



July 28, 2022

Brandy Zackery, P.E.
Arnold Consulting Engineering Services, Inc.
P.O. Box 1338
Bowling Green, KY 42102

Dear Ms. Zackery,

The following are the results of a site noise study which analyzes potential noise emissions from the operation of proposed a car wash in Port St. Lucie, Florida.

Background

The study is based on the following:

- 1) review of the provided Site Plan
- 2) documents containing acoustical measurements conducted at various similar commercial car wash locations (by other acoustical consultants)
- 3) estimated receiving property ambient sound levels based on traffic data and sound level measurements taken in similar traffic conditions.
- 4) acoustical analysis conducted in office

Noise Sources

The primary car wash noise sources include the following proposed equipment:

- Ten (10) Tech 21 15HP Drying/Blower Fans – located toward the exit (east) side of the car wash building
- Fifteen (15) Vacutech individual vacuum stations located to the north of the car wash building
- Two (2) Vacutech T-4 vacuum system turbines located behind an 8' tall enclosure toward the Western Portion of the property

Surrounding Uses

Per the SPRC Document, the following are uses for the adjacent parcels in each direction.

Direction	Future Land Use	Zoning	Existing Use	Distance from Car Wash Building Exit (feet)
North	U	OSC	Drainage right-of-way and passive park	80 ft. to property line 660 ft. to nearest building.
South	CS/CH	PUD	Bank and Medical Office	250 ft. to property line 340 ft. to nearest building.
East	ROI	P	Office Building	140 ft. to property line 260 ft. to nearest building.
West	ROI	CG	Vacant	560 ft. to property line (no building on property)

CG – General Commercial, U- Utility, OSC- Open Space Conservation, CS/CH- Commercial Service, ROI- Residential/Office/Institutional, P- Professional

The distance from the Car Wash Building Exit (the anticipated loudest location of the proposed business) to the nearest building is shown for purposes of discussion later in this report.

The distance from each of the primary Car Wash noise sources to the neighboring property lines will be used to calculate the anticipated operational sound levels at the adjacent receiving property lines, for comparison to the ordinance decibel limits.

Exhibit A shows the location of the subject and receiving property lines.

Noise Ordinance

The Code of City Ordinances Sec. 94.04 defines the maximum permissible sound levels for commercial land uses as 65 dBA from 7am to 11pm and 60 dBA from 11pm to 7am.

“No person shall operate or cause to be operated any source of sound from any location in such a manner as to create a sound level which exceeds the limits set forth ... for property in the receiving land use category when measured at or beyond the approximate real property line of the receiving property.”

Ambient Sound Levels at Adjacent Properties

Primary Noise sources

The primary sources of ambient noise at the nearest property lines are as follows:

- Heavy vehicular traffic on SW Gatlin Boulevard (45 speed limit, AADT 46000 vehicles, 2208 trucks).

Other noise sources include (but are not limited to)

- Moderate vehicular traffic on adjacent local roads (SW Import Drive AADT 1750 vehicles, 217 trucks).
- Aircraft flyovers
- Bus stop immediately South of subject parcel

Ambient Sound Level Estimates by Receiver Location

North Receiver Location

The parcel north of the property line contains a ditch leading to a water retention pond further north, which is flanked by a small empty grassy area that abuts SW Import Drive. This grassy does not appear large enough to construct a building, and therefore this area is not likely to be regularly inhabited, save people walking along the sidewalk. Residential properties are further north (nearest property is about 575 ft. from subject property).

Based on the distance to SW Gatlin Boulevard and SW Import Drive, the anticipated ambient noise at the north property line is in the 47-65 dBA range, based on FDOT traffic counts (using HUD noise assessment methodology).

Heavy Trucks on Gatlin will typically measure between 62-81 dBA

Other Receiver Locations

The other parcels sit immediately adjacent to SW Gatlin Boulevard and SW Import Drive.

Based on the distance to SW Gatlin Boulevard and SW Import Drive, the anticipated ambient noise at the south and east property line is in the 52-70 dBA range, based on FDOT traffic counts (using HUD noise assessment methodology).

Heavy Trucks on Gatlin will typically measure between 65-85 dBA

Despite the west Receiver Location being further from SW Import Drive, the anticipated ambient noise should be fall within the same range as the south and east receiver locations.

