

# **Exhibit 12 - Noise Management Plan Rush SOUTH 4-65 29-30 3BH, 3CH, 3DH, 4AH, 4BH, 4CH & 4DH (Phase 2) Noise Modeling Report**

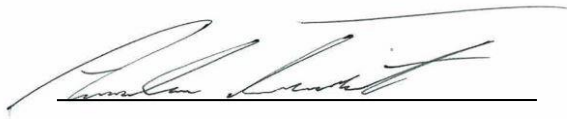
**June 28, 2019**

Prepared for:

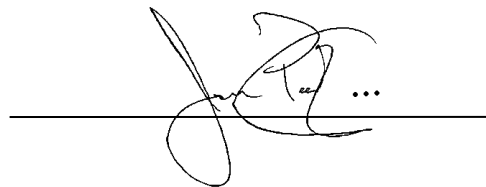
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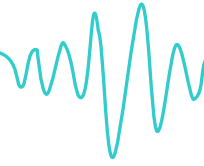
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## 1. Introduction

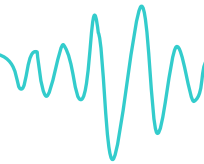
The purpose of this study is to assess the noise impact of the drilling and fracing operations at the Rush 4-65 29-30 Phase 2 pad located approximately 0.75 miles southeast of the E Jewel Avenue and S Powhatan Mile Road intersection in Arapahoe County, Colorado as shown in Figure 1-1. The drilling and fracing noise levels have been assessed in terms of the Colorado Oil and Gas Conservation Commission (COGCC) Noise Standards as well as the Oil and Gas Operator Agreement between ConocoPhillips Company and Burlington Resources Oil & Gas Company LP and the City of Aurora, Colorado dated June 5, 2019. To assess the noise impact, a noise model representing the drilling and fracing operations was constructed and compared to the allowable noise levels.

The following is provided in this report:

- A review of the COGCC Noise Standards
- The results of the noise modeling representing the drilling and fracing operations at the site



Figure 1-1 Pad Location



## 2. Noise Fundamentals

Sound is most commonly experienced by people as pressure waves passing through air. These rapid fluctuations in air pressure are processed by the human auditory system to produce the sensation of sound. The rate at which sound pressure changes occur is called the frequency. Frequency is usually measured as the number of oscillations per second or Hertz (Hz). Frequencies that can be heard by a healthy human ear range from approximately 20 Hz to 20,000 Hz. Toward the lower end of this range are low-pitched sounds, including those that might be described as a “rumble” or “boom”. At the higher end of the range are high-pitched sounds that might be described as a “screech” or “hiss”.

Environmental noise generally derives, in part, from a combination of distant noise sources. Such sources may include common experiences such as distant traffic, wind in trees, and distant industrial or farming activities. These distant sources create a low-level “background noise” in which no particular individual source is identifiable. Background noise is often relatively constant from moment to moment, but varies slowly from hour to hour as natural forces change or as human activity follows its daily cycle.

Superimposed on this low-level, slowly varying background noise is a succession of identifiable noisy events of relatively brief duration. These events may include the passing of single-vehicles, aircraft flyovers, screeching of brakes, and other short-term events. The presence of these short-term events causes the noise level to fluctuate. Detailed acoustical definitions are provided in Appendix A.

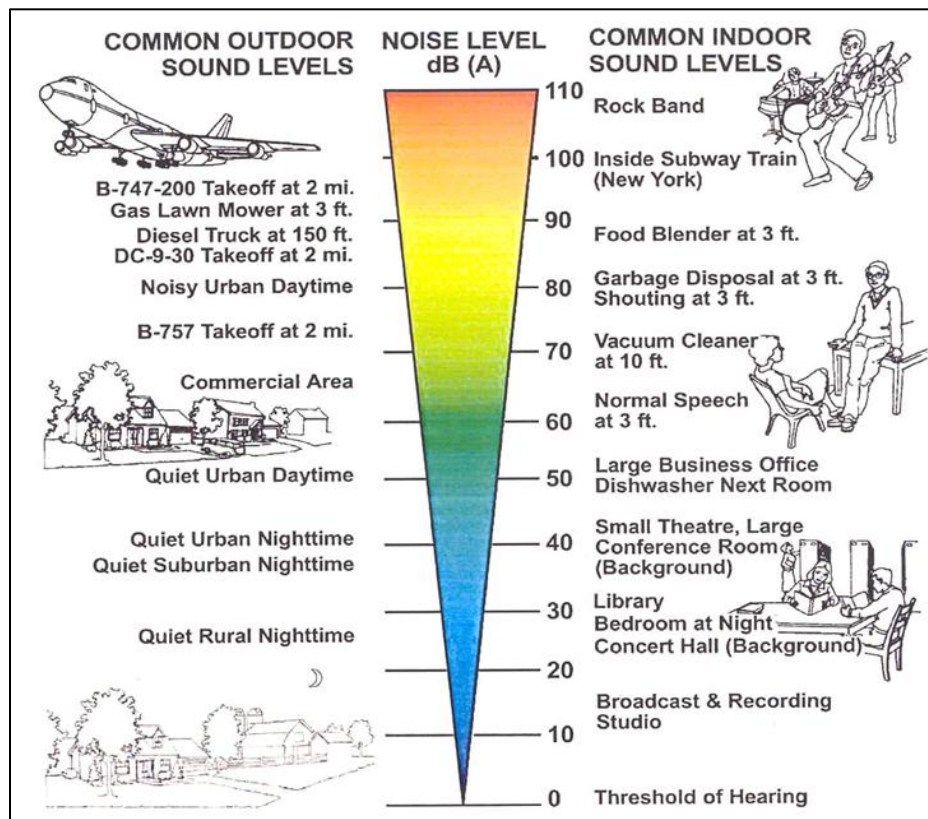
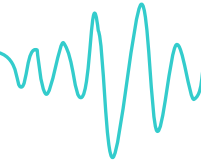


Figure 2-1 Typical Indoor and Outdoor Sound Levels



## 3. Noise Standards

### 3.1 Colorado Oil and Gas Conservation Commission (COGCC)

The analysis was developed to evaluate drilling and fracing noise levels at adjacent occupied structures and verify compliance of drilling operations with the Colorado Oil and Gas Conservation Commission (COGCC) Section 802 “Noise Abatement” requirements. The COGCC Code lists exterior noise limits for stationary noise sources. The noise limits are provided in Table 3-1.

