Hanson Aggregates New York LLC

SOUND LEVEL AND ATTENUATION ANALYSIS
FOR
HONEOYE FALLS QUARRY
PROPOSED EXPANSION
TOWNS OF AVON & RUSH
LIVINGSTON & MONROE COUNTIES
MLR #80030

PREPARED FOR:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
REGION 8
6274 EAST AVON-LIMA ROAD
AVON, NY 14414-8519

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May 1, 2012
***Rev.1,* November 18, 2013**
***Rev. 2,* May 15, 2015**
Rev. 3, February 2, 2016

Table of Contents

Tables

Appendices

1.0 INTRODUCTION

Hanson Aggregates New York LLC (Hanson) proposes to add approximately 63.6 acres to the current life of mine at the Honeoye Falls Quarry. The proposed expansion is necessary to allow the facility to remain in business and continue to meet the local demands for construction aggregates. A sound level and attenuation analysis was performed to evaluate the potential sound level increase at adjacent residences (Receptors) related to the proposed expansion of the Honeoye Falls Quarry. This report details the results of the noise impact study.

Currently, approximately 429 acres of land have been permitted to mine by the New York State Department of Environmental Conservation (NYSDEC) since 1975. The quarry has been in operation since 1959. No changes to the method of mining are proposed in this modification. The processing plants will remain in their current locations within the permitted area. Hanson will continue to use the existing entrance to the facility from Honeoye Falls No. 6 Road.

Hanson proposes to extend the limits of mining further into parcels of land it owns to the west of the currently permitted facility. To do so, Hanson must apply to the NYSDEC for a modification to its current Mined Land Reclamation permit. The following *Sound Level and Attenuation Analysis Report* has been prepared in support of the application to modify the mining permit. The analysis of potential noise impacts was performed using the NYSDEC Program Policy, “Assessing and Mitigating Noise Impacts” (DEP-00-1).

1.1 SITE DESCRIPTION

Hanson currently operates a consolidated limestone quarry at 2049 Honeoye Falls No. 6 Road, Honeoye Falls, NY 14472, approximately 2 miles west of the Village of Honeoye Falls. Hanson owns and leases approximately 594.6 acres of land at the subject site, which is located in both Monroe and Livingston Counties. The area of proposed expansion is currently used primarily for agricultural purposes, with some areas containing wooded land. No houses or other structures are within the project area. Nearby land-uses are agriculture, undeveloped woodland, and residential. The expansion area is on the east side of Oak Openings Road, approximately 0.3 miles southeast of the intersection of Oak Openings Road and Honeoye Falls No. 6 Road. The project area is within both the Towns of Rush and Avon.

Limestones of the Onondaga Formation are quarried and processed for use as construction aggregate. The current quarrying operations will continue as they are presently performed in the permitted area. Operations within the proposed expansion area will include: removal and staging of overburden (in berms); drilling, blasting, and breaking; and loading and hauling of “shot rock.” No processing of aggregate will occur in the proposed expansion area.

Removal of overburden is necessary to expose the limestone deposit. To minimize environmental disturbance, overburden is removed only in the area to be prepared for drilling and blasting. The overburden is used to construct berms around the perimeter of the excavation area to provide noise attenuation, visual screening, a safety barrier, and for stormwater control.

2.0 METHOD OF MINING AND PROCESSING

2.1 CURRENT MINING AND PROCESSING METHODS

Mining is conducted using standard quarrying practices as follows:

- Overburden in the form of topsoil, subsoil and loose rock is removed using an excavator, loader and/or a bulldozer and is stock-piled or formed into berms along the perimeter of the quarry.
- Holes are drilled in the competent rock in predetermined patterns set by a licensed blaster.
- Blasting agents are loaded into the holes and detonated to fracture the rock.
- If necessary, a hydraulic rock-breaker is used to fracture the shot rock into smaller pieces.
- Front-end loaders or excavators load the fractured rock into haul trucks for transfer to the processing plant for crushing and sizing.
- Fractured stone is processed at the Main Processing Plant and Crusher Run Plant located toward the center of the site and/or, is processed at a portable crushing and screening plant used throughout the existing quarry.
- Commercial trucks are loaded by front-end loader or equivalent within the processing plant and stockpile area as well as within the quarry. Processed stone is also moved by loader and/or haul truck to the two hot-mix asphalt plants located toward the southwestern portion of the site.

2.2 EXPANSION AREA MINING AND PROCESSING METHODS

Mining is to be conducted within the expansion area using the same methods as listed above. The current locations of the primary crusher, crusher-run plant, and other processing equipment are to remain the same. No changes to the location or method of mining, or production operations are proposed.

3.0 SOUND LEVELS

Sound levels were measured to record the ambient levels around the perimeter of the quarry and to determine the sound levels of equipment used during mining activities. Sound monitoring was performed in accordance with applicable methods specified in ASTM E-1780, *Standard Guide for Measuring Outdoor Sound Received from a Nearby Fixed Source.* Casella CEL 480 Type 2 Integrating and Logging Sound Level Meters were used to monitor the ambient and equipment sound levels. Measurements were taken using the A weighted scale[1]. A listing of the measured results of each test conducted to determine ambient sound levels and equipment sound levels is attached in Appendix I of this report.

3.1 AMBIENT SOUND LEVEL RESULTS

Ambient sound levels were determined at four (4) points within or around the proposed expansion area as shown on the Acoustic Study Map in Appendix II of this report. Ambient monitoring points

[1] The use of weighting filters such as the A-weighted filter is a simplified technique used to account for dependence of perceived loudness upon frequency (Rau & Wooten, 1980). The A-weighted filter is most commonly used in measuring environmental noise. Generally speaking, the A-weighted filter conforms approximately to the response of the human ear.

were selected based on their proximity to Receptors relative to the proposed expansion area and accessibility. The ambient points were centrally located near several groups of residences to obtain the general ambient levels expected in the vicinity of each group.

Ambient Point #1 was located in the northernmost portion of the proposed area, approximately 850-feet from the closest residence to the north. Ambient Point #2 was located along the western perimeter of the proposed expansion area, approximately 330-feet from the nearest residence to the west. Ambient Point #3 was located to the southwest of the proposed expansion area, approximately 150 feet east of Oak Openings Road, approximately 430-feet from the closest residence. Ambient Point #4 was added at the request of NYSDEC, after the initial round of ambient sound level measurements, to provide an additional representative ambient sound level in the vicinity of the residences to the north. This point was located next to a swimming pool in the back yard of a residence located approximately 875-feet north of the proposed expansion area (1815 Honeoye Falls No. 6 Road).

All of the approximate locations of the ambient monitoring points used in the "Sound Level and Attenuation Analysis" were reviewed with and agreed upon by NYSDEC Region 8 staff from the Division of Minerals, as well as the Division of Permits prior to commencing the noise monitoring study, and follow-up ambient sound monitoring.

Ambient sound levels were measured at the above monitoring points during a full shift (minimum) of normal daytime operations. Refer to the Acoustic Study Worksheets in Appendix I for environmental conditions.

The recorded Equivalent Sound Levels[2] for the four (4) ambient points are as follows:

Equivalent Sound Level [decibels (dBA)]

Ambient Point #1:	**54.9 dBA**
Ambient Point #2:	**52.0 dBA**
Ambient Point #3:	**49.5 dBA**
Ambient Point #4:	**49.4 dBA**

Although the four ambient points have the same land use (i.e., rural residential and agriculture, adjacent to mining), Ambient Point #1 is slightly higher. This is likely due to Ambient Point #1 being the closest monitoring location to the Crusher Run Plant, approximately 1,950 feet way; and the primary aggregate processing plant, approximately 2,550 feet away. Ambient Point #2 and Ambient Point #3, are progressively further from the processing areas. Although Ambient Points #2 and #3 are further away, they are closer to the road than Ambient Point #1. Ambient Point #4 is the furthest from the existing processing plant, and had the lowest ambient sound level. This ambient monitoring point was located in the backyard of a nearby resident, next to a swimming pool. The yard was surrounded by mature woods.

This diversity of ambient point locations provides a good representative sampling of the ambient noise within the vicinity of the proposed modification area, accounting for both road noise and the existing quarry operation, as well as other area noise sources (e.g., agricultural activity).

For the purposes of assessing potential noise impacts upon Receptors to the north of the proposed expansion area, Ambient Point #4, the lowest of all ambient measurements was used. To provide additional perspective on the potential noise impacts upon northern Receptors, the average of both

[2] As stated in the New York State Department of Environmental Conservation Program Policy "Assessing and Mitigating Noise Impacts": Equivalent Sound Level (L_{eq}) is an expression of overall sound. L_{eq} assigns a single value of sound level for a period of time in which varying levels of sound are experienced over that time period. The L_{eq} value provides an indication of the effects of sound on people. It is also useful in establishing the ambient sound levels at a potential source.

northern ambient points (#1 and #4), 52.2 dBA, was also used to fully characterize potential noise impacts on Receptors to the north. For perspective, additional analysis of potential noise impacts at the closest Receptor (#6R), the average of ambient noise measurements (52.1 dBA) from ambient points #1, #2, and #4, which surround this Receptor, are also presented. For noise impacts to the east and south, ambient points #2 and #3 provide accurate characterizations of existing noise levels at Receptors in these directions.

3.2 RECEPTOR LOCATIONS

For the purposes of this study, every adjacent residence located at properties along the perimeter of the proposed expansion area was selected as a Receptor. The receptor locations are consistent with DEP-00-1 which states that receptor locations may be "at the location of use or inhabitance on adjacent property." In line with the NYSDEC guidance document, the calculations were based on distances to "locations of use" such as swimming pools, backyards, etc., wherever practical.

There are nine (9) adjoining residential properties to the north and west of the proposed modification area. These are identified herein and on the "Acoustic Study Map" (Appendix II) as "R1" through "R9." The two closest residential Receptors are approximately 246-feet north ("R6") and 557-feet west ("R7"). The next closest Receptor ("4R") is approximately 851-feet away, and the remaining four residences ("1R," "2R," "3R," and "5R") are approximately 1,000-1200-feet away. Two distant Receptors ("8R" and "9R") to the southwest were included in the noise impact evaluation and are greater than 2,000 feet away. The anticipated worse-case sound levels at each representative "location of use" attributed to the proposed expansion were calculated and are included in this analysis. The calculated sound levels were then compared to the levels found at the representative ambient monitoring point(s).

Based on comments verbally received from the NYSDEC on the revised *Sound Level and Attenuation Analysis Report,* dated November 18, 2013, the projected noise levels at Receptors were calculated at exterior areas of occupancy (e.g., pools, back yard, etc.), if closer, rather than the residence. Using these exterior locations as outdoor Receptor points, is a conservative approach since Americans spend approximately 90% of their time indoors (USEPA, 1989).

3.3 EQUIPMENT SOUND LEVEL RESULTS

Sound levels produced by the actual equipment typically operated at the Honeoye Falls plant that will be used within the expansion area were measured. Each piece of equipment was measured at two or three locations around each apparatus while being used normally. Since the crushers and processing equipment will remain in their current locations (i.e., not within the proposed modification area), these were not individually monitored but are accounted for in the ambient sound measurements and equipment sound measurements as background noise.

