Growler Low-Frequency Noise:
Effects on Ebey's Reserve's Soundscape and Historical Structures

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Context

Soundscape. There is no doubt that the unique soundscape of our special places contribute to the sense of the place and its heritage assets. For example, churchyards, burial mounds, ruined buildings can all have a very distinct sense of place, which is at least partially the result of the absence, or at least recession of the invasive sounds of everyday noise. Soundscapes include the sound of birds, the wind, waves, crickets and insects sound, etc. Parks and monuments, like the Olympic National Park and Ebey's Historic Reserve, all have their own unique, yet so vulnerable, soundscapes.

Sounds experienced when visiting a special place can magnify or detract from the experience. Imagine, if you will, going to a native American Museum where artifacts are solemnly presented, rendering a serene sense of spiritual being, only to have an unruly family of loud children running about screaming and creating a general sense of mayhem. Museums are not playgrounds; nor are our parks military training fields.

A variety of laws, executive orders, and regulations clearly charge the National Park Service (NPS), a partner in Ebey's Historic Reserve, with preserving cultural resources and providing for their enjoyment "*in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.*" Parks offer special opportunities for people to experience their cultural inheritance by offering

special protection for cultural and environmental resources. Impacts to context or setting, such as when aircraft fly over an 1800s reenactment or an ancient religious ceremony, can significantly reduce the associations that connect us with that cultural heritage.

Structures. A critical aspect of our cultural resources (e.g., historic structures) is their that they are not renewable: If they lose significant material aspect, context, associations, and integrity, they are lost forever. The responsibility of the NPS is to minimize loss of pre-historic and historic material. Closely related but secondary responsibilities include maximizing the expression of historic character, integrating site development with natural processes, sustaining the lifeways of ethnic groups, increasing our knowledge of past human behavior, and supporting the interpretation of park resources.

Possible adverse aircraft overflight impacts on cultural resources entrusted to the NPS include physical impacts from vibrations, loss of historical or cultural context or setting, and interference with visitors' park experience. The term "adverse effect" has special meaning when used in association with historical properties. The definition put forth in The National Historic Preservation Act of 1966 states: *"An undertaking is considered to have an adverse effect when the effect on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association."*

Physical impacts that harm cultural objects reduce visitor opportunity for associative connections. Hence, integrity of the objects is fundamental to the enjoyment and understanding of the cultural heritage of Ebey's National Historical Reserve.

In addition to NPS's charge, Island County's Comprehensive Plan supports the goals and policies of Ebey's Reserve. Washington State's Growth Management

Act outlines 13 goals that communities must plan by. Goal 13 is to "*identify and encourage the preservation of lands, sites, and structures, that have historical or archaeological significance.*" Given the abundance of Island County's historical resources, their preservation is a high priority within the community, and several sections of the the county's Comprehensive Plan include the preservation of Ebey's Reserve.

Growler LFN Threatens the Reserve

Growler noise is both extremely loud and includes low-frequency noise (LFN) that causes vibration that can adversely impact structures. Damage to the Reserve's structures is not acceptable and make it impossible for the National Park Service and the Ebey's National Historical Reserve Board and partners to fulfill their congressional mandate for protecting this non-renewable cultural resource.

Based on the research, including the Navy's own research of LFN, there is cause for real concern. The Navy's expanded number of jets and flight operations at the Outlying Landing Field (OLF) in Coupeville, open the door to multiple adverse impacts on the fragile historic properties within the Reserve, as well as its cultural and historical heritage, soundscape, and visitor appreciation of the Reserve and its environs. It may even damage the ground base.

The Growler produces more LFN than any of its predecessors and has a greater potential geographic impact because it travels further than high frequency noise. This increases the potential to impact structures well outside of the current FCLP flight patterns at the OLF. Not only is this cause for concern for the structures within the Reserve but also cause for serious preservation concerns in the town of Coupeville, established as a Historic District within the Reserve and recognized for its large number of fine examples of Victorian houses.

The Navy recognizes low-frequency noise impacts and discusses it in the context of structures at NAS Whidbey, Indian Burial Grounds, and other historic sites. From the Navy's own website: "*The EA-18G Growler has more low frequency content than the Prowler it is replacing. Close to the airfield, there might be a slight increase in potential for noise--induced vibration in areas where the peak sound levels exceed 110 dB*[1]." However, the Navy does not discuss the coastline and high bluffs that surround much of Whidbey Island and the Reserve.