**Table 3-1 COGCC Sec. 802(b) Noise Abatement Requirements “Exterior Noise Level Limits”**

Zone	7:00 am to next 7:00 pm	7:00 pm to next 7:00 am
Residential/Agricultural/Rural	55 dBA	50 dBA
Commercial	60 dBA	55 dBA
Light Industrial	70 dBA	65 dBA
Industrial	80 dBA	75 dBA

Section 802.b of the standard states:

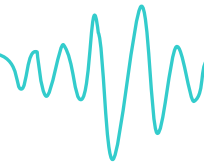
The type of land use of the surrounding area shall be determined by the Director in consultation with the Local Government Designee taking into consideration any applicable zoning or other local land use designation. In the hours between 7:00 a.m. and the next 7:00 p.m. the noise levels permitted above may be increased ten (10) dB(A) for a period not to exceed fifteen (15) minutes in any one (1) hour period. The allowable noise level for periodic, impulsive or shrill noises is reduced by five (5) dB (A) from the levels shown.

- (1) Except as required pursuant to Rule 604.c.(2)A., operations involving pipeline or gas facility installation or maintenance, the use of a drilling rig, completion rig, workover rig, or stimulation is subject to the maximum permissible noise levels for industrial zones.

Section 802C.(1) of the standard states:

Sound levels shall be measured at a distance of three hundred and fifty (350) feet from noise source. At the request of the complainant, the sound level shall also be measured at a point beyond three hundred fifty (350) feet that the complainant believes is more representative of the noise impact. If an oil and gas well site, production facility, or gas facility is installed closer than three hundred and fifty (350) feet from an existing occupied structure, sound levels shall be measured at a point twenty-five feet from the structure toward the noise source. Noise levels from oil and gas facilities located on surface property owned, leased, or otherwise controlled by the operator shall be measured at the three hundred and fifty (350) feet or at the property line, whichever is greater.





Section 802(d) of the standard states:

In situations where the complainant or Commission onsite inspection indicates that low frequency noise is a component of the problem, the Commission shall obtain a sound level measurement twenty-five (25) feet from the exterior wall of residence or occupied structure to the noise source, using a noise meter calibrated to the dB(C). If this reading exceeds 65 dB(C), the Commission shall require the operator to obtain a low frequency noise impact analysis by qualified sound expert, including identification of any reasonable control measures available to mitigate such low frequency noise impact.

## **3.2 Colorado Oil and Gas Conservation Commission Setback Rules**

Section 604.c.(2)

### **A. Noise.**

Operations involving pipeline or gas facility installation or maintenance, or the use of a drilling rig, are subject to the maximum permissible noise levels for Light Industrial Zones, as measured at the nearest Building Unit. Short-term increases shall be allowable as described in 802.c. Stimulation or re-stimulation operations and Production Facilities are governed by Rule 802.

## **3.3 The Oil and Gas Operator Agreement Between ConocoPhillips Company and Burlington Resources Oil & Gas Company LP and The City of Aurora, Colorado Dated June 5, 2019.**

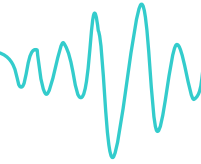
Exhibit C, 2. Noise Mitigation

### **2.2 Noise Baseline Study**

Operator shall perform a baseline noise study if a New Well is planned within 2,640 feet of an area with five Residential Building Units or one High Occupancy Building. If the noise study indicate the need for sound mitigation, Operator shall utilize appropriate measures to meet acceptable OSHA and COGCC requirements for A and C scale sound unless Operator obtains waivers from all affected property owners within that distance. Operator shall provide a copy of the noise study to the City.

Based on the COGCC noise regulations, the operational drilling noise levels at the site will be limited to the light industrial limit of 65.0 dBA at 350 feet from the noise sources or the property line of the site (whichever is farther) and 65.0 dBC at a distance of 25 feet from occupied structures near the site. The operational fracing noise levels at the site will be limited to the industrial limit of 75.0 dBA at 350 feet from the noise sources or the property line of the site (whichever is farther) and 65.0 dBC at a distance of 25 feet from occupied structures near the site.

The offset distances to the nearest Residential Building Units are greater than 2,640 ft. and therefore no additional requirements above and beyond COGCC requirements are included in this study. An ambient study was not conducted therefore the COGCC dBA and dBC noise limits remain the default.



## 4. Rush 4-65 29-30 Phase 2 Pad Noise Modeling

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The noise impact analysis was conducted with the application of three-dimensional computer noise modeling software. All models in this report are developed with SoundPLAN 8.0 software using the ISO 9613-2 standard. Noise levels are predicted based on the locations, noise levels and frequency spectra of the noise sources, and the geometry and reflective properties of the local terrain, buildings and barriers.

Sound level data utilized in the drilling model was based on file data of the Nabors B-16 rig. Rig placement and orientation was coordinated with ConocoPhillips and oriented to minimize noise impact when possible. The rig was modeled with the V-door facing east and the backyard equipment positioned on the south side of the pad. The predicted modeling results are dependent on equipment and mitigation orientation as indicated.

