May 24, 2021 ADI Letter #4

Noise impacts near Foxcroft Lake and Dunn residence, additional mitigation, and buffer clarification

1. *In your report, "Wake Stone Triangle Quarry Expansion Acoustical Study," on page 28, Figure 14 shows an isopleth depicting the sound increase between existing and future conditions. The greatest noise impacts off the property occur across Foxcroft Lake and at the Dunn residence. Based on Figure 14, there is concern that the noise from the quarrying operation may have an impact on the Park. The Division understands that the isopleths in Figure 14 were developed using conservative modeling and did not take into consideration vegetation.*

   It is important to note that the isopleths illustrated in Figure 14 of the "Wake Stone Triangle Quarry Expansion Acoustical Study" depict only the Cadna-A Model suggested potential increase of quarry-related noise by comparing modeled future quarry noise levels to modeled noise levels attributable to present day quarry activities. It does not represent an increase between existing and future conditions for **all noise sources**, including airport and interstate highway noise.

   A. *Please supply a written explanation as to how the current vegetation on the east side of Foxcroft Lake would affect the noise impact that is being shown in Figure 14. In addition, please propose other mitigating devices needed to reduce the noise impacts on the east side of Foxcroft Lake.*

      The attached memo from Erich Thalheimer (WSP) dated August 9, 2021, addresses the effects existing vegetation on the east side of Foxcroft Lake might have on quarry noises experienced in Umstead State Park. This vegetation will primarily provide a visual screen of proposed future quarry activities from the small area of concern northeast of the lake.

      The Cadna-A noise model indicated that the dominant source of quarry noise in this area was anticipated to be from the proposed use of the existing perimeter road on the north side of the existing quarry pit (Pit 1). To lessen the effects of this model-suggested noise increase on that small section of Umstead State Park immediately northeast of Foxcroft Lake, WSC directed WSP to examine additional mitigation measures that we might employ. Various sound barrier walls were considered and modeled at different locations and heights to achieve a reduction in modeled noise. For the area northeast of Foxcroft Lake, the most effective (and only practicable) additional mitigation was the inclusion of a sound barrier wall along the north side of the existing Triangle Quarry perimeter haul road and across the proposed bridge. Modeling of a 12-foot barrier wall was enough to eliminate the haul route as the dominant source of noise for the area. However, to also function effectively as a visual barrier and to be consistent with the noise barriers previously proposed along the northeast sections of this haul road, Wake Stone will construct a 14-foot acoustical barrier wall as illustrated on the Wake Stone Site Plan set revised August 4, 2021.

B. *The Dunn residence seems to be an area of offsite high noise level increase. Please provide either additional enhanced mitigation to the proposed plan or supply a written explanation as to how the proposed mitigation measures will adequately protect the Dunn residence.*

The attached memo from Erich Thalheimer (WSP) dated August 9, 2021, also addresses the noise concerns for the Dunn residence. Wake Stone maintains that a significantly adverse effect in terms of quarry related noise would be defined as a 10-decibel increase in noise attributable to quarry activities. Furthermore, a significantly adverse effect to a private residence is not a denial criterion. However, Wake Stone strives to minimize the impact of quarry operations to all its neighbors.

In response to the DEMLR request to re-examine the model predicted noise levels at the Dunn residence, Wake Stone explored many options, including Cadna-A model runs to ascertain berm height that would be required to yield any significant reduction in modeled noise levels. Through that effort it was determined that placement of a sufficiently high berm was impractical. As another possible solution, Wake Stone examined the potential use of "sound walls" such as employed along public highway rights-of-way and in certain industrial applications. Through several iterations of modeling, a wall design varying from 16-24 feet high was determined to provide an acceptable reduction in modeled noise levels at the Dunn residence. Although construction of such a wall will result in significant additional site development costs to Wake Stone, we are proposing to replace much of the originally planned security fence and vegetated earthen berm with such an engineered sound wall. These proposed changes are illustrated on the attached "Proposed Additional Noise Mitigation" schematic, and on the Wake Stone Site Plan set last revised August 4, 2021. These drawings illustrate the location and height of the two different walls, as modeled by WSP. The originally proposed security fence will still be utilized along Interstate Highway 40, and from the eastern end of the wall to Crabtree Creek to minimize land disturbance in those areas. In addition to providing improved noise reduction, site security, and visual barriers as compared to the previously proposed security fence, vegetated earthen berm, and 100' unexcavated buffers, Wake Stone believes that a decorative "DOT-style" noise barrier wall also has the following advantages:

- The area of initial land disturbance (particularly along Old Reedy Creek Road) will be significantly reduced.
- The time needed to construct a sound wall will be significantly less than the time to construct an earthen berm (weeks versus months), and significant volumes of dirt will not need to be hauled to the construction area.
- A decorative (formed panel) sound wall barrier would be much more esthetically pleasing than the chain-link and barbed wire security fence, especially in high visibility areas such as along the Old Reedy Creek Road public thoroughfare.
- Although it will require a significant up-front capital investment by Wake Stone to construct a decorative formed panel wall, these costs will be offset by recovery of additional reserves made available in portions of the area previously designated for berm construction.

