



EVALUATION OF SITE SOUND EMISSIONS
3501 STATE ROUTE 66 REDEVELOPMENT
NEPTUNE, NJ

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INTRODUCTION

Ostergaard Acoustical Associates (OAA) was asked to assist with the evaluation of potential sound emissions from a proposed redevelopment project along State Route 66 in the Township of Neptune, New Jersey. The project comprises a large warehouse building, a retail building, and a park. The site, which currently accommodates a defunct office complex, is located northwest of the intersection of State Route 66 and Green Glove Road. Future tenants are unknown, but the site has potential to operate around the clock; of greatest interest is activity occurring during the nighttime hours, potentially affecting nearby noise sensitive receptors.

The purpose of this sound study is to analyze future site sound emissions and to determine if mitigation measures are needed to comply with applicable code limits and/or to minimize the acoustical impact and potential for noise complaints. Sound emissions from the facility were evaluated against applicable Township of Neptune and the State of New Jersey noise codes.

The site will contribute steady sound from rooftop HVAC equipment and intermittent sound from motor vehicle activity, particularly truck activity. Personnel and patron vehicles will also be active on site. These vehicles are also substantially lower in sound level than trucks and are prominent throughout the area. Hence, they are generally not a concern and were not included in this sound study. The focus of this study is to evaluate on-site sound produced at residential receptors, which are located east of the site. Commercial and industrial receptors are not of much concern given that they are not particularly noise sensitive, and often do not operate at night.

Note that acoustical modelling for this professional acoustical evaluation relied on analyses in octave frequency bands. However, in the interest of providing a concise report of findings, results in this report are provided using the most common metric of environmental sound, the A-weighted sound level. Full acoustical data for any aspect of this project are available upon request.

Work by OAA was overseen by Benjamin C. Mueller, P.E., with assistance from OAA Staff. The representative Cardinal Point Management, LLC coordinating the project is Gregory Williams.

SITE AND VICINITY

Figure 1 is an aerial image obtained from Google Earth showing the site outlined in red. The property currently accommodates a large office complex that has been abandoned for over a decade. The existing site will be demolished and the parcel will be redeveloped to accommodate a single warehouse building, a retail building, and a park. Per the Township zoning map, the site is located in C-1, Planned Commercial Development, zone in the Hospital Support Overlay area. Our understanding of zoning/land uses in the various directions is as follows:

- ❑ Abutting the site to the north are various warehouse buildings and light industrial uses located in C-3, Route 66W Commercial, zone. Beyond that are single-family residences fronting on Jumping Brook Road, over 800 feet away from the site. Due to the large distance and the shielding caused by the warehouses between those residences and the site, there is no acoustical concern about those residences.
- ❑ Along the east side of the site is Green Grove Road. Across the road are single-family residences in R-2, Low Density Single-Family Residential, zone. To the southeast are assorted commercial uses that are located in C-1 zone.
- ❑ South of the site is State Route 66 with a Wawa gas station, a hotel, and a nursing center, all located in C-1 zone. Beyond the State Route 66 corridor is undeveloped woodland and Green Grove Elementary School in mixed area R-1/PUD, Very Low Density Single-Family Residential/ Planned Unit Development, zones. A residential community is south east in the R-2 zone.
- ❑ West of the site are more warehouse buildings and commercial uses that are located in C-1 and C-3 zones.

Plans call for the construction of a 251,022 ft² warehouse building located on the east portion of the site, and a 15,000 ft² retail building located on the south portion of the site. Site access will be provided from three driveways; one driveway is via Green Grove Road to the southeast, and two driveways are via State Route 66 to the south and southwest. Truck activity will only use the westernmost driveway and will be concentrated in the dock area located along the west side of the warehouse building. Personnel vehicle parking areas are provided along the north side of the warehouse building. Retail patrons will park in lots east, south, and west sides of the retail building.



Figure 1 — Google Earth image showing the proposed 3501 State Route Redevelopment, Neptune, NJ. The site property line is approximately outlined in red.

