Final
Environmental Assessment
for Basing F-15EX Eagle II
First Operational Combat Squadron
at Portland Air National Guard Installation,
Portland, Oregon

May 2024

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ACRONYMS AND ABBREVIATIONS

Acronym	*Definition*
°F	degree Fahrenheit
142 WG	142d Wing
ACA	Aerospace Control Alert
ACAM	Air Conformity Applicability Model
ACM	Asbestos-Containing Material
AEDT	Aviation Environmental Design Tool
AFB	Air Force Base
AFFF	Aqueous Film Forming Foam
AGE	Aerospace Ground Equipment
AGL	Above Ground Level
ALP	Airport Layout Plan
ANG	Air National Guard
AOC	Area of Concern
APE	Area of Potential Effects
AR-	aerial refueling
ARTCC	Air Route Traffic Control Center
AST	Aboveground Storage Tank
AT/FP	Antiterrorism/Force Protection
ATC	Air Traffic Control
ATCAA	Air Traffic Control Assigned Airspace
BAA	Backup Aerospace Vehicles Authorized
BASH	Bird/Wildlife Aircraft Strike Hazard
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practice
CDNL	C-Weighted Day-Night Average Sound Level
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2e	carbon dioxide equivalent
CSO	Combat Systems Officer
CWA	Clean Water Act
DAF	Department of the Air Force
DAFI	Department of the Air Force Instruction
DAFMAN	Department of the Air Force Manual
dB	Decibel
dBA	A-Weighted Decibel
DEQ	Department of Environmental Quality
DNL	Day-Night Average Sound Level
DNWG	Department of Defense Noise Working Group

Acronym	*Definition*
DoD	Department of Defense
EA	Environmental Assessment
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EO	Executive Order
EPA	United States Environmental Protection Agency
ERP	Environmental Restoration Program
ESA	Endangered Species Act
ESI	Expanded Site Inspection
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
FY	fiscal year
GHG	greenhouse gas
HAP	Hazardous Air Pollutant
ICRMP	Integrated Cultural Resources Management Plan
IFR	Instrument Flight Rules
LBP	Lead-Based Paint
L_{dnmr}	Onset-Rate Adjusted Day-Night Average Sound Level
L_{eq}	Equivalent Sound Level
LID	Low Impact Development
L_{max}	Maximum Sound Level
MACA	Mid-air Collision Avoidance
MBTA	Migratory Bird Treaty Act
MCDD	Multnomah County Drainage District
MOA	Military Operations Area
MSL	mean sea level
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFA	No Further Action
NGB	National Guard Bureau
NHPA	National Historic Preservation Act
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NWSTF	Naval Weapons Systems Training Facility
O_3	ozone
OPS 1	First Operational Combat Squadron
ORS	Oregon Revised Statutes
OWS	Oil/Water Separator
PAA	Primary Aerospace Vehicles Authorized

Acronym	*Definition*
PCB	Polychlorinated Biphenyl
PDX	Portland International Airport
PFAS	Per- and Polyfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
PM_{10}	particulate matter less than or equal to 10 microns in diameter
POL	petroleum, oil, and lubricant
PRL	Potential Release Location
QD	Quantity-Distance
RAP	Ready Aircrew Program
ROI	Region of Influence
RPZ	Runway Protection Zone
$SC\text{-}CO_2$	social cost of carbon dioxide
SEL	Sound Exposure Level
SF	square foot/feet
SFHA	Special Flood Hazard Area
SHPO	State Historic Preservation Office(r)
SI	Site Inspection
SO_2	sulfur dioxide
SUA	Special Use Airspace
SWPCP	Stormwater Pollution Control Plan
U.S.	United States
UFC	Unified Facilities Criteria
USC	United States Code
USCB	United States Census Bureau
USFWS	United States Fish and Wildlife Service
UST	Underground Storage Tank
VFR	Visual Flight Rules
VOC	Volatile Organic Compound
W-	Warning Area

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION

The Department of the Air Force (DAF) proposes to recapitalize its existing F-15C inventory at Portland Air National Guard (ANG) installation[1] with the newer and more capable F-15EX "Eagle II" aircraft. Recapitalization is the acquisition of the new generation F-15EX aircraft and construction and upgrade of specific facilities for one squadron of F-15EX aircraft to support current and future combat and mission readiness. The squadron would consist of up to 24 F-15EX aircraft that would replace the existing 20 F-15C aircraft currently based at the Portland ANG installation.

The ANG is a Directorate within the National Guard Bureau (NGB). The NGB is a joint activity of the Department of Defense (DoD) and serves as a channel of communication and funding between the Air Force and ANG organizations throughout the United States (U.S.), its territories, and the District of Columbia. The ANG's federal mission is to maintain well-trained, well-equipped units available for prompt mobilization during wartime and to provide assistance during national emergencies (such as natural disasters or civil disturbances). During peacetime, the combat-ready units and their support units are assigned to most DAF major commands to carry out missions compatible with training, mobilization readiness, humanitarian, and contingency operations. When ANG units are not mobilized or under federal control, they report to the governor of their respective state, territory, or the commanding general of the District of Columbia National Guard. The ANG maintains the majority of U.S. alert sites for air defense, provides tactical airlift, air refueling tankers, general purpose fighters, rescue and recovery capabilities, tactical air support, weather flights, strategic airlift, special operations capabilities, and aeromedical evacuation units. The basing of the F-15EX aircraft would enhance the capability of the DAF while preserving the Air Superiority and Homeland Defense missions.

The NGB is the lead agency for the Proposed Action and is responsible for the scope and content of the Environmental Assessment (EA). The Federal Aviation Administration (FAA) is serving as a cooperating agency because the scope of the Proposed Action and alternatives involve activities under their jurisdiction by law and for which they have special expertise, refer to Section 1.6 for details. The NGB and FAA coordinated from the outset and developed this document to meet each agency's distinct obligations under the National Environmental Policy Act (NEPA) (42 United States Code [USC] Sections 4321–4374) to support the decision making of both agencies.

[1] The Portland ANG installation comprises leased land from the Port of Portland within the boundaries of the Portland International Airport (PDX). The 142nd Wing of the ANG is the unit that operates the Portland ANG installation. See Section 1.3.1 for additional background information and Figure 1.3-1 for the general location of the Portland ANG installation within the airport property.

This EA considers the potential consequences to the human and natural environment that may result from implementation of this action and is prepared in accordance with NEPA, 40 Code of Federal Regulations (CFR) Parts 1500–1508, 32 CFR Part 989 et seq., *Environmental Impact Analysis Process (EIAP)*, and FAA Order 1050.1F, *Environmental Impacts Policy and Procedures*.

1.2 PURPOSE AND NEED

The purpose of the Proposed Action is to maintain combat capability and mission readiness efficiently and effectively in the full spectrum of DAF aircraft as the ANG faces deployments for conflicts abroad, while also providing for homeland defense. This includes the effective management of the fighter aircraft assigned to ANG.

In order to meet this purpose, the DAF needs to recapitalize the existing F-15C inventory at Portland ANG installation that is reaching the end of its service life with the more modern F-15EX aircraft. The F-15 Eagle fighter aircraft has provided the backbone of the DAF's air dominance mission for more than 40 years. The DAF determines the service life of a fleet based on capability and structural integrity of the aircraft constrained by economic reality. The DAF has decided it is not economically feasible to retain the F-15C aircraft beyond fiscal year (FY) 2026. The F-15EX is an affordable, low-risk solution that maintains capacity and adds capability to the DAF, including an advanced cockpit, active electronically scanned array radar, digital electronic warfare suite, fast mission computer, and modern sensors to remain ahead of current and evolving threats.

Because the NGB Proposed Action involves construction of infrastructure necessary to support the F-15EX basing at the Portland ANG installation, on leased land within the boundaries of the Portland International Airport (PDX), the Port of Portland would need to request approval from the FAA for certain changes to their Airport Layout Plan (ALP). Thus, the FAA's federal action is approval of the Port of Portland's ALP. The purpose and need of the FAA's action is to ensure the components of the proposed project subject to FAA approval do not derogate aviation safety and meet FAA airport design standards at PDX.

1.3 PORTLAND AIR NATIONAL GUARD INSTALLATION

1.3.1 Location and Background

The Portland ANG installation is located at PDX, approximately 6 miles northeast of the city of Portland, in Multnomah County, Oregon, as shown in Figure 1.3-1. The Portland ANG installation is located on 222 acres of land leased from the Port of Portland Authority, and shares runways with PDX. The installation boundaries are shown in Figure 1.3-2. The Portland ANG installation includes facilities for refueling, light repairs, and staging of aircraft on to the runways of PDX.

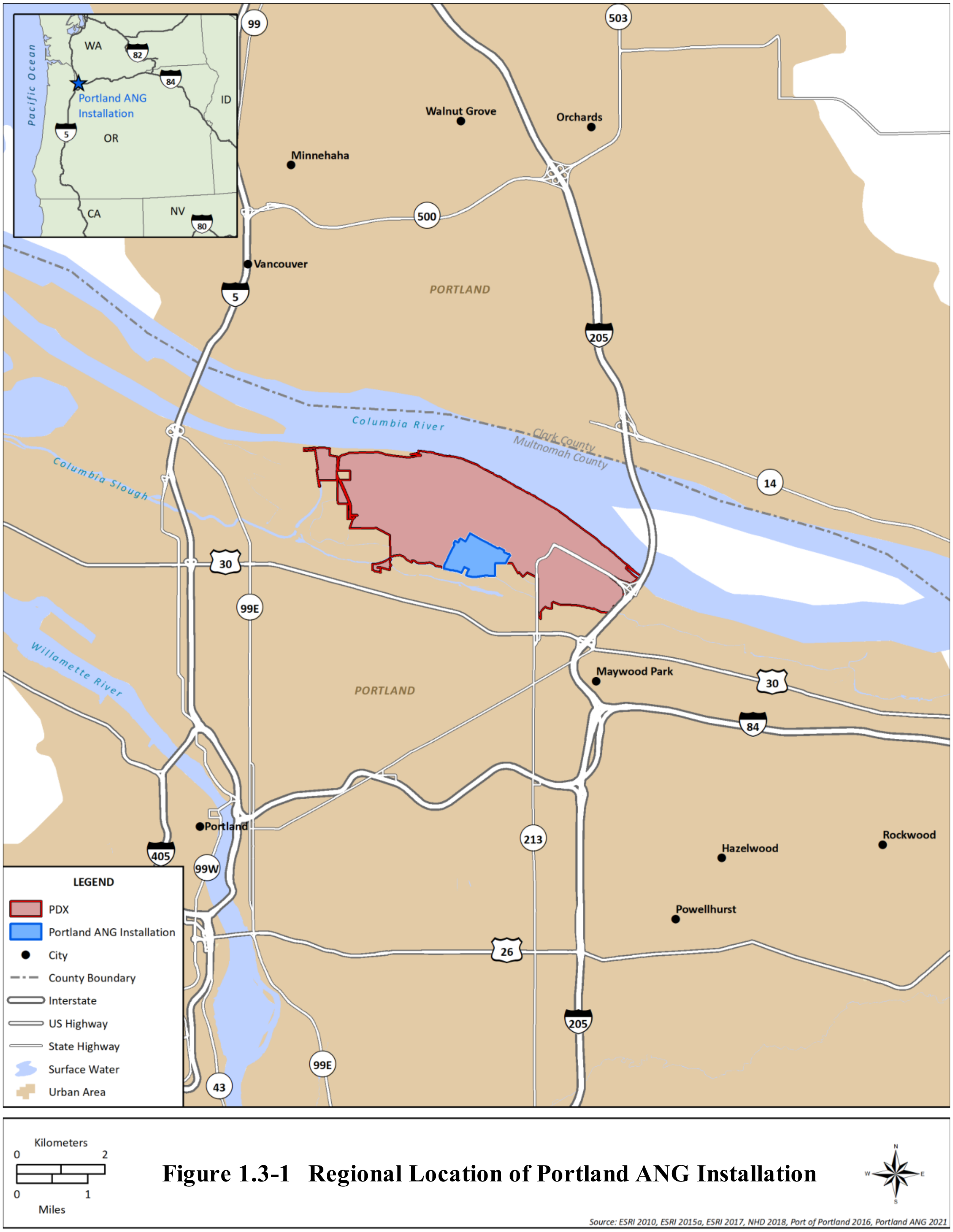

Figure 1.3-1 Regional Location of Portland ANG Installation

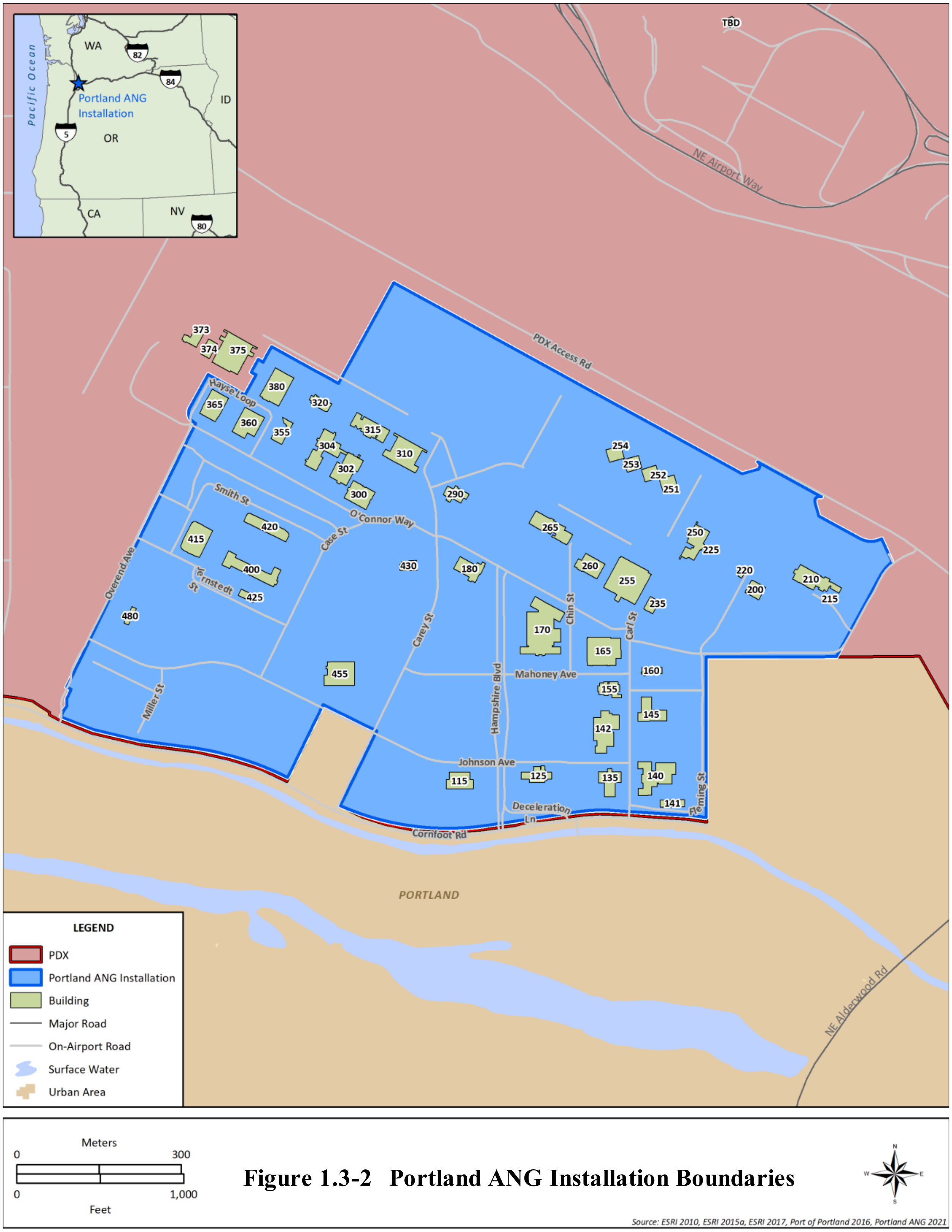

Figure 1.3-2 Portland ANG Installation Boundaries

The Portland ANG installation also provides vehicle maintenance facilities and other support equipment, as well as facilities and staff to maintain roadways, structures, and grounds.

The 142d Wing (142 WG) is located on the Portland ANG installation, which is the North American Aerospace Defense Command's principal Aerospace Control Alert (ACA) location in the Pacific Northwest. A total of 1,506 personnel are assigned to the 142 WG at the Portland ANG installation (Oregon ANG 2020a).

1.3.2 Airfield and Airspace Operations

Table 1.3-1 provides definitions for airfield and airspace terms used in this EA.

Table 1.3-1 Definition of Airspace Terms

Term	*Definition*
Sortie	Consists of a single military aircraft activity beginning from the aircraft takeoff through landing and may include one or more flight or training operations in between. The term sortie is commonly used when summarizing the amount of flight activities originating from the Portland ANG installation from a training perspective and mission standpoint. Therefore, the number of airfield departures presented in this EA equals the number of sorties originating from the Portland ANG installation.
Operation	The additional activities occurring between the takeoff and landing portion are also counted as operations. An operation applies to both airfield and airspace activities and represents the primary analytic and descriptive quantifier of aircraft flight activities presented in this EA. At an airfield, an operation comprises one action such as a landing or a takeoff. For airspace and ranges, an operation comprises the use of one airspace unit (e.g., MOA, Restricted Area, ATCAA) by one aircraft. Each time a single aircraft flies in a different airspace unit, one operation is counted for the unit. Thus, different installations could support the same number of sorties for the same aircraft type yet generate different numbers of operations in the airspace due to the configuration of airspace units.
Closed Pattern	Consists of an aircraft performing successive operations while in the vicinity of the airfield. For the purposes of analysis in this EA, a closed pattern event is defined as a departure and subsequent approach to the same runway.

Legend: ATCAA = Air Traffic Control Assigned Airspace; EA = Environmental Assessment; MOA = Military Operations Area.

F-15 arrival patterns at PDX follow those described in both the Airport Part 150 study as well as those described in the 2009 F-15 *Final Arrival Pattern Noise Study* (Oregon ANG 2009). Closed patterns are rarely flown at PDX and are generally limited to emergency use. The most common type of closed pattern event at the Portland ANG installation is the Instrument Flight Rules (IFR) patterns extending more than 10 miles from the airfield. Each IFR closed pattern generates a total of two airfield operations (one departure and one approach).

1.3.2.1 Existing Training Operations

Ready Aircrew Program (RAP) is a continuation training program designed to focus training on capabilities needed to accomplish a unit's basic tasked missions. Each RAP qualification level is defined by a total number of RAP sorties, broken down into mission types and associated events as determined by the Major Command and unit commanders. The 142 WG is responsible for air-to-air mission training with the F-15C along with their ACA mission. Information on annual flight operations is presented in Table 1.3-2.

Table 1.3-2 142 WG Annual Flight Operations Information

Description	*Annual Training Information*
Flight hours per year for F-15C, under current manning and RAP training requirements	4,120 hours
Average sortie duration	1.7 hours
Annual F-15C sorties[1] • Operations occur between 7 a.m. and 10 p.m. daily. • Night operations (defined as the acoustic nighttime, between 10 p.m. and 7 a.m.) are restricted to special or emergency circumstances through an agreement between the ANG and PDX. • Nighttime pilot proficiency training typically takes place during the months of September through April in order to stay within the 7 a.m. to 10 p.m. window and operations are assumed to occur once per month (no nighttime departures and very rare nighttime arrivals typically occurring only a few minutes after the period change at 10 p.m.	2,424 sorties
Closed patterns • Generally limited to emergency use, not assumed to occur during existing operations.	0 closed patterns

Notes: [1]The 142 WG policies and procedures limit their use of afterburner power during takeoff to only when required for safety purposes, which is dependent upon a series of inputs that include the runway length, aircraft thrust, aircraft takeoff weight, and atmospheric conditions. At PDX, the F-15C aircraft are able to utilize military power for takeoff when temperatures are less than 80 degrees Fahrenheit, which amounts to 95 percent of departures throughout the year with the remaining 5 percent requiring afterburner power.
Legend: 142 WG = 142d Wing; ANG = Air National Guard; PDX = Portland International Airport; RAP = Ready Aircrew Program.
Source: NGB 2021.

Training operations currently take place within existing military airspace and military training ranges to include Warning Area (W-) 570, Eel Military Operations Area (MOA) (including Aerial Refueling [AR-] tracks AR-683 and AR-628), Juniper/Hart MOAs, Varmit AR-645, and Redhawk MOA (see Figure 3.2-2). Under current operations, supersonic flights over land occur in the Juniper/Hart MOAs and Air Traffic Control Assigned Airspace (ATCAA) at an altitude where noise impacts on the ground are negligible – above 30,000 feet mean sea level (MSL). Over-water supersonic flights are permitted within W-570 but must occur above 10,000 feet MSL and at least 15 nautical miles offshore with the aircraft nose pointed away from the coastline. No supersonic activity occurs within the Eel MOAs or ATCAAs or within the Redhawk MOAs or ATCAAs at any altitudes (Oregon ANG 2017a). Additional airspace used less frequently includes Dolphin, W-93, COD ATCAA, W-237, Okanogan and Roosevelt MOAs, and Visual Route 1355 (NGB 2021).

Naval Weapons Systems Training Facility (NWSTF) Boardman in Boardman, Oregon provides a primary air-to-ground inert employment training range utilized for daytime air-to-ground strafe training with F-15C approximately 2 weeks per year (approximately 4 days at the NWSTF Boardman Range per 2-week event). According to the Boardman Range 2015 *Final Environmental Impact Statement (EIS) for Military Readiness Activities at Naval Weapons Systems Training Facility Boardman* (2015 Final EIS), Navy Hornets generate a majority of the sorties in Boardman and the existing F-15C activity accounts for less than 5 percent of aircraft overflights (Department of the Navy 2015). Under current conditions, the 142 WG F-15C operations are estimated to represent approximately 1.5 percent of the total annual fixed-wing operations, based on the hours presented in the 2015 Final EIS,

Mountain Home special use airspace (SUA) in Mountain Home, Idaho is currently used for approximately 2 weeks per year, often in conjunction with a bi-annual exercise called "Gunfighter Flag." The Mountain Home SUA is primarily used by local aircraft based at Mountain Home Air Force Base (AFB), including F-15E and F-15SG aircraft, as well as off-station and transient users. According to the *EIS for Airspace Optimization for Readiness at Mountain Home Air Force Base, Idaho*, local aircraft currently account for approximately 65 percent of the total annual sorties flown in the Mountain Home SUA and other users account for approximately 35 percent of annual sorties (DAF 2023a). Based on the total current annual hours flown by non-local users at Mountain Home as presented in the EIS, 142 WG F-15C operations under current conditions are estimated to represent approximately less than 1 percent of total operations in the Mountain Home SUA.

1.3.2.2 Chaff and Flare Operations

Existing training operations within the existing military airspace include the use of chaff and flares, which are the principal defensive countermeasures dispensed by military aircraft to avoid detection or attack by enemy air defense systems and keep aircraft from being successfully targeted by weapons. Defensive countermeasures deployment in authorized airspace is governed by a series of regulations based on safety, environmental considerations, and limitations based on the type of defensive countermeasure being used. Chaff and flare operations are currently authorized within the W-570, W-237, W-93, Juniper/Hart MOAs, Redhawk MOA, Okanagan MOA, Roosevelt MOA, and Dolphin MOA. Chaff and flare characteristics are described in Table 1.3-3.

Table 1.3-3 Description of Chaff and Flare

Type	*Characteristics*	*Considerations for Use*
Chaff	• Bundles of approximately 5 to 5.6 million aluminum-coated silica fibers. • Individual fibers range in length from 0.3 to 1 inch or more, thickness similar to fine human hair. • Designed to remain in the air long enough to confuse enemy radar – when dispensed from aircraft, fibers form an electronic "cloud" that breaks the radar signal and temporarily hides the maneuvering aircraft from radar detection. • Once deployed, chaff bundles break apart and the fibers disperse and drift with prevailing winds.	• Chaff fibers can drift as far as 100 miles depending on the altitude of chaff release and local wind conditions[2] before settling to the surface. • Clumps of non-deployed chaff have been found on the ground at training ranges and on public or private property under airspace where chaff is used for training. • Assuming a 99% reliability rate and the large area covered by training airspace, encountering a clump of non-deployed chaff would be rare. For 20,000 chaff bundles deployed annually over a 2,000-square mile area, an estimate of one clump of non-deployed chaff would occur per 20 square miles per year[1].
Flares	• Mixtures of magnesium and Teflon designed to burn at a temperature in excess of 2,000 °F to simulate jet exhaust to mislead heat-sensitive or heat seeking targeting systems. • An electrical charge ignites the impulse cartridge and produces hot gases that push the piston, flare pellet, felt spacers, and end cap out of the aircraft into the airstream. • Magnesium flare pellet is completely consumed, and several small pieces of residual material fall to the ground: a piston (typically made of plastic), end cap, one or two felt spacers, and a piece of the mylar wrapping that could be from 1-inch by 1-inch to 2-inches by 13-inches depending on the extent to which the burning flare consumed the wrapper. • Three types of ignition mechanisms: (1) Non-parasitic: discharged from the aircraft before ignition. (2) Parasitic: ignites inside the tube within the aircraft and is discharged already burning. (3) Semi-parasitic: thrust out of the case by a firing mechanism, which prevents the ignition of the pellet while still in the case. • Designed to burn out within 500 feet from the time of release – generally 3 to 5 seconds[1].	• Flare reliability is critical as failure could have a catastrophic effect on a targeted aircraft and create a safety concern for the pilot. Flares are designed and manufactured to a reliability rate of 99% with a 95% confidence level (improper flare functioning could occur in approximately 1% of flares[3]). Flare procurement specifications require a manufactured lot of several thousand flares pass an ignition and ejection test for the success of ignition and burn, pellet breakup, and indication of dispenser damage[1]. A random sample of 80 flares is drawn from each lot and failure of 3 flares in the sample group results in the entire lot being rejected. • A dud flare on public or private land could be a safety concern (any dud flare found should be treated as unexploded ordnance). Surveys were performed beneath two active military ranges resulting in a calculated ratio of approximately 1 dud flare in 10,000. There is no instance of a dud flare or any flare striking an individual on the ground and the probability of such occurring would be extremely rare[1]. • Fire risk is directly associated to release altitude of a flare and the risk of fire can be greatly reduced through establishing minimum altitudes for deployment of flares[1]. The minimum altitude for flare use by F-15s over all federal land is 700 feet AGL[4] and 2,000 feet AGL over non-government-owned or -controlled property unless otherwise specified in governing regulations[5]. The Oregon ANG have voluntarily raised the minimum elevation to 5,000 feet AGL within the Juniper/Hart MOA to further minimize fire risk[4].

Notes: [1]DAF 2011.
[2]Arfsten et al. 2002.
[3]DAF 1997.
[4]Oregon ANG 2017a.
[5]DAF 2022a.

Legend: % = percent; °F = degrees Fahrenheit; AGL = Above Ground Level; ANG = Air National Guard; DAF = Department of the Air Force; MOA = Military Operations Area.

1.4 SUMMARY OF KEY ENVIRONMENTAL REQUIREMENTS

The NGB has prepared this EA based upon federal and state laws, statutes, regulations, and policies pertinent to the implementation of the Proposed Action alternatives. A description of relevant laws and regulations is included in Appendix A.

1.5 RESOURCES NOT CARRIED FORWARD FOR DETAILED ANALYSIS

The Proposed Action is not expected to appreciably affect the resources described in Table 1.5-1; therefore, they are not carried forward for detailed analysis in this EA.

Table 1.5-1 Resources Not Carried Forward for Detailed Analysis

Resource	*Rationale*
Visual Resources	The Proposed Action would not have appreciable effects to visual resources. The existing view is an airfield with supporting infrastructure, and existing facilities are equipped with lighting throughout the parking areas, pedestrian walkways, and access points. There are no aesthetically sensitive locations or designated historic districts (Oregon ANG 2012) within the viewshed of the proposed activity areas under the Proposed Action (including the training airspace). During the proposed construction and demolition activities at the installation, the visual characteristics of areas undergoing development would be temporarily altered by the use of construction equipment, and the delivery and stockpiling of construction materials. At the completion of construction, the proposed facilities and associated infrastructure would remain as permanent visual features within the viewshed; however, the principal visual features of the facility would remain consistent with existing conditions. These effects would be negligible; therefore, visual resources were not carried forward for detailed analysis in this EA.
Infrastructure and Utilities	Construction or infrastructure changes would occur under the Proposed Action but not cause substantial modifications to the existing infrastructure or utilities on Portland ANG installation. Additionally, the operational phase of the Proposed Action would not appreciably increase demand for utilities and would be adequate to support the Proposed Action. Therefore, this resource is not carried forward for further detailed analysis in this EA.
Transportation	The Proposed Action would include a slight increase in personnel (110 people) under Alternative 1 and Alternative 2, and no increase in personnel under Alternative 3, or the No Action Alternative. Traffic patterns or volumes would not appreciably increase due to the proposed increase in personnel or due to the temporary construction activities; therefore, transportation as a resource was not carried forward for detailed analysis in this EA.

Legend: ANG = Air National Guard; EA = Environmental Assessment.

1.6 PUBLIC AND AGENCY REVIEW OF ENVIRONMENTAL ASSESSMENT

The environmental analysis process, in compliance with NEPA guidance, includes public and agency review of information pertinent to the Proposed Action and alternatives. A newspaper advertisement of the Draft EA and Finding of No Significant Impact (FONSI) was published in the *Oregonian* newspaper inviting the public to review and comment on the Draft EA. Copies of the Draft EA and FONSI were made available for review online at https://www.142wg.ang.af.mil/

and at the Multnomah County Belmont Library, 1038 SE César E. Chávez Boulevard, Portland, Oregon 97217. The public and agency review period ended on March 5, 2024. No public comments on the Draft EA were received. Tribal and Agency response letters received are provided in Appendix B, and the comments are addressed in the Final EA.

Scoping is an early and open process for developing the breadth of issues to be addressed in an EA and for identifying significant concerns related to an action. Per the requirements of Executive Order (EO) 12372, *Intergovernmental Review of Federal Programs*, as amended by EO 12416, federal, state, and local agencies with jurisdiction that could potentially be affected by the proposed and alternative actions were notified during the development of this EA. Through these letters, NGB notifies relevant federal, state, and local agencies and allows sufficient time to make known the environmental agencies' concerns specific to a proposed action. Comments and concerns submitted by these agencies as part of this process are incorporated into the analysis of potential environmental impacts conducted as part of the EA. Those letters are included in Appendix B.

The FAA is serving as a cooperating agency for this EA pursuant to 40 CFR Section 1501.8 (see Appendix B for a copy of the Cooperating Agency letter). The FAA has jurisdiction by law and special expertise relating to the NGB F-15EX basing proposal at PDX where the ANG is a tenant.

FAA's authorities and special expertise is based on its statutory responsibilities under the Airport and Airway Improvement Act of 1982 (49 USC Section 47101) and Section 163 of the 2018 FAA Reauthorization Act and relevant implementing regulations. The FAA is also responsible for providing leadership in planning and developing a safe and efficient national airport system and satisfying the needs of aviation interests of the United States, with due consideration for economics, the environment, local proprietary rights, and safeguarding the public investment. This includes oversight and administration of airport planning and development, airport noise compatibility planning, safety of airport operations, protection of airspace on and immediately adjacent to an airport, and environmental reviews of airport improvement projects. The FAA's Office of Airports is the lead within the FAA for the development of this EA and coordinated internally to address all resources of concern under the FAA's jurisdiction to ensure that the environmental review under NEPA and other regulatory processes are efficient and completed in a timely manner.

If the FAA receives a request from the Port of Portland (airport sponsor) for approval of certain changes to their ALP, the FAA would be responsible for an environmental review under NEPA for its federal action and may rely on the information and analyses in this EA for its decision-making purposes.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This chapter presents a detailed description of the Proposed Action to base one squadron of F-15EX aircraft at the Portland ANG installation in Portland, Oregon and the associated facility construction, renovation, and demolition projects that would occur on land leased from the Port of Portland and within the boundary of PDX to support the aircraft conversion. The details of the Proposed Action through the alternatives presented in this chapter form the basis for the analyses of potential environmental effects presented in Chapter 4.0. Additionally, this chapter includes a discussion of considerations used to identify reasonable alternatives and discusses the No Action Alternative.

2.1.1 Renovation, Demolition, and Construction Projects

Renovation, demolition, and new construction of multiple facilities would be required under all Proposed Action alternatives (Alternatives 1, 2, and 3). Proposed numbers of aircraft and personnel were used to define facility requirements, which were estimated using planning factors. Table 2.1-1 details the proposed construction projects requiring interior renovations only (no new impervious surface created) and Table 2.1-2 lists the proposed demolition and new construction projects for the Proposed Action. Both renovation and construction projects are conservatively assumed to take approximately 1 year to complete from the anticipated construction start date listed in the table. The location of the proposed projects are shown on Figure 2.1-1 and more detailed construction footprint maps are included in Appendix A.

Table 2.1-1 Proposed Interior-only Renovation Projects for Basing F-15EX at the Portland ANG Installation

Map #	*Start Year*	*Action*	*Building Size (SF)*	*Included under Alternative*		
				1	*2*	*3*
4A[1]	2026	**Avionics Building 270 Repairs.** Building systems upgrades (e.g., HVAC, plumbing, electrical).	12,796	Yes	Yes	Yes
16	2030	**Repair LRS Building 170.** Building systems upgrades (e.g., HVAC, plumbing, electrical).	56,876	Yes	Yes	Yes
22	2027	**Repair near Building 432 POL.** Upgrade outdoor spill containment.	150	Yes	Yes	Yes

Notes: [1]Project 4A (renovations) and Project 4B (new construction; see Table 2.1-2, below) are both related to Building 270 but have different disturbance footprints.
Legend: HVAC = Heating, Ventilation, and Cooling; LRS = Logistics Readiness Squadron; POL = petroleum, oil, and lubricants; SF = square feet.

Table 2.1-2 Proposed Construction and Demolition Projects for Basing F-15EX at the Portland ANG Installation

Map #	*Start Year*	*Action*	*Total Area of New Ground Disturbance (SF)*[1]	*Demolition (SF)*	*New Impervious Surface (SF)*	*Included under Alternative*		
						1	*2*	*3*
1[2]	2025	**Demolish and Reconstruct Battery Shop (Building 240).** Includes LOX and Helium Facility. Under Alternatives 1 and 2, the building would be demolished but the uses would be consolidated in the Universal Large Hangar (Project 2A-C), and new ground disturbance is included under that project. Under Alternative 3, the building would be reconstructed as a 1,600 SF facility in the same location, to support the continued F-15C mission.	1,600	2,800	0	Yes	Yes	Yes
2A[2]	2026	**Construct Universal Large Hangar (new building, no number) – Phase 1.** To meet requirements for air-to-ground mission. Hangar would be approximately 35,500 SF and 50 feet tall. Includes 49,700 SF of connecting concrete ramps.	85,200	0	85,200	Yes	Yes	No
2B[2]	2027	**Construct Universal Large Hangar (new building, no number) – Phase 2.** To meet requirements for air-to-ground mission. 34,350 SF of Maintenance Shops and Squadron Operations space would be constructed in Phase 2.	34,350	0	34,350	Yes	Yes	No
2C[2]	2028	**Construct Universal Large Hangar (new building, no number) – Phase 3.** To meet requirements for air-to-ground mission. 34,350 SF of Maintenance Shops and Squadron Operations space would be constructed in Phase 3.	34,350	0	34,350	Yes	Yes	No
3	2025	**Construct Aircraft Support Equipment Covered Storage (new structure, no building number).** To meet requirements for F-15EX conversion.	6,500	0	6,500	Yes	Yes	No
4B[3]	2026	**Construct Addition to Avionics Building 270.**	2,804	0	2,804	Yes	Yes	Yes

Map #	*Start Year*	*Action*	*Total Area of New Ground Disturbance (SF)*[1]	*Demolition (SF)*	*New Impervious Surface (SF)*	*Included under Alternative*		
						1	*2*	*3*
5	2027	**Demolish and Reconstruct Building 165 (Warehouse/ Storage Building).** Needed to accommodate uses from buildings demolished due to land use restructuring (e.g., return of leased lands to the Port of Portland – Project 6).	25,380	20,004	0	Yes	Yes	Yes
6	2028	**Demolish Buildings 475, 491, 495, 496, 497, and 498 in Parcel D-2.** Required as building is located on leased lands that would be returned to Port of Portland upon lease expiration in 2030.	0	23,167	0	Yes	Yes	Yes
7	2028	**Separate Utilities in Parcel D-1.** Utilities for continued use of the Portland ANG installation needs to be separated from the ones on the leased lands that would be returned to Port of Portland upon lease expiration in 2030.	0	387	0	Yes	Yes	Yes
8	2029	**Demolish Combat Arms Training Range, Buildings 485 and 480.** No construction proposed to occur to replace these buildings.	0	64,733	0	Yes	Yes	Yes
9	2029	**Construct New BCE Pavement and Ground Facility (new building, no number).** Facility to store heavy equipment currently stored outdoors.	6,500	0	6,500	Yes	Yes	Yes
10	2029	**Construct Add-on to Building 115 for CERFP/DOMOPS.**	1,200	0	1,200	Yes	Yes	Yes
11	2029	**Construct Covered Storage Shed for CERFP/DOMOPS.**	2,800	0	2,800	Yes	Yes	Yes
12	2030	**Repair/Increase Size of South Alert Berm.**	6,600	0	6,600	Yes	Yes	Yes
13	2030	**Construct Add-on Crew Readiness Area for CSOs (Building 210).** To meet requirements for air-to-ground mission.	1,200	0	1,200	Yes	Yes	No
14[4]	2030	**Construct Arm/De-arm Pad with Berm.** SF includes aprons connecting to the new pad.	12,000	0	12,000	Yes	Yes	No
15A[5]	2030	**Construct F-15EX Simulator Facility (Next to Building 265).** To enable backseat cockpit training.	20,000	0	20,000	Yes	Yes	No

Map #	*Start Year*	*Action*	*Total Area of New Ground Disturbance (SF)*[1]	*Demolition (SF)*	*New Impervious Surface (SF)*	*Included under Alternative*		
						1	*2*	*3*
15B[5]	2030	**Demolish and Re-build Building 265.** Larger operations facility to support increased operations footprint.	1,300	23,700	1,300	Yes	Yes	No
17A	2030	**Construct Additional Admin Area for M&I Air-to-Ground (new building, no number).** Maintenance bay required to execute small maintenance related to air-to-ground mission. Includes demolition of a portion of Building 400.	4,400	5,158	4,400	Yes	Yes	No
17C	2032	**Construct MUNS Storage Igloo (new building, no number).** To meet space requirements for air-to-ground mission.	3,600	0	3,600	Yes	Yes	No
17D	2032	**Install MUNS Maintenance Trailer (new building, no number).** Includes construction of a concrete pad for trailer to be placed on. To meet requirements for air-to-ground mission.	1,200	0	1,200	Yes	Yes	No
17E	2032	**Construct new MUNS Perimeter Fence.** Fence will be 2,600 linear feet, with a 1-foot assumed width for the total disturbance SF.	2,600	0	2,600	Yes	Yes	No
17F	2032	**Construct Additional Conventional Munitions Admin Facility (Addition to Building 400).** To meet space requirements for air-to-ground mission. Includes 20,632 SF of interior renovation, moving the existing perimeter fence and constructing new utilities.	5,000	0	1,240	Yes	Yes	No
18[2]	2032	**Demolish Building 255.** To support the F-15EX mission. Consolidate operations and maintenance functions in new Universal Hangar Building.	0	64,738	0	Yes	Yes	No
19[2]	2033	**Demolish Building 275.**	0	12,269	0	Yes	Yes	No

Map #	Start Year	Action	Total Area of New Ground Disturbance (SF)[1]	Demolition (SF)	New Impervious Surface (SF)	Included under Alternative		
						1	2	3
20[2]	2034	**Demolish Building 160**	0	4,382	0	Yes	Yes	No
21[2]	2035	**Partial Demolition of Building 265**	0	15,520	0	Yes	Yes	No

Notes: [1]For building construction projects, the area of total ground disturbance represents the square-footage of a 1-story building to be constructed, unless a building height is specified in the project description.
[2]Projects 2A through 2C are associated with demolition projects 1, 18, 19, 20 and 21, as these functions would be relocated to the Universal Hangar once constructed.
[3]Project 4A (renovations; see Table 2.1-1) and Project 4B (new construction) are both related to Building 270 but have different disturbance footprints.
[4]Project 14 may require a concrete batch plant for construction, if determined by the contractor and would likely be located just south of the where Project 17 would be constructed, pending FAA approval. There are two location options shown on the figure, annotated as 14.1 and 14.2.
[5]Project 15A and 15B will both occur and are related to Building 265 (these are not options for construction).

Legend: ANG = Air National Guard; BCE = Base Civil Engineer; CERFP/DOMOPS = Chemical Biological Radiological Nuclear Enhanced Response Force Package/Domestic Operations; CSO = Combat Systems Officer; LOX = liquid oxygen; M&I = maintenance and inspection; MUNS = Munitions Squadron; SF = square feet.

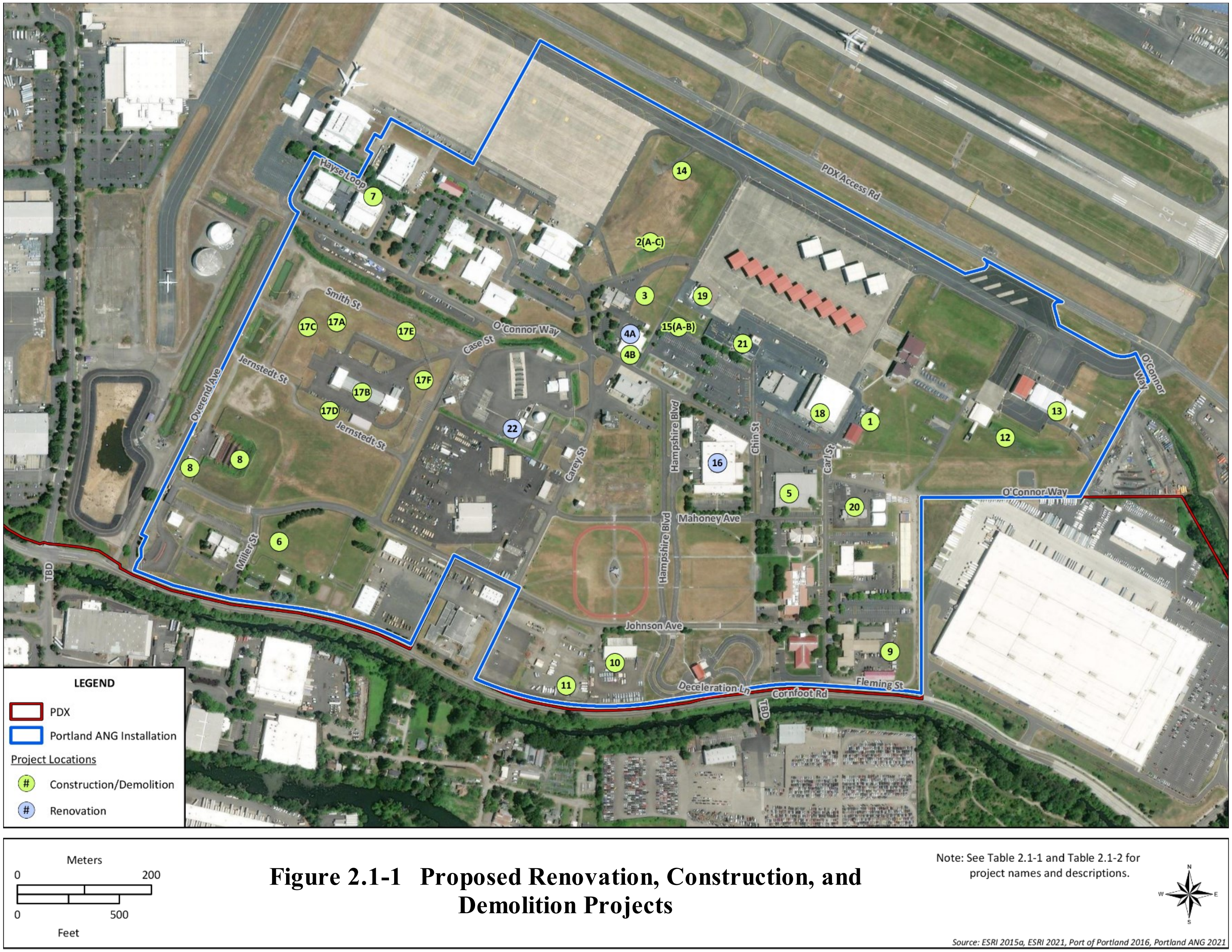

Figure 2.1-1 Proposed Renovation, Construction, and Demolition Projects

2.2 SELECTION CRITERIA

In order to assess viable alternatives for the F-15EX basing, including a requirement to establish a first operational combat squadron (OPS 1) for the F-15EX, the selection standards shown in Table 2.2-1 were considered. These standards do not represent absolute requirements for basing the OPS 1 but criteria used by the NGB to rank potential locations.

Table 2.2-1 Selection Standards Used to Rank Potential F-15EX OPS 1 Locations

Selection Standard	*Criteria*
Mission	Optimized to meet F-15EX training requirements.
Training Infrastructure	• Ceiling greater than 3,000 feet, visibility greater than 3 miles for 350 days per year • Airspace meets training requirements • Electronic warfare training range attributes and availability • Air-to-ground range attributes and availability
Capacity	Enough capacity to accommodate a squadron with up to 24 F-15EX aircraft.
Operations Facilities	Already constructed or space available to construct: • One Squadron Operations/Aircraft Maintenance Unit facility (16,400 SF) • Two-bay flight simulator facility (15,400 SF) • Aircraft ramp/parking (40,000 SF)
Logistics Facilities	Already constructed or space available to construct: • Maintenance hangars (34,000 SF) • Corrosion control • Munitions storage and maintenance (8,700 SF) • Jet Engine Intermediate Maintenance (6,600 SF) • Engine test cell • Maintenance training facility (15,400 SF) • Supply warehouse/parts storage (17,400 SF)
Base Support	Availability and ability to provide housing, dormitory, childcare, dining facility, fitness center, medical/dental care.

Legend: OPS 1 = First Operational Combat Squadron; SF = square feet.

Considering the above standards, the DAF considered an enterprise of five ANG combat squadron locations that currently have F-15C aircraft for replacement with F-15EX and/or the F-35A:

- 104th Fighter Wing Installation, located at Westfield-Barnes Regional Airport, Massachusetts
- 125th Fighter Wing Installation, located at Jacksonville International Airport, Florida
- 159th Fighter Wing Installation, located at Naval Air Station Joint Reserve Base, New Orleans, Belle Chasse, Louisiana
- 144th Fighter Wing Installation, located at Fresno Yosemite International Airport, California
- 142 WG installation, located at PDX, Oregon

The 142 WG installation at PDX was determined by the Secretary of the Air Force to be the preferred location for the F-15EX OPS 1 due to the strategic importance of the 142 WG location and its assigned North American Aerospace Defense Command ACA mission. The importance of this mission is a matter of past historic legislative record and continues to the present day and into the future. The newer and more capable F-15EX aircraft is needed to support the 142 WG's combat and mission readiness, and to effectively support the readiness and lethality requirements of the National Defense Strategy. The other potential locations listed above were eliminated from further analysis since they would be analyzed separately for either F-15EX or F-35A combat squadrons in a separate NEPA document.

During the development of the Proposed Action, alternative locations for each construction project were evaluated based on the mission needs of the 142 WG and other selection criteria such as the ability to collocate like services, site availability, and facility condition. Based on this evaluation, with the exception of those projects that have alternative locations, the proposed location for each of the construction projects was determined to be the only feasible alternative that met the purpose and need of this Proposed Action. Each of the facilities proposed for demolition were also evaluated for potential re-use and none were considered suitable.

2.3 ALTERNATIVE 1

Alternative 1 would entail the full replacement of the F-15C aircraft with one squadron of F-15EX aircraft, to include 20 aircraft (18 Primary Aerospace Vehicles Authorized [PAA] and 2 Backup Aerospace Vehicles Authorized [BAA]) and associated personnel, including the specifically itemized construction and structural improvement projects necessary to facilitate the multi-role (air-to-air and air-to-ground) mission conversion requirements efficiently and effectively. Backup aircraft such as BAA are assigned to allow for the execution of normally forecast assigned mission activities during scheduled and unscheduled depot level maintenance on PAA (DAF 2019).

Alternative 1 would result in an increase of approximately 110 personnel (including a mix of officers and enlisted personnel) due to the requirement for a second aircrew member (i.e., Combat Systems Officer [CSO]) for the added air-to-ground mission. The F-15EX aircraft would utilize existing military airspace and military training ranges. Total annual operations at PDX or within the associated airspace would be slightly higher than existing conditions/No Action Alternative, with 446 more annual operations, which equals a 9 percent increase from current conditions. The allocation and use of defensive countermeasures is not expected to change from the current usage with the F-15EX. They would be used for ACA missions and would also be used in training. The unit would continue to receive the same allocation of chaff and flares that they currently receive. They would be used at the same rates in the same places, subject to the same restrictions that exist now. A portion of the sorties would also be shifted from the current air-to-air training to air-to-ground training events with different requirements to occur at established ranges like NWSTF Boardman or Mountain Home SUA.

2.3.1 Renovation, Demolition, and Construction Projects

Tables 2.1-1 and 2.1-2 detail the renovation, demolition, and construction projects for implementation of Alternative 1 (indicated in the table by a "Yes" under the Alternative 1 column) and are depicted on Figure 2.1-1. Under Alternative 1, new construction would result in up to 182,044 SF of new facilities, and up to 214,802 SF of new impervious surface. The total construction footprint analyzed represents the largest possible footprint of each of the options.

2.3.2 Airfield Operations

Training requirements for Alternative 1 would remain similar to the existing F-15C as described in Section 1.3.2. The NGB proposes to implement a 4,500 annual flying hour program, which was calculated from an anticipated 250 flying hours per PAA aircraft. The 142 WG operators reviewed these training requirements along with the following assumptions to determine the RAP production needed per month and the corresponding flying schedule for the F-15EX with 18 PAA:

- Added air-to-ground mission (shifts some air-to-air training time to air-to-ground but no effect on total RAP or airfield operations);
- 2,647 annual F-15EX sorties (consistent with existing average sortie duration of 1.7 hours); and
- 5,294 annual airfield operations (comprised of 2,647 departures, 2,647 arrivals, and no closed patterns) – an increase of 9 percent over existing conditions/No Action Alternative.

As discussed in Section 1.3.2.2, *Existing Training Operations*, under Alternative 1, the following would remain consistent with existing operations:

- Closed patterns at PDX would be limited to emergency use and assumed to be essentially zero;
- Operations occur between 7 a.m. and 10 p.m. daily; and
- Use of afterburner by the 142 WG is limited to condition required for safety.

Because of the higher thrust to weight ratio of the F-15EX, when compared to the existing F-15C under both afterburner and non-afterburner conditions, the need for afterburner power would decrease under Alternative 1. However, this analysis conservatively assumes that the afterburner use by F-15EX would remain the same as existing F-15C at 5 percent of departures. Table 2.3-1 shows the change in the number of 142 WG operations per year at PDX from existing conditions/No Action Alternative due to Alternative 1.

Table 2.3-1 Existing Conditions/No Action Alternative and Proposed Alternative 1 Military Annual Airfield Operations by 142 WG at PDX

Aircraft	*Depart*	*Arrive*	*Closed Patterns*	*Total Airfield Operations*
Existing Conditions/No Action Alternative[1]				
F-15C	2,424	2,424	0	4,848
Alternative 1				
F-15EX	2,647	2,647	0	5,294
			Total Change in Airfield Operations	+446

Note: [1]The existing conditions represent a multi-year average (2017–2019), which accounts for year-to-year fluctuations. Because 2020 and 2021 were atypical years due to COVID-19 disruptions, these years have been excluded from the 3-year average. The No Action Alternative for this EA is equivalent to the existing conditions in terms of aircraft and airfield operations.

Legend: 142 WG = 142d Wing; PDX = Portland International Airport.

2.3.3 Airspace

Total sorties and thus corresponding activities in the associated airspace would increase approximately 9 percent under Alternative 1, relative to existing conditions/No Action Alternative, due to the increase in flight hours per PAA. The F-15EX would continue to utilize existing military airspace and military training ranges. The new air-to-ground training flights would occur in the previously established airspace currently used by the 142 WG, as described in Section 2.3.2. Thus, a portion of the sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements. The result would increase the F-15EX use of NWSTF Boardman to support additional strafe training requirements and Mountain Home SUA to support inert weapons release training requirements, for up to 4 weeks per year at each location (an increase of 2 weeks per year at each location from existing conditions/No Action Alternative). As these sorties would shift to NWSTF Boardman and Mountain Home, the F-15EX use of W-570 and Eel MOA would decrease by an estimated 15 percent, while use of all other associated airspace would not change.

Aircrew air-to-ground training would be accomplished through three primary methods: (1) aircraft training mode (i.e., air-to-ground ordnance is neither physically loaded nor released from the aircraft), (2) simulator training events, or (3) during deployments to various training locations that support live/inert air-to-ground weapons release events (e.g., Mountain Home SUA and NWSTF Boardman). For munitions assembly and load training at the Portland ANG installation at PDX, only inert air-to-ground munitions would be used and no live explosives are proposed to be assembled, stored, or loaded. On seldom occasions, the inert ordnance would be loaded on aircraft at the Portland ANG installation and released in local approved restricted areas (i.e., Mountain Home SUA and NWSTF Boardman).

2.4 ALTERNATIVE 2

Like Alternative 1, Alternative 2 would entail the full replacement of the F-15C aircraft with one squadron of F-15EX aircraft and associated personnel including the specifically itemized construction and structural improvement projects necessary to facilitate the multi-role (air-to-air and air-to-ground) mission conversion requirements efficiently and effectively. The primary difference is that the replacement squadron of F-15EX would include a total of 24 aircraft (21 PAA, 2 BAA, and 1 Attrition Reserve). This is four more aircraft total than Alternative 1 – three PAA and one Attrition Reserve. Attrition Reserve is an additional category of backup aircraft that are planned to be provided as new production aircraft are available above PAA and BAA requirements (DAF 2019).

As with Alternative 1, training would utilize existing military airspace and military training ranges, and a portion of training sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements to occur at established ranges like NWSTF Boardman or Mountain Home SUA. Annual operations at PDX or the associated airspace would be slightly higher than Alternative 1, with 1,328 more annual operations compared to existing conditions/No Action Alternative, which is an increase of 27 percent over current conditions. This is 882 more annual operations than Alternative 1 (or approximately 17 percent more than Alternative 1). As with Alternative 1, the unit would continue to receive the same allocation of chaff and flares that they currently receive. They would be used at the same rates in the same places, subject to the same restrictions that exist now. Alternative 2 would result in the same increase in personnel as Alternative 1 (approximately 110 personnel) for the added air-to-ground mission.

2.4.1 Renovation, Demolition, and Construction Projects

The renovation (Table 2.1-1) and construction/demolition projects (Table 2.1-2) are the same as those that would be implemented for Alternative 1 (Figure 2.1-1), with 182,044 SF of new facilities and up to 214,802 SF of new impervious surface being constructed.

2.4.2 Airfield Operations

As with Alternative 1, Alternative 2 would add the air-to-ground mission, which would not affect how the aircraft depart or arrive at PDX, but rather how aircraft would train in the airspace (see Section 2.3.3 above). Under Alternative 2, the NGB proposes to implement a 5,250 annual flying hour program, calculated from an anticipated 250 hours per PAA aircraft. The corresponding flying schedule for the F-15EX with 21 PAA includes:

- Added air-to-ground mission (shifts some air-to-air training time to air-to-ground but no effect on total RAP or airfield operations);
- 3,088 annual F-15EX sorties (average sortie duration of 1.7 hours); and
- 6,176 annual airfield operations (comprised of 3,088 departures, 3,088 arrivals, and no closed patterns) (Table 2.4-1).

Table 2.4-1 Existing Conditions/No Action Alternative and Proposed Alternative 2 Military Annual Airfield Operations by 142 WG at PDX

Aircraft	*Depart*	*Arrive*	*Closed Patterns*	*Total Airfield Operations*
Existing Conditions/No Action Alternative[1]				
F-15C	2,424	2,424	0	4,848
Alternative 2				
F-15EX	3,088	3,088	0	6,176
Total Change in Airfield Operations				+1,328

Note: [1]The existing conditions represent a multi-year average (2017–2019), which accounts for year-to-year fluctuations. Because 2020 and 2021 were atypical years due to COVID-19 disruptions, these years have been excluded from the 3-year average. The No Action Alternative for this EA is equivalent to the existing conditions in terms of aircraft and airfield operations.

Legend: 142 WG = 142d Wing; PDX = Portland International Airport.

2.4.3 Airspace

Airspace use under Alternative 2 is the same as described under Alternative 1, but with an increase in use of approximately 27 percent relative to existing conditions/No Action Alternative, and 17 percent more than Alternative 1. Additional use of NWSTF Boardman and Mountain Home SUA would be the same as Alternative 1 – up to an additional 4 weeks per year at each location (an increase of 2 weeks per year at each location from existing conditions/No Action Alternative). Aircrew air-to-ground training would be accomplished via the same modes as described for Alternative 1 (i.e., aircraft training mode, simulator training events, or during deployments to various training locations that support live/inert air-to-ground weapons release events at locations such as Mountain Home SUA and NWSTF Boardman). As with Alternative 1, no air-to-ground munitions with live explosives are proposed to be assembled, stored, or loaded at the Portland ANG installation under Alternative 2, but inert air-to-ground munitions would be used for munitions assembly and load training at the installation.

2.5 ALTERNATIVE 3

Under Alternative 3, the existing F-15C flying mission would remain in place at the Portland ANG installation until the projected end of the airframe mission or future required mission change proposals are presented. Under Alternative 3, no additional personnel would be added. Any previously planned construction and repair projects required for current mission sustainment, as identified in Tables 2.1-1 and 2.1-2 with a “Yes” under “Alternative 3,” would be implemented.

These projects reflect the need to sustain the 142 WG mission regardless of the airframe that is being flown. Under Alternative 3, new construction would result in up to 40,504 SF of new facilities, and up to 19,904 SF of new impervious surface. The total construction footprint analyzed represents the largest possible footprint of each of the options.

2.6 NO ACTION ALTERNATIVE

Analysis of the No Action Alternative provides the benchmark, enabling decision-makers to compare the magnitude of the environmental effects of the Proposed Action or alternatives. Section 1502.14(d) of Council on Environmental Quality (CEQ) regulations implementing NEPA requires an EA to analyze the No Action Alternative. No action means that an action would not take place, and the resulting environmental effects from taking no action are compared with the effects of allowing the proposed activity to go forward. Under the No Action Alternative, no F-15EX operational aircraft would be based at the Portland ANG installation, no personnel changes or construction (even construction for the F-15C aircraft) would be performed, and no training activities by the F-15EX operational aircraft would be conducted in the airspace. Under the No Action Alternative, the NGB would continue to conduct their current mission using existing, legacy aircraft with multiple configurations and existing infrastructure.

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3.0 EXISTING CONDITIONS

This section describes relevant existing environmental conditions for resources potentially affected by various alternatives described in Chapter 2.0. As directed by guidelines contained in NEPA, CEQ regulations, and 32 CFR Part 989 et seq., the description of the affected environment focuses only on those resource areas potentially subject to impacts and is commensurate with the anticipated level of environmental impact.

This EA analyzes potential environmental effects for the following resource areas: noise, airspace, air quality, water resources, geological resources, cultural resources, safety, hazardous materials and wastes, biological resources, socioeconomics and environmental justice, land use, and Section 4(f). Based on the low potential for impacts to visual resources, infrastructure and utilities, and the transportation resource areas (as described in Section 1.5), these resource areas are not analyzed in this EA.

As described in Section 1.1, the FAA is a cooperating agency for this EA. Table 3.0-1 describes where the analysis for each Environmental Impact Category per FAA Order 1050.1F can be found within this EA.

Table 3.0-1 FAA Environmental Impact Categories Crosswalk

FAA Impact Category[1]	*Section Where Analysis Appears in this EA*
Air quality	Air Quality: Section 3.3, 4.3, 5.1.3
Biological resources (including fish, wildlife, plants, and wetlands)	Biological Resources: Section 3.9, 4.9, 5.1.9
Climate	Air Quality: Section 3.3, 4.3, 5.1.3
Coastal resources	Biological Resources: Section 3.9.1
Department of Transportation Act, Section 4(f)[2]	Cultural Resources: Section 3.6, 4.6, 5.1.6 Section 4(f): Section 3.12, 4.12. 5.1.12
Farmlands	Geological Resources: Section 3.5, 4.5. 5.1.5
Hazardous materials, solid waste, and pollution prevention	Hazardous Materials and Wastes: Section 3.8, 4.8, 5.1.8
Historical, architectural, archaeological, and cultural resources	Cultural Resources: Section 3.6, 4.6, 5.1.6
Land Use	Land Use: Section 3.11, 4.11, 5.1.11
Natural resources and energy supply	Irreversible and Irretrievable Commitment of Resources: Section 5.2
Noise and compatible land use	Noise: Section 3.1, 4.1, 5.1.1
Socioeconomics, environmental justice, and children's environmental health and safety risks	Socioeconomics and Environmental Justice: Section 3.10, 4.10, 5.1.10
Visual effects (including light emissions)	Visual Resources (not carried forward in EA): Section 1.5
Water resources (including floodplains, surface waters, groundwater, and wild and scenic rivers)	Water Resources: Section 3.4, 4.4, 5.1.4

FAA Impact Category[1]	*Section Where Analysis Appears in this EA*
Cumulative Resources	Cumulative Resources: Chapter 5
Irreversible and Irretrievable Commitment of Resources	Irreversible and Irretrievable Commitment of Resources: Section 5.2

Notes: [1]Environmental impact categories as defined in Order 1050.1F 4-1 (https://www.faa.gov/about/office_org/headquarters_offices/apl/environ_policy_guidance/policy/faa_nepa_order).
[2]Properties collectively referred to as "Section 4(f) properties" are those publicly and privately owned properties that are listed in or eligible for listing in the National Register of Historic Places including publicly owned parks, recreation areas, wildlife and/or waterfowl refuges, and significant historic properties. Pursuant to the provisions of Section 4(f) of the U.S. Department of Transportation Act of 1966 (49 USC 303[c]), Section 4(f) properties are protected from use by Department of Transportation projects unless there is no feasible or prudent alternative.
Legend: FAA = Federal Aviation Administration.

3.1 NOISE

3.1.1 Existing Conditions

This EA evaluates noise effects to people, land uses, and historic structures, as well as wildlife and domesticated animals. Noise effects on populations are evaluated in the noise, socioeconomics, environmental justice, and cultural resources sections; noise effects to land uses and historic structures are evaluated in Section 4.11 and Section 4.6, respectively; and the potential noise effects to wildlife and domesticated animals is addressed in Section 4.9. A discussion of noise metrics and noise analysis methodologies can be found in Appendix C and the supporting noise study is included in Appendix D. The region of influence (ROI) for noise associated with this EA includes the area in the vicinity of the installation and areas under the airspace that would be used by the 142 WG.

3.1.1.1 Airfield Noise

Many components may generate noise and warrant analysis as contributors to the total noise impact. The 142 WG is based at PDX and leases land within the airport boundary. The predominant noise sources at PDX consist of aircraft operations of an active airfield. Construction, ground support equipment along the runway, and vehicular traffic all contribute to the noise environment, though are generally transitory and provide a negligible contribution to the overall average noise level at PDX. The cities of Portland and Vancouver have established noise overlay zones for the areas immediately surrounding PDX (Figure 3.1-1). These zones are intended to notify the public owners of property within the overlay district that certain levels of noise on properties in the district are to be expected, and that such levels of sound reasonably require that special construction standards involving sound insulation be met on all new residential construction in the district (City of Vancouver 2007; City of Portland 2020a). Note that the 50 percentile forecast mentioned in Figure 3.1-1 refers to an overall airfield operations estimate and is unrelated to the percent afterburner conditions analyzed within this EA. Additional detail on land use is provided in Section 3.11, *Land Use*.

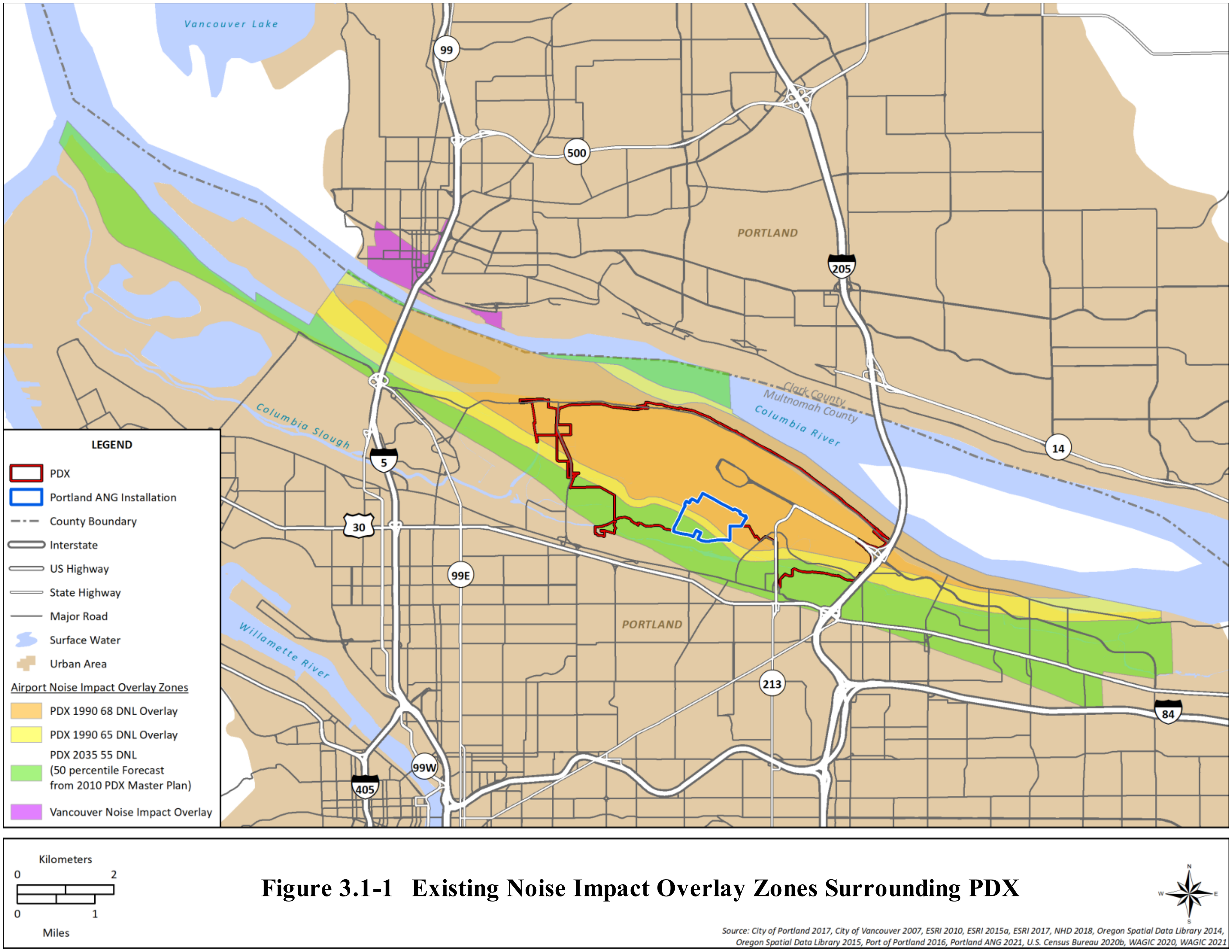

Figure 3.1-1 Existing Noise Impact Overlay Zones Surrounding PDX

Source: City of Portland 2017, City of Vancouver 2007, ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Oregon Spatial Data Library 2014, Oregon Spatial Data Library 2015, Port of Portland 2016, Portland ANG 2021, U.S. Census Bureau 2020b, WAGIC 2020, WAGIC 2021

Because 142 WG operations vary year to year, the flying hour program of record is used for analysis because it presents the condition that accounts for the full environmental impacts possible. The current 142 WG flying program equates to 4,848 annual airfield operations at PDX, which is broken down equally between departures and arrivals and no closed patterns, as summarized in Table 3.1-1. Annual military operations at PDX were largely unaffected by COVID-19 and these existing 142 WG operations would continue at a similar rate into the foreseeable future (2025 to 2030) based upon current training requirements and funding.

Unlike military operations, the civil operations at PDX were adversely affected by COVID-19. According to the FAA Operations Network database there was a drastic reduction in civil aircraft operations at PDX during COVID-19 which affected years 2020 and 2021. As described within the supporting noise study provided in Appendix D, a pre-COVID-19 3-year average of historical civil aircraft operations (between 2017–2019) provided the best authoritative estimate available at the time of analysis that PDX operations ‘existing condition’ would likely recover to in the near future. Because the timeframe of civil operations recovery post COVID-19 would be similar to the beginning of the implementation of the proposed alternatives, the noise exposure would be the same for both existing conditions and the No Action Alternative. Table 3.1-1 summarizes both the civil aircraft category that contains all privately owned aircraft and the military aircraft that are government owned and operated. This amounts to 229,928 civil aircraft operations at PDX, or 98 percent of all PDX airfield operations that are estimated for 2025 through 2030. Specific details on operation type by aircraft and runway can be found in Appendix C.

Table 3.1-1 Average Annual Operations under Existing Conditions/No Action Alternative

Category	***Aircraft Group (examples of common aircraft within group)***	***Departures***			***Arrivals***			***Grand Total***	***% of Operations***
		Day	***Night***	***Total***	***Day***	***Night***	***Total***		
Military	F-15C	2,424		2,424	2,412	12	2,424	4,848	*2%*
Civil[1]	Jet Airliner (Boeing 737 series, Airbus A320 series)	46,373	11,432	57,805	47,177	10,680	57,857	115,662	50%
	Bus Jet (G550, Cessna 550 Citation, Learjet 35A)	20,599	1,241	21,840	21,229	602	21,831	43,671	19%
	Turboprop regional airliner (Dash 8, BN-2, Embraer 120)	21,951	1,720	23,671	21,504	2,199	23,703	47,374	21%
	Two engine prop (DHC 6, Cessna 441, Beech Baron 58)	4,964	1,043	6,007	4,858	1,193	6,051	12,058	5%
	Single engine prop (Piper PA-24, Cessna 206)	4,685	894	5,579	4,143	1,441	5,584	11,163	5%
	Civil total	*98,572*	*16,330*	*114,902*	*98,911*	*16,115*	*115,026*	*229,928*	*98%*
Grand Total		**100,996**	**16,330**	**117,326**	**101,323**	**16,127**	**117,450**	**234,776**	***100%***

Note: [1]Aircraft types listed represent the most frequent types operating at PDX within each group with FAA tower category. The noise study in Appendix D provides a detailed list of all individual aircraft types modeled.
Legend: % = percent; PDX = Portland International Airport.

In addition to flight operations occurring to or from PDX runways, the analysis also considered static engine run-ups occurring while aircraft are parked on the ground. Helicopter operations were modeled to the PDX runway. These focused on the various military aircraft engine maintenance and pre-flight checks that are described in detail within the supporting noise study provided in Appendix D.

Figure 3.1-2 shows the resulting noise modeling software calculated Day-Night Average Sound Level (DNL) contours for the 65 to 85 decibels (dB) in 5-dB increments. This represents the existing conditions/No Action Alternative at PDX based upon the updated operations presented in Table 3.1-1. Noise generated from aircraft operations at PDX occurs within the airfield, over the Columbia River, and extends to cover areas to the south and southeast of the airfield. Portions of the 65 dB DNL contour extend to the northwest of the installation, but the area exposed is non-residential.

Table 3.1-2 shows the acreage breakdown (excluding water bodies) for PDX and the numbers of households and population exposed to each DNL range based upon a proportional distribution of households throughout each census block group. A total of 5,310 acres are exposed to 65 dB DNL or greater noise levels with 2,398 of those acres located outside of PDX property. Outside of PDX property, 230 acres of land is subjected to 70 dB DNL or greater and 4 acres of land is experiencing DNL of 75 dB or greater. An estimated 44 households and 133 people are exposed to 65 dB DNL or greater, and 1 of those households and 9 people are exposed to 70 dB DNL. No households or population are exposed to 75 dB DNL or greater.

Table 3.1-2 Noise Exposure Acreage, Households, and Population under Existing Conditions/No Action Alternative

DNL (dBA)	*Acreage*			*Households Off Installation*	*Population Off Installation*
	On Installation	*Off Installation*	*Total*		
65+	2,913	2,398	5,310	44	133
70+	2,080	230	2,310	1	9
75+	917	4	920	0	0
80+	455	0	455	0	0
85+	195	0	195	0	0

Legend: dBA = A-weighted decibel; DNL = Day-Night Average Sound Level.

Table 3.1-3 shows the DNL values at each of the POIs under the existing conditions/No Action Alternative. Values range from 47 to 68 dB DNL. Most of these values are well below the DoD threshold of 65 dB DNL for land use recommendations for noise sensitive land uses with the exception of PO-S-13 representing the former site of ITT Technical Institute located approximately 1 mile southeast of PDX's primary runway.

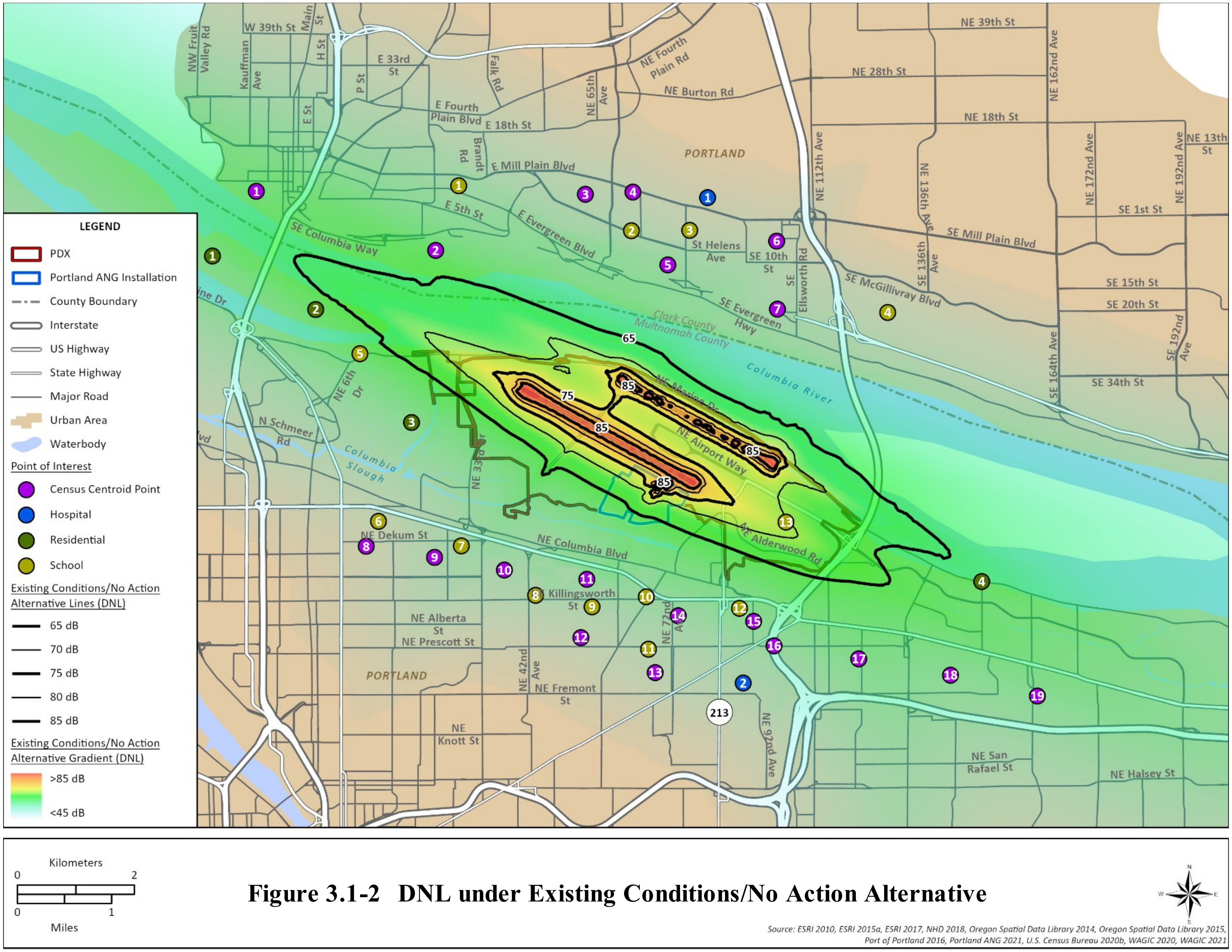

Figure 3.1-2 DNL under Existing Conditions/No Action Alternative

Source: ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Oregon Spatial Data Library 2014, Oregon Spatial Data Library 2015, Port of Portland 2016, Portland ANG 2021, U.S. Census Bureau 2020b, WAGIC 2020, WAGIC 2021

Table 3.1-3 POI Noise Exposure under Existing Conditions/No Action Alternative

Map ID	*Point Type*	*Named POI*[1]	*Existing Conditions/No Action Alternative DNL*[2] *(dB)*
PO-C-01	Census Tract Centroid	Census Tract 424	61
PO-C-02	Census Tract Centroid	Census Tract 426.01	62
PO-C-03	Census Tract Centroid	Census Tract 429	51
PO-C-04	Census Tract Centroid	Census Tract 430	49
PO-C-05	Census Tract Centroid	Census Tract 431	55
PO-C-06	Census Tract Centroid	Census Tract 412.07	49
PO-C-07	Census Tract Centroid	Census Tract 412.08	53
PO-C-08	Census Tract Centroid	Census Tract 36.01	48
PO-C-09	Census Tract Centroid	Census Tract 36.02	52
PO-C-10	Census Tract Centroid	Census Tract 36.03	52
PO-C-11	Census Tract Centroid	Census Tract 74	55
PO-C-12	Census Tract Centroid	Census Tract 75	49
PO-C-13	Census Tract Centroid	Census Tract 29.01	50
PO-C-14	Census Tract Centroid	Census Tract 76	55
PO-C-15	Census Tract Centroid	Census Tract 77	57
PO-C-16	Census Tract Centroid	Census Tract 78	56
PO-C-17	Census Tract Centroid	Census Tract 79	59
PO-C-18	Census Tract Centroid	Census Tract 95.02	58
PO-C-19	Census Tract Centroid	Census Tract 95.01	58
PO-H-01	Healthcare Facility	PeaceHealth Southwest Medical Center	47
PO-H-02	Healthcare Facility	Park Forest Care Center	52
PO-R-01	Residential Area	Census Tract 72.01	60
PO-R-02	Residential Area	North Lotus Beach Drive	63
PO-R-03	Residential Area	Northeast Blue Heron Drive & Northeast 20th Avenue	58
PO-R-04	Residential Area	Northeast Marine Drive & Northeast 138th Avenue	63
PO-R-05	Residential Area	Census Tract 102	56
PO-S-01	School	Harney Elementary School	54
PO-S-02	School	Slavic Christian Academy	52
PO-S-03	School	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy	50
PO-S-04	School	Riverview Elementary School	50
PO-S-05	School	Bridges Middle School	62
PO-S-06	School	Woodlawn Elementary School	50
PO-S-07	School	Faubion Elementary School	54
PO-S-08	School	Portland Community College – Portland Metropolitan Workforce Training Center	53
PO-S-09	School	Trinity Lutheran School	52
PO-S-10	School	Community Transitional School	56
PO-S-11	School	Scott Elementary School	51

Map ID	*Point Type*	*Named POI[1]*	*Existing Conditions/No Action Alternative DNL[2] (dB)*
PO-S-12	School	Helensview High School	58
PO-S-13[1]	School	Former site of ITT Technical Institute and University of Phoenix[1]	**68**

Note: [1]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.
[2]**Bold** numbers represent points exposed to DNL of 65 dB or greater.
Legend: dB = decibel; DNL = Day-Night Average Sound Level; ID = Identification; POI = Point of Interest.

Although the FAA requires only the DNL metric for evaluating noise exposure resulting from aviation activities, consistent with DoD requirements described in Appendix D, the following discussion presents DoD supplemental metric noise results for classroom learning impacts, speech interference, sleep disturbance, and the potential for hearing loss.

Table 3.1-4 presents the existing conditions/No Action Alternative for classroom learning interference for schools S-01 through S-13. The classroom learning interference metrics for all other POIs are presented in the noise study in Appendix D, to address any daycare facilities that could occur near or operated out of residences. As described in Appendix C, the school screening threshold of 60 dB $L_{eq(8hr)}$ equates to an interior level of 45 dB $L_{eq(8hr)}$ with windows open and represents the point at which studies have found classroom learning impacts (DoD Noise Working Group [DNWG] 2009a, 2013a). Existing operations at PDX results in three school POIs, Bridges Middle School (PO-S-05), Helensview High School (PO-S-12), and the former site of ITT Technical Institute (PO-S-13) experiencing exterior $L_{eq(8hr)}$ above the threshold ranging from 61 to 73 dB, which equates to interior levels with windows open of 46 to 58 dB. Additional school impact analysis involves determining the number of noise-generated speech interfering events per school day hour that exceed an interior maximum sound level (L_{max}) of 50 dB (equivalent to an exterior L_{max} of 65 dB for windows open). Number of classroom interfering events ranges from 1 to a maximum of 28 PO-S-13, as presented in Table 3.1-4. Time above an interior level of 50 dB (equivalent to an exterior of 65 dB for windows open) varies from 2 to 6 minutes per school day.

Table 3.1-4 Classroom Learning Interference under Existing Conditions/No Action Alternative

ID	*Location[3]*	*Outdoor $L_{eq(8hr)}$ (dBA)[2]*	*Number of Speech Interfering Events per School Day Hour[1]*	*Time above 50 dBA per 8-hour school day (minutes)[1,4]*
PO-S-01	Harney Elementary School	55	4	2
PO-S-02	Slavic Christian Academy	51	1	3
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy	49	1	3
PO-S-04	Riverview Elementary School	52	1	3
PO-S-05	Bridges Middle School	**65**	11	3
PO-S-06	Woodlawn Elementary School	50	1	2

ID	*Location*[3]	*Outdoor $L_{eq(8hr)}$ (dBA)*[2]	*Number of Speech Interfering Events per School Day Hour*[1]	*Time above 50 dBA per 8-hour school day (minutes)*[1,4]
PO-S-07	Faubion Elementary School	54	2	2
PO-S-08	Portland Community College - Portland Metropolitan Workforce Training Center	55	1	6
PO-S-09	Trinity Lutheran School	54	1	3
PO-S-10	Community Transitional School	58	1	6
PO-S-11	Scott Elementary School	53	1	3
PO-S-12	Helensview High School	**61**	4	2
PO-S-13[5]	Former site of ITT Technical Institute and University of Phoenix[5]	**73**	28	3

Notes: [1]Assumes 90% of ANG daytime operations occur during the school day; windows open condition with noise level reduction of 15 dB due to building attenuation.
[2]**Bold** numbers represent schools exposed to exterior $L_{eq(8hr)}$ of greater than 60 dB, equivalent to the recommended interior threshold of 45 dB with windows open.
[3]Table presents the analysis for the school POI (S), but results are provided for all POI within the noise study in Appendix D because populated areas may include additional educational facilities (such as daycare operated out of a personal residence).
[4]Time above only includes military operations because the AEDT software used for civil aircraft modeling does not readily calculate this metric.
[5]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.
Legend: AEDT = Aviation Environmental Design Tool; ANG = Air National Guard; dBA = A-weighted decibel; ID = Identification; $L_{eq(8hr)}$ = 8-hour Equivalent Sound Level.

Table 3.1-5 presents the existing conditions/No Action Alternative for speech interference based upon the numbers of events per average hour during the DNL daytime period for both a windows open and windows closed condition. The number of speech interfering events with windows open ranges from none at 9 POIs to 16 at PO-S-13. With windows closed, the number of speech interfering events ranges from none at 31 POIs to 8 at PO-S-13.

Table 3.1-5 Speech Interference Events under Existing Conditions/No Action Alternative (per average hour – daytime)

Map ID[1]	*Named POI*	*Existing Conditions/No Action Alternative (events per hour)*[4]	
		Windows Open[2]	*Windows Closed*[3]
PO-C-01	Census Tract 424	13	1
PO-C-02	Census Tract 426.01	10	1
PO-C-03	Census Tract 429	1	0
PO-C-04	Census Tract 430	0	0
PO-C-05	Census Tract 431	1	0
PO-C-06	Census Tract 412.07	0	0
PO-C-07	Census Tract 412.08	0	0
PO-C-08	Census Tract 36.01	1	0
PO-C-09	Census Tract 36.02	1	0
PO-C-10	Census Tract 36.03	1	0
PO-C-11	Census Tract 74	1	1
PO-C-12	Census Tract 75	0	0
PO-C-13	Census Tract 29.01	0	0
PO-C-14	Census Tract 76	1	0
PO-C-15	Census Tract 77	2	0

Map ID[1]	*Named POI*	*Existing Conditions/No Action Alternative (events per hour)*[4]	
		Windows Open[2]	*Windows Closed*[3]
PO-C-16	Census Tract 78	1	0
PO-C-17	Census Tract 79	1	0
PO-C-18	Census Tract 95.02	1	0
PO-C-19	Census Tract 95.01	3	0
PO-H-01	PeaceHealth Southwest Medical Center	0	0
PO-H-02	Park Forest Care Center	1	0
PO-R-01	Census Tract 72.01	8	0
PO-R-02	North Lotus Beach Drive	9	1
PO-R-03	Northeast Blue Heron Drive & Northeast 20th Avenue	4	0
PO-R-04	Northeast Marine Drive & Northeast 138th Avenue	13	3
PO-R-05	Census Tract 102	3	0
PO-S-01	Harney Elementary School	2	0
PO-S-02	Slavic Christian Academy	1	0
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy	0	0
PO-S-04	Riverview Elementary School	0	0
PO-S-05	Bridges Middle School	7	1
PO-S-06	Woodlawn Elementary School	1	0
PO-S-07	Faubion Elementary School	1	1
PO-S-08	Portland Community College – Portland Metropolitan Workforce Training Center	1	0
PO-S-09	Trinity Lutheran School	1	0
PO-S-10	Community Transitional School	1	0
PO-S-11	Scott Elementary School	0	0
PO-S-12	Helensview High School	2	0
PO-S-13[2]	Former site of ITT Technical Institute and University of Phoenix[2]	16	8

Notes: [1]School POI (S) included because residential areas or other noise sensitive uses are often located nearby schools for which these results would apply
[2]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.
[2]Assumes 15 dB noise level reduction.
[3]Assumes 25 dB noise level reduction.
[4]Based upon an average DNL daytime period between 7 a.m. and 10 p.m.
Legend: ID = Identification; POI = Point of Interest.

Analysis of the potential for sleep disturbance involves determining the number and sound exposure level (SEL) of nighttime aircraft events to estimate the 'probability of awakening' metric. As detailed in Appendix D, the probability of awakening with windows open ranges from 79 percent at one location (PO-S-13), 1 to 9 percent at eight locations, and a negligible probability of awakening at 30 locations. The probability of awakening with windows closed reduces to 63 percent at one location (PO-S-13), 1 to 6 percent at five locations, and a negligible probability of awakening at 33 locations.

DoD guidance prescribes analysis of the potential for hearing loss due to elevated aircraft noise levels. The screening process begins by identifying residential areas exposed to DNL of 80 dB or greater (DNWG 2013b). As summarized in Table 3.1-2, no land outside of PDX is exposed to 80 dB DNL or greater, so no residents experience the potential for hearing loss under existing conditions/No Action Alternative.

3.1.1.2 Airspace Noise

The 142 WG F-15C currently utilize W-570 and Eel MOA (including AR-683 and AR 628) as the primary training areas when weather and sea states permit. W-570 is located over water beginning 12 nautical miles from the shore and minimum operating altitude in Eel MOA is 11,000 feet MSL, which reduces noise concerns at the ground level below (see Figure 3.2-2). Secondary training areas for the F-15C comprise Juniper/Hart MOAs and Varmit AR-645 that are utilized for over-land and low-altitude training when the primary airspace is not available with minimum altitudes of 11,000 feet MSL in the southern portion and 300 feet above ground level (AGL) in the north. Redhawk MOA provides backup over-land training airspace with minimum altitudes of 11,000 feet MSL. NWSTF Boardman provides primary air-to-ground inert employment training and is utilized for daytime air-to-ground strafe training with F-15C approximately 2 weeks per year. Mountain Home SUA is used for approximately 2 weeks per year, usually in conjunction with Gunfighter Flag, down to ground level within the range. Additional airspace used less frequently includes Dolphin, W-93, and COD, W-237, Okanogan and Roosevelt MOAs, and Visual Route 1355.

The *EIS for Proposed Establishment and Modification of Oregon Military Training Airspace* assessed the potential environmental impacts associated with airspace modifications for F-15 training and utilization (Oregon ANG 2017a), which continue to operate in a similar way today. The Proposed Action evaluated in the 2017 Oregon Airspace EIS forms the current conditions for this EA. The 2017 Oregon Airspace EIS indicated noise levels under the 142 WG's primary airspace, W-570 and Eel MOAs, vary from 35 to 41 dB Onset-Rate Adjusted Day-Night Average Sound Level (L_{dnmr}) (Oregon ANG 2017a). Noise levels in the secondary airspace, Juniper/Hart MOAs, vary from 35 to 46 dB L_{dnmr}. Noise levels in backup over-land training areas, Redhawk MOAs, each equated to 35 dB L_{dnmr} (Oregon ANG 2017a). L_{dnmr} is a DoD metric similar to DNL but adds an adjustment to account for the rapid onset of aircraft noise that can create a "startle" effect and is computed on a busiest month basis instead of the average annual basis of DNL. Because FAA Order 1050.1F specifies the use of DNL for all civil aircraft noise exposure analysis, these L_{dnmr} noise levels have been converted to DNL for FAA considerations, as shown in Table 3.1-6.

Table 3.1-6 Existing Conditions/No Action Alternative Airspace Noise Levels (DNL)

Airspace	*Noise Level (DNL)*
W-570 and Eel MOAs	30 to 36 dB
Juniper/Hart MOAs	30 to 41 dB
Redhawk MOAs	30 dB

Legend: dB = decibel; DNL = Day-Night Average Sound Level; MOA = Military Operations Area.

In addition to L_{dnmr}, military aircraft operating within SUA may generate sonic booms while operating at speeds greater than the speed of sound (supersonic). As described in the 2017 Oregon Airspace EIS, supersonic operations occur in the over water training areas (W-570) above 10,000 feet MSL and within the Juniper/Hart ATCAAs above 30,000 feet MSL with supersonic training time varying from 3 to 16.5 total hours during a typical year within each subarea of that airspace. The 2017 Oregon Airspace EIS concluded that both F-15C sub- and supersonic airspace activity would not result in significant noise impacts (Oregon ANG 2017a).

3.2 AIRSPACE

3.2.1 Existing Conditions

This resource includes evaluation of both airspace management and the use of airfields and their surrounding airspace. The ROI for the Proposed Action includes airspace in and around PDX to include the various SUA listed in Section 1.3.2 and described below in Section 3.2.2.3, *Special Use Airspace*.

The FAA is responsible for managing national airspace assets through a variety of regulations and procedures. As necessary, the FAA coordinates with federal (including DoD), state, and local community aviation entities to determine the best use of these assets. All aircraft are subject to FAA regulations. The regulations for these categories are based on the types of flying activity, volume of traffic, hazard potential, national security, and other factors. There are two categories of airspace or airspace areas, regulatory and non-regulatory. Within these two categories, there are four types of airspace—Controlled, Uncontrolled, Special Use, and Other.

PDX is serviced by a total of three runways, which include two parallel runways 10R/28L and 10L/28R, and one intersecting runway 03/21 which intersects with runway 10R/28L. Neither runway is designated as the primary instrument runway. The runway in use and primary instrument runway would be determined by air traffic control (ATC) (142 WG 2019). PDX is controlled and staffed by the FAA. FAA controlling agencies are responsible for the safe, orderly, and expeditious flow of air traffic. These agencies are the Portland (P80) Terminal Approach Control and Portland Tower. Both control facilities operate 24 hours a day, 7 days a week to provide both Visual Flight Rules (VFR) and IFR services to military and civilian aircraft (142 WG 2019).

3.2.1.1 Airspace Designation

PDX is surrounded by Class "C" airspace (PDX Class C) which is controlled airspace surface to 4,000 feet MSL within a 5 nautical mile radius of PDX. PDX Class C airspace outer shelf extends to 10 nautical miles from PDX and ranges in altitude depending on quadrant of airspace being flown. Generally, reserved for the more crowded airport environments, FAA regulations require two-way communications with the controlling ATC facility for entry and/or operation. Additionally, a Mode C transponder and Automatic Dependent Surveillance-Broadcast is required within and above all Class C airspace up to 10,000 feet MSL for civilian operated aircraft (FAA 2022). All aircraft operating at PDX, including those operated by the 142 WG out of the Portland ANG installation (i.e., land leased from the Port of Portland within the PDX property boundary), must operate in accordance with FAA regulations for Class C airspace.

Satellite airports in the vicinity of PDX Class C airspace are the Portland-Troutdale airport (KTTD) which is a tower-controlled Class D airfield, Grove Field (1W1), Fly for Fun (W56), Pearson Field (KVUO), and three private airfields.

PDX contains various instrument departure and arrival procedures to efficiently sequence aircraft into and out of the PDX terminal environment. PDX has six Standard Instrument Departure Procedures, five Standard Terminal Arrivals, and 24 Instrument Approach Procedures.

The airspace between the PDX Class C and the various locations where training activities occur (such as SUA) is generally either Class A (at or above 18,000 feet MSL) or Class E (below 18,000 feet MSL). Flying in these areas is the same for military aircraft as for civil aircraft. As such, they both operate under the same FAA rules, regulations, and procedures. Military aircraft outside of SUA use these parts of the National Airspace System like any other aircraft and are allowed to operate within each airspace class's rules. While operating in the Class A and Class E airspace, military aircraft are controlled by the same agencies controlling civil aircraft, and depending on whether VFR or IFR, they are offered the same levels of control or advisories as are appropriate or required.

3.2.1.2 Air Traffic Count

The FAA reported a total of 208,459 tower operations for calendar year 2021. Total military operations equal 3,595 or 1.7 percent of total air traffic (Table 3.2-1).

Table 3.2-1 PDX FAA Airport Traffic Count (2021)

Year	*Facility*	*Local*		*Airport Operations*[1]	*Tower Operations*[2]
		Civil	*Military*		
2021	PDX	204,864	3,595	170,627	208,459

Notes: [1]Airport Operations: The number of arrivals and departures from the airport at which the airport traffic control tower is located.
[2]Portland Tower Operations from January 1, 2021 to December 31, 2021.
Legend: FAA = Federal Aviation Administration; PDX = Portland International Airport.
Source: FAA 2022.

3.2.1.3 Special Use Airspace

Table 3.2-2 includes a description of the SUA used by the 142 WG. The 142 WG utilizes over-land and over-water SUA to meet RAP training requirements (Figure 3.2-1).

Table 3.2-2 SUA Used by the 142 WG

SUA	*Description*
W-570	W-570 is 69 nautical miles west of PDX and is the 142 WG's primary over-water training airspace. W-570 is scheduled Monday–Friday, 0830–1130 and 1215-1515. Two weeks per quarter, the 142 WG also schedules W-570 to satisfy night training objectives. Night flying missions are scheduled Monday–Thursday, 1500–1800L and 1900–2200. W-570 offers a large amount of airspace within close proximity to PDX with minimal restrictions. Within the confines of W-570, chaff, flare, and supersonic operations are authorized. Supersonic operations are restricted to above 10,000 feet MSL, 15 nautical miles away from coast, parallel to or pointed away from the coast. Aerial refueling can be conducted in AR-628, which is within the boundaries of W-570. Furthermore, the 116th Air Control Squadron provides Command and Control for air-to-air training missions within the complex.
W-237	W-237 is 115 nautical miles northwest of PDX and is utilized approximately twice per year for EA-18G aircraft integration missions. Airspace controlling agency is FAA Seattle ARTCC and times of use are documented in applicable Notices to Airmen. W-237 are offshore areas used for joint combat training tactics to include intercepts and aerial refueling.
W-93	W-93 is 120 nautical miles southwest of the Portland ANG installation. This Warning Area's controlling agency is the FAA Seattle ARTCC and utilized approximately twice per year as a weather backup for W-570.
Eel MOA	The Eel MOA is located 38 nautical miles west of PDX and just east of the border of W-570. Eel MOA contains AR-683 and offers space for subsonic training. Chaff and flares are not authorized within Eel MOA. Eel MOA is utilized in 60 percent of all 142 WG training missions and scheduled in conjunction with W-570.
Juniper/Hart MOAs	The Juniper/Hart MOAs are located 127 nautical miles southeast of PDX and offer MOA offers low-altitude training, supersonic above 30,000 feet MSL, chaff and flare operations along with Command and Control support. Refueling track AR-645 (Varmit) is located just west of the border of the Juniper A/B MOA to support refueling operations. It is currently utilized for 25 percent of 142 WG training missions.
Redhawk MOA	The Redhawk MOA primarily serves as the backup MOA for Juniper/Hart MOAs when weather or scheduling conflicts occur. Chaff and flare operations are authorized within Redhawk MOA. This MOA is utilized by the 142 WG approximately once per quarter.

SUA	*Description*
Okanogan MOA	The Okanogan MOA is located 175 nautical miles northeast of the Portland ANG installation. The Okanogan MOA's controlling agency is the FAA Seattle ARTCC. Times of activation are intermittent by Notice to Airmen. Chaff and flare operations are authorized above 2,000 feet AGL. The Okanogan MOA is utilized by the 142 WG approximately two or fewer times per year for EA-18G aircraft interoperability training.
Roosevelt MOA	The Roosevelt MOA is 215 nautical miles northwest of the Portland ANG installation. The Roosevelt MOA is controlled by the FAA Seattle ARTCC. Times of use are intermittent by Notice to Airmen. Chaff and flare operations are authorized above 2,000 feet AGL. The Roosevelt MOA is utilized by the 142 WG approximately two or fewer times per year for EA-18G aircraft interoperability training.
Dolphin MOA	The Dolphin MOA is located 96 nautical miles southwest of the Portland ANG installation and borders W-93, which is the Warning Area to the west. The Dolphin MOA's controlling agency is the FAA Seattle ARTCC and active daily 0800–1600, other times by Notice to Airmen. Chaff and flare operations are authorized. The 142 WG utilizes the Dolphin MOA approximately two or fewer times per year.
NWSTF Boardman	NWSTF Boardman is a combination of MOA and restricted area. The Boardman MOA is located 102 nautical miles east of PDX and excludes R-5701 and R-5706 when active. The NWSTF Boardman, R-5701 and R-5706, when active supports strafe and inert air-to-ground weapons employment and is the primary air-to-ground range for the F-15C. Chaff and flare operations are not authorized. NWSTF Boardman is currently utilized by the 142 WG approximately two weeks per year.
Mountain Home SUA	The Mountain Home SUA is located 285 nautical miles southeast of PDX and includes various MOAs and Restricted Areas that can support kinetic and non-kinetic missions. The complex can provide low-altitude training and offers Command and Control support. Chaff and flare operations are authorized. The 142 WG utilizes the Mountain Home SUA approximately two weeks per year, usually in conjunction with Exercise Gunfighter Flag to test combat capabilities against near-peer adversaries.

Legend: 142 WG = 142d Wing; AGL = above ground level; ANG = Air National Guard; AR- = Aerial Refueling; ARTCC = Air Route Traffic Control Center; FAA = Federal Aviation Administration; MOA = Military Operations Area; MSL = mean sea level; NWSTF = Naval Weapons Systems Testing Facility; PDX = Portland International Airport; R- = Restricted Area; SUA = Special Use Airspace; W- = Warning Area.

Source: FAA 2023a, Oregon ANG 2020b, 2021a.

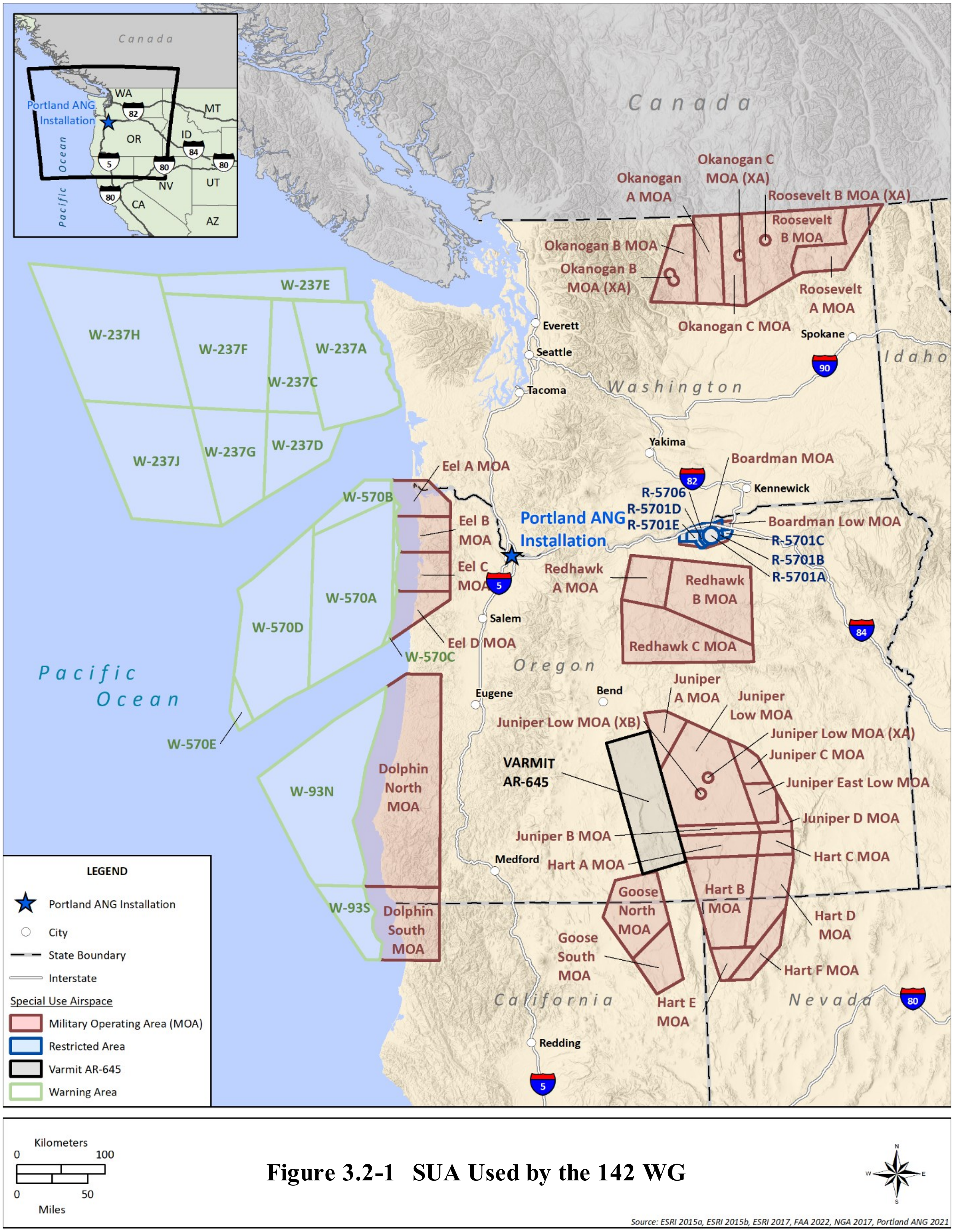

Figure 3.2-1 SUA Used by the 142 WG

Source: ESRI 2015a, ESRI 2015b, ESRI 2017, FAA 2022, NGA 2017, Portland ANG 2021

3.3 AIR QUALITY

3.3.1 Existing Conditions

Under the Clean Air Act, "criteria pollutants" include carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide, ozone (O_3), lead, suspended particulate matter (measured less than or equal to 10 microns in diameter [PM_{10}] and suspended particulate matter less than or equal to 2.5 microns in diameter [$PM_{2.5}$]). The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) (40 CFR Part 50) for criteria pollutants. Additionally, the General Conformity Rule (40 CFR 93, Subpart B) applies to federal actions occurring in nonattainment or maintenance areas when the total direct and indirect emissions of the relevant pollutants (or their precursors) exceed specified thresholds. The Oregon Department of Environmental Quality (DEQ) is the regulatory agency that oversees programs to restore, maintain, and enhance the state's air quality through implementation of pollution controls (Oregon DEQ 2022a).

Hazardous air pollutants (HAPs) are pollutants that do not have established NAAQS but are still regulated under the federal Clean Air Act because of their potentially adverse effects on human health and the environment. HAP emissions are typically one or more orders of magnitude smaller than concurrent emissions of criteria air pollutants, and only become a concern when large amounts of fuel, explosives, or other materials are consumed during a single activity or in one location. Mobile sources, such as aircraft operations, would function intermittently over a large area and would produce negligible ambient HAP emissions. Therefore, HAPs would not create significant or adverse health risks to humans living adjacent to airfields or underneath airspace in which aircraft operate and are not further evaluated in the analysis.

The Portland ANG installation operates under a Standard Air Contaminant Discharge Permit from the Oregon DEQ, permit number 26-3254-ST-01 (Oregon DEQ 2020). This is a synthetic minor source permit, meaning the Portland ANG installation has the potential to emit pollutants at or above the thresholds for major sources (sources with the potential to emit 100 tons of any criteria pollutant or 10 tons of any single HAP or 25 tons of any combination of HAPs), but has chosen to limit its potential to emit through federally enforceable physical or operational restrictions on the facility (Oregon DEQ 2023).

The 2020 and 2021 Stationary Source Air Emissions Inventory for the Portland ANG installation is found in Table 3.3-1.

Table 3.3-1 Potential to Emit and Calendar Years 2020 and 2021 Stationary Source Air Emissions Inventory (tons per year) for the Portland ANG Installation

Year	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
PTE (annual)	8.2	42.4	35.2	2.0	2.3	2.3	6,030
2020	1.54	1.43	1.42	0.05	0.11	0.10	1,381
2021	0.56	1.87	1.84	0.06	0.14	0.13	ND

Legend: ANG = Air National Guard; CO = carbon monoxide; CO_2e = carbon dioxide equivalent; ND = no data available in the 2021 monthly rolling totals report related to GHG emissions; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; PM_{10} = particulate matter less than or equal to 10 microns in diameter; PTE = potential to emit; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
Source: Oregon ANG 2021b, 2022a; Oregon DEQ 2020.

Existing conditions/No Action Alternative for airfield operations include 20 F-15C aircraft that are scheduled to be replaced by the F-15EX. For the air quality analysis, only the emissions from aircraft to be replaced have been analyzed, as all other aircraft and their activities would remain the same. The existing emissions from the 4,848 annual F-15C operations (2,424 departures and 2,424 arrivals) at the Portland ANG installation in Multnomah County are presented in Table 3.3-2. Emission estimates were developed for the F-15C aircraft using the DAF's Air Conformity Applicability Model (ACAM) version 5.0.18a using installation-specific data including military and afterburner takeoffs, landings, annual engine testing, and aerospace ground equipment (AGE). Aircraft emissions are considered within the volume of air extending up to the mixing height of 3,000 feet AGL (40 CFR Section 93.153(c)(2)). The height of the mixing level determines the volume of air within which pollutants can disperse. Pollutants that are released above the mixing height typically will not disperse downward and thus will have little or no effect on ground level concentrations of pollutants.

Table 3.3-2 Existing Annual F-15C Emissions Estimates (tons per year)

Year	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
F-15C Airfield Operations (mobile sources)	38.92	45.51	157.75	6.01	4.23	3.82	17,451
Jet Engine Test Cell (stationary source)	0.15	0.38	0.61	0.03	0.02	0.02	104
Total	39.07	45.88	158.36	6.05	4.25	3.83	17,556

Legend: CO = carbon monoxide; CO_2e = carbon dioxide equivalent; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; PM_{10} = particulate matter less than or equal to 10 microns in diameter; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

Unlike local aircraft operations at an airfield, operations within MOAs are infrequent and sporadic. Annual operations within the existing Juniper Low MOA, between 500 and 11,000 feet AGL, are up to 90 hours flight hours per year, with only a small fraction of that flight time occurring below 3,000 feet AGL (Oregon ANG 2017a).

The potential effects of proposed greenhouse gas (GHG) emissions are by nature global and result in cumulative impacts because most individual anthropogenic sources of GHG emissions are not large enough to have a noticeable effect on climate change. The impact of proposed GHG emissions is discussed in the context of cumulative impacts in Section 5.1.3, *Air Quality*.

3.4 WATER RESOURCES

3.4.1 Existing Conditions

Water resources evaluated in this analysis include surface water, groundwater, floodplains, and wild and scenic rivers. Within the project area, the Columbia River is not listed as a wild and scenic river for any augment of the river from the Oregon state line to the confluence with the Pacific Ocean (National Park Service 2022). Therefore, wild and scenic rivers are not discussed further in this analysis.

The ROI for the Proposed Action includes the surface water, groundwater, and floodplains in and directly around PDX. Water resources under the Portland ANG installation associated airspace would not be affected by the Proposed Action flights in the SUA and are not discussed further in this analysis.

3.4.1.1 Surface Water

The Portland ANG installation is located on a levee-protected floodplain of the Columbia River and is bordered by the Columbia River to the north and the Columbia Slough to the south. Natural and significant surface water bodies and both navigable and non-navigable waterways are located at and adjacent to the Portland ANG installation (Oregon ANG 2021c). The Portland ANG installation has many stormwater conveyances, including storm sewers and drainage swales. Surface water from the Portland ANG installation flows west into two stormwater detention ponds equipped with outfalls that can be closed to allow the ponds to be used as containment areas (Oregon ANG 2018). Stormwater is discharged from the upper pond to the lower pond, then conveyed to the PDX detention pond, and ultimately to the Columbia Slough. Two small areas on the northern part of the Portland ANG installation drain onto PDX, and stormwater from the modular/indoor firing range is discharged directly into the sanitary sewer system. The Columbia Slough receives water from springs to the northeast of the PDX and local groundwater seepage from shallow saturated zones, as well as local surface water runoff from many properties including the Portland ANG installation (Oregon ANG 2021c).

The Portland ANG installation maintains a Stormwater Pollution Control Plan (SWPCP) to monitor stormwater discharge, manage stormwater, and comply with the Oregon DEQ National Pollutant Discharge Elimination System (NPDES) General Stormwater Discharge Permit (1200-Z). The Portland ANG installation must also comply with NPDES Waste Discharge Permit (No. 101647) for discharges of de-icing material in stormwater and NPDES Waste Discharge

Permit (GEN17A) for discharges from fixed and mobile washing operations. Additionally, the NPDES General Stormwater Discharge Permit No. 1200-C regulates stormwater from periodical construction activities on base. As described in the SWPCP, the 142 WG has constructed an infiltration basin that accepts the stormwater from Outfall 008, which drains the northeastern corner of the installation, adjacent to the airfield (Oregon ANG 2019a). Consistent with the goals of the Energy Independence and Security Act Section 438 to maintain or reduce the volume of stormwater runoff, this infiltration basin has eliminated some of the stormwater runoff from impervious areas under normal conditions and provides an opportunity for groundwater recharge and additional treatment of stormwater runoff (Oregon ANG 2019a).

3.4.1.2 Groundwater

There are two aquifers under the Portland ANG installation, which include unconsolidated deposits and Miocene basaltic-rock aquifers (Oregon ANG 2018). The zones of groundwater at the Portland ANG installation include an upper zone at 5.5 to 9 feet below ground surface, the shallow zone at 7.5 to 21 feet below ground surface, the deep zone at 28 to 41 feet below ground surface, and the Columbia River Sand Aquifer at 48 to 280 feet below ground surface (Oregon ANG 2018). Groundwater flow varies in direction between these zones and fluctuates seasonally (Oregon ANG 2017b). Groundwater predominantly flows towards the west and northwest in the shallow aquifer, though the flow direction varies considerably locally (Oregon ANG 2018). The upper layers are influenced by changes in the Columbia River as a result of water releases from the Bonneville Dam, shallow zone water levels are influenced by surface water recharge that occurs from stormwater drainages and the Columbia Slough, and the deep zone and Columbia River Sand Aquifer are influenced by Columbia River water levels (Oregon ANG 2018).

3.4.1.3 Floodplains

The Portland ANG installation is located within Flood Insurance Rate Map Panel No. 4101830105F. The Federal Emergency Management Agency (FEMA) has identified both moderate flood hazard areas (Zone X) and severe flood hazard areas (Zone AH) within the installation's boundaries (FEMA 2010). The majority of the installation has been identified as Special Flood Hazard Area (SFHA) Zone X, subject to the 500-year flood, as well as an area with reduced flood risk due to the levee. Areas associated with drainages located near the Columbia Slough in the south and west portions of the installation have been identified as SFHA Zone AH and are located within the 100-year floodplain (Figure 3.4-1).

The Multnomah County Drainage District (MCDD) manages flood control at PDX and the Portland ANG installation (Oregon ANG 2021c). The MCDD uses pumps and levees to manage and maintain the flow and flood storage levels of the Columbia Slough.

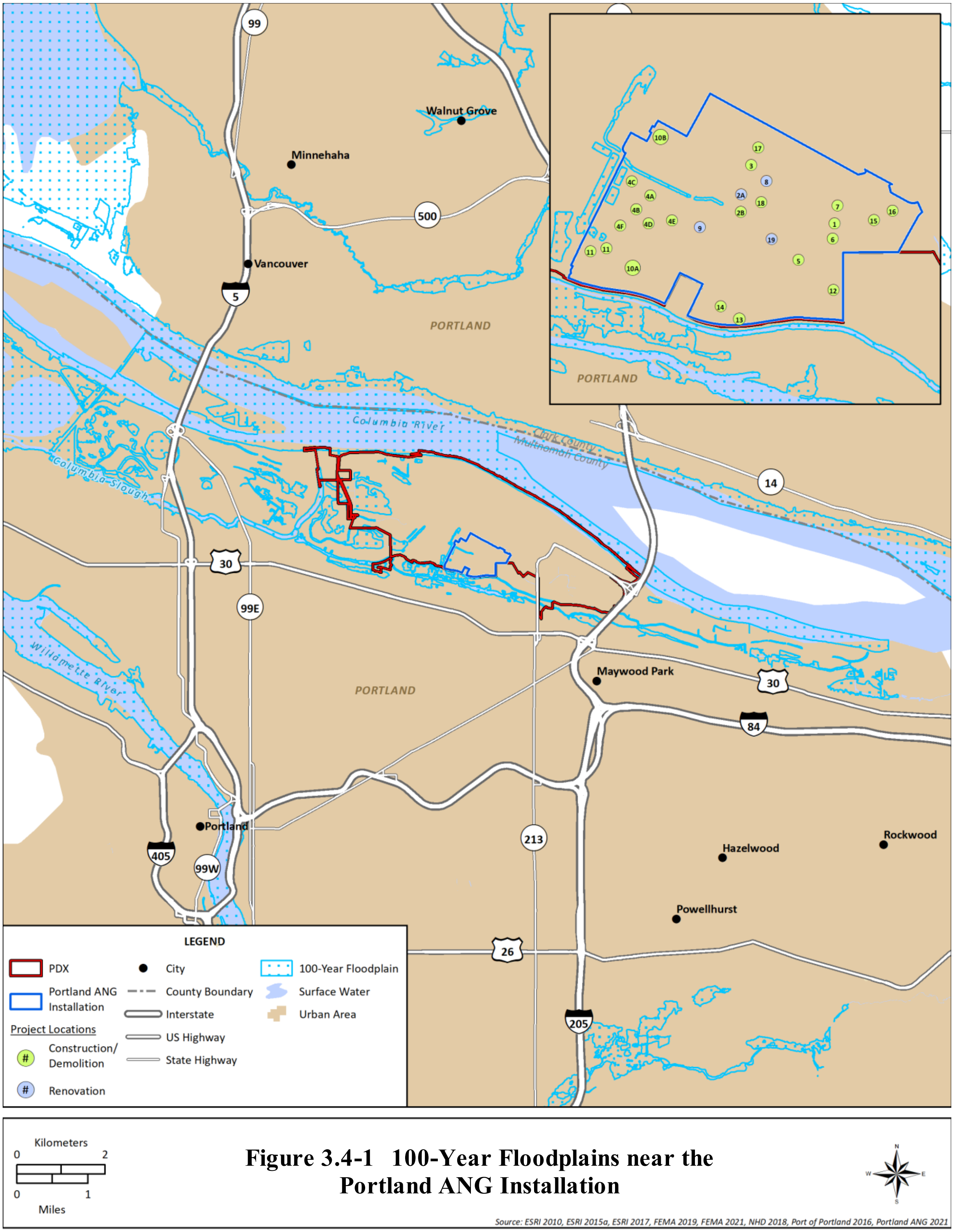

Figure 3.4-1 100-Year Floodplains near the Portland ANG Installation

Source: ESRI 2010, ESRI 2015a, ESRI 2017, FEMA 2019, FEMA 2021, NHD 2018, Port of Portland 2016, Portland ANG 2021

3.5 GEOLOGICAL RESOURCES

3.5.1 Existing Conditions

The discussion of geological resources includes topography, geology, soils, and farmland associated with the affected environment. The ROI for the Proposed Action includes the land area in and directly around PDX. Geological resources under the Portland ANG installation associated airspace would not be affected by the Proposed Action flights in the SUA and are thus not discussed further in this analysis.

3.5.1.1 Geology and Topography

The Portland ANG installation is located within the Portland/Vancouver Basin of the Willamette Valley Physiographic region (Oregon ANG 2018). The Portland ANG installation is located at an elevation of approximately 10 to 20 feet MSL and generally slopes to the north or northwest toward the Columbia River at a gradient ranging from 0 to 3 percent (Oregon ANG 2018).

The Portland/Vancouver basin was formed in the early tertiary period and is filled with 1,800 feet of late Tertiary and Quaternary sediments, including unconsolidated and semi-unconsolidated, alluvium, and glacial lacustrine deposits (Oregon ANG 2018). The Parkrose Formation, near the Portland ANG installation, is comprised of lacustrine siltstones, sandstones, and claystones. Troutdale Gravel is comprised of gravel and sand from the Columbia River. The Columbia River Sand consists of sand with small amounts of silt and gravel (Oregon ANG 2018).

The Portland ANG installation is considered to be within the earthquake zone of the Cascadia fault, located off the coast of Oregon (see inset in Figure 3.5-1) (Oregon Seismic Safety Policy Advisory Commission 2013). If an earthquake with a magnitude of 9.0 were to occur, buildings at the Portland ANG installation could experience moderate damage due to ground failure and liquefaction. Additionally, based on results of the 2015 Port of Portland Corporate Seismic Risk Assessment Study (Port of Portland 2015), the runways at PDX, which are used by the 142 WG but are not located within the installation boundary, are highly susceptible to seismically induced liquefaction.

3.5.1.2 Soils

The native soils underlying the Portland ANG installation are of the Sauvie-Rafton-Pilchuck series (Table 3.5-1). The soil at the Portland ANG installation primarily consists of an urban fill complex that has been heavily disturbed by previous development, with the exception of around 1 percent of the soil that is Sauvie silt loam along the installation's eastern boundary (Figure 3.5-1).

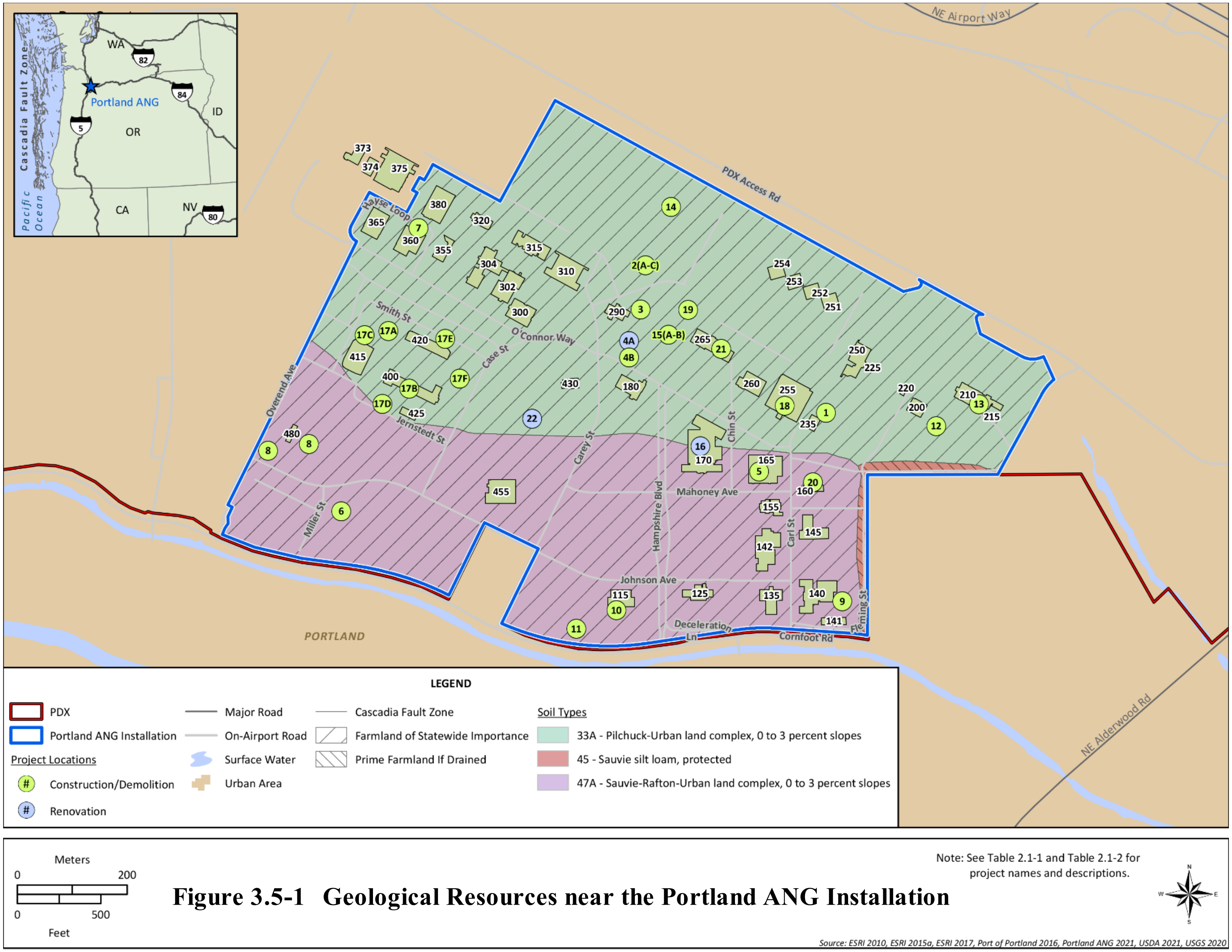

Figure 3.5-1 Geological Resources near the Portland ANG Installation

Source: ESRI 2010, ESRI 2015a, ESRI 2017, Port of Portland 2016, Portland ANG 2021, USDA 2021, USGS 2020

Table 3.5-1 Soil Types and Characteristics

Soil Type	*Occurrence at the Portland ANG Installation (as a percentage)*	*Characteristics*	*Farmland*
Pilchuck – Urban Land Complex	67%	Pilchuck: deep, excessively drained soils found in floodplain landforms with sandy alluvium. Urban land component: soil from cut/fill sites used for urban development. High water table (2–4 feet below the surface) from November to April.	Farmland of statewide importance
Sauvie-Rafton Urban Land Complex	32%	Sauvie: deep, poorly drained soils found largely in alluvial material. Rafton: very poorly drained, very deep soils found on floodplains with slopes of 0 to 2 percent.	Farmland of statewide importance
Sauvie silt loam	1%	Deep, poorly drained soils found largely in alluvial material.	Prime Farmland if drained

Legend: % = percent; ANG = Air National Guard.
Sources: Oregon ANG 2018; Natural Resources Conservation Service 2022.

3.5.1.3 Farmland

The majority of the Portland ANG installation is designated as farmland of statewide importance but not prime farmland, with one very small part of the southeastern portion of the base (i.e., Sauvie silt loam) designated as prime farmland if drained (see Table 3.5-1).

3.6 CULTURAL RESOURCES

3.6.1 Existing Conditions

Cultural resources can be broadly defined as sites and districts; structures; artifacts; features that display evidence of human activity; and landscapes and features that play a fundamental role in a specific community's identity, beliefs, or value system. Cultural resources can be divided into three major categories: archaeological resources (precontact and historic), architectural resources, and traditional cultural resources.

Cultural resources that have been determined eligible for inclusion in the National Register of Historic Places (NRHP) are historic properties. Historic properties are afforded protection and consideration under the National Historic Preservation Act (NHPA). Historic properties must retain aspects of integrity defined in the regulations as location, design, setting, materials, workmanship, feeling, and association.

Several federal laws and regulations address cultural resources, including the NHPA (1966), the Archaeological and Historic Preservation Act (1974), American Indian Religious Freedom Act (1978), the Archaeological Resources Protection Act (1979), and Native American Graves Protection and Repatriation Act (1990). Coordination with federally recognized Native American

Tribes must occur in accordance with EO 13175, *Consultation and Coordination with Indian Tribal Governments*, along with other DoD specific policies and instructions: Annotated American Indian and Alaska Native Policy (1999); DoD Instruction 4710.02, *Interaction with Federally Recognized Tribes*; and Department of the Air Force Instruction (DAFI) 90-2002, *Interactions with Federally Recognized Tribes*.

In 2017, the Portland ANG was awarded an Integrated Cultural Resources Management Plan (ICRMP) Waiver by the NGB Cultural Resources Program Manager for a period of 5 years, valid from 1 April 2018 to 31 March 2023 (NGB 2017). The ICRMP Waiver was issued to the Portland ANG based on the following: cultural resources surveys had been completed and NGB/A4AM determined the report's findings continued to be valid; there were no known historic and or archaeological resources present, the Oregon State Historic Preservation Office (SHPO) concurred in writing at the time with a finding of no historic properties present, and the Oregon SHPO concurred in writing at the time that all facilities turning 50 years of age subsequent to the surv ey's publication are not eligible for listing in the NRHP (NGB 2017).

The affected environment for cultural resources is based on the establishment of the area of potential effects (APE) of an undertaking, through consultation with the Oregon SHPO. An APE is defined in 36 CFR Section 800.16(d) as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist." The APE, and therefore the affected environment, for this project includes the Portland ANG installation encompassing the areas where ground-disturbing activities, including new construction, building renovations and modifications, and building demolitions would occur. The APE is also defined as the areas affected by noise levels of 65 dB DNL and greater from the aircraft operations. Where present, operations are evaluated for their potential to affect historic properties where noise could adversely impact them. The areas affected by noise generated and release of chaff and flares underlying the SUA and other existing airspace and training areas also fall under the APE.

The NGB is consulting with the Oregon SHPO on the relevant undertaking that is part of the Proposed Action and the development of a project Programmatic Agreement. The 142 WG is conducting government-to-government consultation with the federally recognized Tribal Nations associated with the location of the Portland ANG installation, which include Confederated Tribes of the Warm Springs Reservation, the Confederated Tribes of Grand Ronde, and the Confederated Tribes of Siletz Indians. See Appendix B for all Section 106 and government-to-government correspondence.

3.6.1.1 Installation

Archaeological Resources

All installation areas with a potential sensitivity for archaeological resources have been surveyed, with one archaeological isolate identified that is considered not eligible for listing in the NRHP (Oregon ANG 2012).

Architectural Resources

An architectural survey conducted in 2002 recorded all buildings constructed at the 142 WG prior to 1990 and those built prior to 1957 (45 years or older, at the time) were evaluated for NRHP eligibility (Oregon ANG 2012). In addition, Cold War era buildings (built between 1946 and 1989) were evaluated for the NRHP under Criteria Consideration G. As a result of the survey, Buildings 494 and 495 were recommended eligible for listing in the NRHP for their architectural significance. This determination received SHPO concurrence in 2002, 2012, and 2017 (Oregon ANG 2012; Johnson 2012; Gabriel 2017). There are no historic districts or historic landscapes present at the 142 WG (Oregon ANG 2012).

Traditional Cultural Resources

To date, no traditional cultural resources or Native American sacred places have been identified at the Portland ANG installation (Oregon ANG 2012). Six federally recognized Tribal Nations have interest in the location of the Portland ANG installation and include the Confederated Tribes of the Warm Springs Reservation, the Confederated Tribes of Grand Ronde Community of Oregon, Confederated Tribes of the Umatilla Indian Reservation, the Cowlitz Indian Tribe, Nez Perce Tribe, and the Confederated Tribes of Siletz Indians (Oregon ANG 2012).

Off-Installation

One NRHP-listed historic property is located within the APE surrounding PDX: the Raymond and Catherine Fisher house, a Tudor-style residence built in 1929 located along Marine Drive and was the first house constructed in the Golf Acres development associated with the Columbia-Edgewater Golf Course (Fitzgerald 2006; National Park Service 2023).

Two NRHP-eligible properties are located within the APE surrounding PDX: an English cottage home built in 1927 on Northeast Elrod Road and a contemporary single dwelling home built in 1966 on Northeast Marine Drive (Oregon SHPO 2023a, 2023b, 2023c).

3.6.1.2 Airspace

Training operations currently take place within W-570, Eel MOA, Juniper/Hart MOAs, Varmit AR-645, and Redhawk MOAs and are described in Section 3.2.2.3, *Special Use Airspace*. The 2017 Oregon EIS found 6,898 total historic sites are recorded in counties below the SUA. Of these, 426 were considered historic properties and are listed in the NRHP (Oregon ANG 2017a).

A response from the Confederated Tribes of the Colville Reservation was received that confirmed there are traditional properties, historic properties, and other resources of cultural importance to the people of the Colville Tribes within portions of the airspace APE (Appendix B).

3.7 SAFETY

3.7.1 Existing Conditions

Day-to-day operations and maintenance activities are performed in accordance with applicable DAF safety regulations, published Air Force Technical Orders, and identified guidelines in Department of the Air Force Manual (DAFMAN) 91-203, *Air Force Occupational Safety, Fire and Health Standard* and DAFI 91-202, *The U.S. Air Force Mishap Prevention Program*. In their entirety, these regulations, orders, and guidelines provide for the safety, fire protection, and health for DAF military and civilian employees.

The ROI for ground and aircraft safety impact analysis includes the PDX, areas immediately adjacent to the airport, the airspace utilized by aircraft stationed at the Portland ANG installation and areas underneath.

3.7.1.1 Ground Safety

Fire/Crash Response

The 142 WG fire department currently responds to all ANG-related fire and emergency incidents. The 142 WG is currently deficient in dispatch services and, due to training and technical limitations, multiple delayed responses by the fire department have occurred. The 142 WG is working to find an acceptable solution to develop adequate dispatch functions, including exploring the potential for a mutual aid agreement for emergency response with the Port of Portland (142 WG 2021a; Oregon ANG 2022b). In the event of civilian aircraft crashes at PDX, the 142 WG responds and provides support as requested by the Port of Portland, FAA, or National Transportation Safety Board (142 WG 2021b).

Runway Protection Zones

On FAA-controlled runways, runway protection zones (RPZs) are trapezoidal zones extending outward from the ends of active runways at commercial airports and delineate those areas recognized as having the greatest risk of aircraft mishaps, most of which occur during takeoff or landing (Figure 3.7-1).

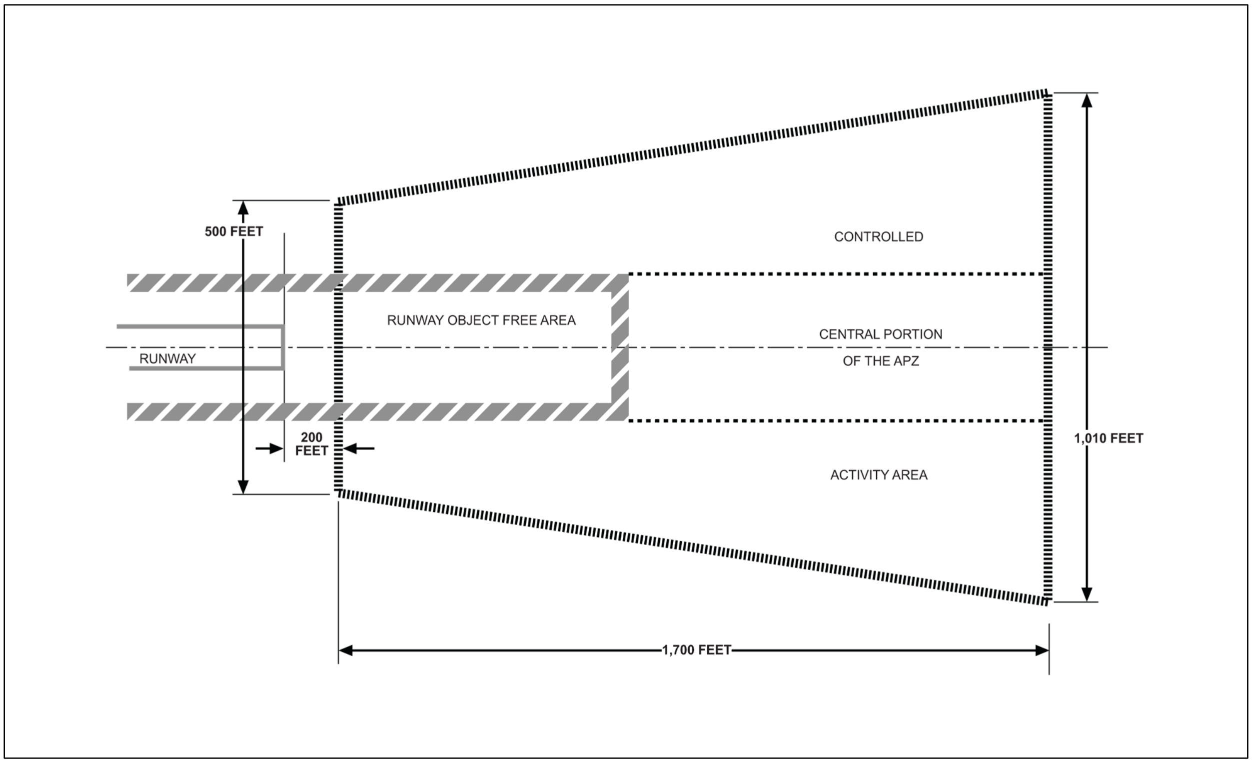

Figure 3.7-1 Example of an FAA-controlled Runway Protection Zone

RPZs associated with runway 10L-28R and the northern end of Runway 3-21 all occur within the boundary of PDX and the Columbia River. RPZs associated with Runway 10R-28L are located primarily within PDX boundaries; however, RPZs at both ends of the runway extend off airport property into areas zoned as industrial. The Runway 3-21 southwestern RPZ extends off PDX property over areas zoned as open space and industrial (Figure 3.7-2).

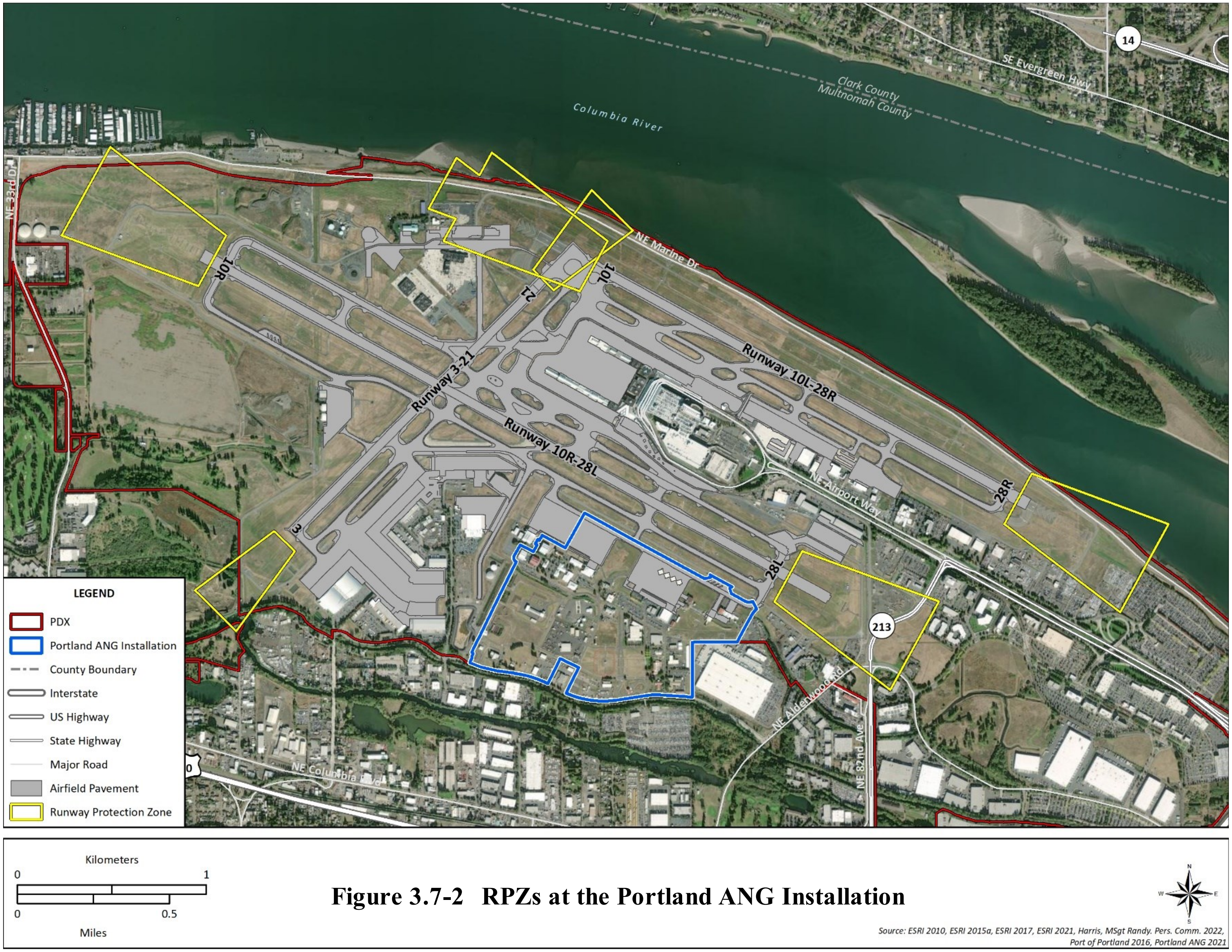

Figure 3.7-2 RPZs at the Portland ANG Installation

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Harris, MSgt Randy. Pers. Comm. 2022, Port of Portland 2016, Portland ANG 2021

<u>*Explosive Safety*</u>

The 142 WG stores, maintains, and uses a small range of munitions required for executing their mission. All ordnance is handled and stored in accordance with DAF explosive safety procedures, and all munitions maintenance is carried out by trained, qualified personnel using DAF-approved technical data. Quantity-Distance (QD) arcs have been established for these areas, including the munitions shop (Building 400) located just east of Runway 3-1 (Figure 3.7-3). Additional areas on the installation where QD arcs have been developed include the alert aircraft hangar (Building 210), four aircraft hangars (Buildings 251-254), nine aircraft shelters (Buildings 81-89), and the aircraft parking ramp in the northeast corner of the installation. No waivers are required for the existing facilities (142 WG 2021c).

<u>*Antiterrorism/Force Protection*</u>

Many of the military facilities at the 142 WG were constructed before Antiterrorism/Force Protection (AT/FP) considerations became a critical concern. Thus, many facilities do not currently comply with all current AT/FP standards. As new construction occurs and as facilities are modified, the 142 WG incorporates these standards to the maximum extent practical during project planning and design phases to ensure AT/FP compliance.

3.7.1.2 Flight Safety

<u>*Flight Safety Procedures*</u>

Aircraft flight operations conducted by the 142 WG are governed by standard flight rules set forth under DAFMAN 11-202 Volume 3 and the 142 WG Instruction 13-204. The 142 WG Commander delegates a Supervisor of Flying during wing flying to ensure flight safety and to streamline communication between pilots, ATC, and commanders (142 WG 2019).

<u>*Aircraft Mishaps*</u>

Worldwide historic mishap data is consolidated for the F-15 and maintained by the Air Force Safety Center. The mishap data does not consider the model of F-15 but instead consolidates all data to type of aircraft. The F-15 aircraft (all models) have flown 6,982,447 hours since the aircraft entered the DAF inventory between 1972 and 2021. Over that period, 160 Class A mishaps have occurred, and 127 aircraft have been destroyed. This results in a lifetime Class A mishap rate of 3.20 annual mishaps per 100,000 flight hours, and a lifetime destroyed aircraft rate of 1.82 annual aircraft destroyed per 100,000 flight hours (Air Force Safety Center 2021).

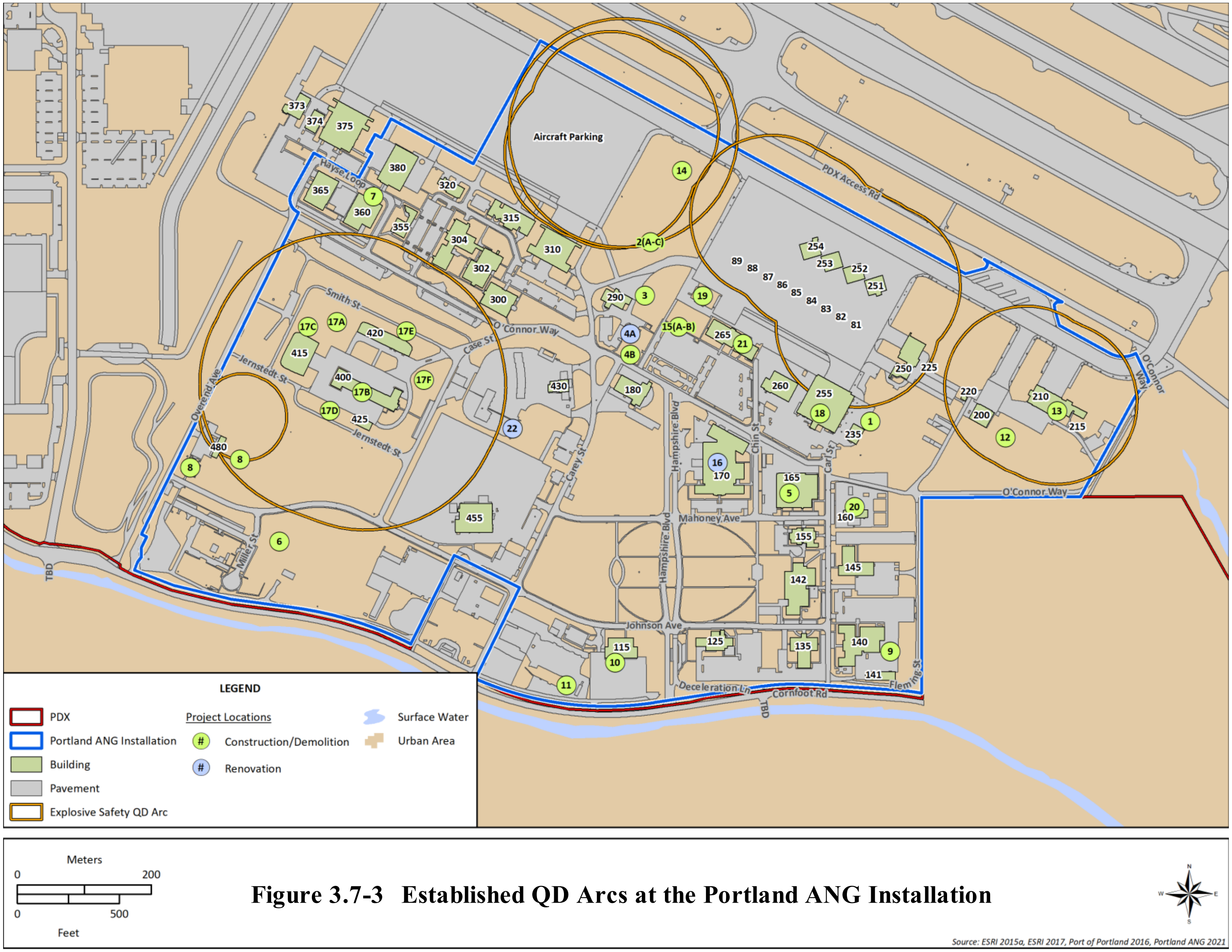

Figure 3.7-3 Established QD Arcs at the Portland ANG Installation

Bird/Wildlife Aircraft Strike Hazards

The 142 WG actively implements the *142 WG Bird-Aircraft Strike Hazard Plan 91-212*, thereby reducing the potential for a bird strike to occur. Key elements of the plan include monitoring the airfield for bird and other wildlife activity, issuing bird hazard warnings, initiating bird/wildlife avoidance procedures when potentially hazardous bird/wildlife activities are reported, and submitting Bird/Wildlife Aircraft Strike Hazard (BASH) reports for all incidents. Between August 2018 and April 2021, 14 Class E bird strikes were documented by the 142 WG Safety (142 WG 2021d).

Mid-Air Collision Avoidance

The 142 WG aircraft utilized various airspace as described in Section 1.3.2. Flight operations are conducted in accordance with FAA and DAF regulations. PDX is a high-volume airport with over 140,148 total aircraft operations in FY 2021 (PDX 2022). To minimize the potential for a mid-air collision, the 142 WG actively implements the *142 WG Mid-Air Collision Avoidance (MACA) Program,* as mandated by DAFI 91-202, to educate all military and civilian pilots on F-15 flying activity to generate awareness. The 142 WG Chief of Safety is the delegated authority to prepare and monitor the overall MACA program.

Chaff and Flare Use

As described in Section 1.3.2, the 142 WG currently use chaff and flare as part of their F-15C training operations within military airspace in Oregon and at Mountain Home AFB. These operations follow existing regulations and military guidance to ensure their safe use, such as DAFMAN 11-214 (flare deployment) and Chairman of the Joint Chiefs of Staff Manual 3212.02D (chaff deployment). Existing use of chaff and flare during military training in the ROI were evaluated in the 2017 Oregon Airspace EIS and the 2023 Mountain Home AFB EIS and determined to not pose significant safety concerns related to wildfires, potential impacts to water bodies, or to wildlife (Department of the Navy 2015; Oregon ANG 2017a; DAF 2023a).

3.8 Hazardous Materials and Wastes

3.8.1 Existing Conditions

The ROI for hazardous materials and wastes primarily consists of the Portland ANG installation, with additional information presented for the surrounding vicinity, where relevant. The ROI does not include areas under the airspace used by the units, as air operations do not affect or generate hazardous materials and wastes on the ground under the airspace.

3.8.1.1 Hazardous Materials

Hazardous materials are used at the Portland ANG installation for many functions, including fueling operations; vehicle, airplane, and helicopter maintenance; and training operations. Types of hazardous substances found on the Portland ANG installation include batteries; petroleum, oils, and lubricants (POLs); paints; thinners; sealants; solvents; pesticides; and fuels (i.e., Jet A, gasoline, diesel) (Oregon ANG 2017b). Aboveground storage tanks (ASTs) and other containers are used for bulk fluid storage on the installation including fuels, used oils, transformer mineral oil, and hydraulic fluids, and other materials (i.e., deicing fluid, liquid oxygen, and fire suppression agents). The 142 WG has two underground storage tanks (USTs) (UST-200-1 and UST-260-1) for skimmed oil that are regulated under 40 CFR 280 and Oregon State Administrative Rules 340-150. The remaining USTs at the installation are not regulated (Oregon ANG 2022c). Individual storage tanks and their location, contents, capacity, tank material, and installation date are described in detail in the *Spill Prevention, Control, and Countermeasure Plan* (Oregon ANG 2022c).

3.8.1.2 Hazardous Waste Management

The 142 WG is regulated as a Large Quantity Generator of hazardous waste and maintains EPA Identification Number OR1570024264. The 142 WG *Spill Prevention, Control, and Countermeasure Plan* contains the governing regulations for spill prevention and describes specific protocols for preventing and responding to releases, accidents, and spills involving oils and hazardous materials (Oregon ANG 2022c). The 2022 *Hazardous Waste Management Plan* outlines procedures for controlling and managing hazardous wastes from the point of generation until final disposal (Oregon ANG 2022d).

Currently, there are 13 oil/water separators (OWSs) on the Portland ANG installation that range in capacity from 100 to 840 gallons, located at Buildings 180, 200, 210, 250 (2), 255, 260, 265, 290, 310, 430, 455, and the stormwater pond. All the OWSs, apart from a 110-gallon OWS located at the stormwater pond, discharge to the sanitary sewer collection system, as permitted to discharge under the City's *Oil/Water Separator Wastewater Discharge Authorization* (ACDM-2018-002), which is renewed annually.

3.8.1.3 Toxic Substances

Regulated toxic substances typically associated with buildings and facilities include asbestos, lead-based paint (LBP), and polychlorinated biphenyls (PCBs). An asbestos survey was performed at the Portland ANG installation in 1996 and 2006 (Oregon ANG 2017b). Asbestos-containing material (ACM) was found to be present in 13 of the buildings that were surveyed (Table 3.8-1). ACM in these buildings is managed through the *Asbestos Management Plan*

(Oregon ANG 2021d). It should be noted that the surveys conducted to detect ACM on the installation were nondestructive surveys. Therefore, walls and floors were not penetrated to determine whether or not there was hidden ACM in the building materials (Oregon ANG 2021d).

Table 3.8-1 Buildings Identified with ACM at the Portland ANG Installation

Building	*Location*	*Material*
2006 Asbestos Survey		
Building 142	Storage Room	12 x 12 floor tile, mastic
Building 165	Women's Room	12 x 12 floor tile, mastic
Building 260	Restroom	Transite Wallboard
	Shop Office	12 x 12 Floor Tile, Mastic
Building 360	Room 40	12 x 12 Floor Tile, Mastic
Building 365	Room 112	12 x 12 Floor Tile, Mastic
Building 455	Room Office	Office: 12 x 12 Floor Tile, Mastic Shop: 12 x 12 Floor Tile, Mastic
Building 490	Storage Area	12 x 12 Floor Tile, Mastic
	Roof	Shingle, Roofing Material
	Exterior Wall	Transite Siding
Building 494	Office	12 x 12 Floor Tile, Mastic
	West Classroom	12 x 12 Floor Tile, Mastic
	Exterior Wall	Tar Paper
	Exterior Wall	Transite Siding
Building 4945	Exterior Wall	Transite Siding
Building 1001	Roof	Shingle, Roofing Material
Building 1004	Men's Locker Room	12 x 12 Floor Tile, Mastic
	Storage	12 x 12 Floor Tile, Mastic
1996 Asbestos Survey		
Building 260	Jet Engine Maintenance Shop	Transite Wallboard, 12 x 12 White Floor Tile, Mastic 12 x 12 Light Gray Floor Tile, Mastic
Building 440	Vehicle Ops Administration	12 x 12 Floor Tile, Mastic
Building 455	Vehicle Maintenance Shop	12 x 12 Floor Tile, Mastic
Building 491	Recreation Center	12 x 12 Floor Tile, Mastic

Note: Portions of the following buildings were found to have ACM in the 1996 Asbestos Survey but have since been demolished: Building 490 (Base Exchange), Building 503 (Headquarters), Building 165 (South End), and Building 1004 (Supply and Equipment Warehouse).
Legend: ACM = asbestos-containing material; ANG = Air National Guard.
Sources: Oregon ANG 2017b, 2021d.

A LBP survey has not been conducted at the 142 WG installation. Based on the age of several buildings at the installation, there is a potential that LBP was used. In addition, it was determined during a Range Quantitative Assessment performed in 2014 that there is lead dust present in the gravel bed within the firing range (Building 480); however, no response action is required (Oregon ANG 2017b).

According to the Hazardous Waste Management Plan, the 142 WG is considered "PCB-free;" however, PCB ballasts are sometimes discovered onsite and are shipped as PCB waste. The *Hazardous Waste Management Plan* explains how to handle PCB items if they are identified to ensure that the 142 WG complies with federal regulations under 40 CFR 761 (Oregon ANG 2022d).

3.8.1.4 Contaminated Sites

Environmental Restoration Program Sites

A total of 13 sites on the Portland ANG installation have been investigated under the DAF Environmental Restoration Program (ERP) (Oregon ANG 2017b). Figure 3.8-1 shows the location of the sites and Table 3.8-2 provides details for the ERP sites. The previously designated ERP Site 6 is now ERP Site 11.

Areas of Concern

In response to perfluorooctane sulfonate (PFOS)/perfluorooctanoic acid (PFOA) (part of a large group of lab-made chemicals known as per- and polyfluoroalkyl substances [PFAS]) and other emerging contaminants, the DAF has established a program to systematically identify potential releases, respond to drinking water contamination, and prevent future contamination (Oregon ANG 2017b; DAF 2022b). Ten potential Areas of Concern (AOCs) or potential release locations (PRLs) related to PFAS containing materials[2] were identified at the Portland ANG installation during a preliminary assessment in August 2015. Of these 10 sites, nine were recommended for further investigation to characterize potential PFAS containing materials (Oregon ANG 2019b). A site investigation for the ponds/stormwater retention basins was recommended as all of the previously aforementioned releases to the stormwater system eventually made their way to these two ponds. Additionally, there was a release of aqueous film forming foam (AFFF) which contains PFOS and PFOA on 7 August 2008 (1/2 to 1 cup of pure AFFF) which migrated from Building 180 to the ponds via the stormwater drainage. In 2019, a Phase III regional site inspection (SI) was conducted at nine PRLs to determine if PFAS contaminated groundwater has reached the installation boundary; provide a defensible no further action (NFA) decision for qualifying PRLs; and develop data quality objectives for additional investigation for PRLs not meeting the NFA criteria or an interim response action, if appropriate (Oregon ANG 2019b).

