associated with the most restrictive, currently active airspace class apply.

Class A airspace, in general, extends from 18,000 ft MSL to 60,000 ft MSL over the contiguous United States and over Alaska. All traffic operating in Class A airspace must operate under IFR unless otherwise authorized.

Class B airspace usually extends from the surface to 10,000 ft MSL in regions surrounding the busiest airports as defined by the number of IFR operations. It usually takes the form of three or more stacked layers constructed so that they contain all published instrument procedures for the associated airport. To operate in Class B airspace, aircraft must contact air traffic control and receive permission to operate in the area. Air traffic control provides separation services to all aircraft operating within the airspace.

Class C airspace generally encompasses airspace from the surface to 4,000 ft MSL in two layers, one extending to five nautical miles (NM) from the airport center and the second extending to ten NM from the center. It allows for air traffic control services to airports with a control tower and that receive radar approach services, as well as having a certain level of commercial enplanements. Military airports with periodic high-density operations may also be included in Class C airspace. Operating within Class C airspace requires the establishment and maintenance of two-way radio communications with the associated air traffic control facility before entering and throughout operation within the airspace.

Class D airspace covers the airspace from the surface to 2,500 ft MSL at airports with a control tower that are not otherwise covered by Class B or C airspace. Class D airports with standard instrument approach procedures (SIAPs) may include Class D or Class E extensions to the main Class D airspace to provide separation and protection for these operations. Operations within this airspace are authorized with active radio communication with the tower or by prior authorization or arrangement.

Class E airspace generally covers all other airspace that does not fall under Class A, B, C, or D as described above. It extends from the surface to an overlying or adjacent airspace or to a specified altitude; it does not exist above 18,000 ft MSL. As mentioned above, extensions designed to protect IAPs at Class D airports may be Class E airspace. Additionally, Federal airways, terminal and en route transition areas, en route domestic and offshore airspace below 18,000 ft MSL, and airspace from 14,500 ft MSL up to but not including 18,000 ft MSL are considered Class E airspace.

All airspace not designated as one of these five classes is considered Class G or uncontrolled airspace. This airspace extends from the surface to the overlying Class E airspace and air traffic control does not provide services in this airspace.

A.2 Special Use Airspace

Special Use Airspace, or SUA, designates airspace in which limitations may be imposed on non-participating aircraft or to which certain flight operations must be confined. SUA is defined for specific purposes and benefit specific users, usually military operators. These areas have designated altitudes and operating conditions during which they may be active, as well as specific controlling agencies. The typical types of SUAs are prohibited areas, restricted areas, warning areas, military operating areas, alert areas, and controlled firing areas. This section discusses restricted areas and controlled firing areas (CFA) as these are the relevant types of SUA for this EA.

Restricted areas (R-XXXX) designate airspace where operations are likely hazardous to non-participating aircraft and fall under the jurisdiction of the U.S. government. In these areas, non-participating aircraft are not strictly prohibited but are subject to restrictions on operations. However, restricted areas do remove airspace from the use of all users and thus require a public rulemaking process to establish one.

Hazards associated with restricted areas often are not visible to operators, though IFR operations may be allowed to transit the area under air traffic control and on proper routings. If the restricted area is inactive and is not under the controlling agency's control (i.e., has been released to the FAA), specific clearance to transit the area is not required. However, if the area is active and under the controlling agency's use, ATC will issue clearances to ensure aircraft avoid the airspace.

CFAs are intended to contain activities that, if not isolated and conducted in a controlled environment, could be hazardous to non-participating aircraft. Conducting these types of activities in a CFA allows for immediate suspension of the activities if a non-participating aircraft approaches the area. Non-participating aircraft are not required to avoid the CFA, nor are any communications and separation requirements imposed. Upon approach of a non-participating aircraft, CFA users are responsible for terminating the hazardous activities.

A.3 Air Traffic System Routes (Airways)

En route operations take place between the conclusion of a departure procedure to the beginning of an arrival procedure. Procedures during this phase of flight fall under flight standards set out under FAA Order 8260.3 United States Standard for Terminal Instrument Procedures (TERPS) and other similar publications. Under IFR, defined routes or airways provide standardized paths, altitudes, speeds, and other requirements for flights operating on these routes. In the NAS, three types of airways exist: Victor airways, jet routes, and high-altitude routes. As jet routes and high-altitude routes exist above 18,000 ft MSL and do not apply to this action, they are not discussed here.

Victor airways (V-XXX) provide low-altitude navigation between 1,200 ft AGL (approximately 4,700 to 6,700 ft MSL in the vicinity of the LHTA) up to but not including 18,000 ft MSL and usually extend four NM to either side of the centerline. The centerline is defined by a straight-line path between two navigational aids.

A.4 Instrument Flight Procedures

Instrument Flight Procedures (IFPs) is a collective term that includes three distinct kinds of procedures:

- Departure Procedures, including Standard Instrument Departures (SIDs) and Obstacle Departure Procedures (ODPs), developed to facilitate efficient air traffic management and obstacle and terrain avoidance on departure,
- Standard Arrival Routes (STARs), developed to facilitate air traffic management of arrival traffic in a terminal area, and
- Standard Instrument Approach Procedures (SIAPs), developed to enable safe descent of aircraft through inclement weather (limited visibility and clouds) to the runway environment.

IFPs are charted and textual descriptions of a course or route to be flown, minimum and maximum altitudes to be observed, and similar procedural information that, when followed by pilots, facilitates separation of aircraft from other aircraft and from terrain while operating under IFR.

A.4.1 Standard Instrument Departure Procedures

Instrument departure procedures are IFR procedures that provide obstacle clearance when leaving the terminal area on the way to join an en route structure such as an airway. Departure procedures can either be an Obstacle Departure Procedure (ODP) or a Standard Instrument Departure procedure (SID). An ODP provides obstacle clearance during departures. When one exists, it is the default IFR departure procedure for that runway. This ensures that pilots are aware of the obstacle(s) and is used if air traffic control does not provide vectors or assign a SID.

A SID is requested and assigned by air traffic controllers and is often used at airports operating within busy terminal areas. The intent of these procedures is to increase efficiency and capacity of the airspace by reducing pilot and controller workloads through common procedures, simplified clearances, and reduced communication needs. The SID allows a flight to depart a terminal area in the desired direction of flight via a defined route, using defined speeds, altitudes, and distances. These defined characteristics allow air traffic control to integrate the departing aircraft into the en route flows more effectively and efficiently.

A.4.2 Standard Arrival Procedures

A Standard Terminal Arrival Route (STAR) is used by IFR aircraft arriving at a certain airport and specifies the route, altitude, and speed the aircraft will fly during the arrival phase of flight. As with SIDs, the STAR and other arrival procedures simplify communications and understanding between the pilot and air traffic control by providing a transition between the en route and the final, or approach, phase of IFR flight. It places flights on a known, consistent path, allowing air traffic control to sequence aircraft more easily and efficiently for arrival.

A.4.3 Standard Instrument Approach Procedures

A standard instrument approach procedure (SIAP) is a defined procedure that allows an aircraft under IFR to transition from the en route flight environment of airways and air routes to the initiation of landing procedures in the terminal environment. Such a procedure consists of defined maneuvers with reference to flight instruments that provide protection from obstacles, providing safe and predictable transition to a point where the runway can be visually acquired, and landing can be completed.

A.5 References

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1.3 NOISE MODEL OPERATIONAL DATA DOCUMENTATION

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FINAL DRAFT Noise Model Operational Data Documentation for Limestone Hills Training Area, MT

Environmental Assessment for Establishment and Operation of Helicopter Aerial Gunnery Range and Establishment of Restricted Airspace

HMMH Report No. 309640.001
September 2022

Prepared for:

AEM Group Environmental Services
44339 Plymouth Oaks Blvd
Plymouth, MI 48170

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Executive Summary

This Noise Model Operational Data Documentation (NMODD) Technical Study is in support of an Environmental Assessment (EA), pursuant to the National Environmental Policy Act (NEPA), for the establishment and operation of an aerial gunnery range at Limestone Hills Training Area (LHTA), Montana (MT) and establishment of special use airspace Restricted Area R-4601 (USACE 2022). The LHTA is operated by the Montana Army National Guard (MTARNG) for ground-based gunnery, air drop, and helicopter training without aerial gunnery in accordance with a Letter of Authorization from the Federal Aviation Administration (FAA) granting the using agency (MTARNG) the authority to operate a Controlled Firing Area (CFA) at the LHTA. A CFA does not authorize aerial gunnery training. The Air Force Global Strike Command (AFGSC) proposes to establish the AGR at the LHTA to fulfill training requirements of the 40th Helicopter Squadron (40 HS) and 341 Missile Wing Security Forces Group (341 MW SFG), which are based at the Malmstrom Air Force Base (AFB) in Cascade County, MT. To support the AFGSC's Proposed Action, MTARNG seeks FAA approval to establish a joint-use special use airspace (SUA) Restricted Area, called R-4601, to permit the proposed aerial gunnery training at the LHTA. The proposed establishment of the SUA at the LHTA also would enable MTARNG helicopter aircrews to satisfy their aerial gunnery training requirements at the LTHA.

Operational Scenarios Modeled

This NMODD considers three scenarios for the EA:

- Baseline/No Action Alternative (referred to as simply "Baseline" for brevity). This is existing use of the LHTA by the MTARNG.
- Proposed Action/Alternative 1 (referred to as "Alt 1"). The Proposed Action considers use of the Aerial Gunnery Training area by the MTARNG and the 40 HS, with convoy training by the 40 HS and 341 MW SFG along Blue Route Road.
- Alternative 2 ("Alt 2") considers the same Aerial Gunnery Training as Alt 1, except convoy training is proposed for the 40 HS along Old Woman's Grave Road, instead of Blue Route Road.

Modeling was accomplished with the Military Operating Area and Range Noise Model (MRNMAP) and NMAP computer programs of the Department of Defense's NOISEMAP suite of programs. MRNMAP was used for airspace flight operations to compute Onset-rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}) and Day-Night Average Sound Level (DNL). NMAP, the legacy core program of the suite, was used for modeling static operations associated with operations prior to gunnery range training to compute DNL. As NMAP cannot compute L_{dnmr}, NMAP's DNL results were added to MRNMAP's L_{dnmr} results to compute total L_{dnmr} for the Proposed Action scenarios. L_{dnmr} and DNL contours of 65, 70 and 75 decibels (dB) are shown.

Interviews Conducted

Information used for the noise modeling was obtained from the points of contact for the MTARNG and 40 HS listed in the table below.

Unit	Name	Email
40HS	Colonel Kurt Skarsted (USAF AFGSC)	kurt.r.skarstedt.mil@mail.smil.mil
40HS	Major Tristan Fitzgerald (USAF AFGSC)	tristan.fitzgerald.1@us.af.mil
40HS	Chris Smith (CTR USAF AFGSC)	christopher.smith.362.ctr@us.af.mil
MTARNG	Lt Kevin Stein (1LT USARMY NG MTARNG)	kevin.a.stein3.mil@mail.mil
MTARNG	Rebekah Myers (NFG NG MTARNG)	rebekah.l.myers2.nfg@mail.mil
MTARNG	Jay Lovelady (CW2 USARMY NG MTARNG)	martin.j.lovelady.mil@mail.mil
MTARNG	Kyle Herman (CW3 USARMY NG MTARNG)	kyle.p.herman2.mil@mail.mil

Results Summary

The 65 L_{dnmr} (or DNL) contour would remain almost entirely within LHTA's boundary for Alt 1 or Alt 2, though it would exceed the boundary by up to 430 feet in some areas. No residential areas would be affected.

Contents

Figures

Tables

1 Modeling Overview

In support of the Environmental Assessment (EA), pursuant to the National Environmental Policy Act (NEPA), for the establishment of an aerial gunnery range at Limestone Hills Training Area (LHTA), the purpose of this Noise Model Operational Data Documentation (NMODD) is to document the project's noise modeling and summarize environmental impacts, if any. The LHTA is approximately 30 miles south southeast of Helena, MT.

Section 1.1 describes the noise metric and levels of significance. Section 1.2 describes the computer noise model(s) used for the project.

1.1 Noise Metrics and Levels of Significance

Per Department of Defense (DoD) guidelines (AFM 32-7067; AFI 32-7070; AFI 32-1015), the primary noise metric used herein is the Onset-rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}), a variant of Day-Night Average Sound Level (DNL) metric, describing the noise environment for aircraft operations occurring in Special Use Airspace. The second metric was the DNL, due to the Federal Aviation Administration (FAA) being a cooperating agency for this EA. Efforts to provide a national uniform standard for noise assessment have resulted in the U.S. Environmental Protection Agency adopting DNL as the standard noise descriptor for use in land use planning.

The DNL metric can be used to describe different types of sounds. Because human hearing picks up noise energy in certain frequency ranges better than others, sound energy in certain frequency bands is emphasized when measuring noise to best predict effects. For aircraft noise and most other types of sound, the frequencies most easily audible to humans are emphasized using a function known as A-weighting. Because A-weighting is prevalent, sounds can be assumed to be A-weighted unless otherwise specified. The DNL metric uses A-weighting.

The Air Force uses the DNL descriptor in assessing the amount of aircraft noise exposure and as a metric for community response to the various levels of exposure. The DNL values most used for planning purposes are 65, 70, 75, and 80 decibels (dB). Land use guidelines are based on the compatibility of various land uses with these noise exposure levels. It is generally recognized that a noise environment descriptor should consider, in addition to the annoyance of a single event, the effect of repetition of such events and the time of day in which these events occur. DNL begins with a single-event descriptor and adds corrections for those effects. DNL defines daytime as 0700 to 2200 hours, and nighttime as 2200 to 0700 hours, local time. Since the primary development concern is residential, nighttime events are considered more annoying than daytime events and are weighted by a factor of 10. As diagrammed in Figure 1-1, DNL values are computed from the single-event noise descriptor, plus corrections for number of flights and time of day.

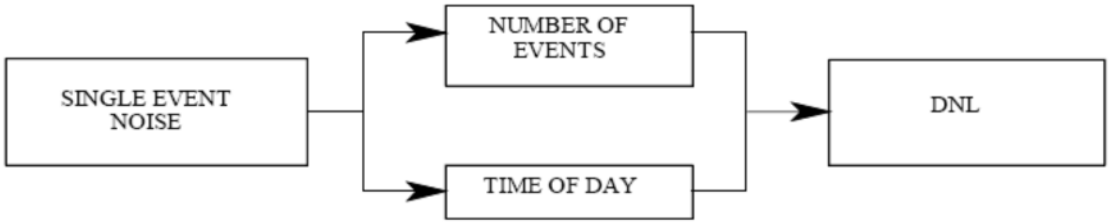

Figure 1-1 A-weighted Day-Night Average Sound Level

L_{dnmr} differs from DNL in two (2) ways:

1) L_{dnmr} includes a startle correction for high-speed low-altitude flight (the 'r' in L_{dnmr}), whereas DNL does not.

2) DNL is typically based on *annual* average daily operations. L_{dnmr} 's average daily operations are based on the busiest month, i.e., the month of the year with the most operations (the 'm' in L_{dnmr}), to avoid discounting periods of low or non-existent activity in annual averaging. For this EA, FAA allowed the use of the busiest month's average daily operations for the computation of DNL, in lieu of the annual average daily operations.

As part of the extensive data collection process, detailed information is gathered on the type of aircraft, time of day, and the number of sorties for each training mission. This information is used in conjunction with the single-event noise descriptor to produce DNL values from each aircraft type. These values are combined on an energy summation basis to provide total L_{dnmr} or DNL values, when appropriate, on a grid of ground-based points in the project's study area. Equal value points are connected to form the contour lines.

