NEW CUMBERLAND – WV ROUTE 2 IMPROVEMENTS
STATE PROJECT U215-2-6.20 00
PRELIMINARY DESIGN NOISE ANALYSIS
HANCOCK COUNTY, WEST VIRGINIA

PREPARED FOR

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS

PREPARED BY

FEBRUARY 2019

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WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
BUILDING 5, ROOM A-317
CAPITOL COMPLEX
1900 KANAWHA BLVD., EAST
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FEBRUARY 8, 2019

R16-0357.000

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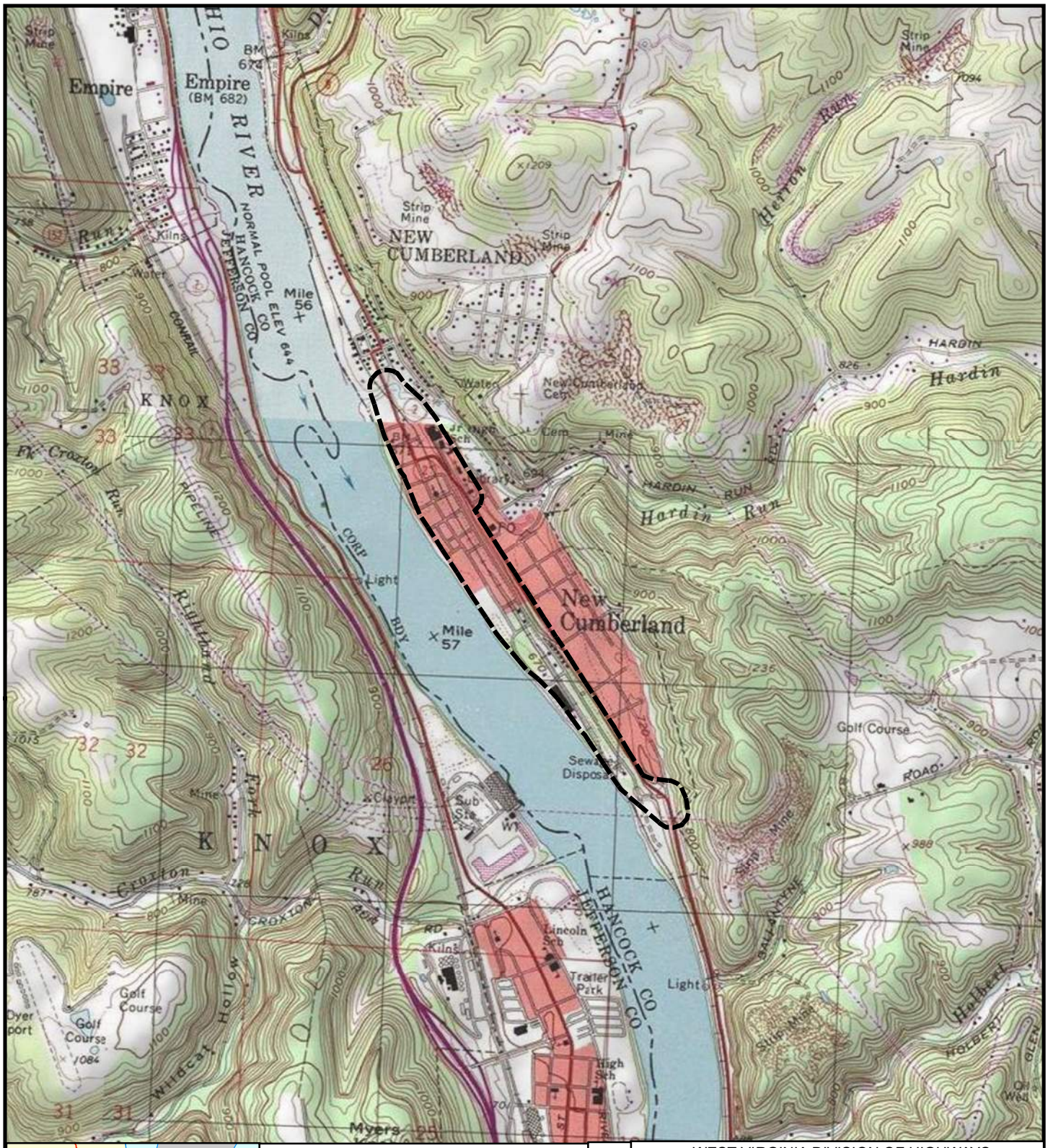
1.0 INTRODUCTION

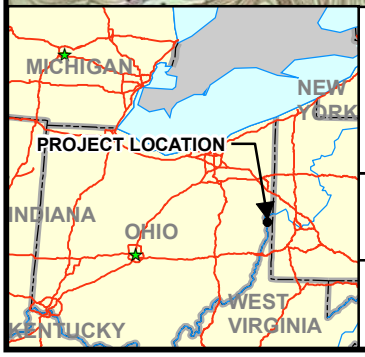
The study area for the proposed WV Route 2 Intersection Improvement Project is in Hancock County, West Virginia, within the boundaries of the City of New Cumberland. The project consists of five alternatives to address substandard roadway geometry and a narrow corridor on Ridge Avenue. Currently, truck traffic is not able to make the 90-degree turn at the intersection of Chester Street and Madison Street without climbing curbs. Truck traffic is also unable to travel on the narrow, 16-foot-wide Ridge Avenue without posing a risk to pedestrians on the sidewalk. The project location is shown on Figure 1. Five alternatives have been proposed. Alternatives 1 and 3 consist of widening the current alignment of Madison Street and North Chester Street. Alternative 2 shifts the intersection of Madison Street and North Chester Street approximately 40 feet east. Alternative 4 consists of a new two-lane roadway constructed from the western terminus of Ridge Avenue to North Chester Street, west of New Cumberland Park. Alternative 5A consists of a new two-lane roadway constructed following Industrial Park Road, transitioning to a new alignment, and connecting to South Chester Street. Slight alterations to the alignment of South Chester Street are required.

A noise analysis was undertaken to identify and evaluate the potential noise impacts resulting from the proposed project. This analysis identifies the fundamentals of noise, noise-sensitive areas within the project area, noise impact criteria prescribed by federal and West Virginia Division of Highways (WVDOH) regulations, and WVDOH analysis procedures. In addition, the analysis uses quantitative modeling using TNM2.5 to analyze traffic sound levels under the existing and design year (2033) No Build and Build alternatives and identifies areas which exceed the prescribed noise abatement criteria (NAC). Sound level predictions based on future traffic and roadway improvements were compared to the NAC to delineate noise-impacted land uses. Construction noise impacts and minimization techniques are also presented in this analysis.

2.0 SUMMARY

Impacts to Pride Park along Ridge Avenue have been identified for Alternatives 1, 2, 3, and 4 and the No Build option with the increased 2033 design year traffic. Impacts approaching 69 dBA were identified at Noise Receptor M2 for Alternative 3. Noise mitigation is not feasible or reasonable for the impacted locations.





LEGEND

STUDY AREA

SOURCES: USGS QUAD. SHEETS - EAST LIVERPOOL SOUTH, WV-PA-OH 1985 AND WEIRTON, WV-PA-OH 1978

0 720m

0 2,000' 4,000'

N

WEST VIRGINIA DIVISION OF HIGHWAYS

WV 2 IMPROVEMENTS - NEW CUMBERLAND
MADISON AND CHESTER STREETS INTERSECTION
CITY OF NEW CUMBERLAND
HANCOCK COUNTY, WEST VIRGINIA

PROJECT LOCATION

FIGURE - 1

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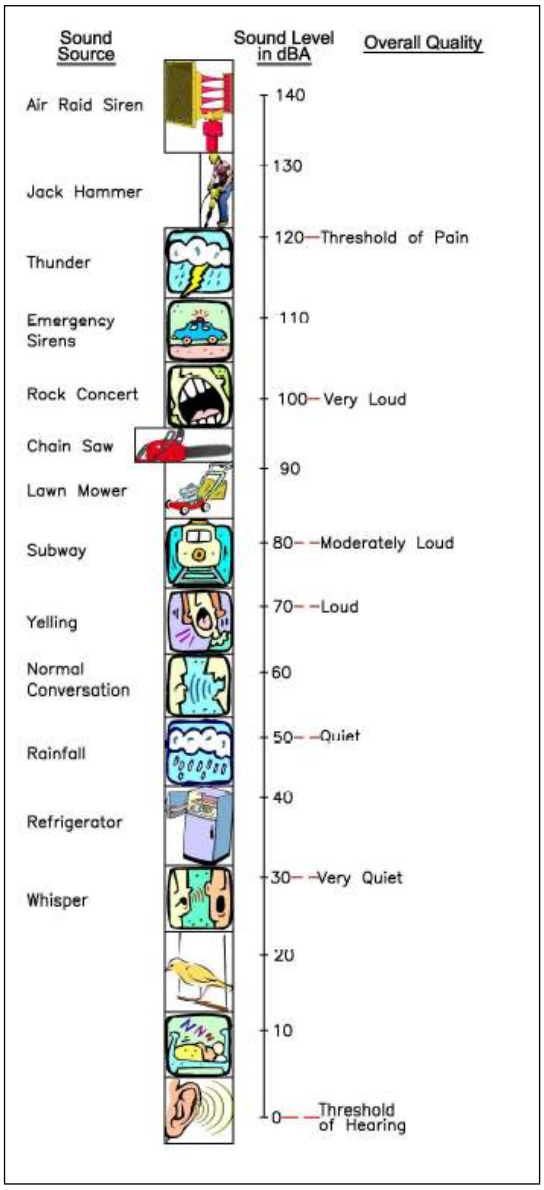
3.0 FUNDAMENTALS OF SOUND AND METHODOLOGY

3.1 FUNDAMENTALS OF SOUND

Sound is the vibration of air molecules in waves similar to ripples on water. When these vibrations reach our ears, we hear what we call sound. Noise is defined as "unwanted sound." Therefore, it can be considered a psychological phenomenon and not a physical one. The roar of racecars adds to the excitement of spectators and hence would be considered sound. This same roar may annoy nearby neighbors thereby becoming noise. Factors playing a role in the perception of sound include magnitude, amplitude, duration, frequency, source, and receiver.

The intensity or loudness of sound is measured in units referred to as decibels (dB). Sound waves are created by the rapid movement of an object and the rate at which the object moves back and forth is called their frequency measured in hertz (Hz). While the human ear can detect sounds from about 20 Hz to 20,000 Hz, it is more sensitive to frequencies between 500 and 4,000 Hz. To account for this occurrence, the A-weighted scale has been developed to place an emphasis on those frequencies which are more detectable to the human ear. The A-weighted scale, which has been in existence for over 40 years, is generally used in community and city noise ordinances and is expressed in units of dBA (decibels in the A-weighting). Researchers have established a correlation between the measurement of sound, the A-weighted decibel (dBA), and its associated perceived human response. Figure 2 represents this correlation of qualitative and quantitative descriptions. The A-weighted scale weighs the sound measurement unit of decibels to match the response of the human ear. It accounts for the fact that sounds of equal amplitude but different frequencies are not necessarily perceived to be equally loud.