The measured Equivalent Sound Levels for the equipment are summarized in Table 3-1 below.

Table 3-1, Equipment Sound Level Measurements
Hanson Aggregates New York LLC – Honeoye Falls Quarry

Equipment	Equivalent Sound-Level (L_{eq}) Results (dBA)		
Ingersoll-Rand Drill-Rig Model T4BH (Cummins 700 hp engine, 1250 cfm: 350 psi compressor; two 25' drill steel lengths (50' hole), Halco Dominator 600 down hole drill hammer)	Driver/Cab (Left) Side: 90.3 dBA @ 50 ft. Avg: 87.6 dBA	Front Side: 84.2 dBA @ 50 ft.	Fan (Right) Side: 88.5 dBA @ 50 ft.
Loader and Haul Trucks Loader: CAT 990 9.5 cuyd bucket Haul Trucks: (2) CAT 773D 50 ton (1) Hitachi-Euclid EH1100 60 ton *Note: CAT 330C rock breaker also working in pit, approx. 150'-175' behind meter.	Loader Side: 79.2dBA @ 100 ft.	Haul Truck Side: 74.3 dBA @ 100 ft. 80.6 dBA @ 50 ft.	---
Loader and Haul Trucks Loader: CAT 988H 8.5 cuyd bucket Haul Trucks: (1) CAT 773D 50 ton (1) Hitachi-Euclid EH1100 60 ton	Loader Side: 72.6 dBA @ 100 ft.	Haul Truck Side: 70.0 dBA @ 100 ft.	---
CAT 330C Hydraulic Excavator with Rock Breaker *Note: Loader and haul trucks also working in pit, approx. 50' from rock breaker.	Driver's Side: 78.3 dBA @ 100 ft. from point of operation	---	---

Based on the sound-level measurements recorded on the mobile equipment to be operated within the proposed expansion area, the noise produced by the drill-rig (Ingersoll-Rand Drill-Rig Model T4BH) operation was the loudest of all equipment typically operated at the quarry. Even though the drill-rig is used intermittently for brief periods during mining operations, this equipment was selected as the reference noise Source for the purposes of calculating anticipated worse-case sound levels at Receptor locations. For an estimate of the potential worse-case noise impacts from typical on-going operations to be performed in the proposed expansion area, the noise perceived at Receptors that is produced by a loader and haul truck (80.6 dBA), operating near the quarry perimeter, was also calculated. This estimate is considered to be "worse-case" since the operation of mobile equipment will be behind one or more quarry faces which are known to provide significant additional noise attenuation.

For the purposes of estimating sound levels generated by the drill-rig, the average of the three separate measurements was used. The reason the three measurements were averaged to obtain the most representative estimated noise level, is because the drill-rig is rarely ever continuously in the same position when drilling a blast hole pattern. The drill-rig will be pointed north, south, east, and west as needed to access the pre-determined blast holes to be drilled. Due to this normal fluctuation of the drill-rig positioning, the average sound level obtained from different sides of the drill-rig is most representative of the noise it produces. In general, the noisiest side (driver/cab) of the drill-rig is typically facing inward toward the quarry pit (and away from Receptors), whenever feasible, so the driver can monitor the proximity of the rig to the quarry face. Due to these factors, the average 87.6 dBA, is the most accurate estimate of drill-rig noise with respect to nearby Receptors.

To estimate sound levels generated by the combined operation of a loader and haul truck, the highest sound level, 80.6 dBA, from the mobile equipment monitoring study was used as a conservative estimate. It is noted that this measured sound level is the actual combined sound of a haul truck and loader as they operated normally loading out shot rock within the existing quarry.

3.4 NOISE EVALUATION

Since the majority of quarrying operations are performed behind quarry walls, which attenuate noise to levels that do not typically significantly increase ambient noise, the potential noise impacts considered in this evaluation are: 1) Noise from drill-rig operating at the quarry perimeter; 2) Noise from berm construction; and 3) Noise from typical quarry equipment (haul truck with loader). It is noted that noise from the drill-rig and berm construction are short-term and intermittent.

A worse-case scenario was used for the analysis of drill-rig noise. The noise from a drill-rig operating at the top elevation (i.e., not behind any quarry face), right at the perimeter of the proposed modification area boundary, was used in the calculation of projected noise at Receptors.

It is noted that both the drill-rig noise and berm construction sound, will be temporary, short-term, and intermittent. Almost all activities to occur within the proposed expansion area will be behind one or more quarry high-walls which will keep ambient noise levels consistent with existing levels. There is much literature that has shown that berms of 10-feet high or more can reduce sound pressure levels by 10-20 dBA.

4.0 ATTENUATION CALCULATION METHODOLOGY

Sound propagation outdoors is typically affected by several environmental factors that reduce, or attenuate, the sound pressure levels. These environmental factors include distance, elevations, barriers between the Source and Receptor, ground cover, land forms and structures, wind, temperature, humidity, and time of year. Each environmental factor will typically reduce the sound level at the Receptor by a large or small percentage.

For this analysis, attenuation values due to distance (wave divergence) and barriers, plus vegetation were calculated. Additional attenuation is likely to take place due to other conditions (e.g., wind, relative humidity, etc). These additional attenuation factors were not taken into account due to excessive variations and to prepare a conservative study (worse-case). It is also noted that the attenuation calculations are based on the noise source (e.g., drill-rig) operating at the top elevation (i.e., not behind a quarry face), right at the perimeter of the proposed expansion boundary. This scenario is a worse-case since the progression of the existing quarry into the proposed expansion area will generally be from east to west. Therefore, for almost the entire life of the quarry, drilling and quarry equipment operation will be behind a minimum 15-foot to 100-foot high face until the quarry approaches full build-out and drilling (intermittent) for the final benches occurs. This high rock wall will provide significant additional noise attenuation. As a conservative approach, however, the noise from the drill-rig and, haul truck and loader, while they operated above the high-wall was considered in this noise impact study. Therefore, the potential noise impacts from drill-rig operation discussed in this report are for this an extremely short-term activity. Likewise, the temporary noise from earth-moving equipment operating at the closest point relative to Receptors during initial berm construction was calculated. The noise of a haul truck and loader calculated in this assessment is conservative, since these will always be operated behind at least one quarry face, which will provide more noise attenuation.

4.1 WAVE DIVERGENCE

The sound pressure level generated by a noise source decreases with increasing distance from the source due to wave divergence (Rau & Wooten, 1980). It has been found that the decrease in sound pressure level over distance from any single noise source normally follows the “inverse square law.” That is, the sound pressure level changes in inverse proportion to the square of the distance from the sound source. Therefore, at distances greater than 50 feet from a sound source, every doubling of the distance causes a 6 dB reduction in sound from the source through a homogeneous loss-free atmosphere.

For this analysis the following equation provided in the Handbook of Environmental Acoustics (1994), by James P. Cowan, was used to determine the sound pressure level attenuation due to wave divergence (distance):

SPL_2 = Sound Pressure Level at Receptor
SPR_1 = Sound Pressure Level at Source
d_1 = Distance from Source to Sound Level Meter
d_2 = Distance from Source to Receptor

$$SPL_1 - [20 \times \log(d_2/d_1)] = SPL_2$$

4.2 Barrier Attenuation

As a condition of the mining permit, vegetated berms of varying heights will be constructed around the proposed expansion area as mining progresses into the proposed area. The berms will provide noise attenuation, as well as serve as a visual and safety barrier. Berm heights will vary as necessary to provide the required noise attenuation. Barriers such as berms, walls, hills, structures, etc., in the transmission path between a source of sound and the Receptor can provide a significant reduction in the level of noise at the Receptor. The noise is attenuated by diffraction of the sound waves as they pass over the top of the barrier causing a "sound shadow" on the opposite side of the barrier (e.g., berm). This diffraction is calculated using a Fresnel number, which is a calculation of attenuation. The following equation as provided by Cowan (1994) was used to calculate the applicable Fresnel number and associated sound level attenuation due to barriers (in this case the perimeter earthen berm) at Receptors surrounding the Honeoye Falls Quarry. It is noted that calculations in this noise analysis accounted for differences in elevation between Source and Receptor.

Step 1: Calculate the path length difference (m): $£ = d_1 + d_2 - d$

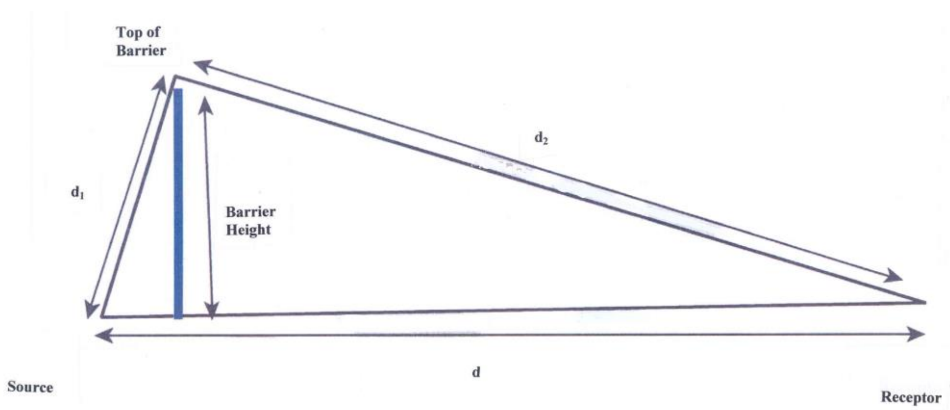


Diagram #1: Noise Barrier Geometry: The path d is called the line of sight between the source and receiver (Rau & Wooten, 1980).

Step 2: Determine the dimensionless Fresnel number N given by:

$$N = 2\,(d_1 + d_2 - d) \div \lambda$$

Where λ = the wavelength of the sound[3]. Having *N*, the sound attenuation (dB) caused by the barrier can be obtained from the curves shown in the figure below.