1.2 Computer Model

Data describing aircraft operational usage including the number and duration of runs by type of aircraft, altitude distributions, engine settings, airspeed and activity time is assembled. This data is combined with flight area data, both tracks with a centerline and dispersal width and with regions flown in irregular patterns. Trained personnel process the data for input into the computer programs. Aircraft operations parameters are reviewed for accuracy by operational unit points of contact prior to running the noise model.

Table 1-1 lists the computerized noise models used for this NMODD and pertinent modeling parameters discussed herein. The models used are described briefly below.

NOISEMAP is a suite of computer programs and components developed by the US Department of Defense to predict noise exposure near an airfield due to aircraft flight, maintenance, and ground run-up operations. The components of NOISEMAP are as follows:

- BaseOps is the input module for NOISEMAP and is used to enter detailed aircraft flight track and profile and ground maintenance operational data.
- NOISEFILE is a comprehensive database of measured military and civil aircraft noise data. Aircraft operational information is matched with the noise measurements in NOISEFILE after the

detailed aircraft flight and ground maintenance operational data have been entered into BaseOps.

- NMAP and MRNMAP are the core computational modules in NOISEMAP. NMAP and MRNMAP take BaseOps input and uses the NOISEFILE database to calculate the noise levels caused by aircraft events at specified grid points in the airbase vicinity. The output of NMAP is a series of georeferenced data points, specific grid point locations, and corresponding noise levels.

- NMPlot is the program for viewing and editing the sets of georeferenced data points. NMPlot plots the NMAP output from the noise contour grid and can export the noise contours as files used in mapping programs for analyzing the noise impacts.

For the purposes of this project, MRNMAP was used for airspace flight operations. NMAP was used to model static operations in the LHTA associated with some of the airspace flight operations. Noise exposure was computed in terms of L_{dnmr} and DNL for average daily operations during the busiest month. L_{dnmr} and DNL contours of 65, 70 and 75 decibels (dB) will be shown.

Table 1-1 Noise Models and Parameters

Aircraft Noise Models		
Software	Analysis	Version
NMAP	Runup Operations (HARM pad)	7.3 (2-28-2017)
MRNMAP	Distributed airspace operations	3.0 (10-22-2020)
Modeling Parameters		
Modeling Parameter		Description
Receiver Grid Spacing		500 ft in x and y
Flying Days per Month (MRNMAP)		15 (40 HS) / 20 (MTARNG)
Magnetic Declination (see Section 5)		0 deg East
Reference Point Elevation		4,700 ft MSL
Topography (runups only)		
Elevation and Impedance Grid Spacing		100 ft in x and y
Flow Resistivity of Land Areas (soft)		225 kPa-s/m^2
Weather (modeled conditions)		
Temperature (deg F)	Relative Humidity (%)	Pressure (inHg)
61.8	45	25.6

As listed in Table 1-2, the study considers five unique airframes. The CH-47D and UH-60A were the only CH-47 and UH-60 available in both programs' databases, respectively. MRNMAP does not contain reference acoustic data for the UH-72 helicopter. The UH-72 was modeled with MRNMAP's DAUPHIN SA365N. NMAP does not contain reference acoustic data for the UH-1N. The UH-1N was modeled with NMAP's UH-1M. Neither MRNMAP nor NMAP contain reference acoustic data for the MH-139 helicopter. The MH-139 helicopter was modeled with MRNMAP/NMAP's UH60A, which is consistent with recent/previous environmental modeling for Malmstrom Air Force Base (AFB) (Czech and Rancourt 2019).

Table 1-2 Aircraft Substitutions

Aircraft Type Needed	Modeled in MRNMAP with	Modeled in NMAP with
CH-47 Chinook	CH47D	CH47D
UH-60 Blackhawk	UH60A	UH60A
UH-72 Lakota	DAUPHIN SA365N	n/a
UH-1N Huey	UH-1N	UH-1M
MH-139 Grey Wolf	UH60A	UH60A

The suite's NMPlot program was used to (energy) sum grids of DNL from NMAP and L_{dnmr} from MRNMAP (for the Proposed Action scenarios). Due to a bug in MRNMAP, each route could be run with a single flight profile. Due to this issue, each aircraft activity (CH-47 Air Training, CH-47 Aerial Gunnery, UH-1N Convoy Training… etc.) to be run as a separate case and the results were combined using the same grid summation process.

The airfield modeling uses a local coordinate system with the origin near geographic center of the LHTA, which has coordinates of 46.281656° North / 111.57739° West and an elevation of 4,700 feet above Mean Sea Level (MSL). The magnetic declination was not relevant to this modeling (see Section 5) and was set to 0 degrees. All maps in this report depict a north arrow pointing to true north.

For NMAP modeling, the land of the study area was assigned as being an acoustically "soft" surface, with a flow resistivity of 225 kPa-s/m^2. There were no bodies of water modeled.

Local weather conditions (e.g., temperature, relative humidity, and air pressure) influence how quickly sound is absorbed by the atmosphere as it travels outward from its source. This report utilized detailed daily average weather conditions averaged for each month. June was determined by the DoD to be the busiest month and the average weather data from 1998 to 2020 is shown in Table 1-3. The average temperature and pressure during the month of June for the 23 years of data was used as the modeling condition shown in Table 1-1 above. Humidity data was derived from graphical information of humidity at the LHTA over 2020 (USAF 2021).

Table 1-3 Average Daily Weather Data

Source: USAF 2021

June of Year	Temperature	Pressure (in Hg)
2020	61.8	25.99
2019	63.0	26.03
2018	61.9	26.00
2017	64.2	26.02
2016	66.5	26.07
2015	69.6	26.04
2014 not included in dataset		
2013	61.3	26.02
2012	62.8	25.94
2011	58.1	25.95
2010	59.0	26.02
2009	60.3	25.99
2008	61.8	26.01
2007	65.6	25.99
2006	65.0	26.08
2005	62.4	25.96
2004	51.8	26.04
2003	63.2	25.97
2002	62.8	25.98
2001	64.1	25.97
2000	N/A	25.96
1999	58.8	25.98
1998	55.1	25.99
1997	60.0	25.96

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2 Flight Operations

Section 2.1 provides a summary of the modeled flight operations. Section 2.2 describes the flight operations for the Baseline/No Action scenario. Sections 2.3 and 2.4 describe the flight operations for the Montana Army National Guard (MTARNG)and the 40th Helicopter Squadron (40 HS), respectively.

2.1 Summary

This NMODD considers three scenarios for the EA:

1. Baseline/No Action Alternative (referred to as simply "Baseline" for brevity). This is existing use of the LHTA by the MTARNG.
2. Proposed Action/Alternative 1 (referred to as "Alt 1"). The Proposed Action considers use of the Aerial Gunnery Training area by the MTARNG and the 40 HS, with convoy training by the 40 HS along Blue Route Road.
3. Alternative 2 ("Alt 2") considers the same Aerial Gunnery Training as Alt 1, but convoy training is proposed for the 40 HS along Old Woman's Grave Road, instead of Blue Route Road.

Table 2-1 summarizes the flight sorties at the LHTA for the three modeled scenarios during their busiest month (June). To discount periods of low or non-existent activity in annual averaging, for this EA, FAA allowed the use of the busiest month's average daily operations for the computation of DNL, in lieu of the annual average daily operations The MTARNG currently conducts 228 sorties during the busiest month, with approximately 25 percent during nighttime. The MTARNG's tempo would increase to 263 sorties during their busiest month for the Proposed Action, with a 1 percent increase in their overall nighttime percentage. The increase in sorties by the MTARNG for Alts 1 and 2 would only be due to MTARNG's proposed Aerial Gunnery training. The 40 HS proposes 58 monthly sorties for Aerial Gunnery training at LHTA, with nearly half during nighttime.

Table 2-1 Summary of Busiest Month Flight Sorties, by Scenario

Squadron/ Unit	Representing Aircraft Type	Existing/Baseline/No Action			Proposed Action (Alt 1 and Alt 2)		
		Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total
MTARNG	CH-47	66.30	22.70	89.00	76.10	26.90	103.00
	UH-60	84.15	27.85	112.00	98.85	34.15	133.00
	UH-72	20.40	6.60	27.00	20.40	6.60	27.00
40 HS	UH-1N	-	-	-	15.00	14.00	29.00
	MH-139	-	-	-	15.00	14.00	29.00
MTARNG		170.85	57.15	228.00	195.35	67.65	263.00
40 HS		-	-	-	30.00	28.00	58.00
Total		170.85	57.15	228.00	225.35	95.65	321.00

2.2 Baseline/No Action

Table 2-2 shows the distribution of busiest month flight sorties by MTARNG training activity. For Baseline, the MTARNG's Readiness Level Progression accounts for approximately 40 percent of their 228 total sorties. The other training activities, except what is referred to by the pilots as the Mission Equipment Package, each contribute approximately nine percent of the total sorties. Mission Equipment Package is the least frequent with two percent of the total sorties. The day/night split for all MTARNG's activities, except Night Vision Goggle (NVG) training, is 85 percent during daytime and 15 percent during nighttime. MTARNG NVG training are 100 percent during nighttime. Every Baseline sortie in Table 2-2 includes the following operations:

- Range Ingress (from Helena)
- Range Egress (to Helena)

2.3 MTARNG Component of Proposed Action

All MTARNG's operations from the Baseline would remain the same for the Proposed Action, i.e., no change in tempo or day/night split. In addition, for the Proposed Action, MTARNG would also conduct aerial gunnery training. The day/night split for MTARNG's proposed Aerial Gunnery training would be 70 percent daytime and 30 percent nighttime. Each MTARNG Aerial Gunnery sortie listed in Table 2-2 would consist of the following operations:

- Range Ingress (from Helena)
- Range Clearing Maneuver
- Helicopter Armament Refueling and Maintenance (HARM) Pad Ingress/Egress and Static operations
- Pre-fire crew briefings and Mission setup in the Loiter Zones
- Target Area Gunnery Fire
- Transitions between the North and South Loiter Zones
- Fire Clearing Scan
- Range Egress (to Helena)

Table 2-2 MTARNG Flight Sorties for Busiest Month

Source: MTARNG and 40 HS 2021

Training Activity	Airframe	Baseline/No Action			Proposed Action		
		Day (0700-2200)	Night (2200-0700)	Total	Day (0700-2200)	Night (2200-0700)	Total
Mission Equipment Package	CH-47	-	-	-	-	-	-
	UH-60	-	-	-	-	-	-
	UH-72	4.25	0.75	5.00	4.25	0.75	5.00
Forward Arming and Refueling Points	CH-47	5.95	1.05	7.00	5.95	1.05	7.00
	UH-60	7.65	1.35	9.00	7.65	1.35	9.00
	UH-72	1.70	0.30	2.00	1.70	0.30	2.00
Hoist	CH-47	5.95	1.05	7.00	5.95	1.05	7.00
	UH-60	7.65	1.35	9.00	7.65	1.35	9.00
	UH-72	1.70	0.30	2.00	1.70	0.30	2.00
High Altitude Landings	CH-47	5.95	1.05	7.00	5.95	1.05	7.00
	UH-60	7.65	1.35	9.00	7.65	1.35	9.00
	UH-72	1.70	0.30	2.00	1.70	0.30	2.00
Personnel Recovery	CH-47	5.95	1.05	7.00	5.95	1.05	7.00
	UH-60	7.65	1.35	9.00	7.65	1.35	9.00
	UH-72	1.70	0.30	2.00	1.70	0.30	2.00
Slingload	CH-47	5.95	1.05	7.00	5.95	1.05	7.00
	UH-60	7.65	1.35	9.00	7.65	1.35	9.00
	UH-72	-	-	-	-	-	-
Mountain Flying Techniques	CH-47	5.95	1.05	7.00	5.95	1.05	7.00
	UH-60	7.65	1.35	9.00	7.65	1.35	9.00
	UH-72	1.70	0.30	2.00	1.70	0.30	2.00
Night Vision Goggle	CH-47	-	11.00	11.00	-	11.00	11.00
	UH-60	-	13.00	13.00	-	13.00	13.00
	UH-72	-	3.00	3.00	-	3.00	3.00
Readiness Level Progression	CH-47	30.60	5.40	36.00	30.60	5.40	36.00
	UH-60	38.25	6.75	45.00	38.25	6.75	45.00
	UH-72	7.65	1.35	9.00	7.65	1.35	9.00
Aerial Gunnery	CH-47	-	-	-	9.80	4.20	14.00
	UH-60	-	-	-	14.70	6.30	21.00
	UH-72	-	-	-	-	-	-

2.4 40 HS Component of Proposed Action

As listed in Table 2-3, the 40 HS proposes 56 busiest month sorties of Aerial Gunnery training and 2 busiest month sorties of Convoy Dry-Fire Training. The day/night split for the proposed 40 HS Aerial Gunnery training is 50 percent daytime and 50 percent nighttime. The 40 HS plans for all their Convoy training to be during the daytime.

Each 40 HS Aerial Gunnery sortie listed in Table 2-3 would consist of the same types of operations as listed in Section 2.3 for the MTARNG Aerial Gunnery sorties, except the 40 HS's Range Ingress and Egress differ. See Section 3 for further information.

In addition to operating within the LHTA as discussed above, each 40 HS Convoy sortie listed in Table 2-3 would consist of the following operations:

- Range Ingress
- Range Egress

These are also described in Section 3.

Table 2-3 Proposed 40 HS Flight Sorties for Busiest Month

Source: MTARNG and 40 HS 2021

Training Activity	Airframe	Proposed Sorties Day (0700-2200)	Proposed Sorties Night (2200-0700)	Proposed Sorties Total
Aerial Gunnery	UH-1N	14.0	14.0	28.0
	MH-139	14.0	14.0	28.0
Convoy Dry-Fire Training	UH-1N	1.0	-	1.0
	MH-139	1.0	-	1.0
Subtotals				
Aerial Gunnery		28.0	28.0	56.0
Convoy Dry-Fire		2.0	-	2.0

3 Flight Areas and Routes

As shown in Figure 3-1, the LHTA lies approximately 29 miles southeast of Helena Regional Airport and 5 miles west of the town of Townsend (signified by the Townsend Airport). MRNMAP requires laterally (and vertically) distributed flight operations to be described in terms of their flight areas or routes and corridors. Sections 3.1 and 3.2 describe the modeled flight areas and routes for Baseline and Proposed Action, respectively.

3.1 Baseline/No Action

The MTARNG provided flight area and route information for Baseline (MTARNG 2020). MTARNG's ingress/egress to/from the LTHA is via the Helena-LHTA corridor shown in Figure 3-2 based on information provided by the USAF (USAF 2020). The route's modeled name is "Ingress/Egress" and is approximately 26 nautical miles (nmi) in length, with a (corridor) width of 1 nmi, i.e., 0.5 nmi between the edge lines and the center in Figure 3-2. As mentioned in Section 2, each sortie includes one ingress operation and one egress operation.

The training Baseline activities listed in Table 2-2 were modeled in the areas and routes/corridors shown in Figure 3-3, as provided by the MTARNG (MTARNG 2020). All activities in Table 2-2 utilize the large Primary Training Area, except for Forward Arming and Refueling Points (FARP) which utilizes the "FARP Area". An active mine, called "Active Mine", and the town of Townsend are Avoidance areas, i.e., areas in which training flights are not allowed, are shown by the brown circles.

3.2 Proposed Action

40 HS is based at Malmstrom Air Force Base (AFB) in Great Falls, MT. To ingress/egress the LHTA and Helena, 40 HS would primarily utilize the legs emanating from Great Falls/Malmstrom AFB shown in Figure 3-2. The route between Malmstrom AFB and LHTA has the modeled name "Malm" is approximately 72 nmi long with the same width as the "Ingress/Egress". The route between Helena and Malmstrom, modeled with the name "Helena" is approximately 62 nmi long with the same width as the other two routes.