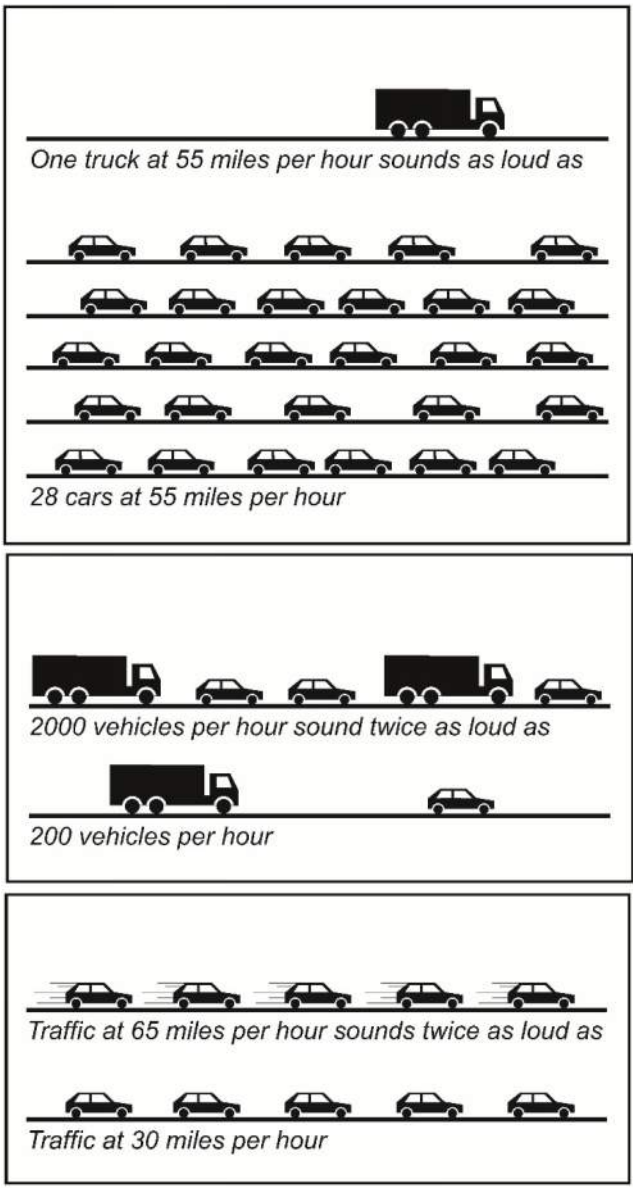
FIGURE 2
COMMON SOUND LEVELS



Because sound is actually an energy level, it must be recorded on a logarithmic scale and expressed in logarithmic units called decibels (dB). Given this scale, a doubling of a noise source will result in a 3-decibel increase in total level (i.e., 50 dBA + 50 dBA = 53 dBA, not 100 dBA). Typically, a change in sound level between 2 and 3 dBA is barely perceptible, while a change of 5 dBA is readily noticeable by most people. A 10-dBA increase is usually perceived as a doubling of loudness, and conversely, noise is perceived to be reduced by one-half when a sound level is reduced by 10 dBA.

The principal noise sources of highway vehicles are the exhaust system, engine, and tires. Exhaust noise is typically controlled by mufflers, assuming that they are used and are functioning properly. Engine noise can only be controlled by vehicle manufacturers and proper maintenance, factors over which WVDOH has no control. Tire noise is generated by the interaction of each vehicle's tires with the road surface. Engine and exhaust noise are usually louder than tire noise at vehicular speeds under 30 miles per hour (mph). The reverse is normally true for vehicular speeds over 30 mph. Highways are typically dominated by tire noise while local streets are typically dominated by engine and exhaust noise. The overall noise level generated by vehicles on a highway depends on the number of vehicles, the speed of the vehicles, and the types of vehicles. Figure 3 depicts generally how these factors influence noise levels.

FIGURE 3
TRAFFIC NOISE RELATIONSHIPS



3.2 METHODOLOGY

The first step of the preliminary design noise analysis is the identification and selection of noise-sensitive receptors. Sensitive receptors are defined as those land uses which are especially susceptible to noise impacts. These may include hospitals, schools, residences, motels, hotels, recreational areas, parks, and places of worship. The land use categories identified within the project study are considered Activity Categories B, C, D, F, and G as defined by the Federal Highway Administration (FHWA) traffic noise regulations (23 CFR Part 772). Sensitive receptors were identified within Land Use Categories B and C. Table 1 provides a brief description of the various activity categories as well as the absolute federal/state noise criteria for each.

TABLE 1
NOISE ABATEMENT CRITERIA
HOURLY A-WEIGHTED SOUND LEVEL IN DECIBELS [Leq(h)] (dBA)

ACTIVITY CATEGORY	Leq(h)[1]	DESCRIPTION OF ACTIVITY CATEGORY
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[2]	67 (Exterior)	Residential
C[2]	67 (Exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52 (Interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E[2]	72 (Exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A, B, or C.
F	--	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	Undeveloped lands that are not permitted.

[1] Impact thresholds should not be used as design standards for noise abatement purposes.
[2] Includes undeveloped lands permitted for this activity category.
Source: 23 CFR Part 772

Modeling of the project area was accomplished by applying the FHWA Traffic Noise Model (TNM) computer model, Version 2.5. This program is described in the U.S. Department of Transportation "FHWA Traffic Noise Model User's Guide," FHWA-PD-96-009, January 1998. The model has been established as a reliable tool for representing noise generated by highway traffic. TNM requires the definition of physical features within the sound propagation path (terrain, vegetation, building rows, ground zones, barriers) as well as traffic volumes and speeds for several vehicle types.

Sound levels are projected for the future design year for the proposed alignment and compared to the noise abatement criteria (NAC) for compliance. If the criteria are approached or exceeded at any receptor (or residence represented by that receptor), abatement considerations are warranted to attempt to provide a substantial noise reduction at the noise-impacted receptor.

Existing background noise measurements were conducted for 20-minute durations at six receptor locations within the project area on December 6 and 20, 2017. These background noise measurements were applied to other adjacent receptor locations which experience similar existing acoustic conditions. These data were used for model validation and as a baseline for comparison with the WVDOH substantial increase over existing NAC (i.e., 15 dBA). The future design year conditions were modeled using TNM2.5 and incorporated design features such as the earthwork (cut/fill), structures, and roadway elevational data as well as existing features such as vegetation (forested areas) and significant terrain features.

4.0 NOISE IMPACT CRITERIA

The WVDOH Highway Traffic Noise Policy (July 13, 2011) was used to provide impact thresholds along the proposed route for the varying land use in the project area in conjunction with Title 23 of the Code of Federal Regulations Part 772 (23 CFR 772). Traffic noise impacts are defined in these documents as "impacts which occur when predicted traffic noise levels approach or exceed Noise Abatement Criteria (Table 1 in preceding section), or when the predicted traffic noise levels substantially exceed the existing noise levels." WVDOH defines the approach as 1 dBA less than the NAC and substantial increase as 15 dBA over existing conditions. All of the receptors analyzed have a 66 dBA NAC.

5.0 NOISE LEVEL MEASUREMENTS

Short-term (20 minutes in duration) noise measurements were obtained at nine locations within the project corridor on December 6 and December 20, 2017. All monitoring was performed using Metrosonics dB-3080 sound analyzers. Field calibration of the meters was performed immediately prior to noise monitoring using a Metrosonics cl-304 sound level calibrator. This equipment meets all requirements of the American National Standard Specification for Sound Level Meters, ANSI S1.4-1983 (R1990), Type 2. Noise measurements were in the A-weighted scale and reported in decibels (dBA). The data collection procedure involved the Leq measurements in consecutive 30-second intervals. Hourly average noise levels [Leq(h)] were derived at each location from the 20-minute Leq values. Existing noise measurements were collected under meteorologically acceptable conditions when the pavement was dry and winds were calm or light. Additional data collected at each monitoring location included atmospheric conditions such as wind speed, humidity, and ambient temperature. Monitoring was conducted in accordance with the U.S. Department of Transportation, FHWA “Measurement of Highway-Related Noise," FHWA Report No. FHWA-PD-96-046, May 1996. Please refer to Appendix A for the noise monitoring data sheets.

The local roadway network is the dominant source of traffic noise in the study area and contributes to sound levels for the homes immediately adjacent to the roadway. The monitored Leq in the study corridor ranged from 48 dBA to 64dBA. Additional noise monitoring data (site sketches) are located in Appendix A. In addition to the roadway traffic, an active railroad line runs through the entire project area; however, no trains were observed during the field visits. Coordination with WVDOH confirmed that there are two trains per day of less than 20 cars traveling at 10 mph.

6.0 MODEL VALIDATION

Upon measurement of the existing noise levels, a noise model of the existing roadway network was constructed in order to verify that the sound propagation paths within the model are accurate and that the modeling techniques are correct. Traffic volumes, composition, and speeds that were observed during the short-term monitoring periods were used to generate the validation model's sound levels. This model typically serves as the basis for the future design model. Table 2 compares the results of the validation model with the measured noise levels.

TABLE 2
MODEL VALIDATION

RECEPTOR SITE NUMBER	MEASURED LEVEL (DBA)	MODELED LEVEL (DBA)	DIFFERENCE (DBA)
M1	56.1	57.2	1.1
M2	59.2	61.7	2.5
M3	57.8	56.5	-1.3
M4	53.9	52.4	-1.5
M5	49.0	46.2	-2.8
M6	64.4	62.3	-2.1
M7	48.4	N/A	N/A
M8	51.3	51.2	-0.1
M9	51.7	N/A	N/A

Noise monitoring locations M1 through M6 and M8 are close enough in proximity to WV 2 that traffic-generated noise is the most dominant component of the acoustic environment at each monitoring location. These monitored locations were able to be accurately modeled within the acceptable 3 dBA range. However, because noise monitoring sites M7 and M9 were not near a traffic noise source, the sound level is composed of background sources and therefore cannot be accurately validated in the model. For these sites, the background noise levels were factored into the existing noise levels to account for the lack of traffic noise.

7.0 NOISE LEVEL PROJECTIONS

Noise level projections of all sites were made with the FHWA Traffic Noise Model (TNM2.5). Noise modeling was performed at 71 locations (Figure 4) for the design year (2033) Build Alternatives 1, 2, 3, 4, and 5A (Appendix B). The modeling incorporated traffic volumes, speeds and compositions, terrain and elevation changes, building rows, as well as the design features (lane addition). Sensitive receptors were sited at representative residential locations within the City of New Cumberland. The results of the modeling are discussed in Section 13.0.

WEST VIRGINIA DIVISION OF HIGHWAYS

WV 2 IMPROVEMENTS - NEW CUMBERLAND
MADISON AND CHESTER STREETS INTERSECTION
CITY OF NEW CUMBERLAND
HANCOCK COUNTY, WEST VIRGINIA

NOISE ANALYSIS LOCATIONS OVERVIEW

FIGURE - 4

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M5
M4
M1
M3
M2
M6
M9
R14
R13
R12
R15
R7
R6
R8
R9
R10
R11
R5
R1
R2
R3
R4
2-13
2-12
2-11
3-04
1-03
1-04
1-02
1-01
1-05
1-06
1-07
1-10
1-08
1-09
1-11
1-12
1-13
1-14
2-10
2-09
2-08
2-14
2-06
2-05
2-04
Park Pl
N Court St
Ridge Ave
Valley St
Valley St
Fillmore St
Adams St
Jefferson St
Madison St
Clay St
Doyles Alley
Garfield St
S Chestnut St
S Chestnut St
N Hogan Alley
N River Ave
S Chester St
S Chester St
S Hogan Alley
S River Ave
Harrison St
Taylor St
Polk St
Pierce St
Morris St
Morris St
Cambells Alley
Ohio
Legend
ALTERNATIVE 1
ALTERNATIVE 2
ALTERNATIVE 3
ALTERNATIVE 4
ALTERNATIVE 5A
STUDY AREA
NOISE RECEPTOR LOCATION
MONITORED RECEPTOR
MODELED RECEPTOR
SOURCE: BING 2019 (BASE IMAGERY)
0 75 150 Feet
N
WEST VIRGINIA DIVISION OF HIGHWAYS
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MADISON AND CHESTER STREETS INTERSECTION
CITY OF NEW CUMBERLAND
HANCOCK COUNTY, WEST VIRGINIA
NOISE ANALYSIS LOCATIONS DETAIL
FIGURE - 4
SHEET 1 OF 2
SKELLY and LOY Inc.
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Ridge Ave
Ridge Ave
Ridge Ave
2nd Ave
S Chestnut St
S Chestnut St
S Chestnut St
S Chestnut St
S Chestnut St
S Chestnut St
Porter St
Chelsea Hill
May St
May St
Cronin St
S Chester St
S Chester St
Pottery Rd
1-15
1-26
1-16
1-17
1-34
1-20
1-19
1-21
1-25
1-24
1-22
M8
1-33
1-18
1-31
1-28
1-32
1-29
1-27
1-30
2-03
3-02
M7
3-01
Legend
ALTERNATIVE 1
ALTERNATIVE 2
ALTERNATIVE 3
ALTERNATIVE 4
ALTERNATIVE 5A
STUDY AREA
NOISE RECEPTOR LOCATION
MONITORED RECEPTOR
MODELED RECEPTOR
SOURCE: BING 2019
(BASE IMAGERY)
0 75 150 Feet
N
WEST VIRGINIA DIVISION OF HIGHWAYS
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MADISON AND CHESTER STREETS INTERSECTION
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HANCOCK COUNTY, WEST VIRGINIA
NOISE ANALYSIS LOCATIONS DETAIL
FIGURE - 4
SHEET 2 OF 2
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8.0 TRAFFIC

The WVDOH and FHWA regulations state that "in predicting noise levels and assessing noise impacts, traffic characteristics that will yield the worst hourly traffic noise impact on a regular basis for the design year shall be used." The level of highway noise is often related directly to traffic volume and speed. The A.M. and P.M. peak hours are the peak traffic times; therefore, they represent the worst hourly traffic noise impact. The following traffic data were used in the analysis.

