

Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

NOISE
TECHNICAL REPORT

JANUARY 2026

Maryland Transportation Authority
MDTA

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ABBREVIATIONS AND ACRONYMS

ARDS	Alternatives Retained for Detailed Study
dB(A)	A-Weighted Sound Level in Decibels
CFR	Code of Federal Regulations
CS	Critical Sensitive
EB	Eastbound
ECA	Extra-Cost Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ER	Equivalent Residences
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
Leq(h)	One Hour Equivalent Sound Level
LOS	Level of Service
MDOT	Maryland Department of Transportation
MDTA	Maryland Transportation Authority
NAC	Noise Abatement Criteria
NEPA	National Environmental Policy Act
NSA	Noise Sensitive Area
PTSU	Part-time Shoulder Use
ROD	Record of Decision
SF-p-r	Square-footage per residence
SHA	State Highway Administration
SUP	Shared Use Path
TDM	Transportation Demand Management
TMS	Traffic Monitoring Sessions
TNM	Traffic Noise Model
TSM	Transportation System Management
WB	Westbound

1 INTRODUCTION

The Chesapeake Bay Crossing Study (Bay Crossing Study) is a two-tiered engineering and environmental study being advanced by the Maryland Transportation Authority (MDTA) in coordination with the Federal Highway Administration (FHWA). The Bay Crossing Study is addressing existing and future transportation issues at the William Preston Lane, Jr. Memorial Bridge (Bay Bridge) and its approaches along U.S. 50/301. Each tier of the Bay Crossing Study involves development of an Environmental Impact Statement (EIS), in compliance with the National Environmental Policy Act (NEPA), to describe potential significant environmental effects and inform the evaluation of alternatives. Tier 1 of the Bay Crossing Study (Tier 1 Study) was completed in April 2022. At that time, the FHWA issued a Final EIS/Record of Decision (FEIS/ROD) identifying Corridor 7, the corridor including the Bay Bridge and its approaches, as the Selected Corridor Alternative for further evaluation. Tier 2 of the Bay Crossing Study (Tier 2 Study) was launched in June 2022 to focus on a project-level (site-specific) analysis within the Tier 1 Selected Corridor Alternative (Corridor 7). Study limits for the Tier 2 Study analysis are defined in **Section 2.2**. The Tier 2 NEPA process was initiated formally with publication of a Notice of Intent (NOI) to prepare an EIS in the Federal Register on November 15, 2024.

The purpose of this Noise Technical Report is to present an assessment of the potential direct impacts of the build alternatives to the noise environment. The proposed improvements include substantial horizontal and vertical alterations, as well as additional through traffic lanes; therefore, this project is classified as a Type I project as defined in Title 23 of the Code of Federal Regulations (CFR) Part 772 (23 CFR Part 772). The objective of the Type I noise study is to present the predicted loudest-hour build traffic noise levels to determine if these noise levels cause a traffic noise impact at adjacent noise sensitive land uses, and if so, to determine whether noise abatement is feasible and reasonable for the build alternatives within the noise study area.

2 BACKGROUND

The Chesapeake Bay is one of Maryland's most important natural, economic, and cultural resources and the largest estuary in the United States. The 64,000-square-mile watershed that flows into the Chesapeake Bay spans six states and the District of Columbia and includes 150 major rivers and over 100,000 tributaries. The Chesapeake Bay has historically shaped the region's identity, culture, and traditions.

The Bay Bridge is a two-span structure that crosses the Chesapeake Bay from Anne Arundel County on the Western Shore to Queen Anne's County on the Eastern Shore. The original span opened in 1952, and the second span opened in 1973. Today, the two-lane original span typically carries eastbound traffic, and the three-lane second span typically carries westbound traffic. However, lanes on the bridge can be reversed to accommodate periods of heavy traffic. The approaches along U.S. 50/301 on each shore have six lanes (three lanes for each travel direction). The Bay Bridge has become one of Maryland's most iconic and recognizable landmarks, used by millions of Maryland residents and other travelers every year.

2.1 The Tiered NEPA Process

To study possible solutions that could address transportation issues, specifically as they relate to congestion, the MDTA and FHWA are conducting the Bay Crossing Study as a tiered NEPA study. The tiered approach to NEPA has allowed the MDTA and FHWA to focus on broader, planning-level decisions related to the preferred location of a potential new Bay crossing in the Tier 1 Study EIS. In the subsequent Tier 2 Study EIS, the MDTA and FHWA analyzed more specific, project-level alternatives and potential impacts.

The Tier 1 Study evaluated 14 possible alternative corridor locations over a broad geographic area that spanned nearly 100 miles of the Chesapeake Bay between Harford and Cecil counties to the north and St. Mary's and Somerset counties to the south. The Tier 1 Study identified Corridor 7 as the Selected Corridor Alternative, which is a two-mile-wide and approximately 22-mile-long corridor that follows existing U.S. 50/301 and includes the location of the existing Bay Bridge.

The Tier 2 Study involves a project-level (site-specific) alternatives analysis within the Tier 1 Selected Corridor Alternative (Corridor 7). The focus of the Tier 2 Study is to identify the environmental impacts associated with alternatives to address the Tier 2 Study's Purpose and Need. This technical report supports the evaluation presented in the EIS.

2.2 Study Limits

The MDTA analyzed the traffic volumes along Corridor 7 and its interchanges to determine appropriate study limits for the Tier 2 Study. The Tier 2 western study limit has been identified as the MD 2/MD 450 interchange just east of the Severn River Bridge, and the Tier 2 eastern study limit has been identified as the U.S. 50/301 split.

2.3 Purpose and Need

The purpose of the Tier 2 Study is to address existing and future transportation capacity needs and access across the Chesapeake Bay and at the Chesapeake Bay Bridge approaches along the U.S. 50/301 corridor. The Tier 2 Study is evaluating measures to reduce congestion, improve

travel times and reliability, mobility, and roadway deficiencies, and accommodate maintenance activities and navigation, while minimizing impacts to local communities and the environment. Five needs have been identified:

- **Adequate Capacity and Reliable Travel Times** – Capacity of the Bay Bridge and its approaches on U.S. 50/301 are not sufficient to accommodate existing and anticipated traffic demand, resulting in traffic congestion on the Bay Bridge and adjacent roadway network.