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2 PFAS-containing materials covered under the memo "*Interim Guidance on Destruction or Disposal of Materials Containing Per- and Polyfluoroalkyl Substances in the United States*" includes all "covered material" under Section 343 of the National Defense Authorization Act for Fiscal Year 2022, which means "any [Aqueous Film Forming Foam] AFFF formulation containing PFAS, material contaminated by AFFF release, or spent filter or other PFAS-contaminated material resulting from site remediation or water filtration that—

(A) has been used by the Department of Defense or a military department;
(B) is being discarded for disposal by the Department of Defense or a military department; or
(C) is being removed from sites or facilities owned or operated by the Department of Defense." (Assistant Secretary of Defense for Energy, Installations, and Environment 2023)

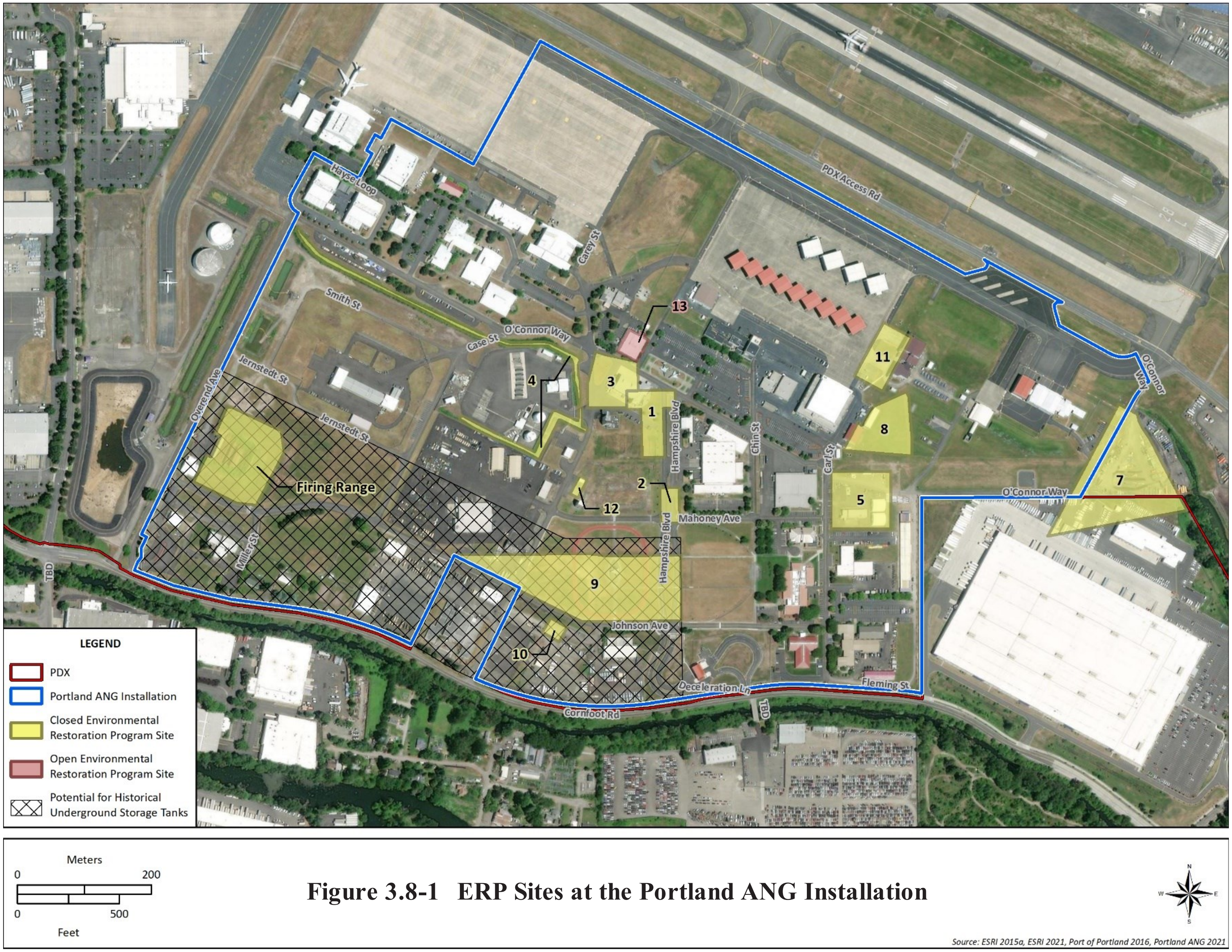

Figure 3.8-1 ERP Sites at the Portland ANG Installation

Source: ESRI 2015a, ESRI 2021, Port of Portland 2016, Portland ANG 2021

Table 3.8-2 ERP Sites on the Portland ANG Installation

ERP Site ID	*Site Name and Location*	*Materials of Concern*	*Status*	*Land Use Controls*
1	Central Hazardous Waste Storage Area	Central Hazardous Waste Storage Area was contaminated by waste including waste oil, solvents, fuels, shop wastes, electrical transformers, and capacitors. Site remedy included in situ oxidation – potassium permanganate injection with MNA.	Closed, NFA – 09 September 2017	• Restrict shallow and deep aquifer groundwater use, other than for monitoring. • Notify new owner that closure was not to residential use standards, should land be transferred to another property owner.
2	Civil Engineering Hazardous Storage Area	Civil Engineering Hazardous Material Storage Area was contaminated by solvents, paint thinners, and methyl ethyl ketone. Site remedy included in situ oxidation – potassium permanganate injection with MNA.	Closed, NFA – 09 September 2017	• Restrict shallow and deep aquifer groundwater use, other than for monitoring. • Notify new owner that closure was not to residential use standards, should land be transferred to another property owner.
3	Hush House Area	Hush House Area was contaminated by waste oil, fuel, and solvents. Site remedy included in situ oxidation – potassium permanganate injection with MNA.	Closed, NFA – 09 September 2017	• Restrict shallow and deep aquifer groundwater use, other than for monitoring. • Restrict access to site soils in GeoBase; include outline of site in GeoBase; verify no residential construction has occurred at the site. • Notify new owner that closure was not to residential use standards, should land be transferred to another property owner.
4	Main Drainage Ditch	Main Drainage Ditch- In 1987, petroleum and oil were reported in ditch downstream from the flight apron outfall. Ditch received surface water runoff from adjacent facilities. No records of waste intentionally being disposed of in ditch were found.	Closed, NFA – 27 July 2009	• Restrict shallow and deep groundwater use, other than for monitoring. • Restrict access to site soils in GeoBase; include outline of site in GeoBase; verify no residential construction has occurred at the site. • Notify new owner that closure was to Industrial Standards, should land be transferred to another property owner.
5	AGE Maintenance Shop	AGE Maintenance Shop was contaminated by spent battery acid, solvents, lubricants, antifreeze, cleaning solutions, and auto fluids were generated. Former LUST contained heating oil. Record of Decision for site recommended NFA based on risk assessment.	Closed, NFA – 10 December 2004	• Restrict access to site soils in GeoBase; include outline of site in GeoBase; verify no residential construction has occurred at the site. • Notify new owner that closure was to Industrial Standards (soil only), should land be transferred to another property owner.

ERP Site ID	Site Name and Location	Materials of Concern	Status	Land Use Controls
7	Burn Pit Area	Burn Pit Area was contaminated by flammable liquids including waste oil, JP-4 jet fuel, and solvents were reportedly burned in the pit as part of fire training exercises. Record of Decision for site recommended NFA based on risk assessment. (Note: Although located outside the Installation boundary, ANG used the former IRP Site 7 Burn Pit for fire training exercises between 1957 and 1978. The Portland ANG installation requested that this area be investigated during the Phase III regional site inspections for perfluorinated compounds (see Table 3.8-4 below).	Closed, NFA – 10 December 2004	• Restrict access to site soils in GeoBase; include outline of site in GeoBase; verify no residential construction has occurred at site. • Notify new owner that closure was to Industrial Standards (soil only), should land be transferred to another property owner.
8	Sanitary Landfill	Sanitary Landfill received ordinary shop and building refuse, paint cans, oil and paint residue, batteries, and broken equipment and parts were reportedly disposed of in trenches and buried. Record of Decision for site recommended NFA based on risk assessment.	Closed, NFA – 10 December 2004	• None.
9	POL Facility	POL Facility consisted of 12 JP-4 USTs, 2 diesel ASTs, 1 waste oil UST, and a former filling station. Groundwater remedy implemented consisted of in situ oxidation with sodium persulfate injections and MNA. NFA.	Closed, NFA – January 2004	• Restrict shallow and deep groundwater use, other than for monitoring, in GeoBase. • Restrict access to site soils in GeoBase; include outline of site in GeoBase; verify no residential construction has occurred at the site. • Notify new owner that closure was to Industrial Standards, should land be transferred to another property owner.
10	Equipment Wash Rack	Liquids from equipment washing operations discharged via drain pipe to a roadside ditch. Record of Decision for site recommended NFA based on risk assessment.	Closed, NFA – January 2004	• Restrict access to site soils in GeoBase; include outline of site in GeoBase; verify no residential construction has occurred at the site. • Notify new owner that closure was to Industrial Standards (due to soil), should land be transferred to another property owner.

ERP Site ID	*Site Name and Location*	*Materials of Concern*	*Status*	*Land Use Controls*
11	Wash Rack West of Building 250 (Formerly ERP Site 6)	Liquids from aircraft washing operations flowed from wash rack area to the catch basin of the oil/water separator. Prior to removal, cracks were noted in the oil/water separator.	Closed, NFA – 09 September 2017	• Restrictions on groundwater Withdrawal: restrict shallow and deep groundwater use, other than for monitoring, in GeoBase. • Restrict access to site soils in GeoBase; include outline of site in GeoBase; verify no residential construction has occurred at the site. • Notify new owner that closure was not to residential standards, should land be transferred to another property owner.
12	Former Vehicle Maintenance Area Slump	A former vehicle maintenance sump was identified at Building 188. The sump collected water from adjacent vehicle bays via a trench drainage system.	Closed, NFA – December 2013	• Residual contamination is present in the sump area that will need to be managed if encountered/removed by future work in the building area. It is not expected to present a human health risk, but exceeding Oregon DEQ. • Clean Fill criteria necessitates disposal at a solid waste landfill (soil) or other appropriate facility (groundwater) if excavated at a later date.
13	Building 270	Contamination identified during trenching at Building 270. Identified as a new ERP Site. Contaminated soil was encountered during utility trenching west of Building 270. Laboratory results of the soil sampling indicated petroleum constituents (diesel and oil), metals contamination, and human E. coli which has been found to exceed thresholds. The excavated soils were disposed of at the Waste Management Subtitle D landfill. Further investigation of this site would be conducted through the ERP.	Active	• Land use controls would be forthcoming following investigation.

Legend: AGE = Aerospace Ground Equipment; ANG = Air National Guard; DEQ = Department of Environmental Quality; ERP = Environmental Restoration Program; IRP = Installation Restoration Program; MNA = Monitored Natural Attenuation; NFA = No Further Action.
Source: Oregon ANG 2017b; Oregon DEQ 2022b.

Figure 3.8-2 shows the AOCs, and Table 3.8-3 provides details for the AOCs and the recommendations based on the 2019 SI. Only eight of the PRLs investigated during the 2019 SI were from the 2015 *Preliminary Assessment*.

Table 3.8-3 AOCs of PFOS/PFOA

AOC/ PRL ID[1]	*Site Name and Location*	*Material Disposed History*	*Recommendations*[2]
1	Base Supply – Building 170	The 142 WG has stored AFFF at this location at least since 1980. According to 142 WG personnel, no AFFF was spilled in the building.	NFA determined after 2015 Preliminary Assessment due to no reported AFFF spills in the building.
2	New Fire Department – Building 180	Fire Department personnel indicated that there were minor spills that occurred during filling the vehicles over the years from onsite containers and minor leaks from the equipment. Additionally, at least three occurrences of AFFF being discharged to the stormwater system were documented in the Annual Stormwater Reports.	**Soil**: Although screening criteria were not exceeded, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration. **Groundwater**: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells.
3	Hangar 250	Minor leaks of AFFF have occurred in the mechanical room. There are no records of inadvertent releases in the hangar; however, if releases did occur, they may have potentially impacted the adjacent ramp.	**Soil**: Although screening criteria were not exceeded, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration. **Groundwater**: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells.
4	Hangar 255	Minor leaks of AFFF have occurred in the mechanical room, with one inadvertent release in the main hangar. It is likely that most of the inadvertent release of AFFF was hosed off into the trench drain that connects to the sanitary sewer systems, with some of the AFFF making its way onto the ramp, and then into the storm sewer system.	**Soil**: Although screening criteria were not exceeded, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration. **Groundwater**: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells.

AOC/ PRL ID[1]	*Site Name and Location*	*Material Disposed History*	*Recommendations[2]*
5	Old Fire Department and Swale – Building 290	Fire Department personnel indicated that there were minor spills that occurred during filling the vehicles over the years from onsite containers and minor leaks from the equipment. Additionally, at least one occurrence of AFFF being discharged to the stormwater system is documented in the Annual Stormwater Reports. Reports of AFFF making its way to the drainage swale have also been documented.	**Soil**: Although screening criteria were not exceeded, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration. **Groundwater**: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. **Surface Water and Sediment**: Determine PFAS impact to sediment and surface water through additional sampling of surface water and sediment at the drainage swale.
6	Hangar 310	Minor leaks of AFFF have occurred in the mechanical room, with an inadvertent release in the main hangar. It is likely that most of the inadvertent release of AFFF was hosed off into the trench drain that connects to the sanitary sewer systems, with some of the AFFF making its way onto the ramp, and then into the storm sewer system.	**Soil**: Although screening criteria were not exceeded, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration. **Groundwater**: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells.
7	Hangar 380	AFFF was stored in fire suppression equipment in the mechanical room of Hangar 380. The fire suppressions system tanks are no longer present and were reportedly removed in 2005. There were no known discharges in the room or in the main hangar; however, if releases did occur, they may have potentially impacted the adjacent ramp.	**Soil**: Although screening criteria were not exceeded, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration. **Groundwater**: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. **Surface Water and Sediment**: Determine PFAS impact to sediment and surface water through additional upgradient sampling of surface water and sediment and evaluate potential downgradient impacts.

AOC/ PRL ID[1]	*Site Name and Location*	*Material Disposed History*	*Recommendations*[2]
8	Hangar 375	Minor leaks of AFFF have occurred in the mechanical room, with an inadvertent release in the main hangar. It is likely that most of the inadvertent release of AFFF was hosed off into the trench drain that connects to the sanitary sewer systems, with some of the AFFF making its way onto the ramp, and then into the storm sewer system.	**Soil**: Although screening criteria were not exceeded, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration. **Groundwater**: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells.
9	POL Storage – Building 431	This building formerly contained the AFFF system tank that provided fire protection for the fuel tanks.	Note: During the 2019 SI, it was determined that investigation at the POL Storage – Building 431 would be replaced with investigation at former IRP Site 7 (designated as PRL 11 or AOC 11). PRL 9 was determined to not be a concern for PFAS because no documented releases had occurred at Building 431.
10	Ponds / Stormwater Retention Basins	These two ponds receive 95 percent of the installation's stormwater discharges. All of the previously aforementioned releases to the stormwater system eventually made their way to these two ponds.	**Soil**: Although screening criteria were not exceeded, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration. **Groundwater**: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells. **Surface Water and Sediment**: Determine PFAS impact to surface water through additional upgradient sampling of surface water and sediment and evaluate potential downgradient impacts.
11	Former IRP Site 7 Burn Pit	Flammable liquids including waste oil, JP-4 were reportedly burned in the pit as part of fire training exercises. Although located outside the Installation boundary, ANG used the former IRP Site 7 Burn Pit for fire training exercises between 1957 and 1978.	**Soil**: Although screening criteria were not exceeded, additional surface and subsurface soil samples are proposed to determine if an unidentified source exists and if so, to determine the nature and extent in the vertical and horizontal directions given the potential for soil to groundwater migration. **Groundwater**: Determine the nature and extent both vertically and horizontally through the sampling of existing and additional new monitoring wells.

AOC/ PRL ID[1]	*Site Name and Location*	*Material Disposed History*	*Recommendations*[2]
N/A	Ditch from Building 180 to the Ponds	Release of AFFF (1/2 – 1 cup of pure AFFF) on 7 August 2008 that migrated from the Building 180 to the ponds via the stormwater drainage.	N/A

Notes: [1]The AOCs were previously referred to as PRLs, but as PFAS was reported in media at several of the sites, they are more accurately referred to as AOCs
[2]See the 2019 Site Inspection Report for Perfluorooctane Sulfonate and Perfluorooctanoic Acid at Portland Air National Guard Base for further details regarding the investigation of the PRLs/AOCs.

Legend: AFFF = aqueous film forming foam; AOC = area of concern; IRP = Installation Restoration Program; N/A = Not Applicable; PFAS = per- and polyfluoroalkyl substances; PFOA = perfluorooctanoic acid; PFOS = perfluorooctane sulfonate; POL = Petroleum, Oils, and Lubricants; PRL = Potential release location; SI = Site inspection.

Source: Oregon ANG 2017b, 2019b.

Figure 3.8-2 AOCs at the Portland ANG Installation

Source: ESRI 2015a, ESRI 2021, Port of Portland 2016, Portland ANG 2021

Between October 2019 and June 2020, an Expanded Site Inspection (ESI) was performed to investigate PFAS in soil, groundwater, surface water, sediment, and stormwater at the Portland ANG Installation in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process (Oregon ANG 2021c). An additional AOC, the Former ANG Fire Station (AOC 12), was identified in the Port's Preliminary Assessment of AFFF use at PDX (Oregon ANG 2021c). This AOC was included for initial investigation during the ESI. The AOCs were previously referred to as PRLs, but as PFAS was reported in media at several of the sites, they are more accurately referred to as AOCs (Oregon ANG 2021c). Based on the ESI results, the following are recommended:

- Further investigation should be completed as part of the CERCLA process.
- Additional investigation of PFOS concentrations in soil at AOC 4 and AOC 11 should be conducted to delineate concentrations to the screening level of 130,000 nanograms per kilogram. Future phases of CERCLA work should evaluate the applicability of industrial/commercial worker receptor scenarios at these AOCs for risk-based screening levels.
- Further evaluation of seasonal fluctuations in groundwater flow directions in the Overbank Deposits and the Upper Columbia River Sand Aquifer should be conducted.
- Additional investigation of PFOA and PFOS concentrations should be conducted north of AOC 12 and to the west of groundwater monitoring well, MW-PORDG-11S to fully delineate impacts from ANG AOCs and to consider the former PAMCOR hangar as a secondary/alternate source area for PFOA and PFOS concentrations at groundwater monitoring well, MW-PORDG-11S. Additional samples from the existing shallow Overbank Deposits monitoring wells should be collected to confirm PFOA and PFOS concentrations.
- Additional samples from the existing Upper Columbia River Sand Aquifer monitoring wells should be collected to confirm that the Columbia River Sand Aquifer is not impacted by PFOA and PFOS at concentrations above the screening criteria.
- Further evaluation of sediment, surface water, and stormwater should be conducted through collection of additional data downgradient of the installation with a focus on known stormwater discharge points in the Columbia Slough and the McBride Slough, along with an evaluation of upgradient PFOA and PFOS contributions from the Port's stormwater system and other potential contributors to McBride Slough and Columbia Slough.

Table 3.8-4 provides a summary of the screening level exceedances based on the 2021 ESI.

Table 3.8-4 Summary of Screening Level Exceedances Expanded Site Inspection Report for PFAS Portland ANG Installation, Portland, Oregon

AOC/Area Identifier	*AOC/Area Name*	*Screening Level Exceedance[1] (Exceedance of Lifetime Health Advisory for Drinking Water Shown in Yellow Highlight)*					
		Soil	*Shallow OD Groundwater*	*Deeper Upper CRSA Groundwater*	*Surface Water*	*Sediment*	*Stormwater*
2	New Fire Department – Building 180	No	Yes	No	-	-	-
3	Hangar 250	No	Yes	-	-	-	-
4	Hangar 255		Yes	-	-	-	-
5	Old Fire Department and Swale – Building 290	No	Yes	-	-	Yes	-
6	Hangar 310	No	Yes	-	-	-	-
7	Hangar 380	No	Yes	-	Yes	Yes	-
8	Hangar 375	No	Yes	No	-	-	-
10	Ponds/ Stormwater Retention Basins	No	Yes	-	Yes	Yes	-
11	Former IRP Site 7 Burn Pit	Yes	Yes	No	-	-	Yes
12	Former Air National Guard Fire Station	No	Yes	-	-	-	-
DG	Assumed Downgradient	-	Yes	No	Yes	No	-
UP	Assumed Upgradient	-	No	-	Yes	No	-

Legend: AOC = Area of Concern; CRSA = Columbia River Sand Aquifer; DG = Downgradient; IRP = Installation Restoration Program; OD = Overbank Deposits; UP = upgradient.

Notes: [1]See the 2021 Final Report for the Expanded Site Inspection for Per- and Poly-fluoroalkyl Substances (PFAS) for the Portland Air National Guard Base for further details regarding the investigation of the AOCs. AOC/PRL 1 Site was recommended for NFA after 2015 Preliminary Assessment due to no reported AFFF spills in the building and was not investigated in the 2019 SI or the 2021 ESI.

Conclusion based on results from 2019 SI and 2021 ESI. "-" indicates that samples were not collected in that area.

Source: Oregon ANG 2021c.

3.9 BIOLOGICAL RESOURCES

3.9.1 Existing Conditions

The Proposed Action includes continued flight training in existing SUA. Due to the nature of the actions proposed within the airspace, coastal resources and plant species were excluded from extensive review and analysis within the airspace, along with marine species, invertebrates, and fish. Additionally, although the Eel and Dolphin MOAs extend over the designated Oregon coastal zone, the floor of these MOAs is 11,000 feet above MSL and continued training under the Proposed Action would be consistent with existing conditions and would not impact the coastal zone. Therefore, discussion of and analysis of impacts to the Oregon coastal zone are not addressed further in this EA.

The ROI for biological resources primarily consists of the Portland ANG installation, with additional information presented for the surrounding vicinity where relevant, and the areas under the airspace used by the units. The proposed activities would not result in new ground disturbance, and ordnance delivery and chaff and flare use would be consistent with current levels and would occur in locations already used and authorized for those purposes.

3.9.1.1 Vegetation

Vegetation at the Portland ANG installation is characterized predominantly by grassed and landscaped areas, with little native vegetation. Developed/paved impervious areas comprise 65 percent of the installation; much of the rest of the base is characterized by landscaped lawn areas. Shrubs and herbaceous vegetation, including willows and wetland species, are located north of Building 420. Table 3.9-1 lists common vegetation species found within the Portland ANG installation.

Table 3.9-1 Common Vegetation Occurring at the Portland ANG Installation

Common Name	*Scientific Name*
Trees	
Red maple	*Acer rubrum*
Douglas fir	*Pseudotsuga menziesii*
Cherry	*Prunus* sp.
European beech	*Fagus sylvatica*
Vine maple	*Acer circinatum*
Shrubs and Groundcover	
Cotoneaster	*Cotoneaster* sp.
Zabel laurel	*Prunus laurocerasus*
Japanese pieris	*Pieris japonica*
St. Johnswort	*Hypericum perforatum*
Invasive Species	
English ivy	*Hedera helix*
Himalayan blackberry	*Rubus armeniacus*
Scotch broom	*Cytisus scoparius*

Legend: ANG = Air National Guard.
Source: Griffith 2011; Oregon ANG 2022e.

3.9.1.2 Wildlife

Wildlife includes all fish, amphibian, reptile, bird, and mammal species with the exception of those identified as special status species (special status wildlife species are addressed separately due to their protected status).

Wildlife habitat within the installation is limited due to the amount of natural vegetation, fragmentation, and disturbed nature of the surrounding area. In addition, the high level of activity and noise surrounding airport further diminishes the overall quality of the existing habitat to support wildlife. Several species of wildlife are found in the areas surrounding the Portland ANG installation, due in part to the location of the Portland ANG installation in proximity to the Pacific Flyway and the confluence of two large river systems (Oregon ANG 2020c). The presence of wetland vegetation and standing water features in parts of the airfield provide food and cover for wildlife and invertebrate species and may attract wildlife to the site (Oregon ANG 2020c), with the small stormwater ponds and landscaped areas within the installation supporting the greatest diversity and number of wildlife species.

The airspace utilized by the 142 WG operations covers over 32,321 square miles of land within Oregon, California, Washington, Idaho, and Nevada. Wildlife within these areas occur within the Northern Rockies, Columbia Plateau, Blue Mountains, Northern Basin and Range, Klamath Mountains, and Coast Range ecoregions which are generally dominated by Pacific temperate rainforests that provide habitat for a wide variety of wildlife (Griffith 2011).

Bird and mammal species that may occur at or near the Portland ANG installation or under the airspace used by the units are listed in Table 3.9-2.

Table 3.9-2 Bird and Mammal Species Potentially Occurring on the Portland ANG Installation and under the Airspace

Common Name	*Scientific Name*
Birds	
House sparrows	*Passer domesticus*
Barn owls	*Tyto alba*
Swallows	*Hirundo* spp.
American robins	*Turdus migratorius*
Tree swallows	*Tachycineta bicolor*
Western tanagers	*Piranga ludiviciana*
House finches	*Carpodacus mexicanus*
Rock pigeons	*Columba livia*
Mourning doves	*Zenaida macroura*
European starlings	*Sturnus vulgaris*
red-winged blackbirds	*Agelaius phoeniceus*
American crows	*Corvus brachyrhynchos*
Brown-headed cowbird	*Molothrus ater*
American kestrels	*Falco sparverius*
Turkey vultures	*Cathartes aura*
Red-tailed hawks	*Buteo jamaicensis*
Bald eagles	*Haliaeetus leucocephalus*
Osprey	*Pandion haliaetus*
Canada geese	*Branta canadensis*
Mallards	*Anas platyrhynchos*
Double-crested cormorants	*Phalacrocorax auritus*
Tundra swan	*Cygnus columbianus*
Great blue heron	*Ardea herodias*
Killdeer	*Charadrius vociferous*
Herring gull	*Larus argentatus*
California gull	*Larus californicus*
Ring-billed gull	*Larus delawarensis*
Mammals	
Coyotes	*Canis latrans*
Black-tailed deer	*Odocoileus hemionus*
Rabbits	*Sylvilagus* spp.
Voles	*Microtus canicaudus*
Raccoons	*Procyon lotor*
Mice	*Peromyscus maniculatus*
Black bears	*Ursus americanus*
Cougars	*Puma concolor*
Bobcats	*Lynx rufus*
Mule deer	*Odocoileus hemionus*

Legend: ANG = Air National Guard.
Sources: Griffith 2011; Oregon ANG 2008, 2020c.

3.9.1.3 Threatened, Endangered, and Special Status Species

Special status species are defined as those plant and animal species listed as endangered, threatened, and species proposed for listing by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA), and by State agencies. Special status species also include birds protected under the federal Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA), and other species-specific conservation legal authorities.

No federally or state listed plant or wildlife species have been documented within the Portland ANG installation. However, the installation is within the potential range for the following species, which are federally threatened, and state listed: Nelson's checker-mallow (*Sidalcea nelsoniana*), Northern spotted owl (*Strix occidentalis*), yellow-billed cuckoo (*Coccyzus americanus*), bull trout (*Salvelinus confluentus*), and streaked horned lark (*Eremophila alpestris strigata*). A federal candidate species, the monarch butterfly (*Danaus plexippus*), may also occur (USFWS 2013, 2022a). Table 3.9-3 identifies these species and their potential occurrence on the installation and under the airspace.

Streaked horned lark habitat is not located within the Portland ANG installation itself, but there is known streaked horned lark nesting and foraging habitat on PDX lands to the north and west of the Portland ANG installation. One known breeding site is at the Southwest Quad at the PDX, approximately 1.5 miles north of the Portland ANG installation (USFWS 2013). The location of the Southwest Quad in relation to the critical approach and departure paths for aircraft using Runway 10R results in this species becoming vulnerable to bird aircraft strikes. Runway 10R is located outside of Portland ANG installation property; however, the installation does use the runway for aircraft takeoff and landing. To avoid take of this special status species and remain compliant with the ESA, daily presence/absence surveys for streaked horned larks have also been conducted by PDX wildlife management staff during nesting season since 2006. Despite these search efforts, no streaked horned larks have been detected. Provisions for "incidental take" under the ESA for streaked horned larks "taken" due to aircraft/wildlife strikes was provided by the USFWS at the time of listing (USFWS 2013; Oregon ANG 2022e).

Table 3.9-3 Federal and State Listed Species Potentially Occurring on the Portland ANG Installation and under the Airspace

Common Name	*Scientific Name*	*Status*	*Potential Occurrence on the Portland ANG Installation*	*Potential Occurrence Under the Airspace*
Plants				
White rock larkspur	*Delphinium leucophaeum*	SE	Y	Y
Nelson's checker-mallow	*Sidalcea nelsoniana*	ST, T	Y	Y
Peacock larkspur	*Delphinium pavonaceum*	SE	Y	Y
Birds				
Greater sage-grouse	*Centrocercus urophasianus*	NT	N	Y
Marbled murrelet	*Brachyramphus marmoratus*	SE, T	N	Y
Northern spotted owl	*Strix occidentalis*	ST, T	Y	Y
Yellow-billed cuckoo	*Coccyzus americanus*	T	Y	Y
Streaked horned lark	*Eremophila alpestris strigata*	T	Y	Y
Western snowy plover	*Charadrius nivosus*	ST, T	N	Y
Mammals				
Canada lynx	*Lynx canadensis*	T	N	Y
Gray wolf	*Canis lupus*	E	N	Y
Grizzly bear	*Ursus arctos horribilis*	T	N	Y
North American wolverine	*Gulo luscus*	T	N	Y
Pacific marten, coastal DPS	*Martes caurina*	T	N	Y
Red tree vole	*Arborimus longicaudus*	C	N	Y
Southern mountain caribou	*Rangifer tarandus* ssp. *Caribou*	E	N	Y
Fish				
Bull trout	*Salvelinus confluentus*	T	Y	Y
Hutton tui chub	*Gila bicolor ssp.*	ST, T	N	Y
Lost river sucker	*Deltistes luxatus*	SE, E	N	Y
Tidewater goby	*Eucyclogobius newberryi*	E	N	Y
Warner sucker	*Catostomus warnerensis*	ST, T	N	Y
Insects				
Monarch butterfly	*Danaus plexippus*	C	Y	N

Legend: ANG = Air National Guard; C = Federal Candidate for Listing; DPS = Distinct Population Segment; E = Federally Endangered; N = No potential for occurrence; NT = Near Threatened; PT = Proposed Federally Threatened; SE = State Endangered; ST = State Threatened; T = Federally Threatened; Y = Yes, potential for occurrence.

Sources: Oregon ANG 2022e; Idaho Department of Fish and Game 2022; Oregon Department of Fish and Wildlife 2021; Nevada Department of Wildlife 2023; USFWS 2013, 2022a.

Designated critical habitat for the Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*Oncorhynchus keta*), and steelhead (*Oncorhynchus mykiss*) is located within the Columbia Slough. This designated critical habitat is located outside of the installation boundary; however, water quality within the Columbia Slough can be influenced by activities at the Portland ANG installation as three drainage basins discharge into the Middle Columbia Slough. Chinook salmon, chum salmon, and steelhead migrate from the ocean to the freshwater streams and rivers of their birthplace to spawn, which includes the Columbia Slough. Juvenile salmon may spend 3 months to 2 years within the freshwater habitat before migrating to the ocean to feed and mature.

A total of 23 migratory birds of concern with potential to occur on the installation were identified and 26 migratory birds also have potential to occur under the airspace, as shown in Table 3.9-4. All of the migratory birds identified appear on the USFWS Birds of Conservation Concern list.

Table 3.9-4 Potentially Occurring Migratory Birds at the Portland ANG Installation and under the Airspace

Common Name	*Scientific Binomial*	*Potential Occurrence on the Portland ANG Installation*	*Potential Occurrence Under the Airspace*	*Seasonal Occurrence*
Tricolored blackbird	*Agelaius tricolor*	Y	Y	Breeding
Short-eared owl	*Asio flammeus*	Y	Y	Year-round
Ferruginous hawk	*Buteo regalis*	N	Y	Breeding
Cassin's finch	*Carpodacus cassinii*	Y	Y	Year-round
Purple finch	*Carpodacus purpureus*	Y	Y	Year-round
Olive-sided flycatcher	*Contopus cooperi*	Y	Y	Breeding
Willow flycatcher	*Empidonax traillii*	Y	Y	Breeding
Peregrine falcon	*Falco peregrinus*	Y	Y	Year-round, Breeding
Bald eagle	*Haliaeetus leucocephalus*	Y	O	Breeding
Caspian tern	*Hydroprogne caspia*	Y	O	Breeding
Lewis's woodpecker	*Melanerpes lewis*	Y	Y	Year-round
Long-billed curlew	*Numenius americanus*	Y	Y	Breeding
Sage thrasher	*Oreoscoptes montanus*	N	Y	Breeding
Flammulated owl	*Otus flammeolus*	N	Y	Breeding
Fox sparrow	*Passerella liaca*	Y	Y	Year-round, Breeding
White-headed woodpecker	*Picoides albolarvatus*	N	Y	Year-round
Vesper sparrow	*Pooecetes gramineus* ssp. *Affinis*	N	Y	Breeding
Rufous hummingbird	*Selasphorus rufus*	Y	Y	Breeding
Williamson's sapsucker	*Sphyrapicus thyroideus*	N	Y	Breeding
Brewer's sparrow	*Spizella breweri*	Y	Y	Breeding
Calliope hummingbird	*Stellula calliope*	N	Y	Breeding
Black swift	*Cypseloides niger*	Y	Y	Breeding
Clark's grebe	*Aechmophorus clarkia*	Y	Y	Breeding

Common Name	Scientific Binomial	Potential Occurrence on the Portland ANG Installation	Potential Occurrence Under the Airspace	Seasonal Occurrence
Evening grosbeak	*Coccothraustes vespertinus*	Y	Y	Breeding
Golden eagle	*Aquila chrysaetos*	Y	Y	Breeding
Lesser yellowlegs	*Tringa flavipes*	Y	Y	Transient
Marbled godwit	*Limosa fedoa*	Y	Y	Transient
Olive-sided flycatcher	*Contopus cooperi*	Y	Y	Breeding
Short-billed dowitcher	*Limnodromus griseus*	Y	Y	Breeding
Western grebe	*Aechmophorus occidentalis*	Y	Y	Breeding
Allen's hummingbird	*Selasphorus sasin*	N	Y	Breeding
American white pelican	*Pelecanus erythrorhynchos*	N	Y	Breeding
Black oystercatcher	*Haematopus bachmani*	N	Y	Breeding
Black swift	*Cypseloides niger*	N	Y	Breeding
Black turnstone	*Arenaria melanocephala*	N	Y	Transient
Bobolink	*Dolichonyx oryzivorus*	N	Y	Breeding
Brown pelican	*Pelecanus occidentalis*	N	Y	Breeding
Long-eared owl	*Asio otus*	N	Y	Breeding
Long-tailed duck	*Clangula hyemalis*	N	Y	Transient
Mountain plover	*Charadrius montanus*	N	Y	Breeding
Oak titmouse	*Baeolophus inornatus*	N	Y	Breeding
Pinyon jay	*Gymnorhinus cyanocephalus*	N	Y	Breeding
Red phalarope	*Phalaropus fulicarius*	N	Y	Transient
Red-necked phalarope	*Phalaropus lobatus*	N	Y	Transient
Sage thrasher	*Oreoscoptes montanus*	N	Y	Breeding
Virginia's warbler	*Vermivora virginiae*	N	Y	Breeding
Willet	*Tringa semipalmata*	N	Y	Breeding
Wrentit	*Chamaea fasciata*	N	Y	Breeding
Yellow rail	*Coturnicops noveboracensis*	N	Y	Breeding

Legend: ANG = Air National Guard; N = No potential for occurrence; O = Observed; Y = Yes, potential for occurrence.
Sources: Oregon Biodiversity Information Center 2010; USFWS 2022a, 2022b.

Although not federally listed as threatened or endangered, the bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*) have potential to occur at the installation and are protected under the BGEPA as well as the MBTA. No eagle nests are present on the installation or adjacent properties (Oregon ANG 2022e).

A total of 22 federally listed, proposed to be federally listed, and candidate species have been observed or have the potential to occur under the proposed airspace. Of those, nine are also state listed species (see Table 3.9-1). Critical habitat for other species does not occur under the airspace. In addition, 49 migratory birds that occur on the USFWS Birds of Conservation Concern list have the potential to occur under the airspace (see Table 3.9-2).

3.9.1.4 Wetlands

Wetlands are considered sensitive habitats and are subject to federal regulatory authority under Sections 401 and 404 of the Clean Water Act (CWA) and EO 11990, *Protection of Wetlands*. A total of four wetland areas have been identified on the installation totaling approximately 0.89 acres (Figure 3.9-1). The U.S. Army Corps of Engineers determined that these wetlands were not considered jurisdictional (Oregon ANG 2022e).

Meters
0 200
0 500
Feet

Figure 3.9-1 Wetlands in the Vicinity of the Project Locations

Note: See Table 2.1-1 and Table 2.1-2 for project names and descriptions.
Note: INRMP GIS data has been requested.

Source: ESRI 2015a, ESRI 2017, NWI 2019, Port of Portland 2016, Portland ANG 2021

3.10 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

3.10.1 Existing Conditions

Socioeconomic effects are driven in part by access points and built infrastructure that determine where people who work at the installation live, spend money, and pay taxes. Multnomah County, Oregon is considered the ROI for socioeconomic effects of the Proposed Action. Socioeconomic data provided in this section are presented for the U.S., state of Oregon Multnomah County, and the city of Portland to characterize current socioeconomic conditions, which are used to gauge the level of impacts that are associated with project activities.

The ROI for environmental justice, children's health and safety, and the elderly includes census tracts that contain project components, adjacent census tracts, and census tracts that fall under noise contour lines of 65 dB DNL or higher (as identified in Section 3.1). These areas include portions of both Multnomah County in Oregon and Clark County in Washington. The Portland ANG installation is located in Census Tract 73 in Multnomah County, and portions of 11 census tracts in Multnomah County and 3 census tracts in Clark County, Washington fall under noise contour lines of 65 dB DNL or higher.

3.10.1.1 Population

In 2020, Multnomah County had a total population of 815,428 which was a 10.9 percent increase over the previous 10 years as shown in Table 3.10-1.

Table 3.10-1 Population in the ROI over Time

Area	*2010*	*2020*	*Percent Change*
United States	308,745,538	331,449,281	7.4
Oregon	3,831,074	4,237,256	10.6
Multnomah County	735,334	815,428	10.9
City of Portland	583,776	652,503	11.8

Legend: ROI = Region of Influence.
Sources: USCB 2010, 2020a.

3.10.1.2 Employment and Earnings

Table 3.10-2 shows the Bureau of Labor Statistics' employment data for Multnomah County in August 2022 as compared to employment information from Oregon and the U.S.

Table 3.10-2 Employment in the ROI

Area	*Civilian Labor Force*	*Employed*	*Unemployed*	*Unemployment Rate (percent)*
United States	164,971,000	158,714,000	6,256,000	3.8
Oregon	2,217,815	2,122,424	95,391	4.3
Multnomah County	480,549	460,340	20,209	4.2

Legend: ROI = Region of Influence.
Sources: Bureau of Labor Statistics 2022a, 2022b, 2022c.

Median and mean household incomes as well as median earnings for workers and per-capita income in Multnomah County are higher than the state and national levels (Table 3.10-3).

Table 3.10-3 Incomes in the ROI

Area	*Median Household Income*	*Mean Household Income*	*Median Earnings for Workers*	*Per Capita Income*
United States	$64,994	$91,547	$36,280	$35,384
Oregon	$65,667	$88,137	$35,166	$35,393
Multnomah County	$71,425	$98,213	$39,488	$41,612

Legend: ROI = Region of Influence.
Source: USCB 2020b.

3.10.1.3 Housing

In 2020, Multnomah County had a total of 353,735 housing units, 18,886 of which were vacant as shown in Table 3.10-4.

Table 3.10-4 Housing in the ROI

Area	*Total Housing Units*	*Vacant Housing Units*	*Rental Vacancy Rate (percent)*	*Median Value of Owner-Occupied Housing Units*	*Median Gross Rent*	*Persons per Household*
United States	138,432,751	16,078,532	5.8	$229,800	$1,096	2.6
Oregon	1,788,855	146,276	3.6	$336,700	$1,173	2.5
Multnomah County	353,735	18,886	4.1	$410,800	$1,309	2.4
City of Portland	293,208	16,066	4.0	$438,500	$1,325	2.3

Legend: ROI = Region of Influence.
Source: USCB 2020b.

3.10.1.4 Schools

There are a total of 159 public schools in Multnomah County and 59 private schools and their respective student-teacher ratios are shown in Table 3.10-5.

Table 3.10-5 Public and Private Schools in Multnomah County

School Type	*Number of Schools*	*Number of Students*	*Number of Teachers*	*Student-Teacher Ratio*
Public	159	85,931	4,694.5	18.3
Private	59	11,195	824.5	13.6
Total	218	97,126	5,519.0	17.6

Note: Public School data is from 2020–2021 and Private School data is from 2019–2020.
Sources: National Center for Education Statistics 2020, 2021.

3.10.1.5 Environmental Justice

Figure 3.10-1 shows the location of the environmental justice communities near the Portland ANG Installation, which is located within the boundaries of PDX. Table 3.10-6 displays the total households, and total and percent of low-income households in the ROI. Table 3.10-7 displays the total population, total and percentage of minority, children under 18 years of age, and elderly populations in the ROI. Areas that have a higher percentage of their population that are low-income when compared to their reference county are considered to be a low-income area. Areas where 50 percent of the population or more are from a minority group, or are higher than the reference county, are considered a minority area. In 2020, an estimated 13 percent of households in Multnomah County had incomes below the poverty level. An estimated 31 percent of the residents of Multnomah County were a member of a minority group in 2020. Comparing this reference group to those persons affected by the existing noise contours shown in Tables 3.10-9 and 3.10-10, 12 percent of those individuals are considered to be low-income, which is slightly lower than the reference group of 13 percent; and 32 percent are recognized as a member of a minority group, which is slightly higher than the reference group of 31 percent.

Table 3.10-6 Total Households, and Total and Percent Low-income Households for the United States, States of Oregon and Washington and ROI

Geographic Area	*Total Households*	*Low-income Households*	*Percent Low-income*
United States	127,544,730	16,336,940	13%
Oregon	1,642,579	196,538	12%
Washington	2,905,822	284,425	10%
Multnomah County, OR	334,849	42,572	13%
Clark County, WA	178,478	14,895	8%

Source: USCB 2020b.

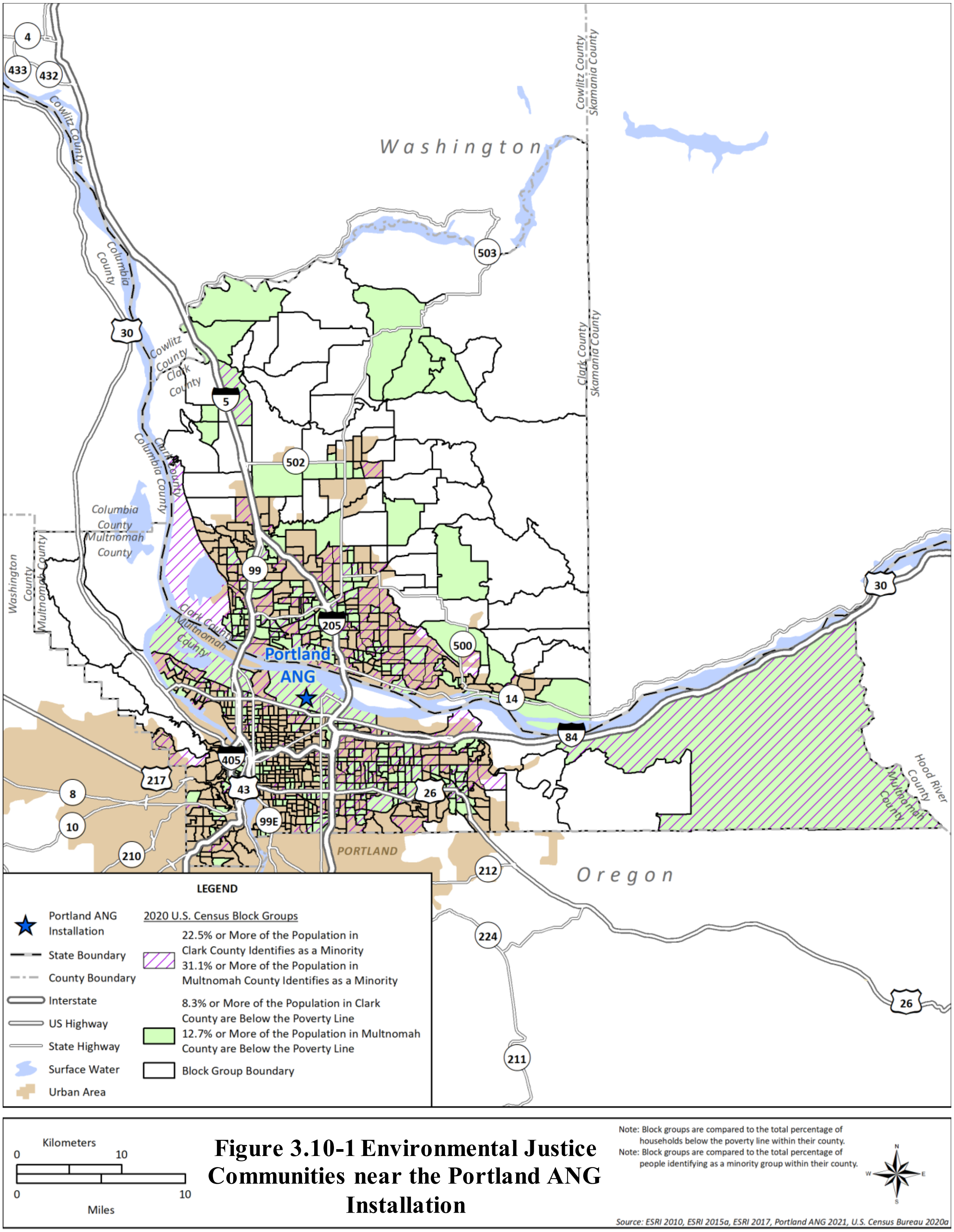

Figure 3.10-1 Environmental Justice Communities near the Portland ANG Installation

Table 3.10-7 Total Population, Total and Percent Minority, Children, and Elderly Populations for the United States, States of Oregon and Washington and ROI

Geographic Area	*Total Population*	*Minority Population*	*Percent Minority*	*Children Under 18*	*Percent Children Under 18*	*Elderly*	*Percent Elderly*
United States	326,569,308	130,317,933	40%	73,296,738	22%	52,362,817	16%
Oregon	4,176,346	1,047,852	25%	867,076	21%	734,932	18%
Washington	7,512,465	2,444,556	33%	1,653,469	22%	1,160,604	15%
Multnomah County, OR	809,869	251,644	31%	151,312	19%	108,984	13%
Clark County, WA	481,950	108,574	23%	115,360	24%	74,453	15%

Legend: % = percent; OR = Oregon; WA = Washington.
Source: USCB 2020b.

Tables 3.10-8 and 3.10-9 display the same information for those populations affected by the existing noise contours associated with the F-15C aircraft.

Table 3.10-8 Total Households, and Total and Percent Low-income Households Affected by Noise Greater than 65 dB DNL Under Existing F-15C Operations

Noise Level (dB DNL)	*Total Households*	*Low-income Households*	*Percent Low-income*
65–70	43	5	11%
70–75	1	0.45	37%
75–80	0	0	0%
80–85	0	0	0%
85+	0	0	0%
Total	**44**	**5**	**12%**

Legend: % = percent; dB = decibel; DNL = Average Day-Night Sound Level.
Source: USCB 2020b.

Table 3.10-9 Total Current Population, Minority Low-income, Children and Elderly Populations Affected by Noise Greater than 65 dB DNL Under Existing F-15C Operations

Noise Level (dB DNL)	*Total Population*	*Minority Population*	*Percent Minority*	*Children Under 18*	*Percent Children Under 18*	*Elderly*	*Percent Elderly*
65–70	124	39	32%	12	9%	18	15%
70–75	9	3	32%	0	5%	1	8%
75–80	0	0	0%	0	0%	0	0%
80–85	0	0	0%	0	0%	0	0%
85+	0	0	0%	0	0%	0	0%
Total	**133**	**42**	**32%**	**12**	**9%**	**19**	**14%**

Legend: % = percent; dB = decibel; DNL = Average Day-Night Sound Level.
Source: USCB 2020b.

3.10.1.6 Protection of Children and the Elderly

Due to their physiological and behavioral traits, children may be more susceptible and vulnerable to environmental health and safety risks than adults. As a whole, the ROI for the protection of children analysis have a lower percentage of population aged 17 or younger (9 percent) than or Multnomah (19 percent) or Clark (24 percent) counties (U.S. Census Bureau [USCB] 2020b).

Locations where children spend a large amount of their time or locations where children would likely be present in concentrated numbers are identified as areas that are of potential increased risk. Residential areas are locations where children live and would spend a large amount of their time. Schools and childcare facilities are identified as locations where children would likely be present in concentrated numbers and may be vulnerable to impacts. In the ROI, 14 percent of the population are elderly, which is slightly more than Multnomah County (13 percent) and slightly less than Clark County (15 percent).

3.11 LAND USE

3.11.1 Existing Conditions

The ROI for land use is the area including and immediately surrounding the Portland ANG installation at PDX, with additional information presented for the surrounding vicinity, where relevant. The ROI also includes areas under the airspace. Due to the nature of the actions proposed within the airspace, land use was excluded from extensive review and analysis within the airspace. The proposed activities would not result in new ground disturbance, and ordnance delivery and chaff and flare use would occur in locations already used and authorized for those purposes.

The City of Portland's 2035 Comprehensive Plan includes five objectives that focus on economic prosperity, human health, environmental health, equity, and resilience to guide future growth and development in the city (City of Portland 2020a). The Port of Portland manages PDX as a regional, national, and international air transportation hub. The aircraft noise environment around PDX is governed by the City of Portland zoning code Chapter 33.470 established in 1980, which establishes aircraft noise level areas in the surrounding community that must be mitigated by developers of new or major remodeling of residential construction in order to be issued a city permit (City of Portland 2020b). The City of Vancouver zoning code Chapter 20.520 has provisions similar to those in Portland which also govern the noise environment around PDX (City of Vancouver 2007). These noise overlay zones are depicted in Figure 3.1-1.

Land use surrounding PDX is comprised primarily of industrial, open space, water features, residential, mixed use, and commercial uses. The Columbia River and associated waterfront open space is located to the north forming the northern and northeastern border of PDX. The eastern and southern portions are primarily industrial with pockets of open space and residential. West of the airport includes commercial, industrial, residential, and mixed uses.

Land use immediately surrounding the Portland ANG installation to the west, north, east, and south is zoned for industrial uses. PDX surrounds the installation on the western and northern sides. The Columbia Slough flows along the southern border of the installation. There are pockets of land in the industrial area where existing zoning predates the adoption of the current industrial zoning code. These include small pockets of residential, residential farm/forest, and open space to the south (Whitaker Ponds Nature Park) and southeast (Colwood National Golf Cub) of the installation (City of Portland 2020a). Beyond PDX across State Highway 30 to the south, land uses are primarily residential and mixed-use areas.

The DoD has established noise compatibility criteria for various land uses. According to these criteria, sound levels up to 65 dB DNL are compatible with land uses such as residences, transient lodging, and medical facilities. Currently, aircraft noise from PDX exposes approximately 2,398 acres of off-airport areas of industrial, commercial, mixed use, open space/recreation, and residential land uses to noise levels between 65 and 75 dB DNL. Section 3.1, *Noise*, discusses existing noise levels at POIs such as schools and churches located within the 65 dB DNL off-airport noise contour areas. Figure 3.11-1 shows existing noise contours and the land use in the vicinity of PDX. Existing noise contours extend off-airport primarily to the northwest and southeast. Northwest of the airport, 65 dB DNL noise contours overlap with a small portion of residential, commercial, industrial, and open space in Multnomah County. Existing noise contours also cross over the Columbia River into Clark County and overlap with small portions of industrial and open space. To the southeast, 65 dB DNL contours extend over industrial and some open space uses. Land use activities most sensitive to noise typically include residential and commercial use, public services, and areas associated with cultural and recreational uses, such as parks/open space.

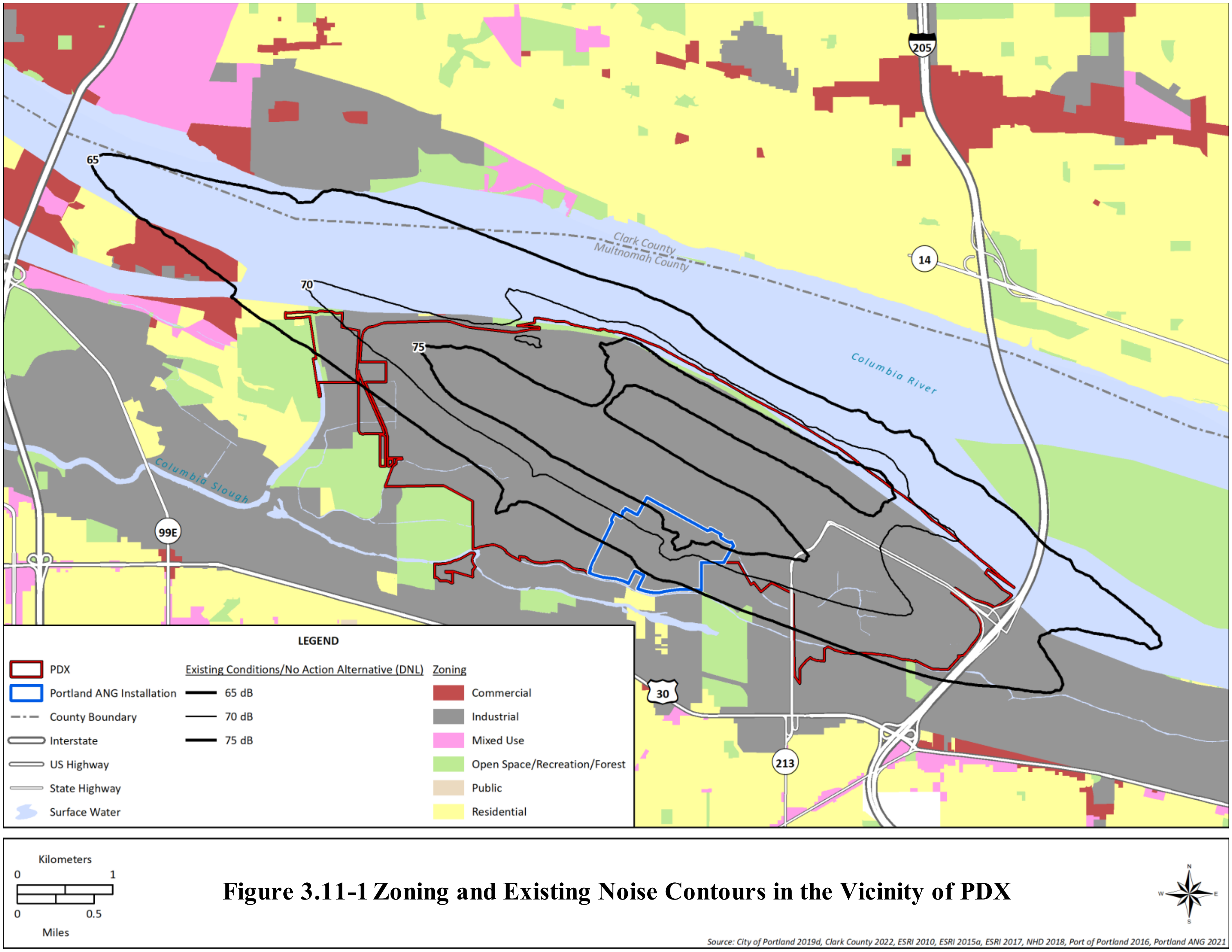

Figure 3.11-1 Zoning and Existing Noise Contours in the Vicinity of PDX

3.12 DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(f)

Section 4(f) of the Department of Transportation Act of 1966, codified as 49 USC Section 303(c), protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public or private historic sites. Section 4(f) provides that the Secretary of Transportation may approve a transportation program or project that requires the use of any publicly owned land from a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance, or land from any publicly or privately owned historic site of national, state, or local significance, only if there is no feasible and prudent alternative to the use of such land and the program or project includes all possible planning to minimize harm resulting from the use.

The ROI for Section 4(f) natural resources (parks, recreation areas, and refuges) includes the construction ROI and the surrounding area where potential impacts from noise as a result of implementation of the F-15EX airframe could occur. The APE as described under Section 3.6, *Cultural Resources*, is used to assess historic sites as they relate to Section 4(f) resources in addition to the surrounding area potentially impacted by noise. SUA actions (including military flight operations and designation of airspace for such operations) are exempt from the requirements of Section 4(f) and therefore, airspace is not analyzed further for Section 4(f) resources.

3.12.1 Department of Transportation Section 4(f) Resources

Section 4(f) Parks, Recreation Areas, and Refuges are described in Table 3.12-1.

Table 3.12-1 Section 4(f) Parks, Recreation Areas, and Refuges in the Vicinity of PDX

Section 4(f) Parks, Recreation Areas, and Refuges[1]	*Description*
Columbia Slough Natural Area/Trail, City of Portland Parks and Recreation, Columbia Slough Watershed Council	The Columbia Slough is approximately 19 miles long and stretches from its origin at Fairview Lake westward to its confluence with the Willamette River. Despite its urbanized character, the Columbia Slough contains high levels of biodiversity including mammals such as deer, beaver, and river otter, and about 175 bird species. Western painted turtles (one of only two turtle species in Oregon) and several salmonid species inhabit portions of the slough. The slough provides a valuable wildlife corridor that runs from the Sandy River Delta to the Willamette River.
Columbia Slough Natural Trail, City of Portland	A 1.2-mile paved biking and walking path along the Columbia Slough in North Portland offers access to wildlife and views of Mt St Helens, Mt Adams, and Mt Hood. The path supports commuters and recreational users and serves as a connection between Colwood Natural Area and Whitaker Ponds Nature Park.
Johnson Lake Property, City of Portland	Johnson Lake Property is a 15.5-acre natural protected area located along the Columbia Slough. Johnson Lake is a spring-fed lake bought by City of Portland in 1996.

***Section 4(f) Parks, Recreation Areas, and Refuges*[1]**	***Description***
Catkin Marsh Natural Area, City of Portland	Catkin Marsh Natural Area is a 54-acre natural protected area with multiple wetlands known as Catkin Marsh. The wetlands collect surface water from surrounding land and direct it to the Lower Columbia Slough, which is a designated critical habitat for salmon and provide connectivity to the Columbia Slough.
Government Island State Recreation Area, Oregon State Park	17-acre historic scenic nature preserve, and archaeological site comprised of three islands, including Lemon Island. The interior of the island contains protected natural areas, such as Jewett Lake, and is accessible only by permit through the Port of Portland. The islands feature freshwater wetlands that support a variety of wildlife species, including several species of salmon, salamanders, bats, turtles, and birds.
Lemon Island, Oregon State Park	A densely vegetated and hard to navigate island popular with boaters. The island is seasonally connected to Government Island. Lemon Island is the westernmost extent of the Government Island complex. Open year-round, the island is only accessible by boat. The island is owned by the Port of Portland and leased to and maintained by the Oregon Parks and Recreation Department as a State Recreation Area. Camping is allowed on the island below the vegetation line, and vault toilets and picnic tables are scattered around the islands.
Marine Park, City of Vancouver, Washington	58-acre park in the City of Vancouver, Washington (Clark County) next door to Vancouver's Water Resources Education Center and boat launch site operated by the City of Vancouver.
Columbia Edgewater Golf Club and Riverside Golf and Country Club	Two privately owned golf courses; therefore, these resources were not further analyzed under 4(f).
Colwood National Golf Club, City of Portland/EMSWCD	In 2015, the EMSWCD awarded a grant to the City of Portland to support the acquisition of a natural area at Colwood National Golf Course in northeast Portland. This grant supports the dedication of 37 acres as a natural area, 32 acres of those are to be restored as forest and wetland areas. The City of Portland originally purchased the land after The Trust for Public Land negotiated the park acquisition. The project aligns with the EMSWCD's goals to permanently protect special natural areas and provide access to nature for local communities.
Marine Drive Trail/Path, City of Portland	The Marine Drive Path was first conceived in 1972 and is the region's oldest path. The path is heavily used and is a key connection to I-205, several industrial corridors, and it is the main gateway to the Columbia River Gorge. Currently about 17.5 miles are done and just under six miles remain to be paved and connected. The trail provides access to Broughton Beach, a popular recreational area north of PDX.
Broughton Beach/James Gleason Memorial Boat Ramp, Metro Parks and Nature	The park offers picnic and viewing areas, wetland and wildlife habitat, disabled-accessible docks, restrooms, and a seasonal river patrol station. Broughton Beach is one of the few sandy beaches in Portland, attracting a steady stream of visitors to the Columbia River. Broughton Beach is just east of the M. James Gleason Memorial Boat Ramp. It is a popular spot for canoeing, birdwatching, picknickers, sunbathing, wading, and salmon fishing.

Note: [1]Section 4(f) properties were identified in the vicinity of PDX by reviewing park location data from U.S. Geological Survey, Clark and Multnomah Counties, and the City of Portland Parks and Recreation; geographic information system mapping depicting publicly owned properties such as National parks, state forests, wildlife management areas, trails, cemeteries, zoos, tribal lands, and local preserves and conservation areas managed by federal agencies, agencies of the state of Oregon; Clark, and Multnomah Counties; and City of Portland; and information obtained from the NRHP and the cultural resources assessment that was prepared for this project (see Sections 3.6 and 4.6).

Legend: EMSWCD = East Multnomah Soil and Water Conservation District; PDX = Portland International Airport.

3.12.2 Section 4(f) Historic Sites

There is one historic site of national, state, and/or local significance considered a Section 4(f) resource located within the APE surrounding PDX (National Park Service 2023). This Section 4(f) property includes the Raymond and Catherine Fisher house, a Tudor-style residence built in 1929 located along Marine Drive and was the first house constructed in the Golf Acres development associated with the Columbia-Edgewater Golf Course (Fitzgerald 2006). The house is located approximately 0.6 mile to the west of PDX along Marine Drive Trail.

The City of Portland has also mapped areas of archaeological sensitivity that fall within the 65 dB DNL noise contour of the APE. These areas are located to the east and south of the PDX boundary. Due to the sensitive nature of the information, these areas are not plotted on a figure for the public to view. The purpose for these areas is to protect inventoried significant archaeological resources and their functional values in the Columbia South Shore Plan District and PDX Plan District.

The existing ambient noise levels surrounding PDX are typical of those near airport uses and include aircraft, roadway, railroad, commercial, and residential activities (Port of Portland n.d.). PDX focuses flights over the Columbia River and minimizes aircraft noise over residential areas to the greatest extent possible. Development of the "Portland International Airport Noise Impact Zone" (known as the Airport Noise Zone) discourages residential development close to the airport where aircraft noise levels are highest.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 NOISE

4.1.1 Impacts

Table 4.1-1 presents a comparison of the DoD and FAA standards, which includes prescribed software models, noise metrics, and significance determination. Additional details on the methodology, noise modeling software, and approach are discussed in more detail in the noise study in Appendix D.

Table 4.1-1 Comparison of DoD and FAA Noise Analysis Standard Methodologies

Category	*Analysis Type*	*DoD*	*FAA*
Software	Airfield	NMAP, AAM (part of the NOISEMAP Suite of programs)[1,2]	AEDT[6,7]
	Airspace	MR_NMAP (Part of the NOISEMAP Suite of programs)[1] BOOMAP96 (for supersonic operations)	AEDT, but recognizes the DoD's MRNMAP and BOOMAP96 model[6,7]
Primary Noise Metric	Airfield	DNL; CNEL to be used in lieu of DNL for DoD actions occurring within California[1]	DNL; CNEL may be used in lieu of DNL for FAA actions needing approval in California[7]
	Airspace	L_{dnmr}; $CNEL_{mr}$ to be used for DoD actions occurring within California[1]	
Supplemental Noise Metrics	Terminology	Representative POIs[3]	Noise Sensitive Area[7]
	Classroom Learning Interference	$L_{eq(8hr)}$ 60 dB for screening; NA65 and TA65 for impacts during school hours (corresponding to interior L_{max} of 60 dB)[3]	DNL is the recommended metric. DNL analysis may optionally be supplemented on a case-by-case basis with prior permission from FAA[7]
	Speech Interference (Average Day)	NA65 for windows open and NA 75 for windows closed[3]	
	Sleep Disturbance	Probability of awakening utilizing ANSI S12.9-2008. Formally withdraw by ANSI/ASA in 2018 but still used for disclosure purposes until better methodology is developed[4]	
	Potential for Hearing Loss	Report the number of people living within each 1 dB L_{eq24} contour band inside of the 80 DNL (or CNEL) contour[5]	
	Single-Event Comparisons	SEL and L_{max} applicable to both airfield and airspace analysis[3]	

Category	*Analysis Type*	*DoD*	*FAA*
Significance Criteria	In the Vicinity of an Airfield	Evaluating context and intensity of impacts through off-base acreage population and household affected by each DNL (or CNEL) contour	• DNL (or CNEL) Noise exposure contours at least 65, 70, and 75 dB[7] • The location and number of noise sensitive uses in addition to residences (e.g., schools, hospitals, etc.) that would be exposed to DNL 65 dB or greater and experience an increase of DNL 1.5 dB • The identification of noise sensitive areas exposed to aircraft noise above DNL 60 dB but below DNL 65 dB and projected to experience an increase of DNL 3 dB or more, only when DNL 1.5 dB increases are documented within the DNL 65 dB contour
	Under Airspace	Context and Intensity determination based on primary metrics 65 dB noise contours (L_{dnmr} or $CNEL_{mr}$) and supplemental metric levels (SEL and L_{max}), as appropriate	Change-of-exposure tables and maps at population centers to identify where noise will change by the following specified amounts[7]: • For DNL 65 dB and higher: + DNL 1.5 dB • For DNL 60 dB to <65 dB: + DNL 3 dB ("reportable") • For DNL 45 dB to <60 dB: + DNL 5 dB ("reportable")

Notes: [1]DoD 2020a.
[2]Deputy Assistant Secretary of Defense 2022.
[3]DNWG 2009b.
[4]DNWG 2009a.
[5]DNWG 2013.
[6]FAA 2017.
[7]FAA 2023b.

Legend: AEDT = Aviation Environmental Design Tool; ANSI = American National Standards Institute; ASA = Acoustical Society of America; CNEL = Community Noise Equivalent Level; $CNEL_{mr}$ = California Equivalent Onset-Rate Adjusted Day-Night Average Sound Level; dB = decibel; DNL = Day-Night Average Sound Level; DNWG = Defense Noise Working Group; DoD = Department of Defense; EIS = Environmental Impact Statement; FAA = Federal Aviation Administration; L_{dnmr} = Onset-Rate Adjusted Day-Night Average Sound Level; $L_{eq(24)}$ = 24-hour Equivalent Sound Level; $L_{eq(8hr)}$ = 8-hour Equivalent Sound Level; L_{max} = Maximum Sound Level; NA = Number of Events at or above a specified threshold; POI = Point of Interest; TA = Time Above a specified level.

The DAF has no definitive significance threshold for noise impacts in the vicinity of military airfields or beneath SUA, and therefore relies on the context of the local environment and the intensity of the change on that environment. Context refers to the need to consider impacts within the setting in which they occur (e.g., changes in a rural area may elicit more of a response than one in an urban area due to lower background noise levels). Intensity refers to the severity of the noise impact based on a change in the acoustic environment as a result of both single events (SEL, L_{max}) and the combination of all noise events (DNL, L_{dnmr}). To determine the level of significance in the airfield environment, analyzed factors include: (1) changes to land use compatibility in relation to the number and type of structures, and population within the affected area; (2) the potential for increases in events that could result in sleep disturbance, speech interference, and interference with classroom learning; and (3) the potential hearing loss to occur to off-installation populations. Changes in the SUA were based on predicted changes in human annoyance and interference with daily activities.

The FAA has designated significance thresholds for changes in the acoustic environment at civilian airports where proposed actions are subject to NEPA compliance. FAA Order 1050.1F states that an action that "*..would increase noise by DNL 1.5 dB or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the no action alternative for the same timeframe,"* would be considered a significant impact (FAA 2023b).

Consistent with DoD methodology, the analysis considers whether the Proposed Action would cause noise sensitive receptors to be newly subjected to increased noise levels and/or whether the relative change from the existing conditions/No Action Alternative would be substantial. The impacts are also discussed in terms of the FAA criteria.

As described in Section 3.1.2, the current civil operations were temporarily depressed due to COVID-19, so existing conditions were based upon a pre-COVID 3-year average that operations are estimated to return to and would coincide with the No Action condition for this analysis. Therefore, comparison of the action alternatives to either existing conditions or the No Action Alternative is the same. Appendix D presents a review of newly released 2023 FAA Terminal Area Forecasts projecting civil operations at PDX and the effects those civil operations would have on environmental noise impacts.

4.1.1.1 Alternative 1

Under Alternative 1, the 142 WG would perform a full replacement of the F-15C aircraft with one squadron of F-15EX aircraft, to include 20 aircraft (18 PAA and 2 BAA). Alternative 1 would result in an increase from 4,848 annual F-15C operations to 5,294 annual F-15EX operations (9 percent increase), as summarized in Table 4.1-2. As no closed patterns are flown at PDX, the 5,294 annual operations would be comprised of 2,647 departures and 2,647 arrivals. Under Alternative 1, civil aircraft operations would be anticipated to remain consistent with existing conditions/No Action Alternative. As such, no change in the civil component is anticipated under Alternative 1.

Table 4.1-2 Alternative 1 Average Annual Operations

Category	*Aircraft group/type*[1]	*Departures*			*Arrivals*			*Grand Total*
		Day	*Night*	*Total*	*Day*	*Night*	*Total*	
Military	F-15EX	2,647	0	2,647	2,633	14	2,647	5,294
Civil	All	98,572	16,330	114,902	98,911	16,115	115,026	229,928
Grand Total		**101,219**	**16,330**	**117,549**	**101,544**	**16,129**	**117,673**	**235,222**

Note: [1]Aircraft types listed represent the most frequent types operating at PDX.

Airfield Noise

To accomplish the impact analysis, noise modeling using DNL is based on annual average day aircraft operations, which are determined by dividing the total yearly airfield/airport operations by 365 days per year. DNL has two time periods of interest: daytime (7 a.m. to 10 p.m.) and nighttime (10 p.m. to 7 a.m.). As detailed in the noise study in Appendix D, military noise modeling analysis uses the DoD NOISEMAP suite of computer programs and civilian aircraft noise modeling utilized default airport layout and standardized flight profile data (power settings, airspeeds, etc.) available with the Aviation Environmental Design Tool (AEDT) Version 3e software for civilian aircraft operations.

Noise exposure is also presented in terms of DNL at representative POIs and on- and off-airport acreages within each noise contour. All supplemental metric analyses are analyzed at all POIs regardless of type because many noise sensitive locations are located nearby, as listed in Table 4.1-3, and depicted in Figure 4.1-1. Additional modeling details are presented in the noise study in Appendix D.

Table 4.1-3 Representative POIs in the Vicinity of PDX

Map ID	*Point Type*	*Named POI*
PO-C-01	Census Tract Centroid	Census Tract 424
PO-C-02	Census Tract Centroid	Census Tract 426.01
PO-C-03	Census Tract Centroid	Census Tract 429
PO-C-04	Census Tract Centroid	Census Tract 430
PO-C-05	Census Tract Centroid	Census Tract 431
PO-C-06	Census Tract Centroid	Census Tract 412.07
PO-C-07	Census Tract Centroid	Census Tract 412.08
PO-C-08	Census Tract Centroid	Census Tract 36.01
PO-C-09	Census Tract Centroid	Census Tract 36.02
PO-C-10	Census Tract Centroid	Census Tract 36.03
PO-C-11	Census Tract Centroid	Census Tract 74
PO-C-12	Census Tract Centroid	Census Tract 75
PO-C-13	Census Tract Centroid	Census Tract 29.01
PO-C-14	Census Tract Centroid	Census Tract 76
PO-C-15	Census Tract Centroid	Census Tract 77
PO-C-16	Census Tract Centroid	Census Tract 78
PO-C-17	Census Tract Centroid	Census Tract 79
PO-C-18	Census Tract Centroid	Census Tract 95.02
PO-C-19	Census Tract Centroid	Census Tract 95.01
PO-H-01	Healthcare Facility	PeaceHealth Southwest Medical Center

Map ID	Point Type	Named POI
PO-H-02	Healthcare Facility	Park Forest Care Center
PO-R-01	Residential Area	Census Tract 72.01
PO-R-02	Residential Area	N Lotus Beach Dr
PO-R-03	Residential Area	Northeast Blue Heron Drive & Northeast 20th Avenue
PO-R-04	Residential Area	Northeast Marine Drive & Northeast 138th Avenue
PO-R-05	Residential Area	Census Tract 102
PO-S-01	School	Harney Elementary School
PO-S-02	School	Slavic Christian Academy
PO-S-03	School	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy
PO-S-04	School	Riverview Elementary School
PO-S-05	School	Bridges Middle School
PO-S-06	School	Woodlawn Elementary School
PO-S-07	School	Faubion Elementary School
PO-S-08	School	Portland Community College – Portland Metropolitan Workforce Training Center
PO-S-09	School	Trinity Lutheran School
PO-S-10	School	Community Transitional School
PO-S-11	School	Scott Elementary School
PO-S-12	School	Helensview High School
PO-S-13[3]	School	Former site of ITT Technical Institute and University of Phoenix[3]

Notes: [1]The census tracts represent neighborhoods surrounding PDX where noise sensitive locations (such as residences, schools, place of worship, etc. are likely to occur), which differs from specific Environmental Justice analysis communities analyzed in Section 3.10.
[2]Yellow highlighting represents points exposed to DNL of 65 dB or greater.
[3]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.

Legend: dB = decibel; DNL = Day-Night Average Sound Level; ID = Identification; POI = Point of Interest.

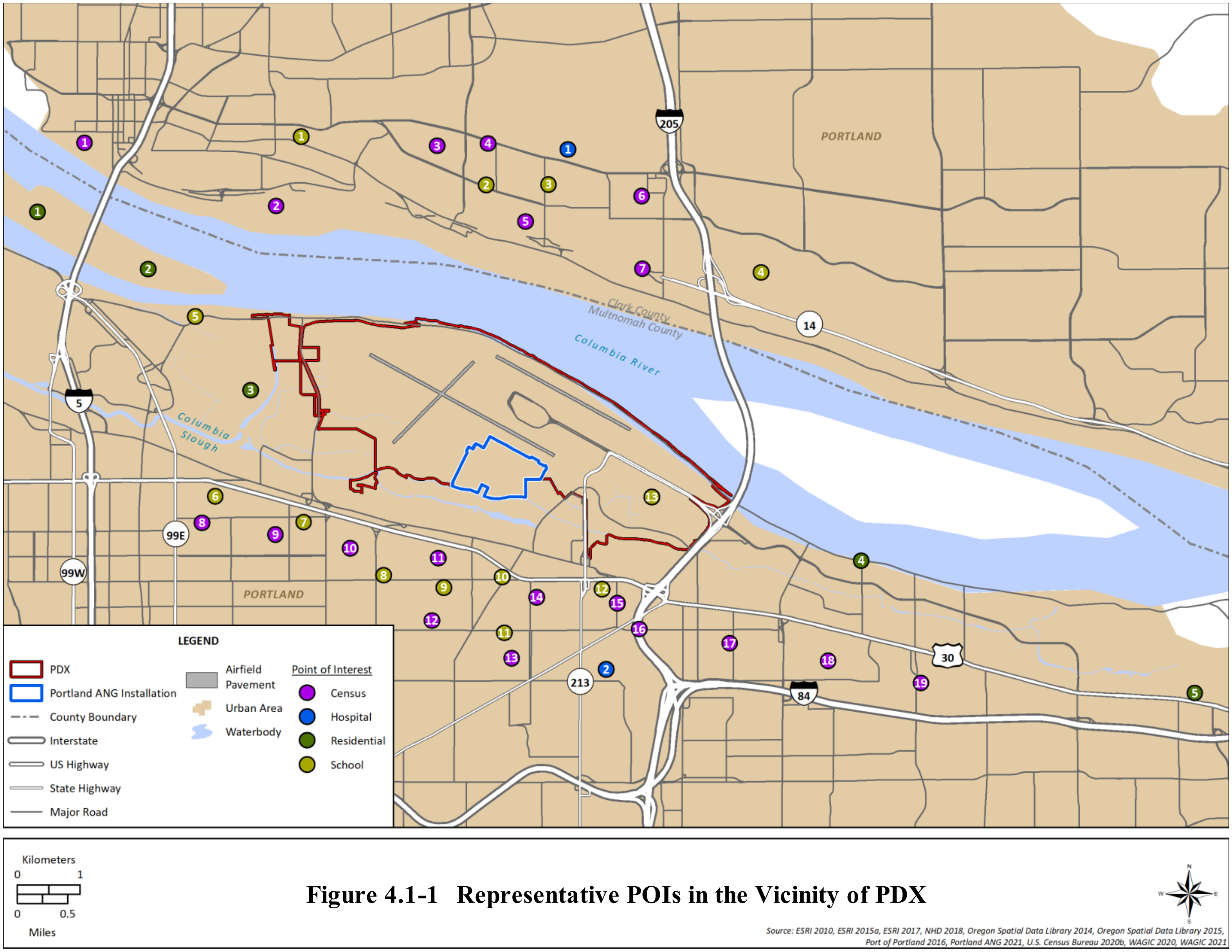

Figure 4.1-1 Representative POIs in the Vicinity of PDX

Source: ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Oregon Spatial Data Library 2014, Oregon Spatial Data Library 2015, Port of Portland 2016, Portland ANG 2021, U.S. Census Bureau 2020b, WAGIC 2020, WAGIC 2021

Figure 4.1-2 shows the DNL noise contours from 65 to 85 dB in 5-dB increments for Alternative 1 conditions at PDX, with a noise gradient for DNL from 45 dB and greater. As with existing conditions/No Action Alternative, noise generated from aircraft operations at PDX would occur within the airfield, over the Columbia River, and extends to cover areas to the south and southeast of the airfield. The 65 dB and greater DNL would be largely contained within the PDX boundary or over water. The noise gradient shows how aircraft noise from PDX would continue to extend well beyond the plotted contour lines but at lower less intrusive noise levels.

Figure 4.1-3 presents a comparison of noise contours from 65 to 85 dB DNL of Alternative 1 and the existing conditions/No Action Alternative. The length of the 65 dB DNL contour would reduce by approximately 4,100 feet to the northwest of the installation and 2,700 feet to the southeast when compared to existing conditions/No Action Alternative. These areas of reduction are primarily commercial or industrial use or over water. The 65 dB DNL would increase in width to the southwest approximately 300 feet and northeast approximately 100 feet over primarily airport property, an uninhabited island in the Columbia River, or over water. Section 4.11, *Land Use*, addresses residential areas exposed to 65 dB DNL or greater in more detail.

Table 4.1-4 shows the acreage breakdown (excluding water bodies) for PDX. A total of 4,502 acres would be exposed to 65 dB DNL or greater noise levels with 1,653 of those acres located outside of PDX property, which would be a decrease of 745 acres from existing conditions/No Action Alternative. The F-15EX climbs quicker on departure than the F-15C, resulting in less noise at ground level in these areas. A subset of land outside of PDX property would also be exposed to greater DNL with 200 acres subjected to 70 dB or greater (30 fewer acres than existing conditions/No Action Alternative) and 5 acres that would be exposed to DNL of 75 dB or greater (1 additional acre from existing conditions/No Action Alternative). No areas outside of PDX property would be exposed to DNL 80 dB or greater.

Table 4.1-4 Alternative 1 Noise Exposure Acreage

DNL (dBA)	*Alternative 1 Acreage*			*Change Relative to Existing Conditions/ No Action Alternative*		
	On Installation	*Off Installation*	*Total*	*On Installation*	*Off Installation*	*Total*
65+	2,849	1,653	4,502	-64	-745	-809
70+	2,004	200	2,204	-76	-30	-105
75+	1005	5	1,009	+88	+1	+89
80+	511	0	511	+56	0	+56
85+	232	0	232	+37	0	+37

Legend: dBA = A-weighted decibel; DNL = Day-Night Average Sound Level.

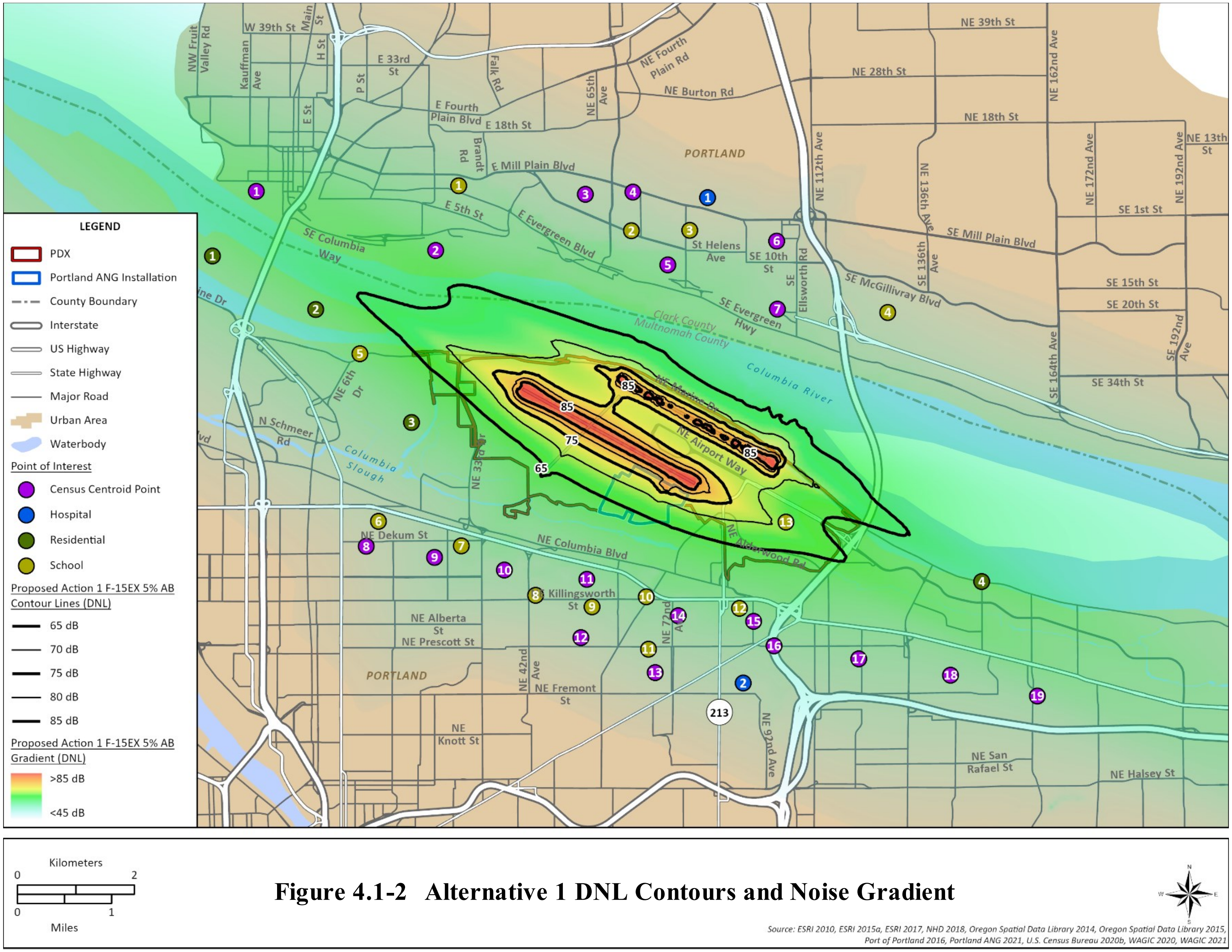

Figure 4.1-2 Alternative 1 DNL Contours and Noise Gradient

Source: ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Oregon Spatial Data Library 2014, Oregon Spatial Data Library 2015, Port of Portland 2016, Portland ANG 2021, U.S. Census Bureau 2020b, WAGIC 2020, WAGIC 2021

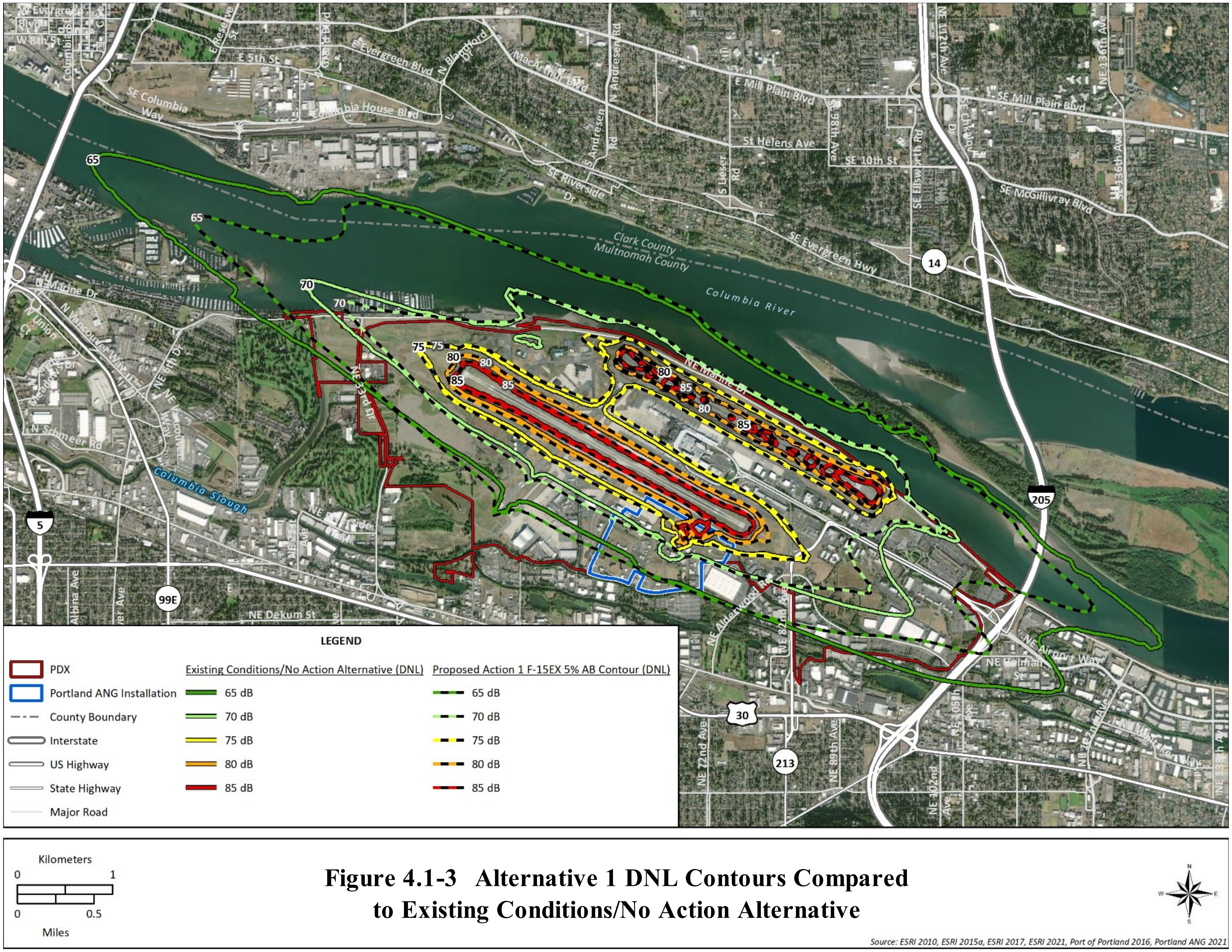

Figure 4.1-3 Alternative 1 DNL Contours Compared to Existing Conditions/No Action Alternative

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021

Table 4.1-5 details the estimated number of households and population that would be exposed to each DNL range under Alternative 1. A total of 12 households and 44 people would be exposed to DNL of 65 dB or greater, which would be a decrease of 31 fewer households and 89 fewer people. An estimated 1 household and 8 people would be exposed to 70 dB DNL or greater, a decrease of 1 household and 1 fewer person from existing conditions/No Action Alternative.

Table 4.1-5 Alternative 1 Households and Population Counts

DNL (dBA)	*Alternative 1*		*Change Relative to Existing Conditions/ No Action Alternative*	
	Households	*Population*	*Households*	*Population*
65+	12	44	-31	-88
70+	1	8	-1	-1
75+	0	0	0	0
80+	0	0	0	0
85+	0	0	0	0

Note: Numbers may not add up due to rounding.
Legend: dBA = A-weighted decibel; DNL = Day-Night Average Sound Level.

Table 4.1-6 describes the estimated DNL values at each of the POIs and the net change compared to existing conditions/No Action Alternative. The DNL would be 48 to 64 dB with the change from existing conditions/No Action Alternative ranging from a decrease of up to 5 dB DNL at 18 POIs, no change at 16 POIs, and increase up to 1 dB DNL at 5 POIs. The number of POIs exposed to 65 dB DNL would decrease to none under Alternative 1.

Table 4.1-6 DNL at POIs for Alternative 1

Map ID	*Point Type[1]*	*Named POI*	*Existing Conditions/ No Action Alternative DNL (dB)[2]*	*Alternative 1 DNL (dB)[2]*	*Increase From Existing Conditions/ No Action Alternative DNL (dB)*
PO-C-01	Census Tract Centroid	Census Tract 424	61	60	-1
PO-C-02	Census Tract Centroid	Census Tract 426.01	62	61	-1
PO-C-03	Census Tract Centroid	Census Tract 429	51	50	-1
PO-C-04	Census Tract Centroid	Census Tract 430	49	49	0
PO-C-05	Census Tract Centroid	Census Tract 431	55	56	+1
PO-C-06	Census Tract Centroid	Census Tract 412.07	49	50	+1
PO-C-07	Census Tract Centroid	Census Tract 412.08	53	54	+1
PO-C-08	Census Tract Centroid	Census Tract 36.01	48	48	0
PO-C-09	Census Tract Centroid	Census Tract 36.02	52	52	0
PO-C-10	Census Tract Centroid	Census Tract 36.03	52	52	0
PO-C-11	Census Tract Centroid	Census Tract 74	55	55	0
PO-C-12	Census Tract Centroid	Census Tract 75	49	50	+1
PO-C-13	Census Tract Centroid	Census Tract 29.01	50	50	0
PO-C-14	Census Tract Centroid	Census Tract 76	55	55	0
PO-C-15	Census Tract Centroid	Census Tract 77	57	56	-1
PO-C-16	Census Tract Centroid	Census Tract 78	56	54	-2

Map ID	*Point Type[1]*	*Named POI*	*Existing Conditions/ No Action Alternative DNL (dB)[2]*	*Alternative 1 DNL (dB)[2]*	*Increase From Existing Conditions/ No Action Alternative DNL (dB)*
PO-C-17	Census Tract Centroid	Census Tract 79	59	54	-5
PO-C-18	Census Tract Centroid	Census Tract 95.02	58	54	-4
PO-C-19	Census Tract Centroid	Census Tract 95.01	58	55	-3
PO-H-01	Healthcare Facility	PeaceHealth Southwest Medical Center	47	48	+1
PO-H-02	Healthcare Facility	Park Forest Care Center	52	51	-1
PO-R-01	Residential Area	Census Tract 72.01	60	58	-2
PO-R-02	Residential Area	North Lotus Beach Drive	63	61	-2
PO-R-03	Residential Area	Northeast Blue Heron Drive & Northeast 20th Avenue	58	57	-1
PO-R-04	Residential Area	Northeast Marine Drive & Northeast 138th Avenue	63	62	-1
PO-R-05	Residential Area	Census Tract 102	56	55	-1
PO-S-01	School	Harney Elementary School	54	54	0
PO-S-02	School	Slavic Christian Academy	52	52	0
PO-S-03	School	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy	50	50	0
PO-S-04	School	Riverview Elementary School	50	50	0
PO-S-05	School	Bridges Middle School	62	60	-2
PO-S-06	School	Woodlawn Elementary School	50	50	0
PO-S-07	School	Faubion Elementary School	54	54	0
PO-S-08	School	Portland Community College – Portland Metropolitan Workforce Training Center	53	52	-1
PO-S-09	School	Trinity Lutheran School	52	52	0
PO-S-10	School	Community Transitional School	56	56	0
PO-S-11	School	Scott Elementary School	51	51	0
PO-S-12	School	Helensview High School	58	57	-1
PO-S-13[3]	School	Former site of ITT Technical Inst and University of Phoenix[3]	**68**	64	-4

Notes: [1]The census tracts represent neighborhoods surrounding PDX where noise sensitive locations (such as residences, schools, place of worship, etc. are likely to occur), which differs from specific Environmental Justice analysis communities analyzed in Section 3.10.
[2]**Bold** numbers represent points exposed to DNL of 65 dB or greater.
[3]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.
Legend: dB = decibel; DNL = Day-Night Average Sound Level; ID = Identification; POI = Point of Interest.

Although the FAA requires only the DNL metric for evaluating noise exposure resulting from aviation activities, consistent with DoD requirements described in Appendix D, the following discussion presents DoD supplemental metric noise results for classroom learning impacts, speech interference, sleep disturbance, and the potential for hearing loss.

Table 4.1-7 displays results for three metrics used to examine noise effects on classroom learning: outdoor school day sound equivalent level (8-hour equivalent sound level [$L_{eq[8hr]}$]), number of speech interfering events per school day hour, and time above interior 45 A-weighted decibels (dBA) per 8-hour school day. $L_{eq(8hr)}$ is a cumulative metric that calculates the average sound energy aircraft operations generate during a typical school day (7 a.m. to 3 p.m.). Speech interference is measured by the number of events per hour when aircraft noise is greater than or equal to 50 dB L_{max}. Time above a specified threshold is used to quantify the average amount of time schools are exposed to noise levels exceeding the threshold of 50 dBA in an average school day. Under Alternative 1, 2 school locations (PO-S-05 and PO-S-13) would be exposed to outdoor $L_{eq(8hr)}$ above 60 dB, which would be a decrease of 1 fewer location when compared with existing conditions/No Action Alternative. Overall, $L_{eq(8hr)}$ would either not change or decrease up to 4 dB at 6 school POIs and increase by 1 dB at 7 school POIs under Alternative 1. The number of speech interfering events during the school day would generally not change at most POIs but would increase by 1 per hour at 1 school POI (PO-S-05). The duration of time above 50 dB during a typical school day would increase by 1 minute at one location (PO-S-07), and would either not change or decrease by up to 3 minutes at the remaining school POIs.

Table 4.1-7 Alternative 1 Classroom Learning Interference

ID	***Location***[3]	***Outdoor $L_{eq(8hr)}$ (dBA)***[2]		***Number of Speech Interfering Events per School Day Hour***[1]		***Time above 50 dBA per 8-hour school day (minutes)***[1]	
		Alternative 1	***Increase From Existing Conditions/ No Action Alternative***	***Alternative 1***	***Increase From Existing Conditions/ No Action Alternative***	***Alternative 1***	***Increase From Existing Conditions/ No Action Alternative***
PO-S-01	Harney Elementary School	53	-2	4	0	1	-1
PO-S-02	Slavic Christian Academy	52	+1	1	0	3	0
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy	50	+1	1	0	3	0
PO-S-04	Riverview Elementary School	52	0	1	0	3	0
PO-S-05	Bridges Middle School	**61**	-4	12	+1	2	-1
PO-S-06	Woodlawn Elementary School	51	+1	1	0	1	-1
PO-S-07	Faubion Elementary School	55	+1	2	0	3	+1
PO-S-08	Portland Community College – Portland Metropolitan Workforce Training Center	54	-1	1	0	3	-3
PO-S-09	Trinity Lutheran School	55	+1	1	0	3	0
PO-S-10	Community Transitional School	59	+1	1	0	3	-3
PO-S-11	Scott Elementary School	54	+1	1	0	3	0

ID	*Location*[3]	*Outdoor $L_{eq(8hr)}$ (dBA)*[2]		*Number of Speech Interfering Events per School Day Hour*[1]		*Time above 50 dBA per 8-hour school day (minutes)* [1]	
		Alternative 1	*Increase From Existing Conditions/ No Action Alternative*	*Alternative 1*	*Increase From Existing Conditions/ No Action Alternative*	*Alternative 1*	*Increase From Existing Conditions/ No Action Alternative*
PO-S-12	Helensview High School	**60**	-1	4	0	2	0
PO-S-13[4]	Former site of ITT Technical Institute and University of Phoenix[4]	**70**	-3	28	0	2	-1

Notes: [1]Assumes 90% of ANG daytime operations occur during the school day; windows open condition with noise level reduction of 15 dB due to building attenuation.
[2]**Bold** numbers represent schools exposed to exterior $L_{eq(8hr)}$ of greater than 60 dB, equivalent to the recommended interior threshold of 45 dB with windows open.
[3]Table presents the analysis for the school POI (S), but results are provided for all POI within the noise study in Appendix D because populated areas may include additional educational facilities (such as daycare operated out of a personal residence).
[4]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.
Legend: dB = decibels; dBA = A-weighted sound level; ID = Identification; $L_{eq(8hr)}$ = 8-hour equivalent sound level.

Table 4.1-8 presents the Alternative 1 speech interference based upon the numbers of events per average hour during the DNL daytime period for both a windows open and windows closed condition. The number of speech interfering events with windows open would range from none at 1 POI to 16 at PO-S-13. The change in windows open speech interfering events would range from no change at 31 POIs and increase by 1 per average hour at 8 POIs. The number of speech interfering events under Alternative 1 with windows closed would range from none to 9 per average hour. Of the 39 analyzed POIs, the number of interfering events with windows closed would increase by 1 event per average hour at 4 POIs (PO-C-15 Census Tract 77, PO-C-19 Census Tract 95.01, PO-S-12, and PO-S-13), decrease by 1 event per hour at 1 POI (PO-C-11 Census Tract 74), and not change at the remaining 34 POIs.

Table 4.1-8 Alternative 1 Speech Interference Events per Average Hour (Daytime)

Map ID[1]	*Named POI*	*Alternative 1 (events per hour)*		*Increase Compared to Existing Conditions/No Action Alternative (events per hour)*[4]	
		Windows Open[2]	*Windows Closed*[3]	*Windows Open*[2]	*Windows Closed*[3]
PO-C-01	Census Tract 424	13	1	0	0
PO-C-02	Census Tract 426.01	10	1	0	0
PO-C-03	Census Tract 429	1	0	0	0
PO-C-04	Census Tract 430	1	0	+1	0
PO-C-05	Census Tract 431	1	0	0	0
PO-C-06	Census Tract 412.07	1	0	+1	0

Map ID[1]	*Named POI*	*Alternative 1 (events per hour)*		*Increase Compared to Existing Conditions/No Action Alternative (events per hour)*[4]	
		Windows Open[2]	*Windows Closed*[3]	*Windows Open*[2]	*Windows Closed*[3]
PO-C-07	Census Tract 412.08	1	0	+1	0
PO-C-08	Census Tract 36.01	1	0	0	0
PO-C-09	Census Tract 36.02	1	0	0	0
PO-C-10	Census Tract 36.03	1	0	0	0
PO-C-11	Census Tract 74	1	0	0	-1
PO-C-12	Census Tract 75	1	0	+1	0
PO-C-13	Census Tract 29.01	1	0	+1	0
PO-C-14	Census Tract 76	1	0	0	0
PO-C-15	Census Tract 77	2	1	0	+1
PO-C-16	Census Tract 78	1	0	0	0
PO-C-17	Census Tract 79	1	0	0	0
PO-C-18	Census Tract 95.02	1	0	0	0
PO-C-19	Census Tract 95.01	3	1	0	+1
PO-H-01	PeaceHealth Southwest Medical Center	1	0	+1	0
PO-H-02	Park Forest Care Center	1	0	0	0
PO-R-01	Census Tract 72.01	8	0	0	0
PO-R-02	North Lotus Beach Drive	9	1	0	0
PO-R-03	Northeast Blue Heron Drive & Northeast 20th Avenue	4	0	0	0
PO-R-04	Northeast Marine Drive & Northeast 138th Avenue	13	3	0	0
PO-R-05	Census Tract 102	3	0	0	0
PO-S-01	Harney Elementary School	2	0	0	0
PO-S-02	Slavic Christian Academy	1	0	0	0
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy	1	0	+1	0
PO-S-04	Riverview Elementary School	0	0	0	0
PO-S-05	Bridges Middle School	7	1	0	0
PO-S-06	Woodlawn Elementary School	1	0	0	0
PO-S-07	Faubion Elementary School	1	1	0	0
PO-S-08	Portland Community College – Portland Metropolitan Workforce Training Center	1	0	0	0
PO-S-09	Trinity Lutheran School	1	0	0	0
PO-S-10	Community Transitional School	1	0	0	0
PO-S-11	Scott Elementary School	1	0	+1	0

Map ID[1]	*Named POI*	*Alternative 1 (events per hour)*		*Increase Compared to Existing Conditions/No Action Alternative (events per hour)*[4]	
		Windows Open[2]	*Windows Closed*[3]	*Windows Open*[2]	*Windows Closed*[3]
PO-S-12	Helensview High School	2	1	0	+1
PO-S-13[4]	Former site of ITT Technical Institute and University of Phoenix[4]	16	9	0	+1

Notes: [1]School POI (S) included because residential areas or other noise sensitive uses are often located nearby for which these results would apply.
[2]Assumes 15 dB noise level reduction.
[3]Assumes 25 dB noise level reduction.
[4]Based upon an average DNL daytime period between 7 a.m. and 10 p.m.
Legend: dB = decibels; ID = Identification; POI = Point of Interest.

Consistent with existing conditions/No Action Alternative, the probability of awakening was calculated to estimate sleep disturbance due to nighttime aircraft noise. Compared to the probability of awakening under existing conditions/No Action Alternative, there is expected to be no change under Alternative 1. This occurs because nearly all of nighttime operations are due to civil aircraft, which would continue under Alternative 1. Proposed nighttime military F-15 operations would increase from 12 per year to approximately 14 per year, all of which would be arrivals.

DoD guidance prescribes analysis of the potential for hearing loss due to elevated aircraft noise levels beginning at residential areas exposed to DNL of 80 dB or greater (DNWG 2013b). As summarized in Tables 4.1-4 and 4.1-5, no areas outside of PDX and no households or population would be exposed to 80 dB DNL or greater; therefore, the potential for hearing loss as a result of Alternative 1 would not be significant.

Most of the increase in the DNL contours would occur over the water or land utilized for commercial or industrial uses. DNL exposure would decrease in residential areas, and supplemental noise metrics results reflect a general decrease or minimal change. Therefore, no significant impacts due to airfield noise based upon the DoD impact standard would occur with implementation of Alternative 1. As shown in Figure 4.1-3 and detailed in Table 4.1-5, DNL would decrease in residential areas and the number of households and population exposed to 65 dB would decrease. Noise sensitive POIs analyzed in Table 4.1-6 would experience either no change or a reduction in DNL. The only increase in DNL above 65 dB would occur over airport property or over the water and would not impact noise sensitive locations.

Because FAA significance criteria described in FAA Order 1050.1F differs from DoD, the noise study in Appendix D provides details of acreage, off-airport acreage, number of households, and estimated population according to FAA Order 1050.1F thresholds. Specifically, these include exposure of a noise sensitive land use to a 1.5 dB increase in DNL while experiencing DNL 65 dB or greater or be newly exposed to DNL 65 dB by a 1.5 dB increase under Alternative 1. Additionally, FAA Order 1050.1F requires disclosure of noise sensitive areas that would be exposed "to aircraft noise at or above DNL 60 dB but below DNL 65 dB and are projected to experience a noise increase of DNL 3 dB or more, only when DNL 1.5 dB increases are documented within the DNL 65 dB contour." No off-airport residential areas or population would experience an increase in 1.5 dB while exposed to DNL 65 dB or greater or be newly exposed to DNL 65 dB by a 1.5 dB increase and none to an increase of 3 dB while exposed to DNL between 60 and 65 dB. Appendix D also depicts the 39 modeled noise sensitive locations surrounding PDX overlayed with areas of changes to DNL at +1.5 and +3 dB, which show that no noise sensitive areas that would be exposed to 65 dB DNL or greater or newly exposed to DNL 65 dB under Alternative 1 by an increase of 1.5 dB or greater. Therefore, implementation of Alternative 1 would not generate significant or reportable impacts according to FAA Order 1050.1F.

Airspace Noise

Subsonic

Noise analysis for subsonic airspace operations, aircraft traveling at less than the speed of sound, was accomplished by modeling typical airspace profiles for each aircraft associated with this action (current F-15C and proposed F-15EX) and the resulting SEL and L_{max} computed for a range of aircraft altitudes using the MRNMAP software, which is part of the NOISEMAP Suite. Both aircraft were modeled at military power and at an airspeed of 400 knots along a level flight.

Under Alternative 1, the F-15EX would continue to utilize existing military airspace and military training ranges. The types of airspace operations and altitudes flown would remain similar to existing conditions/No Action Alternative for air-to-air training conducted by the 142 WG. New air-to-ground training at existing air-to-ground ranges would occur under Alternative 1. The result would increase the F-15EX use of NWSTF Boardman to support additional strafe training requirements and of the Mountain Home SUA to accomplish inert weapons release for up to 4 weeks per year (up from 2 weeks per year under existing conditions/No Action Alternative). The majority of training operations would continue to occur within W-570, Eel MOA (including AR-683 and AR-628), Juniper/Hart MOAs, Varmit AR-645, and Redhawk MOA with an overall increase from the current seven daily F-15C sorties to an average of eight daily F-15EX sorties.

The increase from seven to eight average sorties would equate to an approximate 0.6 dB increase in L_{dnmr} in the airspace if all other factors were equal. However, the engine types and sound levels generated would differ between the F-15C and F-15EX. Table 4.1-9 details the SEL and L_{max} for both aircraft for a typical airspace profile with military power at 400 knots. The F-15EX would range from 2 to 3 dB greater in SEL when compared to the F-15C. In terms of L_{max}, the F-15EX would range from 4 to 5 dB greater than the F-15C.

Table 4.1-9 F-15C and F-15EX Comparison of L_{max} and SEL for Representative Airspace Profiles

Altitude	*F-15C (PW220)*		*F-15EX (GE-129)*	
	SEL	*L_{max}*	*SEL*	*L_{max}*
500	116	111	119	116
1,000	111	104	113	109
2,000	105	97	107	101
5,000	95	85	98	89
10,000	86	75	88	79

Note: Both aircraft modeled at 400 knots and military power (90% for F-15C and 104% for F-15EX) and straight and level flight.
Legend: L_{max} = Maximum Sound Level; SEL = Sound Exposure Level.

The resulting overall difference in noise between Alternative 1 and existing conditions/No Action Alternative would be the combination of the up to 3 dB greater SEL for the F-15EX and the 0.6 dB from the increase in operations, or +3.6 dB that would be added to the existing noise levels. L_{dnmr} due to Alternative 1 would range from 39 to 45 dB under W-570 and Eel MOAs, 39 to 50 dB under Juniper/Hart MOAs, and up to 39 dB under Redhawk MOAs. With no areas subjected to 65 dB L_{dnmr} (or DNL) and the relative change from existing conditions/No Action Alternative of 3.6 dB or less, implementation of Alternative 1 would not be significant under the DoD criteria.

Alternative 1 airspace noise levels in DNL are shown in Table 4.1-10 for FAA impact consideration under FAA Order 1050.1F.

Table 4.1-10 Alternative 1 Airspace Noise Levels (DNL)

Airspace	*Noise Level (DNL)*	*Change from Existing Conditions/ No Action Alternative*
W-570 and Eel MOAs	34 to 40 dB	+3.6 dB
Juniper/Hart MOAs	34 to 35 dB	+3.6 dB
Redhawk MOAs	34 dB	+3.6 dB

Legend: dB = decibel; MOA = Military Operations Area.

The FAA criteria includes both a significance impact threshold and a reportable change threshold, but implementation of Alternative 1 would not reach any of these FAA thresholds. Therefore, no significant impacts would occur with implementation of Alternative 1.

Supersonic

Aircraft in supersonic flight (i.e., exceeding the speed of sound [Mach 1]) generate an air pressure wave that is sometimes reflected upward resulting from changing air temperatures at different altitudes such that it never reaches the ground (Plotkin et al. 1989). When the pressure wave does reach the ground, it is heard as a sonic boom characterized by a rapid increase in pressure, followed by a decrease before a second rapid return to normal atmospheric levels. This change occurs very quickly, usually within a few tenths of a second and is usually perceived as a "bang-bang" sound. The noise study in Appendix D provides additional details on the supersonic modeling methodology.

F-15EX supersonic operations would occur in existing airspace currently authorized to support supersonic training, including W-570 and Juniper/Hart MOAs. The F-15C and the F-15EX would be of similar airframe size and shape; therefore, producing similar sonic booms. Under Alternative 1, sonic boom events would increase up to 10 percent over existing conditions/No Action Alternative, which would result in an approximate 0.5 dB increase in C-weighted day-night average sound level (CDNL). However, the associated impacts would not be significant due to the altitudes at which supersonic activities would occur and the small change to CDNL. Supersonic operations are authorized in W-570 above 10,000 feet MSL, and above 30,000 feet MSL in the Juniper/Hart MOAs.

Conclusion

The noise levels that would occur due to Alternative 1 would remain well below the threshold at which noise sensitive land uses are recommended (65 dB DNL/L_{dnmr}) for aircraft operations and no noise sensitive locations would be subjected to significant increases in noise. Therefore, implementation of Alternative 1 would not be expected to result in significant long-term noise impacts under either the DoD or FAA criteria.

4.1.1.2 Alternative 2

Under Alternative 2, the 142 WG would perform a full replacement of the F-15C aircraft with one squadron of F-15EX aircraft, to include 24 aircraft (21 PAA, 2 BAA, and 1 Attrition Reserve). Alternative 2 would result in an increase from 4,848 annual F-15C operations to 6,176 annual F-15EX operations representing an increase of approximately 27 percent, as summarized in Table 4.1-10. As no closed patterns are flown at PDX, the 6,176 annual operations would be comprised of 3,088 departures and 3,088 arrivals. Under Alternative 2, civil aircraft operations would be anticipated to remain consistent with existing conditions/No Action Alternative. As such, no change in the civil component is anticipated under Alternative 2.

Table 4.1-11 Alternative 2 Average Annual Operations

Category	*Aircraft Group/Type*[1]	*Departures*			*Arrivals*			*Grand Total*
		Day	*Night*	*Total*	*Day*	*Night*	*Total*	
Military	F-15C	3,088	0	3,088	3,073	15	3,088	6,176
Civil	All	98,572	16,330	114,902	98,911	16,115	115,026	229,928
Grand Total		101,660	16,330	117,990	101,984	16,130	118,114	236,104

Note: [1]Aircraft types listed represent the most frequent types operating at PDX.

Airfield Noise

Figure 4.1-4 shows the DNL noise contours from 65 to 85 dB in 5-dB increments for Alternative 2 conditions at PDX with a noise gradient for DNL of 45 dB and greater. As with existing conditions/No Action Alternative, noise generated from aircraft operations at PDX would occur within the airfield, over the Columbia River, and would extend to cover areas to the south and southeast of the airfield. The 65 dB and greater DNL would be largely contained within the PDX boundary or over water. The noise gradient shows how aircraft noise from PDX would continue well beyond the plotted contour lines but at lower less intrusive noise levels.

Figure 4.1-5 presents a comparison of noise contours from 65 to 85 dB DNL of Alternative 2 and the existing conditions/No Action Alternative. The length of the 65 dB DNL contour would reduce by approximately 3,800 feet to the northwest of the installation and 2,500 feet to the southeast when compared to existing conditions/No Action Alternative. The 65 dB DNL would increase in width to the southwest approximately 500 feet and northeast approximately 200 feet over primarily airport property, an uninhabited island in the Columbia River, or over water.

Table 4.1-12 shows the acreage breakdown (excluding water bodies) for Alternative 2. A total of 4,675 acres would be exposed to 65 dB DNL or greater noise levels with 1,757 of those acres located outside of PDX property, which would be a decrease of 640 acres compared to existing conditions/No Action Alternative. A subset of land outside of PDX property would also be exposed to greater DNL with 238 acres subjected to 70 dB or greater (8 greater acres than existing conditions/No Action Alternative) and 5 acres that would be exposed to DNL of 75 dB or greater (an increase of 2 acres from existing conditions/No Action Alternative). No areas outside of PDX property would be exposed to DNL 80 dB or greater.

Table 4.1-12 Alternative 2 Noise Exposure Acreage

DNL (dBA)	*Alternative 2 Acreage*			*Change Relative to Existing Conditions/No Action Alternative*		
	On Installation	*Off Installation*	*Total*	*On Installation*	*Off Installation*	*Total*
65+	2,918	1,757	4,675	+5	-640	-636
70+	2,057	238	2,296	-23	+8	-14
75+	1069	5	1,074	+152	+2	+154
80+	543	0	543	+88	0	+88
85+	250	0	250	+55	0	+55

Legend: dBA = A-weighted decibel; DNL = Day-Night Average Sound Level.

Table 4.1-13 details the estimated number of households and population that would be exposed to each DNL range under Alternative 2. A total of 15 households and 53 people would be exposed to DNL of 65 dB or greater, which would be a decrease of 29 fewer households and 80 fewer people compared to existing conditions/No Action Alternative. An estimated 1 household and 9 people would be exposed to 70 dB DNL or greater, which would be the same as existing conditions/No Action Alternative.

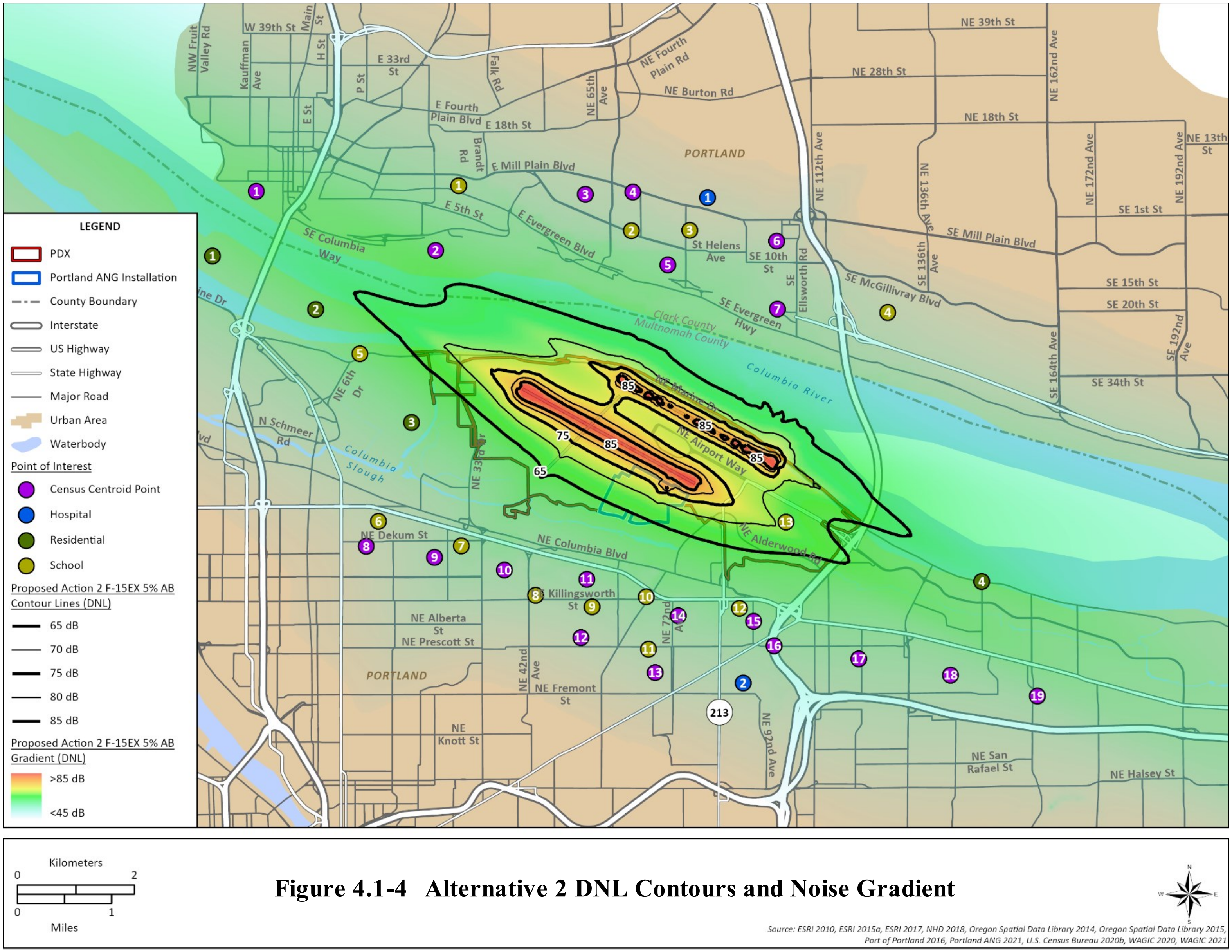

Figure 4.1-4 Alternative 2 DNL Contours and Noise Gradient

Source: ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Oregon Spatial Data Library 2014, Oregon Spatial Data Library 2015, Port of Portland 2016, Portland ANG 2021, U.S. Census Bureau 2020b, WAGIC 2020, WAGIC 2021

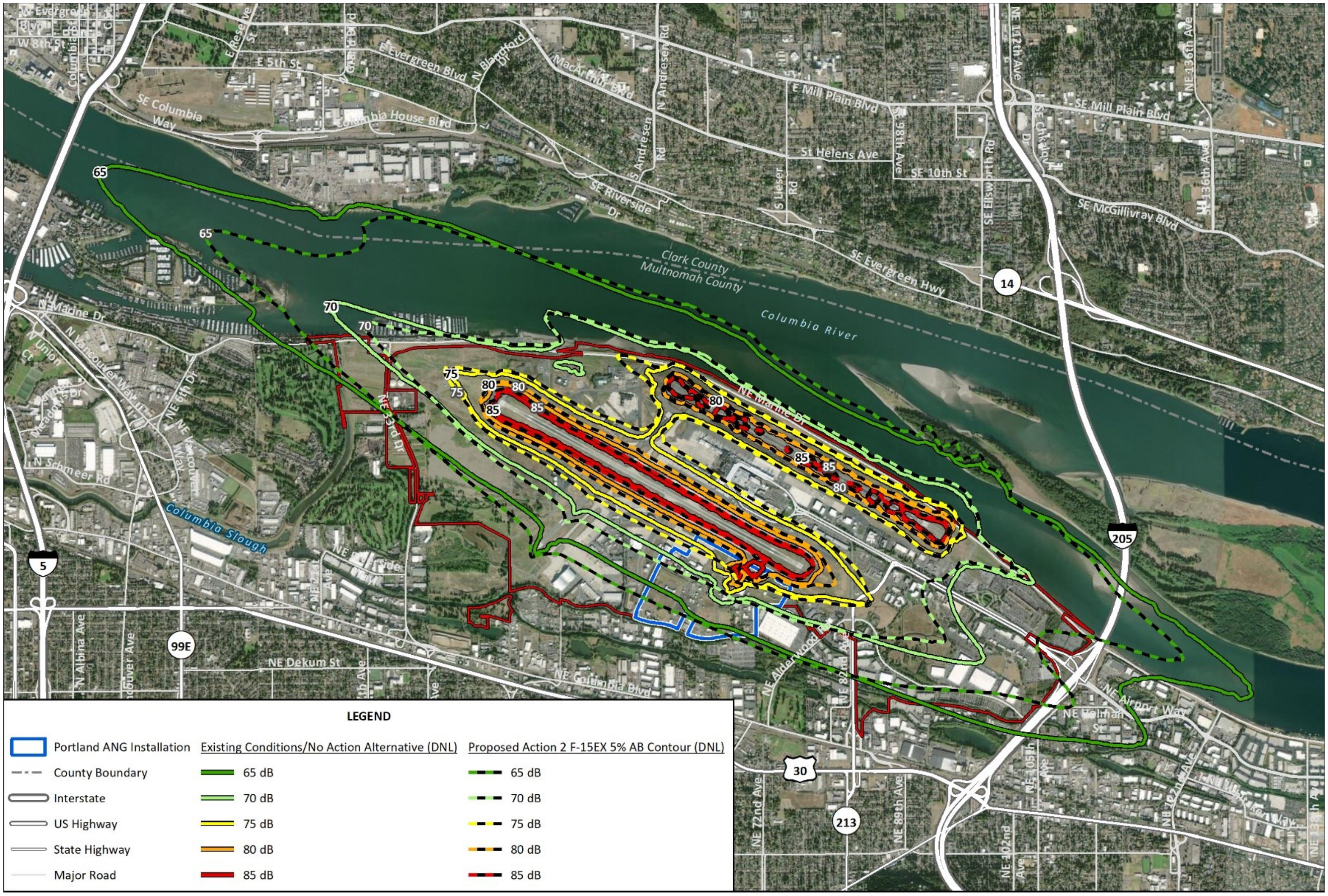

Figure 4.1-5 Alternative 2 DNL Contours Compared to Existing Conditions/No Action Alternative

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021

Table 4.1-13 Alternative 2 Households and Population Counts

DNL (dBA)	*Alternative 2*		*Change Relative to Existing Conditions/No Action Alternative*	
	Households	*Population*	*Households*	*Population*
65+	15	53	-29	-80
70+	1	9	0	0
75+	0	0	0	0
80+	0	0	0	0
85+	0	0	0	0

Legend: dBA = A-weighted decibel; DNL = Day-Night Average Sound Level.

Table 4.1-14 describes the estimated DNL values at each POI and the net change compared to existing conditions/No Action Alternative. The DNL would be 48 to 65 dB with the change from existing conditions/No Action Alternative ranging from a decrease of up to 4 dB DNL at 14 POIs, no change at 13 POIs, and up to an increase up to 2 dB DNL at 12 POIs. The number of POIs exposed to 65 dB DNL would remain at 1 POI, consistent with existing conditions/No Action Alternative.

Table 4.1-14 DNL at POIs for Alternative 2

Map ID	*Point Type[1]*	*Named POI*	*Existing Conditions DNL (dB)[2]*	*Alternative 2 DNL (dB)[2]*	*Increase From Existing Conditions/ No Action Alternative DNL (dB)*
PO-C-01	Census Tract Centroid	Census Tract 424	61	60	-1
PO-C-02	Census Tract Centroid	Census Tract 426.01	62	61	-1
PO-C-03	Census Tract Centroid	Census Tract 429	51	51	0
PO-C-04	Census Tract Centroid	Census Tract 430	49	49	0
PO-C-05	Census Tract Centroid	Census Tract 431	55	57	+2
PO-C-06	Census Tract Centroid	Census Tract 412.07	49	50	+1
PO-C-07	Census Tract Centroid	Census Tract 412.08	53	54	+1
PO-C-08	Census Tract Centroid	Census Tract 36.01	48	49	+1
PO-C-09	Census Tract Centroid	Census Tract 36.02	52	53	+1
PO-C-10	Census Tract Centroid	Census Tract 36.03	52	53	+1
PO-C-11	Census Tract Centroid	Census Tract 74	55	56	+1
PO-C-12	Census Tract Centroid	Census Tract 75	49	50	+1
PO-C-13	Census Tract Centroid	Census Tract 29.01	50	50	0
PO-C-14	Census Tract Centroid	Census Tract 76	55	55	0
PO-C-15	Census Tract Centroid	Census Tract 77	57	57	0
PO-C-16	Census Tract Centroid	Census Tract 78	56	55	-1
PO-C-17	Census Tract Centroid	Census Tract 79	59	55	-4
PO-C-18	Census Tract Centroid	Census Tract 95.02	58	54	-4
PO-C-19	Census Tract Centroid	Census Tract 95.01	58	55	-3
PO-H-01	Healthcare Facility	PeaceHealth Southwest Medical Center	47	48	+1
PO-H-02	Healthcare Facility	Park Forest Care Center	52	51	-1
PO-R-01	Residential Area	Census Tract 72.01	60	58	-2
PO-R-02	Residential Area	North Lotus Beach Drive	63	61	-2

Map ID	*Point Type[1]*	*Named POI*	*Existing Conditions DNL (dB)[2]*	*Alternative 2 DNL (dB)[2]*	*Increase From Existing Conditions/ No Action Alternative DNL (dB)*
PO-R-03	Residential Area	Northeast Blue Heron Drive & Northeast 20th Avenue	58	58	0
PO-R-04	Residential Area	Northeast Marine Drive & Northeast 138th Avenue	63	62	-1
PO-R-05	Residential Area	Census Tract 102	56	55	-1
PO-S-01	School	Harney Elementary School	54	54	0
PO-S-02	School	Slavic Christian Academy	52	52	0
PO-S-03	School	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy	50	50	0
PO-S-04	School	Riverview Elementary School	50	50	0
PO-S-05	School	Bridges Middle School	62	60	-2
PO-S-06	School	Woodlawn Elementary School	50	50	0
PO-S-07	School	Faubion Elementary School	54	55	+1
PO-S-08	School	Portland Community College – Portland Metropolitan Workforce Training Center	53	52	-1
PO-S-09	School	Trinity Lutheran School	52	53	+1
PO-S-10	School	Community Transitional School	56	56	0
PO-S-11	School	Scott Elementary School	51	52	+1
PO-S-12	School	Helensview High School	58	58	0
PO-S-13[3]	School	Former site of ITT Technical Institute and University of Phoenix[3]	**68**	**65**	-3

Notes: [1]The census tracts represent neighborhoods surrounding PDX where noise sensitive locations (such as residences, schools, place of worship, etc. are likely to occur), which differs from specific Environmental Justice analysis communities analyzed in Section 3.10.
[2]**Bold** numbers represent points exposed to DNL of 65 dB or greater.
[3]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.
Legend: dB = decibel; DNL = Day-Night Average Sound Level; ID = Identification; POI = Point of Interest.

Table 4.1-15 displays results for three metrics used to examine noise effects on classroom learning: outdoor school day sound equivalent level ($L_{eq[8hr]}$), number of speech interfering events per school day hour, and time above interior 45 dBA per 8-hour school day (equivalent to exterior 60 dB $L_{eq(8hr)}$ with windows open). Under Alternative 2, 3 school locations would be exposed to outdoor $L_{eq(8hr)}$ above 60 dB, which would be the same as existing conditions/No Action Alternative. Overall, $L_{eq(8hr)}$ would either not change or would decrease under Alternative 2 by up to 4 dB at 6 POIs and would increase by up to 2 dB at 7 locations. The number of speech interfering events during the school day would generally not change at most POIs, but would increase by 1 per hour at 1 school POI. The duration of time above 50 dB during a typical school day would increase by 1 minute at one location, and would either not change or would decrease by up to 3 minutes at the remaining school POI.

Table 4.1-15 Alternative 2 Classroom Learning Interference

ID	Location[3]	Outdoor $L_{eq(8hr)}$ (dBA)[2]		Number of Speech Interfering Events per School Day Hour[1]		Time above 50 dBA per 8-hour school day (minutes)[1]	
		Alternative 2	Increase From Existing Conditions/ No Action Alternative	Alternative 2	Increase From Existing Conditions/ No Action Alternative	Alternative 2	Increase From Existing Conditions/ No Action Alternative
PO-S-01	Harney Elementary School	54	-1	4	0	1	-1
PO-S-02	Slavic Christian Academy	53	+2	1	0	3	0
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy	50	+1	1	0	3	0
PO-S-04	Riverview Elementary School	52	0	1	0	3	0
PO-S-05	Bridges Middle School	**61**	-4	12	+1	2	-1
PO-S-06	Woodlawn Elementary School	51	+1	1	0	1	-1
PO-S-07	Faubion Elementary School	55	+1	2	0	3	+1
PO-S-08	Portland Community College – Portland Metropolitan Workforce Training Center	55	0	1	0	3	-3
PO-S-09	Trinity Lutheran School	55	+1	1	0	3	0
PO-S-10	Community Transitional School	59	+1	1	0	3	-3
PO-S-11	Scott Elementary School	54	+1	1	0	3	0
PO-S-12	Helensview High School	**61**	0	4	0	2	0
PO-S-13[4]	Former site of ITT Technical Institute and University of Phoenix[4]	**70**	-3	28	0	3	0

Notes: [1]Assumes 90% of ANG daytime operations occur during the school day; Windows open condition with noise level reduction of 15 dB due to building attenuation.
[2]**Bold** numbers represent schools exposed to exterior $L_{eq(8hr)}$ of greater than 60 dB, equivalent to the recommended interior threshold of 45 dB with windows open.
[3]Table presents the analysis for the school POI (S), but results are provided for all POI within the noise study in Appendix D because populated areas may include additional educational facilities (such as daycare operated out of a personal residence).
[4]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.
Legend: dBA = A-weighted decibel; $L_{eq(8hr)}$ = 8-hour equivalent sound level.

Table 4.1-16 presents the Alternative 2 speech interference based upon the numbers of events per average hour during the DNL daytime period for both a windows open and windows closed condition. The number of speech interfering events with windows open would range from 1 to a maximum of 17 events at PO-S-13. The change in windows open speech interfering events would range from no change at 28 POIs and increase by 1 per average hour at 11 POIs. The number of speech interfering events under Alternative 2 with windows closed would range from none to 9 per average hour. Of the 39 analyzed POIs, the number of interfering events with windows closed would increase by 1 event per average hour at 12 POIs, and would not change at the remaining 27 POIs.

Table 4.1-16 Alternative 2 Speech Interference Events per Average Hour (Daytime)

Map ID[1]	*Named POI*	*Alternative 2 (events per hour)*		*Increase Compared to Existing Conditions/No Action Alternative (events per hour)*	
		Windows Open[2]	*Windows Closed[3]*	*Windows Open[2]*	*Windows Closed[3]*
PO-C-01	Census Tract 424	13	1	0	0
PO-C-02	Census Tract 426.01	10	1	0	0
PO-C-03	Census Tract 429	1	0	0	0
PO-C-04	Census Tract 430	1	0	+1	0
PO-C-05	Census Tract 431	1	1	0	+1
PO-C-06	Census Tract 412.07	1	0	+1	0
PO-C-07	Census Tract 412.08	1	1	+1	+1
PO-C-08	Census Tract 36.01	1	0	0	0
PO-C-09	Census Tract 36.02	1	1	0	+1
PO-C-10	Census Tract 36.03	1	1	0	+1
PO-C-11	Census Tract 74	1	1	0	0
PO-C-12	Census Tract 75	1	0	+1	0
PO-C-13	Census Tract 29.01	1	0	+1	0
PO-C-14	Census Tract 76	1	0	0	0
PO-C-15	Census Tract 77	2	1	0	+1
PO-C-16	Census Tract 78	1	0	0	0
PO-C-17	Census Tract 79	1	0	0	0
PO-C-18	Census Tract 95.02	1	0	0	0
PO-C-19	Census Tract 95.01	3	1	0	+1
PO-H-01	PeaceHealth Southwest Medical Center	1	0	+1	0
PO-H-02	Park Forest Care Center	1	0	0	0
PO-R-01	Census Tract 72.01	8	0	0	0
PO-R-02	North Lotus Beach Drive	9	1	0	0
PO-R-03	Northeast Blue Heron Drive & Northeast 20th Avenue	4	0	0	0
PO-R-04	Northeast Marine Drive & Northeast 138th Avenue	13	3	0	0
PO-R-05	Census Tract 102	4	0	+1	0
PO-S-01	Harney Elementary School	2	0	0	0
PO-S-02	Slavic Christian Academy	1	0	0	0
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection, and Vancouver Virtual Learning Academy	1	0	+1	0
PO-S-04	Riverview Elementary School	1	0	+1	0
PO-S-05	Bridges Middle School	7	1	0	0
PO-S-06	Woodlawn Elementary School	1	0	0	0
PO-S-07	Faubion Elementary School	1	1	0	0
PO-S-08	Portland Community College – Portland Metropolitan Workforce Training Center	1	1	0	+1
PO-S-09	Trinity Lutheran School	1	1	0	+1
PO-S-10	Community Transitional School	1	1	0	+1

Map ID[1]	*Named POI*	*Alternative 2 (events per hour)*		*Increase Compared to Existing Conditions/No Action Alternative (events per hour)*	
		Windows Open[2]	*Windows Closed[3]*	*Windows Open[2]*	*Windows Closed[3]*
PO-S-11	Scott Elementary School	1	1	+1	+1
PO-S-12	Helensview High School	2	1	0	+1
PO-S-13[4]	Former site of ITT Technical Institute and University of Phoenix[4]	17	9	+1	+1

Notes: [1]School POI (S) included because residential areas or other noise sensitive uses are often located nearby for which these results would apply.
[2]Assumes 15 dB noise level reduction.
[3]Assumes 25 dB noise level reduction.
[4]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.
Legend: dB = decibels; ID = Identification; POI = Point of Interest.

Compared to the probability of awakening under existing conditions/No Action Alternative, there is expected to be no change under Alternative 2. This occurs because nearly all the nighttime operations are due to civil aircraft, which would continue under Alternative 2. Proposed nighttime military F-15EX operations would increase from 12 per year to approximately 15 per year, all of which would be arrivals.

As summarized in Tables 4.1-12 and 4.1-13, no areas outside of PDX and no households or population would be exposed to 80 dB DNL or greater; therefore, the potential for hearing loss as a result of Alternative 2 would not be significant.

Most of the increase in the DNL contours would occur over the water or land utilized for commercial or industrial uses, DNL exposure would decrease in residential areas, and supplemental noise metrics results reflect a general decrease or minimal change. Therefore, no significant impacts due to airfield noise based upon the DoD impact standard would occur with implementation of Alternative 2. As shown in Figure 4.1-5 and detailed in Table 4.1-13, DNL would decrease in residential areas and the number of households and population exposed to 65 dB would decrease. Noise sensitive POIs analyzed in Table 4.1-14 would experience either no change or a reduction in DNL. The only increase in DNL above 65 dB would occur over airport property or over the water and would not impact noise sensitive locations.

Because FAA significance criteria described in FAA Order 1050.1F differs from DoD, the noise study in Appendix D provides details of acreage, off-airport acreage, number of households, and estimated population according to FAA Order 1050.1F thresholds.

Specifically, these include exposure of a noise sensitive land use to a 1.5 dB increase in DNL while experiencing DNL 65 dB or greater or be newly exposed to DNL 65 dB by a 1.5 dB increase under Alternative 2. Additionally, FAA Order 1050.1F requires disclosure of noise sensitive areas that would be exposed "to aircraft noise at or above DNL 60 dB but below DNL 65 dB and are projected to experience a noise increase of DNL 3 dB or more, only when DNL 1.5 dB increases are documented within the DNL 65 dB contour." Although 2 acres off airport would experience an increase greater than 1.5 dB while exposed to greater than 65 dB DNL, these areas occur outside the north side of PDX along the Columbia River and far from residential or other noise sensitive land uses so no noise sensitive areas would be significantly affected. Appendix D also depicts the 39 modeled noise sensitive locations surrounding PDX overlayed with areas of changes to DNL at +1.5 and +3 dB, which show that no noise sensitive areas that would be exposed to 65 dB DNL (or newly exposed to 65 dB DNL) under Alternative 2 would also experience an increase of 1.5 dB or greater. Therefore, implementation of Alternative 2 would not generate significant or reportable impacts according to FAA Order 1050.1F.

Airspace Noise

Under Alternative 2, the F-15EX would continue to utilize existing military airspace and military training ranges as described under Alternative 1. There would be an overall increase from the current seven daily F-15C sorties to an average of nine daily F-15EX sorties, which would equate to an approximately 1.1 dB increase in L_{dnmr} in the airspace if all other factors were equal. Consistent with Alternative 1 and Table 4.1-9, the F-15EX would be approximately 3 dB greater in SEL when compared with the F-15C.

The resulting overall difference in noise between Alternative 2 and existing conditions/No Action Alternative would be the combination of the up to 3 dB greater SEL for the F-15EX and the 1.1 dB from the increase in operations, or +4.1 dB that would be added to the existing noise levels. L_{dnmr} due to Alternative 2 would range from 39 to 46 dB under W-570 and Eel MOAs, 39 to 51 dB under Juniper/Hart MOAs, and up to 40 dB under Redhawk MOAs. With no areas subjected to 65 dB L_{dnmr} (or DNL) and the relative change from existing conditions/No Action Alternative of 4.1 dB or less, implementation of Alternative 2 would not be significant under the DoD criteria.

Alternative 2 airspace noise levels in DNL are shown in Table 4.1-17 for FAA impact consideration under FAA Order 1050.1F.

Table 4.1-17 Alternative 2 Airspace Noise Levels (DNL)

Airspace	*Noise Level (DNL)*	*Change from Existing Conditions/ No Action Alternative*
W-570 and Eel MOAs	34 to 41 dB	+4.1 dB
Juniper/Hart MOAs	34 to 46 dB	+4.1 dB
Redhawk MOAs	35 dB	+4.1 dB

Legend: dB = decibel; MOA = Military Operations Area.

The FAA criteria includes both a significance impact threshold and a reportable change threshold, but implementation of Alternative 2 would not reach any of these FAA thresholds. Therefore, no significant impacts would occur with implementation of Alternative 2.

F-15EX supersonic operations would occur in existing airspace currently authorized to support supersonic training, including W-570 and Juniper/Hart MOAs. The F-15C and the F-15EX would be of similar airframe size and shape; therefore, producing similar sonic booms. Under Alternative 2, sonic boom events would increase up to 27 percent over existing conditions/No Action Alternative, which would result in an approximate 1 dB increase in CDNL. However, the associated impacts would not be significant due to the altitudes at which supersonic activities would occur and the small change to CDNL. Supersonic operations are authorized in W-570 above 10,000 feet MSL, and above 30,000 feet MSL in the Juniper/Hart MOAs.

Conclusion

The noise levels that would occur due to Alternative 2 would remain well below the threshold at which noise sensitive land uses are recommended (65 dB DNL/L_{dnmr}) for aircraft operations and no noise sensitive locations would be subjected to significant increases in noise. Therefore, implementation of Alternative 2 would not be expected to result in significant long-term noise impacts under either the DoD or FAA criteria.

4.1.1.3 Alternative 3

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue as described in Section 1.3.2, the air-to-ground mission would not be added, thus no additional personnel would be added to support an air-to-ground mission. Previously planned construction and repair projects required for current mission sustainment would be implemented. No significant impacts to noise would be expected with implementation of Alternative 3.

4.1.1.4 No Action Alternative

Under the No Action Alternative, the current F-15C platform would continue to fly to their maximum service life. The existing air-to-air mission would continue with use of the Portland ANG installation associated airspace. No construction projects are proposed to occur at the Portland ANG installation under the No Action Alternative. Thus, implementation of the No Action Alternative would not be expected to create significant impacts to noise.

4.2 AIRSPACE

4.2.1 Impacts

4.2.1.1 Alternative 1

Alternative 1 would result in a 9 percent increase in total sorties, from 2,424 sorties under existing conditions/No Action Alternative to 2,647 sorties to support F-15EX training annually. These sorties would require FAA ATC services by Portland Terminal Approach Control and Tower for normal departure and arrival services. Additionally, these sorties, when outside the PDX Class C airspace would require routine services from FAA enroute agencies operating and controlling traffic within the National Airspace System. Each sortie includes a takeoff and landing. Therefore, any added sorties would create two airfield operations. Under Alternative 1, the increase of 223 sorties would add an additional 446 annual airfield operations in which the FAA would be responsible to provide air traffic services for.

The 142 WG schedules their flying around PDX peak civil traffic periods. Additionally, multiple (successive) approaches, meaning back to radar and/or tower patterns are rare events with the typical type landing being a full stop. The average increase in daily airfield operations would be two additional airfield operations per day to support the F-15EX. This should not be enough traffic to cause any significant ATC sector overload or airspace saturation.

All flight operations would take place within existing airspace. No additions to or alterations of airspace are proposed with Alternative 1. There would be an increase from the current seven F-15C sorties to an average of eight F-15EX sorties per day which would utilize existing SUA. To support the air-to-ground mission under Alternative 1, training time at both NWSTF Boardman and the Mountain Home SUA would increase from 2 weeks per year at each location to 4 weeks per year at each location. Based on the assumption of 1.7 hours per sortie and eight sorties per day on average, this would represent approximately 3.4 percent of the total fixed-wing annual operations at NWSTF Boardman as presented in the 2015 Final EIS (Department of the Navy 2015), or an increase of 1.9 percent over existing conditions/No Action Alternative. At Mountain Home, this would represent 1.6 percent of total annual flying hours by non-local users of the Mountain Home SUA (DAF 2023a), an increase of less than 1 percent over existing conditions/No Action Alternative. The additional sorties and airfield operations proposed under Alternative 1 are not anticipated to significantly impact the National Airspace System or the existing capacity of existing SUA. Therefore, no significant airspace impacts would occur with implementation of Alternative 1.

4.2.1.2 Alternative 2

Impacts under Alternative 2 would be the same as described for Alternative 1 except the 142 WG would base three more F-15EX PAA compared with Alternative 1. Under Alternative 2, an average of nine sorties and 18 airfield operations per day are proposed, resulting in an additional 1,328 annual airfield operations more than existing conditions/No Action Alternative. Similar to Alternative 1, training time at both NWSTF Boardman and the Mountain Home SUA would increase from 2 weeks per year at each location to 4 weeks per year at each location. Based on the assumption of 1.7 hours per sortie and nine sorties per day on average, this would represent approximately 3.8 percent of the total fixed wing annual operations at NWSTF Boardman as presented in the 2015 Final EIS (Department of the Navy 2015), or an increase of 2.3 percent over existing conditions/No Action Alternative. At Mountain Home, this would represent 1.7 percent of total annual flying hours by non-local users of the Mountain Home SUA (DAF 2023a), an increase of less than 1 percent over existing conditions/No Action Alternative. The additional sorties and airfield operations proposed under Alternative 2 are not anticipated to significantly impact the National Airspace System or the existing capacity of existing SUA. Therefore, no significant airspace impacts would occur with implementation of Alternative 2.

4.2.1.3 Alternative 3

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue, and no additional personnel would be added to support an air-to-ground mission. Therefore, no significant airspace impacts would occur with implementation of Alternative 3.

4.2.1.4 No Action Alternative

Under the No Action Alternative, the current F-15C platform would continue to fly to their maximum service life. The existing air-to-air mission would continue with use of the Portland ANG installation associated airspace. No construction projects are proposed to occur at the Portland ANG installation under the No Action Alternative. Thus, implementation of the No Action Alternative would not be expected to create significant impacts to airspace.

4.3 AIR QUALITY

4.3.1 Impacts

The air quality impacts presented in this EA were derived by utilizing the same operational data as directed by DAFMAN 32-7002, *Environmental Compliance and Pollution Prevention*. These data are included in the DAF ACAM reports and in supplemental spreadsheets used for analysis of both construction and operational emissions, which are presented in Appendix E. For attainment area criteria pollutants, the EPA's Prevention of Significant Deterioration stationary source permitting threshold of 250 tons per year was used as an initial indicator of the local significance of potential impacts to air quality. The Prevention of Significant Deterioration permitting threshold represents the level of potential new emissions below which a new or existing minor, non-listed stationary source may acceptably emit without triggering the requirement to obtain a permit. Thus, if the intensity of any net emissions increase for an attainment criteria pollutant is below 250 tons per year, it is an indication the air quality impacts would not be significant for that pollutant.

4.3.1.1 Alternative 1

Construction to support the F-15EX transition would begin in FY 2025 and continue through FY 2030. During this time, demolition, construction, and modification activities would take place, involving renovations and additions to several existing buildings, a new simulator complex, and several other new buildings.

Construction of infrastructure to support the F-15EX would generate short-term temporary emissions. The quantity of uncontrolled fugitive dust emissions from a construction site is proportional to the area of land being worked and the level of activity. Fugitive dust emissions would be produced from the ground disturbance, demolition, and outdoor storage of construction materials associated with Alternative 1. Fugitive dust air emissions would be greatest during the initial site grading and excavation and would vary daily depending on the work phase, level of activity, and prevailing weather conditions. Particulate matter emissions would also be produced from the combustion of fuels in vehicles and equipment needed for construction.

Construction activities would incorporate best management practices (BMPs) and environmental control measures (e.g., wetting the ground surface) to minimize fugitive particulate matter emissions. Additionally, work vehicles are assumed to be well maintained and to use diesel particulate filters to reduce particulate matter emissions. Construction activities would comply with Oregon Revised Statutes (ORS) 340-208-0210, to prevent the release of fugitive dust. These BMPs and environmental control measures could reduce uncontrolled particulate matter emissions from a construction site by approximately 50 percent depending upon the number of BMPs and environmental control measures implemented, and the potential for particulate matter emissions.

After construction is complete, changes to stationary source emissions would be evaluated (i.e., addition or modification of fuel-burning equipment, emergency generators, product use in aircraft maintenance facilities, jet engine testing) and, if required, Permit 26-3254-ST-01 would be modified to add or remove sources, as applicable.

While there would be a transition period where the old F-15C aircraft would be phased out and retired, for the purposes of the air quality analysis, it is assumed the 110 personnel would arrive at the same time as the replacement aircraft and the full fleet of F-15EX (18 PAA) would begin operations in calendar year 2025 and would fly 446 more operations per year than under existing conditions/No Action Alternative (approximately a 9 percent increase). This allows for the evaluation of the maximum emissions in 1 year of operations under Alternative 1, with aircraft operations coinciding with the planned construction projects.

Table 4.3-1 presents the net change in emissions from the replacement of the F-15C with the F-15EX. Emissions show a decrease for volatile organic compounds (VOCs), nitrogen oxides (NO_x), CO, SO_2, and carbon dioxide equivalent (CO_2e), even with the increase of 446 airfield operations. PM_{10} and $PM_{2.5}$ would have small emission increases. These changes are due to the difference in the engines used in the two airframes. The record of air analysis is provided in Appendix E.

Table 4.3-1 Alternative 1 Annual F-15EX Emissions Estimates (tons per year)

Year	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
F-15C Existing Airfield Operations	38.92	45.51	157.75	6.01	4.23	3.82	17,451
F-15EX Airfield Operations	14.28	28.58	118.92	4.25	7.82	7.06	12,057
Net Change in Aircraft Emissions – Alternative 1	**-24.65**	**-16.93**	**-38.83**	**-1.76**	**3.59**	**3.25**	**-5,395**

Legend: CO = carbon monoxide; CO_2e = carbon dioxide equivalent; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; PM_{10} = particulate matter less than or equal to 10 microns in diameter; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

Annual emissions, which include the emissions by year of construction, are presented in Table 4.3-2. Construction projects were assumed to begin in the years listed in Tables 2.1-1 and 2.1-2 and be complete within the same year (e.g., if a project is planned for 2025, the construction is assumed to occur between January and December 2025), even though some projects would last longer than 12 months. The net change in emissions is presented below by year, including the net change in emissions from the F-15EX aircraft operations and the additional personnel commuting on a regular basis. Construction projects are anticipated to be complete by 2034, at which time the ongoing "steady-state" emissions will continue with the F-15EX flight operations and commuter emissions.

Table 4.3-2 Alternative 1 Annual Net Change Emissions Estimates (tons per year)

Emissions Source	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
2025 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.32	1.28	1.77	0.01	0.16	0.04	495
Net Change – F-15EX Operations Emissions	-24.65	-16.93	-38.83	-1.76	3.59	3.25	-5,395
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total 2025 Estimated Emissions	**-24.18**	**-15.55**	**-35.00**	**-1.76**	**3.76**	**3.29**	**-4,677**

Emissions Source	***VOCs***	***NO_x***	***CO***	***SO_2***	***PM_{10}***	***$PM_{2.5}$***	***CO_2e***
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2026 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.76	1.70	2.43	0.01	1.31	0.06	644
Net Change – F-15EX Operations Emissions	-24.65	-16.93	-38.83	-1.76	3.59	3.25	-5,395
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total 2026 Estimated Emissions	**-23.74**	**-15.12**	**-34.34**	**-1.76**	**4.91**	**3.31**	**-4,529**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2027 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.94	1.68	2.50	0.01	0.79	0.06	649
Net Change – F-15EX Operations Emissions	-24.65	-16.93	-38.83	-1.76	3.59	3.25	-5,395
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total 2027 Estimated Emissions	**-23.56**	**-15.14**	**-34.27**	**-1.76**	**4.39**	**3.30**	**-4,523**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2028 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.64	1.37	2.05	0.00	0.84	0.05	471
Net Change – F-15EX Operations Emissions	-24.65	-16.93	-38.83	-1.76	3.59	3.25	-5,395
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2028 Total Net Change Emissions	**-23.86**	**-15.45**	**-34.72**	**-1.76**	**4.43**	**3.30**	**-4,702**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2029 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.47	1.94	2.17	0.01	1.15	0.07	686
Net Change – F-15EX Operations Emissions	-24.65	-16.93	-38.83	-1.76	3.59	3.25	-5,395
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2029 Total Net Change Emissions	**-24.02**	**-14.89**	**-34.60**	**-1.76**	**4.74**	**3.32**	**-4,486**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2030 Estimated Annual Net Change Air Emissions							
Construction Emissions	1.25	2.35	3.00	0.01	1.00	0.08	811
Net Change – F-15EX Operations Emissions	-24.65	-16.93	-38.83	-1.76	3.59	3.25	-5,395
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2030 Total Net Change Emissions	**-23.25**	**-14.47**	**-33.77**	**-1.75**	**4.60**	**3.33**	**-4,362**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2031 Estimated Annual Net Change Air Emissions							
Construction Emissions	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Net Change – F-15EX Operations Emissions	-24.65	-16.93	-38.83	-1.76	3.59	3.25	-5,395
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222

Emissions Source	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
2031 Total Net Change Emissions	**-24.50**	**-16.82**	**-36.77**	**-1.76**	**3.60**	**3.25**	**-5,173**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2032 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.27	0.68	1.09	0.00	1.12	0.02	276
Net Change – F-15EX Operations Emissions	-24.65	-16.93	-38.83	-1.76	3.59	3.25	-5,395
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2032 Total Net Change Emissions	**-24.23**	**-16.14**	**-35.68**	**-1.76**	**4.72**	**3.27**	**-4,897**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2033 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.21	1.11	1.64	0.00	1.07	0.04	405
Net Change – F-15EX Operations Emissions	-24.65	-16.93	-38.83	-1.76	3.59	3.25	-5,395
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2033 Total Net Change Emissions	**-24.29**	**-15.71**	**-35.13**	**-1.76**	**4.66**	**3.29**	**-4,767**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2034 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.21	1.11	1.64	0.00	0.41	0.04	402
Net Change – F-15EX Operations Emissions	-24.65	-16.93	-38.83	-1.76	3.59	3.25	-5,395
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2034 Total Net Change Emissions	**-24.29**	**-15.72**	**-35.13**	**-1.76**	**4.00**	**3.29**	**-4,771**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2035 Estimated Annual Net Change Air Emissions							
Net Change – F-15EX Operations Emissions	-24.65	-16.93	-38.83	-1.76	3.59	3.25	-5,395
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2035 Total Net Change Emissions	**-24.50**	**-16.82**	**-36.77**	**-1.76**	**3.60**	**3.25**	**-5,173**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A

Legend: CO = carbon monoxide; CO_2e = carbon dioxide equivalent; NA = not applicable; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; PM_{10} = particulate matter less than or equal to 10 microns in diameter; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

Emissions of VOCs, NO_x, CO, SO_2, and CO_2e under Alternative 1 would decrease for all years of activity. PM_{10} and $PM_{2.5}$ would have small increases well below the 250 tons per year comparative threshold.

Flights in the Portland ANG installation associated airspace would increase by approximately 9 percent, including those using the Juniper/Hart MOAs where the Juniper Low MOA and Juniper East Low MOA allow for low-level flights down to 500 feet AGL. However, a portion of the sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements. The result would increase the F-15EX use of NWSTF Boardman and Mountain Home SUA, where the aircraft typically fly well above the mixing height of 3,000 feet AGL. A portion of the training may occur in the Boardman Low MOA, where flights could pass as low as 500 feet AGL, but these operations within MOAs would be infrequent and sporadic. Thus, even though there is an increase of 9 percent in total operations in the airspace, the amount of time spent flying below the mixing height is anticipated to decrease slightly overall, and the emissions from the F-15EX operations in the airspace are also anticipated to be less than existing emissions from the F-15C. Therefore, Alternative 1 would not be expected to result in a significant impact on air quality.

4.3.1.2 Alternative 2

Air quality impacts would be similar to those described for Alternative 1, but the F-15EX would fly 1,328 additional operations per year than under existing conditions/No Action Alternative (approximately 27 percent increase). The net change in aircraft operations is presented in Table 4.3-3 and the annual net change in emissions, including emissions from implementing construction projects, is included in Table 4.3-4. Emissions of VOCs, NO_x, CO, SO_2, and CO_2e would decrease compared to existing operations while there would be a small increase of PM_{10} and $PM_{2.5}$.

Table 4.3-3 Alternative 2 Annual F-15EX Emissions Estimates (tons per year)

Year	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
F-15C Airfield Operations	38.92	45.51	157.75	6.01	4.23	3.82	17,451
F-15EX Airfield Operations	17.02	33.73	139.71	5.00	9.18	8.29	14,180
Net Change in Aircraft Emissions – Alternative 2	**-21.91**	**-11.78**	**-18.04**	**-1.02**	**4.95**	**4.48**	**-3,271**

Legend: CO = carbon monoxide; CO_2e = carbon dioxide equivalent; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; PM_{10} = particulate matter less than or equal to 10 microns in diameter; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

Table 4.3-4 Alternative 2 Annual Net Change Emissions Estimates (tons per year)

Emissions Source	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
2025 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.32	1.28	1.77	0.01	0.16	0.04	495
Net Change – F-15EX Operations Emissions	-21.91	-11.78	-18.04	-1.02	4.95	4.48	-3,271
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total 2025 Estimated Emissions	**-21.44**	**-10.40**	**-14.21**	**-1.01**	**5.12**	**4.52**	**-2,554**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2026 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.76	1.70	2.43	0.01	1.31	0.06	644
Net Change – F-15EX Operations Emissions	-21.91	-11.78	-18.04	-1.02	4.95	4.48	-3,271
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total 2026 Estimated Emissions	**-21.00**	**-9.97**	**-13.56**	**-1.01**	**6.27**	**4.54**	**-2,406**
Comparative Threshold	250	250	250	250	250	250	N/A

Emissions Source	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
Exceeds Threshold	No	No	No	No	No	No	N/A
2027 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.94	1.68	2.50	0.01	0.79	0.06	649
Net Change – F-15EX Operations Emissions	-21.91	-11.78	-18.04	-1.02	4.95	4.48	-3,271
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total 2027 Estimated Emissions	**-20.82**	**-9.99**	**-13.49**	**-1.01**	**5.75**	**4.53**	**-2,400**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2028 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.64	1.37	2.05	0.00	0.84	0.05	471
Net Change – F-15EX Operations Emissions	-21.91	-11.78	-18.04	-1.02	4.95	4.48	-3,271
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2028 Total Net Change Emissions	**-21.12**	**-10.30**	**-13.93**	**-1.01**	**5.79**	**4.53**	**-2,579**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2029 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.47	1.94	2.17	0.01	1.15	0.07	686
Net Change – F-15EX Operations Emissions	-21.91	-11.78	-18.04	-1.02	4.95	4.48	-3,271
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2029 Total Net Change Emissions	**-21.28**	**-9.74**	**-13.82**	**-1.01**	**6.10**	**4.55**	**-2,363**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2030 Estimated Annual Net Change Air Emissions							
Construction Emissions	1.25	2.35	3.00	0.01	1.00	0.08	811
Net Change – F-15EX Operations Emissions	-21.91	-11.78	-18.04	-1.02	4.95	4.48	-3,271
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2030 Total Net Change Emissions	**-20.51**	**-9.32**	**-12.99**	**-1.01**	**5.96**	**4.56**	**-2,238**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2031 Estimated Annual Net Change Air Emissions							
Construction Emissions	-	-	-	-	-	-	-
Net Change – F-15EX Operations Emissions	-21.91	-11.78	-18.04	-1.02	4.95	4.48	-3,271
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2031 Total Net Change Emissions	**-21.76**	**-11.67**	**-15.99**	**-1.02**	**4.96**	**4.48**	**-3,049**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2032 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.27	0.68	1.09	0.00	1.12	0.02	276
Net Change – F-15EX Operations Emissions	-21.91	-11.78	-18.04	-1.02	4.95	4.48	-3,271
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2032 Total Net Change Emissions	**-21.49**	**-10.99**	**-14.90**	**-1.01**	**6.08**	**4.50**	**-2,773**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2033 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.21	1.11	1.64	0.00	1.07	0.04	405

Emissions Source	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
Net Change – F-15EX Operations Emissions	-21.91	-11.78	-18.04	-1.02	4.95	4.48	-3,271
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2033 Total Net Change Emissions	**-21.55**	**-10.56**	**-14.34**	**-1.01**	**6.03**	**4.52**	**-2,644**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2034 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.21	1.11	1.64	0.00	0.41	0.04	402
Net Change – F-15EX Operations Emissions	-21.91	-11.78	-18.04	-1.02	4.95	4.48	-3,271
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2034 Total Net Change Emissions	**-21.55**	**-10.57**	**-14.35**	**-1.01**	**5.37**	**4.52**	**-2,647**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2035 Estimated Annual Net Change Air Emissions							
Net Change – F-15EX Operations Emissions	-21.91	-11.78	-18.04	-1.02	4.95	4.48	-3,271
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2035 Total Net Change Emissions	**-21.76**	**-11.67**	**-15.99**	**-1.02**	**4.96**	**4.48**	**-3,049**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A

Legend: CO = carbon monoxide; CO_2e = carbon dioxide equivalent; NA = not applicable; NO_X = nitrogen oxides; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; PM_{10} = particulate matter less than or equal to 10 microns in diameter; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

Emissions of criteria pollutants under Alternative 2 would be well below the 250 tons per year comparative threshold for the criteria pollutants, for all years of activity.

