



# Big Sky Acoustics

December 23, 2020

Mr. Ken Stoeber  
TMC, Inc.  
PO Box 69  
Belgrade, MT 59714

**Re: Amendment #2 Morgan Family LLC Site  
Noise Monitoring Report – December 11, 2020  
BSA Project #20174**

Dear Ken:

Attached is the Noise Monitoring Report for the December 11, 2020 compliance monitoring for the Morgan Family LLC Site Amendment #2 operations. No noise level exceedances were measured during the Week 1 stripping and berm construction activities.

If you have any questions or comments, please do not hesitate to call (406) 457-0407 or email me at [sean@bigskyacoustics.com](mailto:sean@bigskyacoustics.com).

Sincerely,



Sean Connolly, INCE Bd. Cert.  
BIG SKY ACOUSTICS

cc: Pat Eller/Morrison-Maierle

## Noise Monitoring Report Field Date: Friday, December 11, 2020

### 1.0 Noise Level Monitoring Methodology

Sean Connolly (INCE Bd. Cert.) of Big Sky Acoustics (BSA) conducted the measurements and field observations. The monitoring was conducted per the requirements listed in *Amendment #2 Morgan Family LLC Site, Environmental Noise Study – Revision 3, Appendix C-Noise Monitoring Plan* (BSA 2020). Measurements were completed according to the American National Standards Institute (ANSI) Standard S12.9-2013/Part 3 (R2018), *Quantities and Procedures for Description and Measurement of Environmental Sound – Part 3: Short-term Measurements with an Observer Present* (ANSI 2018).

**Equipment and Measurement Locations** Property access was arranged by TMC. Noise level measurements were completed at the worst-case locations shown on the attached **Figure 1**, which represent the closest east and south residences to the current Amendment activities (excluding Receptor R5 occupied by a part-owner of TMC).

#### 1. Measurement Location M1:

- GPS coordinates: 45° 36' 44" N, -111° 11' 17" W
- BSA Larson Davis Type 1 Sound Level Meter (BSA LD#1)
- Roland R-07 to record continuous audio
- In yard west of residence R6, south of southeast end of Amendment south berm, 144 feet south of Zachariah Lane centerline.
- Closest residence to south berm construction activities.
- Mic on tripod approximately 8 feet above ground surface (ags), standard 3" windscreen, case locked and left unattended. Equipment checked by BSA at 0740 and 1330 hours on 12/11/20, all OK.
- Measurement period – 1657 hours on 12/10/20 to 1803 hours on 12/11/20
- Calibration – Prior to measurement: 114.0. After measurement: 113.7

#### 2. Measurement Location M2<sub>Yr1-2</sub>:

- GPS coordinates: 45° 36' 57" N, -111° 10' 59" W
- BSA Larson Davis Type 1 Sound Level Meter (BSA LD#2)
- Roland R-07 to record continuous audio
- In field, midway between residences R2 and R4, east of Amendment east berm, approximately 367 feet east of Grey Wolf Trail centerline.
- Closest residences to Year 1 stripping area, east berm construction, and truck hauling.
- Mic on tripod approximately 8 feet ags, standard 3" windscreen, case locked and left unattended. Equipment checked by BSA at 0800 and 1345 hours on 12/11/20, LD#2 OK.
- At 0800 on 12/11 BSA discovered that external battery cable had not been fully inserted into the Roland R-07. It recorded until 2100 hours on 12/10. BSA restarted with an external battery at 0815 hours on 12/11.
- Measurement period – 1617 hours on 12/10/20 to 1824 hours on 12/11/20
- Calibration – Prior to measurement: 114.0, After measurement: 113.9

### 3. Weather Station:

- BSA Kestrel 5500 Weather Station
- Approximately 33 feet south of Measurement Location M2<sub>Yr1-2</sub>, in field mid-way between residences R2 and R4.
- Mounted on tripod approximately 7 feet ags.