- **Mobility** – Congestion at the Bay Bridge and its approaches and subsequent spillover effects on local roadways limit the movement of people, goods, and services across the Chesapeake Bay and in adjacent communities.

- **Roadway Deficiencies** – The bridge does not meet current design standards for design or traffic operations because of existing conditions such as narrow lanes and lack of shoulders.

- **Existing and Future Maintenance Needs** – Due to the age and design life of the existing Bay Bridge, substantial maintenance of the facility will be needed, leading to lane closures that make incident management more difficult and cause increased traffic and congestion delays.

- **Navigation** – The existing Bay Bridge is a key constraint for the height of ships that travel the Chesapeake Bay, including to the Port of Baltimore.

The MDTA has also identified two study objectives:

- **Environmental Responsibility** – Project alternatives will be developed to avoid and minimize impacts to communities and sensitive environmental resources.

- **Cost and Financial Responsibility** – Cost and financial responsibility will be a factor when analyzing and evaluating potential solutions, with regard to the means of paying for the development, operation, and maintenance of all proposed facilities.

3 ALTERNATIVES

The MDTA identified the Alternatives Retained for Detailed Study (ARDS), which are the NEPA range of reasonable alternatives for evaluation in the Tier 2 Study EIS. The ARDS include the No-Build Alternative and six build alternatives, (**Figure 3-1**). Each build alternative includes removing the existing eastbound and westbound Bay Bridge spans and replacing them with two new bridge spans constructed near the location of the existing Bay Bridge. The ARDS are differentiated by the number of lanes provided across the new bridge and on the approaches as well as the bridge location and consist of:

- **Alternative A - No-Build**: retains the existing Bay Bridge, the U.S. 50/301 alignment, and the existing number of lanes: 6 lanes along U.S. 50/301 on the Western Shore, 5 lanes across the Chesapeake Bay on the existing Bay Bridge, and 6 lanes along U.S. 50/301 on the Eastern Shore;

- **Alternative B - 6-8-6 North**: 6 lanes along U.S. 50/301 on the Western Shore, 8 lanes across the Chesapeake Bay on a new bridge with one span to the north of the existing spans and one span in-between the existing spans, and 6 lanes along U.S. 50/301 on the Eastern Shore;

- **Alternative C - 6-8-6 South**: 6 lanes along U.S. 50/301 on the Western Shore, 8 lanes across the Chesapeake Bay on a new bridge with one span to the south of the existing spans and one span in-between the existing spans, and 6 lanes along U.S. 50/301 on the Eastern Shore;

- **Alternative D - 8-8-8 North**: 8 lanes along U.S. 50/301 on the Western Shore, 8 lanes across the Chesapeake Bay on a new bridge with one span to the north of the existing spans and one span in-between the existing spans, and 8 lanes along U.S. 50/301 on the Eastern Shore;

- **Alternative E - 8-8-8 South**: 8 lanes along U.S. 50/301 on the Western Shore, 8 lanes across the Chesapeake Bay on a new bridge with one span to the south of the existing spans and one span in-between the existing spans, and 8 lanes along U.S. 50/301 on the Eastern Shore;

- **Alternative F - 8-10-8 North**: 8 lanes along U.S. 50/301 on the Western Shore, 10 lanes across the Chesapeake Bay on a new bridge with one span to the north of the existing spans and one span in-between the existing spans, and 8 lanes along U.S. 50/301 on the Eastern Shore and

- **Alternative G - 8-10-8 South**: 8 lanes along U.S. 50/301 on the Western Shore, 10 lanes across the Chesapeake Bay on a new bridge with one span to the south of the existing spans and one span in-between the existing spans, and 8 lanes along U.S. 50/301 on the Eastern Shore.

Each of the ARDS will also include an optional pedestrian / bicycle shared use path, tolling, transit-related improvements, Transportation Systems Management (TSM)/ Transportation Demand Management (TDM), stormwater management, utilities, and truck weigh and inspection stations. These common items, in addition to the improvements associated with each build alternative, informed the development of the limit of disturbance (LOD) for each build alternative. Additional detail on the ARDS can be found in the Tier 2 Study Draft EIS.

3.1 Alternative A: No-Build

Alternative A (6-5-6), the No-Build Alternative, would retain the existing Bay Bridge, the U.S. 50/301 alignment, and the existing number of lanes. This alternative would retain six lanes on the approaches on the Eastern and Western Shores and five lanes on the two-span Bay Bridge. The No-Build Alternative will include regular maintenance of the Bay Bridge and U.S. 50/301, but no capital improvements other than currently planned and programmed projects.