ALTERNATIVES 1, 2, 3, AND 4		**ALTERNATIVE 5A**	
Current Year ADT:	**6,330**	**Current Year ADT:**	**6,330**
K Factor (Peak Hour):	11%	K Factor (Peak Hour):	7%
Directional:	50/50	Directional:	50/50
% Total Trucks:	10%	% Total Trucks:	4%
% Medium Trucks:	25%	% Medium Trucks:	25%
% Heavy Trucks:	75%	% Heavy Trucks:	75%
Design Year ADT:	**7,290**	**Design Year ADT:**	**7,290**
K Factor (Peak Hour):	11%	K Factor (Peak Hour):	7%
Directional:	50/50	Directional:	50/50
% Total Trucks:	10%	% Total Trucks:	4%
% Medium Trucks:	25%	% Medium Trucks:	25%
% Heavy Trucks:	75%	% Heavy Trucks:	75%

9.0 PREDICTED NOISE LEVELS

Noise level projections of all sites were made with the FHWA Traffic Noise Model (TNM2.5). Noise modeling was performed at 71 locations for the design year (2033) Build conditions (Figure 4). The modeling incorporated traffic volumes, speeds and compositions, terrain and elevation changes, tree zones, as well as the roadways design features (lane locations and earthwork). Receptors were modeled at every single-family residence located within close proximity to the proposed alternatives. Background sound level contributions (48-50 dBA) were added to remote receptor locations where the traffic noise contribution was minimal. Predicted traffic noise levels are presented in Table 3. TNM 2.5 results tables are available in Appendix C.

TABLE 3
PREDICTED NOISE LEVELS

RECEPTOR IDENTIFICATION		PEAK HOUR SOUND LEVELS (LEQH IN DBA)						
			2033 DESIGN YEAR TRAFFIC					
RECEPTOR ID	RECEPTOR DESCRIPTION	EXISTING (2017) MEASUREMENTS (DBA)	NO BUILD	ALTERNATIVE 1 (DBA)	ALTERNATIVE 2 (DBA)	ALTERNATIVE 3 (DBA)	ALTERNATIVE 4 (DBA)	ALTERNATIVE 5A (DBA)
M1	200 South Court Street	56	63	63	65	63	64	51
M2	200 Madison Street	59	64	64	62	69	52	52
M3	213 North Chester Street	58	62	62	62	62	50	60
M4	104 North Court Street	54	58	57	59	58	63	48
M5	200 North Chester Street	49	52	52	52	52	58	50
M6	Pride Park, Ridge Avenue	64	67	68	70	68	68	56
R1	108 South Chester Street	60	60	60	64	60	40	63
R2	112 South Chester Street	55	55	55	60	55	55	51
R3	111 South Chester Street	57	57	57	60	58	49	63
R4	104 South River Avenue	59	59	59	59	59	59	59
R5	112 Madison Street	63	64	64	61	64	43	55
R6	103 Adams Street	58	58	58	58	58	58	58
R7	101 Adams Street	58	58	58	58	58	58	58

TABLE 3
(CONTINUED)

RECEPTOR IDENTIFICATION		PEAK HOUR SOUND LEVELS (LEQH IN DBA)						
			2033 DESIGN YEAR TRAFFIC					
RECEPTOR ID	RECEPTOR DESCRIPTION	EXISTING (2017) MEASUREMENTS (DBA)	NO BUILD	ALTERNATIVE 1 (DBA)	ALTERNATIVE 2 (DBA)	ALTERNATIVE 3 (DBA)	ALTERNATIVE 4 (DBA)	ALTERNATIVE 5A (DBA)
R8	200 North River Avenue	58	58	58	58	58	58	58
R9	106 South River Avenue	54	54	54	54	55	42	48
R10	102 North River Avenue	52	52	52	51	52	39	46
R11	100 Madison Street	59	59	59	59	59	59	59
R12	110 Ridge Avenue	59	59	59	56	60	N/A	N/A
R13	203 Jefferson Street	53	53	53	52	54	N/A	N/A
R14	200 Railroad Street	54	54	54	53	54	N/A	N/A
R15	106 Adams Street	53	53	53	53	53	46	52
1-01	208 South Chester Street	53	N/A	N/A	N/A	N/A	N/A	58
1-02	204 South Chester Street	52	N/A	N/A	N/A	N/A	N/A	59
1-03	209 South Chestnut Street	55	N/A	N/A	N/A	N/A	N/A	52
1-04	307 South Chestnut Street	54	N/A	N/A	N/A	N/A	N/A	52
1-05	240 Polk Street	52	N/A	N/A	N/A	N/A	N/A	52
1-06	403 South Chestnut Street	52	N/A	N/A	N/A	N/A	N/A	51
1-07	409 South Chestnut Street	52	N/A	N/A	N/A	N/A	N/A	52
1-08	414 South Chester Street	52	N/A	N/A	N/A	N/A	N/A	58
1-09	416 South Chester Street	52	N/A	N/A	N/A	N/A	N/A	59
1-10	404 South Chester Street	52	N/A	N/A	N/A	N/A	N/A	53
1-11	502 South Chester Street	52	N/A	N/A	N/A	N/A	N/A	59
1-12	504 South Chester Street	51	N/A	N/A	N/A	N/A	N/A	59
1-13	508 South Chester Street	51	N/A	N/A	N/A	N/A	N/A	59
1-14	600 South Chester Street	52	N/A	N/A	N/A	N/A	N/A	58
1-15	605 South Chestnut Street	51	N/A	N/A	N/A	N/A	N/A	53
1-16	611 South Chestnut Street	52	N/A	N/A	N/A	N/A	N/A	53

TABLE 3
(CONTINUED)

RECEPTOR IDENTIFICATION		PEAK HOUR SOUND LEVELS (LEQH IN DBA)						
			2033 DESIGN YEAR TRAFFIC					
RECEPTOR ID	RECEPTOR DESCRIPTION	EXISTING (2017) MEASUREMENTS (DBA)	NO BUILD	ALTERNATIVE 1 (DBA)	ALTERNATIVE 2 (DBA)	ALTERNATIVE 3 (DBA)	ALTERNATIVE 4 (DBA)	ALTERNATIVE 5A (DBA)
1-17	705 South Chestnut Street	52	N/A	N/A	N/A	N/A	N/A	53
1-19	719 South Chestnut Street	51	N/A	N/A	N/A	N/A	N/A	53
1-20	709 South Chestnut Street	52	N/A	N/A	N/A	N/A	N/A	53
1-21	801 South Chestnut Street	53	N/A	N/A	N/A	N/A	N/A	53
1-22	237 Cronin Street	53	N/A	N/A	N/A	N/A	N/A	53
M-8	907 Chestnut Street	53	N/A	N/A	N/A	N/A	N/A	54
1-24	815 Chestnut Street	53	N/A	N/A	N/A	N/A	N/A	54
1-25	807 South Chestnut Street	52	N/A	N/A	N/A	N/A	N/A	54
1-26	609 South Chestnut Street	51	N/A	N/A	N/A	N/A	N/A	53
1-18	920 South Chestnut Street	51	N/A	N/A	N/A	N/A	N/A	60
1-27	914 South Chestnut Street	52	N/A	N/A	N/A	N/A	N/A	60
1-28	930 South Chestnut Street	51	N/A	N/A	N/A	N/A	N/A	60
1-29	932 South Chestnut Street	51	N/A	N/A	N/A	N/A	N/A	60
1-30	935 South Chestnut Street	52	N/A	N/A	N/A	N/A	N/A	62
1-31	928 South Chestnut Street	51	N/A	N/A	N/A	N/A	N/A	60
1-32	923 South Chestnut Street	51	N/A	N/A	N/A	N/A	N/A	60
1-33	917 South Chestnut Street	52	N/A	N/A	N/A	N/A	N/A	59
1-34	239 Taylor Street	52	N/A	N/A	N/A	N/A	N/A	53
2-03	627 South Chester Street	52	N/A	N/A	N/A	N/A	N/A	58
2-04	603 South Chester Street	52	N/A	N/A	N/A	N/A	N/A	59
2-05	601 South Chester Street	52	N/A	N/A	N/A	N/A	N/A	62
2-06	124 Cannon Street	52	N/A	N/A	N/A	N/A	N/A	54
M9	503 South Chester Street	52	N/A	N/A	N/A	N/A	N/A	60
2-08	441 Campbell Alley	52	N/A	N/A	N/A	N/A	N/A	53

TABLE 3
(CONTINUED)

RECEPTOR IDENTIFICATION		PEAK HOUR SOUND LEVELS (LEQH IN DBA)						
			2033 DESIGN YEAR TRAFFIC					
RECEPTOR ID	RECEPTOR DESCRIPTION	EXISTING (2017) MEASUREMENTS (DBA)	NO BUILD	ALTERNATIVE 1 (DBA)	ALTERNATIVE 2 (DBA)	ALTERNATIVE 3 (DBA)	ALTERNATIVE 4 (DBA)	ALTERNATIVE 5A (DBA)
2-09	405 S Chester Street	52	N/A	N/A	N/A	N/A	N/A	58
2-10	403 S Chester Street	52	N/A	N/A	N/A	N/A	N/A	59
2-11	209 South Chester Street	52	N/A	N/A	N/A	N/A	N/A	59
2-12	206 Hogan Alley	53	N/A	N/A	N/A	N/A	N/A	60
2-13	115 Madison Street	57	N/A	N/A	N/A	N/A	N/A	64
2-14	501 Campbell Alley	52	N/A	N/A	N/A	N/A	N/A	54
3-01	Baseball Field	49	N/A	N/A	N/A	N/A	N/A	58
3-02	Baseball Field	49	N/A	N/A	N/A	N/A	N/A	58
M7	Baseball Field	50	N/A	N/A	N/A	N/A	N/A	58
3-04	Playground (South Chester Street)	50	N/A	N/A	N/A	N/A	N/A	63

10.0 EXISTING YEAR CONDITION

New Cumberland is a small town along the Ohio River in Hancock County. Like most towns along the Ohio River, WV 2 runs through the town and makes up some of the City streets. This portion of WV 2 is functionally classified as a Rural Principal Arterial in rolling terrain. The speed limit is posted at 25 mph in the area of concern. Traffic consists of all types of vehicles including commercial carriers, buses, and mail carriers. An existing rail line is used twice a day by local trains that are about 20 cars in length and travel at 10 mph. It is assumed that this is not a major noise source area and, for the purposes of this project, has been excluded.

11.0 DESIGN YEAR NO BUILD CONDITIONS

The acoustical environment will remain the same for the No Build scenario. Receptors along WV 2 would experience a gradual increase in sound as the traffic volumes increase to the 2033 No Build Conditions. Very little traffic volume increase is projected for the design year. Therefore, very little increase in traffic noise is projected. Noise impacts at Pride Park were observed in the No Build condition.

