Citizens of Ebey's Reserve (COER) Comments:

Draft Environmental Impact Statement

for Naval Air Station Whidbey Island

Addendum 5:

COER Comments to Kendall Campbell on Section 106 Process

Date: September 1, 2016

To: NAS Whidbey Island Cultural Resources Program Manager, Kendal Campbell, kendall.campbell1@navy.mil

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations in 36 CFR Part 800, Naval Air Station Whidbey Island (NAS Whidbey Island) is continuing consultation first requested on 20 October 2014 and now is asking for comments on this proposed action.

From: Citizens of Ebey's Reserve (COER)
Regarding: Request for Section 106 Comments on the Proposed Definition of the Area of Potential Effect for the Continuation and Increase in Ea-18G Growler Operations at Naval Air Station, Whidbey Island, Island County, Washington.

COMMENTS:

Problems with the DNL Metric

Most of the day–night noise level (DNL) annoyance research has been derived from studies of commercial airports, which generally have frequent daily traffic, but lower maximum sound levels. Extrapolating that database to military jets impacting civilian residents is highly questionable. Paul Schomer (Standards Director, Emeritus, Acoustical Society of America, Schomer and Associates, Inc.) questions "*the substaniated extention of DNL into untested and unsubstantiated regions so loud that hearing protection and warning signs are required*." He goes on to point out that a "*65 DNL for a year is 91 dB if it comes in one day, 140 dB in 1*

second, and 170 dB in 1 ms-permanent hearing loss and damage to the ear but no [DNL] impacts." That clearly shows how and why the DNL is a worthless metric to evaluate health impacts or humans or wildlife.

Indeed, as stated in USACHPPM (1998; page 28), [1] "although the DNL has been emphasized by the DoD and especially the Army as the primary noise exposure metric, this metric applies to community annoyance and is seldom related to behavioral or reproductive effects of wildlife. Hence the DNL metric is of no use or value to evaluate Growler noise impacts on visitors to the Reserve or on its wildlife, or historic structures.

DNL means Day Night Average Sound Levels: A complicated formula is used to figure DNLs but, simply put, it means that quiet times are averaged, with noisy times. This has the effect of making the noisy times seem not so noisy.

DNLs don't tell us what the loudest event is in a 24-hour period nor how many noisy events there may be in a 24-hour period. Our ears don't average noise over 24-hours ---We hear and react to each noise as a separate event.

In looking strictly at annoyance, it similarly follows that an annual average DNL as applied to thousands of annual Reserve visitors is not useful or germane because Growlers have no 'annoyance' effect when not flying overhead and a huge effect when they are.

DNL Flaws in 2005 Finding of No Significant Impact

Other problems impact the Navy's proposed continuance and expansion of Growler flights, as well; i.e., inappropriate data was used to produce the 2005 EA "finding of no significant impact" (FONSI) for the completed transition of Prowlers to Growlers at OLFC in 2013.

The five problems discussed below apply significant question to the validity of the DNL noise contours provided for OLFC by Commander Moore. If those problems were corrected and revised, it would expand the areas of land encompassed within each contour. It follows that

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[1] *Ecological Risk Assessment Framework for Low-Altitude Overflights by Fixed-Wing and Rotary-Wing Military Aircraft.* January 2000. Rebecca A. Efroymson (Oak Ridge National Laboratory), Winifred Hodge Rose and Sarah Nemeth (U. S. Army Construction Engineering Research Laboratory), and Glenn W. Suter II (U. S. Environmental Protection Agency). Research sponsored by the Strategic Environmental Research and Development Program of the U. S. Department of Defense under Interagency Agreement 2107-N218-S1 under contract DE-AC05-00OR22725 with UT-Battelle, LLC. Publication No. 5010, Environmental Sciences Division, ORNL. https://www.researchgate.net/publication/252522677

increased Growler activity at OLFC would further expand the 65 DNL area and encroach even further upon the quiet cultural soundscape and historic buildings and residences of the Reserve, and the intention and purpose of the Ebey's National Historical Reserve.

The following five problems involve fallacious information the Navy data provided to Wyle for its noise study[2] as refuted by actual data obtained by COER via the Freedom of Information Act:

1) Wyle indicated that use of OLFC paths 14 and 32 are split 50:50 (Table A-1 on page A-6), even though use of path 14 has never been near 50%, but instead 5% to 25%. The Navy affirmed in the lawsuit trial record and as iterated by Judge Zilly in his decsion,[3] "*…it is apparent that flight path 14 is now rarely used for FCLP operations….*" So, path 32 has and will continue to be used almost exclusively. This 50:50 misrepresentation, if corrected, would expand the impact area over the Reserve and adjacent Admirals Cove.

2) Wyle also indicated its use of OLFC after 10 PM is 5.8% of the landing practices, and Wyle based its day–night[4] sound level (DNL) analysis on that percentage. However, rather than 5.8%, the actual after 10 PM operations since 2007 averaged 41%, and as high as 63%. Wyle's DNL contours are lower than they should be because they are based on the false 5.8% metric.

3) The 2005 EA FONSI was also greatly influenced by the dubious selection of a single year, 2003, to represent the number of FCLP operations over the 6 years prior to the 2005 EA. The EA stipulated that Navy plans for 2013 and beyond called for 6120 operations annually at OLFC, the so-called "*projected operations*." If the historical base of operations (the so-called "*existing condition*") was greater than the *projected* 6120, then the *projected* number of operations would be less than the *existing condition*. That, in turn, would make the *projected operations* produce less noise than the historical *existing condition*. and that would help establish no environmental impact for the transition to Prowlers. So, the Navy selected 2003 as the base year, which at 7682 operations was the only year of the six preceding years that exceeded the 6120 *projected* operations. Had any year other than 2003 been selected for the comparison year (e.g., 2002 = 4100 operations, or 2001 = 3568, or an average of 2002-2004 = 5117), then the *existing condition* would have been lower than the 6120 *projected operations* and produced an increase in noise, rather than a decrease. No respectable statistician would establish a

[2] Aircraft Noise Study For Naval Air Station Whidbey Island and Outlying Field Coupeville Washington, WR 04-26, Wyle, October 2004
[3] Citizens of Ebey's Reserve v. U. S. Navy,
[4] Night operations drive the DNL level way up due to mathematical weighting.

baseline from a single stochastic year, especially given the wide variation in annual operation totals.

