PUGET SOUND ENERGY

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December 8, 2021

Official Memorandum

RE: Energize Eastside Project, City of Redmond Request for Additional Information Regarding Noise (LAND-2021-00487 AND LAND-2021-00521)

The Energize Eastside Project (Project) includes upgrading approximately 2 miles of two existing 115 kV transmission lines within the City of Redmond (City) with two 230 kV transmission lines beginning at the Redmond/Bellevue city boundary, continuing north along the existing Puget Sound Energy (PSE) transmission line corridor to the Sammamish substation. The project also includes equipment upgrades at the existing Sammamish and Rose Hill substations. The upgrade is located entirely within PSE's existing 100-foot electrical transmission utility corridor and on PSE property.

This memo contains additional information requested by the City regarding Project noise including anticipated construction equipment, corona discharge, and other equipment noise.

Construction Equipment

For typical construction work anticipated for this Project, equipment will include an excavator (81 decibels [dB)], a pump (also 81 dB), a compactor (83 dB), and associated construction vehicles. Based on the logarithmic increase of decibel addition for this equipment, the combined noise output is anticipated to reach up to 87 dB should these three pieces of equipment be in use simultaneously. Given the typically urban and developed conditions in and around the Project area, background noise levels reach approximately 65 dBA during the daytime and may fall between 40 and 50 dBA during nighttime hours[1]. Using these assumptions, airborne noise would attenuate to background levels approximately 630 feet (approximately 0.15 mile) from the boundaries of the Project area.

However, helicopters may be used in select locations within the City to avoid impacts to critical areas. A helicopter will generate approximately 106 dB at 50 feet (100 dB at 100 feet), effectively drowning out all other construction equipment. If a helicopter is used, airborne noise would attenuate to background levels at just over 5,000 feet (approximately 1 mile) from the

[1] City of Bellevue. 2016. Energize Eastside Project, Phase 1 Draft Environmental Impact Statement. Chapter 9 Noise (pg. 9-14). January.

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specific locations where helicopters would be used. The extent of helicopter use for the Project is not fully known at the time of this writing and will be determined during construction. Appendix A includes additional information regarding potential helicopter noise from powerline stringing and pole installation (ESA 2018).

Within the City of Redmond, construction noise is exempt from noise standards during specific hours. Per the Redmond Municipal Code 6.36.050.E.1&2:

1. Sounds from temporary construction may exceed the maximum permissible noise levels between the hours of 7:00 a.m. and 10:00 p.m. unless it impacts residential zones (Class A EDNA).
2. Construction noise that impacts residential zones (Class A EDNA) has the following restricted hours unless it is for single –family home repair, maintenance or construction and meets the requirements set forth in subsections B.1 and B.2 of this section:

Monday through Friday:	7:00 a.m. to 7:00 p.m.
Saturdays:	9:00 a.m. to 6:00 p.m.
Sundays or Legal Holiday:	Prohibited

(Legal holidays for enforcement of this subsection shall be limited to New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving, the day after Thanksgiving and Christmas.)

Corona Discharge (Operational)

Corona is the electrical ionization of the air that occurs near the surface of the energized conductor and suspension hardware because of very high electric field strength. Corona discharge occurs when the voltage of the line exceeds the insulating capability of air and may result in audible noise such as random crackling or hissing being produced by the transmission lines.

The amount of corona produced by an overhead transmission line is a function of the voltage of the line, the diameter of the conductors, the locations of the conductors in relation to each other, the elevation of the line above sea level, the condition of the conductors and hardware, and the local weather conditions.

Corona discharge is greater on misty days because the air has a lower insulating ability when wet. Also, particles such as dust or water droplets that might come in contact with a conductor tend to increase corona discharge. Therefore, the potential for noise from corona discharge is greatest during wet weather. However, the noise generated by falling heavy rain hitting the ground will typically be greater than the noise generated by corona, masking the audible noise

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from the transmission line. Corona generated noise is of concern primarily for transmission lines operating at voltages of 345 kV and above[2].

Previous analyses in the Pacific Northwest indicate that maximum corona noise produced from 230 kV lines at ground level during wet weather conditions is 29 dBA[3]. This is a relatively low noise level that would not be noticeable in most suburban environments. As a point of reference, the U.S. Department of Housing and Urban Development identifies a noise level of 45 dBA (Ldn) as an interior noise goal for federal housing[4] (HUD, 1985), which is equivalent to a steady state noise level over a 24-hour period of 39 dBA.

Other Equipment Noise (Operational)

Transformers and their cooling fans generate noise as could any ancillary equipment such as air handling equipment or backup generator testing. PSE has established noise standards for autotransformers (upon initial installation) of 70 and 65 dBA at 1 meter with and without cooling, respectively. Monitoring at a relatively small substation in a quiet suburban area in Seattle found that typical daytime noise at the fence line during operation of a bank of three transformers with cooling fans running was 64 dBA Leq1[5]. This level of noise could be audible at adjacent sensitive land uses, depending on their distance and the existing ambient noise level. All new equipment installed at the Sammamish and Rose Hill substations will meet PSE noise standards.

Electrical substations are exempt from the maximum permissible noise levels established in Chapter 173-60 of the Washington Administrative Code.