12.0 DESIGN YEAR BUILD ALTERNATIVES

Alternatives 1, 2, 3, 4, and 5A were modeled assuming the design year traffic. A total of 71 locations were modeled. Pride Park exceeds the NAC in all alternatives with the exception of Alternative 5A. One of the residential receptors exceeds the NAC for Alternative 3. While there are some locations that will experience audible increases in traffic noise levels, none was predicted to exceed the 15 dBA increase over existing NAC. Sound levels are presented in Table 3.

12.1 ALTERNATIVE 1

Alternative 1 would improve the existing 90-degree turns by widening on the existing alignment. Chester Street would taper out to make a wider intersection at Madison Street. This would create a 52-foot-wide entrance onto Chester Street from Madison Street. However, this would also create an offset intersection for vehicles traveling south on Chester Street past the Madison intersection. By widening this section of road, the edge of the northbound lane would be shifted approximately eight feet from the existing curb on the northern side of the road. This would allow northbound trucks room for a greater turning radius to avoid running on the sidewalk on the northeast corner of the Chester Street intersection. Receptor M6 (representing Pride Park) is the only noise impact associated with Alternative 1.

12.2 ALTERNATIVE 2

Alternative 2 would improve the existing 90-degree turns by shifting the portion of the road between them approximately 70 feet south of the existing alignment. This would also allow the radius of the intersection of Madison and Chester Streets to be improved without impacting the two-story historic brick building north of the intersection. This would allow northbound trucks room for a greater turning radius to avoid running on the sidewalk on the northeast corner of the Chester Street intersection. By moving the new road alignment, Ridge Hill would be shortened. To avoid impacting the historic wall, widening of this portion of road would be on the western side, which is the same side as the existing sidewalk. No sidewalk would be replaced on this portion of road due to sidewalk plans of the City. Receptor M6 (representing Pride Park) is the only noise impact associated with Alternative 2.

12.3 ALTERNATIVE 3

Alternative 3 would improve the existing 90-degree turns by widening the existing roadway and turns. Instead of creating a skewed intersection and widening to the south, this alternative would improve the inside radius at the intersection of Madison and Chester Streets. This would allow the radius of the intersection of Madison and Chester Streets to be improved but would severely impact the two-story historic brick building north of the intersection. This would allow northbound trucks room for a greater turning radius to avoid running on the sidewalk on the northeast corner of the Chester Street intersection. The 90-degree curve leading up to Court Street would be widened out to 52 feet to help trucks navigate this curve without crossing over the centerline. No sidewalk would be replaced on this portion of road due to sidewalk plans of the City. Receptor M6 (representing Pride Park) and Receptor M2 are the only noise impacts associated with Alternative 3.

12.4 ALTERNATIVE 4

Alternative 4 would improve the existing 90-degree turns by creating a bypass of this portion of the road. This new portion of road would begin at Milepoint 8.13, the south end of an existing WV 2 bridge. The new road would track southeast and run parallel to the railroad tracks for approximately 1,200 feet. This new roadway would intersect the existing Ridge Avenue at a tangent. A T-intersection would be created with the intersection of Madison Street. From this point, existing Ridge Avenue would be widened to avoid impacting the historic wall. No sidewalk would be replaced on this portion of road due to sidewalk plans of the City. After construction is complete, WV 2 traffic would no longer need to navigate the intersection of Madison and Chester Streets. Madison Street would create a T-intersection with the new WV 2 alignment. It is assumed that this T-intersection would be controlled by a stop condition for Madison Street traffic. Receptor M6 (representing Pride Park) is the only noise impact associated with Alternative 4.

12.5 ALTERNATIVE 5A

Alternative 5A would improve the existing 90-degree turns by creating a bypass of this portion of the road. The bypass would begin at the intersection of Industrial Park Road and WV 2. The new roadway would follow a new alignment from Industrial Park Road to the existing terminus of Chester Street. Slight alterations to the alignment of existing Chester Street would also be required. One playground and three baseball fields are present on Chester Street, but the new

alignment will not significantly encroach on the properties. The realigned WV 2 would remove through traffic and trucks from existing Ridge Street and Madison Street and would direct the traffic along the new alignment. No noise impacts have been identified with Alternative 5A.

13.0 NOISE MITIGATION CONSIDERATION

Noise impacts have been identified; therefore, noise mitigation consideration is warranted for this project. All five alternatives exceed the NAC at Receptor M6 (Pride Park). Because Pride Park is less than 20 feet wide and the receptor site is within 15 feet of WV 2, it is not feasible to provide noise mitigation for this park. Alternative 3 also impacts Receptor M2. This receptor represents only one residence, and noise mitigation would not be feasible due to the low density of the Category B receptors.

14.0 CONSTRUCTION NOISE ABATEMENT

The following noise abatement measures may be incorporated into the contract plans and specifications in order to prevent adverse construction noise impact in the vicinity of the proposed project:

> *The contractor shall comply with all state and local sound control and noise level rules, regulations, and ordinances which apply to any work performed pursuant to the contract. Each internal combustion engine used for any purpose on work related to the project shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the project without such muffler.*

APPENDICES

APPENDIX A -
SITE SKETCHES

New Cumberland West Virginia, Noise Measurement

Short-term Monitoring

Site # M1 **Description: 304 Ridge Ave**

20 minute short term measurement

MONITORING INFORMATION

Notes: Leq 56.1 dBA

Date:	12/20/2017
Start Time:	9:50:00 AM
End Time:	10:10:00 AM
Meter ID:	3895

	WB	EB	Other
Roadway:	Ridge Ave		
Cars:	43	56	
MT:	5	2	
HT:	2	2	

SITE SKETCH:

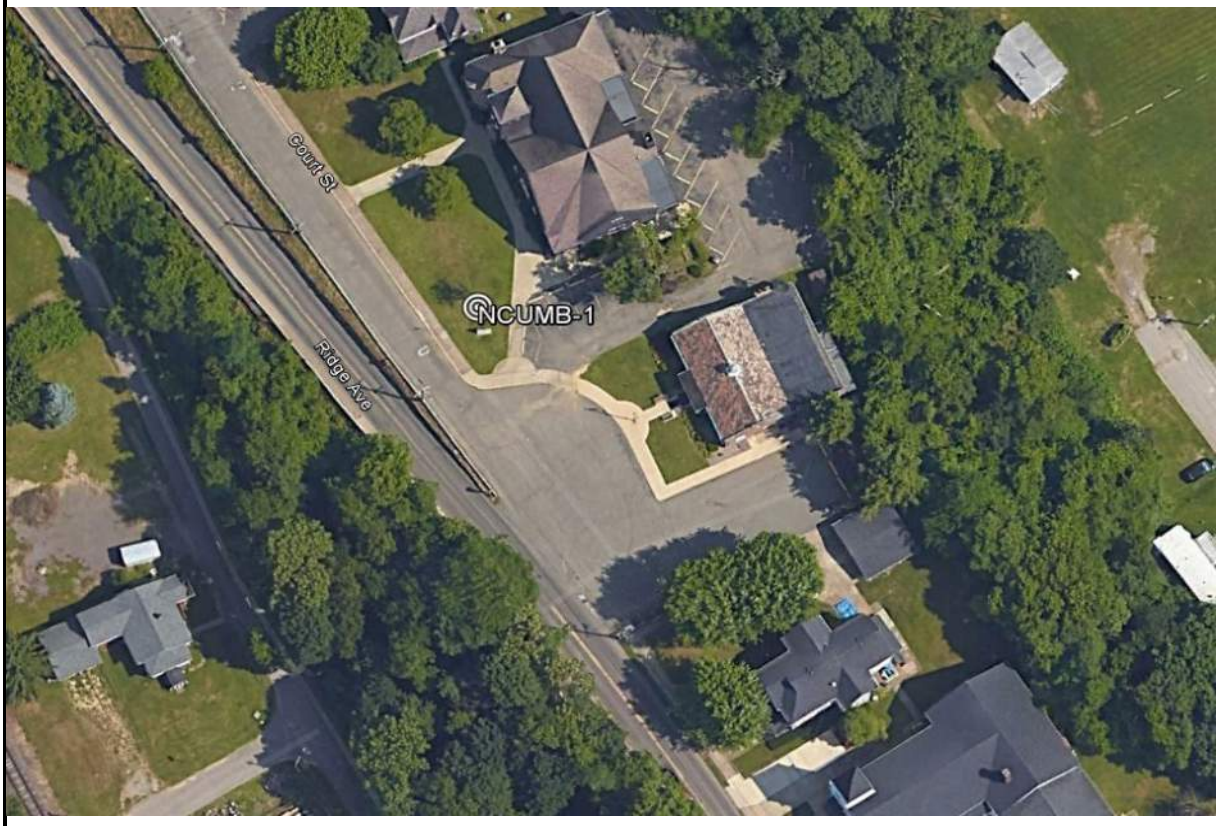
North Arrow

Site Specifics

Pavement Type:	Grade:	Site Surface:	Employee:
Average		Grass	ERZ

Atmospheric Conditions : Clear
45 °F, 63% Humidity, Winds 6 mph.

Plan View



New Cumberland West Virginia, Noise Measurement

Short-term Monitoring

Site # M2 **Description: 100 North Chester St**

20 minute short term measurement

MONITORING INFORMATION

Notes: Leq 59.2 dBA

Date:	12/20/2017
Start Time:	9:50:00 AM
End Time:	10:10:00 AM
Meter ID:	5093

	WB	EB	Other
Roadway:	Ridge Ave		
Cars:	43	56	
MT:	5	2	
HT:	2	2	

SITE SKETCH:

North Arrow

Site Specifics

Pavement Type:	Grade:	Site Surface:	Employee:
Average		Grass	ERZ

Atmospheric Conditions : Clear
45 °F, 63% Humidity, Winds 6 mph.

Plan View

New Cumberland West Virginia, Noise Measurement

Short-term Monitoring

Site # M3 **Description: 107 Adams St**

20 minute short term measurement

MONITORING INFORMATION

Notes: Leq 57.8 dBA

Date:	12/20/2017
Start Time:	9:50:00 AM
End Time:	10:10:00 AM
Meter ID:	3897

	WB	EB	Other
Roadway:	Ridge Ave		
Cars:	43	56	
MT:	5	2	
HT:	2	2	

SITE SKETCH:

North Arrow

Site Specifics

Pavement Type:	Grade:	Site Surface:	Employee:
Average		Grass	ERZ

Atmospheric Conditions : Clear
45 °F, 63% Humidity, Winds 6 mph.