40 HS would fly these routes with two ingress/egress configurations for Aerial Gunnery training. For approximately 70% of the sorties, 40 HS would depart from Malmstrom AFB to LHTA for training, then fly to Helena to refuel before returning (from Helena) to Malmstrom AFB. The remaining 30% of the operations would involve 40 HS flying from Malmstrom AFB to LHTA for training, then to Helena to refuel and back to LHTA for continued training. From the LHTA, they would return to Malmstrom AFB.

For Convoy training sorties, 40 HS would only use the first configuration, i.e., depart from Malmstrom AFB to LHTA for training, then fly to Helena to refuel before returning (from Helena) to Malmstrom AFB for ingress/egress to LHTA.

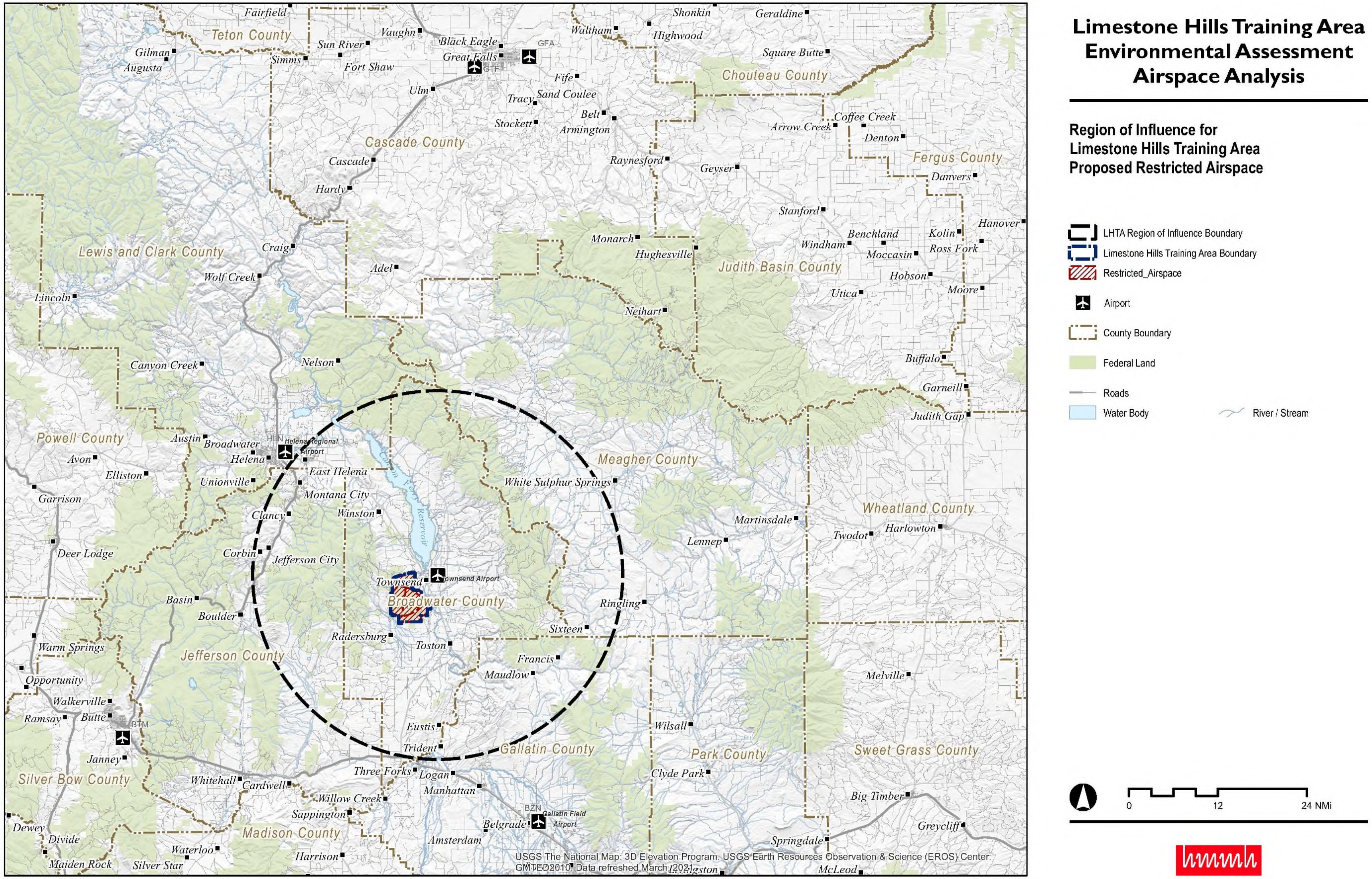

Figure 3-1 Region of Influence for LHTA Proposed Restricted Airspace

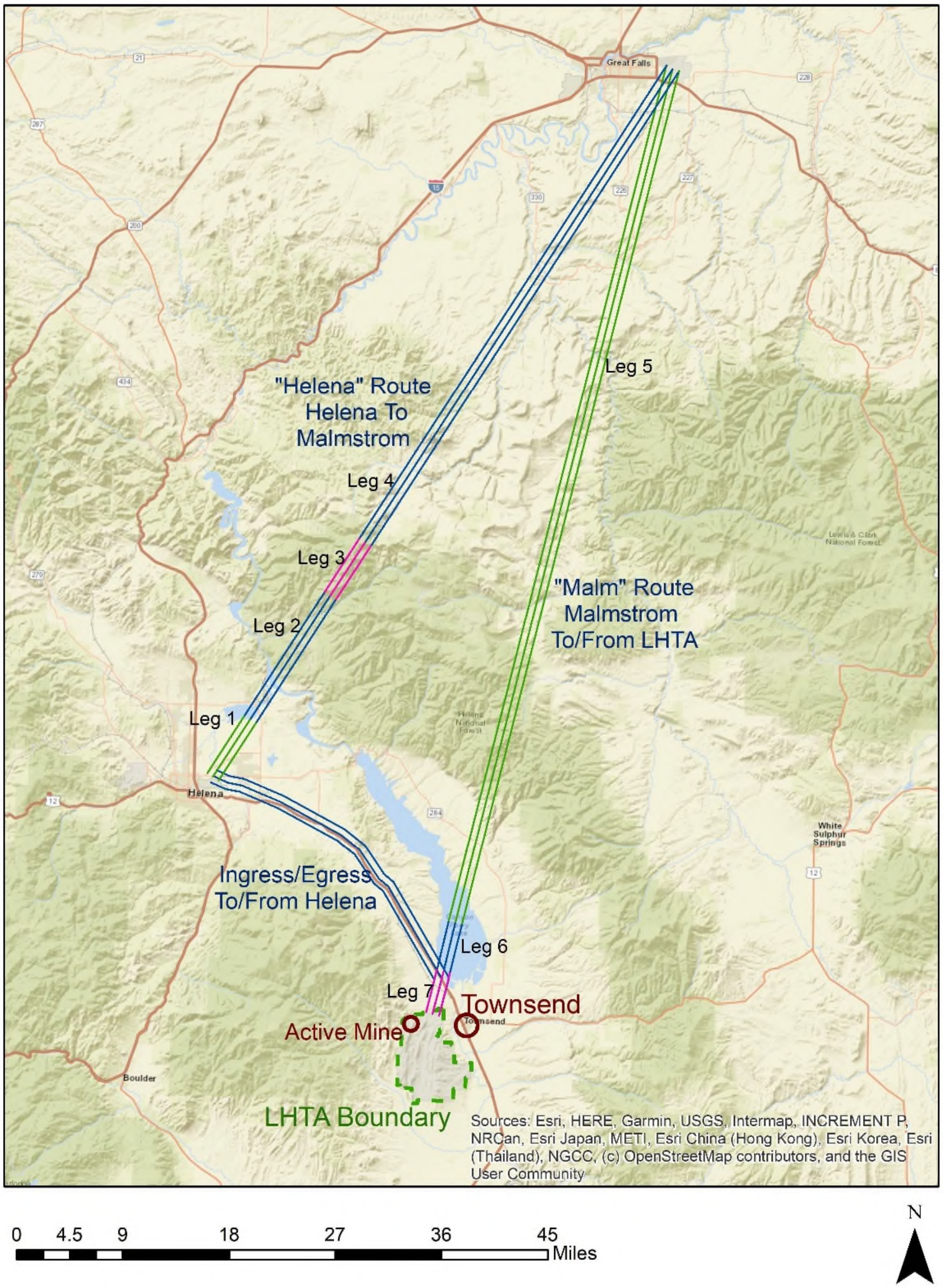

Figure 3-2 Modeled Ingress/Egress Routes for the LHTA

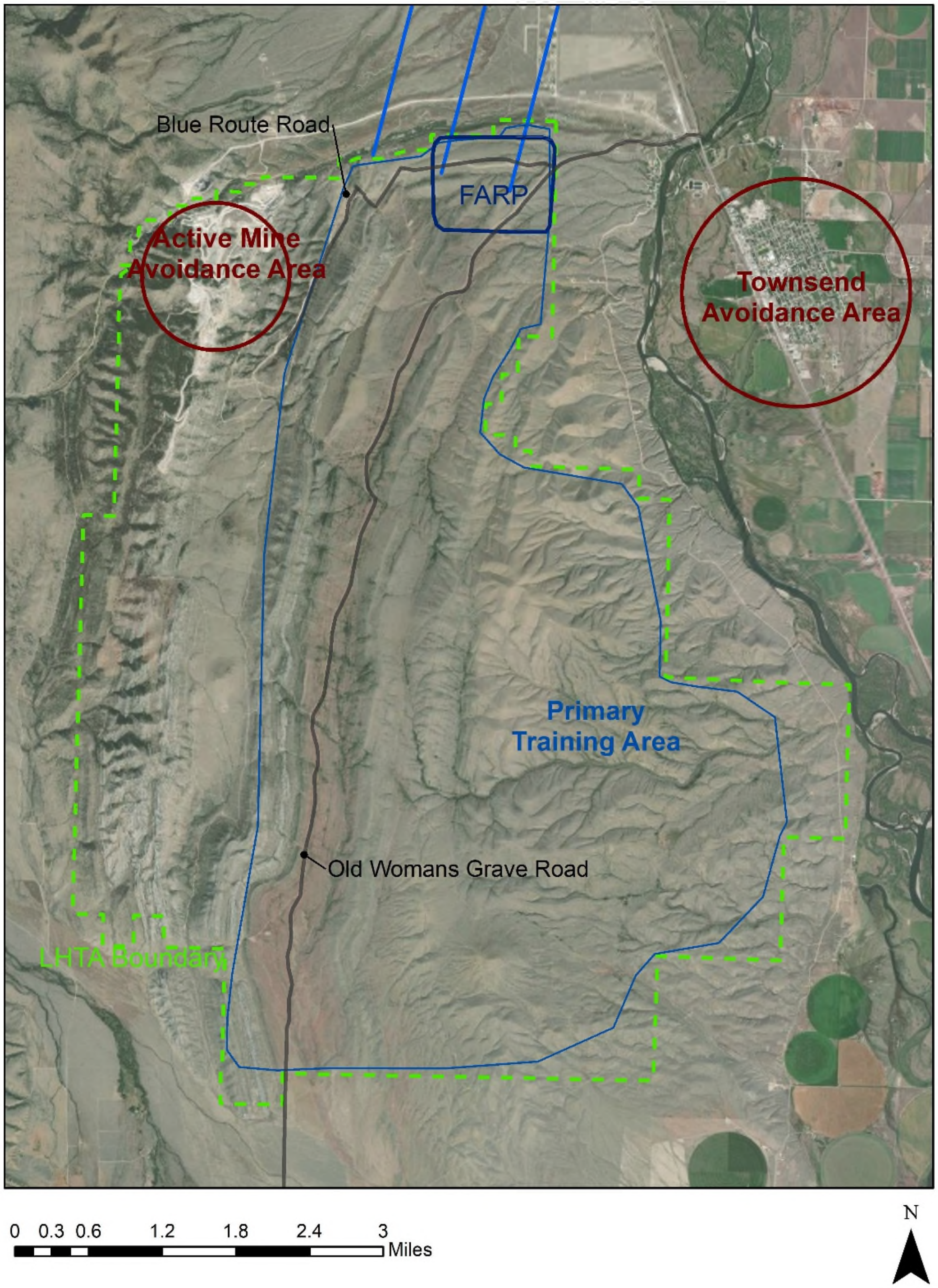

Figure 3-3 Modeled Flight Areas and Corridors for Baseline/No Action in the Vicinity of the LHTA

As part of the proposed Aerial Gunnery training, the MTARNG and 40 HS would visit the HARM Pads after arrival to the LHTA and prior to transition to the gunnery range. The HARM pad modeling areas and point are shown in Figure 3-4. The location of the HARM pad was provided by the USAF (USAF 2020). The descent and takeoff portions of the flights to/from the HARM pads were modeled as distributed flights in the rings in Figure 3-4, i.e., an upside-down wedding cake type of modeling, with each ring's altitude distribution being successively less as the aircraft progress toward the center. Aircraft operating at the HARM pads were modeled as static run-up operations – see Section 5 for more detail. After completion of HARM activity, the aircraft would fly south to the Range Clearing Area shown as the yellow-lined area. The transition from the Ingress/Egress corridor to the HARM pad was not modeled. The transition from the HARM pad to the Range Clearing Area was not modeled due to its proximity to the Range Clearing area.

As described by the USAF (USAF 2020), before use of the gunnery range, the aircraft would obtain clearance for range use through MTARNG Range Control and would then perform a range clearing sweep of the area to ensure that it is safe for firing practice. The yellow-bordered area in Figure 3-4 is the modeled Range Clearing Area. The aircraft would then set-up for gunnery in the North Loiter or South Loiter zones (modeled as the orange-bordered areas) to conduct training and required crew-briefs. Once complete, the aircraft would commit to the firing axis and fly at the entry of the range (the modeled, red-bordered area in Figure 3-4) in position to engage the target. After arriving at the holding point in the opposite loiter area, the crew would debrief the maneuver, perform required checks and functions, and conduct required instruction. The modeled usage is split evenly between the North and South Loiter zones. The aircraft would either transition back to the previous point, via the East or West transition corridors (also modeled with equal usage) shown as black lines, to fly the firing pattern again or brief a new scenario. The east/west transition corridors are modeled with a width of approximately 1,056 ft, i.e., 528 ft between the center, shown a solid black line, and each edge, shown as dashed lines (USAF 2020).