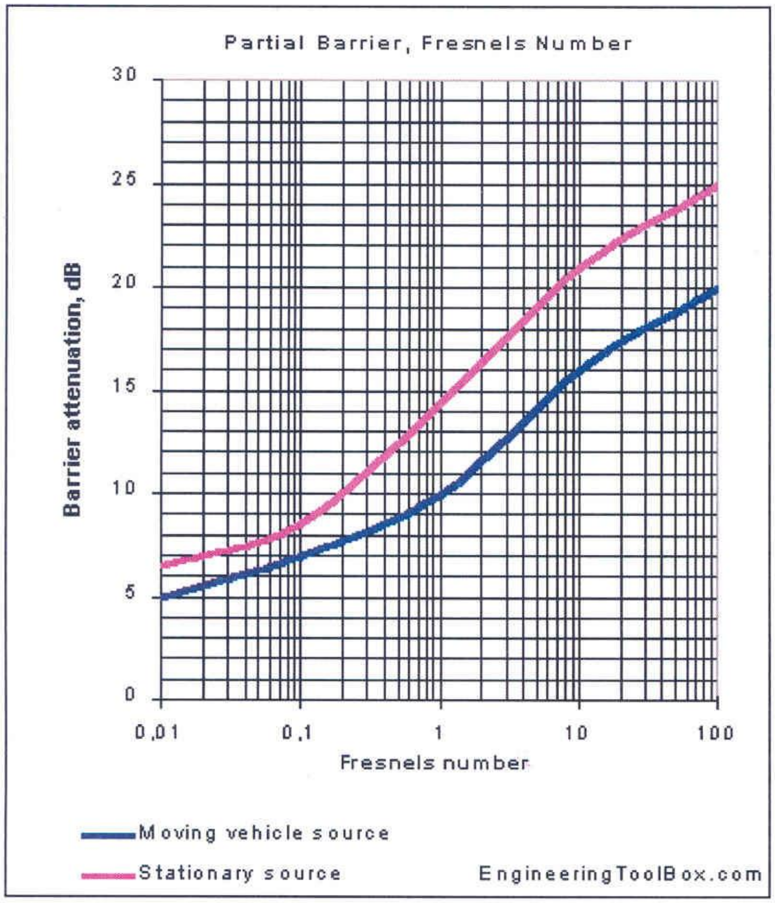


Diagram #2: Sound attenuation of an infinite barrier for a point source and line source as a function of Fresnel Number.

4.3 VEGETATIVE ATTENUATION

Vegetation (e.g. grass, shrubs, and trees) provides varying amounts of sound level attenuation depending upon type, nature of the ground surface, heights of source and receptor, etc. Even though variable, excess attenuation by vegetation that is at least 100 feet in depth is commonly assumed to reduce sound levels by at least 3 to 7 dBA.[4] There is abundant literature in support of vegetation attenuating noise by at least 3 dBA but, also more than 3 dBA. Numerous studies and acoustical references have shown that grasses and/or grasses and shrubs provide at least 3 dBA of noise attenuation, but often more than 3 dBA. These references and journals, include (but are not limited to) those listed below:

[3] For simplification in calculations, 500 Hz was used as the wavelength.

[4] "Assessing and Mitigating Noise Impacts, Program Policy #DEP-00-2, NYSDEC, September 16, 2008.

Crocker, M.J. and Kessler, F.M., 1975, *Noise and Noise Control,* CRC Press.

Lamancusa, J.S., July 20, 2009, Noise Control, Penn State University, p. 10.11

Rau, John G. and Wooten, David C., 1980: Environmental Impact Analysis Handbook, McGraw-Hill, Inc., pp. 4.14-4.32.

Onnu, Michael U., September 24, 2006: Modelling of Excess Noise Attenuation by Grass and Forest, *Nigerian Journal of Physics, pp. 197-202.*

A study by Per Bolund and Sven Hunhammar from Stolkholm University published in the journal, *Ecological Economics,* states that "A soft lawn, rather than concrete pavement, decreases the [sound] level by another 3 dB(A)." As a conservative estimate, however, the lower vegetative screening attenuation of 3 dBA was used in the calculations of total sound levels at the Receptors included in this study, except for a few instances where there was extensive lengths of wooded area far greater than 100-feet. There are more than 100-feet of vegetation in between the potential noise sources and Receptors in all instances, even after the barrier's noise shadow is considered, as described in Section 4.2

The minimum 3 dBA value is recommended in NYSDEC's noise assessment guidance policy (Reference: footnote #4 above). The policy states that "It is best to be conservative and use the lower attenuation of 3 dBA for vegetation due to the variability of the effectiveness of vegetative screens as noise attenuators."

The "Acoustic Study Map" (Appendix II) identifies the vegetative conditions between Receptors and the project area. Site conditions were considered in the calculations and are indicated in the tables included as Appendix IV and Appendix V.

For comparison purposes, potential noise increases at Receptor locations were calculated without including the additional attenuation provided by vegetation. The results of these calculations are summarized in Section 6.2.3, as well as in Table III-B of Appendix III of this "Sound Level and Attenuation Analysis." These calculations are strictly hypothetical since the entire project area is surrounded by grasses, shrubs, and/or trees. They are meant to provide another frame of reference for considering potential noise impacts of the proposed action.

4.4 ATTENUATION BY QUARRY HIGH-WALL

The noise attenuation provided by a quarry high-wall has been previously measured at a similar Hanson quarry (see datasheet from Jordanville Quarry in Appendix I). The attenuation provided by a 35-foot quarry high-wall will keep noise at Receptors to at or near ambient levels. In this case, at the other similar Hanson quarry, the noise of a haul truck and loader was measured to be approximately 82.0 dBA. This sound was reduced to approximately 65.7 dBA when measuring the noise of this equipment standing approximately 10-15 feet from the edge of an approximate 35-foot high face. Based on these readings, the noise was attenuated by 16 dBA due to the 35-foot high quarry face. Similar attenuation by the quarry highwall(s) is expected within the proposed modification area, however, it was not included in this noise impact assessment as a conservative measure.

4.5 ATTENUATION CALCULATION RESULTS

Table 4-1 lists the attenuation calculation results considering the distance, barriers (berms), and vegetation between the Source (i.e., drill-rig) and Receptors. The Receptor and Source Numbers correspond to the Source and Receptor locations shown on the map included in Appendix I.

Attenuation calculations were completed for the closest residences (Receptors) to the perimeter of the proposed quarry expansion. Barrier heights were taken from the height of the berms as indicated on the Honeoye Falls Quarry Mining Plan Map included in the Amended Mined Land-Use Plan. Elevations and distances used to determine attenuation results are listed in Appendix III.

TABLE 4-1: NOISE ATTENUATION CALCULATION RESULTS

Receptor (R) and Source (S) Number	Sound Attenuation due to Distance (dBA)	Sound Attenuation due to Barrier (dBA)	Sound Attenuation due to Vegetation (dBA)[5]	Total Sound Attenuation (dBA)[5]
1R-1S	25.6	15.8	3 (0)	44.4 (41.4)
2R-1S	25.4	15.8	3 (0)	44.2 (41.2)
3R-2S	26.3	15.8	3 (0)	45.1 (42.1)
4R-2S	24.6	15.8	3 (0)	43.4 (40.4)
5R-3S	27.3	17	3 (0)	47.3 (44.3)
6R-3S	13.8	22.3	3 (0)	39.1 (36.1)
7R-4S	20.9	15.8	3 (0)	39.7 (36.7)
8R-5S	32.4	10	3 (0)	45.4 (42.4)
9R-6S	32.6	8	3 (0)	43.6 (40.6)

4.5.1 Worse-Case Scenario: Drill-Rig

As a worse-case scenario, the sound levels were calculated at the Receptors when considering the sound levels of a drill-rig operating at the uppermost elevation near the perimeter of the proposed modification area. The results are shown in Table 4-2 below.

TABLE 4-2: DRILL-RIG LOCATIONS: WORSE-CASE SOUND LEVEL CALCULATION RESULTS AT RECEPTORS

Receptor and Source Number	Sound Level of Source (dBA) (Drill-Rig)	Total Attenuation (dBA)	Ambient Sound Level at Receptor (dBA)(1)	Calculated Sound Level Increase at Receptor (dBA)(2)
1R-1S	87.6	44.4	49.4 (52.2)	+0.9 (+0.5)
2R-1S	87.6	44.2	49.4 (52.2)	+1.0 (+0.5)
3R-2S	87.6	45.0	49.4 (52.2)	+0.8 (+0.4)
4R-2S	87.6	43.4	49.4 (52.2)	+1.1 (+0.6)
5R-3S	87.6	47.3	49.4 (N.A.)	+0.5
6R-3S	87.6	39.1	49.4 (52.1)	+2.6 (+1.6)

[5] The minimum 3 dBA vegetative attenuation value is only included for areas extending at least 100-feet between source and receptor.

[6] For comparison, the total sound attenuation value in parentheses excludes the attenuation provided by vegetation (i.e., zero).

Receptor and Source Number	Sound Level of Source (dBA) (Drill-Rig)	Total Attenuation (dBA)	Ambient Sound Level at Receptor (dBA)(1)	Calculated Sound Level Increase at Receptor (dBA)(2)
7R-4S	87.6	39.7	52.0 (N.A.)	+1.4
8R-5S	87.6	45.4	49.5 (N.A.)	+0.7
9R-6S	87.6	43.6	49.5 (N.A.)	+1.1

Notes: (1) – Noise values shown in parentheses are an average of one or more nearby ambient monitoring points.
(2) – Calculated sound level increase shown in parenthesis based on average ambient noise value.

4.5.2 Common Quarry Scenario: Loader and Haul Truck

In comparison to the worse-case scenario presented in the previous section, the sound levels of common quarry operations, typical of on-going noise, were calculated at the Receptors when considering the sound levels of a haul truck and loader operating at the uppermost elevation near the perimeter of the proposed modification area. It is noted that this "common quarry" scenario is also a worse-case as the majority of quarry operations are conducted behind one or more quarry faces which provide further noise attenuation (not factored into the calculations). The results are shown in Table 4-3 below.

TABLE 4-3: COMMON QUARRY OPERATION: HAUL TRUCK AND LOADER SOUND LEVEL CALCULATION RESULTS AT RECEPTORS

Receptor and Source Number	Sound Level of Source (dBA) (Haul Truck & Loader)	Total Attenuation (dBA)	Ambient Sound Level at Receptor (dBA)(1)	Calculated Sound Level Increase at Receptor (dBA)(2)
1R-1S	80.6	44.4	49.4 (52.2)	+0.2 (+0.1)
2R-1S	80.6	44.2	49.4 (52.2)	+0.2 (+0.1)
3R-2S	80.6	45.0	49.4 (52.2)	+0.2 (+0.1)
4R-2S	80.6	43.4	49.4 (52.2)	+0.3 (+0.1)
5R-3S	80.6	47.3	49.4	+0.1
6R-3S	80.6	39.1	49.4 (52.1)	+0.6 (+0.4)
7R-4S	80.6	39.7	52.0	+0.3
8R-5S	80.6	45.4	49.5	+0.1
9R-6S	80.6	43.6	49.5	+0.2

Notes: (1) – Noise values shown in parentheses are an average of one or more nearby ambient monitoring points.
(2) – Calculated sound level increase shown in parenthesis based on average ambient noise value.

4.6 SOUND LEVEL CALCULATION METHODOLOGY

Assumptions made in calculating sound levels at the Receptors, when considering the sound levels of a drill-rig operating at the uppermost elevation near the perimeter of the proposed modification area, as well as equipment used at the quarry (haul truck and loader); attenuation due to distance, barriers, and vegetation; and the ambient sound levels near the residences at the perimeter of the quarry expansion, are listed below.

Several assumptions were made to finalize the calculations. (The results of the sound level calculations are summarized in Sections 6.1 and 6.2 of this report.)

