V. Heliport Noise Compatibility Study
Good Shepherd Hospital
Hermiston, Oregon

February 8, 2024

Noise Evaluation - Introduction

Noise is sometimes defined as unwanted sound. However, sound is measurable, whereas noise is subjective. The relationship between measurable sound and human irritation is the key to understanding aircraft noise impact. A rating scale has been devised to relate sound to the sensitivity of the human ear. The A-weighted decibel scale (dBA) is measured on a logarithmic or "log" scale, by which is meant that for each increase in sound energy level by a factor of 10, there is a designated increase of 1 dBA. This system of measurement is used because the human ear functions over such an enormous range of sound energy impacts. At a psychological level, there is a rule of thumb that the human ear often "hears" an increase of 10 decibels as equivalent to a "doubling" of sound.

The challenge to evaluating noise impact lies in determining what amount and what kind of sound constitutes noise. The vast majority of people exposed to aircraft noise are not in danger of direct physical harm. However, much research on the effects of noise has led to several generally accepted conclusions:

- The effects of sound are cumulative, therefore, the duration of exposure must be included in any evaluation of noise.
- Noise can interfere with sleep and outdoor activities.
- Noise can disturb communication, TV/radio listening, and relaxation.
- When community noise levels have reached sufficient intensity, a certain percentage of the population is likely to become highly annoyed and object to the noise.

Research has also found that individual responses to noise are difficult to predict[49.] Some people are annoyed by perceptible noise events, while others show little concern over the most disruptive events. However, it is possible to predict the responses of large groups of people – i.e. communities. Consequently, community response, not individual response, has emerged as the prime index of aircraft noise measurement.

Good Shepherd Hospital Helicopter Usage

A helistop has been located at Good Shepherd Hospital for many years. It was reviewed and approved by the City of Hermiston as part of the 2007 Master Plan conditional use permit. The approved plan was to move the prior existing helistop from its position at the northeast side of the campus, 350 feet southwest toward NW 11th Street. In that location it could better coordinate with the emergency medical services at

[49] Beranek, Leo, *Noise and Vibration Control*, McGraw-Hill, 1971, pages ix-x.

the hospital. At the time of that hearing the prior use of the helistop was noted to be used an estimated six times per year.
The helistop was moved to its current position shortly after the Master Plan approval was given by the city.

Records of usage50 from the past three years indicate usage was as follows (note that a "flight" includes both a landing and a takeoff):

2023 168 flights to the hospital
2022 188 flights to the hospital
2021 201 flights to the hospital

Thus over the last three years there has been an average of 186 flights per year. For the purposes of this noise analysis, we will assume there are on average one flight per day at the hospital, thus doubling the more recent usage. Because the federal and state standards of helicopter noise analysis require including a noise penalty for flights that are at "night" where that is considered any flight during the period 10 pm to 7 am, we will assume conservatively that 50% of flights are during that nine-hour period.

Common Noise Levels with Comparison to Helicopter Noise

Table 1 below provides a list of common community noises with the sound level in decibels. Then on the right are listed the noise levels of a common helicopter using the hospital helistop, at different flyover altitudes above ground, to provide a comparison of expected helicopter noise.

Helicopter Flight Paths in the Vicinity of Good Shepherd Hospital

We have worked with the Life Flight Network pilots and staff, and **Drawing AP1.0** shows the existing and expected future flight paths of helicopters. Helicopters will generally try to transit the community at 1500 feet above ground level, except when clouds or visibility requires a lower altitude. From whatever required heading they are approaching the hospital, they will then descend to 500 feet above ground and use the egg-shaped circuit (or "pattern") shown on the drawing for pilot observation of winds, traffic, pedestrians, and other factors that affect a landing, from which point the pilot will determine whether to approach from the northeast, or from the west.

Once inbound on one of those paths, the pilot will then continue the descent at a continuous, steep rate of will then land at the pad, idle the engines, and discharge the patient and then park the helicopter. The departure has a very different profile, with an initial almost vertical climb to between 100 and 130 feet, and

then a forward transition to flight. The pilot will then continue the climb to 1500 feet for transitioning the area to the intended destination.