Under Alternative 2, flights in the Portland ANG installation associated airspace would increase, by approximately 27 percent. However, as with Alternative 1, a portion of the sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements. Thus, even though there is an increase of 27 percent in total operations in the airspace, the amount of time spent flying below the mixing height is anticipated to decrease slightly overall, and the emissions from the F-15EX operations in the airspace are also anticipated to be less than existing emissions from the F-15C. Therefore, Alternative 2 would not be expected to result in a significant impact on air quality.

4.3.1.3 Alternative 3

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue, and no additional personnel would be added to support an air-to-ground mission. Construction projects required to sustain the current mission would be implemented, and the additional (net change) emissions from the construction activities are shown in Table 4.3-5. Emissions of criteria pollutants under Alternative 3 would be well below the 250 tons per year comparative threshold for all years of activity. Therefore, Alternative 3 would not be expected to result in a significant impact on air quality.

Table 4.3-5 Alternative 3 Annual Net Change Emissions Estimates (tons per year)

Emission Source	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
2025 Construction Emissions	0.04	0.21	0.32	0.00	0.05	0.01	82
2026 Construction Emissions	0.14	0.57	0.92	0.00	0.21	0.02	229
2027 Construction Emissions	0.47	1.31	1.85	0.01	0.33	0.04	527
2028 Construction Emissions	0.38	1.97	2.60	0.01	2.05	0.07	717
2029 Construction Emissions	0.47	1.94	2.17	0.01	1.15	0.07	686
2030 Construction Emissions	0.16	0.86	1.20	0.00	0.08	0.03	302
Annual Comparative Threshold	250	250	250	250	250	250	NA
Exceeds Threshold	No	No	No	No	No	No	NA

Legend: CO = carbon monoxide; CO_2e = carbon dioxide equivalent; NA = not applicable; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; PM_{10} = particulate matter less than or equal to 10 microns in diameter; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

4.3.1.4 No Action Alternative

Under the No Action Alternative, the current F-15C platform would continue to fly to their maximum service life. The existing air-to-air mission would continue with use of the Portland ANG installation associated airspace. No construction projects are proposed to occur at the Portland ANG installation under the No Action Alternative. Thus, implementation of the No Action Alternative would not be expected to create significant impacts to air quality.

4.4 WATER RESOURCES

4.4.1 Impacts

4.4.1.1 Alternative 1

Construction Impacts

Surface Water

None of the proposed renovation, demolition, or construction projects associated with Alternative 1 would be located in the immediate vicinity of surface water features on the base. Construction could have localized, site-specific, temporary effects on hydrology and surface water quality through the installation's stormwater system, resulting in potential downstream impacts to the Columbia Slough. Surface water runoff would be expected to increase with an additional 214,802 square feet (SF) of new impervious surfaces. However, BMPs would be incorporated as part of the proposed projects of Alternative 1 during construction and operationally to minimize erosion, runoff, and sedimentation, consistent with the installation's SWPCP. Additionally, construction projects that would result in more than 1 acre of ground-disturbing activities would require 1200-C NPDES Permit coverage pursuant to ORS 468B.035 and 050. Following the completion of construction, the proposed facilities would maintain the existing drainage patterns on the installation.

In accordance with Unified Facilities Criteria (UFC) 3-210-10, *Low Impact Development (LID)* and Section 438 of the Energy Independence and Security Act (requiring federal facility projects of more than 5,000 SF to maintain or restore the predevelopment hydrology of the property), LID techniques (e.g., revegetation using native plants, use of permeable surfaces, installation of vegetated swales) would be incorporated into the proposed development. Overall, implementation of Alternative 1 would not be expected to result in significant impacts to surface water resources on and in the vicinity of the Portland ANG installation.

Groundwater

Implementation of Alternative 1 would result in an increase in impermeable surfaces on the installation. However, some of the projects included in Alternative 1 would be constructed on existing paved or developed areas. Projects that would be constructed outside of paved areas would not require extensive excavation that would require dewatering. Impacts to groundwater recharge due to the establishment of approximately 214,802 SF of additional impermeable surfaces would be minimized through implementation of LID technologies that would ensure predevelopment hydrology is maintained. Therefore, Alternative 1 would not be expected to result in significant impact on groundwater resources.

Floodplains

None of the proposed projects under Alternative 1 are within the 100-year floodplain. All projects are within a designated reduced flood risk area due to the surrounding levee system for the Columbia Slough. Therefore, Alternative 1 would not have impacts to floodplains or be located in areas with high flood risk.

<u>*Operational Impacts*</u>

Once operational, the proposed facilities would generate stormwater runoff from the additional impervious surfaces. Projects included as part of Alternative 1 would be designed with LID techniques so that additional runoff would be minimized, and that predevelopment hydrology is maintained. The existing installation stormwater management system has adequate capacity to accommodate the additional stormwater runoff. Additionally, the installation would continue to monitor stormwater runoff to adhere to the requirements of the industrial stormwater permit issued by the Oregon DEQ. The addition of 110 personnel stationed at the Portland ANG installation would not be expected to impact regional groundwater demand and none of the proposed facilities or improvements would require a substantial increase in local or regional groundwater use. Therefore, implementation of Alternative 1 would not be expected to result in significant long-term impacts to water resources.

4.4.1.2 Alternative 2

Construction under Alternative 2 is the same as described for Alternative 1, and thus involves the same amount of ground disturbance (214,802 SF of new impervious surfaces). Potential impacts and BMPs would be the same as described for Alternative 1. Therefore, Alternative 2 would not be expected to result in significant long-term impacts to water resources.

4.4.1.3 Alternative 3

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue, and no additional personnel would be added to support an air-to-ground mission. The previously planned construction and repair projects required for current mission sustainment would be implemented. Construction impacts would be similar in nature to those described for Alternative 1 but there would be less construction (approximately 194,898 SF less new impervious surface created than under both Alternatives 1 and 2). Therefore, impacts to water resources would be similar to but less than those described for Alternative 1, and would not be expected to result in significant long-term impacts to water resources.

4.4.1.4 No Action Alternative

Under the No Action Alternative, the current F-15C platform would continue to fly to their maximum service life. The existing air-to-air mission would continue with use of the Portland ANG installation associated airspace. No construction projects are proposed to occur at the Portland ANG installation under the No Action Alternative. Thus, implementation of the No Action Alternative would not be expected to create significant impacts to water resources.

4.5 GEOLOGICAL RESOURCES

4.5.1 Impacts

4.5.1.1 Alternative 1

<u>Construction Impacts</u>

Geology and Topography

Potential impacts to geological resources associated with Alternative 1 at the Portland ANG installation would be limited to ground-disturbing activities occurring during renovation, demolition, site preparation, and/or construction. Ground disturbance (i.e., excavation and grading of surface soils) would occur on previously disturbed land and would not disturb underlying geological formations on the installation. Disturbance would be localized to the footprints of the proposed projects and would not have impacts on sensitive or regionally significant geologic or physiographic features.

The topography across the installation is generally flat and level, with no excessive slopes at the project sites. Therefore, impacts to topography resulting from implementation of Alternative 1 would not be significant.

The Portland ANG installation is located within a moderate damage seismic risk zone and within the earthquake zone for the Cascadia fault. However, the likelihood of an earthquake strong enough to cause damage is expected to have a 7 to 15 percent probability of occurring in the next 50 years (Oregon Seismic Safety Policy Advisory Commission 2013). The proposed projects would be constructed in accordance with UFC 3-310-04, *Seismic Design for Buildings*, which adopts the seismic design provisions of the International Building Code for use in DoD building design. Therefore, implementation of Alternative 1 would result in negligible impacts associated with seismicity or geologic hazards.

Soils

Implementation of Alternative 1 would include excavation and site preparation activities associated with construction and would not result in substantial changes to the overall topography of the project area. The soil at the Portland ANG installation primarily consists of fill that has been heavily disturbed by previous development and excessively drained soils found in floodplain landforms with sandy alluvium. These soils pose no development constraints and are capable of supporting the projects associated with Alternative 1. Implementation of standard site preparation and construction techniques would enable development of these project sites, similar to existing facilities developed on the Portland ANG installation. In accordance with Oregon's laws and regulations, all appropriate construction BMPs to control and minimize erosion and sedimentation must be adhered to during all phases of construction. This may include installation of inlet/outlet protections, straw wattles, and sediment fences. Additionally, construction projects that would result in more than 1 acre of ground-disturbing activities would require 1200-C NPDES Permit coverage pursuant to ORS 468B.035 and 050, and adherence to permit-required BMPs. With implementation of BMPs, construction-related impacts to soils would be minimal and localized to the proposed project footprints. Therefore, implementation of Alternative 1 would not be expected to result in significant impacts to soils.

Farmlands

Projects proposed as part of Alternative 1 would be implemented on land identified as being farmland of statewide importance (refer to Table 3.5-2). However, none of the proposed construction projects would be constructed on prime farmland and or convert any new farmland to non-agricultural uses, as the land has been previously disturbed or developed within the Portland ANG installation boundary. Therefore, implementation of Alternative 1 would not be expected to result in significant impacts to farmland.

<u>*Operational Impacts*</u>

Once operational, the proposed facilities would have no impacts to geology, topography, and soils. Projects included as part of Alternative 1 would be engineered such that potential impacts resulting related to geological hazards (e.g., earthquakes) and erosion would be minimized. Therefore, implementation of Alternative 1 would not be expected to result in significant long-term impacts to geological resources.

4.5.1.2 Alternative 2

Construction and potential impacts under Alternative 2 would be the same as described for Alternative 1. While Alternative 2 includes a higher number of annual aircraft operations, the potential impacts would be the same as described for Alternative 1. Therefore, implementation of Alternative 2 would not be expected to result in significant long-term impacts to geological resources.

4.5.1.3 Alternative 3

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue, and no additional personnel would be added to support an air-to-ground mission. The previously planned construction and repair projects required for current mission sustainment would be implemented. Construction and potential impacts under Alternative 3 would be similar to those described for Alternative 1, but would result in less total ground disturbance. Therefore, implementation of Alternative 3 would not be expected to result in significant long-term impacts to geological resources.

4.5.1.4 No Action Alternative

Under the No Action Alternative, the current F-15C platform would continue to fly to their maximum service life. The existing air-to-air mission would continue with use of the Portland ANG installation associated airspace. No construction projects are proposed to occur at the Portland ANG installation under the No Action Alternative. Thus, implementation of the No Action Alternative would not be expected to create significant impacts to geological resources.

4.6 CULTURAL RESOURCES

4.6.1 Impacts

4.6.1.1 Alternative 1

Construction Impacts

Archaeological Resources

There are no known archaeological sites located at the Portland ANG installation and one archaeological isolate was identified but is not eligible for listing in the NRHP (Oregon ANG 2012). Due to the location of the installation near the Columbia River and the use of fill from the Columbia River, there is a high probability of subsurface archaeological resources. The NGB is consulting with the Oregon SHPO on the implementation of a project Programmatic Agreement. NGB is committed to conducting an archaeological survey that includes shovel test pits within areas proposed for ground-disturbing activities using current methodologies in accordance with the *Guidelines for Conducting Field Archaeology in Oregon* (Oregon SHPO 2013). NGB will evaluate any newly found archaeological sites under the criteria of eligibility established in 36 CFR Section 60.4(a–d). If an unanticipated discovery of cultural artifacts occurs or the discovery of unmarked burial(s), including Native American burials or cemeteries from which headstones were relocated but not the physical remains, the activity in the immediate vicinity will cease until an assessment of the materials can be made. The unit commander/supervisor will be notified immediately so the Environmental Manager can be contacted. Protocols found in Standard Operating Procedure No. 6, *Inadvertent Discovery of Cultural Materials* and Standard Operating Procedure No. 7, *Inadvertent Discovery of Unmarked Burials* within the ICRMP will be followed (Oregon ANG 2012).

Architectural Resources

Alternative 1 would involve the interior modification of Buildings 170 and 270, including upgrades to building systems (i.e., electrical; plumbing; and heating, ventilation, and air conditioning) and additions to Buildings 115, 210, 270, and 400. These buildings were constructed in the late 1980s and 1990 and are not eligible for listing in the NRHP (Oregon ANG 2012).

Alternative 1 would also include the demolition of 14 buildings (Buildings 160, 165, 240, 255, 265, 275, 475, 480, 485, 491, 495, 496, 497, and 498). Of these buildings, 7 were determined not eligible for listing in the NRHP. Building 240 (Warehouse built in 1967), Building 275 (Munitions loading crew training built in 1968), and Building 491 (Recreation Center built in 1965) were determined not eligible under Criteria Consideration G for special significance during the Cold War (Oregon ANG 2012). However, these buildings have reached 50 years of age since the last architectural evaluation at the installation and require evaluation under standard NRHP criteria, though it is not likely that they would be eligible due to a lack of historical significance. The NGB is consulting with the Oregon SHPO on the implementation of a project Programmatic Agreement. Prior to the implementation of the project, NGB will conduct an intensive level architectural survey of the five Cold-war era buildings (Buildings 160, 165, 240, 275, and 491) for their significance as a Cold-war era district under the criteria of eligibility established in 36 CFR Section 60.4(a–d). Building 495, a World War II recreation center, was determined eligible for listing in the NRHP and its demolition would be considered an adverse effect. However, the building's demolition was previously mitigated under the Programmatic Agreement signed between the DoD, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers regarding the demolition of World War II temporary buildings effective June 7, 1986. The SHPO concurred with this mitigation in 2017 and NFA would be required (Gabriel 2017).

Traditional Cultural Resources

No traditional cultural resources or sacred sites have been identified at the Portland ANG installation. Government-to-government consultation between the DAF and each federally recognized Tribal Nation associated with the Portland ANG installation, including the Confederated Tribes of the Warm Springs Reservation, the Confederated Tribes of Grand Ronde Community of Oregon, Confederated Tribes of the Umatilla Indian Reservation, the Cowlitz Indian Tribe, Nez Perce Tribe, and the Confederated Tribes of Siletz Indians has been conducted for this action in recognition of their status as sovereign nations, to provide information regarding Tribal concerns per Section 106 of the NHPA, as well as information on traditional cultural resources and sacred sites that may be present on or near the Portland ANG installation.

The Confederated Tribes of Siletz Indians responded stating they were glad to see that there is a plan for an archaeological monitor to be onsite during any ground-disturbing activities necessary for the building demolition, renovation, and construction contemplated by Alternative 1 and Alternative 2 given the possibility of archaeological resources in the Columbia River dredge fill that the facility is largely constructed on. The Tribal Nation also stated that should Alternatives 1 or 2 be selected, they would be interested in understanding if there is any possibility of the required activities disturbing native soil below the dredge fill, where the probability of archaeological resources is higher (Hatch 2024) (Appendix B). However, during consultation with the Oregon SHPO, it was decided that the NGB would conduct an archaeological survey including shovel test pits within areas proposed for ground-disturbing activities using current methodologies prior to implementation of the project.

Operational Impacts

Training requirements for Alternative 1 would remain similar to those for the existing F-15C, but the F-15EX would generate additional airfield operations and the noise level at the airfield would increase slightly (see Section 4.1.2.1). Although there would be a slight increase in noise levels, there would be no effects to NRHP-eligible or -listed archaeological resources, architectural resources, or traditional cultural resources or sacred sites. The NGB is consulting with the Oregon SHPO on its finding of effect for each of the Proposed Action alternatives.

The 2017 *EIS for Proposed Establishment and Modification of Oregon Military Training Airspace* found a fraction of the historic properties would have a potential to be impacted by low-altitude flow activities within the Juniper Low MOAs. All other historic properties beneath the remainder of the Juniper/Hart MOAs, Eel MOA/ATCAA, or Redhawk MOA Complex would not be affected from noise exposure due to the high altitude of the airspace floor (flights occur above 11,000 feet MSL) (Oregon ANG 2017a). Under Alternative 1, the types of airspace operations, altitudes flown, and frequency of use of existing airspace by the 142 WG would remain similar to existing activity, but a portion of the sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements. As a result, F-15EX use of NWSTF Boardman and Mountain Home SUA would increase from 2 weeks per year at each location to 4 weeks per year at each location. As described in Section 4.2.2.1, 142 WG operations under Alternative 1 would continue to represent a small portion of the overall flight operations at these locations: 3.4 percent of the total annual fixed-wing operations at NWSTF Boardman and 1.6 percent of total annual flight operations in the Mountain Home SUA (an increase of 1.9 percent and less than 1 percent from existing conditions/No Action Alternative, respectively). Correspondingly, the F-15EX use of W-570 and Eel MOA would decrease, due to the shift in sorties, while use of all other associated airspace would not be proposed to change. These changes result in an average of eight F-15EX sorties per day that would utilize the existing SUA, compared to the current seven

F-15C sorties. Based on noise level calculations for lands beneath the SUA (Section 4.1.2.1), there would be no adverse effect to cultural resources, historic structures, or traditional cultural resources or sacred sites as a result of the implementation of Alternative 1.

Visual intrusions under Alternative 1 would be minimal and would not represent an increase sufficient to cause adverse impacts to the settings of cultural resources. Due to the high altitude of the overflights, small size, and high speeds of the aircraft during flight, they would not be readily visible to observers on the ground. Flares would not pose a visual intrusion, as flares are small in size and burn only for a few seconds after being deployed from aircraft. See Section 4.7, *Safety*, for analysis of potential fire impacts related to flare use.

No ground disturbance would occur under the airspace due to the implementation of Alternative 1. Use of ordnance and defensive countermeasures would occur in areas already authorized for these activities and thus would not have an adverse effect on archaeological sites or standing structures.

Responses received from Tribal Nations associated with the airspace APE are summarized in Table 4.6-1, and all Section 106 and government-to-government correspondence is included in Appendix B.

Table 4.6-1 Responses from Tribal Nations

Tribal Nation	*Response*
Confederated Tribes of the Colville Reservation	Responded that they concurred with no adverse impacts to historic properties within their Traditional Territories and they attached a map. Confirmed the presence of traditional properties, historic properties, and other resources of cultural importance to the people of the Colville Tribes within portions of the APE. However, no formal consultation was requested as the proposed undertaking will utilize existing SUA.
Confederated Tribes of the Chehalis Reservation	Concurred with the determination of the APE for this undertaking and included no additional comments. However, should additional information become available, including regarding historic properties that have not yet been identified, their assessment may be revised.
Confederated Tribes of Siletz Indians	Responded that they have not received negative feedback from tribal cultural practitioners about the current use of ANG aircraft, and the proposed alternatives seem similar enough to current practice that they do not anticipate the need for further consultation.
Yurok Tribe of the Yurok Reservation	Responded that the undertaking is located within the Umatilla Tribe, Warm Springs, and Grand Ronde area, and thus deferred to those Tribal Nations.
Spokane Tribe of the Spokane Reservation	Responded that the undertaking was outside of their ancestral territory.
Washoe Tribe of Nevada and California	Responded that the proposed project is outside of the ancestral lands of the Washoe Tribe of Nevada and California, and thus deferred to neighboring Native Nations with cultural affiliation.

Legend: APE = area of potential effects; SUA = special use airspace.

Proposed use of the airspace would be similar to ongoing training operations. Given the current use of the airspace and the nature of the proposed future use of the project area, there would be no adverse effects to NRHP-eligible or -listed archaeological resources, architectural resources, or traditional cultural resources or sacred sites. The NGB is consulting with the SHPO on its finding of effect for each of the Proposed Action alternatives. Overall, implementation of Alternative 1 would not result in significant impacts to cultural resources.

4.6.1.2 Alternative 2

Impacts to archaeological resources and traditional cultural resources or sacred sites under Alternative 2 would be similar to those under Alternative 1. Therefore, under Alternative 2 no impacts on archaeological resources or traditional cultural resources or sacred sites are anticipated.

Impacts to architectural resources under Alternative 2 would be the same as those under Alternative 1. Therefore, under Alternative 2 no impacts on architectural resources are anticipated.

Under Alternative 2, airfield operations impacts would be similar in nature to those described for Alternative 1, but there would be a 17 percent increase in airfield operations as compared to Alternative 1, with a resulting slightly higher noise level increase at the airfield (Section 4.1.2.2). Despite the slight increase in noise levels, there would be no adverse effects to NRHP-eligible or -listed archaeological resources, architectural resources, or traditional cultural resources or sacred sites. Similar to Alternative 1, the F-15EX aircraft would utilize existing military airspace and military training ranges and would continue the use of chaff and flares in authorized airspace.

Overall, implementation of Alternative 2 would not result in significant impacts to cultural resources.

4.6.1.3 Alternative 3

Impacts to archaeological resources and traditional cultural resources or sacred sites under Alternative 3 would be similar to that under Alternatives 1 and 2. Therefore, under Alternative 3 no impacts on archaeological resources and traditional cultural resources or sacred sites are anticipated.

Impacts to architectural resources under Alternative 3 would be similar to that under Alternative 1, with some exceptions. Additions to Buildings 210 and 400 are not included in Alternative 3. In addition, Alternative 3 does not include the demolition of Buildings 160, 255, 265, and 275. Therefore, under Alternative 3 no impacts on architectural resources are anticipated.

Training requirements for Alternative 3 would remain in place at the Portland ANG installation and continue flying the allotted sorties. Therefore, there would be no effects to NRHP-eligible or -listed archaeological resources, architectural resources, or traditional cultural resources or sacred sites.

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue, and no additional personnel would be added to support an air-to-ground mission.

Therefore, implementation of Alternative 3 would not result in significant impacts to cultural resources.

4.6.1.4 No Action Alternative

Under the No Action Alternative, the current F-15C platform would continue to fly to their maximum service life. The existing air-to-air mission would continue with use of the Portland ANG installation associated airspace. No construction projects are proposed to occur at the Portland ANG installation under the No Action Alternative. Thus, implementation of the No Action Alternative would not be expected to create significant impacts to cultural resources.

4.7 SAFETY

4.7.1 Impacts

4.7.1.1 Alternative 1

Under Alternative 1, the 142 WG would experience an increase of 110 personnel, an approximate 8 percent increase. Total annual operations at PDX would increase by 446 operations, an approximate 9 percent increase over existing conditions/No Action Alternative. The F-15EX would operate in the same airspace environment as the F-15C aircraft. However, these operations would be performed with a more reliable and modern aircraft. The F-15EX is a new model upgrade to the original F-15 airframe, which includes improved electronics and advanced automation that increases safety and reduces potential for mishaps.

Fire/Crash Response

The 142 WG fire department has existing deficiencies related to fire and/or crash dispatch that would continue unless additional personnel are trained in dispatch operation or mutual aid agreements are put in place that provide additional resources. However, the 142 WG would continue to respond to fire, emergency, and crash incidents that occur at the installation and agreements with local emergency response entities would continue to be developed. Therefore, no adverse impacts are expected under Alternative 1.

Runway Protection Zones

No construction projects would occur within designated RPZs under Alternative 1. RPZ dimensions are specific to the aircraft flown at an airfield and the replacement F-15EX aircraft utilizes the same airframe as the F-15C and thus would not require a change to RPZ layouts under Alternative 1; therefore, no adverse impacts are expected under Alternative 1.

Explosive Safety

Under Alternative 1, there would be no change to the amount or type of live munitions stored on the Portland ANG installation, as inert munitions (i.e., dummy munitions that contain no explosive charge) would be used for assembly and load training to support the added air-to-ground mission. However, there are nine construction projects that would be implemented under Alternative 1 that are located within the footprints of existing QD arcs: Projects 11, 15, 16, and 17A-F, (see Figure 4.7-1 and Table 2.1-2 for a brief description of each project). Of these construction projects, three would potentially require new or modified QD arcs, based on their potential to store live munitions (Projects 14–arm/de-arm pad with berm, 17C–munitions storage igloo, and 17D–munitions maintenance trailer), even though no storage of live munitions is proposed under Alternative 1. QD arcs would be established for each of these facilities that conform to all DAF requirements. Project 8–demolish Combat Arms Training Range would remove a function where munitions were previously used. Project 15–repair/increase size of South Alert Berm would occur within established QD arcs but is intended to address an already established need for a larger berm structure under the current mission. The remaining projects would construct facilities to accommodate the additional 110 personnel and would not require QD arcs to be established or modified. As there would be no change to the amount, type, or handling of munitions at the installation proposed under Alternative 1, there would be no impact related to explosive safety.

Antiterrorism/Force Protection

All construction and modification projects would be conducted in full compliance with AT/FP requirements from design to completion; therefore, AT/FP would be improved under Alternative 1 when compared to existing conditions/No Action Alternative.

Flight Safety Procedures

Under Alternative 1, all flight operations conducted by the 142 WG would continue to be governed by standard flight rules set forth under DAFMAN 11-202 Volume 3 and the 142 WG Instruction 13-204. Additionally, all aircraft would be operated in accordance with FAA and all local flight rules would continue to be adhered to, thus, no adverse impacts to flight safety procedures would occur with the implementation of Alternative 1.

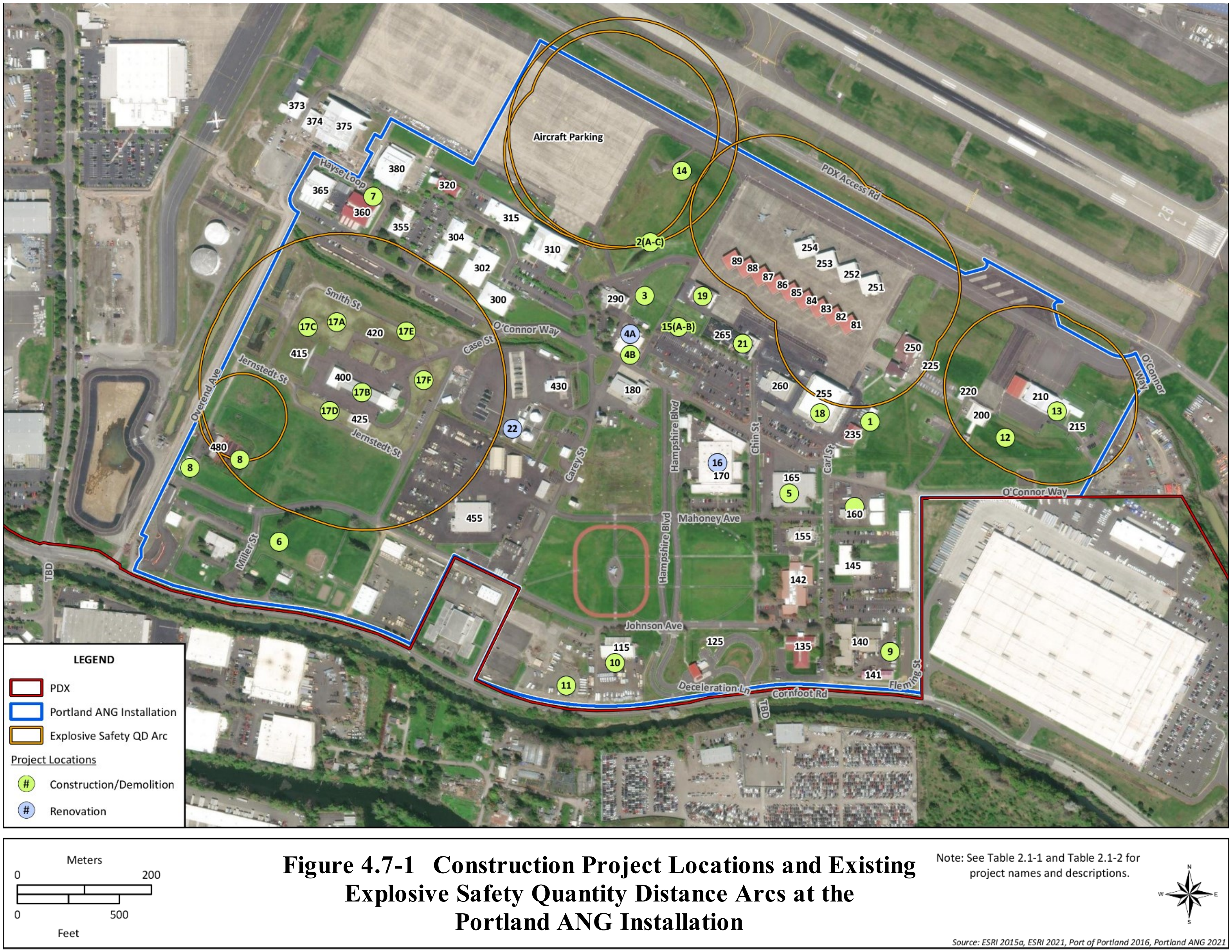

Figure 4.7-1 Construction Project Locations and Existing Explosive Safety Quantity Distance Arcs at the Portland ANG Installation

Aircraft Mishaps

Current airfield and airspace safety procedures discussed previously would continue to be implemented. While the increased number in takeoffs, landings, proficiency training, and other flights typically results in a commensurate increase in the safety risk to aircrews and personnel at the airfield and in applicable airspaces, this risk would be offset by the increased reliability of F-15EXs that are 40 years newer than the F-15C. Thus, operation of the F-15EX would result in less risk to the personnel and aircrew, despite the minimal increase of operations, and no significant increase in air mishaps is expected under Alternative 1.

Bird/Wildlife Aircraft Strike Hazard

The F-15EX would use the same airspace and training ranges as the F-15C and implementation of the BASH program would continue under Alternative 1. Thus, the potential for bird/wildlife aircraft strikes is not anticipated to be statistically different from existing conditions/No Action Alternative. FAA reports 97 percent of bird strikes occur during the takeoff and landing phases of flight. The DAF mitigates these risks through proper risk management procedures. Hazard avoidance is reported, and bird watch conditions are assigned each day of flying to determine risk. Bird watch conditions are separated into categories based on severity and written in accordance with DAFI 91-202, *The U.S. Air Force Mishap Prevention Program.* These conditions, if severe enough, could restrict flying until conditions subside. ATC and weather frequencies broadcast bird watch conditions to prevent a BASH event from occurring. Therefore, implementation of Alternative 1 would not be expected to significantly increase the BASH risk.

Mid-Air Collision Avoidance

Under Alternative 1, the F-15EX would operate similarly to the F-15C under existing conditions/No Action Alternative. The additional 446 annual operations would occur within the already congested PDX terminal airspace, which could increase the possibility of a MACA event. However, Class C airspace is controlled and ATC is in communication with every pilot operating within the confines of the terminal airspace. ATC's duty is to give first priority to separating aircraft and issuing safety alerts, as governed under the FAA Order 7110.65*, Air Traffic Control.* Additionally, the 142 WG implements proactive procedures, such as enforcement of the MACA program and restrictions of successive operations to further reduce risk. Therefore, implementation of Alternative 1 would not be expected to significantly increase the risk of a MACA event.

Chaff and Flare Use

The allocation and use of defensive countermeasures is not expected to change from the current usage with the F-15EX. They would be used for ACA missions and would also be used in training. The unit would continue to receive the same allocation of chaff and flares that they currently receive. They would be used at the same rates in the same places, subject to the same restrictions that exist now. The current and historical use of chaff and flares during training at the Portland ANG installation and within associated airspace has not resulted in direct or indirect impacts to health and safety. The risk of fires from flare use would continue to be managed through implementation of established procedures dictating minimum altitudes for release, to ensure flares burn out fully before reaching the ground or vegetation. With implementation of established operational procedures, no significant impacts to safety would occur from the use of chaff and flares.

4.7.1.2 Alternative 2

Alternative 2 is the same as Alternative 1 except aircraft operations would increase from existing conditions/No Action Alternative by approximately 27 percent, or by 1,328 annual operations. This is 882 more operations, or a 17 percent increase, compared to Alternative 1. The same operational procedures would be utilized under Alternative 2; therefore, no significant impacts to flight safety are expected under Alternative 2.

4.7.1.3 Alternative 3

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue, and no additional personnel would be added to support an air-to-ground mission. Two construction projects would occur within the established QD arcs shown in Figure 4.7-1: Projects 11 and 15. Project 11–demolish Combat Arms Training Range may result in a change to the QD arcs as a range where munitions were used would be removed from that location. Project 15–repair/increase size of South Alert Berm would occur within established QD arcs but is intended to address an already established need for a larger berm structure under the current mission. As there would be no change to the amount, type, or handling of munitions at the installation proposed under Alternative 3, there would be no impact related to explosive safety.

Under Alternative 3, existing F-15C aircraft would remain and continue flying operations to meet mission requirements. As described in Section 1.2, the F-15C aircraft currently based at the Portland ANG installation face increased maintenance issues and decreased supply parts due to the age of the aircraft, which limits flying ability and can present pilot and public safety hazards. The average F-15C/D is 35 years old with over 8,300 flight hours, and the oldest F-15C was delivered in 1979 (DoD 2019). Structural risks and wire chafing issues have led to multiple unplanned groundings for safety concerns. The ability to achieve overall readiness goals is diminished as the aircraft stay grounded longer in order to conduct more inspections, maintenance, and repairs. By continuing to fly the F-15C at the same operations tempo year after year, the potential for aircraft mishap rates could increase under Alternative 3 due to increasing maintenance issues. The current BASH program and MACA program would continue under Alternative 3. Therefore, no significant impacts to safety are expected under Alternative 3.

4.7.1.4 No Action Alternative

Under the No Action Alternative, the current F-15C platform would continue to fly to their maximum service life. The existing air-to-air mission would continue with use of the Portland ANG installation associated airspace. No construction projects are proposed to occur at the Portland ANG installation under the No Action Alternative. Thus, implementation of the No Action Alternative would not be expected to create significant impacts to safety.

4.8 HAZARDOUS MATERIALS AND WASTES

4.8.1 Impacts

4.8.1.1 Alternative 1

<u>*Hazardous Materials*</u>

As a result of Alternative 1, short-term minor impacts are anticipated due to construction activities. The net increase in construction would produce minor increases in handling, storage, use, and transportation of hazardous materials. The temporary increase in additional hazard materials on-site during construction activities would be managed according to the installation's Hazardous Waste Management Plan (Oregon ANG 2022d). Additional aircraft, vehicles, and equipment would increase consumption of operating fluids and fuel; however, the long-term impacts are expected to be minor. No direct work would be performed on the ASTs and no additional ASTs are proposed to be installed. Possible impacts associated with these projects include tank ruptures or leaks during construction. The 142 WG has in place a Spill Prevention, Control, and Countermeasures Plan which would address these impacts should they occur (Oregon ANG 2022c).

The types of hazardous materials needed for maintenance and operation of the F-15EX would be similar to those currently used for maintenance and operation of the F-15C fleet. Under Alternative 1, the total number of airfield operations would increase; therefore, throughput of petroleum substances and hazardous material streams would be expected to increase slightly.

In 2020, the National Defense Authorization Act required all DoD facilities to shut down all hangar fire suppression systems that dispense AFFF by 1 October 2024. In response, the DAF established an AFFF Sundown Policy outlining the service's plan to lockout and tagout all AFFF hangar systems no later than 1 March 2023 (DAF 2023b). Except for four hangars identified by the Assistant Secretary of the Air Force (Installations, Environment, and Energy) as "mission critical," all hangars will be converted to water only sprinkler systems. In addition, AFFF in fire vehicles will be replaced with a fluorine-free foam which is anticipated to be completed by September 2024 (DAF 2023b).

Hazardous Waste

Implementation of Alternative 1 would have short-term minor impacts on hazardous waste accumulation. There would be an increase in temporary construction-related hazardous wastes. All construction hazardous waste would be managed by the contractors and would be applicable to all federal and state rules and regulations. The types of hazardous materials needed for maintenance and operation of the F-15EX would be similar to those currently used for maintenance and operation of the F-15C fleet. The volume of waste generated would be tracked and analyzed to determine whether each type of waste is hazardous. All waste would be properly disposed of in accordance with federal, state, and local requirements. No trash or other solid waste would be buried, burned, or otherwise disposed of at the project site. Any hazardous and deleterious-materials storage, disposal, or accumulation in the vicinity of State waters must comply with Oregon Water Quality Standards (EPA 2022). Alternative 1 would not result in any adverse long-term environmental impacts that would affect the installation. Hazardous waste generation would continue to be managed in accordance with the installation's Hazardous Waste Management Plan and all applicable federal, state, and local regulations. Additionally, no changes to the installation's Large Quantity Generator status are expected to occur. Under Alternative 1, the total number of airfield operations would increase; therefore, throughput of hazardous waste streams would be expected to increase slightly. However, as the new F-15EX aircraft would require less unscheduled maintenance than the aging F-15C they are replacing, this would likely offset the minor increase in hazardous waste generation from increased operations over time.

Toxic Substances

Toxic substances typically associated with buildings and facilities include ACM, LBP, and/or PCBs. No new toxic substances would be used or stored due to the implementation of Alternative 1. ACM is present in Building 491, which is proposed to be demolished under Project 10A and may be present in some of the other buildings being renovated or demolished under Alternative 1. The Portland ANG installation *Asbestos Management Plan* mandates that all facilities are inspected for the presence of ACM prior to renovation, repair, or demolition (Oregon

ANG 2021d). If ACM is discovered within a building that is to be demolished or renovated, the proper state and federal rules and regulations would be followed, including but not limited to, 40 CFR 61.145, *Standard for Demolition and Renovation* and 29 CFR 1926.1101, *Asbestos Construction Standard*.

A LBP survey has not been conducted at the Portland ANG installation. Based on the age of several buildings at the installation, there is the potential for LBP to be present (Oregon ANG 2017b). Hence, all buildings constructed prior to 1978 would be tested for LBP prior to demolition or renovation. As a BMP, contractors who renovate or demolish buildings testing positive for LBP should be certified by the EPA and follow lead-safe work practices. LBP would be managed and disposed of in accordance with Toxic Substances Control Act, Occupational Safety and Health Administration regulations, Oregon requirements, and established DAF procedures.

The abovementioned state and federal rules and regulations as well as BMPs would be followed by the 142 WG during construction; therefore, there would be no significant impacts with respect to toxic substances with the implementation of Alternative 1.

Contaminated Sites

In accordance with DAFI 32-7020, *The Environmental Restoration Program*, construction, modifications, and/or additions to existing buildings can occur on or in proximity to existing ERP sites. Accordingly, the appropriate organizations (e.g., installation planners, ERP managers, design engineers) must consider a compatible land use based on current site conditions and the selected or projected remedial action alternatives. If the potential for uncharacterized ERP sites exist, the 142 WG would be responsible for identifying existing contamination at the proposed construction sites to avoid unknowingly locating construction projects in contaminated areas.

Three ERP sites (Site 3, Site 8, and Site 13) and the firing range (Building 480) overlap with the proposed construction under Alternative 1 (Figure 4.8-1). Site 3 and Site 8 are closed with a determination of NFA, and land use controls are in place and would be followed in relation to any proposed construction activities in these areas (see Table 3.8-2). ERP Site 13 requires further investigation before land use controls can be determined. ERP Site 13 overlaps with Building 270 (Avionics). Project 8 involves the demolition of the firing range, Building 480, and therefore proper lead removal practices would be implemented during demolition activities.

Only one PFAS AOC (PRL 1) overlaps with a proposed project (Project 16) which involves the repair of the Logistics Readiness Squadron Building 170 (Figure 4.8-1). After the 2015 Preliminary Assessment, it was determined that NFA was required because there were no reported AFFF spills in the building.

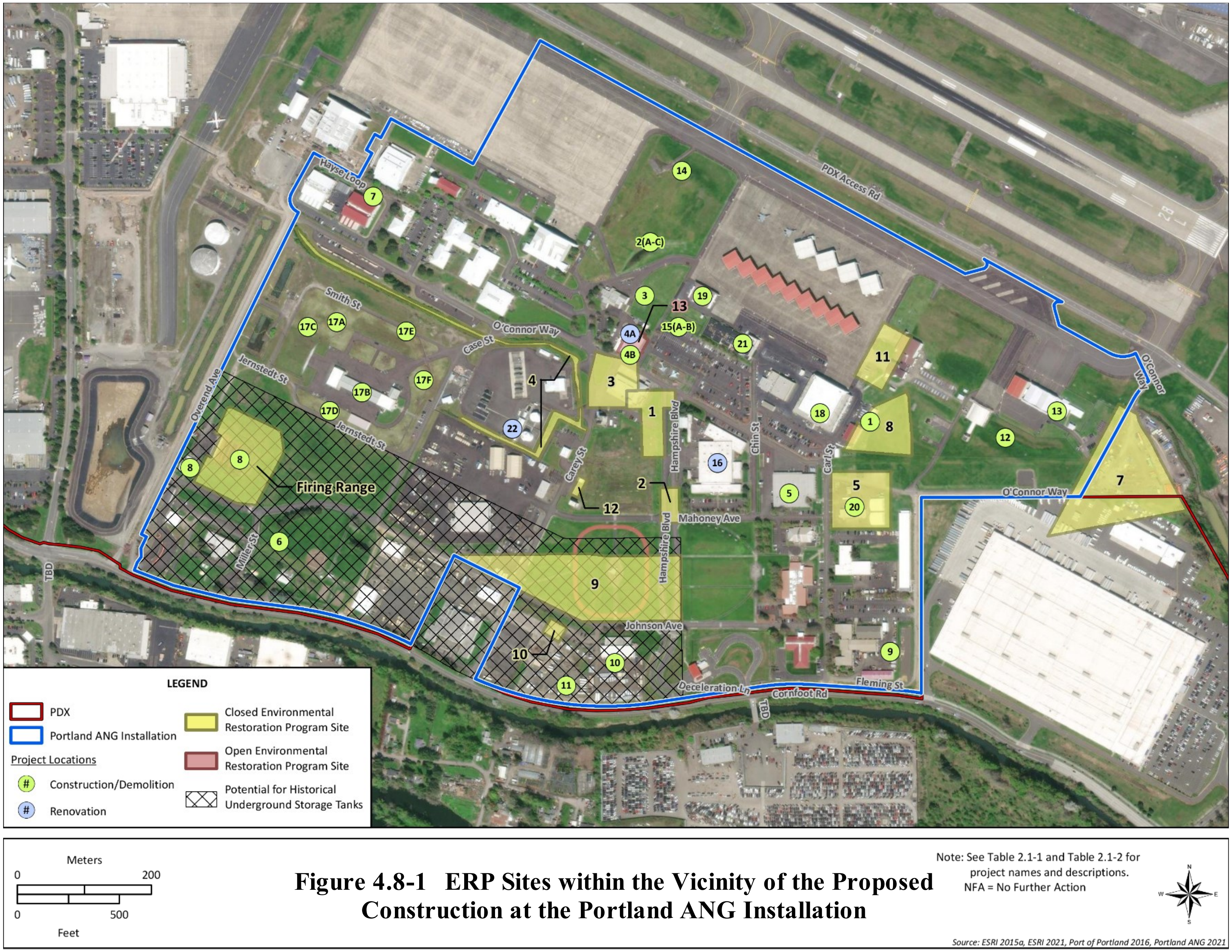

Figure 4.8-1 ERP Sites within the Vicinity of the Proposed Construction at the Portland ANG Installation

The Oregon DEQ reviewed the Draft EA and provided a general comment for consideration with respect to appropriately addressing potential PFAS impacts (Appendix B). PFAS investigations at the Portland ANG installation are in-progress and ongoing. Prior to construction, the Portland ANG installation would review current investigations to determine if there is the potential for PFAS contamination and would coordinate with the Oregon DEQ as needed. If unforeseen modifications required during construction result in the disruption of soil or groundwater in PFAS impacted areas above federal and/or state regulatory limits, a Contaminated Media Management Plan would be developed that detail the procedures for soil and groundwater sampling in accordance with previously approved investigative Work Plans, as well as procedures for encountering of contaminated media, site erosion controls, media disposal, and federal and state agency notification in accordance with current regulatory requirements at the time of construction. In August 2022, the EPA proposed to designate PFAS as hazardous substances under CERCLA. If this designation is finalized, it would impact the management requirements for excavated material (i.e., soil and groundwater) generated during construction. The volume of waste generated would be tracked and analyzed to determine whether each type of waste is hazardous. The DoD management of PFAS is evolving and a recent Office of the Secretary of Defense decision impacted management requirements. On July 7, 2023, the Assistant Secretary of Defense for Energy, Installations, and Environment, issued a memo "Interim Guidance on Destruction or Disposal of Materials Containing Per- and Polyfluoroalkyl Substances in the United States" that directs DoD installations to dispose PFAS-containing materials in hazardous waste landfills, or specialized solid waste landfills with environmental permits, that have composite liners, and gas and leachate collection and treatment systems (Assistant Secretary of Defense for Energy, Installations, and Environment 2023).

Additionally, the southwest area of the installation is mapped in the 2017 *Environmental Baseline Survey* (Oregon ANG 2017b) as having the potential for historical USTs. Army Barracks once occupied the site, and it is unknown if all USTs were removed when these barracks were demolished. Four of the proposed projects (Projects 6, 8, 10, and 11) included under Alternative 1 are located within this area (Figure 4.8-2).

If contaminated media (e.g., soil, vapor, groundwater) was encountered during the course of site preparation (e.g., clearing, grading) or site development (e.g., excavation for installation of building footers) for proposed construction activities, work would cease until the 142 WG Environmental Manager establishes an appropriate course of action for the construction project to ensure that any applicable federal and state agency notification requirements are met, and to arrange for agency consultation as necessary if closed ERP sites are affected. By following these procedures, impacts to ERP Sites 3, 8, and 13; the firing range, AOCs/PRLs, and potential historical USTs would not be significant under Alternative 1.

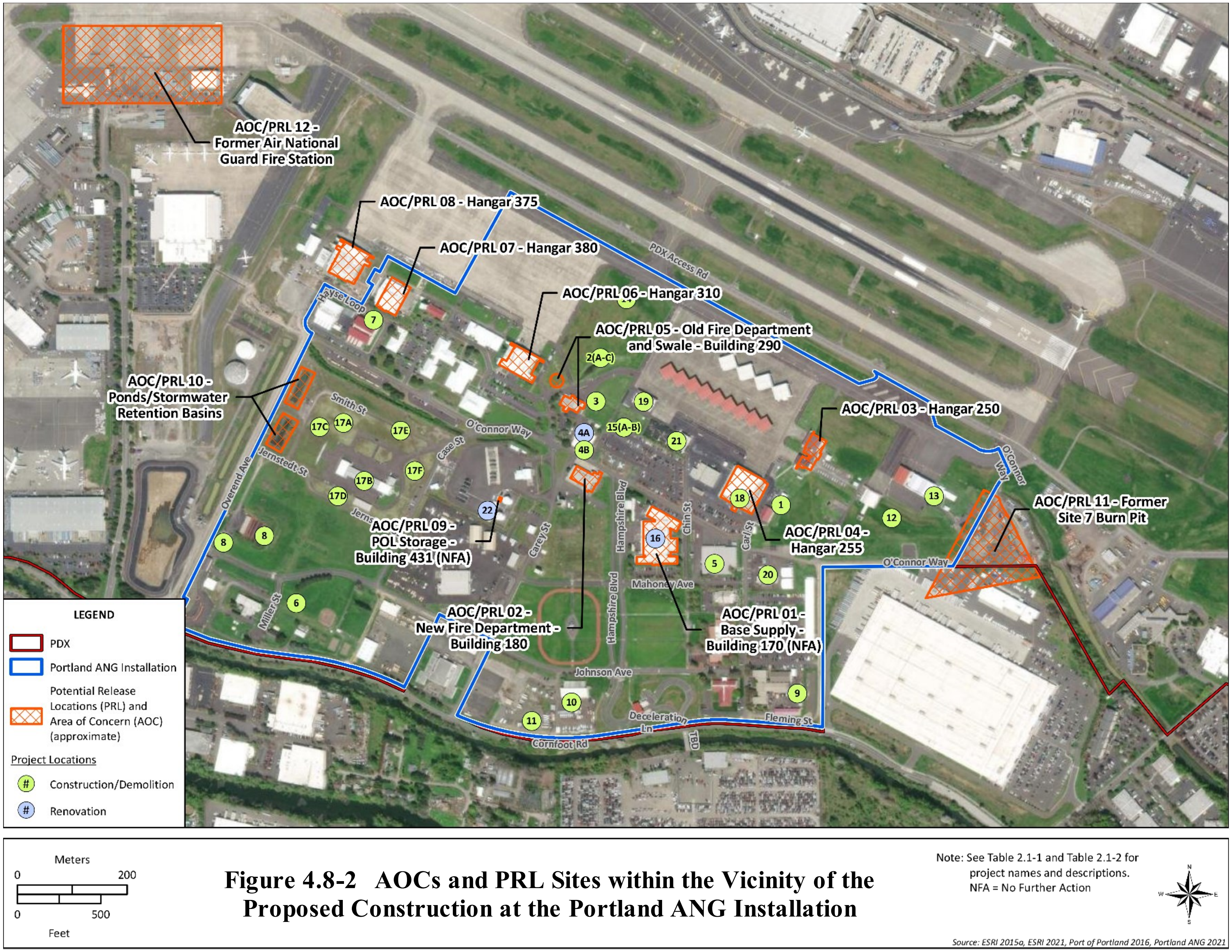

Figure 4.8-2 AOCs and PRL Sites within the Vicinity of the Proposed Construction at the Portland ANG Installation

4.8.1.2 Alternative 2

Construction impacts under Alternative 2 would be the same as described for Alternative 1. As with Alternative 1, the types of hazardous materials needed for maintenance and operation of the F-15EX would be similar to those currently used for maintenance and operation of the F-15C fleet.

Under Alternative 2, the total number of airfield operations would increase 27 percent compared to existing conditions/No Action Alternative and 18 percent compared to Alternative 1; therefore, throughput of petroleum substances and hazardous waste streams would be expected to increase commensurate with the increase in activity, but less unscheduled maintenance would be required on the modern aircraft. Thus, Alternative 2 would potentially involve more hazardous material usage, and generate more hazardous waste. Although there would be an increase in hazardous materials usage and hazardous waste generation, no significant impacts would be expected.

4.8.1.3 Alternative 3

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue, and no additional personnel would be added to support an air-to-ground mission. The previously planned construction and repair projects required for current mission sustainment would be implemented. Construction impacts would be similar in nature to those described for Alternatives 1 and 2 but would result in less ground disturbance. Therefore, impacts to hazardous materials, hazardous waste, toxic substances, or ERP sites would be similar to, but less than those described for Alternative 1. Additionally, under Alternative 3, the ANG would continue to conduct their current mission using existing aircraft. Hazardous materials and waste for operational activities would not be expected to change. Increased maintenance needs for the F-15C as the aircraft continues to age may result in a slight increase in the total amount of hazardous materials and wastes used over time but would continue to be managed under existing plans and procedures. Therefore, there would be no significant impacts to hazardous materials and wastes under Alternative 3.

4.8.1.4 No Action Alternative

Under the No Action Alternative, the current F-15C platform would continue to fly to their maximum service life. The existing air-to-air mission would continue with use of the Portland ANG installation associated airspace. No construction projects are proposed to occur at the Portland ANG installation under the No Action Alternative. Thus, implementation of the No Action Alternative would not be expected to create significant impacts to hazardous materials and wastes.

4.9 BIOLOGICAL RESOURCES

4.9.1 Impacts

4.9.1.1 Alternative 1

Construction Impacts

Vegetation

The installation is composed of cleared or developed land and landscaped areas such as lawns, shrubbery, ornamental trees and maintained open fields of grass. Under Alternative 1, up to an additional 214,802 SF of new impervious surfaces would be built on currently paved areas or actively managed (i.e., mowed and landscaped) areas. Therefore, impacts on vegetation would not be significant under this alternative.

Wildlife

Construction activities would be limited to installation boundaries, and under Alternative 1, impacts on wildlife due to construction at the Portland ANG installation would be minor. Noise associated with construction may cause wildlife to temporarily avoid the area, including those birds which are protected under the MBTA (23 of which may occur at the installation). Noise associated with construction activities, as well as an increase in general industrial activity and human presence, could evoke reactions in these birds. Disturbed nests in the immediate vicinity of construction activity would be susceptible to abandonment and depredation. However, bird and wildlife populations in the vicinity of the installation where project components would occur are accustomed to elevated noise associated with aircraft and general military industrial use. As a result, indirect impacts from construction noise are expected to be minor because the ambient noise levels within the vicinity are higher under existing conditions/No Action Alternative and would be unlikely to substantially increase by the relatively minor and temporary nature of Alternative 1.

Construction, renovation, and demolition projects associated with Alternative 1 would eliminate or displace wildlife from the project footprints and their vicinities. Individuals of the smaller, less mobile, and burrowing species could be killed or injured by construction in new footprints, whereas mobile species (e.g., birds and larger mammal species) would disperse to surrounding areas. However, wildlife occurrence within the installation is very limited because habitat quality is poor and primarily composed of developed land and landscaped areas such as lawns, ornamental trees, or maintained open fields of grass. Any loss of commonly occurring individuals would not represent a noticeable portion of the population; therefore, no significant impacts would occur to wildlife with implementation of Alternative 1.

Threatened, Endangered, and Special Status Species

Five federally listed species have the potential to occur on the installation; however, as described in Section 3.9.2, none are known to occur at the Portland ANG installation and no construction would occur beneath the training airspace.

One federally listed species, the streaked horned lark, has been known to reside on adjacent property owned by the Port of Portland. No observations of the species have been made since surveys began in 2006 (likely due to urbanization and a general lack of suitable habitat). PDX wildlife management staff patrol the Portland ANG installation daily during the nesting season to determine presence and abundance of streaked horned larks (Oregon ANG 2022e). Adherence to the installation's existing BASH program protocols would minimize the potential for these incidents, even with an increase in both flight operations and seasonal migratory bird activity. Due to the overall lack of occurrence of federally listed species, construction associated with Alternative 1 would have no effect on federally listed species. Impacts on potentially occurring state listed, MBTA and BGEPA-protected species on the installation and underlying the 142 WG airspace would be similar to those described within the wildlife section and would be less than significant.

Wetlands

As shown in Figure 3.9-1, none of the proposed construction or facility modification projects associated with Alternative 1 are located in or adjacent to any wetland area; therefore, there is no anticipated impact to wetlands.

Operational Impacts

Wildlife

Operational noise levels at the Portland ANG installation would be expected to increase from the affected environment with the conversion to the F-15EX aircraft. As discussed in Section 2.3.2, the total number of annual airfield operations at the installation is proposed to increase by 9 percent from existing conditions/No Action Alternative, or by 446 operations, with the basing of the F-15EX. However, a total of 1,493 acres located outside of PDX property (primarily commercial and industrial lands) would be exposed to 65 dB DNL or greater noise levels, which would be a decrease of 929 acres from existing conditions/No Action Alternative. Additionally, species on and near the installation are likely accustomed to elevated noise levels associated with aircraft and military operations (Bowles 1995). Therefore, operational noise is not expected to significantly impact terrestrial species in the area.

The increase in airfield operations may result in a slightly increased potential for bird/wildlife aircraft strikes to occur, especially with migratory birds due to the installation's location within the Pacific flyway. Adherence to the existing BASH program guidelines would minimize the risk of bird/wildlife aircraft strikes (see Section 3.7). The 142 WG has developed procedures designed to minimize the occurrence of bird/wildlife aircraft strikes and to monitor and react to heightened risk of bird/wildlife aircraft strikes. When risk increases due to daily and seasonal bird movements, limits are placed on low-altitude flight and some types of training (e.g., multiple approaches, closed pattern work) in the airport environment. For example, under the most severe conditions, flight below 3,500 feet AGL must be avoided to avoid wildlife strikes (Oregon ANG 2020c). Special briefings are provided to pilots whenever the potential exists for increased bird/wildlife aircraft strikes within the airspace. The installation BASH plan also establishes a BASH working group with responsibilities designated to members, and prescribes protocols, recommendations, and guidelines for minimizing BASH hazards.

The types of airspace operations, altitudes flown, and frequency of use of existing airspace by the 142 WG would remain similar to existing activity because the mission requirements would not change under Alternative 1. Therefore, there would be no significant impacts on wildlife within the SUA expected under Alternative 1.

Threatened, Endangered, and Special Status Species

Annual airfield and airspace operations at the Portland ANG installation are projected to increase under Alternative 1. Federally and state listed species that have the potential to occur on the installation and under the airspace are listed in Table 3.9-1. As described in Section 3.9.2, *Existing Conditions*, none are known to occur at the Portland ANG installation. Operational impacts to threatened, endangered, and special status species would be similar to those described for construction impacts. Changes in operational noise are not expected to impact species in the area because species on and near the installation are likely accustomed to elevated noise levels associated with aircraft and military operations (Bowles 1995). As mentioned in Section 3.9, provisions for "incidental take" under the ESA for streaked horned larks "taken" by aircraft/wildlife strikes was provided by the USFWS when they promulgated a special 4(d) rule at the time of listing (USFWS 2013). Since streaked horned larks do not breed on the installation, nor do they use heavily vegetated areas, regular operation and maintenance activities, such as mowing and landscape maintenance would not have an adverse effect on the species. The resulting overall difference in noise under the airspace would be minimal, with approximately +2.6 dB that would be added to the existing noise levels and L_{dnmr} ranging from 38 to 49 dB. Therefore, implementation of Alternative 1 would have no effect on federally listed species. Impacts on potentially occurring state listed, MBTA and BGEPA-protected species on the installation and underlying the 142 WG airspace would be similar to those described within the wildlife section and would be less than significant.

As discussed in Section 3.9.2.3, bald and golden eagles may occur under the 142 WG airspace; however, there are no eagle nests on or in the vicinity of the installation. To reduce potential impacts to eagles that may occur under the airspace, the following avoidance and minimization measures would be adhered to:

- During the breeding season (February to June), do not operate fixed-wing aircraft within 0.5 miles of nest locations.
- Do not locate aircraft corridors within 1,000 feet vertical or horizontal distance from communal roost sites.
- Minimize disruptive activities in the direct flight path between eagle nests and their roost sites and important foraging areas.

Although bald and golden eagles may occur and nest in areas below the airspace adverse effects to bird species are not expected from proposed changes in airspace use, as previously described. With adherence to the avoidance and minimization measures above, impacts to bald and golden eagles would be less than significant and would not rise to the level of "take" under the BGEPA.

Military readiness operations are exempt from the prohibitions of the MBTA, provided they do not result in a significant adverse effect on population of migratory bird species. Regardless, migratory birds occurring on the installation would not be expected to be impacted by the noise from the F-15EX at the Portland ANG installation since they would already be habituated to aircraft noise from existing operations. An increase in airfield operations may result in a slight increased potential for bird/wildlife aircraft strikes to occur, including those with migratory birds. However, adherence to the existing BASH program guidelines would minimize the risk of bird/wildlife aircraft strikes; therefore, no significant impacts would occur.

4.9.1.2 Alternative 2

Impacts on biological resources from construction would be the same as those described under Alternative 1.

Operational impacts would be similar to those described for Alternative 1, but under Alternative 2 airfield operations would increase approximately 27 percent over existing conditions/No Action Alternative (1,328 annual operations), which represents a 17 percent increase in airfield operations compared to Alternative 1. A total of 1,515 acres located outside of PDX property (primarily commercial and industrial lands) would be exposed to 65 dB DNL or greater noise levels, which would be a decrease of 908 acres from existing conditions/No Action Alternative. As with

Alternative 1, the F-15EX aircraft would utilize existing military airspace and military training ranges and would continue the use of chaff and flares in authorized airspace under Alternative 2. Thus, impacts on potentially occurring federally or state listed species underlying the 142 WG airspace would be similar to those described under Alternative 1. Changes in operational noise are not expected to impact terrestrial species in the area because species are likely accustomed to elevated noise levels associated with aircraft and military operations (Bowles 1995). Therefore, no significant impacts on wildlife and special status species from airfield operations under Alternative 2 would occur.

4.9.1.3 Alternative 3

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue, and no additional personnel would be added to support an air-to-ground mission. The previously planned construction and repair projects required for current mission sustainment would be implemented. Construction impacts would be similar in nature to those described for Alternatives 1 and 2 but would result in less ground disturbance. Thus, impacts on biological resources would be similar to but less than those described for Alternative 1. As with Alternative 1, the entirety of the proposed footprint would be constructed in an already urbanized area and would not cause increased effects to wildlife, special status species, vegetation, or wetlands. Therefore, no significant impacts on biological resources would occur with implementation of Alternative 3.

4.9.1.4 No Action Alternative

Under the No Action Alternative, the current F-15C platform would continue to fly to their maximum service life. The existing air-to-air mission would continue with use of the Portland ANG installation associated airspace. No construction projects are proposed to occur at the Portland ANG installation under the No Action Alternative. Thus, implementation of the No Action Alternative would not be expected to create significant impacts on biological resources.

4.10 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

4.10.1 Impacts

In order to comply with EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, and EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, areas containing relatively high disadvantaged or youth populations are given special consideration regarding potential impacts in order to address the potential for disproportionately high or adverse human health or environmental effects to these communities.

Ethnicity and poverty status in the vicinity of the Proposed Action have been examined and compared to county data to determine if any minority or low-income communities could potentially be disproportionately affected by implementation of the Proposed Action.

Three criteria must be met for impacts to minority and low-income communities to be considered significant: (1) there must be one or more such populations within the ROI, (2) there must be adverse impacts from the Proposed Action, and (3) the environmental justice populations within the ROI must bear a disproportionate burden of those adverse impacts. If any of these criteria are not met, then impacts with respect to environmental justice would not be significant. Children are more susceptible to certain adverse impacts such as environmental contaminants or impacts on learning from noise disturbances.

4.10.1.1 Alternative 1

Under Alternative 1, the F-15C aircraft would be replaced by one squadron of F-15EX aircraft, to include 20 aircraft and associated personnel, including the specifically itemized construction and structural improvement projects necessary to facilitate the multi-role (air-to-air and air-to-ground) mission conversion requirements efficiently and effectively.

Construction Impacts

The Portland area has a large population base with an established construction industry and therefore, construction workers would likely be hired from the surrounding area and would not create a population increase or an increase in demand for housing or services. Construction spending would be a minor beneficial impact on economic activity, employment, and wages.

Construction activities would occur within the Portland ANG installation boundary and there are no residential areas adjacent that would be impacted by noise, traffic, dust, or emissions. Therefore, there would be no disproportionately high and adverse health or environmental effects on minority and low-income populations.

Children are not likely to be present without supervision at the Portland ANG installation and there are no locations adjacent to the Portland ANG installation where children would likely be present. Therefore, there would be no environmental health and safety risks that would disproportionately affect children.

Operational Impacts

During operation of Alternative 1, an additional 110 personnel would be required. If all 110 personnel would relocate from outside the area and bring an average-sized family with them (2.6 people per household, see Table 3.10-4), this would lead to a population increase of 286 people.

This would be an increase of less than 0.1 percent over the current population of Multnomah County (see Table 3.10-1). If each family would require a housing unit this would be a demand of 110 units, which is less than 0.1 percent of the housing units in Multnomah County and 0.6 percent of the vacant housing units (see Table 3.10-4). According to the DoD Demographics Profile of the Military Community, 61.4 percent of the average 1.2 family members are children (DoD 2020b). This would lead to roughly 0.74 children per employee which would total 81.4 children and if we assume all the children are school-aged, this would be a 0.1 percent increase in the number of students in Multnomah County. Impacts on population, housing, and schools would be minor and would be offset by the stimulus created by the additional employment and wages in the ROI.

Operation of the F-15EX aircraft would decrease noise levels to the northwest and southeast of the Portland ANG installation, primarily over commercial or industrial use or over the water. The 65 dB DNL noise contour would increase slightly to the southwest and northeast over airport property, an uninhabited island in the Columbia River, and over the water. Tables 4.10-1 and 4.10-2 show how the affected household and population numbers change under the noise contours associated with the F-15EX operations under Alternative 1. Under Alternative 1, 12 households and 44 people would be affected by noise levels of 65 dB or greater, which is a decrease of 31 households and 88 people from existing conditions/No Action Alternative. Of the total households exposed to these noise levels, 14 percent of households are low income. This is slightly greater than the Multnomah County reference of 13 percent. Additionally, of the population exposed to these noise levels, 30 percent are minorities and 7 percent are under the age of 18. These percentages are less than the Multnomah County reference at 31 percent and 19 percent, respectively. The percentage of elderly people exposed to these noise levels under Alternative 1 is the same as the Multnomah County reference at 13 percent.

Table 4.10-1 Total Households and Low-income Households Affected by Noise Greater than 65 dB DNL Under Alternative 1

Noise Level (dB DNL)	*Affected Total Households – Existing Conditions/No Action Alternative*	*Affected Total Households – Alternative 1*	*Affected Low-income Households – Alternative 1*	*Percent Low-income*
65–70	43	11	2	14%
70–75	1	1	0	0%
75–80	0	0	0	0%
80–85	0	0	0	0%
85+	0	0	0	0%
Total	**44**	**12**	**2**	**14%**

Legend: % = percent; dB = decibel; DNL = Average Day-Night Sound Level.
Source: USCB 2020b.

Table 4.10-2 Total Population, Minority Low-income, Children and Elderly Populations Affected by Noise Greater than 65 dB DNL Under Alternative 1

Noise Level (dB DNL)	*Affected Total Population – Existing Conditions/ No Action Alternative*	*Affected Total Population – Alternative 1*	*Affected Minority Population – Alternative 1*	*Percent Affected Minority Population – Alternative 1*	*Affected Population Children Under 18 – Alternative 1*	*Percent Affected Population Children Under 18 – Alternative 1*	*Affected Population Elderly – Alternative 1*	*Percent Affected Population Elderly – Alternative 1*
65–70	124	37	11	30%	3	7%	5	14%
70–75	9	8	3	32%	0	5%	1	8%
75–80	0	0	0	0%	0	0%	0	0%
80–85	0	0	0	0%	0	0%	0	0%
85+	0	0	0	0%	0	0%	0	0%
Total	**133**	**44**	**13**	**30%**	**3**	**7%**	**6**	**13%**

Legend: % = percent; dB = decibel; DNL = Average Day-Night Sound Level.
Source: USCB 2020b.

Figure 4.10-1 shows existing conditions/No Action Alternative and proposed noise contours in the ROI over minority and low-income areas and locations where children would likely be present. In most locations, there would be a decrease and noise levels would remain at levels compatible with the current use. Therefore, there would not be disproportionately high and adverse health or environmental effects on minority and low-income populations.

As described in Section 4.1, under Alternative 1, three school locations would be exposed to outdoor $L_{eq(8hr)}$ at or above 60 dB, the same number of locations as under existing conditions/No Action Alternative. The Helensview High School $L_{eq(8hr)}$ would decrease from 61 to 60 dB, the Bridges Middle school would decrease from 65 dB to 61 dB, and the former ITT Technical Institute would decrease from 73 dB to 70 dB. Therefore, there are no environmental health and environmental health and safety risks that would disproportionately affect children.

4.10.1.2 Alternative 2

Under Alternative 2, impacts would be similar to those described under Alternative 1 although there would be 24 aircraft rather than 20. Construction impacts under Alternative 2 would be the same as those described under Alternative 1. Construction spending would be a minor beneficial impact on economic activity, employment, and wages. Impacts on minority and low-income populations under construction of Alternative 2 would be similar to those described for Alternative 1, and there would not be residential areas adjacent to work areas. Therefore, there would be no disproportionately high and adverse health or environmental effects on minority and low-income populations.

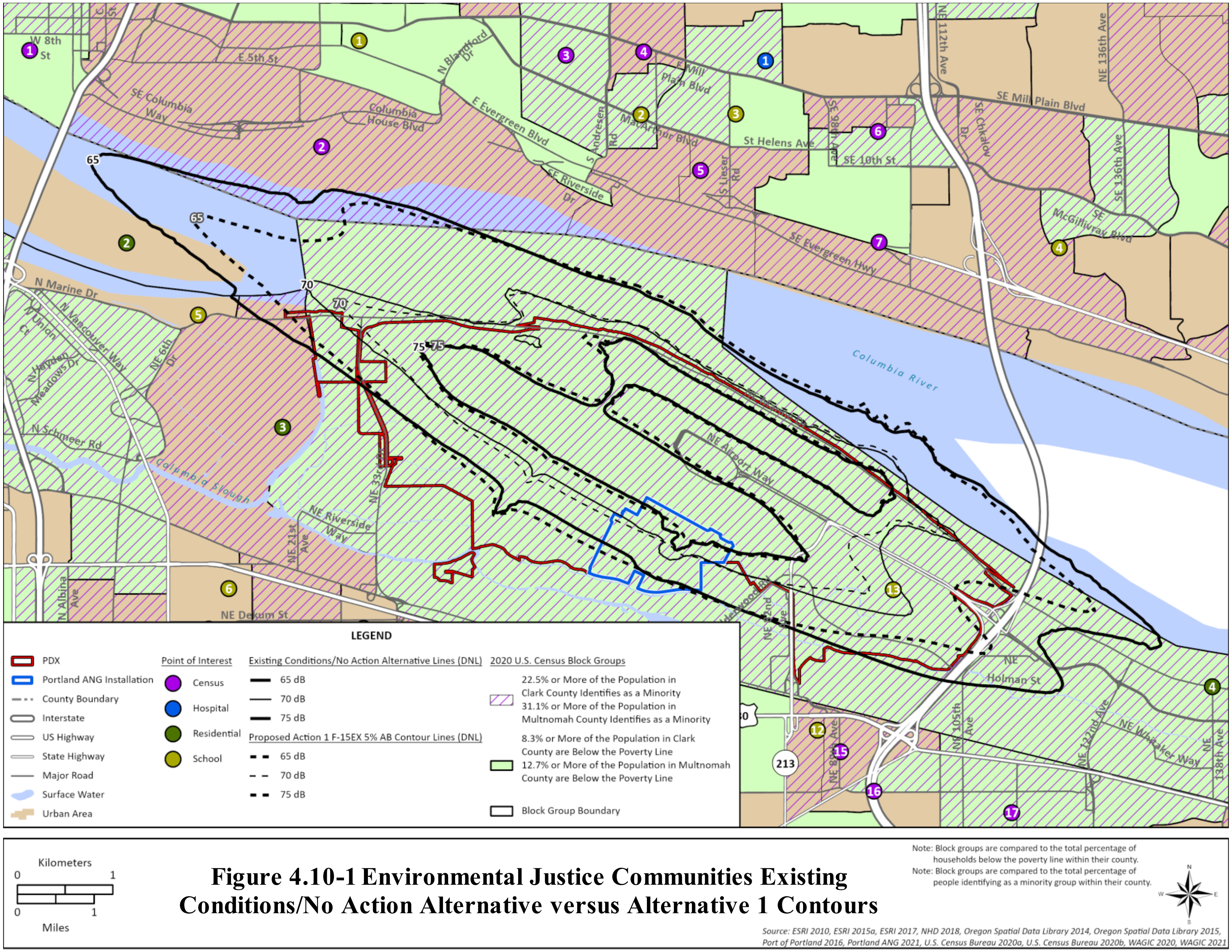

Figure 4.10-1 Environmental Justice Communities Existing Conditions/No Action Alternative versus Alternative 1 Contours

Children are not likely to be present without supervision at the Portland ANG installation and there are no locations adjacent to the Portland ANG installation where children would likely be present. Therefore, there are no environmental health and safety risks that would disproportionately affect children.

The same number of additional personnel would be required under operation of Alternative 2 as under Alternative 1. Therefore, impacts on population, housing, and schools would be minor and would be offset by the stimulus created by the additional employment and wages in the ROI.

Noise impacts under Alternative 2 would be similar to Alternative 1, but would affect a slightly larger area (Figure 4.10-2). Tables 4.10-3 and 4.10-4 show how the affected household and population numbers change under the noise contours associated with the F-15EX operations under Alternative 2. Under Alternative 2, 15 households and 54 people would be affected by noise levels of 65 dB or greater. Of the total households exposed to these noise levels, 15 percent of households are low income. This is slightly greater than the Multnomah County reference of 13 percent. Additionally, of the population exposed to these noise levels, 31 percent are minorities and 8 percent are under the age of 18. The minority population percentage is the same as the Multnomah County reference at 31 percent, and the percentage of children is less than the reference county at 19 percent. The percentage of elderly people exposed to these noise levels under Alternative 2 is the same as the Multnomah County reference at 13 percent.

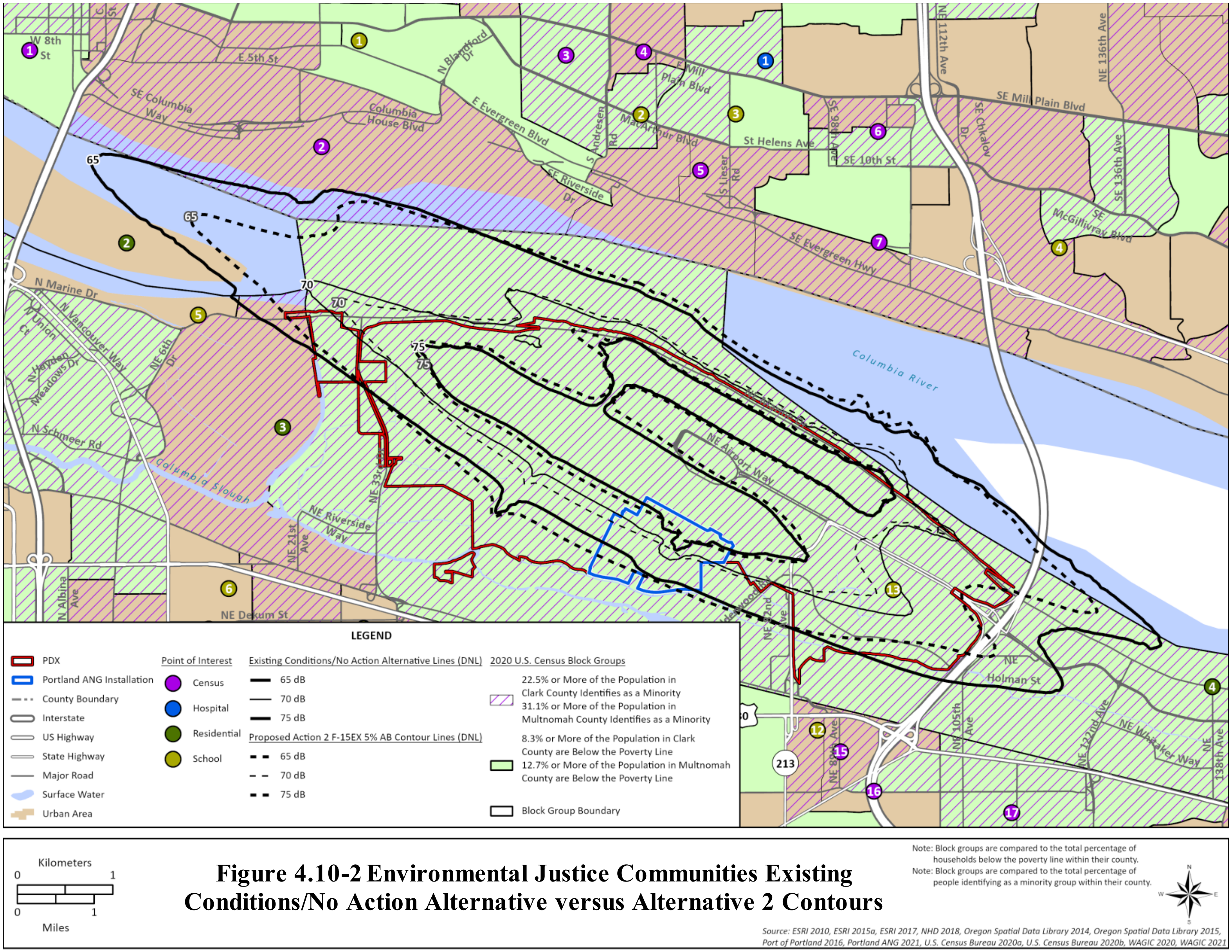

Figure 4.10-2 Environmental Justice Communities Existing Conditions/No Action Alternative versus Alternative 2 Contours

Table 4.10-3 Total Households and Low-income Households Affected by Noise Greater than 65 dB DNL Under Alternative 2

Noise Level (dB DNL)	*Affected Total Households – Existing Conditions/ No Action Alternative*	*Affected Total Households – Alternative 2*	*Affected Low-income Households – Alternative 2*	*Percent Low-income*
65–70	43	14	2	12%
70–75	1	1	0	0%
75–80	0	0	0	0%
80–85	0	0	0	0%
85+	0	0	0	0%
Total	**44**	**15**	**2**	**15%**

Legend: % = percent; dB = decibel; DNL = Average Day-Night Sound Level.
Source: USCB 2020b.

Table 4.10-4 Total Population, Minority Low-income, Children and Elderly Populations Affected by Noise Greater than 65 dB DNL Under Alternative 2

Noise Level (dB DNL)	*Affected Total Population – Existing Conditions/ No Action Alternative*	*Affected Total Population – Alternative 2*	*Affected Minority Population – Alternative 2*	*Percent Affected Minority Population – Alternative 2*	*Affected Population Children Under 18 – Alternative 2*	*Percent Affected Population Children Under 18 – Alternative 2*	*Affected Population Elderly – Alternative 2*	*Percent Affected Population Elderly – Alternative 2*
65–70	124	44	13	30%	4	8%	6	14%
70–75	9	9	3	32%	1	5%	1	8%
75–80	0	0	0	0%	0	0%	0	0%
80–85	0	0	0	0%	0	0%	0	0%
85+	0	0	0	0%	0	0%	0	0%
Total	**133**	**54**	**16**	**31%**	**4**	**8%**	**7**	**13%**

Legend: % = percent; dB = decibel; DNL = Average Day-Night Sound Level.
Source: USCB 2020b.

Residential areas would be newly exposed to noise levels above the recommended compatible use threshold of 65 dB DNL. Residential areas that would be newly exposed to the incompatible noise levels include block groups that are minority or low-income and block groups that are not minority or low-income. Therefore, there would not be disproportionately high and adverse health or environmental effects on minority and low-income populations.

Three school locations would be exposed to outdoor $L_{eq(8hr)}$ at or above 60 dB, the same number of locations as under existing conditions/No Action Alternative. The Helensview High School $L_{eq(8hr)}$ would remain the same (62 dB), while the Bridges Middle school would decrease from 65 dB to 61 dB and the former ITT Technical Institute would decrease from 73 dB to 70 dB. Therefore, there are no environmental health and safety risks that would disproportionately affect children.

4.10.1.3 Alternative 3

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue, and no additional personnel would be added to support an air-to-ground mission. The previously planned construction and repair projects required for current mission sustainment would be implemented. Construction impacts would be similar in nature to those described for Alternatives 1 and 2, but would result in less ground disturbance. Construction spending would be a minor beneficial impact on economic activity, employment, and wages; there would be no disproportionately high and adverse health or environmental effects on minority and low-income populations during construction or operations; and there would be no environmental health and safety risks that would disproportionately affect children. During operations, existing conditions/No Action Alternative would remain unchanged, and no significant impacts would occur.

4.10.1.4 No Action Alternative

Under the No Action Alternative, the current F-15C platform would continue to fly to their maximum service life. The existing air-to-air mission would continue with use of the Portland ANG installation associated airspace. No construction projects are proposed to occur under the No Action Alternative. Thus, implementation of the No Action Alternative would not be expected to create significant impacts to socioeconomics or environmental justice.

4.11 LAND USE

4.11.1 Impacts

The following section describes the affected environment and examines the extent to which the beddown of the F-15EX at the Portland ANG installation would be consistent with state, regional, and local conservation and development plans and zoning regulations. To provide a comparable data set between the City of Portland and Clark County, local zoning categories were consolidated and/or renamed. Table 4.11-1 provides a cross-reference between the county classifications and those used in this analysis.

Table 4.11-1 Zoning Categories

Zoning Classification	*EA Zoning Classification*
City of Portland[1]	
Commercial Employment	Commercial
General Employment 2	Industrial
General Industrial 2	Industrial
Open Space	Open Space/Recreation/Forest
Residential	Residential
Residential Farm/Forest	Residential
Clark County[2]	
Commercial City Center	Commercial
Commercial Waterfront Mixed Use	Mixed Use
Heavy Industrial or Light Industrial	Industrial
Park/Greenway	Open Space/Recreation/Forest
Water	Water

Notes: [1]The City of Portland includes zoning acreage over the Columbia River that crosses a majority of the river up to the Clark County border; therefore, this acreage includes water and land in each respective zoning category.
[2]Clark County does not include water in their zoning acreage and includes water as a separate category.
Source: Clark County 2022.

4.11.1.1 Alternative 1

<u>*Construction Impacts*</u>

Under Alternative 1, proposed construction, demolition, and renovation activities would occur solely within the boundary of the Portland ANG installation. Minor traffic and/or noise disruptions to local businesses and employees at the Portland ANG installation would occur. However, construction activities would be temporary and would occur during normal business hours. No construction projects would occur within designated RPZs. RPZ dimensions are specific to the aircraft flown at an airfield and the replacement F-15EX aircraft utilizes the same airframe as the F-15C and thus would not require a change to RPZ layouts.

The proposed construction activities would improve efficiency in daily operations by providing more efficient and secure operations for the 142 WG. Land uses would be consistent with current functions on the installation and the airport, and all facilities would be designed and sited to be compatible with existing land uses and safety guidelines. Impacts as a result of construction to adjacent land use or land use on the Portland ANG installation would be negligible as land use immediately surrounding the installation is zoned for industrial uses, construction is located solely within the boundary of the Portland ANG installation, and minor traffic and/or noise disruptions would be short term and intermittent.

Construction of the improvements associated with Alternative 1 would occur on the Portland ANG installation property and would not directly impact any Section 4(f) properties. No physical use or temporary occupancy of a 4(f) property for project construction-related activities would occur.

<u>Operational Impacts</u>

Under Alternative 1, annual operations would increase by 446 operations (9 percent increase) with the new F-15EX airframe. The land use analysis compares the proposed noise contours to current noise contours, which show the existing noise environment. The comparison of the proposed contours to the current contours shows potential change in noise conditions and land use compatibility (Table 4.11-2 and Figure 4.11-1). The length of the 65 dB DNL contour would reduce by approximately 4,200 feet to the northwest of the installation and 2,800 feet to the southeast when compared to current conditions. These areas of reduction are primarily commercial, residential, open space, and industrial. The 65 dB DNL would increase in width to the southwest and northeast approximately 100 feet over primarily airport property or an uninhabited island (Lemon Island) in the Columbia River.

Table 4.11-2 Off-Airport Zoning Acreage Affected by Noise Levels 65 dB and Greater under Alternative 1

Zoning Category	*Existing/ No Action 65–70 dB DNL*	*Proposed Alternative 1 65–70 dB DNL*	*Change in Acres*	*Existing/ No Action 70–75 dB DNL*	*Proposed Alternative 1 70–75 dB DNL*	*Change in Acres*	*Existing/ No Action 75–80 dB DNL*	*Proposed Alternative 1 75–80 dB DNL*	*Change in Acres*
Residential[1]	273	138	-136	2	0	-1	0	0	0
Commercial[1]	237	62	-175	0	0	0	0	0	0
Industrial[1]	584	386	-198	72	50	-22	0	0	0
Open Space/ Recreation/ Forest[1]	711	623	-88	153	145	-7	4	5	+1
Water[2]	361	244	-118	0	0	0	0	0	0
Total	**2,168**	**1,453**	**-715**	**226**	**195**	**-31**	**4**	**5**	**+1**

Notes: Numbers may not add up due to rounding.
[1]The City of Portland includes zoning acreage over the Columbia River that crosses a majority of the river up to the Clark County border; therefore, this acreage includes water and land in each respective zoning category.
[2]Clark County does not include water in their zoning acreage and includes water as a separate category.
Legend: dB = decibel; DNL = Day-Night Average Sound Level.

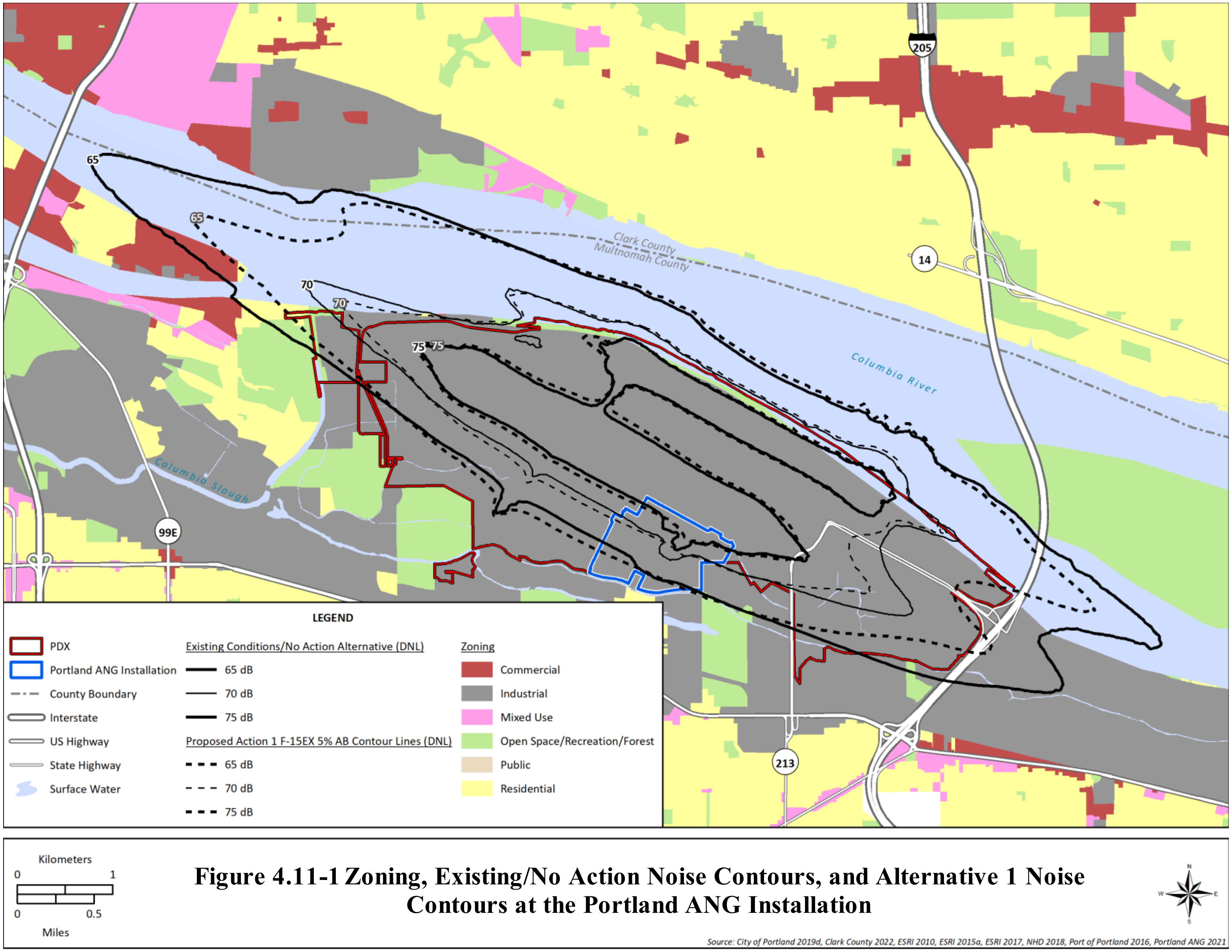

Figure 4.11-1 Zoning, Existing/No Action Noise Contours, and Alternative 1 Noise Contours at the Portland ANG Installation

Source: City of Portland 2019d, Clark County 2022, ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Port of Portland 2016, Portland ANG 2021

Alternative 1 would result in an overall decrease in the off-airport area affected by noise levels greater than 65 dB DNL by approximately 745 acres. Residential land use acreage would decrease 136 acres within the 65 to 70 dB DNL contour area and decrease 1 acre in the 70 to 75 dB DNL. Therefore, no significant operational impacts to land use compatibility would occur with implementation of Alternative 1.

<u>*Airspace*</u>

The F-15EX airframe would utilize existing military airspace and military training ranges, and would continue the use of chaff and flares. Total annual operations at PDX or the associated airspace would be slightly higher than existing conditions/No Action Alternative. A portion of the sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements. The result would increase the F-15EX use of NWSTF Boardman and Mountain Home SUA from 2 weeks per year at each location to 4 weeks per year at each location. The 142 WG operations would continue to represent a small portion of the overall flight operations. At NWSTF Boardman, Alternative 1 would represent 3.8 percent of the total annual fixed-wing operations (an increase of 2.3 percent from existing conditions/No Action Alternative). At Mountain Home, Alternative 1 represents approximately 1.6 percent of total annual flight operations in the SUA (an increase of 0.7 percent from existing conditions/No Action Alternative). Correspondingly, the F-15EX use of W-570 and Eel MOA would decrease, as the sorties would shift to NWSTF Boardman and Mountain Home SUA, while use of all other associated airspace would not change. Changes in noise levels and operations from the F-15C to the F-15EX airframe would occur primarily at elevations above 18,000 feet MSL and would not affect general land use patterns, land ownership, or management of lands or special use areas beneath the airspace. Impacts to land use under the SUA would not occur.

4.11.1.2 Alternative 2

Under Alternative 2, construction would be the same as described for Alternative 1. Alternative 2 would have an additional 1,328 annual operations compared to existing conditions/No Action Alternative (17 percent more than Alternative 1, 27 percent more than existing conditions/No Action Alternative). The comparison of the proposed Alternative 2 contours to the current contours shows potential change in noise conditions and land use compatibility (Table 4.11-3 and Figure 4.11-2). The length of the 65 dB DNL contour would reduce by approximately 4,100 feet to the northwest of the installation and 2,700 feet to the southeast when compared to existing conditions/No Action Alternative. These areas of reduction are primarily commercial, residential, open space, and industrial, and areas over the Columbia River. The 65 dB DNL would increase in width to the southwest and northeast approximately 300 feet over airport property or an uninhabited island (Lemon Island) in the Columbia River.

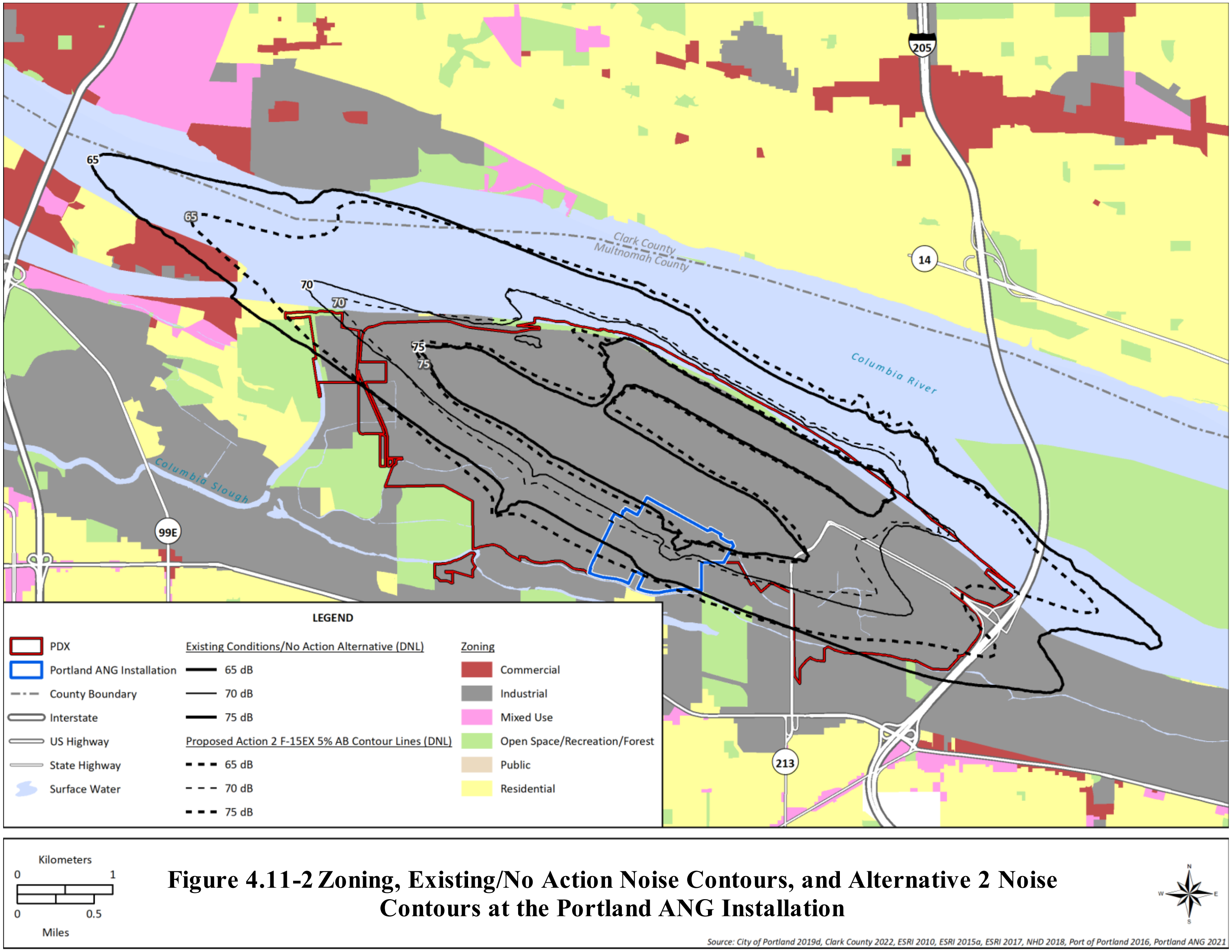

Figure 4.11-2 Zoning, Existing/No Action Noise Contours, and Alternative 2 Noise Contours at the Portland ANG Installation

Source: City of Portland 2019d, Clark County 2022, ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Port of Portland 2016, Portland ANG 2021

Table 4.11-3 Off-Airport Land Use Acreage Affected by Noise Levels 65 dB and Greater under Alternative 2

Zoning Category	*Existing/ No Action 65–70 dB DNL*	*Proposed Alternative 2 65–70 dB DNL*	*Change in Acres*	*Existing/ No Action 70–75 dB DNL*	*Proposed Alternative 2 70–75 dB DNL*	*Change in Acres*	*Existing/ No Action 75–80 dB DNL*	*Proposed Alternative 2 75–80 dB DNL*	*Change in Acres*
Residential[1]	273	143	-130	2	2	0	0	0	0
Commercial[1]	237	68	-170	0	0	0	0	0	0
Industrial[1]	584	389	-195	72	63	-9	0	0	0
Open Space/ Recreation/ Forest[1]	711	638	-74	153	168	+15	4	5	+1
Water[2]	361	281	-81	0	0	0	0	0	0
Total	**2,168**	**1,519**	**-649**	**226**	**232**	**+6**	**4**	**5**	**+1**

Notes: Numbers may not add up due to rounding.
[1]The City of Portland includes zoning acreage over the Columbia River that crosses a majority of the river up to the Clark County border; therefore, this acreage includes water and land in each respective zoning category.
[2]Clark County does not include water in their zoning acreage and includes water as a separate category.
Legend: dB = decibel; DNL = Day-Night Average Sound Level.

Alternative 2 would result in an overall decrease in the off-airport area affected by noise levels greater than 65 dB DNL by approximately 649 acres. Residential land use acreage would decrease 143 acres within the 65 to 70 dB DNL contour area and would remain the same (2 acres) within the 70 to 75 dB DNL contour area. Therefore, no significant operational impacts to land use compatibility would occur with implementation of Alternative 2.

The air-to-ground sorties under Alternative 2 would increase the use of NWSTF Boardman and Mountain Home SUA and would represent 3.8 percent of the total annual fixed-wing operations (an increase of 2.3 percent from existing conditions/No Action Alternative, and 0.4 percent compared to Alternative 1). At Mountain Home, Alternative 2 represents approximately 1.7 percent of total annual flight operations in the SUA (an increase of 0.7 percent from existing conditions/No Action Alternative, and 0.1 percent compared to Alternative 1). Correspondingly, the F-15EX use of W-570 and Eel MOA would decrease, as the sorties would shift to NWSTF Boardman and Mountain Home SUA, while use of all other associated airspace would not change. However, changes in noise levels and increases in operations from the F-15C to the F-15EX airframe would occur primarily at elevations above 18,000 feet MSL and would not affect general land use patterns, land ownership, or management of lands or special use areas beneath the airspace. Impacts to land use under the SUA would not occur.

4.11.1.3 Alternative 3

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue, and no additional personnel would be added to support an air-to-ground mission. The previously planned construction and repair projects required for the current F-15C mission would be implemented. Construction impacts would be similar in nature to those described for Alternative 1 but would be less intensive in magnitude as overall there would be less construction. Therefore, impacts to land use would be similar to but less than those described for Alternative 1, and no significant impacts to land use would occur.

4.11.1.4 No Action Alternative

Under the No Action Alternative, the current F-15C platform would continue to fly to their maximum service life. The existing air-to-air mission would continue with use of the Portland ANG installation associated airspace. No construction projects are proposed to occur at the Portland ANG installation under the No Action Alternative. Thus, implementation of the No Action Alternative would not be expected to create significant impacts to land use.

4.12 DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(f)

4.12.1 Impacts

4.12.1.1 Alternative 1

Section 4(f) Parks, Recreation Areas, and Refuges

As shown on Table 4.12-1 and Figure 4.12-1, there are four potential Section 4(f) resources that fall within the proposed noise contours from 70–85 dB DNL: Broughton Beach, M. James Gleason Memorial Boat Ramp Park, Columbia Slough Trail, and Marine Drive Trail. For 70 dB to 75 dB DNL, most recreational land uses are considered generally compatible up to 75 dB DNL. For parks, land uses are considered compatible up to 75 dB DNL. The 65 to 70 dB DNL are not presented in Table 4.11-3 as land use controls do not exist below 70 dB for recreational purposes.

As shown in Table 4.12-1 and Figure 4.12-1, Broughton Beach and the M. James Gleason Memorial Boat Ramp would experience a minor increase in acres under the 70 to 75 dB DNL when compared to existing conditions/No Action Alternative. The Columbia Slough Trail would experience a slight reduction in the miles under 70 to 75 dB DNL. The Marine Drive Trail, which runs along the edge of the Columbia River just north of the PDX boundary, would experience a slight reduction in miles under the 70 to 75 dB DNL and 75 to 80 dB DNL, and a slight increase (0.1 mile) under the 80 to 85 dB DNL. However, given that the existing acoustic environment is an airport environment (lack of a quiet setting), and direct airplane noise would be intermittent, constructive use of these Section 4(f) resources would not be of such magnitude as to effectively act as a permanent incorporation or to substantially impair these resources. Land use within the Section 4(f) resources remains compatible with Alternative 1 noise exposure levels.

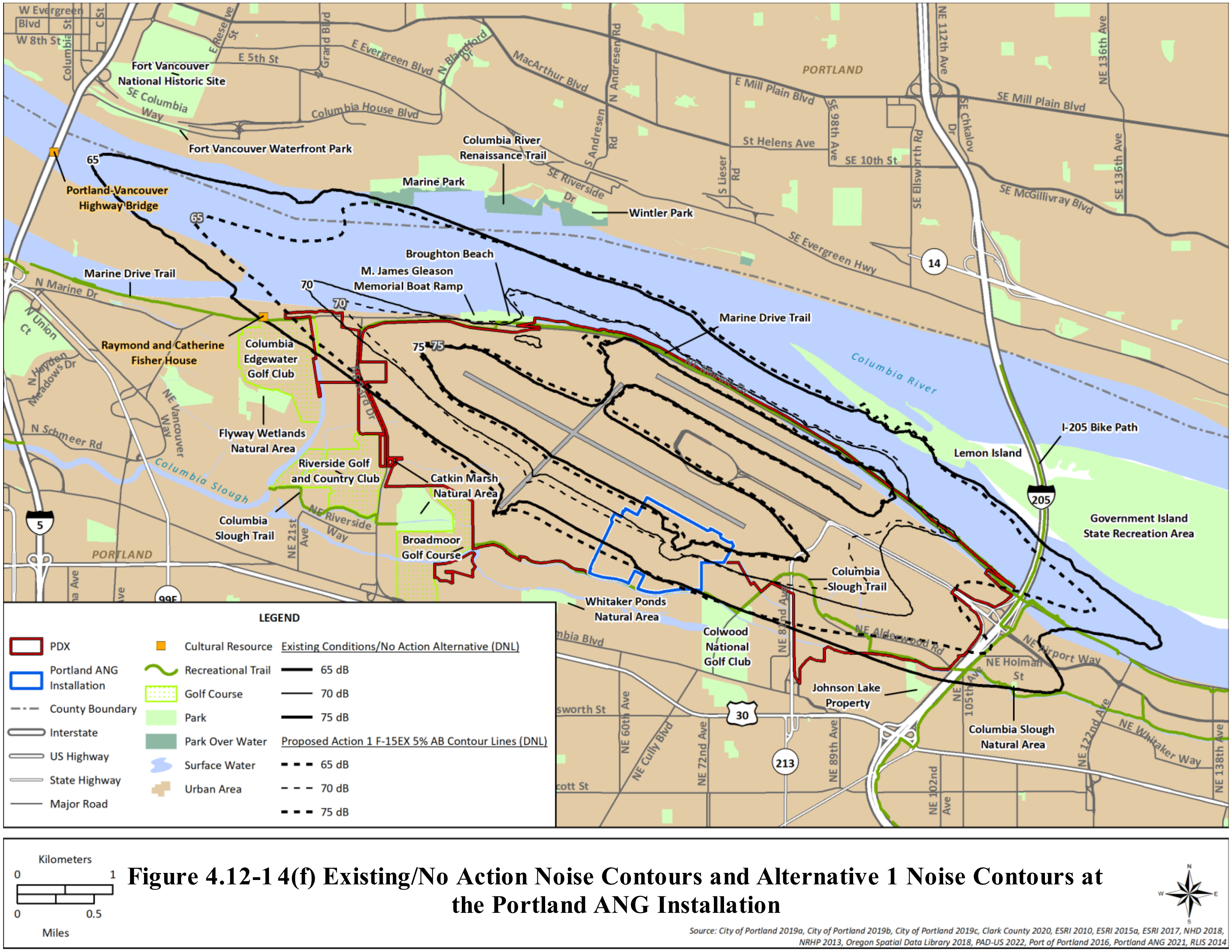

Figure 4.12-1 4(f) Existing/No Action Noise Contours and Alternative 1 Noise Contours at the Portland ANG Installation

Source: City of Portland 2019a, City of Portland 2019b, City of Portland 2019c, Clark County 2020, ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, NRHP 2013, Oregon Spatial Data Library 2018, PAD-US 2022, Port of Portland 2016, Portland ANG 2021, RLIS 2014

Table 4.12-1 Section 4(f) Resources Affected by Noise Levels 70 dB and Greater under Alternative 1

Section 4(f) Resource	*Existing/ No Action 70–75 dB DNL*	*Proposed Alternative 1 70–75 dB DNL*	*Change*	*Existing/ No Action 75–80 dB DNL*	*Proposed Alternative 1 75–80 dB DNL*	*Change*	*Existing/ No Action 80–85 dB DNL*	*Proposed Alternative 1 80–85 dB DNL*	*Change*
Broughton Beach	4.4 acres	4.6 acres	+0.2 acres	0	0	0	0	0	0
M. James Gleason Memorial Boat Ramp	3.9 acres	4.2 acres	+0.3 acres	0	0	0	0	0	0
Columbia Slough Trail	0.4 mile	0.3 mile	-0.1 mile	0	0	0	0	0	0
Marine Drive Trail	4.0 miles	3.9 miles	-0.1 mile	0.3 mile	0.2 mile	-0.1 mile	0.0 mile	0.1 mile	+0.1 mile

Legend: dB = decibel; DNL = Day-Night Average Sound Level.

Section 4(f) Historic Sites

Under Alternative 1, no Section 4(f) properties are present within the APE. Therefore, there would be no adverse effect to historic properties under Section 106 of the NHPA and adverse effect no constructive use, according to the Section 4(f) regulations regarding historic sites.

There would be no direct ground disturbance outside of the Portland ANG installation boundary. Therefore, the archaeologically sensitive areas are exempt per Section 4(f) regulations. Training activities would continue to utilize existing military airspace and military training ranges, and would continue the use of chaff and flares. As described in Section 4.1, F-15EX supersonic operations over land would continue to occur in the Juniper/Hart MOAs above 30,000 feet MSL. The F-15C and the F-15EX would be of similar airframe size and shape; therefore, producing similar sonic booms. Under Alternative 2, sonic boom events could increase up to 9 percent over existing conditions/No Action Alternative, but the associated impacts are anticipated to not be significant due to the altitudes at which supersonic activities would occur.

4.12.1.2 Alternative 2

Construction impacts as they relate to Section 4(f) resources would be similar in nature to those described for Alternative 1. Impacts to historic sites would be similar in nature to those described under Alternative 1. Alternative 2 would have an additional 1,328 annual operations compared to existing conditions/No Action Alternative (17 percent more than Alternative 1). The comparison of the proposed Alternative 2 noise contours to the current contours shows potential change in noise conditions and Section 4(f) compatibility (Table 4.12-2 and Figure 4.12-2). Impacts remain similar to those described under Alternative 1 with slightly higher change in acres as a result of the larger proposed noise contours. The 65 to 70 dB DNL are not presented in Table 4.12-2 as land use controls do not exist below 70 dB for recreational purposes.

Table 4.12-2 Section 4(f) Resources Affected by Noise Levels 70 dB and Greater under Alternative 2

Section 4(f) Resource	*Existing/ No Action 70–75 dB DNL*	*Proposed Alternative 1 70–75 dB DNL*	*Change*	*Existing/ No Action 75–80 dB DNL*	*Proposed Alternative 1 75–80 dB DNL*	*Change*	*Existing/ No Action 80–85 dB DNL*	*Proposed Alternative 1 80–85 dB DNL*	*Change*
Broughton Beach	4.4 acres	4.6 acres	+0.2 acres	0	0	0	0	0	0
M. James Gleason Memorial Boat Ramp	3.9 acres	4.2 acres	+0.3 acres	0	0	0	0	0	0
Columbia Slough Trail	0.4 mile	0.4 mile	0.0 mile	0	0	0	0	0	0
Marine Drive Trail	4.0 miles	4.0 miles	0.0 mile	0.3 mile	0.2 mile	-0.1 mile	0.0 mile	0.1 mile	+0.1 mile

Legend: dB = decibel; DNL = Day-Night Average Sound Level.

As with Alternative 1, given the existing acoustic environment is an airport environment (lack of a quiet setting) and direct airplane noise would be intermittent, constructive use of these 4(f) resources would not be of such magnitude as to effectively act as a permanent incorporation or to substantially impair these resources.

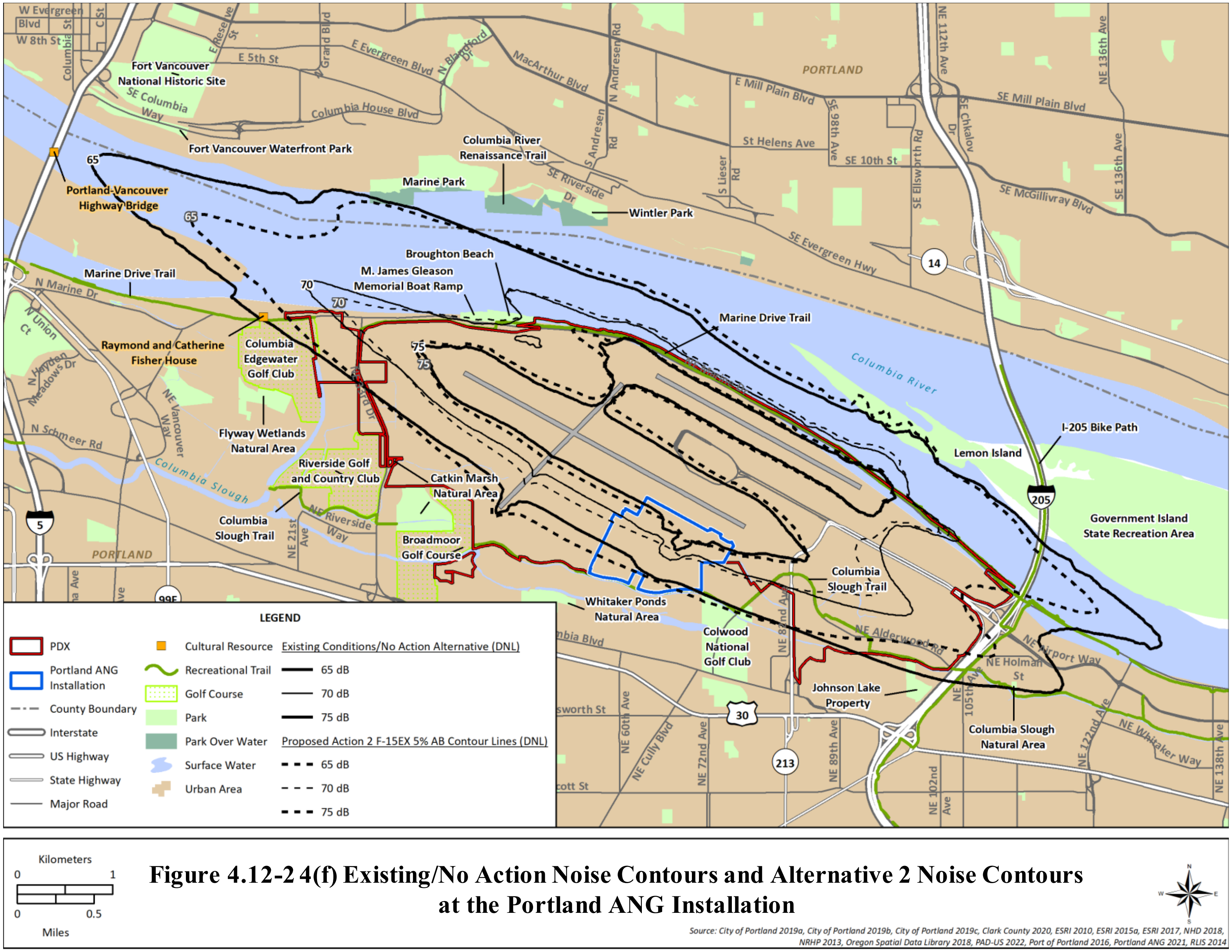

Figure 4.12-2 4(f) Existing/No Action Noise Contours and Alternative 2 Noise Contours at the Portland ANG Installation

Source: City of Portland 2019a, City of Portland 2019b, City of Portland 2019c, Clark County 2020, ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, NRHP 2013, Oregon Spatial Data Library 2018, PAD-US 2022, Port of Portland 2016, Portland ANG 2021, RLIS 2014

4.12.1.3 Alternative 3

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue, and no additional personnel would be added to support an air-to-ground mission. The previously planned construction and repair projects required for the current F-15C mission would be implemented. Construction impacts would be similar in nature to those described for Alternative 1 but would be less intensive in magnitude as overall there would be less construction. Therefore, impacts to Section 4(f) resources would be similar to but less than those described for Alternative 1, and no significant impacts would occur.

4.12.1.4 No Action Alternative

Under the No Action Alternative, the current F-15C platform would continue to fly to their maximum service life. The existing air-to-air mission would continue with use of the Portland ANG installation associated airspace. No construction projects are proposed to occur at the Portland ANG installation under the No Action Alternative. Thus, implementation of the No Action Alternative would not be expected to create significant impacts to Section 4(f) resources.

5.0 CUMULATIVE IMPACTS

5.1 CURRENT AND REASONABLY FORESEEABLE ACTIONS IN THE ROI

In this section, an effort was made to identify past and present actions in the region and those reasonably foreseeable actions that are in the planning phase at this time. Actions that have a potential to interact with the Proposed Action at the Portland ANG installation are included in this cumulative analysis. This approach enables decision-makers to have the most current information available so that they can evaluate the environmental consequences of the beddown of the F-15EX aircraft.

The Portland ANG installation is an active military installation that undergoes changes in mission and training requirements in response to defense policies, current threats, and tactical and technological advances. The installation, like any other major institution (e.g., university, industrial complex), requires new construction, facility improvements, infrastructure upgrades, and maintenance and repairs. In addition, tenant organizations may occupy portions of the installation, conduct aircraft operations, and maintain facilities. All of these actions (i.e., mission changes, facility improvements, and tenant use) will continue regardless of which alternative is selected.

The projects associated with this Proposed Action would have cumulative impacts on resources within the ROI and/or overlap in time; they are listed in Table 5.1-1. Other ongoing maintenance and repair activities would occur within the same footprint as current activities (i.e., repairing existing infrastructure and interior modifications) and would not introduce any newly disturbed or impervious surfaces and are, therefore, not included herein.

Table 5.1-1 Past, Present, and Reasonably Foreseeable Actions

Proponent	*Project Name*	*Anticipated Year for Implementation*
Navy	Military Readiness Activities at Naval Weapons Systems Training Facility Boardman. The Navy issued a ROD on March 31, 2016, selecting the preferred alternative identified in the Final EIS as Alternative 2. The modifications of SUA at NWSTF Boardman are the portion of that action with the potential to contribute to cumulative impacts related to the Proposed Action described in this EA. Following the issuance of the ROD, the expansion area was charted in December 2016. Existing 142 WG operations of the F-15C use this SUA, as will future proposed operations of the F-15EX, and the level of training operations in the SUA described under Alternative 2 have been considered as the current operating condition for the NWSTF Boardman SUA.	2016

Proponent	*Project Name*	*Anticipated Year for Implementation*
Oregon ANG	Proposed Establishment and Modification of Oregon Military Training Airspace. The DAF issued a ROD on August 29, 2017, selecting the preferred alternative identified in the EIS as the Proposed Action. The Proposed Action modifies existing ATCAAs and MOAs operated by the Oregon ANG, as well as establishes new MOAs and ATCAAs. Existing 142 WG operations of the F-15C use the airspace, as will future proposed operations of the F-15EX, and the level of training operations described in the EIS have been considered as the current operating condition for the Oregon airspace.	Past – Implemented in 2017
142 WG	Renovate Building 315. Received CATEX in October 2019. Renovate 304 Ready Crew Squadron Aircrew Flight Equipment facility to remove interior walls to provide an open office concept. Replace HVAC, ductwork and controls, light fixtures, fire alarm system, and electrical outlets. Replace floor tile, carpet, ceiling tile and interior doors, restroom plumbing fixtures and surface finishes, Repair or replace internal roof gutters. Building 315 was constructed in 1989 with no major renovations since. Renovations addressed safety hazards (tripping hazards, poor lighting, insufficient space).	2020
142 WG	Renovate Building 320. Received CATEX in August 2019. Renovate the 304 Ready Crew Squadron Aircrew Flight Equipment to include structural and non-structural renovations. Renovations addressed inadequate space and safety requirements.	2020
Port of Portland	PDX Improvement Projects (PDX Next): <u>Projects Completed Prior to 2021:</u> Flexible Transportation: Created space for light-rail and bike-path enhancements. All car rentals have been brought on-site and opened a flexible transit hub with 2,225 close-in parking spots. Concourse B: The completely redeveloped and expanded concourse includes six new gates for Alaska Airlines. To make room, Concourse A was demolished. Concourse E: In the works for more than 4 years, the freshly expanded Concourse E opened in July 2020, with six new gates for Southwest Airlines.	2021
142 WG	Repair HEF System/Hangar Doors: Interior renovation projects on a 28,018 SF Building. Project in progress as of 2021.	2021
142 WG	Repair Engine Shop HVAC (Building 260). Interior renovation project. Project in progress as of 2021.	2021
142 WG	Repair EOC/DCC (Building 170). Building repairs. Project in progress as of 2021.	2021
142 WG	Construct Flightline Access Gate.	2021
142 WG	Repair Ammo Shop (Building 310). Building repairs on a 24,582 SF building. Project in progress as of 2021.	2021
142 WG	Repair Base Chapel.	2021
142 WG	Repair Base Security.	2022
142 WG	Building 255 Construction and Repair Hangar/Shops. Building is 64,738 SF total.	2022

Proponent	*Project Name*	*Anticipated Year for Implementation*
ODOT	Northeast Airport Way Arterial Corridor Management. Project went to bid for construction September 2022. Installation of traffic signal controllers, CCTV cameras, fiber communication, and other infrastructure along Airport Way from 82nd Avenue to Riverside Parkway, which would be integrated into the City's, ODOT's, and TriMet's Transportation Operation Centers. No duration of construction provided.	2022
DAF	Airspace Optimization for Readiness for Mountain Home AFB. The Proposed Action is to optimize airspace available to Mountain Home AFB, Idaho to achieve and maintain proficiency at low altitudes in mountainous terrain with consistent low altitude floors. The Proposed Action evaluates lowering altitude floors across MOAs for supersonic training. Five action alternatives are under consideration with varying operational floors for low-altitude training (Alternatives 1–3) and supersonic operational floor altitudes (Alternatives A–B). Under Alternatives 1–3, sorties would be assumed to distributed more evenly among the MOAs due to the more consistent altitude floors. The lower operational floors may also result in the capability to conduct more large-scale exercises, so to account for this, other user's activities are anticipated to increase 5 percent over existing conditions. Chaff and flare use by local aircraft will continue at current levels but would increase correspondingly with the other user's projected increase in sorties. Existing 142 WG operations of the F-15C use the airspace, as will future proposed operations of the F-15EX.	2023
142 WG	Buildings 250/235 Construction. Received a CATEX in July 2020, project to construct a 6,500 square foot addition to Building 235, Structural Maintenance Shop, for corrosion control maintenance of aircraft parts and equipment. Facility will support paint stripping, medial blasting, and paint booth operation. Includes reconfiguration and consolidation all corrosion control functions (with the exception of the hangar wash bay) to building 235 provides the most efficient layout for that shop, includes upgrades to meet strict ventilation, exhaust, electrical, and fire suppression requirements and eliminates numerous safety write-ups and mitigation efforts to their existing facilities, and right-sizes this function. The paint booth is being displaced from Building 250 in order to make space for required repairs to the fuel cell maintenance bay.	2023
142 WG	Building 155 Construction and Communications Annex. Received a CATEX in July 2020. Construct a 5,000 square foot Communications Annex to support JISC, radio maintenance, administrative, and storage functions utilizing conventional design and construction methods to accommodate the mission of the facility. Specifically required is space for the storage and maintenance of the JISC, radio maintenance, vehicle radio maintenance and installation, storage, and communications administration. The spaces occupied in Buildings 170, 302, and 475 are all scheduled to be vacated in the coming years (170 through a facility reorganization/consolidation, 302 through conversion to other functions to aid consolidation, and building 475 through demolition prior to divesting land to the Port of Portland). Building 155 is the sole remaining Communications Flight facility and currently serves as their main facility. However, Building 155 is 8,826 SF and is undersized for the total requirement of 13,900 SF (36% undersized). Building 155 does not lend itself to a facility addition due to its configuration and location.	2023

Proponent	*Project Name*	*Anticipated Year for Implementation*
142 WG	Construct Power for Thor at Building 290. Electrical upgrades to the 8,566 SF AGE Maintenance Shop.	2023
Port of Portland	PDX Improvement Projects (PDX Next) to be completed in 2023: Rideshare Center. The dedicated rideshare pickup area arriving in 2023 will further streamline the transportation experience.	2023
Port of Portland	South Runway Panel/Joint Rehabilitation.	2023
City of Portland/Private Development	Dekum Court Apartments Redevelopment: The project is the redevelopment of the existing 40-unit Dekum Court Apartments. The Head Start building on the site would be demolished in order to build two new 3-story 24-unit apartment buildings. Existing Dekum residents will move into the new buildings and the remainder of the existing buildings on site would be demolished in order to build three additional apartment buildings and a community center on the site. The total units to be constructed is 187. In addition to new buildings, there will also be construction of additional site work, parking, playgrounds, and a public path through the site. Phase1 completion is anticipated in early 2023, with Phase 2 to completion to follow in late 2024.	2023
Port of Portland	Basin 6 Regional Stormwater Enhancement: Construction of a concrete dam in an existing stormwater pond, along with gates, valves, instrumentation, walkway, earthwork, bird netting-anchors, etc. at the south side of the PDX airfield.	2024
Port of Portland	Ramp Remain Overnight (RON) Ramp Completion: This project will remove an existing aircraft Lavatory-Dump facility and reconstruct in aircraft rated Portland Cement Concrete pavement. Other project elements include storm drainage and pavement markings.	2024
Port of Portland	Taxiway T, K North and Southwest Runway Exits: This project will reconstruct Taxiway K pavement between Gates D and E1. Rehabilitate pavement on Taxiway T North and South Runway exits (B1, B3, B4, C8, between Exits B4 and B5, E south exit, C east exit at 3/21 and C west arm/de-arm).	2024
142 WG	Building 265 Construction. Add/Alter to Squadron Operations Building.	2024
142 WG	Building 310 Construction.	2024
ODOT	OR99W: N. Schmeer Road-SW Meinecke Parkway and US30BY Kerby-165th Avenue. Upgrade signals, replace or modify signs and road markings, install lighting and bike lane conflict markings to improve safety on this section. Project is in the design phase, goes to bid in February 2024. No duration for construction listed. The portion near the airport that is affected would be the stretch of US30BY that runs east-west south of the airport.	2024
Port of Portland	Sanitary Lift Station Rehabilitation: Rehabilitation of sanitary lift stations at gate C15, gate D9, and midfield lift station.	2025
Port of Portland	Circulation and Capacity Improvements.	2025
Port of Portland	Taxiway A Rehabilitation and Reconstruction: Rehabilitation of Taxiway A including shoulder width upgrade and underground utility rehabilitation as needed.	2025
Port of Portland	Taxiway K West Rehabilitation: This project includes reconstruction of Taxiway K west of Taxiway A5.	2026
Port of Portland	Basin 1 Subarea Stormwater System Improvements.	2026

Proponent	*Project Name*	*Anticipated Year for Implementation*
142 WG	STS Complex Construction: This project would include the construction of a new 75,000 SF facility in the open field near the running track to support the 125 STS. The 125 STS is currently located in Buildings 360 and 365, which are located in Lease Parcel D-1 and scheduled for future giveback to the Port. Therefore, under this project, the 125 STS would relocate from Buildings 360 and 365 and consolidate functions currently housed in those two buildings into the new facility.	2026
Port of Portland	Runway LED Upgrades: This project upgrade Runway 10R-28L and Runway 3-21 lights to LED fixtures and for a new resilient building for airfield lighting system equipment.	2027
Port of Portland	Airport Fire and Rescue Asphalt Apron Rehabilitation	2027
Port of Portland	Basin 7 Regional Stormwater Treatment	2027
Port of Portland	Airport Fire and Rescue Fire Training Pit Improvements	2027
Port of Portland	Northwest Airfield Water Line Improvements Phase 3:	2027
Port of Portland	Airfield Joint Seal Replacement – Terminal Apron and Cargo Center	2027
Port of Portland	Airport Fire and Rescue Space Upgrades & Facility Rehab	2027
Port of Portland	Runway 10L/28R Reconstruction	2027/2028
142 WG	Lease Turn-backs of Parcels D-1 and D-2 and Associated Projects: Parcel D-1: This project would include the demolition of Buildings 315, 320, and 323 – a total of 22,448 SF – and giveback of Lease Parcel D-1 (6.96 acres) including Building 380 (23,940 SF), which is currently used by the 304 RQS to support pararescue operations and training. To replace these facilities, this project would include the construction of a new 47,000-SF consolidated facility on the flightline. The consolidated facility would increase efficiency by eliminating travel to Joint Base Lewis-McChord or NWSTF Boardman in order to achieve training that could otherwise be conducted on-site. Parcel D-2: FY 2018 – Relocate Chapel. ANG installations no longer have space authorization for chapels. Additionally, the existing chapel (Building 495) is located within Lease Parcel D-2, which is subject to give back to the Port in 2030. This project would remove the 3,752-SF chapel and relocate it to the Umatilla Proving Ground, either by deconstruction-and-relocation or as an intact structure, which would be moved by barge. The chapel is a historic World War II-era building that is eligible for listing in the NRHP. The 142 WG has engaged the Oregon SHPO (i.e., SHPO Case Number is 17-1220) regarding preservation and relocation of the chapel to the Umatilla Proving Ground.	2027–2030

Legend: 142 WG = 142d Wing; 304 RQS = 304th Rescue Squadron; AFB = Air Force Base; AGE = Aerospace Ground Equipment; ANG = Air National Guard; ARB = Airfield Regulator Building; ATCAA = Air Traffic Control Assigned Airspace; BY = bypass; CATEX = categorical exclusion; CCTV = closed circuit television; DAF = Department of the Air Force; DCC = Damage Control Center; EA = Environmental Assessment; EIS = Environmental Impact Statement; EOC = Emergency Operations Center; HEF = High-Expansion Foam; HVAC = heating, ventilation, and air conditioning; JISC = Joint Incident Site Communications; LED = Light-emitting Diode; MOA = Military Operations Area; NRHP = National Register of Historic Places; NWSTF = Naval Weapons Systems Training Facility; ODOT = Oregon Department of Transportation; PDX = Portland International Airport; ROD = Record of Decision; RON = Ramp Remain Overnight; SF = square feet; SHPO = State Historic Preservation Office; STS = Special Tactics Squadron; SUA = special use airspace.

5.1.1 Noise

The projects outlined in Table 5.1-1 include various plans to construct or renovate structures, which would result in temporarily increased noise levels during construction activity. However, elevated noise levels would be localized and would primarily affect areas within PDX already exposed to elevated noise from aircraft operations with minimal effects to noise sensitive areas.

The planned Dekum Court Apartment Redevelopment involves creating additional residences on existing property, which would increase the number of people residing at that location. Although the apartment complex is close enough to PDX flight paths to experience aircraft noise, the complex is within a residential area over 1 mile from the 65 dB DNL contours. Therefore, the property is currently considered compatible with PDX noise associated with existing conditions/No Action Alternative and Alternative 1 or 2 operations and the proposed redevelopment would not change that.

The PDX improvement project and other projects identified by the Port of Portland, along with the two Oregon Department of Transportation projects would result in temporary increases to noise levels during construction activity but would not adversely impact noise exposure long-term.

The proposed F-15EX operations under Alternatives 1 and 2, along with the continued F-15C operations under Alternative 3 would involve use of the Mountain Home AFB airspace. Operations under Alternative 3 are not proposed to increase over existing conditions/No Action Alternative. Increased operations under Alternatives 1 and 2 would represent an increase of less than 1 percent over the existing conditions/No Action Alternative, based on the total flying hours by non-local users presented in the Mountain Home Airspace EIS (DAF 2023a). The EIS evaluated a 5 percent increase in operations by non-local users under Alternatives 1 through 3, and thus no significant cumulatively considerable impacts above those described in the EIS would be expected to result from implementation of Alternatives 1, 2, or 3.

Overall, the present and reasonably foreseeable future actions would result in temporary increases to noise during construction, which would be localized around each construction site. Therefore, cumulative impacts to noise as a result of any of the alternatives combined with present and reasonably foreseeable projects would not be significant.

5.1.2 Airspace

Cumulative impacts to airspace resources are not likely to occur with the implementation of any of the alternatives. No new flight procedures, airspace, or reconfigurations are proposed to support the beddown. The F-15EX operations that would occur in the NWSTF Boardman and Portland ANG installation associated airspace in Oregon have factored in the updated NWSTF SUA and

Oregon airspace into the affected environment and analysis of project impacts. The proposed F-15EX operations under Alternatives 1 and 2, along with the continued F-15C operations under Alternative 3 would have limited potential to contribute to potential cumulative impacts with regard to airspace management, when considered cumulatively with the proposed airspace optimization at Mountain Home AFB, as both of these actions are being coordinated with the FAA. Given that the Mountain Home airspace is an area already dominated by military aircraft activity and controlled and scheduled by the DAF through Mountain Home AFB Airspace and Range scheduling function, potential cumulative effects of the airspace expansion in addition to Alternatives 1, 2, or 3 would not be expected to alter regional air traffic patterns, require any changes to military flight procedures, compromise existing regional ATC facilities, or cause over saturation of the airspace. None of the other projects listed in Table 5.1-1 would occur in or affect the existing airspace. Therefore, cumulative impacts to airspace as a result of any of the alternatives combined with present and reasonably foreseeable projects would not be significant.

5.1.3 Air Quality

The projects described in Table 5.1-1 would produce air emissions from fuel burning equipment and particulate matter from ground disturbance. The construction of the Special Tactics Squadron Complex and lease turn-back projects on the Portland ANG installation and the continuation of the PDX Next construction along with the other planned improvement projects identified by the Port of Portland may overlap the construction of the projects to support the F-15EX, but as the emissions for Alternatives 1, 2, and 3 are well below the 250 tons per year comparative threshold, the short-term emissions from these projects considered cumulatively with the action alternatives would not result in the short- or long-term degradation of regional air quality. Similarly, the Mountain Home airspace optimization project would add longer-term operational emissions from the increase in sorties proposed to occur under the alternatives evaluated in the Mountain Home Airspace EIS (DAF 2023a). However, the projected change in emissions reflected in the EIS, when considered cumulatively with the implementation of Alternatives 1, 2, and 3, would not be expected to significantly affect air quality or result in exceedances of the NAAQS. Thus, the impacts of these projects in conjunction with Alternatives 1, 2, and 3 would not have a significant impact on air quality.

5.1.3.1 Greenhouse Gases

For GHGs, the impacts are cumulative and global, and the analysis evaluates emissions considering the No Action Alternative and Alternatives 1, 2, and 3 with a global ROI. Impacts from global climate change experienced locally in the Portland area are anticipated to be similar to those anticipated for the Pacific Northwest region: warmer weather, more precipitation during winter with more rain and less snow in the mountains, and fewer but stronger storms. As described in the Water Resources Section 3.4.2.3, *Floodplains*, FEMA has identified the majority of the installation to be subject to the 500-year flood (SFHA Zone X or moderate flood hazard area), with limited portions in the south and west of the installation near the Columbia Slough in the 100-year floodplain (SFHA Zone AH or severe flood hazard area) (see Figure 3.4-1). However, the Portland ANG installation is within an area considered to have a reduced flood risk due to the levee and pump system managed by the MCDD.

Implementation of Alternative 1, 2, or 3 would contribute directly to emissions of GHGs from the combustion of fossil fuels. Table 5.1-2 presents the total net change to emissions per year and 50-year net change lifecycle emissions.

Table 5.1-2 GHG Emissions Estimates (tons per year)

Activity	*CO_2e*
Alternative 1	
F-15C Current Sorties	64,015
Airfield Totals	17,556
Annual GHG total	81570
50-year lifecycle emissions of F-15C/D	**4,078,508**
F-15EX Sorties	85,650
Airfield Totals	12,126
Annual GHG total	97,776
Total 50-year emissions F-15EX	**4,888,806**
Annual GHG net change	16,206[3]
50-year net change lifecycle emissions	810,298
Alternative 2	
F-15C Current Sorties	64,015
Airfield Totals	17,556
Annual GHG total	81,570
50-year lifecycle emissions of F-15C/D	4,078,508
F-15EX Sorties	**99,919**
Airfield Totals	**14,180**
Annual GHG total	114,100
Total 50-year emissions F-15EX	5,704,979
Annual GHG net change	32,529[4]
50-year net change lifecycle emissions	1,626,471

Note: [1]Existing F-15C flight operations would continue unchanged under Alternative 3.
[2]Alternative 3 and the No Action Alternative are identical except that the Legacy Alternative includes construction.
[3]Equals 14,702 metric tons.
[4]Equals 29,510 metric tons.
Legend: CO_2e = carbon dioxide equivalent; GHG = greenhouse gas.

The social costs of carbon (SC-CO_2), methane, and nitrous oxide allow agencies to understand the benefits of reducing each of these GHGs or the social costs of increasing such emissions, in the policy making process. Collectively referenced as the ‘social cost of GHG,’ it is defined as the monetary value of the net harm to society associated with adding carbon to the atmosphere in a given year. In principle, net harm cost includes the value of all climate change impacts, including but not limited to changes in net agricultural productivity, human health effects, property damage from increased flood risk natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services (White House Office of Management and Budget 2021). For this analysis, only SC-CO_2 is evaluated as the vast majority of emissions are generated by aircraft flying with turbofan engines. These engines generate no methane emissions and very little nitrous oxide emissions. Quantifying the small quantity of nitrous oxide emissions is a current subject of research.

The SC-CO_2 analysis covers a 50-year period after the arrival of the F-15EX, which is the lifetime expectancy of the aircraft and represents the bulk of emissions from the Proposed Action, as shown in Tables 5.1-3 and 5.1-4. These tables show the presumed first year of steady state operations for the F-15EX (2025 under Alternative 1 and 2026 under Alternative 2), and the year 2050 to provide an indication of the increasing monetary value of net harm on an annual basis. While the entire 50-year projected lifecycle would extend to 2075 or 2076, the data on costs that far into the future are not currently available. While there are a number of limitations associated with the modeling used to derive monetary values due to the broad scope of scientific and economic issues across the complex global landscape, providing a monetary characterization of GHG impacts is a useful tool for generally assessing impacts from the emissions, and the estimates likely underestimate the damages from GHG emissions (White House Office of Management and Budget 2021).

Table 5.1-3 SC-CO_2 Select Yearly Estimates Under Alternative 1 for Annual F-15EX Operations Emissions Increase Over 50 Years

Year	*SC-CO_2 Estimates (2020$/Metric Ton at 3% Average Damages)*[1]	*F-15EX Annual Net Change Emissions in Metric Tons*	*SC-CO_2 Emissions 2020$– 3% Average Discount*[2]
CO_2			
2025	$59	14,702	$860,938
2050	$85		$1,244,655
Year	[1]*SC-CO_2 Estimates (2020$/Metric Ton at 3% 95th Percentile Average Damages)*	*F-15EX Annual Net Change Emissions in Metric Tons*	*SC-CO_2 Emissions 2020$– 3% Average Discount 95th Percentile Average Damages*
CO_2			
2025	$176	14,702	$2,590,163
2050	$260		$3,821,733

Notes: [1]Values from White House Office of Management and Budget 2021; represented here rounded to closest whole number.
[2]This is the projected cost in 2020 dollars of implementing the Proposed Action with F-15EX basing using an average discount rate of 3 percent and what would be anticipated to represent the worst-case scenario, which is defined as the 95th percentile of the 3 percent average.

Legend: % = percent; 2020$ = 2020 U.S. dollars; CO_2 = carbon dioxide; SC-CO_2 = social cost of carbon.

Source: White House Office of Management and Budget 2021.

Table 5.1-4 SC-CO_2 Select Yearly Net Change Estimates Under Alternative 2 for Annual F-15EX Operations Emissions Increase Over 50 Years

Year	*SC-CO_2 Estimates (2020$/Metric Ton at 3% Average Damages)*[1]	*F-15EX Annual Net Change Emissions in Metric Tons*	*SC-CO_2 Emissions 2020$–3% Average Discount*[2]
CO_2			
2026	$57	29,510	$1,696,542
2050	$85		$2,498,334
Year	[1]*SC-CO_2 Estimates (2020$/Metric Ton at 3% 95th Percentile Average Damages)*	*F-15EX Annual Net Change Emissions in Metric Tons*	*SC-CO_2 Emissions 2020$–3% Average Discount 95th Percentile Average Damages*
CO_2			
2026	$173	29,510	$5,095,527
2050	$260		$7,671,178

Notes: [1]Values from White House Office of Management and Budget 2021; represented here rounded to closest whole number.
[2]This is the projected cost in 2020 dollars of implementing the Proposed Action with F-15EX basing using an average discount rate of 3 percent and what would be anticipated to represent the worst-case scenario, which is defined as the 95th percentile of the 3 percent average.
Legend: % = percent; 2020$ = 2020 U.S. dollars; CO_2 = carbon dioxide; SC-CO_2 = social cost of carbon.
Source: White House Office of Management and Budget 2021.

Operational energy (aviation fuel and energy to power aircraft) comprises over 80 percent of the DAF's energy use. Life-cycle emissions for the Proposed Action assume no changes in operations from 2030 to 2080. However, ground mobile source emissions are anticipated to reduce as vehicles and equipment are electrified and the DAF implements its Climate Action Plan with goals like an installation portfolio of net-zero emissions by FY 2046 (DAF 2022c). Additionally, reduction of fuel use offers the most significant opportunity to optimize operational capability while reducing GHG emissions. Technological enhancements to achieve reductions include but are not limited to aerodynamic advancements, streamlined flight planning, incorporation of drag reduction technologies, enhanced engine sustainment practices, introduction of electric AGE, and increases in the use of simulation and augmented reality systems.

5.1.4 Water Resources

Cumulative impacts to water resources are not likely to occur. The projects outlined in Table 5.1-1 are anticipated to result in a marginal net increase the amount of impervious surface at the Portland ANG installation and surrounding vicinity within the PDX boundary. Any potential impacts from stormwater runoff would be managed under a project-specific SWPCP, BMPs, and permit requirements. Therefore, cumulative impacts to water resources as a result of any of the alternatives combined with present and reasonably foreseeable projects would not be significant.

5.1.5 Geological Resources

Cumulative impacts to geological resources are not likely to occur with the implementation of Alternatives 1, 2, or 3. Ground-disturbing activities would be localized and would not have major impacts on sensitive or regionally significant geologic or physiographic features. Where erosion hazards may exist, particularly during implementation of projects that require grading, all appropriate construction BMPs must be adhered to in accordance with Oregon's erosion and sediment control laws and regulations. This may include installation of inlet/outlet protections, straw wattles, sediment fences, and other relevant BMPs from the Oregon Department of Transportation *Erosion Control Manual: Guidelines for Developing and Implementing Erosion and Sediment Controls*, April 2005. The use of such BMPs would substantially reduce the potential for erosion and siltation of drainages. Therefore, cumulative impacts to geological resources as a result of any of the alternatives combined with present and reasonably foreseeable projects would not be significant.

5.1.6 Cultural Resources

Cumulative impacts to cultural resources are not likely to occur with the implementation of any of the alternatives. If an unanticipated discovery of cultural artifacts occurs or the discovery of unmarked burial(s), including Native American burials or cemeteries from which headstones were relocated but not the physical remains, the activity in the immediate vicinity will cease until an assessment of the materials can be made. The unit commander/supervisor will be notified immediately so the Environmental Manager can be contacted. Protocols found in Standard Operating Procedure No. 6, *Inadvertent Discovery of Cultural Materials* and Standard Operating Procedure No. 7, *Inadvertent Discovery of Unmarked Burials* within the Integrated Cultural Resources Management Plan will be followed. None of the facilities listed for renovation and/or modification under Alternatives 1, 2, or 3 at the Portland ANG installation or those listed in Table 5.1-1 are eligible for listing in the NRHP. No structural damage to NRHP-listed archaeological or architectural resources would be anticipated, and visual intrusion would not cause adverse effects to the settings of cultural resources underlying the airspace. No traditional cultural resources or sacred sites have been previously identified at the Portland ANG installation or the lands underlying the SUA. However, government-to-government consultation is being conducted between the 142 WG and the federally recognized Tribal Nations, which may be historically, culturally, or linguistically affiliated with the area and have an interest in protecting cultural resources located at the Portland ANG installation. Additionally, NGB is consulting with the Oregon SHPO on the implementation of a project-specific Programmatic Agreement. NGB is committed to conducting an archaeological survey that includes shovel test pits within areas proposed for ground-disturbing activities using current methodologies in accordance with the Oregon SHPOs "Archaeology Field Guidelines." NGB will evaluate any newly found archaeological sites under the criteria of eligibility established in 36 CFR Section 60.4(a–d). Other ongoing or planned training activities would have a similar minimal impact to cultural resources and have or would be coordinated with the SHPO to ensure protection of these resources. Therefore, cumulative impacts to cultural resources as a result of any of the alternatives combined with present and reasonably foreseeable projects would not be significant.

5.1.7 Safety

The projects to be constructed by the 142 WG outlined in Table 5.1-1 would be conducted in accordance with all AT/FP requirements from design to completion; therefore, positive cumulative impacts to AT/FP would occur. Any projects occurring within an established QD arc would adhere to all applicable regulations in DAFMAN 91-201, *Explosive Safety Standards*. Additionally, no explosives would be handled during construction or demolition activities. All projects would be designed in such a way that they would not result in obstructions within RPZs or the airfield and would be coordinated with the 142 WG fire department. The proposed F-15EX operations under Alternatives 1 and 2, along with the continued F-15C operations under Alternative 3 would involve use of the Mountain Home AFB airspace and would continue to involve the use of chaff and flares. Operations under Alternative 3 are not proposed to increase over existing conditions/No Action Alternative. Increased operations under Alternatives 1 and 2 would represent an increase of less than 1 percent over the existing conditions/No Action Alternative, based on the total flying hours by non-local users presented in the Mountain Home Airspace EIS (DAF 2023a). The EIS evaluated a 5 percent increase in operations by non-local users under Alternatives 1 through 3, and thus no significant cumulatively considerable impacts above those described in the EIS would be expected to result from implementation of Alternatives 1, 2, or 3 in the airspace. Therefore, no significant cumulative impacts are expected to occur to Fire/Crash Response, RPZs, Explosive Safety, or Aircraft Safety under any of the alternatives in combination with present and reasonably foreseeable projects.

5.1.8 Hazardous Materials and Wastes

The types of hazardous materials needed for maintenance and operation of the F-15EX would be similar to those currently used for maintenance and operation of the F-15C fleet. Under Alternatives 1 and 2, the total number of airfield operations would increase; therefore, throughput of petroleum substances and hazardous waste streams would be expected to increase slightly. Additionally, it is expected that short-term increases in the quantity of fuel used during construction activities for this action and the present/reasonably foreseeable project would occur. Hazardous waste generation (e.g., used oil, used filters, oily rags) would continue to be managed in accordance with the installation's Hazardous Waste Management Plan and all applicable federal, state, and local regulations. The pollution prevention and waste minimization practices would continue to be managed in accordance with the Hazardous Waste Management Plan and would include any construction-related materials or waste associated with aircraft operations. Additionally, no changes to the installation's Large Quantity Generator status would be expected to occur due to the decrease or no net change in hazardous waste generation from aircraft operations. In addition, any projects proposed for renovation, demolition, or construction would be inspected for ACM and LBP according to established procedures prior to any renovation or demolition activities. Currently, three of the projects listed in Table 5.1-1 could potentially encounter PFOS/PFOA contaminated media (Buildings 250/235 Construction involves Hangar 250 which is PRL 3, Construct Power for Thor at Building 290 which is PRL 5, and Building 310 Construction which is PRL 6). The 142 WG would continue to comply with DAF guidance and policy regarding management of waste streams containing PFAS. Therefore, cumulative impacts to hazardous materials and wastes as a result of any of the alternatives combined with present and reasonably foreseeable projects would not be significant.

5.1.9 Biological Resources

Construction-related impacts to the vegetation at the installation and in the vicinity of projects identified in Table 5.1-1 would be minor due to the lack of sensitive vegetation in the project areas. In general, construction activities at the Portland ANG installation would primarily occur on sites that are already highly altered. These impacts would include the removal of some vegetation and associated wildlife habitat. However, wildlife that use these areas are typical of urban and suburban areas. Future impacts to natural resources on both the installation and PDX would be minimized by avoiding construction, demolition, and activities within wetland areas and areas containing habitat for the streaked horned lark. Therefore, cumulative impacts to biological resources as a result of any of the alternatives combined with present and reasonably foreseeable projects would not be significant.

5.1.10 Socioeconomics and Environmental Justice

The projects listed in Table 5.1-1 include several construction actions within and near the Portland ANG installation. Alternatives 1, 2, and 3 would also include construction actions that would add to demand on the local construction industry; however, the proximity to the large metropolitan area of Portland would mean that the demand would likely be met locally, and a large number of workers would not be expected to relocate to the area. During the construction phase of any of the alternatives, there are not expected to be significant adverse impacts associated with socioeconomics or environmental justice and there would be minor socioeconomic benefits in the ROI due to the increased economic activity associated with construction spending and employment. During operation of any of the alternatives, the noise levels would decrease surrounding the Portland ANG installation. The projects listed in Table 5.1-1 would not have long-term impacts on noise levels. Increases in population in the ROI may occur due to the housing developments identified as well as the relocation of 110 personnel; however, the increased population would be a minor percentage of the total population of the ROI and the increased demand on housing would be offset in part by the proposed housing development at Dekum Court Apartments. Therefore, cumulative impacts to socioeconomics would include minor beneficial impacts from increased construction spending and employment and cumulative impacts during operation would not be significant. No disproportionately high and adverse health or environmental effects would occur on any minority or low-income populations. Therefore, cumulative impacts to socioeconomics and environmental justice as a result of any of the alternatives combined with present and reasonably foreseeable projects would not be significant.

5.1.11 Land Use

The projects listed in Table 5.1-1 include several construction actions within and near the Portland ANG installation; however, elevated noise levels would be localized around each construction site. Potential construction noise levels within PDX would be minimal as PDX is already exposed to elevated noise from aircraft operations and would not generate noise levels to cumulatively affect or change land use compatibilities. In addition, no new flight procedures, airspace, or reconfigurations are proposed and none of the projects listed in Table 5.1-1 would occur in the existing airspace. Cumulative impacts to land use as a result of any of the alternatives combined with present and reasonably foreseeable projects would not be significant.

5.1.12 Department of Transportation Act, Section 4(f)

The projects listed in Table 5.1-1 include several construction actions within and near the Portland ANG installation. Elevated noise levels would be localized around each construction site and would primarily affect areas within PDX already exposed to elevated noise from aircraft operations with minimal effects to noise sensitive areas and would not generate noise levels to cumulatively affect or change Section 4(f) resources. Cumulative impacts to Section 4(f) as a result of any of the alternatives combined with present and reasonably foreseeable projects would not be significant.

5.2 Irreversible and Irretrievable Commitment of Resources

NEPA CEQ regulations require environmental analyses to identify any irreversible and irretrievable commitments of resources that would be involved in the Proposed Action should it be implemented (40 CFR Section 1502.16). Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable timeframe.

Building construction material such as gravel and gasoline usage for construction equipment would constitute the consumption of nonrenewable resources.

The Proposed Action would have irreversible impacts due to the consumption of nonrenewable resources, such as fuel used in aircraft. The primary irretrievable impacts of the Proposed Action would involve the use of energy, labor, materials, and funds. Irretrievable impacts would occur as a result of construction, facility operation, and maintenance activities. Direct losses of biological productivity and the use of natural resources from these impacts would be inconsequential because the relative consumption of these materials is expected to change negligibly.

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APPENDIX A
RELEVANT LAWS, REGULATIONS, AND CONSTRUCTION FOOTPRINT MAP

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TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

AFI	Air Force Instruction
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
DoD	Department of Defense
EA	Environmental Assessment
EO	Executive Order
GHG	Greenhouse Gas
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NGB	National Guard Bureau
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
SHPO	State Historic Preservation Office(r)
SIP	State Implementation Plan
U.S.	United States
USC	United States Code
USEPA	United States Environmental Protection Agency

A RELEVANT LAWS, REGULATIONS, AND CONSTRUCTION PROJECT FOOTRPINT MAP

A.1 NATIONAL ENVIRONMENTAL POLICY ACT

In accordance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code [USC] 4321-4347), Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), and Air Force Instruction (AFI) 32-1015 as promulgated at 32 CFR Part 989 et seq., *Environmental Impact Analysis Process*, the National Guard Bureau (NGB) has prepared this Environmental Assessment (EA), which considers the potential consequences to the human and natural environment that may result from implementation of the Proposed Action activities.

NEPA requires federal agencies to take into consideration the potential environmental consequences of proposed actions in their decision-making process. The intent of NEPA is to protect, restore, and enhance the environment through well-informed federal decisions. The CEQ was established under NEPA to implement and oversee federal policy in this process. The activities addressed within this document constitute a major federal action, and therefore must be assessed in accordance with NEPA. To comply with NEPA, as well as other pertinent environmental requirements, the decision-making process for the Proposed Action includes the development of this EA to address the environmental issues related to the proposed activities. Per CEQ regulations, if a significant impact is found as part of the EA analyses, an Environmental Impact Statement is required.

A.2 WATER RESOURCES REGULATORY REQUIREMENTS

The Clean Water Act (CWA) of 1977 (33 USC § 1251 *et seq.*) regulates pollutant discharges that could affect aquatic life forms or human health and safety.

Under Section 401 of the CWA, a federal agency may not issue a permit or license to conduct any activity that may result in any discharge into waters of the U.S. unless a Section 401 water quality certification is issued, or certification is waived. States and authorized tribes where the discharge would originate are generally responsible for issuing water quality certifications, but in cases where a state or tribe does not have authority, EPA is responsible for issuing certification (33 USC 1341).

Section 402 of the CWA requires that a discharge of any pollutant or combination of pollutants to surface waters that are deemed waters of the U.S. be regulated by a National Pollutant Discharge Elimination System (NPDES) permit. The NPDES and Municipal Separate Storm Sewer System (MS4) permits are required to regulate Portland ANG installation activities and engineering controls are required under these permits to maintain stormwater discharge quality.

Section 404 of the CWA, and Executive Order (EO) 11990, *Protection of Wetlands*, regulate development activities in or near streams or wetlands. Section 404 also regulates development in streams and wetlands and requires a permit from the United States (U.S.) Army Corps of Engineers for dredging and filling in wetlands. Presently, the Portland ANG installation has determinations from the U.S. Army Corps of Engineers and the State Division of Lands that our wetlands are "non-jurisdictional" for a 5-year period following the date on their determination letters (December 2024). The Portland ANG installation must apply for extensions prior to the December 2024 expiration date. EO 11988, *Floodplain Management*, requires federal agencies to take action to reduce the risk of flood damage; minimize the impacts of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains. Federal agencies are directed to consider the proximity of their actions to or within floodplains.

In addition, federal projects with a footprint larger than 5,000 square feet must maintain predevelopment hydrology and prevent any net increase in stormwater runoff as outlined in Unified Facilities Criteria 3-210-10, *Low Impact Development* (as amended, 2010), and consistent with the U.S. Environmental Protection Agency's (USEPA's) *Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act (EISA)* (December 2009).

A.3 CULTURAL RESOURCES REGULATORY REQUIREMENTS

The National Historic Preservation Act (NHPA) of 1966 (16 USC § 470) established the National Register of Historic Places (NRHP) and the Advisory Council on Historic Preservation outlining procedures for the management of cultural resources on federal property. Cultural resources can include archaeological remains, architectural structures, and traditional cultural properties such as ancestral settlements, historic trails, and places where significant historic events occurred. NHPA requires federal agencies to consider potential impacts to cultural resources that are listed, nominated to, or eligible for listing on the NRHP; designated a National Historic Landmark; or valued by modern Native Americans for maintaining their traditional culture.

To be determined eligible for inclusion in the NRHP, a resource must meet at least one of the following criteria:

a. associated with events that have made a significant contribution to the broad patterns of our history; or
b. associated with the lives of persons significant in our past; or
c. embody the distinctive characteristics of a type, period, or method of construction; or represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
d. have yielded, or may be likely to yield, information important in prehistory or history.

Section 106 of NHPA requires federal agencies to consult with State Historic Preservation Officers (SHPOs) if their undertakings might affect such resources. *Protection of Historic and Cultural Properties* (36 CFR Part 800 [2004]) provided an explicit set of procedures for federal agencies to meet their obligations under the NHPA, which includes inventory of resources and consultation with SHPO. At present, the SHPO has issued written approval to demolish the base chapel.

The American Indian Religious Freedom Act (42 USC § 1996) established federal policy to protect and preserve the rights of Native Americans to believe, express, and exercise their traditional religions, including providing access to sacred sites.

The Native American Graves Protection and Repatriation Act (25 USC §§ 3001-3013) requires consultation with Native American tribes prior to excavation or removal of human remains and certain objects of cultural importance.

The Archaeological Resources Protection Act of 1979 (16 USC §§ 470aa-mm) was created to protect archaeological resources and sites on public and Native American lands in addition to encouraging cooperation and exchange of information between governmental authorities, professionals, and private individuals. The act established civil and criminal penalties for destruction and alteration of cultural resources.

On November 27, 1999, the Department of Defense (DoD) promulgated its Annotated American Indian and Alaska Native Policy, which emphasizes the importance of respecting and consulting with tribal governments on a government-to-government basis. This Policy requires an assessment, through consultation, of the effect of proposed DoD actions that may have the potential to significantly affect protected tribal resources, tribal rights, and Indian lands before decisions are made by the respective services (DoD American Indian/Alaska Native Policy), as does DoD Instruction 4710.02, *Interaction with Federally Recognized Tribes* (September 14, 2006). Department of Air Force Instruction (DAFI) 90-2002, *Interactions with Federally Recognized Tribes* (2020), implements DoDI 4710.02. In addition, coordination with federally recognized Native American tribes must occur in accordance with EO 13175, *Consultation and Coordination with Indian Tribal Governments*. Section 106 consultation and government-to-government consultation for this project is on-going. At present, NGB has consulted with the tribes and the State Archeologist in order to establish archaeological sensitivity zones throughout the base and associated standard operating procedures as documented in the base Integrated Cultural Resource Management Plan.

A.4 CLEAN AIR ACT

The Clean Air Act (CAA) (42 USC §§ 7401-7671q, as amended) provided the authority for the USEPA to establish nationwide air quality standards to protect public health and welfare. Federal standards, known as the National Ambient Air Quality Standards (NAAQS), were developed for six criteria pollutants: ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, both coarse and fine inhalable particulate matter (less than or equal to 10 microns in diameter, and particulate matter less than or equal to 2.5 microns in diameter), and lead. The Act also requires that each state prepare a State Implementation Plan (SIP) for maintaining and improving air quality and eliminating violations of the NAAQS. In nonattainment and maintenance areas, the CAA requires federal agencies to determine whether their proposed actions conform with the applicable SIP and demonstrate that their actions would not (1) cause or contribute to a new violation of the NAAQS, (2) increase the frequency or severity of any existing violation, or (3) delay timely attainment of any standard, emission reduction, or milestone contained in the SIP. This EA will present the project conformity applicability analysis and document the conformity-related emission calculation estimates. Conformity with the SIP must be demonstrated prior to implementation of the action.

A.5 GREENHOUSE GAS EMISSIONS

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. These emissions occur from natural processes as well as human activities. The accumulation of GHGs in the atmosphere regulates, in part, the earth's temperature. Scientific evidence suggests a trend of increasing global temperature over the past century potentially due to an increase in GHG emissions from human activities. Potential climate change associated with GHGs may produce negative economic and social consequences across the globe.