1) Since the drill-rig creates the highest sound level for the mobile equipment used at the facility (Refer to Table 3-1), the average of the three measurements (87.6 dBA) around the Ingersoll-Rand T4BH was used as the worse-case "Source" sound level for mobile equipment.
2) A comparison to the worse-case scenario described in #1 above, was performed, using the actual measured noise of a haul truck and loader (operating together), 80.6 dBA, which is more typical of daily, on-going quarry operations than the worse-case scenario of the drill-rig.
3) The ambient sound level measurement closest to each "Receptor" was generally used in the calculations. For comparison purposes, two or more ambient sound levels were averaged together, where appropriate, based on the Receptors' locations.
4) For the "Source" sound level, a worse-case scenario of the drill-rig operating at the upper-most elevation directly at the site boundary, not behind any quarry face, was assumed. It is noted that mining operations inherently will create sound barriers since the expansion area will be opened in the east-southeastern portion, and progress north-northwesterly toward the Receptors. This progression will create sound attenuation by keeping the drill-rig behind the quarry faces as mining progresses for almost the entire life of mine. Drilling will only need to occur intermittently at the perimeter of the expansion area for a relatively brief period as the mine in the expansion area approaches full build-out.
5) When evaluating potential noise impacts from drill-rig operation, the minimal additive effect from multiple sound sources (e.g., drill-rig plus haul truck and loader operating behind the high-walls) is not applicable since only the drill-rig will operate at the top elevation. It is noted that a "worse-case" scenario of the loader and haul truck operating at the edge of the proposed expansion was used in the comparison calculations (even though this equipment will only operate behind one or more quarry faces).
6) The loader and haul truck would be operated behind a quarry face, once drilling and blasting have been completed, to create the working mine faces. Actual noise measurements (see Appendix I) taken at another Hanson quarry atop a working face while a loader and haul trucks operated below, showed that the noise was much less (i.e., 65.7 dBA) than that of the drill-rig (87.6 dBA) thereby not producing an additive effect. Therefore, it can be concluded that there will be no additive effect of the drill-rig noise combined with loader and haul trucks operating behind the quarry face and below the uppermost bench elevation.

5.0 ASSESSMENT OF NOISE IMPACTS DURING INITIAL BERM CONSTRUCTION

As described in Section 3.3 of the Draft Environmental Impact Statement, perimeter berms will be constructed around the perimeter of the proposed modification area as mining progresses. These berms will mitigate noise and visual impacts, as well as provide a safety barrier between the quarry and general public. In conjunction with progressing into "Phase 1," the construction of an earthen berm is anticipated to begin along the western edge of the proposed modification area. Along with stripping, construction of the perimeter berm will start in the southern end and proceed north-northwest along the western perimeter of the proposed modification area. (Refer to "Modification Area Phase Plan" in Appendix II of the Draft Environmental Impact Statement.) It is noted that a temporary safety berm, approximately 4-5 feet high, will be constructed where necessary along the top of the active quarry face(s) as mining progresses in phases within the proposed modification area.

Since berm construction will start in the southwestern corner of the modification area, at the point furthest away from the closest Receptors, the associated potential noise impacts will approach Receptors gradually. As shown on Figure 3, construction of the berm closest to Receptor "7R" will not begin until Phase 3 (approximately 10-15 years from approval of the proposed modification request). Correspondingly, construction of the western half of the northern berm, near Receptor "6R," is anticipated to begin during Phase 4 (approximately 15-20 years in the future).

An assessment of potential noise impacts during berm construction has been included in this study. The table provided as Appendix IV shows the estimated equipment noise perceived at Receptors during initial berm construction. The noise calculations summarized in Appendix IV are conservatively (worse-case) based on the projected cumulative noise from a bull dozer and haul truck operating at the edge of the proposed modification area closest to the nearest Receptor, before any berm construction has been completed. It is noted that, almost immediately, the calculated noise levels at Receptor locations will begin to decrease as the overburden is pushed into berms and the barriers gradually get higher, thereby providing noise attenuation. The table in Appendix V summarizes the attenuation provided by the berms as they are being constructed, at heights of 5-feet and 10-feet.

As shown in Appendix IV, the projected worse-case temporary maximum increase in noise levels above ambient conditions at nearby Receptors, during berm construction, are anticipated to generally be within a range of 2-6 dBA. This range is decreased even lower to approximately 2-4 dBA when compared to the applicable average ambient noise value. The exceptions are the two (2) residences that are closest to the proposed modification area. Appendix IV shows the temporary noise levels anticipated to be at these two (2) closest Receptors identified as "6R" and "7R." These residences are approximately 246-feet (north) and 557-feet (west), respectively. The temporary, intermittent noise increases at the closest Receptor ("6R") will vary as work is performed at various locations along the northern berm as it is being constructed. Most temporary maximum sound increases are anticipated to be between 2-9 dBA, with a highest temporary estimated sound level of 66.6 dBA. This would be a temporary maximum increase above ambient sound by 17.2 dBA or, a 14.4 dBA increase when compared to the average ambient noise value. It is noted that these values are absolute maximum worse-case, assuming no berms in between the equipment and the Receptor. These values will begin to decrease almost immediately, as the berm is being constructed.

Construction of the berms will be on-going, short-term, and intermittent. As overburden is removed to access the bedrock below, it will be moved and shaped to form the perimeter berms. The noise perceived at Receptors will rapidly decrease as the sound-dampening berm is constructed. The length of time it will take to complete the berms will depend upon business demands and operational considerations that determine how much stripping is required. As such, any potential noise impacts upon the two closest Receptors ("6R" and "7R") caused by earth-moving equipment will be intermittent, lasting approximately 1-2 weeks at a time every 1-3 years over an extended period ranging anywhere from 5-20 years. Correspondingly, the noisiest levels would only occur during the initial 4-5 day period when the berm construction is occurring at the point closet to the Receptors.

As shown on the "Acoustic Study Map," berm construction will start in the southernmost portion of the proposed modification area at the commencement of mining in Phase 1. The berm will be added to and proceed northwesterly, as overburden is stripped or relocated. It is anticipated that the southwesterly portion of the berm will be completed during Phase 1, however, construction could carry over into Phase 2 depending upon customer demands and operational considerations that determine how much stripping is required.

In general, segments of the perimeter berm will be completed in conjunction with specific phases as shown on the attached "Acoustic Study Map," as well as Figure 3 ("Modification Area Phase Plan") of the Draft Environmental Impact Statement. The western berm is anticipated to be completed in conjunction with mining in Phase 3. The western portion of the northern berm is anticipated to be constructed in conjunction with mining in Phase 4, with the eastern portion completed during Phase 5. Given the gradual north-northwesterly progression of the perimeter berm construction, any potential short-term noise impacts caused by the earth moving will not occur at Receptor "7R" until approximately 5-10 years following approval of the proposed modification. For Receptor “6R” (closest to the north berm), potential noise impacts would not occur until berm construction commences in conjunction with Phase 4, approximately 15-20 years from the commencement of mining in the proposed modification area. As mentioned previously, any noise impacts at these nearby Receptors will be temporary and intermittent while the berms are being constructed. Ultimately, the berms will serve as an additional noise barrier.

The estimated noise levels at “6R” and “7R” at various locations along the perimeter during construction of the northern and western berms were calculated. The calculated sound levels at Receptor “6R” range from 51.5 to 66.6 dBA, with the greatest noise increase occurring when berm construction is closest to the Receptor. It is noted that the maximum noise level at Receptor “6R” is expected to be very brief (approximately 3-5 days) while the berm is being constructed at the point closest to the Receptor. The noise will decrease to near ambient levels as the berm is built and ultimately finished. Refer to Appendices IV and V.

As previously mentioned, the proposed modification area is currently an active agricultural field. For comparison, noise at Receptor “6R,” from a typical farm tractor (Virginia Cooperative Extension, 2009) at its closest distance to Receptor “6R” would be approximately 62.5 dBA. (Refer to table in Appendix IV.) This maximum noise level from typical farming equipment currently operated within the modification area would be similar to the maximum noise level from earth moving equipment during initial berm construction. The estimated sound level increase at Receptor “6R,” from berm construction would be +17.2 dBA in comparison with the similar noise increase of a farm typical tractor at approximately +13.5 dBA.

The maximum projected noise at the next closest, Receptor “7R” (west), during initial berm construction is estimated to be lower than at “6R” since it is further from the perimeter of the proposed modification area. The calculated sound levels at Receptor “7R” range from 57.2 to 60.1 dBA, with the greatest noise increase occurring when berm construction is closet to the Receptor. (Refer to table in Appendix IV.) For comparison, noise from a typical farm tractor at its closest distance to Receptor “7R” is similar at approximately 55.0 dBA.

As mentioned above, any potential noise impacts upon the two closest Receptors (“6R” and “7R”) caused by earth-moving equipment will be intermittent, lasting approximately 1-2 weeks at a time every 1-3 years over an extended period ranging anywhere from 5-20 years. As previously stated, the noisiest levels would only occur during the initial 4-5 day period when the berm construction is occurring at the point closet to the Receptors.

5.1 Noise Attenuation By Partial Berms

As mentioned above, noise levels at Receptors from earth-moving equipment will begin to decrease as the berms are being formed. The table provided in Appendix V shows the calculated noise levels at the two closest Receptors, “6R” and “7R,” will decrease after the berms reach heights of 5-feet and 10-feet. The noise attenuation provided by the berm at 5-feet high reduces the approximate maximum noise increase at Receptor “6R” in half, bringing the level down from approximately 66.6 dBA to 58.5 dBA (compared to the worse-case Ambient Point #4 value of 49.4 dBA). Since Receptor “6R” is nearly equidistant between Ambient Points #1 (52.0 dBA), #2 (54.9 dBA), and #4 (49.4) a more accurate estimate of ambient noise at Receptor “6R” is the average of these three levels, 52.1 dBA. When compared to the average ambient level, the projected temporary maximum noise increase after the berm reaches 5-feet high would only be approximately 6.9 dBA at Receptor “6R,” as compared to a projected 14.4 dBA increase without any berm present (Appendix IV).

As shown in Appendix V, there will only be an approximate 2.7 dBA increase in noise above ambient at Receptor “7R” once the berm height reaches 5-feet high. Therefore, a 5-foot high berm would reduce the noise at Receptor “7R” from approximately 60.1 dBA (Appendix IV), when no berm is present, down to a projected 54.7 dBA with a 5-foot high berm.

There will only be a noise increase of +0.6 dBA at Receptor "7R" when the berm reaches 10-feet high. Therefore, a 10-foot high berm is projected to decrease the noise at Receptor "7R" from 60.1 dBA with no berm present, down to slightly above ambient at 52.6 dBA. Due to the close proximity of Receptor "6R," there will not be a noticeable additional decrease in sound level as the berm height increases from 5-feet to10-feet high.

The calculated noise attenuation provided by the final berm at all Receptors is provided in Appendix III (for drill-rig).

6.0 RESULTS

6.1 BERM CONSTRUCTION

Perimeter berms will be constructed in stages around the perimeter of the proposed expansion area as mining progresses from southeast to northwest. The length of time it will take to complete the berms will depend upon how much overburden needs to be stripped to access new bedrock. This is a function of business demands and operational considerations. Therefore, berm construction will not occur all at once for an extended amount of time.