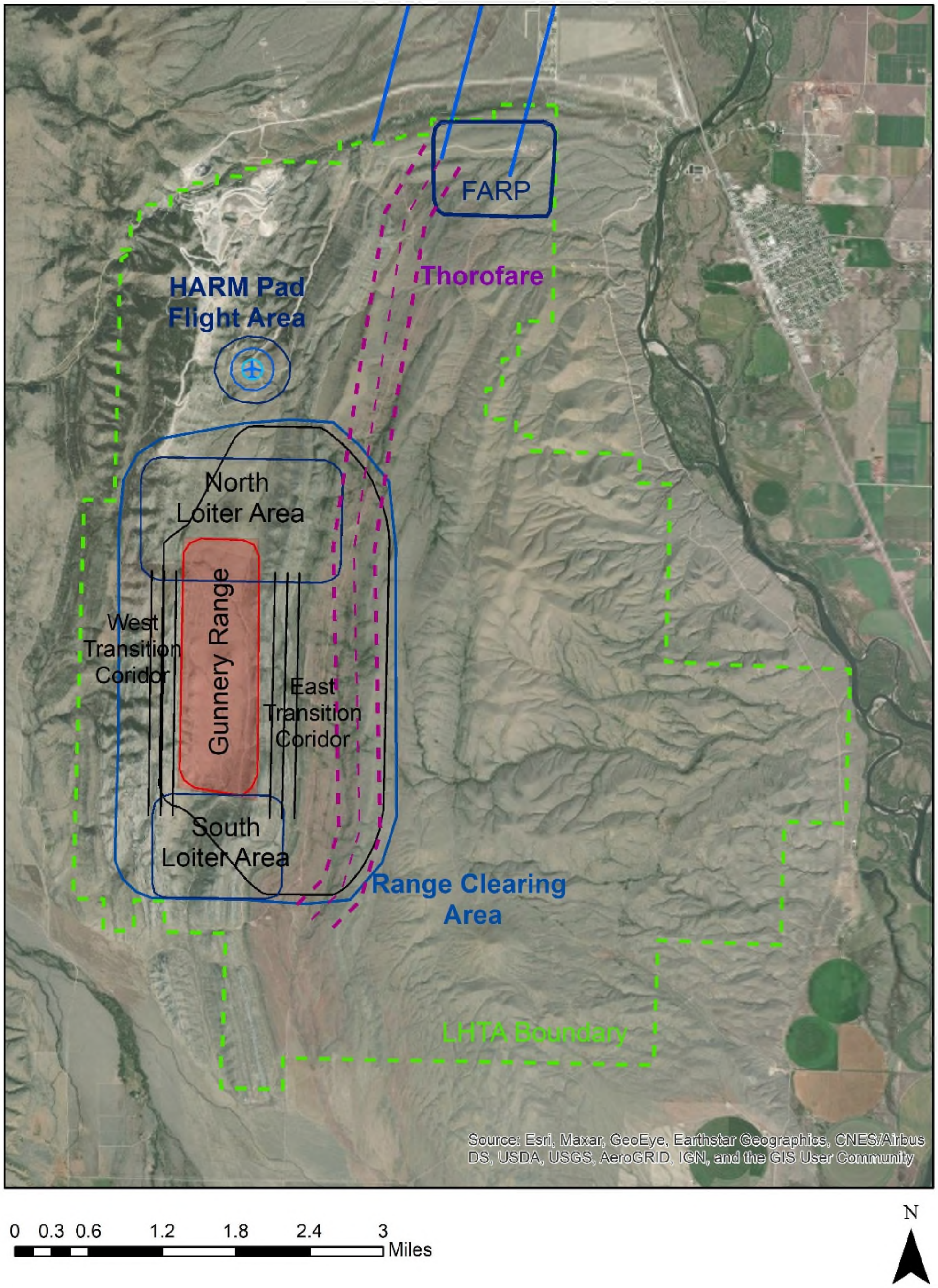

Figure 3-4 Modeled Flight Areas and Corridors Associated with Proposed Aerial Gunnery Training

After the gunnery firing, aircraft would perform another sweep of the clearing area to make sure no fires were started. The aircraft would transition along the modeled corridor called "Thorofare" to the LHTA entry point and egress the LHTA along the Ingress/Egress Corridor(s). The Thorofare corridor is one-third of a mile wide (MTARNG 2020).

Convoy training information came from the military POCs (USAF 2020). To conduct the convoy training the 40 HS would arrive at the LHTA via the “Malm” Ingress/Egress corridor.

For Alt 1, the convoy training at Blue Route Road was modeled with the two blue-bordered areas shown in Figure 3-5, i.e., High Bird Area and Low Bird area. High Bird activity would normally be between 1,000 and 1,500 ft AGL to maintains visual contact with the convoy. High Bird activity was modeled at 1,000 ft AGL. The Low Bird sorties would sweep a much larger area between 50 and 100 ft AGL to detect threats to the convoy. Low Bird activity was modeled at 50 ft AGL.

For Alt 2, the convoy training would occur in the vicinity of Old Woman’s Grave Road (OWGR), instead of in the vicinity of Blue Route Road. The modeled High and Low Bird flight areas are shown as the blue-bordered areas in Figure 3-6 per information provided by the USAF (USAF 2020). Although the flight areas differ from Alt 1, the altitude utilization for the High and Low Bird areas would be identical to those for Alt 1. Aircraft would ingress/egress the OWGR area via the Thorofare corridor.

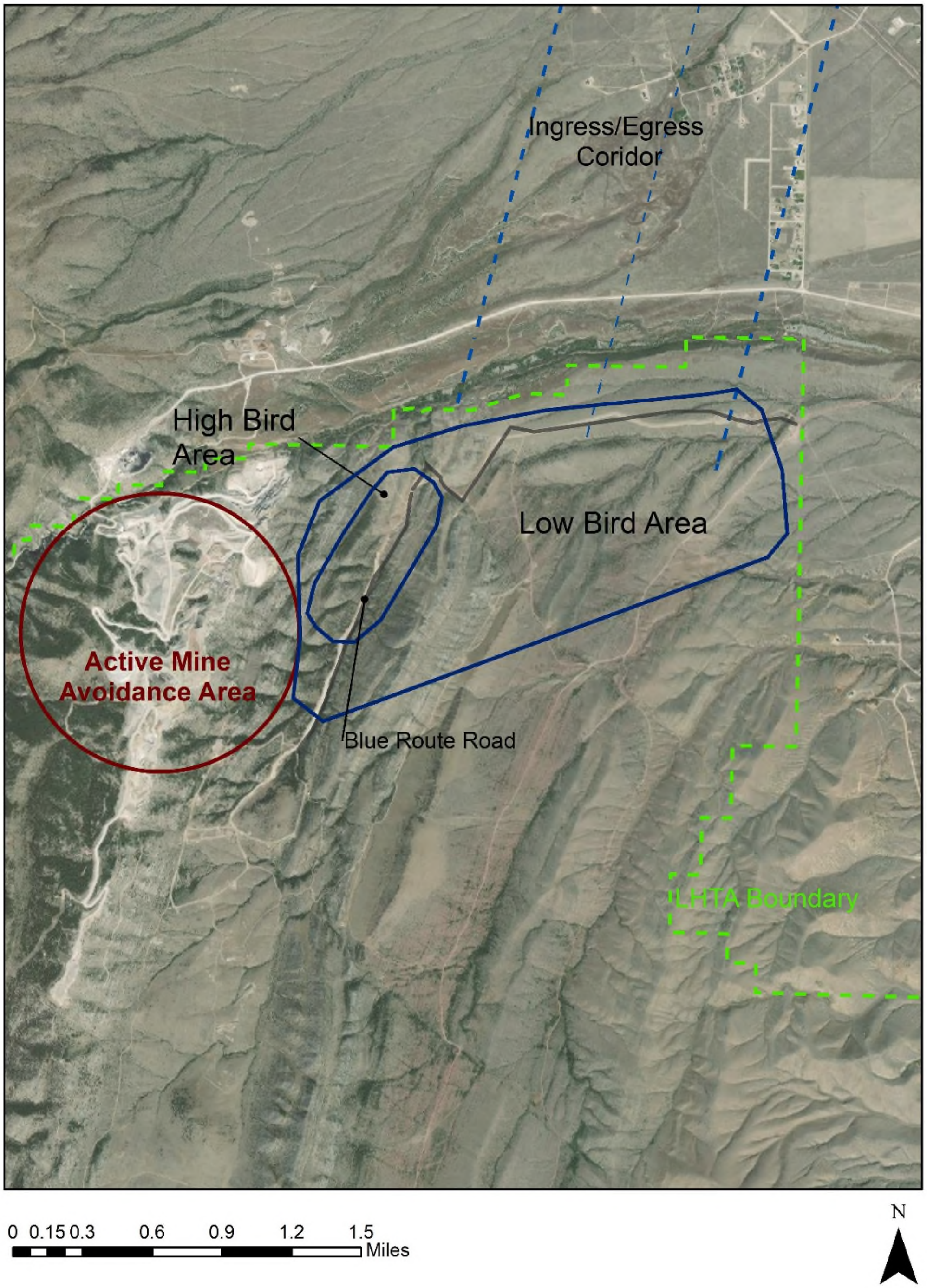

Figure 3-5 Modeled Flight Areas for Proposed Convoy Training for Alt 1 (Blue Route Road)

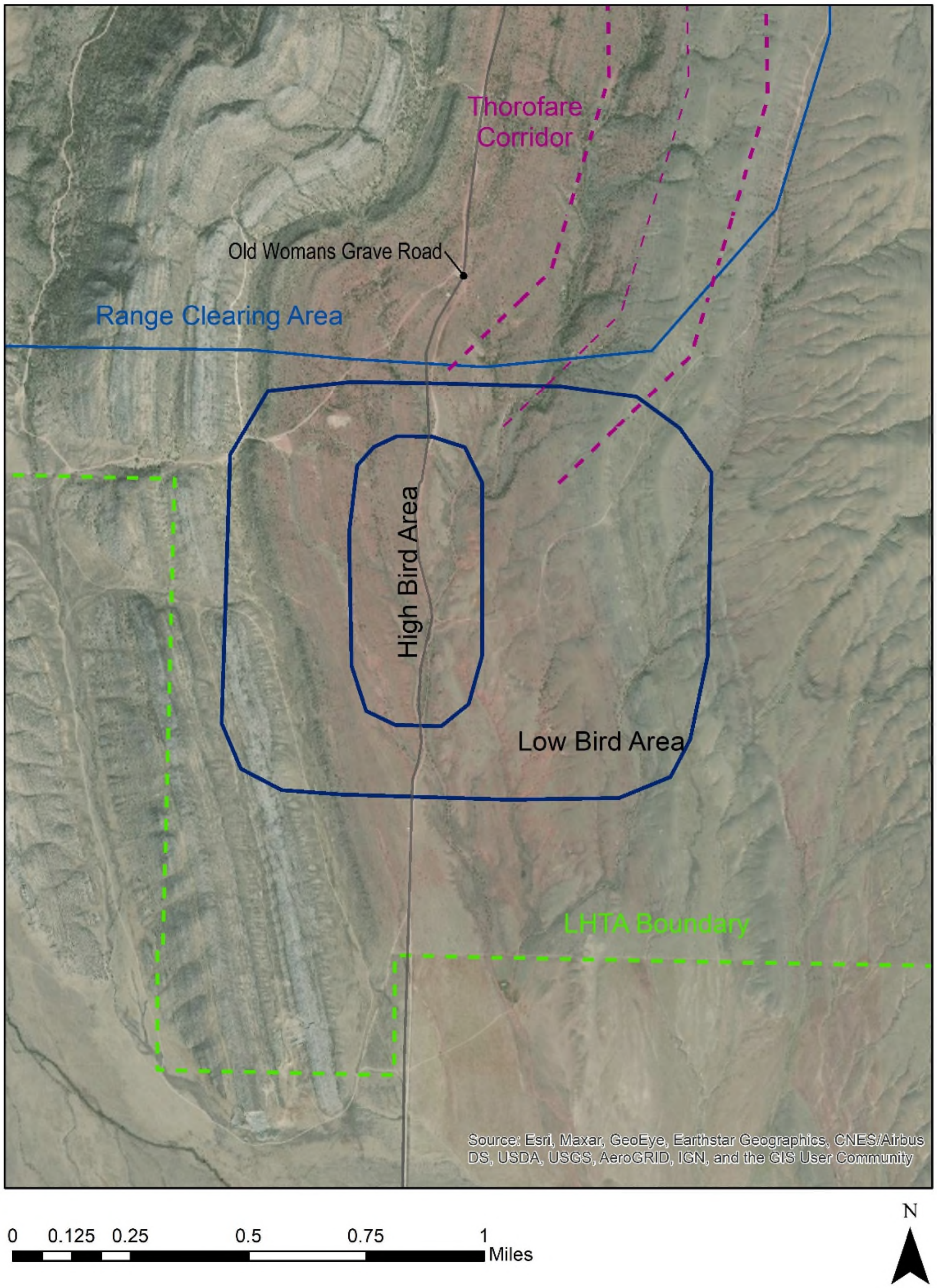

Figure 3-6 Modeled Flight Areas for Proposed Convoy Training for Alt 2 (Old Woman's Grave Road)

4 Flight Profiles and their Utilization

Tables 4-1 through 4-9 detail the operations (or events) produced by the sorties in Tables 2-2 and 2-3 for each of the modeled flight areas and routes/corridors, along with airspace flight profile data provided by the MTARNG and 40 HS for each modeling component. Tables 4-1 through 4-3 address Baseline/No Action for the MTARNG. Tables 4-4 and 4-5 contain the profiles for the proposed MTARNG Aerial Gunnery sorties (from Table 2-2), which were modeled *in addition to* the Baseline/No Action sorties in Tables 4-1 through 4-3. Tables 4-6 through 4-9 detail the 40 HS's proposed Aerial Gunnery and Convoy training profiles from the sorties in Table 2-3 (MTARNG and 40 HS 2021).

Flight profile data includes typical altitude distribution, average airspeed and, for flight areas, average aircraft duration per event. To interpret the Altitude Distribution columns of each table, the following example is provided: In Table 4-1, for MTARNG CH-47 Range Ingress, they typically fly between 500 and 1,000 ft AGL.

In lieu of altitude distributions, 40 HS provided the specific proposed altitudes for their ingress/egress of LHTA and Helena on the modeled "Malm" and "Helena" corridors. Referring to Figure 3-2, the modeled "Helena" corridor would be flown at 1000 ft AGL out of Helena Airport for Leg 1 (5 nmi). 40 HS helicopters would then descend to 500 ft AGL for Leg 2 (11 nmi) and then climb to 2,000 ft AGL to traverse the Gates of the Mountain at Leg 3 (2 nmi). After crossing the Gates of the Mountain, they would descend to 500 ft AGL for the Leg 4 to Malmstrom AFB (44.5 nmi).

The modeled "Malm" corridor would be flown at 500 ft AGL from Malmstrom AFB along Leg 5 (65 nmi). 40 HS helicopters would then, based on information provided by the pilots, climb to 1,000 ft AGL for Leg 6 (3.5 nmi) and descend to 500 ft AGL for Leg 7 to LHTA (3 nmi).