On a national scale, federal agencies are addressing emissions of GHGs by reductions mandated in federal laws and EOs. Most recently, EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, and EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, were enacted to address GHG in detail, including GHG emissions inventory, reduction, and reporting. The Department of the Air Force released a Climate Action Plan in 2022 that establishes climate policies and actions that must be incorporated across the Air Force and Space Force.

State Regulations Related to Greenhouse Gases

The governor of the state of Oregon issued EO 20-04 to go into effect January 2022 that established rules through the Oregon Department of Environmental Quality intended to reduce GHGs. The order requires the state to achieve GHG reductions of at least 45 percent below 1990 emissions levels by 2035 and at least 80 percent below 1990 levels by 2050 (State of Oregon 2020). In December 2021, the State of Oregon adopted a Climate Protection Program to reduce GHGs, achieve co-benefits from other air contaminant reductions, and enhance public welfare for Oregon communities, particularly environmental justice communities. The program requires covered entities, such as fuel suppliers (including diesel, gasoline, natural gas, and propane used in transportation) and existing or proposed new permitted facilities with annual covered emissions that meet or exceed a threshold of 25,000 metric tons of CO_2e, to reduce their GHG emissions and reach an 80 percent reduction by 2050 (Oregon DEQ 2022c). The entities that fall under this program are provided compliance options to minimize business and consumer economic impacts and allows covered fuel suppliers to comply in part with Community Climate Investments, where companies acquire and use a limited number of credits by contributing funds to Oregon DEQ-approved entities to implement GHG emission reductions in Oregon (Oregon DEQ 2022c).

A.6 ENDANGERED SPECIES ACT

The Endangered Species Act of 1973 (16 USC §§ 1531-1544, as amended) established measures for the protection of plant and animal species that are federally listed as threatened and endangered, and for the conservation of habitats that are critical to the continued existence of those species. Federal agencies must evaluate the effects of their proposed actions through a set of defined procedures, which can include the preparation of a Biological Assessment and can require formal consultation with the U.S. Fish and Wildlife Service under Section 7 of the Act. At present, the base has created an Integrated Natural Resource Management Plan (INRMP) in consultation with the USFSW. The most current INRMP annual review with the USFWS completed in 2021 resulted in an updated work plan. Per the INRMP, while no observations on the installation have occurred, the federally threatened streaked horned lark has been identified breeding at a site within the Southwest Quad at the Portland International Airport (PDX), close to the Portland ANG installation western border. Designated critical habitat for Chinook salmon, chum salmon, and steelhead is located within the Columbia Slough. Portland ANG installation stormwater discharges into the Middle Columbia Slough and can impact this critical habitat. Projects with the highest potential for impact include: Projects 10A, 11, 12, 13, and 14 (refer to Table 2.1-2 in the EA).

A.7 OTHER ENVIRONMENTAL REQUIREMENTS

Other environmental requirements that potentially apply to the implementation of this proposal include guidelines promulgated by EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, to ensure that disproportionately high and adverse human health or environmental effects on citizens in these categories are identified and addressed, as appropriate.

Additionally, potential health and safety impacts that could disproportionately affect children are considered under the guidelines established by EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*. In conjunction with "No Further Action" determinations for Environmental Restoration Program (ERP) sites "Land Use Controls" (LUCS) can be established to protect migration of residual contaminants such as the LUCS established at the Portland ANG installation. The aircraft noise environment around PDX is governed by the city of Portland zoning code chapter 33.470 established in 1980 (see attached information guide). This zone code establishes aircraft noise level areas in the surrounding community that must be mitigated by developers of new or major remodeling of residential construction in order to be issued a city permit. The city of Vancouver zoning code chapter 20.520 (see attached) has provisions similar to those in Portland which also govern the noise environment around PDX.

A.8 CONSTRUCTION PROJECT MAP

Figure A-1 shows the project footprints for the renovation, construction and demolition projects listed in Chapter 2 of the EA, Tables 2.1-1 and 2.1-2.

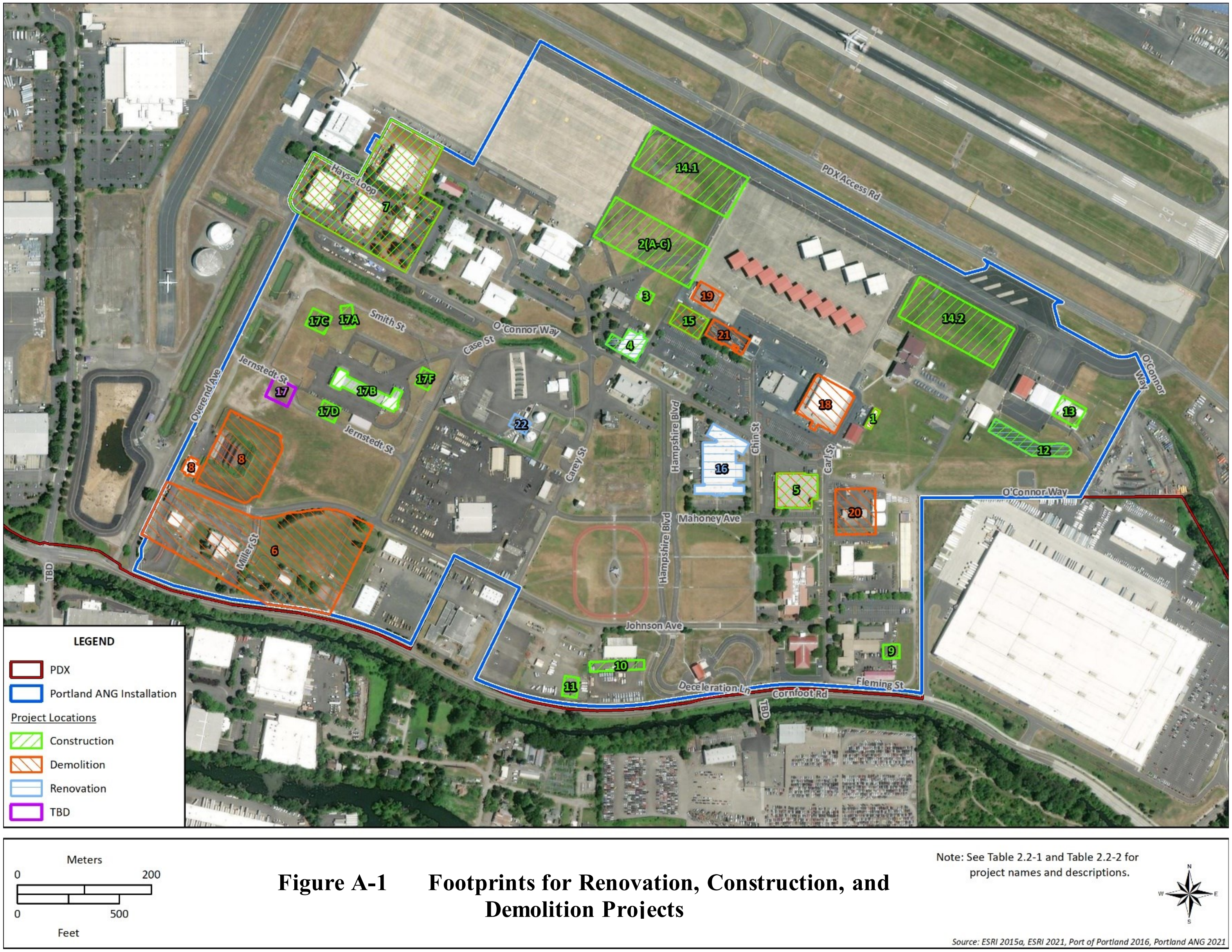

Figure A-1 Footprints for Renovation, Construction, and Demolition Projects

City of Portland Information Guide

ZONING CODE INFORMATION GUIDE

Portland International Airport Noise Impact Overlay Zone
Informational Packet for Residential Projects

The purpose of this packet is to provide information and instructions for residential building permit applicants with property in the Portland International Airport Noise Impact Zone (City of Portland Zoning Code Chapter 33.470). Properties within this overlay zone are identified with an "x" on the City's Official Zoning Maps.

This packet includes the following information:

- **Purpose and Background**
- **Noise overlay map**
- **Permit Instructions**
- **Aircraft Noise Easement form**
- **Aircraft Noise Disclosure Statement form**
- **Resources and Contacts**

Purpose and Background

The Portland International Airport (PDX) Noise Impact Overlay Zone ("x" overlay zone) is intended to reduce the impact of aircraft noise on development within the noise impact area surrounding the Portland International Airport. It also promotes general economic welfare by protecting air transportation and aviation commerce.

The "x" overlay zone was officially adopted by the City of Portland (City) in 1980. Recent updates were completed as part of the 2011 PDX Airport Futures Comprehensive Plan and Zoning Code Amendments. The "x" overlay zone covers an area encircling PDX where noise exposure associated with PDX aircraft operations (based on the federal standard; "Day-Night Level" or DNL) is highest. The boundaries were first defined based on the DNL noise contours established with the 1977 PDX Master Plan. They have since been updated to reflect the changing noise environment and in an effort to discourage non-compatible development.

Three noise contours are identified within the "x" overlay zone (see map on following page).

Red contour represents the 68 DNL, and is based on the 1990 68 dBA DNL noise exposure contour map from a PDX Noise Compatibility Study update. Development within this noise contour is more strictly regulated than the other contours

Yellow contour represents the 65 DNL, and is based on the 65 dBA DNL noise exposure from the same study.

Blue contour represents the 55 DNL, and is the 55 dBA noise exposure contour based on the 2035 50th Percentile Forecast Noise Exposure Map in the 2010 PDX Master Plan Update. The NIZ is designated on the City of Portland Zoning map as the "x" overlay.

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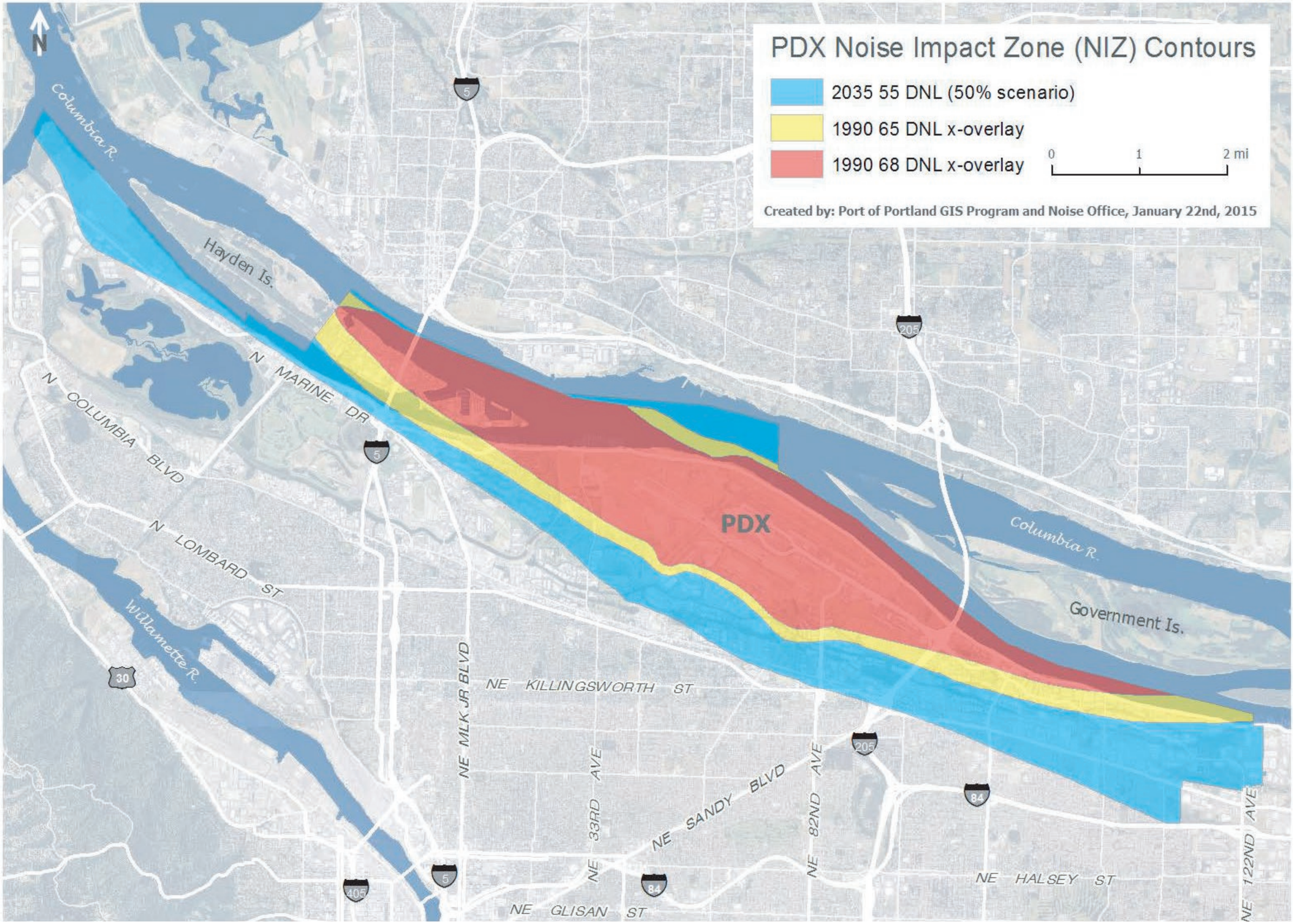
PDX Noise Impact Zone Contour Map



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PORTLAND INTERNATIONAL AIRPORT NOISE IMPACT OVERLAY ZONE

CITY OF PORTLAND OREGON - BUREAU OF DEVELOPMENT SERVICES

Permit Instructions

In order to obtain a building permit for new or “significantly reconstructed” residential units within the “x” overlay zone, specific criteria must be met. Significantly reconstructed is defined in the Zoning Code as: “Reconstructed dwelling units where the total cost of improvements is 75 percent or more of the total assessed improvement value of the site”. For permit approval within the 68 and 65 DNL contours the construction plans must be reviewed and certified by an acoustical engineer licensed in the State of Oregon certifying that once built, the structure will be at or below a day/night average interior noise level of 45 dBA DNL, and a noise easement must be dedicated to the Port of Portland and recorded with Multnomah County Assessment, Recording and Taxation. A noise disclosure statement must also be recorded for any permit approvals within all three contours. Note that new residential development within the 68 DNL contour is prohibited with some exceptions. Refer to Zoning Code Section 33.470.040 for these regulations.

Policy Contour Name	Origin	Development	Requirements
68 DNL	1990 DNL 68 dBA Contour	New residential uses prohibited unless exemptions met	Zoning code exemption required, then Acoustic Engineer’s Certification, Noise Disclosure Statement and Noise Easement
65 DNL	1990 DNL 65 dBA Contour	New residential development with density limits	Acoustic Engineer’s Certification, Noise Disclosure Statement and Noise Easement
55 DNL	2035 DNL 55 dBA Contour (Based on 50th Percentile Operations Forecast from 2011 Airport Futures/Master Plan Update	New residential development or major remodels	Noise Disclosure Statement

The property owner/developer may be eligible for reimbursement by the Port of Portland (Port) for some or all of the costs associated with the acoustical certification and recording fees associated with the noise easement and noise disclosure statement. To qualify for reimbursement from the Port, the engineer must be selected from the Port’s Approved Acoustical Engineer List.

Instructions for meeting the requirements of the City of Portland building code Chapter 33.470 and obtaining reimbursement for certain costs by the Port of Portland.

PRIOR TO BUILDING PERMIT APPLICATION

STEP 1: Review Information Packet

Once it has been determined that your property is located within the PDX Noise Impact Zone (NIZ), City Planning and Zoning staff at the Development Services Center (DSC) will provide the following information:

- This Information Packet which includes information on how to meet the requirements.
- The contour in which the property is located (68, 65, or 55 DNL) within the ”x” overlay zone.

STEP 2: Acoustical Certification

If the property is within 68 or 65 DNL contours, the building plans must be reviewed by an acoustical engineer. The Port of Portland (Port) will reimburse the property owner for the cost of the certification if requested. To be eligible for the reimbursement you must chose an acoustical engineer from the list included with this packet (subject to updates by the Port). If you do not wish to pursue reimbursement, you may choose any acoustical engineer registered in Oregon. The engineer must certify that once built, the structure will be at or below a day/night average interior noise level of 45 dBA DNL

STEP 3: Noise Disclosure and Noise Easement

The property owner must sign and record an Aircraft Noise Disclosure Statement and, if in the 68 or 65 DNL contours, an Aircraft Noise Easement. These documents are included in this packet.

- Fill out both forms completely, including:
    - o Date
    - o Name and signature of property owner
    - o DNL value within the NIZ
    - o Street address of property (For new construction an address will be assigned once the permit is submitted for review with BDS.)
    - o Legal description of property
- Send both forms to the Port Noise Office at the address listed the last page of this packet. A Port representative will review the forms for completeness and legal sufficiency then send them back to you.
- All property owners must sign the forms and have the forms notarized
- Record the forms on the property with Multnomah County Assessenet, Recording and Taxation

SUBMIT BUILDING PERMIT APPLICATION

STEP 4: Submit copies of the following with your building permit application.

- Acoustical engineer's report or certification (68 or 65 DNL only)
- Recorded Aircraft Noise Easement (68 or 65 DNL only)
- Recorded Aircraft Noise Disclosure Statement (68, 65, and 55 DNL)

STEP 5: Reimbursement by the Port of Portland

The Port will reimburse the property owner for the cost of the acoustical certification and recording fees. The Port does not reimburse for additional services including, but not limited to consultations, field work, or expediency charges.

In order to qualify for reimbursement you must meet the requirements of the Port. Contact information is located on the last page of this packet.

Resources and Contacts

CITY OF PORTLAND

Development Services Center
1900 SW 4th Ave
Portland OR 97202
www.PortlandOregon.gov/BDS
503-823-7526

Verify zoning regulations on your property include “x” overlay zone noise contours and regulations.

MULTNOMAH COUNTY Department of County Management

Assessment, Recording and Taxation
501 SE Hawthorne St
Portland OR 97214
www.multco.us/assessment-taxation
503-988-3034

Records documents on property such as the Airport Noise Easement and Disclosure Statement

PORT OF PORTLAND

Noise Management Office
7200 NE Airport Way
Portland OR 97218
503-460-4100
www2.portofportland.com/Inside/NoiseManagement

Information about acoustical engineers and reimburements for “x” overlay

ACOUSTICAL ENGINEERS LIST

The following is contact information for State of Oregon licensed acoustical engineers operating in the Portland Metro area. Listing does not imply recommendation or endorsement by the Noise Control Office or the City of Portland, but is offered only for informational purposes. The collection of names is not exhaustive and changes will be made as they become known. Under Portland City Code 33.470.040, the Port of Portland will reimburse the costs incurred obtaining certification of acoustical engineering insulation as meeting standards for the Portland Airport Impact Zone. Use of the approved firms listed below will qualify for reimbursement by the Port. Other licensed engineers may complete the work required by the code, but a developer or architect will not be eligible to have the code-required acoustical certification costs reimbursed by the Port of Portland.

A Acoustics
Elki Lahav
9324 SW Camille Terrace
Portland, OR 97223-7043
Tel/Fax: (503) 977-2690
elki@aacoustics.com

Acoustics Sciences Corporation
Arthur Noxon
P.O. Box 1189
Eugene, OR 97440
(541) 343-9727
art.n@acousticsciences.com

Altermatt Associates Inc.
Russell Altermatt
6745 SW 13th Ave.
Portland, OR 97219
(503) 221-1044
raltermatt@altermatt.com

CS Acoustical Engineering
Elki Lahav
833 SW 11th Ave, Suite 808
Portland, OR 97205
(503) 227-6233
elki@aacoustics.com

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Todd A. Matthais, P.E.
Acoustic Design Studio
519 SW Park Ave., Ste. 305
Portland OR 97205
(503) 735-5961
todd@acousticdesignstudio.com

Daly-Standlee & Associates, Inc.
Kerrie Standlee
4900 SW Griffith Dr., Suite 205
Beaverton, OR 97005
(503) 646-4420
dsa@acoustechgroup.com

Michael Minor & Associates
4923 SE 36th Ave
Portland, OR 97202
(503) 220-0495
mminor@drnoise.com

PDX Noise Impact Overlay Zone
Port of Portland Reimbursement Checklist

A builder requesting reimbursement of acoustical certification costs or recording fees under the PDX Noise Impact Overlay Zone (NIZ) must provide the following documentation to the Port of Portland Noise Management Office (see contact information above):

For all projects in the NIZ:

- ❑ Copy of signed, notarized, and recorded Noise Disclosure Statement
- ❑ Copy of itemized receipt for recording fees

For projects in the 65 and 68 DNL contours of the NIZ:

- ❑ Copy of the engineers certification report
- ❑ Copy of engineer's itemized invoice to builder
- ❑ Copy of cancelled check or other proof of payment to engineer
- ❑ Copy of signed, notarized, and recorded Noise Easement
- ❑ Copy of itemized receipt for recording fees

For more information visit or call the Planning and Zoning Staff in the
Development Services Center at 1900 SW 4th Avenue, Suite 1500, 503-823-7526
Current Zoning Code is available at www.portlandoregon.gov/zoningcode

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Aircraft Noise Easement

(Adopted by Ordinance No. 158055, December 12, 1985)

This Easement, made this ______ day of ____________________, 20______, between

____

Property Owner or Legal Representative (Print name)

hereinafter referred to as “Grantor,” and THE PORT OF PORTLAND, a port district of the State of Oregon, hereinafter referred to as “Grantee,”

1. For the consideration listed in Paragraph 2 of this Easement, the receipt and sufficiency of which is hereby acknowledged, the Grantor does hereby grant to the Grantee, its successors and assigns, to have and to hold a perpetual easement for aircraft noise impact at the __________ DNL noise level as established by the official Noise Impact Zone boundaries (PDX 1990 DNL contour map) on file with the City of Portland, and as set forth in the Portland International Airport Noise Abatement Plan, until Portland International Airport shall be abandoned or shall cease to be used for public airport purposes, over the following described parcel of land situated in the County of Multnomah, State of Oregon, as follows:

Property location (street address):____

City ____ State ____________ Zip Code ______________

and is more particularly described below:

Legal description: ____

____ (attach additional sheets if needed)

2. Consideration for the mutual promises contained herein includes but is not limited to the following:

(a) The right to construct or reconstruct (as defined in Chapter 33.470 of the Portland City Code) the subject property for residential use.

(b) Grantee promises to be responsible for the costs of acoustical inspection and certification of building plans as set forth in Chapter 33.470 of the Portland City Code.

(c) Grantee promises to pay the recording fees of this document.

3. This Easement shall encompass the right, in the airspace above the surface of the Grantor’s property having the same boundaries as the above described property and extending from the surface upwards to the limits of the atmosphere of the earth, to cause in said airspace a maximum of the DNL noise level as set forth in Paragraph 1 of this Easement and as established by the 1990 DNL contour map as set forth in the Portland International Airport Noise Abatement Plan. An official DNL contour map is on file in the City Permit Center.

4. Grantors, for themselves, their heirs, administrators, executors, successors, and assigns, do hereby fully waive, remise, and release any right or cause of action which they may now have or which they may have in the future against Grantee, its successors and assigns, due to noise, and all other effects of any noise impacts at or below the annual average DNL level set forth in Paragraph 1 of this Easement that may be caused or may have been caused by the operation of aircraft landing at, or taking off from, or operating at or on said Portland International Airport. If the permitted annual average DNL level can be shown to have exceeded that specified in this instrument, this Easement shall remain valid and effective for that DNL level set forth in Paragraph 1 of this Easement, but the exceeded DNL level shall not be protected by this Easement.

5. The granting of this Easement shall establish the Grantor’s right to construct or reconstruct (as defined in Chapter 33.470 of the Portland City Code) for residential use in accordance with all applicable laws. The Grantor’s execution and offering of this Easement is sufficient to fulfill the requirements for the issuing of a building permit if all zoning and other legal requirements have been met.

6. In the event any covenant, condition or provision herein contained is held to be invalid by any court of competent jurisdiction, the invalidity of such covenant, condition or provision shall in no way affect any other covenant, condition or provision herein contained.

7. It is understood and agreed that these covenant and agreements shall run with Grantor's land and shall be recorded, and the covenants and agreements shall be binding upon, heirs, administrators, executors, successors and assigns of the Grantor.

8. If the subject property is a houseboat, the easement and waiver granted herein shall also apply to the houseboat at any location to which the houseboat is moved within the 65 DNL area and all references to "65 DNL" shall mean 65 DNL and any higher DNL established for any location to which the subject property is moved.

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal this

_______ day of __________________, 20_____.

Property Owner (Print Name): ____

Property Owner Signature: ____

State of Oregon)

)

County of Multnomah)

On this _______day of ______________________, 20____, before me personally appeared

____ who being duly sworn, did say that he/she has read the Easement, fully understands the content of the Easement, and that the signing of this instrument is a voluntary act and deed.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first in this Easement written.

____

Notary Public for Oregon

My Commission Expires: ____________________

ACKNOWLEDGED FOR THE PORT OF PORTLAND BY

Name (Signature): _____________________________________ Date: ___________________________

Printed Name: ____ Title: ___________________________

Noise Disclosure Statement

(Adopted by Ordinance No. 158055, December 12, 1985)

Chapter 33.470 of the Portland City Code states that, as a condition for issuance of a building permit for new residential construction or significant reconstruction within the 55 DNL noise contour of the 2035 50th Percentile Forecast Noise Exposure Map (from the 2010 Portland International Airport Master Plan) or greater, the applicant shall sign and record a Noise Disclosure Statement in the following form:

Disclosure Statement

Property location (street address): ____

City ____ State _____________ Zip Code _______________

and is more particularly described below:

Legal description: ____

____ (attach additional sheets if needed)

The property lies within the Portland International Airport Noise Impact Zone as depicted on the official zoning map for the City of Portland. The owner of such land and any potential purchase are hereby notified that this land may be subject to noise impact resulting from aircraft on the approach and departure routes to and from Portland International Airport and is subject to noise levels that may be considered objectionable. By recording this document with Multnomah County Records, all future purchasers are hereby notified that this above described parcel is within the Portland International Airport Noise Impact Zone. This noise disclosure in no way inhibits the property owner from developing his/her property in a manner consistent with the City of Portland Comprehensive Plan, and specifically for residential use where such use is permitted by the Comprehensive Plan and implementing ordinances.

The undersigned owner(s) of said land hereby certify (ies) that (he/she/they) (has/have) read and understand(s) the above disclosure statement and acknowledge(s) the pre existence of the above named airport and the potential for noise impact.

IN WITNESS WHEREOF, the Grantor has hereunto set his hand and seal this

_______ day of ___________________, 20_____.

Property Owner (Print name): ____

Property Owner Signature: ____

State of Oregon)

)

County of Multnomah)

On this _____________ day of ___________________________________, 20____, before

me personally appeared____ who being duly sworn, did say that he/she has read the Disclosure, fully understands the content of the Disclosure, and that the signing of this instrument is a voluntary act and deed.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first in this Disclosure written.

____

Notary Public for Oregon

My Commission Expires: _________________________

ACKNOWLEDGED FOR THE PORT OF PORTLAND BY

Name (Signature): ___________________________________ Date: _________________________

Printed Name: _______________________________________ Title: _________________________

City of Vancouver Zoning Code Chapter 20.520

Chapter 20.520

NOISE IMPACT OVERLAY DISTRICT

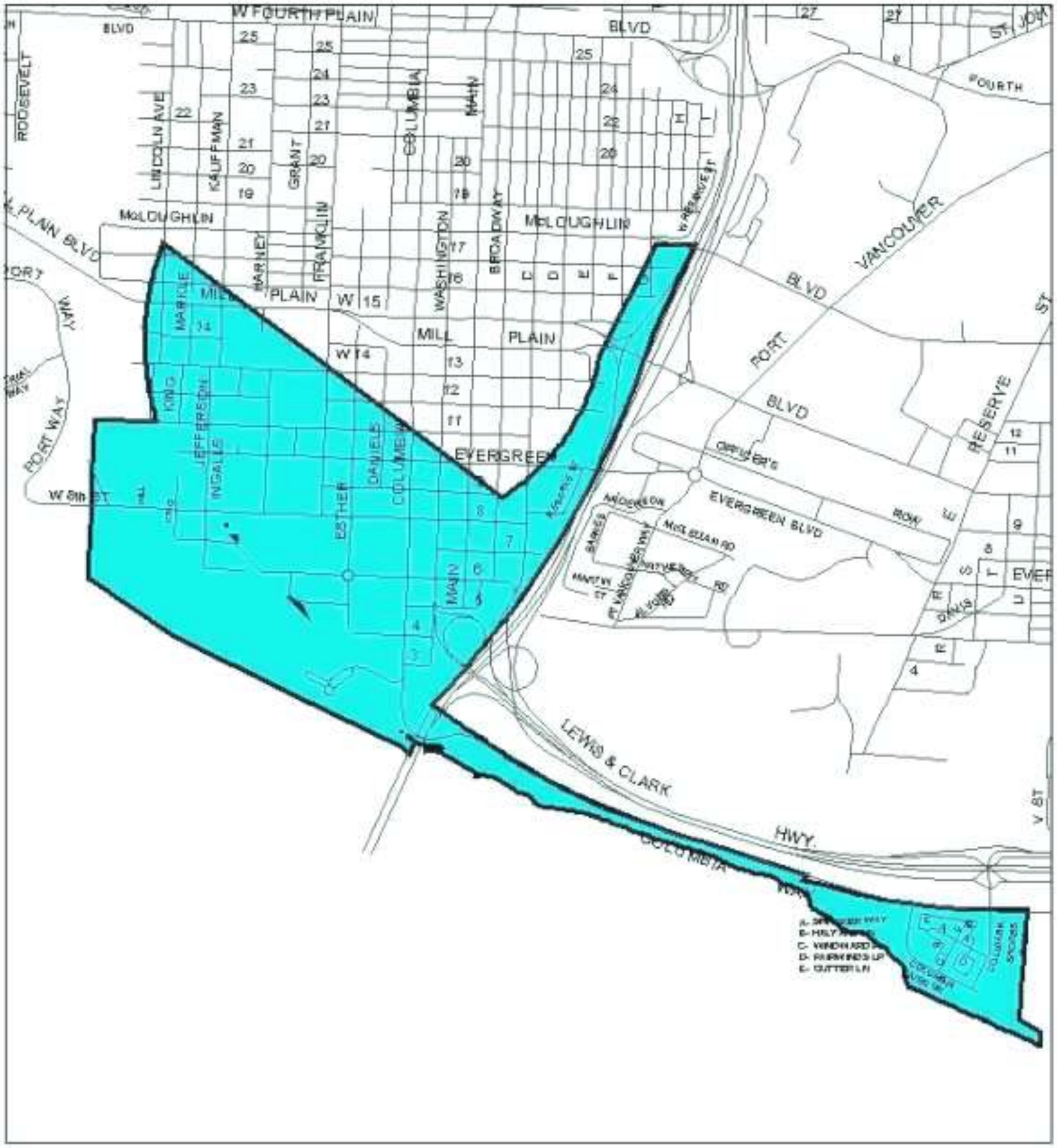
Sections:

Section 20.520.010 Purpose.

General. The purpose of the Noise Impact Overlay District is to provide a means by which the public and owners of property within the overlay district can be advised that unusually high levels of aircraft, railroad and/or traffic noise are to be expected on properties in such a district, and that such levels of sound reasonably require that special construction standards involving sound insulation hereinafter set forth be met on all new residential construction in such a district.
(M-3643, Added, 01/26/2004)

Section 20.520.020 Establishment of Boundaries.

A. Boundaries of Noise District. The boundaries of the Noise Impact Overlay District are as set forth in Figure 20.520-1. Such boundaries delineate that part of the City which is most affected by noise from Portland International Airport, Burlington Northern Railroad, I-5 Freeway and Pearson Airpark, or by the combined effect thereof. Such boundaries are based upon the 1988 65 Ldn Noise Contour shown on the 1983 PIA Noise Abatement Plan and are consistent with the noise impact studies of the Washington State Department of Transportation for the I-5 Corridor. Large-scale maps showing the boundaries of the district shall be maintained in the office of the City's Community and Economic Development Department. For lots or parcels located only partially within the district, this Chapter shall apply if all or part of the exact building site is within the district.



0 1,500 3,000 6,000 Feet

Noise Overlay

FIGURE 20.520-1

N

Noise Impact Overlay

B. Amendment of boundaries. The boundaries of the district hereby created shall be deemed amended whenever such boundaries are found by the Planning Official to require reasonable amendment to comply with the new noise impact standards thereinafter established; provided, in any case where the Planning Official finds it necessary to so amend such boundaries, his action may be appealed to the Planning Commission by any affected property owner or prospective purchaser by means of a Type III procedure, as governed by Section 20.210.060 VMC.

(M-3832, Amended, 06/18/2007, Sec 11; M-3643, Added, 01/26/2004)

Section 20.520.030 Applicability.

A. General. All new residential uses within the Noise Impact Overlay District, are subject to the provisions and the regulations of this Chapter.

B. Regulated structures. These regulations shall apply to:

1. All new residential structures;

2. Expansion by 10 % or more of an existing residential structure; and

3. Reconstruction of an existing residential structure where the cost of reconstruction exceeds 75 % of the value of the original structure.

(M-3643, Added, 01/26/2004)

Section 20.520.040 Approval Process.

A. Permit issuance. The City shall not issue any building permit or other development permit allowing construction of any new residential structure intended for use as a dwelling or dwellings in the Noise Impact Overlay District except in compliance with this Section.

B. Approval process. An applicant for such a permit shall prepare a Noise Impact Reduction Plan subject to the following procedures:

1. Single-family and duplex units. An applicant for a new or expanded single-family and/or duplex unit(s) shall request approval of the Noise Impact Reduction Plan by means of a Type I procedure, as governed by Section 20.210.040 VMC, using the performance standards contained in Section 20.520.050 VMC below.

2. Projects with three or more residential units. An applicant for a project with three or more residential units shall request approval as part of site plan review, as governed by Chapter 20.270 VMC.

C. Submission requirements. The Noise Impact Reduction Plan, must include the following:

1. A map of the property, drawn to scale, and an identification of the sources of noise that result in noise impacts on the property to Ldn levels of 65 or greater.

2. A statement of the methods proposed to be used to accomplish sound reduction.

3. A statement that the applicant has consulted with any agency or corporation responsible for managing noise generated by a source identified in 20.520.020 VMC, and a certification by the applicant that the proposed construction is designed to reduce sound impacts within structures on the property so as to mitigate any conflict between the noise source and the use of the residential building as a dwelling.

4. A time schedule for construction of the project that clearly shows that sound reduction will have been accomplished prior to any occupancy of the rooms for residential use.

5. An estimate of the Ldn values outside of the proposed building, and an evaluation of the dBA level of single impacts, and a statement by the applicant that the existence of noise levels is acknowledged to exist, as governed by Section 20.520.060 VMC below.

(M-3643, Added, 01/26/2004)

Section 20.520.050 Performance Standards.

A. Construction standards. Based on the Noise Impact Reduction Plan required in Section 20.520.040 VMC above, all regulated structures shall be constructed with sound insulation or other means which are rated to provide a decibel reduction sufficient to achieve a day/night average interior noise level of 45 Ldn for that specific property. A Washington licensed professional engineer or registered architect, knowledgeable in acoustical engineering or design, shall certify that the building plans are adequate to reduce interior noise levels to 45 Ldn or less. In preparing this certification the engineer or architect:

1. Must take into account the construction materials, type of foundation, soil type and other physical factors of the site in the evaluation.

2. Must use the ANSI, ISO, ASTM, or another nationally accepted standard for the transmission coefficients of various materials, and may assume all openings, e.g. doors and windows

3. In lieu of Subsection (1) or (2) above, the applicant's engineer or architect may accomplish the certification by a study of existing structures located within the same Ldn Noise Contour and vicinity, e.g., block, subdivision, park or moorage, to determine the expected noise level of the proposed structure(s).

B. Alternate method. In lieu of certification by a registered engineer as provided in subsection (A) above, an applicant may use standard-wall construction as provided in Reference Section 20.520.050-1, provided that the standard construction is rated to provide enough sound insulation that, when such rating is subtracted from the Ldn value established in the Noise Impact Reduction Plan, the average interior noise level will be reduced to 45 Ldn or less.

TABLE 20.520-1
STANDARD WALL CONSTRUCTION

ACOUSTICAL CONSTRUCTION CONCEPTS

(This Section, with some editing, is taken from the Audible Landscape, FHWA[1].)

Noise can be intercepted as it passes through the walls, floors, windows, ceilings and doors of a building. Examples of noise-reducing materials and construction techniques are described in the pages that follow.

To compare the insulation performance of alternative constructions, the Sound Transmission Class (STC) is used as a measure of a material's ability to reduce sound. Sound Transmission Class is equal to the number of decibels a sound is reduced as it passes through a material. Thus, a high STC rating indicates a good insulating material. It takes into account the influence of different frequencies on sound transmission, but essentially the STC is the difference between the sound levels on the side of the partition where the noise originates and the side where it is received. For example, if the external noise level is 85dB and the desired internal level is 45dB, a partition of 40 STC is required. The Sound Transmission Class rating is the official rating endorsed by the American Society of Testing and Measurement. It can be used as a guide in determining what type of construction is needed to reduce noise.

WALLS

Walls provide building occupants with the most protection from exterior noise. Different wall materials and designs vary greatly in their sound insulating properties. **Figure 20.520-2** shows a sample of wall types ranging from the lowest to the highest sound insulation values.

Remember that the effectiveness of best wall construction will be substantially reduced if vents, mail slots or similar openings are permitted in the walls. If vents are permitted the ducts must be specially designed and insulated to make sure noise does not reach the inside. The best approach is simply to eliminate all such openings on affected walls

WINDOWS

Sound enters a building through its acoustically weakest points, and windows are one of the weakest parts of a wall. An open or weak window will severely negate the effect of a very strong wall. Whenever windows are going to be a part of the building design, they should be given acoustical consideration. **Figure 20.520-2** illustrates the effects of windows on the sound transmission of walls. For example, if a wall with an STC rating of 45 contains a window with an STC of 26 covering 30 % of its area, the overall STC of the composite partition will be 35, a reduction of 10dB.

The first step in reducing unwanted sound is to close and seal the windows. The greatest amount of sound insulation can be achieved if windows are permanently sealed. However, operable acoustical windows have been developed which are fairly effective in reducing sound. Whether or not the sealing is permanent, keeping windows closed necessitates the installation of mechanical ventilation systems. The smaller the windows, the greater the transmission loss of the total partition of which the window is a part. Reducing the window size is a technique that is used because: (a) it precludes the cost of expensive acoustical windows; and, (b) it saves money by cutting down the use of glass. The problems with this technique are: (a) it is not very effective in reducing noise; e.g., reducing the proportion of window to wall size from 50 % to 20 % reduces noise by only 3 dB; and, (b) building codes require a minimum window to wall size ratio. If ordinary windows are insufficient in reducing noise impacts in spite of sealing techniques, thicker glass can be installed. In addition, this glass can be laminated with a tough transparent plastic that is both noise and shatter resistant. Glass reduces noise by the mass principle; that is, the thicker the glass, the more noise-resistant it will be. A ½" thick glass has a maximum STC rating of 35dB compared to a 25dB rating for ordinary 3/16" glass. However, glass thickness is only practical up to a certain point, when STC increases become too insignificant to justify the cost. For example, a ½" glass can have an STC of 35; increasing the thickness to ¾" only raises the STC to 37. However, a double glass acoustical window consisting of 2- 3/16" thick panes separated by an airspace will have an STC of 51 and can cost less than either solid window.

In addition to thickness, proper sealing is crucial to the success of the window. To prevent sound leaks, single windows can be mounted in resilient material such as rubber, cork or felt.

Double-glaze windows are paired panes separated by an airspace or hung in a special frame. Generally, the performance of the double-glazed window may be increased with: (a) increased airspace width; (b) increased glass thickness; (c) proper use of seals; (d) slightly dissimilar thickness of the panes; and, (e) slightly nonparallel panes.

In general, the airspace between the panes should not be less than 2-4" if an STC above 40 is desired. If this is not possible, a heavy single-glazed window can be used. The use of slightly nonparallel panes is a technique employed when extremely high sound insulation is required, such as in control rooms of television studios.

The thickness of double-glazed panes may vary from 1/8" to ¼" or more per pane. Although thickness is important, the factors that most determine the noise resistance of the window are the use of sealant and the width of the airspace.

As in the case of all windows, proper sealing is extremely important.

DOORS

Acoustically, doors are even weaker than windows, and more difficult to treat. Any door will reduce the insulation value of the surrounding wall. The common, hollow core wood door has an STC rating of 17dB. Taking up about 20 % of the wall, this door will reduce a 48 STC wall to 24 STC. To reduce noise, a hollow-core door can be replaced by a heavier solid-core wood door that is well sealed and is relatively inexpensive. A solid-core wood door with vinyl seal around the edges and carpeting on the floor will reduce the same 48 STC wall to only 33dB.

The alternative solution to doors is to eliminate them whenever possible from the severely affected walls and place them in more shielded walls.

In any case, no mail slots or similar openings would be allowed in exterior doors.

ROOFS

Acoustical treatment of roofs is not usually necessary unless the noise is extremely severe or the noise source is passing over the building. The ordinary plaster ceiling should provide adequate sound insulation except in extremely severe cases. An acoustically-weak roof which is likely to require treatment is the beamed ceiling. Beamed ceilings may be modified by the addition of a layer of fiberglass or some other noise resistant material. Suspended ceilings are the most effective noise reducers but they are also the most expensive.

REFERENCES

1 U.S. Department of Housing and Urban Development, A Study of Techniques to Increase the Sound of Insulation of Building Elements, Report NO. WR 73-5, Washington, D.C., June, 1973.

2 Ibid.

3 D.E. Bishop and P.W. Hirtle, "Notes on the Sound Transmission Loss of Residential-Type Windows and Doors," Journal of the Acoustical Society of America, 43:4 (1968).

4 U.S. Gypsum, Sound Control...p. 100.

5. Ibid p. 15.

[1] The Audible Landscape: A Manual for Highway Noise and Land Use, U.S. Department of Transportation, the Federal Highway Administration, November, 1974. (GPO Stock #5000-00079)

FIGURE 20.520-2
WALL SOUND INSULATION CHARACTERISTICS

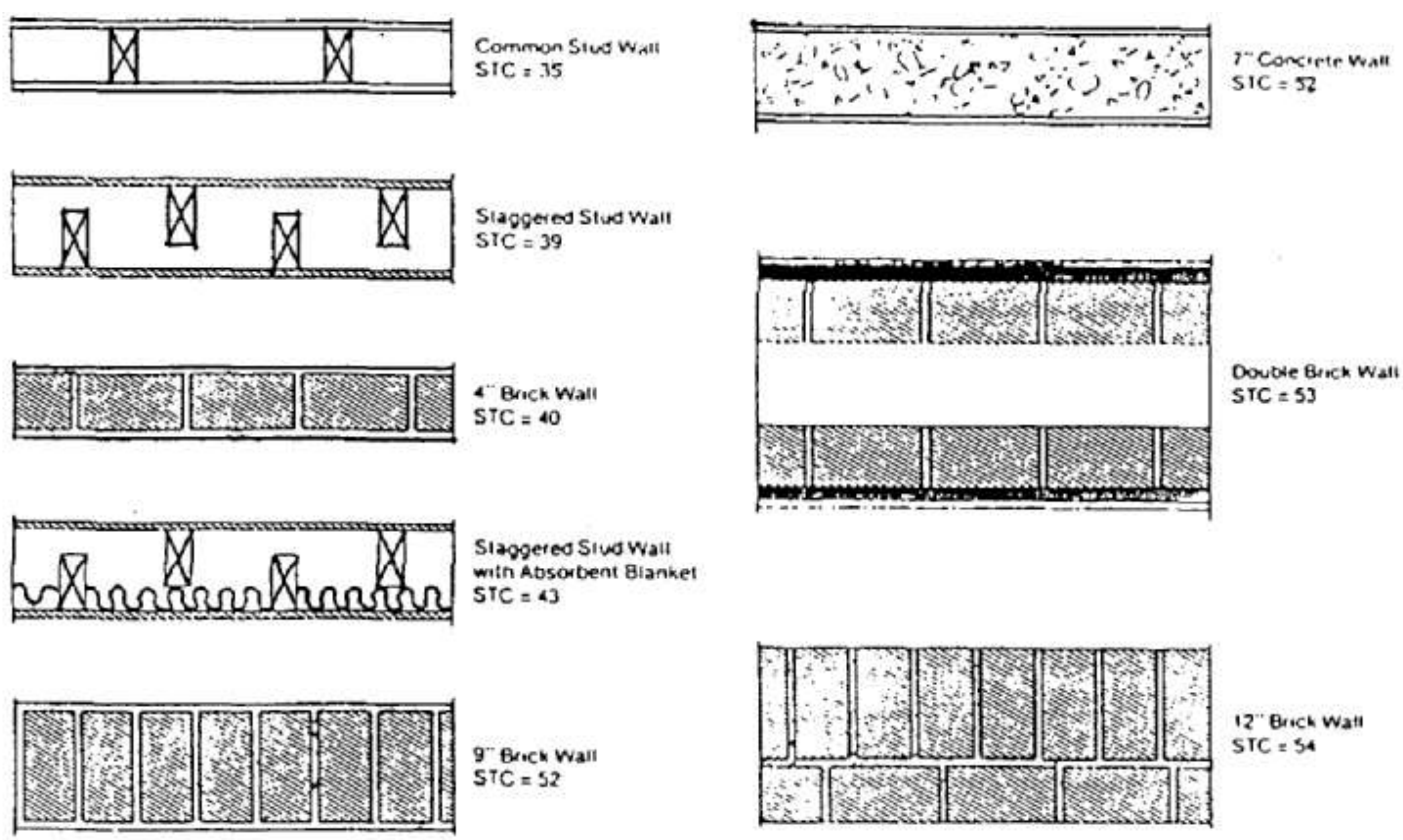
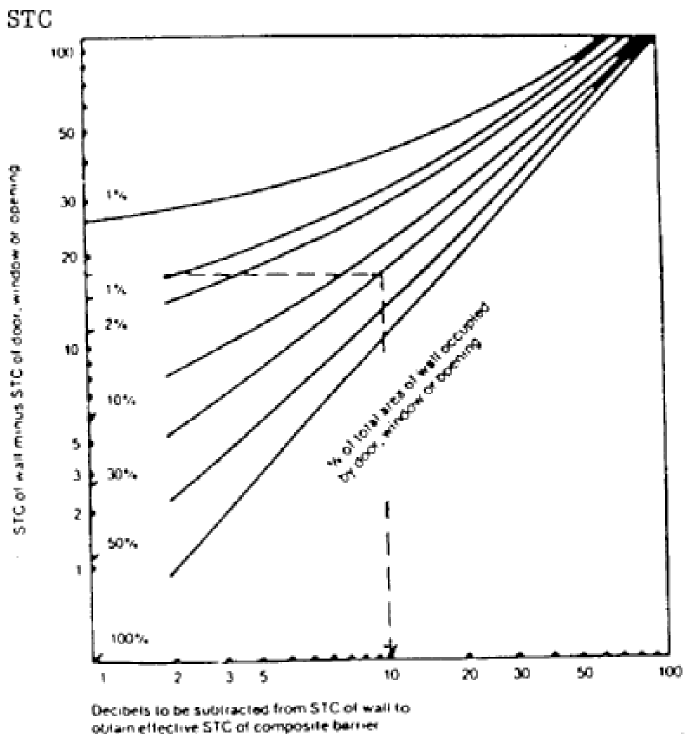


FIGURE 20.520-3
WINDOWS' SOUND TRANSMISSION CHARACTERISTICS



Instructions on use of graph

1. Subtract the STC value of the door, window or opening from the STC value of the wall.
2. Enter the vertical axis of the graph at the point that matches the value from step 1.
3. Read across to the curve that represents the percentage of the total area of the wall that is taken up by the door, window, or opening.
4. Read down to the horizontal axis.
5. Subtract the value on the horizontal axis from the original STC value of the wall. The result is the composite STC value of the wall and the door, window or opening.

(M-3643, Added, 01/26/2004)

Section 20.520.060 Disclosure Statement Required.

Required disclosure statement. As a condition of a building or development permit for residential use within the Noise Impact Overlay District, the applicant shall sign and record a disclosure statement in a form provided by the City consistent with this Chapter. Such statement shall clearly document that the premises may be adversely affected by noise. The statement shall also reference any Noise Impact Reduction Plan applicable to the property, and the applicant shall agree to provide a copy of this statement to all prospective purchasers or tenants of the property who intend to occupy the structure as a dwelling. A signed copy of such statement and proof that it has been recorded with the County Auditor must be presented to the Planning Official prior to issuance of any such permit. If the overlay district is modified under Section 20.520.020(B) VMC so as to reduce the size of such zone or to delete any land therefrom, the affected property owner may amend such disclosure statement to reflect such change, and upon written approval of the Planning Official, may file a supplemental statement showing such change.
(M-3643, Added, 01/26/2004)

Section 20.520.070 Review and Modification.

General. There shall be review by the Planning Commission of the boundaries of the Noise Impact Overlay District at least every 5 years. This review shall be based on the location of the 65 Ldn noise contour provided by the Port of Portland, the Washington Department of Transportation, and/or other reliable sources. (Note: For purposes of establishing review dates, this Chapter was adopted by the City on June 17, 1985.)
(M-3643, Added, 01/26/2004)

APPENDIX B
INTERAGENCY AND INTERGOVERNMENTAL COORDINATION FOR ENVIRONMENTAL PLANNING

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Dear Mr. Mattoch:

Thank you for your two letters dated March 22, 2022 requesting the Federal Aviation Administration (FAA) participation as a cooperating agency to the National Guard Bureau's preparation of two separate Environmental Assessments (EAs) for proposed F-15EX Eagle II aircraft basing at two locations in Oregon. At Portland International Airport, the proposed action consists of replacing the existing F-15C aircraft, and construction, renovation, and demolition of facilities at the 142nd Fighter Wing. As the Crater Lake - Klamath Regional Airport, the proposed action consists of replacing the existing F-15C/D aircraft, and construction, renovation, and demolition of facilities at the 173rd Fighter Wing at Kingsley Field Air National Guard Base.

The FAA's Office of Airports (ARP) supports the Air National Guard's decision to prepare an EA for these proposals and agrees to be a Cooperating Agency pursuant to 40 CFR §1501.8 for both EAs. As a Cooperating Agency, we agree to assign staff with the goal to help develop a single, comprehensive EA and joint decision document to meet each agency's distinct obligations under the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. §§ 4321 - 4374) to support the decision making of both agencies. In addition, for each EA, FAA's ARP will:

- Upon the Air National Guard's request, to the extent practical, support the development of information and analyses, including portions of the EA concerning issues for which ARP has special expertise, with the following exceptions:
  - During document reviews, ARP can develop descriptions specific to our action and role as a cooperating agency and make recommendations to the Air National Guard to correct missing information or deficiencies in the analysis associated with ARP's jurisdiction by law and special expertise.
  - ARP is relying on the Air National Guard, as lead agency, to fund major activities or analyses it requests from ARP pursuant to 40 CFR 1501.8(b)(3). Specifically, the modeling and analysis of military and civil aircraft noise impacts for each civil airport location.
- To the extent practicable, support the Air National Guard's interdisciplinary review capability pursuant to 40 CFR §1501.8 (b)(4).
- Consult with the Air National Guard in development of a schedule, meet the schedule, and elevate, as appropriate, to the senior Air National Guard official, any issues relating to purpose and need, alternatives, or other issues that may affect ARP's ability to meet the Air National Guard's schedule.
- Review and provide comments regarding matters for which ARP has jurisdiction by law

2

and special expertise consistent with 40 CFR §1503.2 and specific comments pursuant to 40 CFR §1503.3, as well as ensuring the EA is legally sufficient for the purposes of relying on the EA pursuant to 40 CFR §1506.3 associated with ARP's separate but connected action.

For the civil airports associated with the two Air National Guard's proposed actions, please note where FAA's ARP has jurisdiction by law, ARP will be an "action agency" on behalf of the FAA. Under the Airport and Airway Improvement Act of 1982 (49 U.S.C. 47101) and relevant implementing regulations, ARP must approve of any changes to an airport sponsor's Airport Layout Plan (ALP). This approval, consistent with provisions under 49 U.S.C 47101 and Section 163 of the 2018 FAA Reauthorization Act, is a major federal action requiring compliance with NEPA. ARP's action, however, is not substantially the same as the Air National Guard's action. Therefore and in addition to being a Cooperating Agency, FAA's ARP needs to ensure the Air National Guard, as the lead agency, prepares an EA that is sufficient for our independent obligation to comply with NEPA. This includes ensuring that the EA meets statutory requirements pursuant to NEPA, regulatory requirements pursuant to 40 CFR Parts 1500-1508, and FAA Order 1050.1F "Environmental Impacts: Policies and Procedures for administering NEPA" so ARP may rely on the final EA and sign a joint decision document.

Since the Air National Guard's proposed actions involve two civilian airports, Klamath Regional Airport and Portland International Airport, within a single state, the Airports District Office for the Northwest Mountain Region will be the lead within FAA for the development of the two EAs. However, we understand that in addition to, and in conjunction with the development of the two EAs, the Air Force is preparing an Environmental Impact Statement (EIS) for the proposed F-35A and F-15EX basing at multiple locations nation-wide, and the ARP Planning and Environmental Division (Headquarters) will be lead office within FAA for the development of the EIS. FAA will ensure our participation in the NEPA processes for the EIS and the two EAs for these aircraft basing actions is consistent and we will coordinate internally, as appropriate.

I trust this is responsive to your request and we look forward to working with your team to develop an achievable schedule and support the Air National Guard throughout the NEPA process. If you or your staff have any questions or concerns, the regional point of contact for this is Ms. Ilon Logan at ilon.logan@faa.gov.

Sincerely,

HEATHER FERNUIK
Digitally signed by HEATHER FERNUIK
Date: 2022.05.13 07:35:06 -06'00'

Heather Fernuik
Director, Airports Division, Northwest Mountain Region

Cc: Ilon Logan, Environmental Protection Specialist, Northwest Mountain Region
Susan Staehle, Environmental Protection Specialist, Airport Planning and Environmental Division

Sample Agency Letter

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE JOINT BASE ANDREWS 20762-5157

28 April 2023

National Guard Bureau (NGB A4/AM)

The Honorable Tina Kotek
Governor of Oregon
900 Court Street, Suite 254
Salem, OR 97301-4047

Dear Governor Kotek,

The National Guard Bureau (NGB), pursuant to National Environmental Policy Act of 1969 (NEPA) (42 United States Code 4321 et seq.), is preparing an Environmental Assessment (EA) that will analyze potential effects to human health and the natural environment. The Department of the Air Force (DAF) proposes to recapitalize its existing F-15C inventory at the Portland Air National Guard (ANG) installation (Attachment 1) with the newer and more capable F-15EX "Eagle II" aircraft. Recapitalization is the acquisition of the new generation F-15EX aircraft and construction and upgrade of specific facilities for one squadron of F-15EX aircraft to support current and future combat and mission readiness. The 142nd Wing (142 WG) at the Portland ANG installation would become the first operational combat squadron (OPS 1) for the F-15EX under this Proposed Action.

The squadron would consist of up to 24 F-15EX aircraft that would replace the existing 20 F-15C aircraft currently based at the Portland ANG installation. The Proposed Action would also include personnel needed to operate and maintain the F-15EX. Additionally, it is feasible the 142 WG could continue operating with their existing legacy F-15C model aircraft for a limited time, in which case, construction associated with operating those legacy aircraft into the future is also being analyzed. The Proposed Action has the potential to affect areas of proposed ground disturbance (including locations of newly constructed buildings), facilities that would be demolished or renovated (Attachments 2 and 3), and lands located beneath existing airspace (Attachment 4). No new airspace or airspace reconfigurations would be established as part of the Proposed Action. However, there would be an increase from the current seven F-15C sorties per day to an average of eight F-15EX sorties per day that utilize the existing special use airspace.

The DAF and the NGB are the lead agencies for the Proposed Action. The Federal Aviation Administration (FAA) is a cooperating agency because the 142 WG is located on a civilian airfield where the FAA would have a federal action in approving changes to the Airport Layout Plan.

As part of our efforts to evaluate the effects of our action, the NGB respectfully requests information or agency-specific preliminary comments that would alleviate or highlight areas of concern preceding the EA. Areas of concern many include potential effects to: physical, ecological, social, cultural, and archaeological resources. The NGB also requests any information that your agency may have regarding other proposed, ongoing, or recently completed projects that could create or exacerbate impacts resulting from the Proposed Action.

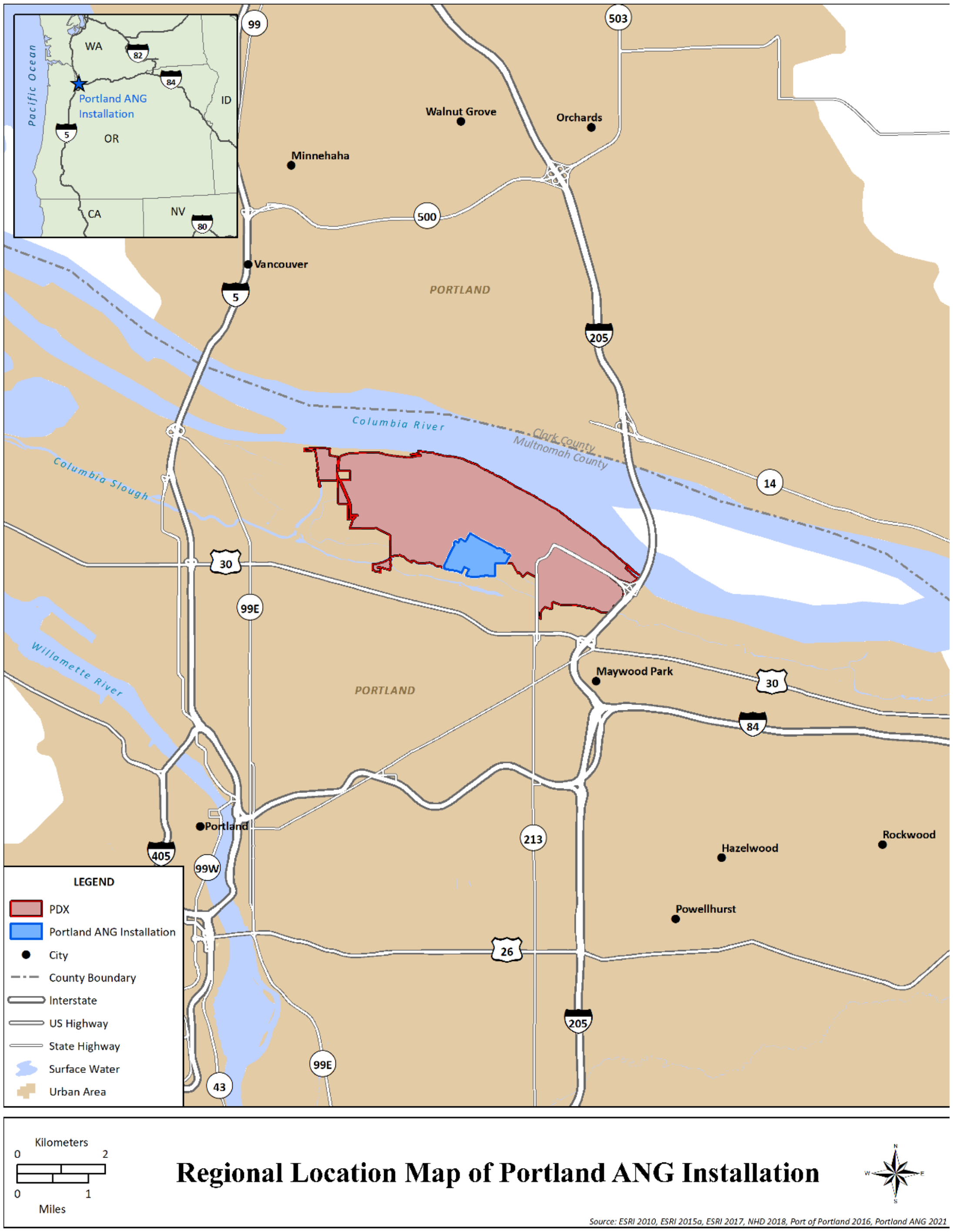
In order for the NGB to address your concerns in a timely manner, please respond to this letter within thirty (30) days of receipt to Will Strickland, NGB Plans and Requirements Branch, ATTN: 142 WG EA, 3501 Fetchet Avenue, Joint Base Andrews, MD 20762-5157 or by email at william.strickland.7@us.af.mil with the subject titled as ATTN: 142 WG EA. Thank you for your assistance.

Sincerely,

Mr. Will Strickland, NGB
Plans and Requirements Branch

Attachments:
1. Regional Location Map of Portland ANG Installation
2. Proposed Renovation, Demolition, and Construction Projects Table
3. Proposed Renovation, Demolition, and Construction Projects Map
4. Portland ANG Installation Special Use Airspace Map

ATTACHMENT 1



Regional Location Map of Portland ANG Installation

ATTACHMENT 2

Proposed Renovation (R), Demolition (D), and Construction (C) Projects Table

Type	*Map #*	*Start Year*	*Action*	*Total Area of New Ground Disturbance or Building Size (SF)[1]*	*Demolition (SF)*	*New Impervious Surface (SF)*
C	1	2025	**Demolish and Reconstruct Battery Shop (Building 240).** Includes LOX and Helium Facility.	1,600	0	0
R	2A[2]	2025	**Avionics Building 270 Repairs.** Building systems upgrades (e.g., HVAC, plumbing, electrical).	12,796	0	0
C	2B[2]	2025	**Construct Addition to Avionics Building 270.**	2,804	0	2,804
C	3	2025	**Construct Aircraft Support Equipment Covered Storage (new structure, no building number).** To meet requirements for F-15EX conversion.	6,500	0	6,500
C	4A	2026	**Construct Additional Admin Area for M&I Air-to-Ground (new building, no number).** Maintenance bay required to execute small maintenance related to air-to-ground mission.	4,400	0	0
D, R	4B	2026	**Repurpose Building 400 for a Conventional Munitions Admin Area (Building 400).** To meet space requirements for air-to-ground mission, requires partial demolition of existing building with interior renovations to the remainder of the facility.	0	4,000	0
C	4C	2026	**Construct MUNS Storage Igloo (new building, no number).** To meet space requirements for air-to-ground mission.	3,600	0	3,600
C	4D	2026	**Install MUNS Maintenance Trailer (new building, no number).** Includes construction of a concrete pad for trailer to be placed on. To meet requirements for air-to-ground mission.	1,200	0	1,200
C	4E	2026	**Construct Additional Conventional Munitions Admin Facility.** To meet space requirements for air-to-ground mission. Includes moving the existing perimeter fence and constructing new utilities.	1,240	0	1,240
C	4F	2026	**Construct MAC Pad.** To meet space requirements for air-to-ground mission.	5,000	0	5,000
D	5	2027	**Demolish and Reconstruct Building 165.** Needed to accommodate land use restructuring resulting from return of leased lands.	19,000	20,004	0
C	6	2027	**Construct Weapons Load Release Building (new building, no number).** To meet requirements of the F-15EX conversion.	14,400	0	14,400
C	7	2027	**Construct F-15EX CFT MX Storage and Pad.** To meet requirements for air-to-ground mission.	2,000	0	9,200
R	8[3]	2027	**Remodel and Repair Building 275 for CTK/AFE.** To meet F-15EX conversion requirements (e.g., upgrade electrical, reconfigure internal floorplan).	12,269	0	0
R	9	2027	**Repair near Building 432 POL.** Upgrade outdoor spill containment.	150	0	0
D	10A	2028	**Demolish Buildings 475, 491, 495, 496, 497, and 498 in Parcel D-2.** Required as building is located on leased lands that would be returned to Port of Portland upon lease expiration in 2030.	0	23,167	0

ATTACHMENT 2

Proposed Renovation (R), Demolition (D), and Construction (C) Projects Table (continued)

Type	*Map #*	*Start Year*	*Action*	*Total Area of New Ground Disturbance or Building Size (SF)[1]*	*Demolition (SF)*	*New Impervious Surface (SF)*
D, C	10B	2028	**Separate Utilities in Parcel D-1.** Utilities for continued use of the Portland ANG installation needs to be separated from the ones on the leased lands that would be returned to Port of Portland upon lease expiration in 2030.	0	387	0
D	11	2029	**Demolish Combat Arms Training Range, Buildings 485 and 480.** No construction proposed to occur to replace these buildings.	0	64,733	0
C	12	2029	**Construct New BCE Pavement and Ground Facility (new building, no number).** Facility to store heavy equipment currently stored outdoors.	6,500	0	6,500
C	13	2029	**Construct Add-on to Building 115 for CERFP/DOMOPS.**	1,200	0	1,200
C	14	2029	**Construct Covered Storage Shed for CERFP/DOMOPS.**	2,800	0	2,800
C	15	2030	**Repair/Increase Size of South Alert Berm.**	6,600	0	6,600
C	16	2030	**Construct Add-on Crew Readiness Area for CSOs (Building 210).** To meet requirements for air-to-ground mission.	1,200	0	1,200
C	17[4]	2030	**Construct Arm/De-arm Pad with Berm.** Aprons would be connected to the new pad.	12,000	0	12,000
C	18A[5]	2030	**Construct F-15EX Simulator Facility (Next to Building 265).** To enable backseat cockpit training.	20,000	0	20,000
D, C	18B[5]	2030	**Demolish and Re-build Building 265.** Larger operations facility to support increased operations footprint.	1,300	23,700	1,300
R	19	2030	**Repair LRS Building 170.** Building systems upgrades (e.g., HVAC, plumbing, electrical).	56,876		
D, C	20A[3]	TBD	**Construct Universal Large Hangar (new building, no number), requires demolition of Building 275, partial demolition of building 265, parking lot area, and security fence.** To meet requirements for air-to-ground mission. Hangar would be approximately 35,000 SF and 50 feet tall, with an additional 27,300 SF of shop space.	62,300	147,256	9,320
C	20B[3]	TBD	**Construct Universal Large Hangar (new building, no number) with new connecting ramps.** To meet requirements for air-to-ground mission. Hangar would be approximately 35,000 SF and 50 feet tall, with an additional 27,300 SF of shop space. This option requires the construction of an additional 58,708 SF of connecting concrete ramp.	119,258	0	119,258

Legend: AFE = Aircrew Flight Equipment; ANG = Air National Guard; BCE = Base Civil Engineer; C = project type: construction; CERFP/DOMOPS = Chemical Biological Radiological Nuclear Enhanced Response Force Package/Domestic Operations; CFT = Contract Field Team; CTK = Consolidated Tool Kit; D = project type: demolition; HVAC = Heating, Ventilation, and Cooling; LOX = liquid oxygen; LRS = Logistics Readiness Squadron; M&I = maintenance and inspection; MAC = Munitions Assembly Conveyor; MUNS = Munitions Squadron; MX = Maintenance Squadron; POL = petroleum, oil, and lubricants; R = project type: renovation; SF = square feet; TBD = to be determined; CSO = Combat Systems Officer.

Notes: [1] For building construction projects, the area of total ground disturbance represents the square-footage of a 1-story building to be constructed; for renovation-only projects, the SF represents the building size.

[2] Project 2A (renovations only) and Project 2B (new construction) are both related to Building 270 but different disturbance footprints.

[3] Projects 20A and 20B are two location options for the construction of the Universal Large Hangar. Project 8 (renovations only) would not occur if Project 20A (new construction) is constructed, as Project 20A would require the demolition of Building 275, and the functions in Building 275 would be relocated to other facilities.

[4] Project 17 may require a concrete batch plant for construction, if determined by the contractor and would likely be located just south of the where Project 17 would be constructed, pending FAA approval.

[5] Projects 18A and 18B will both occur and are related to Building 265 (these are not options for construction).

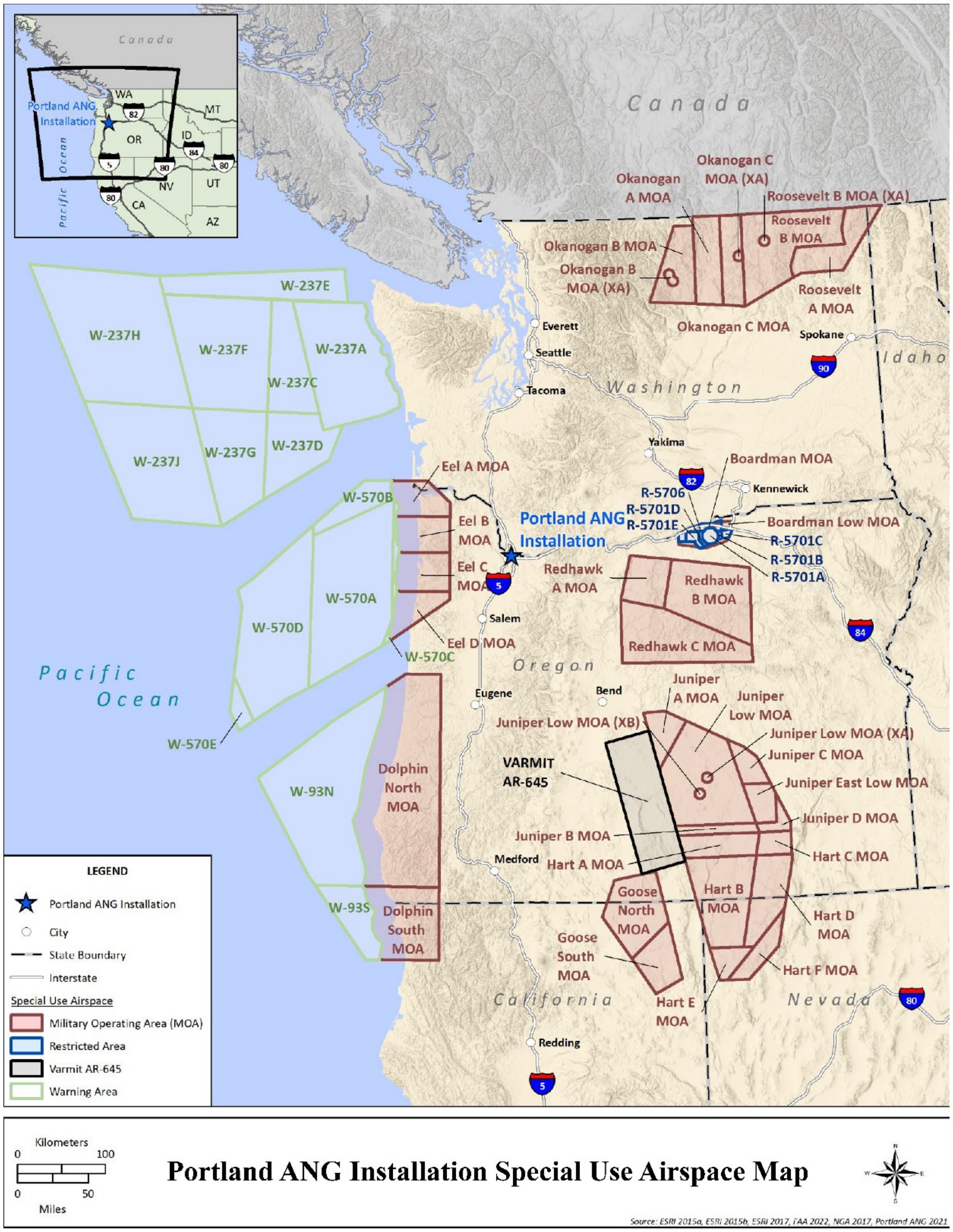
Source: 142 WG 2023.

ATTACHMENT 3

Proposed Renovation, Demolition, and Construction Projects Map

Source: ESRI 2015a, ESRI 2021, Port of Portland 2016, Portland ANG 2021

ATTACHMENT 4



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Sample SHPO Letter

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE JOINT BASE ANDREWS 20762-5157

28 April 2023

Jennifer Harty
Cultural Resources Program Manager
Air National Guard Readiness Center
3501 Fetchet Avenue,
Joint Base Andrews MD 20762-5157

Lisa Sumption
Director
State Historic Preservation Office
Oregon Parks and Recreation Department
725 Summer St., Suite C
Salem, OR 97301

Dear Ms. Sumption,

The National Guard Bureau (NGB) would like to initiate consultation with your office under Section 106 of the National Historic Preservation Act of 1966 (NHPA), and its implementing regulations (36 Code of Federal Regulations [CFR] § 800).

Pursuant to National Environmental Policy Act of 1969 (42 United States Code 4321 et seq.), the NGB is preparing an Environmental Assessment (EA) for a proposed undertaking that will analyze potential effects to human health and the natural environment, including historic and traditional cultural properties. The Department of the Air Force (DAF) proposes to recapitalize its existing F-15C inventory at the Portland Air National Guard (ANG) installation (Attachment 1) with the newer and more capable F-15EX "Eagle II" aircraft. Recapitalization is the acquisition of the new generation F-15EX aircraft and construction and upgrade of specific facilities for one squadron of F-15EX aircraft to support current and future combat and mission readiness. The 142nd Wing (142 WG) at the Portland ANG installation would become the first operational combat squadron (OPS 1) for the F-15EX under this Proposed Action.

The squadron would consist of up to 24 F-15EX aircraft that would replace the existing 20 F-15C aircraft currently based at the Portland ANG installation. The Proposed Action would also include personnel needed to operate and maintain the F-15EX. The NGB has reviewed the undertaking and defined the Area of Potential Effects (APE) as areas proposed to have ground disturbance (including locations of newly constructed buildings), facilities that would be demolished or renovated (Attachments 2 and 3), and lands located beneath existing airspace (Attachment 4). No new airspace or airspace reconfigurations would be established as part of the Proposed Action. However, there would be an increase from the current seven F-15C sorties to an average of eight F-15EX sorties per day that would utilize the existing special use airspace.

The DAF and the NGB are the lead agencies for the Proposed Action. The Federal Aviation Administration (FAA) is a cooperating agency because the 142 WG is located on a civilian airfield where the FAA would have a federal action in approving changes to the Airport Layout Plan.

In accordance with 36 CFR § 800.4(a)1, we are providing your office with this opportunity to comment on our proposed APE for this undertaking. Please respond in writing to the NGB within thirty (30) days. Please provide comments to Jennifer Harty, Cultural Resources Program Manager (A4), ATTN: 142 WG EA, 3501 Fetchet Avenue, Joint Base Andrews, MD 20762-5157 or by email at jennifer.harty@us.af.mil with the subject titled as ATTN: 142 WG EA. Thank you for your assistance.

Sincerely,

Jennifer L. Harty, GS-13, DAF
Cultural Resources Program Manager

Attachments:
1. Regional Location Map of Portland ANG Installation
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Sample Tribal Letter

DEPARTMENT OF THE AIR FORCE
142ND WING (ACC)
PORTLAND AIR NATIONAL GUARD BASE OREGON

28 April 2023

Colonel Todd A. Hofford
Commander
6801 NE Cornfoot Rd.
Portland, OR 97218

Delores Pigsley
Chairperson
Confederated Tribes of Siletz Indians of Oregon
P.O. Box 549
Siletz, OR 97380-0549

Dear Chairperson Pigsley,

In accordance with Executive Order (EO) 13175, *Consultation and Coordination with Indian Tribal Governments*; EO 12372, *Intergovernmental Review of Federal Programs*; Section 106 of the National Historic Preservation Act (36 Code of Federal Regulations Parts 800.2, 800.3, and 800.4); and the National Environmental Policy Act of 1969 (NEPA) (42 United States Code 4321 et seq.), the 142nd Wing (142 WG) and the National Guard Bureau (NGB) would like to initiate government-to-government consultation on a proposed undertaking.

Pursuant to NEPA, the NGB is preparing an Environmental Assessment (EA) that will analyze potential effects to human health and the natural environment, including historic and traditional cultural properties, for a proposed undertaking. The Department of the Air Force (DAF) proposes to recapitalize its existing F-15C inventory at the Portland Air National Guard (ANG) installation (Attachment 1) with the newer and more capable F-15EX "Eagle II" aircraft. Recapitalization is the acquisition of the new generation F-15EX aircraft and construction and upgrade of specific facilities for one squadron of F-15EX aircraft to support current and future combat and mission readiness. The 142 WG at the Portland ANG installation would become the first operational combat squadron (OPS 1) for the F-15EX under this Proposed Action.

The squadron would consist of up to 24 F-15EX aircraft that would replace the existing 20 F-15C aircraft currently based at the Portland ANG installation. The Proposed Action would also include personnel needed to operate and maintain the F-15EX. Additionally, it is feasible the 142 WG could continue operating with their existing legacy F-15C model aircraft for a limited time, in which case, construction associated with operating those legacy aircraft into the future is also being analyzed. The NGB has reviewed the undertaking and defined the Area of Potential Effects (APE) as areas proposed to have ground disturbance (including locations of newly constructed buildings), facilities that would be demolished or renovated (Attachments 2 and 3), and lands located beneath existing airspace (Attachment 4). No new airspace or airspace reconfigurations would be established as part of the Proposed Action. However, there would be an increase from the current seven F-15C sorties to an average of eight F-15EX sorties per day that utilize the existing special use airspace.

The DAF and the NGB are the lead agencies for the Proposed Action. The Federal Aviation Administration (FAA) is a cooperating agency because the 142 WG is located on a civilian airfield where the FAA would have a federal action in approving changes to the Airport Layout Plan.

As part of our efforts to evaluate the effects of our action, we respectfully invite you to consult on and provide comments for our proposed undertaking. If you would like to request formal consultation, we will work with you to adopt procedures that meet the needs and requirements for your Tribe. If you would like to provide assistance in identifying resources that may be affected by our proposal, we especially request your assistance in identifying the following:

- traditional resources that may be located within the current APE;
- historic properties in the APE of which we may not be aware; and/or
- other resources that could be affected by our proposal.

In order for the NGB to address your concerns in a timely manner for both the Tribe and the proposed undertaking, please respond to this letter within thirty (30) days of receipt. Please provide comments to Jennifer Harty, Cultural Resources Program Manager (A4), ATTN: 142 WG EA, 3501 Fetchet Avenue, Joint Base Andrews, MD 20762-5157 or by email at jennifer.harty@us.af.mil with the subject titled as ATTN: 142 WG EA. Thank you for your assistance.

Sincerely,

TODD A. HOFFORD, Colonel, USAF
Commander

Attachments:
1. Regional Location Map of Portland ANG Installation
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4. Portland ANG Installation Special Use Airspace Map

CONFEDERATED TRIBES of the CHEHALIS RESERVATION

May 5, 2023

Colonel Todd A. Hofford
Commander
Department of the Air Force
6801 NE Cornfoot Rd
Portland, OR 97218

RE: Portland ANG Installation Improvement Project

Dear Commander Hofford,

Thank you for contacting this department, pursuant to National Historic Preservation Act Section 106. The materials received for Portland ANG Installation Improvement Project have been reviewed by this office.

The Chehalis Tribe's Historic Preservation Office concurs with determination of the APE for this project and has no further comments at this time.

This determination is based upon the information available at the time of this review. Should additional information become available, our assessment may be revised, including information regarding historic properties that have not yet been identified.

Thank you for the opportunity to comment on this project and we look forward to working through this process together.

Sincerely,

Dan Penn
Tribal Historic Preservation Officer
(360) 709-1747
email: dpenn@chehalistribe.org

P.O. BOX 536 • OAKVILLE, WA. 98568
AC 360-273-5911 • FAX 360-273-5914

Spokane Tribe of Indians
Tribal Historic Preservation Officer

PO Box 100 Wellpinit WA 99040

May 8, 2023

To: Jennifer Harty, Cultural Resources Program Manager

RE: E.O. Intergovernmental Review of Federal Programs:

Ms. Harty,

Thank you for contacting the Spokane Tribe's Historic Preservation Office. We appreciate the opportunity to provide a cultural consult for your project.

Pursuant to compliance with Section 106 of the National Historic Preservation Act and 36 CFR 800, we are hereby in consultation for this project.

This project has been determined to be in the Umatilla Tribe, Warm Springs, Grand Ronde area, therefore I will defer this project to one of those tribes.

Again, thank you for the opportunity to comment, if question arise contact me at 509-258-4222.

Sincerely,

Randy Abrahamson
THPO for the Spokane Tribe

-----Original Message-----
From: HARTY, JENNIFER L CIV USAF ANG NGB/A4VN <jennifer.harty@us.af.mil>
Sent: Thursday, May 11, 2023 8:55 AM
To: Melissa Ayvaz <melissa.ayvaz.hsy@colvilletribes.com>
Cc: Guy Moura <Guy.Moura@colvilletribes.com>; TREECE, ALICIA M CTR USAF ANGRC NGB/A4 <alicia.treece.2.ctr@us.af.mil>
Subject: RE: [Non-DoD Source] ATTN: 142 WG EA

Good morning Ms. Ayvaz,

On behalf of Col Hofford, I would like to thank you for taking the time to comment on our proposed undertaking. We have noted that you currently have no concerns with the proposal. If our undertaking changes, we will provide the updated information to your office for additional review and comment. We understand that you may have concerns at that time.

Respectfully,

//SIGNED//
JENNIFER L. HARTY, M.A., RPA, GS-13, DAF Cultural Resources Program Manager Tribal Liaison
NGB/A4VN Environmental Quality Air National Guard Readiness Center
3501 Fetchet Drive, Joint Base Andrews, MD 20762

NIPR: jennifer.harty@us.af.mil
:8 https://intelshare.intelink.gov/sites/vemo/SitePages/Program.aspx?Program=3

☎ Comm: 240-612-8541| ☎ DSN: 612-8541 | ☎ TW Cell: 701-202-7066

-----Original Message-----
From: Melissa Ayvaz <melissa.ayvaz.hsy@colvilletribes.com>
Sent: Wednesday, May 10, 2023 4:09 PM
To: HARTY, JENNIFER L CIV USAF ANG NGB/A4VN <jennifer.harty@us.af.mil>
Cc: Guy Moura <Guy.Moura@colvilletribes.com>
Subject: [Non-DoD Source] ATTN: 142 WG EA

x̌ast sx̌lx̌ʕalt | good day

Dear Todd,

Thank you for consulting with the Confederated Tribes of the Colville Reservation regarding the proposed undertaking.

Please be advised that portions of the proposed undertaking are within the traditional territories of the twelve constituent tribes of the Confederated Tribes of the Colville Reservation (Colville Confederated Tribes/CCT), which is governed by the Colville Business Council (CBC). The CBC has delegated to the Tribal Historic Preservation Officer (THPO) the responsibility of representing the Colville Tribes with regard to cultural resources management concerns throughout the traditional territories of all of the constituent tribes under Resolution 1996-29. The Chelan, Chief Joseph Band of Nez Perce, Colville, Entiat, Lakes, Methow, Moses-Columbia, Nespelem, Okanogan, Palus, San Poil, and Wenatchi Tribes comprise the Confederated Tribes of the Colville Reservation. These territories include parts of eastern Washington, northeastern Oregon, the Palus (Palouse) territory in Idaho, and south central British Columbia.

We have reviewed the materials provided by your office. There are indeed traditional properties, historic properties and other resources of cultural importance to the people of the Colville Tribes within portions of the APE. However, as the proposed undertaking will utilize existing special use airspace, we do not request formal consultation. We appreciate the consultation. Do not hesitate to contact us with any questions or concerns related to the Tribes cultural resources.

If you have any questions or concerns related to the Tribes cultural resources, please contact me at (509) 634-2697 or CCT THPO Guy Moura at (509) 634-2695. Please note that these comments are based on information available to us at the time of the project review. We reserve the right to revise our comments as information becomes available.
Sincerely, Melissa

qeʔciw̓ýew̓ | lim lemt | thank you,

Melissa Anne Ayvaz, MA, RPA

History/Archaeology Program

Confederated Tribes of the Colville Reservation

21 Colville St, Nespelem, WA, 99155

Desk: 509.634.2697 / Mobile: 509.631.1177

Melissa.Ayvaz.HSY@ColvilleTribes.com <mailto:Melissa.Ayvaz.HSY@colvilletribes.com>

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Oregon Fish and Wildlife Office
2600 SE 98th Avenue, Suite 100
Portland, Oregon 97266
Phone: (503) 231-6179 FAX: (503) 231-6195

File Number: 8181.0511
File Name: Comment Letter 23 225 OR ANG PDX F-15EX
TS Number: 23-225
Ecosphere: n/a

Mr. Will Strickland, NGB
Plans and Requirements Branch
Attn: 142 WG EA, 3501 Fletchet Avenue
Joint Base Andrews, MD 20762-5157

Dear Mr. Strickland,

Thank you for the opportunity to provide information and agency-specific comments as the Department of the Air Force prepares an environmental assessment that will analyze the potential effects from the recapitalization of the F-15C to the F-15EX at the Portland Air National Guard. Your letter requesting information dated April 28, 2023, was received by our office on May 1st, 2023.

To analyze the potential effects to federally listed threatened, endangered and candidate species, we recommend that Department of the Air Force use the Information for Planning and Consultation system https://ipac.ecosphere.fws.gov/ to generate a list of species potentially affected by ground disturbing activities. We further recommend species- specific surveys for any listed plant species that are known to occur in the area.

While we understand that the proposed action does not include expansion or modification of airspace, your letter mentions that the proposed action has the potential to include ground disturbing activities on lands located beneath existing airspace, including the Juniper and Hart Miliary Operating Area complexes. We are attaching comments that we provided on the draft Environmental Impact Statement for the proposed Airspace Optimization for Readiness for the Mountain Home Air Force Base, dated September 21, 2021. These comments include recommendations to obtain a programmatic eagle take permit; recommended design features for avoiding impacts to greater sage-grouse; and multiple recommendations regarding flare use and fire danger.

If you have any questions, please contact Jeff Everett of my staff at Jeff_Everett@fws.gov or 503-807-6192.

Sincerely,

KESSINA LEE Digitally signed by KESSINA LEE Date: 2023.05.08 12:37:02 -07'00'

Kessina Lee
State Supervisor

Attachment:

MHAFB Airspace Optimization DEIS comments September 21, 2021

United States Department of the Interior

FISH AND WILDLIFE SERVICE
La Grande Field Office
3502 Highway 30
La Grande, Oregon 97850
Phone: (541) 962-8584 FAX: (541) 962-8581

Reply To: 8181.0511
File Name: MHAFB_Airspace_Optimization_DEIS_comments.docx
TS Number: 21-545

September 21, 2021

Ms. Robin Divine
Mt. Home AFB Airspace Optimization EIS
c/o Leidos
2109 Air Park Road SE, Suite 200
Albuquerque, NM 87106

Dear Ms. Divine,

Thank you for the opportunity to review and provide comments on the Draft Environmental Impact Statement (DEIS) for Airspace Optimization for Readiness for the Mountain Home Air Force Base, dated July 2021. The Service understands that potential impacts to federally listed species and their habitat have been identified as part of the consultation process with the Service; however, at the request of the Service, consultation on federally listed species will not progress to completion until the Department of the Air Force (DAF) has refined the scope of its preferred alternative, which will be identified in the Final EIS after public and agency concerns are better understood. We provide the following comments on the DEIS concerning noise and disturbance to several special status species and species of concern including bald eagles (*Haliaeetus leucocephalus*), golden eagles (*Aquila chrysaetos*), and Greater sage-grouse (*Certrocercus urophasianus*), and also concerning the risk of fire ignition from the use of flares.

Bald and Golden Eagles
The DEIS states that multiple raptor species, including bald and golden eagles, have been observed within the area of interest as year-round residents, with nests typically occurring on cliff faces (DEIS, pg. 3-92). The DIES further states that sightings occur along low-level routes and are closely monitored for avian hazard activity. The Morley Nelson Snake River Birds of Prey National Conservation Area supports a high concentration of raptors. Section 3.5.4.4.3 of the DEIS (pg. 3-112), Special Status Species, describes specific measures that would avoid and minimize collision risk and disturbance with eagles and other raptors, specifically the following recommendations from the 2007 National Bald Eagle Management Guidelines and the 2017 Human Disturbance of Breeding Golden Eagles (Hansen et al. 2017) may be pertinent to the proposed action:

- During the breeding season (February to June), do not operate fixed-wing aircraft within 0.5 miles of nests, and avoid activities that produce extremely loud noises within 0.5 miles of active nests, except where eagles have shown increased tolerance of such activity.
- Do not locate aircraft corridors within 1,000 feet vertical or horizontal distance from communal roost sites.
- Minimize disruptive activities in the direct flight path between eagle nests and their roost sites and important foraging areas.

The Service strongly recommends that these guidelines be followed as minimum best management practices to avoid and minimize impacts to bald and golden eagles. Under the current regulations for the Bald and Golden Eagle Act the Service has a threshold of "zero" for golden eagle take, including disturbance. Take occurring under an eagle permit would need to be mitigated in kind (i.e., loss of a bird would require conservation of a bird) of which the mechanisms to achieve this are variable. While the intent of these measures is appropriate to minimize impacts the availability of annual monitoring data is not certain and therefore currently makes the measures unachievable. Therefore, the Service views the proposed avoidance and minimization measures in the DEIS as not mitigation suitable to Eagle Act compliance.

The Service is currently working on developing golden eagle specific disturbance guidance but in the interim we are defaulting at minimum to the bald eagle management guidelines. Many biologists do believe golden eagles are more sensitive to disturbance possibly due to the more open habitat they primarily occur in and less frequent exposure to human activity. There is little published empirical data on the impact of potentially disturbing activities to golden eagles. The DAF used the 1,000-foot bald eagle guidance buffer in the EIS analysis as a default though the Service continues to have concerns over the conclusions. Local eagle populations may indeed habituate to low level overflights across the area in the long-term but initially low-level flights near nesting birds, especially during the early courtship and nesting season, is likely to result in disturbance to an unknown number of nesting eagles. Like many species, individual golden eagles show a gradient of tolerance to various activities. Intense and sudden loud noise such as an F-15E coming over a nesting cliff at 500 feet or less will likely cause a reaction from a percentage of the nesting birds. Because of this the Service recommends the DAF seek a programmatic eagle take permit for disturbance to golden eagles. Appropriate avoidance, minimization and monitoring procedures would be a part of permit development.

Greater sage-grouse
Table 3.5-9, Summary of Impacts to Biological Resources from the Proposed Action (DEIS pg. 3-121) describes the noise impact to Greater sage-grouse from all the alternatives of the proposed action as moderate, short-to-medium term impact. Impacts to Greater sage-grouse from sudden, loud noise events are not well studied. However, existing noise related research does document energetic expenditure by avian species following aircraft related noise disturbance. The DEIS-Noise Supporting Information, states: High-noise events (like low altitude aircraft overflight) may cause birds to engage in escape or avoidance behaviors, such as flushing from perches or nests (Ellis et al. 1991). These activities impose an energy cost on the birds that, repeated over the long term, may affect survival or growth. In addition, the birds may spend less time engaged in necessary activities like feeding, preening, or caring for their young because they spend time in noise-avoidance activity (DEIS-Noise Supporting information, pg. 51). Additional research has shown that noise can negatively impact sage-grouse use of the landscape. Blickley et al.

Ms. Robin Divine 3

(2012) showed that peak male lek attendance declined by 73% when exposed to noise associated with roads and decreased 29% when exposed to noise from natural gas drilling. Further, as separate study in Wyoming oil fields showed that at leks where $L_{50} > 25$ dBA, lek attendance by males decreased an average of 25% with 92% of monitored leks showing a decline (Ambrose et al. 2018).

Due to the likely impacts of all of the alternatives as described in Table 3.5-9, the Service recommends that the Final EIS include an analysis of a March 1 to June 30 low-level flight restriction that would reduce disturbance in all sage-grouse habitat during critical lekking and nesting seasons.

Fires
The Biological Resources EIS Supporting Information states that flares are designed to burn completely within the first 400 feet of decent, and under the proposed action, flares would not be released below 2,000 feet above ground level (AGL) (except at Saylor Creek Range, where flares would be released at 700 feet AGL) (Biological Resources Supporting Information, pg. 15). The supporting information further states that the risk of flare-ignited wildfires would further be mitigated by the operational constraint that flares are not released below 5,000 feet AGL during fire season, but it does not describe how fire season is determined or provide a time period (for example, May-October).

The low-level use of flares has been documented as being the source of ignition for several wildfires in Oregon. Between July 6th and July 13th, 2019, seven separate fires were determined to be caused by flare use by the U.S. Air Force. These seven fires, the Willow Fire, the Hart Fire, the McCarty Fire, the Coyote Fire, the Johnson Fire, the Malone Fire, and the Rock Creek Fire, burned approximately 3,243 acres of public lands managed by the Service, the U.S. Bureau of Land Management (BLM), and the Oregon Department of Forestry (ODF) as well as privately owned property. An interagency fire investigation report for these 2019 fires is available by written request to the Service's Office of Law Enforcement; to request a copy of the report please utilize the contact information included in this letter below.

The Service would like to recommend that prior to flights, fire risk would be assessed using the National Fire Danger Rating System (NFDRS) updated daily at http://gacc.nifc.gov/nwcc/, and that flare use be limited to only times when fire danger is low. The Service strongly recommends that 2,000 feet AGL be a minimum for flare use under all alternatives, in all locations, at any time of the year. We further recommend that Mountain Home AFB enter into a Memorandum Of Understanding (MOU) with the Blue Mountain Interagency Dispatch Center in La Grande Oregon (http://bmidc.org/index.shtml) and/or the National Interagency Fire Center in Boise, Idaho (https://www.nifc.gov/) to enhance communication and ensure the safest possible operations. Low-level flights are conducted by state and federal agencies both for firefighting purposes and at various times of the year for wildlife surveys. These low-level agency flights include both helicopter and fixed-wing aircraft. Attached is an example of a similar MOU between the Lakeview Interagency Fire Center and the 173rd FW at Kingsley Field, Oregon.

Additional comments
Section 3.4.1 of the DEIS states that land in the area of interest is owned by private, federal, Native American, and state entities. Federal lands include, for example, lands owned and managed by the USFWS, USFS, BLM and DoD (DEIS pg. 3-49). However, the DEIS also

states in section 3.5.3.3 (page 3-92) that no USFWS National Wildlife Refuges are present in the area of interest. Our office conducted a GIS exercise to clarify this and determined that the closest facility that the Service has jurisdiction over is the Hagerman National Fish Hatchery, located approximately 11 miles from the action area. The closest National Wildlife Refuge is Deer Flat National Wildlife Refuge, located approximately 37 miles from the action area.

Thank you for the opportunity to review the DEIS and provide comments. If you have any questions, please contact Jeff Everett at 503-231-6952 or Jeff_Everett@fws.gov.

Sincerely,

Marisa Meyer

Marisa Meyer
Field Supervisor

Citations

Ambrose, S., C. Florian, H. Copeland, G. Patricelli, T. Hartman, and J. MacDonald. 2018. Sound Levels in Sagebrush Habitats in Wyoming and the Influence of Anthropogenic Sounds on Greater Sage-grouse. Abstract, unpublished presentation from the 31st Biennial Western Agencies Sage and Columbian Sharp-Tailed Grouse Workshop, Billings, MT.

Blickley J. L., K. R. Work, A. H. Krakauer, J. L. Phillips, and S. N. Sells. 2012. Experimental Chronic Noise Is Related to Elevated Fecal Corticosteroid Metabolites in Lekking Male Greater Sage-Grouse (*Centrocercus urophasianus*). PLoS ONE 7(11).

Ellis D. H., C. H. Ellis, and D. P. Mindell. 1991. Raptor responses to low-level jet aircraft and sonic booms. Environmental Pollution 74: 53-83.

Hansen, D.L., R.J. Spaul, B. Woodbridge, D. Leal, J.R. Dunk, J.W. Watson, and J. T. Driscoll. 2017. Human disturbance of breeding golden eagles (*Aquila chrysaetos*). Unpublished report prepared for the Western Golden Eagle Team, U.S. Fish and Wildlife Service. Available online at: https://ecos.fws.gov/ServCat/Reference/Profile/112570

U.S. Fish and Wildlife Service, 2007. National Bald Eagle Management Guidelines. Washington, D.C. 25 pages.

Enclosure

MEMORANDUM OF UNDERSTANDING
BETWEEN
173 FW KINGSLEY FIELD, OREGON
AND
LAKEVIEW INTERAGENCY FIRE CENTER

1. **PURPOSE:** The 173rd Fighter Wing (173 FW) and the Lakeview Interagency Fire Center (LIFC) enter into this agreement to formalize agreed upon processes whereby the 173 FW and LIFC will execute their specific missions, in a manner that suits both entities' needs to the maximum extent possible while maximizing safety. The land management agency units represented by Lakeview Interagency Fire Center in this MOU include the US Forest Service-Fremont-Winema National Forest, the Bureau of Land Management-Lakeview District, the US Fish and Wildlife Service-Sheldon-Hart Mountain National Wildlife Refuge Complex, and the Oregon Department of Forestry-Klamath Lake Unit.

2. **SCOPE:** This Memorandum of Understanding (MOU) documents the agreement between the 173 FW and LIFC pertaining to coordination and de-confliction procedures of flight operations between 173 FW and LIFC within the Military Operations Areas (MOA) (Juniper/Hart MOA Complex, Juniper Low MOA, and Goose MOA) which are typically used by the 173 FW.

3. **AUTHORITIES:** The 173 FW and LIFC enter into this agreement in accordance with applicable regulations and/or instructions.

4. **DESCRIPTION OF PROCEDURES BETWEEN THE 173 FW AND LIFC**

   a. Yearly (late March/early May), both entities will meet to discuss procedures for the upcoming fire season.

   b. Discussion points will be:

      173 FW Fighter Jet Operations

      Air Operations conducted by manned and unmanned aircraft under the operational control of one of the agencies listed in #1 above, which are coordinated, dispatched, and tracked by LIFC.

      Scheduling and execution of flight missions for both entities, including a review of the types of missions commonly flown, and the prioritization of missions including short-notice changes in mission priorities.

      Notification and coordination procedures between both entities during concurrent use of airspace.

      When applicable, the 173 FW biennial Sentry Eagle exercise will include an airspace coordination meeting prior to and throughout the exercise, and an after action review meeting or conference call following the exercise.

5. **RESPONSIBILITIES OF THE ENTITIES:** The following paragraphs identify responsibilities of the organizations involved.

   a. The 173 FW Airfield Management (AM) team will schedule a yearly meeting at a time and place convenient to both entities. If a convenient place cannot be agreed upon, the meeting will rotate yearly between Kingsley Field and Lakeview Dispatch, or via telecom.
   b. LIFC will notify the 173 FW AM when the agencies it supports will operate in airspace used by the 173FW (Juniper/Hart MOA Complex, Juniper Low MOA, and Goose MOA). The 173 FW will manage its operations to de-conflict from airborne operations that are managed by LIFC.
   c. Both parties will agree upon de-confliction procedures. In most cases, fighters may be present in the airspace during two flying periods a day (09:30-11:00 and 13:30-15:00). LIFC will strive to operate outside of those times for non-fire resource management missions; however, certain resource missions must be conducted during those times in order to accomplish partner agency's objectives. In the event there is a need for a resource or tactical fire mission within the specified time frames, LIFC will de-conflict that mission for the affected MOA.
   d. LIFC only has operational oversight of, and is normally only able to de-conflict, tactical mission air resources that are staged at its agencies' bases of operation within the LIFC dispatch zones, and those resources, such as large air tankers, that are launched from other dispatch zones to respond to wildland fire incidents that are currently occurring within the LIFC dispatch areas of jurisdiction.
   e. Tactical mission resources operating under the oversight of LIFC will squawk 1255.
   f. LIFC is unable, and will not, de-conflict airspace for agencies (USFS, BLM, ODF, FWS etc.) or agency-contracted aircraft that transition through the area on an FAA flight plan and other point-to-point non-tactical/mission flights in which it is the Pilot's responsibility to file an FAA flight plan and check NOTAMs for the current and expected status of Military Training Routes and Special Use Airspace.
   g. LIFC is normally "not notified" about agency aircraft (operated by BLM, FWS, ODF or USFS) that are transitioning across LIFC Dispatch areas of jurisdiction on point-to-point cross country transition or reposition flights to other areas of the Western US outside the operational control of LIFC.
   h. LIFC will de-conflict for airspace in which they have knowledge of or anticipate an aircraft to loiter or remain to accomplish its mission. Aircraft that are dispatched to a known fire location or project site are examples of when LIFC will contact the173 FW to de-conflict the airspace. If a TFR is in place for a wildfire, LIFC will assess whether they can limit the TFR hours to daylight hours only. Military aircraft will adhere to the TFR and will not fly within the TFR when it is in place.

6. **FUNDING:** Nothing herein shall be construed to require the exchange of funds or things of value between the agencies that are party to this MOU, nor shall this agreement be construed to require the expenditure of funds by any federal agency in advance of receipt of appropriations.

7. **MISCELLANEOUS:**

   a. Other Relationships or Obligations. This MOU shall not affect any pre-existing or independent relationships or obligations between the parties.

b. This MOU is not an enforceable legal document. It is for the sole benefit of the United States, and it shall not be construed to benefit any party that is not a signatory hereto.

c. Lakeview Interagency Fire Center 541-947-6315

d. Kingsley Field Operations Duty Desk 541-885-6686

8. REVIEW: Review of this document shall occur at a minimum of every five years. Minor changes may be made at any time by correcting the existing document or attaching a memorandum to the basic document. Changes must be coordinated and initialed by a representative of all parties.

9. TERMINATION: This agreement may be terminated, in whole or in part, at any time by any party following a written 30-day notice.

10. EFFECTIVE DATE: This agreement becomes effective upon the date of the last approving signature and will remain in effect until revised or revoked.

11. ACCEPTANCE OF AGREEMENT:

Kurt Duffy

Lt Col Kurt Duffy
173 OSS/OSO
DSN 830-6491

Barry J Imler

Barry Imler
Fremont Winema National Forest
Forest Supervisor

E. Lynn Burkett

E. Lynn Burkett
Lakeview District BLM
District Manager

Dennis Lee

Dennis Lee
Oregon Department of Forestry
Klamath Lake Unit District Forester

John Kasbohm
U. S. Fish and Wildlife Service
Project Leader
Sheldon-Hart Mountain NWRC

Lakeview Interagency Fire Center (LIFC)
Fax – 541-947-6273 Dispatch Center email: orlfcnw@gmail.com

Position	Name	Telephone	Cell	Email
Center Manager	Kim Karalus	(541) 947-6219	(541) 219-0602	kkkaralus@blm.gov
Aviation Dispatcher	Shara Wilkie	(541) 947-6289	(530) 905-0646	swilkie@blm.gov
Aviation Dispatcher	Justin Phillips	(541) 947-6288	(541) 417-0974	
Unit Aviation Manager	Chad Bergren	(541) 947- 6296	(541) 219-2594	kcbergren@fs.fed.us
24 hour contact number:		(541) 947-6315		

Kingsley Field, Oregon
173 Fighter Wing Kingsley email: usaf.or.173-fw.list.oss-afm@mail.mil

Position	Name	Telephone	Cell	Email
Kingsley Field Duty Desk	Various	541-885-6686	N/A	
	Lt.Col Kurt Duffy	541-885-6491	907-397-1745	kurt.a.duffy.mil@mail.mil
24 hour contact number:				

Mission: To enhance the region's economy and quality of life by providing efficient cargo and air passenger access to national and global markets.

PORT OF PORTLAND
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May 26, 2023

William Strickland
Plans & Requirements Branch
Attn: 142 WG EA
3501 Fetchet Ave
Joint Base Andrews, MD 20762-5157

Send via email: william.strickland.7@us.af.mil

Re: **Response to 28 April 2023, letter requesting preliminary comments regarding areas of concern related to the F-15EX Environmental Assessment**

Dear Mr. Strickland:

We are in receipt of your letter dated 28 April 2023, requesting preliminary comments that would alleviate or highlight areas of concern preceding the release of the F-15EX draft Environmental Assessment (EA) including information regarding other proposed, ongoing, or recently completed projects that may create or exacerbate impacts resulting from the Proposed Action. Please find below some preliminary feedback from the Port of Portland's Noise Management, Environmental, and Planning teams.

Noise Management

The Oregon Department of Environmental Quality (DEQ) under ORS 340-035-0045 defines airport noise criterion as 55DNL and above. To be consistent with noise mapping efforts from other Portland International Airport (PDX) related environmental analyses, it is suggested that all contour maps in this EA contain 55 and 60DNL noise contours.

Noise contours in Version 1 of the preliminary draft EA show noise contour growth over baseline. It is our understanding that this noise contour growth is likely due to the higher number of annual operations proposed. If the noise footprint of the F-15EX is higher than the surrogate F-15C and F-15D models used for the contours in Version 1, subsequent contours will likely be larger. An increase in the 55 and 60DNL contours may result in an expansion of the noise contours into non-compatible residential areas. Once the preferred alternative is selected, the Port would like to better understand the number of annual operations anticipated and its impacts on the 55 and 60 DNL contours.

We are interested in seeing operational, measured noise data specific to the F-15EX model compared to the F-15C and F-15D as well as single-event contours based on approach/landing and departure events (typical takeoff power used at PDX), comparing the existing F-15C models and F15-EX models.

7200 NE Airport Way Portland OR 97218
Box 3529 Portland OR 97208
503 415 6000

Environmental and Planning

The identified facility improvements include projects that will require additional coordination with the Port and FAA for planning approval, particularly those that entail construction on or near the airfield and that necessitate a change to the PDX Airport Layout Plan. Based on a high-level review of the projects included in Attachment 2 of your letter, these could include (but are not limited to) all projects that are either Type C (Construction) or D (Demolition), and projects that are Type R (Renovation) that entail a change in building footprint or increase in impervious surface. These projects require concurrence from the Port and subsequent determination of the Federal Aviation Administration's (FAA) scope of authority pursuant to Section 163 of the FAA Reauthorization Act of 2018. Some projects (particularly those on or adjacent to the airfield) may require approvals that constitute federal actions, which in turn trigger National Environmental Policy Act (NEPA) review.

We strongly recommend that the National Guard Bureau (NGB) coordinate preparation of the EA with the Port and the FAA Seattle Airports District Office Environmental Protection Specialist to ensure adequacy of this EA for satisfying NEPA requirements of future Airport Layout Plan (ALP) changes or other FAA actions necessary for development. We also request early planning coordination from NGB on these projects as soon as practical, particularly for projects starting in years 2025 and 2026.

Additionally, the Port wishes to integrate these projects into our upcoming revision of the PDX Master Plan. That project begins this fall and is anticipated for completion in 2026. Following finalization of the EA, we request that NGB or its designate provide an updated Installation Development Plan integrating the projects identified in Attachment 2 in a format that can be aligned with other facility information being collected as part of the Master Plan Update project.

PDX Proposed, Ongoing, and Recently Completed Projects

Below is a table outlining select proposed, ongoing, and recently completed airfield projects at PDX as requested for use in the F15-EX EA cumulative effects analysis. Additional project details can be provided as needed.

Year	Project
2017	Deicing Vault Rehabilitation
2019	Northwest Airfield Water Line Improvements Phase 2
2021	North Ramp Remain Overnight Parking (RON) Reconstruction
2021	Southeast Taxiway T Rehabilitation
2022	Taxiway T Rehabilitation (Between Taxiways B4 and B5)
Ongoing	Terminal Core Redevelopment
2023	South Runway Panel/Joint Rehabilitation
2024	Basin 6 Regional Stormwater Enhancement
2024	RON Ramp Completion
2024	Taxiway T, K North and Southwest Runway Exits
2025	Sanitary Lift Station Rehabilitation
2025	Circulation and Capacity Improvements
2025	Taxiway A Rehabilitation and Reconstruction
2026	Taxiway K West Rehabilitation
2026	Basin 1 Subarea Stormwater System Improvements

Year	Project
2027	Airfield Regulator Building (ARB)/Runway LED Upgrades
2027	Airport Fire and Rescue Asphalt Apron Rehabilitation
2027	Basin 7 Regional Stormwater Treatment
2027	Airport Fire and Rescue Fire Training Pit Improvements
2027	Northwest Airfield Water Line Improvements Phase 3
2027	Airfield Joint Seal Replacement - Terminal Apron & Cargo Center
2027	Airport Fire and Rescue Space Upgrades & Facility Rehab
2027/2028	Runway 10L/28R Reconstruction

Please contact Michelle Hollis, Port of Portland Environmental Planning Manager, at michelle.hollis@portofportland.com, or (503) 415-6832 for additional information and for continued coordination.

We look forward to working with your team on this project and continuing our ongoing partnership.

Regards,

Dan Pippenger
Chief Operating Officer

c: Jenn Bies – Director, Environmental Operations
Michelle Hollis – Manager, Environmental Planning
Sean Loughran – Director, Planning & Development
Steve Nagy – Director, Airport Operations

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 155, 14-D12
Seattle, WA 98101-3144

REGIONAL ADMINISTRATOR'S DIVISION

June 15, 2023

Mr. William Strickland
Plans and Requirement Branch
3501 Fetchet Avenue
Joint Base Andrews, MD 20762-5157

Dear William Strickland:

The U.S. Environmental Protection Agency has reviewed the National Guard Bureau's Notice of Intent to prepare an Environmental Assessment related to the proposal to recapitalize the aircraft at Portland's Air National Guard installation (EPA Project Number 23-0023-USAF). EPA has conducted its review pursuant to the National Environmental Policy Act and our review authority under Section 309 of the Clean Air Act. The CAA Section 309 role is unique to EPA and requires EPA to review and comment publicly on any proposed federal action subject to NEPA's environmental impact statement requirement.

The NOI and its supporting documents describe this recapitalization as the "acquisition of the new generation F-15EX aircraft and construction and upgrade of specific facilities for one squadron of F-15EX aircraft." The squadron would consist of 24 F-15EX aircraft and is meant to replace the 20 F-15C aircraft currently at the installation. It is also stated that the National Guard Bureau (NGB) is analyzing the possible continuation of operating the existing F-15C. The project proposes to conduct approximately 2 acres of ground disturbance and add approximately 1 acre of new impervious surface.

The project has the potential to impact air quality, water quality, and impact communities with environmental justice concerns. The enclosed Detailed Comments provide greater detail regarding EPA's recommendation when developing the environmental analysis of this project.

Thank you for the opportunity to review the NOI for this project. If you have questions about this review, please contact Scott Schlief of my staff at (206) 553-4032 and Schlief.Scott@epa.gov, or me, at (206) 553-1774 or at Chu.Rebecca@epa.gov.

Sincerely,

REBECCA CHU Digitally signed by REBECCA CHU
Date: 2023.06.15 14:54:00 -07'00'

Rebecca Chu, Chief
Policy and Environmental Review Branch

Enclosure

U.S. EPA Detailed Comments on the
National Guard Bureau – Recapitalization at Portland Air National Guard Installation
June 2023

Alternatives Analysis
The notice of intent (NOI) describes a few possible alternatives for this project. These alternatives include replacing the existing F-15C planes with the newer F-15EX planes or bringing in new planes while also keeping some or all of the existing planes for a short, but unspecified, duration.

EPA recommends that the NEPA document specify the number of each plane and the duration each model is anticipated to be in service for each of these various potentialities so that the environmental impacts can be better understood. Additionally, if varying the number and type of planes in service at the airbase will impact the proposed demolition, remodeling, or building of new facilities, EPA recommends these potential changes to the proposal be analyzed in the NEPA document as well. In developing the environmental review for this proposed project under NEPA, EPA recommends reviewing and considering NEPA analyses for similar projects[1].

Water Quality and Aquatic Resources

Clean Water Act § 402
EPA recommends the NEPA analysis identify any discharges to Waters of the United States (WOTUS) that are known, or are likely, to occur during construction and operation of the project and how these discharges would be managed and minimized. Identify the NPDES permits that will be obtained for the construction phase, new (or modifications to) existing permits for operations, and how any previous permit exceedances could be prevented by incorporating pollution prevention measures into the project.

CWA § 303(d)
The CWA requires states to develop a list of impaired waters that do not meet water quality standards, establish priority rankings, and develop action plans called Total Maximum Daily Loads (TMDLs) to improve water quality. EPA recommends the NEPA analysis include information on any CWA § 303(d) impaired waters in the project area and any efforts related to TMDLs. Discuss what effect, if any, project discharges may have on impaired waterbodies.

For example: the Portland Air National Guard Base is adjacent to the Columbia Slough, which is identified as CWA §303(d) impaired by the Oregon Department of Environmental Quality for drinking water, aquatic life, fish and shellfish consumption, swimming, and boating, and for other metrics[2]. The information provided in the NOI indicates that the proposed project may result in up to 2 acres of ground disturbance and an additional 1 acre of impervious surface. EPA recommends the NEPA analysis include information regarding the increased in stormwater discharge from the impervious surfaces, accounting for the climate change impacts to the frequency and intensity of precipitation.

EPA recommends the NEPA analysis describe existing restoration and enhancement efforts for the impaired water bodies and how the proposed project will coordinate with on-going protection efforts,

[1] https://www.angf15ex-f35a-eis.com/, accessed 6/12/2023.
[2] https://mywaterway.epa.gov/community/6801%20NE%20Cornfoot%20Rd.,%20Portland,%20OR%2097218/overview accessed 6/12/2023.

2

and any best management practices and/or mitigation measures that will be implemented to avoid further degradation of impaired waters.

For example: green infrastructure technologies may help to mitigate the impacts of increasing the amount of impervious surfaces within the project area. EPA has a list of green infrastructure technologies and ideas that could be incorporated into the development of alternatives[3]. Additionally, the Portland's Bureau of Environmental Services[4], Oregon's Department of Environmental Quality[5], and nonprofit groups such as the Columbia Slough Watershed Council[6] may have useful information when developing mitigation strategies to address water quality impacts from the proposed project.

CWA § 404
CWA§ 404 requires permits from the U.S. Army Corps of Engineers for the discharge of dredged or fill material into WOTUS. Wetlands, vegetated shallows, mud flats, and cobble substrates are all considered special aquatic sites under the CWA Section 404(b)(1) Guidelines (40 CFR 230). EPA recommends that the NEPA analysis:

- Clearly identify any discharges to WOTUS that are known, or likely, to occur that will be subject to CWA § 404. Identify and describe the impact of those discharges, control measures to be employed to address those impacts, and best management practices to prevent discharge of water and pollutants.
- Include sufficient information that can serve as a basis to determine whether the project would satisfy the requirements for the CWA § 404 permit or identify appropriate measures to mitigate the project's impacts to all WOTUS.
- Structure the alternatives analysis consistent with requirements of both the CWA and NEPA.
- Describe the regulatory criteria and processes utilized to screen potential alternatives and thoroughly evaluate alternatives that would pose less adverse impacts.
- Describe how compensatory mitigation will be quantified and provided to offset impacts, with specific project examples and options, as available.

Air Quality
Information in the NOI indicates an increase in the number of sorties from 7 to 8 per day, as well as construction activities associated with the proposed project.

EPA recommends the NEPA analysis discuss air quality impacts from the proposed project and project construction, maintenance, and operations with respect to criteria air pollutants and air toxics, including diesel particulate matter emissions and fugitive dust emissions. Discuss the direct, indirect, and cumulative impacts of project related air emissions. Disclose current representative background air pollutant concentrations in the areas of the project, if representative monitoring datasets are available, and compare these concentrations to the state and federal ambient air quality standards. Provide an evaluation of wind and precipitation patterns in the vicinity of the project and evaluate how these could influence emissions and air pollutant impacts. Disclose any regulatory air quality requirements related to the project, including any relevant state permitting and pollution control rules.

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[3] https://www.epa.gov/green-infrastructure/what-green-infrastructure#Greenparking, accessed 6/12/2023.
[4] https://www.portland.gov/bes, accessed 6/12/2023.
[5] https://www.oregon.gov/deq/pages/index.aspx, accessed 6/12/2023.
[6] https://www.columbiaslough.org/, accessed 6/12/2023.

For air pollutant emissions expected from both the proposed project and project construction, discuss the potential exposure of these pollutants to nearby sensitive populations. EPA recommends including a discussion of measures to minimize air quality impacts on the local environment and decrease exposure of emissions to sensitive populations. For example, during construction activities, locate construction equipment and staging zones away from sensitive receptors and fresh air intakes to buildings.

When assessing the air quality impacts associated with the number of sorties, EPA recommends the NEPA analysis consider the likely minimum and maximum number of sorties in addition to daily average. Organizations such as the Port of Portland[7] and PDX Clean Air[8], or similar organizations may be helpful in identifying ways to mitigate the air quality impacts of the proposed project.

In quantifying background concentrations, EPA recommends utilizing the lookup tool provided by the NW-AIRQUEST group[9], or similar tool to provide this data.

Environmental Justice
Federal agencies must consider environmental justice (EJ) in their activities under the National Environmental Policy Act[10]. EPA recommends the NEPA document identify and describe where EJ concerns exist within the project area, as well as the direct, indirect, and cumulative impacts of the proposed project on these communities. Further, EPA recommends the NEPA document discuss methods for conducting meaningful engagement opportunities with communities with EJ concerns and how considerations related to concerns raised are incorporated into the NEPA analysis and decision-making processes.

EPA recommends the follow key documents, policies, and tools for considering and addressing EJ concerns associated with the proposed project in the NEPA analysis.

Executive Orders and Policies
Executive Order 12898[11] directs federal agencies to identify and address the disproportionately high and adverse human health effects of federal actions on minority and low-income populations, to the greatest extent practicable and permitted by law.

On April 21, 2023, President Biden signed *Executive Order 14096, Revitalizing Our Nation's Commitment to Environmental Justice for All*[12] which highlights the need for a whole-of-government effort to confront longstanding environmental injustices and inequities. Consistent with Executive Order 12898 and each agency's statutory authority, EO 14096 calls on each agency to make achieving EJ part of its mission, including by carrying out environmental reviews under NEPA in a manner that:

- analyzes direct, indirect, and cumulative effects of federal actions on communities with EJ concerns.
- considers best available science and information on any disparate health effects (including risks) arising from exposure to pollution and other environmental hazards, such as information related

[7] https://www.portofportland.com/, accessed 6/12/2023.
[8] https://portlandcleanair.org/, accessed 6/12/2023.
[9] https://lar.wsu.edu/nw-airquest/, accessed 6/12/2023.
[10] https://www.epa.gov/environmentaljustice/environmental-justice-and-national-environmental-policy-act, accessed 6/12/2023.
[11] https://www.archives.gov/files/federal-register/executive-orders/pdf/12898.pdf, accessed 6/12/2023.
[12] https://www.whitehouse.gov/briefing-room/presidential-actions/2023/04/21/executive-order-on-revitalizing-our-nations-commitment-to-environmental-justice-for-all/, accessed 6/12/2023.

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to the race, national origin, socioeconomic status, age, disability, and sex of the individuals exposed; and

- provides opportunities for early and meaningful involvement in the environmental review process by communities with EJ concerns potentially affected by the proposed action.

EO 14096 also calls on providing opportunities for the meaningful engagement of persons and communities with EJ concerns who are potentially affected by federal activities, including by:

- providing timely opportunities for members of the public to share information or concerns and participate in decision-making processes.
- fully considering public input provided as part of decision-making processes.
- seeking out and encouraging the involvement of persons and communities potentially affected by federal activities by:
  - ensuring that agencies offer or provide information on a federal activity in a manner that provides meaningful access to individuals with limited English proficiency and is accessible to individuals with disabilities.
  - providing notice of and engaging in outreach to communities or groups of people who are potentially affected and who are not regular participants in federal decision-making; and
  - addressing, to the extent practicable and appropriate, other barriers to participation that individuals may face; and
  - providing technical assistance, tools, and resources to assist in facilitating meaningful and informed public participation, whenever practicable and appropriate.

CEQ Environmental Justice Guidance under the National Policy Act[13] (1997) was developed by CEQ in consultation with EPA and other affected agencies as guidance to further assist federal agencies with their NEPA procedures so that EJ concerns are effectively identified and addressed.

"Environmental Justice Interagency Working Group Promising Practices for EJ Methodologies in NEPA Reviews" report, or the Promising Practices Report[14] is a compilation of methodologies gleaned from current agency practices concerning the interface of EJ considerations through NEPA processes.

EJScreen

To identify where EJ concerns may exist within the proposed project area, EPA recommends utilizing our EJScreen mapping tool. Assessing EPA's Environmental Justice Screening and Mapping Tool (EJScreen) information is a useful first step in understanding locations that may be candidates for further review or outreach.[15] EPA considers a project to be in an area of potential EJ concern when an EJScreen analysis for the impacted area shows one or more of the eleven EJ Indexes at or above the 80th percentile in the nation and/or state. At a minimum, EPA recommends an EJScreen analysis consider EJScreen information for the block group(s) that contains the proposed action(s) and a one-mile radius around those block groups.

[13] https://www.epa.gov/sites/default/files/2015-02/documents/ej_guidance_nepa_ceq1297.pdf, accessed 6/12/2023.
[14] https://www.epa.gov/sites/default/files/2016-08/documents/nepa_promising_practices_document_2016.pdf, accessed 6/12/2023.
[15] https://ejscreen.epa.gov/mapper/, accessed 6/12/2023.

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Within the one-mile radius around the proposed project area at the Portland Air National Guard Base, EJScreen identifies several EJ Indexes above the 80th percentile, in both the nation and state.

It is important to consider all areas impacted by the proposed action(s). Areas of impact can be a single block group or span across several block groups and communities.[16] When assessing large geographic areas, consider the individual block groups within the project area in addition to an area-wide assessment. EPA recommends considering including block groups that are near the air base and in the direct flight path of takeoffs and landings as part of the NEPA analysis.

Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators.[17] As the screening tool does not provide data on every environmental impact and demographic factor that may be relevant to a particular location and/or proposed project, consider additional information in an EJ analysis to supplement EJScreen outputs. Further review or outreach may be necessary for the proposed action(s).

Addressing EJ Concerns in the NEPA Process

To address potential EJ concerns associated with the Proposed Project, EPA recommends:

- Applying methods from "Environmental Justice Interagency Working Group Promising Practices for EJ Methodologies in NEPA Reviews" report, or the Promising Practices Report, to this project.[18] The Promising Practices Report is a compilation of methodologies gleaned from current agency practices concerning the interface of EJ considerations through NEPA processes.
- Characterizing project site(s) with specific information or data related to EJ concerns.[19]
- Supplementing data with county level reports and local knowledge. Include identifying and describing communities that utilize the resources within the proposed project area and occur outside of the immediate 1-mile radius.
- Integrating, where available and appropriate, Traditional Ecological Knowledge in evaluating impacts of the proposed project on communities with EJ concerns.

Additional resources that may be useful in incorporating EJ in NEPA analysis include:

- EPA's Guidance for Incorporating EJ Concerns in EPA's NEPA Compliance Analysis[20]
- Guidance for Consideration of Environmental Justice in Clean Air Act 309 Reviews[21]

[16] Agencies should define community as "either a group of individuals living in geographic proximity to one another, or a geographically dispersed set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions" (Interim Justice40 Guidance – Executive Order 14008 on Tackling the Climate Crisis at Home and Abroad, January 27, 2021).

[17] https://www.epa.gov/ejscreen/technical-information-about-ejscreen, accessed 6/12/2023.

[18] https://www.epa.gov/sites/default/files/2016-08/documents/nepa_promising_practices_document_2016.pdf, accessed 6/12/2023.

[19] For more information about potential EJ concerns, refer to the July 21, 2021, Memorandum for the Heads of Departments and Agencies Interim Implementation Guidance for the Justice40 Initiative. https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf, accessed 6/12/2023.

[20] https://www.epa.gov/sites/default/files/2014-08/documents/ej_guidance_nepa_epa0498.pdf, accessed 6/12/2023.

[21] https://www.epa.gov/sites/default/files/2014-08/documents/enviro_justice_309review.pdf, accessed 6/12/2023.

- Memorandum on Addressing Climate Change and Environmental Justice through Reviews Conducted Pursuant to the National Environmental Policy Act and Section 309 of the Clean Air Act[22]
- EPA Legal Tools to Advance Environmental Justice[23]

[22] https://www.epa.gov/system/files/documents/2022-05/EPA%20Policy%20Memo%20Intergration%20of%20EJ%20and%20Climate%20Change%20into%20NEPA%20309%20review%204-26-2022.pdf, accessed 6/12/2023.
[23] https://www.epa.gov/ogc/epa-legal-tools-advance-environmental-justice, accessed 6/12/2023.

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE JOINT BASE ANDREWS 20762-5157

17 January 2024

Alicia Treece
NGB/A4AM NEPA Program Manager
Air National Guard Readiness Center
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Lisa Sumption
Director
State Historic Preservation Office
725 Summer St., Suite C
Salem, OR 97301

SUBJECT: Section 106 Consultation for the Proposed F-15EX Eagle II Operational Beddown, Portland Air National Guard, Oregon

Dear Ms. Sumption,

As described in a letter sent to your office in April 2023, the United States Department of the Air Force (DAF) is proposing to recapitalize its existing F-15C inventory with the newer and more capable F-15EX "Eagle II" aircraft at the at Portland Air National Guard (ANG) installation, located at the Portland International Airport (PDX), in Portland, Oregon (OR). The NGB serves as a channel of communication and funding between the Air Force and State Air National Guard (ANG) organizations in the 54 U.S. states, territories, and the District of Columbia. As such, the National Guard Bureau (NGB) is the lead federal agency and the Federal Aviation Administration (FAA) is a cooperating agency for the preparation of the Environmental Assessment (EA); therefore, FAA Order 1050F, *Environmental Impacts: Policies and Procedures*, also applies to this action. In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (54 United States Code 306108) and its implementing regulations found at Title 36 Code of Federal Regulations (CFR) Section 800, the DAF is continuing consultation with your office and tribal governments who have expressed an interest in the affected area.

The DAF's proposed recapitalization (the undertaking) would consist of one squadron with up to 24 F-15EX aircraft that would replace the existing 20 F-15C aircraft currently based at the Portland ANG installation. The 142nd Wing (142 WG) at the Portland ANG installation would become the first operational combat squadron for the F-15EX under this proposed undertaking.

The NGB has analyzed three alternatives for the undertaking, as well as the No Action Alternative. The proposed undertaking would include renovations to existing facilities, changes in facility use, and new facilities, an increase of approximately 110 personnel, as well as aircraft operations in existing training airspace. A description of the proposed undertaking and the alternatives, with accompanying maps, is included in Enclosure 1. The area of potential effects (APE) was described in the April 2023 letter and is provided in Enclosure 2.

As described in Enclosure 3, identification efforts for historic properties consisted of review of the Portland ANG installation 2012 Integrated Cultural Resources Management Plan, a review of data on-file with the Oregon State Historic Preservation Office through the Oregon Historic Sites Database, and a review of the National Register of Historic Places (NRHP) Geospatial Dataset. This review did not identify any NRHP-eligible archaeological resources or traditional resources that would be affected by the construction activities at the Portland ANG installation, but NRHP-eligible architectural resources would be affected by the undertaking due to demolition. Additionally, historic properties are located within the 65 decibel (dB) day-night average sound level (DNL) noise contour surrounding the Portland ANG. The noise contour encompasses the area that would be subject to noise at 65 dB DNL associated with takeoff and landing of the aircraft. Historic properties are also located under the airspace that would be utilized for training missions.

As described in Enclosure 4, the DAF has reached a determination of *no adverse effects* for the proposed undertaking. In accordance with 36 CFR 800.11(e), we are providing your office the opportunity to comment on our undertaking and effects determination. Please provide any comments to our office, ATTN: 142 WG EA, 3501 Fetchet Avenue, Joint Base Andrews, MD 20762-5157 or by email at ngb.a4.a4a.nepa.comments.org@us.af.mil with the subject titled as ATTN: 142 WG EA. Thank you for your assistance.

Sincerely,

Alicia M. Treece

ALICIA M. TREECE, GS-13, DAF
NGB/A4AM NEPA Program Manager

Enclosures:
1. Description of the Proposed Undertaking
2. Area of Potential Effects
3. Identification of Historic Properties
4. Assessment of Effects
5. Summary of Tribal Consultation
6. References

ENCLOSURE 1
Description of the Proposed Undertaking

The Undertaking (Proposed Action)

The DAF undertaking is to recapitalize its existing F-15C inventory at Portland Air National Guard (ANG) installation with the newer and more capable F-15EX "Eagle II" aircraft. Recapitalization is the acquisition of the new generation F-15EX aircraft and construction and upgrade of specific facilities for one squadron of F-15EX aircraft to support current and future combat and mission readiness. The squadron would consist of up to 24 F-15EX aircraft that would replace the existing 20 F-15C aircraft currently based at the Portland ANG installation. The Proposed Action would also include personnel needed to operate and maintain the F-15EX. Additionally, it is feasible the 142 WG could continue operating their existing legacy F-15C model aircraft for a limited time, in which case, construction associated with operating those legacy aircraft into the future is also analyzed. The Proposed Action has the potential to affect areas of proposed ground disturbance (including locations of newly constructed buildings), facilities that would be demolished or renovated, and lands located beneath the existing airspace. No new airspace or airspace reconfigurations are proposed under the Proposed Action. However, there would be an increase from the current seven F-15C sorties per day to an average of eight F-15EX sorties per day that utilize the existing special use airspace.

Were the DAF to implement the undertaking, the Portland International Airport (PDX) sponsor would need to submit a request to the Federal Aviation Administration (FAA) for changes to the Portland International Airport's Airport Layout Plan (ALP) pursuant to 49 USC 47101 and relevant implementing regulations. The FAA's undertaking would be a direct outcome of the airport sponsor's request for approval to change the ALP related to the construction and demolition within the airport boundary.

Three alternatives and the No Action Alternative were analyzed under the Proposed Action in the Draft Environmental Assessment. The regional location of the Portland ANG installation, located at PDX, in Portland, Oregon is shown below in Figure 1-1. A summary of the alternatives and No Action alternative are provided below.

Alternatives 1 through 3

Alternative 1 would entail the full replacement of the F-15C aircraft with one squadron of F-15EX aircraft, to include 20 aircraft (18 Primary Aerospace Vehicles Authorized [PAA] and 2 Backup Aerospace Vehicles Authorized [BAA]) and associated personnel (an increase of approximately 110 personnel), including the specifically itemized construction and structural improvement projects necessary to facilitate the multi-role (air-to-air and air-to-ground) mission conversion requirements efficiently and effectively.

Renovation, demolition, and new construction of multiple facilities would be required under Action Alternative 1. Proposed numbers of aircraft and personnel were used to define facility requirements, which were estimated using planning factors. Table 1-1 details the proposed construction projects requiring interior renovations; Table 1-2 details the proposed demolition and new construction projects for the Proposed Action. Construction projects were assumed to begin in the years listed in the tables and be complete within the same year (e.g., if a project is planned for 2025, the construction is assumed to occur between January and December 2025), even though some projects would last longer than 12 months. Under Alternative 1, new construction would result in up to 182,044 square feet (SF) of new facilities, and up to 214,802 SF of new impervious surface. The total construction footprint analyzed represents the largest possible footprint of each of the options.

The F-15EX aircraft would utilize existing military airspace and military training ranges (Figure 1-2) and would involve the use of chaff and flares. Chaff and flare use would continue at a similar rate to what is currently used under existing conditions/No Action Alternative, but the increase in training sorties would result in a corresponding increase in chaff and flare use. Total annual operations at PDX or within the associated airspace would be slightly higher than existing conditions/No Action Alternative, with 446 more annual operations, which equals to a 9 percent increase from existing conditions/No Action Alternative. A portion of the sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements.

Alternative 2 would also entail the full replacement of the F-15C aircraft with one squadron of F-15EX aircraft, an increase of 110 associated personnel, and specifically itemized construction and structural improvement projects necessary to facilitate the multi-role (air-to-air and air-to-ground) mission conversion requirements. The primary difference from Action Alternative 1 is that the replacement squadron of F-15EX would include a total of 24 aircraft (21 PAA, 2 BAA, and 1 Attrition Reserve). This would be four more aircraft total than Action Alternative 1 – three PAA and one Attrition Reserve. Attrition Reserve is an additional category of backup aircraft that are planned to be provided as new production aircraft are available above PAA and BAA requirements.

Renovation, demolition, and construction projects would be required for the implementation of Alternative 2 (Table 1-1 and 1-2). The projects would be the same as those that would be implemented for Alternative 1, and new construction would result in up to 175,644 SF of new facilities, and up to 214,802 SF of new impervious surface.

As with Alternative 1, training would utilize existing military airspace and military training ranges, and a portion of training sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements to occur at established ranges. Annual operations at PDX or the associated airspace would be slightly higher than Alternative 1, with 1,328 more annual operations compared to existing conditions/No Action Alternative, which would be an increase of 27 percent over current conditions. This is 882 more annual operations than Alternative 1 (or approximately 17 percent more than Alternative 1). The increased operations would result in a corresponding increase in chaff and flare use within the military airspace and ranges where currently authorized. The increased operations would result in a corresponding increase in chaff and flare use within the military airspace and ranges where currently authorized.

Under Action Alternative 3, the existing F-15C flying mission would remain in place at the Portland ANG installation until the projected end of the airframe mission or future required mission change proposals are presented. No additional personnel would be expected, and any previously planned construction and repair projects required for current mission sustainment would be implemented.

These projects reflect the need to sustain the 142 Wing (WG) mission regardless of the airframe that is being flown. Under Action Alternative 3, new construction would result in up to 40,504 SF of new facilities, and up to 19,904 SF of new impervious surface. The total construction footprint analyzed represents the largest possible footprint of each of the options.

Existing military airspace and military training ranges would continue to be utilized under Alternative 3. There would be no increase to annual operations at PDX or the associated airspace.

No Action Alternative

Under the No Action Alternative, no F-15EX operational aircraft would be based, no personnel changes or construction (even construction for the F-15C aircraft) would be performed, and no training activities by the F-15EX operational aircraft would be conducted in the airspace. The NGB would continue to conduct their current mission using existing, legacy aircraft with multiple configurations and existing infrastructure.

Facility Requirements of the Undertaking

Renovation, demolition, and new construction of multiple facilities would be required under all Proposed Action alternatives (Alternatives 1, 2, and 3). Proposed numbers of aircraft and personnel were used to define facility requirements, which were estimated using planning factors. Table 1-1 details the proposed construction projects requiring interior renovations only (no new impervious surface created) and Table 1-2 lists the proposed demolition and new construction projects for the undertaking. The locations of the proposed projects are shown on Figure 1-3.

Table 1-1. Proposed Interior-only Renovation Projects for Basing F-15EX at the Portland ANG Installation

Map #	*Start Year*	*Action*	*Building Size (SF)*	*Included under Alternative*		
				1	*2*	*3*
4A[1]	2026	**Avionics Building 270 Repairs.** Building systems upgrades (e.g., HVAC, plumbing, electrical).	12,796	Yes	Yes	Yes
16	2030	**Repair LRS Building 170.** Building systems upgrades (e.g., HVAC, plumbing, electrical).	56,876	Yes	Yes	Yes
22	2027	**Repair near Building 432 POL.** Upgrade outdoor spill containment.	150	Yes	Yes	Yes

Notes: [1]Project 4A (renovations) and Project 4B (new construction; see Table 2.1-2, below) are both related to Building 270 but have different disturbance footprints.

Legend: HVAC = Heating, Ventilation, and Cooling; LRS = Logistics Readiness Squadron; POL = petroleum, oil, and lubricants; SF = square feet.

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Table 1-2. Proposed Construction and Demolition Projects for Basing F-15EX at the Portland ANG Installation

Map #	*Start Year*	*Action*	*Total Area of New Ground Disturbance (SF)*[1]	*Demolition (SF)*	*New Impervious Surface (SF)*	*Included under Alternative*		
						1	*2*	*3*
1[2]	2025	**Demolish and Reconstruct Battery Shop (Building 240).** Includes LOX and Helium Facility. Under Alternatives 1 and 2, the building would be demolished but the uses would be consolidated in the Universal Large Hangar (Project 2A-C), and new ground disturbance is included under that project. Under Alternative 3, the building would be reconstructed as a 1,600 SF facility in the same location, to support the continued F-15C mission.	1,600	2,800	0	Yes	Yes	Yes
2A[2]	2026	**Construct Universal Large Hangar (new building, no number) – Phase 1.** To meet requirements for air-to-ground mission. Hangar would be approximately 35,500 SF and 50 feet tall. Includes 49,700 SF of connecting concrete ramps.	85,200	0	85,200	Yes	Yes	No
2B[2]	2027	**Construct Universal Large Hangar (new building, no number) – Phase 2.** To meet requirements for air-to-ground mission. 34,350 SF of Maintenance Shops and Squadron Operations space would be constructed in Phase 2.	34,350	0	34,350	Yes	Yes	No
2C[2]	2028	**Construct Universal Large Hangar (new building, no number) – Phase 3.** To meet requirements for air-to-ground mission. 34,350 SF of Maintenance Shops and Squadron Operations space would be constructed in Phase 3.	34,350	0	34,350	Yes	Yes	No
3	2025	**Construct Aircraft Support Equipment Covered Storage (new structure, no building number).** To meet requirements for F-15EX conversion.	6,500	0	6,500	Yes	Yes	No
4B[3]	2026	**Construct Addition to Avionics Building 270.**	2,804	0	2,804	Yes	Yes	Yes

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Map #	Start Year	Action	Total Area of New Ground Disturbance (SF)[1]	Demolition (SF)	New Impervious Surface (SF)	Included under Alternative		
						1	2	3
5	2027	**Demolish and Reconstruct Building 165 (Warehouse/ Storage Building).** Needed to accommodate uses from buildings demolished due to land use restructuring (e.g., return of leased lands to the Port of Portland – Project 6).	25,380	20,004	0	Yes	Yes	Yes
6	2028	**Demolish Buildings 475, 491, 495, 496, 497, and 498 in Parcel D-2.** Required as building is located on leased lands that would be returned to Port of Portland upon lease expiration in 2030.	0	23,167	0	Yes	Yes	Yes
7	2028	**Separate Utilities in Parcel D-1.** Utilities for continued use of the Portland ANG installation needs to be separated from the ones on the leased lands that would be returned to Port of Portland upon lease expiration in 2030.	0	387	0	Yes	Yes	Yes
8	2029	**Demolish Combat Arms Training Range, Buildings 485 and 480.** No construction proposed to occur to replace these buildings.	0	64,733	0	Yes	Yes	Yes
9	2029	**Construct New BCE Pavement and Ground Facility (new building, no number).** Facility to store heavy equipment currently stored outdoors.	6,500	0	6,500	Yes	Yes	Yes
10	2029	**Construct Add-on to Building 115 for CERFP/DOMOPS.**	1,200	0	1,200	Yes	Yes	Yes
11	2029	**Construct Covered Storage Shed for CERFP/DOMOPS.**	2,800	0	2,800	Yes	Yes	Yes
12	2030	**Repair/Increase Size of South Alert Berm.**	6,600	0	6,600	Yes	Yes	Yes
13	2030	**Construct Add-on Crew Readiness Area for CSOs (Building 210).** To meet requirements for air-to-ground mission.	1,200	0	1,200	Yes	Yes	No
14[3]	2030	**Construct Arm/De-arm Pad with Berm.** SF includes aprons connecting to the new pad.	12,000	0	12,000	Yes	Yes	No
15A[4]	2030	**Construct F-15EX Simulator Facility (Next to Building 265).** To enable backseat cockpit training.	20,000	0	20,000	Yes	Yes	No
15B[4]	2030	**Demolish and Re-build Building 265.** Larger operations facility to support increased operations footprint.	1,300	23,700	1,300	Yes	Yes	No

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Map #	*Start Year*	*Action*	*Total Area of New Ground Disturbance (SF)*[1]	*Demolition (SF)*	*New Impervious Surface (SF)*	*Included under Alternative*		
						1	*2*	*3*
17A	2030	**Construct Additional Admin Area for M&I Air-to-Ground (new building, no number).** Maintenance bay required to execute small maintenance related to air-to-ground mission. Includes demolition of a portion of Building 400.	4,400	5,158	4,400	Yes	Yes	No
17C	2032	**Construct MUNS Storage Igloo (new building, no number).** To meet space requirements for air-to-ground mission.	3,600	0	3,600	Yes	Yes	No
17D	2032	**Install MUNS Maintenance Trailer (new building, no number).** Includes construction of a concrete pad for trailer to be placed on. To meet requirements for air-to-ground mission.	1,200	0	1,200	Yes	Yes	No
17E	2032	**Construct new MUNS Perimeter Fence.** Fence will be 2,600 linear feet, with a 1-foot assumed width for the total disturbance SF.	2,600	0	2,600	Yes	Yes	No
17F	2032	**Construct Additional Conventional Munitions Admin Facility (Addition to Building 400).** To meet space requirements for air-to-ground mission. Includes 20,632 SF of interior renovation, moving the existing perimeter fence and constructing new utilities.	5,000	0	1,240	Yes	Yes	No
18[2]	2032	**Demolish Building 255.** To support the F-15EX mission. Consolidate operations and maintenance functions in new Universal Hangar Building (	0	64,738	0	Yes	Yes	No
19[2]	2033	**Demolish Building 275.**	0	12,269	0	Yes	Yes	No
20[2]	2034	**Demolish Building 160**	0	4,382	0	Yes	Yes	No
21[2]	2035	**Partial Demolition of Building 265**	0	15,520	0	Yes	Yes	No

Notes: [1]For building construction projects, the area of total ground disturbance represents the square-footage of a 1-story building to be constructed, unless a building height is specified in the project description.
[2]Projects 4A through 4C are associated with demolition projects 1, 19, 20 and 21, as these functions would be relocated to the Universal Hangar once constructed.
[3]Project 14 may require a concrete batch plant for construction, if determined by the contractor and would likely be located just south of the where Project 17 would be constructed, pending FAA approval. There are two location options shown on the figure, annotated as 14.1 and 14.2.
[4]Project 15A and 15B will both occur and are related to Building 265 (these are not options for construction).

Legend: ANG = Air National Guard; BCE = Base Civil Engineer; CERFP/DOMOPS = Chemical Biological Radiological Nuclear Enhanced Response Force Package/Domestic Operations; CSO = Combat Systems Officer; LOX = liquid oxygen; M&I = maintenance and inspection; MUNS = Munitions Squadron; SF = square feet.

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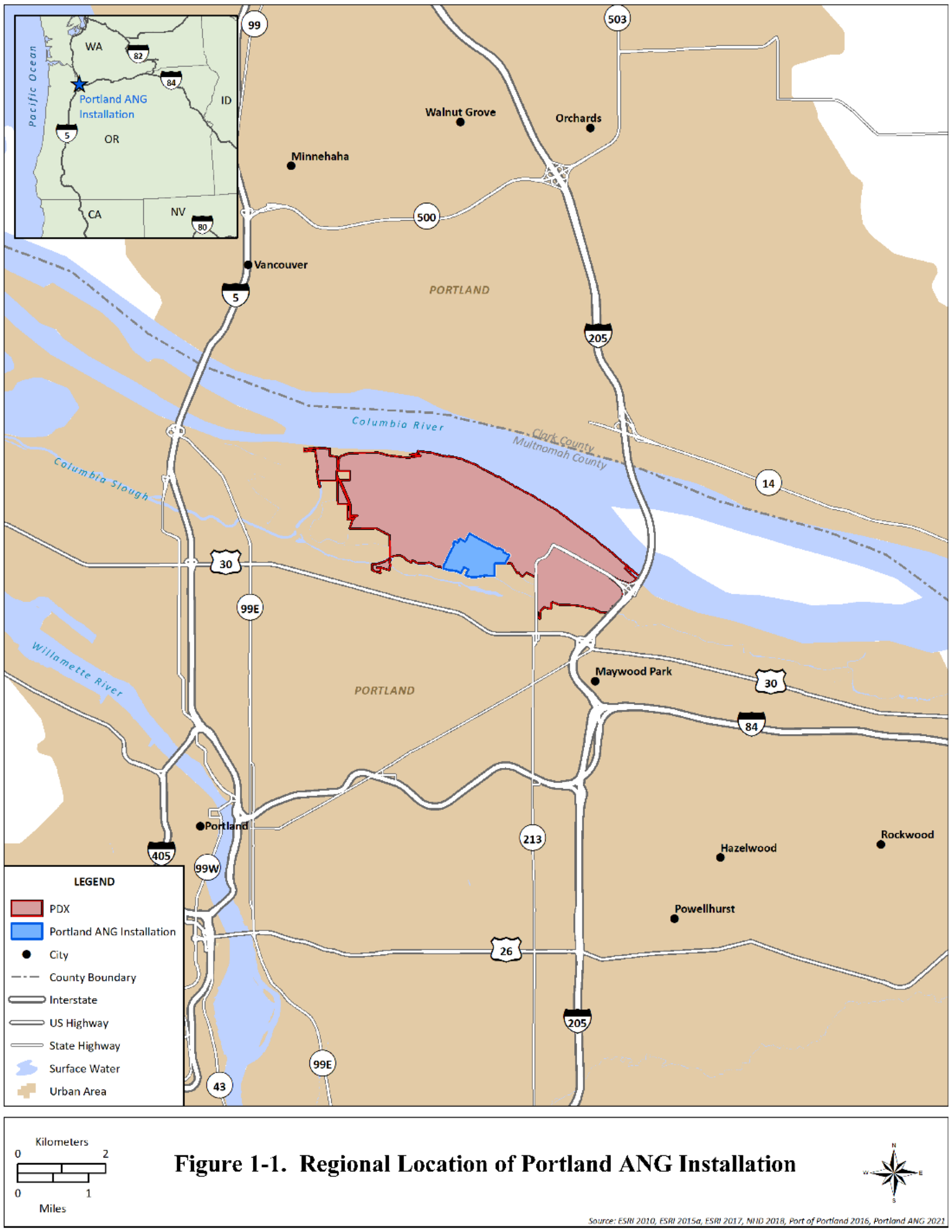

Figure 1-1. Regional Location of Portland ANG Installation

Source: ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Port of Portland 2016, Portland ANG 2021

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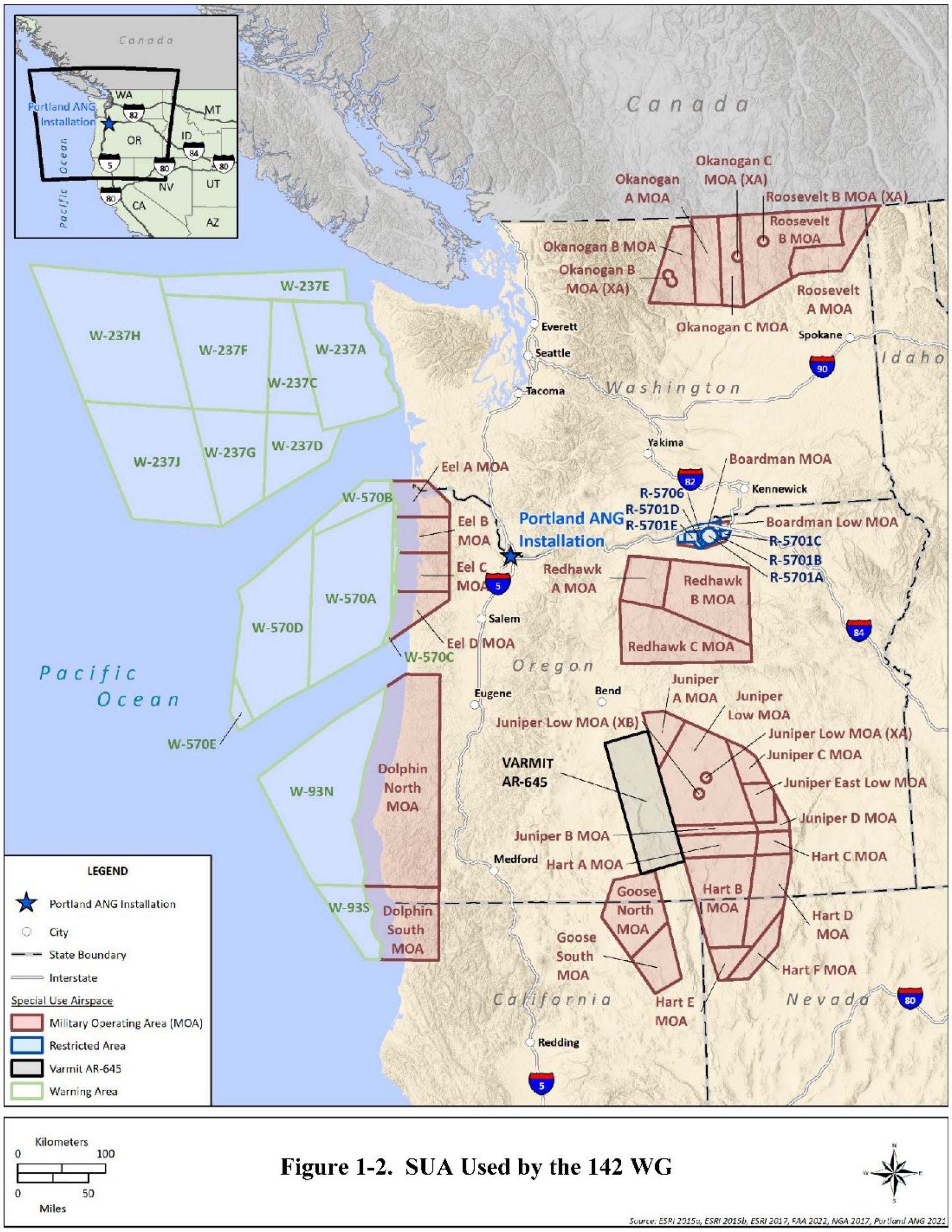

Figure 1-2. SUA Used by the 142 WG

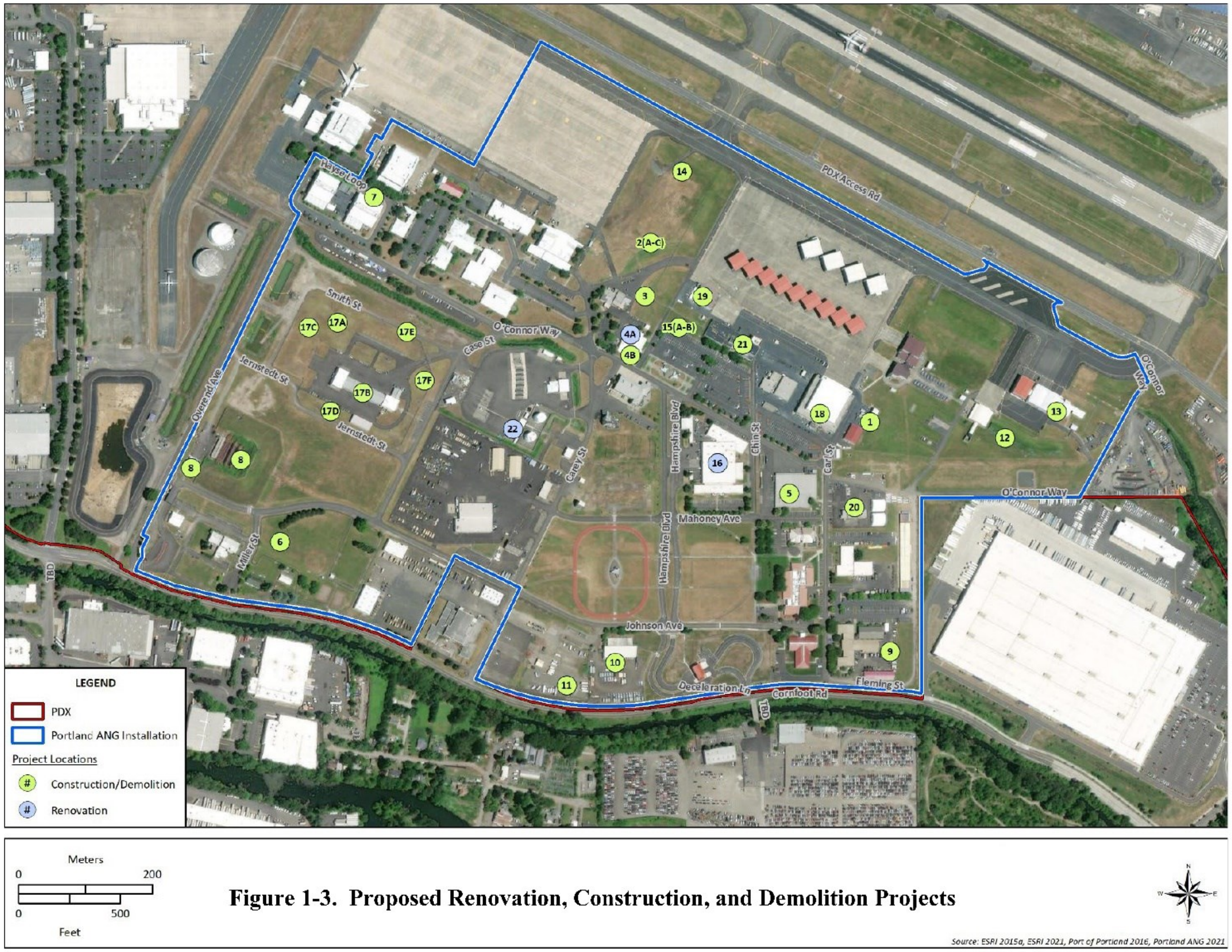

Figure 1-3. Proposed Renovation, Construction, and Demolition Projects

Source: ESRI 2015a, ESRI 2021, Port of Portland 2016, Portland ANG 2021

ENCLOSURE 2
Area of Potential Effects

Analysis of potential effects on cultural resources for the proposed undertaking considers both direct and indirect impacts in accordance with 36 Code of Federal Regulations (CFR) 800.5. Direct impacts may occur by: (1) physically altering, damaging, or destroying all or part of a resource; (2) altering characteristics of the surrounding environment that contribute to resource significance; (3) introducing visual, audible, or atmospheric elements that are out of character with the property or alter its setting; or (4) neglecting the resource to the extent that it deteriorates or is destroyed. Direct impacts can be assessed by identifying the type and location of the Proposed Action and by determining the exact locations of cultural resources that could be affected. Indirect impacts include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5(a)(1)).

The area of potential effects (APE) is the geographic area or areas within which an undertaking (project, activity, program, or practice) may cause changes in the character or use of any historic properties present. The APE is influenced by the scale and nature of the undertaking and may be different for various kinds of effects caused by the undertaking. The APE for this undertaking includes areas proposed to have ground disturbance (including locations of newly constructed buildings), facilities that would be demolished or renovated, off-base land within the 65 decibel (dB) day-night average sound level (DNL) noise contour for the undertaking, and lands located beneath existing airspace. No new airspace or airspace reconfigurations are proposed as part of this undertaking.

The footprints of the proposed construction and renovation projects are described in Table 1-1 and Table 1-2 in Enclosure 1 and the associated APE is depicted on Figure 1-3 of Enclosure 1. The off-base land within the 65 dB DNL noise contour for the undertaking (which encompasses the area that may be subject to noise at 65 dB DNL associated with takeoff and landing of the aircraft, accounting for the greatest potential effect depending on 5 percent, 50 percent, or 95 percent afterburner usage), is shown below in Figure 2-1. The airspace APE is depicted in Figure 1-2 of Enclosure 1.

