Deepwater Port License Application
Blue Marlin Offshore Port (BMOP) Project

Volume IIb – Appendix F

Submitted to:

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Deepwater Port License Application
Blue Marlin Offshore Port (BMOP) Project

Volume I:	General (Public), including Deepwater Port License Application and Appendices (*under separate cover*)
Volume IIa:	Offshore Project Components Environmental Evaluation (Public) (*under separate cover*)
Volume IIb:	**Onshore Project Components, Environmental Evaluation (Public) (*herein*)**
Volume III:	Technical Information [*Confidential*] (*under separate cover*)
Volume IV:	Company and Financial Information [*Confidential*] (*under separate cover*)

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APPENDIX F

NOISE ASSESSMENT FOR HDD OPERATIONS

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BLUE MARLIN OFFSHORE PROJECT

HDD Noise Impact Report

Prepared for:

EXP Energy Services, Inc.

August 5, 2020

HDD Noise Impact Report

Prepared for:
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This document has been prepared by SLR International Corporation (SLR). The material and data in this report were prepared under the supervision and direction of the undersigned.

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ACRONYMS

dB	Decibel
dBA	A-weighted Decibel
DIL	Dynamic Insertion Loss
HDD	Horizontal Directional Drilling
IL	Insertion Loss
L_{eq}	Equivalent Continuous Sound Level
L_{dn}	Day-Night Average Sound Level
MMSCFD	Million Standard Cubic Feet per Day
NR	Noise Reduction
NSA	Noise Sensitive Area
PWL	Sound Power Level
TL	Transmission Loss

SUMMARY

At the request of EXP Energy Services, Inc., SLR International Corporation (SLR) has conducted baseline sound level measurements and conducted a noise impact evaluation for two planned horizontal directional drilling (HDD) crossings associated with the Blue Marlin Offshore Project (BMOP) near Bridge City in Orange County, Texas.

Measurements of the existing environmental ambient sound levels were taken in the vicinity of the closest noise sensitive areas (NSAs) for the planned entry and exit locations for two HDD crossings. The ISO 9613-2 standard was used to calculate the HDD equipment sound level contribution at each NSA. The predicted HDD sound levels were combined with the measured existing ambient sound levels to predict the temporary increase in sound levels at each NSA during HDD activities. Calculations were made for the nearest NSAs to the entry and exit work areas at the crossings.

Bridge City, Texas has a noise ordinance that is that is nuisance-based and provide no numerical limits. There are no other known federal, state, or local noise ordinances that apply to these sites.

The Federal Energy Regulatory Commission (FERC) has established a noise regulation governing interstate gas transmission. While this project is not regulated by the FERC, the FERC noise goals are frequently used for HDD work associated with pipeline development. Therefore, the FERC HDD noise guidelines are included here as a reference for evaluating the noise impact. The FERC noise regulation is receptor based and limits environmental sound level contributions to no more than 55 dBA L_{dn} or, equivalently, no more than a continuous 48.6 dBA L_{eq} at the surrounding NSAs. NSAs are typically residences, schools, churches, or hospitals.

This report presents the results of the sound level measurements and noise impact evaluation for the two planned HDD crossings. Assuming typical drilling equipment without additional noise control treatments or barriers, the predicted sound levels from the HDD activities are expected to be below the FERC criterion at three of the four NSAs. The HDD noise contribution at the closest NSA to the entry work area for one of the crossings are predicted to exceed the FERC target of 55 dBA L_{dn}. However, the guideline could be met with added equipment noise mitigation and/or noise barriers.

1. INTRODUCTION

At the request EXP Energy Services, Inc., SLR International Corporation (SLR) has conducted baseline ambient sound level measurements and a noise impact evaluation for the Blue Marlin Offshore Project (BMOP) near Bridge City in Orange County, Texas.

Each of the two HDD crossings evaluated will have an entry work site and an exit work site. Noise characteristics of typical HDD rigs have been used as the basis for prediction of the noise contributions at noise sensitive areas (NSAs) near the drilling sites.