Plan View

New Cumberland West Virginia, Noise Measurement

Short-term Monitoring

Site # M4 **Description: 104 North Court Street**

20 minute short term measurement

MONITORING INFORMATION

Notes: Leq 53.9 dBA

Date:	12/20/2017
Start Time:	9:50:00 AM
End Time:	10:10:00 AM
Meter ID:	4618

	WB	EB	Other
Roadway:	Ridge Ave		
Cars:	43	56	
MT:	5	2	
HT:	2	2	

SITE SKETCH:

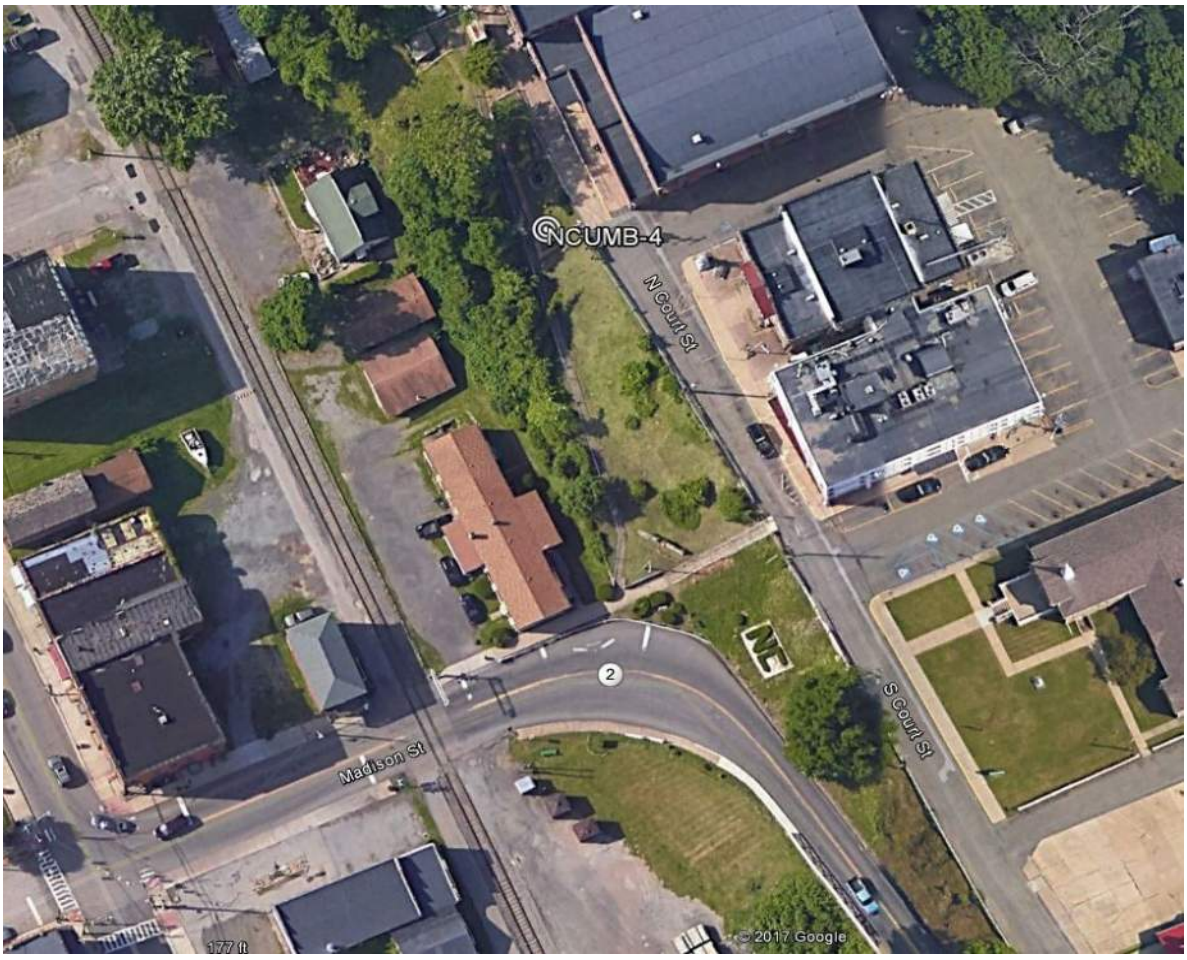
North Arrow

Site Specifics

Pavement Type:	Grade:	Site Surface:	Employee:
Average		Grass	ERZ

Atmospheric Conditions : Clear
45 °F, 63% Humidity, Winds 6 mph.

Plan View



New Cumberland West Virginia, Noise Measurement

Short-term Monitoring

Site # M5 | **Description: New Cumberland Park**

20 minute short term measurement

MONITORING INFORMATION

Notes: Leq 49.7 dBA

Date:	12/20/2017
Start Time:	1:55:00 PM
End Time:	2:14:30 PM
Meter ID:	3895

	WB	EB	Other
Roadway:	Chester St		
Cars:	65	70	
MT:	5	3	
HT:	1	4	

SITE SKETCH:

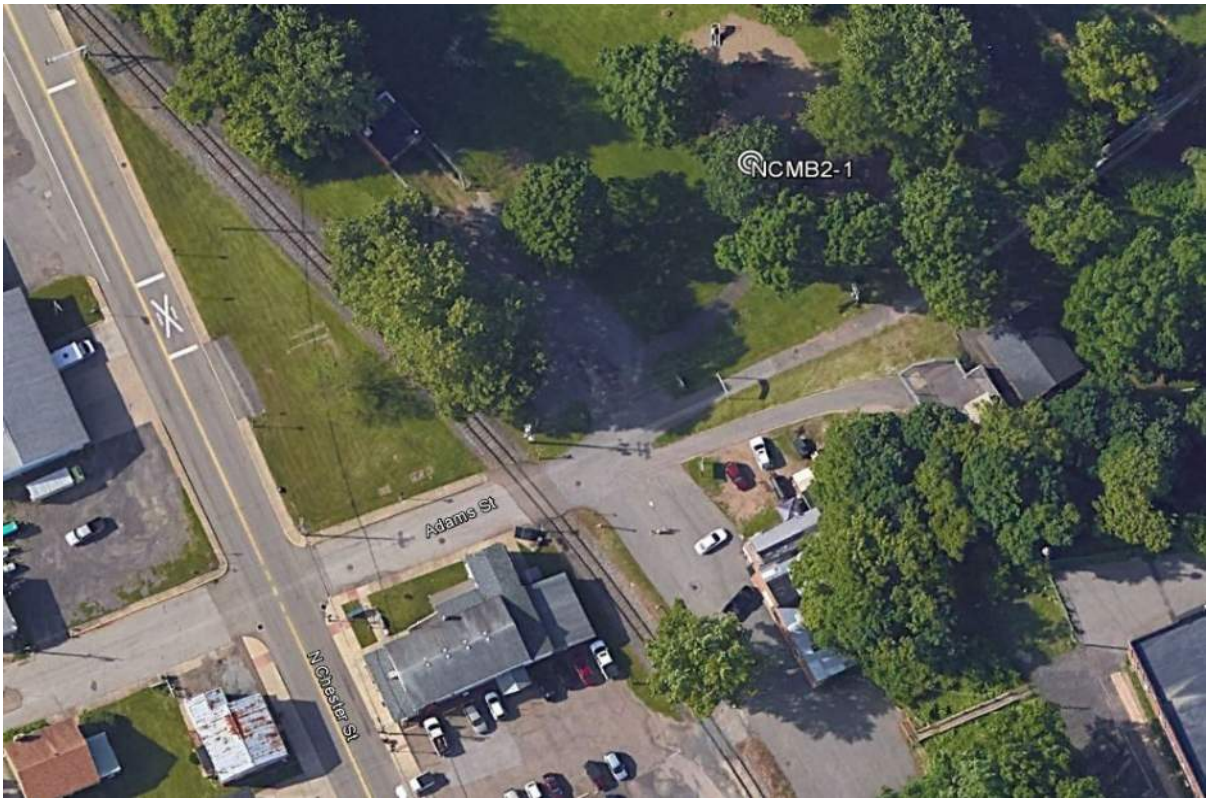
North Arrow

Site Specifics

Pavement Type:	Grade:	Site Surface:	Employee:
Average		Grass	ERZ

Atmospheric Conditions : Clear
38 °F, 56% Humidity, Winds 9 mph.

Plan View



New Cumberland West Virginia, Noise Measurement

Short-term Monitoring

Site # M6 | **Description: Pride Park**

20 minute short term measurement

MONITORING INFORMATION

Notes: Leq 64.4 dBA

Date:	12/20/2017
Start Time:	1:09:00 PM
End Time:	1:28:30 PM
Meter ID:	3895

	WB	EB	Other
Roadway:	Chester St		
Cars:	65	70	
MT:	5	3	
HT:	1	4	

SITE SKETCH:

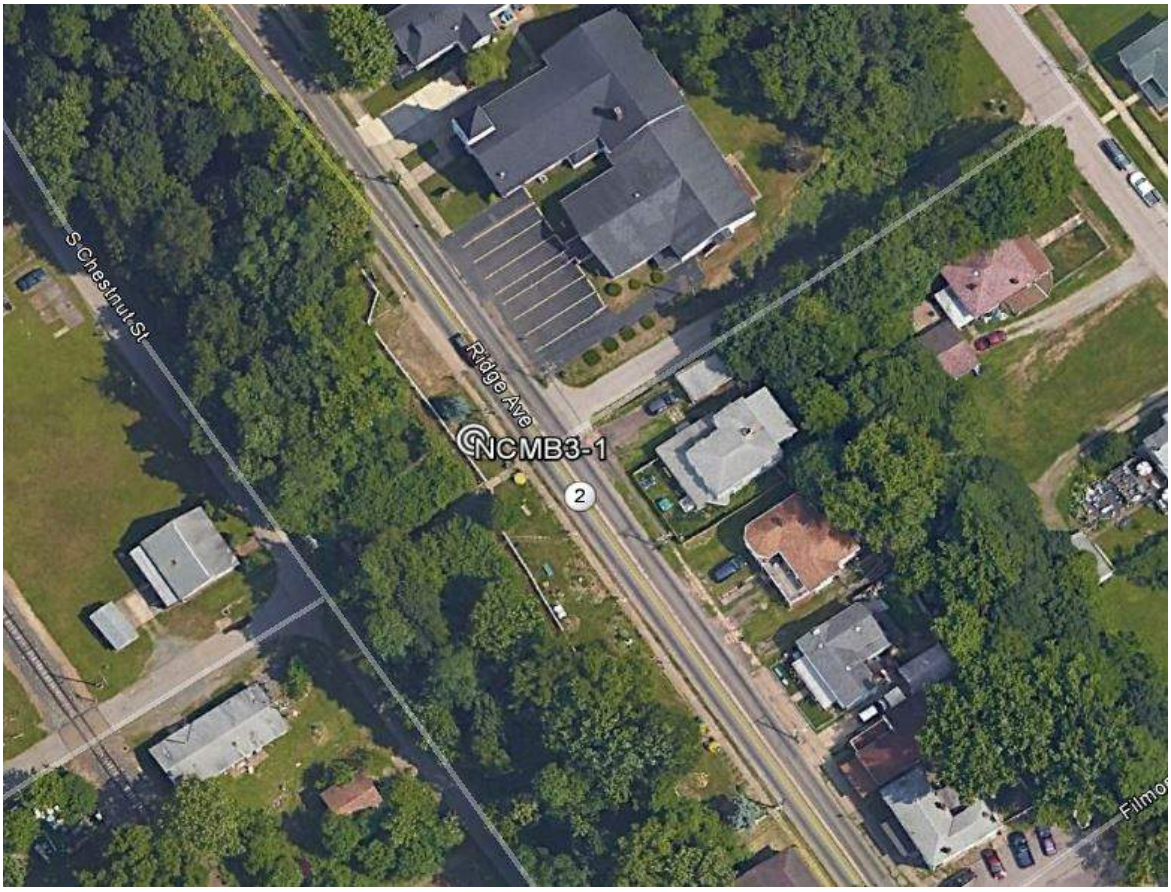
North Arrow

Site Specifics

Pavement Type:	Grade:	Site Surface:	Employee:
Average		Grass	ERZ

Atmospheric Conditions : Clear
38 °F, 56% Humidity, Winds 9 mph.

Plan View



New Cumberland West Virginia, Noise Measurement

Short-term Monitoring

Site # M7 **Description: 800 Chester St**

20 minute short term measurement

MONITORING INFORMATION

Notes: Site was placed near house with no direct line of site to Ridge Ave

Date:	12/20/2017
Start Time:	1:09:00 PM
End Time:	1:28:30 PM
Meter ID:	3897

	WB	EB	Other
Roadway:	Chester St		
Cars:	5	5	
MT:	1	0	
HT:	0	0	

SITE SKETCH:

North Arrow

Site Specifics

Pavement Type:	Grade:	Site Surface:	Employee:
Average		Grass	ERZ

Atmospheric Conditions : Clear
38 °F, 56% Humidity, Winds 9 mph.

Plan View

New Cumberland West Virginia, Noise Measurement

Short-term Monitoring

Site # M8 **Description: 900 Chestnut St**

20 minute short term measurement

MONITORING INFORMATION

Notes: Site was placed near house with no direct line of site to Ridge Ave

Date:	12/20/2017
Start Time:	1:09:00 PM
End Time:	1:28:30 PM
Meter ID:	3895

	WB	EB	Other
Roadway:	Chester St		
Cars:	5	5	
MT:	1	0	
HT:	0	0	

SITE SKETCH:

North Arrow

Site Specifics

Pavement Type:	Grade:	Site Surface:	Employee:
Average		Grass	ERZ

Atmospheric Conditions : Clear
38 °F, 56% Humidity, Winds 9 mph.