Enclosure 2 | 2

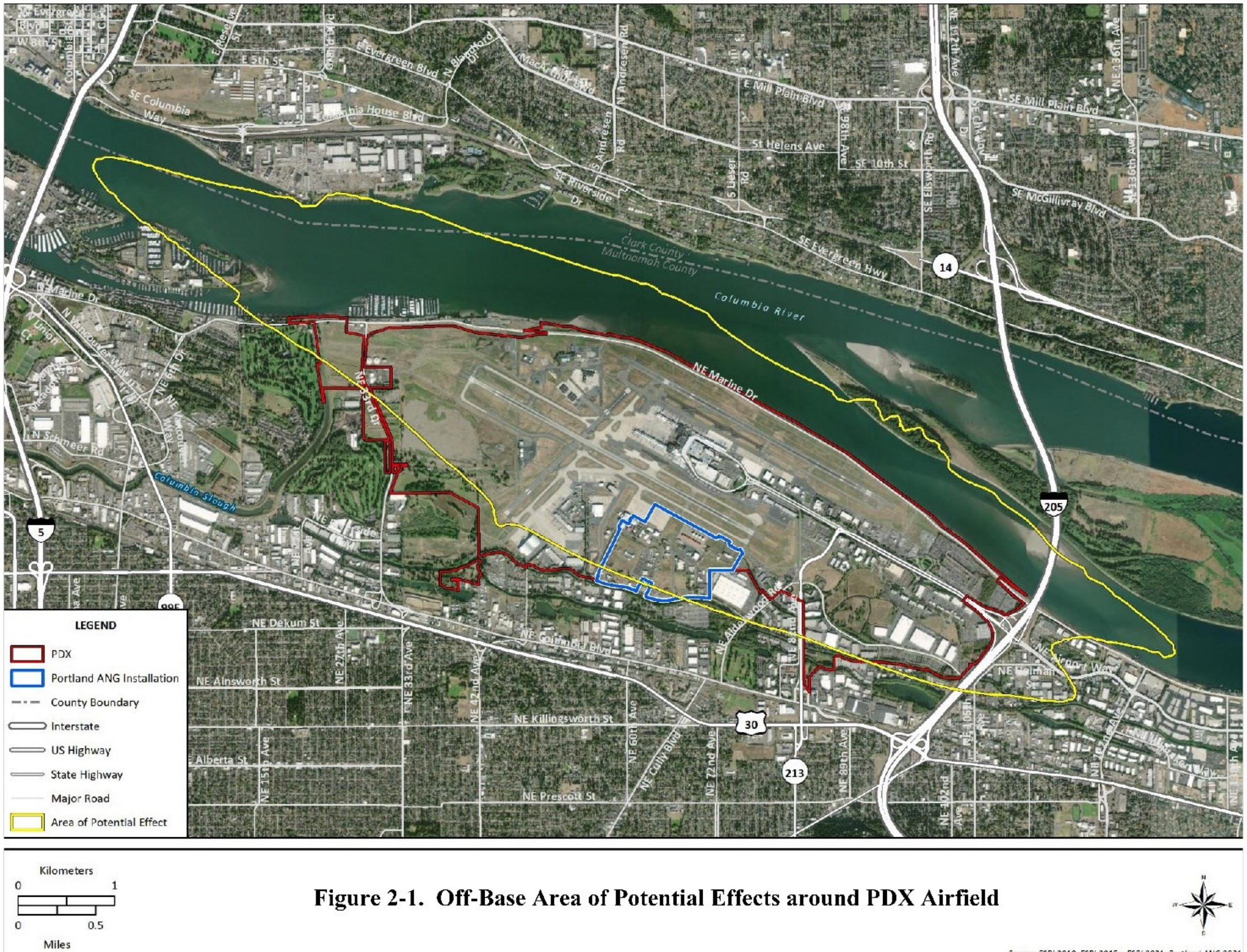

Figure 2-1. Off-Base Area of Potential Effects around PDX Airfield

Source: ESRI 2010, ESRI 2015a, ESRI 2021, Portland ANG 2021

ENCLOSURE 3
Identification of Historic Properties

Efforts to identify historic properties within the area of potential effects (APE) for the undertaking included review of the Oregon Air National Guard (ANG) 2012 Integrated Cultural Resources Management Plan (ICRMP), a review of data on-file with the Oregon State Historic Preservation Office (SHPO) through the Oregon Historic Sites Database, and a review of the National Register of Historic Places (NRHP) Geospatial Dataset.

Installation
The areas of the Portland ANG installation with potential sensitivity for archaeological resources have been previously surveyed, with one archaeological isolate identified that is considered not eligible for listing in the NRHP (Oregon ANG 2012). An architectural survey conducted in 2002 recorded all buildings constructed at the 142 WG prior to 1990 (Oregon ANG 2012). Buildings that were built prior to 1957 (45 years or older, at the time) were evaluated for NRHP eligibility. In addition, Cold War era buildings (built between 1946 and 1989) were evaluated for the NRHP under Criteria Consideration G. As a result of the survey, Buildings 494 and 495 were recommended eligible for listing in the NRHP for their architectural significance. This determination received SHPO concurrence in 2002, 2012, and 2017 (Oregon ANG 2012; Johnson 2012; Gabriel 2017). There are no historic districts or historic landscapes present at the 142 WG (Oregon ANG 2012).

Traditional Cultural Resources
No known traditional cultural resources or sacred sites have been identified at the Portland ANG installation. The 142 Wing (142 WG) has sought input from the federally recognized Tribal Nations with interest in the APE regarding any traditional resources that may be affected by the undertaking. To date, the 142 WG has not received any comments identifying traditional cultural resources that may be affected by the undertaking (refer to Enclosure 5 for a summary).

Off-Base
One NRHP-listed historic property is located within the APE surrounding the Portland International Airport (PDX) (National Park Service 2023). This historic property is the Raymond and Catherine Fisher house, a Tudor-style residence built in 1929 located along Marine Drive and was the first house constructed in the Golf Acres development associated with the Columbia-Edgewater Golf Course (Fitzgerald 2006).

Two NRHP-eligible properties are located within the APE surrounding the PDX (Oregon SHPO 2023a). One property is an English cottage home built in 1927 and located at 3620 NE Elrod Road (Oregon SHPO 2023b). The second property is a contemporary single dwelling home built in 1966 and is located at 13545 NE Marine Drive (Oregon SHPO 2023c).

Airspace

Use of the affected airspace will not involve any ground disturbing activities, therefore, only historic properties that would reasonably be affected by visual (overflights, chaff, and flares) and auditory or noise intrusions were considered. Training operations currently take place within W-

570, Eel Military Operations Area (MOA), Juniper/Hart MOAs, Varmit AR-645, and Redhawk MOAs. The 2017 Oregon EIS found 6,898 total historic sites are recorded in counties below the SUA. Of these, 426 were considered historic properties and are listed in the NRHP (Oregon ANG 2017).

ENCLOSURE 4
Assessment of Effects

Analysis of Effects Methodology

Analysis of potential impacts on cultural resources considers both direct and indirect impacts. Direct impacts may occur by: (1) physically altering, damaging, or destroying all or part of a resource; (2) altering characteristics of the surrounding environment that contribute to resource significance; (3) introducing visual, audible, or atmospheric elements that are out of character with the property or alter its setting; or (4) neglecting the resource to the extent that it deteriorates or is destroyed. Direct impacts can be assessed by identifying the type and location of the undertaking and by determining the exact locations of cultural resources that could be affected. Indirect impacts primarily result from the effects that are farther removed from the immediate project area including visual, audible (noise), or atmospheric changes due to the project implementation, which are harder to quantify.

Aircraft operations are most likely to affect historic buildings, structures, and districts where setting is an important aspect of a property's significance. Visual intrusions can include aircraft overflights which intrude into the viewshed of a cultural resource, thus adversely affecting its setting. The aircraft flying overhead has the potential to adversely affect the setting, feeling, and character of cultural resources within sight of the aircraft. For the special use airspace (SUA), aircraft would be flying at 18,000 feet mean sea level (MSL).

The release of chaff and flares could have a visual effect from residual materials which remain on the ground or land, on structures, or at sacred sites. Studies have shown that chaff and its debris do not pose a significant threat to the visual integrity of archaeological and architectural resources (Government Accountability Office 1998). Chaff does not accumulate to any great degree and the fibers, if found, were often mistaken for natural elements such as animal fur or plant material. The fibers generally dissipate within a few days due to mechanical breakdown from wind, sediment erosion, and rain or snow. Chaff residual plastic materials are typically 1 inch by 1 inch. Flare residual plastic materials, usually red or blue in color, can be 1 inch by 2 inches or larger. Overall, chaff and flares are unlikely to adversely affect cultural resources. The residual materials from chaff and flares fall to the ground in a dispersed fashion and do not collect in quantities great enough to adversely affect the integrity and subsequent NRHP status of archaeological or architectural resources.

Impacts to traditional cultural resources and sacred sites can include the introduction of visual, audible, or atmospheric elements to traditional ceremonial life and traditional practices (i.e., hunting/fishing, vision quests, praying). Impacts to these resources regarding chaff and flare are more difficult to assess as no studies have been conducted on these resources.

Assessment of Effects

Action Alterative 1

Construction Impacts

Archaeological Resources

There are no known archaeological sites located at the Portland Air National Guard (ANG) installation and one archaeological isolate was identified but is not eligible for listing in the National Register of Historic Places (NRHP) (Oregon ANG 2012). It is not expected that undiscovered archaeological resources would be found during implementation of Alternative 1 at the Portland ANG installation. However, due to the location of the installation near the Columbia River and the use of fill from the Columbia River, there is a high probability of subsurface archaeological resources; therefore, an archaeological monitor will be onsite during all ground-disturbing activities. If an unanticipated discovery of cultural artifacts occurs or the discovery of unmarked burial(s), including Native American burials or cemeteries from which headstones were relocated but not the physical remains, the activity in the immediate vicinity will cease until an assessment of the materials can be made. The unit commander/supervisor will be notified immediately so the Environmental Manager can be contacted. Protocols found in Standard Operating Procedure No. 6, *Inadvertent Discovery of Cultural Materials* and Standard Operating Procedure No. 7, *Inadvertent Discovery of Unmarked Burials* within the Integrated Cultural Resources Management Plan (ICRMP) will be followed (Oregon ANG 2012).

Architectural Resources

Alternative 1 would involve the interior modification of Buildings 170 and 270. Interior modifications include upgrading electrical systems; heating, ventilating, and air conditioning systems; and plumbing. Buildings 170 and 270 were built in 1990 and are not eligible for the NRHP. Alternative 1 would include additions to Buildings 115, 210, 270, and 400. These buildings were built in the late 1980s and 1990 are not eligible for listing in the NRHP (Oregon ANG 2012).

Alternative 1 would also include the demolition of 14 buildings (Buildings 160, 165, 240, 255, 265, 275, 475, 480, 485, 491, 495, 496, 497, and 498). Of these buildings, 7 were determined not eligible for listing in the NRHP. Building 240 (Warehouse built in 1967), Building 275 (Munitions loading crew training built in 1968), and Building 491 (Recreation Center built in 1965) were determined not eligible under Criteria Consideration G for special significance during the Cold War (Oregon ANG 2012). However, these buildings have reached 50 years of age since the last architectural evaluation at the installation and require evaluation under standard NRHP criteria, though it is not likely that they would be eligible due to a lack of historical significance. The NGB would coordinate with the Oregon State Historic Preservation Office (SHPO) to evaluate the eligibility of these buildings, and required mitigation if any building is determined eligible, prior to any planned demolition of these structures. This would include the development of a Memorandum of Agreement between the 142 Wing (WG), NGB, the Advisory Council on Historic Preservation, the SHPO, Tribal Nations, and other consulting parties. Building 495, a World War II recreation center, was determined eligible for listing in the NRHP and its demolition would be considered an adverse effect. However, the building's demolition was previously mitigated under the Programmatic Agreement signed between the DoD, the

Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers regarding the demolition of World War II temporary buildings effective June 7, 1986. The SHPO concurred with this mitigation in 2017 and no further action would be required (Gabriel 2017).

Traditional Cultural Resources

No traditional cultural resources or sacred sites have been identified at the Portland ANG installation. Government-to-government consultation between the DAF and each federally recognized Tribal Nation associated with the Portland ANG installation, including the Confederated Tribes of the Warm Springs Reservation, the Confederated Tribes of Grand Ronde Community of Oregon, Confederated Tribes of the Umatilla Indian Reservation, the Cowlitz Indian Tribe, Nez Perce Tribe, and the Confederated Tribes of Siletz Indians have been initiated for this action in recognition of their status as sovereign nations, to provide information regarding Tribal concerns per Section 106 of the NHPA, as well as information on traditional cultural resources and sacred sites that may be present on or near the Portland ANG installation. To date, no responses have been received from these six Tribal Nations associated with the Portland ANG installation.

Operational Impacts

Training requirements for Alternative 1 would remain similar to the existing F-15C. Under Alternative 1, F-15EX would generate an additional 446 airfield operations, which represents a 9 percent increase from the current F-15C existing conditions/No Action Alternative. The noise level at the airfield would increase from 1 to 2 dB DNL. Although there would be a slight increase in noise levels, there would be no effects to NRHP-eligible or -listed archaeological resources, architectural resources, or traditional cultural resources or sacred sites.

The 2017 *EIS for Proposed Establishment and Modification of Oregon Military Training Airspace* found that a fraction of the historic properties would have a potential to be impacted by low-altitude flow activities within the Juniper Low MOAs. All other historic properties beneath the proposed Eel MOA/ATCAA, Redhawk MOA Complex, or the remainder of the Juniper/Hart MOAs would not be affected as the floor of the airspaces are at 11,000 feet MSL limiting noise exposure and associated potential impacts to the historic properties below (Oregon ANG 2017a). Under Alternative 1, the types of airspace operations, altitudes flown, and frequency of use of existing airspace by the 142 WG would remain similar to existing activity. However, a portion of the sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements. The result would increase the F-15 use of NWSTF Boardman and Mountain Home SUA from 2 weeks per year at each location to 4 weeks per year at each location. Under Alternative 1 the 142 WG operations would continue to represent a small portion of the overall flight operations. At NWSTF Boardman, Alternative 1 would represent 3.4 percent of the total annual fixed-wing operations (an increase of 1.9 percent from existing conditions/No Action Alternative) and at Mountain Home Alternative 1 represents approximately 1.6 percent of total annual flight operations in the SUA (an increase of less than 1 percent from existing conditions/No Action Alternative). Correspondingly, the F-15 use of W-570 and Eel MOA would decrease, as these sorties would shift to NWSTF Boardman and Mountain Home SUA, while use of all other associated airspace would not be proposed to change. This would represent an increase from the current seven F-15C sorties to an average of eight F-15EX sorties per day that would utilize the existing SUA. Based on noise level calculations for lands beneath the SUA, there would be no adverse effect to cultural resources, historic structures, or traditional cultural resources or sacred sites as a result of the implementation of Alternative 1.

Visual intrusions under Alternative 1 would be minimal and would not represent an increase sufficient to cause adverse impacts to the settings of cultural resources. Due to the high altitude of the overflights, small size of the aircraft, and the high speeds, the aircraft would not be readily visible to observers on the ground.

No ground disturbance would occur under the airspace due to the implementation of Alternative 1. Use of ordnance and defensive countermeasures would occur in areas already authorized for these activities. Flares deployed from the aircraft would not pose a visual intrusion either, as flares are small in size and burn only for a few seconds. In addition, the high relative altitude of the flights would make them virtually undetectable to people on the ground. The use of defensive countermeasures would not have an adverse effect on archaeological sites or standing structures.

Proposed use of the airspace would be similar to ongoing training operations. Given the current use of the airspace and the nature of the proposed future use of the project area, there would be no adverse effects to NRHP-eligible or -listed archaeological resources, architectural resources, or traditional cultural resources or sacred sites.

Responses from Tribal Nations associated with the airspace APE include the Confederated Tribes of the Colville Reservation, Confederated Tribes of the Chehalis Reservation, Yurok Tribe of the Yurok Reservation, and the Spokane Tribe of the Spokane Reservation. The response from the Confederated Tribes of the Colville Reservation noted they had reviewed the materials provided and there are indeed traditional properties, historic properties, and other resources of cultural importance to the people of the Colville Tribes within portions of the APE. However, as the proposed undertaking will utilize existing special use airspace, we do not request formal consultation. The Confederated Tribes of the Chehalis Reservation Tribal Historic Preservation Office responded that they concurred with the determination of the APE for this undertaking and have no further comments at this time. However, should additional information become available, their assessment may be revised, including information regarding historic properties that have not yet been identified. The Yurok Office of Historic Preservation responded that they reviewed the material and determined the undertaking was outside of their ancestral territory. The Spokane Tribe of the Spokane Reservation responded that the project is located within the Umatilla Tribe, Warm Springs, and Grand Ronde area, therefore the Tribal Nation deferred this project to one of those Tribal Nations. The Yurok Tribe of the Yurok Reservation, Office of Historic Preservation responded that they reviewed the material and determined the undertaking was outside of their ancestral territory.

Proposed use of the airspace would be similar to ongoing training operations. Given the current use of the airspace and the nature of the proposed future use of the project area, there would be no adverse effects to NRHP-eligible or -listed archaeological resources, architectural resources, or traditional cultural resources or sacred sites.

Overall, implementation of Alternative 1 would not result in significant impacts to cultural resources.

Action Alternative 2

Impacts to archaeological resources and traditional cultural resources or sacred sites under Alternative 2 would be similar to those under Alternative 1. Therefore, under Alternative 2 no impacts on archaeological resources or traditional cultural resources or sacred sites are anticipated.

Impacts to architectural resources under Alternative 2 would be the same as those under Alternative 1. Therefore, under Alternative 2 no impacts on architectural resources are anticipated.

Under Alternative 2, airfield operations would increase approximately 27 percent over existing conditions/No Action Alternative, or by 1,328 annual operations. Impacts would be similar in nature to those described for Alternative 1, but there would be a 17 percent increase in airfield operations as compared to Alternative 1. The noise level at the airfield would increase from 2 to 3 dB DNL. Despite the slight increase in noise levels, there would be no adverse effects to NRHP-eligible or -listed archaeological resources, architectural resources, or traditional cultural resources or sacred sites.

Under Alternative 2, the F-15EX aircraft would utilize existing military airspace and military training ranges and would continue the use of chaff and flares in authorized airspace similar to Alternative 1. Total sorties would increase approximately 15 percent under Alternative 2, relative to Alternative 1. As with Alternative 1, a portion of the sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements. The result would increase the F-15 use of NWSTF Boardman and Mountain Home SUA from 2 weeks per year at each location to 4 weeks per year at each location. Under Alternative 2, the 142 WG operations would continue to represent a small portion of the overall flight operations. At NWSTF Boardman, Alternative 2 would represent 3.8 percent of the total annual fixed-wing operations (an increase of 2.3 percent from existing conditions/No Action Alternative, and 0.4 percent compared to Alternative 1). At Mountain Home, Alternative 2 represents approximately 1.7 percent of total annual flight operations in the SUA (an increase of less than 1 percent from existing conditions/No Action Alternative, and 0.1 percent compared to Alternative 1). Correspondingly, the F-15 use of W-570 and Eel MOA would decrease, as the sorties would shift to NWSTF Boardman and Mountain Home SUA, while use of all other associated airspace would not change.

Visual intrusions under Alternative 2 would be minimal and would not represent an increase sufficient to cause adverse impacts to the settings of cultural resources. Due to the high altitude of the overflights, small size of the aircraft, and the high speeds, the aircraft would not be readily visible to observers on the ground.

No ground disturbance would occur under the airspace under Alternative 2. Use of ordnance and defensive countermeasures would occur in areas already authorized for these activities. Flares deployed from the aircraft would not pose a visual intrusion either, as flares are small in size and burn only for a few seconds and the high relative altitude of the flights would make them virtually undetectable to people on the ground. The use of defensive countermeasures would not have an adverse effect on archaeological sites or standing structures.

Given the current use of the airspace and the nature of the proposed future use, there would be no adverse effects to NRHP-eligible or -listed archaeological resources, architectural resources, or traditional cultural resources or sacred sites. Overall, implementation of Alternative 2 would not result in significant impacts to cultural resources.

Action Alternative 3

Impacts to archaeological resources and traditional cultural resources or sacred sites under Alternative 3 would be similar to that under Alternatives 1 and 2. Therefore, under Alternative 3 no impacts on archaeological resources and traditional cultural resources or sacred sites are anticipated.

Impacts to architectural resources under Alternative 3 would be similar to that under Alternative 1, with some exceptions. Additions to Buildings 210 and 400 are not included in Alternative 3. In addition, Alternative 3 does not include the demolition of Buildings 160, 255, 265, and 275. Therefore, under Alternative 3 no impacts on architectural resources are anticipated.

Training requirements for Alternative 3 would remain in place at the Portland ANG installation and continue flying the allotted sorties. Therefore, there would be no effects to NRHP-eligible or -listed archaeological resources, architectural resources, or traditional cultural resources or sacred sites.

Under Alternative 3, existing F-15C aircraft would remain and continue flying the allotted sorties while utilizing existing airspace under their current mission. The air-to-air training mission would continue as described and the air-to-ground mission would not be added. No significant impacts to cultural resources would be expected with implementation of Alternative 3. Overall, implementation of Alternative 3 would not result in significant impacts to cultural resources.

Conclusion

Prior to implementation of the proposed undertaking, the 142 WG and DAF will evaluate Building 240 (Warehouse built in 1967), Building 275 (Munitions loading crew training built in 1968), and Building 491 (Recreation Center built in 1965) for their eligibility to the NRHP in accordance with 36 CFR Section 800. The buildings will be evaluated by a qualified professional meeting Secretary of the Interior's Standards and Guidelines (48 FR 44716-42). If the buildings are determined to not be NRHP-eligible, the 142 WG and NGB will provide documentation of this finding, as set forth in 36 CFR § 800.11(d), to your office. However, if the buildings are determined to be NRHP-eligible and will be adversely affected, then the 142 WG and NGB will mitigate the adverse effect set forth in regulations 36 CFR § 800.6, Resolution of adverse effects.

This will include the development of a Memorandum of Agreement between the 142 WG, NGB, the Advisory Council on Historic Preservation, the SHPO, Tribal Nations, and other consulting parties.

Additionally, due to the location of the installation near the Columbia River and the use of fill from the Columbia River, there is a high probability of subsurface archaeological resources, therefore, an archaeological and tribal monitor will be onsite during all ground disturbing activities. If an unanticipated discovery of cultural materials occurs or the discovery of unmarked burial(s), including Native American burials or cemeteries from which headstones were relocated but not the physical remains, the activity in the immediate vicinity will cease until an assessment of the materials can be made. The unit commander/supervisor will be notified immediately so the Environmental Manager can be contacted. Protocols found in Standard Operating Procedure No. 6, *Inadvertent Discovery of Cultural Materials* and Standard Operating Procedure No. 7, *Inadvertent Discovery of Unmarked Burials* within the ICRMP will be followed.

ENCLOSURE 5
Summary of Tribal Consultation

The following is a list of federally recognized Tribal Nations that have expressed interest in areas included in the area of potential effects (APE) for the proposed undertaking including Portland Air National Guard (ANG) installation and lands below the associated airspace. The U.S. Department of the Air Force (DAF) sent government-to-government consultation letters to each Tribal Nation on 28 April 2023. Tribal Nations that have not responded or have requested additional consultation will receive this consultation package. Responses from Tribal Nations in italics indicate they are outside of the area of potential effects, or they defer to another Tribal Nation and no further consultation is needed.

Table 5-1. Summary of Tribal Consultation

Tribal Nation	*Associated with Airspace*	*Associated with Installation*	*Response*
Alturas Indian Rancheria, California	X		
Bear River Band of the Rohnerville Rancheria, California	X		
Burns Paiute Tribe	X		
Cedarville Rancheria, California	X		
Cher-Ae Heights Indian Community of the Trinidad Rancheria, California	X		
Coeur D'Alene Tribe	X		
Confederated Salish and Kootenai Tribes of the Flathead Reservation	X		
Confederated Tribes and Bands of the Yakama Nation	X		
Confederated Tribes of Siletz Indians of Oregon	X	X	
Confederated Tribes of the Chehalis Reservation	X		The Chehalis Tribe's Historic Preservation Office concurs with determination of the APE for this project and has no further comments at this time. Should additional information become available, our assessment may be revised, including information regarding historic properties that have not yet been identified.
Confederated Tribes of the Colville Reservation	X		We have reviewed the materials provided by your office. There are indeed traditional properties, historic properties, and other resources of cultural importance to the people of the Colville Tribes within portions of the APE. However, as the proposed undertaking will utilize existing special use airspace, we do not request formal consultation. We appreciate the consultation. Do not hesitate to contact us with any questions or concerns related to the Tribes cultural resources.

Enclosure 5 | 2

Table 5-1. Summary of Tribal Consultation

Tribal Nation	*Associated with Airspace*	*Associated with Installation*	*Response*
Confederated Tribes of the Coos, Lower Umpqua and Siuslaw Indians	X		
Confederated Tribes of the Grand Ronde Community of Oregon	X	X	
Confederated Tribes of the Umatilla Indian Reservation	X	X	
Confederated Tribes of the Warm Springs Reservation of Oregon	X	X	
Coquille Indian Tribe	X		
Cow Creek Band of Umpqua Tribe of Indians	X		
Cowlitz Indian Tribe	X	X	
Elk Valley Rancheria, California	X		
Fort Bidwell Indian Community of the Fort Bidwell Reservation of California	X		
Fort McDermitt Paiute and Shoshone Tribes of the Fort McDermitt Indian Reservation, Nevada and Oregon	X		
Hoopa Valley Tribe, California	X		
Kalispel Indian Community of the Kalispel Reservation	X		
Karuk Tribe	X		
Klamath Tribes	X		
Kootenai Tribe of Idaho	X		
Nez Perce Tribe	X	X	
Paiute-Shoshone Tribe of the Fallon Reservation and Colony, Nevada	X		
Pit River Tribe, California	X		
Pyramid Lake Paiute Tribe of the Pyramid Lake Reservation, Nevada	X		
Quartz Valley Indian Community of the Quartz Valley Reservation of California	X		
Reno-Sparks Indian Colony, Nevada	X		
Resighini Rancheria, California	X		
Shoshone-Paiute Tribes of the Duck Valley Reservation, Nevada	X		
Spokane Tribe of the Spokane Reservation	X		This project has been determined to be in the Umatilla Tribe, Warm Springs, Grand Ronde area, therefore I will defer this project to one of those tribes.
Susanville Indian Rancheria, California	X		
Tolowa Dee-ni' Nation (Smith River Rancheria, California)	X		
Walker River Paiute Tribe of the Walker River Reservation, Nevada	X		
Washoe Tribe of Nevada and California	X		
Wiyot Tribe, California	X		

Table 5-1. Summary of Tribal Consultation

Tribal Nation	*Associated with Airspace*	*Associated with Installation*	*Response*
Yurok Tribe of the Yurok Reservation, California	X		The Yurok Office of Historic Preservation has reviewed the material and determined it is outside of our ancestral territory.

ENCLOSURE 6
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_____. 2023c. Oregon Historic Site Record located at13545 NE Marine Dr. Accessed on August 21, 2023. http://heritagedata.prd.state.or.us/historic/.

From: Guy Moura
To: NGB CC/A4A NEPA COMMENTS Org
Cc: POULEY John * OPRD
Subject: [Non-DoD Source] ATTN: 142WG EA
Date: Tuesday, January 30, 2024 1:21:58 PM
Attachments: TraditionalTerritories3_27_17.pdf

You don't often get email from guy.moura@colvilletribes.com. Learn why this is important

Thank you for consulting with the Confederated Tribes of the Colville Reservation. We concur that there will be no adverse impact to historic properties within our Traditional Territories (see attached).

lim ləmt, qeʔciẃyeẃ, thank you

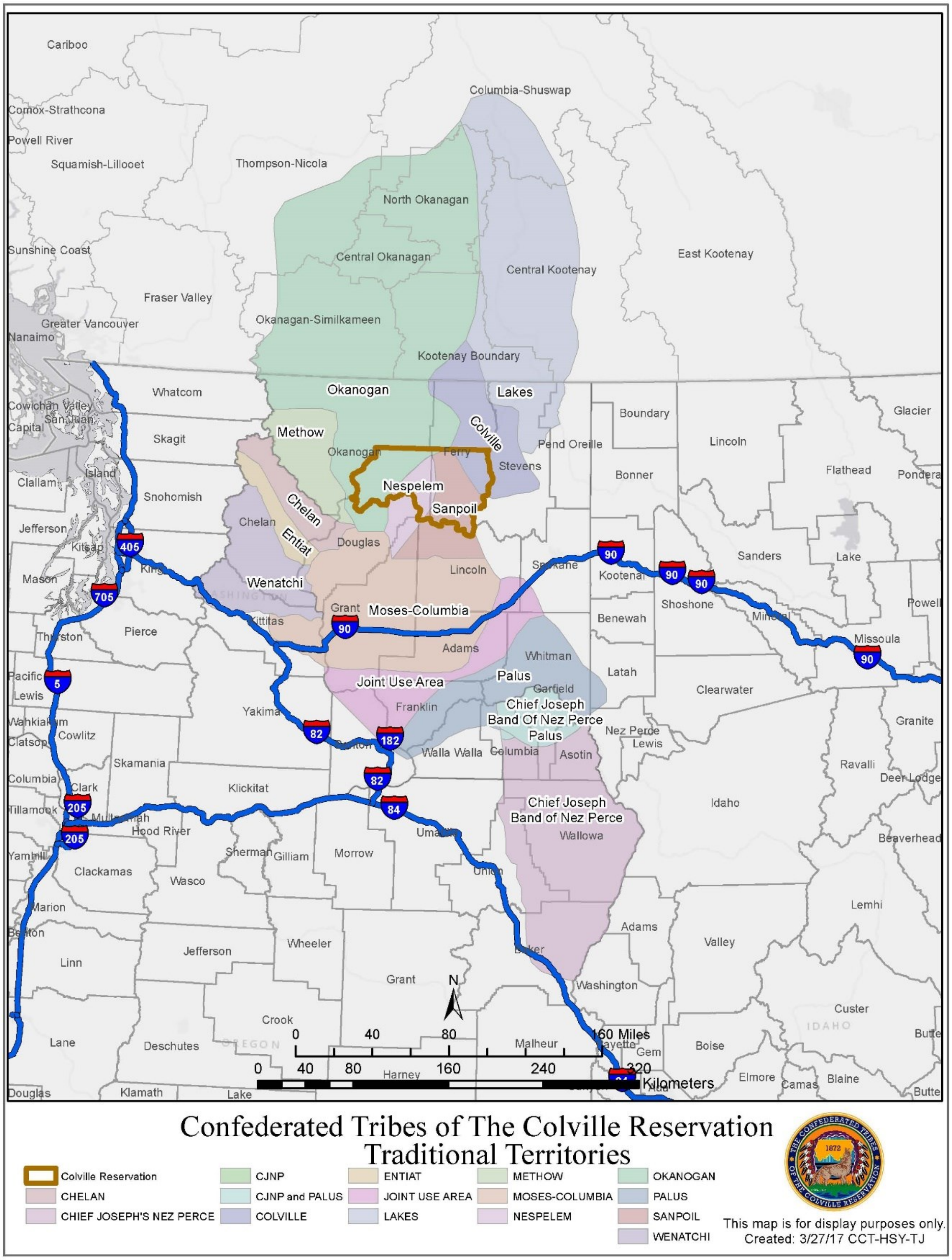
Guy Moura

Manager, History/Archaeology Program

Tribal Historic Preservation Officer

Confederated Tribes of the Colville Reservation

(509) 634-2695


Confederated Tribes of The Colville Reservation
Traditional Territories
Colville Reservation
CHELAN
CHIEF JOSEPH'S NEZ PERCE
CJNP
CJNP and PALUS
COLVILLE
ENTIAT
JOINT USE AREA
LAKES
METHOW
MOSES-COLUMBIA
NESPELEM
OKANOGAN
PALUS
SANPOIL
WENATCHI
This map is for display purposes only.
Created: 3/27/17 CCT-HSY-TJ
Okanogan
Lakes
Colville
Methow
Nespelem
Sanpoil
Chelan
Entiat
Wenatchi
Moses-Columbia
Joint Use Area
Palus
Chief Joseph Band Of Nez Perce Palus
Chief Joseph Band of Nez Perce
0 40 80 160 Miles
0 40 80 160 240 320 Kilometers

From: Peter Hatch
To: NGB CC/A4A NEPA COMMENTS Org
Cc: Sharon Edenfield
Subject: [Non-DoD Source] Fwd: Section 106 Consultation for the Proposed F 15EX Eagle II Operational
Date: Wednesday, January 31, 2024 10:54:56 AM
Attachments: ConfTribesSiletzIndians-Section 106 Consultation Letter_January2024.pdf

You don't often get email from peterh@ctsi.nsn.us. Learn why this is important

Good morning Col. Kosderka and Ms. Treece,

Thank you for reaching out to the Confederated Tribes of Siletz Indians (CTSI) about the proposed recapitalization of the Portland ANG installation. I am glad to see that there is a plan for an archeological monitor to be on site during any ground disturbing activities necessary for the building demolition, renovation and construction contemplated by Alternative 1 and Alternative 2 given the possibility of archeological resources in the Columbia River dredge fill that the facility is largely constructed on. Should Alternatives 1 or 2 be selected we would be especially interested in understanding if there is any possibility of the required activities disturbing native soil below the dredge fill, where the probability of archeological resources is even higher.

Lastly, I would like to note that this inquiry led me to revisit the report prepared in 2011 for the Oregon Air National Guard by Chris Wilson of Science Applications International Corp under ANG Project Number ANG0853327. The archeologist was of course only able to sample undeveloped areas of the base, so it will be necessary to have a qualified archeologist reconsider the affects of this undertaking, especially in light of the revised regulations on archeological sites released in 2023 by the Oregon State Historic Preservation Office. I would further note that the report appears not to mention the Chinookan Village visited by the Lewis & Clark expedition on Nov. 4th 1805, thought broadly by scholars to be near the current location of Portland International Airport. That omission suggests to me that a qualified archeologist could easily delve deeper into the historical record than the previous contractor proved able to.

With regard to the changing use of military operations areas, we have not received negative feedback from tribal cultural practitioners about the current use of ANG aircraft, and the proposed alternatives seem similar enough to current practice that we do not anticipate the need for further consultation. We will reach out should we receive such feedback in the future. Thank you again for reaching out to CTSI about this proposed undertaking.

One note on contacting CTSI, please join us in congratulating Robert Kentta on his retirement! To ensure prompt communication, please send future Section 106 notices to culturalresources@ctsi.nsn.us, which will go to myself and other relevant CTSI staff.

Respectfully,
Peter

Peter Sv-gvs (Black Bear) Hatch
History & Archaeology Specialist
Confederated Tribes of Siletz Indians
P.O. Box 549
Siletz, OR 97380

541-444-8319

Begin forwarded message:

From: Sharon Edenfield <sharone@ctsi.nsn.us>
Subject: Fwd: Section 106 Consultation for the Proposed F 15EX Eagle II Operational
Date: January 31, 2024 at 9:04:51 AM PST
To: Peter Hatch <PeterH@ctsi.nsn.us>

FYI

Sharon

Sent from my iPhone

Begin forwarded message:

From: NGB CC/A4A NEPA COMMENTS Org <NGB.A4.A4A.NEPA.COMMENTS.Org@us.af.mil>
Date: January 31, 2024 at 8:01:57 AM PST
To: Sharon Edenfield <sharone@ctsi.nsn.us>, rkentta@ctsi.nsn.us, Mike Kennedy <MikeK@ctsi.nsn.us>
Subject: Section 106 Consultation for the Proposed F 15EX Eagle II Operational

Good morning Chairperson Pigsley,

As described in a letter sent to your office in April 2023, the United States Department of the Air Force (DAF) is proposing to recapitalize its existing F-15C inventory with the newer and more capable F-15EX "Eagle II" aircraft at the Portland Air National Guard (ANG) installation, located at the Portland International Airport (PDX), in Portland, Oregon (OR). In accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (54 United States Code 306108) and its implementing regulations found at Title 36 Code of Federal Regulations (CFR) Section 800, the DAF is continuing consultation with your office and tribal governments who have expressed an interest in the affected area. Please see the attachment for more information.

Respectfully,

ALICIA M. TREECE, CIV, DAF
NGB/A4AM NEPA Program Manager
Air National Guard Readiness Center
3501 Fetchet Avenue
Joint Base Andrews, MD 20762

Oregon

Tina Kotek, Governor

Parks and Recreation Department
Oregon Heritage/
State Historic Preservation Office
725 Summer St. NE, Suite C
Salem, OR 97301-1266
(503) 986-0690
Fax (503) 986-0793
oregonheritage.org

February 23, 2024

Aliciia Treece, NGB/A4AM NEPA Program Manager
Department of the Air Force
Air National Guard Readiness Center
3501 Fetchet Ave
Joint Base Andrews, MD 20762

RE: SHPO Case No. 24-0320
NGB, Proposed F-15EX Eagle II Operational Beddown, Portland Air National Guard, Oregon
construction for beddown, construction for facilities,
Portland International Airport, Multnomah County

Dear Aliciia Treece:

Thank you for submitting information for the undertaking referenced above. We do not concur that there will be no adverse effect to historic properties for this undertaking because recommend an inventory of the APE be completed before we can offer concurrence. The inventory should include a resurvey of the buildings and structures as a potential district and archaeological survey specific to the area where ground disturbance will take place.

Please address the above issues with a letter or new documentation and resubmit to our office via Go Digital. Please note, since COVID our office now requires digital submissions for Section 106 consultation.

If you have not already done so, be sure to consult with all appropriate Native American tribes and interested parties regarding the proposed undertaking. Additional consultation regarding this case must be sent through Go Digital. In order to help us track the undertaking accurately, reference the SHPO case number above in all correspondence.

Please contact our office if you have any questions, comments or need additional assistance.

Sincerely,

Jamie French, M.A.
Assistant State Archaeologist
(503) 979-7580
Jamie.French@oprd.oregon.gov

From:	HAFLEY Dan * DEQ
To:	NGB CC/A4A NEPA COMMENTS Org
Cc:	REIN, ROGER C CIV USAF ANG 142 MSG/EM; HIGGINBOTHAM, AUBREY M CIV USAF ANG NGB/A4; Breen, David; VANGLUBT Sarah * DEQ
Subject:	[Non-DoD Source] ATTN: PORTLAND F-15EX EA
Date:	Tuesday, February 27, 2024 12:11:17 PM
Attachments:	image001.png

You don't often get email from dan.hafley@deq.oregon.gov. Learn why this is important

To:

Ms. Alicia Treece
3501 Fetchet Ave.
Joint Base Andrews, MD 20762-5157

Oregon Department of Environmental Quality staff reviewed the *Draft Environmental Assessment for Basing F-15EX Eagle II Operational Unit at the Portland ANG Installation, Portland, Oregon* (EA; January 2024) and an accompanying Findings of No Significant Impact (FONSI). We have one general comment for your consideration:

To complement Table 3.8-3 and Figures 3.8-2 and 4.8-1 of the EA, we recommend that a figure or figures be included in the EA showing the location of known PFAS detections in soil, groundwater, and other media, including data from recent Remedial Investigation work (report pending). Areas of construction/demolition presented on Figure 4.8-1 can then be discussed in terms of work having the potential to encounter/disturb contaminated media, which would require contaminated media management and measures to prevent exacerbation of contamination. Page 4-55 of the EA indicates that only one PFAS PRL (PRL 1) overlaps with a proposed project (Project 16); we believe that more support for this determination is required given widespread detections of PFAS is multiple media within the Portland Air National Guard base.

Please confirm receipt of DEQ comments.

Daniel J. Hafley, RG
Project Manager/Hydrogeologist
Northwest Region Cleanup Section
Oregon DEQ
dan.hafley@deq.oregon.gov

Work Schedule: M, Tu, Th 8-4

From: Bernadette Nieto
To: NGB CC/A4A NEPA COMMENTS Org
Subject: [Non-DoD Source] Attn 142 WG EA
Date: Wednesday, March 20, 2024 8:31:28 AM
Attachments: Outlook-2qw4wmry.png

You don't often get email from bernadette.nieto@washoetribe.us. Learn why this is important

Good morning,

I am writing in response to your invitation for consultation regarding Proposed F 15EX Eagle II Operational Beddown, Portland Air National Guard, OR. The letter is dated January 17, 2024.

As the location of the proposed project is outside of the ancestral lands of the Washoe Tribe of Nevada and California, we will defer to our neighboring Native Nations, with cultural affiliation.

I apologize for the late response to your letter. Our THPO, Patrick Burtt, is working to catch up on his work and I am providing some assistance.

Respectfully submitted,

Thank you!

WASHOE TRIBE OF NEVADA & CALIFORNIA
BERNADETTE NIETO, TRIBAL ADMINISTRATOR
919 US HIGHWAY 395 NORTH, GARDNERVILLE, NV 89410
PHONE: 775-265-8600 EXT: 10002

Vision Statement of the Washoe Nation
Preserving, reviving and living the Washoe culture and traditions. Where:

> *Respect for one another and tribal values promote our spiritual, physical and environmental wellness.*
> *Educational opportunities are available for all tribal members and descendants.*
> *A solid economic foundation ensures self-sufficiency for tribal success.*
> *Responsive government promotes teamwork, professionalism, and accountability.*

On safe and secure tribal lands.

CONFIDENTIALITY NOTICE:

APPENDIX C
NOISE MODELING, METHODOLOGY, AND EFFECTS

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ACRONYMS AND ABBREVIATIONS

%	Percent
%HA	Percent Highly Annoyed
AFOSH	Air Force Occupational Safety and Health
AGL	Above Ground Level
ANG	Air National Guard
ANSI	American National Standards Institute
CDNL	C-Weighted Day-Night Average Sound Level
CFR	Code of Federal Regulations
CHABA	Committee on Hearing, Bioacoustics, and Biomechanics
CNEL	Community Noise Equivalent Level
CSEL	C-Weighted Sound Exposure Level
dB	Decibel
dB(A)	A-Weighted Decibels
dBA	A-Weighted Decibels
dBC	C-Weighted Decibel
DLR	German Aerospace Center (*Deutsches Zentrum für Luft und Raumfahrt e.V.*)
DNL	Day-Night Average Sound Level
DoD	Department of Defense
FAA	Federal Aviation Administration
FICAN	Federal Interagency Committee on Aviation Noise
FICON	Federal Interagency Committee on Noise
HA	Highly Annoyed
HYENA	Hypertension and Exposure to Noise near Airports
Hz	Hertz
ISO	International Organization for Standardization
L	Sound Level
L_{dn}	Day-Night Average Sound Level
L_{dnmr}	Onset-Rate Adjusted Monthly Day-Night Average Sound Level
L_{eq}	Equivalent Sound Level
$L_{eq(16)}$	Equivalent Sound Level over 16 hours
$L_{eq(24)}$	Equivalent Sound Level over 24 hours
$L_{eq(30min)}$	Equivalent Sound Level over 30 minutes
$L_{eq(8)}$	Equivalent Sound Level over 8 hours
$L_{eq(h)}$	Hourly Equivalent Sound Level
L_{max}	Maximum Sound Level
L_{pk}	Peak Sound Level
mmHg	millimeters of mercury
MTR	Military Training Route
NA	Number of Events At or Above a Selected Threshold
NAL	Number of Events Above combined with the Threshold Level
NATO	North Atlantic Treaty Organization
NDI	Noise Depreciation Index
NIOSH	National Institute for Occupational Safety and Health
NIPTS	Noise-induced Permanent Threshold Shift
OR	Odds Ratio
OSHA	Occupational Safety and Health Administration
POI	Point of Interest
psf	Pound per Square Foot
PTS	Permanent Threshold Shift
PTSD	Post-traumatic Stress Disorder
RANCH	Road Traffic and Aircraft Noise Exposure and Children's Cognition and Health

SEL	Sound Exposure Level
SIL	Speech Interference Level
SUA	Special Use Airspace
TA	Time Above
TAL	Time Above combined with the Threshold Level
TTS	Temporary Threshold Shift
U.S.	United States
UKDfES	United Kingdom Department for Education and Skills
USC	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WHO	World Health Organization

C NOISE MODELING, METHODOLOGY, AND EFFECTS

Section C.1 of this appendix discusses sound and noise and their potential effects on the human and natural environment. The largest section, Section C.2, reviews the potential effects of noise, focusing on effects on humans but also addressing effects on property values, terrain, structures, and animals. Section C.3 contains the list of references cited.

C.1 NOISE AND SONIC BOOM

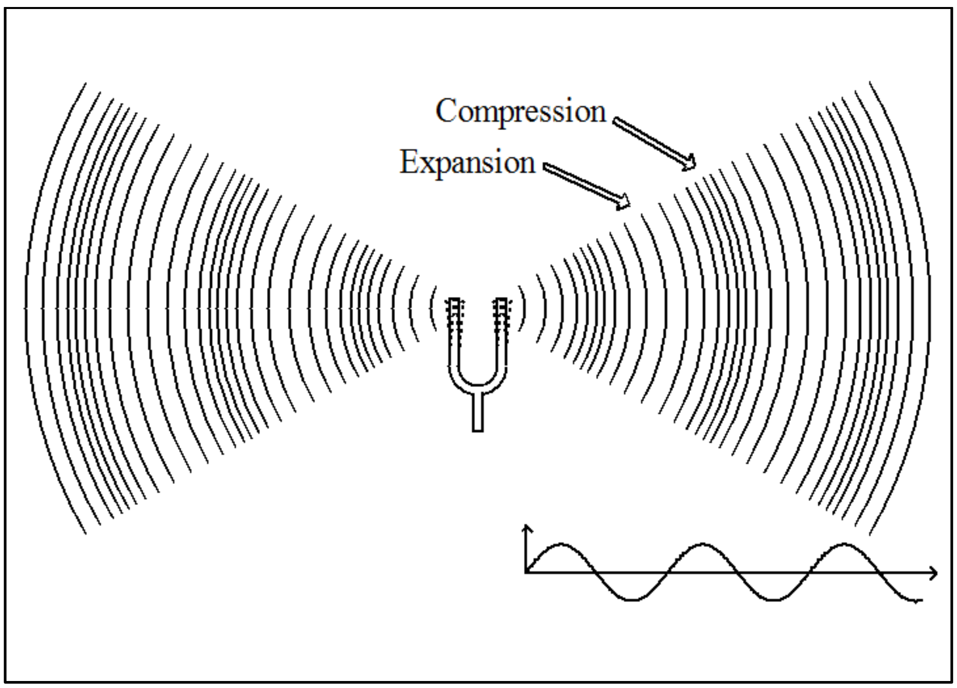
Section C.1.1 provides an overview of the basics of sound and noise. Section C.1.2 defines and describes the different metrics used to describe noise.

C.1.1 Basics of Sound

The following four subsections describe sound waves, sound levels and types of sounds, sonic boom and workplace noise.

C.1.1.1 Sound Waves and Decibels

Sound consists of minute vibrations in the air that travel through the air and are sensed by the human ear. Figure C-1 is a sketch of sound waves from a tuning fork. The waves move outward as a series of crests where the air is compressed and troughs where the air is expanded. The height of the crests and the depth of the troughs are the amplitude or sound pressure of the wave. The pressure determines its energy or intensity. The number of crests or troughs that pass a given point each second is called the frequency of the sound wave.



Source: Wyle Laboratories.

Figure C-1. Sound Waves from a Vibrating Tuning Fork

The measurement and human perception of sound involves three basic physical characteristics: intensity, frequency, and duration.

- *Intensity* is a measure of the acoustic energy of the sound and is related to sound pressure. The greater the sound pressure, the more energy carried by the sound and the louder the perception of that sound.
- *Frequency* determines how the pitch of the sound is perceived. Low frequency sounds are characterized as rumbles or roars, while high frequency sounds are typified by sirens or screeches.
- *Duration* or the length of time the sound can be detected.

As shown in Figure C-1, the sound from a tuning fork spreads out uniformly as it travels from the source. The spreading causes the sound's intensity to decrease with increasing distance from the source. For a source such as an aircraft in flight, the sound level will decrease by about 6 decibels (dB) for every doubling of the distance. For a busy highway, the sound level will decrease by 3 to 4.5 dB for every doubling of distance.

As sound travels from the source, it also gets absorbed by the air. The amount of absorption depends on the frequency composition of the sound, the temperature, and the humidity conditions. Sound with high frequency content gets absorbed by the air more than sound with low frequency content. More sound is absorbed in colder and drier conditions than in hot and wet conditions. Sound is also affected by wind and temperature gradients, terrain (elevation and ground cover), and structures.

The loudest sounds that can be comfortably heard by the human ear have intensities a trillion times higher than those of sounds barely heard. Because of this vast range, it is unwieldy to use a linear scale to represent the intensity of sound. As a result, a logarithmic unit known as the decibel (abbreviated dB) is used to represent the intensity of a sound. Such a representation is called a sound level. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above 120 dB begin to be felt inside the human ear as discomfort. Sound levels between 130 and 140 dB are felt as pain (Berglund and Lindvall 1995).

Because of the logarithmic nature of the decibel unit, sound levels cannot simply be added or subtracted and are somewhat cumbersome to handle mathematically. However, some simple rules are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. For example:

60 dB + 60 dB = 63 dB, and

80 dB + 80 dB = 83 dB.

Second, the total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

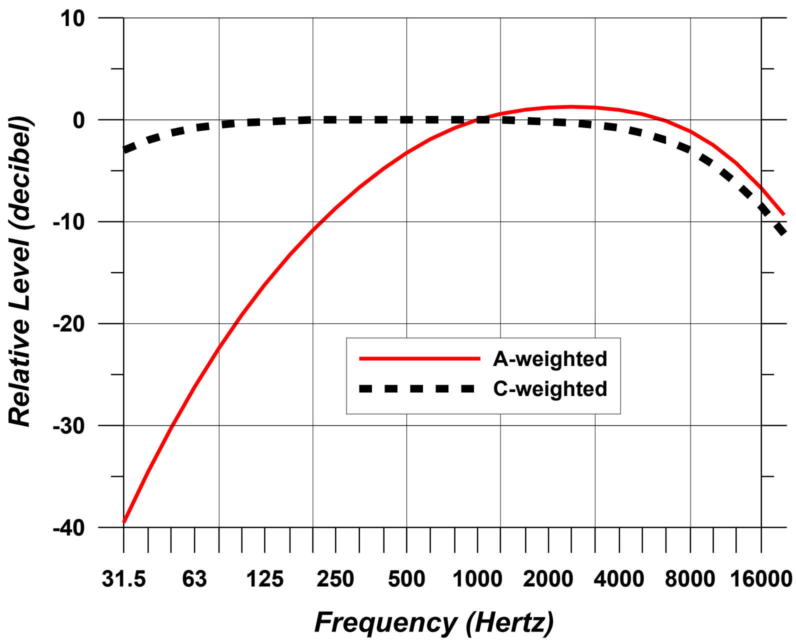
60.0 dB + 70.0 dB = 70.4 dB.

Because the addition of sound levels is different than that of ordinary numbers, this process is often referred to as "decibel addition."

The minimum change in the sound level of individual events that an average human ear can detect is about 3 dB. On average, a person perceives a change in sound level of about 10 dB as a doubling (or halving) of the sound's loudness. This relation holds true for loud and quiet sounds. A decrease in sound level of 10 dB actually represents a 90 percent (%) decrease in sound intensity but only a 50% decrease in perceived loudness because the human ear does not respond linearly.

Sound frequency is measured in terms of cycles per second or hertz (Hz). The normal ear of a young person can detect sounds that range in frequency from about 20 Hz to 20,000 Hz. As we get older, we lose the ability to hear high frequency sounds. Not all sounds in this wide range of frequencies are heard equally. Human hearing is most sensitive to frequencies in the 1,000 to 4,000 Hz range. The notes on a piano range from just over 27 Hz to 4,186 Hz, with middle C equal to 261.6 Hz. Most sounds (including a single note on a piano) are not simple pure tones like the tuning fork in Figure B-1, but contain a mix, or spectrum, of many frequencies.

Sounds with different spectra are perceived differently even if the sound levels are the same. Weighting curves have been developed to correspond to the sensitivity and perception of different types of sound. A-weighting and C-weighting are the two most common weightings. These two curves, shown in Figure C-2, are adequate to quantify most environmental noises. A-weighting puts emphasis on the 1,000 to 4,000 Hz range.



Source: ANSI S1.4A -1985 "Specification of Sound Level Meters."

Figure C-2. Frequency Characteristics of A- and C-Weighting

Very loud or impulsive sounds, such as explosions or sonic booms, can sometimes be felt, and can cause secondary effects, such as shaking of a structure or rattling of windows. These types of sounds can add to annoyance, and are best measured by C-weighted sound levels, denoted dBC. C-weighting is nearly flat throughout the audible frequency range, and includes low frequencies that may not be heard but cause shaking or rattling. C-weighting approximates the human ear's sensitivity to higher intensity sounds.

C.1.1.2 Sound Levels and Types of Sounds

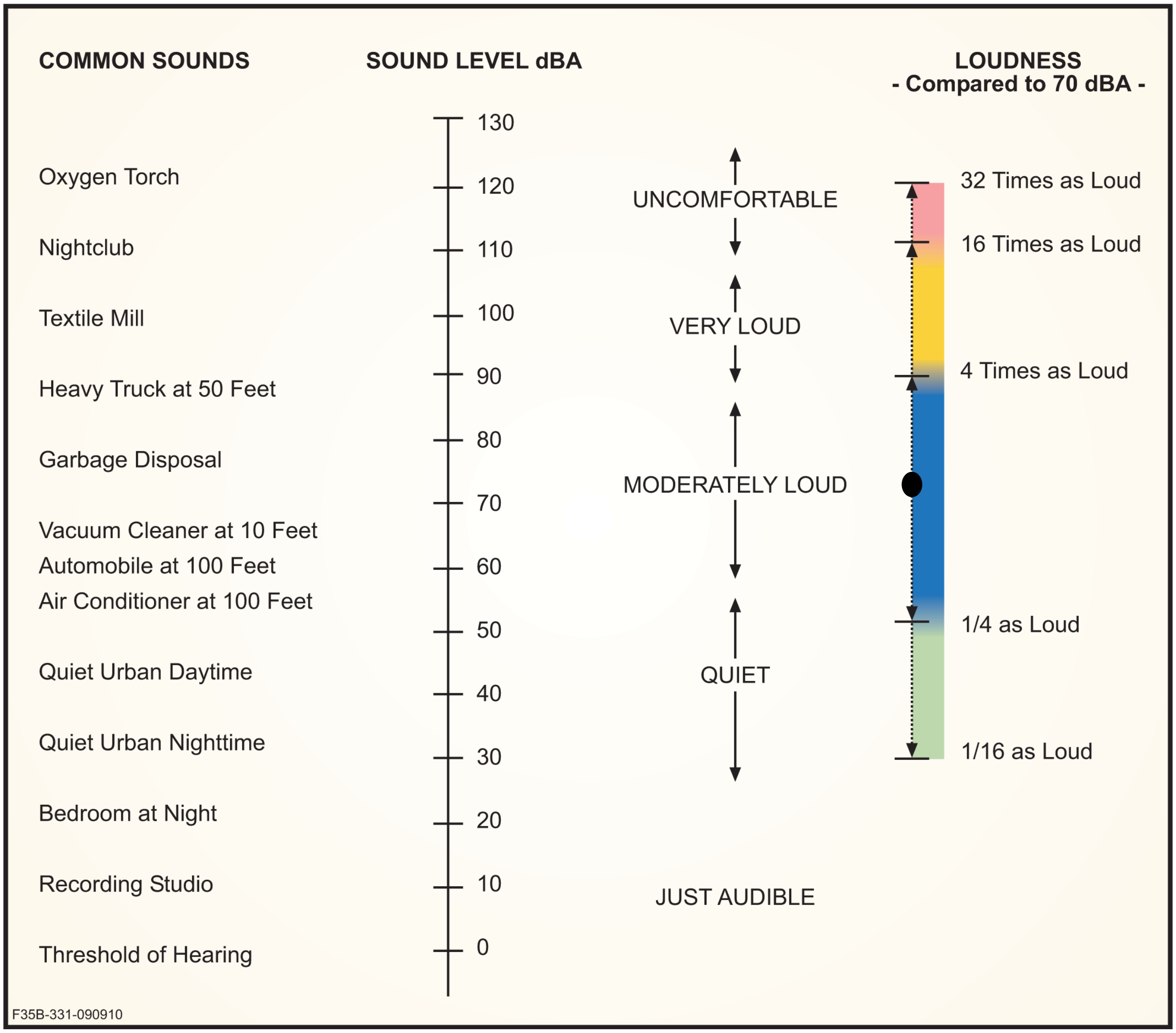
Most environmental sounds are measured using A-weighting. They are called A-weighted sound levels, and sometimes use the unit dBA or dB(A) rather than dB. When the use of A-weighting is understood, the term "A-weighted" is often omitted and the unit dB is used. Unless otherwise stated, dB units refer to A-weighted sound levels.

Sound becomes noise when it is unwelcome and interferes with normal activities, such as sleep or conversation. Noise is unwanted sound. Noise can become an issue when its level exceeds the ambient or background sound level. Ambient noise in urban areas typically varies from 60 to 70 dB, but can be as high as 80 dB in the center of a large city. Quiet suburban neighborhoods experience ambient noise levels around 45-50 dB (U.S. Environmental Protection Agency [USEPA] 1978).

Figure C-3 is a chart of A-weighted sound levels from common sources. Some sources, like the air conditioner and vacuum cleaner, are continuous sounds whose levels are constant for some time. Some sources, like the automobile and heavy truck, are the maximum sound during an intermittent event like a vehicle pass-by. Some sources like "urban daytime" and "urban nighttime" are averages over extended periods. A variety of noise metrics have been developed to describe noise over different time periods. These are discussed in detail in Section C.2.

Aircraft noise consists of two major types of sound events: flight (including takeoffs, landings, and flyovers), and stationary, such as engine maintenance run-ups. The former are intermittent and the latter primarily continuous. Noise from aircraft overflights typically occurs beneath main approach and departure paths, in local air traffic patterns around the airfield, and in areas near aircraft parking ramps and staging areas. As aircraft climb, the noise received on the ground drops to lower levels, eventually fading into the background or ambient levels.

Impulsive noises are generally short, loud events. Their single-event duration is usually less than 1 second. Examples of impulsive noises are small-arms gunfire, hammering, pile driving, metal impacts during rail-yard shunting operations, and riveting. Examples of high-energy impulsive sounds are quarry/mining explosions, sonic booms, demolition, and industrial processes that use high explosives, military ordnance (e.g., armor, artillery and mortar fire, and bombs), explosive ignition of rockets and missiles, and any other explosive source where the equivalent mass of dynamite exceeds 25 grams (American National Standards Institute [ANSI] 1996).



Sources: Harris 1979; Federal Interagency Committee on Aviation Noise (FICAN) 1997.

Figure C-3. Typical A-weighted Sound Levels of Common Sounds

C.1.1.3 Sonic Booms

When an aircraft moves through the air, it pushes the air out of its way. At subsonic speeds, the displaced air forms a pressure wave that disperses rapidly. At supersonic speeds, the aircraft is moving too quickly for the wave to disperse, so it remains as a coherent wave. This wave is a sonic boom. When heard at the ground, a sonic boom consists of two shock waves (one associated with the forward part of the aircraft, the other with the rear part) of approximately equal strength and (for fighter aircraft) separated by 100 to 200 milliseconds. When plotted, this pair of shock waves and the expanding flow between them has the appearance of a capital letter "N," so a sonic boom pressure wave is usually called an "N-wave." An N-wave has a characteristic "bang-bang" sound that can be startling. Figure C-4 shows the generation and evolution of a sonic boom N-wave under the aircraft. Figure C-5 shows the sonic boom pattern for an aircraft in steady supersonic flight. The boom forms a cone that is said to sweep out a "carpet" under the flight track.

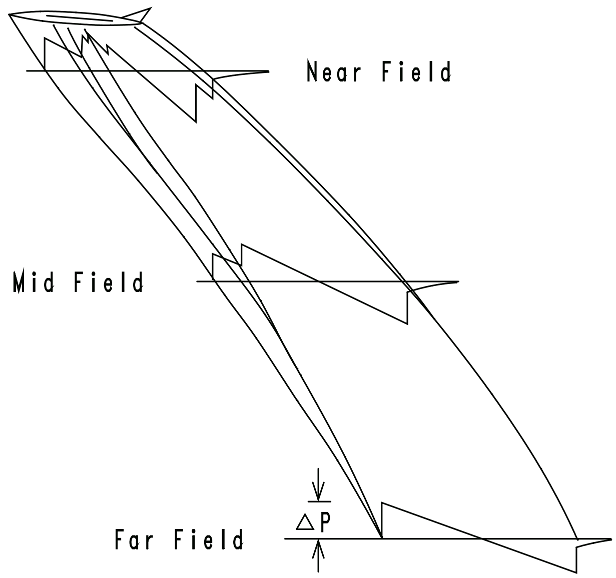


Figure C-4. Sonic Boom Generation and Evolution to N-Wave

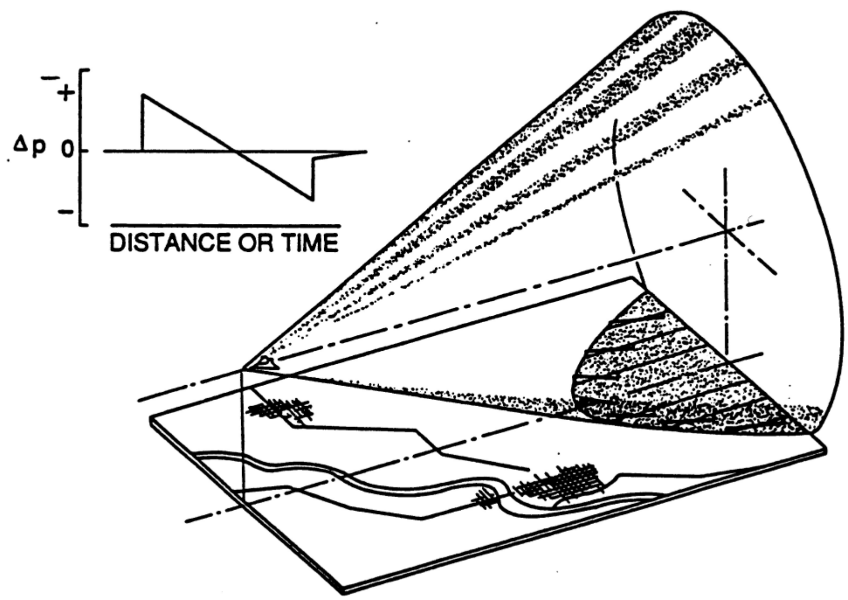


Figure C-5. Sonic Boom Carpet in Steady Flight

The complete ground pattern of a sonic boom depends on the size, shape, speed, and trajectory of the aircraft. Even for a nominally steady mission, the aircraft must accelerate to supersonic speed at the start, decelerate back to subsonic speed at the end, and usually change altitude. Figure C-6 illustrates the complexity of a nominal full mission.

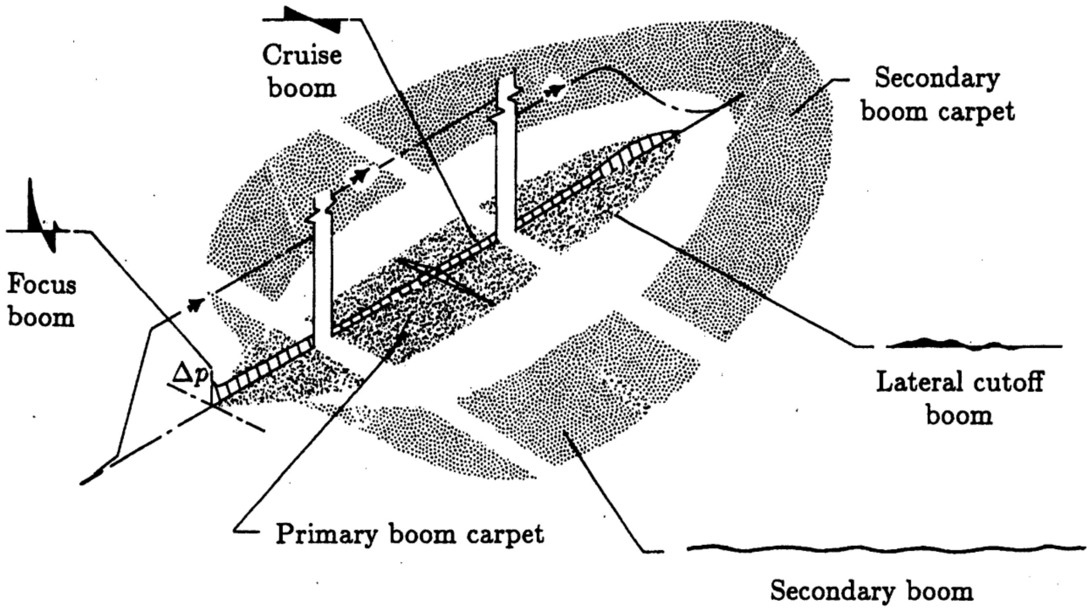


Figure C-6. Complex Sonic Boom Pattern for Full Mission

C.1.1.4 Workplace Noise

In 1972, the National Institute for Occupational Safety and Health (NIOSH) published a criteria document with a recommended exposure limit of 85 dB as an 8-hour time-weighted average. This exposure limit was reevaluated in 1998 when NIOSH made recommendations that went beyond conserving hearing by focusing on the prevention of occupational hearing loss (NIOSH 1998). Following the reevaluation using a new risk assessment technique, NIOSH published another criteria document in 1998 which reaffirmed the 85 dB recommended exposure limit (NIOSH 1998). Active-duty and reserve components of the United States (U.S.) Air Force (including the Air National Guard [ANG]), as well as civilian employees and contracted personnel working on Air Force bases and Air Guard stations must comply with Occupational Safety and Health Administration (OSHA) regulations (29 Code of Federal Regulations [CFR] § 1910.95 Occupational Noise Exposure), Department of Defense (DoD) Instruction 6055.12, Hearing Conservation Program; Air Force Occupational Safety and Health (AFOSH) Standard 48-20 (June 2006), and Occupational Noise and Hearing Conservation Program (including material derived from the International Organization for Standardization [ISO] 1999.2 Acoustics-Determination of Occupational Noise Exposure and Estimation of Noise Induced Impairment). Per AFOSH Standard 48-20, the Hearing Conservation Program is designed to protect workers from the harmful effects of hazardous noise by identifying all areas where workers are exposed to hazardous noise. The following are main components of the program:

1. Identify noise hazardous areas or sources and ensure these areas are clearly marked.

2. Use engineering controls as the primary means of eliminating personnel exposure to potentially hazardous noise. All practical design approaches to reduce noise levels to below hazardous levels by engineering principles shall be explored. Priorities for noise control resources shall be assigned based on the applicable risk assessment code. Where engineering controls are undertaken, the design objective shall be to reduce steady-state levels to below 85 dBA, regardless of personnel exposure time, and to reduce impulse noise levels to below 140 dB peak sound pressure level.
3. Ensure workers with an occupational exposure to hazardous noise complete an initial/reference audiogram within 30 days from the date of the workers' initial exposure to hazardous noise.
4. Ensure new equipment being considered for purchase has the lowest sound emission levels that are technologically and economically possible and compatible with performance and environmental requirements. 42 United States Code (USC) § 4914, *Public Health and Welfare, Noise Control, Development of Low-Noise Emission Products*, applies.
5. Education and training regarding potentially noise hazardous areas and sources, use and care of hearing protective devices, the effects of noise on hearing, and the Hearing Conservation Program.

C.1.2 Noise Metrics

Noise metrics quantify sounds so they can be compared with each other, and with their effects, in a standard way. The simplest metric is the A-weighted level, which is appropriate by itself for constant noise such as an air conditioner. Aircraft noise varies with time. During an aircraft overflight, noise starts at the background level, rises to a maximum level as the aircraft flies close to the observer, then returns to the background as the aircraft recedes into the distance. This is sketched in Figure C-7, which also indicates two metrics (Maximum Sound Level [L_{max}] and Sound Exposure Level [SEL]) that are described in Sections C.2.1 and C.2.3 below. Over time there can be a number of events, not all the same.

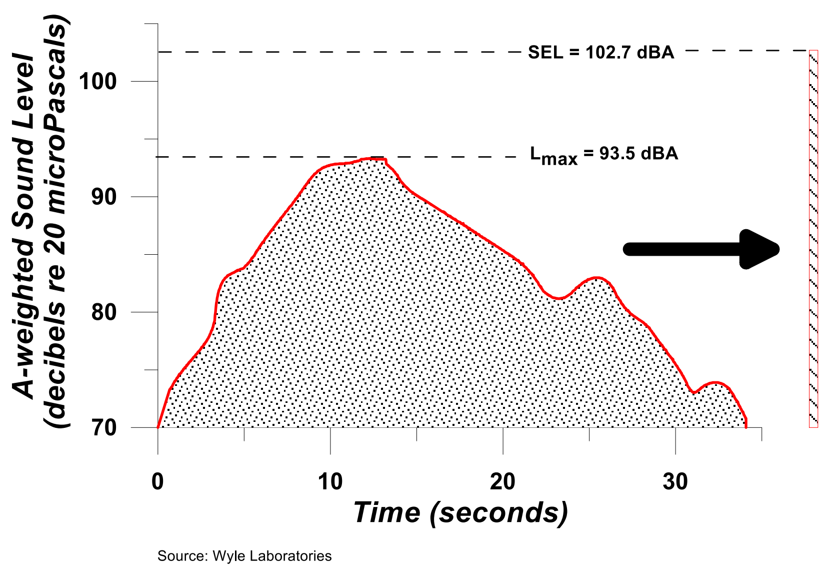


Figure C-7. Example Time History of Aircraft Noise Flyover

There are a number of metrics that can be used to describe a range of situations, from a particular individual event to the cumulative effect of all noise events over a long time. This section describes the metrics relevant to environmental noise analysis.

C.1.2.1 Single Events

Maximum Sound Level (L_{max})

The highest A-weighted sound level measured during a single event in which the sound changes with time is called the maximum A-weighted sound level or Maximum Sound Level and is abbreviated L_{max}. The L_{max} is depicted for a sample event in Figure C-7.

L_{max} is the maximum level that occurs over a fraction of a second. For aircraft noise, the "fraction of a second" is one-eighth of a second, denoted as "fast" response on a sound level measuring meter (ANSI 1988). Slowly varying or steady sounds are generally measured over 1 second, denoted "slow" response. L_{max} is important in judging if a noise event will interfere with conversation, TV or radio listening, or other common activities. Although it provides some measure of the event, it does not fully describe the noise, because it does not account for how long the sound is heard.

Table C-1 reflects L_{max} values for typical military aircraft operating within military airspace associated with this assessment shown with typical flight conditions associated with departure and arrival operations for comparison purposes. On takeoff when reaching 1,000 feet AGL, the F-15C generates an L_{max} of 104 dB and during arrival an L_{max} of 97 dB at the same altitude.

Table C-1. Representative Instantaneous Maximum Sound Levels (L_{max})[1]

Aircraft (engine type)	*Power Setting*	*Power Unit[2]*	*L_{max} (in dBA) At Varying Altitudes (500 feet)*	*L_{max} (in dBA) At Varying Altitudes (1,000 feet)*	*L_{max} (in dBA) At Varying Altitudes (2,000 feet)*	*L_{max} (in dBA) At Varying Altitudes (5,000 feet)*	*L_{max} (in dBA) At Varying Altitudes (10,000 feet)*
Takeoff/Departure Operations							
F-15C (PW220)	90%	NC	111	104	97	85	75
F-16 (PW229)	93%	NC	114	106	98	86	76
F-22	100%	ETR	120	112	105	93	83
F-35A[4]	100%	ETR	119	111	103	91	81
Landing/Arrival Operations[5]							
F-15C (PW220)	75%	NC	104	97	89	77	66
F-16 (PW229)	83.5%	NC	93	86	78	66	56
F-22	43%	ETR	111	104	96	84	73
F-35A[4]	40%	ETR	100	93	85	73	62

Source: NOISEMAP OPX file using standard weather conditions of 59 degrees Fahrenheit and 70% relative humidity.
F-15EX data not available at this time.
1. Power settings indicated may not be comparable across aircraft, that all numbers are rounded, and power settings are typical but not constant for departure/arrival operations.
2. RPM—Revolutions Per Minute; ETR—Engine Thrust Request; NC—Engine Core RPM; and NF—Engine Fan RPM.
3. B-1 Takeoff/Departure modeled with Afterburner; all other departure aircraft modeled without afterburner (if available).
4. Based on 2013 Edwards measurements.
5. All Landing/Arrival aircraft modeled with "parallel-interpolation" power setting for gear down configuration (except if noted).

Sound Exposure Level (SEL)

SEL combines both the intensity of a sound and its duration. For an aircraft flyover, SEL includes the maximum and all lower noise levels produced as part of the overflight, together with how long each part lasts. It represents the total sound energy in the event. Figure C-7 indicates the SEL for an example event, representing it as if all the sound energy were contained within 1 second. Because aircraft noise events last more than a few seconds, the SEL value is larger than L_{max}. It does not directly represent the sound level heard at any given time, but rather the entire event. SEL provides a much better measure of aircraft flyover noise exposure than L_{max} alone.

Table C-2 shows SEL values corresponding to the aircraft and power settings reflected in Table C-1. At 1,000 feet above ground level (AGL), the F-15C generates an SEL of 115 dB on takeoff and an SEL of 94 dB on arrival.

Table C-2. Representative Sound Exposure Levels (SEL)[1]

Aircraft (engine type)	*Power Setting*	*Power Unit[2]*	*SEL (in dBA) At Varying Altitudes (500 feet)*	*SEL (in dBA) At Varying Altitudes (1,000 feet)*	*SEL (in dBA) At Varying Altitudes (2,000 feet)*	*SEL (in dBA) At Varying Altitudes (5,000 feet)*	*SEL (in dBA) At Varying Altitudes (10,000 feet)*
Takeoff/Departure Operations[3]							
F-15C (PW220)	90%	NC	120	115	109	100	91
F-16 (PW229)	93%	NC	119	114	107	98	89
F-22	100%	ETR	127	121	115	106	98
F-35A	100%	ETR	125	119	113	103	95
Landing/Arrival Operation[5]							
F-15C (PW220)	75%	NC	99	94	88	79	71
F-16 (PW229)	83.5%	NC	97	92	86	77	68
F-22	43%	ETR	115	109	103	94	85
F-35A[6]	40%	ETR	107	102	95	86	76

Source: NOISEMAP OPX file using standard weather conditions of 59 degrees Fahrenheit and 70% relative humidity. F-15EX data not available at this time.

1. Power settings indicated may not be comparable across aircraft, that all numbers are rounded, and power settings are typical but not constant for departure/arrival operations.
2. ETR—Engine Thrust Request; NC—Engine Core RPM; and NF—Engine Fan RPM.
3. Takeoff/Departure modeled at 160 knots airspeed for SEL purposes.
4. Departure aircraft modeled without afterburner (if available).
5. All Landing/Arrival aircraft modeled at 160 knots airspeed for SEL purposes.
6. Based on 2013 Edwards measurements.

C-weighted SEL can be computed for impulsive sounds, and the results denoted CSEL or LCE. SEL for A-weighted sound is sometimes denoted ASEL. Within this study, SEL is used for A-weighted sounds and CSEL for C-weighted.

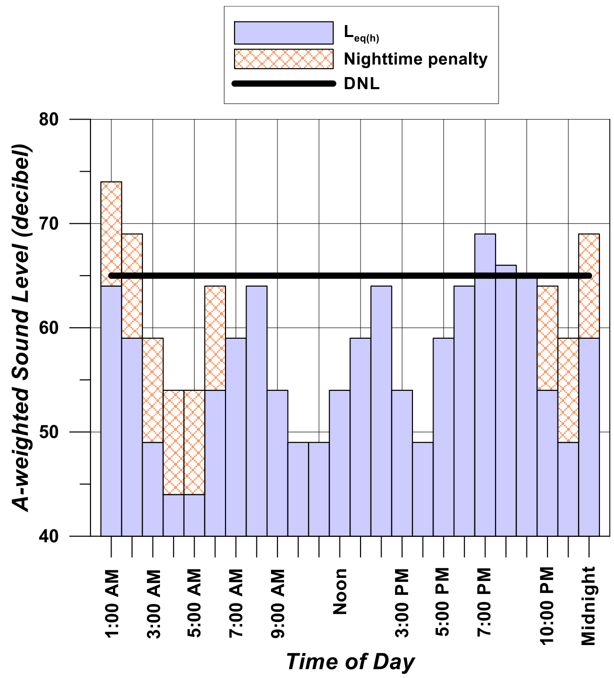
C.1.2.2 Cumulative Events

Equivalent Sound Level (L_{eq})

L_{eq} is a "cumulative" metric that combines a series of noise events over a period of time. L_{eq} is the sound level that represents the decibel average SEL of all sounds in the time period. Just as SEL has proven to be a good measure of a single event, L_{eq} has proven to be a good measure of series of events during a given time period.

The time period of an L_{eq} measurement is usually related to some activity, and is given along with the value. The time period is often shown in parenthesis (e.g., $L_{eq(24)}$ for 24 hours). The $L_{eq(8hr)}$ from 7 a.m. to 3 p.m. provides the noise exposure of a school day for this analysis.

Figure C-8 gives an example of $L_{eq(24)}$ using notional hourly average noise levels ($L_{eq(h)}$) for each hour of the day as an example. The $L_{eq(24)}$ for this example is 61 dB.



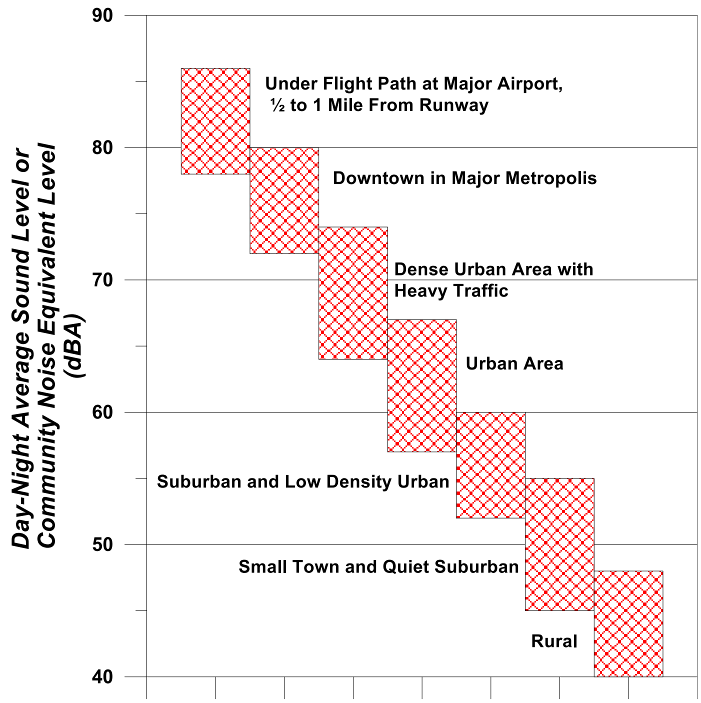
Source: Wyle Laboratories.

Figure C-8. Example of L_{eq}(24), DNL Computed from Hourly Equivalent Sound Levels

Day-Night Average Sound Level (DNL or L_{dn})

DNL is a cumulative metric that accounts for all noise events in a 24-hour period. However, unlike $L_{eq(24)}$, DNL contains a nighttime noise penalty. To account for our increased sensitivity to noise at night, DNL applies a 10 dB penalty to events during the nighttime period, defined as 10:00 p.m. to 7:00 a.m. The notations DNL and L_{dn} are both used for Day-Night Average Sound Level and are equivalent.

For airports and military airfields outside of California, DNL represents the average sound level for annual average daily aircraft events. Figure C-8 gives an example of DNL using notional hourly average noise levels ($L_{eq(h)}$) for each hour of the day as an example. Note the $L_{eq(h)}$ for the hours between 10 p.m. and 7 a.m. have a 10 dB penalty assigned. The DNL for this example is 65 dB. Figure C-9 shows the ranges of DNL that occur in various types of communities. Under a flight path at a major airport the DNL may exceed 80 dB, while rural areas may experience DNL less than 45 dB.



Source: DOD 1978.

Figure C-9. Typical DNL Ranges in Various Types of Communities

The decibel summation nature of these metrics causes the noise levels of the loudest events to dominate the 24-hour average. As a simple example, consider a case in which only one aircraft overflight occurs during the daytime over a 24-hour period, creating a sound level of 100 dB for 30 seconds. During the remaining 23 hours, 59 minutes, and 30 seconds of the day, the ambient sound level is 50 dB. The DNL for this 24-hour period is 65.9 dB. Assume, as a second example that 10 such 30-second overflights occur during daytime hours during the next 24-hour period, with the same ambient sound level of 50 dB during the remaining 23 hours and 55 minutes of the day. The DNL for this 24-hour period is 75.5 dB. Clearly, the averaging of noise over a 24-hour period does not ignore the louder single events and tends to emphasize both the sound levels and number of those events.

A feature of the DNL metric is that a given DNL value could result from a very few noisy events or a large number of quieter events. For example, 1 overflight at 90 dB creates the same DNL as 10 overflights at 80 dB.

DNL does not represent a level heard at any given time, but represent long-term exposure. Scientific studies have found good correlation between the percentages of groups of people highly annoyed and the level of average noise exposure measured in DNL (Schultz 1978; USEPA 1978).

Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr})

Military aircraft utilizing Special Use Airspace (SUA) such as Military Training Routes (MTRs), Military Operations Areas, and Restricted Areas/Ranges generate a noise environment that is somewhat different from that around airfields. Rather than regularly occurring operations like at airfields, activity in SUAs is highly sporadic. It is often seasonal, ranging from 10 per hour to less than 1 per week. Individual military overflight events also differ from typical community noise events in that noise from a low-altitude, high-airspeed flyover can have a rather sudden onset, with rates of up to 150 dB per second.

The cumulative daily noise metric devised to account for the "surprise" effect of the sudden onset of aircraft noise events on humans and the sporadic nature of SUA activity is the Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}). Onset rates between 15 and 150 dB per second require an adjustment of 0 to 11 dB to the event's SEL, while onset rates below 15 dB per second require no adjustment to the event's SEL (Stusnick et al. 1992). The term 'monthly' in L_{dnmr} refers to the noise assessment being conducted for the month with the most operations or sorties—the so-called busiest month.

C.1.2.3 Supplemental Metrics

Number of Events Above (NA) a Threshold Level (L)

The Number of Events Above (NA) metric gives the total number of events that exceed a noise level threshold (L) during a specified period of time. Combined with the selected threshold, the metric is denoted NAL. The threshold can be either SEL or L_{max}, and it is important that this selection is shown in the nomenclature. When labeling a contour line or point of interest (POI), NAL is followed by the number of events in parentheses. For example, where 10 events exceed an SEL of 90 dB over a given period of time, the nomenclature would be NA90SEL(10). Similarly, for L_{max} it would be NA90L_{max}(10). The period of time can be an average 24-hour day, daytime, nighttime, school day, or any other time period appropriate to the nature and application of the analysis.

NA is a supplemental metric. Although NA is relatively new when compared to the longer history of DNL research, it does provide valuable information to help to describe noise to the community in an easy-to-understand manner. A threshold level and metric are selected that best meet the need for each situation. An L_{max} threshold is normally selected to analyze speech interference, while an SEL threshold is normally selected for analysis of sleep disturbance. Consistent with DNWG guidance an interior threshold of 50 dB L_{max} (interior NA50 dB) provides the threshold used in this analysis for speech interference events in classrooms and residences. Because the noise modeling software does not calculate interior L_{max} directly, the analysis instead computes the equivalent exterior NA65 and NA75 dB that coincide windows open condition (typically 15 dB sound attenuation) and windows open condition (typically 25 dB sound attenuation) to determine the aircraft flight operations estimated to exceed the NA50 interior threshold of interest (DNWG 2013).

The NA metric is the only supplemental metric that combines single-event noise levels with the number of aircraft operations. In essence, it answers the question of how many aircraft (or range of aircraft) fly over a given location or area at or above a selected threshold noise level.

Time Above (TA) a Specified Level (L)

The Time Above (TA) metric is the total time, in minutes, that the A-weighted noise level is at or above a threshold. Combined with the threshold level (L), it is denoted TAL. TA can be calculated over a full 24-hour annual average day, the 15-hour daytime and 9-hour nighttime periods, a school day, or any other time period of interest, provided there is operational data for that time. TA is a supplemental metric, used to help understand noise exposure. TA can be shown as contours on a map similar to the way DNL contours are drawn. TA helps describe the noise exposure of an individual event or many events occurring over a given time period. When computed for a full day, the TA can be compared alongside the DNL in order to determine the sound levels and total duration of events that contribute to the DNL. TA analysis is usually conducted along with NA analysis so the results show not only how many events occur, but also the total duration of those events above the threshold. It is useful for describing the noise environment in schools, particularly when assessing classroom or other noise sensitive areas for various scenarios.

This analysis computes interior TA50 dB inside of classrooms to represent the duration of time during a typical school that interior noise levels would exceed 50 dB, the threshold at which speech interfering events occurs. Consistent with the NA methodology, the software computes the exterior TA65 that is converted to interior TA50 assuming a 15 dB reduction for a classroom with windows open (DNWG 2013).

C.2 NOISE AND SONIC BOOM EFFECTS

Noise is of concern because of potential adverse effects. The following subsections describe how noise can affect communities and the environment, and how those effects are quantified. The specific topics discussed are:

- Annoyance,
- Land Use Compatibility,
- Speech interference,
- Sleep disturbance,
- Noise-induced hearing impairment,
- Non-auditory health effects,
- Performance effects,
- Noise effects on children,
- Property values,
- Noise-induced vibration effects on structures and humans,
- Noise effects on terrain,
- Noise effects on historical and archaeological sites,
- Effects on domestic animals and wildlife, and
- Sonic Boom.

C.2.1 Annoyance

With the introduction of jet aircraft in the 1950s, it became clear that aircraft noise annoyed people and was a significant problem around airports. Early studies, such as those of Rosenblith et al. (1953) and Stevens et al. (1953) showed that effects depended on the quality of the sound, its level, and the number of flights. Over the next 20 years considerable research was performed refining this understanding and setting guidelines for noise exposure. In the early 1970s, the USEPA published its “Levels Document” (USEPA 1974) that reviewed the factors that affected communities. DNL (still known as L_{dn} at the time) was identified as an appropriate noise metric, and threshold criteria were recommended.

Threshold criteria for annoyance were identified from social surveys, where people exposed to noise were asked how noise affects them. Surveys provide direct real-world data on how noise affects actual residents.

Surveys in the early years had a range of designs and formats, and needed some interpretation to find common ground. In 1978, Schultz showed that the common ground was the number of people "highly annoyed," defined as the upper 28% range of whatever response scale a survey used (Schultz 1978). With that definition, he was able to show a remarkable consistency among the majority of the surveys for which data were available. Figure C-10 shows the result of his study relating DNL to individual annoyance measured by percent highly annoyed (%HA).

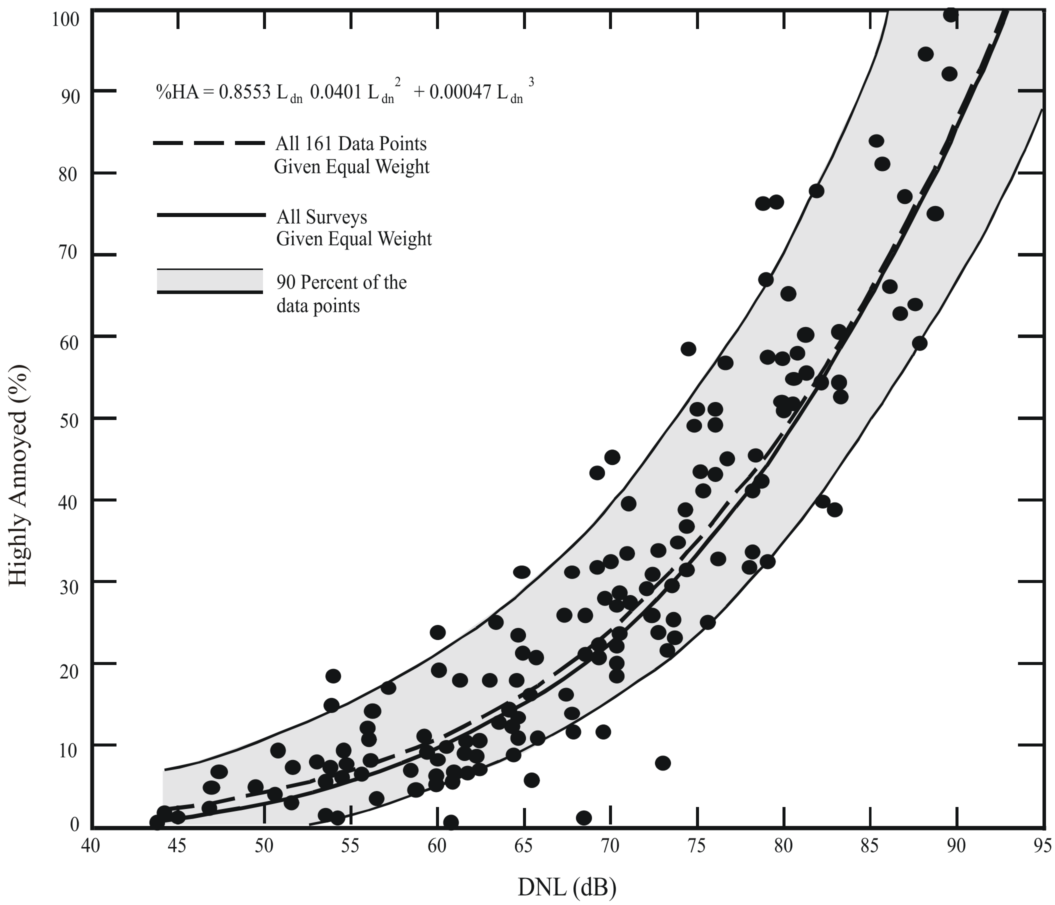


Figure C-10. Schultz Curve Relating Noise Annoyance to DNL (Schultz 1978)

Schultz's original synthesis included 161 data points. Figure C-11 compares revised fits of the Schultz data set with an expanded set of 400 data points collected through 1989 (Finegold et al. 1994). The new form is the preferred form in the U.S., endorsed by the Federal Interagency Committee on Aviation Noise (FICAN) (1997). Other forms have been proposed, such as that of Fidell and Silvati (2004), but have not gained widespread acceptance.

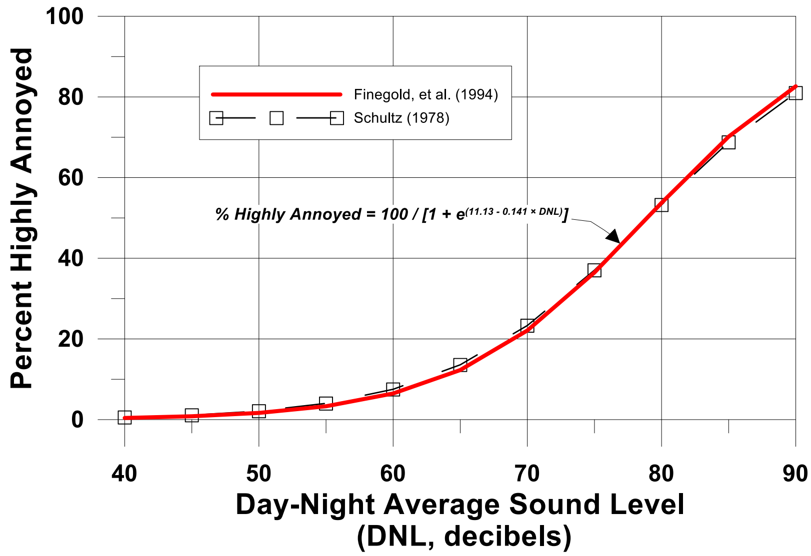


Figure C-11. Response of Communities to Noise; Comparison of Original Schultz (1978) with Finegold et al. (1994)

When the goodness of fit of the Schultz curve is examined, the correlation between groups of people is high, in the range of 85-90%. The correlation between individuals is lower, 50% or less. This is not surprising, given the personal differences between individuals. The surveys underlying the Schultz curve include results that show that annoyance to noise is also affected by non-acoustical factors. Newman and Beattie (1985) divided the non-acoustic factors into the emotional and physical variables shown in Table C-3.

Table C-3. Non-Acoustic Variables Influencing Aircraft Noise Annoyance

Emotional Variables	*Physical Variables*
Feeling about the necessity or preventability of the noise;	Type of neighborhood;
Judgement of the importance and value of the activity that is producing the noise;	Time of day;
Activity at the time an individual hears the noise;	Season;
Attitude about the environment;	Predictability of the noise;
General sensitivity to noise;	Control over the noise source; and
Belief about the effect of noise on health; and	Length of time individual is exposed to a noise.
Feeling of fear associated with the noise.	

Schreckenberg and Schuemer (2010) recently examined the importance of some of these factors on short-term annoyance. Attitudinal factors were identified as having an effect on annoyance. In formal regression analysis, however, sound level (L_{eq}) was found to be more important than attitude.

A recent study by Plotkin et al. (2011) examined updating DNL to account for these factors. It was concluded that the data requirements for a general analysis were much greater than most existing studies. It was noted that the most significant issue with DNL is that it is not readily understood by the public, and that supplemental metrics such as TA and NA were valuable in addressing attitude when communicating noise analysis to communities (DoD 2009a).

A factor that is partially non-acoustical is the source of the noise. Miedema and Vos (1998) presented synthesis curves for the relationship between DNL and percentage "Annoyed" and percentage "Highly

Annoyed" for three transportation noise sources. Different curves were found for aircraft, road traffic, and railway noise. Table C-4 summarizes their results. Comparing the updated Schultz curve suggests that the percentage of people highly annoyed by aircraft noise may be higher than previously thought.

Table C-4. Percent Highly Annoyed for Different Transportation Noise Sources

DNL (dB)	*Percent Highly Annoyed (%HA) Miedema and Vos Air*	*Percent Highly Annoyed (%HA) Miedema and Vos Road*	*Percent Highly Annoyed (%HA) Miedema and Vos Rail*	*Percent Highly Annoyed (%HA) Schultz Combined*
55	12	7	4	3
60	19	12	7	6
65	28	18	11	12
70	37	29	16	22
75	48	40	22	36

Source: Miedema and Vos 1998.

As noted by the World Health Organization (WHO), however, even though aircraft noise seems to produce a stronger annoyance response than road traffic, caution should be exercised when interpreting synthesized data from different studies (WHO 1999).

Consistent with WHO's recommendations, the Federal Interagency Committee on Noise (FICON) (1992) considered the Schultz curve to be the best source of dose information to predict community response to noise, but recommended further research to investigate the differences in perception of noise from different sources.

Sonic boom exposure is assessed cumulatively with C-weighted DNL, denoted CDNL. Correlation between CDNL and annoyance has been established, based on community reaction to impulsive sounds (Committee on Hearing, Bioacoustics and Biomechanics [CHABA] 1981). Values of the C-weighted equivalent to the Schultz curve are different than that of the Schultz curve itself. Table C-5 shows the relation between annoyance, DNL, and CDNL.

Table C-5. Relation Between Annoyance, DNL and CDNL

DNL	*% Highly Annoyed*	*CDNL*
45	0.83	42
50	1.66	46
55	3.31	51
60	6.48	56
65	12.29	60
70	22.10	65

Interpretation of CDNL from impulsive noise is accomplished by using the CDNL versus annoyance values in Table C-3. CDNL can be interpreted in terms of an "equivalent annoyance" DNL. For example, CDNL of 52, 61, and 69 dB are equivalent to DNL of 55, 65, and 75 dB, respectively. If both continuous and impulsive noise occurs in the same area, impacts are assessed separately for each.

C.2.2 Land Use Compatibility

As noted above, the inherent variability between individuals makes it impossible to predict accurately how any individual will react to a given noise event. Nevertheless, when a community is considered as a whole, its overall reaction to noise can be represented with a high degree of confidence. As described above, the best noise exposure metric for this correlation is the DNL or L_{dnmr} for military overflights.

Impulsive noise can be assessed by relating CDNL to an "equivalent annoyance" DNL, as outlined in Section C.2.1.

In June 1980, an ad hoc Federal Interagency Committee on Urban Noise published guidelines (Federal Interagency Committee on Urban Noise 1980) relating DNL to compatible land uses. This committee was composed of representatives from DoD, Transportation, Housing and Urban Development, USEPA, and the Veterans Administration. Since the issuance of these guidelines, federal agencies have generally adopted these guidelines for their noise analyses.

Following the lead of the committee, the DoD adopted the concept of land use compatibility as the accepted measure of aircraft noise effect. Air Force guidelines are presented in Table C-6, along with the explanatory notes included in the regulation. These guidelines are not mandatory (note the footnote "*" in the table), rather they are recommendations to provide the best means for determining noise impact for communities adjacent to bases. Again, these are recommendations only; it is up to the city/county zoning and planning entities to determine what land uses are compatible and how they will deal with incompatibilities (e.g., what type of development is allowed, instituting residential buyouts, or whether noise attenuation efforts will be done in residential units). In general, residential land uses normally are not compatible with outdoor DNL values above 65 dB, and the extent of land areas and populations exposed to DNL of 65 dB and higher provides the best means for assessing the noise impacts of alternative aircraft actions. In some cases, a change in noise level, rather than an absolute threshold, may be a more appropriate measure of impact.

Table C-6. Air Force Land Use Compatibility Recommendations

Land Uses SLUCM NO.	*Land Uses Category*	*Suggested Land Use Compatibility DNL 65-69*	*Suggested Land Use Compatibility DNL 70-74*	*Suggested Land Use Compatibility DNL 75-79*	*Suggested Land Use Compatibility DNL 80-84*	*Suggested Land Use Compatibility DNL >85*
10	**Residential**					
11	Household units	N[1]	N[1]	N	N	N
11.11	Single units: detached	N[1]	N[1]	N	N	N
11.12	Single units: semidetached	N[1]	N[1]	N	N	N
11.13	Single units: attached row	N[1]	N[1]	N	N	N
11.21	Two units: side-by-side	N[1]	N[1]	N	N	N
11.22	Two units: one above the other	N[1]	N[1]	N	N	N
11.31	Apartments: walk-up	N[1]	N[1]	N	N	N
11.32	Apartment: elevator	N[1]	N[1]	N	N	N
12	Group quarters	N[1]	N[1]	N	N	N
13	Residential hotels	N[1]	N[1]	N	N	N
14	Mobile home parks or courts	N	N	N	N	N
15	Transient lodgings	N[1]	N[1]	N[1]	N	N
16	Other residential	N[1]	N[1]	N	N	N
20	**Manufacturing**					
21	Food and kindred products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
22	Textile mill products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
23	Apparel and other finished products; products made from fabrics, leather, and similar materials; manufacturing	Y	Y[2]	Y[3]	Y[4]	N

Land Uses SLUCM NO.	*Land Uses Category*	*Suggested Land Use Compatibility DNL 65-69*	*Suggested Land Use Compatibility DNL 70-74*	*Suggested Land Use Compatibility DNL 75-79*	*Suggested Land Use Compatibility DNL 80-84*	*Suggested Land Use Compatibility DNL >85*
24	Lumber and wood products (except furniture); manufacturing	Y	Y[2]	Y[3]	Y[4]	N
25	Furniture and fixtures; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
26	Paper and allied products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
27	Printing, publishing, and allied industries	Y	Y[2]	Y[3]	Y[4]	N
28	Chemicals and allied products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
29	Petroleum refining and related industries	Y	Y[2]	Y[3]	Y[4]	N
30	**Manufacturing**					
31	Rubber and misc. plastic products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
32	Stone, clay and glass products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
33	Primary metal products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
34	Fabricated metal products; manufacturing	Y	Y[2]	Y[3]	Y[4]	N
35	Professional scientific, and controlling instruments; photographic and optical goods; watches and clocks	Y	25	30	N	N
39	Miscellaneous manufacturing	Y	Y[2]	Y[3]	Y[4]	N
40	**Transportation, Communication and Utilities**					
41	Railroad, rapid rail transit, and street railway transportation	Y	Y[2]	Y[3]	Y[4]	N
42	Motor vehicle transportation	Y	Y[2]	Y[3]	Y[4]	N
43	Aircraft transportation	Y	Y[2]	Y[3]	Y[4]	N
44	Marine craft transportation	Y	Y[2]	Y[3]	Y[4]	N
45	Highway and street right-of-way	Y	Y	Y	Y	N
46	Automobile parking	Y	Y	Y	Y	N
47	Communication	Y	25[5]	30[5]	N	N
48	Utilities	Y	Y[2]	Y[3]	Y[4]	N
49	Other transportation, communication and utilities	Y	25[5]	30[5]	N	N
50	**Trade**					
51	Wholesale trade	Y	Y[2]	Y[3]	Y[4]	N
52	Retail trade – building materials, hardware and farm equipment	Y	25	30	Y[4]	N
53	Retail trade – including shopping centers, discount clubs, home improvement stores, electronics superstores, etc.	Y	25	30	N	N
54	Retail trade – food	Y	25	30	N	N
55	Retail trade – automotive, marine craft, aircraft and accessories	Y	25	30	N	N

Land Uses SLUCM NO.	*Land Uses Category*	*Suggested Land Use Compatibility DNL 65-69*	*Suggested Land Use Compatibility DNL 70-74*	*Suggested Land Use Compatibility DNL 75-79*	*Suggested Land Use Compatibility DNL 80-84*	*Suggested Land Use Compatibility DNL >85*
56	Retail trade – apparel and accessories	Y	25	30	N	N
57	Retail trade – furniture, home, furnishings and equipment	Y	25	30	N	N
58	Retail trade – eating and drinking establishments	Y	25	30	N	N
59	Other retail trade	Y	25	30	N	N
60	**Services**					
61	Finance, insurance and real estate services	Y	25	30	N	N
62	Personal services	Y	25	30	N	N
62.4	Cemeteries	Y	Y[2]	Y[3]	Y[4,11]	Y[6,11]
63	Business services	Y	25	30	N	N
63.7	Warehousing and storage	Y	Y[2]	Y[3]	Y[4]	N
64	Repair services	Y	Y[2]	Y[3]	Y[4]	N
65	Professional services	Y	25	30	N	N
65.1	Hospitals, other medical facilities	25	30	N	N	N
65.16	Nursing homes	N[1]	N[1]	N	N	N
66	Contract construction services	Y	25	30	N	N
67	Government services	Y[1]	25	30	N	N
68	Educational services	25	30	N	N	N
68.1	Child care services, child development centers, and nurseries	25	30	N	N	N
69	Miscellaneous Services	Y	25	30	N	N
69.1	Religious activities (including places of worship)	Y	25	30	N	N
70	**Cultural, Entertainment and Recreational**					
71	Cultural activities	25	30	N	N	N
71.2	Nature exhibits	Y[1]	N	N	N	N
72	Public assembly	Y	N	N	N	N
72.1	Auditoriums, concert halls	25	30	N	N	N
72.11	Outdoor music shells, amphitheaters	N	N	N	N	N
72.2	Outdoor sports arenas, spectator sports	Y[7]	Y[7]	N	N	N
73	Amusements	Y	Y	N	N	N
74	Recreational activities (including golf courses, riding stables, water recreation)	Y	25	30	N	N
75	Resorts and group camps	Y	25	N	N	N
76	Parks	Y	25	N	N	N
79	Other cultural, entertainment and recreation	Y	25	N	N	N
80	**Resource Production and Extraction**					
81	Agriculture (except live- stock)	Y[8]	Y[9]	Y[10]	Y[10,11]	Y[10,11]
81.5-81.7	Agriculture-Livestock farming including grazing and feedlots	Y[8]	Y[9]	N	N	N
82	Agriculture related activities	Y[8]	Y[9]	Y[10]	Y[10,11]	Y[10,11]
83	Forestry activities	Y[8]	Y[9]	Y[10]	Y[10,11]	Y[10,11]
84	Fishing activities	Y	Y	Y	Y	Y

Table B-6. Air Force Land Use Compatibility Recommendations

Land Uses SLUCM NO.	*Land Uses Category*	*Suggested Land Use Compatibility DNL 65-69*	*Suggested Land Use Compatibility DNL 70-74*	*Suggested Land Use Compatibility DNL 75-79*	*Suggested Land Use Compatibility DNL 80-84*	*Suggested Land Use Compatibility DNL >85*
85	Mining activities	Y	Y	Y	Y	Y
89	Other resource production or extraction	Y	Y	Y	Y	Y

Legend:

SLUCM – Standard Land Use Coding Manual, U.S. Department of Transportation
Y (Yes) – Land use and related structures compatible without restrictions.
N (No) – Land use and related structures are not compatible and should be prohibited.
Y^x – Yes with restrictions. The land use and related structures generally are compatible. However, see note(s) indicated by the superscript.
N^x – No with exceptions. The land use and related structures are generally incompatible. However, see note(s) indicated by the superscript.
25, 30, or 35 – The numbers refer to noise level reduction (NLR) levels. NLR (outdoor to indoor) is achieved through the incorporation of noise attenuation into the design and construction of a structure. Land use and related structures are generally compatible; however, measures to achieve NLR of 25, 30, or 35 must be incorporated into design and construction of structures. However, measures to achieve an overall noise reduction do not necessarily solve noise difficulties outside the structure and additional evaluation is warranted. Also, see notes indicated by superscripts where they appear with one of these numbers.
DNL – Day-Night Average Sound Level.
CNEL – Community Noise Equivalent Level (normally within a very small decibel difference of DNL)
Ldn – Mathematical symbol for DNL.

Notes:

1. General

a. Although local conditions regarding the need for housing may require residential use in these zones, residential use is discouraged in DNL 65-69 and strongly discouraged in DNL 70-74. The absence of viable alternative development options should be determined and an evaluation should be conducted locally prior to local approvals indicating that a demonstrated community need for the residential use would not be met if development were prohibited in these zones. Existing residential development is considered as pre-existing, non-conforming land uses.

b. Where the community determines that these uses must be allowed, measures to achieve outdoor to indoor NLR of at least 25 decibels (dB) in DNL 65-69 and 30 dB in DNL 70-74 should be incorporated into building codes and be considered in individual approvals; for transient housing, an NLR of at least 35 dB should be incorporated in DNL 75-79.

c. Normal permanent construction can be expected to provide an NLR of 20 dB, thus the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation, upgraded sound transmission class ratings in windows and doors, and closed windows year-round. Additional consideration should be given to modifying NLR levels based on peak noise levels or vibrations.

d. NLR criteria will not eliminate outdoor noise problems. However, building location, site planning, design, and use of berms and barriers can help mitigate outdoor noise exposure particularly from ground level sources. Measures that reduce noise at a site should be used wherever practical in preference to measures that only protect interior spaces.

2. Measures to achieve NLR of 25 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
3. Measures to achieve NLR of 30 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
4. Measures to achieve NLR of 35 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
5. If project or proposed development is noise sensitive, use indicated NLR; if not, land use is compatible without NLR.
6. Buildings are not permitted.
7. Land use is compatible provided special sound reinforcement systems are installed.
8. Residential buildings require an NLR of 25
9. Residential buildings require an NLR of 30.
10. Residential buildings are not permitted.
11. Land use that involves outdoor activities is not recommended, but if the community allows such activities, hearing protection devices should be worn when noise sources are present. Long-term exposure (multiple hours per day over many years) to high noise levels can cause hearing loss in some unprotected individuals.

C.2.3 Speech Interference

Speech interference from noise is a primary cause of annoyance for communities. Disruption of routine activities such as radio or television listening, telephone use, or conversation leads to frustration and annoyance. The quality of speech communication is important in classrooms and offices. In the workplace, speech interference from noise can cause fatigue and vocal strain in those who attempt to talk over the noise. In schools it can impair learning.

There are two measures of speech comprehension:

1. *Word Intelligibility* – the percent of words spoken and understood. This might be important for students in the lower grades who are learning the English language, and particularly for students who have English as a Second Language.
2. *Sentence Intelligibility* – the percent of sentences spoken and understood. This might be important for high school students and adults who are familiar with the language, and who do not necessarily have to understand each word in order to understand sentences.

U.S. Federal Criteria for Interior Noise

In 1974, the USEPA identified a goal of an indoor $L_{eq(24)}$ of 45 dB to minimize speech interference based on sentence intelligibility and the presence of steady noise (USEPA 1974). Figure C-12 shows the effect of steady indoor background sound levels on sentence intelligibility. For an average adult with normal hearing and fluency in the language, steady background indoor sound levels of less than 45 dB L_{eq} are expected to allow 100% sentence intelligibility.

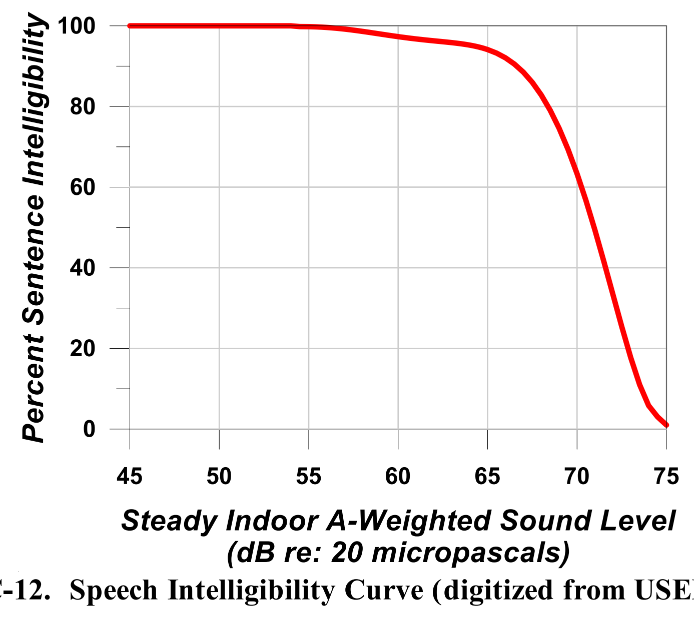


Figure C-12. Speech Intelligibility Curve (digitized from USEPA 1974)

The curve in Figure C-12 shows 99% intelligibility at L_{eq} below 54 dB, and less than 10% above 73 dB. Recalling that L_{eq} is dominated by louder noise events, the USEPA $L_{eq(24)}$ goal of 45 dB generally ensures that sentence intelligibility will be high most of the time.

Classroom Criteria

For teachers to be understood, their regular voice must be clear and uninterrupted. Background noise has to be below the teacher's voice level. Intermittent noise events that momentarily drown out the teacher's voice need to be kept to a minimum. It is therefore important to evaluate the steady background level, the level of voice communication, and the single-event level due to aircraft overflights that might interfere with speech.

Lazarus (1990) found that for listeners with normal hearing and fluency in the language, complete sentence intelligibility can be achieved when the signal-to-noise ratio (i.e., a comparison of the level of the sound to the level of background noise) is in the range of 15 to 18 dB. The initial ANSI classroom noise standard (ANSI 2002) and American Speech-Language-Hearing Association (1995) guidelines concur, recommending at least a 15 dB signal-to-noise ratio in classrooms. If the teacher's voice level is at least 50 dB, the background noise level must not exceed an average of 35 dB. The National Research Council of Canada (Bradley 1993) and WHO (1999) agree with this criterion for background noise.

For eligibility for noise insulation funding, the Federal Aviation Administration (FAA) guidelines state that the design objective for a classroom environment is 45 dB L_{eq} during normal school hours (FAA 1985).

Most aircraft noise is not continuous. It consists of individual events like the one sketched in Figure C-7. Since speech interference in the presence of aircraft noise is caused by individual aircraft flyover events, a time-averaged metric alone, such as L_{eq}, is not necessarily appropriate. In addition to the background level criteria described above, single-event criteria that account for those noisy events are also needed.

A 1984 study by Wyle for the Port Authority of New York and New Jersey recommended using Speech Interference Level (SIL) for classroom noise criteria (Sharp and Plotkin 1984). SIL is based on the maximum sound levels in the frequency range that most affects speech communication (500-2,000 Hz). The study identified an SIL of 45 dB as the goal. This would provide 90% word intelligibility for the short time periods during aircraft overflights. While SIL is technically the best metric for speech interference, it can be approximated by an L_{max} value. A SIL of 45 dB is equivalent to an A-weighted L_{max} of 50 dB for aircraft noise (Wesler 1986).

Lind et al. (1998) also concluded that an L_{max} criterion of 50 dB would result in 90% word intelligibility. Bradley (1985) recommends SEL as a better indicator. His work indicates that 95% word intelligibility would be achieved when indoor SEL did not exceed 60 dB. For typical flyover noise this corresponds to an L_{max} of 50 dB. While WHO (1999) only specifies a background L_{max} criterion, they also note the SIL frequencies and that interference can begin at around 50 dB.

The United Kingdom Department for Education and Skills (UKDfES) established in its classroom acoustics guide a 30-minute time-averaged metric of $L_{eq(30min)}$ for background levels and the metric of $L_{A1,30min}$ for intermittent noises, at thresholds of 30-35 dB and 55 dB, respectively. $L_{A1,30min}$ represents the A-weighted sound level that is exceeded 1% of the time (in this case, during a 30-minute teaching session) and is generally equivalent to the L_{max} metric (UKDfES 2003).

Table C-7 summarizes the criteria discussed. Other than the FAA (1985) 45 dB L_{max} criterion, they are consistent with a limit on indoor background noise of 35-40 dB L_{eq} and a single event limit of 50 dB L_{max}.

It should be noted that these limits were set based on students with normal hearing and no special needs. At-risk students may be adversely affected at lower sound levels.

Table C-7. Indoor Noise Level Criteria Based on Speech Intelligibility

Source	*Metric/Level (dB)*	*Effects and Notes*
U.S. FAA (1985)	$L_{eq(during\ school\ hours)}$ = 45 dB	Federal assistance criteria for school sound insulation; supplemental single-event criteria may be used.
Lind et al. (1998), Sharp and Plotkin (1984), Wesler (1986)	L_{max} = 50 dB / SIL 45	Single event level permissible in the classroom.
WHO (1999)	L_{eq} = 35 dB L_{max} = 50 dB	Assumes average speech level of 50 dB and recommends signal-to-noise ratio of 15 dB.
U.S. ANSI (2010)	L_{eq} = 35 dB, based on Room Volume (e.g., cubic feet)	Acceptable background level for continuous and intermittent noise.
U.K. DFES (2003)	$L_{eq(30min)}$ = 30-35 dB L_{max} = 55 dB	Minimum acceptable in classroom and most other learning environs.

C.2.4 Sleep Disturbance

Sleep disturbance is a major concern for communities exposed to aircraft noise at night. A number of studies have attempted to quantify the effects of noise on sleep. This section provides an overview of the major noise-induced sleep disturbance studies. Emphasis is on studies that have influenced U.S. federal noise policy. The studies have been separated into two groups:

1. Initial studies performed in the 1960s and 1970s, where the research was focused on sleep observations performed under laboratory conditions.
2. Later studies performed in the 1990s up to the present, where the research was focused on field observations.

Initial Studies

The relation between noise and sleep disturbance is complex and not fully understood. The disturbance depends not only on the depth of sleep and the noise level, but also on the non-acoustic factors cited for annoyance. The easiest effect to measure is the number of arousals or awakenings from noise events. Much of the literature has therefore focused on predicting the percentage of the population that will be awakened at various noise levels.

FICON's 1992 review of airport noise issues (FICON 1992) included an overview of relevant research conducted through the 1970s. Literature reviews and analyses were conducted from 1978 through 1989 using existing data (Griefahn 1978; Lukas 1978; Pearsons et al. 1989). Because of large variability in the data, FICON did not endorse the reliability of those results.

FICON did recommend, however, an interim dose-response curve, awaiting future research. That curve predicted the percent of the population expected to be awakened as a function of the exposure to SEL. This curve was based on research conducted for the U.S. Air Force (Finegold 1994). The data included most of the research performed up to that point, and predicted a 10% probability of awakening when exposed to an interior SEL of 58 dB. The data used to derive this curve were primarily from controlled laboratory studies.

Recent Sleep Disturbance Research – Field and Laboratory Studies

It was noted that early sleep laboratory studies did not account for some important factors. These included habituation to the laboratory, previous exposure to noise, and awakenings from noise other than aircraft. In the early 1990s, field studies in people's homes were conducted to validate the earlier laboratory work conducted in the 1960s and 1970s. The field studies of the 1990s found that 80-90% of sleep disturbances were not related to outdoor noise events, but rather to indoor noises and non-noise factors. The results showed that, in real life conditions, there was less of an effect of noise on sleep than had been previously reported from laboratory studies. Laboratory sleep studies tend to show more sleep disturbance than field studies because people who sleep in their own homes are used to their environment and, therefore, do not wake up as easily (FICAN 1997).

Federal Interagency Committee on Aviation Noise

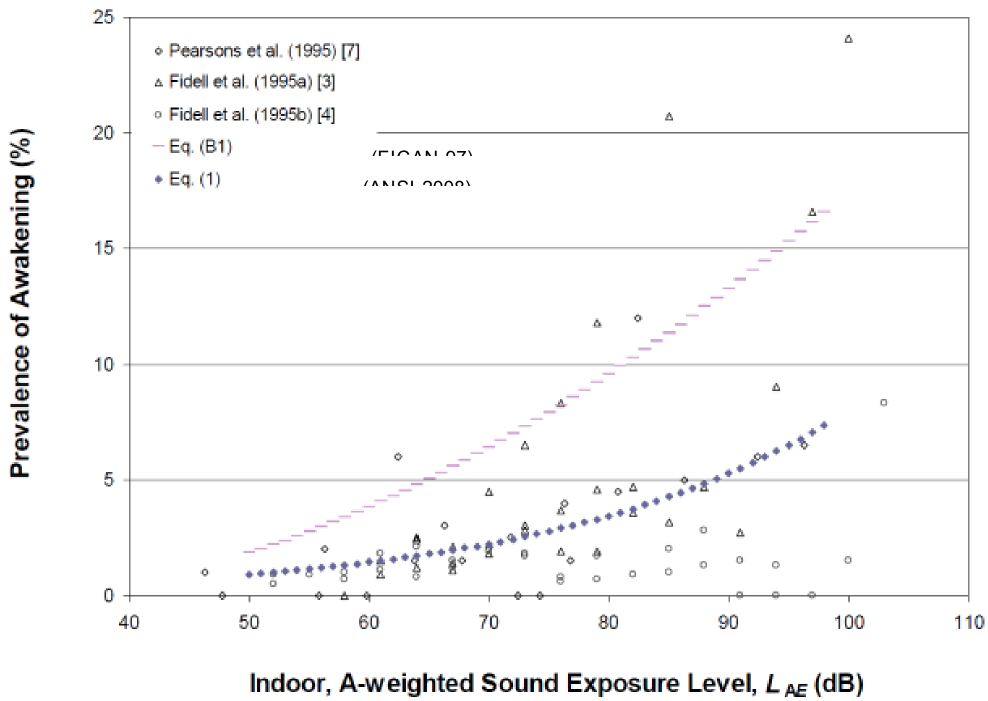
Based on this new information, in 1997 FICAN recommended a dose-response curve to use instead of the earlier 1992 FICON curve (FICAN 1997). Figure C-13 shows FICAN's curve, the red dashed line, which is based on the results of three field studies shown in the figure (Ollerhead et al. 1992; Fidell et al. 1994; Fidell et al. 1995a, 1995b), along with the data from six previous field studies.

The 1997 FICAN curve represents the upper envelope of the latest field data. It predicts the maximum percent awakened for a given residential population. According to this curve, a maximum of 3% of people would be awakened at an indoor SEL of 58 dB. An indoor SEL of 58 dB is equivalent to an outdoor SEL of 83 dB, with the windows closed (73 dB with windows open).

Number of Events and Awakenings

It is reasonable to expect that sleep disturbance is affected by the number of events. The German Aerospace Center (DLR Laboratory) conducted an extensive study focused on the effects of nighttime aircraft noise on sleep and related factors (Basner et al. 2004). The DLR study was one of the largest studies to examine the link between aircraft noise and sleep disturbance. It involved both laboratory and in-home field research phases. The DLR investigators developed a dose-response curve that predicts the number of aircraft events at various values of L_{max} expected to produce one additional awakening over the course of a night. The dose-effect curve was based on the relationships found in the field studies.

An ANSI standards committee (ANSI 2008) took a different approach. The committee used the average of the data shown in Figure C-13 (i.e., the blue dashed line) rather than the upper envelope, to predict average awakening from one event. Probability theory is then used to project the awakening from multiple noise events.



Source: DoD 2009b.

Figure C-13. Sleep Disturbance Dose-Response Relationship

Currently, there are no established criteria for evaluating sleep disturbance from aircraft noise, although recent studies have suggested a benchmark of an outdoor SEL of 90 dB as an appropriate tentative criterion when comparing the effects of different operational alternatives. The corresponding indoor SEL would be approximately 25 dB lower (at 65 dB) with doors and windows closed, and approximately 15 dB lower (at 75 dB) with doors or windows open. According to the ANSI (2008) standard, the probability of awakening from a single aircraft event at this level is between 1 and 2% for people habituated to the noise sleeping in bedrooms with windows closed, and 2-3% with windows open. The probability of the exposed population awakening at least once from multiple aircraft events at noise levels of 90 dB SEL is shown in Table C-8.

Table C-8. Probability of Awakening from NA90SEL

Number of Aircraft Events at 90 dB SEL for Average 9-Hour Night	*Minimum Probability of Awakening at Least Once Windows Closed*	*Minimum Probability of Awakening at Least Once Windows Open*
1	1%	2%
3	4%	6%
5	7%	10%
9 (1 per hour)	12%	18%
18 (2 per hour	22%	33%
27 (3 per hour)	32%	45%

Source: DoD 2009b.

In December 2008, FICAN recommended the use of this new standard. FICAN also recognized that more research is underway by various organizations, and that work may result in changes to FICAN's position. Until that time, FICAN recommends the use of the ANSI (2008) standard (FICAN 2008).

Update

As of July 2018, the ANSI and ASA have withdrawn the 2008 standard, which formed the basis of much of the DNWG 2009 guidance:

> *The decision of Working Group S12/WG 15 to withdraw ANSI/ASA S12.9-2008/Part 6 implies that the method for calculating "at least one behavioral awakening per night" contained in the former Standard should no longer be relied upon for environmental impact assessment purposes. The Working Group believes that continued reliance on the 2008 Standard would lead to unreliable and difficult-to-interpret predictions of transportation-noise-induced sleep disturbance. (ANSI/ASA 2018)*

The 2008 standard relied on the assumption that the calculation for PA from a single event is independent of the subsequent events so multiple events in the same night can simply be combined using the same formula. Additionally, the studies that supported the 2008 standard assumed varying sensitivity to awakening of individual study participants and employed "sensitivity coefficients" to improve the prediction correlation. However, the sensitivity coefficients for residents of airport neighborhoods were not generalizable from one airport to another making accurate prediction at airfields without such studies and sensitivity coefficients difficult and less reliable.

The explanations given by ANSI and ASA for the withdrawal of the 2008 standard include the following criticism:

- When applied to large populations, a fractional increase in noise level produces an unrealistic increase in number of awakenings,
- Lacks advice concerning situational limits of its applicability allowing misapplication in very large study areas resulting in implausibly large total numbers of awakenings, even at imperceptibly low sound levels,
- Lacks guidance about the reliability of its predictions, which encourages practitioners to apply the predictive equations with the assumption of unlimited accuracy,
- Due to the awakening studies' setup, predictions of sleep awakening in settings with greater than 20 nighttime events are dubious.

Additionally, ANSI/ASA 2018 described the relatively small number of field observations of behavioral awakenings attributable to transportation sleep disruption, which lack sufficient representation of the reactions of diverse populations necessary for the typical application of the 2008 standard.

The discussion in ANSI/ASA 2018 included consideration of SEL's value in computing PA and concluded that reliance solely on SEL may not be reliable because awakenings depend only slightly on SEL, particularly at lower levels. A study by Fidell et al. (2013) re-analyzed the same database published in the 2008 ANSI but concluded that PA more closely related to relative SEL rather than absolute, *"Minor differences in prediction of small awakening rates should not interpreted as evidence of meaningfully different environmental impacts of one project alternative with respect to another."*

Summary and Methodology Used in this Analysis

Without a reliable and standardized method to compute PA, or updated guidance from DNWG, this study presents the sleep impact analysis utilizing the previous standard (ANSI/ASA 2008 and DNWG 2009) for environmental impact disclosure purposes. The reader is cautioned that the PA metric provides only a crude estimate because it cannot truly account for all variables that could affect a person's sleep. A comparison of the Current Scenario and Proposed Action awakening percentages showing large changes to PA could provide some insight on whether a particular action would be likely to increase or decrease sleep impacts. However, any additional conclusions may not be supportable.

C.2.5 Noise-Induced Hearing Impairment

Residents in surrounding communities express concerns regarding the effects of aircraft noise on hearing. This section provides a brief overview of hearing loss caused by noise exposure. The goal is to provide a sense of perspective as to how aircraft noise (as experienced on the ground) compares to other activities that are often linked with hearing loss.

Hearing Threshold Shifts

Hearing loss is generally interpreted as a decrease in the ear's sensitivity or acuity to perceive sound (i.e., a shift in the hearing threshold to a higher level). This change can either be a Temporary Threshold Shift (TTS) or a Permanent Threshold Shift (PTS) (Berger et al. 1995).

TTS can result from exposure to loud noise over a given amount of time. An example of TTS might be a person attending a loud music concert. After the concert is over, there can be a threshold shift that may last several hours. While experiencing TTS, the person becomes less sensitive to low-level sounds, particularly at certain frequencies in the speech range (typically near 4,000 Hz). Normal hearing eventually returns, as long as the person has enough time to recover within a relatively quiet environment.

PTS usually results from repeated exposure to high noise levels, where the ears are not given adequate time to recover. A common example of PTS is the result of regularly working in a loud factory. A TTS can eventually become a PTS over time with repeated exposure to high noise levels. Even if the ear is given time to recover from TTS, repeated occurrence of TTS may eventually lead to permanent hearing loss. The point at which a TTS results in a PTS is difficult to identify and varies with a person's sensitivity.

Criteria for Permanent Hearing Loss

It has been well established that continuous exposure to high noise levels will damage human hearing (USEPA 1978). A large amount of data on hearing loss have been collected, largely for workers in manufacturing industries, and analyzed by the scientific/medical community. The OSHA regulation of 1971 places the limit on workplace noise exposure at an average level of 90 dB over an 8-hour work period or 85 dB over a 16-hour period (U.S. Department of Labor 1971). Some hearing loss is still expected at those levels. The most protective criterion, with no measurable hearing loss after 40 years of exposure, is an average sound level of 70 dB over a 24-hour period.

The USEPA established 75 dB $L_{eq(8)}$ and 70 dB $L_{eq(24)}$ as the average noise level standard needed to protect 96% of the population from greater than a 5 dB PTS (USEPA 1978). The National Academy of Sciences CHABA identified 75 dB as the lowest level at which hearing loss may occur (CHABA 1977). WHO concluded that environmental and leisure-time noise below an $L_{eq(24)}$ value of 70 dB "will not cause hearing loss in the large majority of the population, even after a lifetime of exposure" (WHO 1999).

Hearing Loss and Aircraft Noise

The 1982 USEPA Guidelines report (USEPA 1982) addresses noise-induced hearing loss in terms of the "Noise-Induced Permanent Threshold Shift" (NIPTS). This defines the permanent change in hearing caused by exposure to noise. Numerically, the NIPTS is the change in threshold that can be expected from daily exposure to noise over a normal working lifetime of 40 years. A grand average of the NIPTS over time and hearing sensitivity is termed the Average NIPTS, or Ave. NIPTS for short. The Ave. NIPTS that can be expected for noise measured by the $L_{eq(24)}$ metric is given in Table C-9 and assumes exposure to the full outdoor noise throughout the 24 hours. When inside a building, the exposure will be less (Eldred and von Gierke 1993).

Table C-9. Average NIPTS and 10th Percentile NIPTS as a Function of DNL

DNL	*Ave. NIPTS dB**	*10th Percentile NIPTS dB**
75-76	1.0	4.0
76-77	1.0	4.5
77-78	1.6	5.0
78-79	2.0	5.5
79-80	2.5	6.0
80-81	3.0	7.0
81-82	3.5	8.0
82-83	4.0	9.0
83-84	4.5	10.0
84-85	5.5	11.0
85-86	6.0	12.0
86-87	7.0	13.5
87-88	7.5	15.0
88-89	8.5	16.5
89-90	9.5	18.0

Source: DoD 2012.
Note: *Rounded to the nearest 0.5 dB.

The average NIPTS is estimated as an average over all people exposed to the noise. The actual value of NIPTS for any given person will depend on their physical sensitivity to noise – some will experience more hearing loss than others. The USEPA Guidelines provide information on this variation in sensitivity in the form of the NIPTS exceeded by 10% of the population, which is included in the Table C-9 in the "10th Percentile NIPTS" column (USEPA 1982). For individuals exposed to $L_{eq(24)}$ of 80 dB, the most sensitive of the population would be expected to show degradation to their hearing of 7 dB over time.

To put these numbers in perspective, changes in hearing level of less than 5 dB are generally not considered noticeable or significant. Furthermore, there is no known evidence that a NIPTS of 5 dB is perceptible or has any practical significance for the individual. Lastly, the variability in audiometric testing is generally assumed to be ±5 dB (USEPA 1974).

The scientific community has concluded that noise exposure from civil airports has little chance of causing permanent hearing loss (Newman and Beattie 1985). For military airbases, DoD policy requires that hearing risk loss be estimated for population exposed to $L_{eq(24)}$ of 80 dB or higher (DoD 2012), including residents of on-base housing. Exposure of workers inside the base boundary is assessed using DoD regulations for occupational noise exposure.

Noise in low-altitude military airspace, especially along MTRs where L_{max} can exceed 115 dB, is of concern. That is the upper limit used for occupational noise exposure (e.g., U.S. Department of Labor 1971). One laboratory study (Ising et al. 1999) concluded that events with L_{max} above 114 dB have the potential to cause hearing loss. Another laboratory study of participants exposed to levels between 115 and 130 dB (Nixon et al. 1993), however, showed conflicting results. For an exposure to four events across that range, half the subjects showed no change in hearing, a quarter showed a temporary 5 dB decrease in sensitivity, and a quarter showed a temporary 5 dB increase in sensitivity. For exposure to eight events of 130 dB, subjects showed an increase in sensitivity of up to 10 dB (Nixon et al. 1993).

Summary

Aviation noise levels are not comparable to the occupational noise levels associated with hearing loss of workers in manufacturing industries. There is little chance of hearing loss at levels less than 75 dB DNL. Noise levels equal to or greater than 75 dB DNL can occur near military airbases, and DoD policy specifies that NIPTS be evaluated when exposure exceeds 80 dB $L_{eq(24)}$ (DoD 2009c). There is some concern about L_{max} exceeding 115 dB in low-altitude military airspace, but no research results to date have definitely related permanent hearing impairment to aviation noise.

C.2.6 Non-Auditory Health Effects

Studies have been performed to see whether noise can cause health effects other than hearing loss. The premise is that annoyance causes stress. Prolonged stress is known to be a contributor to a number of health disorders. Cantrell (1974) confirmed that noise can provoke stress, but noted that results on cardiovascular health have been contradictory. Some studies have found a connection between aircraft noise and blood pressure (e.g., Michalak et al. 1990; Rosenlund et al. 2001), while others have not (e.g., Pulles et al. 1990).

Kryter and Poza (1980) noted, "It is more likely that noise related general ill-health effects are due to the psychological annoyance from the noise interfering with normal everyday behavior, than it is from the noise eliciting, because of its intensity, reflexive response in the autonomic or other physiological systems of the body."

The connection from annoyance to stress to health issues requires careful experimental design. Some highly publicized reports on health effects have, in fact, been rooted in poorly done science. Meecham and Shaw (1979) apparently found a relation between noise levels and mortality rates in neighborhoods under the approach path to Los Angeles International Airport. When the same data were analyzed by others (Frerichs et al. 1980) no relationship was found. Jones and Tauscher (1978) found a high rate of birth defects for the same neighborhood. But when the Centers for Disease Control performed a more thorough study near Atlanta's Hartsfield International Airport, no relationships were found for levels above 65 dB (Edmonds et al. 1979).

A carefully designed study, Hypertension and Exposure to Noise near Airports (HYENA), was conducted around six European airports from 2002 through 2006 (Jarup et al. 2005, 2008). There were 4,861 subjects, aged between 45 and 70. Blood pressure was measured, and questionnaires administered for health, socioeconomic and lifestyle factors, including diet and physical exercise. Hypertension was defined by WHO blood pressure thresholds (WHO 2003). Noise from aircraft and highways was predicted from models.

The HYENA results were presented as an odds ratio (OR). An OR of 1 means there is no added risk, while an OR of 2 would mean risk doubles. An OR of 1.14 was found for nighttime aircraft noise, measured by L_{night}, the L_{eq} for nighttime hours. For daytime aircraft noise, measured by $L_{eq(16)}$, the OR was 0.93. For road traffic noise, measured by the full day $L_{eq(24)}$, the OR was 1.1.

Note that OR is a statistical measure of change, not the actual risk. Risk itself and the measured effects were small, and not necessarily distinct from other events. Haralabidis et al. (2008) reported an increase in systolic blood pressure of 6.2 millimeters of mercury (mmHg) for aircraft noise, and an increase of 7.4 mmHg for other indoor noises such as snoring.

It is interesting that aircraft noise was a factor only at night, while traffic noise is a factor for the full day. Aircraft noise results varied among the six countries so that result is pooled across all data. Traffic noise results were consistent across the six countries.

One interesting conclusion from a 2013 study of the HYENA data (Babisch et al. 2013) states there is some indication that noise level is a stronger predictor of hypertension than annoyance. That is not consistent with the idea that annoyance is a link in the connection between noise and stress. Babisch et al. (2012) present interesting insights on the relationship of the results to various modifiers.

Two recent studies examined the correlation of aircraft noise with hospital admissions for cardiovascular disease. Hansell et al. (2013) examined neighborhoods around London's Heathrow airport. Correia et al. (2013) examined neighborhoods around 89 airports in the U.S. Both studies included areas of various noise levels. They found associations that were consistent with the HYENA results. The authors of these studies noted that further research is needed to refine the associations and the causal interpretation with noise or possible alternative explanations.

> "Impacts from environmental noise on vulnerable groups (such as those who suffer from post-traumatic stress disorder [PTSD] and autism) have been understudied and are generally underrepresented in study populations, and evidence of differential effects is still highly anecdotal. As a consequence, clear effects are few and this is partly due to the lack of targeted and well-designed studies making clear comparisons between the general population and the potentially susceptible groups and quantifying these differences in terms of noise levels. Setting specific limit values to protect susceptible groups is not yet possible based on the available evidence, although some suggestions have been made in the literature. To further this field, it is necessary in future studies to present and compare subgroup-specific exposure effect relations. Generic use of the term 'vulnerable groups' should be avoided as the mechanisms are quite different and maybe more important, they vary in time, place, and across contexts. Groups at risk or susceptible groups, periods or places would, in most cases, be more appropriate terms to use and are less stigmatizing than the term vulnerability" (van Kamp and Davies 2013).

Summary

The current state of scientific knowledge cannot yet support inference of a causal or consistent relationship between aircraft noise exposure and non-auditory health consequences for exposed residents. The large-scale HYENA study, and the recent studies by Hansell et al. (2013) and Correia et al. (2013) offer indications, but it is not yet possible to establish a quantitative cause and effect based on the currently available scientific evidence.

C.2.7 Performance Effects

The effect of noise on the performance of activities or tasks has been the subject of many studies. Some of these studies have found links between continuous high noise levels and performance loss. Noise-induced performance losses are most frequently reported in studies where noise levels are above 85 dB. Little change has been found in low-noise cases. Moderate noise levels appear to act as a stressor for more sensitive individuals performing a difficult psychomotor task.

While the results of research on the general effect of periodic aircraft noise on performance have yet to yield definitive criteria, several general trends have been noted including:

- A periodic intermittent noise is more likely to disrupt performance than a steady-state continuous noise of the same level. Flyover noise, due to its intermittent nature, might be more likely to disrupt performance than a steady-state noise of equal level.
- Noise is more inclined to affect the quality than the quantity of work.
- Noise is more likely to impair the performance of tasks that place extreme demands on workers.

C.2.8 Noise Effects on Children

Recent studies on school children indicate a potential link between aircraft noise and both reading comprehension and learning motivation. The effects may be small but may be of particular concern for children who are already scholastically challenged.

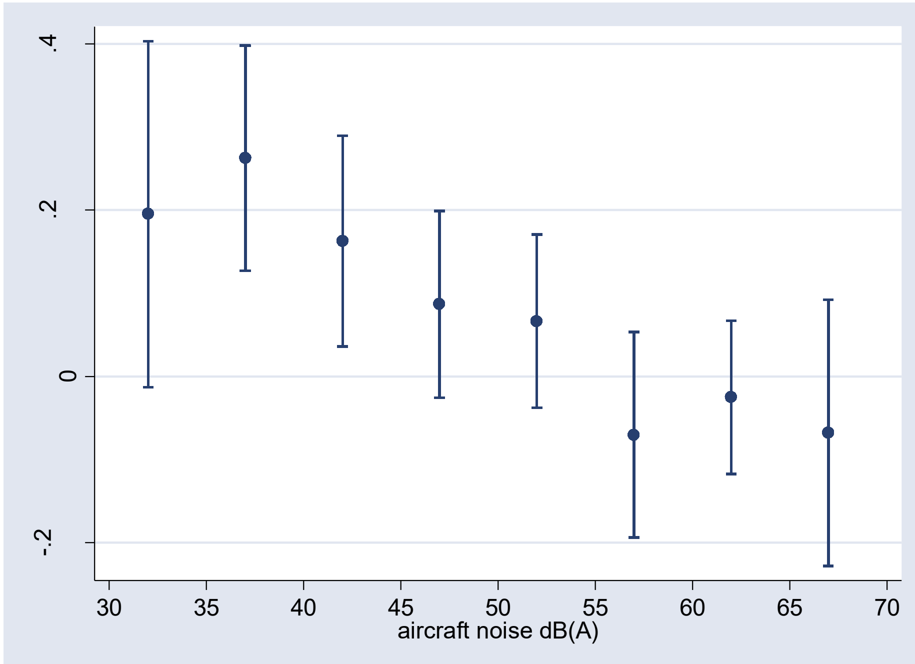
C.2.8.1 Effects on Learning and Cognitive Abilities

Early studies in several countries (Cohen et al. 1973, 1980, 1981; Bronzaft and McCarthy 1975; Green et al. 1982; Evans et al. 1998; Haines et al. 2002; Lercher et al. 2003) showed lower reading scores for children living or attending school in noisy areas than for children away from those areas. In some studies noise exposed children were less likely to solve difficult puzzles or more likely to give up.

More recently, the Road Traffic and Aircraft Noise Exposure and Children's Cognition and Health (RANCH) study (Stansfeld et al. 2005; Clark et al. 2005) compared the effect of aircraft and road traffic noise on over 2.000 children in three countries. This was the first study to derive exposure effect associations for a range of cognitive and health effects, and was the first to compare effects across countries.

The study found a linear relation between chronic aircraft noise exposure and impaired reading comprehension and recognition memory. No associations were found between chronic road traffic noise exposure and cognition. Conceptual recall and information recall surprisingly showed better performance in high road traffic noise areas. Neither aircraft noise nor road traffic noise affected attention or working memory (Stansfeld et al. 2005; Clark et al. 2005).

Figure C-14 shows RANCH's result relating noise to reading comprehension. It shows that reading falls below average (a z-score of 0) at L_{eq} greater than 55 dB. Because the relationship is linear, reducing exposure at any level should lead to improvements in reading comprehension.



Sources: Stansfeld et al. 2005; Clark et al. 2005.

Figure C-14. RANCH Study Reading Scores Varying with L_{eq}

An observation of the RANCH study was that children may be exposed to aircraft noise for many of their childhood years and the consequences of long-term noise exposure were unknown. A follow-up study of the children in the RANCH project is being analyzed to examine the long-term effects on children's reading comprehension (Clark et al. 2009). Preliminary analysis indicated a trend for reading comprehension to be poorer at 15-16 years of age for children who attended noise exposed primary schools. There was also a trend for reading comprehension to be poorer in aircraft noise exposed secondary schools. Further analysis adjusting for confounding factors is ongoing, and is needed to confirm these initial conclusions.

FICAN funded a pilot study to assess the relationship between aircraft noise reduction and standardized test scores (Eagan et al. 2004; FICAN 2007). The study evaluated whether abrupt aircraft noise reduction within classrooms, from either airport closure or sound insulation, was associated with improvements in test scores. Data were collected in 35 public schools near three airports in Illinois and Texas. The study used several noise metrics. These were, however, all computed indoor levels, which makes it hard to compare with the outdoor levels used in most other studies.

The FICAN study found a significant association between noise reduction and a decrease in failure rates for high school students, but not middle or elementary school students. There were some weaker associations between noise reduction and an increase in failure rates for middle and elementary schools. Overall the study found that the associations observed were similar for children with or without learning difficulties, and between verbal and math/science tests. As a pilot study, it was not expected to obtain final answers, but provided useful indications (FICAN 2007).

While there are many factors that can contribute to learning deficits in school-aged children, there is increasing awareness that chronic exposure to high aircraft noise levels may impair learning. This awareness has led WHO and a North Atlantic Treaty Organization (NATO) working group to conclude that daycare centers and schools should not be located near major sources of noise, such as highways, airports, and industrial sites (NATO 2000; WHO 1999). The awareness has also led to the classroom noise standard discussed earlier (ANSI 2002).

C.2.8.2 Health Effects

A number of studies, including some of the cognitive studies discussed above, have examined the potential for effects on children's health. Health effects include annoyance, psychological health, coronary risk, stress hormones, sleep disturbance and hearing loss.

Annoyance. Chronic noise exposure causes annoyance in children (Bronzaft and McCarthy 1975; Evans et al. 1995). Annoyance among children tends to be higher than for adults, and there is little habituation (Haines et al. 2001a). The RANCH study found annoyance may play a role in how noise affects reading comprehension (Clark et al. 2005).

Psychological Health. Lercher et al. (2002) found an association between noise and teacher ratings of psychological health, but only for children with biological risk defined by low birth weight and/or premature birth. Haines et al. (2001b) found that children exposed to aircraft noise had higher levels of psychological distress and hyperactivity. Stansfeld et al. (2009) replicated the hyperactivity result, but not distress.

As with studies of adults, the evidence suggests that chronic noise exposure is probably not associated with serious psychological illness, but there may be effects on well-being and quality of life. Further research is needed, particularly on whether hyperactive children are more susceptible to stressors such as aircraft noise.

Coronary Risk. The HYENA study discussed earlier indicated a possible relation between noise and hypertension in older adults. Cohen et al. (1980, 1981) found some increase in blood pressure among school children, but within the normal range and not indicating hypertension. Hygge et al. (2002) found mixed effects. The RANCH study found some effect for children at home and at night, but not at school. Overall the evidence for noise effects on children's blood pressure is mixed, and less certain than for older adults.

Stress Hormones. Some studies investigated hormonal levels between groups of children exposed to aircraft noise compared to those in a control group. Two studies analyzed cortisol and urinary catecholamine levels in school children as measurements of stress response to aircraft noise (Haines et al. 2001a, 2001b). In both instances, there were no differences between the aircraft noise exposed children and the control groups.

Sleep Disturbance. A sub-study of RANCH in a Swedish sample used sleep logs and the monitoring of rest/activity cycles to compare the effect of road traffic noise on child and parent sleep (Öhrström et al. 2006). An exposure-response relationship was found for sleep quality and daytime sleepiness for children. While this suggests effects of noise on children's sleep disturbance, it is difficult to generalize from one study.

Hearing loss. A few studies have examined hearing loss from exposure to aircraft noise. Noise-induced hearing loss for children who attended a school located under a flight path near a Taiwan airport was greater than for children at another school far away (Chen et al. 1997). Another study reported that hearing ability was reduced significantly in individuals who lived near an airport and were frequently exposed to aircraft noise (Chen and Chen 1993). In that study, noise exposure near the airport was greater than 75 dB DNL and L_{max} were about 87 dB during overflights. Conversely, several other studies reported no difference in hearing ability between children exposed to high levels of airport noise and children located in quieter areas (Andrus et al. 1975; Fisch 1977; Wu et al. 1995). It is not clear from those results whether children are at higher risk than adults, but the levels involved are higher than those desirable for learning and quality of life.

Ludlow and Sixsmith (1999) conducted a cross-sectional pilot study to examine the hypothesis that military jet noise exposure early in life is associated with raised hearing thresholds. The authors concluded that there were no significant differences in audiometric test results between military personnel who as children had lived in or near stations where fast jet operations were based, and a similar group who had no such exposure as children.

C.2.9 Property Values

Noise can affect the value of homes. Economic studies of property values based on selling prices and noise have been conducted to find a direct relation.

The value-noise relation is usually presented as the Noise Depreciation Index (NDI) or Noise Sensitivity Depreciation Index, the percent loss of value per dB (measured by the DNL metric). An early study by Nelson (1978) at three airports found an NDI of 1.8-2.3% per dB. Nelson also noted a decline in NDI over time which he theorized could be due to either a change in population or the increase in commercial value of the property near airports. Crowley (1978) reached a similar conclusion. A larger study by Nelson (1980) looking at 18 airports found an NDI from 0.5 to 0.6% per dB.

In a review of property value studies, Newman and Beattie (1985) found a range of NDI from 0.2 to 2% per dB. They noted that many factors other than noise affected values.

Fidell et al. (1996) studied the influence of aircraft noise on actual sale prices of residential properties in the vicinity of a military base in Virginia and one in Arizona. They found no meaningful effect on home values. Their results may have been due to non-noise factors, especially the wide differences in homes between the two study areas.

Recent studies of noise effects on property values have recognized the need to account for non-noise factors. Nelson (2004) analyzed data from 33 airports, and discussed the need to account for those factors and the need for careful statistics. His analysis showed NDI from 0.3 to 1.5% per dB, with an average of about 0.65% per dB. Nelson (2007) and Andersson et al. (2013) discuss statistical modeling in more detail.

Another recent literature review was conducted by Aliyu et al. (2016) and found similar ranges of impacts. The most common approach used in assessing impacts is the hedonic pricing method where the value of the property is modeled to reflect the contribution of many individual variables (e.g., scenic views, house appearance, and neighborhood demand) which, when taken together, form the total price. The hedonic pricing method requires detailed information on local housing markets and sales prices.

He et al. (2014) used a meta-analysis of more than 60 hedonic price property value studies to model the relationship between city level income and population data and the overall willingness to pay for noise abatement. This approach enables an estimate of noise impacts in locations where detailed housing data is not available. The mean NDI of the hedonic price studies used was 0.75 percent and the median was

0.67 percent. Results of the model are comparable with hedonic price models and the previous studies discussed. Wolfe et al. (2014) use the approach described by He et al. (2014) to compare the impacts related to noise with impacts related to climate and air quality. They show the spatial relationship of noise impacts in areas in the immediate vicinity of the airport and also caution that some hedonic pricing models that are measuring impacts from noise may be capturing impacts associated with air quality as well if this variable is not accounted for.

Similar price impacts were found by Jud and Winkler (2006) and Mense and Kholodilin (2012); however, these studies also showed that the impacts occurred as a result of the announcement of an airport expansion. The anticipation of the noise level rise impacts property values before the noise increases.

Enough data are available to conclude that aircraft noise has a real effect on property values. This effect falls in the range of 0.2 to 2.0% per dB, with the average on the order of 0.5% per dB. The actual value varies from location to location, and is very often small compared to non-noise factors.

C.2.10 Noise-Induced Vibration Effects on Structures and Humans

High noise levels can cause buildings to vibrate. If high enough, building components can be damaged. The most sensitive components of a building are the windows, followed by plaster walls and ceilings. Possibility of damage depends on the peak sound pressures and the resonances of the building. In general, damage is possible only for sounds lasting more than one second above an unweighted sound level of 130 dB (CHABA 1977). That is higher than expected from normal aircraft operations. Even low-altitude flyovers of heavy aircraft do not reach the potential for damage (Sutherland 1990a).

Noise-induced structural vibration may cause annoyance to dwelling occupants because of induced secondary vibrations, or "rattle," of objects within the dwelling – hanging pictures, dishes, plaques, and bric-a-brac. Loose window panes may also vibrate noticeably when exposed to high levels of airborne noise, causing homeowners to fear breakage. In general, rattling occurs at peak unweighted sound levels that last for several seconds at levels above 110 dB, which is well above that considered normally compatible with residential land use. Thus, assessments of noise exposure levels for compatible land use will also be protective of noise-induced rattle.

The sound from an aircraft overflight travels from the exterior to the interior of the house in one of two ways: through the solid structural elements and directly through the air. Figure C-15 illustrates the sound transmission through a wall constructed with a brick exterior, stud framing, interior finish wall, and absorbent material in the cavity. The sound transmission starts with noise impinging on the wall exterior. Some of this sound energy will be reflected away and some will make the wall vibrate. The vibrating wall radiates sound into the airspace, which in turn sets the interior finish surface vibrating, with some energy lost in the airspace. This surface then radiates sound into the dwelling interior. As the figure shows, vibrational energy also bypasses the air cavity by traveling through the studs and edge connections.

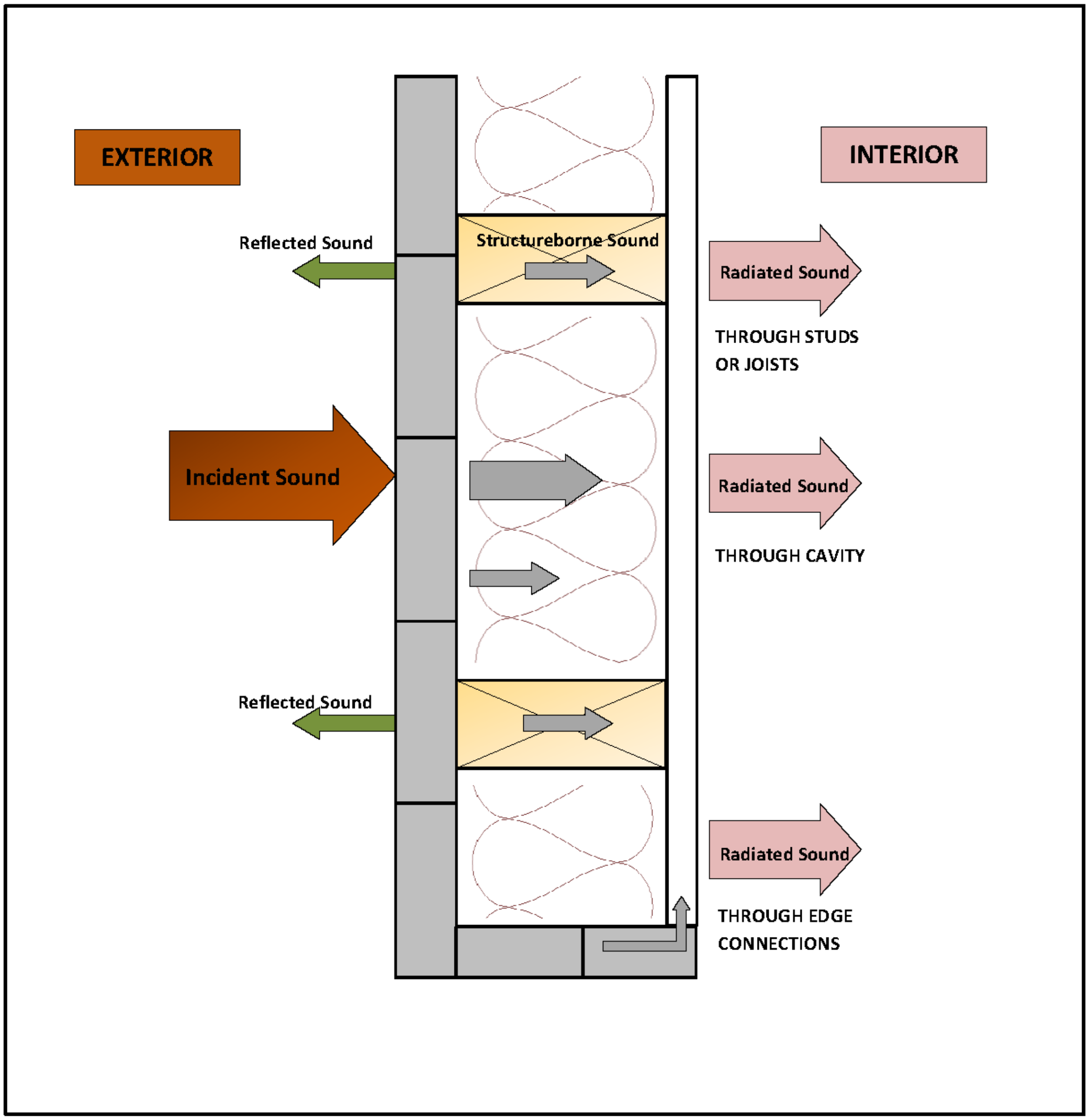


Figure C-15. Depiction of Sound Transmission through Built Construction

Normally, the most sensitive components of a structure to airborne noise are the windows, followed by plastered walls and ceilings. An evaluation of the peak sound pressures impinging on the structure is normally sufficient to determine the possibility of damage. In general, at unweighted sound levels above 130 dB, there is the possibility of structural damage. While certain frequencies (such as 30 Hertz for window breakage) may be of more concern than other frequencies, conservatively, only sounds lasting more than one second above an unweighted sound level of 130 dB are potentially damaging to structural components (von Gierke and Ward 1991).

In the assessment of vibration on humans, the following factors determine if a person will perceive and possibly react to building vibrations:

1. Type of excitation: steady-state, intermittent, or impulsive vibration.
2. Frequency of the excitation. International Organization for Standardization (ISO) standard 2631-2 (ISO 1989) recommends a frequency range of 1 to 80 Hz for the assessment of vibration on humans.
3. Orientation of the body with respect to the vibration.
4. The use of the occupied space (i.e., residential, workshop, hospital).
5. Time of day.

Table C-10 lists the whole-body vibration criteria from ISO 2631-2 for one-third octave frequency bands from 1 to 80 Hz.

Table C-10. Vibration Criteria for the Evaluation of Human Exposure to Whole-Body Vibration

Frequency (Hz)	***RMS Acceleration (m/s/s) Combined Criteria Base Curve***	***RMS Acceleration (m/s/s) Residential Night***	***RMS Acceleration (m/s/s) Residential Day***
1.00	0.0036	0.0050	0.0072
1.25	0.0036	0.0050	0.0072
1.60	0.0036	0.0050	0.0072
2.0	0.0036	0.0050	0.0072
2.50	0.0037	0.0052	0.0074
3.15	0.0039	0.0054	0.0077
4.00	0.0041	0.0057	0.0081
5.00	0.0043	0.0060	0.0086
6.30	0.0046	0.0064	0.0092
8.00	0.0050	0.0070	0.0100
10.00	0.0063	0.0088	0.0126
12.50	0.0078	0.0109	0.0156
16.00	0.0100	0.0140	0.0200
20.00	0.0125	0.0175	0.0250
25.00	0.0156	0.0218	0.0312
31.50	0.0197	0.0276	0.0394
40.00	0.0250	0.0350	0.0500
50.00	0.0313	0.0438	0.0626
63.00	0.0394	0.0552	0.0788
80.00	0.0500	0.0700	0.1000

Source: ISO 1989.

C.2.11 Sonic Booms

Sonic booms are commonly associated with structural damage. Most damage claims are for brittle objects, such as glass and plaster. Table C-11 summarizes the threshold of damage that might be expected at various overpressures. There is a large degree of variability in damage experience, and much damage depends on the pre-existing condition of a structure. Breakage data for glass, for example, spans a range of two to three orders of magnitude at a given overpressure. At 1 psf, the probability of a window breaking ranges from one in a billion (Sutherland 1990b) to one in a million (Hershey and Higgins 1976). These damage rates are associated with a combination of boom load and glass condition. At 10 psf, the probability of breakage is between one in a hundred and one in a thousand. Laboratory tests of glass (White 1972) have shown that properly installed window glass will not break at overpressures below 10 psf, even when subjected to repeated booms, but in the real-world glass is not in pristine condition.