4) In 2005 the Navy asserted in their 2005 AICUZ document that on approach to touchdown Growlers are at 114 decibels (dB) at 1000 feet above ground, or 7 dB louder than Prowlers (107 dB). But the 2012 Navy feed to Wyle somehow found that Growlers on approach were 109 dB and the Prowler was 111 dB. So, in those 7 years between 2005 and 2012, the Growlers inexplicably grew 5 dB quieter and the Prowlers grew 7 dB louder. Which of those disparate Prowler vs. Growler metrics is believable, if either, in light of the above? Note too that Growlers, on their approach and takeoff on either path, cross the most populous portion of the racetrack, often at 200-400 feet above rooftops. By comparison, the FAA with its quieter commercial aircraft standards strictly requires no flyovers be less than 500 feet over people or homes.

5) The well-established standards for calculating an annual 24-hour average DNL is different for airports used daily versus those used intermittently. Those used daily are to be calculated based on all 365 days of use in the year; DNLs for airstrips used intermittently are to be based on just the "busy days" of use. In other words, if the airport averages just 50 days of use per year, the DNL should be averaged over just those 50 days, not all 365 days of the year. Averaging OLFC use over 365 days would reduce the area under each noise contours, while use of 50 days would increase the areas. Yet the Navy has been unable to confirm how the DNLs were averaged, as requested by COER (July 3, 2016, letter). In essence Commander Moore indicated that the average could be an average of "busy days" only (i.e., all days OLFC was used in an average year) **or** an average over all 365 days in the average year. He wasn't sure which. If the Navy used the 365-day averaging method, then the DNLs Commander Moore provided would likely understate the DNL, such that the 65 DNL contour might actually be close to 70 DNL, and the 60 DNL might be a close to 65 DNL.

Those five data irregularities have a profound effect on the assessment of environmental impacts related to the Prowler–Growler transition and the related 2005 EA's dubious "finding of no significant impact" at OLFC. It follows that the contours Commander Moore provided for the Section 106 Process understate the 65 DNL area, which, in reality, extends further into Ebey's Reserve than shown on current maps.

Problems with Modeling the DNL Contour

The modeling used to prepare the DNLs is also potentially problematic. The Navy has recently asserted it was not necessary to have on-site noise studies for OLFC in the current EIS process,

and have opted to use modeled (NOISEMAP) data instead. The contours provided for this Section 106 Process were derived from the 2005 NOISEMAP data.

Modeled data, however, can fail to reflect actual on-site measurements. A study of 36 sites around Raleigh–Durham airport[5] found the modeled data consistently **underestimated** the actual on-site noise by 5–15 decibels; that is, the actual noise levels were roughly 50% to 150% louder than the NOISEMAP (1991–1998) and INM (1999–2002) models had indicated.

ISO Invalidates 65-dB DNL Threshold

In 1992 the Federal Aviation Administration (FAA), based on a synthesis of 1978 studies, established in Regulation Part 150 that a maximum average DNL of 65 dB or above is incompatible with residential communities, and that communities in affected areas may eligible for mitigation such as soundproofing.

The 65 DNL was established in 1992 by the Federal Interagency Committee on Noise (FICON) from a dose/response curve showing that at 65 DNL 12.3% of the population is highly annoyed by aircraft noise. It hence was established as the point at which the FAA considers significant noise impact to begin. Based on that science, Congress adopted 12.3% as the threshold that should not be exceeded, and 65 DNL became the standard.

The Navy's Air Installations Compatible Use Zones (AICUZ)[6] similarly adopted the 65 DNL for its land-use compatibility determinations concerning aircraft noise, noting the sources as the Federal Interagency Committee on Urban Noise, "Guidelines for Considering Noise In Land Use Planning and Control" (Reference (km)) as endorsed by FICON in the "Federal Agency Review of Selected Airport Noise Analysis Issues" (see section 2.b in http://www.dtic.mil/whs/directives/corres/pdf/416557p.pdf).

New scientific information, however, now shows the 1978 studies and dose/response curve were flawed, making the 65 DNL invalid. On March 9, 2016, the International Organization for Standardization (ISO) – an independent, non-governmental organization of 162 national standards bodies – published a revision of ISO Standard on measurement and assessment of environmental noise. The revised ISO standard reflects 5 years of analysis by an ISO technical committee, which produced the new dose/response curve based on recent research. An American

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[5] *Technical Report on Preparation of Day-Night Sound Level (DNL) Contours of Aircraft Noise During 2003 Raleigh-Durham International Airport North Carolina*. March 2005. HMMH Report 295097.001 . Harris Harris Miller & Hanson, Inc., 15 New England Executive Park, Burlington, MA 01803 http://198.1.119.239/~flyrduco/rduaircraftnoise/noiseinfo/downloads/RDU_2003_DNL.pdf

[6] AICUZ Study Update for Naval Air Station Whidbey Island's Ault Field and Outlying Landing Field Coupeville, Washington. Final Submission. March 2005. (This study was produced by The Onyx Group of Alexandria, VA and San Diego, CA, under the direction of the NAVFAC Southwest)

National Standards Institute (ANSI) version of the ISO standard has been developed, which further mirrors ISO findings and validates the pervasive concurrence of noise experts. To be consistent with 12.3% annoyance, the correct standard needs to be reduced to 55 DNL.

The technical team's findings show that at 65 DNL, actually 28% of individuals will be highly annoyed by aircraft noise, rather than the old prediction of 12.3%, or about twice that predicted by the old dose/response curve. So, to achieve the congressional limit of 12.3%, the FAA will need to adopt the 55 DNL standard and can no longer hold up the old standard as scientifically valid.

The 65 DNL underestimates by nearly 50% the annoyance impacts among Ebey's Reserve visitors and residents. So, to comply with 12.3% standard, the attendant contour needs to be 55 DNL, which will therefore encompass a much larger area of the Reserve. And it that regard, as discussed above, the existing 55 DNL contour in the maps provided by Commander Moore is smaller than it would be if corrected for data anomalies.