Project Site Analysis

Project Site Noise Sources

Exhibit B shows the location of the primary car wash noise sources.

Sound level data of the primary car wash noise sources are based on the following documents (See Exhibit C for document excerpts showing data).

- Noise Study for Omaha Take 5 CarWash (Fan Noise contours with distance) - conducted by Thornton
- Noise Study for Barrie, Canada CarWash – conducted by Trow Associates
- Noise Assessment of 10 and 15 HP Fans – conducted by Trow Associates
- Vacutech Sound Study of 30 individual vacuum stations
- Vacutech Measurements of vacuum system turbine noise

Calculations are based on the following source sound level measurements:

Sound Source	Sound Measurement Distance (feet)	Sound Level (dBA)	Measurement Quantity
(10) Drying/Blowing Fans	9.8 (3m)	88.0	1
(15) Vacutech Vacuum Stations	45	57.3	30
(2) Vacuum System Turbines	10	69.0	1

The sound level contributions from each of these sound sources were calculated individually and summed together to arrive at the anticipated noise emissions at each of the four receiving property lines and compared to the decibel limits contained in the PSL Noise Ordinance described on page 2 of this report.

The following chart shows the anticipated noise emissions from each of the primary sound sources at each of the four receiving property lines.

Receiver	Vacuum Distance (feet)	Vacuum Sound (dBA)	Fan Distance (feet)	Fan Sound (dBA)	Turbine Distance (feet)	Turbine Sound (dBA)**	Total Sound (dBA)
North	45	54.3	80	51.5*	50	48.5	56.8
East	260	42.9	140	62.9	625	32.1	62.9
South	270	42.6	250	44.1*	260	37.8	47.0
West	400	40.1	560	53.8	60	47.3	54.9

*** Note – fan noise to north and south will be significantly mitigated by walls of the car wash building**

**** Note – turbines will be shielded via 8ft high masonry wall**

Discussion

Based on the results of the calculations, the decibel limits of The Code of City Ordinances Sec. 94.04 will not be exceeded. Furthermore, the anticipated traffic noise events (especially larger trucks) at each of the receiving properties will exceed the anticipated operational sound levels from the proposed car wash.

Conclusion

In conclusion, the results of this study reveal that there are no anticipated noise impacts associated with the activities from the operation of the proposed car wash. The loudest of noise events anticipated on the adjacent properties are lower in intensity than the frequent traffic of automobiles and heavy trucks traveling on the adjacent roadways (specifically SW Gatlin Boulevard).

Please contact me if you have any comments/questions.

Best regards,



Michael Keane, P.E.
President, Keane Acoustics, Inc.
FL License # 64563

TABLE OF EXHIBITS

EXHIBIT A	Subject and Receiving Properties
EXHIBIT B	Site Plan
EXHIBIT C	Noise Source Sound Levels Used for Calculation