Table C-11. Possible Damage to Structures From Sonic Booms

Sonic Boom Overpressure Nominal (psf)	*Type of Damage*	*Item Affected*
0.5 - 2	Plaster	Fine cracks; extension of existing cracks; more in ceilings; over door frames; between some plaster boards.
0.5 - 2	Glass	Rarely shattered; either partial or extension of existing.
0.5 - 2	Roof	Slippage of existing loose tiles/slates; sometimes new cracking of old slates at nail hole.
0.5 - 2	Damage to outside walls	Existing cracks in stucco extended.
0.5 - 2	Bric-a-brac	Those carefully balanced or on edges can fall; fine glass, such as large goblets, can fall and break.
0.5 - 2	Other	Dust falls in chimneys.
2 - 4	Glass, plaster, roofs, ceilings	Failures show that would have been difficult to forecast in terms of their existing localized condition. Nominally in good condition.
4 - 10	Glass	Regular failures within a population of well-installed glass; industrial as well as domestic greenhouses.
4 - 10	Plaster	Partial ceiling collapse of good plaster; complete collapse of very new, incompletely cured, or very old plaster.
4 - 10	Roofs	High probability rate of failure in nominally good state, slurry-wash; some chance of failures in tiles on modern roofs; light roofs (bungalow) or large area can move bodily.
4 - 10	Walls (out)	Old, free standing, in fairly good condition can collapse.
4 - 10	Walls (in)	Inside ("party") walls known to move at 10 psf.
Greater than 10	Glass	Some good glass will fail regularly to sonic booms from the same direction. Glass with existing faults could shatter and fly. Large window frames move.
Greater than 10	Plaster	Most plaster affected.
Greater than 10	Ceilings	Plaster boards displaced by nail popping.
Greater than 10	Roofs	Most slate/slurry roofs affected, some badly; large roofs having good tile can be affected; some roofs bodily displaced causing gale-end and will-plate cracks; domestic chimneys dislodged if not in good condition.
Greater than 10	Walls	Internal party walls can move even if carrying fittings such as hand basins or taps; secondary damage due to water leakage.
Greater than 10	Bric-a-brac	Some nominally secure items can fall; e.g., large pictures, especially if fixed to party walls.

Source: Haber and Nakaki 1989.

Damage to plaster occurs at similar ranges to glass damage. Plaster has a compounding issue in that it will often crack due to shrinkage while curing, or from stresses as a structure settles, even in the absence of outside loads. Sonic boom damage to plaster often occurs when internal stresses are high from these factors.

Some degree of damage to glass and plaster should thus be expected whenever there are sonic booms, but usually at the low rates noted above. In general, structural damage from sonic booms should be expected only for overpressures above 10 psf.

C.2.12 Noise and Sonic Boom Effects on Terrain

It has been suggested that noise levels associated with low-flying aircraft may affect the terrain under the flight path by disturbing fragile soil or snow, especially in mountainous areas, causing landslides or avalanches. There are no known instances of such events. It is improbable that such effects would result from routine subsonic aircraft operations.

In contrast to subsonic noise, sonic booms are considered to be a potential trigger for snow avalanches. Avalanches are highly dependent on the physical status of the snow, and do occur spontaneously. They can be triggered by minor disturbances, and there are documented accounts of sonic booms triggering avalanches. Switzerland routinely restricts supersonic flight during avalanche season. Landslides are not an issue for sonic booms. There was one anecdotal report of a minor landslide from a sonic boom generated by the Space Shuttle during landing, but there is no credible mechanism or consistent pattern of reports.

C.2.13 Noise Effects on Historical and Archaeological Sites

Historical buildings and sites can have elements that are more fragile than conventional structures. Aircraft noise may affect such sites more severely than newer, modern structures. In older structures, seemingly insignificant surface cracks caused by vibrations from aircraft noise may lead to greater damage from natural forces (Hanson et al. 1991). There are few scientific studies of such effects to provide guidance for their assessment.

For example, one study involved measurements of noise and vibration in a restored plantation house, originally built in 1795. It is located 1,500 feet from the centerline at the departure end of Runway 19L at Washington Dulles International Airport. The aircraft measured was the Concorde. There was special concern for the building’s windows, since roughly half of the 324 panes were original. No instances of structural damage were found. Interestingly, despite the high levels of noise during Concorde takeoffs, the induced structural vibration levels were actually less than those induced by touring groups and vacuum cleaning (Wesler 1977).

As for conventional structures, noise exposure levels for normally compatible land uses should also be protective of historic and archaeological sites. Unique sites should, of course, be analyzed for specific exposure.

C.2.14 Effects on Domestic Animals and Wildlife

Domestic animals and wildlife have different hearing thresholds, frequency response, and tolerance characteristics than do humans. There is a large difference in response even among different animal species. Evaluation of noise impacts on wildlife using metrics primarily intended for human impact should be done with caution and makes evaluation of impacts on wildlife even more difficult. As such, evaluations in this appendix have been based primarily on historical response to sounds rather than to absolute sound levels.

Hearing is critical to an animal's ability to react, compete, reproduce, hunt, forage, and survive in its environment. While the existing literature does include studies on possible effects of jet aircraft noise and sonic booms on wildlife, there appears to have been little concerted effort in developing quantitative comparisons of aircraft noise effects on normal auditory characteristics. Behavioral effects have been relatively well described, but the larger ecological context issues, and the potential for drawing conclusions regarding effects on populations, has not been well developed.

The relationships between potential auditory/physiological effects and species interactions with their environments are not well understood. Manci et al. (1988), assert that the consequences that physiological effects may have on behavioral patterns are vital to understanding the long-term effects of noise on wildlife. Questions regarding the effects (if any) on predator-prey interactions, reproductive success, and intra-inter specific behavior patterns remain.

The following discussion provides an overview of the existing literature on noise effects (particularly jet aircraft noise) on animal species. The literature reviewed here involves those studies that have focused on the observations of the behavioral effects that jet aircraft and sonic booms have on animals.

A great deal of research was conducted in the 1960s and 1970s on the effects of aircraft noise on the public and the potential for adverse ecological impacts. These studies were largely completed in response to the increase in air travel and as a result of the introduction of supersonic jet aircraft. According to Manci et al. (1988), the foundation of information created from that focus does not necessarily correlate or provide information specific to the impacts to wildlife in areas overflown by aircraft at supersonic speed or at low altitudes.

The abilities to hear sounds and noise and to communicate assist wildlife in maintaining group cohesiveness and survivorship. Social species communicate by transmitting calls of warning, introduction, and other types that are subsequently related to an individual's or group's responsiveness.

Animal species differ greatly in their responses to noise. Noise effects on domestic animals and wildlife are classified as primary, secondary, and tertiary. Primary effects are direct, physiological changes to the auditory system, and most likely include the masking of auditory signals. Masking is defined as the inability of an individual to hear important environmental signals that may arise from mates, predators, or prey. There is some potential that noise could disrupt a species' ability to communicate or could interfere with behavioral patterns (Manci et al. 1988). Although the effects are likely temporal, aircraft noise may cause masking of auditory signals within exposed faunal communities. Animals rely on hearing to avoid predators, obtain food, and communicate with, and attract, other members of their species. Aircraft noise may mask or interfere with these functions. Other primary effects, such as ear drum rupture or temporary and permanent hearing threshold shifts, are not as likely given the subsonic noise levels produced by aircraft overflights.

Secondary effects may include non-auditory effects such as stress and hypertension; behavioral modifications; interference with mating or reproduction; and impaired ability to obtain adequate food, cover, or water. Tertiary effects are the direct result of primary and secondary effects, and include population decline and habitat loss. Most of the effects of noise are mild enough that they may never be detectable as variables of change in population size or population growth against the background of normal variation (Bowles 1995). Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) also influence secondary and tertiary effects, and confound the ability to identify the ultimate factor in limiting productivity of a certain nest, area, or region (Smith et al. 1988). Overall, the literature suggests that species differ in their response to various types, durations, and sources of noise (Manci et al. 1988).

Many scientific studies have investigated the effects of aircraft noise on wildlife, and some have focused on wildlife "flight" due to noise. Animal responses to aircraft are influenced by many variables, including size, speed, proximity (both height above the ground and lateral distance), engine noise, color, flight profile, and radiated noise. The type of aircraft (e.g., fixed wing versus rotor-wing [helicopter]) and type of flight mission may also produce different levels of disturbance, with varying animal responses (Smith et al. 1988). Consequently, it is difficult to generalize animal responses to noise disturbances across species.

One result of the Manci et al. (1988) literature review was the conclusion that, while behavioral observation studies were relatively limited, a general behavioral reaction in animals from exposure to aircraft noise is the startle response. The intensity and duration of the startle response appears to be dependent on which species is exposed, whether there is a group or an individual, and whether there have been some previous exposures. Responses range from flight, trampling, stampeding, jumping, or running, to movement of the head in the apparent direction of the noise source. Manci et al. (1988) reported that the literature indicated that avian species may be more sensitive to aircraft noise than mammals.

C.2.14.1 Domestic Animals

Although some studies report that the effects of aircraft noise on domestic animals is inconclusive, a majority of the literature reviewed indicates that domestic animals exhibit some behavioral responses to military overflights but generally seem to habituate to the disturbances over a period of time. Mammals in particular appear to react to noise at sound levels higher than 90 dB, with responses including the startle response, freezing (i.e., becoming temporarily stationary), and fleeing from the sound source. Many studies on domestic animals suggest that some species appear to acclimate to some forms of sound disturbance (Manci et al. 1988). Some studies have reported such primary and secondary effects as reduced milk production and rate of milk release, increased glucose concentrations, decreased levels of hemoglobin, increased heart rate, and a reduction in thyroid activity. These latter effects appear to represent a small percentage of the findings occurring in the existing literature.

Some reviewers have indicated that earlier studies, and claims by farmers linking adverse effects of aircraft noise on livestock, did not necessarily provide clear-cut evidence of cause and effect (Cottereau 1978). In contrast, many studies conclude that there is no evidence that aircraft overflights affect feed intake, growth, or production rates in domestic animals.

Cattle

In response to concerns about overflight effects on pregnant cattle, milk production, and cattle safety, the U.S. Air Force prepared a handbook for environmental protection that summarized the literature on the impacts of low-altitude flights on livestock (and poultry) and includes specific case studies conducted in numerous airspaces across the country. Adverse effects have been found in a few studies but have not been reproduced in other similar studies. One such study, conducted in 1983, suggested that 2 of 10 cows in late pregnancy aborted after showing rising estrogen and falling progesterone levels. These increased hormonal levels were reported as being linked to 59 aircraft overflights. The remaining eight cows showed no changes in their blood concentrations and calved normally. A similar study reported abortions occurred in three out of five pregnant cattle after exposing them to flyovers by six different aircraft. Another study suggested that feedlot cattle could stampede and injure themselves when exposed to low-level overflights (U.S. Air Force 1994a).

A majority of the studies reviewed suggests that there is little or no effect of aircraft noise on cattle. Studies presenting adverse effects to domestic animals have been limited. A number of studies (Parker and Bayley 1960; Casady and Lehmann 1967; Kovalcik and Sottnik 1971) investigated the effects of jet aircraft noise and sonic booms on the milk production of dairy cows. Through the compilation and examination of milk production data from areas exposed to jet aircraft noise and sonic boom events, it was determined that milk yields were not affected. This was particularly evident in those cows that had been previously exposed to jet aircraft noise.

A study examined the causes of 1,763 abortions in Wisconsin dairy cattle over a 1-year time period and none were associated with aircraft disturbances (U.S. Air Force 1993). In 1987, researchers contacted seven livestock operators for production data, and no effects of low-altitude and supersonic flights were noted. Of the 43 cattle previously exposed to low-altitude flights, 3 showed a startle response to an F/A-18 aircraft flying overhead at 500 feet AGL and 400 knots by running less than 10 meters. They resumed normal activity within 1 minute (U.S. Air Force 1994a). Beyer (1983) found that helicopters caused more reaction than other low-aircraft overflights, and that the helicopters at 30-60 feet overhead did not affect milk production and pregnancies of 44 cows in a 1964 study (U.S. Air Force 1994a).

Additionally, Beyer (1983) reported that five pregnant dairy cows in a pasture did not exhibit fright-flight tendencies or disturb their pregnancies after being overflown by 79 low-altitude helicopter flights and 4 low-altitude, subsonic jet aircraft flights. A 1956 study found that the reactions of dairy and beef cattle to noise from low-altitude, subsonic aircraft were similar to those caused by paper blowing about, strange persons, or other moving objects (U.S. Air Force 1994a).

In a report to Congress, the U.S. Forest Service concluded that "evidence both from field studies of wild ungulates and laboratory studies of domestic stock indicate that the risks of damage are small (from aircraft approaches of 50-100 meters), as animals take care not to damage themselves (U.S. Forest Service 1992). If animals are overflown by aircraft at altitudes of 50-100 meters, there is no evidence that mothers and young are separated, that animals collide with obstructions (unless confined) or that they traverse dangerous ground at too high a rate." These varied study results suggest that, although the confining of cattle could magnify animal response to aircraft overflight, there is no proven cause and effect link between startling cattle from aircraft overflights and abortion rates or lower milk production.

Horses

Horses have also been observed to react to overflights of jet aircraft. Several of the studies reviewed reported a varied response of horses to low-altitude aircraft overflights. Observations made in 1966 and 1968 noted that horses galloped in response to jet flyovers (U.S. Air Force 1993). Bowles (1995) cites Kruger and Erath as observing horses exhibiting intensive flight reactions, random movements, and biting/kicking behavior. However, no injuries or abortions occurred, and there was evidence that the mares adapted somewhat to the flyovers over the course of a month (U.S. Air Force 1994a). Although horses were observed noticing the overflights, it did not appear to affect either survivability or reproductive success. There was also some indication that habituation to these types of disturbances was occurring.

LeBlanc et al. (1991), studied the effects of F-14 jet aircraft noise on pregnant mares. They specifically focused on any changes in pregnancy success, behavior, cardiac function, hormonal production, and rate of habituation. Their findings reported observations of "flight-fright" reactions, which caused increases in heart rates and serum cortisol concentrations. The mares, however, did habituate to the noise. Levels of anxiety and mass body movements were the highest after initial exposure, with intensities of responses decreasing thereafter. There were no differences in pregnancy success when compared to a control group.

Swine

Generally, the literature findings for swine appear to be similar to those reported for cows and horses. While there are some effects from aircraft noise reported in the literature, these effects are minor. Studies of continuous noise exposure (i.e., 6 hours, 72 hours of constant exposure) reported influences on short-term hormonal production and release. Additional constant exposure studies indicated the observation of stress reactions, hypertension, and electrolyte imbalances (Dufour 1980). A study by Bond et al. (1963), demonstrated no adverse effects on the feeding efficiency, weight gain, ear physiology, or thyroid and adrenal gland condition of pigs subjected to observed aircraft noise. Observations of heart rate increase were recorded; noting that cessation of the noise resulted in the return to normal heart rates. Conception rates and offspring survivorship did not appear to be influenced by exposure to aircraft noise.

Similarly, simulated aircraft noise at levels of 100-135 dB had only minor effects on the rate of feed utilization, weight gain, food intake, or reproduction rates of boars and sows exposed, and there were no injuries or inner ear changes observed (Gladwin et al. 1988; Manci et al. 1988).

Domestic Fowl

According to a 1994 position paper by the U.S. Air Force on effects of low-altitude overflights (below 1,000 feet) on domestic fowl, overflight activity has negligible effects (U.S. Air Force 1994b). The paper did recognize that given certain circumstances, adverse effects can be serious. Some of the effects can be panic reactions, reduced productivity, and effects on marketability (e.g., bruising of the meat caused during "pile-up" situations).

The typical reaction of domestic fowl after exposure to sudden, intense noise is a short-term startle response. The reaction ceases as soon as the stimulus is ended, and within a few minutes all activity returns to normal. More severe responses are possible depending on the number of birds, the frequency of exposure, and environmental conditions. Large crowds of birds, and birds not previously exposed, are more likely to pile up in response to a noise stimulus (U.S. Air Force 1994b). According to studies and interviews with growers, it is typically the previously unexposed birds that incite panic crowding, and the tendency to do so is markedly reduced within five exposures to the stimulus (U.S. Air Force 1994b). This suggests that the birds habituate relatively quickly. Egg productivity was not adversely affected by infrequent noise bursts, even at exposure levels as high as 120-130 dB.

Between 1956 and 1988, there were 100 recorded claims against the Navy for alleged damage to domestic fowl. The number of claims averaged three per year, with peak numbers of claims following publications of studies on the topic in the early 1960s. Many of the claims were disproved or did not have sufficient supporting evidence. The claims were filed for the following alleged damages: 55% for panic reactions, 31% for decreased production, 6% for reduced hatchability, 6% for weight loss, and less than 1% for reduced fertility (U.S. Air Force 1994b).

C2.14.2 Wildlife

Studies on the effects of overflights and sonic booms on wildlife have been focused mostly on avian species and ungulates such as caribou and bighorn sheep. Few studies have been conducted on marine mammals, small terrestrial mammals, reptiles, amphibians, and carnivorous mammals. Generally, species that live entirely below the surface of the water have also been ignored due to the fact they do not experience the same level of sound as terrestrial species (National Park Service 1994). Wild ungulates appear to be much more sensitive to noise disturbance than domestic livestock. This may be due to previous exposure to disturbances. One common factor appears to be that low-altitude flyovers seem to be more disruptive in terrain where there is little cover (Manci et al. 1988).

Mammals

TERRESTRIAL MAMMALS

Studies of terrestrial mammals have shown that noise levels of 120 dB can damage mammals' ears, and levels at 95 dB can cause temporary loss of hearing acuity. Noise from aircraft has affected other large carnivores by causing changes in home ranges, foraging patterns, and breeding behavior. One study recommended that aircraft not be allowed to fly at altitudes below 2,000 feet AGL over important grizzly and polar bear habitat. Wolves have been frightened by low-altitude flights that were 25-1,000 feet AGL. However, wolves have been found to adapt to aircraft overflights and noise as long as they were not being hunted from aircraft (Dufour 1980).

Wild ungulates (American bison, caribou, bighorn sheep) appear to be much more sensitive to noise disturbance than domestic livestock (Weisenberger et al. 1996). Behavioral reactions may be related to the past history of disturbances by such things as humans and aircraft. Common reactions of reindeer kept in an enclosure exposed to aircraft noise disturbance were a slight startle response, rising of the head, pricking ears, and scenting of the air. Panic reactions and extensive changes in behavior of individual animals were not observed. Observations of caribou in Alaska exposed to fixed-wing aircraft and helicopters showed running and panic reactions occurred when overflights were at an altitude of 200 feet or less. The reactions decreased with increased altitude of overflights, and, with more than 500 feet in altitude, the panic reactions stopped. Also, smaller groups reacted less strongly than larger groups. One negative effect of the running and avoidance behavior is increased expenditure of energy. For a 90-kilogram animal, the calculated expenditure due to aircraft harassment is 64 kilocalories per minute when running and 20 kilocalories per minute when walking. When conditions are favorable, this expenditure can be counteracted with increased feeding; however, during harsh winter conditions, this may not be possible. Incidental observations of wolves and bears exposed to fixed-wing aircraft and helicopters in the northern regions suggested that wolves are less disturbed than wild ungulates, while grizzly bears showed the greatest response of any animal species observed (Weisenberger et al. 1996).

It has been proven that low-altitude overflights do induce stress in animals. Increased heart rates, an indicator of excitement or stress, have been found in pronghorn antelope, elk, and bighorn sheep. As such reactions occur naturally as a response to predation, infrequent overflights may not, in and of themselves, be detrimental. However, flights at high frequencies over a long period of time may cause harmful effects. The consequences of this disturbance, while cumulative, are not additive. It may be that aircraft disturbance may not cause obvious and serious health effects, but coupled with a harsh winter, it may have an adverse impact. Research has shown that stress induced by other types of disturbances produces long-term decreases in metabolism and hormone balances in wild ungulates.

Behavioral responses can range from mild to severe. Mild responses include head raising, body shifting, or turning to orient toward the aircraft. Moderate disturbance may be nervous behaviors, such as trotting a short distance. Escape is the typical severe response.

BIRDS

Auditory research conducted on birds indicates that they fall between the reptiles and the mammals relative to hearing sensitivity. According to Dooling (1978), within the range of 1,000 to 5,000 Hz, birds show a level of hearing sensitivity similar to that of the more sensitive mammals. In contrast to mammals, bird sensitivity falls off at a greater rate to increasing and decreasing frequencies. Passive observations and studies examining aircraft bird strikes indicate that birds nest and forage near airports. Aircraft noise in the vicinity of commercial airports apparently does not inhibit bird presence and use.

High noise events (like a low-altitude aircraft overflight) may cause birds to engage in escape or avoidance behaviors, such as flushing from perches or nests (Ellis et al. 1991). These activities impose an energy cost on the birds that, over the long term, may affect survival or growth. In addition, the birds may spend less time engaged in necessary activities like feeding, preening, or caring for their young because they spend time in noise-avoidance activity. However, the long-term significance of noise-related impacts is less clear. Several studies on nesting raptors have indicated that birds become habituated to aircraft overflights and that long-term reproductive success is not affected (Ellis et al. 1991; Grubb and King 1991). Threshold noise levels for significant responses range from 62 dB for Pacific black brant to 85 dB for crested tern (Brown 1990; Ward and Stehn 1990).

Songbirds were observed to become silent prior to the onset of a sonic boom event (F-111 jets), followed by "raucous discordant cries." There was a return to normal singing within 10 seconds after the boom (Higgins 1974 in Manci et al. 1988). Ravens responded by emitting protestation calls, flapping their wings, and soaring.

Manci et al. (1988), reported a reduction in reproductive success in some small territorial passerines (i.e., perching birds or songbirds) after exposure to low-altitude overflights. However, it has been observed that passerines are not driven any great distance from a favored food source by a nonspecific disturbance, such as aircraft overflights (U.S. Forest Service 1992). Further study may be warranted.

A cooperative study between the DoD and the U.S. Fish and Wildlife Service (USFWS), assessed the response of the red-cockaded woodpecker to a range of military training noise events, including artillery, small arms, helicopter, and maneuver noise (Pater et al. 1999). The project findings show that the red-cockaded woodpecker successfully acclimates to military noise events. Depending on the noise level that ranged from innocuous to very loud, the birds responded by flushing from their nest cavities. When the noise source was closer and the noise level was higher, the number of flushes increased proportionately. In all cases, however, the birds returned to their nests within a relatively short period of time (usually within 12 minutes). Additionally, the noise exposure did not result in any mortality or statistically detectable changes in reproductive success (Pater et al. 1999). Red-cockaded woodpeckers did not flush when artillery simulators were more than 122 meters away and SELs were 70 dB.

Lynch and Speake (1978) studied the effects of both real and simulated sonic booms on the nesting and brooding eastern wild turkey in Alabama. Hens at four nest sites were subjected to between 8 and 11 combined real and simulated sonic booms. All tests elicited similar responses, including quick lifting of the head and apparent alertness for 10-20 seconds. No apparent nest failure occurred as a result of the sonic booms. Twenty-one brood groups were also subjected to simulated sonic booms. Reactions varied slightly between groups, but the largest percentage of groups reacted by standing motionless after the initial blast. Upon the sound of the boom, the hens and poults fled until reaching the edge of the woods (approximately 4-8 meters). Afterward, the poults resumed feeding activities while the hens remained alert for a short period of time (approximately 15-20 seconds). In no instances were poults abandoned, nor did they scatter and become lost. Every observation group returned to normal activities within a maximum of 30 seconds after a blast.

RAPTORS

In a literature review of raptor responses to aircraft noise, Manci et al. (1988) found that most raptors did not show a negative response to overflights. When negative responses were observed they were predominantly associated with rotor-winged aircraft or jet aircraft that were repeatedly passing within 0.5 mile of a nest.

Ellis et al. (1991), performed a study to estimate the effects of low-level military jet aircraft and mid- to high-altitude sonic booms (both actual and simulated) on nesting peregrine falcons and seven other raptors (common black-hawk, Harris' hawk, zone-tailed hawk, red-tailed hawk, golden eagle, prairie falcon, bald eagle). They observed responses to test stimuli, determined nest success for the year of the testing, and evaluated site occupancy the following year. Both long- and short-term effects were noted in the study. The results reported the successful fledging of young in 34 of 38 nest sites (all eight species) subjected to low-level flight and/or simulated sonic booms. Twenty-two of the test sites were revisited in the following year, and observations of pairs or lone birds were made at all but one nest. Nesting attempts were underway at 19 of 20 sites that were observed long enough to be certain of breeding activity. Reoccupancy and productivity rates were within or above expected values for self-sustaining populations.

Short-term behavior responses were also noted. Overflights at a distance of 150 meters or less produced few significant responses and no severe responses. Typical responses consisted of crouching or, very rarely, flushing from the perch site. Significant responses were most evident before egg laying and after young were "well grown." Incubating or brooding adults never burst from the nest, thus preventing egg breaking or knocking chicks out of the nest. Jet passes and sonic booms often caused noticeable alarm; however, significant negative responses were rare and did not appear to limit productivity or reoccupancy. Due to the locations of some of the nests, some birds may have been habituated to aircraft noise. There were some test sites located at distances far from zones of frequent military aircraft usage, and the test stimuli were often closer, louder, and more frequent than would be likely for a normal training situation (Ellis et al. 1991).

Manci et al. (1988), noted that a female northern harrier was observed hunting on a bombing range in Mississippi during bombing exercises. The harrier was apparently unfazed by the exercises, even when a bomb exploded within 200 feet. In a similar case of habituation/non-disturbance, a study on the Florida snail-kite stated the greatest reaction to overflights (approximately 98 dB) was "watching the aircraft fly by." No detrimental impacts to distribution, breeding success, or behavior were noted.

Bald Eagle. A study by Grubb and King (1991) on the reactions of the bald eagle to human disturbances showed that terrestrial disturbances elicited the greatest response, followed by aquatic (i.e., boats) and aerial disturbances. The disturbance regime of the area where the study occurred was predominantly characterized by aircraft noise. The study found that pedestrians consistently caused responses that were greater in both frequency and duration. Helicopters elicited the highest level of aircraft-related responses. Aircraft disturbances, although the most common form of disturbance, resulted in the lowest levels of response. This low response level may have been due to habituation; however, flights less than 170 meters away caused reactions similar to other disturbance types. Ellis et al. (1991) showed that eagles typically respond to the proximity of a disturbance, such as a pedestrian or aircraft within 100 meters, rather than the noise level. Fleischner and Weisberg (1986) stated that reactions of bald eagles to commercial jet flights, although minor (e.g., looking), were twice as likely to occur when the jets passed at a distance of 0.5 mile or less. They also noted that helicopters were four times more likely to cause a reaction than a commercial jet and 20 times more likely to cause a reaction than a propeller plane.

The USFWS advised Cannon Air Force Base that flights at or below 2,000 feet AGL from October 1 through March 1 could result in adverse impacts to wintering bald eagles (USFWS 1998). However, Fraser et al. (1985), suggested that raptors habituate to overflights rapidly, sometimes tolerating aircraft approaches of 65 feet or less.

Golden Eagle. In their guidelines for aerial surveys, USFWS (Pagel et al. 2010) summarized past studies by stating that most golden eagles respond to survey aircraft (fixed- and rotary-wing) by remaining on their nests, and continuing to incubate or roost. Surveys take place generally as close as 10 to 20 meters from cliffs (including hovering less than 30 seconds, if necessary, to count eggs) and no farther than 200 meters from cliffs depending on safety (Pagel et al. 2010).

Grubb et al. (2007) experimented with multiple exposure to two helicopter types and concluded that flights with a variety of approach distances (800, 400, 200, and 100 meters) had no effect on golden eagle nesting success or productivity rates within the same year or on rates of renewed nesting activity the following year when compared to the corresponding figures for the larger population of non-manipulated nest sites (Grubb et al. 2007). They found no significant, detrimental, or disruptive responses in 303 helicopter passes near eagles. In 227 AH-64 Apache helicopter experimental passes (considered twice as loud as a civilian helicopter also tested) at test distances of 0–800 meters from nesting golden eagles, 96% resulted in no more response than watching the helicopter pass. No greater reactions occurred until after hatching when individual golden eagles exhibited five flatten and three fly behaviors at three nest sites. The flight responses occurred at approach distances of 200 meters or less. No evidence was found of an effect on subsequent nesting activity or success, despite many of the helicopter flights occurring during early courtship and nest repair. None of these responding pairs failed to successfully fledge young, except for one nest that fell later in the season. Excited, startled, avoidance reactions were never observed. Non-attending eagles or those perched away from the nests were more likely to fly than attending eagles, but also with less potential consequence to nesting success (Grubb et al. 2007). Golden eagles appeared to become less responsive with successive exposures. Much of helicopter sound energy may be at a lower frequency than golden eagles can hear, thus reducing expected impacts. Grubb et al. (2007) found no relationship between helicopter sound levels and corresponding eagle ambient behaviors or limited responses, which occurred throughout recorded test levels (76.7–108.8 dB, unweighted). The authors thought that the lower-than-expected behavioral responses may be partially due to the fact that the golden eagles in the area appear acclimated to the current high levels of outdoor recreational, including aviation, activities. Based on the results of this study, the authors recommended reduction of existing buffers around nest sites to 100 meters (325 feet) for helicopter activity.

Richardson and Miller (1997) reviewed buffers as protection for raptors against disturbance from ground-based human activities. No consideration of aircraft activity was included. They stressed a clear line of sight as an important factor in a raptor's response to a particular disturbance, with visual screening allowing a closer approach of humans without disturbing a raptor. A Geographic Information System-assisted viewshed approach combined with a designated buffer zone distance was found to be an effective tool for reducing potential disturbance to golden eagles from ground-based activities (Richardson and Miller 1997). They summarized recommendations that included a median 0.5-mile (800-meter) buffer (range = 200-1,600 meters, n = 3) to reduce human disturbances (from ground-based activities such as rock climbing, shooting, vehicular activity) around active golden eagle nests from February 1 to August 1 based on an extensive review of other studies (Richardson and Miller 1997). Physical characteristics (i.e., screening by topography or vegetation) are important variables to consider when establishing buffer zones based on raptors' visual- and auditory-detection distances (Richardson and Miller 1997).

Osprey. A study by Trimper et al. (1998), in Goose Bay, Labrador, Canada, focused on the reactions of nesting osprey to military overflights by CF-18 Hornets. Reactions varied from increased alertness and focused observation of planes to adjustments in incubation posture. No overt reactions (e.g., startle response, rapid nest departure) were observed as a result of an overflight. Young nestlings crouched as a result of any disturbance until 1 to 2 weeks prior to fledging. Helicopters, human presence, float planes, and other ospreys elicited the strongest reactions from nesting ospreys. These responses included flushing, agitation, and aggressive displays. Adult osprey showed high nest occupancy rates during incubation regardless of external influences. The osprey observed occasionally stared in the direction of the flight before it was audible to the observers. The birds may have been habituated to the noise of the flights; however, overflights were strictly controlled during the experimental period. Strong reactions to float planes and helicopter may have been due to the slower flight and therefore longer duration of visual stimuli rather than noise-related stimuli.

Red-tailed Hawk. Andersen et al. (1989), conducted a study that investigated the effects of low-level helicopter overflights on 35 red-tailed hawk nests. Some of the nests had not been flown over prior to the study. The hawks that were naïve (i.e., not previously exposed) to helicopter flights exhibited stronger avoidance behavior (9 of 17 birds flushed from their nests) than those that had experienced prior overflights. The overflights did not appear to affect nesting success in either study group. These findings were consistent with the belief that red-tailed hawks habituate to low-level air traffic, even during the nesting period.

UPLAND GAME BIRDS

Greater Sage-grouse. The greater sage-grouse was recently designated as a candidate species for protection under the Endangered Species Act after many years of scrutiny and research (USFWS 2010). This species is a widespread and characteristic species of the sagebrush ecosystems in the Intermountain West. Greater sage-grouse, like most bird species, rely on auditory signals as part of mating. Sage-grouse are known to select their leks based on acoustic properties and depend on auditory communication for mating behavior (Braun 2006). Although little specific research has been completed to determine what, if any, effects aircraft overflight and sonic booms would have on the breeding behavior of this species, factors that may be important include season and time of day, altitude, frequency, and duration of overflights, and frequency and loudness of sonic booms.

Booth in 2009 found, while attempting to count sage-grouse at leks (breeding grounds) using light sport aircraft at 150 meters (492 feet) to 200 meters (650 feet) AGL, that sage-grouse flushed from leks on 12 of 14 approaches when the airplane was within 656 to 984 feet (200–300 meters) of the lek (Booth et al. 2009). In the other two instances, male grouse stopped exhibiting breeding behavior and crouched but stayed on the lek. The time to resumption of normal behavior after disturbance was not provided in this study. Strutting ceased around the time when observers on the ground heard the aircraft. The light sport aircraft could be safely operated at very low speed (68 kilometers/hour or 37 nautical miles/hour) and was powered by either a two-stroke or a four-stroke engine. It is unclear how the response to the slow-flying light sport aircraft used in the study would compare to overflight by military jets, operating at speeds 10 to 12 times as great as the aircraft used in the study. It is possible that response of the birds was related to the slow speed of the light sport aircraft causing it to resemble an aerial predator.

Other studies have found disturbance from energy operations and other nearby development have adversely affected breeding behavior of greater sage-grouse (Holloran 2005; Doherty 2008; Walker et al. 2007; Harju et al. 2010). These studies do not specifically address overflight and do not isolate noise disturbance from other types (e.g., visual, human presence) nor do they generally provide noise levels or qualification of the noise source (e.g., continuous or intermittent, frequency, duration).

Because so few studies have been done on greater sage-grouse response to overflights or sonic booms, research on related species may be applicable. Observations on other upland game bird species include those on the behavior of four wild turkey (*Meleagris gallapavo*) hens on their nests during real and simulated sonic booms (Manci et al. 1988). Simulated sonic booms were produced by firing 5-centimeter mortar shells, 300 to 500 feet from the nest of each hen. Recordings of pressure for both types of booms measured 0.4 to 1.0 psf at the observer's location.

Turkey hens exhibited only a few seconds of head alert behavior at the sound of the sonic boom. No hens were flushed off the nests, and productivity estimates revealed no effect from the booms. Twenty brood groups were also subjected to simulated sonic booms. In no instance did the hens desert any poults (young birds), nor did the poults scatter or desert the rest of the brood group. In every observation, the brood group returned to normal activity within 30 seconds after a simulated sonic boom. Similarly, researchers cited in Manci et al. (1988) observed no difference in hatching success of bobwhite quail (*Colinus virginianus*) exposed to simulated sonic booms of 100 to 250 micronewtons per square meter.

MIGRATORY WATERFOWL

Fleming et al. (1996) conducted a study of caged American black ducks found that noise had negligible energetic and physiologic effects on adult waterfowl. Measurements included body weight, behavior, heart rate, and enzymatic activity. Experiments also showed that adult ducks exposed to high noise events acclimated rapidly and showed no effects.

The study also investigated the reproductive success of captive ducks, which indicated that duckling growth and survival rates at Piney Island, North Carolina, were lower than those at a background location. In contrast, observations of several other reproductive indices (i.e., pair formation, nesting, egg production, and hatching success) showed no difference between Piney Island and the background location. Potential effects on wild duck populations may vary, as wild ducks at Piney Island have presumably acclimated to aircraft overflights. It was not demonstrated that noise was the cause of adverse impacts. A variety of other factors, such as weather conditions, drinking water and food availability and variability, disease, and natural variability in reproduction, could explain the observed effects. Fleming noted that drinking water conditions (particularly at Piney Island) deteriorated during the study, which could have affected the growth of young ducks. Further research would be necessary to determine the cause of any reproductive effects (Fleming et al. 1996).

Another study by Conomy et al. (1998) exposed previously unexposed ducks to 71 noise events per day that equaled or exceeded 80 dB. It was determined that the proportion of time black ducks reacted to aircraft activity and noise decreased from 38% to 6% in 17 days and remained stable at 5.8% thereafter. In the same study, the wood duck did not appear to habituate to aircraft disturbance. This supports the notion that animal response to aircraft noise is species-specific. Because a startle response to aircraft noise can result in flushing from nests, migrants and animals living in areas with high concentrations of predators would be the most vulnerable to experiencing effects of lowered birth rates and recruitment over time. Species that are subjected to infrequent overflights do not appear to habituate to overflight disturbance as readily.

Black brant studied in the Alaska Peninsula were exposed to jets and propeller aircraft, helicopters, gunshots, people, boats, and various raptors. Jets accounted for 65% of all the disturbances. Humans, eagles, and boats caused a greater percentage of brant to take flight. There was markedly greater reaction to Bell-206-B helicopter flights than fixed-wing, single-engine aircraft (Ward et al. 1986).

The presence of humans and low-flying helicopters in the Mackenzie Valley North Slope area did not appear to affect the population density of Lapland longspurs, but the experimental group was shown to have reduced hatching and fledging success and higher nest abandonment. Human presence appeared to have a greater impact on the incubating behavior of the black brant, common eider, and Arctic tern than fixed-wing aircraft (Gunn and Livingston 1974).

Gunn and Livingston (1974) found that waterfowl and seabirds in the Mackenzie Valley and North Slope of Alaska and Canada became acclimated to float plane disturbance over the course of 3 days. Additionally, it was observed that potential predators (bald eagle) caused a number of birds to leave their nests. Non-breeding birds were observed to be more reactive than breeding birds. Waterfowl were affected by helicopter flights, while snow geese were disturbed by Cessna 185 flights. The geese flushed when the planes were less than 1,000 feet, compared to higher flight elevations. An overall reduction in flock sizes was observed. It was recommended that aircraft flights be reduced in the vicinity of premigratory staging areas.

Manci et al. 1988, reported that waterfowl were particularly disturbed by aircraft noise. The most sensitive appeared to be snow geese. Canada geese and snow geese were thought to be more sensitive than other animals such as turkey vultures, coyotes, and raptors (Edwards et al. 1979).

WADING AND SHOREBIRDS

Black et al. (1984), studied the effects of low-altitude (less than 500 feet AGL) military training flights with sound levels from 55 to 100 dB on wading bird colonies (i.e., great egret, snowy egret, tricolored heron, and little blue heron). The training flights involved three or four aircraft, which occurred once or twice per day. This study concluded that the reproductive activity—including nest success, nestling survival, and nestling chronology—was independent of F-16 overflights. Dependent variables were more strongly related to ecological factors, including location and physical characteristics of the colony and climatology.

Another study on the effects of circling fixed-wing aircraft and helicopter overflights on wading bird colonies found that at altitudes of 195 to 390 feet, there was no reaction in nearly 75% of the 220 observations. Approximately 90% displayed no reaction or merely looked toward the direction of the noise source. Another 6% stood up, 3% walked from the nest, and 2% flushed (but were without active nests) and returned within 5 minutes (Kushlan 1979). Apparently, non-nesting wading birds had a slightly higher incidence of reacting to overflights than nesting birds. Seagulls observed roosting near a colony of wading birds in another study remained at their roosts when subsonic aircraft flew overhead (Burger 1981). Colony distribution appeared to be most directly correlated to available wetland community types and was found to be distributed randomly with respect to MTRs. These results suggest that wading bird species presence was most closely linked to habitat availability and that they were not affected by low-level military overflights (U.S. Air Force 2000).

Burger (1986) studied the response of migrating shorebirds to human disturbance and found that shorebirds did not fly in response to aircraft overflights, but did flush in response to more localized intrusions (i.e., humans and dogs on the beach). Burger (1981) studied the effects of noise from JFK Airport in New York on herring gulls that nested less than 1 kilometer from the airport. Noise levels over the nesting colony were 85-100 dB on approach and 94-105 dB on takeoff. Generally, there did not appear to be any prominent adverse effects of subsonic aircraft on nesting, although some birds flushed when the Concorde flew overhead and, when they returned, engaged in aggressive behavior. Groups of gulls tended to loaf in the area of the nesting colony, and these birds remained at the roost when the Concorde flew overhead. Up to 208 of the loafing gulls flew when supersonic aircraft flew overhead. These birds would circle around and immediately land in the loafing flock (U.S. Air Force 2000).

In 1970, sonic booms were potentially linked to a mass hatch failure of sooty terns on the Dry Tortugas (Austin et al. 1970). The cause of the failure was not certain, but it was conjectured that sonic booms from military aircraft or an overgrowth of vegetation were factors. In the previous season, sooty terns were observed to react to sonic booms by rising in a "panic flight," circling over the island, then usually settling down on their eggs again. Hatching that year was normal. Following the 1969 hatch failure, excess vegetation was cleared and measures were taken to reduce supersonic activity. The 1970 hatch appeared to proceed normally. A colony of noddies on the same island hatched successfully in 1969, the year of the sooty tern hatch failure.

Subsequent laboratory tests of exposure of eggs to sonic booms and other impulsive noises (Cottereau 1972; Cogger and Zegarra 1980; Bowles et al. 1991, 1994) failed to show adverse effects on hatching of eggs. A structural analysis by Ting et al. (2002) showed that, even under extraordinary circumstances, sonic booms would not damage an avian egg.

Burger (1981) observed no effects of subsonic aircraft on herring gulls in the vicinity of JFK International Airport. The Concorde aircraft did cause more nesting gulls to leave their nests (especially in areas of higher density of nests), causing the breakage of eggs and the scavenging of eggs by intruder prey. Clutch sizes were observed to be smaller in areas of higher-density nesting (presumably due to the greater tendency for panic flight) than in areas where there were fewer nests.

Fish and Amphibians

The effects of overflight noise on fish and amphibians have not been well studied, but conclusions regarding their expected responses have involved speculation based upon known physiologies and behavioral traits of these taxa (Gladwin et al. 1988). Although fish do startle in response to low-flying aircraft noise, and probably to the shadows of aircraft, they have been found to habituate to the sound and overflights. Amphibians that respond to low frequencies and those that respond to ground vibration, such as spadefoot toads, may be affected by noise.

Summary

Some physiological/behavioral responses such as increased hormonal production, increased heart rate, and reduction in milk production have been described in a small percentage of studies. A majority of the studies focusing on these types of effects have reported short-term or no effects.

The relationships between physiological effects and how species interact with their environments have not been thoroughly studied. Therefore, the larger ecological context issues regarding physiological effects of jet aircraft noise (if any) and resulting behavioral pattern changes are not well understood.

Animal species exhibit a wide variety of responses to noise. It is therefore difficult to generalize animal responses to noise disturbances or to draw inferences across species, as reactions to jet aircraft noise appear to be species-specific. Consequently, some animal species may be more sensitive than other species and/or may exhibit different forms or intensities of behavioral responses. For instance, wood ducks appear to be more sensitive and more resistant to acclimation to jet aircraft noise than Canada geese in one study. Similarly, wild ungulates seem to be more easily disturbed than domestic animals.

The literature does suggest that common responses include the “startle” or “fright” response and, ultimately, habituation. It has been reported that the intensities and durations of the startle response decrease with the numbers and frequencies of exposures, suggesting no long-term adverse effects. The majority of the literature suggests that domestic animal species (cows, horses, chickens) and wildlife species exhibit adaptation, acclimation, and habituation after repeated exposure to jet aircraft noise and sonic booms.

Animal responses to aircraft noise appear to be somewhat dependent on, or influenced by, the size, shape, speed, proximity (vertical and horizontal), engine noise, color, and flight profile of planes. Helicopters also appear to induce greater intensities and durations of disturbance behavior as compared to fixed-wing aircraft. Some studies showed that animals that had been previously exposed to jet aircraft noise exhibited greater degrees of alarm and disturbance to other objects creating noise, such as boats, people, and objects blowing across the landscape. Other factors influencing response to jet aircraft noise may include wind direction, speed, and local air turbulence; landscape structures (i.e., amount and type of vegetative cover); and, in the case of bird species, whether the animals are in the incubation/nesting phase.

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APPENDIX D
SUPPORTING NOISE STUDY

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Noise Study
for Basing F-15EX Eagle II
First Operational Combat Squadron
at the Portland Air National Guard Installation,
Portland, Oregon

SEMPER VIGILANS

January 2024

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ACRONYMS AND ABBREVIATIONS

%	percent
142 WG	142nd Fighter Wing
A/B	Afterburner
AAD	Average Annual Day
AEDT	Aviation Environmental Design Tool
AGL	Above Ground Level
ANG	Air National Guard
ANSI	American National Standards Institute
ASA	Acoustical Society of America
ATCT	Air Traffic Control Tower
DAF	Department of the Air Force
dB	Decibel
dBA	A-weighted decibel
DNL	Day-Night Average Sound Level
DNWG	Department of Defense Noise Working Group
DoD	Department of Defense
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FICON	Federal Interagency Committee on Noise
Hz	Hertz
IFR	Instrument Flight Rules
kPa-s/m^2	kilopascal-seconds per square meter
L_{dnmr}	Onset-Rate Adjusted Monthly Day-Night Average A-weighted Sound Level
L_{eq}	Equivalent Sound Level
L_{max}	Maximum Sound Level
MOA	Military Operations Area
MRNmap	Military Operating Area and Range Noise Model
MSL	mean sea level
NED	National Elevation Dataset
NEM	Noise Exposure Map
OPSNET	Operations Network
NGB	National Guard Bureau
PA	Probability of Awakening
PAA	Primary Aerospace Vehicle Authorized
PDX	Portland International Airport
POI	Point of Interest
SEL	Sound Exposure Level
SI	Straight In
SUA	Special Use Airspace
TAF	Terminal Area Forecast
U.S.	United States
USGS	United States Geological Survey
W-	Warning Area

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1.0 INTRODUCTION

1.1 BACKGROUND

The United States (U.S.) Department of the Air Force (DAF) and National Guard Bureau (NGB) propose to maintain the combat capability of the Air National Guard (ANG) by recapitalizing the remaining F-15C aircraft, which are being retired due to age and associated maintenance costs. The NGB is the lead agency for the Proposed Action and is responsible for the scope and content of the Environmental Assessment (EA) while the Federal Aviation Administration (FAA) is serving as a cooperating agency. This study addresses the 142nd Wing (142 WG) located at Portland International Airport (PDX) in Portland, Oregon (Figure 1-1). This noise study is in support of the beddown, operation, and associated infrastructure construction of one squadron of F-15EX Eagle II (F-15EX) aircraft at PDX. Figure 1-2 depicts the 142 WG's associated training airspace, which would be utilized by the F-15EX.

In situations that require the preparation of a noise analysis in accordance with FAA Order 1050.1F, information in forecasts is a key data point when preparing this type of analysis under NEPA. Airports can rely on a forecast they prepare, and is approved by the FAA, or seek approval from the FAA to use the Terminal Area Forecast (TAF), which is issued annually and projects civilian and commercial operations into the near future, and these projections are utilized to determine operations levels associated with the noise impact analysis. However, operational data based on a TAF was not utilized to inform development of the inputs for the noise modeling and subsequent noise impact analysis described in this noise study. Instead, the NGB relied upon the 'best available information' at the time of preparing this analysis, which was a combination of civilian aircraft operations as modeled in the prior 2010 PDX Noise Exposure Map (NEM) update completed under 14 CFR Part 150 and average historical civilian operations levels from the FAA Operations Network (OPSNET) for the period of 2017 to 2019. As described in this study, the 2010 PDX NEM update 2017 forecast condition civilian operations were used, and then scaled to a three-year historical average of recorded operations levels in the FAA OPSNET at PDX from 2017-2019. This scaling was done due to significant changes in civil air traffic associated with COVID-19 at PDX that were not reflected in the 2010 PDX NEM update. This study assumed that the three-year historical average of civilian operations at PDX as recorded in the FAA OPSNET from 2017-2019 was representative of when civilian air traffic associated with this action would return to pre-COVID conditions and represented the 'best available' data source from which to forecast civilian operations at the time the proposed action or alternatives would be implemented. This study also assumed that there would not be substantial additional growth in civilian operations at PDX above and beyond the pre-COVID conditions at the time the proposed action or alternatives would be implemented. Thus, the No Action Alternative for this study and associated EA was assumed to be equivalent to the existing conditions prior to COVID interruptions in terms of aircraft and PDX airfield operations.

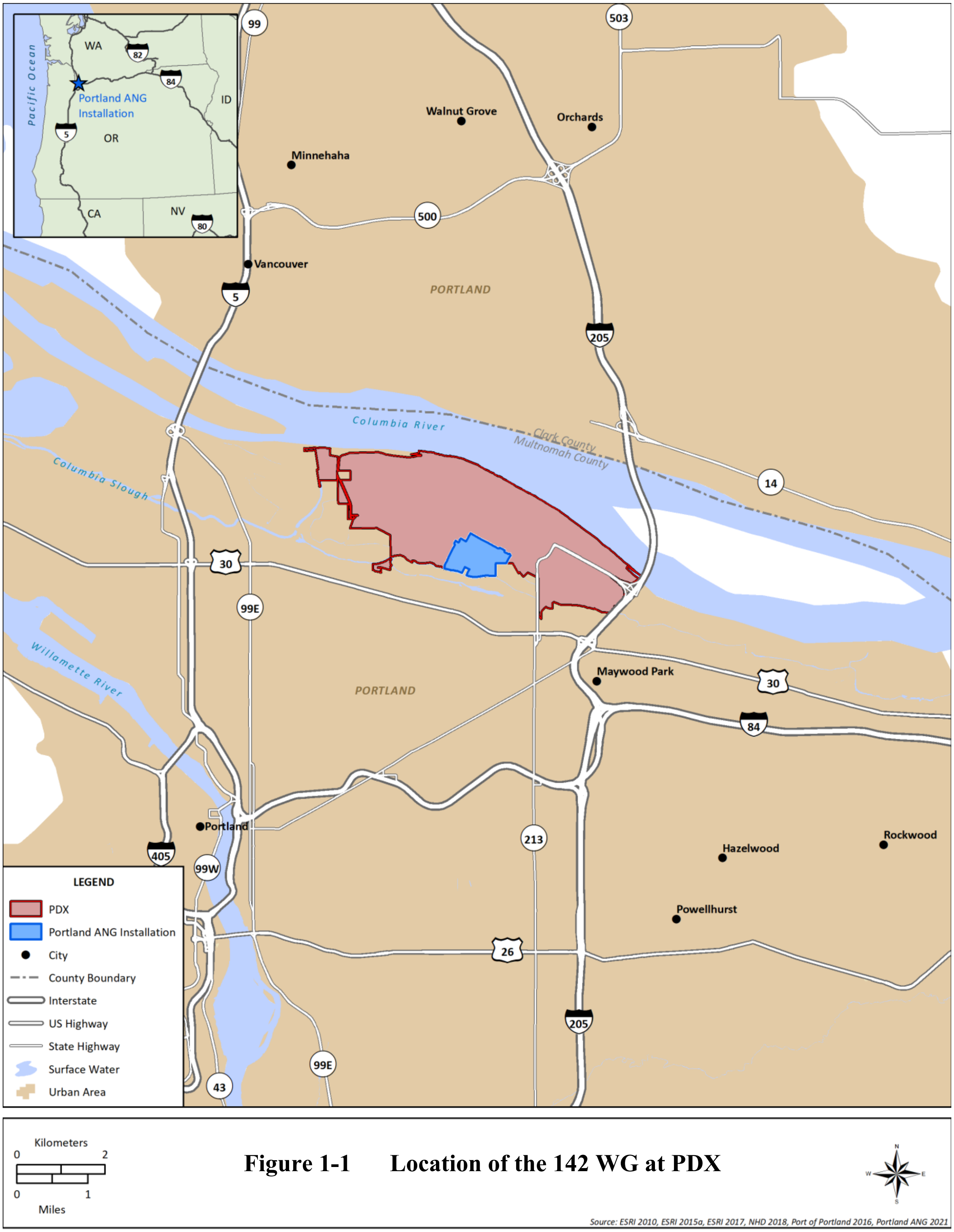


Figure 1-1 Location of the 142 WG at PDX

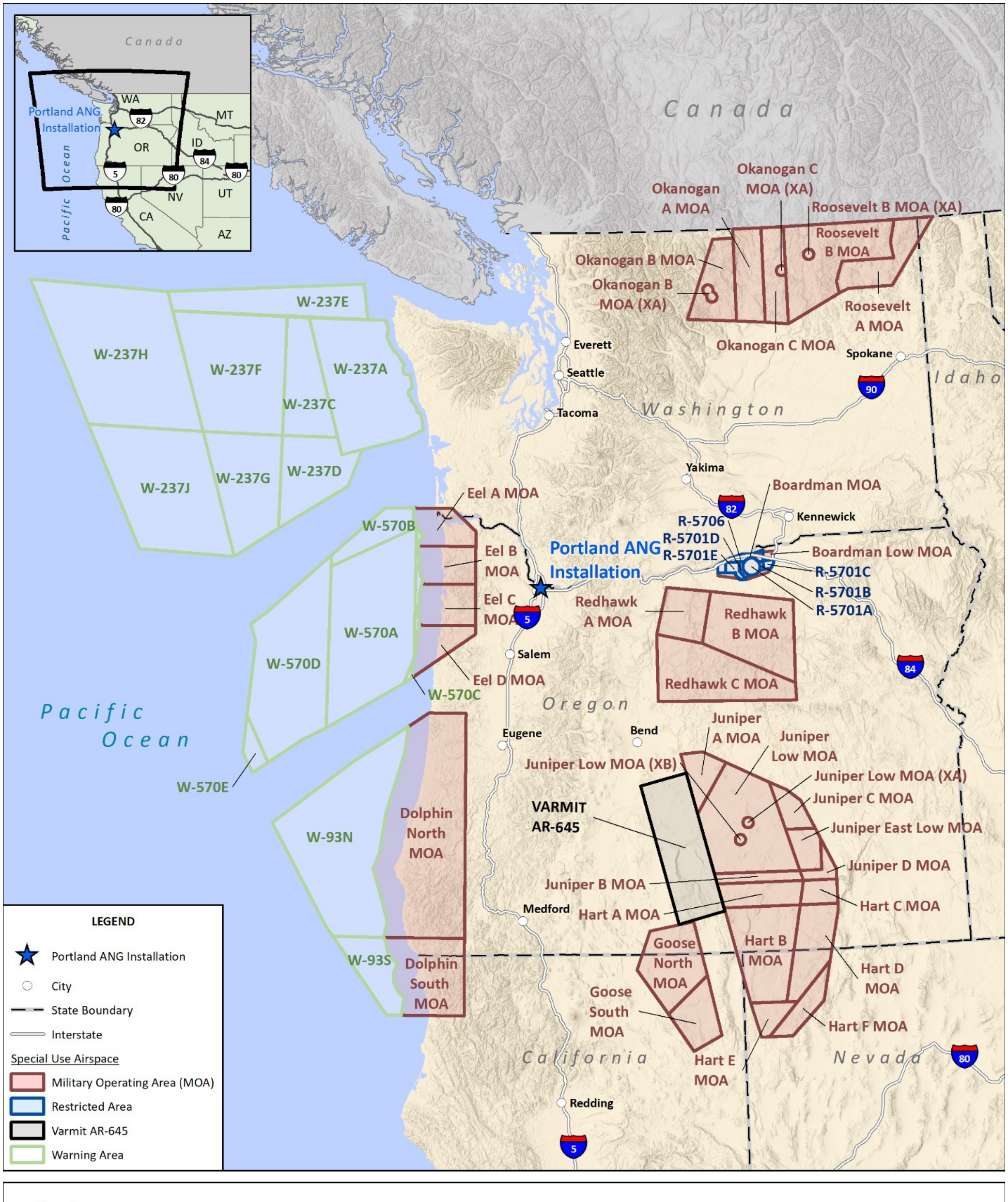


Figure 1-2 Airspace Associated with the 142 WG at PDX

Source: ESRI 2015a, ESRI 2015b, ESRI 2017, FAA 2022, NGA 2017, Portland ANG 2021

Though the analysis of aircraft (military and civil) noise impacts was completed during the development of this study, updated civil aircraft operations data became available for 2022 in the FAA 2022 TAF prior to the planned date for the publication of the associated draft EA for public review. Therefore, before publishing the draft EA for the public review period, the NGB in coordination with the FAA, determined it was appropriate to consider if this updated civil aircraft operations data would change the results of the noise analysis, and conducted a comparative review. Section 7.0 is this study presents the additional, comparative review of the newly available 2022 civilian aircraft fleet mix and FAA 2022 TAF and evaluates their potential effects on the noise analysis presented in this study and associated draft EA to best inform both the public and decision makers. This review found that the updates to projections of civil aircraft operations and fleet mix would result in a reduction in noise impacts as shown in Section 7.0 of this study. Therefore, noise impacts and the conclusions based upon use of the FAA 2022 TAF and 2022 civilian aircraft fleet mix would not substantially change from those currently presented in this study and associated draft EA. Estimated changes in acreages and number of individuals affected utilizing the FAA 2022 TAF and 2022 civilian fleet mix can be found in Section 7.0 of this study.

Military flight operations were modeled with the Department of Defense's (DoD) approved Noisemap software based on interviews with members of the 142 WG to reflect current operational data for based military operations that are anticipated to continue unchanged into the near future. The civil aircraft and transient military modeling utilized the previously prepared 2017 Part 150 analysis, which was converted into an Aviation Environmental Design Tool (AEDT) version 3e study with operations scaled by aircraft group. Fleet mix and stage lengths were maintained identical to those in the Part 150 model. Transient military operations remain consistent with the Part 150 study with only minor adjustments to flight tracks based upon military personnel input.

This analysis also includes various possible afterburner usage scenarios. The F-15EX is modeled with 5 and 20 percent afterburner usage for departures. Because of the higher thrust to weight ratio of the F-15EX, when compared to the existing F-15C under both afterburner and non-afterburner conditions, the need for afterburner power would likely decrease. However, this analysis conservatively assumes that the afterburner use by F-15EX would remain the same as existing F-15C at 5 percent of departures as well as provide noise analysis if afterburner use would increase up to 20 percent. All other flight activity would remain consistent with existing conditions.

Thus, within this Noise Study for the 142 WG, the following aircraft alternatives and afterburner usage scenarios were modeled:

- F-15C – 18 Primary Aerospace Vehicle Authorized (PAA) (existing conditions)
- F-15EX – 18 PAA (Proposed Alternative 1)
    - 5 percent afterburner usage
    - 20 percent afterburner usage
- F-15EX – 21 PAA (Proposed Alternative 2)
    - 5 percent afterburner usage
    - 20 percent afterburner usage

1.2 DOCUMENT STRUCTURE

Section 1.0 introduced this study; while Section 2.0 describes the methodology used in the analysis. Section 3.0 provides the modeling data used and the noise exposure for the current operations (existing conditions). Section 4.0 provides the modeling data used and the noise exposure for the proposed F-15EX alternatives (and their various afterburner scenarios). Section 5.0 presents conclusions and Section 6.0 presents the references.

2.0 METHODOLOGY

The DoD, a member of the Federal Interagency Committee on Noise (FICON), follows FICON recommendations on the types of metrics to describe noise exposure for environmental impact assessment (FICON 1978), while the Defense Noise Working Group (DNWG) provides guidance on military noise modeling methodology. The following subsections describe these noise metrics and noise modeling methodology. Additionally, the methodology presents noise results consistent with FAA Order 1050.1F requirements for FAA review as a cooperating agency.

2.1 NOISE MODELING AND PRIMARY NOISE METRICS

The DoD prescribes use of the Noisemap suite of computer programs (Wyle 1998; Wasmer Consulting 2006) containing the core computational programs called “NMAP,” version 7.3, and “MRNMap,” version 3.0, and the FAA’s AEDT 3e for environmental analysis of aircraft noise. For this noise study, the Noisemap suite of programs refers to BASEOPS as the input module, Noisemap as the noise model for predicting noise exposure in the installation environment, and MRNMap as the noise model used to predict noise exposure in the Special Use Airspace (SUA). Supersonic noise is estimated with BOOMAP96. NMPLOT is the tool used to combine the noise contours produced by Noisemap and AEDT into a single Noise Exposure Map (NEM). Table 2-1 presents noise modeling parameters used in this analysis. The FAA Order 1050.1F specifies AEDT for civil aircraft noise modeling and recognizes the DoD noise models for military aircraft.

Table 2-1 Noise Modeling Parameters

Software	***Analysis***	***Version***
NMAP	Airfield noise – military aircraft	7.3
AEDT	Airfield noise – civilian aircraft	3e
MRNMap	Airspace Noise (subsonic)	3.0
Parameter	***Description***	
Receiver Grid Spacing	500 ft in x and y	
Metrics	DNL (Annual Average Day basis) L_{dnmr}, SEL, L_{max}, L_{eq}, NA	
Basis	AAD Operations (NMAP/AEDT); Busiest Month (MRNMap)	
Topography		
Elevation Data Source	USGS 30m NED	
Elevation Grid Spacing	500 ft in x and y	
Impedance Data Source	USGS Hydrography DLG	
Impedance Grid spacing	500 ft in x and y	
Flow Resistivity of Ground (soft/hard)	225 kPa-s/m^2 / 100,000 kPa-s/m^2	

Noisemap Modeled Weather (Monthly Averages 2020-2022)	
Temperature	59°F
Relative Humidity	70%
Barometric Pressure	29.92 in Hg

Notes: AEDT modeling utilized standard weather conditions.
Legend: °F = degrees Fahrenheit; % = percent; AAD = Average Annual Day; AEDT = Aviation Environmental Design Tool; CDNL = C-weighted Day-Night Average Sound Level; DLG = Digital Line Graph; DNL = Day-Night Average Sound Level; ft = feet; in Hg = inches Mercury; kPa-s/m^2 = kilopascal-seconds per square meter; L_{dnmr} = Onset-Rate Adjusted Monthly Day-Night Average Sound Level; L_{eq} = Equivalent Sound Level; L_{max} = maximum sound level; m = meters; NA = Number of Events at or above a specified threshold; NED = National Elevation Dataset; SEL = Sound Exposure Level; USGS = United States Geological Survey.

Human hearing sensitivity to differing sound pitch, measured in cycles per second or hertz (Hz), varies by frequency. To account for this effect, sound measured for environmental analysis utilizes A-weighting, which emphasizes sound roughly within the range of typical speech and de-emphasizes very low and very high frequency sounds. All decibels (dB) presented in this study utilize A-weighted (dBA or dB[A]) but are presented as dB for brevity, unless otherwise noted.

The primary noise metric utilized in this analysis for noise impacts is the Day-Night Average Sound Level (L_{dn}, also written as DNL), which is A-weighted applicable for subsonic aircraft operations. DNL is a cumulative metric that includes all noise events occurring in a 24-hour period with a nighttime noise penalty applied to events occurring after 10 p.m. (2200) and before 7 a.m. (0700). The daytime period is defined as 7 a.m. (0700) to 10 p.m. (2200). An adjustment (penalty) of 10 dB is added to events occurring during the nighttime period to account for the added intrusiveness while people are most likely to be relaxing at home or sleeping. Note that “daytime” and “nighttime” in calculation of DNL always correspond to the times given above. This is often different than the “day” and “night” used commonly in military aviation, which are directly related to the times of sunrise and sunset applicable for military training in dark conditions. These times vary latitudinally, and throughout the year with the seasonal changes.

DoD Noise Program Policy (DoD Instruction 4715.13, 28 January 2020) requires the use of the DNL noise metric to describe aircraft noise exposure levels at airfields based on average annual day (AAD) averaged over 365 days for purpose of long-term compatible land use planning. Consistent with that standard, this study analyzed both military and civil aircraft operations at the airfield on an average annual basis. Flight activity in the SUA can vary throughout the year, so AAD may not always be the most informative approach for SUA. Therefore, the SUA analysis considers the ‘busiest month’ to better reflect flight activity during an average day of the ‘worst month’ of the year. FAA Order 1050.1F specifies DNL for all aircraft noise impact analysis calculated on an average annual day basis.

Assessment of noise associated with a proposed action requires prediction of future conditions that cannot be easily measured until after implementation or would require excessive cost or time to measure. The solution to this includes the use of computer software to simulate the future conditions, as detailed in the following sections. A recent congressionally-mandated study compared the accuracy of noise modeling methods described in this section to real-world field measurements. The report found that DoD-approved noise models operate as intended providing accurate prediction of noise exposure levels from aircraft operations for use in impact assessments and long-term land use planning (Department of the Navy 2021). The study also determined that the largest variable in any aircraft noise-modeling effort is the expected operational flight parameter data, such as runway and flight track utilization, altitudes at various points in the flight track, engine power settings, and other parameters.

2.1.1 Portland International Airport (PDX)

2.1.1.1 Airport Facilities

Airspace

The airspace surrounding PDX, as with all airspace within the U.S. National Airspace System, is classified into a number of classes (A, B, C, D, E, and G) based on availability of air traffic control services and/or restrictions of ownership (civilian versus military). PDX is considered a Class C airport, which is positively controlled by an Air Traffic Control Tower (ATCT) that operates 24 hours daily. PDX's Class C airspace extends from the surface to 4,000 feet above ground level (AGL).

Air Traffic Control Tower

The airport's ATCT is an FAA facility which is staffed 24 hours daily. The ATCT, located on an airfield, is responsible for the movement of aircraft on and around the immediate airport.

Runways

PDX is comprised of two runways parallel to one another oriented in a northwest to southeast direction and a crosswind runway oriented northeast and southwest, as depicted in Figure 2-1. The majority of aircraft operations and all DoD aircraft operations occur along the longer parallel Runways 10L/28R and 10R/28L. A minority of civil general aviation aircraft operations occur on the shorter Runway 03/21.

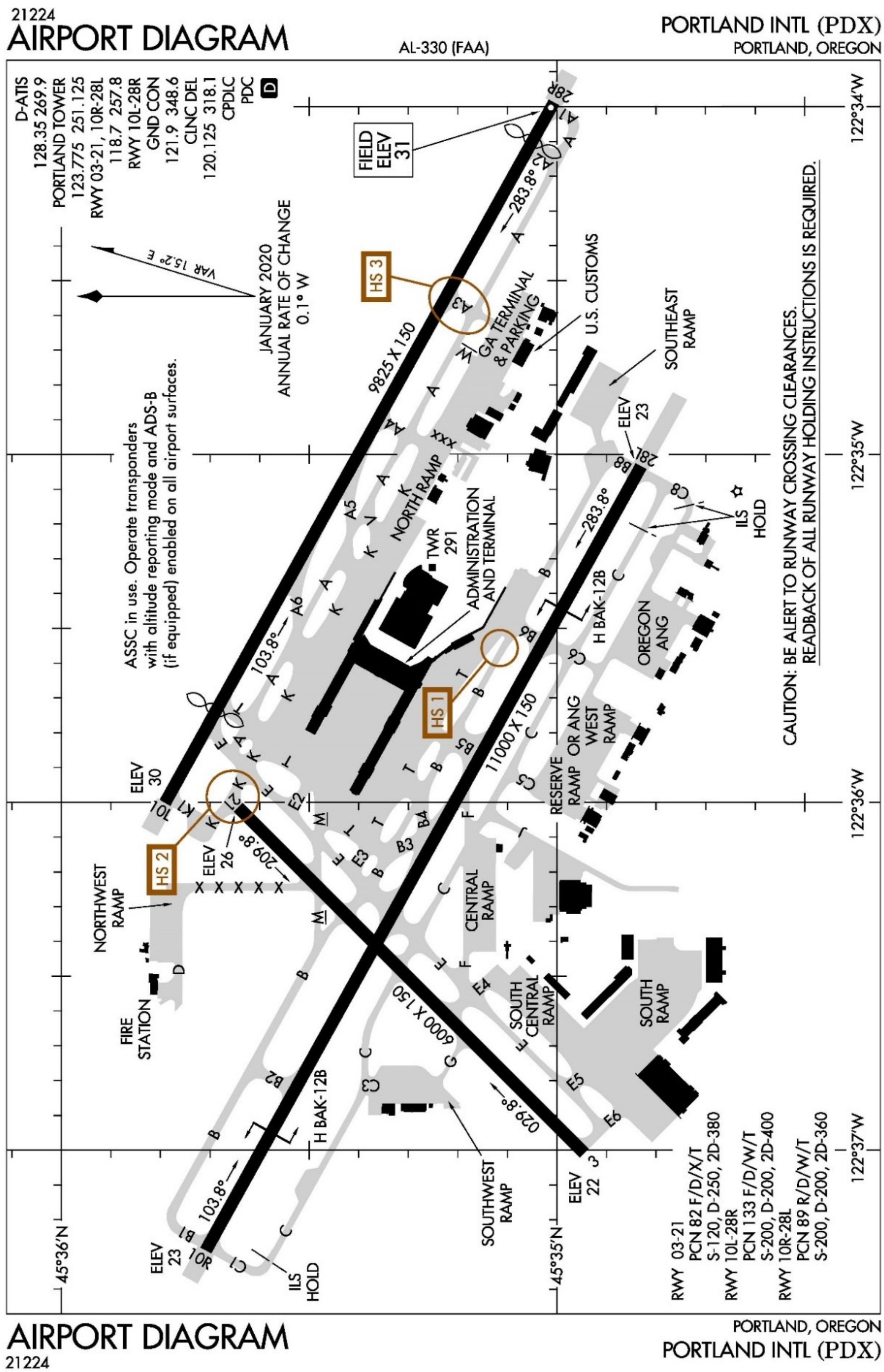


Figure 2-1 Airport Layout Diagram

Aircraft Noise Modeling

Modeling of military aircraft noise using the Noisemap software suite was accomplished by determining and building each aircraft's flight tracks (paths over the ground) and profiles, which includes altitude, airspeed, power settings, and other flight conditions. This information was developed iteratively with a team primarily made up of representatives from the installation's flying squadrons, air traffic controllers, the PDX airport manager, as well as the NGB. The data was compiled in a data validation package, reviewed by the team, and approved for use by the NGB team prior to modeling (NGB 2022). This data has been combined with the numbers of each type of operation by aircraft/track/profile, local climate, terrain surrounding the airfield, and similar data related to aircraft engine runs that occur at specific locations on the ground (e.g., pre- and post-flight and maintenance activities). Standard noise modeling methodology was carried forward adhering to both FAA and DoD noise modeling criteria. For instance, AEDT utilized the standard runway endpoints, weather, and aircraft flight profiles. Appendix A shows summary flight tracks, as well as representative flight profiles for the aircraft operations modeled.

Noisemap's ability to account for the effects of sound propagation includes consideration of varying terrain elevation, taken from the U.S. Geological Survey (USGS) National Elevation Dataset (NED), and ground impedance conditions, taken from USGS Hydrography data. In this case, "soft ground" (e.g., grass-covered ground) is modeled with a flow resistivity of 225 kilopascal-seconds per square meter (kPa-s/m^2) and "hard ground" (in this case, water) is modeled with a flow resistivity of 100,000 kPa-s/m^2. For ambient temperature, humidity, and pressure, each month was assigned a temperature, relative humidity, and barometric pressure from data available for that month for the years 2020 through 2022. Noisemap then determined and used the month with the weather values that produced the median results in terms of noise propagation effect (with the values noted in Table 2-1). Conversely, AEDT used standard weather conditions.

Table 2-2 details runway parameters available in AEDT and denotes which runways were utilized in this study along with the standard AEDT conditions for elevation, glide slope, and threshold crossing height. No helipads were modeled and helicopter operations were modeled on runways.

Table 2-2 Runway Modeling Parameters

Runway End[1]	*Latitude*	*Longitude*	*Elevation (ft MSL)*	*Glide Slope*	*Threshold Crossing Height (ft AGL)*	*Used in Case*
03C	45.58242335	-122.616814	21.5	3	35	yes
21C	45.59405252	-122.600239	26.7	3.6	32	yes
10LC	45.59651534	-122.6000137	29	3	60	yes
28RC	45.58343555	-122.5664556	28.7	3	65	yes
10R	45.5951498	-122.6214729	22.4	3	71	yes
28L	45.58051458	-122.583903	22.5	3	60	yes
03	45.58242335	-122.616814	21.5	3	35	no
21	45.59599548	-122.5974691	26.7	3.6	32	no
10L	45.59479904	-122.5956083	29	3	60	no
28R	45.58415089	-122.5682896	28.7	3	65	no
11	45.59071167	-122.6362643	20	3	60	no
29	45.57485322	-122.595533	20	3	60	no

Runway End[1]	*Latitude*	*Longitude*	*Elevation (ft MSL)*	*Glide Slope*	*Threshold Crossing Height (ft AGL)*	*Used in Case*
Runway	*Length (ft)*	*Width (ft)*	*Used in Case*			
03C-21C	5,999	150	yes			
10LC-28RC	9,826	150	yes			
10R-28L	11,000	150	yes			
03-21	7,001	150	no			
10L-28R	7,999	150	no			
11-29	11,925	200	no			

Note: Helicopter operations modeled to runways
Legend: AGL = above ground level; ft = foot/feet; MSL = mean sea level

The results of the DoD's Noisemap and FAA's AEDT modeling were combined for all aircraft activity at the airport for both existing conditions and proposed future conditions. The civil modeling operations within AEDT are held constant throughout all scenarios analyzed because nothing associated with the Proposed Action would affect civil aircraft operations, only the military component modeled with Noisemap. Additionally, this allows the difference between scenarios to be solely attributable to the F-15EX. The combined noise exposure is presented in terms of contours, i.e., which are lines of equal DNL value. DNL contours of 65 to 85 dB, presented in 5-dB increments, provide a graphical depiction of the aircraft noise environment in the vicinity of the airfield. In addition to the DNL plots, specific noise sensitive locations (schools, hospitals, places of worship, and residential neighborhoods) have been identified in the surrounding communities referred to as representative Points of Interest (POIs) in accordance to DoD guidance (DNWG 2009a). FAA Order 1050.1F uses different terminology and instead considers 'noise sensitive areas' or 'noise sensitive uses.' Table 2-3 lists and Figure 2-2 presents the 39 selected representative POIs used for this study. Section 2.2 provides a discussion on the supplemental metric noise calculations performed for each POI.

2.1.2 Special Use Airspace

In the SUA environment, the Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}) serves as the primary noise metric, with predicted sound levels based on the month with the most aircraft activity in each airspace unit to account for the sporadic nature of operations. L_{dnmr} is the U.S. Government standard for modeling and predicting the cumulative noise exposure and assessing community noise impacts in the SUA environment. L_{dnmr} is identical to the DNL except that an additional penalty is applied to account for the startle effect due to the quick increase in sound level created by aircraft operating at low altitudes and high rates of speed (over 400 knots). The penalty is based on how quickly the sound increases when heard by an observer on the ground, described as 'rise-time' rate, and ranges for 0 to up to 11 dB.

Table 2-3 POIs in the Vicinity of PDX

Map ID	*Point Type*	*Named POI*[1]
PO-C-01	Census Tract Centroid	Census Tract 424
PO-C-02	Census Tract Centroid	Census Tract 426.01
PO-C-03	Census Tract Centroid	Census Tract 429
PO-C-04	Census Tract Centroid	Census Tract 430
PO-C-05	Census Tract Centroid	Census Tract 431
PO-C-06	Census Tract Centroid	Census Tract 412.07
PO-C-07	Census Tract Centroid	Census Tract 412.08
PO-C-08	Census Tract Centroid	Census Tract 36.01
PO-C-09	Census Tract Centroid	Census Tract 36.02
PO-C-10	Census Tract Centroid	Census Tract 36.03
PO-C-11	Census Tract Centroid	Census Tract 74
PO-C-12	Census Tract Centroid	Census Tract 75
PO-C-13	Census Tract Centroid	Census Tract 29.01
PO-C-14	Census Tract Centroid	Census Tract 76
PO-C-15	Census Tract Centroid	Census Tract 77
PO-C-16	Census Tract Centroid	Census Tract 78
PO-C-17	Census Tract Centroid	Census Tract 79
PO-C-18	Census Tract Centroid	Census Tract 95.02
PO-C-19	Census Tract Centroid	Census Tract 95.01
PO-H-01	Healthcare Facility	PeaceHealth Southwest Medical Center
PO-H-02	Healthcare Facility	Park Forest Care Center
PO-R-01	Residential Area	Census Tract 72.01
PO-R-02	Residential Area	North Lotus Beach Drive
PO-R-03	Residential Area	Northeast Blue Heron Drive & Northeast 20th Avenue
PO-R-04	Residential Area	Northeast Marine Drive & Northeast 138th Avenue
PO-R-05	Residential Area	Census Tract 102
PO-S-01	School	Harney Elementary School
PO-S-02	School	Slavic Christian Academy
PO-S-03	School	Lieser School, Early Childhood Education Center, Vancouver Home Connection, and Vancouver Virtual Learning Academy
PO-S-04	School	Riverview Elementary School
PO-S-05	School	Bridges Middle School
PO-S-06	School	Woodlawn Elementary School
PO-S-07	School	Faubion Elementary School
PO-S-08	School	Portland Community College - Portland Metropolitan Workforce Training Center
PO-S-09	School	Trinity Lutheran School
PO-S-10	School	Community Transitional School
PO-S-11	School	Scott Elementary School
PO-S-12	School	Helensview High School
PO-S-13[2]	School	Former site of ITT Technical Institute and University of Phoenix

Notes: [1]The census tracts represent neighborhoods surrounding PDX where noise sensitive locations (such as residences, schools, places of worship, etc. are likely to occur).
[2]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.

Legend: ID = Identification; PDX = Portland International Airport; POI = Point of Interest.

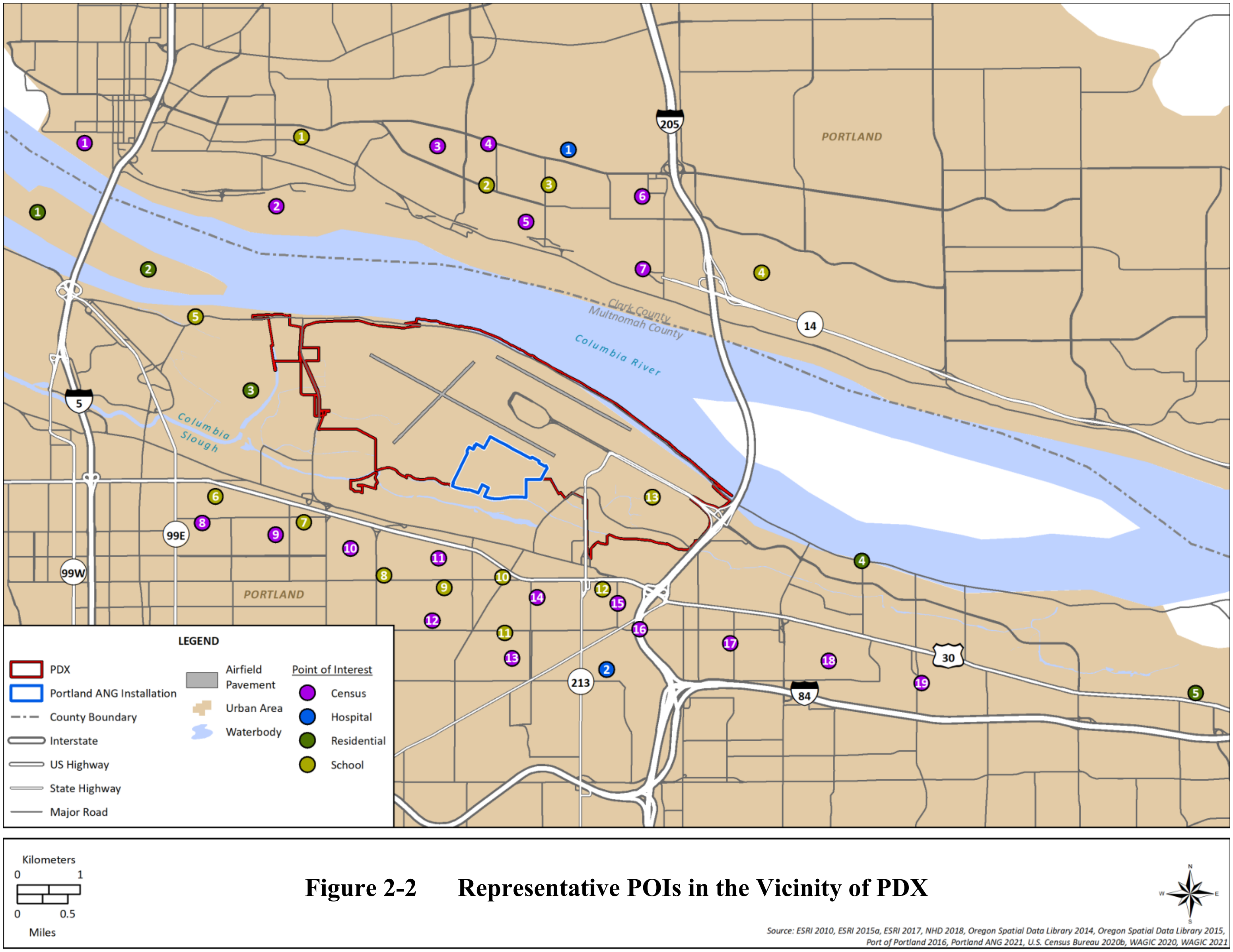


Figure 2-2 Representative POIs in the Vicinity of PDX

Source: ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Oregon Spatial Data Library 2014, Oregon Spatial Data Library 2015, Port of Portland 2016, Portland ANG 2021, U.S. Census Bureau 2020b, WAGIC 2020, WAGIC 2021

If there are large variations in the distribution of airspace utilization from one month to the next, then L_{dnmr} would be based upon the month with the most aircraft activity in each airspace unit to account for the sporadic nature of operations. However, the airspace training considered in this study for the existing F-15C and proposed F-15EX remains relatively consistent, so an average month of training forms the basis for the airspace noise analysis. Existing conditions noise levels were obtained through prior National Environmental Policy Act analysis in the 2017 *Environmental Impact Statement (EIS) for Proposed Establishment and Modification of Oregon Military Training Airspace*, which assessed the potential environmental impacts associated with airspace modifications for F-15 training and utilization (Oregon ANG 2017). Changes to the noise levels due to the proposed replacement of F-15C with F-15EX was estimated with the MRNmap software.

2.2 ADDITIONAL (SUPPLEMENTAL) NOISE METRICS

While a cumulative metric, such as DNL is appropriate to predict the overall noise environment at airfields (and the airspace equivalent [L_{dnmr}] in the vicinity of SUA), a full description of noise impacts to noise sensitive locations requires additional metrics. The DoD expands upon DNL with the following supplemental metrics described in the DNWG guidelines (DNWG 2009a):

- A measure of the greatest sound level generated by single aircraft events: Maximum Sound Level (L_{max}),
- A combination of the sound level and duration: Sound Exposure Level (SEL),
- Number of Events at or above a specified threshold,
- Equivalent Sound Level (L_{eq}),
- Time Above a specified level, and
- Probability of Awakening (PA).

Number of Events at or above a specified threshold, Time Above a specified level, and L_{eq} use a specified period of time that can include an average 24-hour day, DNL daytime, DNL nighttime, school day, or other time period appropriate for the analysis. Details on the use of these supplemental metrics in this study are described in the following sections.

The FAA relies solely on DNL as the primary noise metric for aircraft noise impact analysis (FAA Order 1050.1F) so the supplemental metrics provided in this study apply specifically to DoD requirements (DNWG 2009a).

2.2.1 Maximum Sound Level

The highest A-weighted sound level measured during a single event in which the sound changes with time is called the maximum A-weighted sound level or L_{max}. L_{max} is the maximum level that occurs over one-eighth of a second and denoted as "fast" response on a sound level meter (American National Standards Institute [ANSI] 1988). Although useful in determining when a noise event may interfere with conversation, TV or radio listening, or other common activities, L_{max} does not fully describe the noise because it does not account for how long the sound is heard.

2.2.2 Sound Exposure Level

SEL combines both the intensity of a sound and its duration by providing the sound level that would contain the same sound energy of an event if occurring over a 1 second period. This means that SEL does not represent a sound level that is heard directly at any given time. However, SEL provides a much better metric for comparison of aircraft flyovers than L_{max} because it allows normalization of disparate events to their 1 second energy average. SEL values are larger than those for L_{max} for the same event because aircraft noise events last more than a few seconds.

2.2.3 Equivalent Sound Level

The L_{eq} is a "cumulative" metric that combines a series of noise events over a period of time by averaging the sound energy. The time period specified for L_{eq} is typically provided along with the value and relates to a type of activity and presented in parenthesis (e.g., $L_{eq(24)}$ for 24 hours). An $L_{eq(8)}$ is used in this study to represent a typical school day occurring from 7 a.m. (0700) to 3 p.m. (1500).

2.2.4 Potential for Hearing Loss

People exposed to high noise environments over a long period of time are at an increased risk of experiencing permanent hearing loss. Hearing loss is generally interpreted as a decrease in the ear's sensitivity to perceived sound, which can be either temporary or permanent. Various governmental organizations, including the Occupational Safety and Health Administration, have identified noise thresholds varying from 70 to 85 dB L_{eq} to protect workers with the exposure assumption of 40 hours per week over a 40-year work lifetime.

Exposure to noise for people residing in areas adjacent to airfields is quite different from a work environment. When people are indoors, the sound levels experienced decrease due to building attenuation. Additionally, when people spend time away from home, the exposure to noise from the airfield in question is removed so the Occupational Safety and Health Administration standards would tend to overpredict the hearing loss risk. By definition, DNL is equal to or greater than L_{eq}, so the DoD selected a screening threshold of 80 dB DNL of residences to ensure a conservative approach to assessing the potential for hearing loss (DNWG 2012). If residences are identified within the 80 dB DNL, or greater, additional analysis of L_{eq} should be performed.

2.2.5 Residential Speech Interference

Aircraft noise events can disrupt activities like conversation or watching television when indoor L_{max} exceeds 50 dB because word intelligibility decreases at that level (DNWG 2013a). This study determines the number of potential speech interfering events at residential POIs during a 15-hour day (from 7 a.m. [0700] until 10 p.m. [2200]) and presents the average hourly number of events.

2.2.6 Classroom Learning Interference

A noisy environment can adversely affect and interfere with classroom learning. Various governmental organizations have identified both L_{eq} and number of interfering events as suitable criteria for classroom impacts. Consistent with DoD recommendations, this study used an exterior L_{eq} of 60 dB (equivalent to 45 dB interior L_{eq} with windows open) as a screening criteria to determine schools at risk of classroom learning affects (DNWG 2009a). Locations that exceed this threshold have been further analyzed by counting the number of events per hour above an interior L_{max} of 50 dB, which equates to the highest permissible classroom level for speech intelligibility. The standard noise level reduction due to building attenuation of 15 dB for windows open and 25 dB for windows closed have been utilized to convert between exterior and interior sound levels. The duration, in minutes, that interior sound levels would exceed 50 dB has also been computed to provide an assessment of the relative time per day that students and teachers may be impacted.

2.2.7 Residential Sleep Disturbance

2.2.7.1 Background

Sleep disturbance can be caused by excessive noise, which can hinder people's ability to fall asleep or cause people to wake from sleep. A method for calculation of the PA from at least one event per night is described in ANSI/Acoustical Society of America (ASA) S12.9-2008/Part 6. The standard utilizes the estimated interior SEL caused by aircraft events along with the number of occurrences per night to calculate the PA from that event. The resulting PA estimates the percentage of the population that would be awakened at least once per night under the noise conditions assessed. For instance, 1 percent PA estimates that 1 percent of the population would be awakened. Multiple events can be combined to determine the PA for all events during a single night. ANSI recommends that only events occurring during the DNL nighttime with SELs between 50 and 100 dB should be used for this PA calculation. Data suggests that events below 50 dB do not contribute significantly to PA and the formula under-predicts PA for events over 100 dB. The DNWG for environmental impact analysis has endorsed this ANSI/ASA 2008 methodology (DNWG 2009b).

In addition to the ANSI/ASA 2008 methodology, the DNWG guidance identifies outdoor numbers of events above an SEL of 90 dB as an additional criteria for sleep disturbance analysis:

> *Currently, there are no established criteria for evaluating sleep disturbance from aircraft noise, although recent studies have suggested a benchmark of an outdoor SEL of 90 dB as an appropriate tentative criterion when comparing the effects of different operational alternatives. The corresponding indoor SEL would be approximately 25 dB lower (at 65 dB) with doors and windows closed, and approximately 15 dB lower (at 75 dB) with doors or windows open.*

As described in DNWG (2009b), comparison of exterior number of events above 90 dB SEL across multiple study scenarios allows for sleep disturbance impacts to be considered. This does make use of the same PA formula identified in ANSI/ASA 2008 but groups all events as either equal to 90 dB exterior SEL or below the threshold for consideration.

As of July 2018, the ANSI and ASA have withdrawn the 2008 standard, which formed the basis of much of the DNWG 2009b guidance:

> *The decision of Working Group S12/WG 15 to withdraw ANSI/ASA S12.9-2008/Part 6 implies that the method for calculating "at least one behavioral awakening per night" contained in the former Standard should no longer be relied upon for environmental impact assessment purposes. The Working Group believes that continued reliance on the 2008 Standard would lead to unreliable and difficult-to-interpret predictions of transportation-noise-induced sleep disturbance (ANSI/ASA 2018).*

Without a reliable and standardized method to compute PA, or updated guidance from DNWG, this study presents the sleep impact analysis utilizing the previous standard (ANSI/ASA 2008; DNWG 2009b) for environmental impact disclosure purposes. The reader is cautioned that the PA metric provides only a crude estimate because it cannot truly account for all variables that could affect a person's sleep. A comparison of existing conditions and various Proposed Action scenario awakening percentages showing large changes to PA could provide some insight on whether a particular action would be likely to increase or decrease sleep impacts. However, any additional conclusions may not be supportable.

3.0 EXISTING CONDITIONS

The following subsections detail the modeling data and the resultant noise exposure for the existing conditions at the installation as well as within the SUA associated with 142 WG operations.

3.1 INSTALLATION/AIRPORT

3.1.1 Modeling Data

Because the 142 WG operations fluctuate year to year, the flying hour program of record is used for analysis because it presents the condition that accounts for the full environmental impacts possible and is applicable for both the current year and into the foreseeable future of 2025 through 2030 (the timeline proposed for the action alternatives). The current 142 WG flying program equates to 4,848 annual airfield operations at PDX, which is broken down equally between departures and arrivals and no closed patterns, as summarized in Table 3-1. DNL nighttime F-15C operations are rare with no departures between 10 p.m. (2200) and 7 a.m. (0700) and an average of only one DNL nighttime arrival per month. Civil aircraft operations total 229,928 and account for 98 percent of all airfield operations. The civil existing conditions represents a projected condition based upon a recovery of civil operation to pre-COVID levels that would occur in the 2025 to 2030 timeframe. Within civil aircraft operations, jet airliners (such as B737 and Airbus A320 series aircraft) account for nearly half of civil activity followed by regional turbo-propeller airliners (Dash 8, BN-2, and Embraer 120) at 20 percent, and business jets (G550, Cessna 550 Citation, and Learjet 35A) at 19 percent. The development of the civil aircraft operations modeled and tabulated in Table 3-1 are discussed in the following paragraph and the appendix presents the detailed modeled civil operations by aircraft type and series and runway utilization percentages for each aircraft.

Table 3-1 Average Annual Operations under Existing Conditions

Category	*FAA Tower Category*	*Aircraft group/type*[2]	*Departures*			*Arrivals*			*Grand Total*
			Day	*Night*	*Total*	*Day*	*Night*	*Total*	
Military	Military	F-15C	2,424		2,424	2,412	12	2,424	4,848
Civil[1]	Air Carrier	Jet Airliner (Boeing 737 series, Airbus A320 series)	46,373	11,432	57,805	47,177	10,680	57,857	115,662
	Air Taxi	Bus Jet (G550, Cessna 550 Citation, Learjet 35A)	20,599	1,241	21,840	21,229	602	21,831	43,671
	Air Taxi/ General Aviation	Turboprop regional airliner (Dash 8, BN-2, Embraer 120)	21,951	1,720	23,671	21,504	2,199	23,703	47,374
	Air Taxi/ General Aviation	Two engine prop (DHC 6, Cessna 441, Beech Baron 58)	4,964	1,043	6,007	4,858	1,193	6,051	12,058
	General Aviation	Single engine prop (Piper PA-24, Cessna 206)	4,685	894	5,579	4,143	1,441	5,584	11,163
		Civil total	*98,572*	*16,330*	*114,902*	*98,911*	*16,115*	*115,026*	*229,928*
Grand Total			**100,996**	**16,330**	**117,326**	**101,323**	**16,127**	**117,450**	**234,776**

Note: [1]Aircraft types listed represent the most frequent types operating at PDX within each group.
[2]Table A-1 included in Appendix D of the noise study details operations by modeled AEDT ANP type.

Table 3-2 summarizes the PDX FAA Operations Network collected operations for calendar years 2017 through 2021. Because 2020 and 2021 were atypical years due to COVID-19 disruptions, these years have been excluded from dataset and a 3-year average of 2017 through 2019 provides the existing conditions that PDX are projected to recover to in the next few years. This represents a total of approximately 234,000 annual operations at PDX and was used to scale the prior projected 2017 scenario of the 2010 Part 150 study by aircraft category. The 3-year average of 2017 to 2019 data from the FAA OPSNET data source provided the best available data at the time to estimate the civil operations recovery into the future (2025 through 2030) to match the Proposed Action implementation schedule for impact comparison.

Table 3-2 PDX FAA Operations Network Airfield Operations

Military/ Civil	*Based or Transient*	*Category*	*2017*	*2018*	*2019*	*2020*	*2021*	*2017–2019 3-Year Average*
Military	Based	Based Total	47	3	7	36	18	19
Military	Transient	Transient Total	4,097	3,517	3,870	2,347	2,972	3,828
Military		**Total**	**4,144**	**3,520**	**3,877**	**2,383**	**2,990**	***3,847***
Civil	Based	Local Civil Total	1,266	2,247	2,537	3,517	2,878	2,017
Civil	Transient	*Air Carrier*	185,560	193,177	195,747	113,740	129,487	*191,495*
Civil	Transient	*Air Taxi*	23,166	20,661	20,634	19,981	21,644	*21,487*
Civil	Transient	*General Aviation*	14,813	14,388	15,589	11,233	13,628	*14,930*
Civil	Transient	Transient Total	223,539	228,226	231,970	144,954	164,759	227,912
Civil		**Total**	**224,805**	**230,473**	**234,507**	**148,471**	**167,637**	**229,928**
Grand Total			**228,949**	**233,993**	**238,384**	**150,854**	**170,627**	***233,775***

The use of afterburner power (A/B) for military jets depends upon the aircraft loading and weather conditions with heavy loadings and hot weather necessitating A/B from brake release until approximately the end of the runway after liftoff. F-15C aircraft are able to utilize military power for takeoff at PDX when temperatures are less than 80 degrees Fahrenheit, which amounts to 95 percent of departures throughout the year with the remaining 5 percent requiring A/B.

- F-15C Departure = 95 percent military, 5 percent A/B

Military arrivals to PDX can be first broken down between Break arrivals and Straight In (SI) arrivals. Breaks occur primarily during 4 months of the year in the summer months with clearer visibility during which 75 percent of arrivals are breaks and the remaining SI. During the other 8 months, weather conditions generally preclude break arrivals so SI arrivals constitute nearly all arrivals. On an annualized basis, 25 percent of arrivals are breaks and the remaining 75 percent SI. For noise mitigation purposes, the air traffic management primary break pattern direction occurs to the south for 98 percent of break arrivals. F-15C favor the northern parallel runway for breaks north and the southern runway for breaks to the south to avoid conflicting with departure or arrival operations on the other.

- F-15C Arrivals = 25 percent breaks, 75 percent SI
  - Break direction = 98 percent south, 2 percent north

The SI arrivals can further be split between instrument and visual arrivals. However, both SI arrival types share the same ground flight tracks in the area of interest for noise impacts in the vicinity of PDX with altitudes differing only slightly. Therefore, a single flight track and profile will be used for each runway for all SI arrivals. Section 4.0 presents these modeled flight tracks and Section 5.0 the modeled flight profiles.

Two types of closed patterns often flown by military aircraft include touch and go patterns that remain within a few nautical miles of the runway and larger Instrument Flight Rules (IFR) patterns generally extending at least 10 nautical miles from the runway. Due to noise mitigation agreements, the touch and go patterns are very rare at PDX, with fewer than one occurring each year. Because the larger IFR pattern is not flown on purpose to practice instrument landings, these events are infrequent and primarily occur at the request of air traffic control to deal with congestion where F-15C aircraft are routed out and back into the airfield along the same path as the SI arrivals. Due to rarity of IFR patterns and the co-located flight tracks and flight profiles along their lowest altitude portions, it is not necessary to split out these operations from the SI arrivals because it would not change the noise results.

The runway utilizations modeled in this study mirror the runway usage modeled in the previous Part 150 study, which are summarized in Table 3-3 for military operations. Civil runway utilization is presented in the appendix.

Table 3-3 Military Runway Utilization (All Scenarios)

Operation Type	*10L*	*10R*	*28L*	*28R*
Departure	0%	64%	30%	6%
Arrivals	0%	45%	55%	0%

Figure 3-1 represents the modeled static run-up profile locations. Consistent with the flight operations, maintenance run-up activities were modeled on an AAD basis. Table 3-4 presents the static run-up operations profiles for based aircraft at PDX. No civil aircraft maintenance run-ups were modeled in AEDT for any scenarios.

Table 3-4 Ground and Maintenance Engine Operations for Based Military Aircraft at PDX

Aircraft	*Description*	*Pad*	*Heading*	*Power (%NC)*	*Num Engines*	*Duration*	*Annual Events*	*Day/Night Split*[1]
F-15C (modeled with F-15E PW220)[2]	2 Engine Checks	Ramp	90	63% (idle)	2	9 mins	72	100% / 0%
				80%	2	1 mins	72	100% / 0%
		Ramp	90	63% (idle)	2	30 mins	34	70% / 30%
				80%	2	1 mins	34	70% / 30%
	1 Engine Checks	Ramp	90	63% (idle)	1	23 mins	524	100% / 0%
				80%	1	2 mins	524	100% / 0%
	Pre/Post flight	Ramp	90	63% (idle)	2	30 mins	2,424	100% / 0%
	Hush House Engine Runs	HH	45	63%	1	113 mins	12	100% / 0%
				80%	1	30 mins		
				90% MIL	1	40 mins		
				AB	1	8 mins		

Notes: [1]Day = 0700–2200, Night = 2200–0700.
[2]F-15C maintenance operations to be replaced by F-15EX but scaled up proportional by number of flight operations.
Legend: % = percent; %NC = percent speed of the compressor stage; AB = afterburner; MIL = 'Military power,' the greatest power setting without afterburner; PDX = Portland International Airport; Rwy = Runway.

3.1.2 Noise Exposure

3.1.2.1 Day-Night Average Sound Level Contours and Point of Interest Levels

Figure 3-2 shows the software noise modeled DNL noise contours from 65 to 85 dB in 5-dB increments for the existing conditions at PDX overlaid on gradient mapping of DNL by color shading. Noise generated from aircraft operations at PDX occurs within the airfield, over the Columbia River, and extends to cover areas to the south and southeast of the airfield. Portions of the 65 dB DNL contour extend to the northwest of the installation, but the area exposed is non-residential.

Table 3-5 shows the DNL values at each of the POIs under the existing conditions. Values range from 47 to 68 dB DNL. Most of these values are well below the DoD threshold of 65 dB DNL for land use recommendations for noise sensitive land uses with the exception of PO-S-13 representing the former site of ITT Technical Institute located approximately 1 mile southeast of PDX's primary runway, which is included in the analysis in case it is repurposed as another noise sensitive use in the near future.

3.1.2.2 Acreage, Housing, and Population

Table 3-6 shows the acreage breakdown (excluding water bodies) for PDX and the numbers of households and population exposed to each DNL range based upon a proportional distribution of households throughout each census block group. A total of 5,310 acres are exposed to 65 dB DNL or greater noise levels with 2,398 of those acres located outside of PDX property. A subset of land outside of PDX property is also exposed to greater DNL with 230 acres subjected to 70 dB or greater and 4 acres experiencing DNL of 75 dB or greater. An estimated 44 households and 133 people are exposed to 65 dB DNL or greater, and 1 of those households and 9 people are exposed to 70 dB DNL. No households or population are exposed to 75 dB DNL or greater.

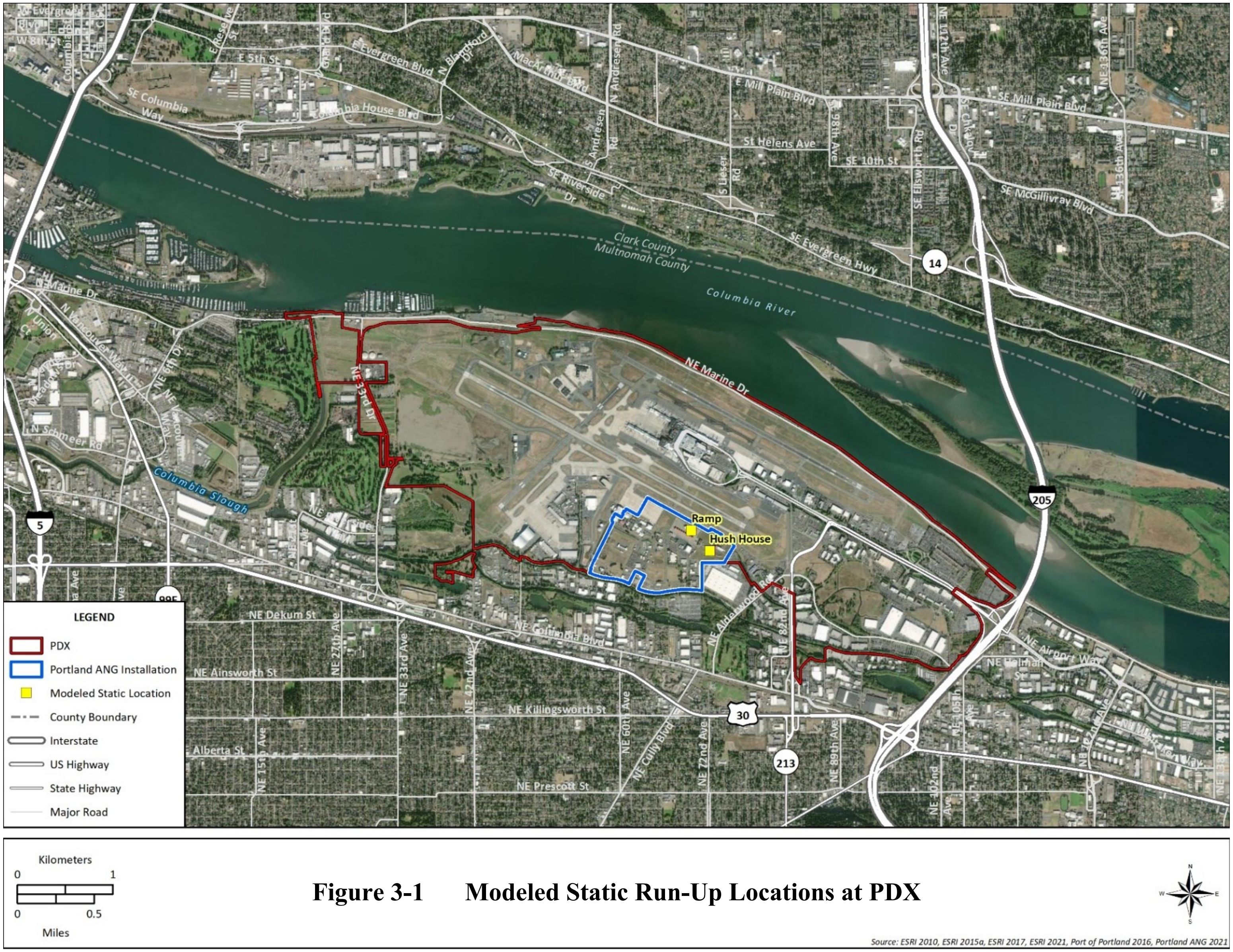


Figure 3-1 Modeled Static Run-Up Locations at PDX

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021

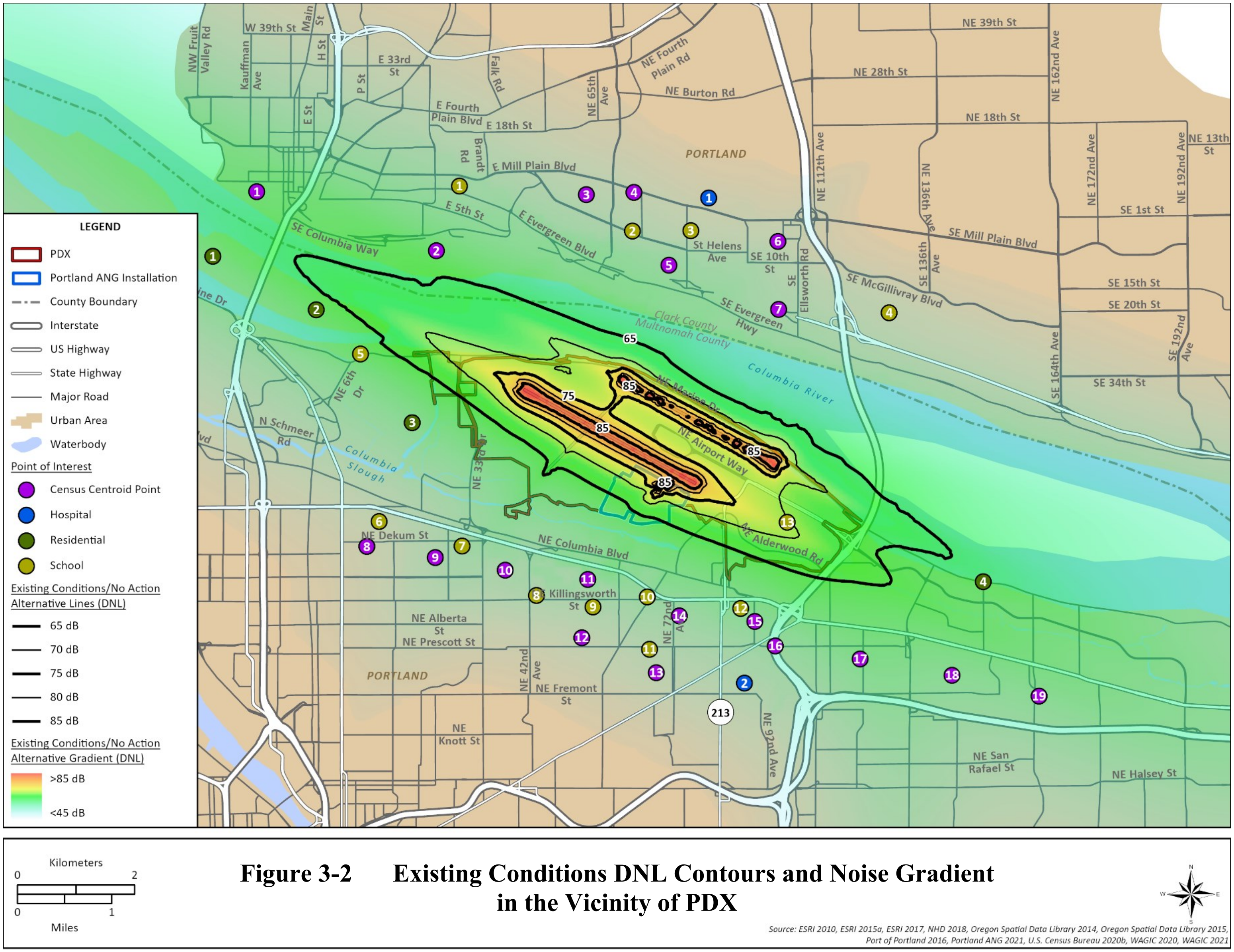


Figure 3-2 Existing Conditions DNL Contours and Noise Gradient in the Vicinity of PDX

Source: ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Oregon Spatial Data Library 2014, Oregon Spatial Data Library 2015, Port of Portland 2016, Portland ANG 2021, U.S. Census Bureau 2020b, WAGIC 2020, WAGIC 2021

Table 3-5 Existing Conditions DNL at POIs in the Vicinity of PDX

Map ID	Point Type	Named POI[1]	Existing Conditions DNL[2] (dB)
PO-C-01	Census Tract Centroid	Census Tract 424	61
PO-C-02	Census Tract Centroid	Census Tract 426.01	62
PO-C-03	Census Tract Centroid	Census Tract 429	51
PO-C-04	Census Tract Centroid	Census Tract 430	49
PO-C-05	Census Tract Centroid	Census Tract 431	55
PO-C-06	Census Tract Centroid	Census Tract 412.07	49
PO-C-07	Census Tract Centroid	Census Tract 412.08	53
PO-C-08	Census Tract Centroid	Census Tract 36.01	48
PO-C-09	Census Tract Centroid	Census Tract 36.02	52
PO-C-10	Census Tract Centroid	Census Tract 36.03	52
PO-C-11	Census Tract Centroid	Census Tract 74	55
PO-C-12	Census Tract Centroid	Census Tract 75	49
PO-C-13	Census Tract Centroid	Census Tract 29.01	50
PO-C-14	Census Tract Centroid	Census Tract 76	55
PO-C-15	Census Tract Centroid	Census Tract 77	57
PO-C-16	Census Tract Centroid	Census Tract 78	56
PO-C-17	Census Tract Centroid	Census Tract 79	59
PO-C-18	Census Tract Centroid	Census Tract 95.02	58
PO-C-19	Census Tract Centroid	Census Tract 95.01	58
PO-H-01	Healthcare Facility	PeaceHealth Southwest Medical Center	47
PO-H-02	Healthcare Facility	Park Forest Care Center	52
PO-R-01	Residential Area	Census Tract 72.01	60
PO-R-02	Residential Area	North Lotus Beach Drive	63
PO-R-03	Residential Area	Northeast Blue Heron Drive & Northeast 20th Avenue	58
PO-R-04	Residential Area	Northeast Marine Drive & Northeast 138th Avenue	63
PO-R-05	Residential Area	Census Tract 102	56
PO-S-01	School	Harney Elementary School	54
PO-S-02	School	Slavic Christian Academy	52
PO-S-03	School	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy	50
PO-S-04	School	Riverview Elementary School	50
PO-S-05	School	Bridges Middle School	62
PO-S-06	School	Woodlawn Elementary School	50
PO-S-07	School	Faubion Elementary School	54
PO-S-08	School	Portland Community College – Portland Metropolitan Workforce Training Center	53
PO-S-09	School	Trinity Lutheran School	52
PO-S-10	School	Community Transitional School	56

Map ID	*Point Type*	*Named POI[1]*	*Existing Conditions DNL[2] (dB)*
PO-S-11	School	Scott Elementary School	51
PO-S-12	School	Helensview High School	58
PO-S-13[3]	School	Former Site of ITT Technical Institute and University of Phoenix	**68**

Notes: [1]The census tracts represent neighborhoods surrounding BAF where noise sensitive locations (such as residences, schools, places of worship, etc. are likely to occur.
[2]Bold represents points exposed to DNL of 65 dB or greater.
[3]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.
Legend: dB = decibel; DNL = Day Night Average Sound Level; ID = Identification; PDX = Portland International Airport; POI = Point of Interest.

Table 3-6 Existing Conditions Noise Exposure Acreage in the Vicinity of PDX

DNL Band (dB)	*Existing Conditions Acreage*		
	On Airport	*Off Airport*	*Total*
65–70	2,913	2,398	5,310
70–75	2,080	230	2,310
75–80	917	4	920
80–85	455	0	455
85+	195	0	195
Total >65dB	**2,913**	**2,398**	**5,310**

Legend: dB = decibel; DNL = Day-Night Average Sound Level; PDX = Portland International Airport.

The population and household analysis reviewed census block groups and included all households and population for each block group completely within each DNL contour band. For block groups partially within a DNL contour band, the number of households and population were scaled based upon the proportion of block group area within each DNL contour band from 65 to 80 dB because households in these areas are generally equally distributed throughout each block group. Households are counted manually for DNL bands of 80 dB and above because populations in these high noise areas are often not evenly distributed and 80 dB DNL is the threshold to screen for the potential for hearing loss analysis. Table 3-7 lists estimated households and population off-base that are currently exposed to each DNL contour band under existing conditions. An estimated 44 households and 133 people are exposed to 65 dB DNL or greater, and 1 of those households and 9 people are exposed to 70 dB DNL. No households or population are exposed to 75 dB DNL or greater.

Table 3-7 Existing Conditions Estimated Households and Population in the Vicinity of PDX

DNL Band (dB)	*Existing Conditions*	
	Households	*Population*
65–70	44	133
70–75	1	9
75–80	0	0
80–85	0	0
85+	0	0
Totals	**44**	**133**

Legend: dB = decibel; DNL = Day Night Average Sound Level; PDX = Portland International Airport.

3.1.2.3 Classroom Learning Interference

Table 3-8 presents the existing conditions for classroom learning interference for schools S-01 through S-13. The classroom learning interference metrics for all other POIs are presented to address any daycare facilities that could occur near or operated out of residences. The school screening threshold of 60 dB $L_{eq(8hr)}$ equates to an interior level of 45 dB $L_{eq(8hr)}$ with windows open and represents the point at which studies have found classroom learning impacts (DNWG 2009b, 2013a). Existing operations at PDX results in three school POIs, S-05 Bridges Middle School, S-12 Helensview High School, and S-13, the former site of ITT Technical Institute, experiencing exterior $L_{eq(8hr)}$ above the threshold ranging from 61 to 73 dB, which equates to interior levels with windows open of 46 to 58 dB. Additional school impact analysis involves determining the number of noise-generated speech interfering events per school day hour that exceed an interior L_{max} of 50 dB (equivalent to an exterior L_{max} of 65 dB for windows open). Number of classroom interfering events ranges from 1 to a maximum of 28 at S-13, the former site of ITT Technical Institute, as presented in Table 3-8. Time above an interior level of 50 dB (equivalent to an exterior of 65 dB for windows open) varies from 2 to 6 minutes per school day.

Table 3-8 Existing Conditions Classroom Learning Interference in the Vicinity of PDX

ID	*Location*[1]	*Outdoor $L_{eq(8hr)}$ (dB)*[2]	*Number of Speech Interfering Events per School Day Hour*[3]	*Time above interior 50 dB per 8-hour school day (minutes)*[3]
PO-S-01	Harney Elementary School	55	4	2
PO-S-02	Slavic Christian Academy	51	1	3
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy	49	1	3
PO-S-04	Riverview Elementary School	52	1	3
PO-S-05	Bridges Middle School	**65**	11	3
PO-S-06	Woodlawn Elementary School	50	1	2
PO-S-07	Faubion Elementary School	54	2	2
PO-S-08	Portland Community College - Portland Metropolitan Workforce Training Center	55	1	6
PO-S-09	Trinity Lutheran School	54	1	3

ID	*Location*[1]	*Outdoor $L_{eq(8hr)}$ (dB)*[2]	*Number of Speech Interfering Events per School Day Hour*[3]	*Time above interior 50 dB per 8-hour school day (minutes)*[3]
PO-S-10	Community Transitional School	58	1	6
PO-S-11	Scott Elementary School	53	1	3
PO-S-12	Helensview High School	**61**	4	2
PO-S-13[4]	Former Site of ITT Technical Institute and University of Phoenix	**73**	28	3

Notes: [1]Assumes 90 percent of ANG daytime operations occur during the school day; windows open condition with Noise Level Reduction of 15 dB due to building attenuation.
[2]**Bold** numbers represent schools exposed to exterior $L_{eq(8hr)}$ of greater than 60 dB, equivalent to the recommended interior threshold of 45 dB with windows open.
[3]Time above only includes military operations because the AEDT software used for civil aircraft modeling does not readily calculate this metric.
[4]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.
Legend: dBA = A-weighted decibel; ID = Identification; $L_{eq(8hr)}$ = 8-hour Equivalent Sound Level; PDX = Portland International Airport.

3.1.2.4 Non-school Speech Interference

In addition to speech interference analysis, this study considers the potential for aircraft noise to interfere with non-school speech at all POIs during the DNL daytime period. Table 3-9 presents the existing conditions for speech interference based upon the numbers of events per average hour during the DNL daytime period for both a windows open and windows closed condition. The number of speech interfering events with windows open ranges from none at 9 POIs to 16 at S-13 the former site of ITT Technical Institute. With windows closed, the number of speech interfering events ranges from none at 31 POIs to 8 at S-13, the former site of ITT Technical Institute.

Table 3-9 Existing Conditions Non-school Speech Interference Events per Average Hour in the Vicinity of PDX (Daytime)

Map ID[1]	*Named POI*	*Windows Open*[2]	*Windows Closed*[3]
PO-C-01	Census Tract 424	13	1
PO-C-02	Census Tract 426.01	10	1
PO-C-03	Census Tract 429	1	0
PO-C-04	Census Tract 430	0	0
PO-C-05	Census Tract 431	1	0
PO-C-06	Census Tract 412.07	0	0
PO-C-07	Census Tract 412.08	0	0
PO-C-08	Census Tract 36.01	1	0
PO-C-09	Census Tract 36.02	1	0
PO-C-10	Census Tract 36.03	1	0
PO-C-11	Census Tract 74	1	1
PO-C-12	Census Tract 75	0	0
PO-C-13	Census Tract 29.01	0	0
PO-C-14	Census Tract 76	1	0
PO-C-15	Census Tract 77	2	0
PO-C-16	Census Tract 78	1	0
PO-C-17	Census Tract 79	1	0
PO-C-18	Census Tract 95.02	1	0

Map ID[1]	*Named POI*	*Windows Open*[2]	*Windows Closed*[3]
PO-C-19	Census Tract 95.01	3	0
PO-H-01	PeaceHealth Southwest Medical Center	0	0
PO-H-02	Park Forest Care Center	1	0
PO-R-01	Census Tract 72.01	8	0
PO-R-02	North Lotus Beach Drive	9	1
PO-R-03	Northeast Blue Heron Drive & Northeast 20th Avenue	4	0
PO-R-04	Northeast Marine Drive & Northeast 138th Avenue	13	3
PO-R-05	Census Tract 102	3	0
PO-S-01	Harney Elementary School	2	0
PO-S-02	Slavic Christian Academy	1	0
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy	0	0
PO-S-04	Riverview Elementary School	0	0
PO-S-05	Bridges Middle School	7	1
PO-S-06	Woodlawn Elementary School	1	0
PO-S-07	Faubion Elementary School	1	1
PO-S-08	Portland Community College – Portland Metropolitan Workforce Training Center	1	0
PO-S-09	Trinity Lutheran School	1	0
PO-S-10	Community Transitional School	1	0
PO-S-11	Scott Elementary School	0	0
PO-S-12	Helensview High School	2	0
PO-S-13[4]	Former Site of ITT Technical Institute and University of Phoenix	16	8

Notes: [1]School POI included because residential areas or other noise sensitive uses are often located nearby schools for which these results would apply
[2]Assumes 15 dB Noise Level Reduction.
[3]Assumes 25 dB Noise Level Reduction.
[4]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.
Legend: ID = Identification; PDX = Portland International Airport; POI = Point of Interest.

3.1.2.5 Probability of Awakening

Analysis of the potential for sleep disturbance involves determining the number and SEL of DNL nighttime aircraft events to estimate the PA metric. As presented in Table 3-10, PA with windows open ranges from 79 percent at one location (S-13, the former site of ITT Technical Institute), 1 to 9 percent at eight locations, and a negligible PA at 30 locations. PA with windows open reduces to 63 percent at one location (S-13 ITT Technical Institute), 1 to 6 percent at five locations, and a negligible PA at 33 locations.

Table 3-10 Existing Conditions Estimated Probability of Awakening in the Vicinity of PDX

Map ID	*Named POI*[1]	*Windows Open*[2]	*Windows Closed*[3]
PO-C-01	Census Tract 424	2%	1%
PO-C-02	Census Tract 426.01	2%	1%
PO-C-03	Census Tract 429	<1%	<1%
PO-C-04	Census Tract 430	<1%	<1%
PO-C-05	Census Tract 431	<1%	<1%
PO-C-06	Census Tract 412.07	<1%	<1%
PO-C-07	Census Tract 412.08	<1%	<1%

Map ID	*Named POI[1]*	*Windows Open[2]*	*Windows Closed[3]*
PO-C-08	Census Tract 36.01	<1%	<1%
PO-C-09	Census Tract 36.02	<1%	<1%
PO-C-10	Census Tract 36.03	<1%	<1%
PO-C-11	Census Tract 74	<1%	<1%
PO-C-12	Census Tract 75	<1%	<1%
PO-C-13	Census Tract 29.01	<1%	<1%
PO-C-14	Census Tract 76	<1%	<1%
PO-C-15	Census Tract 77	<1%	<1%
PO-C-16	Census Tract 78	<1%	<1%
PO-C-17	Census Tract 79	<1%	<1%
PO-C-18	Census Tract 95.02	<1%	<1%
PO-C-19	Census Tract 95.01	<1%	<1%
PO-H-01	PeaceHealth Southwest Medical Center	<1%	<1%
PO-H-02	Park Forest Care Center	<1%	<1%
PO-R-01	Census Tract 72.01	1%	1%
PO-R-02	North Lotus Beach Drive	3%	2%
PO-R-03	Northeast Blue Heron Drive & Northeast 20th Avenue	1%	<1%
PO-R-04	Northeast Marine Drive & Northeast 138th Avenue	9%	6%
PO-R-05	Census Tract 102	<1%	<1%
PO-S-01	Harney Elementary School	<1%	<1%
PO-S-02	Slavic Christian Academy	<1%	<1%
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection and Virtual Learning Academy	<1%	<1%
PO-S-04	Riverview Elementary School	<1%	<1%
PO-S-05	Bridges Middle School	1%	<1%
PO-S-06	Woodlawn Elementary School	<1%	<1%
PO-S-07	Faubion Elementary School	1%	<1%
PO-S-08	Portland Community College – Portland Metropolitan Workforce Training Center	<1%	<1%
PO-S-09	Trinity Lutheran School	<1%	<1%
PO-S-10	Community Transitional School	<1%	<1%
PO-S-11	Scott Elementary School	<1%	<1%
PO-S-12	Helensview High School	<1%	<1%
PO-S-13[4]	Former Site of ITT Technical Institute and University of Phoenix	79%	63%

Notes: [1]Non-residential POIs included because residential areas are often located nearby other noise sensitive areas for which these results would apply.
[2]Assumes 15 dB Noise Level Reduction.
[3]Assumes 25 dB Noise Level Reduction.
[4]No current noise sensitive uses at this location because both ITT Technical Institute and University of Phoenix closed. However, this POI remains in the table in case the site is repurposed for other noise sensitive uses in the future.
Legend: < = less than; ID = Identification; PDX = Portland International Airport; POI = Point of Interest.

3.1.2.6 Potential for Hearing Loss

DoD guidance prescribes analysis of the potential for hearing loss due to elevated aircraft noise levels. The screening process begins by identifying residential areas exposed to DNL of 80 dB or greater (DNWG 2013b). As summarized in Table 3-6, no land outside of PDX is exposed to 80 dB DNL or greater, so no residents experience the potential for hearing loss under existing conditions.

3.2 SPECIAL USE AIRSPACE

As depicted in Figure 1-2, the 142 WG utilizes both over-land and over-water airspace. The following section describes the modeling data and resulting noise exposure for both subsonic and supersonic operations.

3.2.1 Modeling Data (Subsonic)

The 142 WG F-15C currently utilizes Warning Area (W-) 570 and Eel Military Operations Areas (MOA) (including AR-683 and AR 628) as the primary training areas when weather and sea states permit. W-570 is located over water beginning 12 nautical miles from the shore and minimum operating altitude in Eel MOAs are 11,000 feet above mean sea level (MSL), which reduces noise concerns at the ground level below (see Figure 1-2). Secondary training areas for the F-15C comprise Juniper/Hart MOAs and Varmit AR-645 that are utilized for over-land and low-altitude training when the primary airspace is not available with minimum altitudes of 11,000 feet MSL in the southern portion and 300 feet AGL in the north. Redhawk MOA provides backup over-land training airspace with minimum altitudes of 11,000 feet MSL. Naval Weapons System Training Facility Boardman provides primary air-to-ground inert employment training and is utilized for daytime air-to-ground strafe training with F-15C approximately 2 weeks per year. Mountain Home SUA is used for approximately 2 weeks per year, usually in conjunction with Gunfighter Flag down to ground level within the range. Additional airspace used less frequently includes Dolphin, W-93, and COD, W-237, Okanagan and Roosevelt MOAs, and Visual Route 1355.

3.2.2 Noise Exposure (Subsonic)

The 2017 *EIS for Proposed Establishment and Modification of Oregon Military Training Airspace* assessed the potential environmental impacts associated with airspace modifications for F-15 training and utilization (Oregon ANG 2017). The Proposed Action evaluated in the EIS forms the existing conditions for this noise study because current use by the primary aircraft (i.e., F-15C) remains consistent with that modeling. As described in the *EIS for Proposed Establishment and Modification of Oregon Military Training Airspace*, noise levels under the 142 WG's primary airspace, W-570 and Eel MOAs, vary from 35 to 41 dB L_{dnmr} (Oregon ANG 2017). Noise levels in the secondary airspace evaluated in the EIS, Juniper/Hart MOAs, vary from 35 to 46 dB L_{dnmr}. Noise levels in backup over-land training areas, Redhawk MOAs, each equated to 35 dB L_{dnmr} (Oregon ANG 2017).

Although DNL was not computed directly for the prior airspace analyses, DNL can be calculated by converting the numbers of modeled busiest month of L_{dnmr} to the average day of DNL. Based upon this adjustment to calculate average day DNL, it ranges from 32 to 38 dB in W-570 and Eel MOAs, 32 to 43 dB in Juniper/Hart, and 32 dB in Redhawk MOAs.

3.2.3 Modeling Data and Noise Exposure (Supersonic)

In addition to L_{dnmr}, military aircraft operating within SUA may generate sonic booms while operating at speeds greater than the speed of sound (supersonic). As described in the *EIS for Proposed Establishment and Modification of Oregon Military Training Airspace*, supersonic operations occur in the over-water training areas (W-570) at various altitudes and within the Juniper/Hart Air Traffic Control Assigned Airspace above 30,000 feet MSL with supersonic training time varying from 3 to 16.5 total hours during a typical year within each subarea of that airspace. The *EIS for Proposed Establishment and Modification of Oregon Military Training Airspace* concluded that both F-15C sub- and supersonic airspace activity would not result in significant noise impacts (Oregon ANG 2017).

4.0 PROPOSED ACTION ALTERNATIVES AND AFTERBURNER SCENARIOS

The following section details the modeling data and the resultant noise exposure for four afterburner scenarios, in which the F-15EX aircraft would replace the F-15C aircraft of the 142 WG at PDX, as described in Section 1.1. All other aircraft operations (other than the 142 WG) are assumed to remain unchanged from those described in Section 3.0, *Existing Conditions* for this analysis.

4.1 INSTALLATION

4.1.1 Modeling Data

Under this proposal, the 18 F-15C aircraft based at PDX would be replaced with either 18 or 21 F-15EX aircraft. For this analysis, two F-15EX afterburner scenarios for each of the two proposed alternatives of F-15EX aircraft basing have been modeled. Should either of the numbers of F-15EX aircraft be based at PDX, it is most likely that the F-15EX would fly approximately 5 percent of the time using afterburner on take-off, the same as existing F-15C. Though for the sake of a robust analysis, an additional scenario with 20 percent afterburner use has been analyzed. With a planned annual flying hour program of 4,500 for the 18 PAA F-15EX and an assumed sortie duration matching current F-15C at 1.7 hours, the result would be 2,647 annual proposed sorties that would occur under both Alternative 1 afterburner scenarios. Consistent with the existing conditions, some of these sorties would occur at other installations but for a conservative analysis, it has been assumed that all sorties would occur at PDX.

Each F-15EX sortie would generate a departure and arrival operation and the number of closed patterns is assumed to proportionally match the existing conditions for the F-15C closed patterns, which would remain at none, as summarized below:

Alternative 1 (A and B)

- Annual Flying hours = 4,500
- Average Sortie Duration = 1.7 hours (to match average F-15C)
- Annual Sorties = 2,647
- Annual Operations = 5,294
    - Departures = 2,647
    - Arrivals = 2,647
    - Closed Patterns = 0 (same as existing F-15C)
- Day/night operations = Assumed same as existing F-15C (night = 10 p.m.–7 a.m. [2200–0700])
    - Depart at night = none
    - Arrive at night = approximately 1 per month
    - Closed pattern at night = 0 percent (only for emergency use and often none per year)

Alternative 2 (A and B)

- Annual Flying hours = 5,250

- Average Sortie Duration = 1.7 hours (to match average F-15C)
- Annual Sorties = 3,088
- Annual Operations = 6,176
  - Departures = 3,088
  - Arrivals = 3,088
  - Closed Patterns = 0 (only for emergency use and often none per year)
- Day/night operations = Assumed same as existing F-15C (night = 10 p.m.–7 a.m. [2200–0700])
  - Depart at night = none
  - Arrive at night = approximately 1 per month
  - Closed pattern at night = 0 percent

Table 4-1a and 4-1b detail the modeled annual flight operations at PDX that would occur under Alternative 1 or Alternative 2 scenarios. Should the F-15EX be based at PDX, that would eliminate all F-15C operations and would add either 5,294 or 6,176 F-15EX flight operations per year. All other aircraft operations would remain the same as described under the existing conditions.

Table 4-1a Alternative 1A and 1B Proposed Aircraft Operations for PDX

Category	***Aircraft group/type[1]***	***Departures***			***Arrivals***			***Grand Total***
		Day	***Night***	***Total***	***Day***	***Night***	***Total***	
Military	F-15EX	2,647	0	2,647	2,633	14	2,647	5,294
Civil	All	98,572	16,330	114,902	98,911	16,115	115,026	229,928
Grand Total		**101,219**	**16,330**	**117,549**	**101,544**	**16,129**	**117,673**	**235,222**

Note: [1]Aircraft types listed represent the most frequent types operating at PDX.
Legend: PDX = Portland International Airport.

Table 4-1b Alternative 2A and 2B Proposed Aircraft Operations for PDX

Category	***Aircraft Group/Type***	***Departures***			***Arrivals***			***Grand Total***
		Day	***Night***	***Total***	***Day***	***Night***	***Total***	
Military	F-15C	3,088	0	3,088	3,073	15	3,088	6,176
Civil	All	98,572	16,330	114,902	98,911	16,115	115,026	229,928
Grand Total		101,660	16,330	117,990	101,984	16,130	118,114	236,104

Note: [1]Aircraft types listed represent the most frequent types operating at PDX.
Legend: PDX = Portland International Airport.

4.1.1.1 Departures

The principal difference between the proposed aircraft afterburner scenarios involves the use of afterburner for departure operations. The follow describes the five scenarios considered in this analysis:

- F-15EX Alternative 1A = 18 PAA F-15EX and afterburner use of 5 percent on departures (most likely)
- F-15EX Alternative 1B = 18 PAA F-15EX and afterburner use on 20 percent of departures
- F-15EX Alternative 2A = 21 PAA F-15EX and afterburner use of 5 percent on departures (most likely)
- F-15EX Alternative 2B = 21 PAA F-15EX and afterburner use on 20 percent of departures

4.1.1.2 Arrivals and Closed Patterns

The F-15EX and F-35A proposed alternatives would follow the same arrival types at similar rates proportional to the existing F-15C at PDX.

4.1.1.3 DNL Nighttime (10 p.m.–7 a.m. [2200–0700]) Operations

DNL nighttime operations at PDX would remain near zero for F-15EX with night operations comprising one arrival per month and no DNL nighttime departures.

4.1.1.4 Runway Use

The proposed F-15EX aircraft would utilize PDX runways at the same proportion as the existing conditions for the F-15C aircraft.

4.1.1.5 Maintenance or Static Operations

Tables 4-2 and 4-3 present the run-up operations profiles for F-15EX under both sets of alternatives that would replace the existing conditions for the F-15C run-ups. Note that the run-up type operations for F-15EX would not change for the analyzed 1A vs 1B or 2A vs 2B, which only affects the departure flight operations. Figure 3-1 identifies the locations modeled for existing run-up operations, which would be utilized under the proposed alternatives.

Table 4-2 F-15EX Alternative 1A and 1B Annual Maintenance and Ground Engine Runs

Aircraft	*Description*	*Pad*	*Heading*	*Power (%NC)*	*Num Engines*	*Duration*	*Annual Events*	*Day/Night Split[1]*
F-15EX (modeled with GE-129)	2 Engine Checks	Ramp	90	63% (idle)	2	9 mins	78	100%/0%
				80%	2	1 mins	78	100%/0%
		Ramp	90	63% (idle)	2	30 mins	37	70%/30%
				80%	2	1 mins	37	70%/30%
	1 Engine Checks	Ramp	90	63% (idle)	1	23 mins	571	100%/0%
				80%	1	2 mins	571	100%/0%
	Pre/Post flight	Ramp	90	63% (idle)	2	30 mins	2,647	100%/0%
	Hush House Engine Runs	HH	45	63%	1	113 mins	13	100%/0%
				80%	1	30 mins		
				90% MIL	1	40 mins		
				AB	1	8 mins		

Notes: [1]Day = 0700–2200, Night = 2200–0700.
Legend: % = percent; %NC = percent speed of the compressor stage

Table 4-3 F-15EX Alternative 2A and 2B Annual Maintenance and Ground Engine Runs

Aircraft	*Description*	*Pad*	*Heading*	*Power (%NC)*	*Num Engines*	*Duration*	*Annual Events*	*Day/Night Split[1]*
F-15EX (modeled with GE-129)	2 Engine Checks	Ramp	90	63% (idle)	2	9 mins	92	100%/0%
				80%	2	1 mins	92	100%/0%
		Ramp	90	63% (idle)	2	30 mins	43	70%/30%
				80%	2	1 mins	43	70%/30%
	1 Engine Checks	Ramp	90	63% (idle)	1	23 mins	668	100%/0%
				80%	1	2 mins	668	100%/0%
	Pre/Post flight	Ramp	90	63% (idle)	2	30 mins	3,088	100%/0%
	Hush House Engine Runs	HH	45	63%	1	113 mins	15	100%/0%
				80%	1	30 mins		
				90% MIL	1	40 mins		
				AB	1	8 mins		

Notes: [1]Day = 0700–2200, Night = 2200–0700.
Legend: % = percent; %NC = percent speed of the compressor stage.

4.1.2 Noise Exposure

4.1.2.1 Day-Night Average Sound Level Contours and Point of Interest Levels

Figure 4-1 shows the DNL noise contours from 65 to 85 dB in 5-dB increments for Alternative 1A conditions at PDX (18 PAA F-15EX with 5 percent afterburner use on departures), with a noise gradient for DNL from 55 dB and greater based upon software noise modeling. As with existing conditions, noise generated from aircraft operations at PDX would occur within the airfield, over the Columbia River, and extends to cover areas to the south and southeast of the airfield. The 65 dB and greater DNL would be largely contained within the PDX boundary or over water. The noise gradient shows how aircraft noise from PDX would continue to extend well beyond the plotted contour lines but at lower less intrusive noise levels.

Figure 4-2 shows the DNL noise contours from 65 to 85 dB in 5-dB increments for Alternative 1B conditions at PDX (18 PAA F-15EX with 20 percent afterburner use on departures), with a noise gradient for DNL from 55 dB and greater. The Alternative 1B 65 dB and greater DNL would be similar to Alternative 1A, but the contours would be wider due to the increase in afterburner departure operations and shorter in length due to afterburner departures gaining altitude quicker resulting in lower noise levels at ground level.

Figure 4-3 shows the DNL noise contours from 65 to 85 dB in 5-dB increments for Alternative 2A conditions at PDX (21 PAA F-15EX with 5 percent afterburner use on departures), with a noise gradient for DNL from 55 dB and greater. The shape of the contours would be most similar to Alternative 1A, which shares the same proportion of afterburner departures. However, the overall size of the DNL contours would increase approximately 100 to 200 feet due to the increase in operations.

Figure 4-4 shows the DNL noise contours from 65 to 85 dB in 5-dB increments for Alternative 2B conditions at PDX (21 PAA F-15EX with 20 percent afterburner use on departures), with a noise gradient for DNL from 55 dB and greater. Alternative 2B 65 dB and greater DNL would be similar to Alternative 2A, but the contours would be wider due to the increase in afterburner departure operations and shorter in length due to afterburner departures gaining altitude quicker resulting in lower noise levels at ground level.

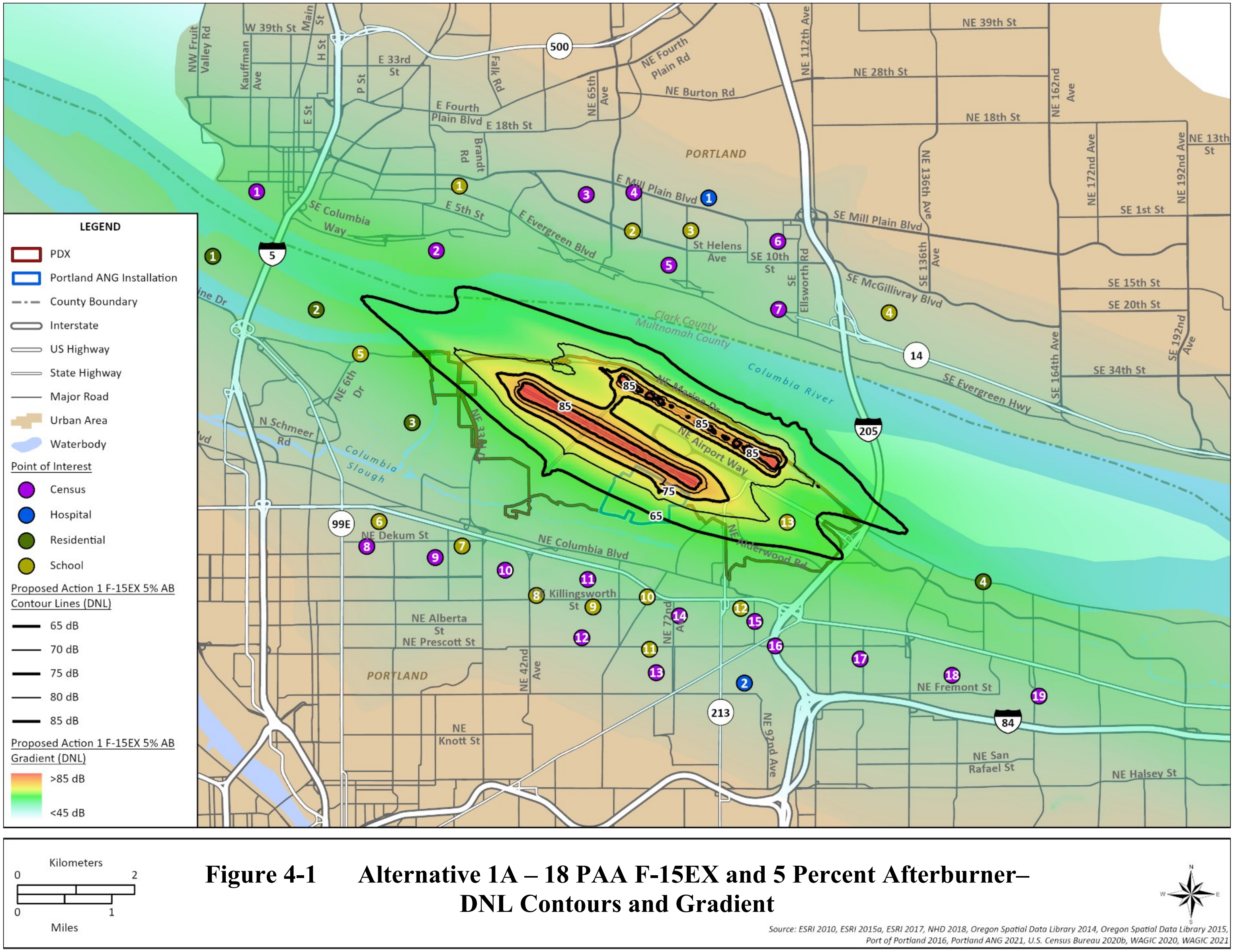


Figure 4-1 Alternative 1A – 18 PAA F-15EX and 5 Percent Afterburner–DNL Contours and Gradient

Source: ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Oregon Spatial Data Library 2014, Oregon Spatial Data Library 2015, Port of Portland 2016, Portland ANG 2021, U.S. Census Bureau 2020b, WAGIC 2020, WAGIC 2021

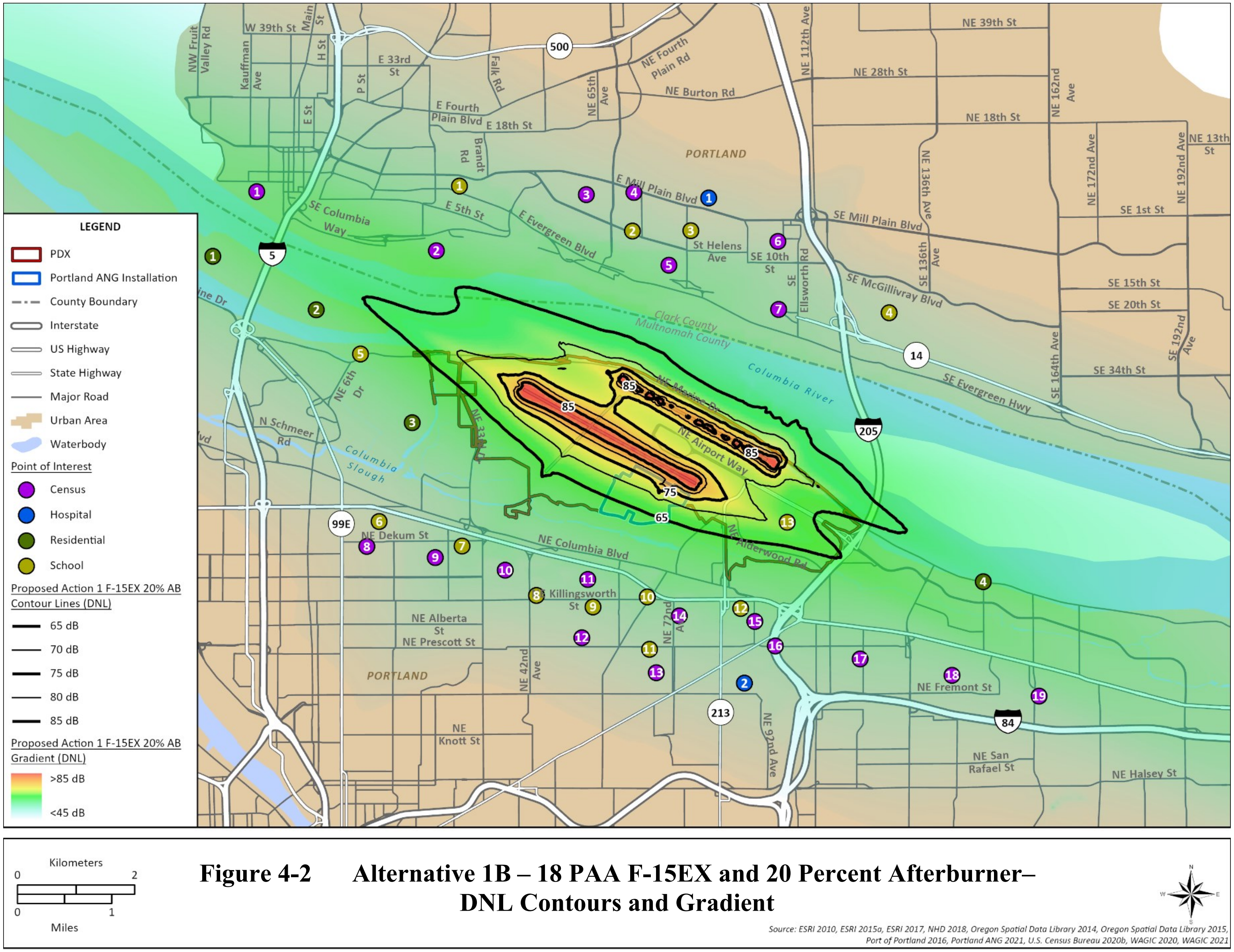
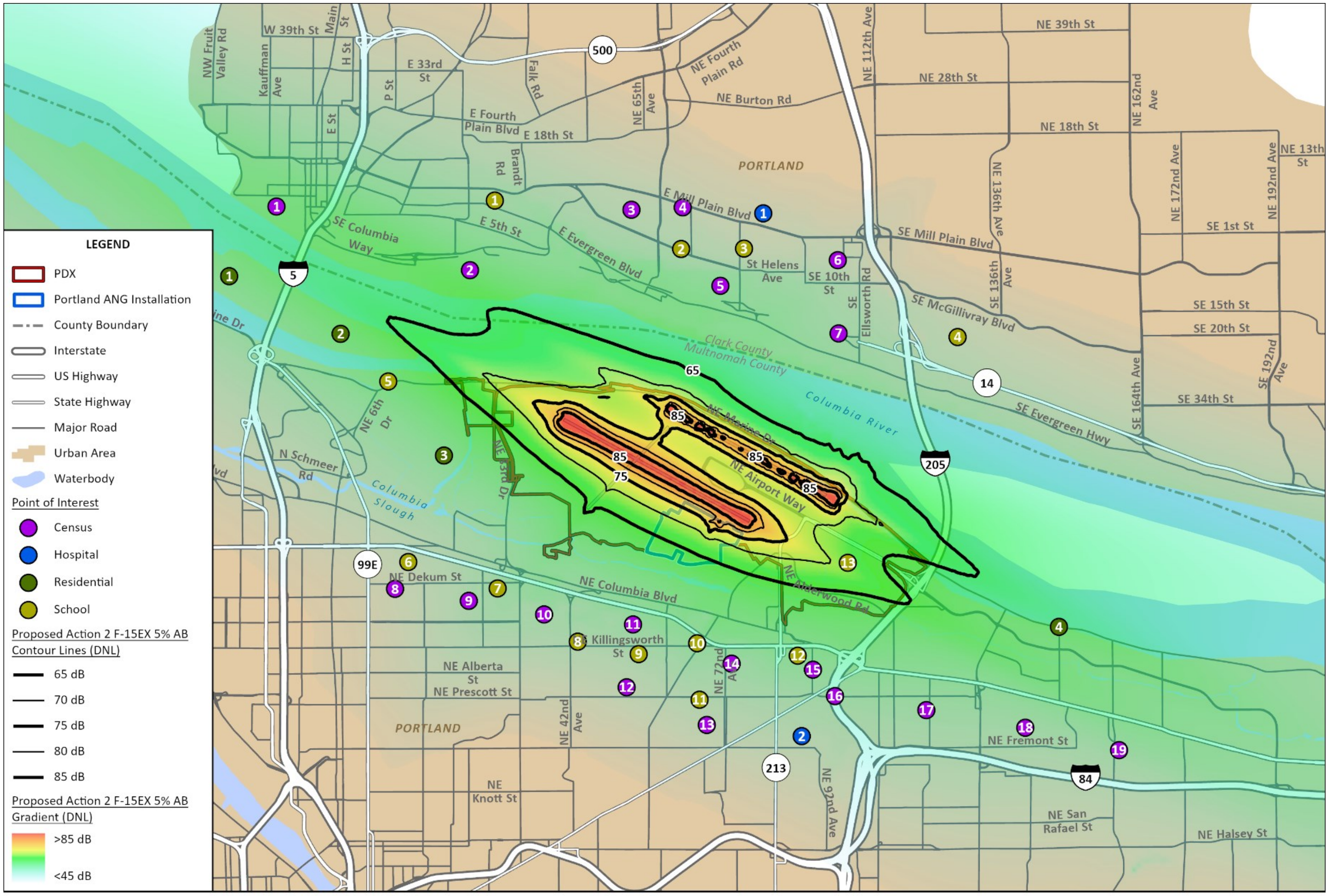


Figure 4-2 Alternative 1B – 18 PAA F-15EX and 20 Percent Afterburner– DNL Contours and Gradient

Source: ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Oregon Spatial Data Library 2014, Oregon Spatial Data Library 2015, Port of Portland 2016, Portland ANG 2021, U.S. Census Bureau 2020b, WAGIC 2020, WAGIC 2021



Kilometers
0 2
0 1
Miles

Figure 4-3 Alternative 2A – 21 PAA F-15EX and 5 Percent Afterburner– DNL Contours and Gradient

Source: ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Oregon Spatial Data Library 2014, Oregon Spatial Data Library 2015, Port of Portland 2016, Portland ANG 2021, U.S. Census Bureau 2020b, WAGIC 2020, WAGIC 2021

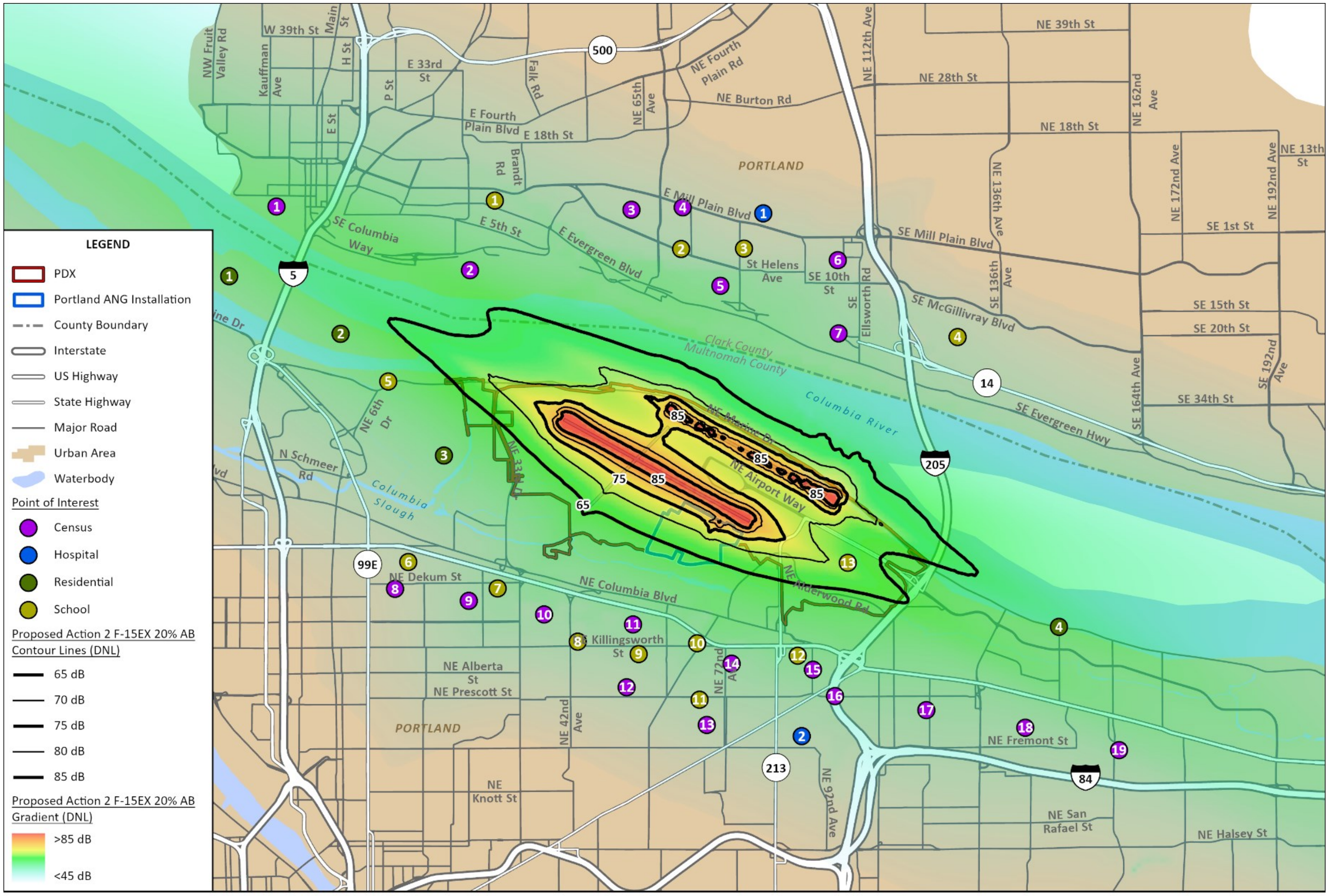


Figure 4-4 Alternative 1B – 21 PAA F-15EX and 20 Percent Afterburner– DNL Contours and Gradient

Source: ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Oregon Spatial Data Library 2014, Oregon Spatial Data Library 2015, Port of Portland 2016, Portland ANG 2021, U.S. Census Bureau 2020b, WAGIC 2020, WAGIC 2021

Figure 4-5 presents a comparison of the 65 dB DNL contour that result from each of the four proposed scenarios to the existing conditions. Note that the existing condition is projected to the timeframe of 2025 through 2030, so existing conditions is the same in terms of aircraft noise as the No Action Alternative. Both Alternative 1 scenarios (5 percent and 20 percent afterburner) would result in similarly sized 65 dB DNL contours. The higher use of afterburner would cause a small increase in the width of the contours but a small decrease in the length. The two Alternative 2 scenarios (5 percent and 20 percent afterburner) would be larger than the Alternative 1 scenarios due to the increase in operations. Alternative 2 scenarios would follow the same trend with similar overall sizes for both afterburner conditions and greater afterburner use causing larger contour width but shorter length.

Table 4-4 details the calculated DNL at all POIs for existing conditions and the four proposed scenarios summarizing the numbers of POIs that would be exposed to relevant DNL thresholds of 65, 70, and 75 dB. Both Alternative 1A and 1B conditions would result in no POIs exposed to DNL of 65 dB or greater (a decrease of one POI) and no POIs exposed to DNL of 70 dB or greater thresholds. Both Alternative 2A and 2B conditions would result in one POI exposed to DNL of 65 dB or greater (same as existing conditions) and no POIs exposed to DNL of 70 dB or greater thresholds.

Table 4-5 presents the change in DNL at each POI for each action alternative relative to existing conditions/no action along with a summary of the number of POIs experiencing a decrease, no change, or several magnitudes of increase. Alternative 1A would result in 34 POIs that would experience either a decrease or no change to DNL, 5 POIs that would experience an increase in DNL of 1 dB, and no POIs that would experience an increase in DNL of 2 to 4 dB or greater. Alternative 1B would result in 28 POIs that would experience either a decrease or no change to DNL, 10 POIs that would experience an increase in DNL of 1 dB, 1 POI that would experience an increase in DNL of 2 to 4 dB, and no POIs that would experience an increase in DNL of 5 dB or greater. Alternative 2A would result in 27 POIs that would experience either a decrease or no change to DNL, 11 POIs that would experience an increase in DNL of 1 dB, 1 POI that would experience an increase in DNL of 2 to 4 dB, and no POIs that would experience an increase in DNL of 5 dB or greater. Alternative 2B would result in 24 POIs that would experience either a decrease or no change to DNL, 13 POIs that would experience an increase in DNL of 1 dB, 2 POIs that would experience an increase in DNL of 2 to 4 dB, and no POIs that would experience an increase in DNL of 5 dB or greater.

4.1.2.2 Acreage, Housing, and Population

Table 4-6 presents acreage for both on- and off -airport for all proposed alternatives and the change in acreage relative to existing conditions. Under Alternative 1A, a total of 1,653 off-airport acres would be exposed to 65 dB DNL or greater, a decrease of 745 acres from the existing conditions. The off-airport acreage would be composed of 1,453 acres exposed to 65 to 70 dB DNL (a decrease of 715 acres), 195 acres exposed to 70 to 75 dB DNL (a decrease of 31 acres), 5 acres exposed to 75 to 80 dB DNL (an increase of 1 acre), and no acres exposed to 80 dB DNL or greater (same as existing conditions).