Table 1: Noise Level Thermometer of Common Community Sounds

120 dBA	* Chain Saw @ 3'	
	* Fire Truck Siren & Horn @ 20'	
110 dBA		
	* Chain Saw @ 100'	
100 dBA		Helicopter takeoff or landing at 100 foot distance (note only occurs on Hospital property)
	* Lawnmower @ 3'	
90 dBA		
	* Bus or Truck @ 50'	
		Helicopter Flyover at 300 feet above ground
80 dBA		
	* Bus or Motorcycle @ 100'	
		Helicopter Flyover at 400 feet above ground
	* Inside pickup truck @ 60 mph	
	* Neighbor's Lawnmower @ 100'	
70 dBA		
		Helicopter Flyover at 1000 feet above ground
	* Dishwasher on in Kitchen @ 10'	
	* Heavy Rain with no Wind	
	* Car @ 100'	Helicopter Flyover at 1500 feet above ground
60 dBA	* TV on in Living Room @ 10'	
	* Conversation @ 5' - Inside	
50 dBA		
	* Robin singing @ 50'	
	* 5 mph Wind in Trees @ 50'	
40 dBA		
	* Quiet House @ 5:30 AM - Inside	
30 dBA		

Note: These data were all measured by the author or taken from sources that accurately measured the condition. Helicopter sound levels are taken from FAA generated reports.

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NOISE LEVEL

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It is important to note that in very high wind speeds the pilot may make the landing or takeoff in different directions than the two shown. All aircraft have the best rate of climb or of controlled descent, while flying into the wind, because then the ground speed is the lowest. Thus, there could be highly unusual wind conditions where a helicopter pilot will elect to land more directly from the north or even the south. The safety of the patient and the crew always the Life Flight Network pilot's first priority.

It is noted that the two designated approach-departure paths are shown extending well beyond the 500 foot altitude circuit, because under FAA standards (Advisory Circular AC150-5390 Heliport Design), for safety purposes each path should be shown as extending out for 4000 feet in horizontal distance, with a very gentle slope of 8 horizontal to 1 vertical (7.1 degree slope). This is a specified area in which to identify obstacles that could be obstructions to flight. Things like parking lot light poles in that zone will likely have obstruction lights added to them so that the pilot easily sees them at night. The FAA's purpose in creating much shallower flight paths is to ensure that a helistop can be used by other types of helicopters that may not have as good flight climb characteristics as Life Flight Network's helicopters. Note that there may be other Army or Coast Guard helicopters that need this kind of shallow approach, and may occasionally use the helistop during emergencies.

A review of **Drawing AP1.0** shows the expected helicopter noise level that can be expected to be measured at locations around hospital. There is no federal or state standard that these must conform to, but when put in the perspective of common other urban sounds like lawn mowers, leaf blowers, trucks, and busses, I their level is comparable. The reason for this is that the hospital campus is large, and the helicopter takes off in the middle of the campus and can gain altitude before needing to fly over other community areas.

Noise Abatement Procedures and Fly Friendly Program

The Life Flight Network pilots are committed to work with the community to minimize noise impacts to residential areas, to the extent possible. **Drawing AP1.0** shows that the residential area to the south of the hospital is marked with crosshatching, and the note "No Overflight below 1000 Feet if Possible." The exceptions, if needed by the pilot, will be when clouds are low, or there is poor visibility due to falling rain or snow, and the delivery of the patient to the hospital requires that the helicopter fly lower as a requirement for the flight to remain safe.

DNL Methodology

State or local governments are prohibited from establishing laws governing the noise of aircraft, because the federal government wants the airspace available for all aircraft independent of what state or location they come from. This relates to government's role in ensuring interstate commerce exists between the states. Concerning the flight of aircraft, federal law states:

> "The United States Government has exclusive sovereignty of airspace of the United States."
> - 49 U.S.C. 40103(a)

This result in the federal government itself being the sole regulator of aircraft noise, which it does by: a) ensuring that each manufactured aircraft comply with a required noise certification, and b) providing standards for evaluating the noise impact of aircraft on noise sensitive community uses.

As to the latter noise impact, the U. S. Environmental Protection Agency (EPA), the Department of Housing and Urban Development (HUD), and the Federal Aviation Administration (FAA) have jointly established a methodology to relate measurable sound from a variety of sources to community response. It has been termed "Day-Night Average Sound Level" (DNL or Ldn) and has been adopted by all three agencies for use in evaluating noise impacts. In a general sense, it is the yearly average of aircraft-created noise for a specific location (i.e., from an airport), but includes a calculation penalty for each night flight, due to quieter background levels at night and the higher sensitivity to noise while sleeping. On a map it's units of measurement are designated as Ldn sound level (dBA sound level with day-night accounted for).