OLFC Violates Navy's Own Encroachment Guidelines

During a recent attempt to build an outlying field in eastern North Carolina, the Navy sought 30,000 acres of relatively undeveloped land in order to comply with its AICUZ land-use guidelines. By comparison at only 700 acres OLFC falls 29,300 acres short. This is why, in 1987, a Navy planning document (Navy document 101) examined the status of OLFC for future use and called for alternatives to OLFC be investigated by the Navy because of the surrounding encroachment. Instead, the Navy administrators issued a permanent waiver for the use of OLFC.

As a result of the Navy's self-issued waiver, the 65 DNL contour includes much of the Reserve with its historic farms and homes, as well as the adjacent residential area and several state and local parks, a well-used children's athletic field and dog park, a youth shelter, County re-cycling Center, and a Transportation Center with above-ground fuel tanks. And of course, when the Growlers are practicing at OLFC all these areas are highly impacted by the loudest noise imaginable, juxtapose against the expected natural beauty and soundscape of the Reserve.

Because of an interagency agreement among the U. S. Fish and Wildlife Service, the National Park Service, and the Bureau of Land Management with the Federal Aviation Administration, it has imposed a voluntary altitude restriction of 2000 feet above ground level for overflights crossing land administered by the Department of the Interior. The Department of Defense is not bound by this agreement, and policies regarding lands near DoD installations are typically negotiated locally. However, OLFC flight paths are at less than 1000 feet and in some areas 200 to 500 feet above ground level.

Both OLFC flight paths (14 and 32) require these low-level (200–1000 feet) flight altitudes. As explained by this Oak Ridge National Laboratory Report, this violates federal regulation the Department of Defense is supposed to honor but ignores at OLFC:

> The military services are committed to safety and to minimizing the collateral noise associated with low-level flight training. The U. S. Air Force, for example, has set numerous restrictions and tailored its training to reduce noise as much as possible. The DoD in general, in addition to following its own flying rules of low-level altitudes and airspeed, also follows those in Federal Aviation Regulation 91.79 which states that no plane may fly closer than "500 ft [152 m] from any person, vessel, vehicle, or structure." (USAF Fact Sheet 96-17) In addition, because of the greater potential for human annoyance during sleeping hours, low-level flying by military fixed-wing aircraft generally occurs during daylight hours; low-level flying near densely populated areas is prohibited. [7]

DNL Inappropriate Health Impact Metric

The DNL metric used to index annoyance is not the appropriate metric to evaluate impacts of toxic noise on health any more than the average wind speed in New Orleans throughout the year of 2004 is relevant to understanding the damage done by Hurricane Katrina. The Navy's 2005 AICUZ (pages 4-6) clearly states as much (emphasis added):

> *"However, individuals do not "hear" DNL. The DNL contours are* ***intended for land use planning****,* ***not to describe what someone hears when a single event occurs****. Individual or single noise events are described in terms of the Sound Exposure Level (SEL) in units of dB* [decibels][8]. *SEL takes into account the amplitude of a sound and the length of time during which each noise event occurs. It thus provides a direct comparison of the* ***relative intrusiveness*** *among single noise events of different intensities and durations of aircraft overflights.*

In that statement, "*what someone hears*" means "*what someone experiences*" because hearing produces an intertwined psychological, physical, and physiological reaction to sound, and that

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[7] *Ecological Risk Assessment Framework for Low-Altitude Overflights by Fixed-Wing and Rotary-Wing Military Aircraft.* January 2000. Rebecca A. Efroymson (Oak Ridge National Laboratory), Winifred Hodge Rose and Sarah Nemeth (U. S. Army Construction Engineering Research Laboratory), and Glenn W. Suter II (U. S. Environmental Protection Agency). Research sponsored by the Strategic Environmental Research and Development Program of the U. S. Department of Defense under Interagency Agreement 2107-N218-S1 under contract DE-AC05-00OR22725 with UT-Battelle, LLC. Publication No. 5010, Environmental Sciences Division, ORNL. https://www.researchgate.net/publication/252522677

[8] Noise is measured on a log scale in decibel (dB) units. Loudness is a measurement index of the sound we perceive, and hence how it affects our psyche and functionality; sound pressure intensity is the more important metric when it comes to hearing damage and pressure impacts on the body.

biological reaction includes reactions to the sound vibrations that penetrate into the entire body (just as it rattles buildings). Low-frequency sounds are more intense. So, to evaluate the biological complement of noise effects on health, the Navy admits that single noise event metrics (e.g., *sound exposure levels* or SELs), not DNLs, are the appropriate metrics of ubiquitous use in medical research to evaluate noise–health impacts.

In 2013, COER engaged an independent noise study (JGL Noise Study #1[9]) to obtain actual on-site Growler noise data at OLFC (report is available on request). We commissioned the JGL study, rather than simply accept the computer-modeled data used by Wyle Labs because the Navy refused to conduct on-site recordings and modeled DNLs have been shown to be inaccurate. A study of 36 sites around Raleigh–Durham airport[10] found the modeled data consistently underestimated the actual DNLs from on-site noise measurement by 5-15 dB.

The JGL sound data were gathered at five locations around OLFC while Growlers conducted FCLPs on Path 32. One site was directly under the approach over Admirals Cove and another was at a youth ballpark (Rhododendron Park) adjacent to and under the takeoff path, a third was at Ebey's Landing, and the fourth was in farm lands within the Reserve. At each site about 30 Growler flyovers were recorded, and sound levels for each such flyover at all four outdoor sites were very similar having sound exposure levels of 122 to 128 dBA for a recorded session.

At the ballpark/playground for example, Lilly found that had parents and children been present they would have experienced in one 40-min FCLP session (30 flyovers) a cumulative 2.25 minutes of noise over 100 dB or about 1 minute over what EPA has identified as a noise dose sufficient to cause permanent hearing loss. That is, if someone in a 24-hour period is exposed to 1.5 minutes of noise over 100 dB, the EPA indicates that individual will likely suffer some permanent hearing loss. The same is generally true for those visiting portions of the Reserve that were measured. Repeat exposure adds to the loss each time.

This is reinforced by the National Institute for Occupational Safety and Health (NIOSH). They assert that above a critical noise level, the mechanism of hearing damage changes from one based on cumulative noise exposure (i.e., the combination of magnitude and duration of sound) to a mechanism based on sound pressure intensity alone, regardless of duration. They estimate 115 to 120 dBA as the critical noise level at which human hearing is subject to a permanent hearing threshold shift.