2. *Please clarify whether the area around Foxcroft Lake, outside of the 50' wetland buffer, is to be considered a designated undisturbed buffer. Please label and indicate on the mine maps any additional designated undisturbed buffers around Foxcroft lake, including type and size of the buffer.*

   No areas around Foxcroft Lake are currently proposed as "designated undisturbed buffer" other than the mining permit-stipulated stream/wetland buffers and Neuse River Riparian Buffer Rule riparian buffers. However, no land disturbing activities are currently planned east of Foxcroft Lake. Ingress-egress via existing trails, and travel over open forest floor, will be used to access this area for construction and maintenance of the security fence. Wake Stone does not intend to clear any trees except as needed to construct and maintain the security fence between Foxcroft Lake and the easternmost property boundary. However, the need to continue to maintain this security fence for the life of the operation prevents designating this entire area as "undisturbed buffer." Wake Stone cannot and will not engage in any land disturbing activity beyond the limits of disturbance as illustrated in the attached Site Plans and Erosion and Sediment Control Plan without the approval of the Division of Energy, Mineral, and Land Resources.

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MEMORANDUM

To:	Sam Bratton (Wake Stone)
From:	Erich Thalheimer (WSP)
Date:	August 9, 2021
Project Name:	Wake Stone Quarry Noise
Project Number:	31402799.000
Subject:	**Responses to DEMLR ADI Noise Questions 5/24/21**

This memo is intended to respond to ADI questions from DEMLR dated 5-24-21 regarding concerns of increased noise at the area of Umstead State Park east of Foxcroft Lake and at the Dunn residence adjoining the proposed Pit 2 expansion area. An updated sound isopleth graphic is also included, as requested, to supersede Figure 14 in our (WSP's) original report dated 3/12/21.

Responses to Question 1:

A. Existing dense vegetation will remain in the area east of Foxcroft Lake. The benefit of this buffer is primarily visual. The benefit of vegetation for noise attenuation is only significant over longer distances. Therefore, there may be a benefit to areas further inside the park from this undisturbed forested area, but at the location described in this request, i.e. at or near the property line, the vegetation would not play a significant role in reducing the modeled noise levels. For this reason, we did not include vegetation in our noise model in order to be conservative. With our assistance, Wake Stone has examined the feasibility of multiple additional mitigation options, as follows:

   i. Option 1 was the potential placement of a noise barrier (wall or curtain) at or along the proposed security fence between Foxcroft Lake and the eastern property corner at Crabtree Creek. Unfortunately, additional acoustical modeling showed that to achieve any appreciable reduction in noise, this barrier would have to be taller than the proposed 8' security fence. Given that constraint, any additional noise barrier would likely require significant land disturbing activity, would constitute a financial hardship for Wake Stone, and would potentially reduce the effectiveness of this forested area as a visual buffer.

   ii. Option 2 was the potential placement of a noise barrier wall along the existing quarry perimeter (haul) road and the proposed bridge. This haul road noise source was identified in our models as the dominant source of noise likely to affect the area of concern. Modeling of this mitigation measure indicated that such a barrier would remove this road as the dominant noise source and provide approximately 1 decibel noise reduction at the small area of concern northeast of Foxcroft Lake. However, with the removal of the perimeter road as the dominant noise source, the Pit 2 expansion area is then expected to become the dominant source (see Option 3).

   iii. Option 3 was the potential placement of a noise barrier along the western boundary of Foxcroft Lake to further mitigate potential noise from Pit 2. Unfortunately, due to topography, placement of a noise barrier at the outer extents of the proposed pit area would be impracticable and unacceptably costly due to the required height of the barrier and the length of the barrier needed to provide minimal reduction in noise. Construction of such a barrier also has the potential to greatly complicate Wake Stone's grading and site development plan.

It is also important to keep in mind that the noise from Pit 2 will diminish over time as the equipment is moved to lower elevations as the site is developed.