1.1 NOISE CRITERIA

Bridge City, Texas has a noise ordinance that is that is nuisance-based and provide no numerical limits. There are no other known federal, state, or local noise ordinances that apply to these sites.

The Federal Energy Regulatory Commission (FERC) has established a noise regulation governing interstate gas transmission. While this project is not regulated by the FERC, the FERC noise goals are frequently used for HDD work associated with pipeline development. Therefore, the FERC HDD noise guidelines are included here as a reference for evaluating the noise impact. The FERC noise regulation is receptor based and limits environmental sound level contributions to no more than 55 dBA L_{dn} or, equivalently, no more than a continuous 48.6 dBA L_{eq} at the surrounding NSAs. NSAs are typically residences, schools, churches, or hospitals.

1.2 PROPOSED HDD LOCATIONS

The onshore portion of the project will involve several HDD crossings, but only two of these were found to have NSAs within a half mile radius. Only those two crossings will be evaluated for noise impacts. The locations of the proposed drilling sites are shown in **Table 1** along with the distances and directions to the nearest NSAs. There are residential neighborhoods located north and east of both entry and exit locations. There is also a power plant and a substation located south of the ML-05 entry and exit locations.

Table 1: Summary of Proposed HDD Crossings

Location		Coordinates	Distance & Direction to Closest NSA
ML-03	Entry	N 30.045521°	580 ft. East
		W 93.905179°	
	Exit	N 30.038455°	620 ft. North
		W 93.897471°	
ML-05	Entry	N 30.032115°	1650 ft. Northeast
		W 93.890482°	
	Exit	N 30.027588°	1010 ft. East
		W 93.881824°	

1.3 NOISE SENSITIVE AREAS

The closest residential area to each HDD site was identified as an NSA. The NSAs and HDD locations are shown in **Figure 1** and **Figure 2**.

2. BASELINE NOISE SURVEY

A baseline noise survey was conducted by Dylan Blackwell of SLR on June 5, 2020 to characterize ambient environmental sound levels in the area. Short duration daytime sound levels were measured, one near each drilling site.

2.1 MEASUREMENT EQUIPMENT

Sound level equipment used during the survey consisted of the following instruments:

- Larson Davis Model 824 Type 1 Sound Level Meter: s/n 0917
- Brüel & Kjær Calibrator: s/n 2022566

The microphone was positioned approximately five feet above the ground for all measurements. A windscreen was used on the microphone. Equipment was field calibrated before and after measurement intervals. All instrumentation had current laboratory certification. Calibration certificates are available upon request.

2.2 WEATHER CONDITIONS

The weather was appropriate for an environmental sound level survey as shown in **Table 2**.

Table 2: Weather Conditions Summary

Date	June 5, 2020
Temperature	88 – 90°F
Relative Humidity	54 – 61%
Wind Direction	E – ENE
Wind Speed	1 – 2 mph
Sky Condition	Partly Cloudy
Ground Condition	Dry

2.3 MEASUREMENT RESULTS

Measurements were fifteen minutes in duration and were timed to limit contributions from passing vehicles. Sound levels were measured using the slow meter response and A-weighting and were measured in 1/3- and 1/1-octave bands.

The measurements were collected on June 5, 2020. The measurement results are shown in **Table 3**. The ambient sound levels in the area ranged from 49.6 to 62.4 dBA L_{dn}.

The nighttime levels were estimated based on observations of dominant sources and 24-hour measurements taken previously at a nearby location.