**Weather** See weather graphs in **Attachment 1**. Temperature below freezing for entire measurement period. No wind was recorded above 11 mph, and no measurement data was removed by BSA due to weather exceedances. Light snow occurred on December 11<sup>th</sup> from:

- 1430 hours – light snow, not wet
- 1530 hours – snow started sticking to roads
- 1700 hours – snow continued, slowing traffic on US 191, icy road conditions
- 1800 hours – approximately 1-inch of snow on ground surface.

**Frequency** Worst-case 24-hour noise measurements during the Amendment activities are required **weekly** (one week = 5 work days) during Stripping and Berm Construction. Period for this monitoring is:

- Year 1, Week 1: December 8-14, 2020

**Background** Per Section 7.3.3(c) of ANSI S12.9-2013/Part 3 (ANSI 2018), BSA measured the background  $L_{eq}$  between 0600-0700 hours (before construction activities), during one 30-minute (minimum) mid-day break, and between 1700-1800 hours (after construction activities), to determine the ambient sound environment without the influence of TMC's equipment and operations. The measured  $L_{eq}(h)$  data were corrected for background sound representative of the time of day, including traffic. The corrected  $L_{eq}(h)$  data for each hour during Amendment activities was used to calculate the overall  $L_{eq}$  and  $L_{dn}$  values for comparison to the appropriate Permissible Noise Levels (**Section 3**).

**Adjustments** Measurement intervals corrupted by transient noises not associated with Amendment activities, such as aircraft flyovers, excessively barking dogs, residential activities, wind in excess of 11 mph, heavy precipitation, etc., and natural sounds (i.e., birds, insects, leaves rustling, etc. within 1,600 to 10,000 Hertz) were removed by BSA, and the  $L_{eq}(h)$  of the corrupted hour was recalculated according to ANSI S12.9-2013/Part 3 (ANSI 2018) (**Section 3**).

The background  $L_{eq}(h)$  data was adjusted by subtracting a 3 dBA uncertainty factor from the measured values according to Section 7.3.3(c) of ANSI S12.9-2013/Part 3 (ANSI 2018). The uncertainty factor was used since the measurements are intended to determine compliance.

For tonal noises detected during the Amendment activities (i.e., heard during the fieldwork or on the recorded data), BSA added 5 dB penalty to the measured  $L_{eq}$  according to Table 2 of ANSI S12.9/Part 4 (ANSI 2020). The penalty was applied to the measured  $L_{eq}(h)$  value before correcting for background, according to Annex B of ANSI S12.9/Part 3 (ANSI 2018) (**Section 3**).

## 2.0 Field Observations

**Onsite** TMC was stripping the Year 1 area (**Figure 1**), and concurrently constructing the east and south berms around the Amendment perimeter. On December 11<sup>th</sup>, the east berm was approximately 8 feet ags, and TMC was beginning the construction of the south berm. These activities began on Tuesday, December 8, 2020, occurring weekdays from 0700 to 1700 hours, and the bridge over the Farmers Canal, connecting the Amendment area to the existing Morgan Pit, had been completed. At night the construction equipment was stored in the existing Morgan Pit. No additional equipment (e.g., crusher, loaders, conveyors, etc.) were located or operated onsite.

On December 11<sup>th</sup>, the operations began at 0700 hours, all construction activities ceased for 45 minutes for lunch (1200 to 1245), and the operations ceased at 1700 hours. The TMC equipment operating during the measurements included two haul trucks and two excavators. All four pieces of equipment operated simultaneously and were equipped with broadband backup alarms. One excavator was stripping the north end of the Year 1 topsoil (near the bridge) and loading the two haul trucks. The trucks proceeded south along the inside of the east berm, dumping material along the berm. The other excavator was located on at southeast corner (approximately 541 feet north of Measurement Location M1 driveway), scraping the topsoil to start construction of the south berm, and proceeded west. At end of day, southeast berm was approximately 6 feet ags. The onsite operations are documented in the photos below.