The basic unit in the computation of DNL is the sound exposure level (SEL). An SEL is computed by mathematically summing the dBA level for each second during which a noise event occurs. For example, the noise level of an aircraft might be recorded as it approaches, passes overhead, and then departs. The recorded noise level of each second of the noise event is then added logarithmically to compute the SEL. To provide a penalty for nighttime flights (defined as the hours be between 10 PM and 7 AM), 10 dBA is added to each nighttime dBA measurement, second by second. Due to the mathematics of logarithms, this calculation penalty is equivalent to 10-day flights for each night flight[51].

A DNL level is approximately equal to the average dBA level during a 24-hour period with a weighing for nighttime noise events. The main advantage of DNL is that it provides a common measure for a variety of different noise environments. The same DNL level can describe an area with very few high noise events as well as an area with many low level events.

[51] Where Leq ("Equivalent Sound Level") is the same measure as DNL without the night penalty incorporated, this can be shown through the mathematical relationship of:

$$Leq_d = 10 \log \left(\frac{N_d \times 10^{(SEL/10)}}{86{,}400} \right) \qquad Leq_n = 10 \log \left(\frac{N_n \times 10^{((SEL+10)/10)}}{86{,}400} \right)$$

If SEL equals the same measured sound exposure level for each computation, and if N_d = 10 daytime flights, and N_n = 1 night-time flight, then use of a calculator shows that for any SEL value inserted, $Leq_d = Leq_n$.

Noise Modeling and Contour Criteria

DNL levels are typically depicted as contours. Contours are an interpolation of noise levels drawn to connect all points of a constant level that are derived from a calculation of the Ldn sound levels. The noise contours appear similar to topographical contours and are superimposed on a map of the heliport and its surrounding area. It is this map of noise levels drawn about a heliport that is used to predict community response to the noise from aircraft using that heliport. DNL mapping is best used for comparative purposes, rather than for providing absolute values. That is, valid comparisons can be made between scenarios as long as consistent assumptions and basic data are used for all calculations. It should be noted that a line drawn on a map by a computer does not imply that a particular noise condition exists on one side of the line and not on the other. These calculations can only be used for comparing average noise impacts, not precisely defining them relative to a specific location at a specific time. Noise contours are typically plotted in 5 DNL increments, starting at 55 Ldn.

Noise and Land-Use Compatibility Criteria

Federal regulatory agencies of government have adopted standards and suggested guidelines relating DNL to compatible land uses. Most of the noise and land-use compatibility guidelines strongly support the standard that significant annoyance from aircraft noise levels does not occur outside a 65 Ldn noise contour. Federal agencies supporting this standard include the Environmental Protection Agency, Department of Housing and Urban Development, and the Federal Aviation Administration.

Part 150, Airport Noise Compatibility Planning, of the Federal Aviation Regulations, provides guidance for land-use compatibility around heliports. **Table 2** presents these guidelines. Compatibility or non-compatibility of land use is determined by comparing the noise contours with existing and potential land uses. All types of land uses are compatible in areas below 65 Ldn. Generally, residential and some public uses are not compatible within the 65-70 Ldn, and above. As noted in **Table 2,** some degree of noise level reduction (NLR) from outdoor to indoor environments may be required for specific land uses located within higher level noise contours. Land uses such as commercial, manufacturing, some recreational uses, and agriculture are compatible within 65-70 Ldn contours.

Table 2: Land-Use Compatibility with DNL

	Yearly Day-Night Average Sound Level (Ldn) In Decibels					
Land Use	Below 65	65-70	70-75	75-80	80-85	Over 85
Residential						
Residential, other than mobile homes & transient lodgings.....	Y	N(1)	N(1)	N	N	N

Mobile Home Parks	Y	N	N	N	N	N
Transient Lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and Nursing Homes.	Y	25	30	N	N	N
Churches, Auditoriums, and Concert Halls	Y	25	30	N	N	N
Governmental Services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, Business and Professional.	Y	Y	25	30	N	N
Wholesale and Retail—Building Materials, Hardware and Farm Equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail Trade--General	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing General	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and Optical	Y	Y	25	30	N	N
Agriculture (except livestock) and Forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock Farming and Breeding	Y	Y(6)	Y(7)	N	N	N
Mining and Fishing, Resource Production and Extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor Sports Arenas, Spectator Sports	Y	Y(5)	Y(5)	N	N	N
Outdoor Music Shells, Amphitheaters	Y	N	N	N	N	N
Nature Exhibits and Zoos	Y	Y	N	N	N	N
Amusements, Parks, Resorts and Camps	Y	Y	Y	N	N	N
Golf Courses, Riding Stables and Water Recreation	Y	Y	25	30	N	N

Y (Yes)	Land-use and related structures compatible without restrictions.
N (No)	Land-use and related structures are not compatible and should be prohibited.
NLR	Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into design and construction of the structure.
25, 30 or 35	Land uses and structures generally compatible; measures to achieve NLR or 25, 30, or 35 dB must be incorporated into design and construction of the structure.