These berms will provide mitigation of noise and visual impacts, as well as provide a safety barrier. As expected, there will be higher noise levels at Receptor locations before perimeter berms are constructed, during the actual berm construction activities. During initial construction of the berms, the projected noise level increases at nearby Receptors are anticipated to range between approximately 1.8 dBA-6.6 dBA, with the exception of the two (2) residences ("6R" and "7R") that are closest to the proposed modification area. These two Receptors are estimated to temporarily have maximum sound level increases ranging between 1.0-14.4 dBA, and 5.2-8.1 dBA, respectively, at the outset of berm construction closest to them.

Appendix IV shows the temporary noise levels anticipated to be at the nearby Receptors, including the two (2) closest Receptors identified as "6R" and "7R," during berm construction. Since berm construction will not occur all at once, and will be performed gradually when overburden is stripped as mining progresses north-northwest, potential noise impacts upon Receptors will be intermittent and short-term, lasting approximately 1-2 weeks at a time every 1-3 years over an extended time period (e.g., 5-20 years). The maximum noise increase will occur at the commencement of berm construction at the points closest to the two Receptors ("6R" and "7R") before any berm is present. Therefore, the greatest noise levels will only occur for several days until the section of berm closest to the Receptor is built to full height.

As shown on Figure 3 ("Modification Area Phase Plan") of the Draft Environmental Impact Statement, construction of the berm closest to Receptor "7R" will not begin until Phase 3 (approximately 10-15 years from approval of the proposed modification request). Correspondingly, construction of the western half of the northern berm, near Receptor "6R," is anticipated to begin during Phase 4 (approximately 15-20 years in the future).

Calculated maximum sound levels at receptors during berm construction generally range from 51.3 dBA to 56.0 dBA, except at the two closest Receptors. Estimated maximum sound levels during initial berm construction at the two closest Receptors, 6R and 7R, are 66.6 dBA and 60.1 dBA, respectively. As previously mentioned, these maximum sound levels would only be present temporarily for several days during initial berm construction at the points closest to the Receptors.

For comparison, the calculated maximum noise levels produced by a typical farm tractor, at the two closest Receptors are similar to the noise created during berm construction. The calculated maximum sound generated by a farm tractor at Receptors 6R and 7R, are 62.9 dBA and 55.0, respectively. It is also noted that all of the calculated temporary maximum noise levels resulting from initial berm construction, including the levels at the two closest Receptors, are all below the

67.0 dBA that is recommended by the Federal Highway Administration. (Refer to Section 7.0 below.)

6.2 Post-Berm Construction

An analysis of potential noise impacts after perimeter berms have been completed provides a more representative characterization of typical, long-term noise generated during normal quarry operations than during berm construction.

In this study, the noise produced by a drill-rig, the loudest of all equipment typically operated at the quarry, was used as the basis for calculating anticipated worse-case maximum sound levels at Receptor locations. As previously mentioned, the Receptor locations (where applicable) were the exterior occupancy points (e.g., pool, back yard). Even though the drill-rig is used intermittently during mining operations, this equipment was selected as the reference worse-case noise Source to provide for conservative noise impact evaluation. For comparison purposes, the worse-case noise from a drill-rig, after final berms have been constructed, was compared to the more typical noise of on-going quarry operations, from a haul truck and loader.

It is noted that the attenuation calculations are based on the equipment operating at the top elevation (i.e., not behind a quarry face), right at the perimeter of the proposed expansion boundary. This scenario is worse-case since the progression of the existing quarry into the proposed expansion area will generally be from east to west. Therefore, for almost the entire life of the quarry, drilling and operation of mobile equipment will be behind a minimum 15-foot to 100-foot high face until the quarry approaches full build-out and drilling (intermittent) for the final benches occurs. This high rock wall will provide significant additional noise attenuation sufficient enough to maintain ambient levels at Receptor locations.

The only potential noise impacts that could occur are when equipment is not operating behind the quarry faces, and below the topographic elevations of Receptors. Relative to the lifespan of the proposed modification area (approximately 30-50 years), the duration of potential noise impacts will be brief, lasting about one to three weeks.

It is noted that the maximum noise levels calculated at the nearby Receptors shown in Appendix III would only occur for approximately 3-4 days near the end of the approximate 30-50 year lifespan of the proposed modification area, while a drill-rig is operating at the closest point to a given Receptor. For nearly the entire lifespan of the proposed modification area, there will be no noticeable change in sound levels at Receptor locations since noise from mining activities will be attenuated by quarry high-walls and far below Receptors' elevations. The anticipated noisiest activity (i.e., drill-rig operating right at perimeter atop the closest bench) will be of a short duration (e.g., 4-5 days).

6.2.1 Drill-Rig Scenario Results

The expansion as indicated on the Honeoye Falls Quarry Mining Plan Map included in the Draft Environmental Impact Statement, and as indicated on the maps included in this report, will have the highest calculated sound level of 52.0 dBA (compared to 49.4 dBA ambient) at Receptor 6R, and 53.4 dBA at Receptor 7R (compared to 52.0 ambient), north and west of the proposed expansion area boundary. These two closest receptors excluded, the estimated maximum worse-case noise increases estimated to be produced by a drill-rig operating at the perimeter range between 0.5 dBA to 1.1 dBA.

The closest residence ("6R") is approximately 246-feet from the northwestern expansion area boundary. The calculated sound level at this Receptor, during intermittent drill-rig operation at the point closest, is 53.4 dBA (compared to 49.4 ambient). Therefore, the net sound level change at this closest Receptor will be ±2.6 dBA. This value is the highest calculated sound level change (temporary) at any Receptor. The ±2.6 dBA increase over the ambient sound level will be due to the loudest typical piece of equipment at the quarry (drill-rig) at the closest point adjacent to the residence. As a noise mitigation measure, the proposed excavation area boundary and berm will be set back 30-feet (approx.) further to the south in the northwestern portion of the proposed area to provide sufficient noise attenuation at the residence. Additionally, the final berm height will be the highest at approximately 28-feet, in this location to provide further noise attenuation at Receptor "6R."

The second-closest Receptor (7R), approximately 557 feet to the west of the proposed modification area, had a projected worse-case sound level increase of 1.4 dBA. As a noise mitigation measure, the berm in between this Receptor (7R) and the new mining area will be increased to 20-feet high.

As indicated in the table shown in Appendix III, the majority of sound level changes at Receptor locations during drill-rig operation near the end of the life-of-mine will be around 1 dBA. The 2.6 dBA (max.) increase at the closest Receptor ("6R") is less than 3-6 dBA, which the New York State Department of Environmental Conservation has determined to have no appreciable effect on Receptors (Reference: NYSDEC Program Policy, "Assessing and Mitigating Noise Impacts," February 2, 2001.)

6.2.2 Haul Truck & Loader Scenario Results

Noise from a haul truck operating in tandem with a loader is the most representative scenario for assessing potential long-term, on-going noise from typical daily quarry operations. (As compared to initial berm construction and drill-rig operation at the perimeter of the proposed expansion area.) This section of the report provides an evaluation of the potential noise impacts from typical quarry operations within the project area.

Expectedly, the calculated noise increases were the highest in the haul truck and loader scenario, at the two closest Receptors, 6R and 7R. The projected noise increases in this scenario were 0.6 dBA at Receptor 6R, and 0.3 dBA at Receptor 7R. It is noted that there was also a projected increase of 0.3 dBA at Receptor 4R (attributed to the elevation of the Receptor relative to the Source).

The calculated post-berm construction sound levels increases at all Receptors were all less than 3 dBA. Additionally, the calculated sound levels at all Receptor locations ranged between 50.2 dBA to 55.6 dBA. According to the NYSDEC Program Policy, an ambient noise level of ≤55 dBA is protective of public health and welfare.

As stated in the NYSDEC's "Assessing and Mitigating Noise Impacts" Program Policy (2001), increases ranging between 0-3 dBA above ambient sound levels should have no appreciable effect on Receptors since they are within the range in which most humans can not notice a change. Therefore, the minimal 2.6 (max.) dBA increase to the ambient sound level at one (closest) Receptor ("6R") near the expansion area for a very brief time is not be considered a significant impact.

All of the calculated noise increases at Receptors in the haul truck and loader scenario were far less than 3-6 dBA, which the New York State Department of Environmental Conservation has determined to have no appreciable effect on Receptors (Reference: NYSDEC Program Policy, "Assessing and Mitigating Noise Impacts," February 2, 2001.)

6.2.3 Results With Attenuation By Vegetation Excluded

The minimum attenuation value of 3 dBA for vegetation stated in the NYSDEC's Noise Policy was used in determining potential impacts at Receptors. The NYSDEC Noise Policy states that dense vegetation that is at least 100 feet in depth may reduce sound levels by 3 to 7 dBA. As mentioned in Section 4.3, vegetation of different types has been shown to provide a wide range of noise attenuation, often more than 3 dBA in published studies. As an additional conservative approach and, to eliminate subjectivity with regard to the interpretation of how much attenuation will be provided by the existing grasses, shrubs, and forest that surround the proposed expansion area, projected noise increases at Receptors were also calculated as if no vegetation was present.

The results from these calculations show that the greatest noise increase of +4.2 dBA (if no vegetation was present) would be at Receptor #6R during the temporary use of the drill rig at the perimeter of the proposed expansion area, when compared to the lowest ambient level of 49.4 dBA. When compared to the average ambient noise, the increase at Receptor #6R is projected to be +2.8 dBA if no vegetation was present. When compared to the noise from the operation of a loader and haul truck, the greatest sound level increase would be +1.2 dBA at Receptor #6R based on the lowest ambient noise (49.4 dBA), and +0.8 dBA if compared to the average ambient noise level.

Other than the above worse-case calculated increase of +4.2 (not including the attenuation provided by vegetation) at Receptor #6R, all of the calculated noise increases at Receptors were less than 3 dBA. This is a hypothetical scenario since the entire project area is surrounded by grasses, shrubs, and/or trees.

7.0 NOISE LEVEL GUIDELINES

Although no federal or state regulatory requirements specifically apply to the proposed action, there is regulatory guidance. In addition to the NYSDEC's DEP-00-1 program policy document ("Assessing and Mitigating Noise Impacts"), there are several federal agencies that have established certain criteria for acceptable noise levels for various land uses and development types, including the Federal Highway Administration (FHWA) and federal Department of Housing and Urban Development (HUD). The criteria range in specificity from classification, using quantitative levels (in dBA), to noise types based on time and duration.

The FHWA regulations (23 CFR Part 772) are presented as exterior and interior design levels, such as residential use, undeveloped land, etc. (Refer to Table 7-1.) According the FHWA regulations, "Procedures for Abatement of Highway Traffic Noise and Construction Noise," for activity in areas where "serenity and quiet" are especially important, an exterior design level of 57 dBA is recommended. For area with residences, motels, schools, churches, hospitals, etc., the FHWA recommends an exterior level of 67 dBA.