### Onsite Operations – December 11, 2020

	
<p>Looking east from the north end of the Year 1 area at the stripping operations.</p>	<p>Looking north from Zachariah Lane at the haul truck dumping material along the east berm, the start of the south berm, and the trees TMC planted along the south boundary in Summer 2020.</p>

## Monitoring Locations

1. **Measurement Location M1:** The meter was located in the yard, due west of residence R6 and 144 feet south of Zachariah Lane centerline (**Figure 1**). This was the closest residence to south berm construction activities on December 11, 2020. The excavator was working directly north of the R6 driveway, and moving west while constructing the south berm. The excavator engine was the constant and dominant TMC noise source during the measurement period. The haul trucks transporting and dumping material along the east berm were intermittent TMC noise sources. The excavator stripping the topsoil in the Year 1 area was not audible. Ambient noise sources recorded at Measurement Location M1 included traffic on Zachariah Lane and US 191, aircraft, birds and residential activities. Measurement Location M1 is documented on December 11, 2020 in the below photo.



From Measurement Location M1, in the yard directly west of residence R6, looking north at Zachariah Lane and TMC's excavator constructing the south berm.

2. **Measurement Location M2<sub>Y1-2</sub>:** The meter was located in the field, midway between residences R2 and R4, east of Amendment east berm, and approximately 367 feet east of Grey Wolf Trail centerline (**Figure 1**). The location represents the closest residences to Year 1 stripping area, the east berm construction and truck hauling on December 11, 2020. Construction was occurring during the measurement at residence R3, located east of R2 and northeast of R4 (**Figure 1**). The home is being remodeled and an outbuilding (barn) is being constructed east of the residence, and a Genie Lift and other construction equipment (e.g., saw) were the audible noise sources during the measurement period. Other noise sources included traffic on US 191, TMC haul trucks and excavator movement (faint), aircraft, birds, dog barks (R2), and residential voices and activities. Measurement Location M2<sub>Y1-2</sub> is documented on December 11, 2020 in the photos on the next page.

	
<p>Looking west from Measurement Location M2<sub>Yr1-2</sub> at the east TMC Amendment boundary and berm construction.</p>	<p>Measurement Location M2<sub>Yr1-2</sub> and weather station looking south at residence R4.</p>
	
<p>Measurement Location M2<sub>Yr1-2</sub> and weather station looking north at residence R2.</p>	<p>Looking northeast from Measurement Location M2<sub>Yr1-2</sub> at residence R3 and construction activities.</p>

### 3.0 Measurement Results

**Permissible Noise Levels** that shall not be exceeded by the current Amendment activities at 12 residences and the cemetery shown on **Figure 1**, which excludes the owner/operator residences (Receptors R5 and R14). The Amendment activities that were occurring on December 11, 2020 are highlighted in **Table 1**, on the next page, and include Year 1 Berm Construction and Concurrent Stripping.

**Table 1: Permissible Noise Levels**

Amendment Year	Amendment Activity	Hours	Permissible Noise Level at Receptor	Guideline or Standard Notes (Tables 3-1, 3-2 & 3-3)	Reference
Years 1 – 4	Loading and Offsite Hauling only	0600 – 0700 Weekdays (acoustical nighttime hour)	$L_{eq}(1h)$ 45 dBA	Nighttime, outside at open bedroom window, to avoid sleep disturbance at residence	WHO 1999
Year 1 only	Year 1 Berm Construction and Concurrent Stripping	0700 – 1800 Weekdays	$L_{eq}(8h)$ 80 dBA	At adjacent residential land use	FTA 2018
			$L_{dn}$ 60 dBA	Marginally compatible occurrence during construction of noise attenuation berms at residential outdoor living area	ANSI 2017
Years 2 – 4	Stripping	0700 – 1800 Weekdays	$L_{eq}(11h)$ 50 dBA	At residential outdoor living area, to avoid moderate annoyance	WHO 1999
Year 1 Phase 1	Mining (without Crushing/Processing)				
Year 1 Phase 2 & Years 2 – 4	All Operations <sup>1</sup>				
Years 1 – 4	All Operations <sup>1</sup>	0700 – 1800 Weekdays	$L_{dn}$ 55 dBA	Compatible occurrence to protect public health and welfare in residential areas and other places where quiet is a basis for use	ANSI 2017
Years 1 – 4	Loading, Hauling and/or Maintenance only	0700 to 1700 Saturdays	$L_{eq}(10h)$ 50 dBA	At residential outdoor living area, to avoid moderate annoyance	WHO 1999