REGULATIONS/GOALS

When developing a site of this type, it is appropriate to consider how sound from the facility will likely be received, especially by noise-sensitive receptors. Sound produced by a typical distribution center includes personnel vehicle and truck parking lot activity such as vehicle movement, as well as HVAC rooftop equipment. The major noise sources should be evaluated and compared to applicable noise code regulations. Since warehouse operations can potentially be 24/7, the primary concern with sound emissions is minimizing the acoustical impact/meeting goals at night at residences.

The State of New Jersey Noise Control Regulation, found at N.J.A.C. 7:29, generally requires that steady sound from commercial or industrial properties contribute no more than 65 dB(A) at or within the property line of any residential or commercial receptor. During the nighttime hours (2200-to-0700 hours), the limit drops to 50 dB(A) at residential receptors, while the limit for commercial receptors remains the same. There are no limits for industrial receptors. Note the daytime code limit is designed to protect speech communication whereas the nighttime code limit is designed to limit any sleep disturbance. The State regulation also provides limits in octave frequency bands that correspond to the 65 dB(A) and 50 dB(A) A-weighted limits. The frequency bands cover the audible spectrum, from low-pitched sounds to high-pitched sounds. The limits are more permissive at lower frequencies because human hearing is less sensitive at low frequencies. In addition, impulsive noise, which is any noise less than one second in duration, is limited to 80 dB(A) measured on fast response, regardless of receptor type or time of day. However, during the nighttime at residences, if such impulsive sounds are repeated more than four times over an hour period, they must comply with the residential nighttime limit of 50 dB(A). It should be noted that regulatory limits apply at or within the nearest receptor property line. No limit applies at vacant properties or intervening right-of-way corridors that accommodate railroads, rivers, or roads.

Enforcement guidelines issued by the State provide further direction indicating that compliance measurements are made at the location of the affected person. This is defined as a location where recreation, repose, and conversation will occur. In other words, where a complaint would reasonably occur. Given that the most stringent limit is the State night limit of 50 dB(A) at residences, this code was evaluated at the façade of nearby residences, where receptors would reside during the night. Lastly, exceedance of code limits does not automatically result in a violation of code without a formal complaint. Professional experience is often relied upon to forecast the likelihood of a noise complaint.

The Township of Neptune discusses noise in Chapter 3 Police Regulations, Section 3-1: *Unnecessary and Disturbing Noise*. These code sections discuss noise in a qualitative manner and prohibit unreasonably loud, disturbing, or unnecessary noise. Specific prohibited acts that pertain to the site include excessive noise in connection with construction before 0800 hours or after 1900 hours on weekdays, and between the hours of 0900 and 1600 on specific Saturdays. In addition, motor vehicle horns are prohibited when used for unnecessary and unreasonable periods of time. No Monmouth County noise code was found.

The New Jersey noise code is thorough and appropriate for this project. These limits logically apply at the receptor, and meeting these limits will ensure no negative impact occurs. OAA also proposes to use State noise limits as a determinant for whether there is a disturbance per local noise code §3-1.1. In other words, compliance with the State noise code limits would conclude there is no noise disturbance.

In summary, sound from this site should not exceed the 50 dB(A) limit during the nighttime hours at the façade of nearby residential dwellings and 65 dB(A) at residences during the daytime and at nearby commercial properties at all times. No limit needs to be met at vacant and unused properties.

EXPECTED SOUND EMISSIONS

Acoustical modelling software, specifically CadnaA, was used to create and analyze site sound emissions for the site. The model takes into account relevant parameters between the noise source and receptor positions of interest to predict how sound will propagate. In addition to distance attenuation, the model accounts for the effects of terrain, various types of ground cover, shielding by structures, and reflections from buildings.

In the model, buildings are white and the site property line is outlined in red. Elevation information exterior to the site was obtained from the [New Jersey Geographic Information Network](#) and was incorporated into the model. Elevation contours are shown in teal. Model results show only the sound emissions of the site, which are directly comparable to applicable noise code limits; ambient sound is not included in the model. North is pointing up in all figures. The numbers around the perimeter of each figure represent the scale in feet.