TABLE 7-1, FHWA NOISE ABATEMENT CRITERIA[1]

Activity Category	Design Noise Level (dBA)		Activity Description[2]
	L_{eq}	L_{10}	
A	57 (Exterior)	60 (Exterior)	Tracts where serenity and quiet are especially important
B	67 (Exterior)	70 (Exterior)	Residences, motels, schools, churches, hospital, etc.
C	72 (Exterior)	75 (Exterior)	Developed lands other than those above
D	52 (Interior)	55 (Interior)	Building interiors
(1) Source: 23 CFR Part 772 – Procedures for the Abatement of Highway Traffic Noise and Construction Noise.			
(2) Either L_{eq} or L_{10} can be used (but not both) may be used on a project. The L_{eq} or L_{10} Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.			

HUD has established a goal for *"normally acceptable"* noise conditions in its "Noise Assessment Guidelines" set forth under 24 CFR Part 51 – Environmental Criteria and Standards, Subpart B – Noise Abatement and Control. Under the HUD criteria, the outdoor noise should not exceed 65 dBA for a 24-hour period. Levels greater than 65 dBA but under 75 dBA for a 24 hour period are considered *"normally unacceptable,"* and usually require mitigative measures.

The NYSDEC's Program Policy – "Assessing and Mitigating Noise Impacts," (DEP-00-1) states:

> "c. Thresholds for Significant Sound Pressure Level (SPL) Increase
> The goal for any permitted operation should be to minimize increases in sound pressure level above ambient levels at the chosen point of sound reception. Increases ranging from 0-3 dB should have no appreciable effect on receptors. Increases from 3-6 dB may have potential for adverse noise impact only in cases where the most sensitive of receptors are present. Sound pressure increases of more than 6 dB may require closer analysis of impact potential depending on existing SPLs and the character of surrounding land use and receptors. SPL increases approaching 10 dB result in a perceived doubling of SPL. The perceived doubling of the SPL results from the fact that SPLs are measured on a logarithmic scale. An increase of 10 dBA deserves consideration of avoidance and mitigation measures in most cases. The above thresholds as indicators of impact potential should be viewed as guidelines subject to adjustment as appropriate for the specific circumstances one encounters."
>
> The NYSDEC program policy goes on to say, "In non-industrial settings the SPL should probably not exceed ambient noise by more than 6 dBA at the receptor. An increase of 6 dBA may cause complaints. There may be occasions where an increase in SPLs of greater than 6 dBA might be acceptable. The addition of any noise source, in a non-industrial setting, should not raise the ambient noise level above a maximum of 65 dBA."

To provide additional perspective on the potential noise from the proposed action, Diagrams #3 and #4 below show common noise sources and their respective sound levels in comparison to the projected maximum project noise. In general, the maximum noise levels potentially generated during the project (e.g., berm construction, mobile equipment operation) are within the range of sound of "normal speech." It is noted that the existing ambient levels are within the "moderate" characterization depicted in Diagram #4, and that the projected noise from the proposed project are also characterized as "moderate."

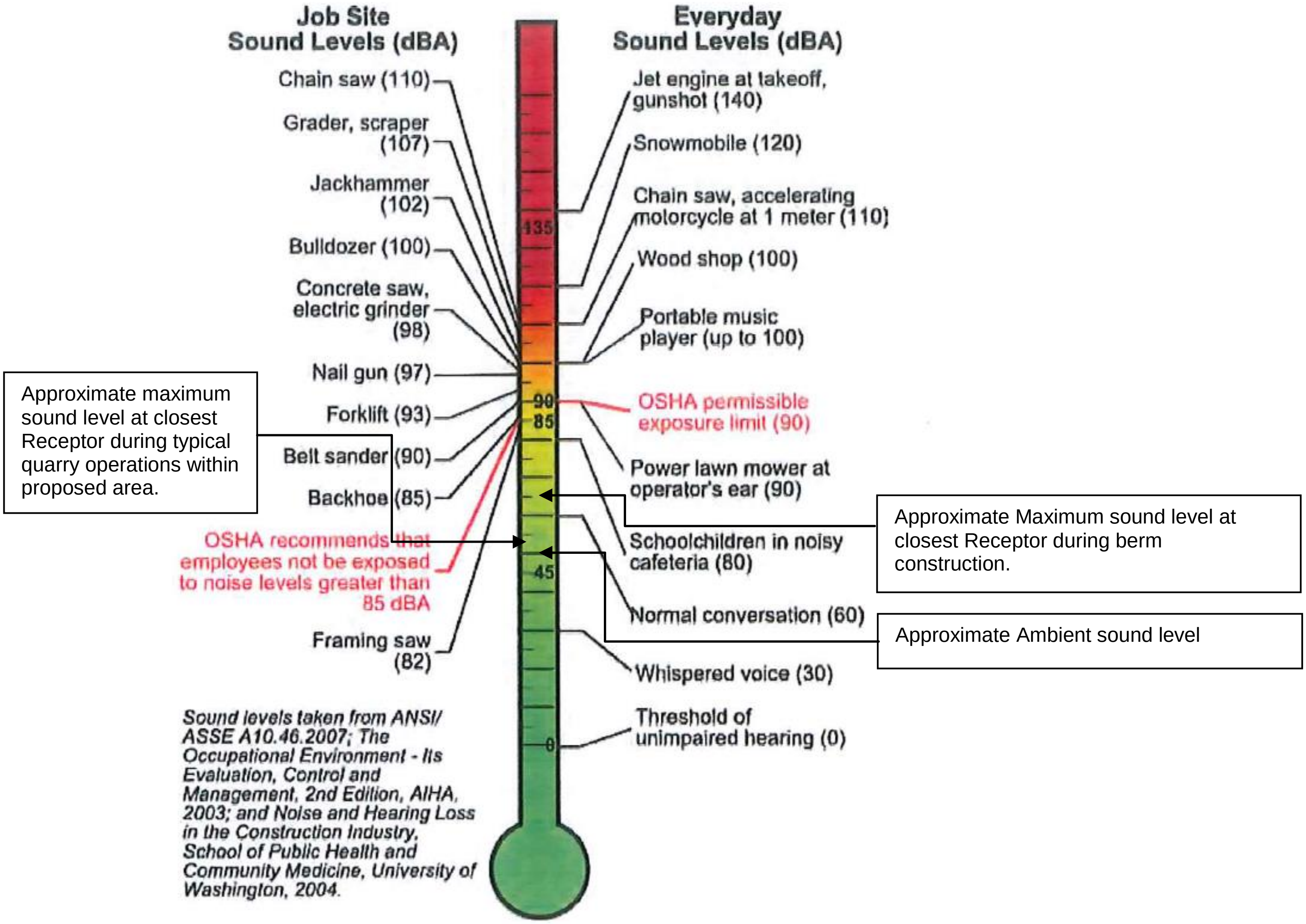
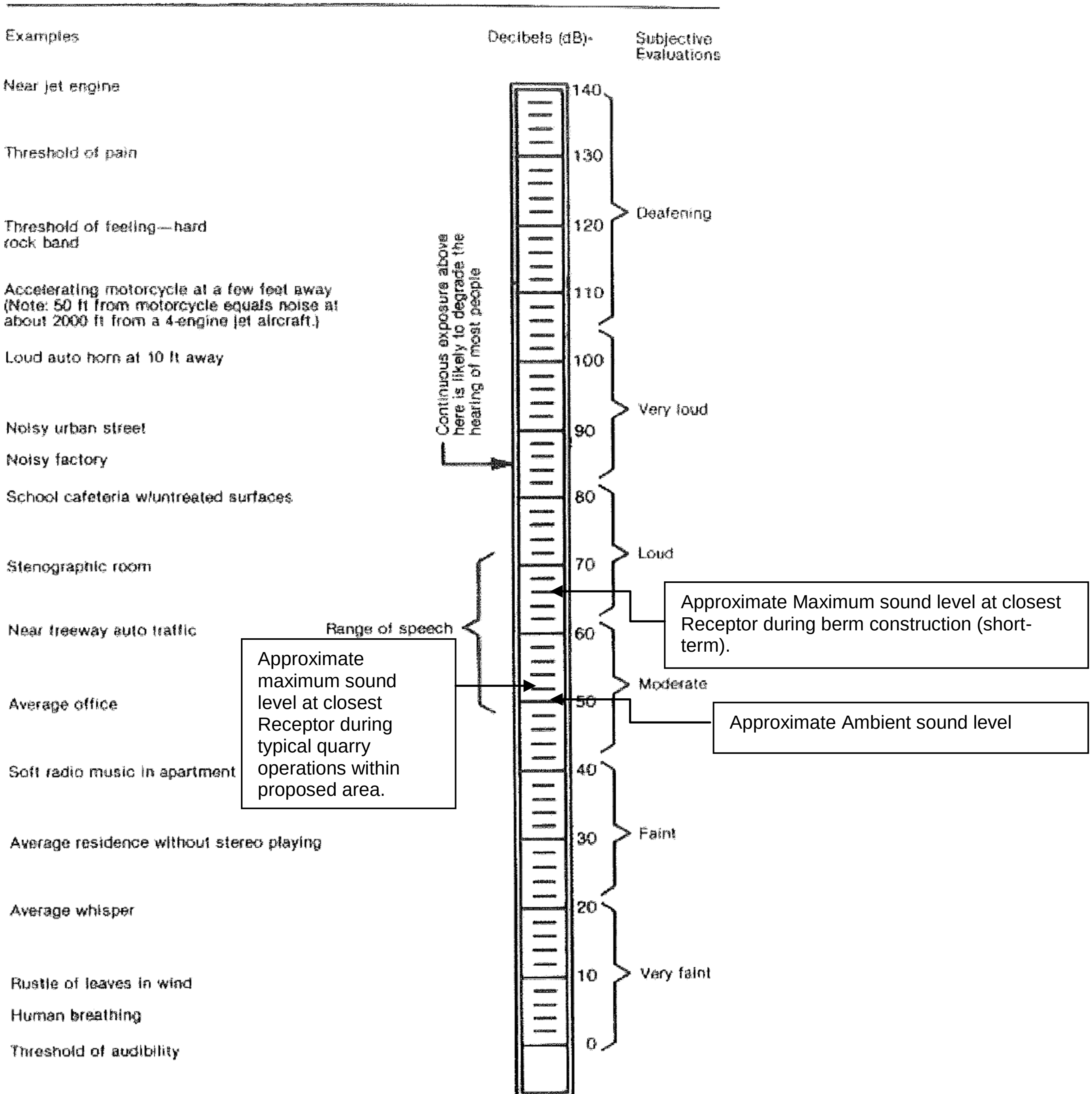


Diagram #3: Typical Sound Levels of Common Noise Sources (OSHA, 2011).

Some common, easily recognized sounds are listed below in order of increasing sound intensity levels in decibels. The sound levels shown for occupied rooms are typical general activity levels only and do *not* represent criteria for design.



*dB are "average" values as measured on the A-scale of a sound-level meter
(From *Concepts in Architectural Acoustics*: M. David Egan. McGraw Hill, 1972.)

Diagram #4: Common Recognized Sounds (HUD, 2009).