Plan View

New Cumberland West Virginia, Noise Measurement

Short-term Monitoring

Site # M9 **Description: 503 Chester St**

20 minute short term measurement

MONITORING INFORMATION

Notes: Site was placed near house with no direct line of site to Ridge Ave

Date:	12/20/2017
Start Time:	1:09:00 PM
End Time:	1:28:30 PM
Meter ID:	5093

	WB	EB	Other
Roadway:	Chester St		
Cars:	5	5	
MT:	1	0	
HT:	0	0	

SITE SKETCH:

North Arrow

Site Specifics

Pavement Type:	Grade:	Site Surface:	Employee:
Average		Grass	ERZ

Atmospheric Conditions : Clear
38 °F, 56% Humidity, Winds 9 mph.

Plan View

APPENDIX B -
ALTERNATIVE MAPPING

HK-0234 First United Presbyterian Church

HK-0233 Swaney Memorial Library

HK-1411 Union Soldier Monument

COURT ST

WV 2 0+00

1+00

2+00

3+00

4+00

5+00

6+00

7+00

8+00

9+00

10+00

11+00

12+00

12+55

WV 2

RIDGE AVE

HK-0405 First National Bank-Graham Building

MADISON ST

CHESTER ST

HK-0420 McNeil Building

Legend

NRHP Listed

NRHP Individually Eligible

0 40 80 Feet

N

WEST VIRGINIA DIVISION OF HIGHWAYS
STATE PROJECT # U215-2-6.20 00

NEW CUMBERLAND WEST VIRGINIA 2

CITY OF NEW CUMBERLAND

HANCOCK COUNTY, WEST VIRGINIA

HISTORIC RESOURCES AND ALTERNATIVE 1

FIGURE - 1
01-06-2016

SKELLY and LOY Inc.
CONSULTANTS IN
ENVIRONMENT - ENERGY
ENGINEERING - PLANNING

HK-0234 First United Presbyterian Church

HK-0233 Swaney Memorial Library

HK-1411 Union Soldier Monument

COURT ST

HK-0405 First National Bank-Graham Building

WV 2

20+00

21+00

22+00

23+00

24+00

25+00

26+00

27+00

28+00

29+00

30+00

31+00

32+00

32+29

WV 2

RIDGE AVE

MADISON ST

CHESTER ST

HK-0420 McNeil Building

Legend

NRHP Listed

NRHP Individually Eligible

0 40 80 Feet

N

WEST VIRGINIA DIVISION OF HIGHWAYS
STATE PROJECT # U215-2-6.20 00

NEW CUMBERLAND WEST VIRGINIA 2

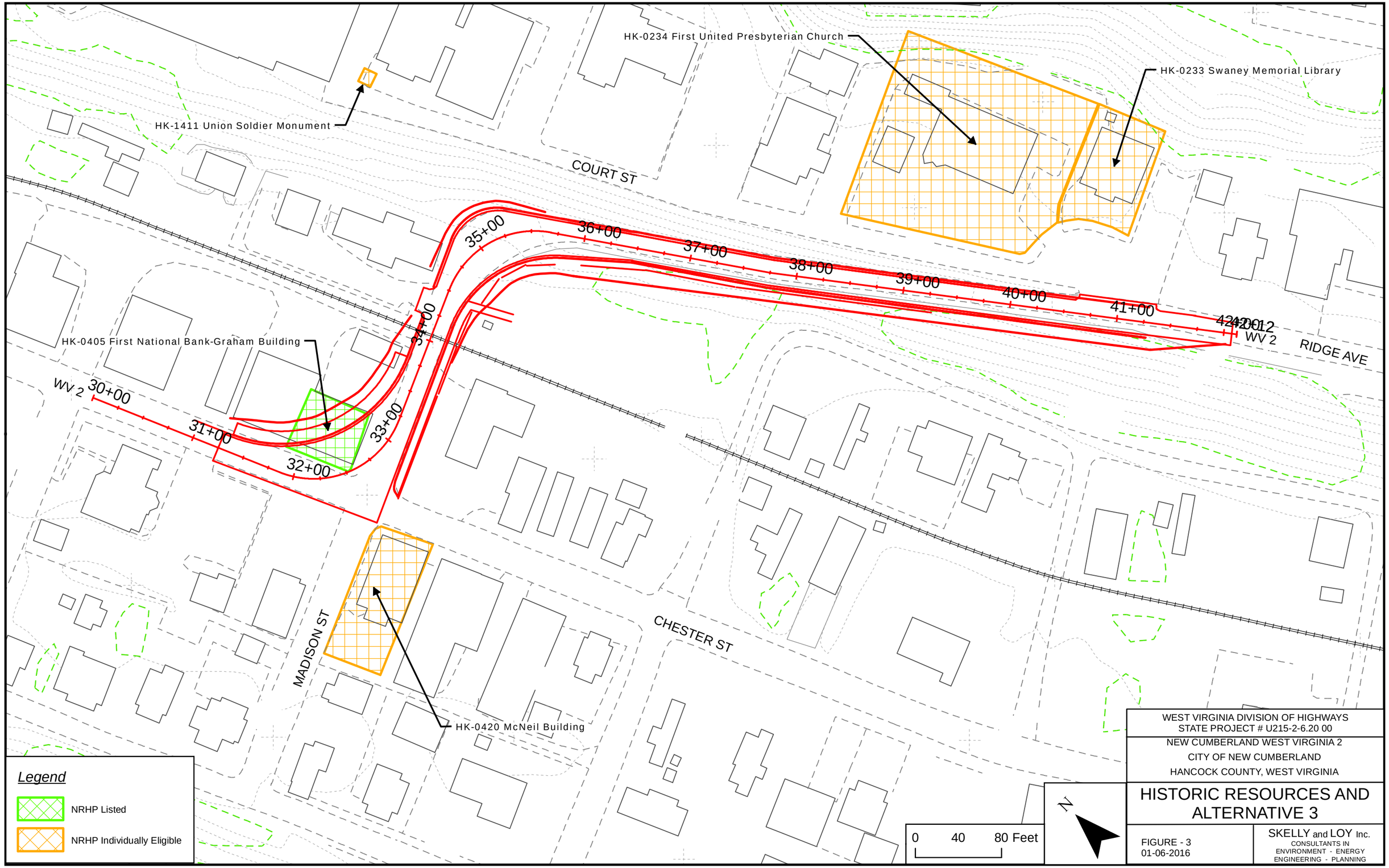
CITY OF NEW CUMBERLAND

HANCOCK COUNTY, WEST VIRGINIA

HISTORIC RESOURCES AND ALTERNATIVE 2

FIGURE - 2
01-06-2016

SKELLY and LOY Inc.
CONSULTANTS IN
ENVIRONMENT - ENERGY
ENGINEERING - PLANNING



WEST VIRGINIA DIVISION OF HIGHWAYS
STATE PROJECT # U215-2-6.20 00

NEW CUMBERLAND WEST VIRGINIA 2

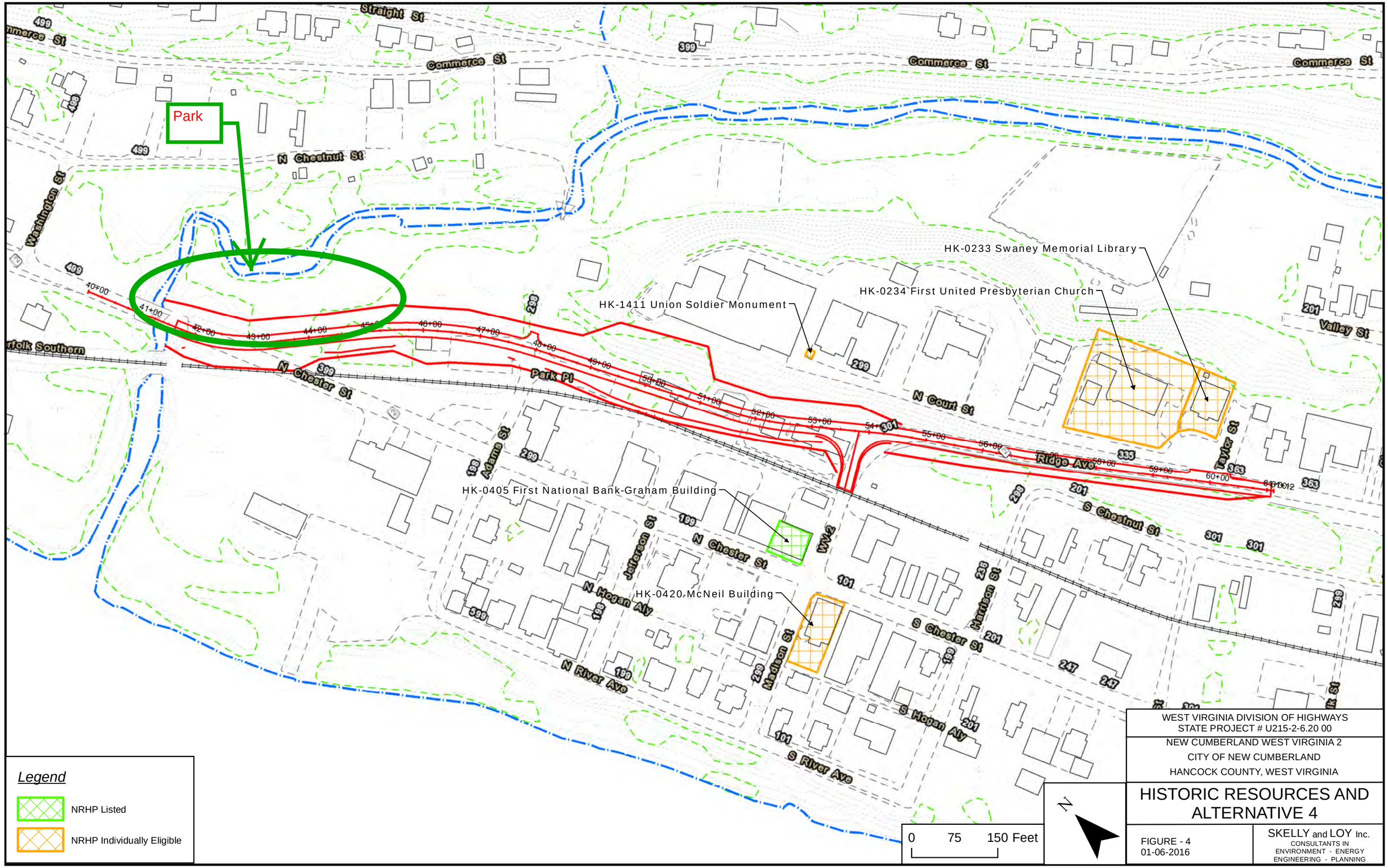
CITY OF NEW CUMBERLAND

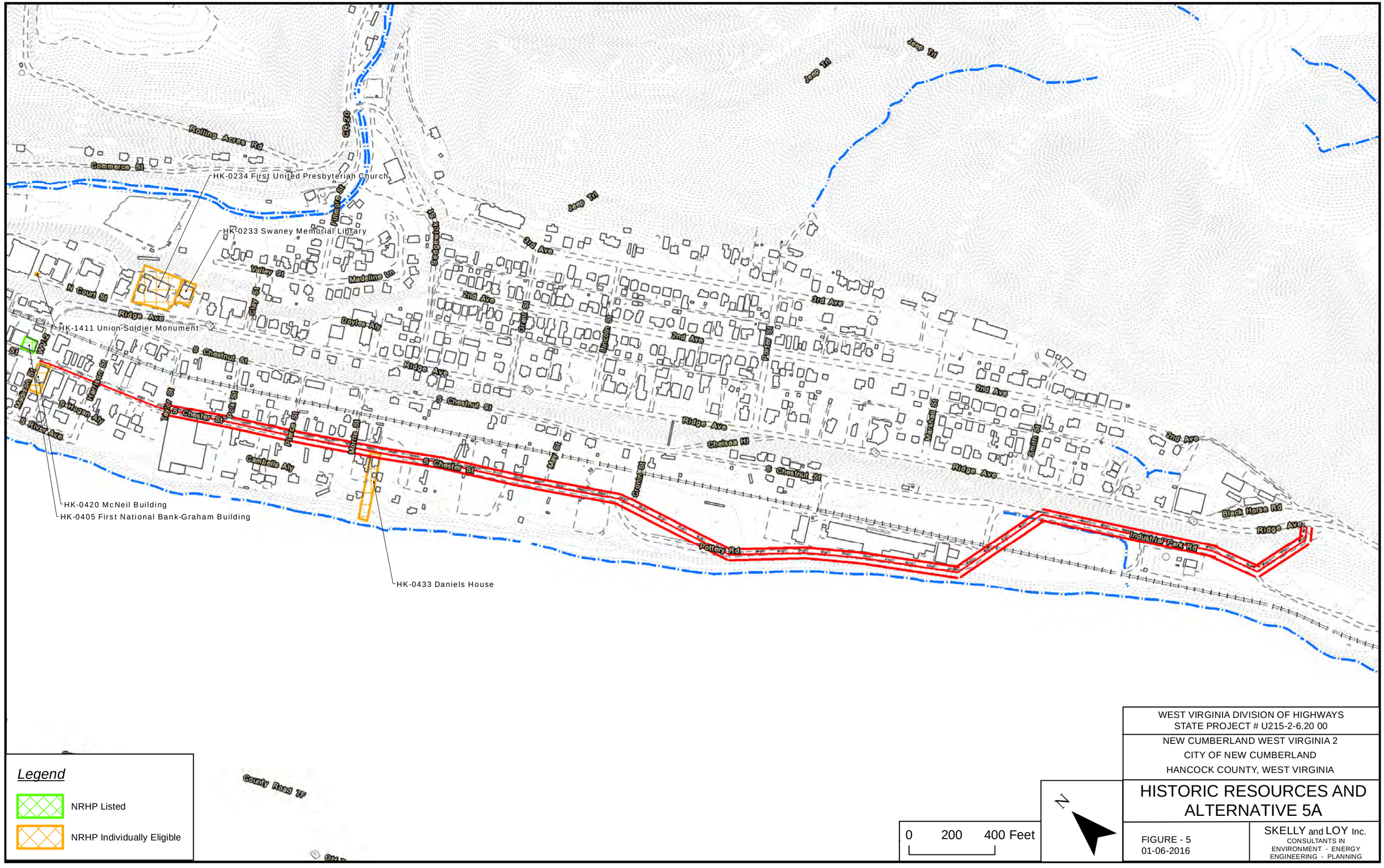
HANCOCK COUNTY, WEST VIRGINIA

HISTORIC RESOURCES AND ALTERNATIVE 3

FIGURE - 3
01-06-2016

SKELLY and LOY Inc.
CONSULTANTS IN
ENVIRONMENT - ENERGY
ENGINEERING - PLANNING


Park
HK-0233 Swaney Memorial Library
HK-0234 First United Presbyterian Church
HK-1411 Union Soldier Monument
HK-0405 First National Bank-Graham Building
HK-0420 McNeil Building
Commerce St
Straight St
N Chestnut St
Washington St
Norfolk Southern
N Chester St
Park Pl
N Court St
Valley St
Ridge Ave
S Chestnut St
Adams St
Jefferson St
N Hogan Aly
N River Ave
Madison St
Harrison St
S Chester St
S Hogan Aly
S River Ave
Taylor St
WV-2
40+00
41+00
42+00
43+00
44+00
46+00
47+00
48+00
49+00
50+00
51+00
52+00
53+00
54+00
55+00
56+00
58+00
59+00
60+00
61+0012
0
75
150 Feet
N
Legend
NRHP Listed
NRHP Individually Eligible
WEST VIRGINIA DIVISION OF HIGHWAYS
STATE PROJECT # U215-2-6.20 00
NEW CUMBERLAND WEST VIRGINIA 2
CITY OF NEW CUMBERLAND
HANCOCK COUNTY, WEST VIRGINIA
HISTORIC RESOURCES AND ALTERNATIVE 4
FIGURE - 4
01-06-2016
SKELLY and LOY Inc.
CONSULTANTS IN ENVIRONMENT - ENERGY ENGINEERING - PLANNING



Legend

- NRHP Listed
- NRHP Individually Eligible

0 200 400 Feet

N

WEST VIRGINIA DIVISION OF HIGHWAYS
STATE PROJECT # U215-2-6.20 00

NEW CUMBERLAND WEST VIRGINIA 2
CITY OF NEW CUMBERLAND
HANCOCK COUNTY, WEST VIRGINIA

HISTORIC RESOURCES AND ALTERNATIVE 5A

FIGURE - 5
01-06-2016

SKELLY and LOY Inc.
CONSULTANTS IN
ENVIRONMENT - ENERGY
ENGINEERING - PLANNING

APPENDIX C -
TNM 2.5 OUTPUT TABLES

	A	B	C	D	E	F	G	H	I	J	K	L
1	Existing Monitored											
2	Receiver											
3	Name	No.	#DUs	Existing	No Barrier					With Barrier		
4				LAeq1h	LAeq1h		Increase over existing		Type	Calculated	Noise Reduction	
5					Calculated	Crit'n	Calculated	Crit'n	Impact	LAeq1h	Calculated	Goal
6								Sub'l Inc				
7												