Ultimately, the only additional noise mitigation measures that are practicable for Wake Stone to propose included (1) erecting a substantial noise barrier wall along the Dunn property, the northern side of Pit 2, and along Old Reedy Creek Road, in lieu of the previously proposed earthen berm, and (2) a 12 foot tall noise barrier along the end of the haul road and associated bridge to reduce noise affecting the Foxcroft Lake area. **Updated Figure 14** (below) shows the modeled sound isopleth contours with this additional mitigation.

B. The Dunn residence was also raised as an area of concern for increased noise. WSP contends that the only statutory requirement for residential neighbors is that the operation will not "constitute a direct and substantial physical hazard." The modeled noise levels do not come anywhere close to posing a "physical hazard" associated with hearing conservation or loss. Nevertheless, Wake Stone had attempted to minimize noise concerns at the Dunn residence by previously proposing an earthen berm, the tallest section of which was around the Dunn property. Additional mitigation measures were explored and modeled by WSP to evaluate their efficacy. However, due to the location of the Dunn's house being uphill from the proposed Pit 2 expansion area, it was determined that the height of an earthen berm needed to reduce the modeled noise levels by just 1 to 2 decibels was unacceptably tall, would increase the footprint of disturbed land area required, and would increase the time it would take to construct such a berm. That led Wake Stone to examine the feasibility of a DOT-style sound wall, made of concrete panels or equivalent, which presented a host of improvements over the previously proposed earthen berm:

    i. The area of land disturbance required for construction would be significantly less with a sound wall than that needed for an earthen berm.

    ii. The time needed to construct a sound wall would be several weeks rather than several months for an earthen berm.

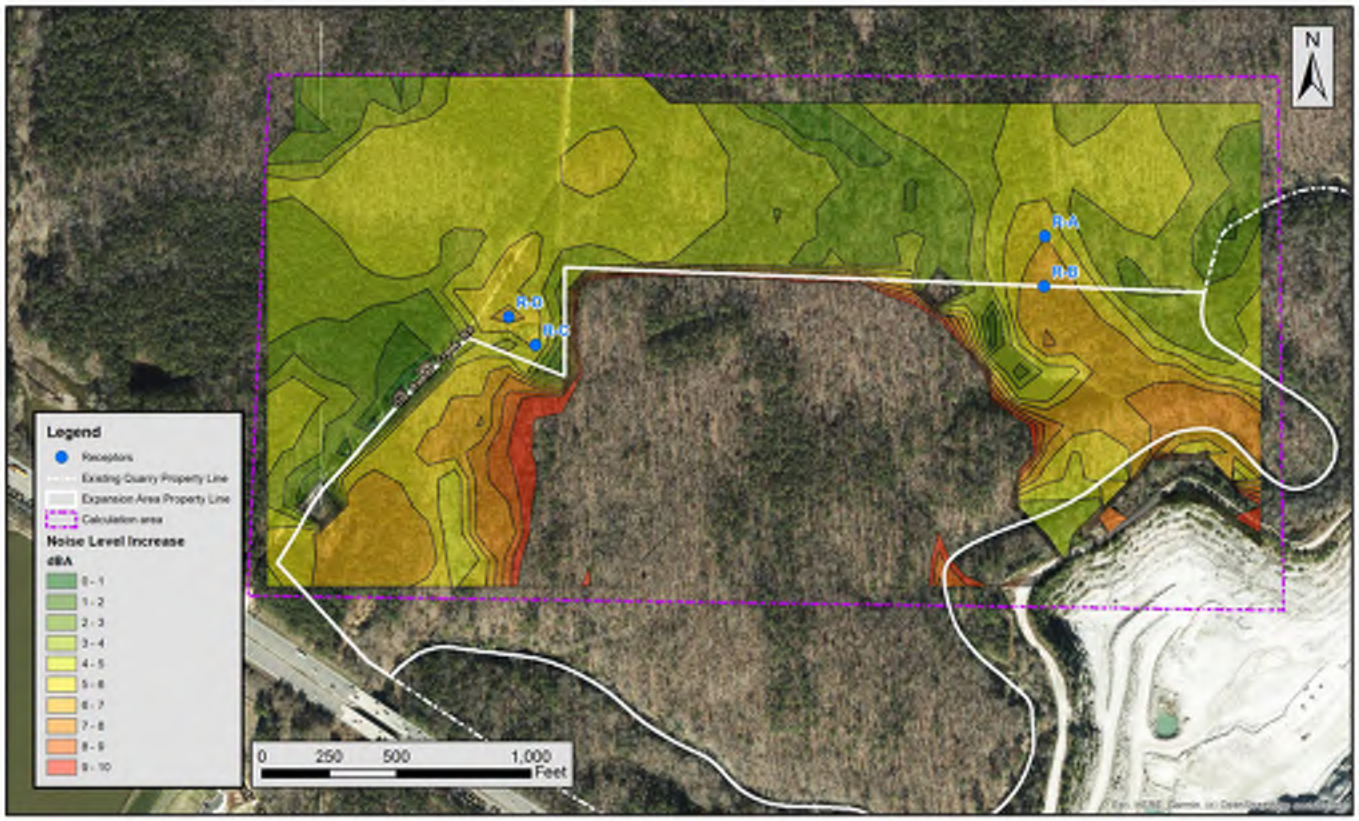
    iii. The height of a sound wall could be easily varied to provide optimum noise reduction for neighboring properties.