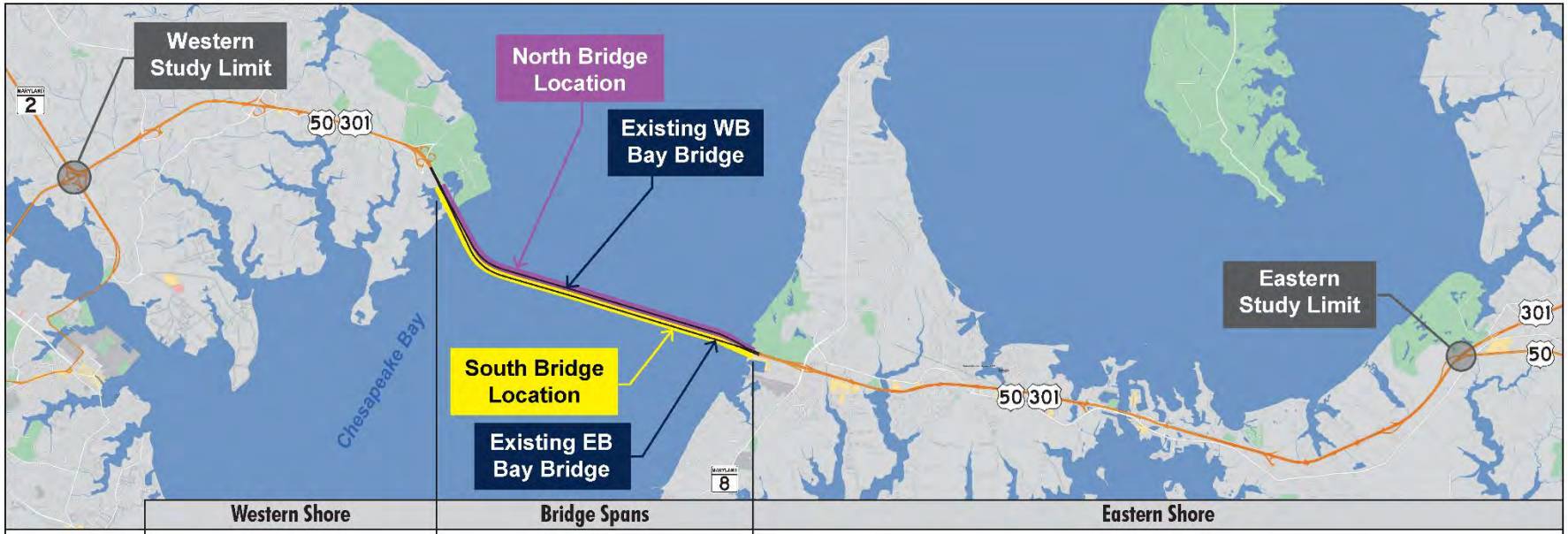
3.2 Alternative B: 6-8-6 North

Alternative B (6-8-6 North) would replace the existing Bay Bridge spans with two new bridge spans and would consist of six lanes along U.S. 50/301 on the Western Shore (three per direction), eight lanes on a new bridge (four per direction), and six lanes along U.S. 50/301 on the Eastern Shore (three per direction). The two new bridge spans would consist of one span to the north and one span in between the location of the existing bridge spans. The approach roadways would remain on the existing roadway alignment, except where necessary to connect to the new bridge spans. Thus, with Alternative B, the five existing bridge lanes would be increased to eight bridge lanes; however, the number of lanes on the Western Shore and Eastern Shore would not change and would remain at six total travel lanes beyond the immediate tie-ins to the new bridge spans.

3.3 Alternative C: 6-8-6 South

Alternative C (6-8-6 South) would replace the existing Bay Bridge spans with two new bridge spans and would consist of six lanes along U.S. 50/301 on the Western Shore (three per direction), eight lanes on a new bridge (four per direction), and six lanes along U.S. 50/301 on the Eastern Shore (three per direction). The two new bridge spans would include one span to the south and one span in between the location of the existing bridge spans. The approach roadways would remain on the existing roadway alignment, except where necessary to connect to the new bridge spans. Thus, with Alternative C, the five existing bridge lanes would be increased to eight bridge lanes; however, the number of lanes on the Western Shore and Eastern Shore would not change and would remain at six total travel lanes beyond the immediate tie-ins to the new bridge spans.

Figure 3-1: Alternatives Summary



	Western Shore	Bridge Spans	Eastern Shore
Alternative A: No-Build	6 Lanes	5 Lanes	6 Lanes
Alternative B	6 Lanes	8 Lanes NORTH	6 Lanes
Alternative C	6 Lanes	8 Lanes SOUTH	6 Lanes
Alternative D	8 Lanes	8 Lanes NORTH	8 Lanes
Alternative E	8 Lanes	8 Lanes SOUTH	8 Lanes
Alternative F	8 Lanes	10 Lanes NORTH	8 Lanes
Alternative G	8 Lanes	10 Lanes SOUTH	8 Lanes

3.4 Alternative D: 8-8-8 North

Alternative D (8-8-8 North) would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), eight lanes on a new bridge (four per direction), and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). The two new bridge spans would include one span to the north and one span in between the location of the existing bridge spans. Alternative D would increase the number of lanes along the U.S. 50/301 approaches to eight lanes from the MD 2/MD 450 interchange on the Western Shore to the U.S. 50/301 split on the Eastern Shore and would generally remain on the existing roadway alignment except where necessary to connect to the new bridge spans. Thus, with Alternative D, the five existing bridge lanes would be increased to eight bridge lanes and the number of lanes on the Western Shore and Eastern Shore would increase from six total travel lanes to eight total travel lanes.

3.5 Alternative E: 8-8-8 South

Alternative E (8-8-8 South) would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), eight lanes on a new bridge (four per direction), and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). The two new bridge spans would include one span to the south and one span in between the location of the existing bridge spans. Alternative E would increase the number of lanes along the U.S. 50/301 roadway approaches to eight lanes from the MD 2/MD 450 interchange on the Western Shore to the U.S. 50/301 split on the Eastern Shore and would generally remain on the existing roadway alignment except where necessary to connect to the new bridge spans. Thus, with Alternative E, the five existing bridge lanes would be increased to eight bridge lanes and the number of lanes on the Western Shore and Eastern Shore would increase from six total travel lanes to eight total travel lanes.

3.6 Alternative F: 8-10-8 North

Alternative F (8-10-8 North) would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), ten lanes on a new bridge (five per direction), and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). The two new bridge spans would include one span to the north and one span in between the location of the existing bridge spans. Alternative F would increase the number of lanes along the U.S. 50/301 approach roadway to eight lanes from the MD 2/MD 450 interchange on the Western Shore to the U.S. 50/301 split on the Eastern Shore and would generally remain on the existing roadway alignment except where necessary to connect to the new bridge spans. Thus, with Alternative F, the five existing bridge lanes would be increased to ten bridge lanes and the number of lanes on the Western Shore and Eastern Shore would increase from six total travel lanes to eight total travel lanes.