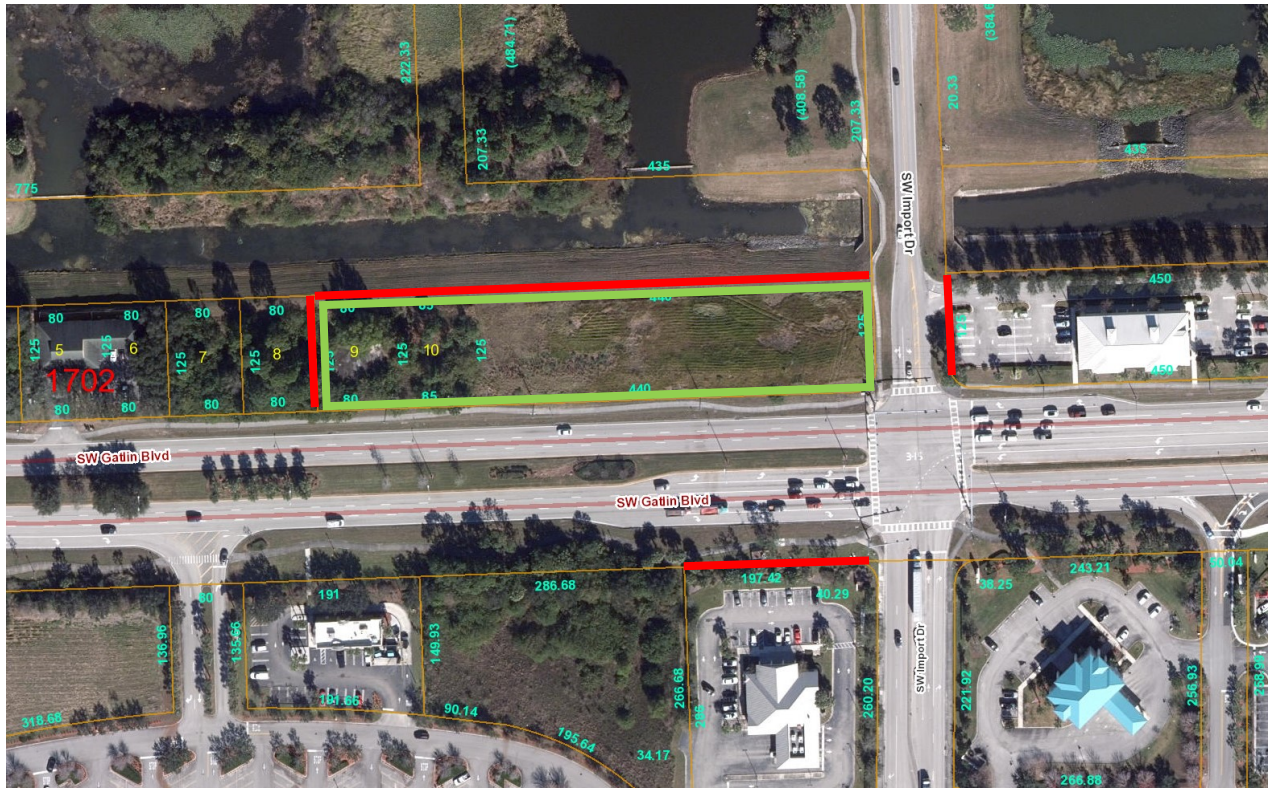
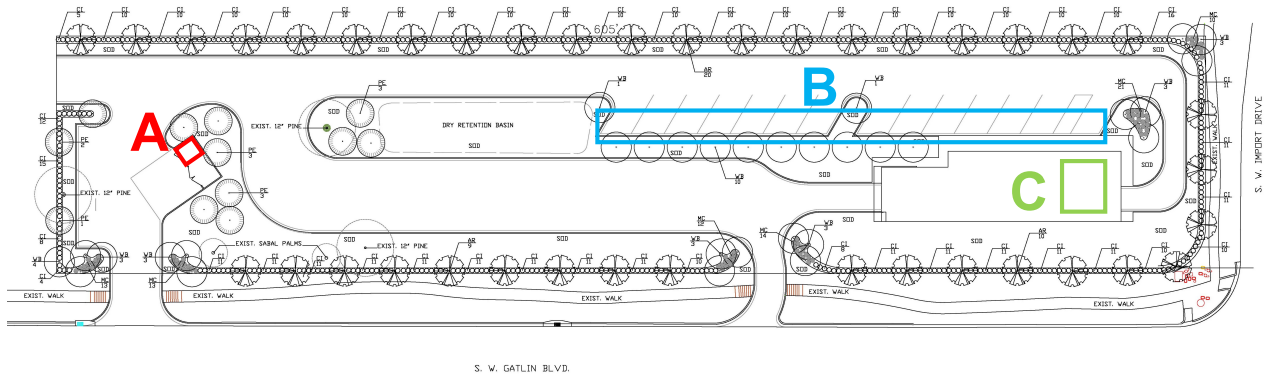


EXHIBIT A Subject Property (in green) and Receiving Property Lines (in red)



S. W. GATLIN BLVD.

LANDSCAPE CONTRACTOR NOTES

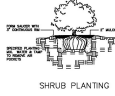
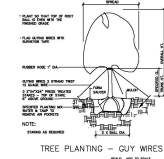
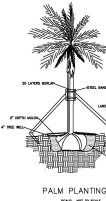
ALL PLANT MATERIAL SHALL BE ORDERED 4 TO 6 WEEKS PRIOR TO BE RECEIVED BY THE LANDSCAPE ARCHITECT. THESE PLANTS SHALL BE NOT REPT THE PROPORTION OF SIZE OR GROW RATE BE INDICATED.