NOTES:

1. Where the community determines that residential uses must be allowed, measures to achieve outdoor to indoor Noise Levels Reduction (NLR) of at least 25dB and 30dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB; thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year-round. However, the use of NLR criteria will not eliminate outdoor noise problems.
2. Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.
3. Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

4. Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received office areas, noise sensitive areas, or where the normal noise level is low.
5. Land-use compatible, provided special sound reinforcement systems are installed.
6. Residential buildings require an NLR of 25.
7. Residential buildings require an NLR of 30.
8. Residential buildings not permitted.

SOURCE: Federal Aviation Regulations, Part 150, Airport Noise Compatibility Planning, dated January 18, 1985.

Oregon DEQ Standards

When aircraft are in flight, landing, or taking off, they are regulated solely by the FAA since navigable airspace is under federal jurisdiction. However, because aircraft noise occurs at and around heliports, it is also a concern to local governments. The State of Oregon Administrative Rules Section OAR 340-35-045 requires that when establishing a new heliport or performing heliport master planning with changes to the helistop location, that a projected noise impact analysis must be prepared and made available to the local land use determination agency.

The state heliport noise standards are administered by the Department of Environmental Quality (DEQ), and require that an "airport noise impact boundary" be depicted around an airport. A heliport is a kind of airport, so this applies. DEQ defines this boundary with an annual average day-night noise level of 55 Ldn. This standard is considerably more conservative than the federal standard of 65 LDN and thus promotes a higher level of scrutiny in the land use evaluation of heliport development proposals. DEQ reviews submittals to ensure that they are accurate portrayals of the boundary, but does not evaluate whether the noise levels are acceptable for specific land uses within the boundary. Since this project does not involve establishing a new heliport, or changes to a helistop location, there is no requirement to coordinate with Oregon DEQ on airport noise.

Since there is no change to the helistop location, this noise study does not require review by DEQ. In any case a review of **Drawing AP1.1** shows that the 55 Ldn contour exists only on the hospital property, and thus there is no noise impact to the larger community based on the DEQ standards.

Local City and County Standards

Under the city's conditional use standards, the City of Hermiston has the right to grant or take away the right for a helistop. But it is questionable whether the city has the legal right to set limits of control for the noise level of helicopters when they are in flight. The federal government reserves the right to control all airspace that aircraft use, to maintain a useful way for aircraft to remain functional and useful – and to promote interstate travel. The Bell 407 helicopter that Life Flight Network uses at this site has an FAA noise certification that specifies the aircraft has been tested and that flyover at 392 feet above ground at

specified speed has an SEL (sound exposure level) of 85.1 dBA. This noise standard has been approved by the FAA in the certification of the aircraft, that allows it into the federal airspace. This standard was used in the calculation of the DNL for this report. Under FAA and EPA rules, local governments are not permitted to create additional noise or emissions limitations on the use of the helicopter.

The city has an ordinance concerning "Excessive Noise" in Section 92.23 which does not specifically identify or discuss aircraft or helicopter noise. Section 92.29 Exceptions, Section D exempts "the emission of sound in the performance of emergency work," – the full section is quoted below:

> "D. The emission of sound for the purpose of alerting individuals to the existence of an emergency or the emission of sound in the performance of emergency work."