8				dBA	dBA	dBA	dB	dB		dBA	dB	dB
9												
10	M1	1	1	56.1	57.2	66	1.1	10	----	57.2	0	8
11	M2	2	1	59.2	61.7	66	2.5	10	----	61.7	0	8
12	M3	3	1	57.8	56.5	66	-1.3	10	----	56.5	0	8
13	M4	4	1	53.9	52.4	66	-1.5	10	----	52.4	0	8
14	M5	5	1	49	46.2	66	-2.8	10	----	46.2	0	8
15	M6	6	1	64.4	62.3	66	-2.1	10	----	62.3	0	8

Exisiting (2017) Modeled												
Receiver												
Name	No.	#DUs	Existing	No Barrier					With Barrier			
			LAeq1h	LAeq1h		Increase over existing		Type	Calculated	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n	Impact	LAeq1h	Calculated	Goal	Calculated
							Sub'l Inc					minus
												Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
M1	1	1	56.1	63.1	66	7	10	----	63.1	0	8	-8
M2	2	1	59.2	64.1	66	4.9	10	----	64.1	0	8	-8
M3	3	1	57.8	61.6	66	3.8	10	----	61.6	0	8	-8
M4	4	1	53.9	58	66	4.1	10	----	58	0	8	-8
M5	5	1	49	52.1	66	3.1	10	----	52.1	0	8	-8
M6	6	1	64.4	67.4	66	3	10	Snd Lvl	67.4	0	8	-8
R1	7	1	0	60.2	66	60.2	10	----	60.2	0	8	-8
R2	8	1	0	55	66	55	10	----	55	0	8	-8
R3	9	1	0	57.3	66	57.3	10	----	57.3	0	8	-8
R4	10	1	0	38.6	66	38.6	10	----	38.6	0	8	-8
R5	11	1	0	63.4	66	63.4	10	----	63.4	0	8	-8
R6	12	1	0	42.1	66	42.1	10	----	42.1	0	8	-8
R7	13	1	0	45.4	66	45.4	10	----	45.4	0	8	-8
R8	14	1	0	44.1	66	44.1	10	----	44.1	0	8	-8
R9	15	1	0	54	66	54	10	----	54	0	8	-8
R10	16	1	0	51.5	66	51.5	10	----	51.5	0	8	-8
R11	17	1	0	46.5	66	46.5	10	----	46.5	0	8	-8
R12	18	1	0	59.4	66	59.4	10	----	59.4	0	8	-8
R13	19	1	0	53	66	53	10	----	53	0	8	-8
R14	20	1	0	54.1	66	54.1	10	----	54.1	0	8	-8
R15	21	1	0	53.1	66	53.1	10	----	53.1	0	8	-8

2033 No Build Model												
Receiver												
Name	No.	#DUs	Existing	No Barrier					With Barrier			
			LAeq1h	LAeq1h		Increase over existing		Type	Calculated	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n	Impact	LAeq1h	Calculated	Goal	Calculated
							Sub'l Inc					minus
												Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
M1	1	1	56.1	63.1	66	7	10	----	63.1	0	8	-8
M2	2	1	59.2	64.1	66	4.9	10	----	64.1	0	8	-8
M3	3	1	57.8	61.6	66	3.8	10	----	61.6	0	8	-8
M4	4	1	53.9	58	66	4.1	10	----	58	0	8	-8
M5	5	1	49	52.1	66	3.1	10	----	52.1	0	8	-8
M6	6	1	64.4	67.4	66	3	10	Snd Lvl	67.4	0	8	-8
R1	7	1	0	60.3	66	60.3	10	----	60.3	0	8	-8
R2	8	1	0	55	66	55	10	----	55	0	8	-8
R3	9	1	0	57.4	66	57.4	10	----	57.4	0	8	-8
R4	10	1	0	38.6	66	38.6	10	----	38.6	0	8	-8
R5	11	1	0	63.5	66	63.5	10	----	63.5	0	8	-8
R6	12	1	0	42.2	66	42.2	10	----	42.2	0	8	-8
R7	13	1	0	45.4	66	45.4	10	----	45.4	0	8	-8
R8	14	1	0	44.1	66	44.1	10	----	44.1	0	8	-8
R9	15	1	0	54.1	66	54.1	10	----	54.1	0	8	-8
R10	16	1	0	51.5	66	51.5	10	----	51.5	0	8	-8
R11	17	1	0	46.5	66	46.5	10	----	46.5	0	8	-8
R12	18	1	0	59.4	66	59.4	10	----	59.4	0	8	-8
R13	19	1	0	53	66	53	10	----	53	0	8	-8
R14	20	1	0	54.1	66	54.1	10	----	54.1	0	8	-8
R15	21	1	0	53.1	66	53.1	10	----	53.1	0	8	-8

Alternative 1												
Receiver												
Name	No.	#DUs	Existing	No Barrier					With Barrier			
			LAeq1h	LAeq1h		Increase over existing		Type	Calculated	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n	Impact	LAeq1h	Calculated	Goal	Calculated
							Sub'l Inc					minus
												Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
M1	1	1	56.1	63.1	66	7	10	----	63.1	0	8	-8
M2	2	1	59.2	64.1	66	4.9	10	----	64.1	0	8	-8
M3	3	1	57.8	61.6	66	3.8	10	----	61.6	0	8	-8
M4	4	1	53.9	57.4	66	3.5	10	----	57.4	0	8	-8
M5	5	1	49	52.1	66	3.1	10	----	52.1	0	8	-8
M6	6	1	64.4	67.5	66	3.1	10	Snd Lvl	67.5	0	8	-8
R1	7	1	0	60.2	66	60.2	10	----	60.2	0	8	-8
R2	8	1	0	55.4	66	55.4	10	----	55.4	0	8	-8
R3	9	1	0	57.4	66	57.4	10	----	57.4	0	8	-8
R4	10	1	0	38.7	66	38.7	10	----	38.7	0	8	-8
R5	11	1	0	63.7	66	63.7	10	----	63.7	0	8	-8
R6	13	1	0	42.3	66	42.3	10	----	42.3	0	8	-8
R7	14	1	0	45.5	66	45.5	10	----	45.5	0	8	-8
R8	15	1	0	44.3	66	44.3	10	----	44.3	0	8	-8
R9	17	1	0	54.3	66	54.3	10	----	54.3	0	8	-8
R10	18	1	0	51.5	66	51.5	10	----	51.5	0	8	-8
R11	19	1	0	46.7	66	46.7	10	----	46.7	0	8	-8
R12	20	1	0	59.2	66	59.2	10	----	59.2	0	8	-8
R13	21	1	0	53.1	66	53.1	10	----	53.1	0	8	-8
R14	22	1	0	54	66	54	10	----	54	0	8	-8
R15	23	1	0	53.3	66	53.3	10	----	53.3	0	8	-8