Table 3: Summary of Short-Term Measurement Data

Measurement Location	Start Time (HH:MM)	Duration (Min)	Measured Daytime Level, dBA L_d	Estimated Nighttime Level, dBA L_n[1]	Day-Night Level, dBA L_{dn}	Noise Sources Present
ML-03E	11:26 AM	15	44.3	43.8	50.3	Traffic on Highway 1442, birds, insects, residents, planes, distant lawn equipment, dog barking.
ML-03X	11:51 AM	15	43.6	43.1	49.6	Traffic on Highway 1442, birds, insects, planes.
ML-05E	12:57 PM	15	56.0	56.0	62.4	Adjacent Entergy Sabine power plant and substation, insects.
ML-05X	12:30 PM	15	50.2	50.2	56.6	Adjacent Entergy Sabine power plant and substation, insects, birds.

[1] The nighttime levels at ML-03E and ML-03X were estimated by applying a 0.5 dB day-night reduction based on overnight measurements taken at a nearby location a similar distance from roadways. The nighttime levels at ML-05E and ML-05X were assumed to be the same as the daytime levels since the dominant noise source is the adjacent power plant that is assumed to run 24-hours a day.

3. NOISE IMPACT EVALUATION

3.1 HDD EQUIPMENT DATA

The HDD entry and exit sites will have several equipment sound sources in operation during the temporary construction work. On the entry side, this will include the drilling rig itself, mud pumps, generators, drilling mud mixers, shale shakers, light plants, and the driving engines associated with this equipment; there will also be ancillary mobile equipment such as cranes, front-end loaders, forklifts, and trucks. On the exit side, less equipment is required, typically including a backhoe or bulldozer, and possibly a generator and light plant.

The actual equipment used and the site layout and configuration will depend on the drilling contractor selected for the project, the site conditions, and other factors. No blasting or pile driving is planned during construction of this project.

Typical sound power levels (PWL) for general HDD construction operations based on measurements of previous operations are given in **Table 4**. These values represent conservative estimates without assumption of any additional noise control treatments. The levels assume that all original equipment manufacturer noise control treatments are correctly installed and that all operating equipment is well-maintained and in good operating condition. These levels also assume some slight typical shielding and screening effects from the tanks and trailers that are used in HDD operations.

Table 4: Total Sound Power Levels of HDD Entry and Exit Equipment

	Linear Sound Power Level (PWL) Values at Octave Band Center Frequencies, dB									Total
	31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dBA**
Entry Site	118	115	112	114	112	109	108	106	98	115.2
Exit Site	110	108	105	102	100	98	95	92	88	103.2

3.2 NOISE MODEL RESULTS

A computer noise model was constructed to calculate the expected temporary sound level contributions due to the HDD equipment. The computer model was developed using Cadna/A, version 2020 MR 1, build 177.5010, a commercial noise modeling package developed by DataKustik GmbH. The software takes into account spreading losses, ground and atmospheric effects, shielding from barriers and buildings, reflections from surfaces and other sound propagation properties. The software is based on published engineering standards. The ISO 9613 standard was used for air absorption and other noise propagation calculations. To be conservative, foliage was not included in the model. The terrain was modeled based on imported commercially available topographical data at a resolution of 10 by 10 meters. A temperature of 20 degrees Celsius and 70 percent relative humidity were used for the atmospheric absorption calculations.

The modeled contributions of HDD noise along with measured ambient levels are shown in **Table 5**. The calculations assume that HDD work will take place 24-hours per day. Color contours of the predicted levels for each HDD location are shown in **Figure 3** and **Figure 4**, attached.

The HDD noise level is predicted to be below the FERC criterion of 55 dBA L_{dn} at three of the closest NSAs. The noise levels are predicted to exceed the FERC criterion at NSA-03E (Entry side) only. However, this exceedance can be resolved by using a noise barrier to mitigate the sound levels, see Section 3.3.