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[9] Whidbey Island Military Jet Noise Study, JGL Acoustics report to David Mann, June 10, 2013, available at http://citizensofebeysreserve.com/References/Files/JGL%20Noise%20Report.pdf)

[10] Technical Report on Preparation of Day-Night Sound Level (DNL) Contours of Aircraft Noise During 2003 Raleigh-Durham International Airport North Carolina. March 2005. HMMH Report 295097.001 . Harris Harris Miller & Hanson, Inc., 15 New England Executive Park, Burlington, MA 01803 http://198.1.119.239/~flyrduco/rduaircraftnoise/noiseinfo/downloads/RDU_2003_DNL.pdf

The Navy has argued that the 2013 JGL noise study lacked statistical robustness because it was a stochastic one-time sample that might lack repeatability due to weather. That possibility lacks credibility because all sites were well within one mile of the jet path; Lilly explained it this way:

> *Temperature profiles, humidity, and wind all can affect the resulting sound level, but these environmental effects are insignificant unless the listener is at least a mile or more away from the source. The greater the distance, the greater the effect. Sometimes the environmental conditions will cause the noise level to increase by 10 dB (or more) and other times it might decrease the level by 10 dB (or more). Atmospheric conditions will have no impact on the areas directly below (or within a mile of) the flight patterns.* (Jerry Lilly, JGL Acoustics)

To address the possibility that the May 2013 JGL noise sampling was atypical of routine FCLPs at OLFC, COER again commissioned Lilly to conduct a second set of samples in February 2016 with repeat sampling at the two of the same sites and two additional sites not sampled in 2013 (also available at http://citizensofebeysreserve.com/LinksAndFiles.html).

Samples at the 2016 repeated sites produced almost identical results with the 2013 measurements, while the two new sites showed that noise was extremely consistent across the full approach path above Admirals Cove. The consistency (i.e., the standard deviation was very low) between the two independent sampling periods show that the JGL measurements were reliable and valid, as explained by Lilly:

> *The primary purpose for this study was to determine if there is any significant difference in the measured noise levels when compared with the data collected in 2013. …The fact that the measured change from 2013 to 2016 is less than half of the standard deviation of the maximum noise level within a single session suggests that the difference is insignificant. <JGL Acoustics>*

It is also noteworthy that the JGL sound exposure levels (SELs) at position 1 and 6, which are under the path 32 approach over Admirals Cove) are very similar to the approach sound exposure levels (SELs) for Growlers stated in the 2005 AICUZ.

Further, based on a Navy study (Wyle Aircraft Noise Study dated October 2012), the Growler produces more low-frequency noise, on average 11 decibels, than the Prowler aircraft previously used by the Navy at Whidbey. This increased low frequency noise has a greater impact on areas further from the base (i.e., San Juan Islands) because it travels further than high frequency noise. © 2005 Acoustical Society of America.

COER also retained a well-known environmental and occupational health physician, Dr. James Dalgren, professor at UCLA and on the staff at Cedars Sinai Hospital in Los Angeles, to review the Lilly and Wyle sound data and advise as to the attendant health risks. His conclusion in July 2014 is that "*the Navy has created a public health emergency at Central Whidbey Island*." He went on to say:

> *"If there was a poisonous gas cloud over Central Whidbey and people were falling over dead, they would know why. But because the health impacts are more gradual and cumulative most citizens do not yet know why they are suffering more strokes, more severe strokes, strokes at a younger age, cardiovascular events such as arrhythmias, heart attacks, hypertension, psychological damage such as anxiety, depression and panic attacks, along with sleep disorders, weight gains, hearing loss, tinnitus, and in children, especially, troubling learning disorders and attention deficit disorder."*

As per state and national guidelines and law addressing noise exposure, Coupeville has sustained noise levels above the "community exposure level" threshold. This is reflected in a review of the scientific literature on noise–health studies by experts at the University of Washington, which confirms that public health is a real issue of great concern under OLFC's jet shadow. All of that extensive research information has been compiled and is available at http://citizensofebeysreserve.com/Files/Community%20Aircraft%20Noise_A%20Public%20Health%20Issue.pdf .

It is clear that visitors to the Reserve and its surrounds are put at health risk due to the toxic noise levels they can be exposed to. Increased Growler operations will only exacerbate those risks.

Low-Frequency Noise: Growler Worse than Prowler

The Growler sound profile is substantially different from the Prowler. From the Navy's own website: "The EA-18G 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."

As mentioned above, based on a Navy study (Wyle Aircraft Noise Study, October 2012), the Growler produces more low-frequency noise than the Prowler. Low-frequency noise has a greater impact on areas because it travels further than high frequency noise.

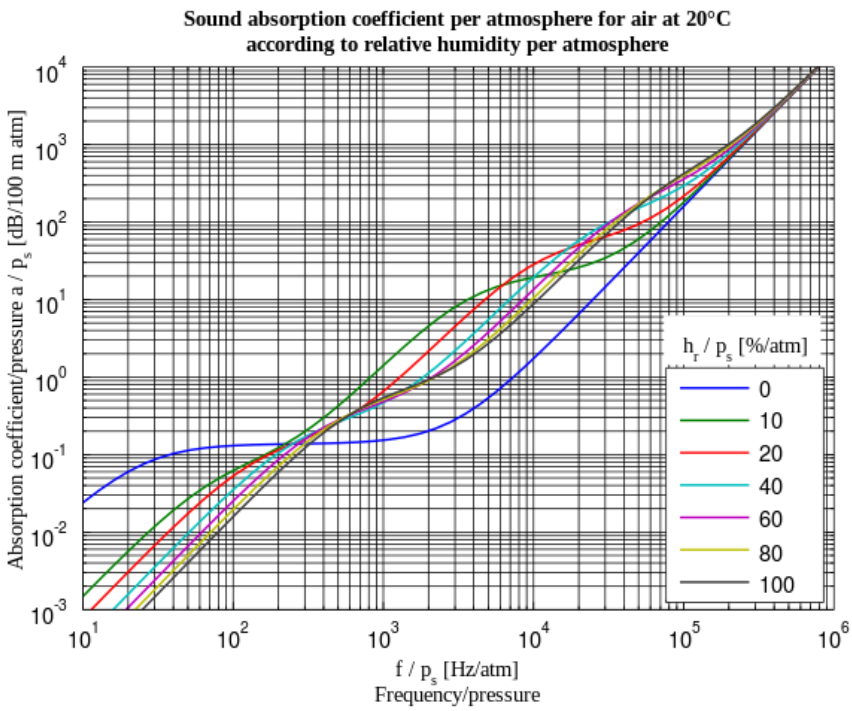
This low-frequency noise (LFN) has adverse impacts on both human health and historic building structures, and because this sound travels much further, it has potential to impact structures well outside of the current FCLP flight patterns of the OLFC pathways 14 and 32. This could be a cause for serious preservation concerns in the town of Coupeville, Washington State's second oldest town, and recognized for its large number of fine examples of Victorian houses.