Sound level data utilized in the fracing model was based on file data of the Halliburton Q10 Fleet. Fleet placement and orientation was coordinated with ConocoPhillips and oriented to minimize noise impact when possible. Eleven hydraulic fracturing pump trucks operating simultaneously have been included in the model and were positioned west of the well heads. The predicted modeling results are dependent on equipment and mitigation orientation as indicated.

The noise sensitive receptor locations have been chosen to be consistent with the requirements of the COGCC noise standards. The requirements state that dBA noise levels shall comply with the applicable noise limits as measured at 350 feet from the nearest noise source or at the property line, whichever is greater. The requirements state that dBC noise levels shall comply with the applicable noise limits as measured at 25 feet from the exterior wall of nearby residences or occupied structures. Figure 4-1 shows the dBA and dBC noise sensitive receptor locations.

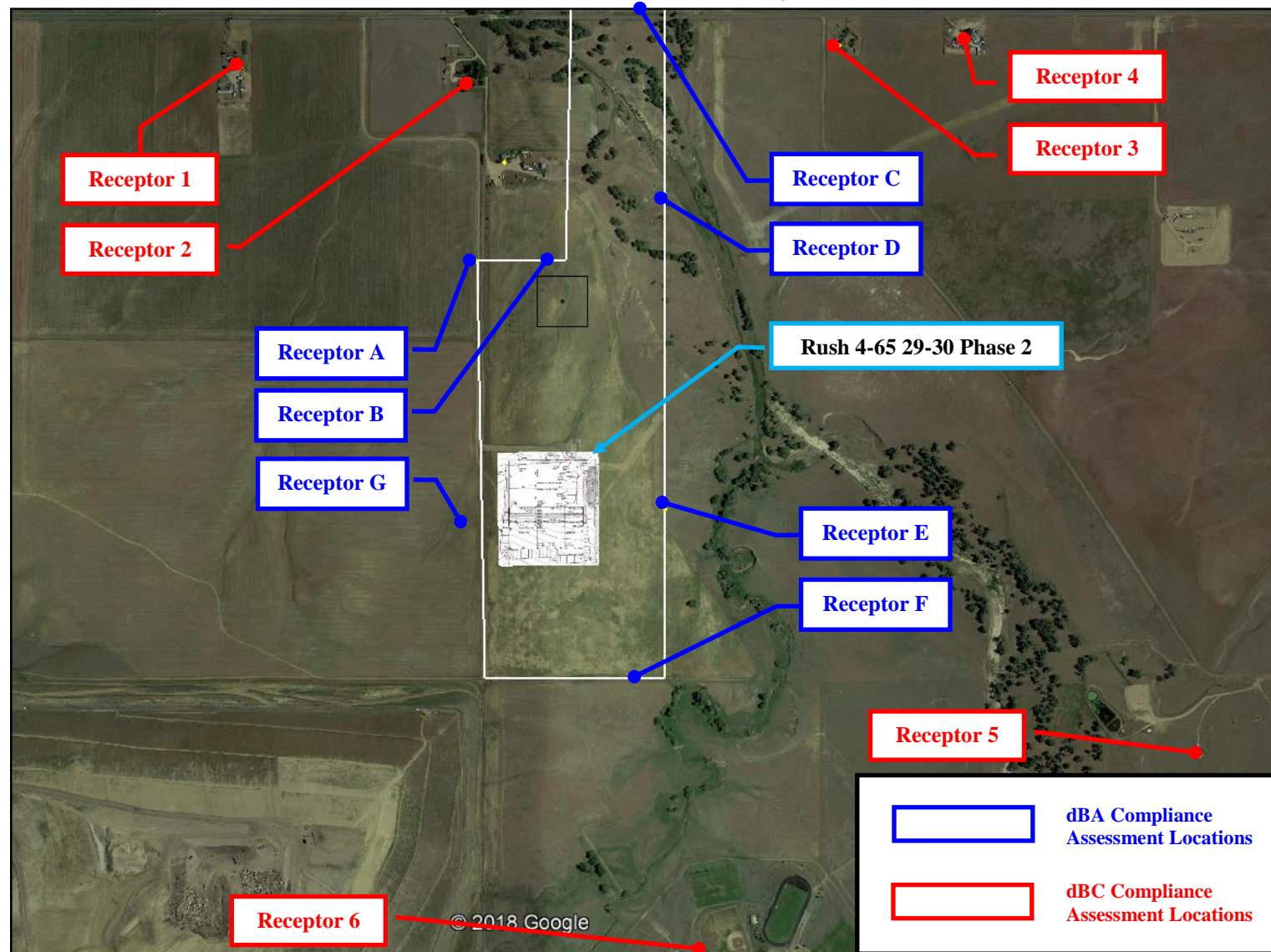
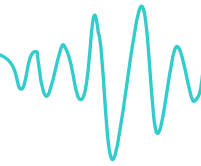


Figure 4-1 Receptor Locations



## 4.1 Unmitigated Noise Modeling Results

The results of the unmitigated drilling and fracing noise modeling are presented in Table 4-1 and

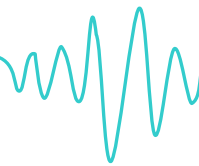
Table 4-2. The locations in the tables correspond to the locations identified in Figure 4-1. The predicted noise levels represent only the contribution of the project operations and do not include ambient noise or noise from other facilities. Actual field sound level measurements may vary from the modeled noise levels due to other noise sources such as traffic, other facilities, other human activity, or environmental factors. The results of the noise modeling are also shown as noise contour maps. Figure 4-2 shows the unmitigated drilling noise contour map in the A-weighted scale and Figure 4-3 shows the unmitigated drilling noise contour map in the C-weighted scale. Figure 4-4 shows the unmitigated fracing noise contour map in the A-weighted scale and Figure 4-5 shows the unmitigated fracing noise contour map in the C-weighted scale. The noise contours are provided in 5 dB increments with the color scale indicating the sound level of each contour.