The acoustical model shows the results graphically as A-weighted sound level contours, in 1 dB increments, and tabulates the summed A-weighted sound levels at ten discrete locations of interest nearby the site. Sound level contours are at ear height, 5 feet above grade. Locations A and B are the nearest residential receptors to the east. Location C is at the nearest commercial property northwest of the site and Location D is at the nearest warehouse building west of the site. Location E is at the hotel located south of the site across State Route 66. All Locations are modelled at the façade of receptors at a height of 20 feet above grade to represent a second-story receptor.

Note that hotels accommodate patrons during the nighttime hours and can sometimes be considered as potentially noise sensitive. Our professional experience has shown that these uses are regularly constructed in noisy, well-traveled areas, and utilize windows and façade construction necessary to maintain the desired level of quiet for their clientele.

HVAC Sound

Rooftop HVAC equipment produces noise that is nominally steady in nature, and hence will not vary significantly over time. Based on OAA's experience with other similar projects, a conservative approximation for a warehouse of this size is to assume 1 ton of cooling per 725 square feet of building. This equates to about thirteen (13) 25-ton HVAC units for the warehouse building. A total of four (4) 25-ton HVAC units were modelled for the retail building to be conservative. These units were evenly spread out on the rooftop of each building and the sound power level for each of these was assumed to be 93 dB(A) re 1 picowatt based on manufacturers' data and professional experience. Note that this assumes warehouse space will be heated and cooled; this overestimates HVAC requirements as most warehouses are only heated.

The noise from the rooftop units was included in the HVAC sound model. HVAC noise sources are shown as blue "+"s. Noise sources were placed 4 feet above the rooftop, and sound was projected off site. Figure 2 shows the results graphically and tabulates the summed A-weighted sound levels at the nearby Locations of interest.



Figure 2 — A-weighted sound emission contours, 5 feet above grade, for sound from rooftop HVAC equipment. HVAC units shown with a blue + sign. Buildings shown in white, site property line outlined in red. Sound emissions tabulated at 20 feet above grade for all Locations.

The results show that with all rooftop units operating, HVAC sound levels off site receptors are in the range of 35-to-45 dB(A), meeting the State nighttime code limit of 50 dB(A) by a margin of 5 dB(A) or more for the residences nearby and by a margin of 19 dB(A) or more for commercial properties. As a result, HVAC sound will have no negative acoustical impact on the surrounding area. Note that for these model results to be realized, acoustical performance of HVAC equipment must be acoustically aligned with what was modelled.

Truck Activity

OAA has had the opportunity to visit various logistics facilities and industrial parks over the years to survey and document the sounds of truck activity. The warehouse will have over-the-road line-haul trucks and potentially have terminal tractors (yard tractors) active on site. Line-haul trucks deliver trailers from off-site whereas terminal tractors do not leave the site and move trailers between the docks and parking areas. Terminal tractors, if present, are responsible for the majority of back-up movements on-site. From an acoustical aspect, terminal tractors and line-haul trucks are acoustically equivalent.

Truck noise in a dock area can routinely produce maximum sound levels of 79 dB(A) when measured at a distance of 50 feet from the source. This sound level was determined by looking at a wide variety of truck activity, such as truck movement, air brakes, back-up alarms, and coupling/decoupling, and distilling it to a single conservative maximum level and spectrum for use in acoustical studies such as this. A driving truck exhibits slightly lower maximum sound levels of 74 dB(A) when measured 50 feet from the source. The height of a truck source for all truck activity is modelled at a conservative height of 8 feet above grade. OAA has found that using these maximum sound levels at this height ensures a conservative approach to evaluating truck sound within the truck court. When specific individual activities are modelled at their actual height and sound level, results are typically lower in level than predicted below. For example, many of the high sound level activities, such as back-up alarms and air brakes, occur at a height of 4 feet above grade, not 8 feet. This is a critical detail when evaluating the effectiveness of a sound barrier or berm and when considering intervening topography. It is also important to recognize that all truck noise is dynamic in nature. Maximum sound levels only occur for a short duration and are not representative of the constant sound level produced by on-site trucks. Although not modeled in this report, for comparison passenger vehicles produce maximum sound levels of 59 dB(A) at 50 feet.