    iv. A more decorative (formed panel) concrete sound wall barrier could replace the security fence along the majority of the perimeter, thus providing security as well as a visual and noise barrier.

    v. The area that was proposed for the earthen berm would be available for Pit 2 development which would increase the stone reserves available to Wake Stone. This would allow Wake Stone to eventually recoup the high cost of this initial investment for the noise wall.

Consequently, Wake Stone is proposing replacing the previously proposed security fence and earthen berm with a decorative DOT-style sound wall from the new driveway entrance at the westernmost point of the property to Foxcroft Lake. The wall would be 16 feet high along Old Reedy Creek Road and along Umstead State Park, and 16 to 24 feet high around the Dunn residence. The originally proposed chain-link security fence would still be utilized along I-40 to Crabtree Creek and from Foxcroft Lake east to Crabtree Creek for security in order to minimize disturbance in these areas. **Updated Figure 14** (below) shows the modeled sound isopleth contours of this newly proposed mitigation.

Updated Figure 14. Quarry Site Isopleth Sound Difference Contours (Future – Existing)



Note: Sound isopleth contour levels attributable only to noise produced by Wake Stone's operations (i.e. does not include other background noise sources such as traffic noise from I-40 or aircraft noise from Raleigh Durham Airport).

Table 1 is a summary of the modeled sound levels predicted at the four discrete receptors shown above. Receptors R-A and R-B were included in the model to evaluate future noise conditions in more detail affecting the Foxcroft Lake area, and receptors R-C and R-D were added to better evaluate the front and back yards belonging to the Dunn residence. *It should be noted these subsequent noise mitigation efforts were voluntary on Wake Stone's part, and we still maintain they were not statutorily required.*

The point of this summary table is to demonstrate that Wake Stone's current proposed design involving a slightly larger Pit 2 with concrete panel wall in place of the earthen berm perform as well or better to reduce noise levels affecting Umstead Park and the Dunn residence. Thus, it can be shown (in **Table 1**) that Wake Stone's current proposed design is as good or better at reducing noise as the design proposed in the report dated 3/12/21 at the majority of receptors.

Table 1. Summary of Wake Stone Quarry Predicted Sound Levels

Noise Receptor	Predicted Noise Levels from Wake Stone Operations For Worst-Case 280 feet Production Scenario (Leq(h) dBA)			
	Final Report 3/12/21	Current Proposal	Change in Noise Level	Comments
R-1: Residence Property Line	48.6	43.1	- 5.5	Notably quieter
R-2: Company Mill Trail	52.4	52.4	0.0	
R-3: Picnic Area	52.1	52.1	0.0	
R-4: Residences	35.2	35.2	0.0	
R-5: Reedy Creek Park Trail	38.6	38.5	-0.1	Slightly quieter
R-6: North Turkey Creek Trail	31.1	31.1	0.0	
R-7: Foxcroft Lake	53.2	53.0	-0.2	Slightly quieter
R-8: Crabtree Creek	50.3	51.0	0.7	Slightly louder
R-A: Near Foxcroft Lake	55.4	55.4	0.0	
R-B: Foxcroft Property Line	57.1	56.7	-0.4	Slightly quieter
R-C: Dunn Back Yard	53.3	51.7	-1.6	Slightly quieter
R-D: Dunn Front Yard	45.0	44.1	-0.9	Slightly quieter

Professional Certification:

I hereby certify that this plan, specification, or report was prepared or reviewed by me and that I am a duly certified acoustical professional as recognized by the Institute for Noise Control Engineering (INCE).

Erich Thalheimer

ERICH THALHEIMER
INCE BOARD CERTIFIED NO. 20104

16' Pre-Cast Wall
18' Pre-Cast Wall
20' Pre-Cast Wall
22' Pre-Cast Wall
24' Pre-Cast Wall
20' Pre-Cast Wall
16' Pre-Cast Wall
16' Pre-Cast Wall
14' PVC Wall

Proposed Additional Noise Mitigation