The results of the unmitigated noise modeling indicate that for both the drilling and fracing operations, all modeled receptors are predicted to comply with the A-weighted and C-weighted COGCC noise limits as well as the Oil and Gas Operator Agreement between ConocoPhillips Company and Burlington Resources Oil & Gas Company LP and the City of Aurora, Colorado, therefore, mitigation is not recommended.

**Table 4-1 A-Weighted Unmitigated Noise Modeling Results**

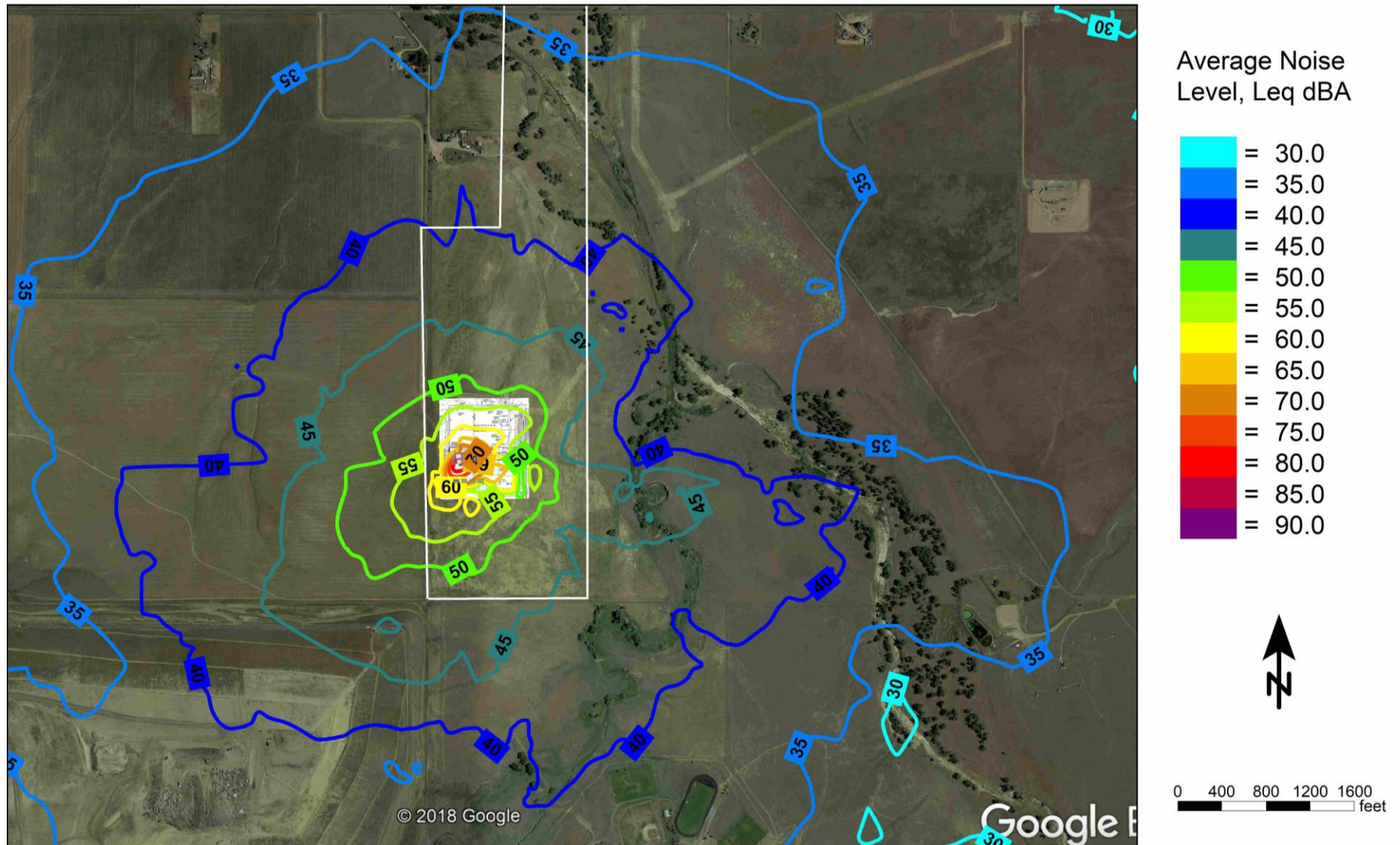
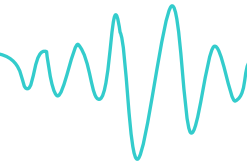
Receptor	Drilling	Fracing
A	40.4	56.9
B	39.2	55.2
C	34.1	48.3
D	37.5	53.5
E	41.5	59.1
F	44.5	58.4
G	52.9	64.9
<b>COGCC Noise Limit</b>	<b>70.0 Day / 65.0 Night</b>	<b>80.0 Day / 75.0 Night</b>