Table 5: Modeled HDD Sound Level Contributions at the Nearest NSAs

HDD Location	Closest NSA	Measured Ambient dBA	Modeled HDD, dBA		Total Ambient Plus HDD dBA	Temporary Increase at NSA
		L_{dn}	L_{eq}	L_{dn}	L_{dn}	ΔdB
HDD-03	NSA-03E	50.3	58.7	**65.1**	65.2	15.0
	NSA-03X	49.6	47.4	**53.8**	55.2	5.6
HDD-05	NSA-05E	62.4	48.0	**54.4**	63.0	0.6
	NSA-05X	56.6	43.9	**50.3**	57.5	0.9

3.3 POTENTIAL MITIGATION

There are two main noise mitigation options: construction of a temporary sound barrier and temporary relocation. At the HDD-03 entry location, the noise levels at NSA-03E and other nearby residences could be mitigated by placing a 25-foot-tall L-shaped barrier between the drilling equipment and the NSA. Currently the work area is modeled as a 50 foot by 300-foot area. A 25-foot-tall 450-foot-long barrier was included in the model at a distance of 20 feet from the modeled HDD noise source. The exact barrier height and location required to meet the FERC 55 dBA L_{dn} noise goal will depend on the equipment layout, so in practice, a barrier that is shorter in length will likely suffice. With the barrier in place, HDD activity will meet the FERC goal. These results are shown in **Table 6** and **Figure 5**.

Table 6: Modeled HDD Sound Level Contribution at NSA-03E with a 25-Foot Tall Barrier

HDD Location	Closest NSA	Measured Ambient dBA	Modeled HDD, dBA		Total Ambient Plus HDD dBA	Temporary Increase at NSA
		L_{dn}	L_{eq}	L_{dn}	L_{dn}	ΔdB
HDD-03	NSA-03E	50.3	44.8	**51.2**	53.8	3.5

In the event the sound barrier does not sufficiently mitigate the sound levels, or if BMOP and the NSA residents agree prior to erecting the sound barrier, BMOP could offer reimbursement for temporary relocation of the NSA residents during drilling activities.

3.4 LOW-FREQUENCY NOISE AND VIBRATION

Low-frequency (below 100 Hz) sound emissions can be of concern with drilling operations since they may induce vibrations in nearby structural elements such as windows, walls, and floors. NASA has developed a set of criteria (NASA TM-83288) for evaluating the potential for low-frequency sound energy to excite nearby structural elements and cause vibration and rattling. The worst-case modeled noise levels were at NSA-03E. The modeled low-frequency levels for this scenario fall below the NASA criteria, meaning no low frequency induced vibrations are expected to be caused by any of the planned HDD activity for the project.

4. SUMMARY AND CONCLUSIONS

At the request of EXP Energy Services, Inc., SLR International Corporation (SLR) has conducted baseline sound level measurements and conducted a noise impact evaluation for two planned HDD crossings associated with the Blue Marlin Offshore Project (BMOP) in Orange County Texas near Bridge City.

Although this project is not FERC regulated, noise modeling indicates that the sound level contribution due to the HDD work will be below the FERC criterion of 55 dBA L_{dn} at all NSAs with the noise control treatments described in this report.

LIMITATIONS

The services described in this work product were performed in accordance with generally accepted professional consulting principles and practices. No other representations or warranties, expressed or implied, are made. These services were performed consistent with our agreement with our client. This work product is intended solely for the use and information of our client unless otherwise noted. Any reliance on this work product by a third party is at such party's sole risk.

Opinions and recommendations contained in this work product are based on conditions that existed at the time the services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. The data reported and the findings, observations, and conclusions expressed are limited by the scope of work. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this work product.

This work product presents professional opinions and findings of a scientific and technical nature. The work product shall not be construed to offer legal opinion or representations as to the requirements of, nor the compliance with, environmental laws rules, regulations, or policies of federal, state or local governmental agencies.