[2] U.S. DOE (Department of Energy). 2006. Bonneville Power Administration, Transmission Business Line Policy T2006-1, Audible Noise Policy, 2006.
[3] Oregon DOE (Department of Energy). 2013. Site Certificate Application for Troutdale Energy Center, Exhibit AA, March, 2013.
[4] HUD (U.S. Department of Housing and Urban Development). 1985. The Noise Guidebook. Available at http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/environment/training/guidebooks/noise; divided into chapters with Chapter 1 at http://portal.hud.gov/hudportal/documents/huddoc?id=DOC_16414.pdf. Accessed October 1, 2015.
[5] Environmental Science Associates monitored noise levels at the Delridge substation in May 2013 as part of a data gathering effort for the preparation of the Environmental Impact Statement for the proposed Denny Substation in Seattle.

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Technical memorandum

date	January 16, 2018
to	Reema Shakra, Project Manager
cc	Mark Johnson, Project Director
from	Chris Sanchez, Senior Technical Associate
subject	Helicopter Noise from the Installation of Transmission Poles and Lines

In response to your e-mail, this memorandum responds to your request for impact analysis of noise from transmission pole/line installations using helicopters. The following is a synopsis of potential noise impacts and how they may apply to elements of the Energize Eastside Project. ESA estimated the 1-hour equivalent sound level (Hourly Leq) values that would be associated with pole/line installations as well as landing zone areas.

It is assumed that the pole installation would be conducted using a heavy duty helicopter, such as CH47D Chinook, and line installation would be conducted using a light duty helicopter, such as Hughes 500D. The Federal Aviation Administration's (FAA) Aviation Environmental Design Tool version 2d (AEDT 2d) includes a set of data called Noise-Power-Distance (NPD) data for both helicopters. NPD data includes A-weighted maximum noise levels (LAMAX) for hovering operations at the distances from 200 feet to 25,000 feet. For this study, the following are used as a reference noise level for helicopter activities:

- CH47D – 86 dBA LAMAX at 200 feet
- H500D – 80 dBA LAMAX at 200 feet

These maximum noise levels were then used to estimate average hourly noise levels associated with helicopter construction activity. For pole installation, it was assumed that a CH47D helicopter would be hovering at one location for the entire hour. For line installation, it was assumed that the H500D helicopter operating time would be approximately 15 minutes per hour at tubular steel pole (TSP) sites during sock line stringing. At the landing zone, it was assumed that helicopters would take 15 minutes per hour related to helicopter landing and takeoff. For both pole and line installation, it was assumed that the helicopter would hover approximately 250 feet above the ground. Based on the above assumptions, following hourly Leq levels will be used:

- CH47D Hovering – 86 dBA Hourly Leq at 200 feet
- CH47D at Landing Zone – 80 dBA Hourly Leq at 200 feet
- H500D Hovering and at Landing Zone – 74 dBA Hourly Leq at 200 feet

As shown in **Table 1**, *Construction Noise Levels at Sensitive Receptor Locations,* hourly average helicopter noise levels associated with these construction activities at the closest sensitive receptor locations would range from 69 dBA to 82 dBA for helicopter activities at a lateral distance of 200 to 350 feet.

For the Energize Eastside Project, a mitigation measure to avoid some non-noise related impacts would involve the use of helicopters for pole installation and line stringing. At some locations, sensitive receptors could be as close as 15 feet laterally from the proposed alignment. Consequently, noise levels at immediately adjacent receptors to pole installation and line stringing would essentially be the same as the reference noise level at a height of 200 feet. Assuming that helicopter landing zones would have a 350-foot buffer from the nearest sensitive receptor, noise levels at such receptors would be the same as predicted in Table 1, below.

Most cities in the project area have a noise ordinance that limits the hours of construction activity but do not establish a quantitative noise standard. As an example, under the Bellevue City Code (BCC), noise emanating from construction sites is prohibited outside of the hours of 7 a.m. to 6 p.m. Monday through Friday, and 9 a.m. to 6 p.m. on Saturdays. No construction site noise is permitted on Sundays and legal holidays. If after-hours sounds from a construction site are clearly audible across a real property boundary or at least 75 feet from their source, it will be considered a noise disturbance (BCC 9.18.040.A.4) Additionally, sounds created by the repair or installation of essential utility services and streets are exempt from the restrictions of the noise ordinance (BCC 9.18.020.B.2) as are sounds originating from aircraft in flight (BCC 9.18.020.A.6).

Consequently, while helicopter noise would likely be clearly audible at the nearest receptors it would still be consistent with the restrictions of local noise ordinances and would be temporary in nature as construction activities would take less than three days to complete at any given location, with the exception of activities at the helicopter landing zones.

TABLE 1
CONSTRUCTION NOISE LEVELS AT SENSITIVE RECEPTOR LOCATIONS

Construction Noise Source	Distance to Closest Sensitive Receptor[a]	Hourly Leq at Closest Sensitive Receptor
CH47D – Pole Installation[b]	320 feet	82 dBA
H500D – Line Installation[c]	320 feet	70 dBA
CH47D at Landing Zone[d]	350 feet	75 dBA
H500D at Landing Zone[d]	350 feet	69 dBA

[a] Direct distances between a helicopter and a receptor based on the hovering height of 250 feet and horizontal distance to a receptor of 200 feet with the assumption of 6 dB noise propagation rate per doubling the distance.

[b] Helicopter Hourly Leq values near pole installation are calculated assuming the helicopter would hover above the site at an elevation of approximately 250 feet above the ground surface for an hour.

[c] Helicopter Hourly Leq values near TSP locations are calculated assuming the helicopter would hover above the site at an elevation of approximately 250 feet above the ground surface for up to 15 minutes per hour.

[d] Helicopter Hourly Leq values are calculated assuming the helicopter would operate in the immediate vicinity of the helicopter landing zone for up to 15 minutes per hour.

SOURCE: ESA, 2018