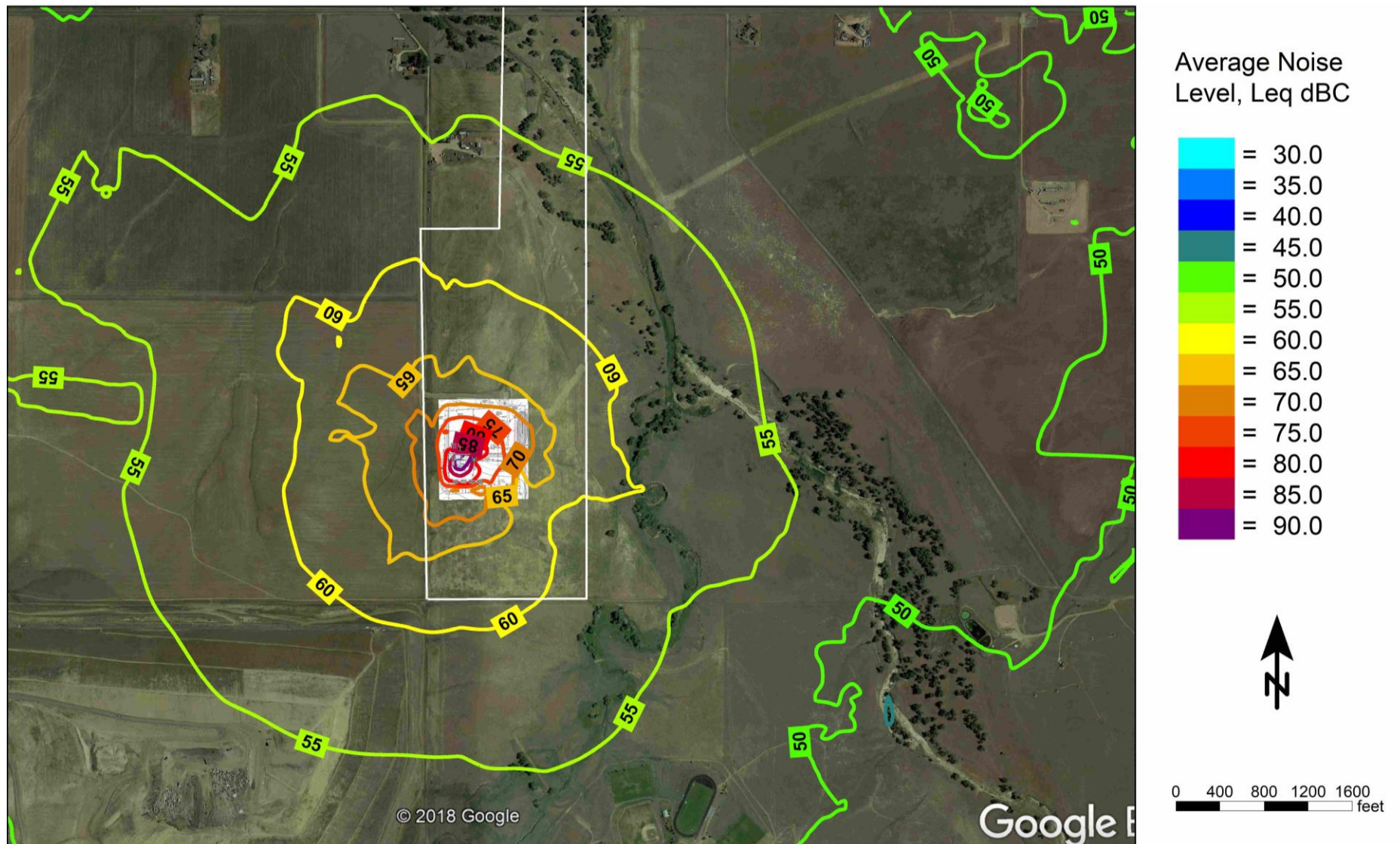
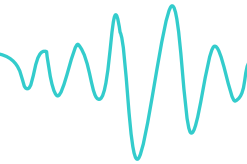
**Table 4-2 C-Weighted Unmitigated Noise Modeling Results**

<b>Receptor</b>	<b>Drilling</b>	<b>Fracing</b>
1	52.3	63.8
2	53.9	63.2
3	51.5	63.4
4	53.7	62.7
5	49.8	59.2
6	53.4	62.3
<b>COGCC Noise Limit</b>	<b>65.0</b>	