The reasonlow-frequency sound travels further has to do with what's stopping the sound. Sound

is a pressure wave vibration of molecules. Whenever you give molecules a "push" you lose some energy to heat. Because of this, sound is lost to heating of the medium it is propagating through. The attenuation of sound waves is frequency-dependent in most materials. https://en.wikibooks.org/wiki/Engineering_Acoustics/Outdoor_Sound_Propagation

This means that low frequencies are not absorbed at nearly the same rate as high frequencies, so low frequencies travel further through air. See Wikipedia for the technical details and formulas of acoustic attenuation.

Here is a graph of the attenuation of sound at difference frequencies (accounting for atmospheric pressure and humidity):



From Physics Stack Exchange

Another effect that affects sound propagation, especially through walls, and other relative hard surfaces is reflection. Reflection is also frequency-dependent. High frequencies are better reflected than low frequencies, which are able to pass through a barrier.

All noise consists of pressure fluctuations in the air. For LFN these fluctuations occur between 20 and 160 times per second. Most everyday sounds fluctuate much faster than this (up to 16 thousand time per second), so the term “low frequency” means that the fluctuations are relatively slow compared with other types of sound. Said another way, in audiology, the measured range is restricted to the frequencies relevant to speech 125–8000 Hz (i.e., SI symbol for hertz, meaning

“frequency” or specific to sound, “cycles per second”). Low-frequency sound may be loosely defined as having frequencies below this range.

Sounds in this frequency range would typically be heard as a low rumble. Sometimes there is also a sensation of vibration or pressure on the ears. The scientific way of writing the frequency range is 20Hz to 160Hz.

According to Mireille Oud, a medical physicist in an article *Low-Frequency Noise: a biophysical phenomenon*, “there is no shielding against LFN. Since LFN propagation is mainly structure-borne, closing doors and windows is not effective. Earplugs are of no use, because LFN bypasses the eardrum.” [11]

Examples of Frequency & Effects on Human Health

The effects of LFN on human health have been widely documented; the following are examples:

7 Hz: Supposedly the most dangerous frequency corresponding with the median alpha-rhythm frequencies of the brain. It has also been alleged that this is the resonant frequency of the body’s organs therefore organ rupture and even death can occur at prolonged exposure.[12]

1–10 Hz: “Intellectual activity is first inhibited, blocked, and then destroyed. As the amplitude is increased, several disconcerting responses have been noted. These responses begin a complete neurological interference. The action of the medulla is physiologically blocked, its autonomic functions cease.”[13]

43–73 Hz:“…lack of visual acuity, IQ scores fall to 77% of normal, distortion of spatial orientation, poor muscular coordination, loss of equilibrium, slurred speech, and blackout”. [14]

50—100 Hz: “…intolerable sensations in the chest and thoracic region can be produced—— even with the ears protected. Other physiological changes that can occur include chest all vibration and some respiratory rhythm changes in human subjects, together with hypopharyngeal fullness (gagging). The frequency range between 50 and 100 Hz also produces mild nausea and giddiness at levels of 150–155 dB, at which point subjective tolerance is reached. At 150–155 dB or 0.63–1.1 kPa (Pa is the SI symbol for pascal or pressure/stress; k = kilo or 1000), respiration-

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[11] Mireille Oud, Low-frequency Noise: a biophysical phenomenon, Presented at Congress “Noise, Vibrations, Air Quality, Field & Building”, 6 November 2012, Nieuwegein, The Netherlands.
[12] Organ Music Instills Religious Feelings,’ by Jonathan Amos, 9/8/2003
[13] *Gavreau V., “Sons graves intenses et infrasons” in: Scientific Progres – la Nature (Sept. 1968) p. 336-344*
[14] *Gavreau V., “Sons graves intenses et infrasons” in: Scientific Progres – la Nature (Sept. 1968) p. 336-344*

related effects include substernal discomfort, coughing, severe substernal pressure, choking respiration, and hypopharyngeal discomfort."[15]

100 Hz: At this level, a person experiences irritation, "mild nausea, giddiness, skin flushing, and body tingling." Following this, a person undergoes "vertigo, anxiety, extreme fatigue, throat pressure, and respiratory dysfunction."[16]

In researching impacts of low-frequency sound, numerous references were found, both old and recent, to demonstrate the well-known characteristics and adverse impacts of low-frequency sound —not assessed by the Navy in its Environmental Assessments (EA) in regard to the EA-18G Growler.

The research strongly supports serious health effects of LFN like vertigo, disturbed sleep, stress, hypertension, and heart rhythm disorders. An excerpt[17] had this to say:

> Although the effects of lower intensities of low frequency noise are difficult to establish for methodological reasons, evidence suggests that a number of adverse effects of noise in general may be greater for low frequency noise than for the same noise energy in higher frequencies: loudness judgments and annoyance reactions are greater for low frequency noise than other noises for equal sound pressure level regardless of which weighting scheme is employed (Goldstein, 1994); annoyance is exacerbated by rattle or vibration induced by low frequency noise; speech intelligibility may be reduced more by low frequency noise than other noises (except those in the frequency range of speech itself because of the upward spread of masking) (Pickett, 1959; Loeb, 1986).

