Memo

Date:	September 27, 2019
Project:	Cargill Cedar Rapids Rail Yard Noise study – Stewart Road site
To:	Eric Ruttum
From:	Tim Casey, Sanvisna Kogelen
Subject:	Stewart Road Rail Yard Noise Analysis

HDR performed an analysis of potential noise emissions from Cargill's proposed rail yard operations at the Stewart Road site in Cedar Rapids, IA. The noise analysis utilized geographic information system (GIS) technology, digital aerial photographs, digital topographic data provided by the City of Cedar Rapids, digital drawings of the proposed rail yard, and Cadna-A acoustical modeling software. Cadna-A is based on international acoustical standards, including ISO-9613 (noise propagation outdoors). Noise analysis results in this memo are provided for planning purposes, to guide the design of the proposed facility.

NOISE LIMITS AND NOISE SOURCES

Based on conversations between Cargill and City of Cedar Rapids, HDR assumed that the site is subject to the Cedar Rapids noise ordinances found in Chapter 56. Under that ordinance the City of Cedar Rapids considers locomotives to be motor vehicles, whose noise limit is a maximum sound pressure level (L_{max}) of 90 dBA. The L_{max} is an instantaneous noise level, not a noise level averaged over a period of time. Activities at the rail yard will include stop and start movements of locomotives and railcars. Therefore the noise sources modeled in this noise assessment are rail car coupling clangs and noise from idling locomotives; these are considered the loudest sources of noise from the proposed rail yard. Rail car coupling clangs occur one at a time, therefore to simplify the noise assessment only one car coupling clang event was modeled; this facilitates a comparison with the instantaneous L_{max} noise limit of 90 dBA. Table 1 presents unweighted spectral noise emissions data for these sources.

Table 1. Unweighted Spectral Noise Emission Levels

Source Type	Octave Band(Hz)								
	31.5	63	125	250	500	1000	2000	4000	8000
Idling Locomotive (dB)	117	121	118	115	112	107	103	102	104
Coupling Clang (dB)	105	109	110	110	113	109	110	105	87