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Table 4-1 Modeled Events and Flight Profiles for Baseline/No Action for MTARNG CH-47

Source: MTARNG and 40 HS 2021

<table>
<tr><th rowspan="2">Mission Name</th><th rowspan="2">Modeled as a Flight Area (A) or Route/ Corridor (R)</th><th rowspan="2">Modeled Flight Area or Route/Corridor Name</th><th colspan="2">Busiest Month Events</th><th rowspan="2">Modeled Average Airspeed (kts)</th><th rowspan="2">Modeled Average Event Duration (in Flight Areas Only)</th><th colspan="10">Typical Altitude Distribution (ft AGL)</th></tr>
<tr><th>Daytime (0700-2200)</th><th>Nighttime (2200-0700)</th><th>5</th><th>25</th><th>50</th><th>100</th><th>200</th><th>300</th><th>500</th><th>700</th><th>1000</th><th>1500</th></tr>
<tr><td>Range Ingress</td><td>R</td><td>InEgress</td><td>66.30</td><td>22.70</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">100%</td><td></td></tr>
<tr><td>Forward Arming and Refueling</td><td>A</td><td>FARP Area</td><td>5.95</td><td>1.05</td><td>90</td><td>30 min</td><td></td><td colspan="3">100%</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Hoist</td><td>A</td><td>Training</td><td>5.95</td><td>1.05</td><td>90</td><td>1 hr</td><td></td><td colspan="3">100%</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>High Altitude Landings</td><td>A</td><td>Training</td><td>5.95</td><td>1.05</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="3">40%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Personnel Recovery</td><td>A</td><td>Training</td><td>5.95</td><td>1.05</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="3">40%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Slingload</td><td>A</td><td>Training</td><td>5.95</td><td>1.05</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="3">40%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Mountain Flying Techniques</td><td>A</td><td>Training</td><td>5.95</td><td>1.05</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="2">30%</td><td colspan="2">10%</td><td></td><td></td><td></td></tr>
<tr><td>Night Vision Goggle</td><td>A</td><td>Training</td><td>-</td><td>11.00</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="2">30%</td><td colspan="2">10%</td><td></td><td></td><td></td></tr>
<tr><td>Readiness Level Progression</td><td>A</td><td>Training</td><td>30.60</td><td>5.40</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="2">30%</td><td colspan="2">10%</td><td></td><td></td><td></td></tr>
<tr><td>Range Egress</td><td>R</td><td>InEgress</td><td>66.30</td><td>22.70</td><td>90</td><td>N/A</td><td></td><td></td><td colspan="2"></td><td></td><td></td><td colspan="3">100%</td><td></td></tr>
</table>

Table 4-2 Modeled Events and Flight Profiles for Baseline/No Action for MTARNG UH-60

Source: MTARNG and 40 HS 2021

<table>
<tr><th rowspan="2">Mission Name</th><th rowspan="2">Modeled as a Flight Area (A) or Route/ Corridor (R)</th><th rowspan="2">Modeled Flight Area or Route/Corridor Name</th><th colspan="2">Busiest Month Events</th><th rowspan="2">Modeled Average Airspeed (kts)</th><th rowspan="2">Modeled Average Event Duration (in Flight Areas Only)</th><th colspan="10">Typical Altitude Distribution (ft AGL)</th></tr>
<tr><th>Daytime (0700-2200)</th><th>Nighttime (2200-0700)</th><th>5</th><th>25</th><th>50</th><th>100</th><th>200</th><th>300</th><th>500</th><th>700</th><th>1000</th><th>1500</th></tr>
<tr><td>Range Ingress</td><td>R</td><td>InEgress</td><td>84.15</td><td>27.85</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">100%</td><td></td></tr>
<tr><td>Forward Arming and Refueling</td><td>A</td><td>FARP Area</td><td>7.65</td><td>1.35</td><td>90</td><td>30 min</td><td></td><td colspan="3">100%</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Hoist</td><td>A</td><td>Training</td><td>7.65</td><td>1.35</td><td>90</td><td>1 hr</td><td></td><td colspan="3">100%</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>High Altitude Landings</td><td>A</td><td>Training</td><td>7.65</td><td>1.35</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="3">40%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Personnel Recovery</td><td>A</td><td>Training</td><td>7.65</td><td>1.35</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="3">40%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Slingload</td><td>A</td><td>Training</td><td>7.65</td><td>1.35</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="3">40%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Mountain Flying Techniques</td><td>A</td><td>Training</td><td>7.65</td><td>1.35</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="2">30%</td><td colspan="2">10%</td><td></td><td></td><td></td></tr>
<tr><td>Night Vision Goggle</td><td>A</td><td>Training</td><td>-</td><td>13.00</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="2">30%</td><td colspan="2">10%</td><td></td><td></td><td></td></tr>
<tr><td>Readiness Level Progression</td><td>A</td><td>Training</td><td>38.25</td><td>6.75</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="2">30%</td><td colspan="2">10%</td><td></td><td></td><td></td></tr>
<tr><td>Range Egress</td><td>R</td><td>InEgress</td><td>84.15</td><td>27.85</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">100%</td><td></td></tr>
</table>

Table 4-3 Modeled Events and Flight Profiles for Baseline/No Action for MTARNG UH-72

Source: MTARNG and 40 HS 2021

<table>
<tr><th rowspan="2">Mission Name</th><th rowspan="2">Modeled as a Flight Area (A) or Route/ Corridor (R)</th><th rowspan="2">Modeled Flight Area or Route/Corridor Name</th><th colspan="2">Busiest Month Events</th><th rowspan="2">Modeled Average Airspeed (kts)</th><th rowspan="2">Modeled Average Event Duration (in Flight Areas Only)</th><th colspan="10">Typical Altitude Distribution (ft AGL)</th></tr>
<tr><th>Daytime (0700-2200)</th><th>Nighttime (2200-0700)</th><th>5</th><th>25</th><th>50</th><th>100</th><th>200</th><th>300</th><th>500</th><th>700</th><th>1000</th><th>1500</th></tr>
<tr><td>Range Ingress</td><td>R</td><td>InEgress</td><td>20.4</td><td>6.6</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">100%</td><td></td></tr>
<tr><td>Mission Equipment Package</td><td>A</td><td>Training</td><td>4.25</td><td>0.75</td><td>90</td><td>1 hr</td><td></td><td></td><td></td><td></td><td></td><td></td><td>100%</td><td></td><td></td><td></td></tr>
<tr><td>Forward Arming and Refueling</td><td>A</td><td>FARP Area</td><td>1.7</td><td>0.3</td><td>90</td><td>30 min</td><td></td><td colspan="3">100%</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Hoist</td><td>A</td><td>Training</td><td>1.7</td><td>0.3</td><td>90</td><td>1 hr</td><td></td><td colspan="3">100%</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>High Altitude Landings</td><td>A</td><td>Training</td><td>1.7</td><td>0.3</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="3">40%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Personnel Recovery</td><td>A</td><td>Training</td><td>1.7</td><td>0.3</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="3">40%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Mountain Flying Techniques</td><td>A</td><td>Training</td><td>1.7</td><td>0.3</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="2">30%</td><td colspan="2">10%</td><td></td><td></td><td></td></tr>
<tr><td>Night Vision Goggle</td><td>A</td><td>Training</td><td>-</td><td>3.00</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="2">30%</td><td colspan="2">10%</td><td></td><td></td><td></td></tr>
<tr><td>Readiness Level Progression</td><td>A</td><td>Training</td><td>7.65</td><td>1.35</td><td>90</td><td>1 hr</td><td></td><td colspan="2">60%</td><td colspan="2">30%</td><td colspan="2">10%</td><td></td><td></td><td></td></tr>
<tr><td>Range Egress</td><td>R</td><td>InEgress</td><td>20.40</td><td>6.60</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">100%</td><td></td></tr>
</table>

Table 4-4 Modeled MTARNG CH-47 Events and Flight Profiles for Proposed Action and Alternatives (in addition to No Action)

Source: MTARNG and 40 HS 2021

<table>
<tr><th rowspan="2">Mission Name</th><th rowspan="2">Modeled as a Flight Area (A) or Route/ Corridor (R)</th><th rowspan="2">Modeled Flight Area or Route/Corridor Name</th><th colspan="2">Busiest Month Events</th><th rowspan="2">Modeled Average Airspeed (kts)</th><th rowspan="2">Modeled Average Event Duration (in Flight Areas Only)</th><th colspan="10">Typical Altitude Distribution (ft AGL)</th></tr>
<tr><th>Daytime (0700-2200)</th><th>Nighttime (2200-0700)</th><th>5</th><th>25</th><th>50</th><th>100</th><th>200</th><th>300</th><th>500</th><th>700</th><th>1000</th><th>1500</th></tr>
<tr><td>Range Ingress</td><td>R</td><td>InEgress</td><td>9.80</td><td>4.20</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">100%</td><td></td></tr>
<tr><td>To HARM Pads</td><td>R</td><td>ToPads</td><td>9.80</td><td>4.20</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td colspan="2">100%</td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">HARM Pads</td><td>A</td><td>HARM_1</td><td>19.60</td><td>8.40</td><td>70</td><td>60 s</td><td></td><td></td><td></td><td></td><td colspan="2">100%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>A</td><td>HARM_2</td><td>19.60</td><td>8.40</td><td>35</td><td>60 s</td><td></td><td></td><td></td><td colspan="2">100%</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>A</td><td>HARM_3</td><td>19.60</td><td>8.40</td><td>15</td><td>60 s</td><td colspan="4">100%</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Range Clearing Maneuver</td><td>A</td><td>Clearing</td><td>19.60</td><td>8.40</td><td>70</td><td>20 min (27 for night)</td><td></td><td></td><td>10%</td><td colspan="2">20%</td><td colspan="2">50%</td><td colspan="2">20%</td><td></td></tr>
<tr><td rowspan="4">Gunnery Range</td><td>A</td><td>LoiterN</td><td>2.45</td><td>1.05</td><td>90</td><td>23 min</td><td></td><td></td><td colspan="3">40%</td><td colspan="3">40%</td><td colspan="2">20%</td></tr>
<tr><td>A</td><td>LoiterS</td><td>2.45</td><td>1.05</td><td>90</td><td>23 min</td><td></td><td></td><td colspan="3">40%</td><td colspan="3">40%</td><td colspan="2">20%</td></tr>
<tr><td>R</td><td>TransEast</td><td>0.20</td><td>0.08</td><td>90</td><td>N/A</td><td></td><td></td><td colspan="3">50%</td><td colspan="4">50%</td><td></td></tr>
<tr><td>R</td><td>TransWest</td><td>0.20</td><td>0.08</td><td>90</td><td>N/A</td><td></td><td></td><td colspan="3">50%</td><td colspan="4">50%</td><td></td></tr>
<tr><td>Target Area</td><td>A</td><td>Gunnery</td><td>9.80</td><td>4.20</td><td>70</td><td>44 min</td><td></td><td></td><td></td><td></td><td colspan="3">100%</td><td></td><td></td><td></td></tr>
<tr><td>Transition Out</td><td>R</td><td>Thorofare</td><td>9.80</td><td>4.20</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td colspan="2">100%</td><td></td><td></td><td></td></tr>
<tr><td>Range Egress</td><td>R</td><td>InEgress</td><td>9.80</td><td>4.20</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">100%</td><td></td></tr>
</table>

Table 4-5 Modeled MTARNG UH-60 Events and Flight Profiles for Proposed Action and Alternatives (in addition to No Action)

Source: MTARNG and 40 HS 2021

<table>
<tr><th rowspan="2">Mission Name</th><th rowspan="2">Modeled as a Flight Area (A) or Route/ Corridor (R)</th><th rowspan="2">Modeled Flight Area or Route/Corridor Name</th><th colspan="2">Busiest Month Events</th><th rowspan="2">Modeled Average Airspeed (kts)</th><th rowspan="2">Modeled Average Event Duration (in Flight Areas Only)</th><th colspan="10">Typical Altitude Distribution (ft AGL)</th></tr>
<tr><th>Daytime (0700-2200)</th><th>Nighttime (2200-0700)</th><th>5</th><th>25</th><th>50</th><th>100</th><th>200</th><th>300</th><th>500</th><th>700</th><th>1000</th><th>1500</th></tr>
<tr><td>Range Ingress</td><td>R</td><td>InEgress</td><td>14.70</td><td>6.30</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">100%</td><td></td></tr>
<tr><td>To HARM Pads</td><td>R</td><td>ToPads</td><td>14.70</td><td>6.30</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td colspan="2">100%</td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">HARM Pads</td><td>A</td><td>HARM_1</td><td>29.40</td><td>12.60</td><td>70</td><td>60 s</td><td></td><td></td><td></td><td></td><td colspan="2">100%</td><td></td><td></td><td></td><td></td></tr>
<tr><td>A</td><td>HARM_2</td><td>29.40</td><td>12.60</td><td>35</td><td>60 s</td><td></td><td></td><td></td><td colspan="2">100%</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>A</td><td>HARM_3</td><td>29.40</td><td>12.60</td><td>15</td><td>60 s</td><td colspan="4">100%</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Range Clearing Maneuver</td><td>A</td><td>Clearing</td><td>29.40</td><td>12.60</td><td>70</td><td>20 min (27 for night)</td><td></td><td></td><td>10%</td><td colspan="2">20%</td><td colspan="2">50%</td><td colspan="2">20%</td><td></td></tr>
<tr><td rowspan="4">Gunnery Range</td><td>A</td><td>LoiterN</td><td>3.68</td><td>1.58</td><td>90</td><td>23 min</td><td></td><td></td><td colspan="3">40%</td><td colspan="3">40%</td><td colspan="2">20%</td></tr>
<tr><td>A</td><td>LoiterS</td><td>3.68</td><td>1.58</td><td>90</td><td>23 min</td><td></td><td></td><td colspan="3">40%</td><td colspan="3">40%</td><td colspan="2">20%</td></tr>
<tr><td>R</td><td>TransEast</td><td>0.29</td><td>0.13</td><td>90</td><td>N/A</td><td></td><td></td><td colspan="3">50%</td><td colspan="4">50%</td><td></td></tr>
<tr><td>R</td><td>TransWest</td><td>0.29</td><td>0.13</td><td>90</td><td>N/A</td><td></td><td></td><td colspan="3">50%</td><td colspan="4">50%</td><td></td></tr>
<tr><td>Target Area</td><td>A</td><td>Gunnery</td><td>14.70</td><td>6.30</td><td>70</td><td>44 min</td><td></td><td></td><td></td><td></td><td colspan="3">100%</td><td></td><td></td><td></td></tr>
<tr><td>Transition Out</td><td>R</td><td>Thorofare</td><td>14.70</td><td>6.30</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td colspan="2">100%</td><td></td><td></td><td></td></tr>
<tr><td>Range Egress</td><td>R</td><td>InEgress</td><td>14.70</td><td>6.30</td><td>90</td><td>N/A</td><td></td><td></td><td></td><td></td><td></td><td></td><td colspan="3">100%</td><td></td></tr>
</table>

Table 4-6 Modeled 40 HS UH-1N Events and Flight Profiles for Proposed Action and Alternatives

Source: MTARNG and 40 HS 2021

Mission Name	Modeled as a Flight Area (A) or Route/ Corridor (R)	Modeled Flight Area or Route/Corridor Name	Busiest Month Events		Modeled Average Airspeed (kts)	Modeled Average Event Duration (in Flight Areas Only)	Typical Altitude Distribution (ft AGL)									
			Daytime (0700-2200)	Nighttime (2200-0700)			5	25	50	100	200	300	500	700	1000	1500
Range Ingress	R	InEgress	4.00	4.00	90	N/A						33%	33%		33%	
	R	Malm	14.00	14.00	90	N/A							Legs 5, 7		Leg 6	
To HARM Pads	R	ToPads	14.00	14.00	90	N/A						100%				
HARM Pads	A	HARM_1	28.00	28.00	70	60 s					100%					
	A	HARM_2	28.00	28.00	35	60 s				100%						
	A	HARM_3	28.00	28.00	15	60 s	100%									
Range Clearing Maneuver	A	Clearing	28.00	28.00	70	20 min (27 for night)			10%	20%		50%		20%		
Gunnery Range	A	LoiterN	3.50	3.50	90	23 min			40%			40%			20%	
	A	LoiterS	3.50	3.50	90	23 min			40%			40%			20%	
	R	TransEast	0.28	0.28	90	N/A			50%			50%				
	R	TransWest	0.28	0.28	90	N/A			50%			50%				
Target Area	A	Gunnery	14.00	14.00	70	44 min					100%					
Transition Out	R	Thorofare	14.00	14.00	90	N/A						100%				
Range Egress	R	InEgress	14.00	14.00	90	N/A						33%	33%		33%	
	R	Malm	4.00	4.00	90	N/A							Legs 5, 7		Leg 6	
Return to Malmstrom	R	Helena	10.00	10.00	90	N/A							Legs 2, 4		Leg 1	Leg 3

Table 4-7 Modeled 40 HS MH-139 Events and Flight Profiles for Proposed Action and Alternatives