The following excerpts are from a study[18] summarizing 25 years of research on health impacts pertaining to LFN:

> **Abstract:** Respiratory pathology induced by low frequency noise (LFN, < 500 Hz, including infrasound) is not a novel subject given that in the 1960's, within the context of U.S. and U.S.S.R. Space Programs, other authors have already reported its existence. Within the scope of vibroacoustic disease (VAD), a whole-body pathology caused by excessive exposure to LFN, respiratory pathology takes on specific features. Initially, respiratory pathology was not considered a consequence of LFN exposure; but today, LFN can be regarded as a major agent of disease that targets the respiratory system. The goal of this report is to put forth what is known to date on the clinical signs of respiratory pathology seen in VAD patients.

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[15] Acoustic Trauma: Bioeffects of Sound,' by Alex Davies

[16] *Gavreau V., "Sons graves intenses et infrasons" in: Scientific Progres – la Nature (Sept. 1968) p. 336-344*

[17] Stalker, From a Short History of Sound Weapons Pt2: Infrasound, January 14, 2008

[18] Respiratory pathology in vibroacoustic disease: 25 years of research, Branco NA[1], Ferreira JR, Alves-Pereira M.

The methods explain, **"**Data from the past 25 years of research will be taken together and presented…"…" and the results section goes on to state:

> In persons exposed to LFN on the job, respiratory complaints appear after the first 4 years of professional activity. At this stage, they disappear during vacation periods or when the person is removed form his /her workstation for other reasons. With long-term exposure, more serious situations can arise, such as, atypical pleural effusion, respiratory insufficiency, fibrosis and tumours. There is no correlation with smoking habits. In LFN-exposed animal models, morphological changes of the pleura, and loss of the phagocytic ability of pleural mesothelial cells (explaining the atypical pleural effusions). Fibrotic lesions and neo-vascularization were observed along the entire respiratory tract. Fibrosis lesions and neovascularisation were observed through-out the respiratory tract of the animals seen. Pre-malignant lesions, metaplasia e displasia, were also identified.

And the authors go on in the discussion to explain, "LFN is an agent of disease and the respiratory tract is one of its preferential targets. The respiratory pathology associated with VAD needs further in-depth studies in order to achieve a greater understanding, and develop methods of pharmacological intervention."

Excerpts from another publication: Noise-induced extra-aural pathology: a review and commentary, Alves-Pereira M,> further define LFN health effects.

> **Abstract:** The focus of this review paper will be the effects of acoustic phenomenon (noise), characterized by large pressure amplitude ≥≥90 dB) and low frequency (≤≤500 Hz) (LPALF) on humans and animal models. Current concepts imply the assumption that such LPALF noise impinges only on, or through, the somatic medium of the auditory system. As a consequence of this assumption, the effect of noise on humans is only regulated for purposes of hearing conservation. Guidelines and regulations governing occupational noise assessments are biased toward the subjective human perception of sound. The author will not make the assumption that airborne acoustic phenomena impacts only on the auditory system, and will present a literature review providing evidence for such position. The purpose of this review paper is to defend the existence of extra-aural, noise-induced pathology, particularly the vibroacoustic disease; and to advance the recognition that the respiratory tract could very well be a target organ of this environmental stressor.

An epidemiological survey[19] examined low frequency noise from plant and appliances in or near domestic buildings by comparing to a control group of dwellings had comparable conditions to the test group except that there was no low frequency noise.

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[19] Alves-Pereira M, Noise-induced extra-aural pathology: a review and commentary,1999

There were 27 individuals in the test group and 22 in the control group. The test group suffered more from their noise exposure than the control group did (as indicated in the table below); they were less happy, less confident and more inclined to depression, among others.

Symptom	**Test group %**	**Control group %**
Chronic fatigue	59	38
Heart ailments anxiety, stitch, beating palpitation	81	54
Chronic insomnia	41	9
Repeated headaches	89	59
Repeated ear pulsation, pains in neck, backache	70	40
Frequent ear vibration, eye ball and other pressure	55	5
Shortness of breath, shallow breathing, chest trembling	58	10
Frequent irritation, nervousness, anxiety	93	59
Frustration, depression, indecision	85	19
Depression	30	5

The World Health Organization recognizes the special place of low frequency noise as an environmental problem. Its publication on Community Noise (Berglund et al., 2000) makes a number of references to low frequency noise, some of which are as follows:

> *"For noise with a large proportion of low frequency sounds a still lower guideline* (than 30dBA) *is recommended"*
>
> *"When prominent low frequency components are present, noise measures based on A-weighting are inappropriate"*
>
> *"Since A-weighting underestimates the sound pressure level of noise with low frequency components, a better assessment of health effects would be to use C-weighting"*
>
> *"It should be noted that a large proportion of low frequency components in a noise may increase considerably the adverse effects on health"*
>
> *"The evidence on low frequency noise is sufficiently strong to warrant immediate concern"*

World Health Organization, Guidelines for Community Noise , edited by B. Berglund, T. Lindvall, and D. H. Schuela, Cluster of Sustainable Development and Healthy Environment, Department of the Protection of the Human Environment, Occupational and Environmental Health, Geneva, Switzerland, 1999.

Mirowska and Mroz. 2000. As reported in https://www.wind-watch.org/documents/review-of-published-research-on-low-frequency-noise-and-its-effects/

It is important to note that while the intensity of Growlers practice at OLFC is not constant but episodic, the sound intensity far exceeds anything like the intensity the subjects above experienced.

Impact of LFN on Structures and the Environment

According to Norman Lederman, MS, Director of Research & Development, Oval Window Audio[20], the commonly used A-weighted decibel metric, is scientifically inaccurate; the C-weighted metric should instead be used.

> Low frequency noise pollution is an intrusive and unhealthy by-product of aviation. In addition, the current acceptance of A-weighted noise measurements largely understates the degree that low frequency noise pollution impacts the environment. For example, using A-weighting...a low frequency noise of 50 Hz, which vibrates homes and is felt in the body, is under measured by 30 dB as compared to 1.3 dB in measurements taken with C-weighting. Overall measurements are under measured by 7-8 dB A weighting as compared to C-weighting……

> Strong low-frequency components produced by aircraft may rattle doors, windows, and other contents of houses. These secondary physical sound sources may be much more annoying than the original primary low frequency component the low-frequency range of 15-400 Hz. It may then under predict perceived loudness by 7 to 8 dBA, relative to a 1,000 Hz target noise (Kjellberg & Goldstein, 1985).