3.7 Alternative G: 8-10-8 South

Alternative G (8-10-8 South) would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), ten lanes on a new bridge (five per direction), and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). The two new bridge spans would include one span to the south and one span in between the location of the existing bridge spans. Alternative G would increase the number of lanes along the U.S. 50/301 approach roadway to eight lanes from the MD 2/MD 450 interchange on the Western Shore to the U.S. 50/301 split on the Eastern Shore

and would generally remain on the existing roadway alignment except where necessary to connect to the new bridge spans. Thus, with Alternative G, the five existing bridge lanes would be increased to ten bridge lanes and the number of lanes on the Western Shore and Eastern Shore would increase from six total travel lanes to eight total travel lanes.

3.8 Other Components of the Build Alternatives

3.8.1 Optional Pedestrian / Bicycle Shared Use Path

All proposed build alternatives include the option for the safe inclusion of a pedestrian/bicycle shared use path (SUP) along a new bridge. The MDTA has identified connections to existing and proposed trails and recreational facilities on the Eastern Shore and Western Shore.

3.8.2 Tolling

The MDTA owns and operates the Bay Bridge and uses tolls from its eight facilities to maintain and operate all their facilities. The Bay Bridge will continue to be a tolled facility and the MDTA will continue to manage it and the toll to address the current and future traffic and the associated congestion.

3.8.3 Transit-related Improvements

Transit-related improvements would be made through a financial commitment from the MDTA that would focus on providing a one-time investment for local transit agencies near the Bay Bridge. The same commitment would be made for all alternatives and would not be used to differentiate between alternatives.

All transit-related opportunities would be determined in the future, closer to the time of construction. The MDTA would coordinate with the Maryland Transit Administration (MTA), local governments, and local transit agencies to help determine the opportunities. However, these agencies would determine the transit-related improvements that would be most beneficial for them at that time, and they would be separate and distinct projects from the Bay Crossing.

3.8.4 TSM TDM Considerations

Two TSM/TDM improvements were considered with the retained build alternatives for potential implementation: congestion pricing and part-time shoulder use (PTSU) lanes.

The Bay Bridge will continue to be a tolled facility. If a build alternative is selected, congestion pricing could be used in the future to provide flexibility for toll management strategies that the MDTA could use to further reduce congestion and achieve transportation goals.

The shoulders on the bridge would be full width (12 feet wide) to accommodate future maintenance needs and incident management; therefore, they would also be wide enough to accommodate a PTSU lane. Although the build alternatives have been developed to accommodate PTSU, the operation of PTSU lanes is not being included as part of the alternatives. Future implementation of PTSU is not precluded.

3.8.5 Stormwater Management (SWM)

A planning-level, conceptual SWM analysis was completed that identified the stormwater needs and potential treatment locations throughout the study area for each build alternative.

3.8.6 Utilities

The study area along U.S. 50/301 contains public utilities including: potable water, sanitary sewer, natural gas, electric power/distribution, communications, and cable television. The build alternatives would impact some of these utilities that are in close proximity to U.S. 50/301, and the impacts to these utilities and associated replacements have been included in the build alternatives.

3.8.7 Truck Weigh and Inspection Station

There are two existing Truck Weigh and Inspection Stations (TWIS) along U.S. 50/301 between Oceanic Drive and the Bay Bridge, one in each direction. As part of the build alternatives, these facilities would be upgraded and relocated where necessary.

3.8.8 Limits of Disturbance (LOD)

The LOD is the proposed boundary that would include all construction, erosion and sediment control, SWM, and right-of-way offsets. The LODs for the alternatives were developed from the proposed horizontal and vertical geometry, typical sections, roadside design, and proposed interchange modifications. For Alternatives B and C, the number of lanes on the Western Shore and Eastern Shore would not change and would remain at six total travel lanes beyond the immediate tie-ins to the new bridge spans. This would mean the limits of roadway improvements associated with Alternatives B and C would end at the immediate tie-ins to the new bridge spans, compared with the limits of roadway improvements for Alternatives D through G, which would end at the study limits (MD 2/MD 450 and the U.S. 50/301 Split). Due to the shorter distance of proposed roadway modifications associated with Alternatives B and C, the LODs associated with these two build alternatives are smaller than the LODs associated with the other build alternatives.

4 REGULATORY CONTEXT

FHWA regulations provided in 23 CFR Part 772 require all highway agencies to have policies for traffic noise abatement for highway projects. To evaluate highway noise projects, the MDTA follows the Maryland Department of Transportation State Highway Administration's (SHA) Traffic Noise Policy referenced in the SHA *Highway Noise Abatement Planning and Engineering Guidelines* (2020)[1].

4.1 Highway Noise Fundamentals

The assessment of highway noise impacts distinguishes between the concepts of "sound" and "noise." When an object moves, sound is created. The movements cause vibrations of the air molecules to move in waves like ripples on water. Sound is heard when the vibrations reach a person's ears. Noise is defined by the U.S. Environmental Protection Agency (EPA) and FHWA as unpleasant, unwanted sound. Highway noise is unwanted sounds generated on streets and highways.

The level of highway traffic noise depends primarily on the following three elements:

- traffic volume
- traffic speed
- the number of trucks in the flow of traffic

The level of highway traffic noise is increased as these elements increase. Vehicle noise is a combination of the noises produced by the engine, exhaust, and tire interaction with the roadway pavement. FHWA has established the following vehicle categories for traffic noise analyses:

- Automobiles - vehicles with two axles and four tires
- Medium trucks - all cargo vehicles with two axles and six tires
- Heavy trucks - all cargo vehicles with three or more axles
- Buses - all vehicles designed to carry more than nine passengers
- Motorcycles - all vehicles with two or three tires and an open-air driver/passenger compartment

When considering highway traffic noise impacts it is important to understand that perceived noise levels are affected by distance from the noise source, terrain between the noise source and receptor, and vegetation and other natural or manmade obstacles between the noise source and receptor.