FIGURES

Figure 1: Map of HDD-03 NSA and Measurement Locations

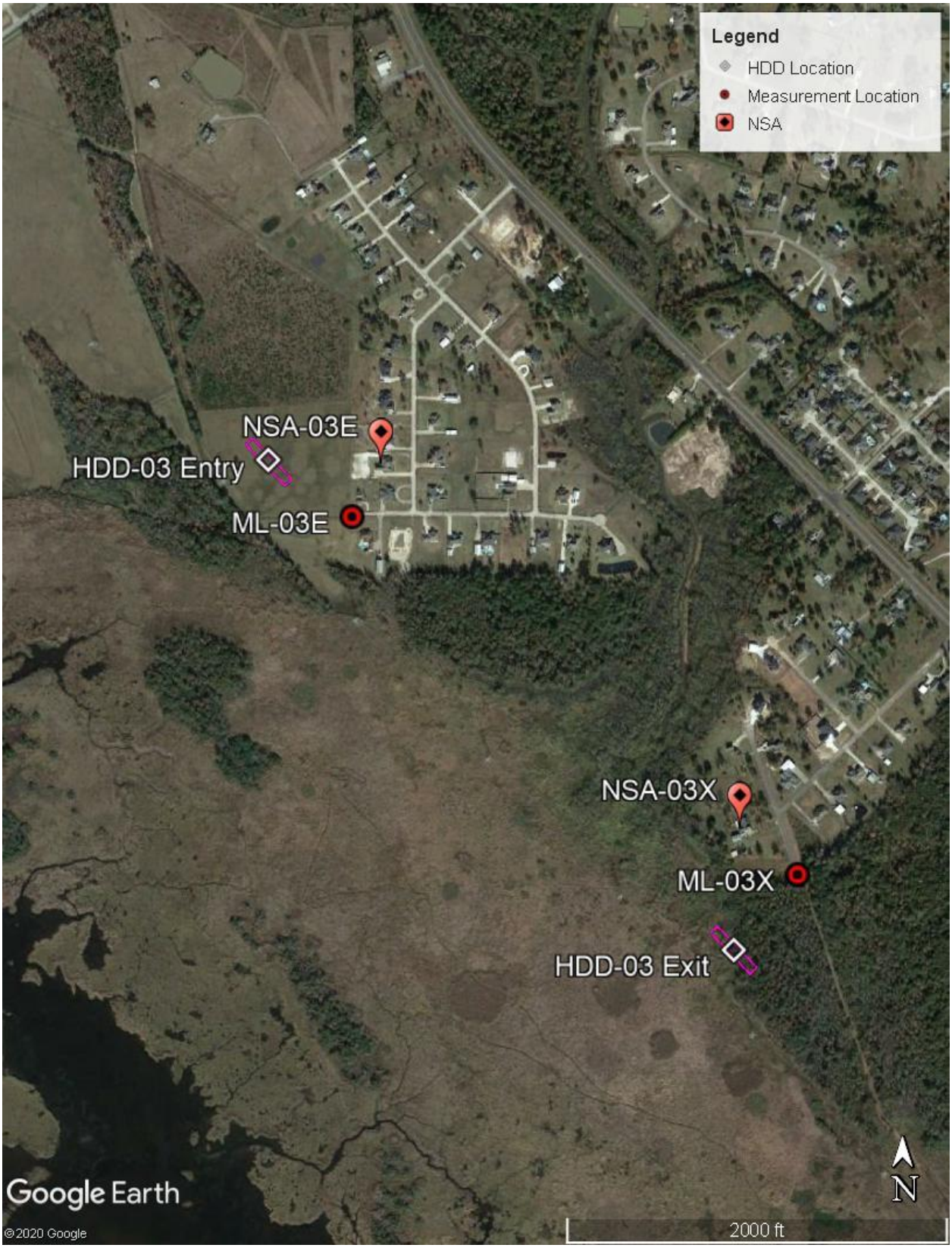

Figure 2: Map of HDD-05 NSA and Measurement Locations