**Note:**

<sup>1</sup> All Operations = Mining + Crushing + Processing + Loading + Hauling + Maintenance with all equipment operating (worst-case conditions).

**Data Summary**

**Measurement Location M1:** BSA evaluated and adjusted the data per TMC’s Noise Monitoring Plan (BSA 2020), summarized in **Section 1**. Transient sounds removed from the data set included vehicle passbys on Zachariah Lane, BSA checking the sound level meter and locking the case, aircraft flyovers, geese, residents talking outside and snow shoveling.

A tonal noise penalty (5 dBA) was assessed by BSA for the excavator working the south berm. Based on the measured 1/3-octve band frequency spectrum and audio recorded at Measurement Location M1, the backhoe was making an audible “squeaking” sound throughout the day as it moved forward and backward, but not when it was rotating in a stationary location. The “squeak” was evident in the 1,250 Hertz band, and is tonal according to Annex C of ANSI S12.9/Part 4 (ANSI 2020). Since the tonal noise was due to Amendment activities, the 5 dBA penalty was added to each measured  $L_{eq}(h)$  during operating hours. To address this type of tonal noise for the equipment used during Amendment activities, BSA notified TMC on December 23, 2020 to properly lubricate the equipment to eliminate the tonal noise.

The  $L_{eq}(h)$  data was corrected for background sound (based on time of day), resulting in the Amendment activity noise levels. BSA used the corrected  $L_{eq}(h)$  data to calculate the overall  $L_{eq}$

and  $L_{dn}$  data during the operating hours (0700 to 1200 and 1300 to 1700 hours). The resulting overall  $L_{eq}$  and  $L_{dn}$  data results are less than the permissible noise levels of  $L_{eq}(8h)$  80 dBA and  $L_{dn}$  60 dBA, listed in **Table 1**. The Measurement Location M1 data results are summarized in **Table 2**.

**Table 2: Measurement Location M1  
Data Summary**

Start Time	Measured $L_{eq}(h)$	$L_{eq}(h)$ after Transient Data Deleted	Adjustments <sup>1,2</sup>	Adjusted $L_{eq}(h)$	$L_{eq}(h)$ minus Background	Background Correction per ANSI 2018	Corrected $L_{eq}(h)$
06:00:00	45.0	44.0	-3	41.0			
07:00:00	54.2	52.7	5	57.7	16.7	0.0	57.7
08:00:00	54.0	52.4	5	57.4	16.4	0.0	57.4
09:00:00	49.8	48.5	5	53.5	12.5	0.0	53.5
10:00:00	54.7	53.3	5	58.3	17.7	0.0	58.3
11:00:00	51.2	49.8	5	54.8	14.2	0.0	54.8
12:00:00	45.4	43.6	-3	40.6			
13:00:00	51.1	49.7	5	54.7	14.1	0.0	54.7
14:00:00	52.5	51.4	5	56.4	15.9	0.0	56.4
15:00:00	50.5	49.1	5	54.1	29.1	0.0	54.1
16:00:00	45.4	43.6	5	48.6	23.6	0.0	48.6
17:00:00	35.2	28.0	-3	25.0			
<b>Overall <math>L_{eq}</math>:</b>	<b>52.2</b>	<b>50.9</b>					<b>55.8</b>
<b>Calculated <math>L_{dn}</math>:</b>	<b>50.8 (24-hr)</b>	<b>46.6 (9-hr)</b>					<b>51.5 (9-hr)</b>

**Notes:**

- 1 3 dBA uncertainty factor subtracted from background  $L_{eq}(h)$  (**Section 1**).
- 2 5 dBA tonal penalty added to operating hours  $L_{eq}(h)$  (**Section 1**).