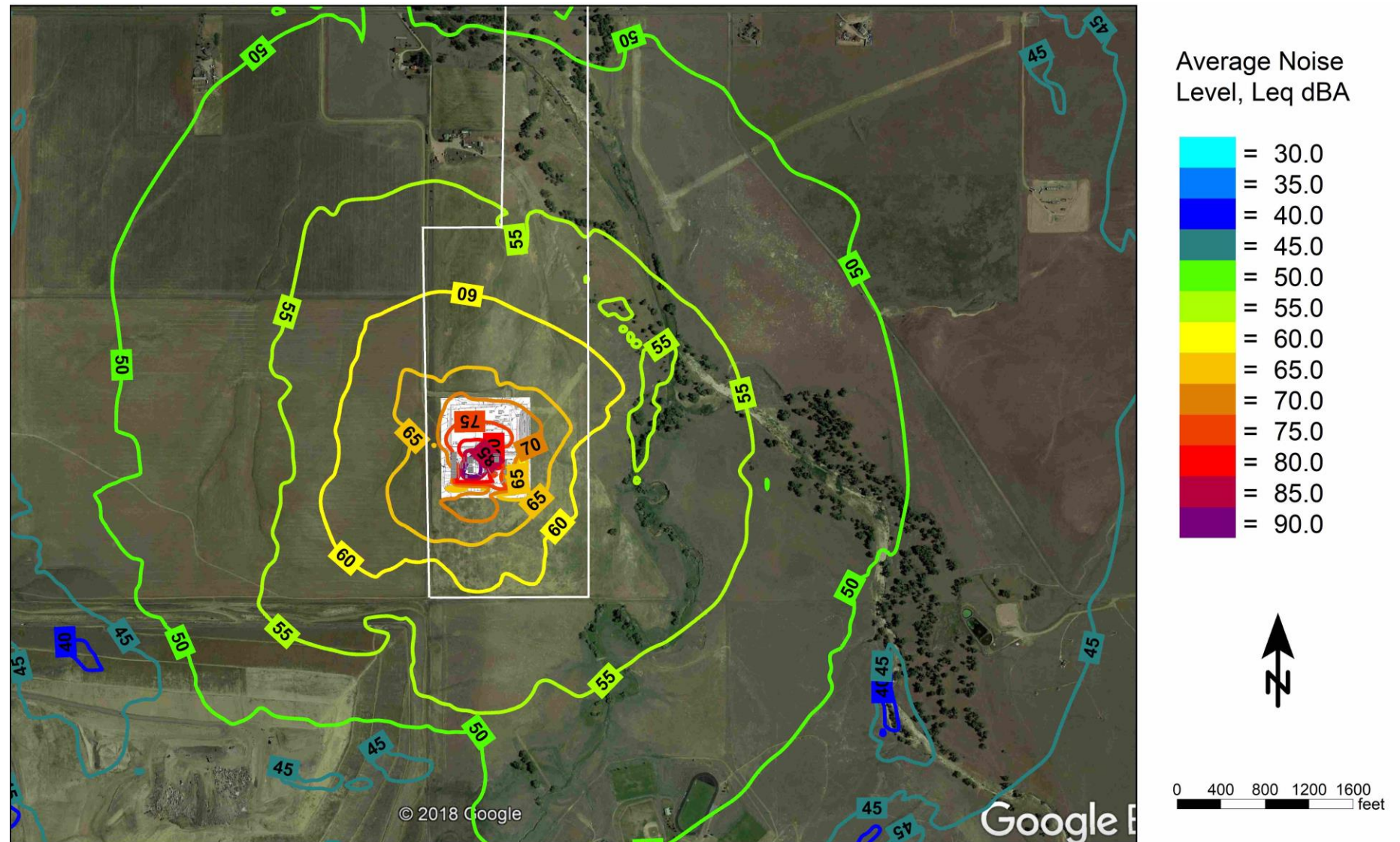
**Figure 4-2 Unmitigated Drilling Noise Contour Map (dBA)**





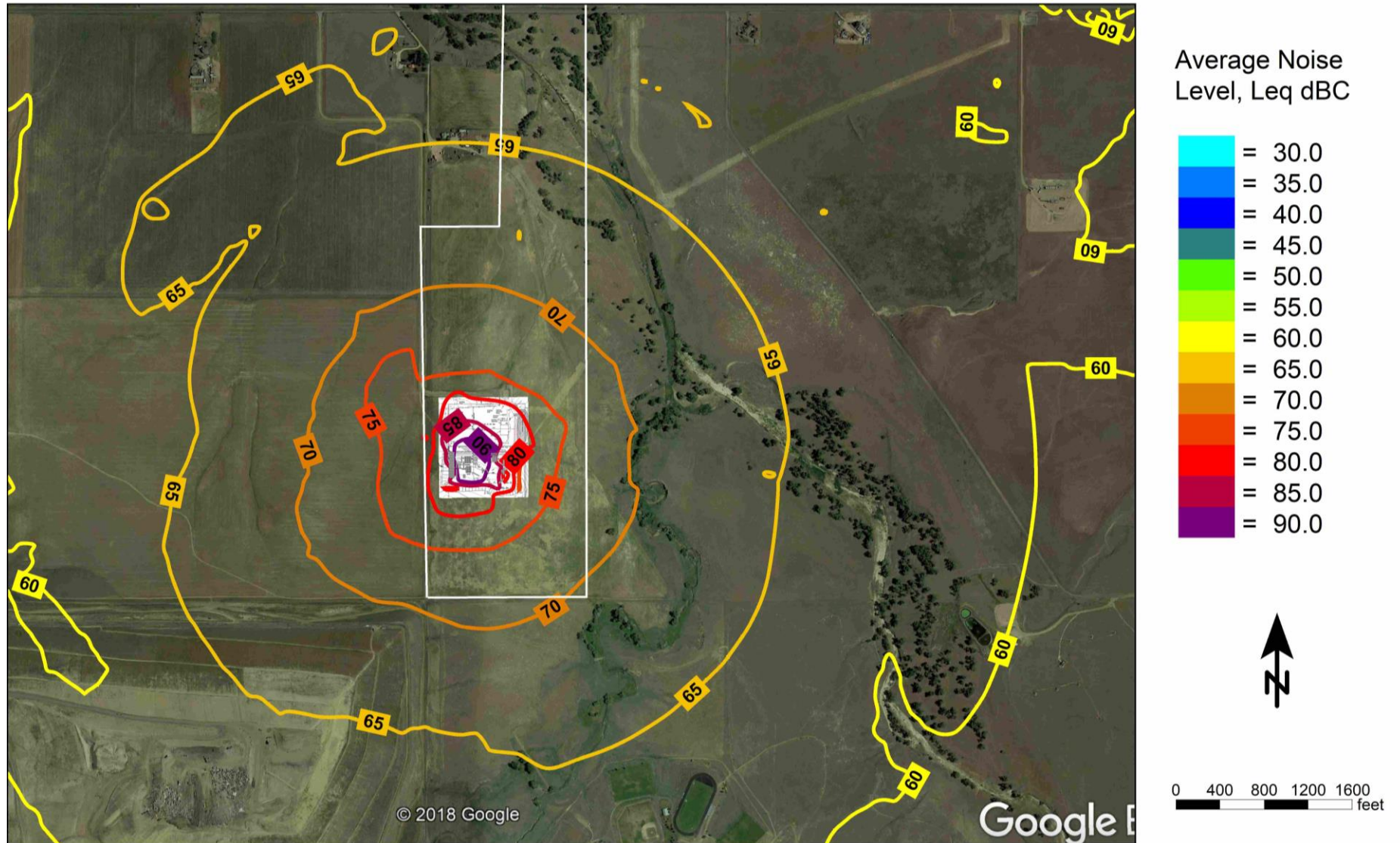
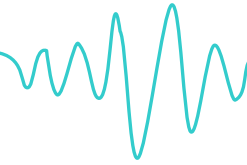
**Figure 4-3 Unmitigated Drilling Noise Contour Map (dBC)**