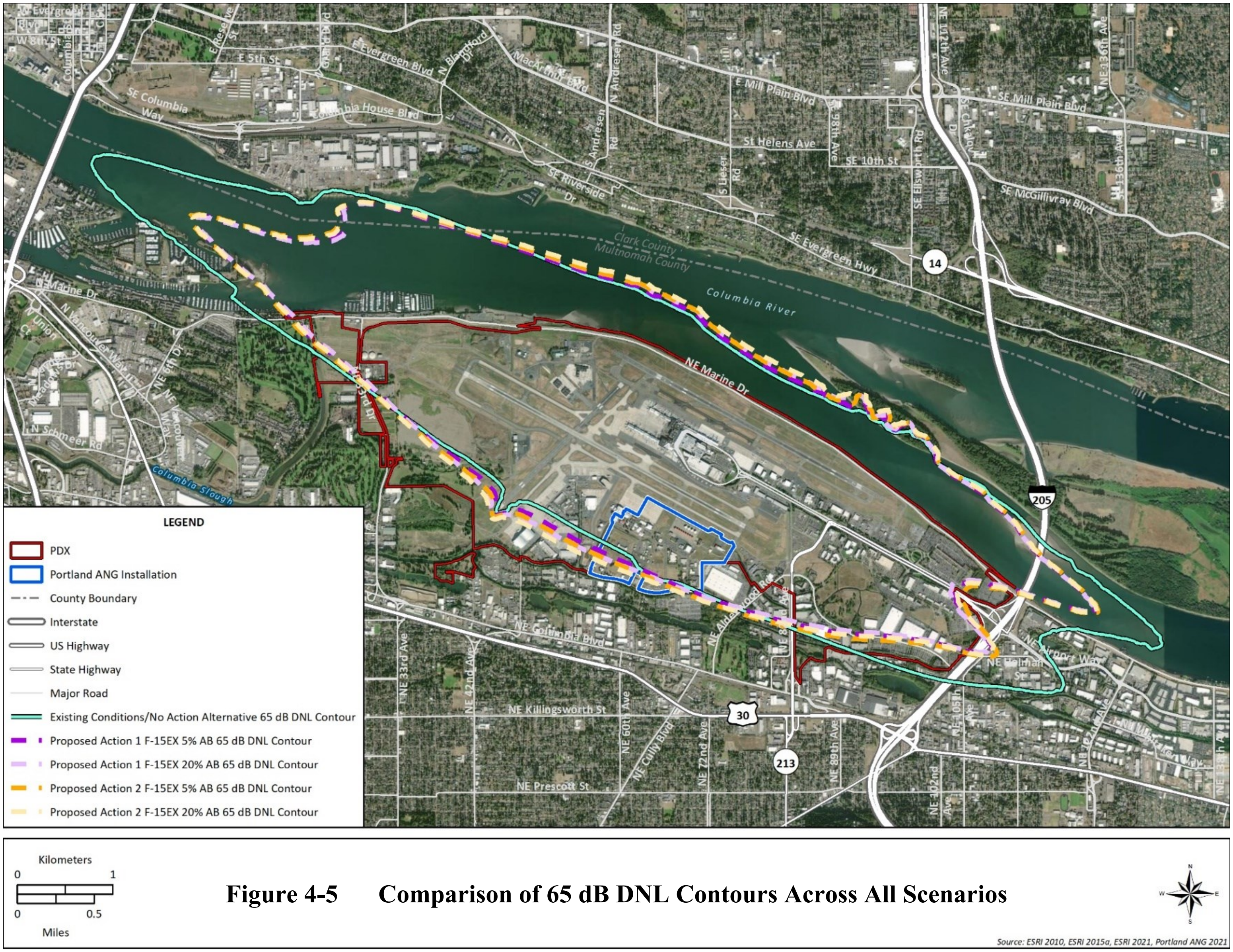


Figure 4-5 Comparison of 65 dB DNL Contours Across All Scenarios

Source: ESRI 2010, ESRI 2015a, ESRI 2021, Portland ANG 2021

Table 4-4 DNL at POIs in the Vicinity of PDX for all Scenarios

Map ID	*Named Point of Interest*	*Existing Conditions/ No Action*	*Alt 1A, F-15EX 5% A/B*	*Alt 1B, F-15EX 20% A/B*	*Alt 2A, F-15EX 5% A/B*	*Alt 2B, F-15EX 20% A/B*
PO-C-01	Census Tract 424	61	60 (-1)	60 (-1)	60 (-1)	60 (-1)
PO-C-02	Census Tract 426.01	62	61 (-1)	61 (-1)	61 (-1)	61 (-1)
PO-C-03	Census Tract 429	51	50 (-1)	51 (0)	51 (0)	51 (0)
PO-C-04	Census Tract 430	49	49 (0)	49 (0)	49 (0)	50 (+1)
PO-C-05	Census Tract 431	55	56 (+1)	57 (+2)	57 (+2)	57 (+2)
PO-C-06	Census Tract 412.07	49	50 (+1)	50 (+1)	50 (+1)	50 (+1)
PO-C-07	Census Tract 412.08	53	54 (+1)	54 (+1)	54 (+1)	55 (+2)
PO-C-08	Census Tract 36.01	48	48 (0)	49 (+1)	49 (+1)	49 (+1)
PO-C-09	Census Tract 36.02	52	52 (0)	53 (+1)	53 (+1)	53 (+1)
PO-C-10	Census Tract 36.03	52	52 (0)	53 (+1)	53 (+1)	53 (+1)
PO-C-11	Census Tract 74	55	55 (0)	56 (+1)	56 (+1)	56 (+1)
PO-C-12	Census Tract 75	49	50 (+1)	50 (+1)	50 (+1)	50 (+1)
PO-C-13	Census Tract 29.01	50	50 (0)	50 (0)	50 (0)	50 (0)
PO-C-14	Census Tract 76	55	55 (0)	55 (0)	55 (0)	55 (0)
PO-C-15	Census Tract 77	57	56 (-1)	56 (-1)	57 (0)	56 (-1)
PO-C-16	Census Tract 78	56	54 (-2)	54 (-2)	55 (-1)	55 (-1)
PO-C-17	Census Tract 79	59	54 (-5)	54 (-5)	55 (-4)	55 (-4)
PO-C-18	Census Tract 95.02	58	54 (-4)	54 (-4)	54 (-4)	54 (-4)
PO-C-19	Census Tract 95.01	58	55 (-3)	55 (-3)	55 (-3)	55 (-3)
PO-H-01	PeaceHealth Southwest Medical Center	47	48 (+1)	48 (+1)	48 (+1)	48 (+1)
PO-H-02	Park Forest Care Center	52	51 (-1)	51 (-1)	51 (-1)	51 (-1)
PO-R-01	Census Tract 72.01	60	58 (-2)	58 (-2)	58 (-2)	58 (-2)
PO-R-02	North Lotus Beach Drive	63	61 (-2)	60 (-3)	61 (-2)	61 (-2)
PO-R-03	Northeast Blue Heron Drive & Northeast 20th Avenue	58	57 (-1)	57 (-1)	58 (0)	58 (0)
PO-R-04	Northeast Marine Drive & Northeast 138th Avenue	63	62 (-1)	62 (-1)	62 (-1)	62 (-1)
PO-R-05	Census Tract 102	56	55 (-1)	55 (-1)	55 (-1)	55 (-1)
PO-S-01	Harney Elementary School	54	54 (0)	54 (0)	54 (0)	54 (0)
PO-S-02	Slavic Christian Academy	52	52 (0)	52 (0)	52 (0)	52 (0)
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection, and Vancouver Virtual Learning Academy	50	50 (0)	50 (0)	50 (0)	50 (0)
PO-S-04	Riverview Elementary School	50	50 (0)	50 (0)	50 (0)	51 (+1)
PO-S-05	Bridges Middle School	62	60 (-2)	60 (-2)	60 (-2)	60 (-2)
PO-S-06	Woodlawn Elementary School	50	50 (0)	50 (0)	50 (0)	50 (0)
PO-S-07	Faubion Elementary School	54	54 (0)	55 (+1)	55 (+1)	55 (+1)
PO-S-08	Portland Community College - Portland Metropolitan Workforce Training Center	53	52 (-1)	52 (-1)	52 (-1)	53 (0)
PO-S-09	Trinity Lutheran School	52	52 (0)	53 (+1)	53 (+1)	53 (+1)
PO-S-10	Community Transitional School	56	56 (0)	56 (0)	56 (0)	57 (+1)
PO-S-11	Scott Elementary School	51	51 (0)	51 (0)	52 (+1)	52 (+1)
PO-S-12	Helensview High School	58	57 (-1)	57 (-1)	58 (0)	57 (-1)
PO-S-13	Former Site of ITT Technical Institute and University of Phoenix	**68**	64 (-4)	64 (-4)	**65 (-3)**	**65 (-3)**

Legend: DNL = Day-Night Average Sound Level; ID = Identification; POI = Point of Interest.

Table 4-5 Change to DNL at POIs in the Vicinity of PDX for all Scenarios

Condition	*Existing Conditions*	*Alt 1A, F-15EX 5% A/B*	*Alt 1B, F-15EX 20% A/B*	*Alt 2A, F-15EX 5% A/B*	*Alt 2B, F-15EX 20% A/B*
Number of POIs exposed to 65 dB DNL or greater	1	0	0	1	1
Number of POIs exposed to 70 dB DNL or greater	0	0	0	0	0
Number of POIs exposed to 75 dB DNL or greater	0	0	0	0	0
Change to number of POIs exposed to 65 dB DNL		-1	-1	0	0
Change to number of POIs exposed to 70 dB DNL		0	0	0	0
Change to number of POIs exposed to 75 dB DNL		0	0	0	0
Number of POIs with decrease of 1 dB or greater		18	17	14	15
Number of POIs with no change		16	11	13	9
Number of POIs with increase of 1 dB		5	10	11	13
Number of POIs with increase of 2 to 4 dB		0	1	1	2
Number of POIs with increase of 5 dB or greater		0	0	0	0

Legend: % = percent; A/B = Afterburner; dB = decibel; DNL = Day-Night Average Sound Level; POI = Point of Interest.

Table 4-6 Acreage within DNL in the Vicinity of PDX for All Scenarios

Scenario	*DNL (dB)*	*On Airport*	*Off Airport*	*Total*	*Change Relative to Existing Conditions/No Action*		
					On Airport	*Off Airport*	*Total*
Alt 1 F-15EX 5% A/B	65–70	845	1,453	2,297	+12	-715	-704
	70–75	1,000	195	1,195	-163	-31	-195
	75–80	494	5	499	+32	+1	+34
	80–85	279	-	279	+19	0	+19
	85+	232	-	232	+37	0	+37
	Total >65 dB	2,849	1,653	4,502	-64	-745	-808
Alt 1 F-15EX 20% A/B	65–70	851	1,472	2,324	+18	-696	-677
	70–75	972	199	1,171	-191	-27	-219
	75–80	504	5	509	+42	+1	+44
	80–85	286	-	286	+26	0	+26
	85+	249	-	249	+54	0	+54
	Total >65 dB	2,862	1,677	4,539	-51	-721	-771
Alt 2 F-15EX 5% A/B	65–70	860	1,519	2,379	+27	-649	-622
	70–75	989	233	1,222	-174	+7	-168
	75–80	526	5	531	+64	+1	+66
	80–85	293	-	293	+33	0	+33
	85+	250	-	250	+55	0	+55
	Total >65 dB	2,918	1,757	4,675	+5	-641	-635
Alt 2 F-15EX 20% A/B	65–70	867	1,536	2,403	+34	-632	-598
	70–75	960	239	1,199	-203	+13	-191
	75–80	536	6	541	+74	+2	+76
	80–85	300	-	300	+40	0	+40
	85+	269	-	269	+74	0	+74
	Total >65 dB	2,931	1,781	4,712	+18	-617	-598

Legend: % = percent; A/B = Afterburner; dB = decibel; DNL = Day-Night Average Sound Level.

Under Alternative 1B, a total of 1,677 off-airport acres would be exposed to 65 dB DNL or greater, a decrease of 721 acres from the existing conditions. The off-airport acreage would be composed of 1,472 acres exposed to 65 to 70 dB DNL (a decrease of 696 acres), 199 acres exposed to 70 to 75 dB DNL (a decrease of 27 acres), 5 acres exposed to 75 to 80 dB DNL (an increase of 1 acre), and no acres exposed to 80 dB DNL or greater (same as existing conditions).

Under Alternative 2A, a total of 1,757 off-airport acres would be exposed to 65 dB DNL or greater, a decrease of 641 acres from the existing conditions. The off-airport acreage would be composed of 1,519 acres exposed to 65 to 70 dB DNL (a decrease of 649 acres), 233 acres exposed to 70 to 75 dB DNL (an increase of 7 acres), 5 acres exposed to 75 to 80 dB DNL (an increase of 1 acre), and no acres exposed to 80 dB DNL or greater (same as existing).

Under Alternative 2B, a total of 1,781 off-airport acres would be exposed to 65 dB DNL or greater, a decrease of 617 acres from the existing conditions. The off-airport acreage would be composed of 1,539 acres exposed to 65 to 70 dB DNL (a decrease of 632 acres), 239 acres exposed to 70 to 75 dB DNL (an increase of 13 acres), 6 acres exposed to 75 to 80 dB DNL (an increase of 2 acre), and no acres exposed to 80 dB DNL or greater (same as existing).

Table 4-7 presents the number of households, estimated population, and off-airport acreage exposed to 65 dB DNL or greater for all analyzed scenarios.

Table 4-7 Acreage, Households, and Estimated Population by DNL Contour in the Vicinity of PDX

Scenario	*DNL (dB)*	*Off Airport Acreage*	*Households*	*Estimated Population*	*Change from No Action Alternative Acreage*	*Change from No Action Alternative Households*	*Change from No Action Alternative Estimated Population*
Alt 1 F-15EX 5% A/B	65–70	1,453	11	37	-715	-32	-87
	70–75	195	1	8	-31	0	-1
	75–80	5	0	0	+1	0	0
	80–85	0	0	0	0	0	0
	85+	0	0	0	0	0	0
	Total	**1,653**	**12**	**44**	**-745**	**-32**	**-89**
Alt 1 F-15EX 20% A/B	65–70	1472	10	34	-696	-33	-90
	70–75	199	1	7	-27	0	-2
	75–80	5	0	0	+1	0	0
	80–85	0	0	0	0	0	0
	85+	0	0	0	0	0	0
	Total	**1,677**	**11**	**41**	**-721**	**-33**	**-92**
Alt 2 F-15EX 5% A/B	65–70	1,519	14	44	-649	-29	-80
	70–75	233	1	9	+7	0	0
	75–80	5	0	0	+1	0	0
	80–85	0	0	0	0	0	0
	85+	0	0	0	0	0	0
	Total	**1,757**	**15**	**53**	**-641**	**-29**	**-80**

Scenario	*DNL (dB)*	*Off Airport Acreage*	*Households*	*Estimated Population*	*Change from No Action Alternative Acreage*	*Change from No Action Alternative Households*	*Change from No Action Alternative Estimated Population*
Alt 2 F-15EX 20% A/B	65–70	1,536	12	39	-632	-31	-85
	70–75	239	1	9	+13	0	0
	75–80	6	0	0	+2	0	0
	80–85	0	0	0	0	0	0
	85+	0	0	0	0	0	0
	Total	**1,781**	**14**	**48**	**-617**	**-30**	**-85**

Legend: % = percent; A/B = Afterburner; dB = decibel; DNL = Day-Night Average Sound Level.

Under Alternative 1A, a total of 12 households and 44 people would be exposed to DNL of 65 dB or greater, a decrease of 32 households and 89 fewer people.

Under Alternative 1B, a total of 11 households and 41 people would be exposed to DNL of 65 dB or greater, a decrease of 33 households and 92 fewer people.

Under Alternative 2A, a total of 15 households and 53 people would be exposed to DNL of 65 dB or greater, a decrease of 29 households and 80 fewer people.

Under Alternative 2B, a total of 14 households and 48 people would be exposed to DNL of 65 dB or greater, a decrease of 30 households and 85 fewer people.

These decreases in households and population exposed to DNL of 65 dB or greater would be due to the quicker climb of the F-15EX when compared with the existing F-15C resulting in decreased noise at ground level under portions of the departure flight tracks.

4.1.2.3 Classroom Learning Interference

Although classroom learning interference analysis only applies to the 13 school POIs, Table 4-8 presents $L_{eq(8hr)}$ for all 39 POIs because smaller daycare centers and learning facilities may exist at or near residential areas that may find the information useful. Under Alternatives 1A, 1B, and 2A, the number of school type POIs exposed to greater than 60 dB $L_{eq(8hr)}$ would remain at three, consistent with existing conditions. Under Alternative 2A, the number of school POIs exposed to 60 dB $L_{eq(8hr)}$ would increase by one and PO-S-10 Community Transition School would experience an increase in $L_{eq(8hr)}$ of 2 dB.

Table 4-9 presents the average number of speech interfering events per school day hour from PDX aircraft operations. Under all four proposed scenarios, the number of speech interfering events per school day hour would not change relative from existing conditions for 12 of the 13 school POIs. All proposed scenarios would result in one additional event per school day hour at PO-S-05 Bridges Middle School.

Table 4-10 presents the estimated time in minutes during an average school day that interior noise levels would be above an interior level of 50 dB. Under all proposed scenarios, no school POIs would be exposed to greater than 5 minutes of elevated interior noise levels above 50 dB, which would be a decrease of one fewer school POIs from existing. In general, the duration of time would either not change or would decrease while the largest increase in time would not exceed one additional minute when compared to existing conditions.

Table 4-8 Classroom Screening Criteria ($L_{eq[8hr]}$) for POIs in the Vicinity of PDX

ID	*Location*	*Existing Conditions*	*Alt 1A, F-15EX 5% A/B*	*Alt 1B, F-15EX 20% A/B*	*Alt 2A, F-15EX 5% A/B*	*Alt 2B, F-15EX 20% A/B*
PO-C-01	Census Tract 424	61	58 (-3)	58 (-3)	58 (-3)	58 (-3)
PO-C-02	Census Tract 426.01	62	60 (-2)	60 (-2)	61 (-1)	60 (-2)
PO-C-03	Census Tract 429	51	50 (-1)	50 (-1)	50 (-1)	50 (-1)
PO-C-04	Census Tract 430	49	49 (0)	49 (0)	50 (+1)	50 (+1)
PO-C-05	Census Tract 431	57	59 (+2)	60 (+3)	60 (+3)	60 (+3)
PO-C-06	Census Tract 412.07	48	49 (+1)	49 (+1)	49 (+1)	49 (+1)
PO-C-07	Census Tract 412.08	55	56 (+1)	57 (+2)	57 (+2)	58 (+3)
PO-C-08	Census Tract 36.01	49	49 (0)	49 (0)	49 (0)	50 (+1)
PO-C-09	Census Tract 36.02	52	53 (+1)	53 (+1)	53 (+1)	54 (+2)
PO-C-10	Census Tract 36.03	52	53 (+1)	53 (+1)	53 (+1)	54 (+2)
PO-C-11	Census Tract 74	58	58 (0)	59 (+1)	59 (+1)	59 (+1)
PO-C-12	Census Tract 75	51	52 (+1)	52 (+1)	52 (+1)	53 (+2)
PO-C-13	Census Tract 29.01	52	52 (0)	52 (0)	52 (0)	53 (+1)
PO-C-14	Census Tract 76	57	57 (0)	57 (0)	58 (+1)	58 (+1)
PO-C-15	Census Tract 77	60	59 (-1)	59 (-1)	60 (0)	59 (-1)
PO-C-16	Census Tract 78	59	57 (-2)	57 (-2)	58 (-1)	57 (-2)
PO-C-17	Census Tract 79	63	57 (-6)	57 (-6)	58 (-5)	57 (-6)
PO-C-18	Census Tract 95.02	61	56 (-5)	55 (-6)	56 (-5)	56 (-5)
PO-C-19	Census Tract 95.01	60	55 (-5)	55 (-5)	55 (-5)	55 (-5)
PO-H-01	PeaceHealth Southwest Medical Center	47	47 (0)	48 (+1)	48 (+1)	48 (+1)
PO-H-02	Park Forest Care Center	55	53 (-2)	53 (-2)	53 (-2)	53 (-2)
PO-R-01	Census Tract 72.01	61	57 (-4)	57 (-4)	57 (-4)	57 (-4)
PO-R-02	North Lotus Beach Drive	65	60 (-5)	60 (-5)	60 (-5)	60 (-5)
PO-R-03	Northeast Blue Heron Drive & Northeast 20th Avenue	59	59 (0)	59 (0)	59 (0)	59 (0)
PO-R-04	Northeast Marine Drive & Northeast 138th Avenue	64	61 (-3)	61 (-3)	61 (-3)	61 (-3)
PO-R-05	Census Tract 102	56	53 (-3)	53 (-3)	53 (-3)	53 (-3)
PO-S-01	Harney Elementary School	55	53 (-2)	53 (-2)	54 (-1)	54 (-1)
PO-S-02	Slavic Christian Academy	51	52 (+1)	52 (+1)	53 (+2)	53 (+2)
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection, and Vancouver Virtual Learning Academy	49	50 (+1)	50 (+1)	50 (+1)	50 (+1)
PO-S-04	Riverview Elementary School	52	52 (0)	52 (0)	52 (0)	53 (+1)
PO-S-05	Bridges Middle School	**65**	**61 (-4)**	**61 (-4)**	**61 (-4)**	**61 (-4)**
PO-S-06	Woodlawn Elementary School	50	51 (+1)	51 (+1)	51 (+1)	52 (+2)
PO-S-07	Faubion Elementary School	54	55 (+1)	56 (+2)	55 (+1)	56 (+2)
PO-S-08	Portland Community College - Portland Metropolitan Workforce Training Center	55	54 (-1)	55 (0)	55 (0)	55 (0)
PO-S-09	Trinity Lutheran School	54	55 (+1)	55 (+1)	55 (+1)	56 (+2)
PO-S-10	Community Transitional School	58	59 (+1)	59 (+1)	59 (+1)	**60 (+2)**

ID	*Location*	*Existing Conditions*	*Alt 1A, F-15EX 5% A/B*	*Alt 1B, F-15EX 20% A/B*	*Alt 2A, F-15EX 5% A/B*	*Alt 2B, F-15EX 20% A/B*
PO-S-11	Scott Elementary School	53	54 (+1)	54 (+1)	54 (+1)	54 (+1)
PO-S-12	Helensview High School	**61**	**60 (-1)**	**60 (-1)**	**61 (0)**	**60 (-1)**
PO-S-13	Former Site of ITT Technical Institute and University of Phoenix	**73**	**70 (-3)**	**69 (-4)**	**70 (-3)**	**70 (-3)**
Number of School POIs greater than 60 dB $L_{eq(8hr)}$		3	3	3	3	4

Notes: [1]Assumes 90% of ANG daytime operations occur during the school; Windows open condition with Noise Level Reduction of 15 dB due to building attenuation.
[2]Parenthetical number represents the change to $L_{eq(8hr)}$ relative to existing.

Legend: % = percent; A/B = Afterburner; ID = Identification; $L_{eq(8hr)}$ = 8-hour Equivalent Sound Level; PDX = Portland International Airport; POI = Point of Interest.

Table 4-9 Classroom Speech Interfering Events per School Day Hour in the Vicinity of PDX

ID	*Location*	*Existing Conditions*	*Alt 1A, F-15EX 5% A/B*	*Alt 1B, F-15EX 20% A/B*	*Alt 2A, F-15EX 5% A/B*	*Alt 2B, F-15EX 20% A/B*
PO-C-01	Census Tract 424	22	22 (0)	22 (0)	22 (0)	22 (0)
PO-C-02	Census Tract 426.01	18	18 (0)	18 (0)	18 (0)	18 (0)
PO-C-03	Census Tract 429	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-C-04	Census Tract 430	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-C-05	Census Tract 431	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-C-06	Census Tract 412.07	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-C-07	Census Tract 412.08	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-C-08	Census Tract 36.01	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-C-09	Census Tract 36.02	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-C-10	Census Tract 36.03	1	1 (0)	1 (0)	2 (+1)	2 (+1)
PO-C-11	Census Tract 74	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-C-12	Census Tract 75	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-C-13	Census Tract 29.01	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-C-14	Census Tract 76	1	1 (0)	1 (0)	2 (+1)	2 (+1)
PO-C-15	Census Tract 77	4	4 (0)	4 (0)	4 (0)	4 (0)
PO-C-16	Census Tract 78	2	2 (0)	2 (0)	2 (0)	2 (0)
PO-C-17	Census Tract 79	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-C-18	Census Tract 95.02	2	2 (0)	2 (0)	2 (0)	2 (0)
PO-C-19	Census Tract 95.01	5	6 (+1)	6 (+1)	6 (+1)	6 (+1)
PO-H-01	PeaceHealth Southwest Medical Center	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-H-02	Park Forest Care Center	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-R-01	Census Tract 72.01	13	13 (0)	14 (+1)	14 (+1)	14 (+1)
PO-R-02	North Lotus Beach Drive	16	16 (0)	16 (0)	16 (0)	16 (0)
PO-R-03	Northeast Blue Heron Drive & Northeast 20th Avenue	6	6 (0)	6 (0)	6 (0)	6 (0)
PO-R-04	Northeast Marine Drive & Northeast 138th Avenue	22	22 (0)	22 (0)	22 (0)	22 (0)
PO-R-05	Census Tract 102	6	6 (0)	6 (0)	6 (0)	6 (0)
PO-S-01	Harney Elementary School	4	4 (0)	4 (0)	4 (0)	4 (0)
PO-S-02	Slavic Christian Academy	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection, and Vancouver Virtual Learning Academy	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-S-04	Riverview Elementary School	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-S-05	Bridges Middle School	11	12 (+1)	12 (+1)	12 (+1)	12 (+1)

ID	*Location*	*Existing Conditions*	*Alt 1A, F-15EX 5% A/B*	*Alt 1B, F-15EX 20% A/B*	*Alt 2A, F-15EX 5% A/B*	*Alt 2B, F-15EX 20% A/B*
PO-S-06	Woodlawn Elementary School	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-S-07	Faubion Elementary School	2	2 (0)	2 (0)	2 (0)	2 (0)
PO-S-08	Portland Community College - Portland Metropolitan Workforce Training Center	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-S-09	Trinity Lutheran School	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-S-10	Community Transitional School	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-S-11	Scott Elementary School	1	1 (0)	1 (0)	1 (0)	1 (0)
PO-S-12	Helensview High School	4	4 (0)	4 (0)	4 (0)	4 (0)
PO-S-13	Former Site of ITT Technical Institute and University of Phoenix	28	28 (0)	28 (0)	28 (0)	28 (0)

Notes: [1]Assumes 90 percent of ANG daytime operations occur during the school day; Windows open condition with Noise Level Reduction of 15 dB due to building attenuation.
[2]Parenthetical represents the change to average number of classroom speech interfering events per hour relative to existing conditions.
Legend: % = percent; A/B = Afterburner; ID = Identification; PDX = Portland International Airport.

Table 4-10 Classroom Time Above Interior 50 dB during 8-hour School Day in the Vicinity of PDX

ID	*Location*	*Existing Conditions*	*Alt 1A, F-15EX 5% A/B*	*Alt 1B, F-15EX 20% A/B*	*Alt 2A, F-15EX 5% A/B*	*Alt 2B, F-15EX 20% A/B*
PO-C-01	Census Tract 424	2	3 (+1)	2 (0)	3 (+1)	3 (+1)
PO-C-02	Census Tract 426.01	2	1 (-1)	1 (-1)	1 (-1)	1 (-1)
PO-C-03	Census Tract 429	2	1 (-1)	2 (0)	1 (-1)	2 (0)
PO-C-04	Census Tract 430	2	2 (0)	2 (0)	2 (0)	3 (+1)
PO-C-05	Census Tract 431	2	3 (+1)	3 (+1)	3 (+1)	3 (+1)
PO-C-06	Census Tract 412.07	2	3 (+1)	3 (+1)	3 (+1)	4 (+2)
PO-C-07	Census Tract 412.08	3	3 (0)	3 (0)	3 (0)	4 (+1)
PO-C-08	Census Tract 36.01	2	1 (-1)	2 (0)	1 (-1)	2 (0)
PO-C-09	Census Tract 36.02	2	3 (+1)	3 (+1)	3 (+1)	3 (+1)
PO-C-10	Census Tract 36.03	3	3 (0)	3 (0)	3 (0)	3 (0)
PO-C-11	Census Tract 74	6	3 (-3)	3 (-3)	3 (-3)	4 (-2)
PO-C-12	Census Tract 75	3	3 (0)	3 (0)	3 (0)	4 (+1)
PO-C-13	Census Tract 29.01	2	2 (0)	3 (+1)	3 (+1)	3 (+1)
PO-C-14	Census Tract 76	2	2 (0)	3 (+1)	2 (0)	3 (+1)
PO-C-15	Census Tract 77	2	1 (-1)	2 (0)	2 (0)	2 (0)
PO-C-16	Census Tract 78	2	1 (-1)	2 (0)	2 (0)	2 (0)
PO-C-17	Census Tract 79	2	2 (0)	2 (0)	3 (+1)	2 (0)
PO-C-18	Census Tract 95.02	3	3 (0)	3 (0)	4 (+1)	4 (+1)
PO-C-19	Census Tract 95.01	2	3 (+1)	3 (+1)	4 (+2)	4 (+2)
PO-H-01	PeaceHealth Southwest Medical Center	2	3 (+1)	3 (+1)	3 (+1)	3 (+1)
PO-H-02	Park Forest Care Center	2	1 (-1)	2 (0)	2 (0)	2 (0)
PO-R-01	Census Tract 72.01	2	3 (+1)	2 (0)	3 (+1)	3 (+1)
PO-R-02	North Lotus Beach Drive	3	3 (0)	3 (0)	3 (0)	3 (0)
PO-R-03	Northeast Blue Heron Drive & Northeast 20th Avenue	2	1 (-1)	2 (0)	1 (-1)	2 (0)
PO-R-04	Northeast Marine Drive & Northeast 138th Avenue	3	3 (0)	3 (0)	4 (+1)	4 (+1)
PO-R-05	Census Tract 102	2	2 (0)	2 (0)	3 (+1)	2 (0)
PO-S-01	Harney Elementary School	2	1 (-1)	1 (-1)	1 (-1)	1 (-1)

ID	Location	Existing Conditions	Alt 1A, F-15EX 5% A/B	Alt 1B, F-15EX 20% A/B	Alt 2A, F-15EX 5% A/B	Alt 2B, F-15EX 20% A/B
PO-S-02	Slavic Christian Academy	3	3 (0)	3 (0)	3 (0)	4 (+1)
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection, and Vancouver Virtual Learning Academy	3	3 (0)	3 (0)	3 (0)	4 (+1)
PO-S-04	Riverview Elementary School	3	3 (0)	3 (0)	3 (0)	3 (0)
PO-S-05	Bridges Middle School	3	2 (-1)	2 (-1)	2 (-1)	3 (0)
PO-S-06	Woodlawn Elementary School	2	1 (-1)	2 (0)	1 (-1)	2 (0)
PO-S-07	Faubion Elementary School	2	3 (+1)	3 (+1)	3 (+1)	3 (+1)
PO-S-08	Portland Community College - Portland Metropolitan Workforce Training Center	6	3 (-3)	3 (-3)	3 (-3)	3 (-3)
PO-S-09	Trinity Lutheran School	3	3 (0)	3 (0)	3 (0)	4 (+1)
PO-S-10	Community Transitional School	6	3 (-3)	3 (-3)	3 (-3)	4 (-2)
PO-S-11	Scott Elementary School	3	3 (0)	3 (0)	3 (0)	4 (+1)
PO-S-12	Helensview High School	2	2 (0)	2 (0)	2 (0)	2 (0)
PO-S-13	Former Site of ITT Technical Institute and University of Phoenix	3	2 (-1)	2 (-1)	3 (0)	3 (0)

Notes: [1]Assumes 90 percent of ANG daytime operations occur during the school day;
Windows open condition with Noise Level Reduction of 15 dB due to building attenuation.
[2]Parenthetical represents the change to time above 50 dB, in minutes, relative to existing.
Legend: dB = decibel; ID = Identification; PDX = Portland International Airport.

4.1.2.4 Non-school Speech Interference

Table 4-11 details the number of speech interfering events during the DNL daytime (7 a.m. to 10 p.m. [0700 to 2200]) per average day for both windows open and windows closed conditions. Under both Alternatives 1A and 1B, the number of POIs that would be exposed to one to two events per average hour would increase by eight locations with windows open and increase by two locations with windows closed when compared with existing conditions. There would be no change to the number of POIs exposed to greater than two events per average hour under any of the four proposed scenarios for either windows open or windows closed conditions.

Table 4-11 Non-School Speech Interfering Events per Day During DNL Daytime in the Vicinity of PDX

ID	Location	Existing Conditions	Alt 1A, F-15EX 5% A/B	Alt 1B, F-15EX 20% A/B	Alt 2A, F-15EX 5% A/B	Alt 2B, F-15EX 20% A/B
PO-C-01	Census Tract 424	13 / 1	13 / 1	13 / 1	13 / 1	13 / 1
PO-C-02	Census Tract 426.01	10 / 1	10 / 1	10 / 1	10 / 1	10 / 1
PO-C-03	Census Tract 429	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-C-04	Census Tract 430	0 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-C-05	Census Tract 431	1 / 0	1 / 0	1 / 0	1 / 1	1 / 1
PO-C-06	Census Tract 412.07	0 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-C-07	Census Tract 412.08	0 / 0	1 / 0	1 / 0	1 / 1	1 / 1
PO-C-08	Census Tract 36.01	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-C-09	Census Tract 36.02	1 / 0	1 / 0	1 / 0	1 / 1	1 / 1
PO-C-10	Census Tract 36.03	1 / 0	1 / 0	1 / 0	1 / 1	1 / 1
PO-C-11	Census Tract 74	1 / 1	1 / 0	1 / 0	1 / 1	1 / 1
PO-C-12	Census Tract 75	0 / 0	1 / 0	1 / 0	1 / 0	1 / 0

ID	*Location*	*Existing Conditions*	*Alt 1A, F-15EX 5% A/B*	*Alt 1B, F-15EX 20% A/B*	*Alt 2A, F-15EX 5% A/B*	*Alt 2B, F-15EX 20% A/B*
PO-C-13	Census Tract 29.01	0 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-C-14	Census Tract 76	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-C-15	Census Tract 77	2 / 0	2 / 1	2 / 1	2 / 1	2 / 1
PO-C-16	Census Tract 78	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-C-17	Census Tract 79	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-C-18	Census Tract 95.02	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-C-19	Census Tract 95.01	3 / 0	3 / 1	3 / 1	3 / 1	3 / 1
PO-H-01	PeaceHealth Southwest Medical Center	0 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-H-02	Park Forest Care Center	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-R-01	Census Tract 72.01	8 / 0	8 / 0	8 / 0	8 / 0	8 / 0
PO-R-02	North Lotus Beach Drive	9 / 1	9 / 1	9 / 1	9 / 1	9 / 1
PO-R-03	Northeast Blue Heron Drive & Northeast 20th Avenue	4 / 0	4 / 0	4 / 0	4 / 0	4 / 0
PO-R-04	Northeast Marine Drive & Northeast 138th Avenue	13 / 3	13 / 3	13 / 3	13 / 3	13 / 3
PO-R-05	Census Tract 102	3 / 0	3 / 0	3 / 0	4 / 0	4 / 0
PO-S-01	Harney Elementary School	2 / 0	2 / 0	2 / 0	2 / 0	2 / 0
PO-S-02	Slavic Christian Academy	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection, and Vancouver Virtual Learning Academy	0 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-S-04	Riverview Elementary School	0 / 0	0 / 0	0 / 0	1 / 0	1 / 0
PO-S-05	Bridges Middle School	7 / 1	7 / 1	7 / 1	7 / 1	7 / 1
PO-S-06	Woodlawn Elementary School	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0
PO-S-07	Faubion Elementary School	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1
PO-S-08	Portland Community College - Portland Metropolitan Workforce Training Center	1 / 0	1 / 0	1 / 0	1 / 1	1 / 1
PO-S-09	Trinity Lutheran School	1 / 0	1 / 0	1 / 0	1 / 1	1 / 1
PO-S-10	Community Transitional School	1 / 0	1 / 0	1 / 0	1 / 1	1 / 1
PO-S-11	Scott Elementary School	0 / 0	1 / 0	1 / 0	1 / 1	1 / 1
PO-S-12	Helensview High School	2 / 0	2 / 1	2 / 1	2 / 1	2 / 1
PO-S-13	Former Site of ITT Technical Institute and University of Phoenix	16 / 8	16 / 9	16 / 9	17 / 9	17 / 9

Note: [1]Values represent events for conditions with windows open / windows closed.
Legend: % = percent; A/B = Afterburner; DNL = Day-Night Average Sound Level; ID = Identification; PDX = Portland International Airport.

4.1.2.5 Probability of Awakening

Table 4-12 presents the existing conditions estimated PA and the change that would occur under each of the proposed scenarios. The existing conditions PA ranges from less than 1 percent at 30 POIs for windows open to up to 79 percent at PO-S-13, the former site of ITT Technical Institute, which does not include any residential areas, so PA is not applicable.

Under all four proposed scenarios, there would be no change to PA when compared to existing. This would occur because civil aircraft account for nearly all the DNL nighttime operations for all scenarios and the DNL nighttime operations by the 142 WG would remain very rare at about one per month.

Table 4-12 Estimated Change to Probability of Awakening Relative to Existing Conditions in the Vicinity of PDX

ID	*Location*	*Existing Conditions PA*	*Change Relative to Existing Conditions*			
			Alt 1A, F-15EX 5% A/B	*Alt 1B, F-15EX 20% A/B*	*Alt 2A, F-15EX 5% A/B*	*Alt 2B, F-15EX 20% A/B*
PO-C-01	Census Tract 424	2% / 1%	-2 / -1	0 / 0	0 / 0	0 / 0
PO-C-02	Census Tract 426.01	2% / 1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-03	Census Tract 429	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-04	Census Tract 430	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-05	Census Tract 431	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-06	Census Tract 412.07	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-07	Census Tract 412.08	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-08	Census Tract 36.01	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-09	Census Tract 36.02	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-10	Census Tract 36.03	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-11	Census Tract 74	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-12	Census Tract 75	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-13	Census Tract 29.01	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-14	Census Tract 76	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-15	Census Tract 77	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-16	Census Tract 78	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-17	Census Tract 79	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-18	Census Tract 95.02	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-C-19	Census Tract 95.01	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-H-01	PeaceHealth Southwest Medical Center	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-H-02	Park Forest Care Center	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-R-01	Census Tract 72.01	1% / 1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-R-02	North Lotus Beach Drive	3% / 2%	0 / 0	0 / 0	0 / 0	0 / 0
PO-R-03	Northeast Blue Heron Drive & Northeast 20th Avenue	1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-R-04	Northeast Marine Drive & Northeast 138th Avenue	9% / 6%	0 / 0	0 / 0	0 / 0	0 / 0
PO-R-05	Census Tract 102	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-01	Harney Elementary School	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-02	Slavic Christian Academy	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-03	Lieser School, Early Childhood Education Center, Vancouver Home Connection, and Vancouver Virtual Learning Academy	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-04	Riverview Elementary School	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-05	Bridges Middle School	1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-06	Woodlawn Elementary School	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-07	Faubion Elementary School	1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-08	Portland Community College - Portland Metropolitan Workforce Training Center	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-09	Trinity Lutheran School	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-10	Community Transitional School	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-11	Scott Elementary School	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-12	Helensview High School	<1% / <1%	0 / 0	0 / 0	0 / 0	0 / 0
PO-S-13	Former Site of ITT Technical Institute and University of Phoenix	79% / 63%	0 / 0	0 / 0	0 / 0	0 / 0

ID	*Location*	*Existing Conditions PA*	*Change Relative to Existing Conditions*			
			Alt 1A, F-15EX 5% A/B	*Alt 1B, F-15EX 20% A/B*	*Alt 2A, F-15EX 5% A/B*	*Alt 2B, F-15EX 20% A/B*
POIs with no change			39 / 39	39 / 39	39 / 39	39 / 39
POIs with increase of 1 percent or greater			0 / 0	0 / 0	0 / 0	0 / 0

Notes: [1]Non-residential POIs included because residential areas are often located nearby other noise sensitive areas for which these results would apply.
[2]Assumes 15 dB Noise Level Reduction.
[3]Assumes 25 dB Noise Level Reduction.
Legend: % = percent; < = less than; A/B = Afterburner; ID = Identification; PA = Probability of Awakening; PDX = Portland International Airport; POI = Point of Interest.

4.1.2.6 Potential for Hearing Loss

Potential for hearing loss analysis applies in situations where off-airport areas where people may be exposed over long periods of time exposed to DNL of 80 dB or greater. None of the four proposed scenarios or the existing conditions generates DNL off-airport at levels of 80 dB DNL or greater, so no people off-airport would be at risk for potential for hearing loss.

4.1.2.7 FAA Impact Analysis

FAA Order 1050.1F defines the FAA's significance threshold for noise as: "The action would increase noise by DNL 1.5 dB or more for a noise sensitive area that is exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the no action alternative for the same timeframe." Although not required, the discussion includes analysis of whether reportable changes to noise exposure would occur at noise sensitive areas, which would be an increase of 3 dB DNL or more for locations that would be exposed to DNL of 60 to 65 dB.

Table 4-13 details the total acreage, off-airport acreage, number of households, and estimated population that would be exposed to a 1.5 dB increase in DNL while experiencing DNL 65 dB or greater under all four proposed scenarios. Although the noise level would increase in areas off-airport by greater than 1.5 dB DNL for three of the four proposed scenarios (Alt 1B, Alt 2A, and Alt 2B), review of aerial imagery confirmed that none of these areas contain residential units. Therefore, none of the four scenarios would exceed the FAA's significance criteria described in 1050.1F when applied to residential areas. Reporting 3 dB increases in DNL while the Proposed Action DNL would range between 60 and 65 dB is only required by 1050.1F when a significant increase above DNL 65 dB would occur. Table 4-13 also provides this result; however, no residential areas would exceed these criteria in the vicinity of PDX as a 'reportable' increase in noise.

Table 4-13 FAA DNL Exposure Thresholds Affecting Acreage, Population, and Households

Scenario	*FAA Criteria*[1]	*Acreage*	*Off-Airport Acreage*	*Population*	*Households*
Alt 1A 5% AB	+1.5 dB (or higher) Change within 65+ dB DNL	204.52	0	N/A	N/A
	+3 dB (or higher) Change within 60–65 dB DNL	0	0	N/A	N/A
Alt 1B 20% AB	+1.5 dB (or higher) Change within 65+ dB DNL	783.31	0.001	N/A[2]	N/A[2]
	+3 dB (or higher) Change within 60–65 dB DNL	0	0	N/A	N/A
Alt 2A 5% AB	+1.5 dB (or higher) Change within 65+ dB DNL	874.46	1.62	N/A[2]	N/A[2]
	+3 dB (or higher) Change within 60–65 dB DNL	0	0	N/A	N/A
Alt 2B 20% AB	+1.5 dB (or higher) Change within 65+ dB DNL	1166.28	19.16	N/A[2]	N/A[2]
	+3 dB (or higher) Change within 60–65 dB DNL	0	0	N/A	N/A

Notes: [1]FAA 1050.1F Desk Reference specifies the following criteria for areas surrounding airports:
For DNL 65 dB and higher: + DNL 1.5 dB is considered significant change;
For DNL 60 dB to <65 dB: + DNL 3 dB is considered reportable change.
[2]Analysis of aerial imagery confirmed no households or population reside within this area.
Legend: AB=afterburner; dB = decibel; DNL = Day-Night Average Sound Level; N/A = Not Applicable.

Figure 4-6 presents the relevant DNL ‘difference’ contour bands (reduction or no change, increase less than 1.5 dB, increase 1.5 to 3 dB) for Alternative 1A. No areas would be exposed to an increase of 3 dB DNL or greater. Areas off-airport to the northwest or southeast would experience either a reduction or no change to DNL, which would occur because the F-15EX departures would climb quicker than the existing F-15C and would be at greater altitudes in these areas resulting in lower noise levels experienced at ground level. The areas to the northeast and southwest would experience increases of less than 1.5 dB due to the greater engine noise of the F-15EX during takeoff roll on the runway where both the F-15EX or F-15C would be at the same altitude. As shown in Figure 4-6, no identified noise sensitive areas (or POIs) would experience an increase of 1.5 dB while being exposed to 65 dB DNL (or any DNL for that matter).

Figures 4-7 through 4-9 present the DNL ‘difference’ contour bands for Alternative 1B, Alternative 2A, and Alternative 2B, respectively. In all three cases, no noise sensitive locations would experience a 1.5 dB increase in DNL while exposed to 65 dB DNL. Also, no noise sensitive locations would experience a 3 dB increase in DNL while exposed to DNL between 60 and 65 dB.

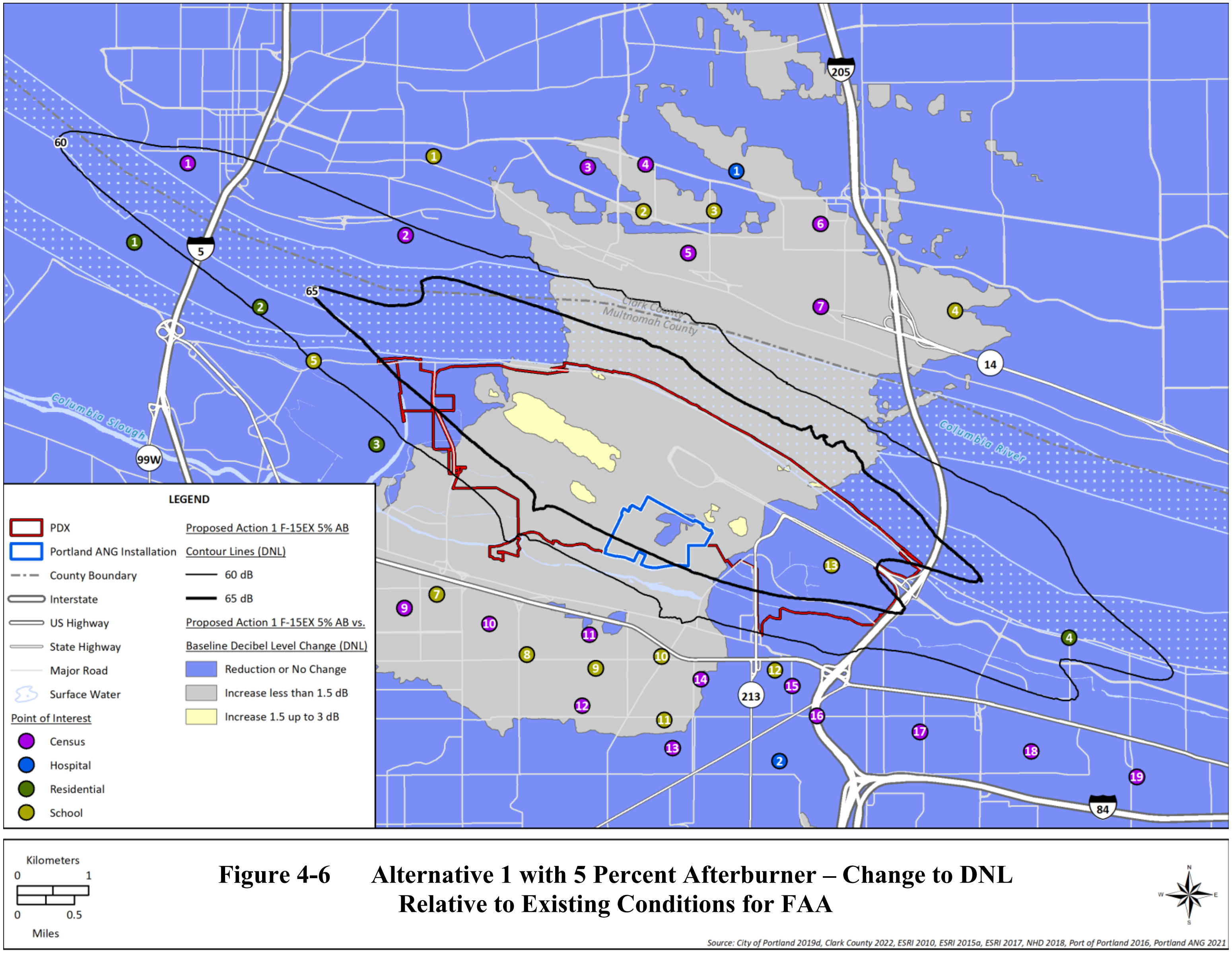


Figure 4-6 Alternative 1 with 5 Percent Afterburner – Change to DNL Relative to Existing Conditions for FAA

Source: City of Portland 2019d, Clark County 2022, ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Port of Portland 2016, Portland ANG 2021

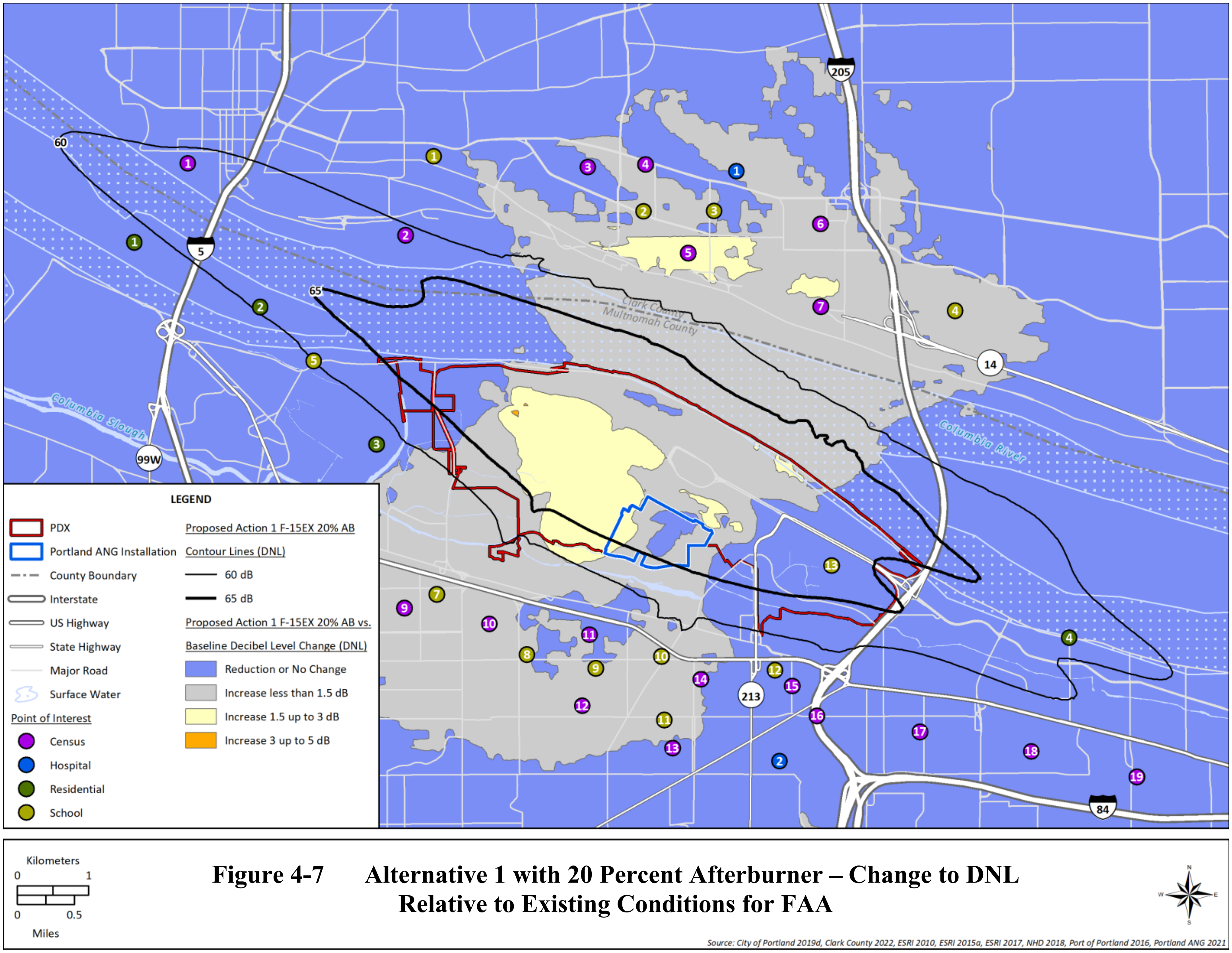


Figure 4-7 Alternative 1 with 20 Percent Afterburner – Change to DNL Relative to Existing Conditions for FAA

Source: City of Portland 2019d, Clark County 2022, ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Port of Portland 2016, Portland ANG 2021

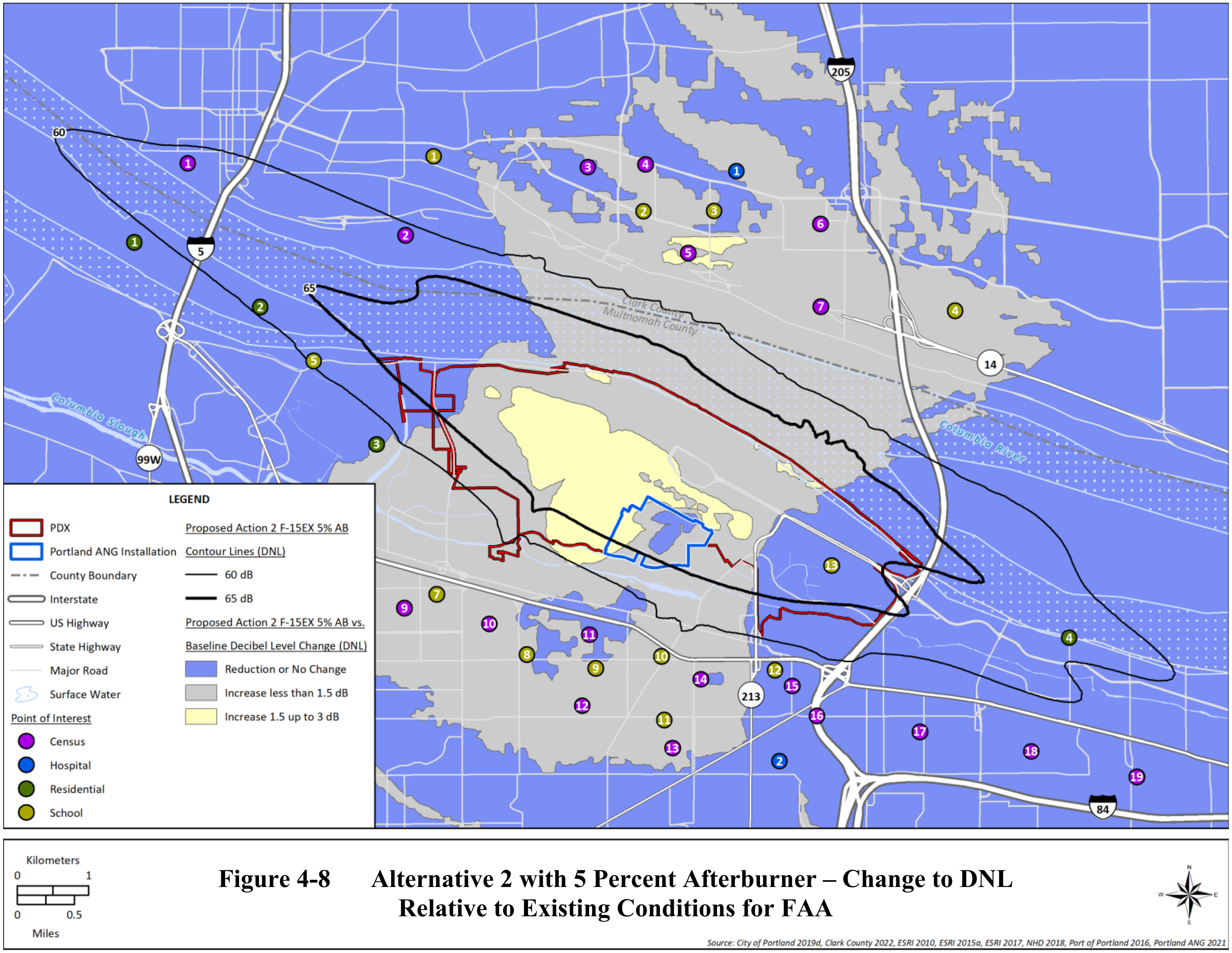


Figure 4-8 Alternative 2 with 5 Percent Afterburner – Change to DNL Relative to Existing Conditions for FAA

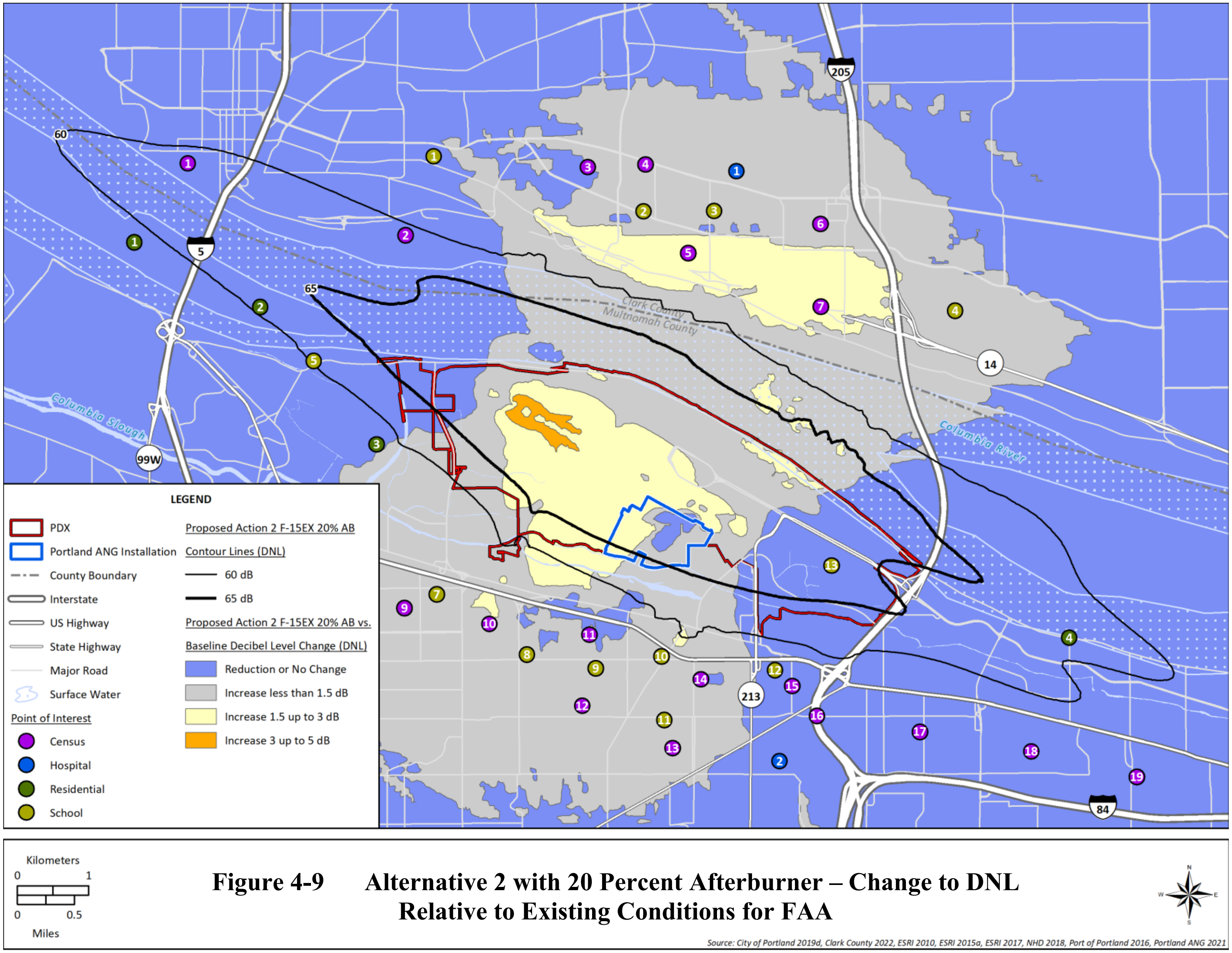


Figure 4-9 Alternative 2 with 20 Percent Afterburner – Change to DNL Relative to Existing Conditions for FAA

Source: City of Portland 2019d, Clark County 2022, ESRI 2010, ESRI 2015a, ESRI 2017, NHD 2018, Port of Portland 2016, Portland ANG 2021

4.2 SPECIAL USE AIRSPACE

The following section details the modeling data and the resultant noise exposure for the proposed scenarios for aircraft training activity in the 142 WG associated airspace. Under the Proposed Action, F-15EX aircraft would replace the F-15C aircraft of the 142 WG. Alternative 1A and 1B reflect the same numbers of F-15EX and only differ by afterburner usage rates at PDX, so the airspace conditions would be the same for both. Similarly, Alternative 2A and 2B include the same numbers of operations so the airspace analysis presents analysis for one Alternative 1 and one Alternative 2 condition. Other aircraft type operations would remain unchanged from those described in Section 3.0, *Existing Conditions*.

4.2.1 Modeling Data (Subsonic)

The proposed F-15EX aircraft would not require any changes to the current lateral or vertical configurations of any MOA, Restricted Area, Warning Area, or Air Traffic Control Assigned Airspace, nor would it alter their normal scheduled times of use. Since SUA scheduled activation times would not change from the existing conditions, the impacts to the National Airspace System would be unaffected. Visual flight rules aircraft would still be allowed to exercise their right to transition through MOAs and IFR aircraft would not experience any extra flight plan deviations because the SUA activation times would remain the same. Air Traffic Control would continue to provide the required separation pertaining to specific aircraft and type in the SUA.

Under Alternative 1 (includes both 1A and 1B), F-15EX aircraft would conduct up to 2,647 annual sorties, an increase of 9 percent above the 2,424 currently flown by the F-15C. Under Alternative 2 (includes both 2A and 2B), F-15EX aircraft would conduct up to 3,088 annual sorties, an increase of 27 percent above the 2,424 currently flown by the F-15C. Since air-to-ground ordnance delivery would be impractical when operating from PDX, it is likely that some portion of the training syllabus would have to be flown from other bases for all proposed scenarios. This analysis presents a 'worst-case' for noise impacts, assuming that the entire year of training would occur in the SUA currently used by the 142 WG, with no training deployments elsewhere to achieve training requirements.

The proportion of time for each sortie in the MOA spent between 500 feet AGL and 10,000 feet MSL would not change for the F-15EX aircraft when compared with the F-15C existing conditions. Table 4-14 details the anticipated changes to altitude usage with the largest difference occurring above 18,000 feet MSL where aircraft noise reaching the ground would be negligible.

Table 4-14 Existing Conditions and Proposed MOA Use by Altitude

Altitude (feet)	*Existing Conditions Percentage Use F-15C*	*Proposed Percentage Use F-15EX*	*F-15EX Change from Existing Conditions*
500–3,000 AGL	1	1	0
3,000–5,000 AGL	1	1	0
5,000–10,000 MSL	5	5	0
10,000 MSL–18,000 MSL	36	38	+2
18,000 MSL–30,000 MSL	17	30	+13
Above 30,000	40	25	-15

Legend: AGL = above ground level; MSL = mean sea level.

4.2.2 Noise Exposure (Subsonic)

Aircraft altitudes, speeds, and power settings vary while operating within the airspace based upon the training exercise. For comparison, Table 4-15 presents single-event noise levels in terms of SEL and L_{max} for the F-15C and F-15EX. In general, the F-15EX would be 2 to 3 dB greater in terms of SEL and 4 to 5 dB greater in L_{max} when compared to the F-15C at times when both aircraft would operate at military power and 400 knots.

Table 4-15 SEL and L_{max} Comparison for Typical Military Airspace Profiles

Altitude (feet AGL)	*F-15C (PW-220)*		*F-15EX (GE-129)*	
Metric	*SEL*	*L_{max}*	*SEL*	*L_{max}*
500	116	111	119	116
1,000	111	104	113	109
2,000	105	97	107	101
5,000	95	85	98	89
10,000	86	75	88	79

Note: All aircraft modeled at military power and 400 knots for comparison.
Legend: AGL = above ground level; L_{max} = Maximum Sound Level; SEL = Sound Exposure Level.
Source: Noisemap version 7.3.

The resulting overall difference in noise between Alternative 1 (1A and 1B) and existing conditions would be the combination of the up to 3 dB greater SEL for the F-15EX and the 0.6 dB from the increase in operations of 9 percent, or +3.6 dB that would be added to the existing noise levels. L_{dnmr} due to Alternative 1 (1A and 1B) would range from 39 to 45 dB under W-570 and Eel MOAs, 39 to 50 dB under Juniper/Hart MOAs, and up to 39 dB under Redhawk MOAs.

The resulting overall difference in noise between Alternative 2 (2A and 2B) and existing conditions would be the combination of the up to 3 dB greater SEL for the F-15EX and the 1.1 dB from the increase in operations of 27 percent, or +4.1 dB that would be added to the existing noise levels. L_{dnmr} due to Alternative 2 (2A and 2B) would range from 39 to 46 dB under W-570 and Eel MOAs, 39 to 51 dB under Juniper/Hart MOAs, and up to 40 dB under Redhawk MOAs.

In terms of average day DNL, for FAA requirements, the change relative from existing conditions would be the same as change that would occur for L_{dnmr} with an increase of +3.6 dB DNL for Alternative 1(1A and 1B). Resulting DNL for these Alternative 1 scenarios would range from 36 to 42 dB under W-570 and Eel MOAs, 36 to 47 dB under Juniper/Hart MOAs, and up to 36 dB under Redhawk MOAs. Similarly, the increase in DNL for Alternative 2 (2A and 2B) would be the same 4.1 dB increase as reported for change to L_{dnmr}. Resulting DNL for these Alternative 2 scenarios would range from 36 to 43 dB under W-570 and Eel MOAs, 36 to 48 dB under Juniper/Hart MOAs, and up to 37 dB under Redhawk MOAs.

4.2.3 Modeling Data (Supersonic)

Supersonic flight would primarily be associated with air combat training. Some of these training sorties require aircraft to exceed Mach 1.0 (supersonic) for brief periods of time, which creates a shock wave. Depending on the aircraft's altitude and the local atmospheric conditions, this shock wave can reach the ground, causing a "sonic boom." Higher altitudes and warmer surface temperatures can result in the sonic boom not reaching the surface of the earth. Lower altitudes for supersonic flight and higher speeds (higher Mach numbers) increase the likelihood and intensity of sonic booms.

Supersonic operations for the F-15EX would be in the same airspace as the existing F-15C, but the frequency of supersonic events would increase proportional to the overall increase in sorties. The altitudes and duration for each individual supersonic flight for the F-15EX scenarios is expected to remain similar to existing conditions.

4.2.4 Noise Exposure (Supersonic)

Supersonic operations are authorized in W-570 above 10,000 feet MSL, and above 30,000 feet MSL in the Juniper/Hart MOAs. Under Alternative 1 (1A and 1B), sonic boom events would increase up to 10 percent over existing conditions. A sonic boom is characterized by a rapid increase in pressure, followed by a decrease before a second rapid return to normal atmospheric levels typically occurring within a fraction of a second. A sonic boom is often perceived as a "bang-bang" sound. Under Alternative 1, sonic boom events would increase up to 10 percent over existing conditions, which would result in an approximate 0.5 dB increase in CDNL. The associated impacts are anticipated to not be significant due to the altitudes at which supersonic activities would occur and the small change to CDNL, which would remain well below 62 dB. Impacts to people would similarly be unlikely due to the altitudes at which supersonic activities would occur under Alternative 1.

Under Alternative 2 (2A and 2B), sonic boom events would increase up to 27 percent over existing conditions, which would result in an approximate 1 dB increase in CDNL. However, impacts to people would be unlikely due to the altitudes at which supersonic activities would occur. The associated impacts are anticipated to not be significant due to the altitudes at which supersonic activities would occur and the small change to CDNL, which would remain well below 62 dB. Impacts to people would similarly be unlikely due to the altitudes at which supersonic activities would occur under Alternative 2.

5.0 NO ACTION ALTERNATIVE

Under the No Action Alternative, noise levels and exposure from aircraft operations would be identical as described within the Section 3.0, *Existing Conditions*, for both PDX and SUA training. F-15C aircraft activity would remain at approximately 4,848 operations at PDX and 2,424 sorties that would occur within SUA. As the civil existing is a projected condition post-COVID that assumes civil operations would recover further to their pre-COVID levels, the civilian operations would stay constant through No Action as well as the proposed alternatives because all share the same timeline of 2025 to 2030.

6.0 CONCLUSION

Table 6-1 presents a quantitative summary of the potential noise impacts associated with the four proposed F-15EX scenarios as compared to the existing conditions. Noise analysis results summarized in the table include acreage and households/population impacted, number of POIs affected, number of school POIs affected, and PA.

Table 6-1 Summary of Potential Noise Impacts Associated with all Proposed Scenarios at PDX

Category	*Condition*	*Existing Conditions*	*Alt 1A, F-15EX 5% A/B*	*Alt 1B, F-15EX 20% A/B*	*Alt 2A, F-15EX 5% A/B*	*Alt 2B, F-15EX 20% A/B*
DNL: Number of POIs	Exposed to >65 dB DNL	1	0 (-1)	0 (-1)	1	1
	Exposed to >70 dB DNL	0	0	0	0	0
	Exposed to >75 dB DNL	0	0	0	0	0
	Decrease of 1 dB or greater		18	17	14	15
	No change		16	11	13	9
	Increase of 1 dB		5	10	11	13
	Increase of 2 to 4 dB		0	1	1	2
	Increase of 5 dB or greater		0	0	0	0
Off-Base Exposure, >65 dB DNL	Acreage	2,398	1,653 (-745)	1,677 (-721)	1,757 (-641)	1,781 (-617)
	Households	44	12 (-32)	11 (-33)	15 (-29)	14 (-30)
	Estimated Population	133	44 (-89)	41 (-92)	53 (-80)	48 (-85)
School, $L_{eq(8hr)}$: Number of School POIs	Greater than 60 dB $L_{eq(8hr)}$	3	3 (0)	3 (0)	3 (0)	4 (+1)
School, Numbers of Events per Average School Day Hour: Number of School POIs	With No Interfering Events	0	0 (0)	0 (0)	0 (0)	0 (0)
	With 1 Interfering Event	8	8 (0)	8 (0)	8 (0)	8 (0)
	With >1 Interfering Events	4	4 (0)	4 (0)	4 (0)	4 (0)
School, Time Above Interior 50 dB for 8 Hour School Day: Number of School POIs	Duration of 5 min or less	12	13 (+1)	13 (+1)	13 (+1)	13 (+1)
	Duration of >5–10 minutes	1	0 (-1)	0 (-1)	0 (-1)	0 (-1)
	Duration of >10 minutes	0	0 (0)	0 (0)	0 (0)	0 (0)
Speech Interfering Events per Average Hour, Windows Open: Number of POIs	With No Events	9	1 (-8)	1 (-8)	0 (-9)	0 (-9)
	With 1–2 Events	20	28 (+8)	28 (+8)	29 (+9)	29 (+9)
	With >2 Events	10	10 (0)	10 (0)	10 (0)	10 (0)
Speech Interfering Events per Average Hour, Windows Closed: Number of POIs	With No Events	31	29 (-2)	29 (-2)	20 (-11)	20 (-11)
	With 1-2 Events	6	8 (+2)	8 (+2)	17 (+11)	17 (+11)
	With >2 Events	2	2 (0)	2 (0)	2 (0)	2 (0)
Probability of Awakening with Windows Open: Number of POIs	With <1% PA	30	30 (0)	30 (0)	30 (0)	30 (0)
	With 1% to 10% PA	9	9 (0)	9 (0)	9 (0)	9 (0)
Probability of Awakening with Windows Open: Number of POIs	With <1% PA	33	33 (0)	33 (0)	33 (0)	33 (0)
	With 1% to 10% PA	6	6 (0)	6 (0)	6 (0)	6 (0)
FAA Order 1050.1F Criteria Impacts (population/household/ Noise sensitive location)	Significant: >+1.5 dB Change within 65+ dB DNL		0/0/0	0/0/0	0/0/0	0/0/0
	Reportable: >+3 dB Change within 60–65 dB DNL		0/0/0	0/0/0	0/0/0	0/0/0

Notes: Parenthetical represents change from the existing conditions.
Legend: % = percent; < = less than; > = greater than; A/B = Afterburner; dB = decibel; DNL = Day-Night Average Sound Level; PDX = Portland International Airport.

7.0 TERMINAL AREA FORECAST ANALYSIS

As described in Section 3.1.1, the NGB relied upon the 'best available information' at the time of preparing this analysis, which was a combination of civilian aircraft operations as modeled in the prior 2010 PDX NEM update completed under 14 CFR Part 150 and averaged historical civilian operations levels from the FAA OPSNET. The 2022 TAF (published in 2023) presented new civil operations projections to 2025, that totaled 231,290 annual operations. This data became available prior to the publication of this final noise study. Therefore, this section describes additional analysis of that recently released TAF civil data and the potential impacts associated with those operations as compared to the 2017 to 2019, 3-year average of civil data utilized in Chapters 3, 4, and 5 of this noise study. The comparison of the noise modeling prepared for the draft EA to 2022 TAF operational data maintains all other modeling conditions, such as runway use, fleet mix, and stage length, as detailed in Appendix A of this document.

Table 7-1 Modeled Flight Operations at PDX for 3-year Average and TAF

Airport		*PDX*	*PDX*
Data Set		*EA 2017–2019 3-year Average*	*TAF[1] (projection for 2025)*
Itinerant Operations	Air Carrier	191,495	189,255
	Air Taxi	21,487	19,792
	General Aviation	14,930	16,732
	Military	3,828	3,017
	Total	231,740	228,796
Local Operations	Civil	2,017	2,482
	Military	19	12
	Total	2,036	2,494
Total Operations		233,775	231,290

Notes: [1]2022 TAF for 2025 Forecast Year prepared by FAA Office of Environment and Energy, Noise Division – November 6, 2023.
Legend: EA = Environmental Assessment; PDX = Portland International Airport; TAF = Terminal Area Forecast.
Source: FAA 2023.

Figures 7-1 through 7-5 depict the resulting DNL contours for the existing conditions and four proposed alternatives. For all scenarios analyzed, the 65 dB DNL contour for the 2022 TAF 2025 forecast year would be approximately the same as the 3-year average data over land and to the south of PDX. The 65 dB DNL would decrease approximately 1 dB DNL to the northwest and decrease less than 1 dB DNL to the southeast over the Columbia River for all scenarios.

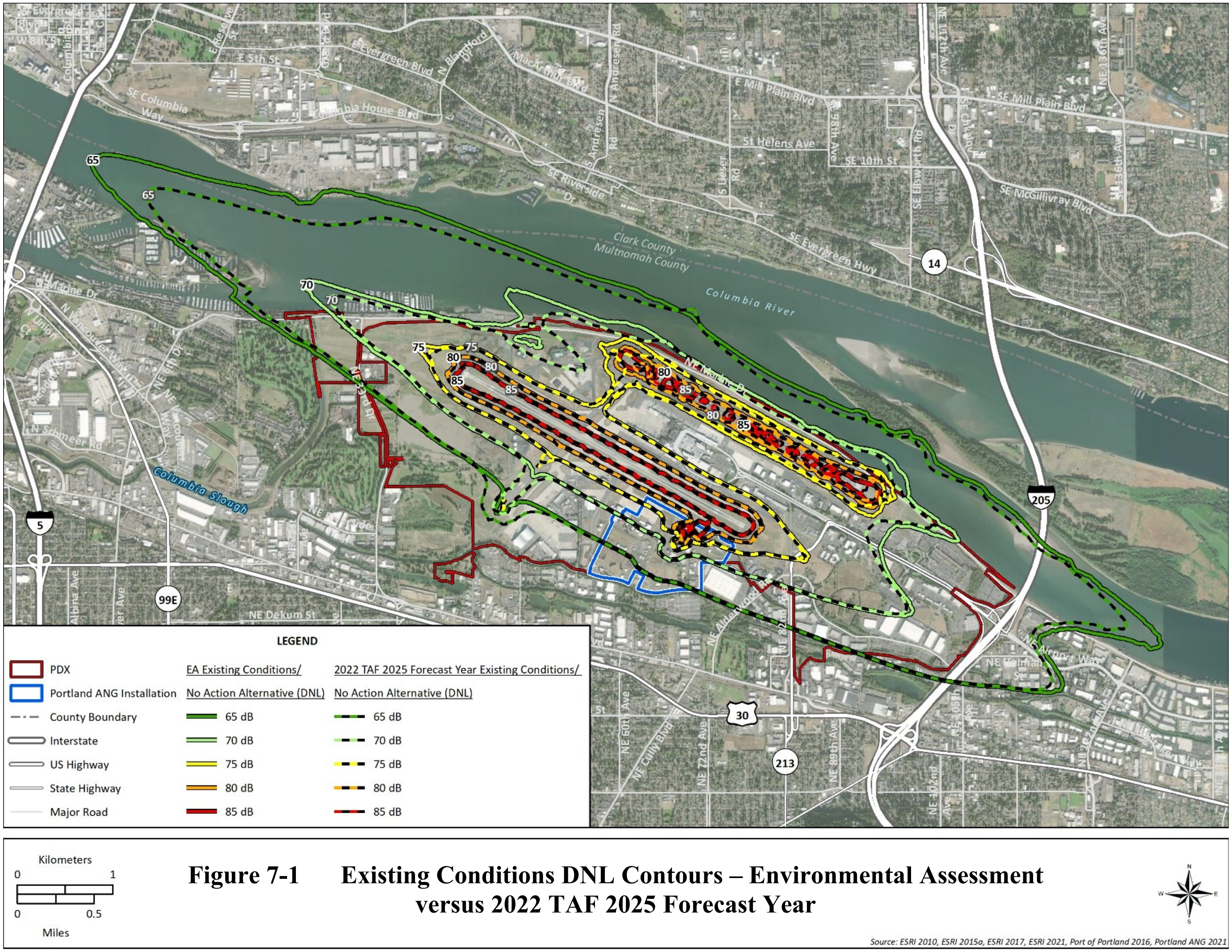


Figure 7-1 Existing Conditions DNL Contours – Environmental Assessment versus 2022 TAF 2025 Forecast Year

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021

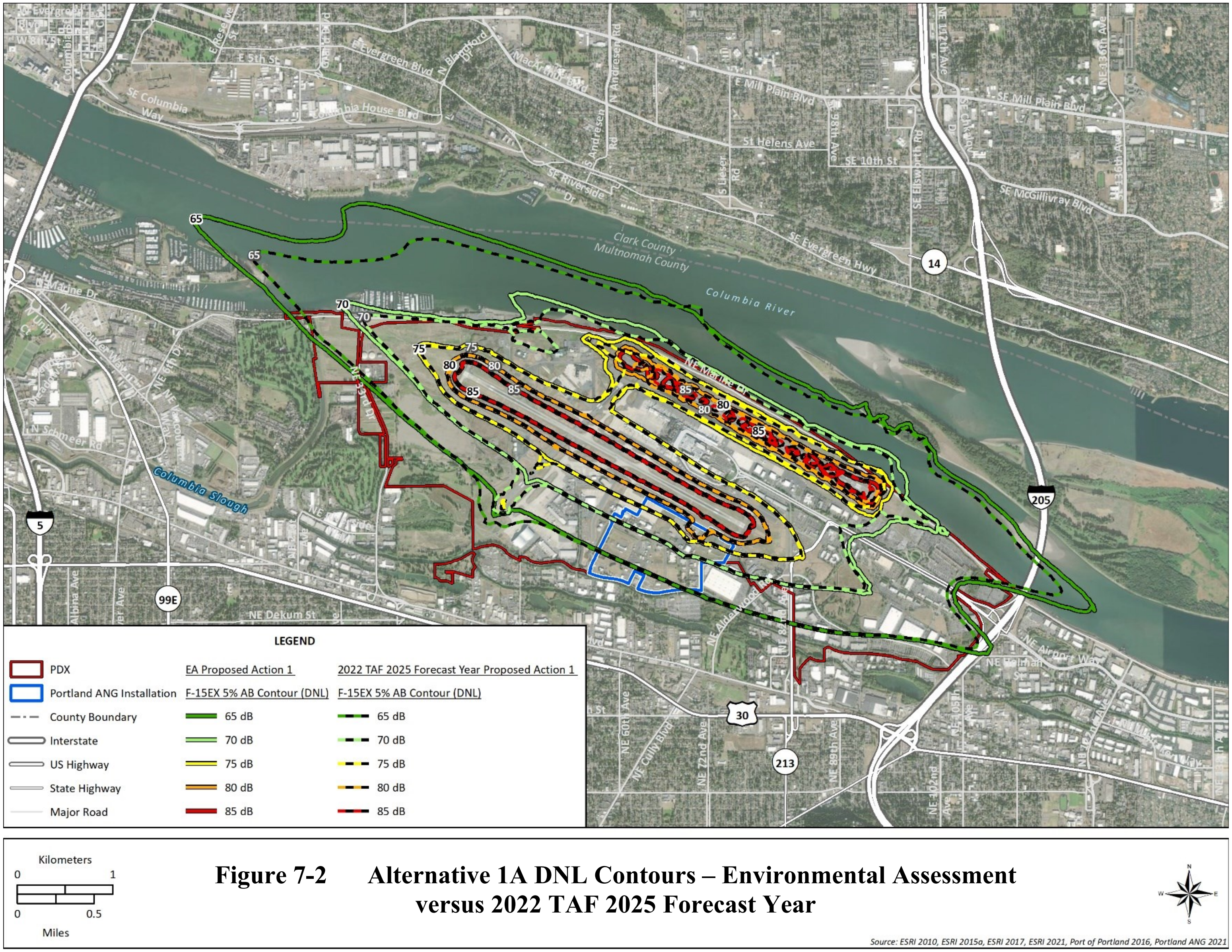
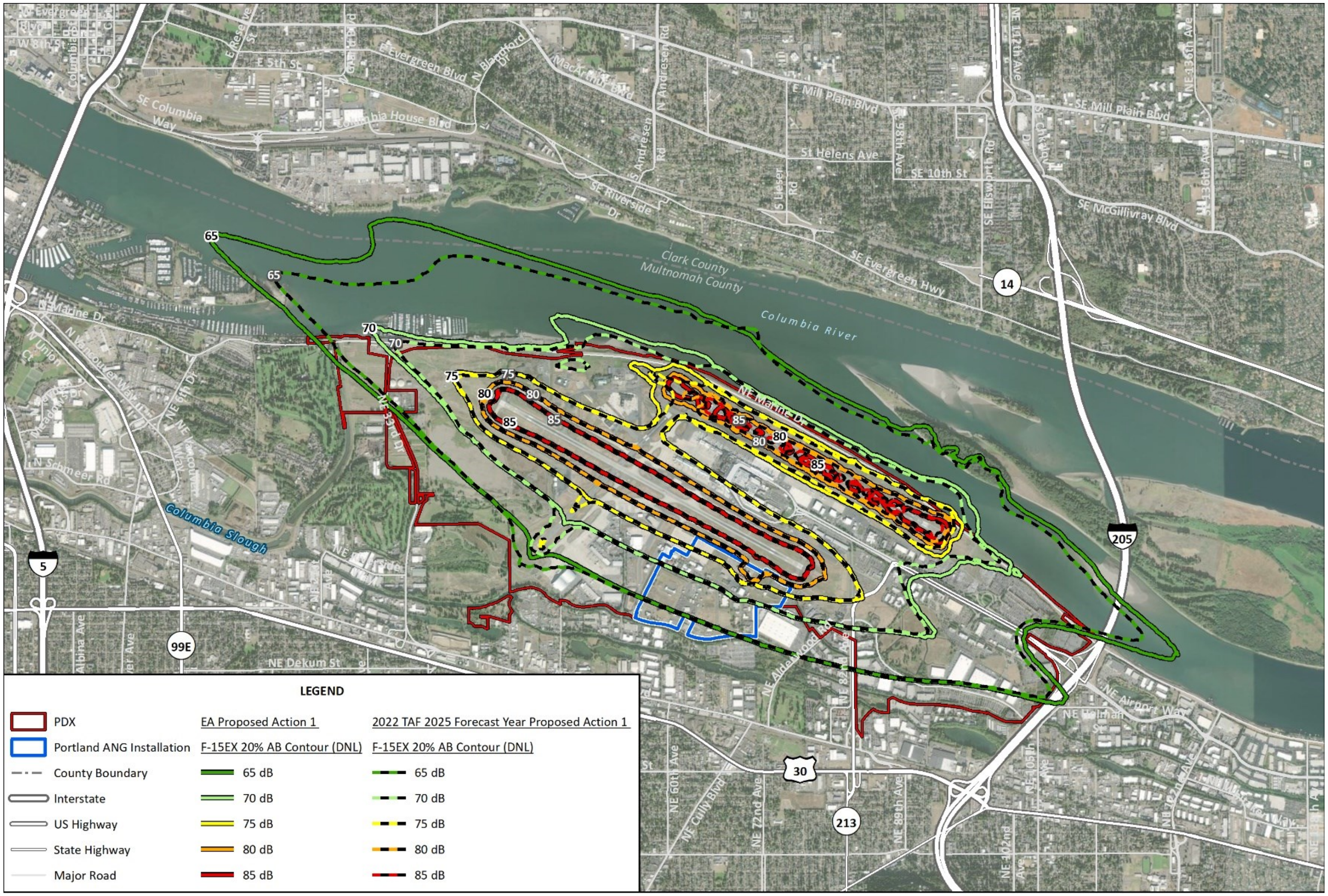


Figure 7-2 Alternative 1A DNL Contours – Environmental Assessment versus 2022 TAF 2025 Forecast Year

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021



Kilometers
0 1
0 0.5
Miles

Figure 7-3 Alternative 1B DNL Contours – Environmental Assessment versus 2022 TAF 2025 Forecast Year

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021

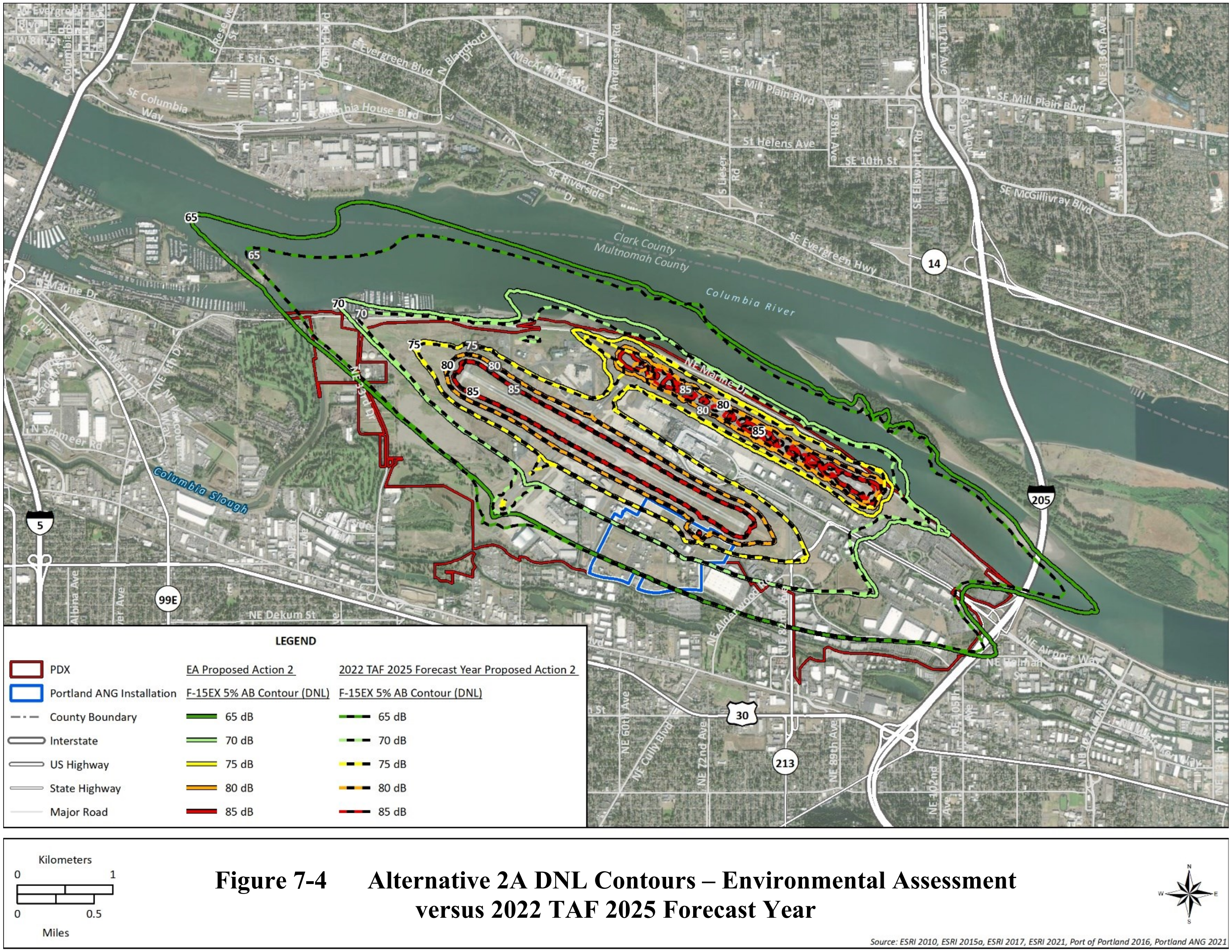


Figure 7-4 Alternative 2A DNL Contours – Environmental Assessment versus 2022 TAF 2025 Forecast Year

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021

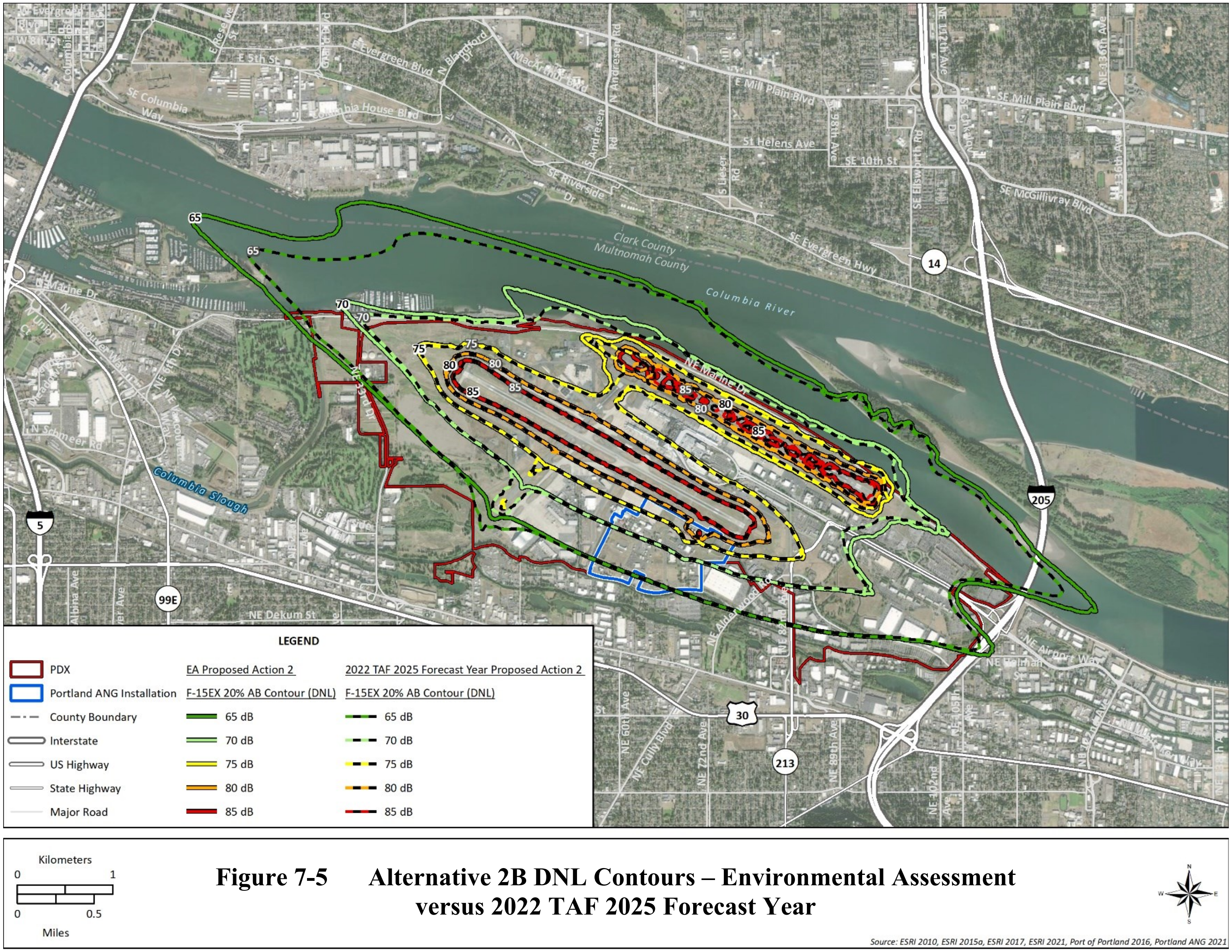


Figure 7-5 Alternative 2B DNL Contours – Environmental Assessment versus 2022 TAF 2025 Forecast Year

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021

Table 7-2 presents the off-airport acreage and estimated total population impacted by 65 dB DNL or greater. With the 2022 TAF 2025 forecast year operations, a total of 1,913 off-airport acres would be exposed to 65 dB DNL or greater representing a decrease of 485 fewer acres than with the 3-year average operations used in the noise study and associated Environmental Assessment. The four proposed alternatives would result in 1,200 to 1,400 off-airport acres exposed to 65 dB with the 2022 TAF 2025 forecast year operations, which would be approximately 400 fewer acres than would occur with the 3-year average operations.

In terms of population affected by 65 dB DNL or greater, the 2022 TAF 2025 forecast year operations would result in 107 people for existing conditions and 27 to 31 people exposed under the four proposed alternatives, as detailed in Table 7-2. The number of people exposed to 65 dB DNL would decrease for existing conditions and all four proposed alternatives under the 2022 TAF 2025 forecast year operations when compared to the 3-year average operations analyzed in this noise study.

The review of the 2022 TAF 2025 forecast year operations and resulting off-airport acres and exposed population shows that conclusion based upon the originally analyzed 2017–2019, 3-year average operations would not change. There would be no significant noise impact under either sets of civil operational data and the off-airport acreage and population exposed to 65 dB DNL would decrease for the four proposed scenarios, whether assessed with the 3-year average or the TAF.

Table 7-2 2022 TAF 2025 Forecast Year Acreage and Estimated Population by DNL Contour in the Vicinity of PDX

Scenario	*DNL (dB)*	*TAF Off Airport Acreage*	*TAF Estimated Population*	*Difference from EA Modeling Acreage*	*Difference from EA Modeling Estimated Population*
Existing Conditions	65–70	1,816	101	-582	-32
	70–75	96	5	-134	-4
	75–80	1	0	-3	0
	80–85	0	0	0	0
	85+	0	0	0	0
	Total	**1,913**	**107**	**-485**	**-26**
Alt 1A F-15EX 5% A/B	65–70	1,151	23	-302	-14
	70–75	92	5	-103	-3
	75–80	3	0	-2	0
	80–85	0	0	0	0
	85+	0	0	0	0
	Total	**1,246**	**27**	**-407**	**-17**
Alt 1B F-15EX 20% A/B	65–70	1,176	22	-296	-12
	70–75	99	4	-100	-3
	75–80	3	0	-2	0
	80–85	0	0	0	0
	85+	0	0	0	0
	Total	**1,278**	**26**	**-399**	**-15**
Alt 2A F-15EX 5% A/B	65–70	1,225	24	-294	-20
	70–75	126	7	-107	-2
	75–80	3	0	-2	0
	80–85	0	0	0	0
	85+	0	0	0	0
	Total	**1,354**	**31**	**-403**	**-22**
Alt 2B F-15EX 20% A/B	65–70	1,257	23	-279	-16
	70–75	131	6	-108	-3
	75–80	3	0	-3	0
	80–85	0	0	0	0
	85+	0	0	0	0
	Total	**1,391**	**29**	**-390**	**-19**

Legend: % = percent; A/B = Afterburner; dB = decibel; DNL = Day-Night Average Sound Level; PDX = Portland International Airport; TAF = Terminal Area Forecast.

8.0 REFERENCES

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APPENDIX A
NOISE MODELING SUPPORTING DATA

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MILITARY FLIGHT TRACKS

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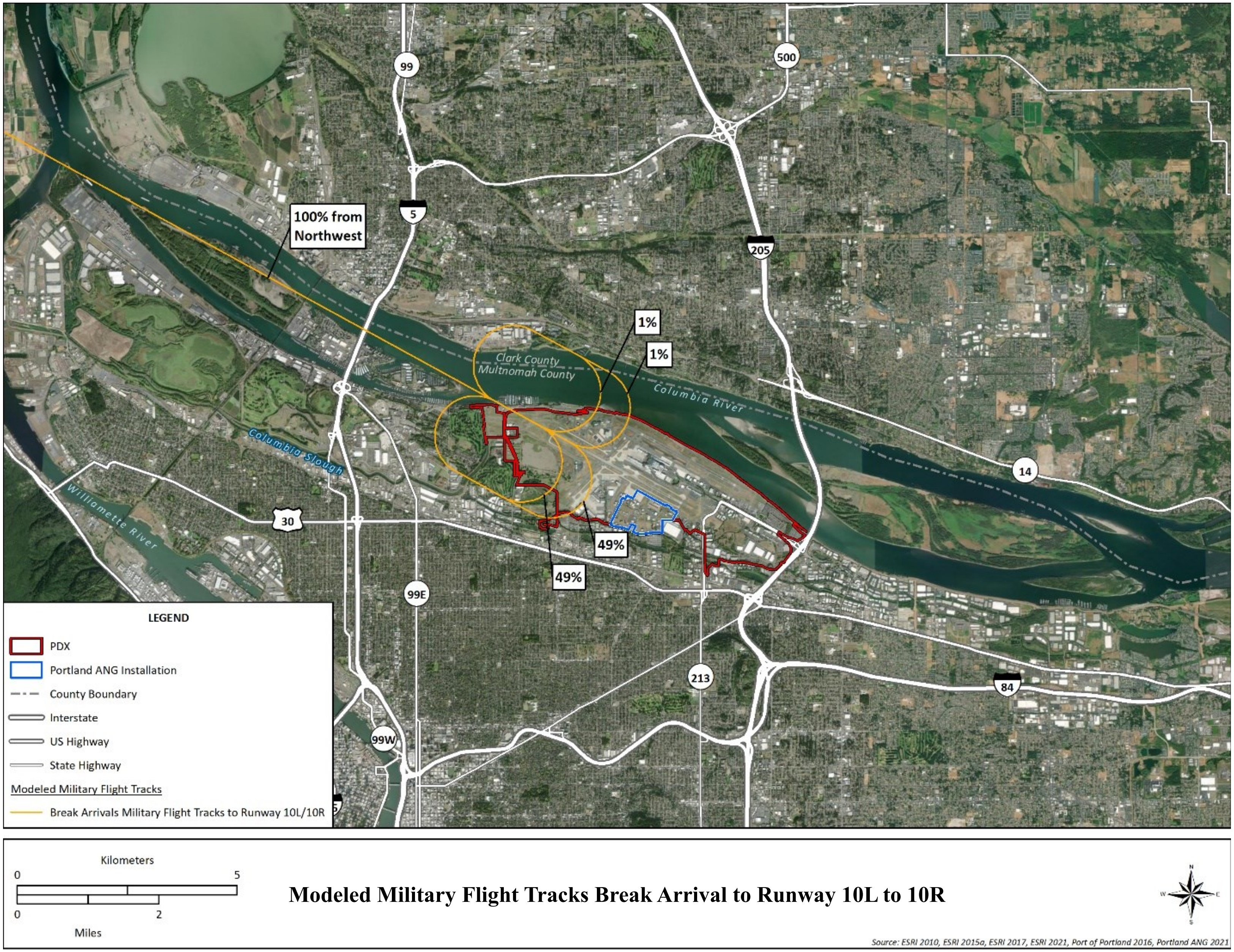
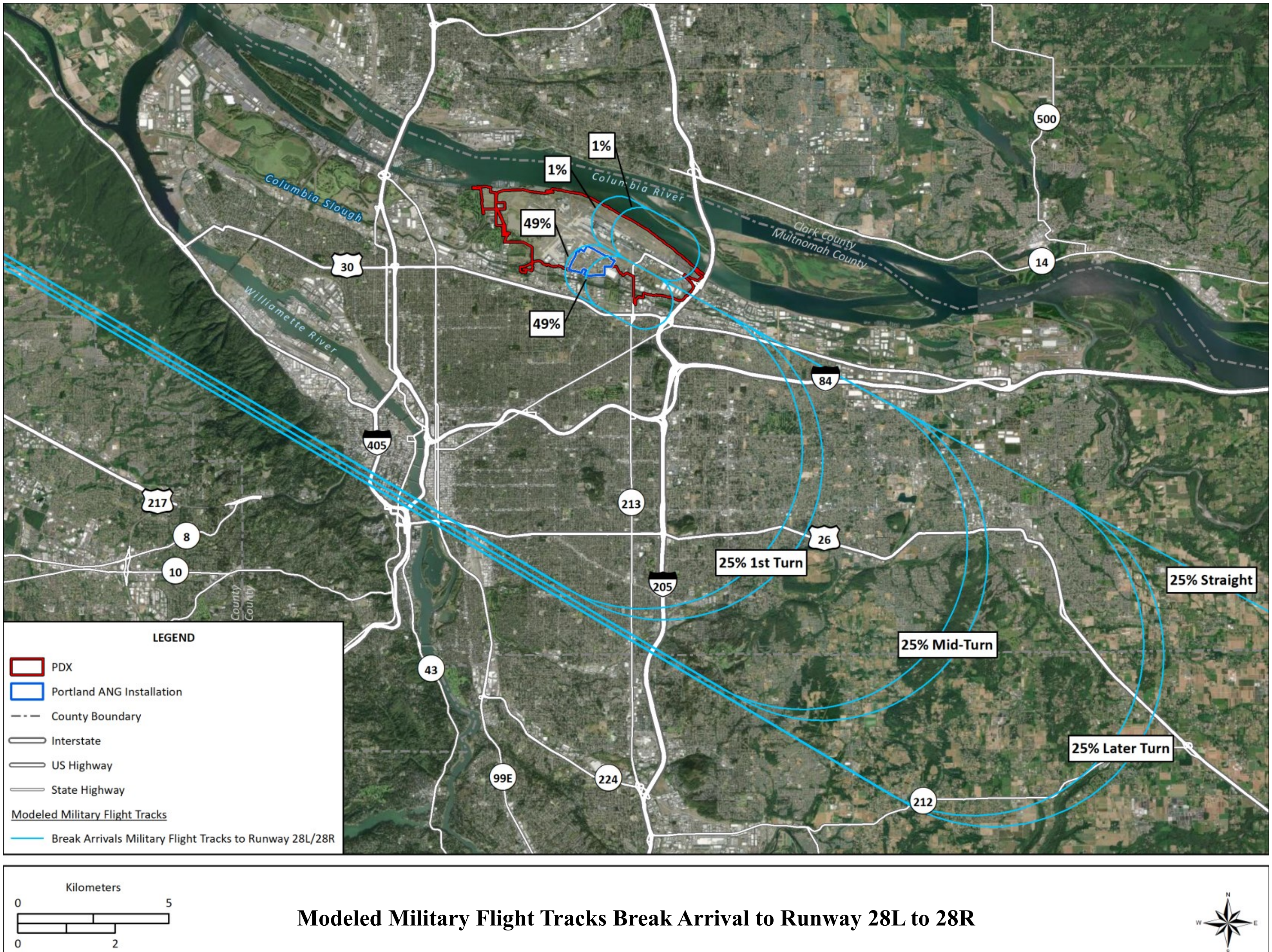
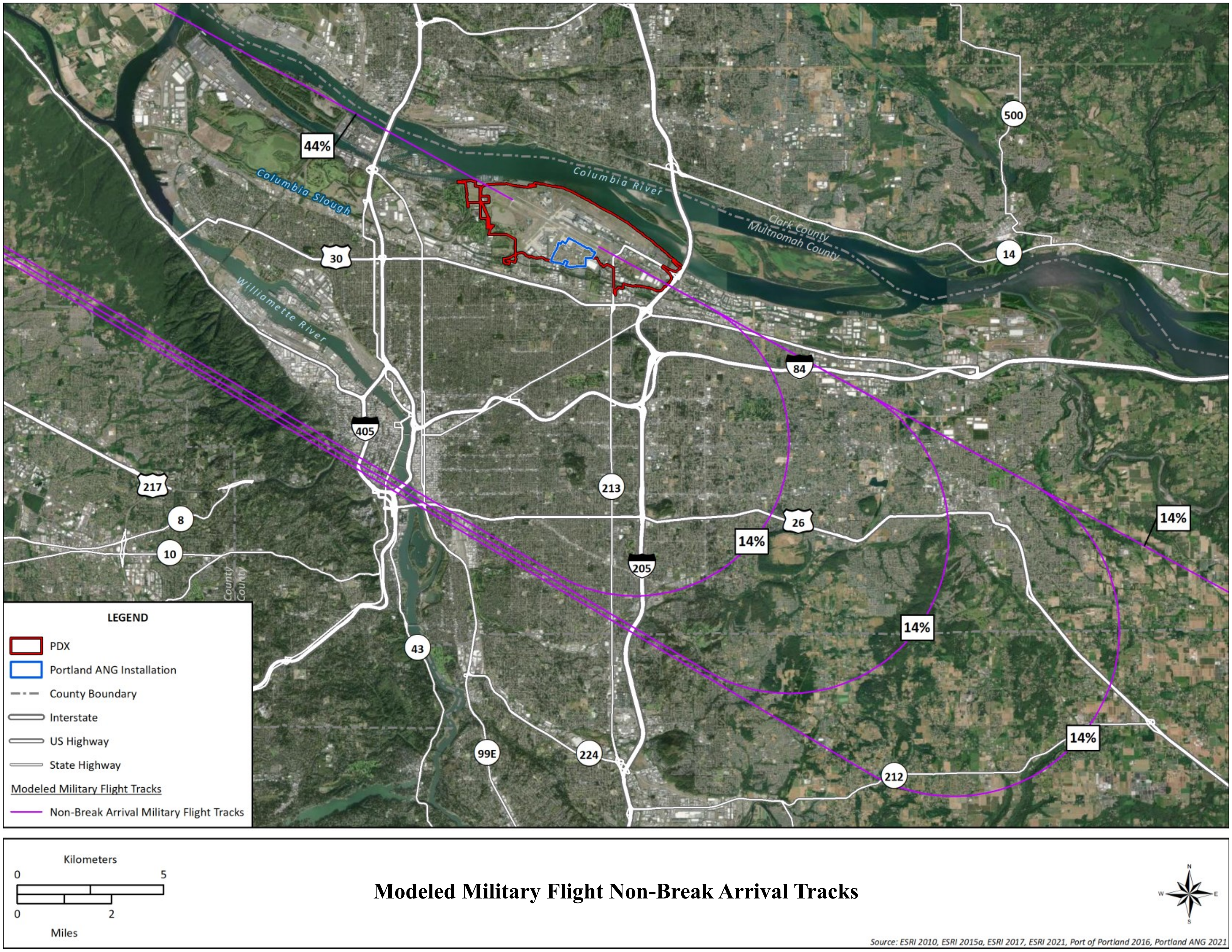


Modeled Military Flight Tracks Break Arrival to Runway 10L to 10R



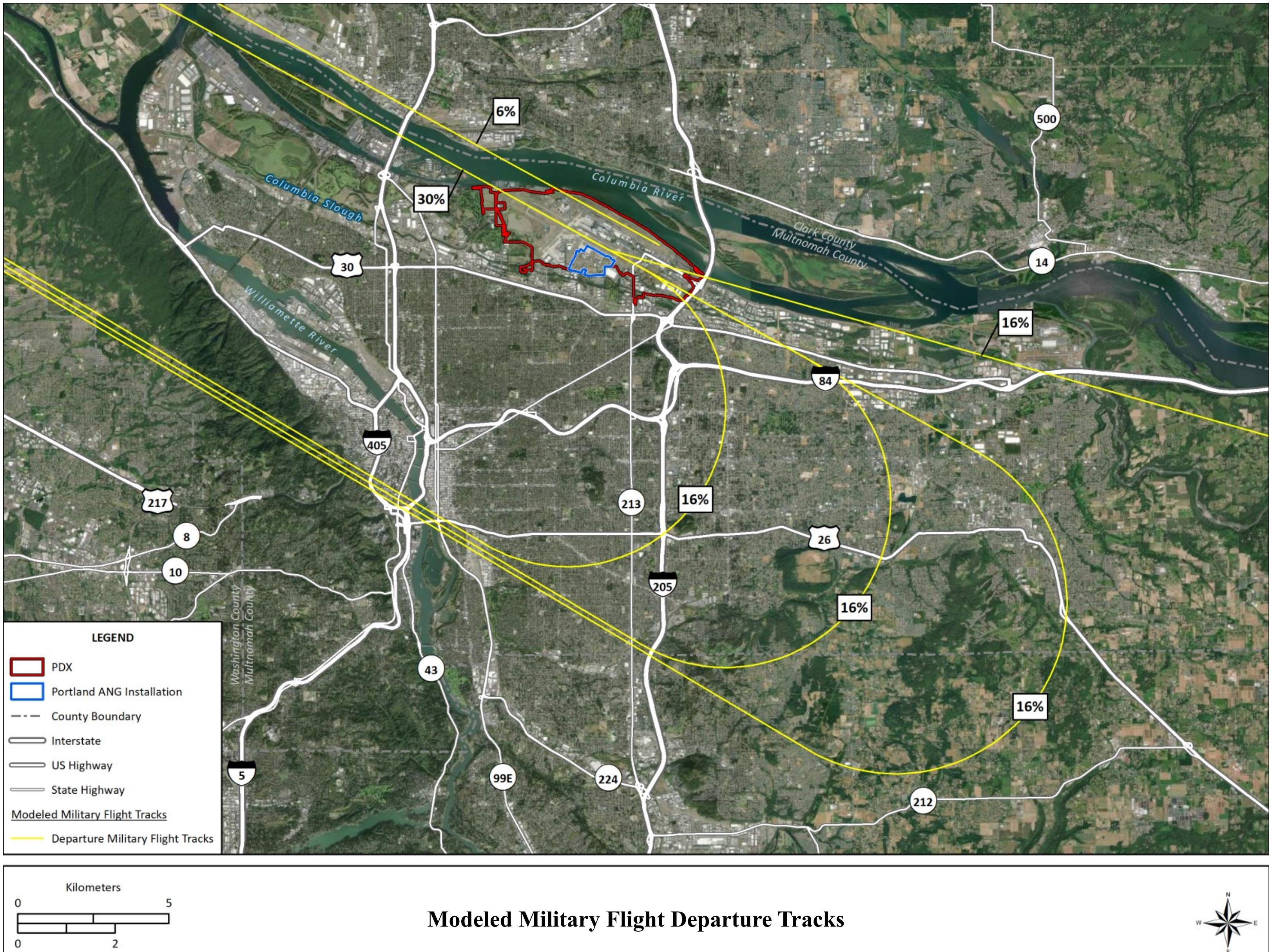
Modeled Military Flight Tracks Break Arrival to Runway 28L to 28R

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021



Modeled Military Flight Non-Break Arrival Tracks

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021



Modeled Military Flight Departure Tracks

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021

MILITARY FLIGHT PROFILES

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F-15C
(Modeled as F-15E with PW 220 engine)

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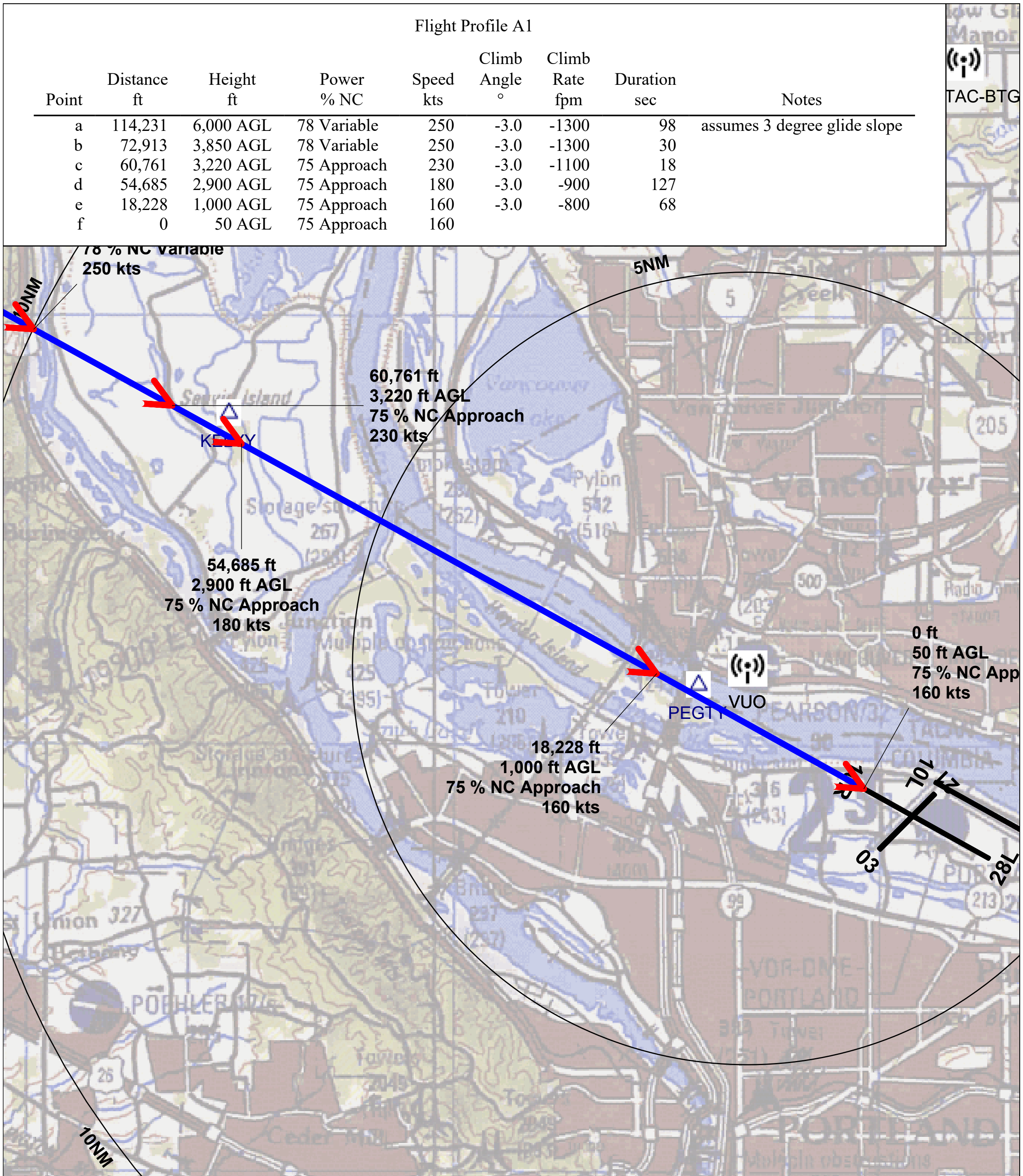
Flight Profile A1

Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	114,231	6,000 AGL	78 Variable	250	-3.0	-1300	98	assumes 3 degree glide slope
b	72,913	3,850 AGL	78 Variable	250	-3.0	-1300	30	
c	60,761	3,220 AGL	75 Approach	230	-3.0	-1100	18	
d	54,685	2,900 AGL	75 Approach	180	-3.0	-900	127	
e	18,228	1,000 AGL	75 Approach	160	-3.0	-800	68	
f	0	50 AGL	75 Approach	160				



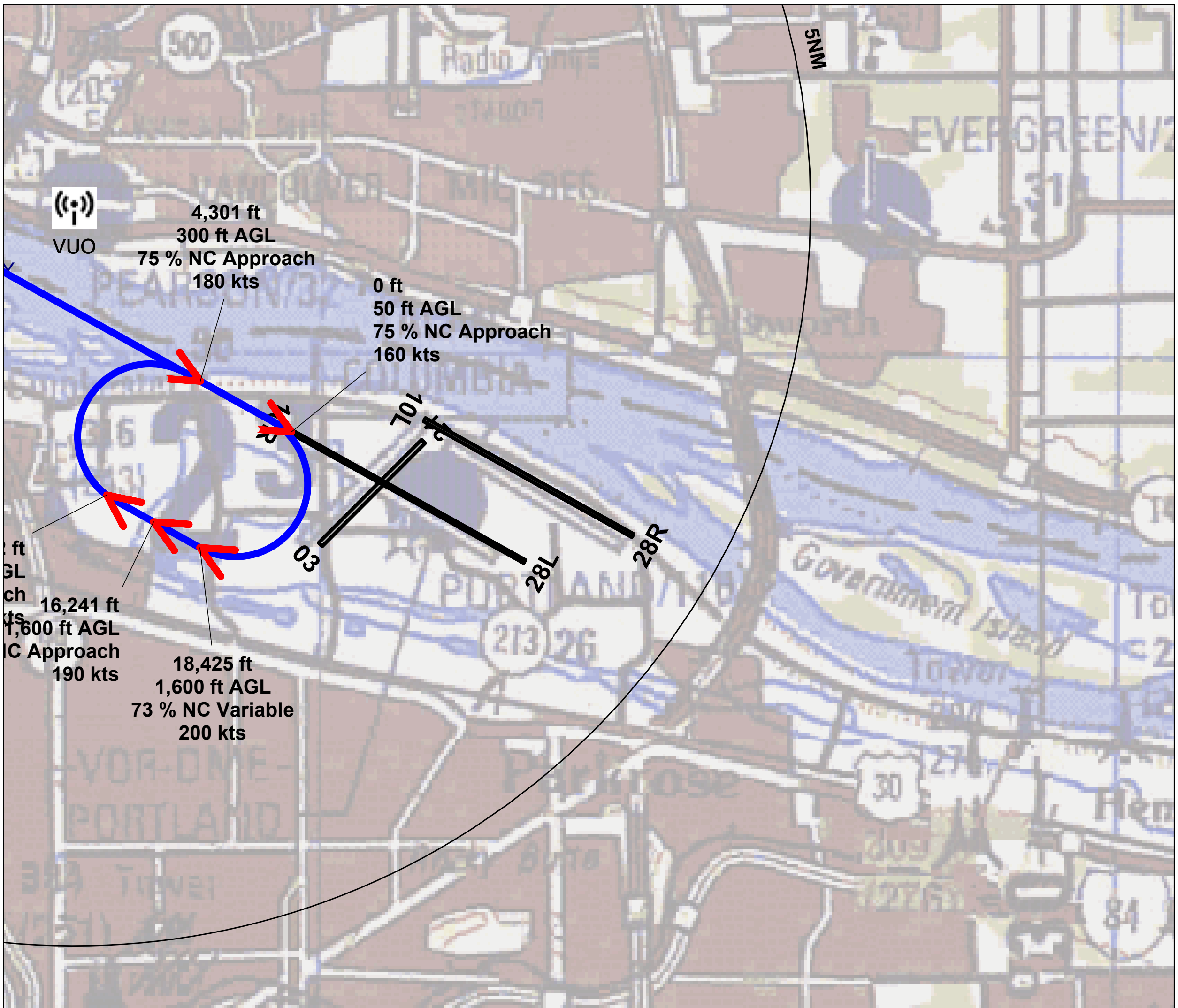
Based F-15C - ILS to Runway 10R

Flight Profile A1

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000 48,000

Scale in Feet 1:144,000 (1 inch = 12,000 feet)

N



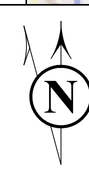
Flight Profile A10s

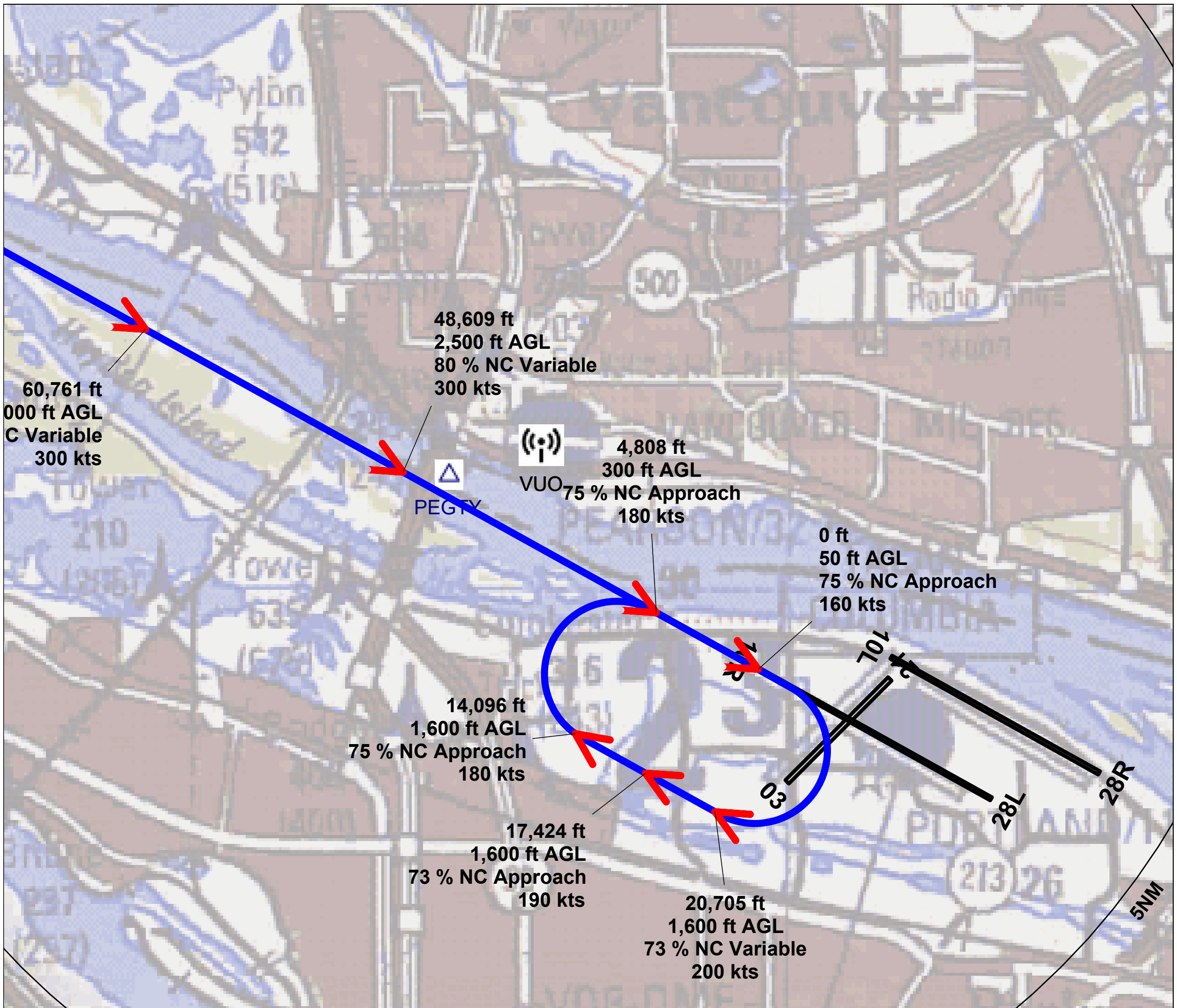
Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	116,048	6,000 AGL	80 Variable	300	-3.5	-1900	96	
b	67,636	3,000 AGL	80 Variable	300	0.0	0	26	
c	54,685	3,000 AGL	80 Variable	300	-2.4	-1200	24	break point, rwy numbers
d	42,533	2,500 AGL	80 Variable	300	-2.1	-900	57	
e	18,425	1,600 AGL	73 Variable	200	0.0	0	7	begin downwind
f	16,241	1,600 AGL	73 Approach	190	0.0	0	7	mid downwind, drop gear
g	14,012	1,600 AGL	75 Approach	180	-7.6	-2400	32	end downwind
h	4,301	300 AGL	75 Approach	180	-3.3	-1000	15	
i	0	50 AGL	75 Approach	160				

Based F-15C - Runway 10R break, right, 1st ship

Flight Profile A10s

Scale in Feet 1:89,100 (1 inch = 7,430 feet)





Flight Profile A11s

Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	116,048	6,000 AGL	80 Variable	300	-4.0	-2100	86	
b	72,636	3,000 AGL	80 Variable	300	0.0	0	23	
c	60,761	3,000 AGL	80 Variable	300	-2.4	-1200	24	2 nm from runway threshold
d	48,609	2,500 AGL	80 Variable	300	-1.8	-800	66	break point, 5 seconds passed rwy threshold
e	20,705	1,600 AGL	73 Variable	200	0.0	0	10	begin downwind
f	17,424	1,600 AGL	73 Approach	190	0.0	0	11	mid downwind, drop gear
g	14,096	1,600 AGL	75 Approach	180	-8.0	-2600	31	end downwind
h	4,808	300 AGL	75 Approach	180	-3.0	-900	17	
i	0	50 AGL	75 Approach	160				

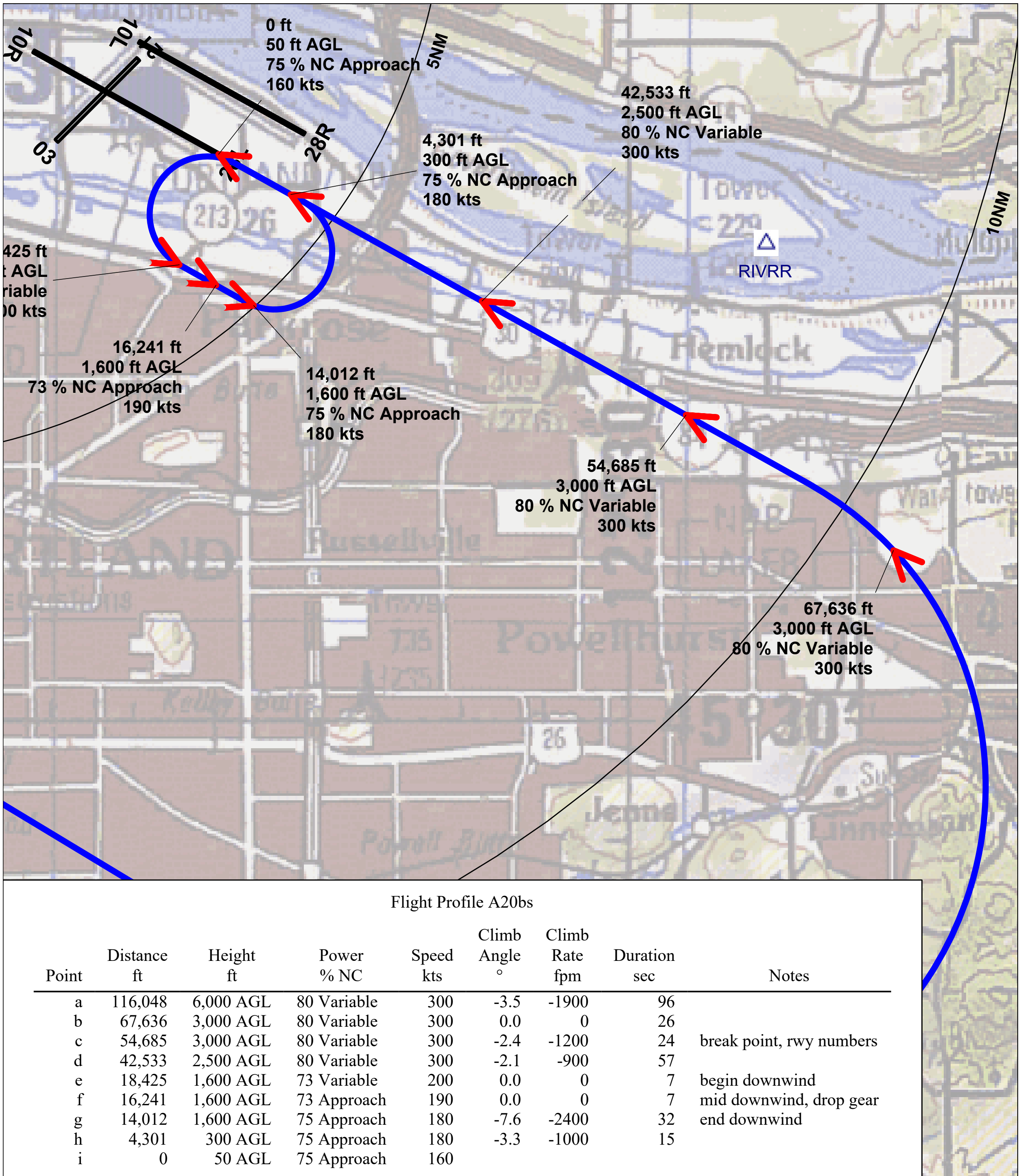
Based F-15C - Runway 10R break, right, 2st ship

Flight Profile A11s

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000

Scale in Feet 1:89,100 (1 inch = 7,420 feet)

N



Flight Profile A20bs

Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	116,048	6,000 AGL	80 Variable	300	-3.5	-1900	96	
b	67,636	3,000 AGL	80 Variable	300	0.0	0	26	
c	54,685	3,000 AGL	80 Variable	300	-2.4	-1200	24	break point, rwy numbers
d	42,533	2,500 AGL	80 Variable	300	-2.1	-900	57	
e	18,425	1,600 AGL	73 Variable	200	0.0	0	7	begin downwind
f	16,241	1,600 AGL	73 Approach	190	0.0	0	7	mid downwind, drop gear
g	14,012	1,600 AGL	75 Approach	180	-7.6	-2400	32	end downwind
h	4,301	300 AGL	75 Approach	180	-3.3	-1000	15	
i	0	50 AGL	75 Approach	160				

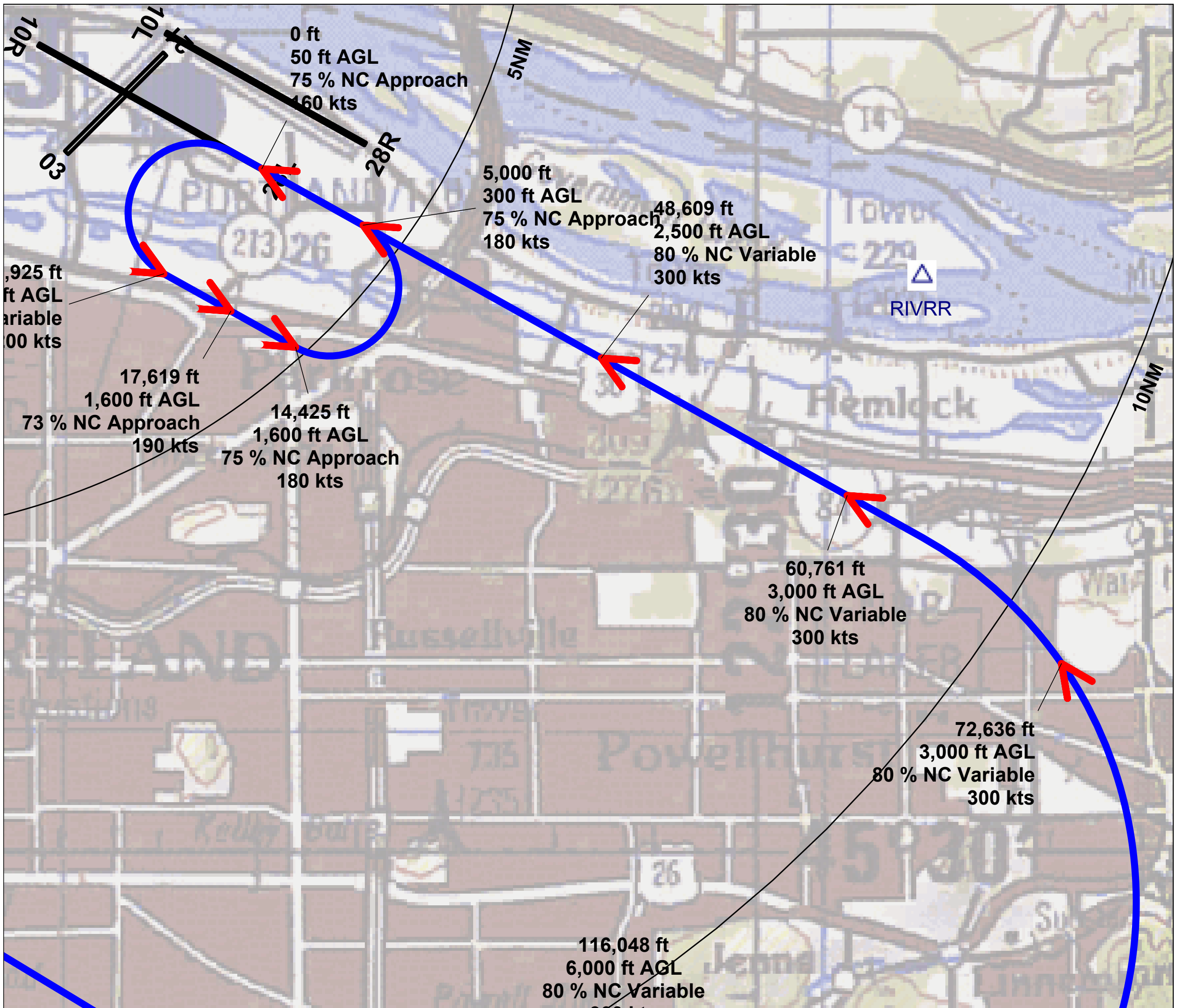
Based F-15C - Runway 28L break, left, 1st ship

Flight Profile A20bs

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000

Scale in Feet 1:97,300 (1 inch = 8,110 feet)

N



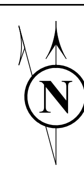
Flight Profile A21bs

Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	116,048	6,000 AGL	80 Variable	300	-4.0	-2100	86	
b	72,636	3,000 AGL	80 Variable	300	0.0	0	23	
c	60,761	3,000 AGL	80 Variable	300	-2.4	-1200	24	2 nm from runway threshold
d	48,609	2,500 AGL	80 Variable	300	-1.9	-800	66	break point, 5 seconds passed rwy threshold
e	20,925	1,600 AGL	73 Variable	200	0.0	0	10	begin downwind
f	17,619	1,600 AGL	73 Approach	190	0.0	0	10	mid downwind, drop gear
g	14,425	1,600 AGL	75 Approach	180	-7.9	-2500	31	end downwind
h	5,000	300 AGL	75 Approach	180	-2.9	-900	17	
i	0	50 AGL	75 Approach	160				

Based F-15C - Runway 28L break, left, 2st ship

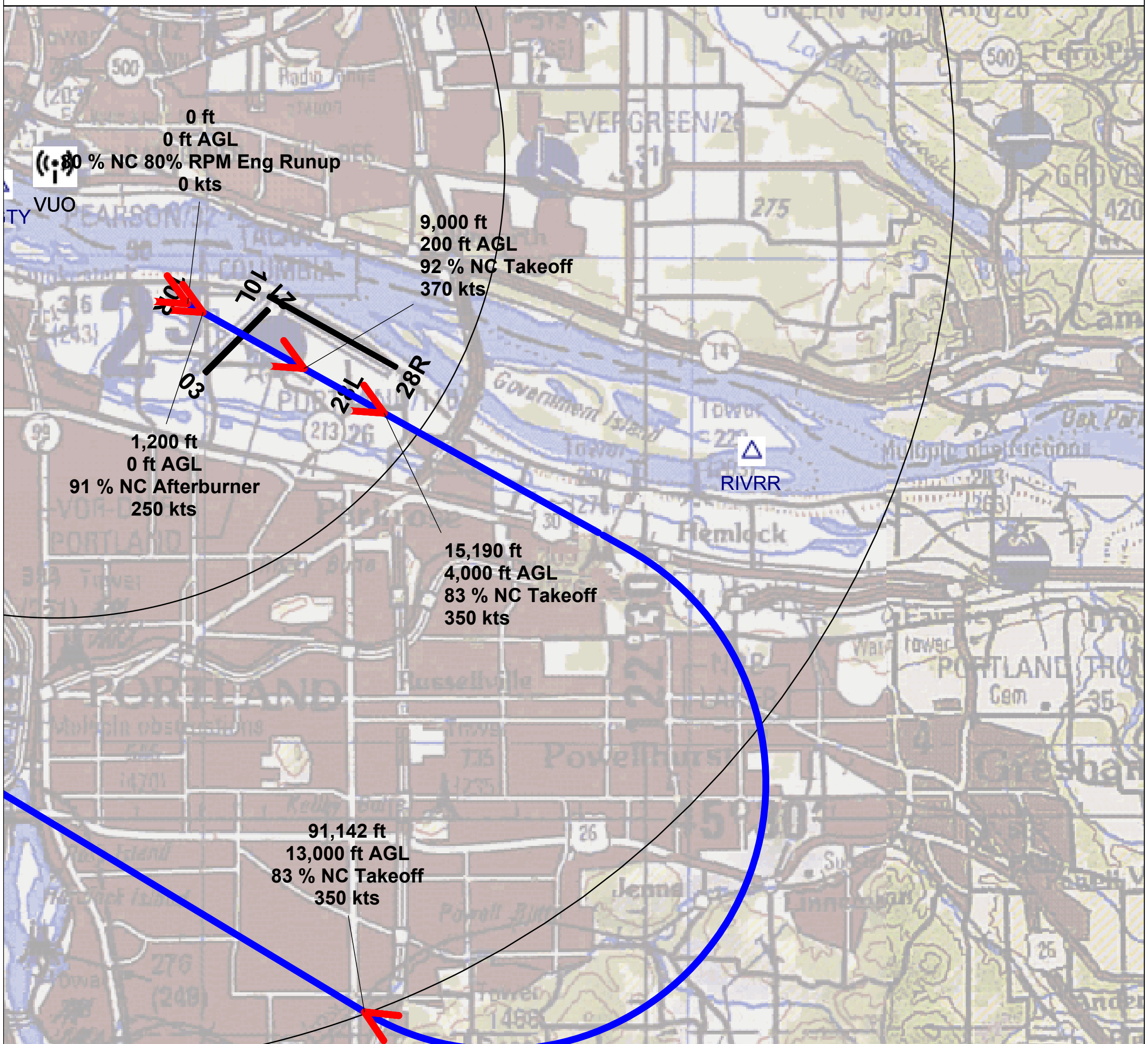
Flight Profile A21bs

Scale in Feet 1:93,000 (1 inch = 7,750 feet)



Flight Profile D1ABb

Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	N
a	0	0 AGL	80 80% RPM Eng Runup	0	0.0	0	6	
b	1,200	0 AGL	91 Afterburner	250	1.5	800	15	
c	9,000	200 AGL	92 Takeoff	370	31.5	22400	10	
d	15,190	4,000 AGL	83 Takeoff	350	6.8	4200	129	maintain rwy heading and climb
e	91,142	13,000 AGL	83 Takeoff	350				beyond study area after aircraft



Based F-15C - AB Departure from Runway 10R

Flight Profile D1ABb

Prior to brake release, aircraft sits at 80 % NC 80% RPM Eng Runup for 5 sec

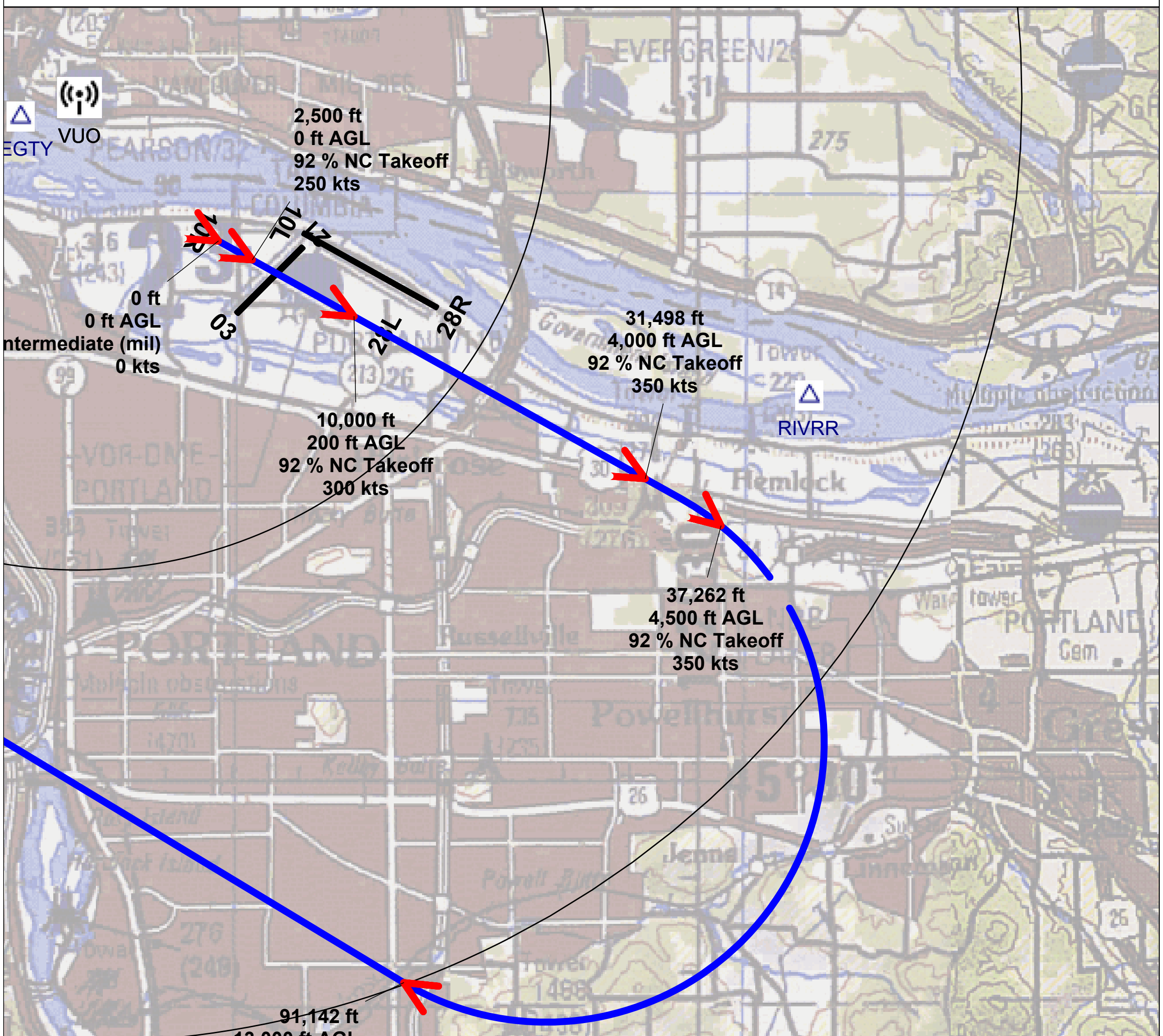
0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000 48,000

Scale in Feet 1:142,000 (1 inch = 11,800 feet)

N

Flight Profile D1MILb

Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	0 AGL	80 Intermediate (mil)	0	0.0	0	12	
b	2,500	0 AGL	92 Takeoff	250	1.5	700	16	
c	10,000	200 AGL	92 Takeoff	300	10.0	5800	39	
d	31,498	4,000 AGL	92 Takeoff	350	5.0	3100	10	
e	37,262	4,500 AGL	92 Takeoff	350	9.0	5600	91	maintain rwy heading and climb unt
f	91,142	13,000 AGL	83 Takeoff	350				beyond study area after aircraft turn



Based F-15C - MIL Departure from Runway 10R

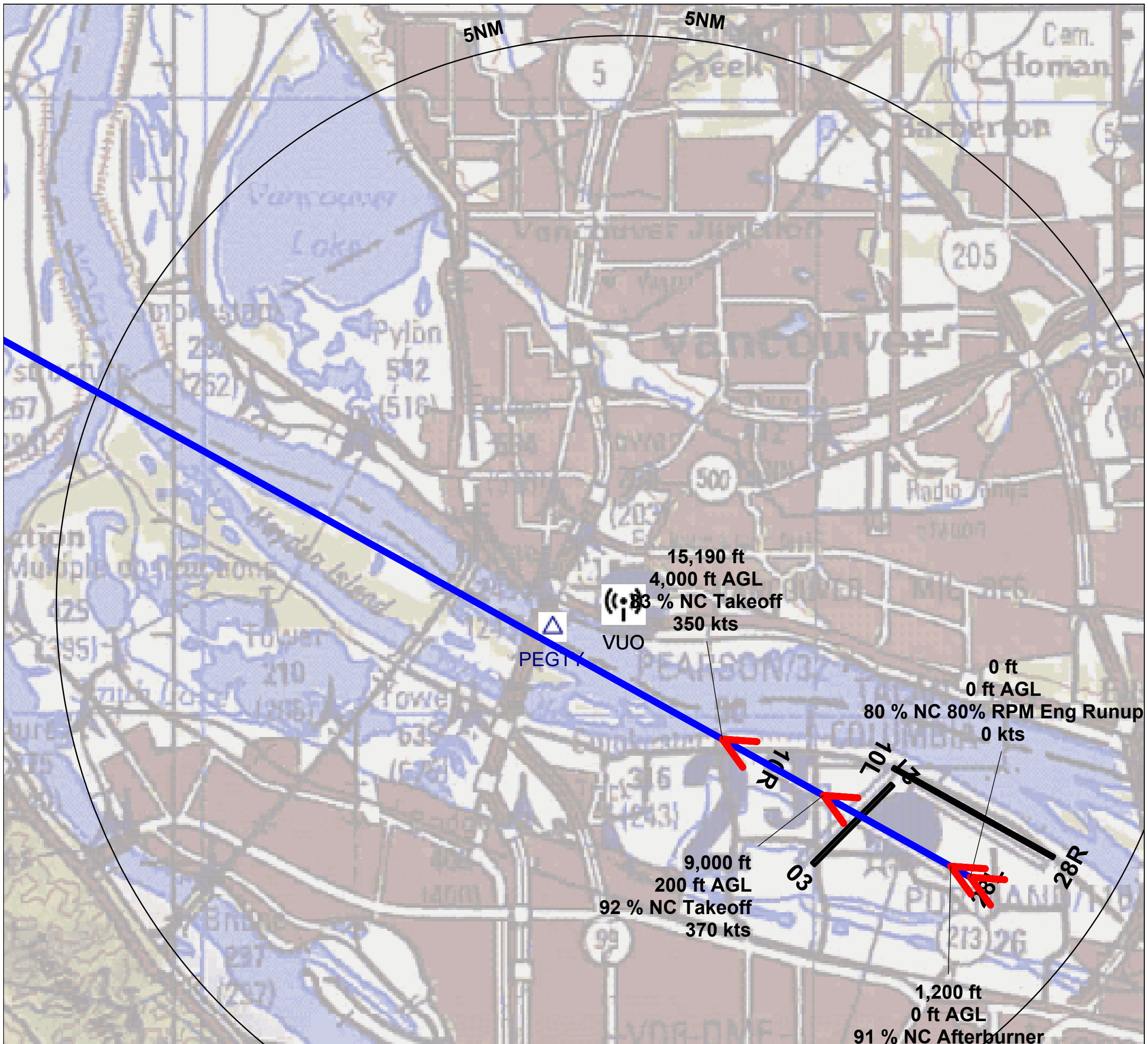
Flight Profile D1MILb

Prior to brake release, aircraft sits at 80 % NC Intermediate (mil) for 5 sec

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000 48,000

Scale in Feet 1:137,000 (1 inch = 11,500 feet)

N



Flight Profile D3AB

Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	N
a	0	0 AGL	80 80% RPM Eng Runup	0	0.0	0	6	
b	1,200	0 AGL	91 Afterburner	250	1.5	800	15	
c	9,000	200 AGL	92 Takeoff	370	31.5	22400	10	
d	15,190	4,000 AGL	83 Takeoff	350	6.8	4200	129	maintain rwy heading and climb
e	91,142	13,000 AGL	83 Takeoff	350				beyond study area after aircraft

Based F-15C - AB Departure from Runway 28L

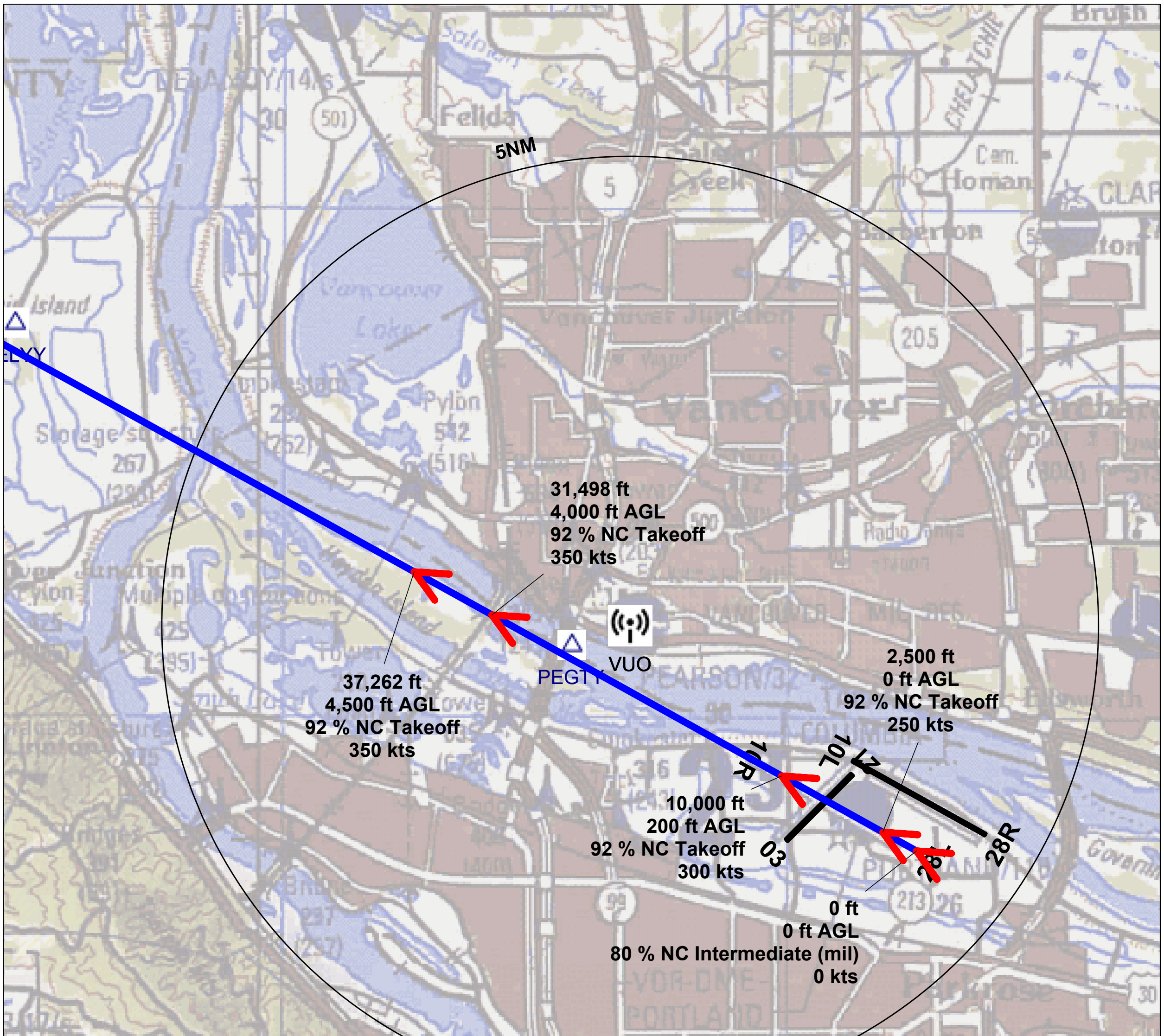
Flight Profile D3AB

Prior to brake release, aircraft sits at 80 % NC 80% RPM Eng Runup for 5 sec

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000

Scale in Feet 1:113,000 (1 inch = 9,390 feet)

N



Flight Profile D3MIL

Point	Distance ft	Height ft	Power % NC	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	0	0 AGL	80 Intermediate (mil)	0	0.0	0	12	
b	2,500	0 AGL	92 Takeoff	250	1.5	700	16	
c	10,000	200 AGL	92 Takeoff	300	10.0	5800	39	
d	31,498	4,000 AGL	92 Takeoff	350	5.0	3100	10	
e	37,262	4,500 AGL	92 Takeoff	350	9.0	5600	91	maintain rwy heading and climb unt
f	91,142	13,000 AGL	83 Takeoff	350				beyond study area after aircraft turn

Based F-15C - MIL Departure from Runway 28L

Flight Profile D3MIL

Prior to brake release, aircraft sits at 80 % NC Intermediate (mil) for 5 sec

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000 48,000

Scale in Feet 1:138,000 (1 inch = 11,500 feet)

N

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F-15EX
(Modeled as F-15EX with G-129 engine)

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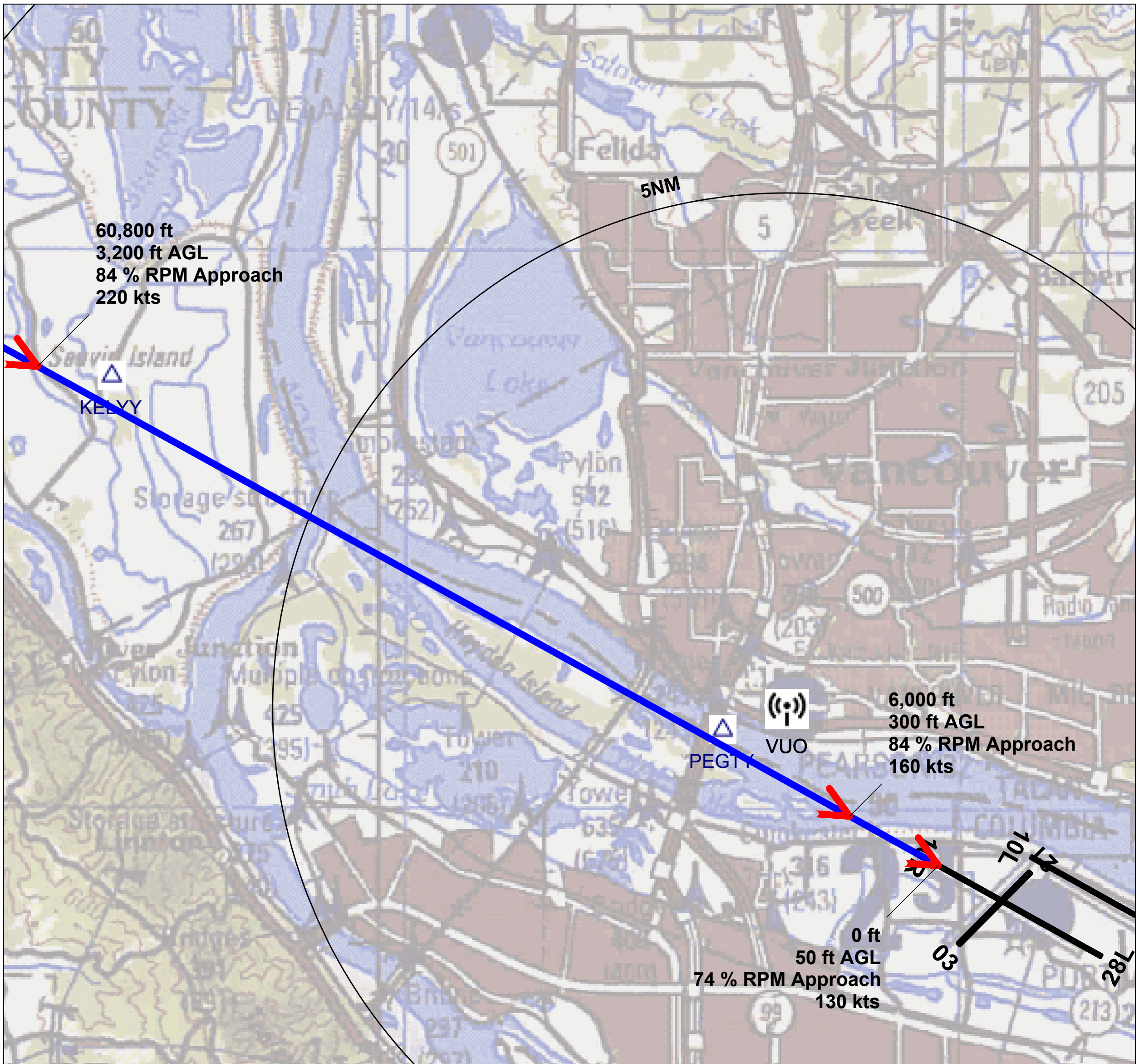