8.0 NOISE MITIGATION

The NYSDEC Program Policy #DEP-00-1 ("Assessing and Mitigating Noise Impacts") will be used as a guide when considering best management practices (BMPs) for noise mitigation. It is noted that Hanson Aggregates already employees many of the BMPs listed in the DEC policy document. Noise mitigation measures to be implemented with respect to the proposed modification area are summarized below:

a) An earthen berm will be constructed around the perimeter of the proposed modification area. Berm heights have been designed to attenuate potential noise increases at Receptor locations for the noisiest equipment activities to less than 3 dBA, which has been shown to be imperceivable to the human ear.

b) During initial berm construction, the back-up alarms on all involved mobile equipment [e.g., loader(s) and haul truck(s)] will be disabled and MSHA-compliant silent strobe-light back-up indicators will be installed to reduce equipment noise.

c) Construction of perimeter earth berms will be limited to the hours of 9 a.m.-5 p.m., Monday through Friday.

d) Since mining will gradually progress from the southeast to northwest toward Receptors, almost all noise will be unperceived because mobile equipment will be operated below Receptor elevations and behind quarry faces for nearly the entire lifespan of the proposed modification area. (The exceptions to this are the initial construction of perimeter berms and drill-rig operation atop the upper bench as the mine nears full build-out, which are both temporary and of relatively brief durations.)

e) No processing equipment is proposed to be operated within the modification area, thereby, keeping it below Receptor elevations and behind quarry faces, far removed from Receptors.

f) Mining operations within the proposed modification area will be completed in multiple phases beginning at the furthest point from the closest Receptors.

9.0 CONCLUSIONS

The worse-case scenarios were used to project the maximum potential noise levels at nearby Receptor locations from the proposed modification area. When calculating projected sound levels, it was assumed that the noise source (e.g., drill-rig) was operating at the perimeter of the modification area and not behind any quarry high-walls.

Four (4) ambient noise levels were obtained within the vicinity of the nearby Receptors, including one homeowner's back yard. For each calculation of projected noise at a Receptor, the most representative and/or conservative ambient measurement was used to estimate the maximum projected noise.

To estimate the noise associated with the proposed action, the sound levels generated by the actual equipment operated at the quarry was measured. From these measurements, the noisiest equipment (i.e., drill-rig) was used as the basis of the worse-case scenario calculations. It is noted that this noise will be temporary, short-term, and intermittent.

The conclusions from the "Sound Level and Attenuation Analysis," are summarized below:

1) The potential for noise impacts is limited to the two closest Receptors, identified as "6R" and "7R." Through mitigative measures, mainly increased berm heights, the calculated sound level increases at these two Receptors are still below 3 dBA. Increases of 3 dBA have been shown to be imperceptible to the human ear.

2) The less than 3 dBA maximum increases, from a drill-rig operating at the quarry perimeter at the point closest to Receptors and not behind a quarry high-wall, that are projected, are consistent with DEP-001 ("Assessing and Mitigating Noise Impacts") which states, "Increases ranging from 0-3 dB should have no appreciable effect on receptors."

3) The calculated worse-case sound increases from typical, on-going operation of a haul truck and loader (operating at the perimeter and not behind a quarry high-wall), are all less than 1 dBA, which will be imperceptible to the human ear.

4) The potential for the most significant noise impacts are anticipated to occur during the initial berm construction activities, performed closest to Receptor locations. These berms will ultimately reduce noise, as well as provide a visual and safety barrier.

5) The noise levels from berm construction will rapidly begin to decrease as the berms become higher. Noise from berm construction will be short-term and intermittent, lasting approximately 1-2 weeks at a time every 1-3 years over an extended period (e.g., 5-20 years). The greatest sound levels would be present for approximately 4-5 days as the berms are initially constructed at the point closest to the Receptors.

6) Noise from berm construction (max. 66.6 dBA) at the closest Receptor ("6R") is similar to that of a typical farm tractor, 62.9 dBA, that is currently used within the proposed modification area.

7) Since mining and associated berm construction will progress in phases, any significant noise impacts will be intermittent and of a relatively short duration rather than all at once for a long duration.

8) The calculated sound levels at Receptors from a drill-rig operating at the quarry perimeter and not behind a quarry high-wall are all 53 dBA or less. This sound level is less than the 57 dBA recommended by the FHWA, for areas where "serenity and quiet" are especially important. The projected drill-rig noise at Receptors is also significantly below the 67 dBA that the FHWA recommends for residences, motels, schools, churches, hospitals, etc.

9) The highest calculated short-term noise level at any Receptor ("6R" – the closest to the proposed modification area), during berm construction is 66.6 dBA, which is also below the 67 dBA recommended by the FWHA. As previously stated, this noise will be temporary while berms are constructed at the point closest to the Receptor.

10) A conservative approach to assessing potential project noise impacts was used for this "Sound Level and Attenuation Analysis." Worse-case scenarios were used to project the maximum noise levels at Receptor locations. The significant noise attenuation provided by the quarry high-walls, behind which nearly all activities will occur, was not included in the assessment to provide the most conservative estimate.

11) The minimum attenuation value of 3 dBA for vegetation stated in the NYSDEC's Noise Policy was used in determining potential impacts. Vegetation has been shown to provide far more attenuation than 3 dBA in numerous studies. As an additional conservative approach and, to eliminate subjectivity with regard to the interpretation of how much attenuation will be provided by the existing grasses, shrubs, and forest that surround the proposed expansion area, projected noise increases at Receptors were also calculated as if no vegetation was present. The results are provided in Tables III-A and III-B of Appendix III.

    The results from these calculations show that the greatest noise increase of +4.2 dBA (if no vegetation was present) would be at Receptor #6R during the temporary use of the drill rig at the perimeter when compared to the lowest ambient level of 49.4. When compared to the average ambient noise, the increase at Receptor #6R is projected to be +2.8 dBA.

12) Other than the above worse-case calculated increase of +4.2 (not including the attenuation provided by vegetation) at Receptor #6R, all of the calculated noise increases at Receptors were less than 3 dBA.

13) As stated in the NYSDEC's "Assessing and Mitigating Noise Impacts," (DEP-00-1), "the goal for any permitted operation should be to minimize increases in sound pressure level above ambient levels at the chosen point of sound reception." "Increases ranging from 0-3 dB should have no appreciable effect on receptors." Increases ranging between 0-3 dBA above ambient sound levels should have no appreciable effect on Receptors since they are within the range in which most humans can not notice a change." "Increases from 3-6 dB may have potential for adverse noise impact only in cases where the most sensitive of receptors are present." Given that the calculated sound level changes at all Receptors

14) Based on the NYSDEC's acceptable noise level increases stated in the NYSDEC's Noise Policy (DEP-00-1), the calculated noise increases in all scenarios considered in this Sound Level and Attenuation Analysis, including the scenario that excluded attenuation provided by vegetation, demonstrate that the proposed action will not have a significant impact with regard to noise.

10.0 REFERENCES

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23 CFR Part 772 – Procedures for Abatement of Highway Traffic Noise and Construction Noise

24 CFR Part 51 – Environmental Criteria and Standards, Subpart B – Noise Abatement and Control

Appendix I

Acoustic Study Worksheets

Appendix II

Acoustic Study Map

Appendix III

Sound Level and Attenuation Analysis

Measurements and Calculation Results

Appendix III
Sound Level and Attenuation Analysis
Measurements and Calculation Results – 2 Worse-Case Scenarios (Table III-A)

Receptor & Source No.[6]	Elevation of Receptor (ft AMSL)	Elevation of Source (ft)[7]	Approx. Distance from Source to Receptor (ft)	Distance from Source to Barrier (ft)	Elevation of Barrier (ft AMSL)	Sound Level of Drill-Rig (dBA)	Sound Level of Haul Truck & Loader (dBA)	Sound Attenuation Due to Distance (dBA)	Sound Attenuation Due to Barrier (dBA)	Sound Attenuation Due to Vegetation	Sound Attenuation Total (dBA)	Ambient Sound Level (dBA)[8]	DRILL-RIG Calculated Cumulative Sound Level at Receptor with Attenuation by Barrier, Distance, and Vegetation (dBA)[9]	LOADER & HAUL TRUCK Calculated Cumulative Sound Level at Receptor with Attenuation by Barrier, Distance, and Vegetation (dBA)[9]	*Final Calculated Sound Level Change at Receptor (dBA) From Drill-Rig Noise[9]*	*Final Calculated Sound Level Change at Receptor (dBA) From Loader & Haul Truck Noise[9]*
1R-1S	698	706	952	42	720	87.6	80.6	25.6	15.8	3	44.4	49.4 (52.2)	50.3 (52.7)	49.6 (52.3)	+0.9 (+0.5)	+0.2 (+0.1)
2R-1S	700	706	934	40	720	87.6	80.6	25.4	15.8	3	44.2	49.4 (52.2)	50.4 (52.7)	49.6 (52.3)	+1.0 (+0.5)	+0.2 (+0.1)
3R-2S	705	713	1027	42	730	87.6	80.6	26.3	15.8	3	45.1	49.4 (52.2)	50.2 (52.6)	49.6 (52.3)	+0.8 (+0.4)	+0.2 (+0.1)
4R-2S	715	713	851	42	730	87.6	80.6	24.6	15.8	3	43.4	49.4 (52.2)	50.5 (52.8)	49.7 (52.4)	+1.1 (+0.6)	+0.3 (+0.2)
5R-3S	712	721	1,207	72	746	87.6	80.6	27.3	17	3	47.3	49.4 (N.A.)	49.9	49.5	+0.5	+0.1
6R-3S	720	721	246	44	746	87.6	80.6	13.8	22.3	3	39.1	49.4 (52.1)	52.0 (53.7)	50.0 (52.5)	+2.6 (+1.6)	+0.6 (+0.4)
7R-4S	705	708	557	43	725	87.6	80.6	20.9	15.8	3	39.7	52.0 (N.A.)	53.4	52.3	+1.4	+0.3
8R-5S	720	708	2,093	29	715	87.6	80.6	32.4	10	3	45.4	49.5 (N.A.)	50.2	49.6	+0.7	+0.1
9R-6S	720	711	2,134	35	715	87.6	80.6	32.6	8	3	43.6	49.5 (N.A.)	50.6	49.7	+1.1	+0.2

Measurements and Calculation Results – 2 Worse-Case Scenarios – NOISE ATTENUATION BY VEGETATION EXCLUDED (Table III-B)