According to FHWA's *Highway Traffic Noise Analysis and Abatement Guidance*, sound level changes between 2 and 3 decibels (dBs), which are units that represent relative acoustic energy intensities, are barely perceptible if the sounds are of similar character, while a change of 5 dBs is readily noticeable by most people. Because decibels are measured on a logarithmic scale, a 10 dB increase is generally perceived as a doubling of loudness (a sound level of 70 dB is twice as loud to the listener as a level of 60 dB). Conversely, the loudness is perceived to be reduced by approximately one-half when a sound level is reduced by approximately 10 dBs.

[1] https://www.roads.maryland.gov/OHD2/SHA_Noise_Policy.pdf

Table 4-1 provides a spectrum of examples of common outdoor noise levels, their respective noise-level decibels, and corresponding indoor noise-level examples.

Table 4-1: Common Outdoor and Indoor Noise Levels

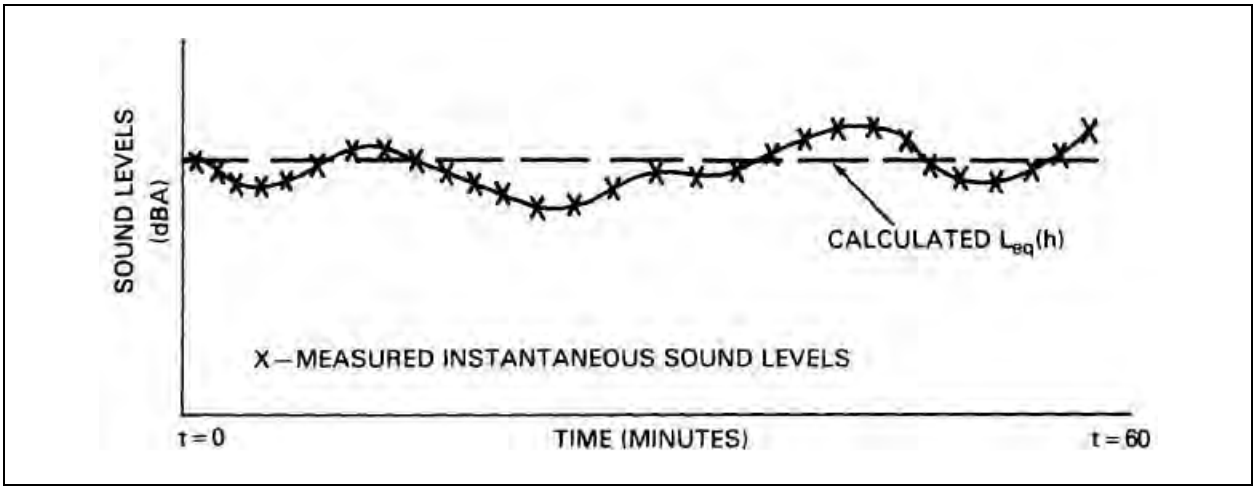
Common Outdoor Noise Example	Noise Level (decibels)	Common Indoor Noise Example
	110	Rock Band
Jet Flyover at 1,000 feet	100	Inside Subway Train
Gas Lawn Mower at 3 feet		
Diesel Truck at 50 feet	90	Food Blender at 3 feet
Noisy Urban Daytime	80	Garbage Disposal at 3 feet, Shouting at 3 feet
Gas Lawn Mower at 100 feet	70	Vacuum Cleaner at 10 feet
Commercial Area		Normal Speech at 3 feet
	60	
		Large Business Office
Quiet Urban Daytime	50	Dishwasher, Next Room
Quiet Urban Nighttime	40	Small Theater, Large Conference Room (background)
Quiet Suburban Nighttime		Library
	30	
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (background)
	20	
		Broadcast and Recording Studio
	10	Threshold of Hearing
	0	

Adapted from the American Association of State Highway and Transportation Official's Guide on Evaluation and Attenuation of Traffic Noise (1974)

People respond differently to sound energy in varying acoustic frequency ranges. Sounds heard in the environment usually consist of a range of frequencies, each at a different level. The method of correlating human response to equivalent sound pressure levels at different frequencies is called weighting. The weighting system used to correlate human hearing to frequency response is the A-weighting scale, and the resultant sound pressure level is called A-weighted sound pressure level. The A-weighted decibel scale, also known as dB(A), is generally used in assessing highway community noise exposure because this scale closely approximates the frequency response of the human ear.

The A-weighted equivalent sound level (Leq), or Leq averaged over one hour (Leq (h)), are the descriptors used most frequently in highway noise analyses. The Leq is the equivalent steady-state sound level, which represents the mean energy of sound intensity level for a given time period. This is the descriptor that will be used in this highway noise analysis. The concept of the Leq is illustrated in **Figure 4-1**, below.

Figure 4-1: Sound Level Versus Time



Source: http://www.fhwa.dot.gov/environment/noise/construction_noise/special_report/hcn02.cfm

4.2 Noise Abatement Criteria

FHWA guidelines require agencies define impact criteria as those noise levels that approach the Noise Abatement Criteria (NAC) (at least 1 dB(A) less than the NAC) in the CFR, based upon the identified type of activity or land use. The MDTA follows the SHA Traffic Noise Policy. The majority of Noise Sensitive Areas (NSAs) that SHA evaluates fall within Activity Categories B and C. This typically includes ground-level outdoor living spaces where frequent human use typically occurs but may also include the evaluation of upper floors in certain instances. Activity Category B noise sensitive receptors are defined exclusively as residences. Category C noise sensitive receptors consist of non-residential land uses not specifically covered in Category A or B, as defined in **Table 4-2**. Activity Categories F and G are considered non-noise sensitive land use types.