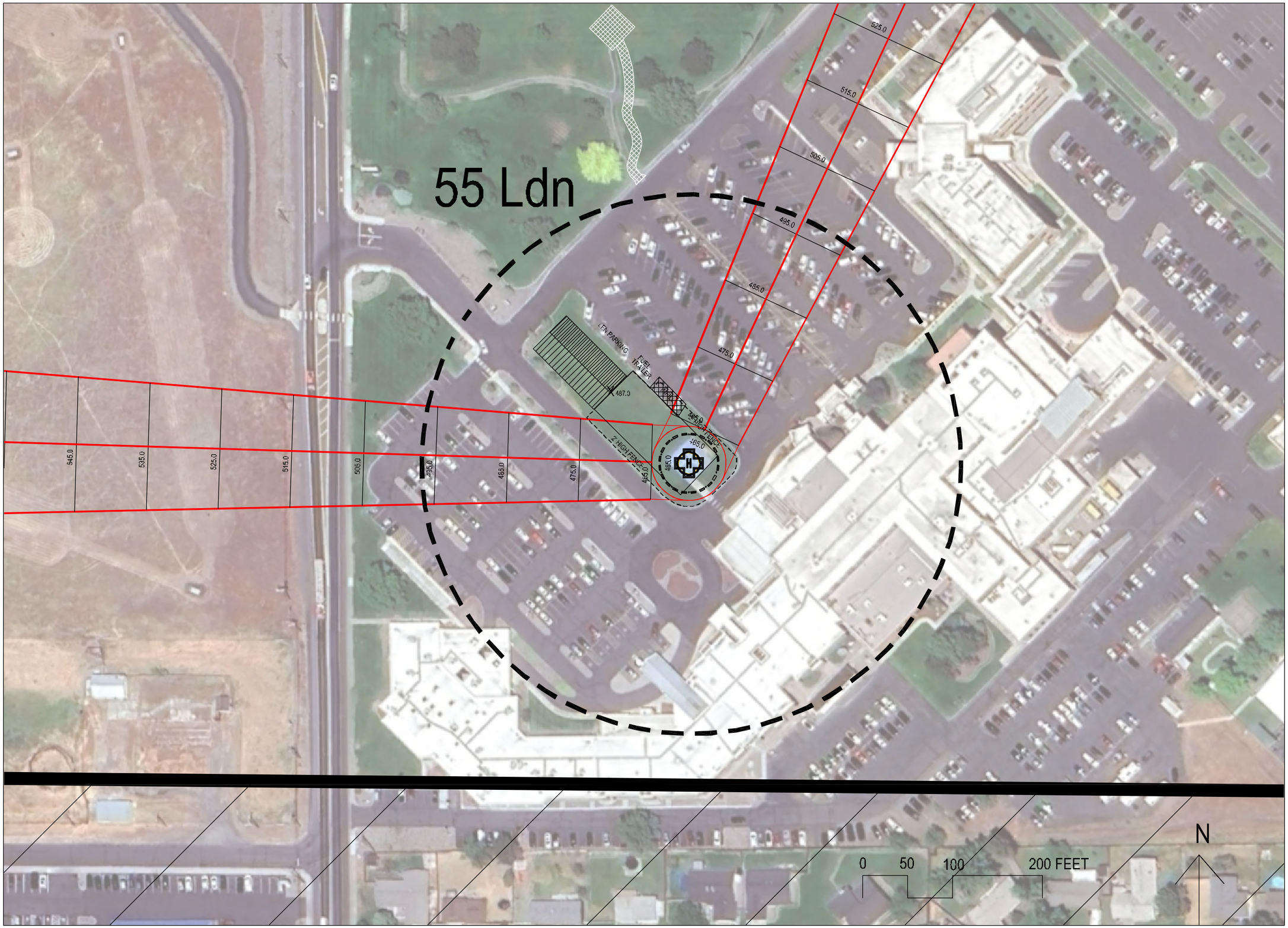
The helicopters used at the hospital are only for emergency medical services, so the noise from the helicopter may be even locally exempt under this clause.

DNL Analysis

A calculation of the Ldn levels were made based on noise level data provided from FAA sources, and from FAA reviewed sources. The calculation was based on 365 takeoffs and 365 landings per year, with 50% of those being during the hours of 10pm to 7am and receiving the 10 dBA penalty. Flight paths were modeled based on typical usage described by pilots. **Drawing AP1.1** shows the results of this case. The 55 Ldn contour remains only on the hospital property, and thus by this analysis using federal standards and Oregon standards there is no significant noise impact.

Conclusions

The existing 55 Ldn contour remains on the hospital property as shown on **Drawing AP1.1**. Since there are no 65 Ldn contours on adjacent properties these results are consistent with FAA goals of minimizing noise impact to residential and other noise sensitive areas. It further complies with the State of Oregon's more restrictive standard of 55 Ldn for considering further noise study. Thus, the Good Shepherd Hospital heliport meets the federal and state standards for ensuring no significant noise impacts exist to adjacent noise sensitive uses and the local community.



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APPROACH ZONE
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