Source: MTARNG and 40 HS 2021

Mission Name	Modeled as a Flight Area (A) or Route/ Corridor (R)	Modeled Flight Area or Route/Corridor Name	Busiest Month Events		Modeled Average Airspeed (kts)	Modeled Average Event Duration (in Flight Areas Only)	Typical Altitude Distribution (ft AGL)									
			Daytime (0700-2200)	Nighttime (2200-0700)			5	25	50	100	200	300	500	700	1000	1500
Range Ingress	R	InEgress	4.00	4.00	90	N/A						33%	33%		33%	
	R	Malm	14.00	14.00	90	N/A							Legs 5, 7		Leg 6	
To HARM Pads	R	ToPads	14.00	14.00	90	N/A						100%				
HARM Pads	A	HARM_1	28.00	28.00	70	60 s					100%					
	A	HARM_2	28.00	28.00	35	60 s				100%						
	A	HARM_3	28.00	28.00	15	60 s	100%									
Range Clearing Maneuver	A	Clearing	28.00	28.00	70	20 min (27 for night)			10%	20%		50%		20%		
Gunnery Range	A	LoiterN	3.50	3.50	90	23 min			40%			40%			20%	
	A	LoiterS	3.50	3.50	90	23 min			40%			40%			20%	
	R	TransEast	0.28	0.28	90	N/A			50%			50%				
	R	TransWest	0.28	0.28	90	N/A			50%			50%				
Target Area	A	Gunnery	14.00	14.00	70	44 min					100%					
Transition Out	R	Thorofare	14.00	14.00	90	N/A						100%				
Range Egress	R	InEgress	14.00	14.00	90	N/A						33%	33%		33%	
	R	Malm	4.00	4.00	90	N/A							Legs 5, 7		Leg 6	
Return to Malmstrom	R	Helena	10.00	10.00	90	N/A							Legs 2, 4		Leg 1	Leg 3

Table 4-8 Modeled 40 HS Events and Flight Profiles for Alternative 1 (Blue Route Rd; in addition to Tables 4-6 & 4-7)

Source: MTARNG and 40 HS 2021

Mission Name	Modeled as a Flight Area (A) or Route/ Corridor (R)	Modeled Flight Area or Route/Corridor Name	Busiest Month Events: Daytime (0700-2200)	Busiest Month Events: Nighttime (2200-0700)	Modeled Average Airspeed (kts)	Modeled Average Event Duration (in Flight Areas Only)	Typical Altitude Distribution (ft AGL): 5	25	50	100	200	300	500	700	1000	1500
40 HS UH-1N																
Range Ingress	R	Malm	1.0	-	90	N/A							Legs 5, 7		Leg 6	
Blue Rt Road - High	A	Blue_Rt_High	1.0	-	60	90 min									100%	
Blue Rt Road - Low	A	Blue_Rt_Low	1.0	-	100	90 min			100%							
Range Egress	R	InEgress	1.0	-	90	N/A						33%	33%		33%	
Return to Malmstrom	R	Helena	1.0	-	90	N/A							Legs 2, 4		Leg 1	Leg 3
40 HS MH-139																
Range Ingress	R	Malm	1.0	-	90	N/A							Legs 5, 7		Leg 6	
Blue Rt Road - High	A	Blue_Rt_High	1.0	-	60	90 min									100%	
Blue Rt Road - Low	A	Blue_Rt_Low	1.0	-	100	90 min			100%							
Range Egress	R	InEgress	1.0	-	90	N/A						33%	33%		33%	
Return to Malmstrom	R	Helena	1.0	-	90	N/A							Legs 2, 4		Leg 1	Leg 3

Table 4-9 Modeled 40 HS Events and Flight Profiles for Alternative 2 (OWGR; in addition to Tables 4-6 & 4-7)

Source: MTARNG and 40 HS 2021

			Busiest Month Events				Typical Altitude Distribution (ft AGL)									
Mission Name	Modeled as a Flight Area (A) or Route/ Corridor (R)	Modeled Flight Area or Route/Corridor Name	Daytime (0700-2200)	Nighttime (2200-0700)	Modeled Average Airspeed (kts)	Modeled Average Event Duration (in Flight Areas Only)	5	25	50	100	200	300	500	700	1000	1500
40 HS UH-1N																
Range Ingress	R	Malm	1.0	-	90	N/A							Legs 5, 7		Leg 6	
Transition to OWG Rd	R	Thorofare	2.0	-	90	N/A						100%				
OWG Road - High	A	OWG_Rt_High	1.0	-	60	90 min									100%	
OWG Road - Low	A	OWG_Rt_Low	1.0	-	100	90 min			100%							
Range Egress	R	InEgress	1.0	-	90	N/A						33%	33%		33%	
Return to Malmstrom	R	Helena	1.0	-	90	N/A							Legs 2, 4		Leg 1	Leg 3
40 HS MH-139																
Range Ingress	R	Malm	1.0	-	90	N/A							Legs 5, 7		Leg 6	
Transition to OWG Rd	R	Thorofare	2.0	-	90	N/A						100%				
OWG Road - High	A	OWG_Rt_High	1.0	-	60	90 min									100%	
OWG Road - Low	A	OWG_Rt_Low	1.0	-	100	90 min			100%							
Range Egress	R	InEgress	1.0	-	90	N/A						33%	33%	33%		
Return to Malmstrom	R	Helena	1.0	-	90	N/A							Legs 2, 4		Leg 1	Leg 3

5 Run-up Operations and Locations

The proposed operations at the HARM Pad provided by the MTARNG and 40 HS were modeled as run-ups with NMAP. Table 5-1 list the modeled run-up operations. Modeled average daily events were assigned to each run-up profile by dividing the busiest month operations by 15 for 40 HS and by 20 for MTARNG (per Table 1-1). The HARM Pad location is shown as the airplane symbol in Figure 3-4. There was no notable variation in the noise effects from the direction of the run-ups, so each airframe was run with a single heading of true north and magnetic declination did not need to be specified.

Table 5-1 Modeled Busiest Month Run-Up Operations at the HARM Pad

Unit	Type	# Engines Running, each Event	Duration of Each Event (Minutes)	Daytime (0700-2200)	Nighttime (2200-0700)	Total
MTARNG	CH-47	2	4	9.8	4.2	14.0
MTARNG	UH-60	2	4	14.7	6.3	21.0
40th HS	UH-1N	1	4	7.0	7.0	14.0
40th HS	MH-139	2	4	7.0	7.0	14.0

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6 Noise Exposure

The L_{dnmr}, and DNL when different, of each scenario and modeled airspace are shown in Table 6-1. The Convoy Training at Old Woman's Grave Road conducted in Alt 2 is done in a smaller area than Alt 1's Blue Route Road concentrating the noise in a smaller area and increasing the L_{dnmr}/DNL of Alt 2's Convoy and Training Area relative to Alt 1. The North Loiter area's proximity to the HARM Pad with a uniform distributed sound level over 85 dB L_{dnmr}/DNL would raise its overall noise level over 70 dB L_{dnmr}/DNL, however, since the areas do not overlap, the distributed L_{dnmr}/DNL are not combined in the table.

The L_{dnmr} contours for the Baseline scenario are shown in Figure 6-1. The 65 L_{dnmr} contour is confined within the LHTA boundary in most places. The 65 L_{dnmr} contour exceeds the extent of the northern part of the LHTA east of the refueling area by 375 ft and northwest of the FARP area by 210 ft shown in Figure 6-2. There are two areas along the east edge where the LHTA boundary cuts inward (westward) and the 65 L_{dnmr} contour remains outside by 65 ft in the north and 90 ft in the south. No residential areas are affected.

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Table 6-1 Individual L_{dnmr} and DNL for Modeled LHTA Airspaces

Modeled as a Flight Area (A) or Route/ Corridor (R)	Modeled Flight Area or Route/Corridor Name	Potentially Additive to Other Areas/Routes?	L_{dnmr} (dB) for Scenario (DNL, in parentheses if different)*						
				Alt 1			Alt 2		
			Baseline/No Action	Proposed Activity[1]	All Activity[2]	Change from All Activity	Proposed Activity[1]	All Activity[2]	Change from All Activity
R	InEgress	No	47.7	51.4		3.7	51.4		3.7
A	FARP Area	Yes	76.8 (76.5)	76.9 (76.5)		0.1 (-)	76.6 (76.5)		-0.2 (-)
A	Training	Yes	65.3	65.3		-	65.3		-
R	Malm[3]	No	37	46.9 to 48.2			46.9 to 48.2		9.9 to 11.2
R	Helena[3]	No	37	41.0 to 45.6			41.0 to 45.6		4.0 to 8.6
A	Blue Route Rd High Bird	Yes	65.3	66.5	69.0	3.7	n/a	65.3	-
A	Blue Route Rd Low Bird	Yes	65.3	66.2	68.8	3.5	n/a	65.3	-
A	Clearing	Yes	65.3	65.8	68.6	3.3	65.8	68.6	3.3
A	Gunnery	Yes	65.3	72.6	73.3	8	72.6	73.3	8
A	HARM Pad	Yes	65.3	85.8 (84.9)	85.8 (84.9)	20.5 (19.6)	86.0 (84.9)	86.0 (84.9)	20.7 (19.6)
A	Loiter North	Yes	65.3	67.8	69.7	4.4	67.8	69.7	4.4
A	Loiter South	Yes	65.3	68.9	70.5	5.2	68.9	70.5	5.2
R	ToPads	Yes	65.3	66.3 (65.5)	68.8 (68.4)	3.5 (3.1)	66.3 (65.5)	68.8 (68.4)	3.5 (3.1)
R	TransEast	Yes	65.3	68.6	70.3	5	68.6	70.3	5
R	TransWest	Yes	65.3	65.9	68.6	3.3	65.9	68.6	3.3
R	Thorofare	Yes	65.3	59.8	66.4	1.1	59.9	66.4	1.1
A	OWG Rd High Bird	Yes	65.3	n/a	65.3	-	67.5	69.5	4.2
A	OWG Rd Low Bird	Yes	65.3	n/a	65.3	-	67.2	69.4	4.1

* uniform distributed level for areas; noise level under centerline for routes/corridors

Note:

1. Indicates noise level resulting from Area or Route/Corridor specific operations.
2. Indicates noise levels resulting from all range operations within the specific Area or Route/Corridor.
3. No baseline use of these routes; Representative ambient levels obtain from NPS for Grand Portage National Monument, 2021….

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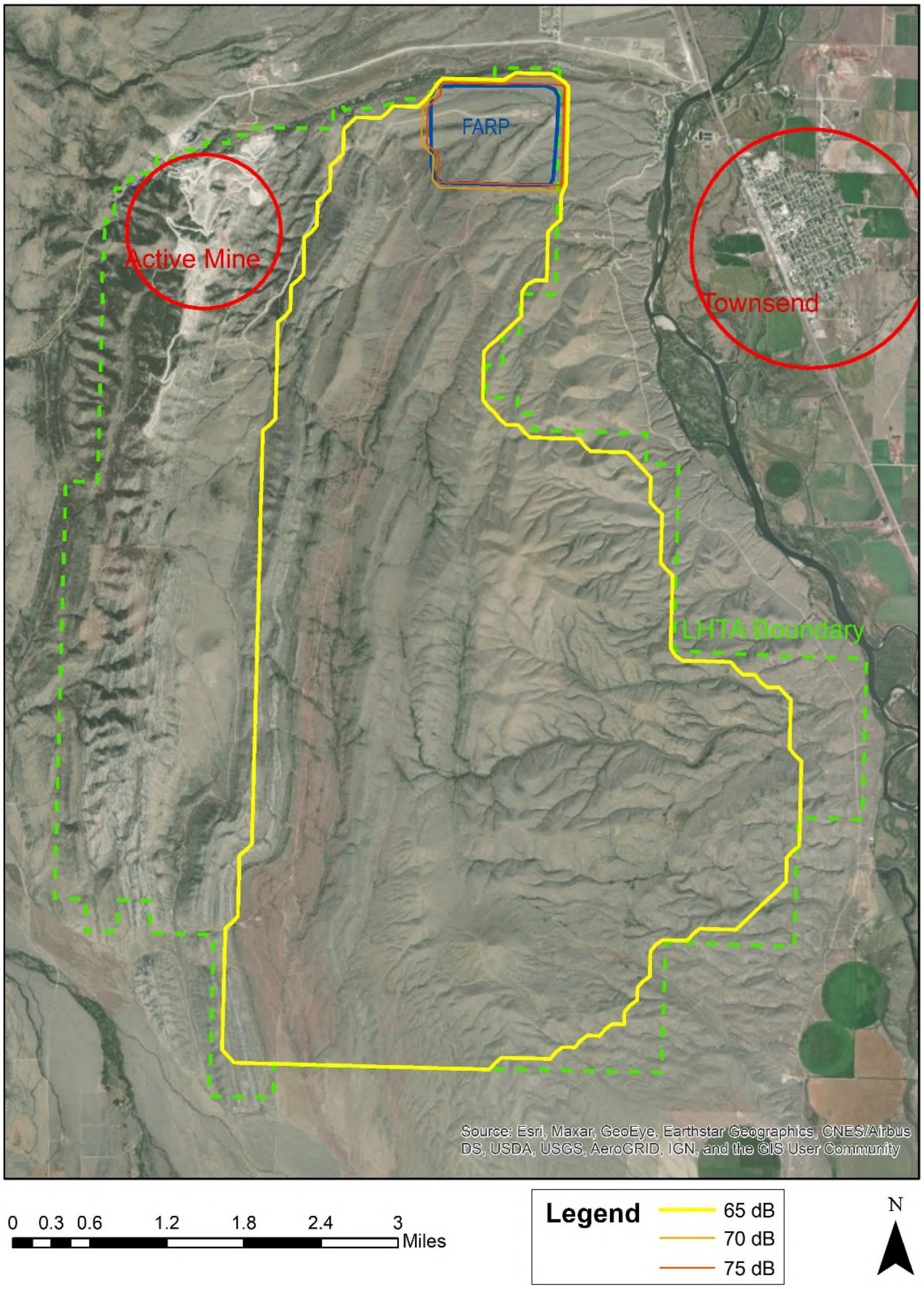