THE LANDSCAPE CONTRACTOR SHALL VERIFY A COMPLETE FURNISHING LISTING IS PROVIDED TO THE LANDSCAPE ARCHITECT. THE LANDSCAPE ARCHITECT SHALL BE RESPONSIBLE FOR THE SELECTION OF THE COLOR AND ANY SUBSTITUTIONS. ANY SUBSTITUTIONS SHALL BE APPROVED BY THE LANDSCAPE ARCHITECT.

THE LANDSCAPE CONTRACTOR SHALL LAY OUT AND MARK TO BE PLANTED AND MARKED A 10' GRID WITH THE LANDSCAPE ARCHITECT FOR APPROVAL AND RECORD.

THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING UTILITIES AND STRUCTURES. THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING UTILITIES AND STRUCTURES. THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING UTILITIES AND STRUCTURES.

THE LANDSCAPE CONTRACTOR SHALL GUARANTEE THAT ALL PLANT MATERIAL SHALL BE ORDERED 4 TO 6 WEEKS PRIOR TO BE RECEIVED BY THE LANDSCAPE ARCHITECT. THESE PLANTS SHALL BE NOT REPT THE PROPORTION OF SIZE OR GROW RATE BE INDICATED.



PLANT MATERIAL LIST

TREES & PALMS (N indicates native trees)					
Code	Name	Quantity	Scientific Name	Common Name	Planting Size
AB	10	10	ADIC. RUBRUM	FLORIDA RED MAPLE	10' X 6" ACT. P. 1/2" DBH
FE	10	10	FICUS ELLIOTTI	POINCIANA	10' DA. 1 1/2" DBH
WB	30	30	WEDDINGIA BIFURCATA	FERTIL PALM	10' DA. 1 1/2" DBH
SHRUBS & GROUNDCOVERS (N indicates native shrub or ground cover)					
Code	Name	Quantity	Scientific Name	Common Name	Planting Size
CI	455	455	CHRYSOMALANUS SEACO	RED TIP CROCOPALM	24" X 24" #3, 2.5' OC
FC	82	82	HELANDERBERGIA CAPILLARIS	PINK HEARTY GRASS	10' X 10" #3, 2.5' OC
OTHER MATERIALS					
MULCH	17	17	50% YRS. ENVIRO. MULCH (EST.)		
SOD	25,000	25,000	50% FT. ST. AUGUSTINE FLORIDANA SOD (EST.)		

ALL PLANT MATERIAL TO BE INSTALLED ARE TO CONFORM TO THE STANDARDS OF FLORIDA NO. 1 OR BETTER. ALL LANDSCAPING TO BE IRRIGATED BY AUTOMATIC MEANS. PLANTS SHALL BE MAINTAINED FREE OF ALL FEEDING CATEGORY 1 SPECIES.



DATE: 4/30/22
SCALE: 1" = 20'

LANDSCAPE PLAN
CAR WASH
PORT ST. LUCIE, FLORIDA

DANIEL J. SUGG, LANDSCAPE ARCHITECT, FL, LIC. #766
POST OFFICE BOX 335, JENSEN BEACH, FLORIDA 34958
TEL. 772-485-1776 danlandarch@gmail.com

EXHIBIT B Site Plan

- Key**
- A – Vacuum System Turbines Location**
 - B – Vacuum System Turbines Location**
 - C – Drying/Blower Fans Location**

wash operates with the doors closed, the sound levels will be significantly reduced, but as no manufacturer sound data with the doors closed was available, the exact reduction cannot be accurately predicted. A reduction of 6-10 dBA is a reasonable estimate.