Trucks were modelled at various on-site locations. During the daytime, trucks will have access to the entire site and hence were modelled in the truck court as well as around the ring access road. During the night hours, trucks will be restricted to only operating on the west side of the building, to avoid impacting residences during the nighttime hours. A review of the traffic study and data provided by the Institute of Transportation Engineers for Land Use Code 150 – Warehouses, indicates that during the day, a typical busy hour might see close to ten trucks in a given hour. During the night, maximum hourly truck counts are only 1-to-3 in a given hour. Therefore, for the daytime analysis a total of five driving trucks and two dock activity trucks were modeled. For the nighttime analysis, and two driving trucks and two yard activity trucks were modeled on the west side of the site. For all models, all trucks are producing maximum sound levels at the same time, which is conservative. Driving trucks are shown as pink “+”s and each modelled with a sound pressure level of 74 dB(A) at 50 feet. Trucks contributing yard activity are shown as white “+”s and modelled with a sound pressure level of 79 dB(A) at 50 feet. HVAC noise sources were also included in the model to represent worst-case conditions, and are shown as blue “+”s. The results for daytime warehouse operations are provided in Figure 3. Figure 4 provides the result for the nighttime operations.

Results in Figure 3 show maximum off-site sound levels at residential receptors and noise sensitive receptors are at or below the daytime noise code limit for all locations with maximum sound level of 65 dB(A) at Location A. Sound emissions at all other locations are lower and in the 53-to-62 dB(A) range.

Results in Figure 4 have similar compliance conclusions. Intermittent maximum sound levels at off-site residential receptors are well below the residential nighttime noise code limit. In addition, the commercial noise code limit of 65 dB(A) is met at all other receptors. Therefore, no mitigation is needed for this site other than to restrict truck activity on the ring access road during the nighttime hours. Results show that truck activity can occur within the truck court and fully comply with the State nighttime noise code limit.