**Measurement Location M2<sub>Yr1-2</sub>:** BSA saved and observed the hourly and event sound level data before leaving the Measurement Location M2<sub>Yr1-2</sub> on December 11, 2020. When downloading the data to a computer, only the overall data for the entire measurement period was downloaded, without the hourly or event data needed to perform the adjustments and calculations according to the Noise Monitoring Plan (BSA 2020). The data file was deleted from the meter and unrecoverable. Weekly noise level measurements were also conducted during the berm construction and stripping operations on December 18, 2020, and BSA used a different sound level meter to complete those measurements.

The overall data that was downloaded is shown in **Table 3**, and includes the same overall data from Measurement Location M1 for comparison. The overall data shown in **Table 3** is the raw measured data, and does not include any adjustments for transient sources or corrections for background noise. As shown, even without those corrections, the measured  $L_{dn}$  44.9 dBA at Measurement Location M2<sub>Yr1-2</sub> is less than the permissible noise level of  $L_{dn}$  60 dBA listed in **Table 1**. The 15-hour  $L_{day}$  43.3 dBA level (between 0700 and 2200 hours) is also below the permissible noise level of  $L_{eq}(8h)$  80 dBA (**Table 1**). Since there were no exceedances at Measurement Location M1 (**Table 2**), and the measured Location M2<sub>Yr1-2</sub> data is less than the measured Location M1 data, there were no exceedances at Measurement Location M2<sub>Yr1-2</sub>.

**Table 3: Unadjusted Overall Measured Data at M1 and M2**

Location	Measurement times	L <sub>dn</sub>	L <sub>day</sub> (0700 to 2200 hours)	L <sub>night</sub> (2200 to 0700 hours)
M1	12/10/20, 1657 to 12/11/20, 1803	50.6 dBA	50.4 dBA	40.9 dBA
M2	12/10/20, 1617 to 12/11/20, 1824	44.9 dBA	43.3 dBA	36.7 dBA

**References**

American National Standards Institute (ANSI). 2020. *Quantities and Procedures for Description and Measurement of Environmental Sound – Part 4: Noise Assessment and Prediction of Long-Term Community Response*. ANSI/ASA S12.9-2005/Part 4 (R2020).