Flight Profile XA1

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	120,000	5,250 AGL	86 Variable	250	0.0	0	50	Level to intercept GS
b	100,000	5,250 AGL	82 Variable	220	-3.0	-1200	106	3deg GS clean
c	60,800	3,200 AGL	84 Approach	220	-3.0	-1000	171	gear down at 10nm
d	6,000	300 AGL	84 Approach	160	-2.4	-600	25	mile final
e	0	50 AGL	74 Approach	130				Over threshold

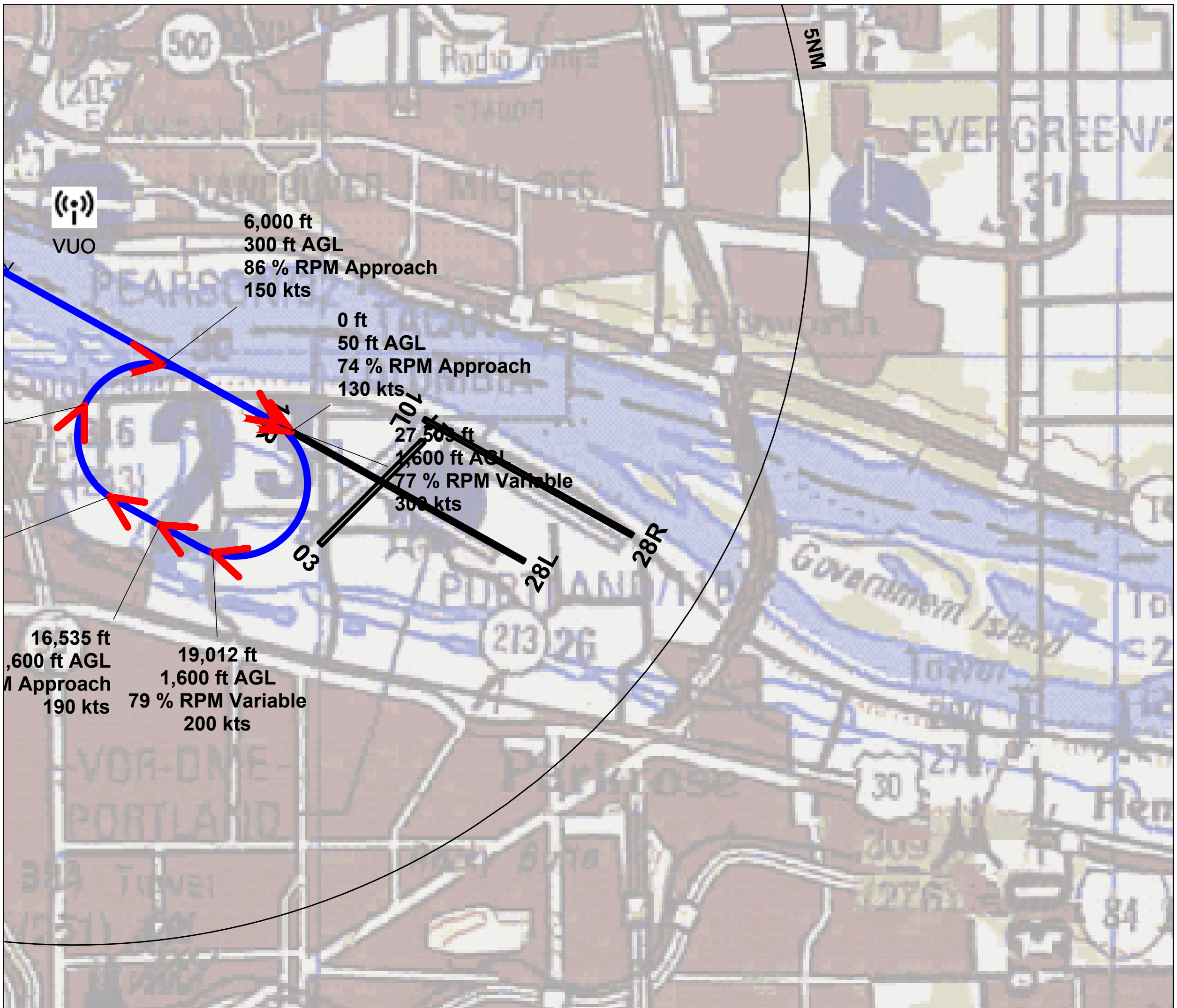
Based F-15EX - ILS to Runway 10R

Flight Profile XA1

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000

Scale in Feet 1:123,000 (1 inch = 10,300 feet)

N



Flight Profile XA10s

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	153,999	10,000 AGL	74 Variable	300	-6.3	-3400	149	Descent
b	78,516	1,600 AGL	84 Variable	300	0.0	0	101	level at pattern altitude at initial (5nm from
c	27,503	1,600 AGL	77 Variable	300	0.0	0	20	begin break turn
d	19,012	1,600 AGL	79 Variable	200	0.0	0	8	begin downwind clean
e	16,535	1,600 AGL	79 Approach	190	0.0	0	8	Gear Down
f	14,161	1,600 AGL	83 Approach	180	-13.0	-3800	15	Start turn
g	9,906	620 AGL	80 Approach	150	-4.7	-1200	15	90 deg to go
h	6,000	300 AGL	86 Approach	150	-2.4	-600	25	wings level 1nm
i	0	50 AGL	74 Approach	130				threshold

Based F-15EX - Runway 10R break, right, 1st ship

Flight Profile XA10s

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000

Scale in Feet 1:89,100 (1 inch = 7,430 feet)

N

Flight Profile XA11s

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	153,999	10,000 AGL	74 Variable	300	-6.3	-3400	149	Descent
b	78,516	1,600 AGL	84 Variable	300	0.0	0	96	level at pattern altitude at initial (5nm from
c	30,098	1,600 AGL	77 Variable	300	0.0	0	22	begin break turn
d	20,925	1,600 AGL	79 Variable	200	0.0	0	13	begin downwind clean
e	16,535	1,600 AGL	79 Approach	190	0.0	0	8	Gear Down
f	14,161	1,600 AGL	83 Approach	180	-13.0	-3800	15	Start turn
g	9,906	620 AGL	80 Approach	150	-4.7	-1200	15	90 deg to go
h	6,000	300 AGL	86 Approach	150	-2.4	-600	25	wings level 1nm
i	0	50 AGL	74 Approach	130				threshold

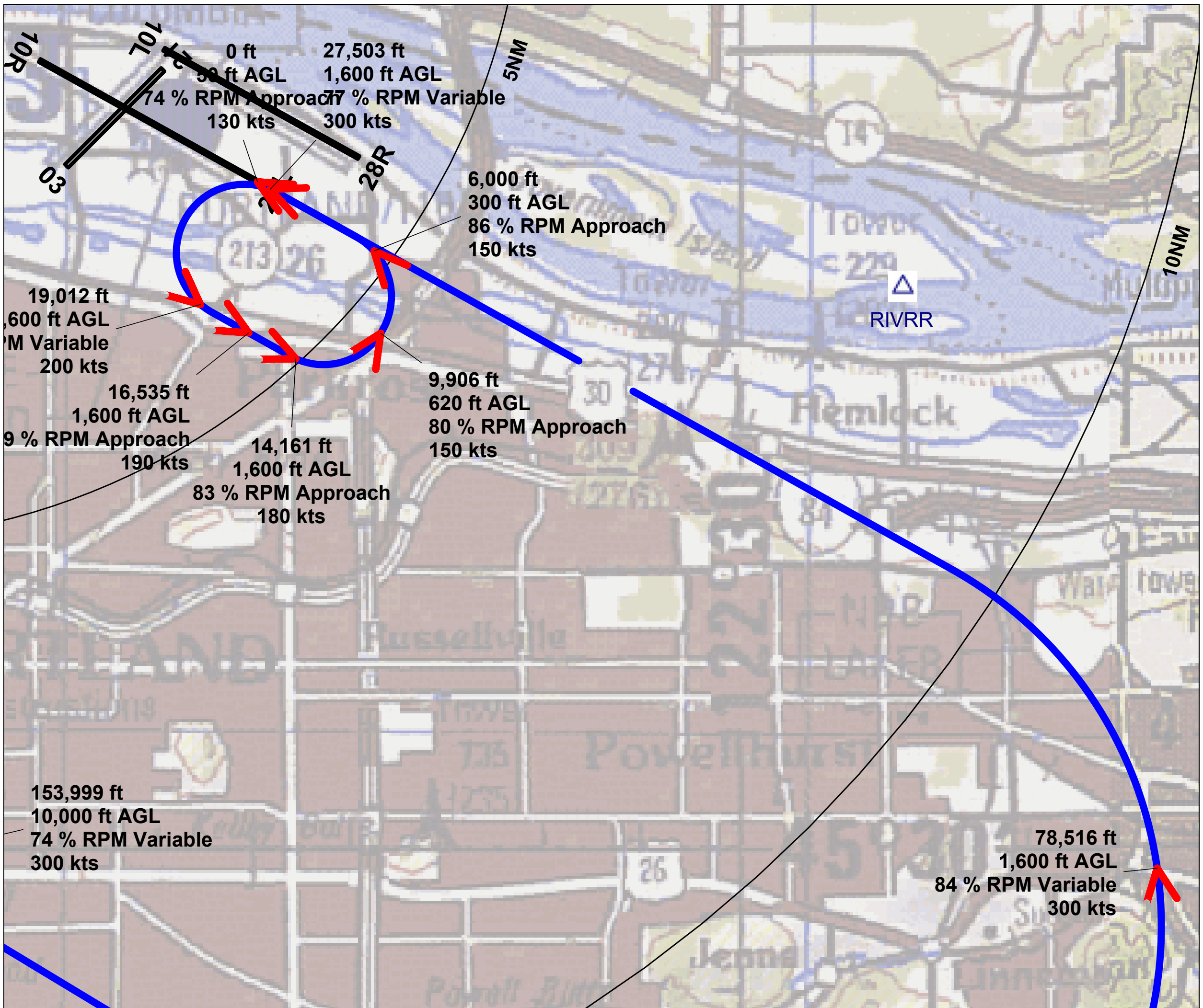
Based F-15EX - Runway 10R break, right, 2st ship

Flight Profile XA11s

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000

Scale in Feet 1:89,100 (1 inch = 7,420 feet)

N



Flight Profile XA20bs

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	220,000	10,000 AGL	83 Variable	300	0.0	0	130	Descent
b	153,999	10,000 AGL	74 Variable	300	-6.3	-3400	149	Descent
c	78,516	1,600 AGL	84 Variable	300	0.0	0	101	level at pattern altitude at initial (5nm from
d	27,503	1,600 AGL	77 Variable	300	0.0	0	20	begin break turn
e	19,012	1,600 AGL	79 Variable	200	0.0	0	8	begin downwind clean
f	16,535	1,600 AGL	79 Approach	190	0.0	0	8	Gear Down
g	14,161	1,600 AGL	83 Approach	180	-13.0	-3800	15	Start turn
h	9,906	620 AGL	80 Approach	150	-4.7	-1200	15	90 deg to go
i	6,000	300 AGL	86 Approach	150	-2.4	-600	25	wings level 1nm
j	0	50 AGL	74 Approach	130				threshold

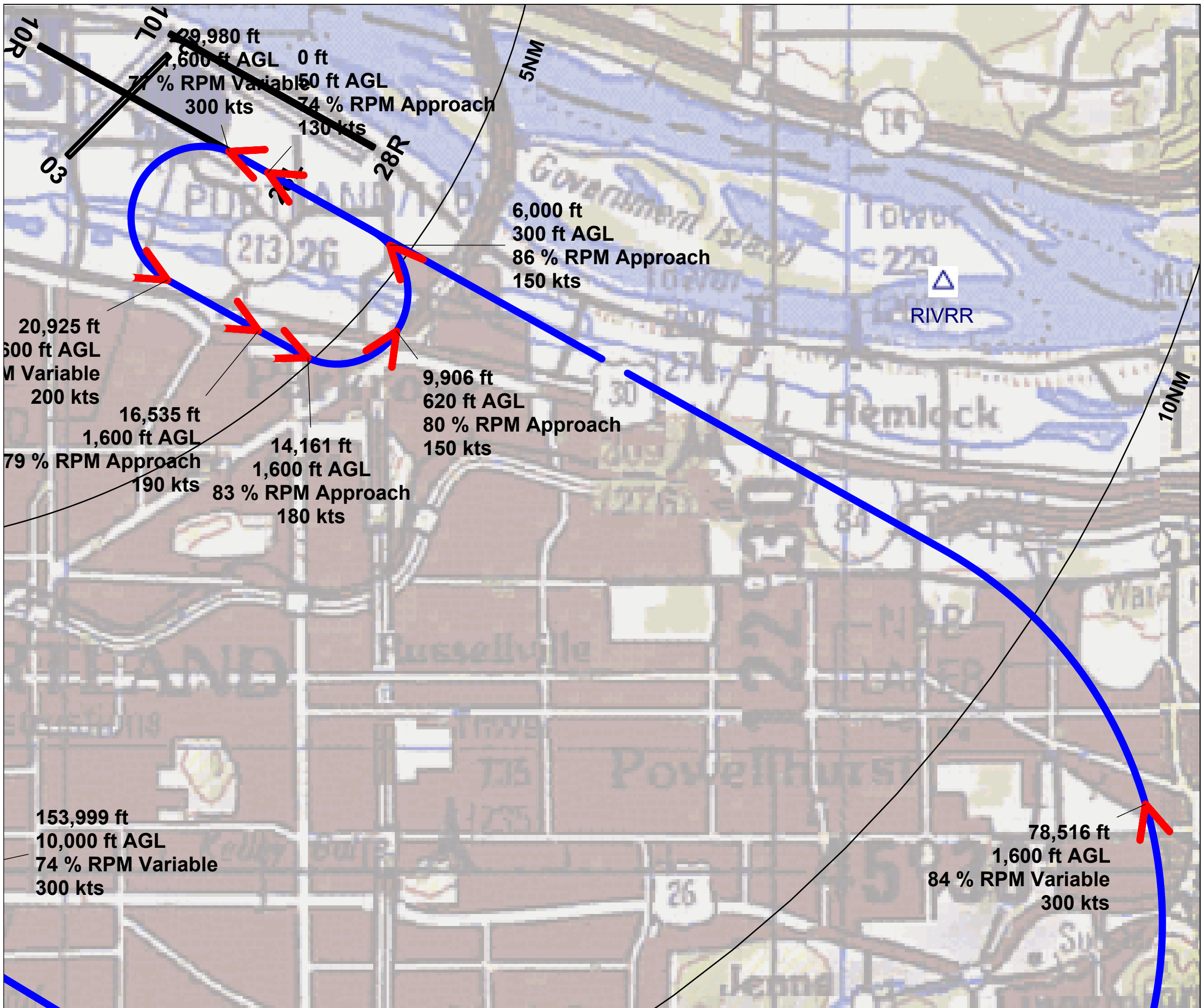
Based F-15EX - Runway 28L break, left, 1st ship

Flight Profile XA20bs

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000

Scale in Feet 1:97,300 (1 inch = 8,110 feet)

N



Flight Profile XA21bs

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	Notes
a	220,000	10,000 AGL	83 Variable	300	0.0	0	130	Descent
b	153,999	10,000 AGL	74 Variable	300	-6.3	-3400	149	Descent
c	78,516	1,600 AGL	84 Variable	300	0.0	0	96	level at pattern altitude at initial (5nm from
d	29,980	1,600 AGL	77 Variable	300	0.0	0	21	begin break turn
e	20,925	1,600 AGL	79 Variable	200	0.0	0	13	begin downwind clean
f	16,535	1,600 AGL	79 Approach	190	0.0	0	8	Gear Down
g	14,161	1,600 AGL	83 Approach	180	-13.0	-3800	15	Start turn
h	9,906	620 AGL	80 Approach	150	-4.7	-1200	15	90 deg to go
i	6,000	300 AGL	86 Approach	150	-2.4	-600	25	wings level 1nm
j	0	50 AGL	74 Approach	130				threshold

Based F-15EX - Runway 28L break, left, 2st ship

Flight Profile XA21bs

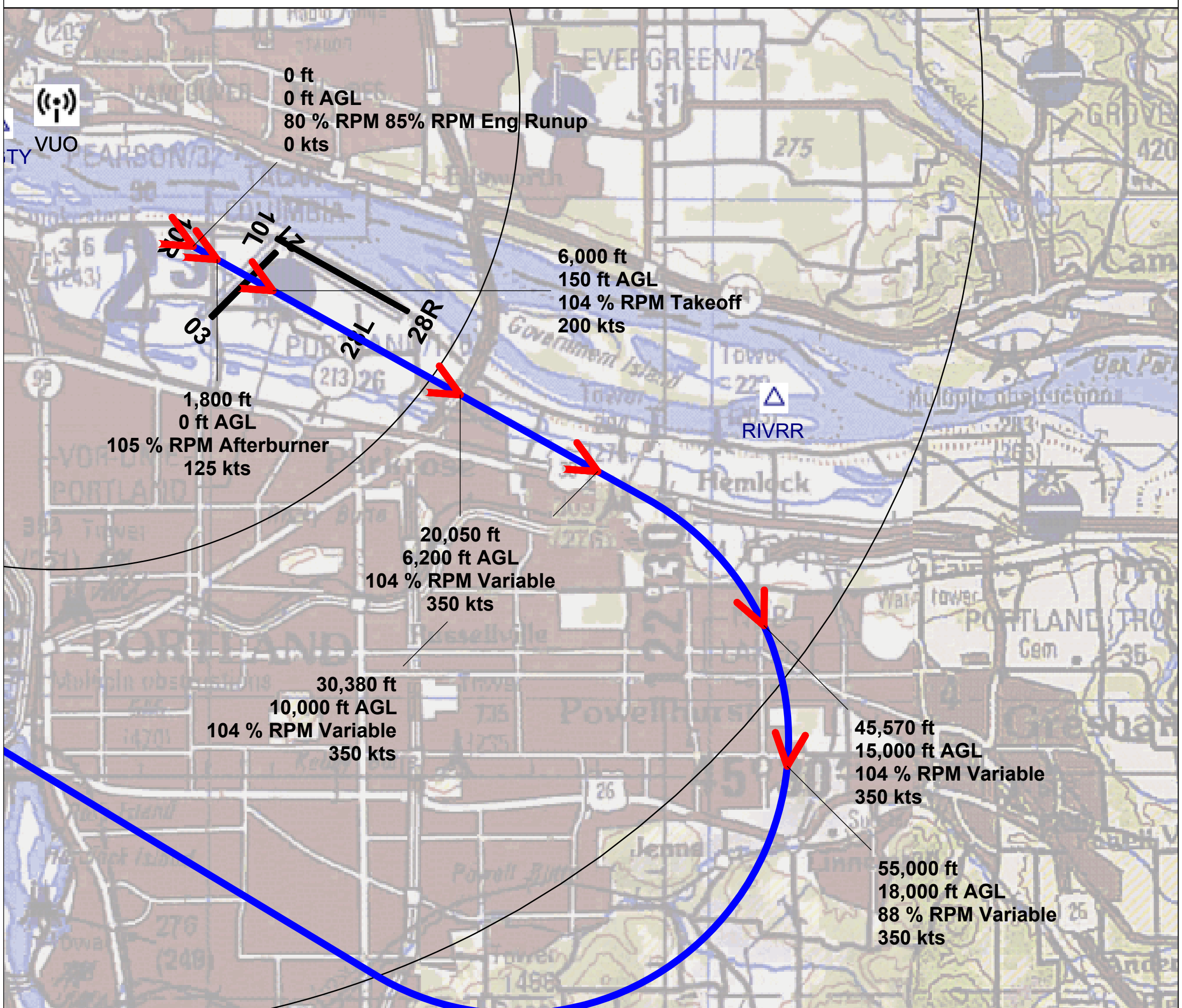
0 4,000 8,000 12,000 16,000 20,000 24,000 28,000

Scale in Feet 1:93,000 (1 inch = 7,750 feet)

N

Flight Profile XD1ABb

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	N
a	0	0 AGL	80 85% RPM Eng Runup	0	0.0	0	17	noisefile has a "85% Eng Runu
b	1,800	0 AGL	105 Afterburner	125	2.0	600	15	1800' to reach 125 start rotate
c	6,000	150 AGL	104 Takeoff	200	23.3	12000	30	into MIL, cleaning gear
d	20,050	6,200 AGL	104 Variable	350	20.2	13000	17	
e	30,380	10,000 AGL	104 Variable	350	18.2	11700	26	
f	45,570	15,000 AGL	104 Variable	350	17.6	11300	16	
g	55,000	18,000 AGL	88 Variable	350	0.0	0	251	assume level at 18k
h	203,247	18,000 AGL	88 Variable	350				



Based F-15EX - AB Departure from Runway 10R

Flight Profile XD1ABb

Prior to brake release, aircraft sits at 80 % RPM 85% RPM Eng Runup for 5 sec

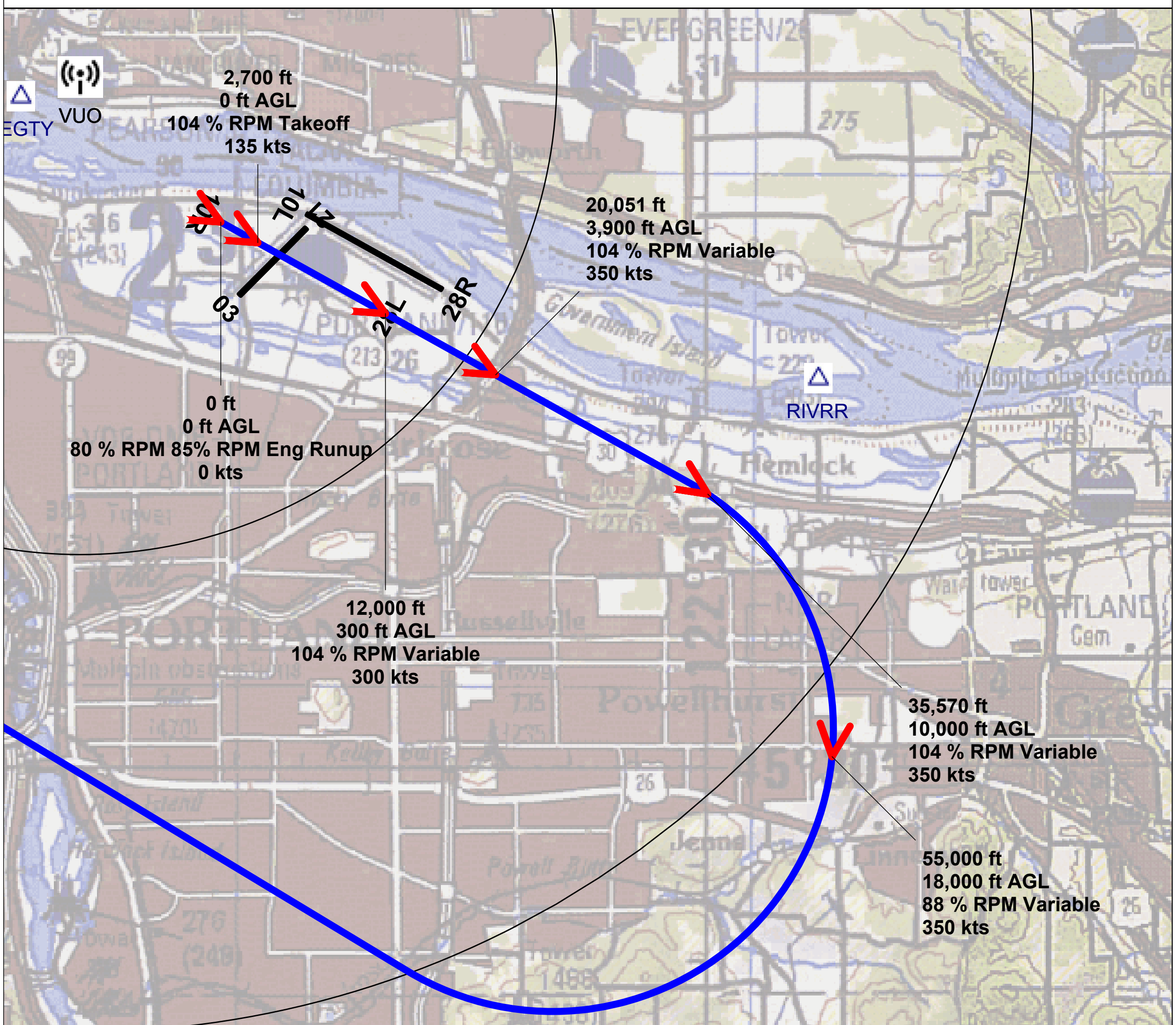
0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000 48,000

Scale in Feet 1:142,000 (1 inch = 11,800 feet)

N

Flight Profile XD1MILb

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	N
a	0	0 AGL	80 85% RPM Eng Runup	0	0.0	0	24	noisefile has a "85% Eng Runu
b	2,700	0 AGL	104 Takeoff	135	1.8	700	25	2700' to reach 135
c	12,000	300 AGL	104 Variable	300	24.1	14700	15	
d	20,051	3,900 AGL	104 Variable	350	21.5	13900	26	3.9kft at 3.3nm
e	35,570	10,000 AGL	104 Variable	350	22.4	14600	33	10k at 5.8nm
f	55,000	18,000 AGL	88 Variable	350	0.0	0	259	assume level at 18k
g	207,911	18,000 AGL	88 Variable	350				



Based F-15EX - MIL Departure from Runway 10R

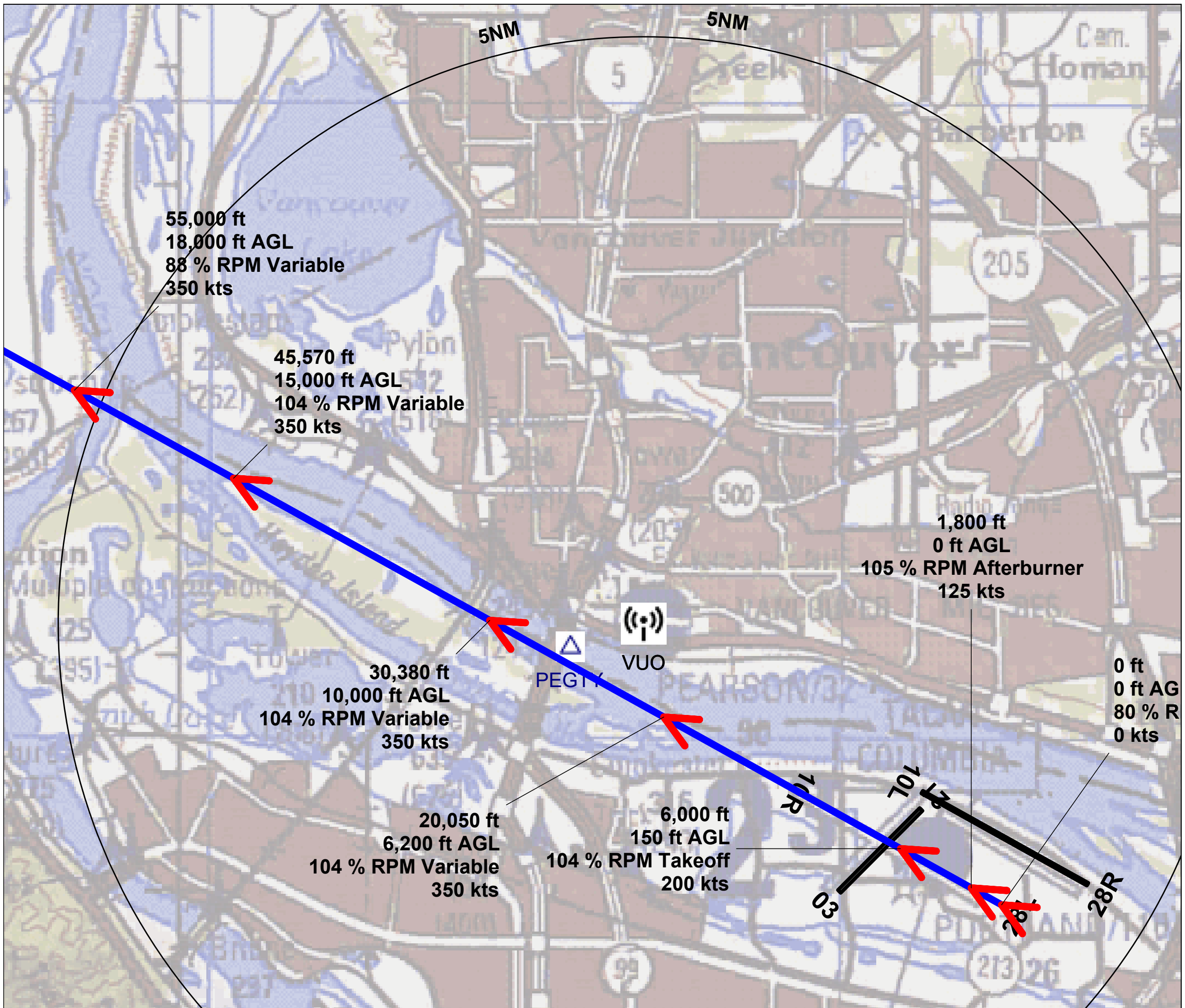
Flight Profile XD1MILb

Prior to brake release, aircraft sits at 80 % RPM 85% RPM Eng Runup for 5 sec

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000 48,000

Scale in Feet 1:137,000 (1 inch = 11,500 feet)

N



Flight Profile XD3AB

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	N
a	0	0 AGL	80 85% RPM Eng Runup	0	0.0	0	17	noisefile has a "85% Eng Runu
b	1,800	0 AGL	105 Afterburner	125	2.0	600	15	1800' to reach 125 start rotate
c	6,000	150 AGL	104 Takeoff	200	23.3	12000	30	into MIL, cleaning gear
d	20,050	6,200 AGL	104 Variable	350	20.2	13000	17	
e	30,380	10,000 AGL	104 Variable	350	18.2	11700	26	
f	45,570	15,000 AGL	104 Variable	350	17.6	11300	16	
g	55,000	18,000 AGL	88 Variable	350	0.0	0	212	assume level at 18k
h	180,000	18,000 AGL	88 Variable	350				

Based F-15EX - AB Departure from Runway 28L

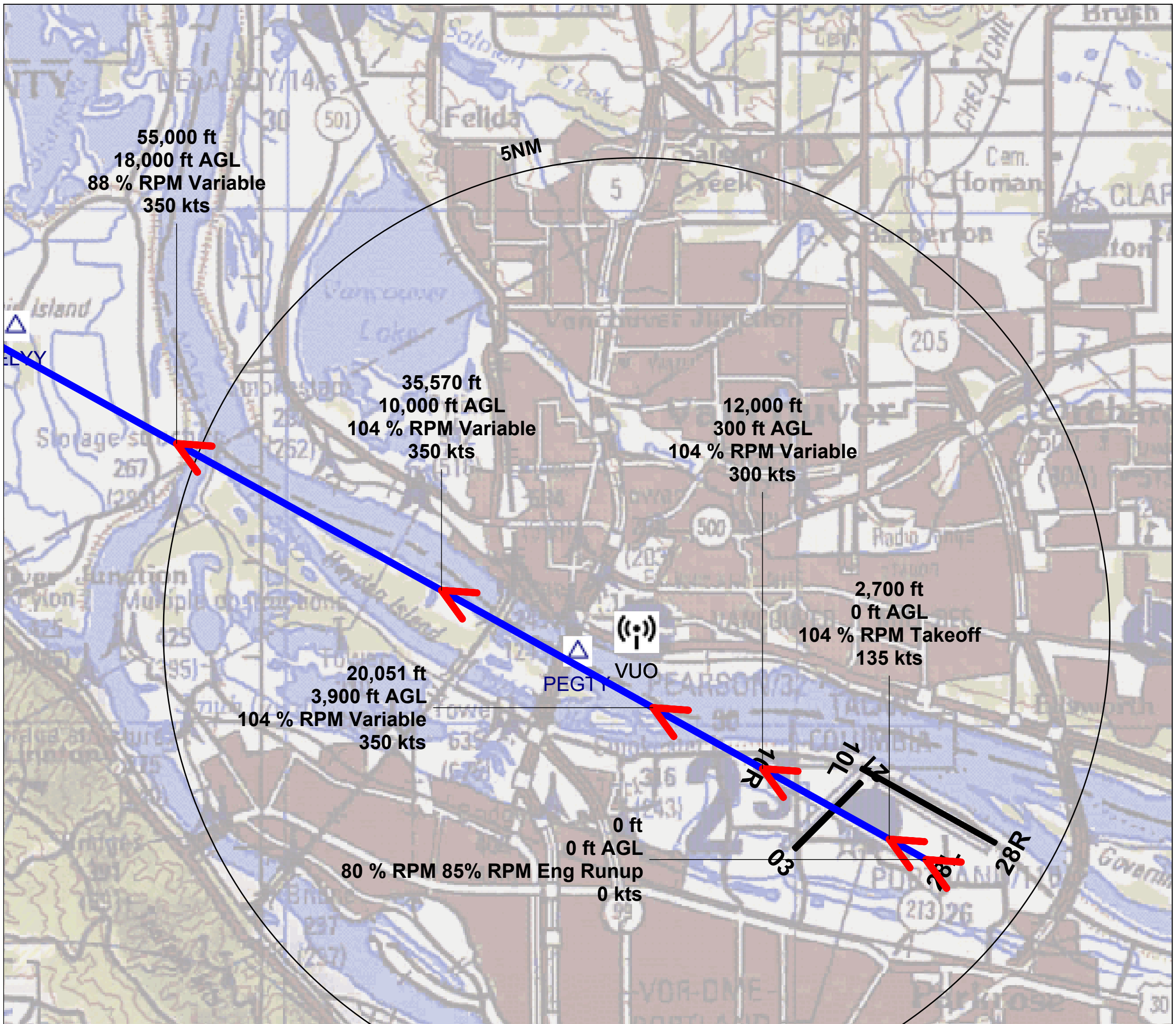
Flight Profile XD3AB

Prior to brake release, aircraft sits at 80 % RPM 85% RPM Eng Runup for 5 sec

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000

Scale in Feet 1:113,000 (1 inch = 9,390 feet)

N



Flight Profile XD3MIL

Point	Distance ft	Height ft	Power % RPM	Speed kts	Climb Angle °	Climb Rate fpm	Duration sec	N
a	0	0 AGL	80 85% RPM Eng Runup	0	0.0	0	24	noisefile has a "85% Eng Runu
b	2,700	0 AGL	104 Takeoff	135	1.8	700	25	2700' to reach 135
c	12,000	300 AGL	104 Variable	300	24.1	14700	15	
d	20,051	3,900 AGL	104 Variable	350	21.5	13900	26	3.9kft at 3.3nm
e	35,570	10,000 AGL	104 Variable	350	22.4	14600	33	10k at 5.8nm
f	55,000	18,000 AGL	88 Variable	350	0.0	0	110	assume level at 18k
g	120,000	18,000 AGL	88 Variable	350				

Based F-15EX - MIL Departure from Runway 28L

Flight Profile XD3MIL

Prior to brake release, aircraft sits at 80 % RPM 85% RPM Eng Runup for 5 sec

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000 40,000 44,000 48,000

Scale in Feet 1:138,000 (1 inch = 11,500 feet)

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CIVIL AIRCRAFT

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Table A-1. AEDT Modeling of Civil Aircraft by Airframe

Airframe	FAA Tower Category	AEDT ANP Type	Arrival			Departure			Grand Total
			Day	Night	Total	Day	Night	Total	
Airbus A300F4-600 Series	Air Carrier	A300-622R	160	242	402	0	399	399	801
Airbus A319-100 Series	Air Carrier	A319-131	1508	861	2369	1506	860	2366	4735
Airbus A320-200 Series	Air Carrier	A320-211	8179	1938	10117	7958	2146	10104	20221
Airbus A330-300 Series	Air Carrier	A330-301	1167	0	1167	1168	0	1168	2335
Airbus A340-200 Series	Air Carrier	A340-211	248	0	248	250	0	250	498
Boeing 737-300 Series	Air Carrier	7373B2	215	0	215	106	107	213	428
Boeing 737-400 Series	Air Carrier	737400	215	0	215	106	107	213	428
Boeing 737-700 Series	Air Carrier	737700	18727	3655	22382	19792	2578	22370	44752
Boeing 737-800 Series	Air Carrier	737800	13141	2721	15862	12267	3597	15864	31726
Boeing 747-400 Series	Air Carrier	747400	0	149	149	0	138	138	287
Boeing 757-200 Series	Air Carrier	757PW	1484	213	1697	1264	438	1702	3399
Boeing 757-300 Series	Air Carrier	767300	160	0	160	160	0	160	320
Boeing 767-200 Series	Air Carrier	767CF6	469	513	982	47	932	979	1961
Boeing 767-300 Series	Air Carrier	767300	0	170	170	168	0	168	338
Boeing 777-200-ER	Air Carrier	777200	500	16	516	518	0	518	1034
McDonnell Douglas DC10-30	Air Carrier	DC1030	935	135	1070	1063	0	1063	2133
McDonnell Douglas MD-11	Air Carrier	MD11GE	69	67	136	0	130	130	266
Bombardier Challenger 600	Air Taxi	CL600	230	3	233	223	12	235	468
Bombardier Challenger 601	Air Taxi	CL601	395	3	398	388	12	400	798
Bombardier de Havilland Dash 8 Q400	Air Carrier	DHC8	16938	1195	18133	17156	957	18113	36246
Bombardier Learjet 25	Air Taxi	LEAR25	244	5	249	238	13	251	500
Bombardier Learjet 35A/36A (C-21A)	Air Taxi	LEAR35	1075	22	1097	1041	54	1095	2192
Britten-Norman BN-2 Islander	General Aviation	BEC58P	2384	763	3147	2382	763	3145	6292
Cessna 172 Skyhawk	General Aviation	CNA172	157	13	170	154	9	163	333
Cessna 206	General Aviation	CNA206	232	25	257	230	26	256	513
Cessna 441 Conquest II	General Aviation	CNA441	1075	84	1159	1147	17	1164	2323
Cessna 550 Citation Bravo	Air Taxi	CNA55B	2825	68	2893	2728	161	2889	5782
Cessna 650 Citation III	Air Taxi	CNA560XL	417	9	426	400	27	427	853
Cessna 750 Citation X	Air Taxi	CNA750	244	5	249	238	13	251	500
Dassault Falcon 20-D	Air Taxi	FAL20	161	0	161	161	0	161	322
DeHavilland DHC-6-200 Twin Otter	Air Taxi	DHC6	2995	679	3674	2915	753	3668	7342
DeHavilland DHC-8-100	Air Taxi	DHC8	270	0	270	267	0	267	537
Embraer EMB120 Brasilia	General Aviation	EMB120	1912	241	2153	2146	0	2146	4299
Gulfstream G550	Air Taxi	GV	14578	475	15053	14142	911	15053	30106
Gulfstream II-B	Air Taxi	GIIB	239	0	239	239	0	239	478
Gulfstream IV-SP	Air Taxi	GIV	366	5	371	357	13	370	741
Israel IAI-1125 Astra	Air Taxi	IA1125	455	7	462	444	25	469	931
Piper PA-24 Comanche	General Aviation	PA31	3754	1403	5157	4301	859	5160	10317
Beech 1900-D	Air Taxi	1900D	186	81	267	223	0	223	490
Beech Baron 58	General Aviation	BEC58P	602	349	951	679	273	952	1903
Grand Total			**98911**	**16115**	**115026**	**98572**	**16330**	**114902**	**229928**

Note: Modeled with Standard AEDT flight profiles

Table A2: Civil Aircraft Modeled Departure Runway Utilization

Aircraft Type and Series	FAA Tower Category	AEDT ANP Type	03C	10LC	10R	21C	28L	28RC
Airbus A300F4-600 Series	Air Carrier	A300-622R	0%	23%	19%	0%	27%	31%
Airbus A319-100 Series	Air Carrier	A319-131	0%	25%	20%	0%	27%	27%
Airbus A320-200 Series	Air Carrier	A320-211	0%	26%	21%	0%	27%	25%
Airbus A330-300 Series	Air Carrier	A330-301	0%	27%	26%	0%	25%	21%
Airbus A340-200 Series	Air Carrier	A340-211	0%	27%	26%	0%	25%	21%
Boeing 737-300 Series	Air Carrier	7373B2	0%	24%	20%	1%	28%	28%
Boeing 737-400 Series	Air Carrier	737400	0%	24%	20%	1%	28%	28%
Boeing 737-700 Series	Air Carrier	737700	0%	27%	21%	0%	27%	25%
Boeing 737-800 Series	Air Carrier	737800	0%	26%	21%	0%	27%	25%
Boeing 747-400 Series	Air Carrier	747400	0%	23%	19%	0%	27%	31%
Boeing 757-200 Series	Air Carrier	757PW	0%	26%	24%	0%	25%	24%
Boeing 757-300 Series	Air Carrier	767300	0%	27%	26%	0%	25%	21%
Boeing 767-200 Series	Air Carrier	767CF6	0%	23%	19%	0%	27%	31%
Boeing 767-300 Series	Air Carrier	767300	0%	27%	26%	0%	25%	21%
Boeing 777-200-ER	Air Carrier	777200	0%	27%	26%	0%	25%	21%
Boeing MD-10-30	Air Carrier	DC1030	0%	27%	26%	0%	25%	21%
Boeing MD-11	Air Carrier	MD11GE	0%	23%	19%	0%	27%	31%
Bombardier Challenger 600	Air Taxi	CL600	0%	28%	22%	0%	26%	24%
Bombardier Challenger 601	Air Taxi	CL601	0%	28%	22%	0%	26%	24%
Bombardier de Havilland Dash 8 Q400	Air Carrier	DHC8	1%	28%	26%	2%	23%	21%
Bombardier Learjet 25	Air Taxi	LEAR25	0%	28%	22%	0%	26%	24%
Bombardier Learjet 35A/36A (C-21A)	Air Taxi	LEAR35	0%	28%	22%	0%	26%	24%
Britten-Norman BN-2 Islander	General Aviation	BEC58P	2%	4%	43%	7%	18%	26%
Cessna 172 Skyhawk	General Aviation	CNA172	2%	4%	46%	8%	15%	26%
Cessna 206	General Aviation	CNA206	2%	4%	45%	7%	15%	26%
Cessna 441 Conquest II	General Aviation	CNA441	1%	28%	26%	2%	23%	21%
Cessna 550 Citation Bravo	Air Taxi	CNA55B	0%	28%	22%	0%	26%	24%
Cessna 650 Citation III	Air Taxi	CNA560XL	0%	28%	22%	0%	26%	24%
Cessna 750 Citation X	Air Taxi	CNA750	0%	28%	22%	0%	26%	24%
Dassault Falcon 20-D	Air Taxi	FAL20	0%	28%	22%	0%	26%	24%
DeHavilland DHC-6-200 Twin Otter	Air Taxi	DHC6	1%	26%	25%	2%	24%	22%
DeHavilland DHC-8-100	Air Taxi	DHC8	1%	28%	26%	1%	23%	21%
Embraer EMB120 Brasilia	General Aviation	EMB120	1%	28%	26%	1%	23%	21%
Gulfstream G550	Air Taxi	GV	0%	28%	22%	0%	26%	24%
Gulfstream II-B	Air Taxi	GIIB	0%	28%	22%	0%	26%	24%
Gulfstream IV-SP	Air Taxi	GIV	0%	28%	22%	0%	26%	24%
Israel IAI-1125 Astra	Air Taxi	IA1125	0%	28%	22%	0%	26%	24%
Piper PA-24 Comanche	General Aviation	PA31	0%	26%	0%	1%	0%	73%
Raytheon Beech 1900-D	Air Taxi	1900D	1%	28%	26%	1%	23%	21%
Raytheon Beech Baron 58	General Aviation	BEC58P	0%	27%	0%	2%	0%	71%
Grand Total			**0%**	**26%**	**22%**	**1%**	**24%**	**27%**

Note: Totals may not add due to rounding

Table A3: Civil Aircraft Modeled Arrival Runway Utilization

Aircraft Type and Series	FAA Tower Category	AEDT ANP Type	03C	10LC	10R	21C	28L	28RC
Airbus A300F4-600 Series	Air Carrier	A300-622R	0%	26%	25%	1%	24%	25%
Airbus A319-100 Series	Air Carrier	A319-131	0%	24%	25%	0%	25%	25%
Airbus A320-200 Series	Air Carrier	A320-211	0%	24%	25%	0%	26%	25%
Airbus A330-300 Series	Air Carrier	A330-301	0%	22%	23%	0%	27%	28%
Airbus A340-200 Series	Air Carrier	A340-211	0%	22%	23%	0%	27%	28%
Boeing 737-300 Series	Air Carrier	7373B2	0%	23%	24%	0%	27%	26%
Boeing 737-400 Series	Air Carrier	737400	0%	23%	24%	0%	27%	26%
Boeing 737-700 Series	Air Carrier	737700	0%	24%	25%	0%	26%	26%
Boeing 737-800 Series	Air Carrier	737800	0%	24%	25%	0%	26%	25%
Boeing 747-400 Series	Air Carrier	747400	0%	28%	26%	1%	22%	24%
Boeing 757-200 Series	Air Carrier	757PW	0%	23%	23%	0%	26%	27%
Boeing 757-300 Series	Air Carrier	767300	0%	22%	23%	0%	27%	28%
Boeing 767-200 Series	Air Carrier	767CF6	0%	25%	24%	1%	24%	26%
Boeing 767-300 Series	Air Carrier	767300	0%	28%	26%	1%	22%	24%
Boeing 777-200-ER	Air Carrier	777200	0%	22%	23%	0%	27%	28%
Boeing MD-10-30	Air Carrier	DC1030	0%	23%	23%	0%	26%	27%
Boeing MD-11	Air Carrier	MD11GE	0%	25%	24%	1%	24%	26%
Bombardier Challenger 600	Air Taxi	CL600	0%	23%	24%	0%	27%	26%
Bombardier Challenger 601	Air Taxi	CL601	0%	23%	24%	0%	27%	26%
Bombardier de Havilland Dash 8 Q400	Air Carrier	DHC8	5%	25%	26%	1%	21%	21%
Bombardier Learjet 25	Air Taxi	LEAR25	0%	23%	24%	0%	27%	26%
Bombardier Learjet 35A/36A (C-21A)	Air Taxi	LEAR35	0%	23%	24%	0%	27%	26%
Britten-Norman BN-2 Islander	General Aviation	BEC58P	32%	11%	23%	8%	8%	19%
Cessna 172 Skyhawk	General Aviation	CNA172	37%	8%	21%	5%	10%	20%
Cessna 206	General Aviation	CNA206	36%	8%	21%	6%	9%	20%
Cessna 441 Conquest II	General Aviation	CNA441	5%	25%	26%	1%	21%	22%
Cessna 550 Citation Bravo	Air Taxi	CNA55B	0%	23%	24%	0%	27%	26%
Cessna 650 Citation III	Air Taxi	CNA560XL	0%	23%	24%	0%	27%	26%
Cessna 750 Citation X	Air Taxi	CNA750	0%	23%	24%	0%	27%	26%
Dassault Falcon 20-D	Air Taxi	FAL20	0%	23%	24%	0%	27%	26%
DeHavilland DHC-6-200 Twin Otter	Air Taxi	DHC6	4%	24%	26%	2%	22%	22%
DeHavilland DHC-8-100	Air Taxi	DHC8	5%	25%	26%	1%	21%	21%
Embraer EMB120 Brasilia	General Aviation	EMB120	5%	24%	26%	2%	22%	22%
Gulfstream G550	Air Taxi	GV	0%	23%	24%	0%	27%	26%
Gulfstream II-B	Air Taxi	GIIB	0%	23%	24%	0%	27%	26%
Gulfstream IV-SP	Air Taxi	GIV	0%	23%	24%	0%	27%	26%
Israel IAI-1125 Astra	Air Taxi	IA1125	0%	23%	24%	0%	27%	26%
Piper PA-24 Comanche	General Aviation	PA31	3%	31%	1%	3%	0%	62%
Raytheon Beech 1900-D	Air Taxi	1900D	4%	24%	26%	2%	22%	22%
Raytheon Beech Baron 58	General Aviation	BEC58P	4%	36%	1%	2%	0%	57%
Grand Total			**2%**	**24%**	**24%**	**1%**	**23%**	**26%**

Note: Totals may not add due to rounding

Table A-4. TAF Analysis: Portland CY 2022 Fleet Mix

Prepared by FAA Office of Environment and Energy, Noise Division - November 6, 2023

PDX Fleet Mix from FAA CY 2022 National Inventory by AEDT Equipment Type and FAA Tower Category

Tower Category	AEDT Equipment ID	AEDT ANP Type	Representative Aircraft	Departures			Arrivals			Local		
				Day	Night	Total	Day	Night	Total	Day	Night	Total
Air Carrier	5969	A310-304	Airbus A310-200 Series, Airbus A310-300 Series, Airbus A310-200 Series Freighter	0.3%	0.0%	0.4%	0.3%	0.0%	0.4%	0.0%	0.0%	0.0%
	957	A319-131	Airbus A318-100 Series, Airbus A319-100 Series, Airbus A319-100 X/LR, Airbus A319CJ, Airbus A319-NEO	1.9%	0.4%	2.3%	1.7%	0.6%	2.3%	0.0%	0.0%	0.0%
	1019	A320-232	Airbus A320-200 Series	2.1%	1.4%	3.5%	2.2%	1.3%	3.5%	0.0%	0.0%	0.0%
	2454	A320-211	Airbus A320-200 Series, Airbus A320-100 Series, COMAC C919	4.6%	0.5%	5.1%	4.1%	1.0%	5.1%	0.0%	0.0%	0.0%
	6637	A320-271N	Airbus A320-NEO	1.3%	0.6%	1.8%	1.4%	0.4%	1.8%	0.0%	0.0%	0.0%
	1040	A321-232	Airbus A321-100 Series, Airbus A321-200 Series, Airbus A321-NEO	3.1%	1.6%	4.7%	3.2%	1.5%	4.7%	0.0%	0.0%	0.0%
	5292	A330-343	Airbus A330-200 Series, Airbus A330-300 Series, Airbus A330-800-NEO, Airbus A330-200 Series Freighter, Airbus A330-900N Series (Neo)	0.4%	0.0%	0.4%	0.3%	0.2%	0.4%	0.0%	0.0%	0.0%
	4037	A330-301	Airbus A330-200 Series, Airbus A330-300 Series, Airbus A330-200 Series Freighter	0.3%	0.0%	0.3%	0.3%	0.0%	0.3%	0.0%	0.0%	0.0%
	1674	HS748A	Saab 2000, BAE Jetstream 61 ATP, ATR 72-200, Fokker F27-100 Series, Fokker F27-300 Series, Fokker F27-700 Series, Fokker F27-200 Series, Fokker F27-400 Series, Fokker F27-500 Series, Fokker F27-600 Series, Fokker F50, Fokker F60, Nord Transall C-160, Fokker F27 Friendship, Fairchild Hiller FH-227, Gulfstream I, Hawker HS748-1, Hawker HS748-2, Hawker HS748-2A, Hawker HS748-2B, NAMC YS-11-100 Series, NAMC YS-11A-200 Series, NAMC YS-11A-300 Series, NAMC YS-11A-400 Series, NAMC YS-11A-500 Series, NAMC YS-11A-600 Series, NAMC YS-11A-700 Series, DHC-5 Buffalo; C-8A; CC-115, Aeritalia G.222; C-27A, Antonov AN8	0.3%	0.0%	0.3%	0.3%	0.0%	0.3%	0.0%	0.0%	0.0%
	176	737700	Boeing 737-600 Series, Boeing 737-700 Series, Antonov 148-100A, MC-21-200, Antonov 148-100B, Antonov 148-100E, SMR80, Airbus A220-100, Boeing 737-700 Freighter, Airbus A220-300, Boeing 737-700C, Bombardier CS100, Bombardier CS300, Boeing C-40	7.2%	2.3%	9.5%	5.6%	3.9%	9.5%	0.0%	0.0%	0.0%
	6406	7378MAX	Boeing 737-8, Boeing 737-9	3.5%	0.9%	4.4%	2.7%	1.7%	4.4%	0.0%	0.0%	0.0%
	2417	737800	Boeing 737-800 Series, Boeing Business Jet II, Boeing 737-900 Series, Boeing 737-900-ER, Boeing 737-800 Short Field Package-Next Gen, MC-21-300, Boeing Business Jet (BBJ), SMR100, BOEING 737-800 Poseidon, Boeing 737-800BCF	24.5%	7.7%	32.3%	23.2%	9.1%	32.3%	0.0%	0.0%	0.0%
	4089	757PW	Boeing 757-200 Series, Boeing 757-200 Series Freighter	0.4%	0.3%	0.7%	0.3%	0.4%	0.7%	0.0%	0.0%	0.0%
	4653	757RR	Tupolev 204, Boeing 757-200 Series, Boeing 757-200 Series Freighter, Tupolev 204 Freighter, Tupolev 214, Tupolev 204 SM, United Aircraft Corporation (Irkut) MC-21 - 300	0.5%	0.2%	0.6%	0.3%	0.3%	0.6%	0.0%	0.0%	0.0%
	4087	7673ER	Boeing 767-300 ER, Boeing 767-300 ER Freighter	4.0%	1.2%	5.2%	3.6%	1.6%	5.2%	0.0%	0.0%	0.0%
	3971	MD11GE	Boeing MD-11, Boeing MD-11-ER, Boeing MD-11 Freighter, Boeing MD-11BCF	1.0%	0.4%	1.4%	0.7%	0.7%	1.4%	0.0%	0.0%	0.0%
	3970	MD11PW	Boeing MD-11, Boeing MD-11-ER, Boeing MD-11 Freighter, Boeing MD-11BCF	0.6%	0.3%	0.9%	0.5%	0.5%	0.9%	0.0%	0.0%	0.0%

Tower Category	AEDT Equipment ID	AEDT ANP Type	Representative Aircraft	Departures			Arrivals			Local		
				Day	Night	Total	Day	Night	Total	Day	Night	Total
	1705	DHC830	Convair CV-580, ATR 42-400, ATR 42-500, ATR 72-200, Bombardier de Havilland Dash 8 Q400, DeHavilland DHC-8-200, DeHavilland DHC-8-300, Bombardier de Havilland Dash 8 Q300, Bombardier de Havilland Dash 8 Q200, Ilyushin 114, Antonov 140, Ilyushin 114-300, Antonov 70, Canada Air CL-215, ATR 72-600, ATR 42-600, ATR 72-600 Freighter, CAIC China Aviation Industry Corp MA-60, CAIC China Aviation Industry Corp MA-600	9.3%	0.5%	9.8%	9.4%	0.4%	9.8%	0.0%	0.0%	0.0%
	3071	EMB175	Embraer ERJ175-LR, Embraer ERJ175, Mitsubishi Spacejet M90	15.4%	1.0%	16.4%	14.8%	1.5%	16.4%	0.0%	0.0%	0.0%
	Total			80.7%	19.3%	100.0%	74.9%	25.1%	100.0%	0.0%	0.0%	0.0%
	3160	B407	Bell 407 / Rolls-Royce 250-C47B	2.4%	0.1%	2.5%	2.5%	0.1%	2.5%	0.0%	0.0%	0.0%
	4125	B429	Bell 429	2.0%	0.1%	2.2%	2.0%	0.2%	2.2%	0.0%	0.0%	0.0%
	5345	CL600	Bombardier Challenger 600, Bombardier Challenger 300, Fokker (VFW) 614, Bombardier CRJ-100, Bombardier CRJ-200, Bombardier Challenger 604, Gulfstream G200, Bombardier CRJ-400, Bombardier CRJ-200-LR, Bombardier CRJ-200-ER, Bombardier CRJ-400-LR, Bombardier Challenger 605, Bombardier Challenger 850, Bombardier Challenger 601, Bombardier Challenger 350, Bombardier Challenger 650, Bombardier (Canadair) Challenger 800, Bombardier (Canadair) CRJ100PF Bulk Freighter, Bombardier (Canadair) CRJ200PF Bulk Freighter	4.1%	0.3%	4.4%	3.9%	0.5%	4.4%	0.0%	0.0%	0.0%
	1882	GASEPF	Robin DR 400, Robin R 2160 Alpha Sport, Robin R 3000, EADS Socata TB-9 Tampico, Cessna 150 Series, Piper PA-28 Cherokee Series, Aero Commander (Single engine) (FAS), Aeronca 15 Sedan (FAS), Beech 23 Musketeer Sundowner (FAS), Beech 24 Musketeer Super Sierra (FAS), Beech 77 Skipper (FAS), Beechcraft Musketeer Model 19 (FAS), Cessna 140 (FAS), Cessna 152 (FAS), Cessna 162 (FAS), Cozy (FAS), Diamond DV-20 Katana (FAS), Diamond HK36 Super Dimona (FAS), GC1 Globe Swift (FAS), Grob G115A/B/C/D/E Bavarian (FAS), Grumman AA-5A/B (FAS), Gulfstream American GA-7 Cougar (FAS), Lancair 320 (FAS), Piper J-3 Cub (FAS), Piper PA-18-150 (FAS), Piper PA-38 Tomahawk (FAS), Sequoia Falco (FAS), Stinson (FAS), Vans RV12 (FAS), Vans RV3 (FAS), Vans RV4 (FAS), Velocity (FAS), Zenair CH-100/150/250 (FAS)	5.2%	0.2%	5.4%	4.6%	0.9%	5.5%	3.9%	0.0%	3.9%
	1265	CNA172	Lancair 360, Aviat Husky A1B, Cessna 172 Skyhawk, Raytheon Beech D17S Staggerwing, Rans S7S, American Champion Cibrata (FAS), American Champion Scout (FAS), Cessna 170 (FAS), Cessna 175 (FAS), Cessna 177 (FAS), Piper PA-22-150 (FAS), Piper Pacer (FAS)	7.6%	1.0%	8.6%	6.4%	1.5%	7.9%	6.3%	0.0%	6.3%
	1262	CNA182	Cessna 182, Cessna Aircraft Company 180F, Cessna 182 R (FAS), Cessna 185 Skywagon	2.7%	0.4%	3.1%	3.1%	0.5%	3.6%	2.4%	0.0%	2.4%
	2106	CNA208	Pilatus PC-6 Porter, Piper PA46-TP Meridian, Pilatus PC-12, EADS Socata TBM-700, Cessna 208 Caravan, SOCATA TBM 850, DeHavilland DHC-3 Turbo Otter, EPIC LT/Dynasty, Extra EA-500, Quest Kodiak 100, Myasishchev M-101T, Pacific Aerospace P-750 XSTOL, DAHER TBM 900/930, DeHavilland DHC-2 Turbo Beaver, EMBRAER EMB-314 (FAS), Beechcraft T-6 Texan 2 (FAS), Socata TBM-9 (FAS), SCF Technoavia SM-92T	7.6%	3.6%	11.2%	7.7%	3.6%	11.2%	54.0%	0.0%	54.0%

Tower Category	AEDT Equipment ID	AEDT ANP Type	Representative Aircraft	Departures			Arrivals			Local		
				Day	Night	Total	Day	Night	Total	Day	Night	Total
General Aviation	3045	CNA560E	Cessna 560 Citation Encore, Hawker Beechcraft Corp Beechjet 400A, Hawker Beechcraft Corp Beechjet 400T T-1A Jayhawk, Hawker Beechcraft Corp Nextant Aerospace 400NXT	1.7%	0.1%	1.7%	1.6%	0.2%	1.8%	0.0%	0.0%	0.0%
	1303	CNA560U	Cessna 560 Citation V, Cessna 560 Citation Ultra	0.8%	0.0%	0.8%	0.7%	0.1%	0.8%	0.0%	0.0%	0.0%
	6070	CNA560XL	Cessna 560 Citation Excel, Cessna 560 Citation XLS	4.7%	0.4%	5.1%	4.5%	0.6%	5.0%	0.0%	0.0%	0.0%
	6386	CNA680	Cessna 680 Citation Sovereign, Cessna Citation Hemisphere, Cessna 680-A Citation Latitude, Cessna 700 Citation Longitude	1.0%	0.1%	1.1%	1.0%	0.2%	1.1%	0.0%	0.0%	0.0%
	1307	CNA750	Cessna 750 Citation X, Dornier 328 Jet, Raytheon Hawker 4000 Horizon, Bombardier Learjet 60, CX 750 Citation X+, Dassault Falcon 2000-EX, Dassault Falcon 2000, Dassault Falcon 2000-LX, Embraer Praetor 500, Dassault Falcon 2000-DX	3.0%	0.2%	3.2%	2.8%	0.4%	3.2%	0.0%	0.0%	0.0%
	6060	CNA525C	Cessna CitationJet CJ3 (Cessna 525B), Cessna CitationJet CJ4 (Cessna 525C), Cessna CitationJet CJ2 (Cessna 525A), Cessna CitationJet CJ/CJ1 (Cessna 525)	7.5%	0.3%	7.7%	6.5%	1.3%	7.8%	0.0%	0.0%	0.0%
	6281	COMSEP	Cirrus SR20, 1985 1-ENG COMP, Cirrus SR22 Turbo (FAS), Cirrus SR22 (FAS)	2.5%	0.2%	2.6%	2.5%	0.2%	2.6%	1.9%	0.0%	1.9%
	1318	FAL900EX	Dassault Falcon 50, Dassault Falcon 50-EX, Dassault Falcon 900, Dassault Falcon 900-B, Dassault Falcon 900-C, Dassault Falcon 900-EX, Falcon 900DX, Dassault Falcon 900-LX, Yakovlev 40 Codling	1.0%	0.1%	1.1%	1.1%	0.0%	1.1%	0.0%	0.0%	0.0%
	6288	PA30	Vulcanair P.68, Piper PA-30 Twin Comanche, Diamond DA42 Twin Star, Diamond DA62, Piper PA44 (FAS), Piper PA-44-180 (FAS), Tecnam P2006T (FAS), Piper PA-44-180T (FAS)	0.9%	0.0%	0.9%	0.9%	0.0%	0.9%	0.7%	0.0%	0.7%
	3802	ECLIPSE50	Eclipse 500 / PW610F, Hawker Beechcraft Corp Beechjet 400A, SJ-30-1/-2/-2+, CIRRUS SF-50 Vision	0.5%	0.1%	0.5%	0.5%	0.0%	0.5%	0.0%	0.0%	0.0%
	4917	CNA55B	Cessna 550 Citation II, Cessna S550 Citation S/II, Cessna 551 Citation IISP, Cessna 552 T-47A, Raytheon Premier I, Aerospatiale SN 601 Corvette, Cessna 550 Citation Bravo, Embraer Phenom 300 (EMB-505), Embraer Legacy 650, Pilatus PC-24, Embraer Legacy 500 (EMB-550)	2.9%	0.1%	3.0%	2.6%	0.5%	3.0%	0.0%	0.0%	0.0%
	4198	CL601	Bombardier Challenger 601, Bombardier Challenger 602, Gulfstream G280, Bombardier Challenger 600, Bombardier (Canadair) CRJ200 ExecLiner, Bombardier (Canadair) CRJ200 328 Designs, Embraer Praetor 600	1.1%	0.1%	1.2%	1.1%	0.1%	1.2%	0.0%	0.0%	0.0%
	1925	GV	Gulfstream G-5 Gulfstream 5 / G-5SP Gulfstream G500, Gulfstream G550, Gulfstream V-SP, Gulfstream Aerospace Gulfstream G500 (G-7), Gulfstream G600	0.9%	0.0%	1.0%	0.8%	0.2%	1.0%	0.0%	0.0%	0.0%
	4215	G650ER	Gulfstream G650, Gulfstream G650ER	2.2%	0.4%	2.6%	2.3%	0.3%	2.6%	0.0%	0.0%	0.0%
	1922	GIV	Gulfstream G300, Gulfstream G350, Gulfstream G400, Gulfstream G450, Gulfstream IV-SP, Falcon 7X, Dassault Falcon 8X	0.8%	0.0%	0.8%	0.7%	0.1%	0.8%	0.0%	0.0%	0.0%
	6071	CNA510	Honda HA-420 Hondajet, CESSNA CITATION 510, Embraer Phenom 100 (EMB-500), EPIC Victory, Cirrus Vision SF50 (FAS), Embraer Legacy 450 (EMB-545)	1.5%	0.0%	1.5%	1.3%	0.2%	1.6%	0.0%	0.0%	0.0%

Tower Category	AEDT Equipment ID	AEDT ANP Type	Representative Aircraft	Departures			Arrivals			Local		
				Day	Night	Total	Day	Night	Total	Day	Night	Total
	1474	DHC6	BAE Jetstream 31, BAE Jetstream 32, BAE Jetstream 32-EP, Austrailia GAF N22/24 Nomad, SIAI-Marchetti SF-600 Canguro, CASA 212-200 Series, Raytheon Beech 18, Bombardier CL-415, Fairchild SA-227-AC Metro III, Xian Yunshuji Y-7, Embraer 312 Tucano, Grumman C-1 Trader, Fairchild Metro IVC, Embraer EMB110 Bandeirante, Israel IAI-201 Arava, Israel IAI-101 Arava, Neiva NE-821 Caraja, Harbin Y-12, Raytheon King Air 100, Raytheon King Air 90, Raytheon Beech 99, CASA 212-100 Series, Dornier 228-100 Series, Raytheon Super King Air 200, American Jet Hustler 400 A, DeHavilland DHC-6-300 Twin Otter, Reims-Cessna 406 Caravan II, DeHavilland DHC-6-100 Twin Otter, DeHavilland DHC-6-200 Twin Otter, Equator P-550 Turbo, Raytheon Super King Air 300, Ayres Turbo Thrush T-65, Dornier 128 Skyservant, Piaggio P-166, Raytheon Starship 2000, Rockwell Twin Commander 690, CASA 212-300 Series, Let 410, Let 410-UVP, Let 420 Tubolet, Mitsubishi MU-2, Fairchild SA-226-TC Metro II, Fairchild SA-227-AT Expeditor, Piaggio P.180 Avanti, Fairchild SA-26-T Merlin II, Grumman S-2E Tracker, Grumman G-21G Goose, C-26A, CASA 212-400 Series, Fairchild SA-226-T Merlin III, Shorts Skyvan SC7-3-1, Shorts Skyvan SC7-3-2, Shorts Skyvan SC7-3A-1, Antonov AN28 Cash, PZL M-28 Skytruck, Embraer EMB-121 Xingu, Evektor EV-55, Dornier Seastar CD-1/CD-2, Antonov An-2 MS, Antonov An-2 MS Freighter, Viking Air DHC-6-400 Guardian, CAIC China Aviation Industry Corp MA-60, CAIC China Aviation Industry Corp MA-600, SHERPA Sherpa K-650T, Grumman G-73 Mallard, Aero Commander 680 Turbo Commander, Gulfstream Gulfstream S-2T Marsh Airtanker	5.9%	1.2%	7.1%	6.5%	0.6%	7.1%	26.2%	0.0%	26.2%
	1196	BEC58P	Cessna 421 Piston, Britten-Norman BN-2 Islander, Britten-Norman BN-2A Series Mk III Trislander, Piper PA-31 Navajo, Rockwell Twin Commander 700, Cessna 337 Skymaster, Aerostar PA-60, Piper PA-23 Apache/Aztec, Piper PA-27 Aztec, Raytheon Beech Baron 58, Raytheon Beech 60 Duke, Cessna 310, Rockwell Twin Commander 500, Piper PA-34 Seneca, Rockwell Twin Commander 680, Cessna 340, Cessna 402, Cessna 404 Titan II, Cessna 414, Raytheon Beech 55 Baron, Beech 75 (FAS), Beech 95 (FAS), Beech E-55 (FAS), Beechcraft 56TC Baron (FAS), Beechcraft 76 Duchess, Beechcraft Queen Air 65/70/80 (FAS), Beechcraft Twin Bonanza (FAS), Cessna T303 Crusader (FAS), Cessna 320 (FAS), Cessna 335/340 (FAS), Tecnam P2012 Traveller, Cessna 401 (FAS), Cessna 401A (FAS), Cessna 401B (FAS), Cessna 411 (FAS), Cessna 411A (FAS), Beechcraft A56TC Baron (FAS), Rockwell Twin Commander 685, Rockwell Twin Commander 520, Rockwell Twin Commander 560	1.2%	0.0%	1.3%	1.3%	0.0%	1.3%	1.0%	0.0%	1.0%

Tower Category	AEDT Equipment ID	AEDT ANP Type	Representative Aircraft	Departures Day	Departures Night	Departures Total	Arrivals Day	Arrivals Night	Arrivals Total	Local Day	Local Night	Local Total
	1276	GASEPV	Maule MT-7-235, Ryan Navion B, Ryan Navion F, Piper PA-32 Cherokee Six, Boeing Stearman PT-17 / A75N1, Ryan ST3KR, Raytheon Beech Bonanza 36, Cessna 210 Centurion, ATI AT-802, ATI AT-502, ATI AT-502A, ATI AT-602, Helio U-10 Super Courier, Ayres S2R-T34 Turbo-Thrush, ATI AT-502B, Mooney M20-K, EADS Socata TB-10 Tobago, Spencer S-12 Air Car, Piper PA-24 Comanche, EADS Socata TB-20 Trinidad, DeHavilland DHC-2 Beaver, DeHavilland DHC-3 Otter, Piper PA46 (Piston), Beechcraft Bonanza 33 (FAS), Beechcraft Bonanza 35 (FAS), Beechcraft T-34 Mentor (FAS), Bellanca 8 Scout Super Decathlon (FAS), Bellanca Viking (FAS), Cessna 177 Cardinal RG (FAS), Cessna 180 (FAS), Cessna 190 (FAS), Cessna 195 (FAS), Cessna 205 (FAS), Cessna 207 (Turbo) Stationair (FAS), Cessna 210 Turbo (FAS), Cessna 400 (FAS), Columbia Aircraft Lancair (COL3/4 All Types) (FAS), Commander 114/115 (FAS), Diamond DA40, EAGLE DW-1 Eagle (FAS), Express 2000 (FAS), EXTRA EA-300 (FAS), GippsAero GA8 Airvan (FAS), Glasair (FAS), Lancair ES (FAS), Lancair Evolution (FAS), Lancair Legacy 2000 (FAS), Meyers Aero Commander 200 (FAS), Model 35 Bonanza (FAS), North American T-6 Texan (FAS), Piper PA-36 Pawnee Brave (FAS), Piper PA46 Malibu (FAS), Pitts Special S-1 (FAS), Vans RV10 (FAS), Vans RV6 (FAS), Vans RV-7, Vans RV8 (FAS), Vans RV9 (FAS), Zlin Aircraft Z 143 L	4.7%	0.2%	4.9%	4.5%	0.3%	4.8%	3.5%	0.0%	3.5%
	2014	LEAR35	Rockwell Sabreliner 65, Lockheed L-1329 Jetstar I, Lockheed L-1329 Jetstar II, Hawker HS-125 Series 1, Raytheon Hawker 1000, Hawker HS-125 Series 3, Hawker HS-125 Series 400, Hawker HS-125 Series 700, Raytheon Hawker 800, Dassault Falcon 100, Dassault Falcon 10, Hawker HS-125 Series 600, Bombardier Learjet 55, Bombardier Learjet 60, Bombardier Learjet 31, Bombardier Learjet 35, Bombardier Learjet 36, Bombardier Learjet 40, Bombardier Learjet 45, Bombardier Learjet 45-XR, Raytheon Hawker 900, Raytheon Hawker C-29A, Bombardier Learjet 35A/36A (C-21A), Hawker 900XP, Bombardier Learjet 70, Bombardier Learjet 75	5.5%	0.4%	6.0%	5.2%	0.8%	6.0%	0.0%	0.0%	0.0%
	1	H500D	Robinson R22, Hughes OH-6 Cayuse, Hughes 500D, Schweizer S269D/330	5.1%	0.2%	5.3%	5.2%	0.1%	5.4%	0.0%	0.0%	0.0%
	3161	R44	Robinson R44 Raven / Lycoming O-540-F1B5, Enstrom 280FX/F-28F	2.9%	0.1%	3.0%	3.0%	0.1%	3.1%	0.0%	0.0%	0.0%
	Total			90.0%	10.0%	100.0%	86.5%	13.5%	100.0%	100.0%	0.0%	100.0%
	4125	B429	Bell 429	0.9%	0.1%	0.9%	0.9%	0.1%	0.9%	0.0%	0.0%	0.0%
	5345	CL600	Bombardier Challenger 600, Bombardier Challenger 300, Fokker (VFW) 614, Bombardier CRJ-100, Bombardier CRJ-200, Bombardier Challenger 604, Gulfstream G200, Bombardier CRJ-400, Bombardier CRJ-200-LR, Bombardier CRJ-200-ER, Bombardier CRJ-400-LR, Bombardier Challenger 605, Bombardier Challenger 850, Bombardier Challenger 601, Bombardier Challenger 350, Bombardier Challenger 650, Bombardier (Canadair) Challenger 800, Bombardier (Canadair) CRJ100PF Bulk Freighter, Bombardier (Canadair) CRJ200PF Bulk Freighter	3.6%	0.2%	3.8%	3.2%	0.6%	3.8%	0.0%	0.0%	0.0%

Tower Category	AEDT Equipment ID	AEDT ANP Type	Representative Aircraft	Departures			Arrivals			Local		
				Day	Night	Total	Day	Night	Total	Day	Night	Total
Air Taxi	1705	DHC830	Convair CV-580, ATR 42-400, ATR 42-500, ATR 72-200, Bombardier de Havilland Dash 8 Q400, DeHavilland DHC-8-200, DeHavilland DHC-8-300, Bombardier de Havilland Dash 8 Q300, Bombardier de Havilland Dash 8 Q200, Ilyushin 114, Antonov 140, Ilyushin 114-300, Antonov 70, Canada Air CL-215, ATR 72-600, ATR 42-600, ATR 72-600 Freighter, CAIC China Aviation Industry Corp MA-60, CAIC China Aviation Industry Corp MA-600	2.3%	0.5%	2.8%	2.7%	0.1%	2.8%	0.0%	0.0%	0.0%
	2106	CNA208	Pilatus PC-6 Porter, Piper PA46-TP Meridian, Pilatus PC-12, EADS Socata TBM-700, Cessna 208 Caravan, SOCATA TBM 850, DeHavilland DHC-3 Turbo Otter, EPIC LT/Dynasty, Extra EA-500, Quest Kodiak 100, Myasishchev M-101T, Pacific Aerospace P-750 XSTOL, DAHER TBM 900/930, DeHavilland DHC-2 Turbo Beaver, EMBRAER EMB-314 (FAS), Beechcraft T-6 Texan 2 (FAS), Socata TBM-9 (FAS), SCF Technoavia SM-92T	37.9%	1.9%	39.8%	35.9%	4.0%	39.8%	0.0%	0.0%	0.0%
	1303	CNA560U	Cessna 560 Citation V, Cessna 560 Citation Ultra	0.4%	0.0%	0.4%	0.3%	0.1%	0.4%	0.0%	0.0%	0.0%
	6070	CNA560XL	Cessna 560 Citation Excel, Cessna 560 Citation XLS	1.8%	0.0%	1.9%	1.5%	0.3%	1.9%	0.0%	0.0%	0.0%
	6386	CNA680	Cessna 680 Citation Sovereign, Cessna Citation Hemisphere, Cessna 680-A Citation Latitude, Cessna 700 Citation Longitude	3.2%	0.1%	3.3%	2.8%	0.5%	3.3%	0.0%	0.0%	0.0%
	1307	CNA750	Cessna 750 Citation X, Dornier 328 Jet, Raytheon Hawker 4000 Horizon, Bombardier Learjet 60, CX 750 Citation X+, Dassault Falcon 2000-EX, Dassault Falcon 2000, Dassault Falcon 2000-LX, Embraer Praetor 500, Dassault Falcon 2000-DX	1.9%	0.1%	2.0%	1.8%	0.2%	2.0%	0.0%	0.0%	0.0%
	6060	CNA525C	Cessna CitationJet CJ3 (Cessna 525B), Cessna CitationJet CJ4 (Cessna 525C), Cessna CitationJet CJ2 (Cessna 525A), Cessna CitationJet CJ/CJ1 (Cessna 525)	1.3%	0.1%	1.4%	1.1%	0.3%	1.4%	0.0%	0.0%	0.0%
	1657	DHC8	ATR 42-400, ATR 42-500, Antonov 32 Cline, ATR 42-200, ATR 42-300, DeHavilland DHC-8-100, Bombardier de Havilland Dash 8 Q100, ATR 42-320, CASA 295, Antonov 24 Coke, Antonov 26 Curl, Antonov 30 Clank, Convair CV-440, Antonov 38-100, Antonov 38-110, Antonov 38-120, Beriev Be-12/Be-14, Alenia C-27J, Curtiss-Wright C-46, Convair CV-240/T-29, ATR 42-600	2.4%	0.3%	2.7%	2.6%	0.1%	2.7%	0.0%	0.0%	0.0%
	1708	EMB120	Embraer EMB120 Brasilia	3.8%	3.2%	6.9%	6.9%	0.0%	6.9%	0.0%	0.0%	0.0%
	4917	CNA55B	Cessna 550 Citation II, Cessna S550 Citation S/II, Cessna 551 Citation IISP, Cessna 552 T-47A, Raytheon Premier I, Aerospatiale SN 601 Corvette, Cessna 550 Citation Bravo, Embraer Phenom 300 (EMB-505), Embraer Legacy 650, Pilatus PC-24, Embraer Legacy 500 (EMB-550)	2.2%	0.1%	2.3%	2.0%	0.3%	2.3%	0.0%	0.0%	0.0%
	1922	GIV	Gulfstream G300, Gulfstream G350, Gulfstream G400, Gulfstream G450, Gulfstream IV-SP, Falcon 7X, Dassault Falcon 8X	1.1%	0.1%	1.2%	1.0%	0.2%	1.2%	0.0%	0.0%	0.0%
	6071	CNA510	Honda HA-420 Hondajet, CESSNA CITATION 510, Embraer Phenom 100 (EMB-500), EPIC Victory, Cirrus Vision SF50 (FAS), Embraer Legacy 450 (EMB-545)	0.4%	0.0%	0.4%	0.3%	0.1%	0.4%	0.0%	0.0%	0.0%
	36	1900D	Raytheon Beech 1900-C, Raytheon Beech 1900-D, BAE Jetstream 1, BAE Jetstream 200 Series	7.6%	2.3%	9.9%	9.9%	0.0%	9.9%	0.0%	0.0%	0.0%

Tower Category	AEDT Equipment ID	AEDT ANP Type	Representative Aircraft	Departures			Arrivals			Local		
				Day	Night	Total	Day	Night	Total	Day	Night	Total
	1474	DHC6	BAE Jetstream 31, BAE Jetstream 32, BAE Jetstream 32-EP, Austrailia GAF N22/24 Nomad, SIAI-Marchetti SF-600 Canguro, CASA 212-200 Series, Raytheon Beech 18, Bombardier CL-415, Fairchild SA-227-AC Metro III, Xian Yunshuji Y-7, Embraer 312 Tucano, Grumman C-1 Trader, Fairchild Metro IVC, Embraer EMB110 Bandeirante, Israel IAI-201 Arava, Israel IAI-101 Arava, Neiva NE-821 Caraja, Harbin Y-12, Raytheon King Air 100, Raytheon King Air 90, Raytheon Beech 99, CASA 212-100 Series, Dornier 228-100 Series, Raytheon Super King Air 200, American Jet Hustler 400 A, DeHavilland DHC-6-300 Twin Otter, Reims-Cessna 406 Caravan II, DeHavilland DHC-6-100 Twin Otter, DeHavilland DHC-6-200 Twin Otter, Equator P-550 Turbo, Raytheon Super King Air 300, Ayres Turbo Thrush T-65, Dornier 128 Skyservant, Piaggio P-166, Raytheon Starship 2000, Rockwell Twin Commander 690, CASA 212-300 Series, Let 410, Let 410-UVP, Let 420 Tubolet, Mitsubishi MU-2, Fairchild SA-226-TC Metro II, Fairchild SA-227-AT Expeditor, Piaggio P.180 Avanti, Fairchild SA-26-T Merlin II, Grumman S-2E Tracker, Grumman G-21G Goose, C-26A, CASA 212-400 Series, Fairchild SA-226-T Merlin III, Shorts Skyvan SC7-3-1, Shorts Skyvan SC7-3-2, Shorts Skyvan SC7-3A-1, Antonov AN28 Cash, PZL M-28 Skytruck, Embraer EMB-121 Xingu, Evektor EV-55, Dornier Seastar CD-1/CD-2, Antonov An-2 MS, Antonov An-2 MS Freighter, Viking Air DHC-6-400 Guardian, CAIC China Aviation Industry Corp MA-60, CAIC China Aviation Industry Corp MA-600, SHERPA Sherpa K-650T, Grumman G-73 Mallard, Aero Commander 680 Turbo Commander, Gulfstream Gulfstream S-2T Marsh Airtanker	17.0%	1.0%	18.0%	17.5%	0.5%	18.0%	0.0%	0.0%	0.0%
	2014	LEAR35	Rockwell Sabreliner 65, Lockheed L-1329 Jetstar I, Lockheed L-1329 Jetstar II, Hawker HS-125 Series 1, Raytheon Hawker 1000, Hawker HS-125 Series 3, Hawker HS-125 Series 400, Hawker HS-125 Series 700, Raytheon Hawker 800, Dassault Falcon 100, Dassault Falcon 10, Hawker HS-125 Series 600, Bombardier Learjet 55, Bombardier Learjet 60, Bombardier Learjet 31, Bombardier Learjet 35, Bombardier Learjet 36, Bombardier Learjet 40, Bombardier Learjet 45, Bombardier Learjet 45-XR, Raytheon Hawker 900, Raytheon Hawker C-29A, Bombardier Learjet 35A/36A (C-21A), Hawker 900XP, Bombardier Learjet 70, Bombardier Learjet 75	2.1%	0.1%	2.2%	2.0%	0.2%	2.2%	0.0%	0.0%	0.0%
	Total			89.7%	10.3%	100.0%	92.4%	7.6%	100.0%	0.0%	0.0%	0.0%

Table A-5. TAF Analysis: PDX CY 2022 Stagelength Distribution
Prepared by FAA Office of Environment and Energy, Noise Division - November 6, 2023
PDX Departure Stagelength Distribution from FAA CY 2022 National Inventory by AEDT Equipment Type

AEDT Equipment ID	AEDT ANP Type	Stagelength Distribution														
		1		2		3		4		5		6		7		
		Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Total
176	737700	43.6%	15.6%	26.4%	7.0%	1.0%	0.1%	3.5%	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
2417	737800	13.9%	4.5%	33.3%	7.0%	8.3%	2.8%	20.2%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
36	1900D	75.0%	25.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
6406	7378MAX	22.8%	7.0%	27.5%	7.5%	2.8%	1.2%	25.8%	4.9%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
4089	757PW	17.8%	2.5%	10.0%	17.8%	13.8%	6.7%	13.2%	14.4%	3.8%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
4653	757RR	20.7%	0.5%	5.9%	15.5%	18.5%	6.2%	6.2%	2.7%	23.9%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
4087	7673ER	11.9%	0.9%	11.5%	0.8%	14.8%	2.1%	31.1%	25.2%	0.0%	0.0%	0.0%	0.0%	1.7%	0.0%	100.0%
5969	A310-304	3.9%	0.4%	5.7%	1.7%	79.5%	0.0%	4.8%	3.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
957	A319-131	35.5%	7.0%	39.5%	8.4%	0.0%	0.3%	5.6%	3.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
2454	A320-211	29.3%	3.4%	50.2%	6.0%	6.1%	0.0%	4.5%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1019	A320-232	15.3%	2.5%	37.9%	11.0%	0.0%	0.0%	6.1%	27.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
6637	A320-271N	0.2%	0.0%	64.2%	20.2%	0.0%	0.0%	5.2%	10.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1040	A321-232	2.5%	0.3%	7.5%	1.2%	36.8%	18.4%	19.2%	14.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
4037	A330-301	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.0%	0.0%	0.0%	0.0%	96.0%	0.0%	0.0%	0.0%	100.0%
5292	A330-343	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	94.5%	2.8%	0.0%	0.0%	2.4%	0.0%	0.0%	0.0%	100.0%
3160	B407	96.5%	3.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
4125	B429	93.1%	6.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1196	BEC58P	96.7%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
5345	CL600	94.1%	5.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
4198	CL601	93.4%	6.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1265	CNA172	88.2%	11.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1262	CNA182	86.2%	13.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
2106	CNA208	90.3%	9.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
6071	CNA510	97.6%	2.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
6060	CNA525C	95.6%	4.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
4917	CNA55B	95.8%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
3045	CNA560E	93.6%	6.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1303	CNA560U	94.9%	5.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
6070	CNA560XL	94.6%	5.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
6386	CNA680	94.3%	5.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1307	CNA750	93.7%	6.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
6281	COMSEP	94.1%	5.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1474	DHC6	90.7%	9.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1657	DHC8	85.4%	14.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1705	DHC830	93.0%	7.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
3802	ECLIPSE5	60.0%	5.8%	31.3%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1708	EMB120	54.8%	45.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
3071	EMB175	55.2%	4.6%	36.2%	1.4%	2.5%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1318	FAL900EX	38.3%	1.2%	23.7%	1.2%	9.5%	0.0%	20.3%	4.6%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
4215	G650ER	36.0%	10.1%	25.2%	1.4%	4.5%	0.0%	19.9%	1.5%	0.0%	0.0%	1.3%	0.0%	0.0%	0.0%	100.0%
1882	GASEPF	95.6%	4.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1276	GASEPV	96.9%	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1922	GIV	94.5%	5.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1925	GV	93.3%	6.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1	H500D	96.4%	3.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
1674	HS748A	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
2014	LEAR35	93.2%	6.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
3971	MD11GE	27.1%	4.4%	10.5%	0.1%	0.1%	0.0%	24.8%	32.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
3970	MD11PW	17.3%	3.9%	19.2%	0.2%	0.0%	0.2%	26.5%	32.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
6288	PA30	95.5%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
3161	R44	97.1%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%

Table A-6 Modeled Flight Track Utilization

Rwy	Track	Utilization%		Rwy	Track	Utilization%
10L	E10LCA1H	2%		10R	E10RA1H	1.8%
10L	E10LCA1L	4.0%		10R	E10RA1L	4.9%
10L	E10LCA1P	1.2%		10R	E10RA1P	0.5%
10L	E10LCA1S	0.7%		10R	E10RA1S	0.5%
10L	E10LCA1T	0.7%		10R	E10RA1T	1.0%
10L	E10LCA2H	2.3%		10R	E10RA2H	1.0%
10L	E10LCA2L	5.0%		10R	E10RA2L	4.1%
10L	E10LCA2P	1.5%		10R	E10RA2P	0.5%
10L	E10LCA2S	0.7%		10R	E10RA2S	0.5%
10L	E10LCA2T	1.3%		10R	E10RA2T	1.0%
10L	E10LCA3H	2.3%		10R	E10RA3H	0.8%
10L	E10LCA3L	4.0%		10R	E10RA3L	3.9%
10L	E10LCA3P	1.2%		10R	E10RA3P	0.5%
10L	E10LCA3S	0.4%		10R	E10RA3S	0.5%
10L	E10LCA3T	1.3%		10R	E10RA3T	1.0%
10L	E10LCA4L	4.0%		10R	E10RA4L	4.9%
10L	E10LCA4P	1.2%		10R	E10RA4P	0.7%
10L	E10LCA4T	0.7%		10R	E10RA4T	1.0%
10L	E10LCA5T	0.7%		10R	E10RA5L	4.1%
10L	E10LCA6T	0.7%		10R	E10RA5T	1.0%
10L	E10LCD1H	1.2%		10R	E10RA6L	4.9%
10L	E10LCD1L	7.0%		10R	E10RA6T	1.0%
10L	E10LCD1P	1.1%		10R	E10RA7T	0.5%
10L	E10LCD1S	0.4%		10R	E10RA8T	1.0%
10L	E10LCD1T	1.2%		10R	E10RA9T	1.0%
10L	E10LCD2H	3.9%		10R	E10RD1H	3.0%
10L	E10LCD2L	7.0%		10R	E10RD1L	8.5%
10L	E10LCD2P	1.1%		10R	E10RD1P	0.6%
10L	E10LCD2S	0.7%		10R	E10RD1S	0.5%
10L	E10LCD2T	1.2%		10R	E10RD1T	0.9%
10L	E10LCD3H	3.9%		10R	E10RD2H	3.0%
10L	E10LCD3L	7.0%		10R	E10RD2L	8.5%
10L	E10LCD3P	1.6%		10R	E10RD2P	0.9%
10L	E10LCD3T	1.2%		10R	E10RD2S	0.3%
10L	E10LCD4H	3.9%		10R	E10RD2T	0.6%
10L	E10LCD4L	7.0%		10R	E10RD3H	2.1%
10L	E10LCD4P	1.3%		10R	E10RD3L	7.6%
10L	E10LCD4T	0.8%		10R	E10RD3P	0.6%
10L	E10LCD5H	2.7%		10R	E10RD3S	0.3%
10L	E10LCD5L	7.0%		10R	E10RD3T	0.6%
10L	E10LCD5P	0.8%		10R	E10RD4H	2.1%
10L	E10LCD5T	1.2%		10R	E10RD4L	6.4%
10L	E10LCD6T	1.2%		10R	E10RD4P	0.6%
				10R	E10RD4S	0.5%
				10R	E10RD4T	0.9%
				10R	E10RD5L	6.0%
				10R	E10RD5S	0.5%
				10R	E10RD5T	0.9%
				10R	E10RD6T	0.9%

Table A-6 Modeled Flight Track Utilization (Continued)

Rwy	Track	Utilization%		Rwy	Track	Utilization%
28L	W28LA1H	0.9%		28R	W28RC1H	3.3%
28L	W28LA1J	3.8%		28R	W28RC2H	3.3%
28L	W28LA1P	0.9%		28R	W28RC3H	3.3%
28L	W28LA1S	0.3%		28R	W28RCA1H	2.0%
28L	W28LA1T	0.5%		28R	W28RCA1J	4.5%
28L	W28LA2H	0.9%		28R	W28RCA1P	0.8%
28L	W28LA2J	3.8%		28R	W28RCA1S	0.5%
28L	W28LA2P	0.5%		28R	W28RCA1T	0.6%
28L	W28LA2S	0.3%		28R	W28RCA2H	2.0%
28L	W28LA2T	0.9%		28R	W28RCA2J	3.4%
28L	W28LA3H	1.7%		28R	W28RCA2P	0.8%
28L	W28LA3J	2.4%		28R	W28RCA2S	1.7%
28L	W28LA3T	0.5%		28R	W28RCA2T	1.1%
28L	W28LA4H	0.9%		28R	W28RCA3H	1.1%
28L	W28LA4J	4.6%		28R	W28RCA3J	4.5%
28L	W28LA4P	0.9%		28R	W28RCA3P	1.5%
28L	W28LA4T	0.9%		28R	W28RCA3T	0.6%
28L	W28LA5J	4.6%		28R	W28RCA4H	2.0%
28L	W28LA5P	0.5%		28R	W28RCA4J	5.1%
28L	W28LA5T	0.9%		28R	W28RCA4P	0.2%
28L	W28LA6J	4.6%		28R	W28RCA4T	1.1%
28L	W28LA6P	0.5%		28R	W28RCA5J	4.3%
28L	W28LA6T	0.5%		28R	W28RCA5P	0.8%
28L	W28LA7J	4.6%		28R	W28RCA5T	0.6%
28L	W28LA8J	2.6%		28R	W28RCA6J	5.4%
28L	W28LD1H	2.8%		28R	W28RCA6P	0.6%
28L	W28LD1J	7.9%		28R	W28RCD1J	8.2%
28L	W28LD1P	0.9%		28R	W28RCD1P	1.1%
28L	W28LD1S	0.5%		28R	W28RCD1S	0.6%
28L	W28LD1T	0.9%		28R	W28RCD1T	1.0%
28L	W28LD2H	2.8%		28R	W28RCD2J	6.9%
28L	W28LD2J	7.1%		28R	W28RCD2P	1.1%
28L	W28LD2P	0.3%		28R	W28RCD2S	0.3%
28L	W28LD2S	0.3%		28R	W28RCD2T	1.0%
28L	W28LD2T	0.9%		28R	W28RCD3J	8.9%
28L	W28LD3H	2.0%		28R	W28RCD3P	1.2%
28L	W28LD3J	7.1%		28R	W28RCD3S	1.1%
28L	W28LD3P	0.6%		28R	W28RCD3T	1.0%
28L	W28LD3S	0.5%		28R	W28RCD4J	8.9%
28L	W28LD3T	0.9%		28R	W28RCD4P	1.1%
28L	W28LD4J	7.9%		28R	W28RCD4S	0.5%
28L	W28LD4P	0.6%		28R	W28RCD4T	0.7%
28L	W28LD4S	0.5%		28R	W28RCD5T	1.0%
28L	W28LD4T	0.6%		28R	W28RCD6T	0.7%
28L	W28LD5J	7.9%				
28L	W28LD5P	0.9%				
28L	W28LD5T	0.9%				
28L	W28LD6P	0.6%				
28L	W28LD6T	0.9%				

Table A-6 Modeled Flight Track Utilization (Continued)

Rwy	Track	Utilization%
03	E03CA1S	5.8%
03	E03CA1T	11.5%
03	E03CD1S	5.8%
03	W03CA1P	15.4%
03	W03CA1S	11.5%
03	W03CA1T	11.5%
03	W03CD1S	11.5%
03	W03CD1T	13.5%
03	W03CD2T	13.5%
21	E21CA1H	11.9%
21	E21CA1L	20.2%
21	E21CA1P	4.2%
21	E21CA1S	3.6%
21	E21CA1T	6.5%
21	E21CA2P	1.2%
21	E21CA2S	3.6%
21	E21CD1L	16.1%
21	E21CD1P	1.2%
21	E21CD1S	3.6%
21	E21CD2P	1.8%
21	W21CA1S	1.8%
21	W21CA1T	6.5%
21	W21CD1P	4.2%
21	W21CD1S	3.6%
21	W21CD1T	6.0%
21	W21CD2T	4.2%

CIVIL FLIGHT TRACKS

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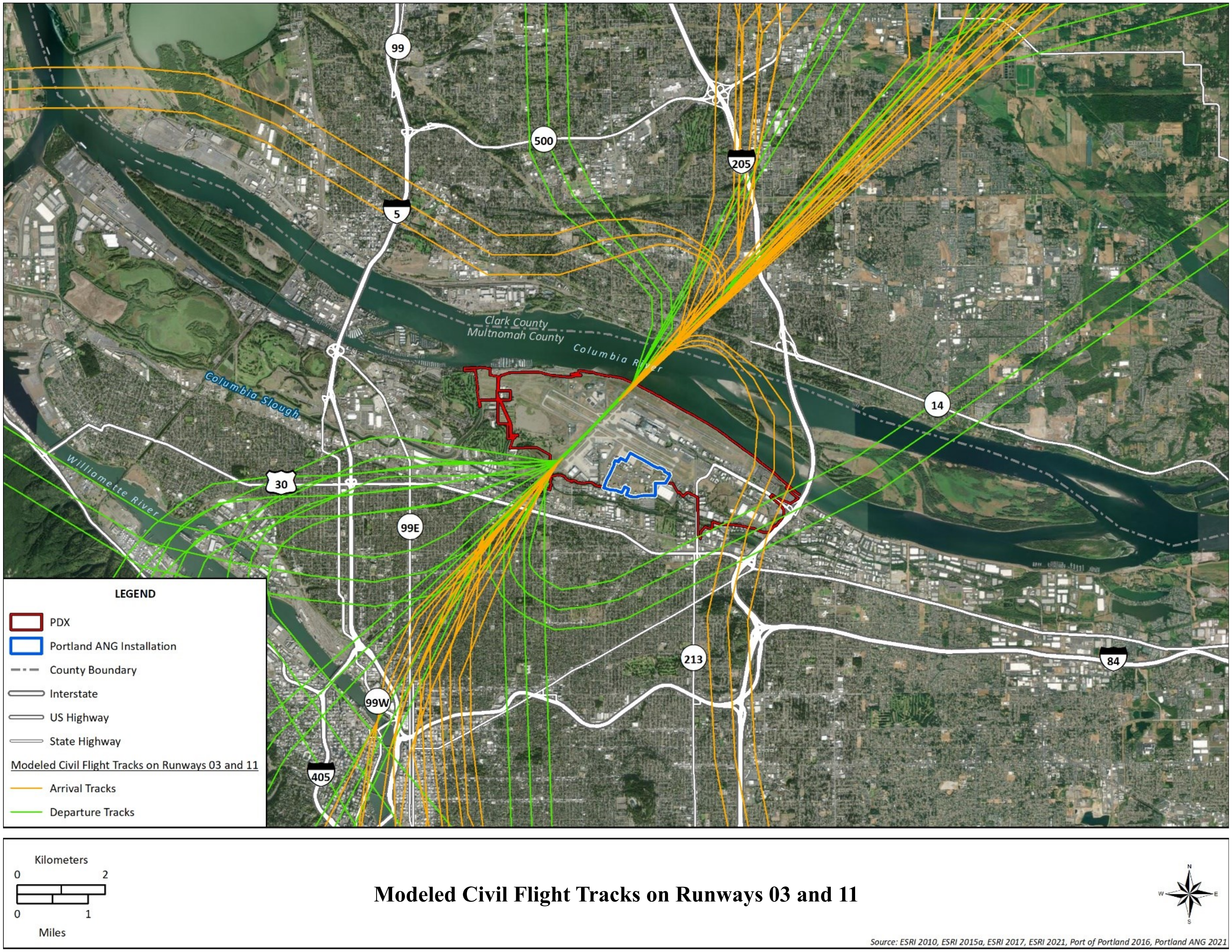
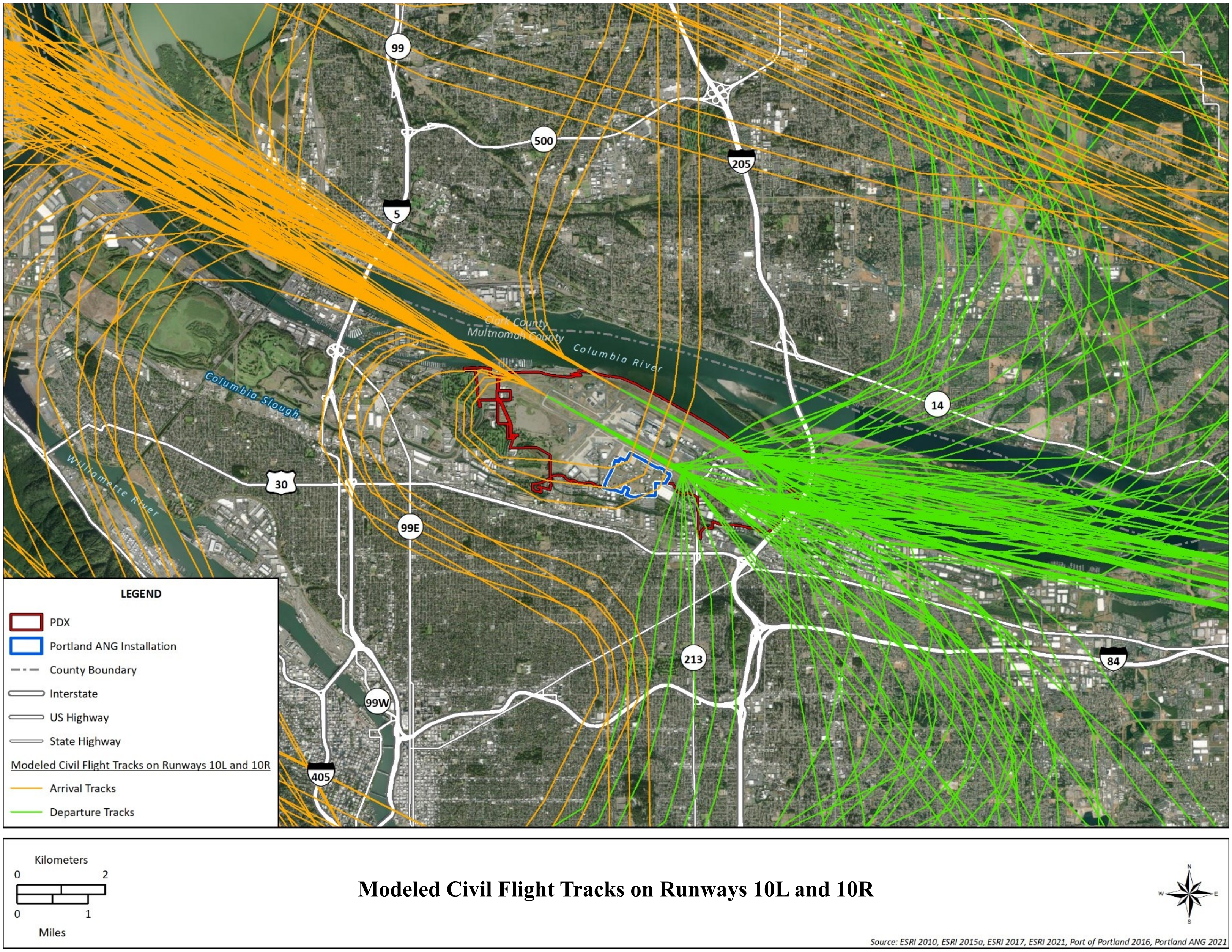


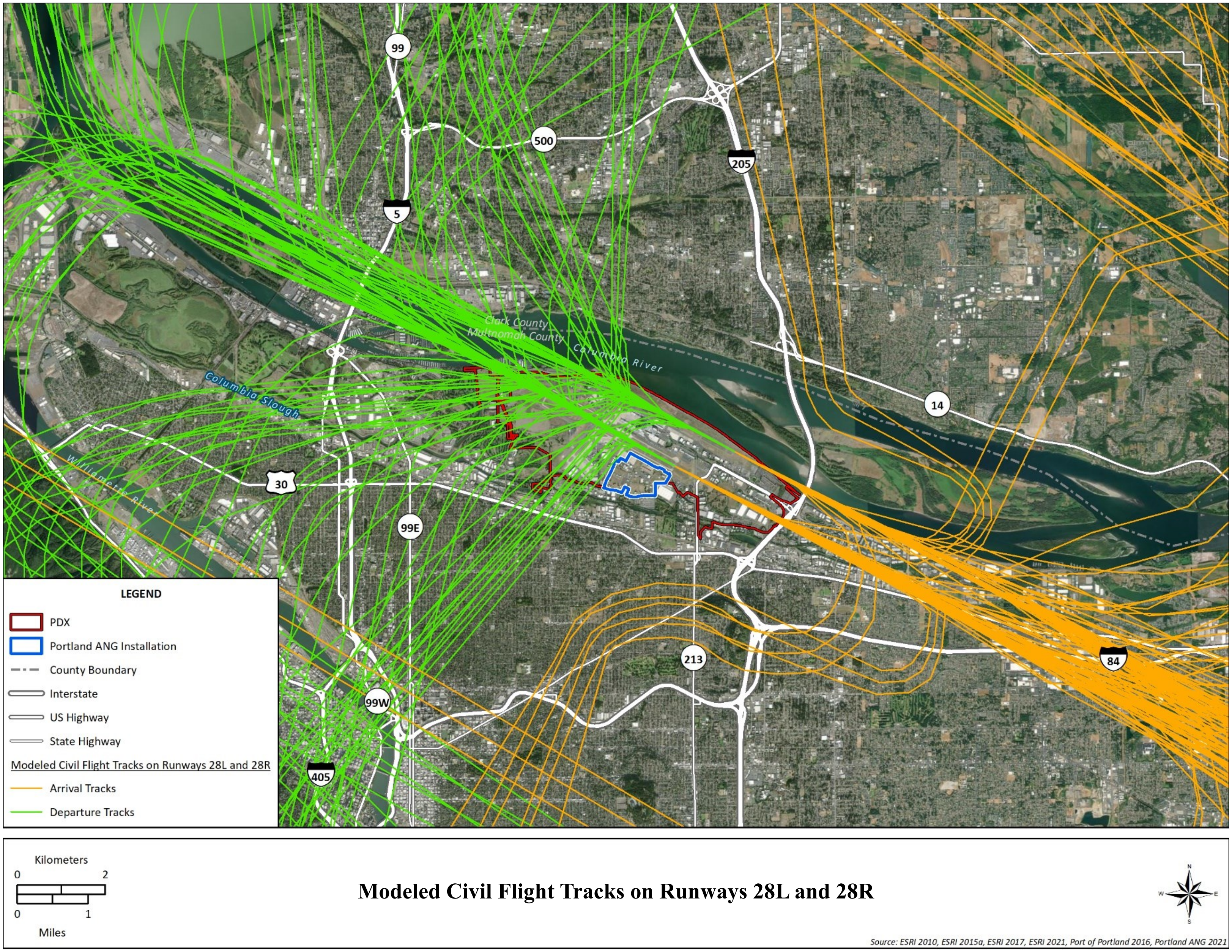
Modeled Civil Flight Tracks on Runways 03 and 11

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021



Modeled Civil Flight Tracks on Runways 10L and 10R

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021



Modeled Civil Flight Tracks on Runways 28L and 28R

Source: ESRI 2010, ESRI 2015a, ESRI 2017, ESRI 2021, Port of Portland 2016, Portland ANG 2021

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APPENDIX E
RECORD OF AIR ANALYSIS

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Appendix E
Air Quality Analysis Resources and Methodologies

The following information is provided for additional detail on air pollutants evaluated in the Proposed Action air quality impacts analysis and on the methodology used in the impact analysis.

Criteria Pollutants

National Ambient Air Quality Standards (NAAQS) are currently established for the criteria air pollutants ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), respirable particulate matter (including particulates equal to or less than 10 microns in diameter [PM10] and particulates equal to or less than 2.5 microns in diameter [PM2.5]), and lead (Pb). The primary NAAQS represent maximum levels of background air pollution that are considered safe, with an adequate margin of safety to protect public health. Secondary NAAQS represent the maximum pollutant concentration necessary to protect vegetation, crops, and other public resources in addition to maintaining visibility standards.

The criteria pollutant O3 is not usually emitted directly into the air but is formed in the atmosphere by photochemical reactions involving sunlight and previously emitted pollutants, or "O3 precursors." These O3 precursors consist primarily of nitrogen oxides (NOx) and volatile organic compounds (VOCs) that are directly emitted from a wide range of emission sources. For this reason, regulatory agencies limit atmospheric O3 concentrations by controlling VOC pollutants (also identified as reactive organic gases) and NOx.

The USEPA has recognized that particulate matter emissions can have different health effects depending on particle size and, therefore, developed separate NAAQS for coarse particulate matter (PM10) and fine particulate matter (PM2.5). The pollutant PM2.5 can be emitted from emission sources directly as very fine dust and/or liquid mist or formed secondarily in the atmosphere as condensable particulate matter, typically forming nitrate and sulfate compounds. Secondary (indirect) emissions vary by region depending upon the predominant emission sources located there and thus which precursors are considered significant for PM2.5 formation and identified for ultimate control.

The CAA and USEPA delegated responsibility for ensuring compliance with NAAQS to the states and local agencies. As such, each state must develop air pollutant control programs and promulgate regulations and rules that focus on meeting NAAQS and maintaining healthy ambient air quality levels. When a region or area fails to meet a NAAQS for a pollutant, that region is classified as "non-attainment" for that pollutant. In such cases, the affected state must develop a state implementation plan (SIP) that is subject to USEPA review and approval. A SIP is a compilation of regulations, strategies, schedules, and enforcement actions designed to move the state into compliance with all NAAQS. Any changes to the compliance schedule or plan (e.g., new regulations, emissions budgets, controls) must be incorporated into the SIP and approved by USEPA.

Analytical Methodology

Construction

USAF ACAM was used to model construction activities at Portland ANGB. Construction emissions were quantified based on construction footprints. Equipment selection and duration were based on the South Coast Air Quality Management District construction survey to estimate default phase lengths based on total project acreage. These data are found in Appendix A of the CALEEMOD Users Guide (Trinity Consultants 2021). Additional information used for estimating worker and vendor trips were generated using the same resource.

Truck sizes were selected based on average standards – concrete truck capacity = 9 CY of material

Dump truck sizes vary based on material weight and range from 10-16 CY. 12 CY was used as average capacity for the construction.

F-15C and F-15EX Aircraft

Departures, landings and closed patterns for these aircraft were evaluated in ACAM. EnviroSolutio provided time in modes (TIMs) for closed patterns and landings. Departure TIMS were calculated separately because of the requirement to use two distinct departures types: Military departure and Afterburner departure. These were further allocated based on frequency of use at the installation, as identified in the EA.

Data provided by Fresno ANGB were used as surrogates for the jet engine test cell activity at Portland ANGB. Increases in jet engine test cell use were based on the proportion of increase in aircraft populations and engine use.

AGE data were provided by Fresno ANGB. Where AGE equipment was located in ACAM, those emission factors were used to calculate the AGE emissions.

Engine maintenance data for the aircraft was obtained from the noise study for Portland ANGB.

Greenhouse Gases (GHGs)

GHG emissions are generated by both natural processes and human activities. The accumulation of GHGs in the atmosphere helps regulate the earth's temperature and contribute to global climate change. Primary GHGs include water vapor, methane, NO_x, hydrofluorocarbons, and chlorofluorocarbons. While water vapor is considered a GHG, note that atmospheric temperature controls the amount of water vapor in the air and the other GHGs control the atmospheric temperature. As a result, the amount of water vapor in the air is determined by the amount of other GHGs present in the atmosphere. This is how the greenhouse effect has rapidly increased over the last 100 years –when emissions of CO_2 and other GHGs significantly increased due to man's activities.

Each GHG has an estimated global warming potential (GWP), which is a function of its atmospheric lifetime and its ability to absorb and radiate infrared energy emitted from the earth's surface. The GWP of a particular gas provides a relative basis for calculating its CO2 equivalent

(CO2e) or the amount of CO2e to the emissions of that gas. CO2 has a GWP of 1 and is, therefore, the standard by which all other GHGs are measured.

GHG Emissions

Because GHG emission impacts are independent of altitude, the entire flight horizon for all aircraft sorties was estimated. In addition to land, departure and closed pattern operations, estimates of emissions for sorties was based on the settings for approach and intermediate (Climb out) operations. These were split 50/50 for the sortie duration. Average sortie duration is 1.7 hours for Portland ANGB.

A 50-year lifetime horizon was estimated based on the lifespan of the F-15C, though the F-15EX has an estimated lifetime in excess of 50 years. Building emissions for the 50-year period were not calculated as too little information is available on what sources could exist and the DAF's plan to become net zero by 2046 cannot be calculated, though emissions would be anticipated to steadily decline over the period.

The social cost of carbon dioxide emissions was calculated through 2050. The actual 50-year timespan would extend to 2075, but the Federal Office of Management and Budget has not published the cost of GHG emission tons past 2050. These data may or may not be available by the time the EA is published in its final form. The SC-CO2 is a measure, in dollars, of the long-term damage done by a ton of CO2 emissions in a given year. The dollar figure can also represent the value of damages avoided for an emission reduction. The cost analysis evaluated two different discount rates. A 3% discount provides a statistical average of damages. A more conservative discount uses the 95th percentile of estimates based on the 3 percent discount rate, with a higher cost to society per ton of CO_2 emitted. The 95th percentile rate is close to the revised cost values that EPA is considering for a new estimate for the social cost of carbon emissions using a 2% discount rate

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AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:
Base: PORTLAND IAP
State: Oregon
County(s): Multnomah
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: EA for Basing F-15EX Eagle II Operational Unit at Portland ANGB

c. Project Number/s (if applicable):

d. Projected Action Start Date: 1 / 2025

e. Action Description:

Alternative 1: Full replacement of the F-15C aircraft with one squadron of F-15EX aircraft, to include 20 aircraft (18 PAA and 2 BAA) and associated personnel, including the specifically itemized construction and structural improvement projects necessary to facilitate the dual role (air-to-air and air-to-ground) mission. Alternative 1 would result in an increase of approximately 110 personnel. Total annual operations at Portland IAP or the associated airspace would increase by 446 annual operations, and a portion of the airspace sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements. Alternative 1 does not require the establishment of new air-to-ground ranges.

Alternative 2: Full replacement of the F-15C aircraft with one squadron of F-15EX aircraft, to include 24 aircraft (21 PAA, 2 BAA, and 1 Attrition Reserve) and the addition of 110 personnel, including the specifically itemized construction and structural improvement projects necessary to facilitate the dual role (air-to-air and air-to-ground) mission. Total annual operations at Portland IAP or the associated airspace would increase, with 1,328 more annual operations compared to the baseline, and a portion of the airspace sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements. Alternative 2 does not require the establishment of new air-to-ground ranges.

Alternative 3: Under Alternative 3, the existing F-15C flying mission would remain in place at Portland ANGB until the projected end of the airframe mission or future required mission change proposals are presented. Any previously planned construction and repair projects required for the current mission, which reflect needs to sustain the 142 WG mission regardless of the airframe that is being flown, would be constructed under this alterantive with no change to air operations.

No Action Alternative: Under the No Action Alternative, no F-15EX operational aircraft would be based, no personnel changes or construction (even construction for the F-15C/D aircraft) would be performed, and no training activities by the F-15EX operational aircraft would be conducted in the airspace. Under the No Action Alternative, the NGB would continue to conduct their current mission using existing, legacy aircraft with multiple configurations and existing infrastructure.

f. Point of Contact:
Name: Caitlin Jafolla
Title: Air Quality SME
Organization: Cardno now Stantec
Email:
Phone Number:

2. Air Impact Analysis: Based on the attainment status at the action location, the requirements of the General Conformity Rule are:

_____ applicable
__X__ not applicable

Total net direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the start of the action through achieving "steady state" (i.e., net gain/loss upon action fully implemented) emissions. The ACAM analysis used the latest and most accurate emission estimation techniques available; all algorithms, emission factors, and methodologies used are described in detail in the USAF Air Emissions Guide for Air Force Stationary Sources, the USAF Air Emissions Guide for Air Force Mobile Sources, and the USAF Air Emissions Guide for Air Force Transitory Sources.

"Insignificance Indicators" were used in the analysis to provide an indication of the significance of potential impacts to air quality based on current ambient air quality relative to the National Ambient Air Quality Standards (NAAQSs). These insignificance indicators are the 250 ton/yr Prevention of Significant Deterioration (PSD) major source threshold for actions occurring in areas that are "Clearly Attainment" (i.e., not within 5% of any NAAQS) and the GCR de minimis values (25 ton/yr for lead and 100 ton/yr for all other criteria pollutants) for actions occurring in areas that are "Near Nonattainment" (i.e., within 5% of any NAAQS). These indicators do not define a significant impact; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for all criteria pollutant is considered so insignificant that the action will not cause or contribute to an exceedance on one or more NAAQSs. For further detail on insignificance indicators see chapter 4 of the Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide, Volume II - Advanced Assessments.

The action's net emissions for every year through achieving steady state were compared against the Insignificance Indicator and are summarized below.

Analysis Summary:

Emissions Source	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
2025 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.32	1.28	1.77	0.01	0.16	0.04	495
Net Change – F-15EX Operations Emissions	-24.53	-15.50	-37.44	-1.68	3.68	3.33	-5,214
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total 2025 Estimated Emissions	**-24.06**	**-14.12**	**-33.61**	**-1.67**	**3.84**	**3.37**	**-4,497**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2026 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.76	1.70	2.43	0.01	1.31	0.06	644
Net Change – F-15EX Operations Emissions	-24.53	-15.50	-37.44	-1.68	3.68	3.33	-5,214
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total 2026 Estimated Emissions	**-23.62**	**-13.69**	**-32.95**	**-1.67**	**4.99**	**3.39**	**-4,348**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

Emissions Source	***VOCs***	***NO_x***	***CO***	***SO_2***	***PM_{10}***	***$PM_{2.5}$***	***CO_2e***
2027 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.94	1.68	2.50	0.01	0.79	0.06	649
Net Change – F-15EX Operations Emissions	-24.53	-15.50	-37.44	-1.68	3.68	3.33	-5,214
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total 2027 Estimated Emissions	**-23.44**	**-13.71**	**-32.88**	**-1.67**	**4.47**	**3.39**	**-4,342**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2028 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.64	1.37	2.05	0.00	0.84	0.05	471
Net Change – F-15EX Operations Emissions	-24.53	-15.50	-37.44	-1.68	3.68	3.33	-5,214
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2028 Total Net Change Emissions	**-23.74**	**-14.02**	**-33.33**	**-1.67**	**4.52**	**3.38**	**-4,521**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2029 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.47	1.94	2.17	0.01	1.15	0.07	686
Net Change – F-15EX Operations Emissions	-24.53	-15.50	-37.44	-1.68	3.68	3.33	-5,214
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2029 Total Net Change Emissions	**-23.91**	**-13.46**	**-33.21**	**-1.67**	**4.82**	**3.40**	**-4,305**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2030 Estimated Annual Net Change Air Emissions							
Construction Emissions	1.25	2.35	3.00	0.01	1.00	0.08	811
Net Change – F-15EX Operations Emissions	-24.53	-15.50	-37.44	-1.68	3.68	3.33	-5,214
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2030 Total Net Change Emissions	**-23.13**	**-13.04**	**-32.39**	**-1.67**	**4.68**	**3.41**	**-4,181**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

Emissions Source	***VOCs***	***NO_x***	***CO***	***SO_2***	***PM_{10}***	***$PM_{2.5}$***	***CO_2e***
2031 Estimated Annual Net Change Air Emissions							
Construction Emissions	-	-	-	-	-	-	-
Net Change – F-15EX Operations Emissions	-24.53	-15.50	-37.44	-1.68	3.68	3.33	-5,214
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2031 Total Net Change Emissions	**-24.38**	**-15.39**	**-35.38**	**-1.67**	**3.68**	**3.33**	**-4,992**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2032 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.27	0.68	1.09	0.00	1.12	0.02	276
Net Change – F-15EX Operations Emissions	-24.53	-15.50	-37.44	-1.68	3.68	3.33	-5,214
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2032 Total Net Change Emissions	**-24.11**	**-14.71**	**-34.29**	**-1.67**	**4.80**	**3.35**	**-4,716**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2033 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.21	1.11	1.64	0.00	1.07	0.04	405
Net Change – F-15EX Operations Emissions	-24.53	-15.50	-37.44	-1.68	3.68	3.33	-5,214
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2033 Total Net Change Emissions	**-24.17**	**-14.28**	**-33.74**	**-1.67**	**4.75**	**3.37**	**-4,586**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2034 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.21	1.11	1.64	0.00	0.41	0.04	402
Net Change – F-15EX Operations Emissions	-24.53	-15.50	-37.44	-1.68	3.68	3.33	-5,214
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2034 Total Net Change Emissions	**-24.17**	**-14.29**	**-33.74**	**-1.67**	**4.09**	**3.37**	**-4,590**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

Emissions Source	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
2035 Estimated Annual Net Change Air Emissions							
Net Change – F-15EX Operations Emissions	-24.53	-15.50	-37.44	-1.68	3.68	3.33	-5,214
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2035 Total Net Change Emissions	**-24.38**	**-15.39**	**-35.38**	**-1.67**	**3.68**	**3.33**	**-4,992**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A

None of estimated annual net emissions associated with this action are above the insignificance indicators, indicating no significant impact to air quality. Therefore, the action will not cause or contribute to an exceedance on one or more NAAQSs.No further air assessment is needed.

Caitlin Jafolla

31 January 2024

Caitlin Jafolla, Air Quality SME

DATE

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

1. General Information: The Air Force's Air Conformity Applicability Model (ACAM) was used to perform an analysis to assess the potential air quality impact/s associated with the action in accordance with the Air Force Manual 32-7002, Environmental Compliance and Pollution Prevention; the Environmental Impact Analysis Process (EIAP, 32 CFR 989); and the General Conformity Rule (GCR, 40 CFR 93 Subpart B). This report provides a summary of the ACAM analysis.

a. Action Location:
Base: PORTLAND IAP
State: Oregon
County(s): Multnomah
Regulatory Area(s): NOT IN A REGULATORY AREA

b. Action Title: EA for Basing F-15EX Eagle II Operational Unit at Portland ANGB

c. Project Number/s (if applicable):

d. Projected Action Start Date: 1 / 2025

e. Action Description:

Alternative 1: Full replacement of the F-15C aircraft with one squadron of F-15EX aircraft, to include 20 aircraft (18 PAA and 2 BAA) and associated personnel, including the specifically itemized construction and structural improvement projects necessary to facilitate the dual role (air-to-air and air-to-ground) mission. Alternative 1 would result in an increase of approximately 110 personnel. Total annual operations at Portland IAP or the associated airspace would increase by 446 annual operations, and a portion of the airspace sorties would be shifted from the current air-to-air training to air-to-ground training events with different requirements. Alternative 1 does not require the establishment of new air-to-ground ranges.

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Alternative 3: Under Alternative 3, the existing F-15C flying mission would remain in place at Portland ANGB until the projected end of the airframe mission or future required mission change proposals are presented. Any previously planned construction and repair projects required for the current mission, which reflect needs to sustain the 142 WG mission regardless of the airframe that is being flown, would be constructed under this alterantive with no change to air operations.

No Action Alternative: Under the No Action Alternative, no F-15EX operational aircraft would be based, no personnel changes or construction (even construction for the F-15C/D aircraft) would be performed, and no training activities by the F-15EX operational aircraft would be conducted in the airspace. Under the No Action Alternative, the NGB would continue to conduct their current mission using existing, legacy aircraft with multiple configurations and existing infrastructure.

f. Point of Contact:
Name: Caitlin Jafolla
Title: Air Quality SME
Organization: Cardno now Stantec
Email:
Phone Number:

2. Air Impact Analysis: Based on the attainment status at the action location, the requirements of the General Conformity Rule are:

_____ applicable
__X__ not applicable

Total net direct and indirect emissions associated with the action were estimated through ACAM on a calendar-year basis for the start of the action through achieving "steady state" (i.e., net gain/loss upon action fully implemented) emissions. The ACAM analysis used the latest and most accurate emission estimation techniques available; all algorithms, emission factors, and methodologies used are described in detail in the USAF Air Emissions Guide for Air Force Stationary Sources, the USAF Air Emissions Guide for Air Force Mobile Sources, and the USAF Air Emissions Guide for Air Force Transitory Sources.

"Insignificance Indicators" were used in the analysis to provide an indication of the significance of potential impacts to air quality based on current ambient air quality relative to the National Ambient Air Quality Standards (NAAQSs). These insignificance indicators are the 250 ton/yr Prevention of Significant Deterioration (PSD) major source threshold for actions occurring in areas that are "Clearly Attainment" (i.e., not within 5% of any NAAQS) and the GCR de minimis values (25 ton/yr for lead and 100 ton/yr for all other criteria pollutants) for actions occurring in areas that are "Near Nonattainment" (i.e., within 5% of any NAAQS). These indicators do not define a significant impact; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for all criteria pollutant is considered so insignificant that the action will not cause or contribute to an exceedance on one or more NAAQSs. For further detail on insignificance indicators see chapter 4 of the Air Force Air Quality Environmental Impact Analysis Process (EIAP) Guide, Volume II - Advanced Assessments.

The action's net emissions for every year through achieving steady state were compared against the Insignificance Indicator and are summarized below.

Analysis Summary:

Emissions / ***Source***	***VOCs***	***NO_x***	***CO***	***SO_2***	***PM_{10}***	***$PM_{2.5}$***	***CO_2e***
2025 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.32	1.28	1.77	0.01	0.16	0.04	495
Net Change – F-15EX Operations Emissions	-21.55	-7.52	-13.91	-0.76	5.20	4.72	-2,733
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total 2025 Estimated Emissions	**-21.09**	**-6.14**	**-10.08**	**-0.75**	**5.37**	**4.76**	**-2,016**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2026 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.76	1.70	2.43	0.01	1.31	0.06	644
Net Change – F-15EX Operations Emissions	-21.55	-7.52	-13.91	-0.76	5.20	4.72	-2,733
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total 2026 Estimated Emissions	**-20.65**	**-5.71**	**-9.43**	**-0.75**	**6.52**	**4.78**	**-1,867**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

2027 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.94	1.68	2.50	0.01	0.79	0.06	649
Net Change – F-15EX Operations Emissions	-21.55	-7.52	-13.91	-0.76	5.20	4.72	-2,733
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total 2027 Estimated Emissions	**-20.47**	**-5.74**	**-9.35**	**-0.75**	**6.00**	**4.77**	**-1,862**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2028 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.64	1.37	2.05	0.00	0.84	0.05	471
Net Change – F-15EX Operations Emissions	-21.55	-7.52	-13.91	-0.76	5.20	4.72	-2,733
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2028 Total Net Change Emissions	**-20.77**	**-6.05**	**-9.80**	**-0.75**	**6.04**	**4.77**	**-2,040**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2029 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.47	1.94	2.17	0.01	1.15	0.07	686
Net Change – F-15EX Operations Emissions	-21.55	-7.52	-13.91	-0.76	5.20	4.72	-2,733
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2029 Total Net Change Emissions	**-20.93**	**-5.48**	**-9.68**	**-0.75**	**6.35**	**4.79**	**-1,825**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2030 Estimated Annual Net Change Air Emissions							
Construction Emissions	1.25	2.35	3.00	0.01	1.00	0.08	811
Net Change – F-15EX Operations Emissions	-21.55	-7.52	-13.91	-0.76	5.20	4.72	-2,733
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2030 Total Net Change Emissions	**-20.16**	**-5.07**	**-8.86**	**-0.75**	**6.21**	**4.80**	**-1,700**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2031 Estimated Annual Net Change Air Emissions							
Construction Emissions	-	-	-	-	-	-	-
Net Change – F-15EX Operations Emissions	-21.55	-7.52	-13.91	-0.76	5.20	4.72	-2,733
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2031 Total Net Change Emissions	**-21.41**	**-7.42**	**-11.85**	**-0.76**	**5.21**	**4.72**	**-2,511**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A

AIR CONFORMITY APPLICABILITY MODEL REPORT
RECORD OF AIR ANALYSIS (ROAA)

2032 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.27	0.68	1.09	0.00	1.12	0.02	276
Net Change – F-15EX Operations Emissions	-21.55	-7.52	-13.91	-0.76	5.20	4.72	-2,733
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2032 Total Net Change Emissions	**-21.14**	**-6.74**	**-10.76**	**-0.75**	**6.33**	**4.74**	**-2,235**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2033 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.21	1.11	1.64	0.00	1.07	0.04	405
Net Change – F-15EX Operations Emissions	-21.55	-7.52	-13.91	-0.76	5.20	4.72	-2,733
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2033 Total Net Change Emissions	**-21.20**	**-6.31**	**-10.21**	**-0.75**	**6.28**	**4.76**	**-2,106**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2034 Estimated Annual Net Change Air Emissions							
Construction Emissions	0.21	1.11	1.64	0.00	0.41	0.04	402
Net Change – F-15EX Operations Emissions	-21.55	-7.52	-13.91	-0.76	5.20	4.72	-2,733
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2034 Total Net Change Emissions	**-21.20**	**-6.31**	**-10.21**	**-0.75**	**5.62**	**4.76**	**-2,109**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A
2035 Estimated Annual Net Change Air Emissions							
Net Change – F-15EX Operations Emissions	-21.55	-7.52	-13.91	-0.76	5.20	4.72	-2,733
Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
2035 Total Net Change Emissions	**-21.41**	**-7.42**	**-11.85**	**-0.76**	**5.21**	**4.72**	**-2,511**
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	No	No	No	No	No	No	N/A

None of estimated annual net emissions associated with this action are above the insignificance indicators, indicating no significant impact to air quality.Therefore, the action will not cause or contribute to an exceedance on one or more NAAQSs.No further air assessment is needed.

Caitlin Jafolla

31 January 2024

Caitlin Jafolla, Air Quality SME

DATE

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PORTLAND SUMMARY

Annual Emissions Estimates for Construction: Alt 1 and Alt 2 F-15 EX

Activity	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_{2e}*
2025 Construction Emissions	1.84	1.77	2.42	0.01	1.62	0.05	722
2026 Construction Emissions	0.36	1.41	2.12	0.01	0.22	0.05	571
2027 Construction Emissions	0.73	1.69	2.42	0.01	0.62	0.06	666
2028 Construction Emissions	0.38	1.96	2.59	0.01	2.03	0.07	709
2029 Construction Emissions	0.51	2.09	2.42	0.01	1.15	0.07	752
2030 Construction Emissions	1.20	2.37	2.88	0.01	0.86	0.08	829
						Total	4,247

Annual Airfield Emissions Estimates Beginning in 2025 (tons per year)

ALT 1

Activity	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_{2e}*
F-15C Baseline Airfield Operations	**40.21**	**61.04**	**172.84**	**6.96**	**5.14**	**4.69**	**19,416**
F-15EX Airfield Operations	15.68	45.54	135.41	5.29	8.82	8.02	14,202
Net Change in Airfield Emissions	**-24.53**	**-15.50**	**-37.44**	**-1.68**	**3.68**	**3.33**	**-5,214**
F-15EX – Additional Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total	**-24.38**	**-15.39**	**-35.38**	**-1.67**	**3.68**	**3.33**	**-4,992**

Annual Airfield Emissions Estimates Beginning in 2025 (tons per year)

ALT 2

Activity	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_{2e}*
F-15C Baseline Airfield Operations	**40.21**	**61.04**	**172.84**	**6.96**	**5.14**	**4.69**	**19,416**
F-15EX Airfield Operations	18.65	53.51	158.94	6.20	10.34	9.41	16,683
Net Change in Airfield Emissions	**-21.55**	**-7.52**	**-13.91**	**-0.76**	**5.20**	**4.72**	**-2,733**
F-15EX – Additional Commuter Emissions	0.15	0.10	2.06	0.00	0.00	0.00	222
Total	**-21.41**	**-7.42**	**-11.85**	**-0.76**	**5.21**	**4.72**	**-2,511**

Activity	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_{2e}*
F-15C Baseline Aircraft Operations - MIL Dep	37.05	36.25	151.35	5.50	3.51	3.14	16,614
F-15C Baseline Aircraft Operations - AB Dep	1.53	6.33	0.95	0.18	0.40	0.36	522
Total Aircraft Operations	**38.59**	**42.59**	**152.30**	**5.68**	**3.91**	**3.51**	**17,136**
AGE	1.62	18.45	20.54	1.28	1.23	1.18	2,281
Total Baseline Airfield Operations	**40.21**	**61.04**	**172.84**	**6.96**	**5.14**	**4.69**	**19,416**
Baseline Jet Engine Test Cell	0.15	0.38	0.61	0.03	0.02	0.02	104
Total all sources	40.35	61.41	173.45	7.00	5.16	4.71	19,520

ALT 1 - 20 F-15EX

Activity	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
F-15EX Aircraft Operations - MIL Dep	12.38	24.44	106.64	3.70	7.07	6.36	11,190
F-15EX Aircraft Operations - AB Dep	1.53	0.95	6.33	0.18	0.40	0.36	522
Total Aircraft Operations	**13.91**	**25.39**	**112.98**	**3.88**	**7.47**	**6.73**	**11,712**
AGE	1.77	20.14	22.43	1.40	1.34	1.29	2,490
Total F-15EX Airfield Operations	**15.68**	**45.54**	**135.41**	**5.29**	**8.82**	**8.02**	**14,202**
F-15 EX Jet Engine Test Cell	0.26	0.24	0.60	0.02	0.04	0.03	70
Total all sources	15.94	45.78	136.01	5.31	8.85	8.05	14,272

ALT 2 - 24 F-15EX

Activity	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
F-15EX Aircraft Operations - MIL Dep	14.49	28.61	124.66	4.33	8.26	7.44	13,087
F-15EX Aircraft Operations - AB Dep	1.79	1.11	7.39	0.21	0.47	0.42	609
Total Aircraft Operations	**16.28**	**29.72**	**132.05**	**4.54**	**8.74**	**7.86**	**13,695**
AGE	2.07	23.50	26.17	1.64	1.56	1.51	2,905
Total F-15EX Airfield Operations	**18.34**	**53.23**	**158.22**	**6.18**	**10.30**	**9.37**	**16,601**
F-15 EX Jet Engine Test Cell	0.31	0.29	0.71	0.03	0.04	0.04	83
Total all sources	18.65	53.51	158.94	6.20	10.34	9.41	16,683

Legacy F-15C Construction

Emission Source	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*	*CO_2e*
2025 Construction Emissions	0.35	1.52	2.25	0.01	0.11	0.05	601
2026 Construction Emissions	-	-	-	-	-	-	-
2037 Construction Emissions	0.52	1.57	2.28	0.01	0.34	0.05	628
2028 Construction Emissions	0.38	1.96	2.59	0.01	2.05	0.07	709
2029 Construction Emissions	0.51	2.09	2.42	0.01	1.15	0.07	752
2030 Construction Emissions	0.17	0.87	1.30	0.00	0.08	0.03	313
Comparative Threshold	250	250	250	250	250	250	N/A
Exceeds Threshold	**No**	**No**	**No**	**No**	**No**	**No**	**NA**

Total	3,001

GHG Analysis

Alt 1		
Activity	***CO2e***	metric tons
F-15C Baseline Sorties	64,015	
Airfield Totals	19,520	
Annual GHG total	83,535	
50-yr lifecycle emissions of F-15C/D	**4,176,744**	
F-15EX Sorties	85,650	
Airfield Totals	14,272	
Annual GHG total	99,922	
Total 50-year emissions F-15EX	**4,996,080**	
Annual GHG net change	16,387	14,866
50-yr net change lifecycle emissions	**819,335**	

Alt 2		
Activity	***CO 2e***	metric tons
F-15C Baseline Sorties	64,015	
Airfield Totals	19,520	
Annual GHG total	83,535	
50-yr lifecycle emissions of F-15C/D	4,176,744	
F-15EX Sorties	99,919	
Airfield Totals	**16,683**	
Annual GHG total	116,603	
Total 50-year emissions F-15EX	**5,830,125**	
Annual GHG net change	33,068	29,998
50-yr net change lifecycle emissions	**1,653,381**	

F-15EX Alt 1

2027	$59	14,866	$870,540
2050	$85		$1,258,536
2077	$		

F-15EX Alt 1

2027	$176	14,866	$2,619,052
2050	$260		$3,864,358
2077	$		

F-15EX Alt 2

2026	$57	29,998	$1,724,611
2050	$85		$2,539,668
2076	$		

F-15EX Alt 2

2026	$173	29,998	$5,179,831
2050	$260		$7,798,096
2076	$		

F-15C, F-15EX Maintenance Activities

F-15C							Emission Factors lb/1000 lb fuel			
Aircraft Engine	Power Setting	Percent Thrust/hp	FFR (lb/hr)	Nox	Sox	CO	VOC	PM10	PM2.5	CO2e
F100-PW-220	Idle (Taxi)	3-5 %	2,084	4.61	1.07	35.32	7.94	0.67	0.60	3,214.59
	Approach	13-21	3,837	12.50	1.07	1.92	5.12	0.70	0.63	3,214.59
	Intermediate	45-49	5,770	22.20	1.07	0.86	2.89	0.70	0.63	3,214.59
	Military	86-100	9,679	29.60	1.07	0.86	2.08	0.91	0.82	3,214.59
	Afterburner-5	102-135	41,682	8.20	1.07	11.87	1.6	0.38	0.35	3,214.59

F-15C Maintenance Runs	18 aircraft		12 tests per aircraft			216	Total tests per year					
Description	Power (%)	# engines	Duration (min)	# annual events	Total annual minutes	Nox	Sox	CO	VOC	PM10	PM2.5	CO2e
2 engine checks	63 - Idle	2	9	72	1,296	208	48	1,590	357	30	27	144,703
	80-Intermediate	2	1	72	144	307	15	12	40	10	9	44,516
	63 - Idle	2	30	34	2,040	327	76	2,503	563	47	43	227,773
	80-Intermediate	2	1	34	68	145	7	6	19	5	4	21,021
1 engine check	63-Idle	1	23	524	12,052	1,930	448	14,785	3,324	280	251	1,345,647
	80-Intermediate	1	2	524	1,048	2,237	108	87	291	71	63	323,975
Pre/post flight	63 - idle	2	30	2,424	145,440	23,288	5,405	178,423	40,110	3,385	3,031	16,238,874
Hush House	63-Idle	1	113	12	1,356	217	50	1,664	374	32	28	151,402
	80-Intermediate	1	30	12	360	769	37	30	100	24	22	111,289
	90-MIL	1	40	12	480	2,292	83	67	161	70	63	248,912
	AB	1	8	12	96	547	71	792	107	25	23	214,385
Total Annual Maintenance Emissions in Tons						**16.1**	**3.2**	**100.0**	**22.7**	**2.0**	**1.8**	**9,536.2**

	minutes	divided by	216
Total Idle	16,744	**77.52**	38.76
Total Intermediate	1,620	**7.50**	3.75
Total MIL	480	**2.22**	1.11
AB	96	**0.44**	0.22
		ACAM is applying to 2 engines	Use this

F-15EX							Emission Factors lb/1000 lb fuel			
Aircraft Engine	Power Setting	Percent Thrust/hp	FFR (lb/hr)	Nox	Sox	CO	VOC	PM10	PM2.5	CO2e
F110-GE-129	Idle (Taxi)	4%	961	2.62	1.07	45.04	4.9	2.6	2.34	3,234.00
	Approach	45	4,832	13.42	1.07	1.93	0.03	1.37	1.23	3,234.00
	Intermediate	65	6,939	17.82	1.07	1.53	0.05	0.58	0.52	3,234.00
	Military	76	8,611	20.34	1.07	1.17	0.93	0.14	0.13	3,234.00
	Afterburner-1	99	15,564	7.09	1.07	63.28	53.46	3.35	3.01	3,234.00

F-15EX Maintenance Runs 20 aircraft 12 tests per aircraft 240 Total tests per year

Description	Power (%)	# engines	Duration (min)	# annual events	Total annual minutes	Nox	Sox	CO	VOC	PM10	PM2.5	CO2e
2 engine checks	63 - Idle	2	9	78	1,404	59	24	1,013	110	58	53	72,724
	80-Intermediate	2	1	78	156	321	19	28	1	10	9	58,346
	63 - Idle	2	30	37	2,220	93	38	1,601	174	92	83	114,991
	80-Intermediate	2	1	37	74	153	9	13	0	5	4	27,677
1 engine check	63-Idle	1	23	571	13,133	551	225	9,474	1,031	547	492	680,262
	80-Intermediate	1	2	571	1,142	2,354	141	202	7	77	69	427,122
Pre/post flight	63 - idle	2	30	2,647	158,820	6,665	2,722	114,571	12,464	6,614	5,952	8,226,542
Hush House	63-Idle	1	113	13	1,469	62	25	1,060	115	61	55	76,091
	80-Intermediate	1	30	13	390	804	48	69	2	26	23	145,865
	90-MIL	1	40	13	520	1,518	80	87	69	10	10	241,349
	AB	1	8	13	104	191	29	1,707	1,442	90	81	87,246
Total Annual Maintenance Emissions in Tons						**6.4**	**1.7**	**64.9**	**7.7**	**3.8**	**3.4**	**5,079**

	minutes	divided by	240
Total Idle	18,226	**75.94**	37.97
Total Intermediate	1,762	**7.34**	3.67
Total MIL	520	**2.17**	1.08
AB	104	**0.43**	0.22
			ACAM

F-15EX Maintenance Runs 24 aircraft 12 tests per aircraft 288 Total tests per year

Description	Power (%)	# engines	Duration (min)	# annual events	Total annual minutes	Nox	Sox	CO	VOC	PM10	PM2.5	CO2e
2 engine checks	63 - Idle	2	9	92	1,656	69	28	1,195	130	69	62	85,777
	80-Intermediate	2	1	92	184	379	23	33	1	12	11	68,818
	63 - Idle	2	30	43	2,580	108	44	1,861	202	107	97	133,639
	80-Intermediate	2	1	43	86	177	11	15	0	6	5	32,165
1 engine check	63-Idle	1	23	668	15,364	645	263	11,083	1,206	640	576	795,823
	80-Intermediate	1	2	668	1,336	2,753	165	236	8	90	80	499,680
Pre/post flight	63 - idle	2	30	3,088	185,280	7,775	3,175	133,659	14,541	7,716	6,944	9,597,115
Hush House	63-Idle	1	113	15	1,695	71	29	1,223	133	71	64	87,797
	80-Intermediate	1	30	15	450	927	56	80	3	30	27	168,305
	90-MIL	1	40	15	600	1,751	92	101	80	12	11	278,480
	AB	1	8	15	120	221	33	1,970	1,664	104	94	100,668
Total Annual Maintenance Emissions in Tons						**7.4**	**2.0**	**75.7**	**9.0**	**4.4**	**4.0**	**5,924**

	minutes	divided by	Sox
Total Idle	21,295	**73.94**	36.97
Total Intermediate	2,056	**7.14**	3.57
Total MIL	600	**2.08**	1.04
AB	120	**0.42**	0.21
			ACAM

F-15 Delta for Maintenance Runups

Nox	**Sox**	**CO**	**VOC**	**PM10**	**PM2.5**	**CO2e**	
-9.7	**-1.5**	**-35.1**	**-15.0**	**1.8**	**1.6**	**-4,457**	Alt 1
-8.7	**-1.2**	**-24.3**	**-13.7**	**2.4**	**2.2**	**-3,612**	Alt 2

F-15C vs F-15EX/F-35A flight operations

Aircraft	Departures	Mil Departure	AB Departure	Arrivals
F-15C	2,424	2,303	121	2,424
F-15EX, Alt 1	2,647	2,515	132	2,647
F-15EX, Alt 2	3,088	2,934	154	3,088
Delta 1	**223**			
Delta 2	**664**			

109% increase over baseline

127% increase over baseline

Note: Flight Profiles are updated in final noise study, but SolutioEnvironmental used older profiles for TIMs. The AQ analysis is using information from older profiles as a result.

ALT 1

5.0%				95.0%		
F-15C AB Departure	sec	min		**F-15C MIL Departure**	sec	min
AB	21	0.350		MIL	31.08	0.518
MIL	0.79	0.013		C-O	25.66	0.428
C-O	6.58	0.110				

50.00%				50.00% is how SolutioEnvironmental calculated		
F-15EX AB Departure	sec	min		**F-15EX MIL Departure**	sec	min
AB	32	0.533		MIL	49.833	0.831
MIL	1.735	0.029		C-O	10.417	0.174
C-O	12.397	0.207				

Portland AGE Calcs

Additional AGE

				Avg Run Time			EFs in g/hp-hr						
Equipment	Type	Model	HP	per LTO (hr)	**VOCs**	**CO**	**NOx**	**SO2**	**PM10**	**PM2.5**	**CO2**	**CH4**	
THOR AIR CONDITIONER	AC	THOR 200	208	1.50	0.04210349	0.14409711	0.615664372	0.001473669	0.02655	0.025755506	530.92166	0.00346	
Generator	GENERATOR SET, DIESEL	AM32A-112	160	2.00	0.24099139	0.76100848	2.845397364	0.001699501	0.16607	0.161091763	530.35007	0.01193	generators
Bomblift	TRUCK, BOMBLIFT, AERIAL	MJ-1C	29.1	1.40	0.7644458	3.00906672	4.009126989	0.002189714	0.47272	0.458542353	693.76813	0.02701	aerial lifts
Bomb Lift	TRUCK, BOMBLIFT, AERIAL	MHU-83D/E	26.1	1.40	0.7644458	3.00906672	4.009126989	0.002189714	0.47272	0.458542353	693.76813	0.02701	aerial lifts
N2 Servicing Cart		NGC-15-TM	49	0.80	0.18919873	0.68390584	3.072891824	0.001722915	0.11244	0.109065272	589.81573	0.01737	pumps
N2 Servicing Cart		130009-100	165	0.80	0.24170714	0.76706472	2.849503072	0.001699489	0.17208	0.166919984	530.34694	0.01197	pumps
MC-20	rotary air compressor	MC-20-WHTZ-T4F-E01	10.2	0.20	0.83543873	2.46333552	4.18300723	0.00216191	0.23946	0.232275386	587.97419	0.07362	air compre
HDU-43	duct type heater	HDU-43	6	0.10	0.82921575	2.90657419	4.478111628	0.002161973	0.34067	0.33045481	587.98886	0.0644	generators
NGH	duct type heater	NGH	6	0.10	0.82921575	2.90657419	4.478111628	0.002161973	0.34067	0.33045481	587.98886	0.0644	generators
Hydraulic Purifier	Hyd Purifier	100033-100	10	0.60	0.82921657	2.90657245	4.478112221	0.002161972	0.34067	0.330454726	587.98857	0.0644	pumps

EFs from Nonroad

Emissions in lb/sortie

	VOCs	**CO**	**NOx**	**SO2**	**PM10**	**PM2.5**	**CO2**	**CH4**
THOR 200	0.0290	0.0991	0.4235	0.0010	0.0183	0.0177	365.1923	0.0024
AM32A-112	0.1700	0.5369	2.0074	0.0012	0.1172	0.1136	374.1529	0.0084
MJ-1C	0.0687	0.2703	0.3601	0.0002	0.0425	0.0412	62.3120	0.0024
MHU-83D/E	0.0616	0.2424	0.3230	0.0002	0.0381	0.0369	55.8881	0.0022
NGC-15-TM	0.0164	0.0591	0.2656	0.0001	0.0097	0.0094	50.9729	0.0015
130009-100	0.0703	0.2232	0.8292	0.0005	0.0501	0.0486	154.3372	0.0035
MC-20-WHTZ-T4	0.0038	0.0111	0.0188	0.0000	0.0011	0.0010	2.6444	0.0003
HDU-43	0.0011	0.0038	0.0059	0.0000	0.0005	0.0004	0.7778	0.0001
NGH	0.0011	0.0038	0.0059	0.0000	0.0005	0.0004	0.7778	0.0001
100033-100	0.0110	0.0384	0.0592	0.0000	0.0045	0.0044	7.7778	0.0009

AGE in ACAM

				Avg Run Time			EFs in lb/hr				
Equipment	Type	Model	HP	per LTO (hr)	**VOCs**	**CO**	**NOx**	**SO2**	**PM10**	**PM2.5**	**CO2e**
Generator	GENERATOR, GAS TURBINE	A/M32A-60/A	180	2.00	0.270	5.480	1.820	0.306	0.211	0.205	221.10
Floodlights	FLOODLIGHT SET	FL-1D	10.5	0.53	0.025	0.13	0.17	0.043	0.16	0.155	30.7
Floodlights	FLOODLIGHT SET	NF-2D	10	0.53	0.01	0.08	0.11	0.043	0.01	0.01	22.1
MC-7	rotary air compressor	11M125RPDQ	48	0.70	0.057	0.642	1.285	0.023	0.109	0.105	75
Mule	TEST STAND, HYDRAULIC	TTU-228E/228	130	1.60	0.19	2.46	3.85	0.238	0.083	0.076	172
Mule	TEST STAND, HYDRAULIC	MK-1	unk	0.10	0.026	0.043	0.757	0.018	0.109	0.105	57.2

EFs from ACAM

NF-2 used for NF-2D

Emissions in lb/sortie

	VOCs	**CO**	**NOx**	**SO2**	**PM10**	**PM2.5**	**CO2e**
A/M32A-60/A	0.5400	10.9600	3.6400	0.6120	0.4220	0.4100	442.2000
FL-1D	0.0131	0.0683	0.0893	0.0226	0.0840	0.0814	16.1175
NF-2D	0.0053	0.0420	0.0578	0.0226	0.0053	0.0053	11.6025
11M125RPDQ	0.0399	0.4494	0.8995	0.0161	0.0763	0.0735	52.5000
TTU-228E/228	0.3040	3.9360	6.1600	0.3808	0.1328	0.1216	275.2000
MK-1	0.0026	0.0043	0.0757	0.0018	0.0109	0.0105	5.7200

	Total # of annual Sorties									
F-15C AGE Calc	2,424									
		Total Emissions in Tons								
Additional AGE	**VOCs**	**CO**	**NOx**	**SO2**	**PM10**	**PM2.5**	**CO2**	**CH4**	**N2O**	**CO2e**
THOR 200	70.20	240.26	1026.52	2.46	44.27	42.94	885,226	5.77	2.63	886,155
AM32A-112	412.12	1301.39	4865.89	2.91	284.00	275.48	906,947	20.40	9.31	910,230
MJ-1C	166.43	655.12	872.85	0.48	102.92	99.83	151,044	5.88	2.68	151,991
MHU-83D/E	149.27	587.58	782.87	0.43	92.31	89.54	135,473	5.27	2.41	136,321
NGC-15-TM	39.63	143.27	643.73	0.36	23.55	22.85	123,558	3.64	1.66	124,144
130009-100	170.50	541.10	2010.07	1.20	121.39	117.75	374,113	8.44	3.85	375,472
MC-20-WHTZ-T4F-E01	9.11	26.85	45.60	0.02	2.61	2.53	6,410	0.80	0.37	6,539
HDU-43	2.66	9.32	14.36	0.01	1.09	1.06	1,885	0.21	0.09	1,919
NGH	2.66	9.32	14.36	0.01	1.09	1.06	1,885	0.21	0.09	1,919
100033-100	26.59	93.20	143.59	0.07	10.92	10.60	18,853	2.07	0.94	19,186
A/M32A-60/A	1308.96	26567.04	8823.36	1483.49	1022.93	993.84				1,071,893
FL-1D	31.82	165.44	216.34	54.72	203.62	197.25				39,069
NF-2D	12.73	101.81	139.99	54.72	12.73	12.73				28,124
11M125RPDQ	96.72	1089.35	2180.39	39.03	184.95	178.16				127,260
TTU-228E/228	736.90	9540.86	14931.84	923.06	321.91	294.76				667,085
MK-1	6.30	10.42	183.50	4.36	26.42	25.45				13,865
Total in Tons	**1.62**	**20.54**	**18.45**	**1.28**	**1.23**	**1.18**				**2,281**

Note: MOVES 3 does not calculate N2O for nonroad equipment. The ratio of N2O to CH4 has been used to derive emission values for nonroad equipment (lb): 0.45614
The ratio is from EPA. 2016. Direct Emissions from Mobile Combustion Sources, Table B-8. January.

F-15EX AGE Calc - Alt 1	Total # of annual Sorties									
	2,647	Total Emissions in Tons								
Additional AGE	**VOCs**	**CO**	**NOx**	**SO2**	**PM10**	**PM2.5**	**CO2**	**CH4**	**N2O**	**CO2e**
THOR 200	76.66	262.36	1120.96	2.68	48.34	46.89	966,664	6.31	2.88	967,679
AM32A-112	450.03	1421.12	5313.53	3.17	310.13	300.82	990,383	22.28	10.16	993,968
MJ-1C	181.74	715.39	953.15	0.52	112.39	109.02	164,940	6.42	2.93	165,973
MHU-83D/E	163.01	641.64	854.89	0.47	100.80	97.78	147,936	5.76	2.63	148,863
NGC-15-TM	43.28	156.45	702.95	0.39	25.72	24.95	134,925	3.97	1.81	135,564
130009-100	186.19	590.88	2194.99	1.31	132.56	128.58	408,530	9.22	4.21	410,014
MC-20-WHTZ-T4F-E01	9.95	29.33	49.80	0.03	2.85	2.77	7,000	0.88	0.40	7,141
HDU-43	2.90	10.18	15.68	0.01	1.19	1.16	2,059	0.23	0.10	2,095
NGH	2.90	10.18	15.68	0.01	1.19	1.16	2,059	0.23	0.10	2,095
100033-100	29.03	101.77	156.80	0.08	11.93	11.57	20,588	2.26	1.03	20,951
A/M32A-60/A	1429.38	29011.12	9635.08	1619.96	1117.03	1085.27				1,170,503
FL-1D	34.74	180.66	236.24	59.76	222.35	215.40				42,663
NF-2D	13.90	111.17	152.86	59.76	13.90	13.90				30,712
11M125RPDQ	105.62	1189.56	2380.98	42.62	201.97	194.55				138,968
TTU-228E/228	804.69	10418.59	16305.52	1007.98	351.52	321.88				728,454
MK-1	6.88	11.38	200.38	4.76	28.85	27.79				15,141
Total in Tons	**1.77**	**22.43**	**20.14**	**1.40**	**1.34**	**1.29**				**2,490**

F-15EX AGE Calc - Alt 2 Total # of annual Sorties

3,088 Total Emissions in Tons

Additional AGE	VOCs	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O	CO2e
THOR 200	89.43	306.07	1,307.71	3.13	56.40	54.71	1,127,714	7.36	3.36	1,128,898
AM32A-112	525.01	1,657.88	6,198.79	3.70	361.80	350.94	1,155,384	25.99	11.85	1,159,566
MJ-1C	212.02	834.58	1,111.95	0.61	131.11	127.18	192,420	7.49	3.42	193,625
MHU-83D/E	190.16	748.54	997.31	0.54	117.60	114.07	172,582	6.72	3.06	173,664
NGC-15-TM	50.49	182.51	820.06	0.46	30.01	29.11	157,404	4.63	2.11	158,150
130009-100	217.21	689.32	2,560.69	1.53	154.64	150.00	476,593	10.76	4.91	478,324
MC-20-WHTZ-T4F-E01	11.60	34.21	58.09	0.03	3.33	3.23	8,166	1.02	0.47	8,330
HDU-43	3.39	11.87	18.29	0.01	1.39	1.35	2,402	0.26	0.12	2,444
NGH	3.39	11.87	18.29	0.01	1.39	1.35	2,402	0.26	0.12	2,444
100033-100	33.87	118.73	182.92	0.09	13.92	13.50	24,018	2.63	1.20	24,441
A/M32A-60/A	1667.52	33,844.48	11,240.32	1,889.86	1,303.14	1,266.08				1,365,514
FL-1D	40.53	210.76	275.60	69.71	259.39	251.29				49,771
NF-2D	16.21	129.70	178.33	69.71	16.21	16.21				35,829
11M125RPDQ	123.21	1,387.75	2,777.66	49.72	235.61	226.97				162,120
TTU-228E/228	938.75	12,154.37	19,022.08	1,175.91	410.09	375.50				849,818
MK-1	8.03	13.28	233.76	5.56	33.66	32.42				17,663
Total in Tons	**2.07**	**26.17**	**23.50**	**1.64**	**1.56**	**1.51**				**2,905**

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