Receptor & Source No.[10]	Elevation of Receptor (ft AMSL)	Elevation of Source (ft)[11]	Approx. Distance from Source to Receptor (ft)	Distance from Source to Barrier (ft)	Elevation of Barrier (ft AMSL)	Sound Level of Drill-Rig (dBA)	Sound Level of Haul Truck & Loader (dBA)	Sound Attenuation Due to Distance (dBA)	Sound Attenuation Due to Barrier (dBA)	Sound Attenuation Due to Vegetation	Sound Attenuation Total (dBA)[12]	Ambient Sound Level (dBA)[13]	DRILL-RIG Calculated Cumulative Sound Level at Receptor with Attenuation by Barrier and Distance (dBA)[9] ONLY	LOADER & HAUL TRUCK Calculated Cumulative Sound Level at Receptor with Attenuation by Barrier and Distance (dBA)[9] ONLY	*Final Calculated Sound Level Change at Receptor (dBA) From Drill-Rig Noise[14]*	*Final Calculated Sound Level Change at Receptor (dBA) From Loader & Haul Truck Noise[9]*
1R-1S	698	706	952	42	720	87.6	80.6	25.6	15.8	0	41.4	49.4 (52.2)	51.1 (53.2)	49.8 (52.4)	+1.7 (+1.0)	+0.4 (+0.2)
2R-1S	700	706	934	40	720	87.6	80.6	25.4	15.8	0	41.2	49.4 (52.2)	51.2 (53.2)	49.8 (52.4)	+1.8 (+1.0)	+0.4 (+0.2)
3R-2S	705	713	1027	42	730	87.6	80.6	26.3	15.8	0	42.1	49.4 (52.2)	50.9 (53.0)	49.7 (52.4)	+1.5 (+0.8)	+0.3 (+0.2)
4R-2S	715	713	851	42	730	87.6	80.6	24.6	15.8	0	40.4	49.4 (52.2)	51.4 (53.4)	49.9 (52.5)	+2.0 (+1.2)	+0.5 (+0.3)
5R-3S	712	721	1,207	72	746	87.6	80.6	27.3	17	0	44.3	49.4 (N.A.)	50.3	49.6	+0.9	+0.2
6R-3S	720	721	246	44	746	87.6	80.6	13.8	22.3	0	36.1	49.4 (52.1)	53.6 (54.9)	50.6 (52.9)	+4.2 (+2.8)	+1.2 (+0.8)
7R-4S	705	708	557	43	725	87.6	80.6	20.9	15.8	0	36.7	52.0 (N.A.)	54.5	52.6	+2.5	+0.6
8R-5S	720	708	2,093	29	715	87.6	80.6	32.4	10	0	42.4	49.5 (N.A.)	50.9	49.8	+1.4	+0.3
9R-6S	720	711	2,134	35	715	87.6	80.6	32.6	8	0	40.6	49.5 (N.A.)	51.4	50.0	+1.9	+0.5

[6] - Refer to "Acoustic Study Map" (Appendix II) for Receptor and Source locations.
[7] - Elevation of Source accounts for topographic elevation, height of loudest component on drill-rig, and decrease in elevation due to overburden removal.
[8] - Ambient sound values in parentheses are an average of one or more nearby ambient monitoring points.
[9] - Calculated sound levels shown in parentheses are based on an average ambient noise value.
[10] - Refer to "Acoustic Study Map" (Appendix II) for Receptor and Source locations.
[11] - Elevation of Source accounts for topographic elevation, height of loudest component on drill-rig, and decrease in elevation due to overburden removal.
[12] - For comparison, the total sound attenuation value excludes the attenuation provided by vegetation (i.e., zero instead of the minimum 3 dBA reduction).
[13] - Ambient sound values in parentheses are an average of one or more nearby ambient monitoring points.
[14] - Although at least 100-feet of vegetation are present between all Sources and Receptors, calculated noise increase in this column is based on no vegetation being present for comparison against the NYSDEC minimum 3 dBA attenuation by vegetation. Calculated sound levels shown in parentheses are based on an average ambient noise value.

Appendix IV

Sound Level and Attenuation Analysis

Estimated Equipment Noise During Initial Berm Construction

Appendix IV - Sound Level and Attenuation Analysis - Measurements and Calculation Results

Worse-Case Scenario: Estimated Equipment Noise During Initial Berm Construction

Note: The estimates below are for the initial construction of the perimeter berms and account for projected noise of a bull dozer and haul truck operating at the edge of the proposed modification area closest to the nearest Receptor, before any berm construction has been completed. Berm construction activities will only be performed Monday through Friday between the hours of 9 a.m. – 5 p.m. This phase of berm construction is only anticipated to last 4-5 days before the new berms begin to increase in height as they are being built.

Receptor & Source No.[6]	Elevation of Receptor (ft AMSL)	Elevation of Source (ft)[15]	Distance from Source to Receptor (ft)	Distance from Source to Barrier (ft)	Elevation of Barrier (ft AMSL)[16]	Sound Level of Source (dBA)	Sound Attenuation Due to Distance (dBA)	Sound Attenuation Due to Barrier (dBA)	Sound Attenuation Due to Vegetation	Vegetation Between Source and Receptor	Sound Attenuation Total (dBA)	Calculated Cumulative Sound Level at Receptor with Attenuation by Barrier, Distance, and Vegetation (dBA)	Ambient Sound Level (dBA)	*Final Calculated Sound Level Change at Receptor (dBA)*
1R-1S	698	708	952	0	703	83.3	25.6	0	3	Shrubs; tall grass	28.6	55.8	49.4 (52.2)[11]	***+6.4 (4.5)[8]***
2R-1S	700	708	934	0	703	83.3	25.4	0	3	Shrubs; tall grass	28.4	56.0	49.4 (52.2)[11]	***+6.6 (4.6)[8]***
3R-2S	705	715	1027	0	710	83.3	26.3	0	5	Dense deciduous forest	31.3	53.9	49.4 (52.2)[11]	***+4.5 (2.9)[8]***
4R-2S	715	715	851	0	710	83.3	24.6	0	5	Dense deciduous forest	29.6	55.1	49.4 (52.2)[11]	***+5.7 (3.8)[8]***
5R-3S	712	723	1207	0	718	83.3	27.7	0	5	Dense deciduous forest	32.7	53.1	49.5	***+3.6***
6R-3S	720	723	246	0	718	83.3	13.8	0	3	Shrub-scrub	16.8	66.6	49.4 (52.1)[17]	***+17.2 (+14.4)[8]***
6R-Farm Tractor	720	723	246	0	718	85.8[18]	19.9	0	3	Shrub-scrub	22.8	62.9	49.4 (52.1)[12]	***+13.5 (+10.8)[8]***
6R-3SA	720	720	265	0	715	83.3	14.5	0	3	Shrub-scrub; tall grass	17.5	65.9	49.4 (52.1)[12]	***+16.5 (+13.8)[8]***
6R-3SB	720	714	630	0	709	83.3	22.0	8[13]	3	Shrub-scrub; tall grass	33.0	52.9	49.4 (52.1)[12]	***+3.5 (+2.2)[8]***
6R-3SC	720	709	878	0	704	83.3	24.9	8[13]	3	Shrub-scrub; tall grass	35.9	51.5	49.4 (52.1)[12]	***+2.1 (+1.2)[8]***
6R-3SH	720	727	477	0	722	83.3	19.6	0	5	Dense deciduous forest	24.6	58.7	49.4 (52.1)[12]	***+9.3 (+6.6)[8]***
6R-3SI	720	721	911	0	716	83.3	25.2	0	5	Dense deciduous forest	30.2	53.1	49.4 (52.1)[12]	***+3.7 (1.0)[8]***
7R-4S	705	710	557	0	705	83.3	20.9	0	3	Tall grass; hedge row; lawn	24.0	60.1	52.0	***+8.1***
7R-3SB	705	714	617	0	709	83.3	21.8	0	3	Tall grass; hedge row; lawn	24.8	58.5	52.0	***+6.5***
7R-3SJ	705	719	718	0	714	83.3	23.1	0	3	Tall grass; hedge row; lawn	26.1	57.2	52.0	***+5.2***
7R-Farm Tractor	705	710	603	0	705	85.8[13]	27.6	0	3	Tall grass; hedge row; lawn	30.6	55.0	52.0	***+3.0***
8R-5S	720	710	2093	0	705	83.3	32.4	0	4	Dense deciduous forest; agricultural (corn, hay); tall grass	36.4	51.4	49.5	***+1.9***
9R-6S	720	713	2134	0	708	83.3	32.6	0	4	Dense deciduous forest; agricultural (corn, hay); tall grass	36.6	51.3	49.5	***+1.8***

15 - Elevation of Source accounts for topographic elevation, plus 5-feet to account for cumulative noise from bull dozer and haul truck.

16 - Surface elevation at Source.

17 - Average of Ambient Points #1 and #4 is 52.2 dBA. Since Receptor #6R is approximately equidistant from both ambient points, the average of these two ambient noise points is a more representative estimate of the ambient sound level at Receptor #6R.

18 - Tractor noise is based on the average noise in a comprehensive study of various common farm tractors by Virginia Tech, Publication 442-072, 2009, and calculated noise impact estimate accounts for measurement taken 25-feet away.

13 – Barrier attenuation provided by the natural increase in elevation from the source toward the receptor.

Appendix V

Sound Level and Attenuation Analysis

Estimated Equipment Noise As Initial Berm Construction Progresses

Appendix V - Sound Level and Attenuation Analysis

Measurements and Calculation Results
Worse-Case Scenario: Estimated Equipment Noise As Initial Berm Construction Progresses – Noise Impacts At Closest Receptors When Berm At 5-Feet and 10-Feet High

Receptor & Source No.[6]	Elevation of Receptor (ft AMSL)	Elevation of Source (ft)[9]	Distance from Source to Receptor (ft)	Distance from Source to Barrier (ft)	Elevation of Barrier (ft AMSL)[10]	Sound Level of Source (dBA)	Sound Attenuation Due to Distance (dBA)	Sound Attenuation Due to Barrier (dBA)	Sound Attenuation Due to Vegetation	Vegetation Between Source and Receptor	Sound Attenuation Total (dBA)	Calculated Cumulative Sound Level at Receptor with Attenuation by Barrier, Distance, and Vegetation (dBA)	Ambient Sound Level (dBA)	*Final Calculated Sound Level Change at Receptor (dBA)*
5-Foot High Berm														
6R-3S	720	723	246	5	723	83.3	13.8	8	3	Shrub-scrub	24.8	58.5	49.4 (Ambient Pt. #1) – Worse Case	***+9.6***
													52.1 (Avg. of Ambient Pts. #1 and #2)	***+6.9***
7R-4S	705	710	557	5	715	83.3	20.9	8	3	Tall grass; hedge row; lawn	32.0	54.7	52.0	***+2.7***
10-Foot High Berm														
6R-3S	720	723	246	10	728	83.3	13.8	8	3	Shrub-scrub	24.8	58.5	49.4 (Ambient Pt. #1) – Worse Case	***+9.6***
													52.1 (Avg. of Ambient Pts. #1 and #2)	***+6.9***
7R-4S	705	710	557	10	720	83.3	20.9	15.8	3	Tall grass; hedge row; lawn	39.7	52.6	52.0	***+0.6***

Note: The above estimates are for the initial construction of the perimeter berms and account for projected noise of a bull dozer and haul truck operating at the edge of the proposed modification area closest to the nearest Receptor, before any berm construction has been completed. Berm construction activities will only be performed Monday through Friday between the hours of 9 a.m. – 5 p.m. This phase of berm construction is only anticipated to last 4-5 days before the new berms begin to increase in height as they are being built.