Table 4-2: Noise Abatement Criteria Hourly A-Weighted Sound Level in Decibels dB(A)

Activity Category	Activity Criteria[1] Leq(h)[2]	SHA Approach Criteria	Evaluation Location	Description of Activity Category
A	57	56	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	67	66	Exterior	Residential
C	67	66	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, daycare 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	51	Interior	Auditoriums, daycare 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[3]	72	71	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F
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] Per 23 CFR Part 772 the Leq(h) Activity Criteria values are used to determine impacts only. These values are not design standards for evaluating noise abatement measures.
[2] The equivalent steady-state sound level over a period of time (Leq) contains the same acoustic energy as the time-varying sound level during the same time period. Leq(h) is the hourly value of Leq.
[3] Includes undeveloped lands permitted for this activity category.

According to SHA's *Highway Noise Abatement Planning and Engineering Guidelines* (2020), for a Type I project, an impact is identified when design year noise levels are projected to approach or exceed the appropriate NAC for each land use or when projected noise levels are anticipated to increase substantially (10 dB(A)s) over existing year noise.

4.3 Category D Building Noise Reduction Factors

The SHA approach criterion for a Category D area is 51 dB(A). This equates to a different exterior impact criterion depending on the building type and window condition. **Table 4-3** lists the building noise reduction factors used to estimate interior highway traffic noise impacts for Land Use Activity Category D areas from exterior noise levels.

Table 4-3: Building Noise Reduction Factors for Estimating Interior Impacts for Category D

Exterior Noise Level	Leq(h) [dB(A)]	86		76	71	61
Interior Evaluation	Building Type	Masonry		Light Frame		All
	Window Condition	Double Glazed	Single Glazed	Storm Window	Ordinary Sash (closed)	Open
	Noise Reduction Due to Structure Exterior (dB)	35		25	20	10
Interior Noise Level	Leq(h) [dB(A)]	51		51	51	51

Adapted from Table 6 of report FHWA-HEP-10-025, Highway Traffic Noise: Analysis and Abatement Guidance (FHWA, 2011)
The windows shall be considered open unless there is firm knowledge that the windows are in fact kept closed almost every day of the year.

For example, a structure within a Category D NSA typically consists of a light frame building type with at least an ordinary sash (closed) window condition. In order to be considered impacted, the exterior noise level would have to be equal to or exceed 71 dB(A) (51 + 20 = 71)

For all Category D NSAs, if the exterior noise level is greater than what is shown in **Table 4-3** based on the matching structure type, then this NSA would be deemed impacted. Such a preliminary determination would generally require further analysis conducted in accordance with Section 8 of FHWA's *Noise Measurement Handbook.*

5 METHODOLOGY

Extensive coordination was undertaken with Lead, Cooperating, and Participating federal, state, and local agencies to obtain agreement or concurrence with the following methodology for the Tier 2 Study noise analysis. The MDTA will identify noise impacts (direct or reasonably foreseeable) for all build alternatives as part of the DEIS. This Noise Technical Report focuses on assessing direct noise impacts and abatement measures for any new crossing.

Noise impacts can be assessed both quantitatively and qualitatively. Methodologies for analyzing potential noise impacts on surrounding areas that are further removed from improvements resulting from a proposed project are not addressed in FHWA or MDOT guidance.

The design year traffic projections used for the noise analysis include at least 20 years of traffic growth, including the effects of planned and programmed projects. As a result, the reported noise impacts include this growth and represent both direct and cumulative noise impacts. New alignment projects can cause a redistribution of traffic and might affect development patterns in the project area, leading to higher traffic volumes and indirect noise effects.

Noise analysis limits are defined by the location of the proposed transportation improvements and extend to the distance needed to identify potential noise impacts. It is not uncommon to hear highway noise at a great distance from the highway, although all noise generated from the project may or may not be quantifiable over longer distances given available noise modeling technology.

Sound travels in waves, and propagation is dependent on ground cover, topography and atmospheric conditions, as well as intervening shielding (such as sound barriers, buildings, or vegetation). The noise analysis limits are determined based upon the topography and land use of the area and may be expanded where noise travels further distances such as over water or hard ground. Given the characteristics of traffic noise propagation and noise modeling technology, the quantifiable assessment area typically includes a 500-foot to 1,000-foot buffer from the edge of the proposed shoulder on either side of the alternatives. The MDTA will identify and make a quantitative noise impact assessment of all noise sensitive properties within the noise analysis limits.

Land uses within 500 feet of existing U.S. 50/301 were determined during the Tier 1 Study based upon socioeconomic zoning data available, but the noise analysis area will be extended if impacts are found beyond 500 feet. Land uses were verified during field visits for the Tier 2 Study, including the determination of activity category A and D land uses. The Tier 2 Study also identified and analyzed land that is permitted for development for impact and abatement consideration.

5.1 Analysis and Modeling

Highway noise is evaluated in two categories, Type I and Type II. A Type I analysis is performed when new highways are constructed or existing highways are substantially altered along horizontal and/or vertical alignment. A Type II analysis is performed along existing highways independent of improvements. This report presents the results of the Type I analysis applicable to the build alternatives. U.S. 50/301, MD 2, and MD 18 are the dominant highway noise sources for NSAs within the Tier 2 Study limits.

For this effort, noise sensitive land uses were determined along the Tier 2 Study limits in accordance with SHA's *Highway Noise Abatement Planning and Engineering Guidelines* (2020). Additionally, ambient noise measurements were taken, model validation was completed, and this summary report was developed detailing the ambient measurement and validation modeling results using the FHWA Traffic Noise Model (TNM®) Version 2.5. The model simulates variable inputs for traffic (volume and vehicle type), speed, roadway, design, terrain, propagation, and traffic control features.

The 2011 FHWA *Highway Traffic Noise: Analysis and Abatement Guidance* states that the loudest hourly highway traffic noise levels may not be at the peak traffic hour but instead, during some period when traffic volumes are lower, but the truck mix or vehicle speeds are higher, typically when traffic is free-flowing and at or near Level of Service (LOS) C conditions. This approach, using heavy traffic volumes at free-flow speeds, assures that the worst-case noise levels are considered and projected.