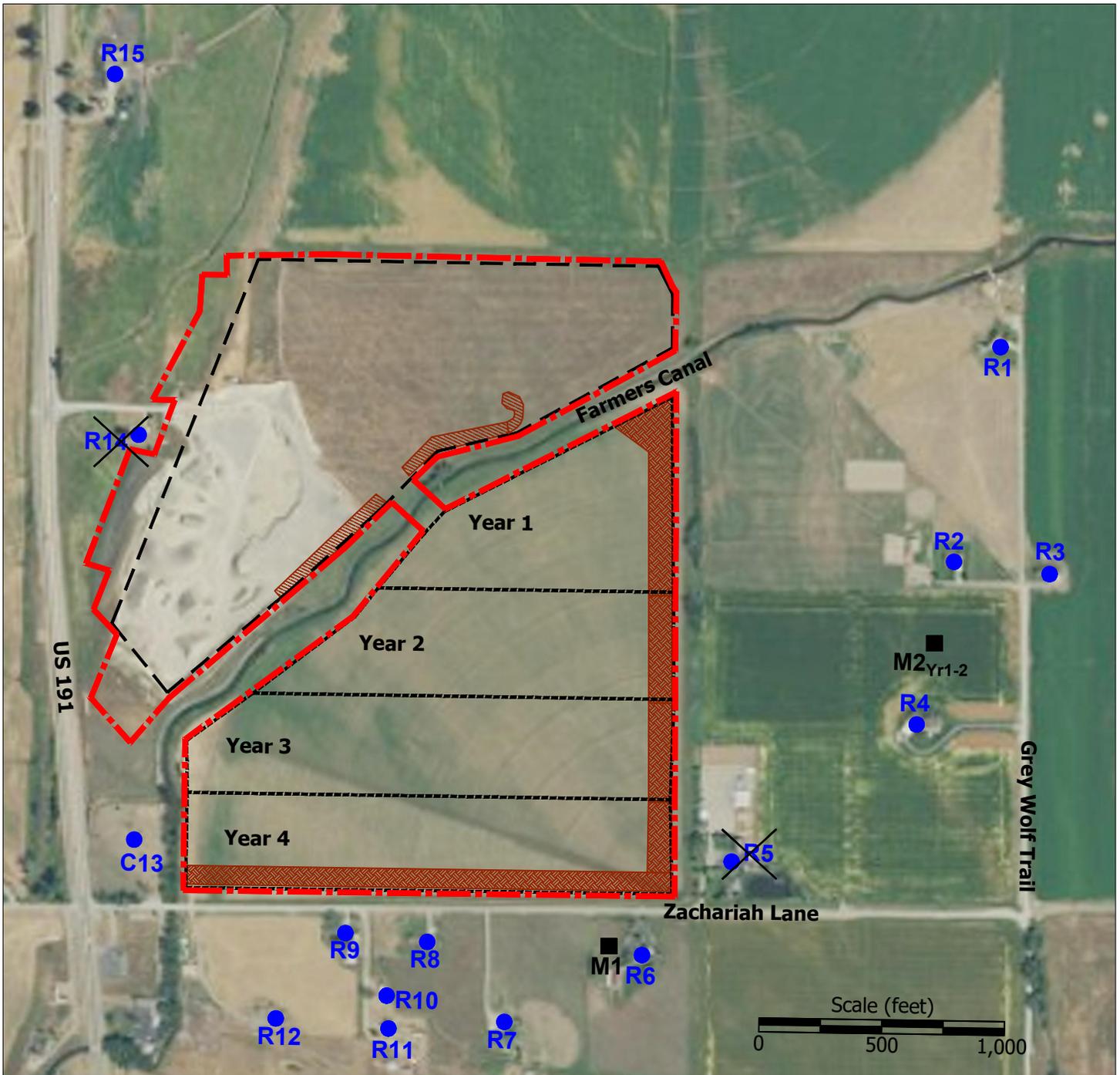
American National Standards Institute (ANSI). 2018. *Quantities and Procedures for Description and Measurement of Environmental Sound – Part 3: Short-term Measurements with an Observer Present*. ANSI/ASA S12.9-2013/Part 3 (R2018).

American National Standards Institute (ANSI). 2017. *Quantities and Procedures for Description and Measurement of Environmental Sound – Part 5: Sound Level Descriptors for Determination of Compatible Land Use*. ANSI/ASA S12.9-2007 (R2017).

Big Sky Acoustics (BSA). 2020. Amendment #2 Morgan Family LLC Site Environmental Noise Study – Revision 3. October 21.

Federal Transit Administration (FTA). 2018. Transit Noise and Vibration Impact Assessment Manual. FTA Report No. 0123. September.

World Health Organization (WHO). 1999. Guidelines for Community Noise.



- - - Boundaries
- - - Existing Morgan pit
- - - Amendment Area (by year)
- Existing berm
- Receptor location
- Noise monitoring location
- Future berm 12 ft above existing grade
- ⊗ Owner/operator residence



**FIGURE 1**

Amendment Area

Noise Monitoring Locations: 12/11/20

TMC Morgan Family LLC Amendment

# ATTACHMENT 1