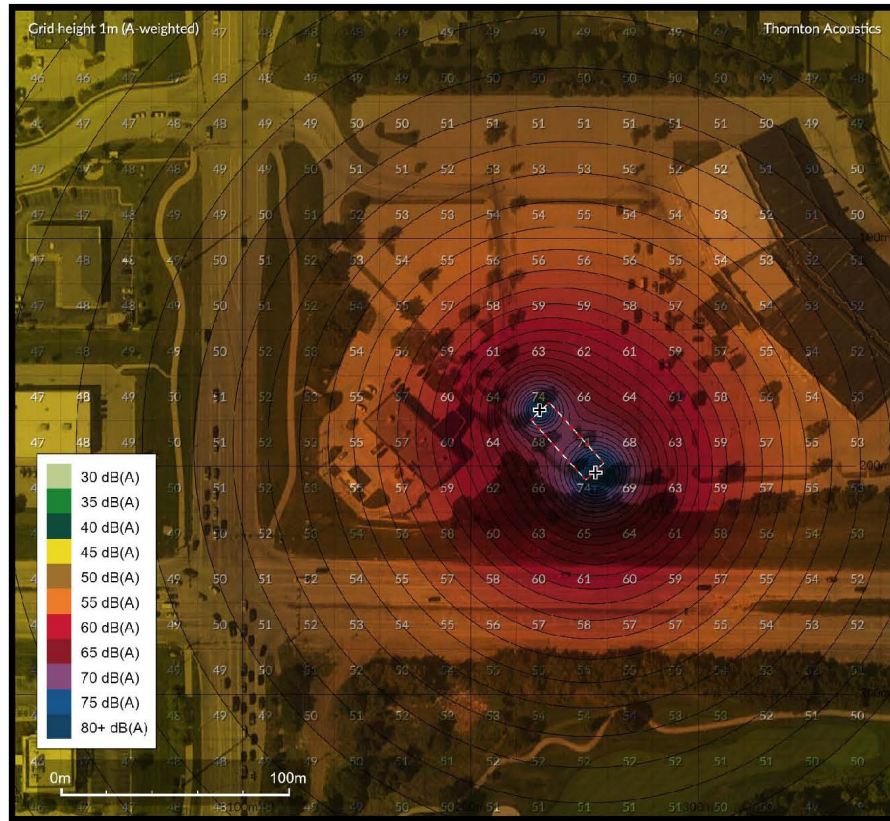


Figure 3 Car Wash predicted sound level emissions contours. The Car Wash building is indicated by the red/white dashed box.

EXHIBIT C Noise Source Sound Levels Used for Calculation
Noise Study for Omaha Take 5 CarWash (Fan Noise contours with distance) - conducted by Thornton

Data used to check distance attenuation and overall decibel level at distance

Table 3: Noise Monitoring Results

Time	Location	Conditions	Leq (dBA)	Peak (dBC)
11:24 – 11:44	2	Background, Dryer off	63.0	98.4
11:45 – 12:05	3	Background, Dryer off	62.2	101.2
12:06 – 12:26	4	Background, Dryer off	68.1	104.6
12:32 – 12:52	2	Dryer and conveyor on, heat saver doors open	80.8	102.0
12:55 – 13:15	3	Dryer and conveyor on, heat saver doors open	73.2	101.7
13:17 – 13:37	4	Dryer and conveyor on, heat saver doors open	68.4	101.8
13:38 – 13:43	1	Dryer and conveyor on, heat saver doors open	92.1	109.8
13:44 – 13:49	5	Dryer and conveyor on, heat saver doors open	87.8	106.5
13:50 – 13:55	6	Dryer and conveyor on, heat saver doors open	58.5	91.7
13:58 – 14:04	6	Dryer on, heat saver & overhead doors closed	55.7	91.5
14:05 – 14:09	6	Background, Dryer off	56.9	91.7

5. Predicted Impact of Noise Arising from Car Wash

The theoretical impact of sound at a receptor arising from a distant source can be calculated following procedures detailed in CSA Z107.55 Recommended Practice for the Prediction of Sound Levels Received at a Distance from an Industrial Plant. The standard recommends that sound levels be predicted using the following equation:

$$L_p = L_w + DI - DIS - A - \Delta$$

Where: L_p = Sound pressure level at receiving location

L_w = Source sound power level

DI = Directivity Index

DIS = Effect of geometric spreading

A = Atmospheric absorption

Δ = Barrier effect

There are presently no barriers between the exit of the car wash and Yonge Street and the distance is small (<100 m); the impact of atmospheric absorption and the barrier effect are therefore considered negligible. Taking the sound pressure level reading of 92.1 dBA at the entrance to the car wash as equivalent to the source sound power level (L_w) and the sound to have a quarter sphere radiation pattern due to the surface configuration of car wash exit intersecting with the ground gives the following calculation of predicted sound level at Monitoring Locations 2 – 4:

Table 4: Predicted Sound Levels

Receptor Location	L_w	DI	DIS	L_p	Leq
2	92.1	6	21.2	76.9	80.8
3	92.1	6	27.2	70.9	73.2
4	92.1	6	39.3	58.8	68.4

EXHIBIT C Noise Source Sound Levels Used for Calculation
Noise Study for Barrie, Canada CarWash – conducted by Trow Associates

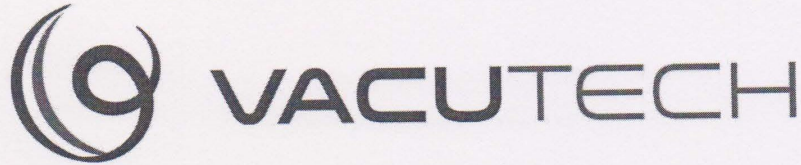
Data used to check distance and building attenuation

Table 9. – Noise Produced by 15 HP Fan with Baffle and Foam Insulation at Maximum Air Flow

Measurement Station	Leq (dBA)	Leq 16k Hz (dBL)	Leq 8k Hz (dBL)	Leq 4k Hz (dBL)	Leq 2k Hz (dBL)	Leq 1k Hz (dBL)	Leq 500 Hz (dBL)	Leq 250 Hz (dBL)	Leq 125 Hz (dBL)	Leq 63 Hz (dBL)	Leq 31.5 Hz (dBL)	Leq 16 Hz (dBL)
1	92.2	58.7	69.7	77.8	82.3	86.5	93.1	90.7	84.3	86.5	74.5	71.7
2	91.5	60.6	73.4	79.5	83.5	86.7	90.5	89.1	84.4	85.4	75	70.6
3	91.6	61.8	71.8	78.6	84.6	86.9	89.5	88.5	84.7	81.8	76	71.9
4	92.1	62.2	71.9	78.2	83.3	86.8	92.3	84.4	84	86.2	79.1	75.1
5	92.3	61.5	72.2	79.6	84.8	87.1	90.9	88.2	84.3	82.6	75	73
6	92.3	59.7	71.6	79.3	83.6	86.6	91.4	89.3	84	85.6	74	68.7
7	88.1	54.4	65.9	74.3	79.3	83.3	88.2	83.6	81.7	82.1	70	64.6
8	87.2	55.5	67.6	74.8	79.8	83.1	86.3	82.7	81.9	81.9	71.7	70.8
9	88.2	55.6	66.9	74.4	80	83.6	87.5	81.6	79.6	79	72.4	72.5
10	88.5	56	67.6	75	80.2	84	88.3	81.1	80	78.6	73.2	73.5
11	87.6	55.3	67.4	75.1	80	82.7	86.1	82	82.3	81.6	70.5	63.5

EXHIBIT C Noise Source Sound Levels Used for Calculation
Noise Assessment of 10 and 15 HP Fans – conducted by Trow Associates

Data determined as average of the above values measured at 3m (9.8 ft)



August 25, 2020

Re: Vacutech Sound Study Projections

To: Darin Kapanjie

Re: Chester Heights, PA Car Wash

The chart below shows a cumulative average of that data taken from express car washes of this type and size. It is presented in an incremental form based on the worst case scenario of the vacuum hoses being off the hook, so to speak. Based on the collective average of the 45' reading to the 85' reading and is presented in the chart below:

Vacutech Noise Study Projections	
Average of all 30 hoses off and in use	
Average @ 45'	57.3 db
Average @ 55'	54.6 db
Average @ 65'	52.1 db
Average @ 75'	49.5 db
Average @ 85'	48.8 db

SOUND LEVEL METER USED: SIMPSON MODEL #40003 – MSHA APPROVED. MEETS OSHA AND WALSH-HEALY REQUIREMENTS FOR NOISE CONTROL. CONFORMS TO ANSI S1.4 1983, IEC 651 SPECS FOR METER TYPE.

NOTE: Typical outside vacuum system with 1.5" x 15' vacuum crevice tools (1" wide by 3/4" opening) in use with customer vacuuming.