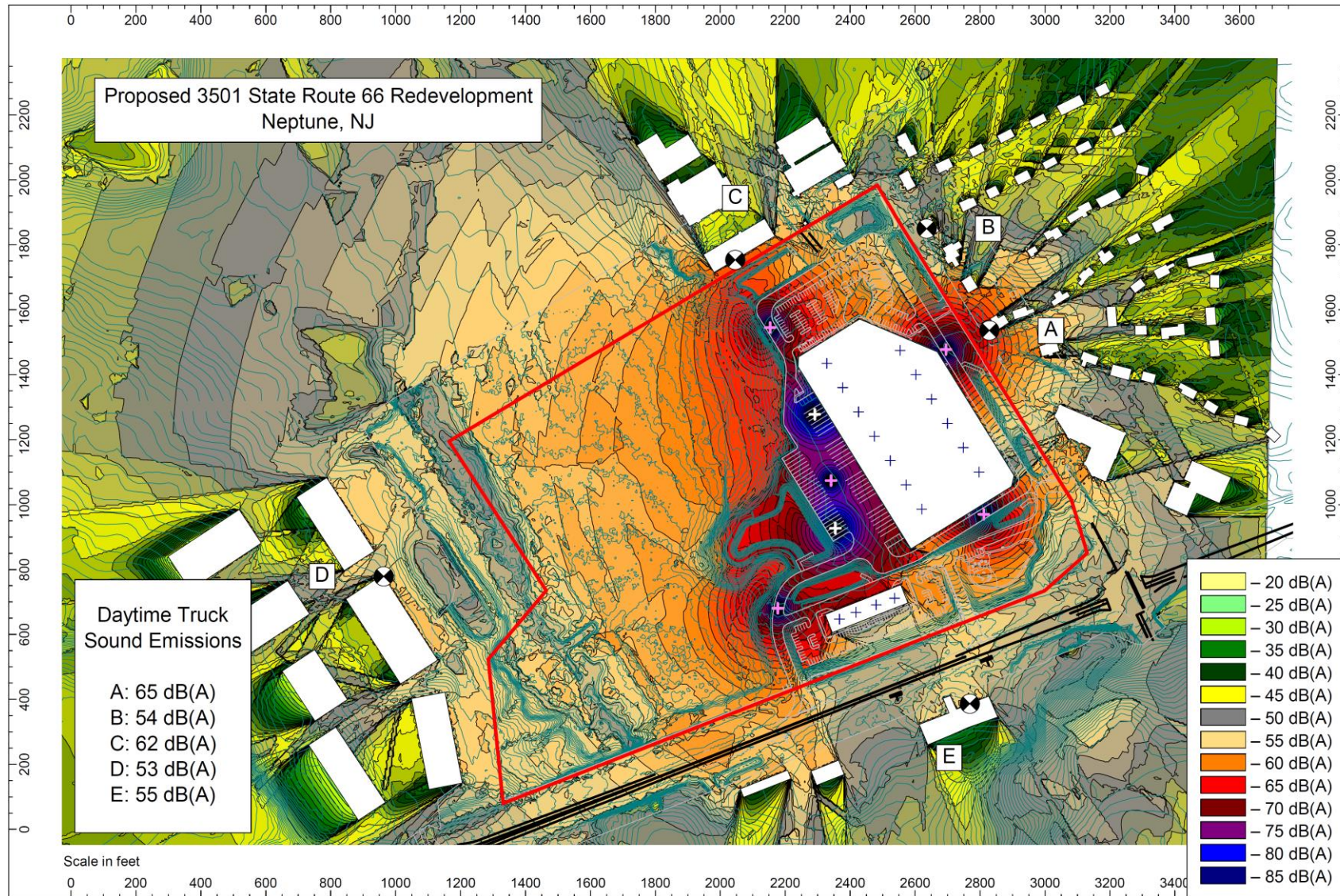


Figure 3 — A-weighted sound level contours, 5 feet above grade, expected for daytime operations consisting of five driving trucks (pink +) and two yard activity trucks (white +). HVAC units shown with a blue + sign. Buildings shown in white, site property line outlined in red. Sound emissions tabulated at 20 feet for all Locations.