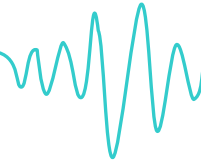
**Figure 4-4 Unmitigated Fracing Noise Contour Map (dBA)**





**Figure 4-5 Unmitigated Fracing Noise Contour Map (dBC)**

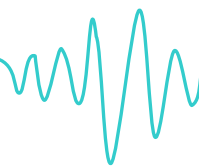




## 5. Conclusion

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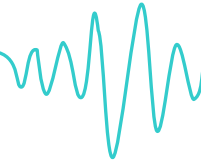
Noise models of the proposed drilling and fracing operations were constructed for the Rush 4-65 29-30 Phase 2 pad in Arapahoe County, Colorado. The results of the unmitigated noise modeling indicate that all modeled receptor locations are predicted to comply with the A-weighted and C-weighted COGCC noise limits as well as the Oil and Gas Operator Agreement between ConocoPhillips Company and Burlington Resources Oil & Gas Company LP and the City of Aurora, Colorado for the proposed drilling and fracing operations. Mitigation is not recommended at this time.



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## **Appendix A    Glossary of Acoustical Terms**

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## **Ambient Noise**

The all-encompassing noise associated with a given environment at a specified time, usually a composite of sound from many sources both near and far.

## **Average Sound Level**

See Equivalent-Continuous Sound Level

## **A-Weighted Sound Level, dB(A)**

The sound level obtained by use of A-weighting. Weighting systems were developed to measure sound in a way that more closely mimics the ear's natural sensitivity relative to frequency so that the instrument is less sensitive to noise at frequencies where the human ear is less sensitive and more sensitive at frequencies where the human ear is more sensitive.

## **C-Weighted Sound Level, dBC**

The sound level obtained by use of C-weighting. Follows the frequency sensitivity of the human ear at very high noise levels. The C-weighting scale is quite flat and therefore includes much more of the low-frequency range of sounds than the A and B scales. In some jurisdictions, C-weighted sound limits are used to limit the low-frequency content of noise sources.

## **Community Noise Equivalent Level (CNEL)**

A 24-hour A-weighted average sound level which takes into account the fact that a given level of noise may be more or less tolerable depending on when it occurs. The CNEL measure of noise exposure weights average hourly noise levels by 5 dB for the evening hours (between 7:00 pm and 10:00 pm), and 10 dB between 10:00 pm and 7:00 am, then combines the results with the daytime levels to produce the final CNEL value. It is measured in decibels, dB.

## **Day-Night Average Sound Level (Ldn)**

A measure of noise exposure level that is similar to CNEL except that there is no weighting applied to the evening hours of 7:00 pm to 10:00 pm. It is measured in decibels, dB.

## **Daytime Average Sound Level**

The time-averaged A-weighted sound level measured between the hours of 7:00 am to 7:00 pm. It is measured in decibels, dB.

## **Decibel (dB)**

The basic unit of measurement for sound level.

## **Direct Sound**

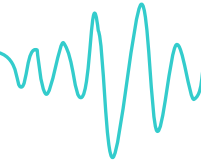
Sound that reaches a given location in a direct line from the source without any reflections.

## **Divergence**

The spreading of sound waves from a source in a free field, resulting in a reduction in sound pressure level with increasing distance from the source.

## **Energy Basis**

This refers to the procedure of summing or averaging sound pressure levels on the basis of their squared pressures. This method involves the conversion of decibels to pressures, then performing the necessary arithmetic calculations, and finally changing the pressure back to decibels.



## **Equivalent-Continuous Sound Level (Leq)**

The average sound level measured over a specified time period. It is a single-number measure of time-varying noise over a specified time period. It is the level of a steady sound that, in a stated time period and at a stated location, has the same A-Weighted sound energy as the time-varying sound. For example, a person who experiences an Leq of 60 dB(A) for a period of 10 minutes standing next to a busy street is exposed to the same amount of sound energy as if he had experienced a constant noise level of 60 dB(A) for 10 minutes rather than the time-varying traffic noise level.

## **Fast Response**

A setting on the sound level meter that determines how sound levels are averaged over time. A fast sound level is always more strongly influenced by recent sounds, and less influenced by sounds occurring in the distant past, than the corresponding slow sound level. For the same non-steady sound, the maximum fast sound level is generally greater than the corresponding maximum slow sound level. Fast response is typically used to measure impact sound levels.

## **Field Impact Insulation Class (FIIIC)**

A single number rating similar to the impact insulation class except that the impact sound pressure levels are measured in the field.

## **Field Sound Transmission Class (FSTC)**

A single number rating similar to sound transmission class except that the transmission loss values used to derive this class are measured in the field.

## **Flanking Sound Transmission**

The transmission of sound from a room in which a source is located to an adjacent receiving room by paths other than through the common partition. Also, the diffraction of noise around the ends of a barrier.

## **Frequency**

The number of oscillations per second of a sound wave

## **Hourly Average Sound Level (HNL)**

The equivalent-continuous sound level, Leq, over a 1-hour time period.

## **Impact Insulation Class (IIC)**

A single number rating used to compare the effectiveness of floor/ceiling assemblies in providing reduction of impact-generated sound such as the sound of a person's walking across the upstairs floor.