EXHIBIT A-5

EXHIBIT C Noise Source Sound Levels Used for Calculation
 Vacutech Sound Study of 30 individual vacuum stations

Given there are 15 stations in the subject project – the equivalent decibel level for the reduction is 3 dB for a total of 54.3 measured at 45'.

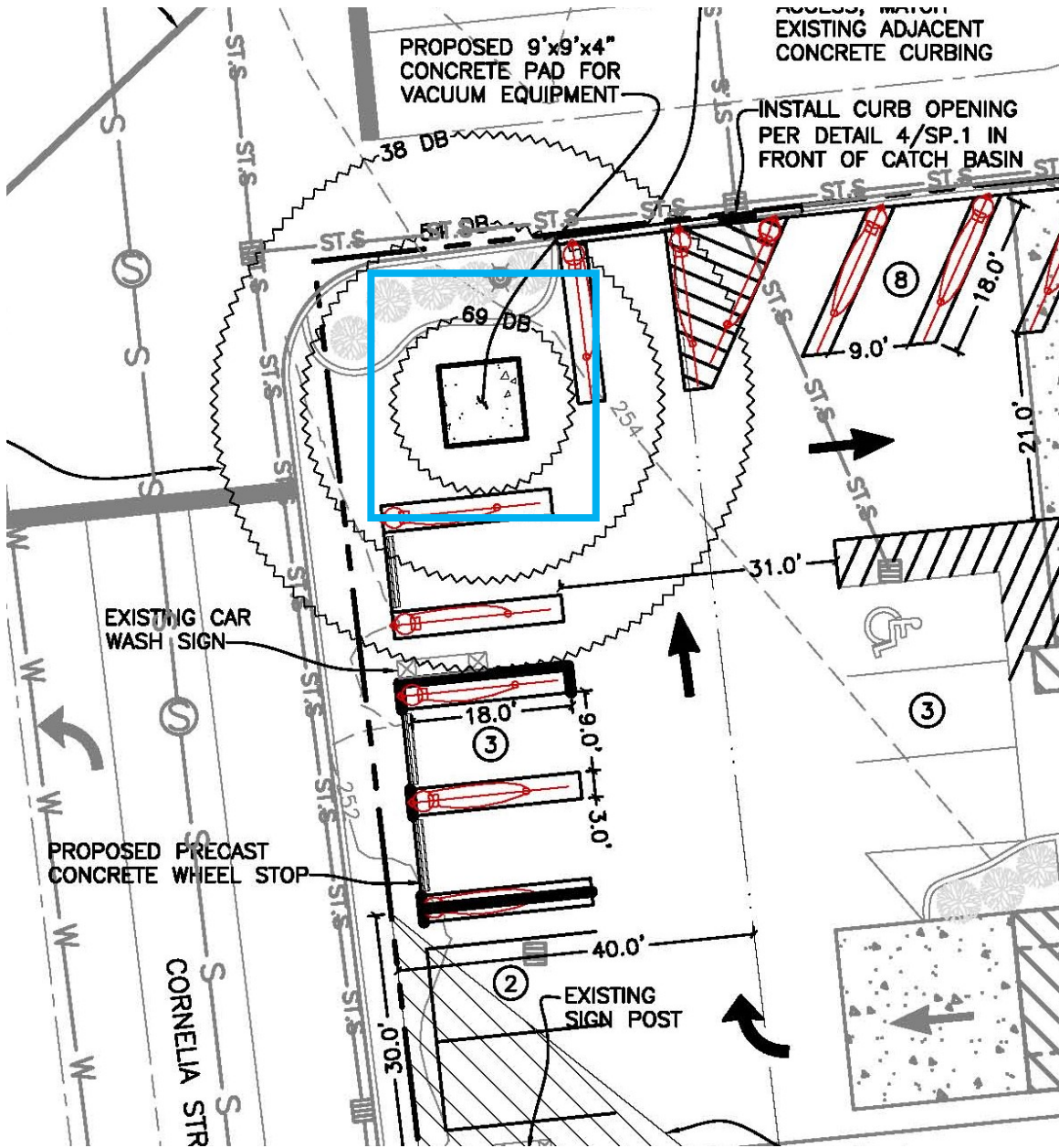


EXHIBIT C Noise Source Sound Levels Used for Calculation

Vacutech Measurements of vacuum system turbine noise

(Taken from Plattsburgh, NY project)