Source: *HDR Engineering, Inc. past project files & database*

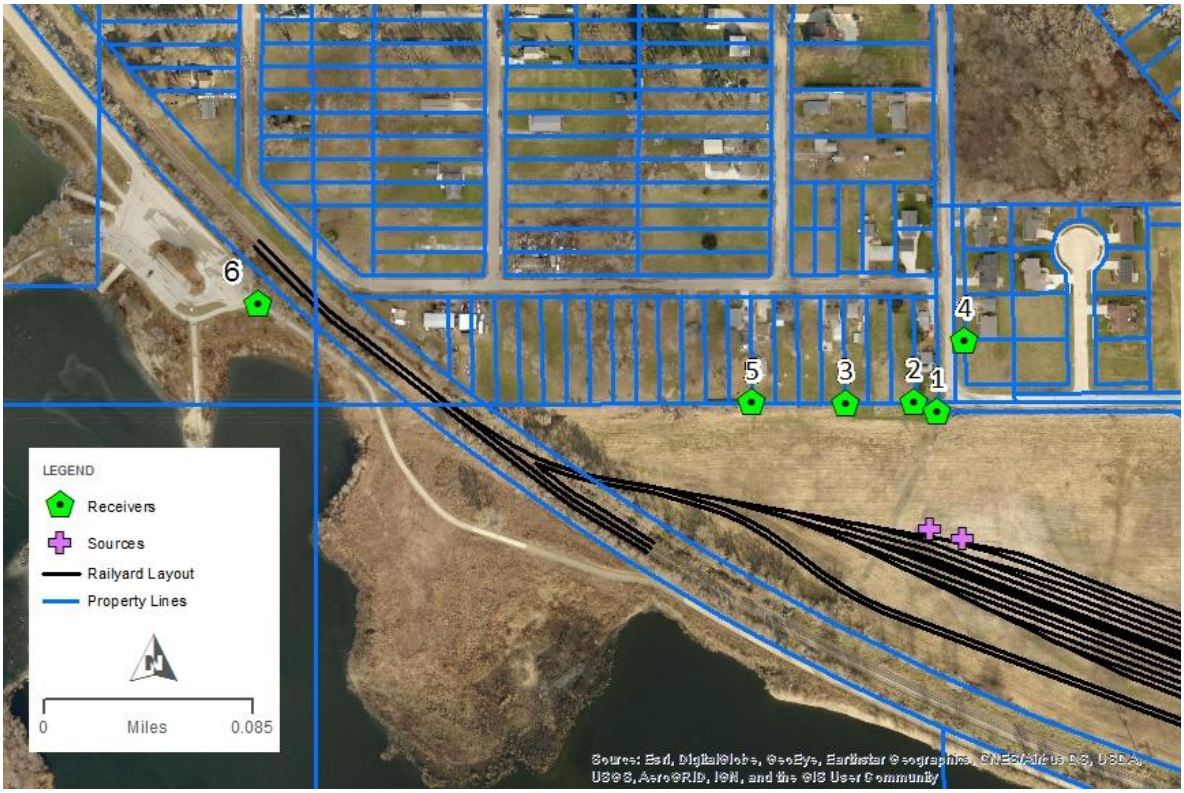
MODELING PROJECT-RELATED NOISE

The proposed rail yard shares a property line with residential parcels on the northern side of the project site. HDR used the Cadna-A acoustical modeling software to evaluate project-related noise at the nearest residential property lines on that side of the proposed site. HDR also configured the Cadna-A model to calculate project-related noise levels at a location that represents the Prairie Park Fishery. A digital file showing property lines was imported into GIS as an aid in determining where modeled noise receivers should be placed.

A digital terrain file, obtained from City of Cedar Rapids, was also imported into the Cadna-A model to account for the changing elevation in the study area and facilitate an evaluation of the effects of terrain on sound propagation. HDR modeled noise emissions from two stationary point sources (one idling locomotive and one railcar couple clang). Potential opportunities to reduce project-related noise were also evaluated (discussed later in this memo).

Figure 1 shows these key features of the noise analysis performed to evaluate project-related noise at residential property lines on the northern side of the proposed site and at the Prairie Park Fishery. The figure shows rail lines in the proposed rail yard, the location of modeled noise sources, and modeled receptors along the northern property line and at the fishery.

Figure 1
Key Features in the Rail Yard Noise Model



The next section presents noise analysis results.

NOISE ANALYSIS RESULTS

Table 2 presents the modeling results for the noise analysis described above. Modeling results show that noise from idling locomotives and car coupling clangs is projected to be lower than the maximum allowable noise level under the city noise ordinance.

Table 2. Noise Modeling Results

Receiver	Calculated L_{max} (dBA)
1	67
2	67
3	65
4	61
5	61
6 Prairie Park Fishery	50

Analysis results indicate that project-related noise, as modeled, is not anticipated to exceed the noise limits in the City of Cedar Rapids noise ordinance.

OPPORTUNITIES TO REDUCE NOISE

To evaluate a potential opportunity to reduce project-related noise at locations off-site, HDR modeled noise barriers at three different heights (10-feet, 15-feet and 20 feet) above ground elevation. HDR modeled the barriers close to the northern property line. HDR also completed a second barrier analysis with a noise barrier located closer to the northern-most track in the proposed rail yard. The noise barriers could be earthen berms or noise walls. The footprint of the noise barriers appears in Figure 2, shown as a solid yellow line.

Figure 2

Location of Modeled Noise Barrier near Northern Property Line

Note that according to ISO 9613 (the international acoustical standard for outdoor sound propagation), noise barriers can theoretically block up to 20 dBA of noise (although noise reductions of that magnitude are very hard to achieve). Once this noise reduction is reached, the ability of the barrier to block more sound quickly deteriorates.

Figure 3 shows the location of the modeled noise barrier near the northern-most rail line in the proposed rail yard.

Figure 3

Location of Modeled Noise Barrier near Northern Rail Line

Table 3 presents noise barrier modeling results for a noise barrier at three different heights above the ground.

Table 3. Noise Barrier Modeling Results

Receiver ID	L_{max} w/o Barrier (dBA)	L_{max} with Barrier in Proposed Rail Yard (dBA)			L_{max} with Barrier Near Northern Rail Line (dBA)		
		10 ft.	15 ft.	20ft	10 ft.	15 ft.	20ft
1	67	61	59	56	62	59	56
2	67	61	58	55	60	57	54
3	65	59	57	54	59	56	54
4	61	57	56	53	58	57	54
5	61	56	54	53	56	54	52
6 Prairie Park Fishery	50	45	45	45	45	45	45

Noise barrier modeling results show that construction of a noise barrier whose height is between 10 and 20 feet can reduce project-related noise levels at residential properties located behind the noise walls. The modeled noise walls are partially effective at reducing noise levels at the fishery; analysis results show a five decibel reduction. However changing the height of the modeled barriers did not improve the noise reduction at the fishery because the fishery is so far away from the noise sources, and because sound refracts around the end of the noise walls.