Figure 3: Predicted Sound Levels Due to HDD-03 with no Mitigation, dBA L_{dn}

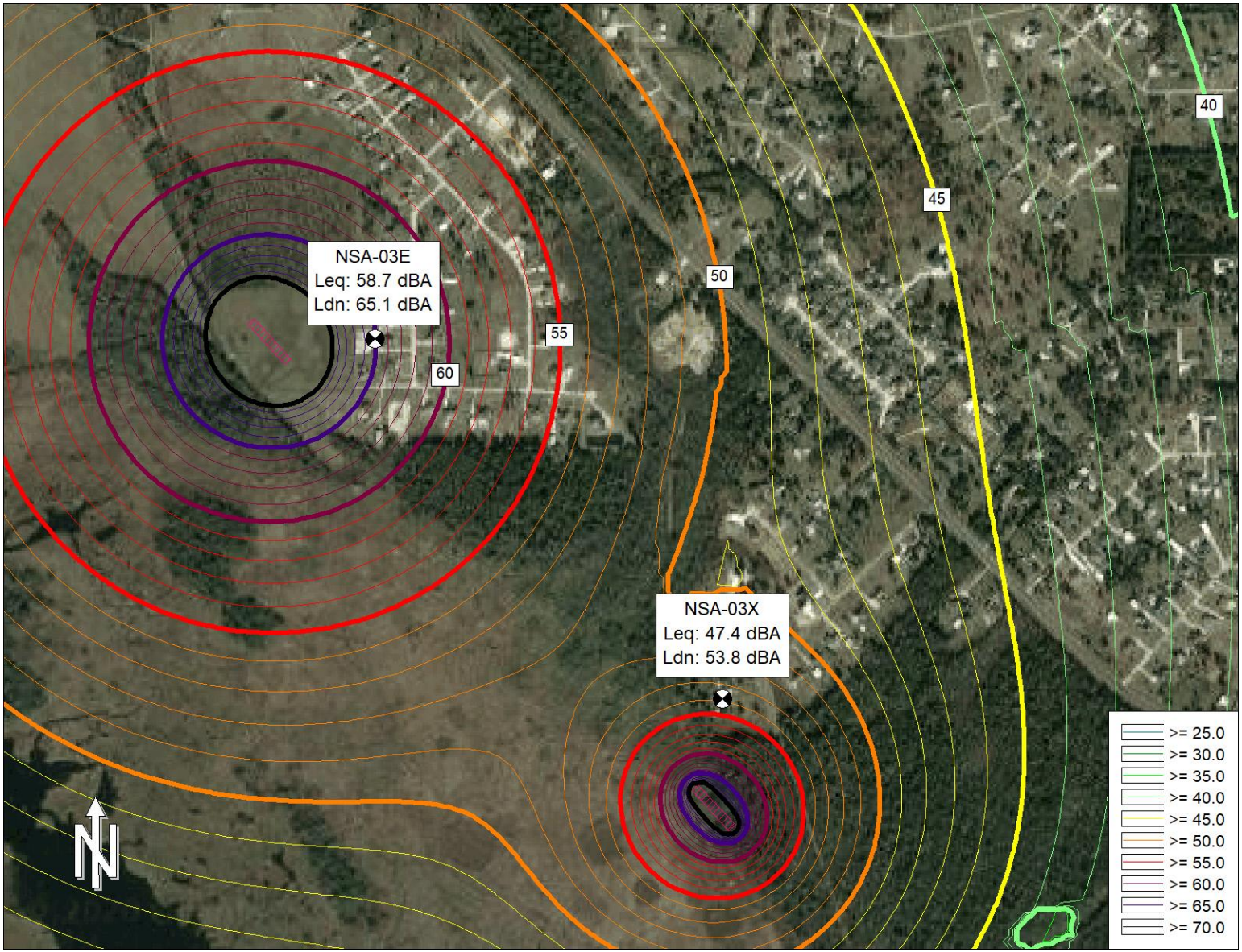

Figure 4: Predicted Sound Levels Due to HDD-05 