5.2 Noise Study Area Sections

Noise study area sections have been established for analysis manageability:

- Section 1: Severn River to MD 179
- Section 2: MD 179 to the Chesapeake Bay
- Section 3: Chesapeake Bay to Kent Narrows
- Section 4: Kent Narrows to U.S. 50/301 split

6 MEASUREMENTS AND TNM VALIDATION

6.1 Introduction

This section separates the different land uses within the Tier 2 Study limits into noise sensitive and non-noise sensitive areas, discusses the noise measurements that were collected for the study, and documents the validation results of the noise prediction modeling.

6.2 Land Uses

The study area was categorized into 251 activity areas of similar land use in accordance with SHA and FHWA policies and guidance. Of these, 157 were identified as NSAs and 95 were identified as non-NSAs. **Appendix A** depicts the various land uses within the noise study limits. A description of each NSA is listed below. Any distance references given are relative to the edge of the near roadway shoulder unless otherwise noted. Equivalent residences for outdoor non-residential noise sensitive uses have been determined when analyzing the number of benefits for proposed mitigation measures.

6.3 Noise Sensitive Areas

Residential NSAs include single-family residences, single-family attached residences (townhouses), and multi-family residences (condominiums and apartments) located in the neighborhoods adjacent to U.S. 50/301. Non-residential NSAs include recreation areas, playgrounds, active sports areas, parks, schools, places of worship, motels, hotels, libraries, and hospitals located adjacent to U.S. 50/301. The NSAs were defined by their corresponding FHWA land use activity category (See **Table 4-2**), where the category letter is added to the end of the NSA designation (e.g., 101-B and 105-C). For NSAs with multiple land uses, the most prevalent land use was identified for the NSA designation.

6.3.1 Section 1: Severn River to MD 179

This portion of the Tier 2 Study corridor is divided into 21 NSAs, which are described in more detail below and shown in **Appendix A**.

NSA 1-01-B

This NSA represents **single-family residences** along South Winchester Road located southwest of the interchange between U.S. 50/301 and MD 2/MD 450. The nearest of these homes is located approximately 120 feet to the south of the existing shoulder of U.S. 50/301. There is an existing noise barrier that protects this NSA from U.S. 50/301 traffic noise. (See **Appendix A**, Map Page 1)

NSA 1-02-B

This NSA represents the **"Severn Side Farm"** single-family residence located southwest of the interchange between U.S. 50/301 and MD 2/MD 450. This home is located approximately 750 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 1)

NSA 1-03-B

This NSA represents **single-family residences** along Severn Heights Overlook located southwest of the interchange between U.S. 50/301 and MD 2/MD 450. The nearest of these homes is located approximately 1,200 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 1)

NSA 1-04-B

This NSA represents **single-family residences** along Baltimore Annapolis Boulevard, Mount Oak Place, Nap Lane, Meadow Hill Drive, and Millridge Court located southeast of the interchange between U.S. 50/301 and MD 2/MD 450. The nearest of these homes is located approximately 120 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Pages 1 and 2)

NSA 1-05-C

This NSA represents the **Red Hot & Blue restaurant** (formerly the Dutch Mill Restaurant) located at 200 Old Mill Bottom Road just east of the Bay Dale Drive overpass. The restaurant is located directly along the existing shoulder of U.S. 50/301. It has a small outdoor seating area that is located directly behind the building and is partially shielded from U.S. 50/301 by the structure. (See **Appendix A**, Map Page 2)

NSA 1-06-B

This NSA represents **single-family residences** along Ferguson Road, Old Mill Bottom Road, Mill Bottom Road, Canterwood Court, Wilkins Lane, Duvall Road, and St. Margarets Road located east of the Bay Dale Drive overpass. The nearest of these homes is located approximately 130 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Pages 2 and 3)

NSA 1-07-C

This NSA represents the **Unity by the Bay Church** located at 4 Pointless Forest Trail, west of the U.S. 50/301/MD 179 interchange. The church itself is located approximately 300 feet off the existing shoulder of U.S. 50/301. The outdoor usage areas are located directly behind the building and are partially shielded from U.S. 50/301 by the church structure. (See **Appendix A**, Map Page 2)

NSA 1-08-E

This NSA represents the **John Hanson Business Center** office building located at 339 Busch's Frontage Road in the southwest quadrant of the U.S. 50/301/MD 179 interchange. The building is located approximately 200 feet from the existing shoulder of eastbound (EB) U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 3)

NSA 1-09-C

This NSA represents the **St. Andrew by the Bay** church located at 701 College Parkway at the U.S. 50/301/MD 179 interchange. The closest structure on the property is located approximately 1,200 feet off the existing shoulder of U.S. 50/301, and the outdoor usage areas are located behind the buildings and are partially shielded from U.S. 50/301 by the church structure. (See **Appendix A**, Map Page 3)

NSA 1-10-C

This NSA represents the **Asbury Broadneck United Methodist Church** located at 657 Broadneck Road at the U.S. 50/301/MD 179 interchange. The church is located approximately 200 feet off the existing shoulder of U.S. 50/301, and there is a fenced-in area along the side of the church facing U.S. 50/301 that appears to be used for daycare. (See **Appendix A**, Map Page 3)

NSA 1-11-B

This NSA represents **single-family residences** along Broadneck Road, Windsor Ridge Lane, Middletown Road, and Leyland Lane located north of U.S. 50/301 and west of the U.S. 50/301/MD 179 interchange. The nearest of these homes is located approximately 250 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Pages 2 and 3)

NSA 1-12-C

This NSA represents the **Annapolitan Assisted Living Facility** located at 84 Old Mill Bottom Road, east of the U.S. 50/301/Bay Dale Drive interchange. The facility is located approximately 225 feet off the north existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 2)

NSA 1-13-B

This NSA represents the **Element at Mill Creek Condominiums** located at 74 Old Mill Bottom Road, north of U.S. 50/301 and east of the U.S. 50/301/Bay Dale Drive interchange. These residences are currently under construction, but since the building permit predates this environmental document, this location has been included in this study. The nearest of these homes is located approximately 250 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 2)