Figure 6-1. L_{dnmr} Contours for Baseline/No Action Scenario

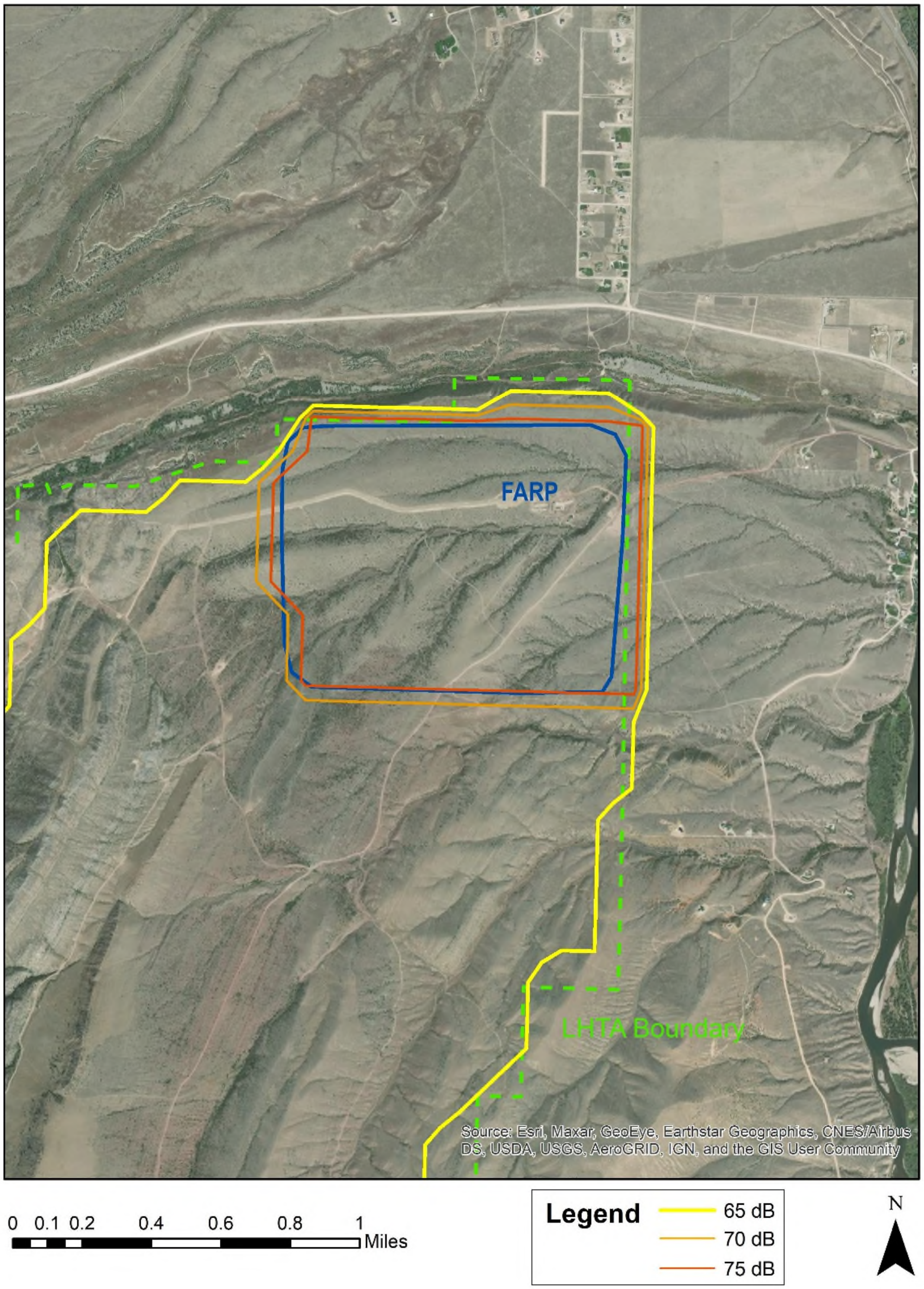

Figure 6-2. L_{dnmr} Contours for Baseline/No Action Scenario Close-up of FARP

The L_{dnmr} contours for the Alt 1 and Alt 2 scenarios are shown in Figure 6-3 and 6-5 respectively. The contours would be mostly contained within the LHTA boundary with the same locations, but slightly larger levels of exceedance. By the FARP the 65 L_{dnmr} contour would exceed the LHTA boundary by 430 feet on the eastern edge and 230 feet northwest of the FARP. Figures 6-4 and 6-6 show a zoomed in view of this area for Alt 1 and Alt 2 respectively. The most visible difference from the Baseline would be the effect of the HARM Pad runups and use of the Aerial Gunnery Range, both of which cause large protrusions of the 65 L_{dnmr} in the western part of the LHTA and a 100 ft exceedance of the 65 L_{dnmr} contour just south of the gunnery range. The alternatives differ from each other with only a slight growth in 65 L_{dnmr} for Alt 1, east of the Active Mine Zone due to the Blue Route Road convoys. No residential areas would be affected.

FAA Order 1050.1F (FAA 2020) provides a significance criteria of an increase of 1.5 dB or greater within the 65 dB DNL contour and while not significant but reportable, an increase of 3 dB or more within the 60 dB DNL contour and an increase of 5 dB within the 45 dB DNL contour.

The DNL contours for the Baseline, Alt1 and Alt 2 are shown in Figures 6-7, 6-8 and 6-9 respectively. In terms of DNL, the contours would be virtually identical to their L_{dnmr} counterparts, as would be expected for helicopter operations on the same (busiest month) operational basis.

As shown in Table 6-1, there are increases of 1.5 dB within the Baseline 65 dB DNL contour, however a review of the 60 dB DNL contour indicates there is a slight increase but no increases of 3 dB or greater. Furthermore, the only area the 60 dB contour extends beyond the boundary of the LHTA is near the FARP area to the northeast and other areas where the 65 dB DNL contour extend beyond the LHTA boundary.