with no Mitigation, dBA L_{dn}

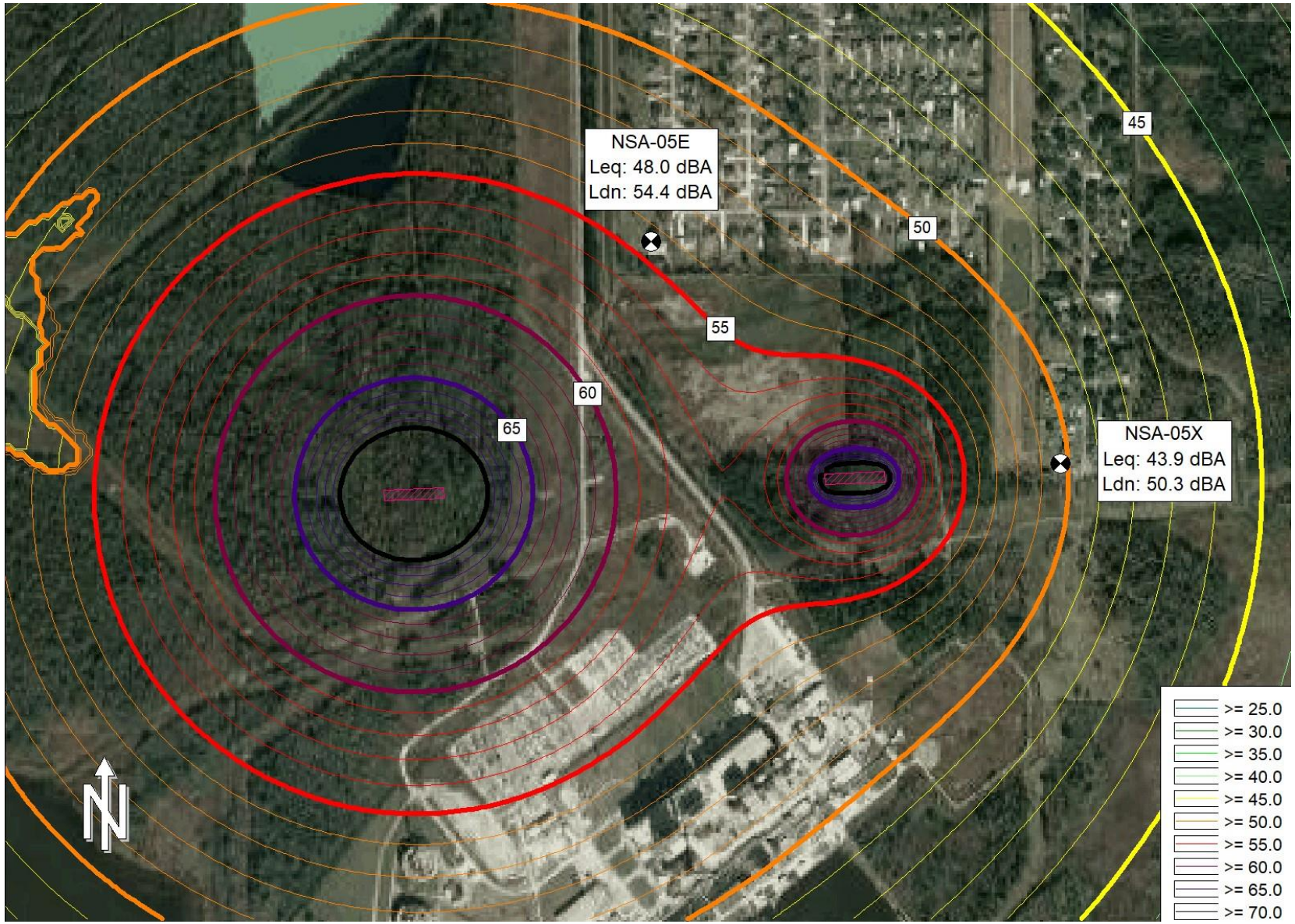

Figure 5: Predicted Sound Levels Due to HDD-03 with a 25-Foot-Tall Barrier, dBA L_{dn}