Alternative 2												
Receiver												
Name	No.	#DUs	Existing	No Barrier					With Barrier			
			LAeq1h	LAeq1h		Increase over existing		Type	Calculated	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n	Impact	LAeq1h	Calculated	Goal	Calculated
							Sub'l Inc					minus
												Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
M1	1	1	56.1	64.8	66	8.7	10	----	64.8	0	8	-8
M2	2	1	59.2	61.5	66	2.3	10	----	61.5	0	8	-8
M3	3	1	57.8	61.6	66	3.8	10	----	61.6	0	8	-8
M4	4	1	53.9	59.1	66	5.2	10	----	59.1	0	8	-8
M5	5	1	49	52.3	66	3.3	10	----	52.3	0	8	-8
M6	6	1	64.4	69.9	66	5.5	10	Snd Lvl	69.9	0	8	-8
R1	7	1	0	64.3	66	64.3	10	----	64.3	0	8	-8
R2	8	1	0	59.9	66	59.9	10	----	59.9	0	8	-8
R3	9	1	0	60.2	66	60.2	10	----	60.2	0	8	-8
R4	10	1	0	40.5	66	40.5	10	----	40.5	0	8	-8
R5	11	1	0	61	66	61	10	----	61	0	8	-8
R6	13	1	0	41.7	66	41.7	10	----	41.7	0	8	-8
R7	14	1	0	45.5	66	45.5	10	----	45.5	0	8	-8
R8	15	1	0	44.2	66	44.2	10	----	44.2	0	8	-8
R9	17	1	0	54.2	66	54.2	10	----	54.2	0	8	-8
R10	18	1	0	50.5	66	50.5	10	----	50.5	0	8	-8
R11	19	1	0	45.5	66	45.5	10	----	45.5	0	8	-8
R12	20	1	0	55.9	66	55.9	10	----	55.9	0	8	-8
R13	21	1	0	52.4	66	52.4	10	----	52.4	0	8	-8
R14	22	1	0	53.2	66	53.2	10	----	53.2	0	8	-8
R15	23	1	0	53.3	66	53.3	10	----	53.3	0	8	-8

Alternative 3												
Receiver												
Name	No.	#DUs	Existing	No Barrier					With Barrier			
			LAeq1h	LAeq1h		Increase over existing		Type	Calculated	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n	Impact	LAeq1h	Calculated	Goal	Calculated
							Sub'l Inc					minus
												Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
M1	1	1	56.1	63.1	66	7	10	----	63.1	0	8	-8
M2	2	1	59.2	68.8	66	9.6	10	Snd Lvl	68.8	0	8	-8
M3	3	1	57.8	61.6	66	3.8	10	----	61.6	0	8	-8
M4	4	1	53.9	57.9	66	4	10	----	57.9	0	8	-8
M5	5	1	49	52.2	66	3.2	10	----	52.2	0	8	-8
M6	6	1	64.4	67.5	66	3.1	10	Snd Lvl	67.5	0	8	-8
R1	7	1	0	59.9	66	59.9	10	----	59.9	0	8	-8
R2	8	1	0	55.3	66	55.3	10	----	55.3	0	8	-8
R3	9	1	0	57.5	66	57.5	10	----	57.5	0	8	-8
R4	10	1	0	38.8	66	38.8	10	----	38.8	0	8	-8
R5	11	1	0	63.9	66	63.9	10	----	63.9	0	8	-8
R6	13	1	0	42.4	66	42.4	10	----	42.4	0	8	-8
R7	14	1	0	45.5	66	45.5	10	----	45.5	0	8	-8
R8	15	1	0	44.4	66	44.4	10	----	44.4	0	8	-8
R9	17	1	0	55	66	55	10	----	55	0	8	-8
R10	18	1	0	51.5	66	51.5	10	----	51.5	0	8	-8
R11	19	1	0	46.5	66	46.5	10	----	46.5	0	8	-8
R12	20	1	0	60.2	66	60.2	10	----	60.2	0	8	-8
R13	21	1	0	53.6	66	53.6	10	----	53.6	0	8	-8
R14	22	1	0	54.2	66	54.2	10	----	54.2	0	8	-8
R15	23	1	0	53.3	66	53.3	10	----	53.3	0	8	-8

Alternative 4												
Receiver												
Name	No.	#DUs	Existing	No Barrier					With Barrier			
			LAeq1h	LAeq1h		Increase over existing		Type	Calculated	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n	Impact	LAeq1h	Calculated	Goal	Calculated
							Sub'l Inc					minus
												Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
M1	1	1	56.1	63.5	66	7.4	10	----	63.5	0	8	-8
M2	2	1	59.2	52.4	66	-6.8	10	----	52.4	0	8	-8
M3	3	1	57.8	49.8	66	-8	10	----	49.8	0	8	-8
M4	4	1	53.9	62.5	66	8.6	10	----	62.5	0	8	-8
M5	5	1	49	57.9	66	8.9	10	----	57.9	0	8	-8
M6	6	1	64.4	67.5	66	3.1	10	Snd Lvl	67.5	0	8	-8
R1	7	1	0	40.3	66	40.3	10	----	40.3	0	8	-8
R2	8	1	0	54.5	66	54.5	10	----	54.5	0	8	-8
R3	9	1	0	49.4	66	49.4	10	----	49.4	0	8	-8
R4	10	1	0	37	66	37	10	----	37	0	8	-8
R5	11	1	0	43	66	43	10	----	43	0	8	-8
R6	12	1	0	37.9	66	37.9	10	----	37.9	0	8	-8
R7	13	1	0	41.6	66	41.6	10	----	41.6	0	8	-8
R8	14	1	0	38.7	66	38.7	10	----	38.7	0	8	-8
R9	15	1	0	41.7	66	41.7	10	----	41.7	0	8	-8
R10	16	1	0	38.8	66	38.8	10	----	38.8	0	8	-8
R11	17	1	0	35.8	66	35.8	10	----	35.8	0	8	-8
R15	21	1	0	46.3	66	46.3	10	----	46.3	0	8	-8

S&L 8-Feb-19
ERZ TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: WV 2 New Cumberland
RUN: Alternative 5A
BARRIER DESIGN: INPUT HEIGHTS
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
M1	1	1	56.1	51.2	66	-4.9	10	----	51.2	0	8	-8
M2	2	1	59.2	52.2	66	-7	10	----	52.2	0	8	-8
M3	3	1	57.8	60.4	66	2.6	10	----	60.4	0	8	-8
M4	4	1	53.9	48.3	66	-5.6	10	----	48.3	0	8	-8
M5	5	1	49	50.2	66	1.2	10	----	50.2	0	8	-8
M6	6	1	64.4	55.9	66	-8.5	10	----	55.9	0	8	-8
R1	7	1	0	62.9	66	62.9	10	----	62.9	0	8	-8
R2	8	1	0	50.9	66	50.9	10	----	50.9	0	8	-8
R3	9	1	0	62.8	66	62.8	10	----	62.8	0	8	-8
R4	10	1	0	47.5	66	47.5	10	----	47.5	0	8	-8
R5	11	1	0	55.3	66	55.3	10	----	55.3	0	8	-8
R6	12	1	0	39.2	66	39.2	10	----	39.2	0	8	-8
R7	13	1	0	44.6	66	44.6	10	----	44.6	0	8	-8
R8	14	1	0	42.5	66	42.5	10	----	42.5	0	8	-8
R9	15	1	0	47.7	66	47.7	10	----	47.7	0	8	-8
R10	16	1	0	46	66	46	10	----	46	0	8	-8
R11	17	1	0	40	66	40	10	----	40	0	8	-8
R15	21	1	0	52.3	66	52.3	10	----	52.3	0	8	-8
1-01	24	1	0	56.4	66	56.4	10	----	56.4	0	8	-8
1-02	25	1	0	57.6	66	57.6	10	----	57.6	0	8	-8
1-03	26	1	0	46.1	66	46.1	10	----	46.1	0	8	-8
1-04	27	1	0	44.9	66	44.9	10	----	44.9	0	8	-8
1-05	28	1	0	45.2	66	45.2	10	----	45.2	0	8	-8
1-06	29	1	0	44.9	66	44.9	10	----	44.9	0	8	-8
1-07	31	1	0	44.8	66	44.8	10	----	44.8	0	8	-8
1-08	32	1	0	57	66	57	10	----	57	0	8	-8
1-09	33	1	0	57.8	66	57.8	10	----	57.8	0	8	-8
1-10	34	1	0	48.7	66	48.7	10	----	48.7	0	8	-8
1-11	35	1	0	58	66	58	10	----	58	0	8	-8
1-12	36	1	0	57.6	66	57.6	10	----	57.6	0	8	-8
1-13	37	1	0	58.1	66	58.1	10	----	58.1	0	8	-8
1-14	38	1	0	57.1	66	57.1	10	----	57.1	0	8	-8
1-15	39	1	0	46.4	66	46.4	10	----	46.4	0	8	-8
1-16	40	1	0	47.7	66	47.7	10	----	47.7	0	8	-8
1-17	43	1	0	47.7	66	47.7	10	----	47.7	0	8	-8
1-19	44	1	0	48.8	66	48.8	10	----	48.8	0	8	-8
1-20	45	1	0	48.4	66	48.4	10	----	48.4	0	8	-8
1-21	46	1	0	47.7	66	47.7	10	----	47.7	0	8	-8
1-22	47	1	0	46.4	66	46.4	10	----	46.4	0	8	-8
1-23	48	1	0	51.2	66	51.2	10	----	51.2	0	8	-8
1-24	49	1	0	50.7	66	50.7	10	----	50.7	0	8	-8
1-25	50	1	0	50.1	66	50.1	10	----	50.1	0	8	-8
1-26	51	1	0	48.3	66	48.3	10	----	48.3	0	8	-8
1-18	52	1	0	59.4	66	59.4	10	----	59.4	0	8	-8
1-27	53	1	0	59	66	59	10	----	59	0	8	-8
1-28	54	1	0	59.5	66	59.5	10	----	59.5	0	8	-8
1-29	55	1	0	59.9	66	59.9	10	----	59.9	0	8	-8
1-30	56	1	0	61.2	66	61.2	10	----	61.2	0	8	-8
1-31	57	1	0	59	66	59	10	----	59	0	8	-8
1-32	58	1	0	59.4	66	59.4	10	----	59.4	0	8	-8
1-33	59	1	0	58	66	58	10	----	58	0	8	-8
1-34	61	1	0	48.4	66	48.4	10	----	48.4	0	8	-8
2-03	62	1	0	57.2	66	57.2	10	----	57.2	0	8	-8
2-04	63	1	0	58.3	66	58.3	10	----	58.3	0	8	-8
2-05	64	1	0	61.4	66	61.4	10	----	61.4	0	8	-8

2-06	65	1	0	51	66	51	10	----	51	0	8	-8
M9	66	1	0	59.7	66	59.7	10	----	59.7	0	8	-8
2-08	67	1	0	48.1	66	48.1	10	----	48.1	0	8	-8
2-09	68	1	0	56.7	66	56.7	10	----	56.7	0	8	-8
2-10	69	1	0	58.3	66	58.3	10	----	58.3	0	8	-8
2-11	70	1	0	58.3	66	58.3	10	----	58.3	0	8	-8
2-12	71	1	0	59	66	59	10	----	59	0	8	-8
2-13	72	1	0	63.4	66	63.4	10	----	63.4	0	8	-8
2-14	77	1	0	49.6	66	49.6	10	----	49.6	0	8	-8
3-01	78	1	0	57.2	66	57.2	10	----	57.2	0	8	-8
3-02	79	1	0	57.8	66	57.8	10	----	57.8	0	8	-8
M7	81	1	0	58	66	58	10	----	58	0	8	-8
3-04	83	1	0	59.8	66	59.8	10	----	59.8	0	8	-8

Dwelling Units	# DUs	Noise Reduction Min dB	Avg dB	Max dB
All Selected	68	0	0	0
All Impacted	0	0	0	0
All that meet NR Goal	0	0	0	0