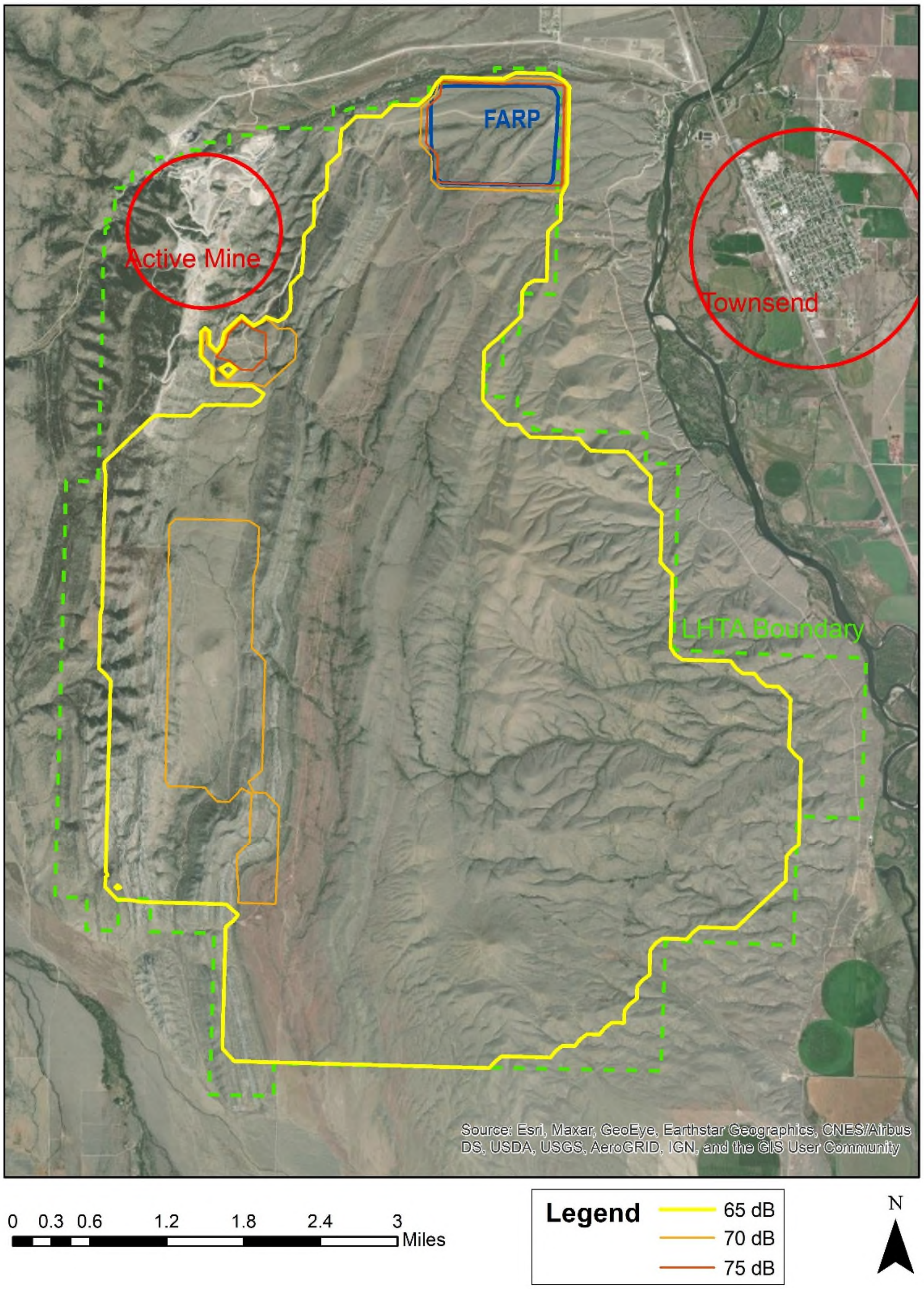

Figure 6-3. L_{dnmr} Contours for Alt 1

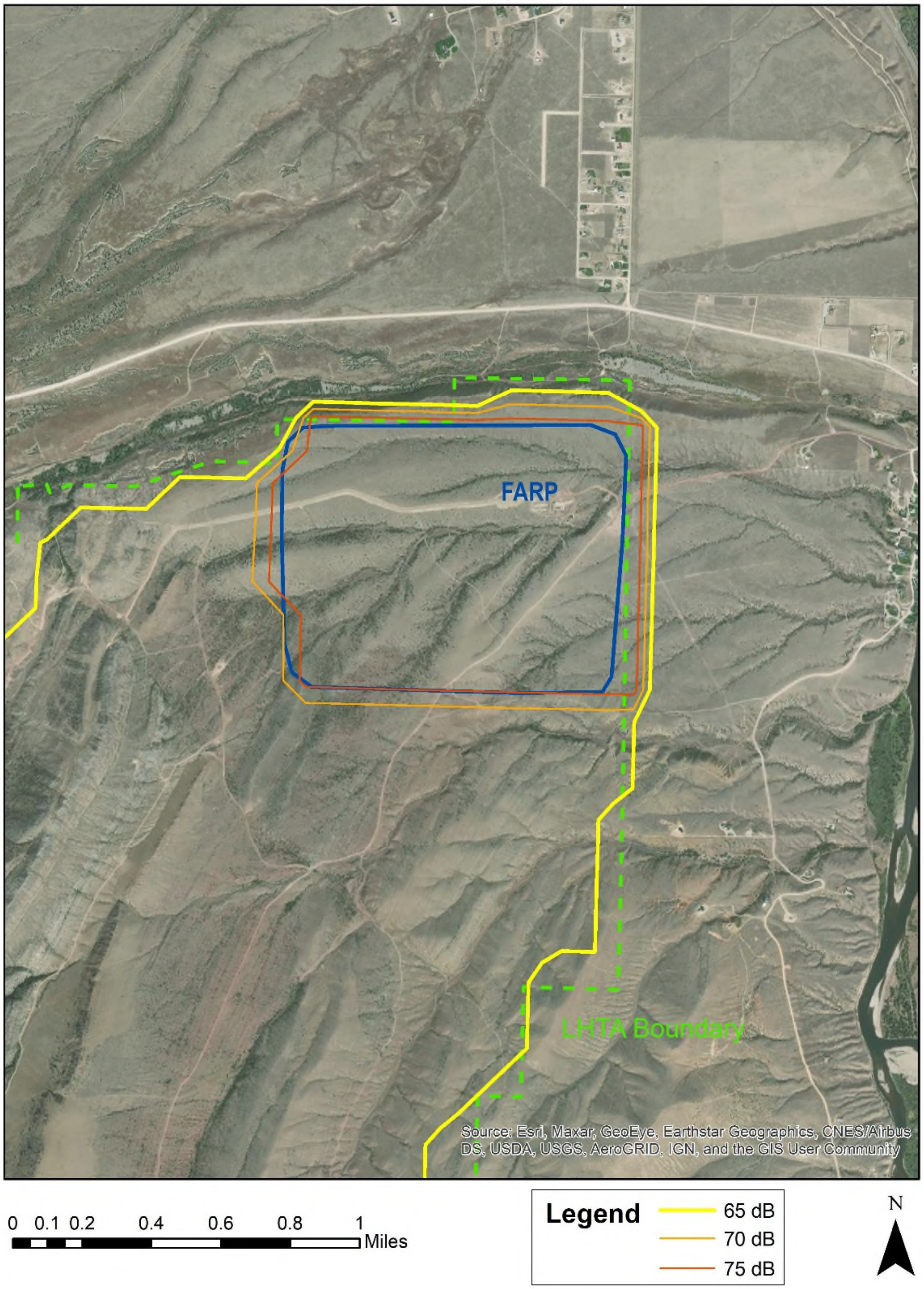

Figure 6-4. L_{dnmr} Contours for Alt 1 Close-up of FARP

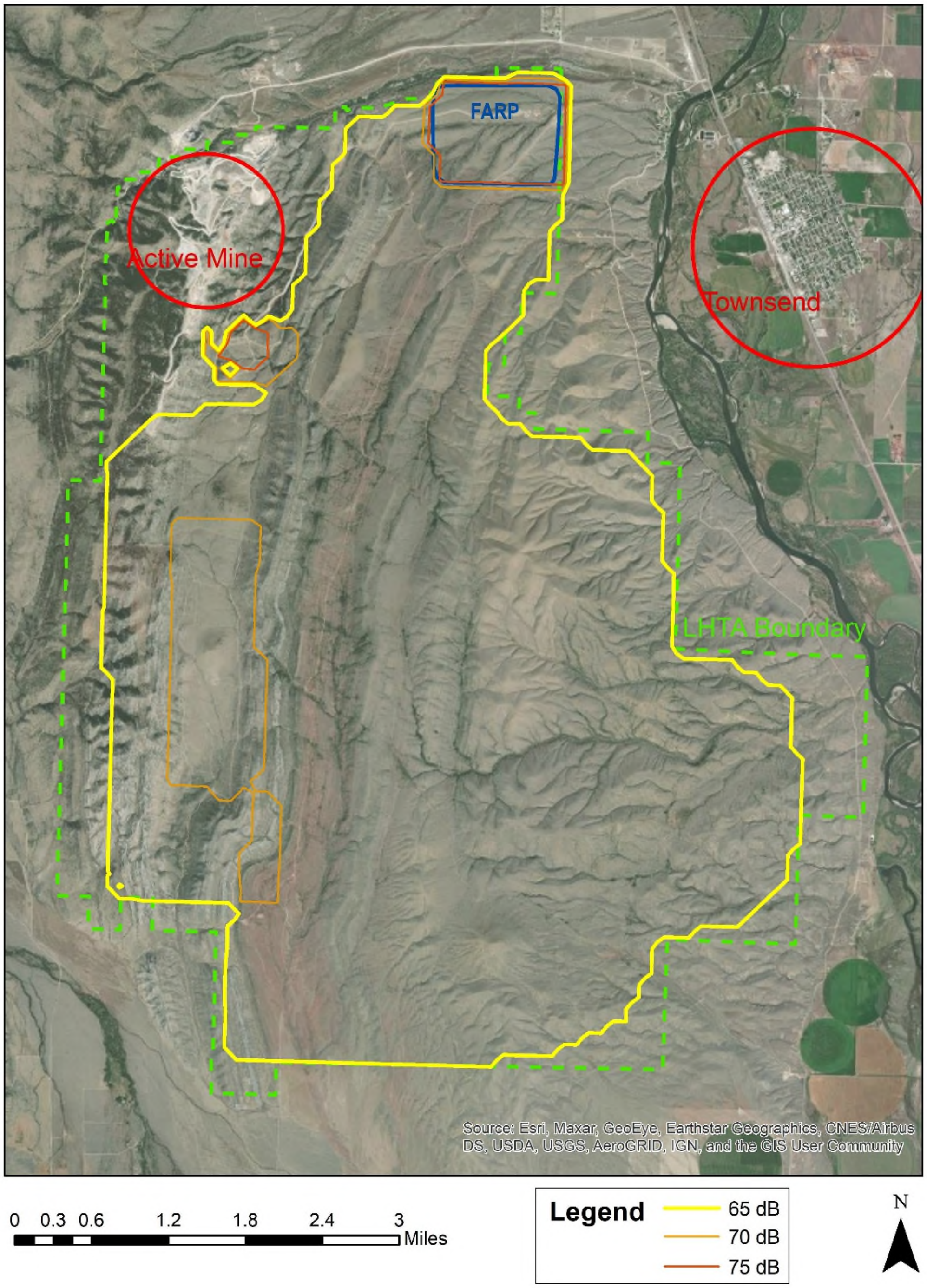

Figure 6-5. L_{dnmr} Contours for Alt 2

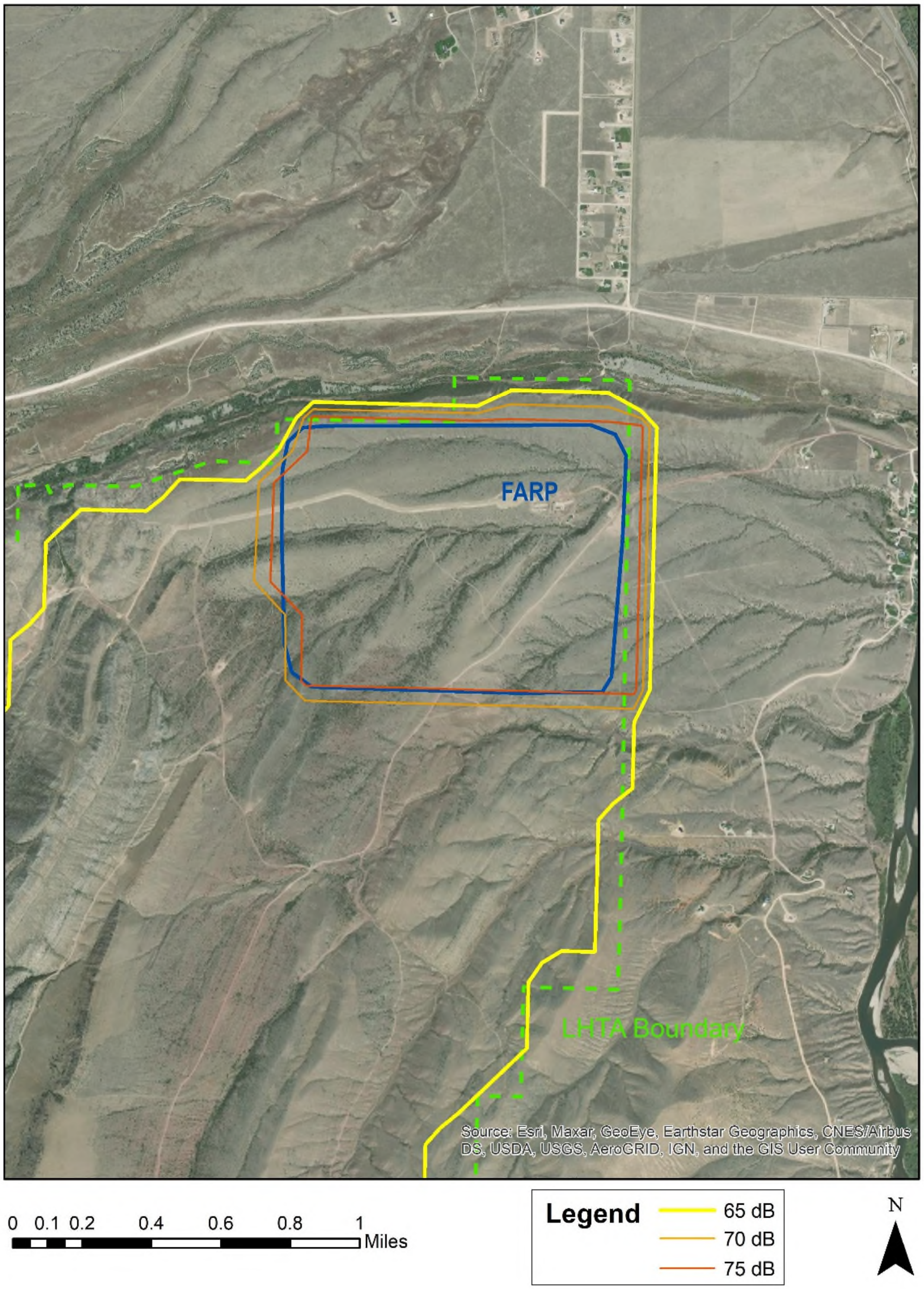

Figure 6-6. L_{dnmr} Contours for Alt 2 Close-up of FARP

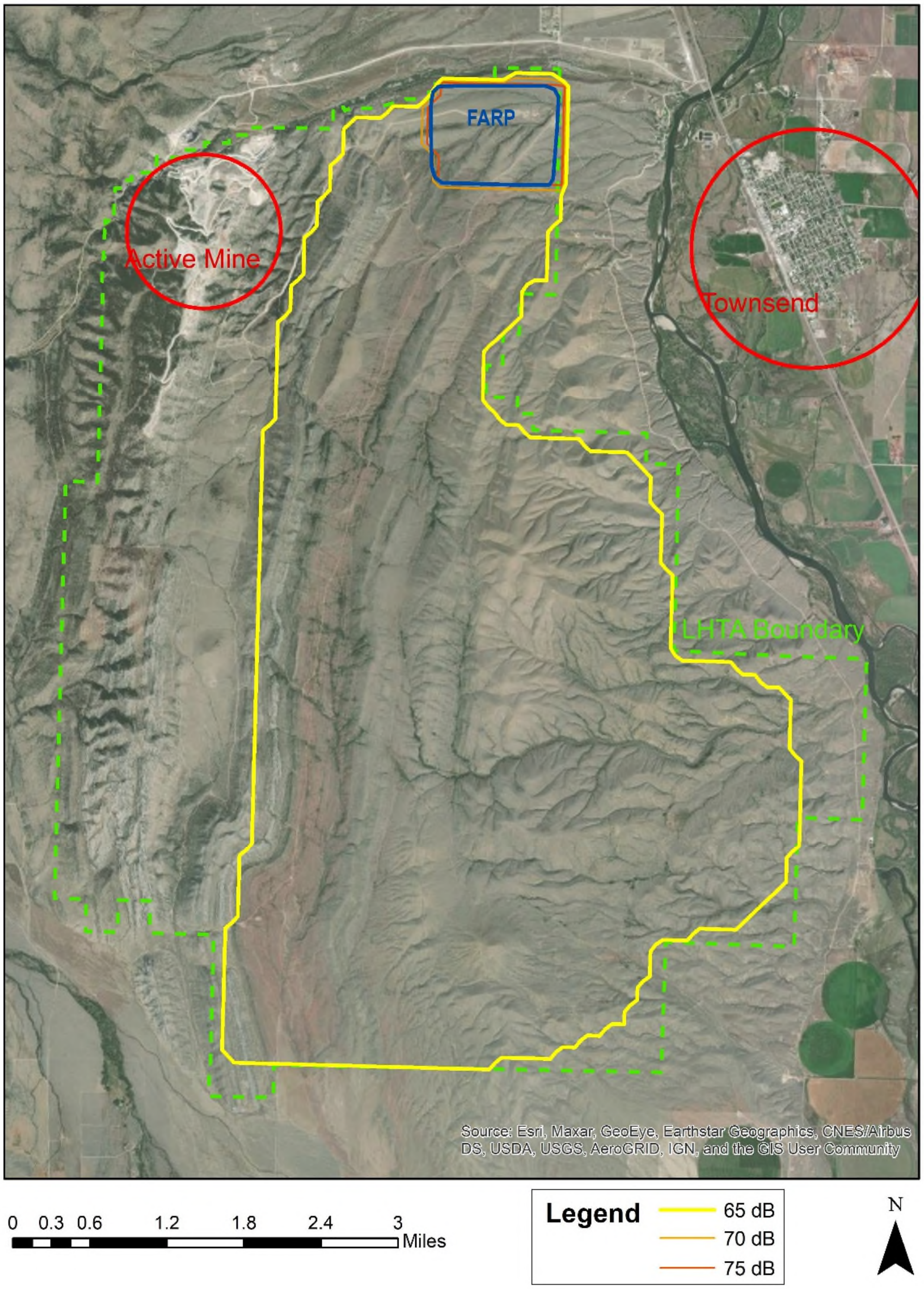

Figure 6-7. DNL Contours for Baseline/No Action Scenario

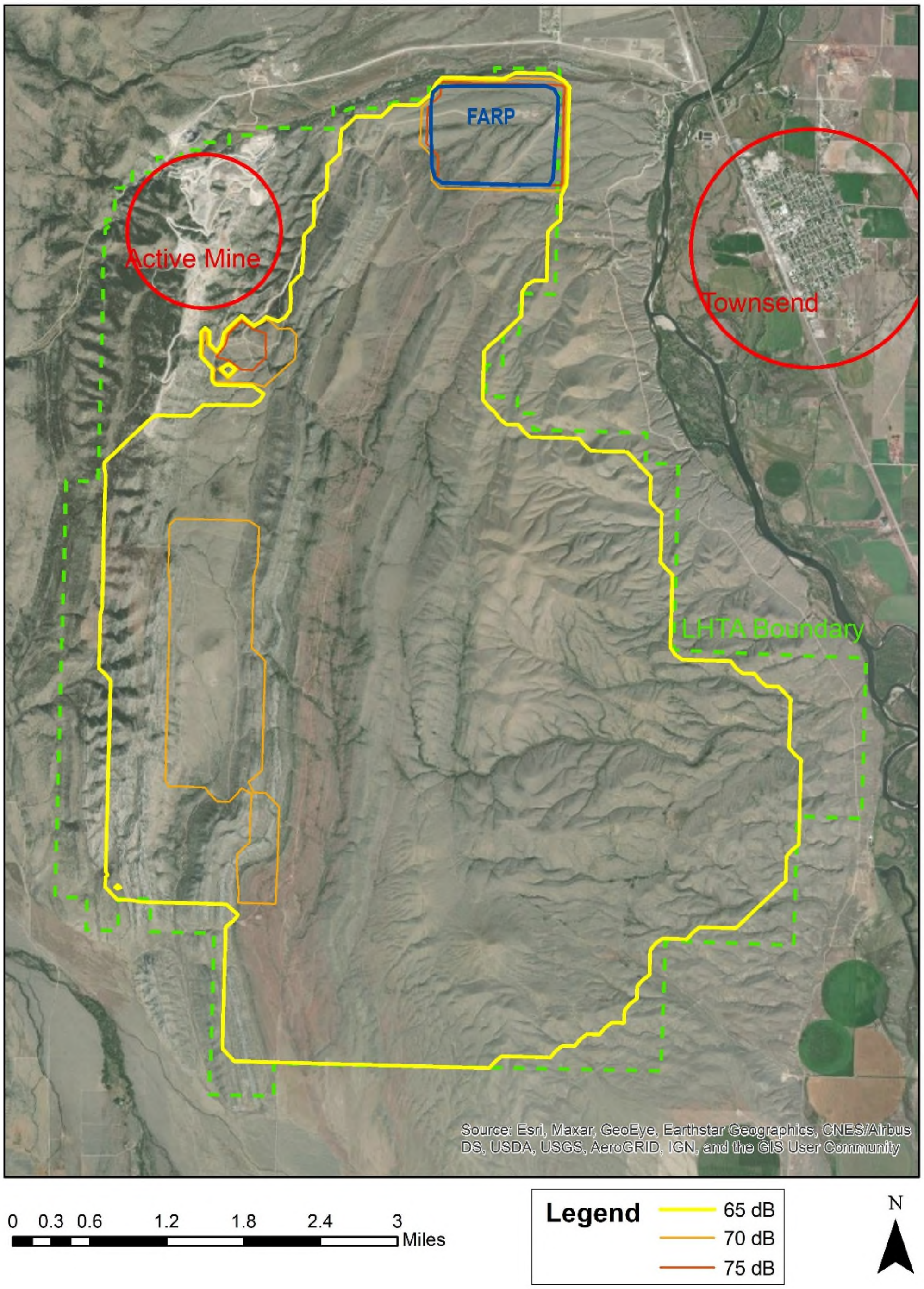

Figure 6-8. DNL Contours for Alt 1

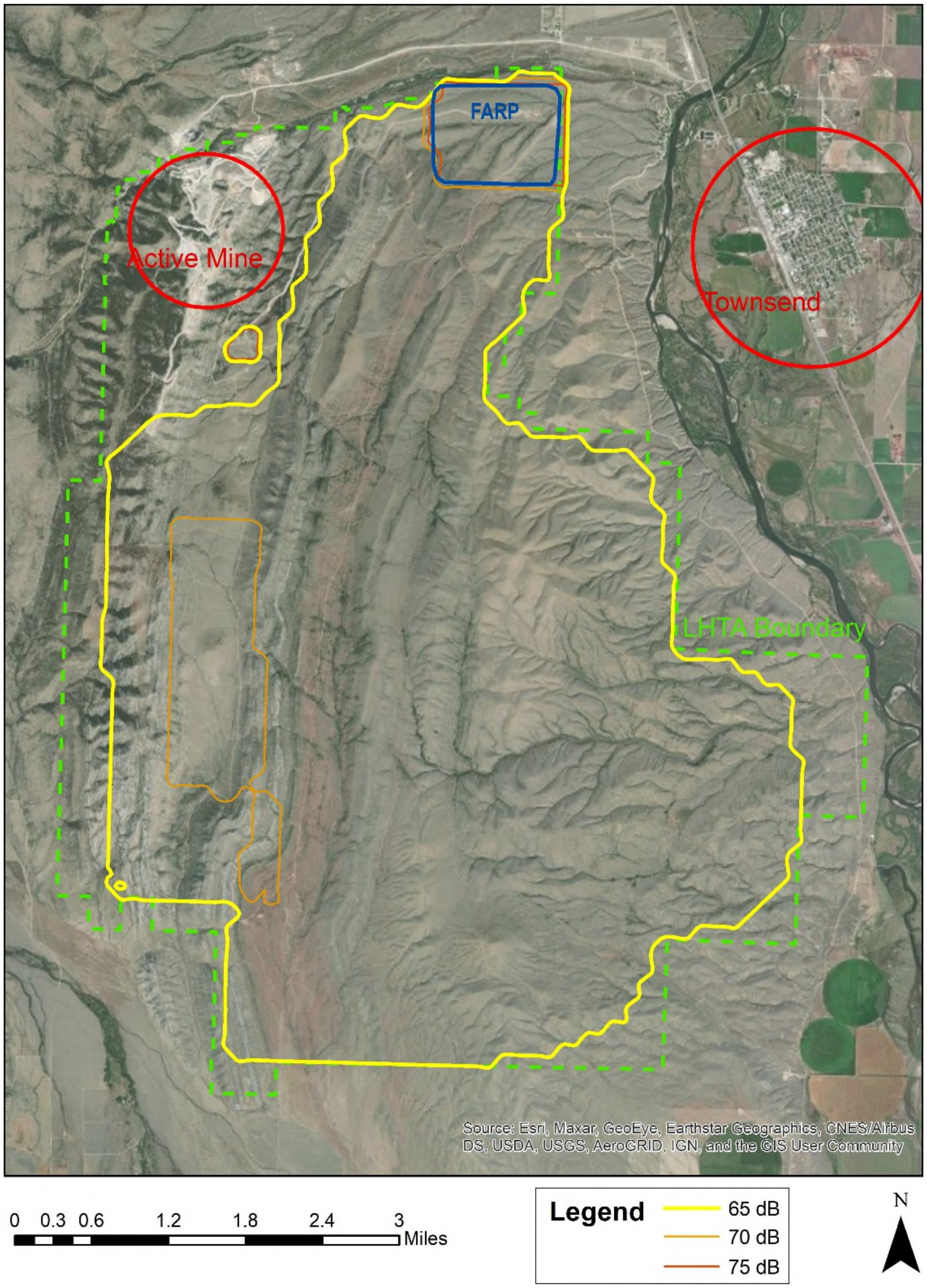

Figure 6-9. DNL Contours for Alt 2

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Appendix A – References/Bibliography

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Appendix B – Acronyms and Abbreviations

341 MW SFG	341 Missile Wing Security Forces Group
40 HS	40^{th} Helicopter Squadron
AFB	Air Force Base
AFGSC	Air Force Global Strike Command
AGL	Above Ground Level
Alt 1	Alternative 1
Alt 2	Alternative 2
CFA	Controlled Firing Area
dB	Decibels
DNL	Day-Night Average Sound Level
DoD	Department of Defense
EA	Environmental Assessment
FAA	Federal Aviation Administration
FARP	Forward Arming and Refueling Points
HARM	Helicopter Armament Refueling and Maintenance
Ldnmr	Onset-rate Adjusted Monthly Day-Night Average Sound Level
LHTA	Limestone Hills Training Area
MRNMAP	Military Operation Area and Range Noise Model
MTARNG	Montana Army National Guard
NEPA	National Environmental Policy Act
NMI	Nautical Mile
NMODD	Noise Model Operational Data Documentation
NVG	Night Vision Goggle
OWGR	Old Woman's Grave Road
POCs	Point of Contact
SUA	Special Use Airspace
USAF	United States Air Force