## **Impact Noise**

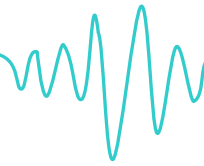
The noise that results when two objects collide.

## **Impulse Noise**

Noise of a transient nature due to the sudden impulse of pressure like that created by a gunshot or balloon bursting.

## **Insertion Loss**

The decrease in sound power level measured at the location of the receptor when an element (e.g., a noise barrier) is inserted in the transmission path between the sound source and the receptor.



## **Inverse Square Law**

A rule by which the sound intensity varies inversely with the square of the distance from the source. This results in a 6dB decrease in sound pressure level for each doubling of distance from the source.

## **$L_n$ Sound Level**

Time-varying noise environments may be expressed in terms of the noise level that is exceeded for a certain percentage of the total measurement time. These statistical noise levels are denoted  $L_n$ , where  $n$  is the percent of time. For example, the  $L_{50}$  is the noise level exceeded for 50% of the time. For a 1-hour measurement period, the  $L_{50}$  would be the noise level exceeded for a cumulative period of 30 minutes in that hour.

## **Masking**

The process by which the threshold of hearing for one sound is raised by the presence of another sound.

## **Maximum Sound Level ( $L_{max}$ )**

The greatest sound level measured on a sound level meter during a designated time interval or event.

## **NC Curves (Noise Criterion Curves)**

A system for rating the noisiness of an occupied indoor space. An actual octave-band spectrum is compared with a set of standard NC curves to determine the NC level of the space.

## **Noise Reduction**

The difference in sound pressure level between any two points.

## **Noise Reduction Coefficient (NRC)**

A single number rating of the sound absorption properties of a material. It is the average of the sound absorption coefficients at 250, 500, 1000, and 2000 Hz, rounded to the nearest multiple of 0.05.

## **Octave**

The frequency interval between two sounds whose frequency ratio is 2. For example, the frequency interval between 500 Hz and 1,000 Hz is one octave.

## **Octave-Band Sound Level**

For an octave frequency band, the sound pressure level of the sound contained within that band.

## **One-Third Octave**

The frequency interval between two sounds whose frequency ratio is  $2^{(1/3)}$ . For example, the frequency interval between 200 Hz and 250 Hz is one-third octave.

## **One-Third-Octave-Band Sound Level**

For a one-third-octave frequency band, the sound pressure level of the sound contained within that band.

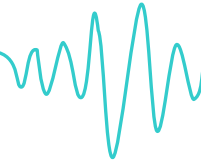
## **Outdoor-Indoor Transmission Class (OITC)**

A single number rating used to compare the sound insulation properties of building façade elements. This rating is designed to correlate with subjective impressions of the ability of façade elements to reduce the overall loudness of ground and air transportation noise.

## **Peak Sound Level ( $L_{pk}$ )**

The maximum instantaneous sound level during a stated time period or event.



**Pink Noise**

Noise that has approximately equal intensities at each octave or one-third-octave band.

**Point Source**

A source that radiates sound as if from a single point.

**RC Curves (Room Criterion Curves)**

A system for rating the noisiness of an occupied indoor space. An actual octave-band spectrum is compared with a set of standard RC curves to determine the RC level of the space.

**Real-Time Analyzer (RTA)**

An instrument for the determination of a sound spectrum.

**Receptor**

A person (or persons) or equipment which is affected by noise.

**Reflected Sound**

Sound that persists in an enclosed space as a result of repeated reflections or scattering. It does not include sound that travels directly from the source without reflections.

**Reverberation**

The persistence of a sound in an enclosed or partially enclosed space after the source of the sound has stopped, due to the repeated reflection of the sound waves.

**Room Absorption**

The total absorption within a room due to all objects, surfaces and air absorption within the room. It is measured in Sabins or metric Sabins.

**Slow Response**

A setting on the sound level meter that determines how measured sound levels are averaged over time. A slow sound level is more influenced by sounds occurring in the distant past than the corresponding fast sound level.

**Sound**

A physical disturbance in a medium (e.g., air) that is capable of being detected by the human ear.

**Sound Absorption Coefficient**

A measure of the sound-absorptive property of a material.

**Sound Insulation**

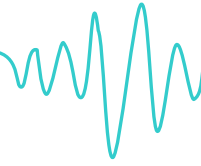
The capacity of a structure or element to prevent sound from reaching a receptor room either by absorption or reflection.

**Sound Level Meter (SLM)**

An instrument used for the measurement of sound level, with a standard frequency-weighting and standard exponentially weighted time averaging.

**Sound Power Level**

A physical measure of the amount of power a sound source radiates into the surrounding air. It is measured in decibels.

**Sound Pressure Level**

A physical measure of the magnitude of a sound. It is related to the sound's energy. The terms sound pressure level and sound level are often used interchangeably.

**Sound Transmission Class (STC)**

A single number rating used to compare the sound insulation properties of walls, floors, ceilings, windows, or doors. This rating is designed to correlate with subjective impressions of the ability of building elements to reduce the overall loudness of speech, radio, television, and similar noise sources in offices and buildings.

**Source Room**

A room that contains a noise source or sources

**Spectrum**

The spectrum of a sound wave is a description of its resolution into components, each of different frequency and usually different amplitude.

**Tapping Machine**

A device used in rating different floor constructions against impacts. It produces a series of impacts on the floor under test, 10 times per second.

**Tone**

A sound with a distinct pitch

**Transmission Loss (TL)**

A property of a material or structure describing its ability to reduce the transmission of sound at a particular frequency from one space to another. The higher the TL value the more effective the material or structure is in reducing sound between two spaces. It is measured in decibels.

**White Noise**

Noise that has approximately equal intensities at all frequencies.

**Windscreen**

A porous covering for a microphone, designed to reduce the noise generated by the passage of wind over the microphone.