Growler LFN impacts could be impacting culturally significant, yet unstable cliffs within the Reserve, including its iconic bluff and bluff trail. A 2005 study[2] focused on a soundscape regime at the low end of the frequency spectrum (e.g., 10–25 Hz, which is inaudible to humans):

> *"[N]onindigenous sound energy may cause noise-induced vibrations in structures. Such low frequency components may be of sufficient magnitude to pose damage risk potential to historic structures and cultural resources. Examples include Anasazi cliff and cave dwellings, and pueblo structures of vega type roof construction. Both are susceptible to noise induced vibration from low-frequency sound pressures that excite resonant frequencies in these structures. The initial damage mechanism is usually fatigue cracking. Many mechanisms are subtle, temporally multi-phased, and not initially evident to the naked eye."*

Whidbey Island has many unstable cliffs already well identified that Growlers regularly fly over, yet no precautionary measures have been taken or considered. That need may be especially critical after long periods of rain that make the bluffs

[1] Wyle Aircraft Noise Study, October 2012.

[2] Louis C. Sutherland and Richard D. Horonjeff, Impact of low-frequency sound on historic structures 2005.

less stable. To date, no investigations have been conducted by the Navy to ascertain the potential threat.

LFN May Damage Historic Structures

The National Historic Preservation Act of 1966 states: *"An undertaking is considered to have an adverse effect when the effect on a historic property may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association."*

The Navy acknowledges that architectural resources within NAS Whidbey and its immediate surroundings may be impacted by noise and vibration from the operation of Growler Aircraft (Draft EIS, pages 4-193-195). The Navy quickly concludes, however, that they do not expect damage to occur from their expanded numbers of flight operations over the Reserve's historic properties, even though it has not presented credible evidence for making that conclusion; nor has it presented any C-scale Growler noise levels, which document LFN that inflicts vibration damage.

According to Norman Lederman, MS, Director of Research & Development, Oval Window Audio[3], the commonly used A-weighted decibel metric, is scientifically inaccurate; the C-weighted metric should instead be used. LFN pollution is an intrusive and unhealthy by-product of aviation. Hence, the ubiquitous military use of A-weighted noise measurements largely understates the degree that LFN impacts the environment. Overall, measurements are under-measured by 7-8 dBA. The main difference, however, is that unlike higher noise frequencies which are deflected by hard surfaces, LFN penetrates them.

Hence, strong LFN produced by aircraft may rattle doors, windows, and contents of houses. These secondary physical sound sources may be more disturbing than

Nederland, CO., USA in his article, *Aviation Low Frequency Noise of April 13, 2001.*

the original primary LFN in the range of 15-400 Hz. It may then under predict noise by 7 to 8 dBA, relative to a 1,000 Hz target noise (Kjellberg & Goldstein, 1985). A 9-dBA increase magnifies the noise energy 8-fold, given the logarithmic decibel scale.

In its Section 106 analysis and report[4] the Navy admits it has very little information on LFN damage potential on structures, let alone historic structures that never had to meet a structural code.

> *Because of a wide range of variations in building code and aircraft types, the U.S. has yet to develop a precise threshold for adverse effects to the integrity of buildings and structures. Therefore, this study [the 106 DOE] applies the same standards used in the 2012 noise study for the assessment of noise and vibration from Navy airfield operations to historic properties within the APE.*

The cited 2012 study by Kester and Czech, which applied to contemporary buildings, indicated that 130 dBC for greater than 1 second appears to be the threshold for causing structural damage. Kester and Czech (2012), however, do not appear in the literature cited section of the Navy's Section 106 report, and it has not been found on line. So, the efficacy and applicability of that study are questionable, most specifically the methods used and scope of the data developed and analyzed.

The JGL Acoustics sound study (JGL Report 2019) included C-weighted decibel recordings at Position 1, but noise measurements there were similar to Positions 2 and 3, which are just north and south of the Reuble farmstead. The measurements show the peaks for the C-weighted recording to be about 3 dB greater that the A-weighted, which were consistently from about 115 to 120 dBC. This, and the doubt related to Kester and Czech's threshold, is a red-flag waving potential vibration damage to historic structures.

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[4] Section 106 Determination of Effect for the EA-18G "Growler" Airfield Operations at the Naval Air Station Whidbey Island Complex. June 2018.

If Kester and Czech's threshold (130 dBC, >1 sec.) is not overstated and does cause structural damage to contemporary buildings, then iterative exposure of old and fragile historical buildings to 115-120 dBC may gradually—exposure after exposure—weaken their structural integrity and durability. Historic structures in the noise zones that could suffer adverse impacts from iterative Growler noise exposures include the following:[5]

Coupeville

Newcomb Property
Bergman House
Benson House
Hughes House
Bradt House

Island County (outside town of Coupeville)

Reuble Farm
John Kineth Farmhouse
Sam Keith House
Wiley Place
Strong Granary
Old Anderson Place
Grove Terry Place
Fort Casey Housing/Myers House
Fort Casey Pump House
C. Wanamaker House
J. Gould House/Miller House
Strong House
Gilbert Place/Eggerman House
Gillespie House
Sam Crockett House

[5]Source: Kwarsick 2004; Island County Department of Planning and Community Development 2004

H. Crockett House/Boyer Farm
Col. W. Crockett Farmhouse
Thomas Sullivan House
Engle Farm