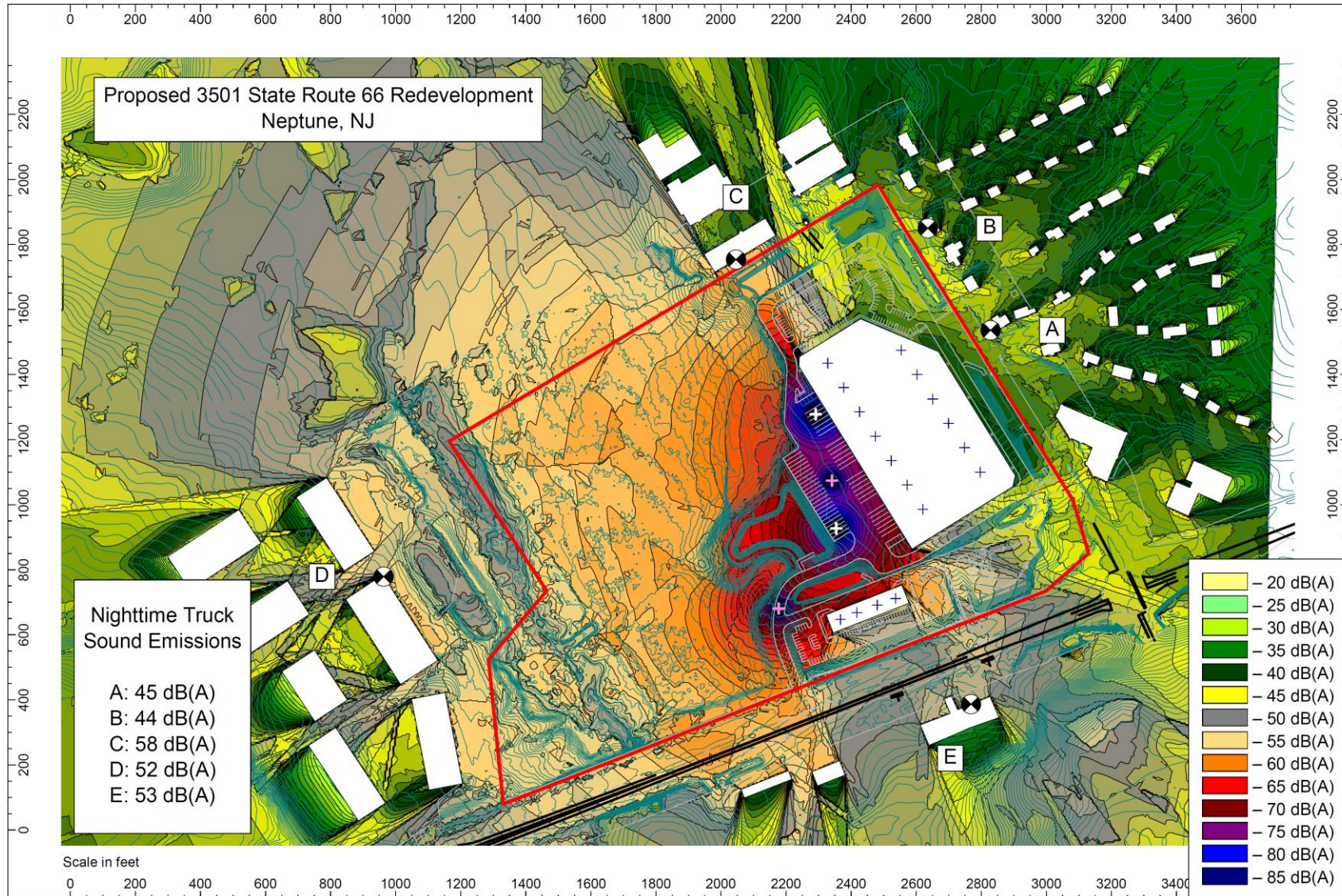


Figure 4 — A-weighted sound level contours, 5 feet above grade, expected for nighttime operations consisting of two driving trucks (pink +) and two yard activity trucks (white +). HVAC units shown with a blue + sign. Buildings shown in white, site property line outlined in red. Sound emissions tabulated at 20 feet for all Locations.

CONCLUSION

Plans call for the construction of a warehouse building located on the east portion of the site, and a retail building located on the south portion of the site. The area surrounding the site is mixed in use with single-family residences nearby east of the site, a hotel on the south, and various commercial and industrial properties in the other directions. The single-family receptors are closest to the site; however, it should be noted that the docks are located on the west side of the building, facing away from residences. This layout allows the building to act as a natural sound barrier for these receptors. An acoustical evaluation was carried out to ensure that site sound emissions meet applicable noise codes and minimize the potential for noise complaints. Meeting these project goals will ensure there is no negative acoustical impact at potentially noise sensitive receptors.

Analyses show that steady HVAC noise is expected to produce sound levels well below the nighttime code limit at all receptors. As a result, steady HVAC sound is not expected to have any negative impact on the surrounding area. Proposed HVAC equipment arrangements can proceed, keeping in mind that any modification to the arrangement may affect site sound emissions. Truck activity associated with the warehouse was also scrutinized, and conservative analyses of daytime and nighttime site activity conclude that all on-site truck activity meets State noise code limits at all receptors. No mitigation is needed to meet code aside from restricting nighttime truck traffic along the eastern driveway. Lastly, while not specifically analyzed, there are no acoustical concerns with other vehicles operating on site. Personnel and patron vehicle activity is lower in level compared to trucks and is not expected to have any negative impact on the area during either the day or night. Potential truck deliveries for the retail building are also not a concern as this use is remote from residences, expected to occur during the daytime hours, and will be low in volume compared to warehouse operations.

The above analysis supports that sound from this site is expected to meet the 50 dB(A) nighttime sound limit at the façade of nearby residential dwellings and 65 dB(A) at the façade of the nearby commercial properties, and hence the site will fully comply with the State noise code. Based on the foregoing, no negative acoustical impact is anticipated from on-site operations and complaints are not anticipated to be directed at the site.