And more recently a study[21] of the impact of low-frequency sound on historic structures <Noise Pollution Clearing House, http://www.nonoise.org/index.htm, **Report to Congress: Report of Effects of Aircraft Overflights on the National Park System EFFECTS ON CULTURAL AND HISTORIC RESOURCES, SACRED SITES, AND CEREMONIES, Chapter 4, September 4, 1994.**>

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

[20] Norman Nederland, CO., USA in his article, *Aviation Low Frequency Noise of April 13, 2001*,
[21] Louis C. Sutherland and Richard D. Horonjeff; Impact of low-frequency sound on historic structures 2005.

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. This paper reviews the types of sources posing the greatest potential threat, their low-frequency spectral characteristics, typical structural responses, and the damage risk mechanisms involved.

Navy's Hearing Conservation Zones: Noise Equals Risk

If areas under the OLFC racetrack were a Navy site, many residents would mandatorily be part of a "*Hearing Conservation Program*"[22] because they are in what the Navy calls a "*Hazardous Noise Area*."

The Navy identifies *hazardous noise areas* wherever the 8-hour time-weighted average noise exceeds 85 dB for more than 2 days in any month. Military and civilian personnel working in such areas are automatically enrolled and identified as "*At Risk*," and must undergo frequent hearing tests and health monitoring.

The noise levels made by Growlers on path 32 as recorded by JGL Acoustics documented sound levels of over 130 dB. The JGL data were examined by another COER-retained noise expert Paul Schomer (Standards Director, Emeritus, of the Acoustical Society of America). Simplified, Dr. Schomer revealed that folks under path 32 are experiencing well over the Navy's threshold for designation of a Hearing Conservation Zone.

For example, in 14 days in July 2012 there were 1122 FCLP overflights, or an average of 80 overflights for each flying day that month. The noise that residents experienced that July exceeded the Navy's Hearing Conservation Zone threshold by more than 7 fold.

What the Navy is required to do for civilian and military folks in their Hearing Conservation Program has five components:

1. **On-Site Noise Measurement,** to identify noise exposure levels and spatial variations.
2. **Engineering Controls,** to reduce the potential hazard to the maximum extent feasible.
3. **Annual Personnel Testing,** to enable timely audiological and medical evaluation.
4. **Hearing Protective Devices,** to be provided and fit to each individual and to be worn until and unless effective engineering controls mitigate the noise hazard.
5. **Education of Personnel,** as required regarding the impacts of noise hazards on human health and proper use and care of hearing protective devices.

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[22] Navy and Marine Corps Public Health Center Technical Manual NMCPHC – TM 6260.51.99-2. Navy Medical Department Hearing Conservation Program Procedures. Navy and Marine Corps Public Health Center, September 15, 2008. http://www.public.navy.mil/surfor/Documents/6260_51_99_2_NMCPHC_TM.pdf

However, there is no protection program at all for those for civilian residents routinely exposed or for Reserve visitors unknowingly exposed, but the mere existence of the DOD program acknowledges the existence of a health risk problem.

Low Frequency Noise (LFN) Impacts on APE Historic Properties

There is no doubt that absence of noise and the presence of sound contribute to the sense of place or setting of many 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 jet noise. Soundscape is an important factor in the Reserve.

A variety of laws, executive orders, and regulations clearly charge the National Park Service (NPS), a partner in the 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 resources.

The NPS Management Policies recognize five broad categories of cultural resources, with many resources often classified into multiple categories.

1. Archeological resources are organized bodies of scientific evidence providing clues to the mystery of past events, primarily objects in context, ranging from household debris in a site from a past culture, to foundations of buildings, to pottery and tools, to paintings or writings.

2. Cultural landscapes are settings humans have created in the natural world showing fundamental ties between people and the land, ranging from formal gardens to cattle ranches, and from cemeteries or battlefields to village squares.

3. Structures are large, mechanical constructions that fundamentally change the nature of human capabilities, ranging from Anasazi cliff dwellings to statues, and from locomotives to temple mounds.

4. Museum objects are manifestations and records of behavior and ideas that span the breadth of human experience and depth of natural history, and may include archeological resources removed from the context where they were found.

5. Ethnographic resources are the foundation of traditional societies and the basis for cultural continuity, ranging from traditional arts and native languages, spiritual concepts and subsistence

activities which are supported by special places in the natural world, structures with historic associations, and natural materials.

An important aspect of cultural resources is their non-renewability: 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."*

While physical impacts can permanently harm objects, impacts to context or setting, such as when aircraft fly over an 1800's reenactment or an ancient religious ceremony, can significantly reduce the associations and integrity of the objects, and the enjoyment and understanding of the cultural heritage.

Growler noise is both extremely loud and includes low-frequency vibrational noise. This adversely impacts and stands in the way of the National Park Service and the Ebey's National Historical Reserve Board fulfilling their mission and directives of protecting this non-renewable cultural resource of National importance.

Based on the research presented in this analysis, including the Navy's own research of low-frequency sound, there is cause for real concern. The Navy's current operations, not to mention proposed operation increases at OLFC, represent adverse impacts on the fragile historic properties the Reserve, as well as the cultural and historical heritage, soundscape, and visitor appreciation of the Reserve.

NASWI 2005 EA: Table 3-26 NRHP-Listed Historic Sites at Ebey's Landing National Historic Reserve Currently Located within the ≥65-dB DNL and are of high concern for low-level noise impacts on fragile historic structures. These properties are all at risk and each should be surveyed and monitored for on-going current impacts.[23]

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[23] **FROM The NAS Whidbey Island's 2005 EA.**

Noise Zone (CY 2003 and CY 2013)
CY 2003
Newcomb Property
Bergman House
Benson House
Hughes House
Bradt House

Island County (outside town of Coupeville)

CY 2003	**CY 2013**
Reuble Farm	Reuble Farm
John Kineth Farmhouse	John Kineth Farmhouse
Sam Keith House	Sam Keith House
Wiley Place	Wiley Place
Strong Granary	Strong Granary
Old Anderson Place	Old Anderson Place
Grove Terry Place	Grove Terry Place
Fort Casey Housing/Myers House	Fort Casey Housing/Myers House
Fort Casey Pump House	Fort Casey Pump House
C. Wanamaker House	C. Wanamaker House
J. Gould House/Miller House	J. Gould House/Miller House
Strong House	Strong House
Gilbert Place/Eggerman House	Gilbert Place/Eggerman House
Gillespie House	Gillespie House
Sam Crockett House	Sam Crockett House
H. Crockett House/Boyer Farm	H. Crockett House/Boyer Farm
	Col. W. Crockett Farmhouse
	Thomas Sullivan House
	Engle Farm

* Source: Kwarsick 2004; Island County Department of Planning and Community Development 2004

In addition, NAS Whidbey Island should agree to provide historical documentation for the Kellog House, a historic house that once occupied the OLF site and was the residence of a physician known as “the Canoe Doctor.”

Island County’s Comprehensive Plan supports the Goals & Policies of Ebey’s Reserve. Washington State’s Growth Management Act outlines thirteen 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.” Few communities however, have thoroughly addressed historic preservation in their Comprehensive Plans. Given the abundance of Island

County's historic resources, historic preservation is a high priority within the community and several sections of the new Comprehensive Plan include the preservation of Ebey's Reserve.

5.3 EBEY'S LANDING HISTORIC RESERVE

National Reserves are geographic areas containing nationally significant resources in which federal, state and/or local agencies, along with the private sector, work cooperatively to manage, protect and interpret the resources.

Ebey's Landing National Historical Reserve (Reserve) was established by an act of Congress in 1978 in order "to preserve and protect a rural community which provides an unbroken historic record from nineteenth century exploration and settlement of Puget Sound up to the present time." (Public Law 95-625, November 10, 1978). The Reserve, is one of the only remaining area in the Puget Sound region where a broad spectrum of Northwest history is clearly visible on the land and protected within a landscape that is lived in and actively farmed. Most of the land remains in private ownership, while retaining its historic, cultural, and rural character.

The Reserve is nationally significant; when it was established, it represented a new approach to preserving land and heritage resources. This new approach recognized that local government, including Island County (the government and its residents) has always been a key partner in the Reserve.

The Reserve's distinct landscape, rural character and heritage resources are economically important within our agricultural, recreation and tourism industries, socially important within our community, and worthy of proactive Preservation.

… The Reserve's boundaries reflect this history and are the same as those of the Central Whidbey Island Historic District established in 1973, which were based on the settlement patterns resulting from the Public Lands Survey Act of 1850, also known as the Donation Land Claim Act. The legislation points to the fact that this is a community that has evolved from early exploration to the present and consists of descendants of original settlers as well as new residents. As such, the Reserve cannot be interpreted from one specific point in time. In addition, most of the land is privately owned, with the rest a combination of local, state, and federal ownership; creating a unique set of circumstances. The NPS has purchased little land within the Reserve, but has actively acquired scenic easements on farms and important open spaces. The concept of the Reserve was a community effort and participating in land protection is voluntary on the part of private landowners. This has been a key to the Reserve's success in the community.

The impetus to protect central Whidbey began from local citizens' initiative to protect Ebey's Prairie from inappropriate development and is well documented in the Reserve's administrative history. The concept of a national historical reserve was viewed as a way to preserve open space with a minimum disturbance to private landowners—to provide initial federal support without threatening local autonomy.

Goal 1. Actively participate as a partner in Ebey's Landing National Historical Reserve in order to "preserve and protect a rural community which provides an unbroken historical record from

> 19th century exploration and settlement in Puget Sound to the present time" (Public Law 95-625, November 10, 1978).
>
> Goal 2. To identify Island County's archaeological resources, and to protect and preserve the cultural, historical, social, educational, and scientific value of these resources in a manner that respects their cultural significance.

Island County and the citizen's of Island County have a long-term investment and commitment in the Reserve and have deemed it a priority in the goals and policies of the new Comprehensive Plan. The intrusion of the Navy's Growler jet noise into the Reserve's soundscape has considerable impact on the County's ability to achieve the protection and pro-active preservation goals published in its Comprehensive Plan. The low-level jet noise degrades and negatively impacts the rural character and the economically important heritage resources within our agricultural, recreation and tourism industries -- so important to the community and to the thousands of visitors who visit the Reserve annually.

One Last Correction

Commander Moore, in his request for comment on this 106 Process, infers that OLFC has been used by the Navy for 74 years, which is off by nearly 25 years. To clarify, the Navy reactivated this 1943 WWII emergency landing strip in the late 1960s for FCLP use. In the intervening 50 or so years, while the jets evolved into the now fastest and loudest jets ever operated by the Navy, the population density in and the Reserve was created.

The often-stated claim that the "Navy was here first" grossly misrepresents actual history and insults the Skagit Indians (one of four groups of Salish Indians), the European settlers, and the founding families of the historic town of Coupeville – the second oldest town in Washington State and Ebey's Reserve. The Navy is actually a johnny-come-lately to Whidbey Island.

Even Admirals Cove, a community of over 600 properties lying directly under the FCLP approach, was planned and initiated in the mid-1960s, at which time public records show the Navy was intending to release OLFC to Island County. It was even offered to the developers of Admirals Cove, but they declined, not realizing that inaction by the County would fail to obtain OLFC for public use. So, even when Admirals Cove was developed, the Navy's plans for the outlying field were conversion to nonmilitary use, and even after OLFC was reactivated in 1967, the Navy's use was supposed to be part-time along with civilian use.

While the Navy infers that its presence grants it some sort of grandfather rights, under that logic the grandfather rights really belong to those preceding the Navy. But, of course, neither is constructive or logical. What has happened here is the pure absence of foresight and meaningful

planning, both by politicians and the Navy, to address change in jets and demographics and to thwart encroachment. Had the proper buffer acreage been obtained for OLFC years ago, the encroachment would not be the problem it is today. While the development surrounding OLFC is too entrenched and important to move, Growlers do move—very fast—and they can do their FCLP sessions at other locations. The only thing preventing that solution is intransigence and the will to do so.

CONCLUSION

We, the Board of Directors of Citizens of Ebey's Reserve (COER), given (1) the inadequacies of the Navy's noise data and its reliance on an improper single noise metric (DNL based on LFN-masking dBA scale), and (2) based on the noise impacts on visitor and resident health and related annoyance and the long-term structural integrity of historic buildings of the Reserve, do hereby recommend that all FCLPs at OLFC and low-level fights over the Reserve be discontinued and redirected to an appropriate remote and environmentally insensitive location.