NSA 1-14-B

This NSA represents **single-family residences** along Bretton View Road, Bretton Reef Court, Bretton View Circle, Brenwoode Road, Brenwoode Court, Lehman Court, Cecilia Court, Blossom Tree Drive, Blossom Tree Court, and Amberwoods Street located north of U.S. 50/301 and east of the U.S. 50/301/Bay Dale Drive interchange. The nearest of these homes is located approximately 325 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 2)

NSA 1-15-E

This NSA represents the **High Tide Offices of Annapolis** office building located at 71 Old Mill Bottom Road and the **Village Inn Motel** located at 69 Old Mill Bottom Road in the northeast quadrant of the U.S. 50/301/Bay Dale Drive interchange. The buildings are located approximately 150 feet north of the existing shoulder of westbound (WB) U.S. 50/301. (See **Appendix A**, Map Page 2)

NSA 1-16-C

This NSA represents the **Chesapeake Montessori School** located at 30 Old Mill Bottom Road, west of the U.S. 50/301/Bay Dale Drive interchange. The facility is located approximately 1,000 feet north of the existing shoulder of U.S. 50/301. There are playgrounds and active sporting areas located behind the school, partially shielded from U.S. 50/301 by the school buildings. (See **Appendix A**, Map Page 2)

NSA 1-17-B

This NSA represents **single-family townhomes** in the Whispering Woods community along Elkwood Court and Sloping Woods Court located north of U.S. 50/301 and west of the U.S. 50/301/Bay Dale Drive interchange. The nearest of these homes is located approximately 850 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 2)

NSA 1-18-B

This NSA represents **single-family residences** along Old Mill Bottom Road and Shot Town Road located north of U.S. 50/301 and west of the U.S. 50/301/Bay Dale Drive interchange. The nearest of these homes is located approximately 75 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 2)

NSA 1-19-B

This NSA represents **single-family residences** along Sam Ryder Road, Nick Road, Nickerson Way, Old Sturbridge Road, Camden Court, Old Winchester Road, and Baltimore Annapolis Boulevard located north of U.S. 50/301 and east of the U.S. 50/301/MD 2 interchange. The nearest of these homes is located approximately 275 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 1)

NSA 1-20-C

This NSA represents the **Montessori International Children's House** school located at 1641 North Winchester Road north of U.S. 50/301 and west of the U.S. 50/301/MD 2 interchange. The facility is located approximately 1,150 feet north of the existing shoulder of U.S. 50/301. There are playgrounds and active sporting areas at the school. (See **Appendix A**, Map Page 1)

NSA 1-21-B

This NSA represents **single-family residences** along Winchester Road and Summers Run located north of U.S. 50/301 and west of the U.S. 50/301/MD 2 interchange. The nearest of these homes is located approximately 175 feet to the north of the existing shoulder of U.S. 50/301. There is an existing noise barrier that protects this NSA. (See **Appendix A**, Map Page 1)

6.3.2 Section 2: MD 179 to the Chesapeake Bay

This portion of the Tier 2 Study corridor is divided into 17 NSAs, which are described in more detail below.

NSA 2-01-B

This NSA represents **single-family residences** along Holly Drive and St. Margarets Road located south of U.S. 50/301 and east of the U.S. 50/301/MD 179 overpass. The nearest of these homes is located approximately 1,000 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 3)

NSA 2-02-E

This NSA represents the **RxNT** office building located at 1449 Whitehall Road in the southeast quadrant of the U.S. 50/301/MD 179 interchange. The building is located approximately 175 feet from the existing shoulder of EB U.S. 50/301. There is an outdoor picnic area located adjacent to the parking lot. (See **Appendix A**, Map Page 3)

NSA 2-03-E

This NSA represents **McDonald's** and **Wendy's** restaurants located at 1450 and 1454 Whitehall Road south of U.S. 50/301, just east of the U.S. 50/301/MD 179 interchange. The restaurant buildings are located approximately 125 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 3)

NSA 2-04-B

This NSA represents **single-family residences** along Cedar Lane Farm Road, Whitehall Road, Bay Head Road, Jenkins Lane, and Ridout Lane located south of U.S. 50/301 and east of the U.S. 50/301/MD 179 interchange. The nearest of these homes is located approximately 560 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 3 and 4)

NSA 2-05-B

This NSA represents **single-family residences** in the St. Margarets Landing community along Stern Court, Lighthouse Landing Lane, Trawler Lane, Trolling Way, Yawl Court, and Sloop Drive located south of U.S. 50/301 and west of the U.S. 50/301/Oceanic Drive interchange. The nearest of these homes is located approximately 600 feet to the south of the existing shoulder of U.S. 50/301. This development is located behind the Jemal's Bay 50 Shopping Center, and the buildings partially shield this NSA from U.S. 50/301 noise. (See **Appendix A**, Map Page 4)

NSA 2-06-B

This NSA represents **single-family residences** along Colbert Road, Skidmore Drive, Col-Mar Lane, Carrs Road, and Holly Beach Farm Road located south of U.S. 50/301 and west of the U.S. 50/301/Oceanic Drive interchange. The nearest of these homes is located approximately 100 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 4)

NSA 2-07-E

This NSA represents the **Northrop Grumman** office complex located at 895 Oceanic Drive south of U.S. 50/301 and east of the U.S. 50/301/Oceanic Drive interchange along the Western Shore of the Chesapeake Bay. The closest building is located approximately 2,000 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 5)

NSA 2-08-C

This NSA represents **Sandy Point State Park** located at 1100 E College Parkway north of U.S. 50/301 and east of the U.S. 50/301/Oceanic Drive interchange along the Western Shore of the Chesapeake Bay. The park offers swimming beaches, fishing, hiking, playground, and picnicking activities throughout the facility. The beach extends to within approximately 125 feet of the existing shoulder of WB U.S. 50/301. A majority of the outdoor activities take place approximately 750 feet away from the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Pages 4 and 5)

NSA 2-09-B

This NSA represents **single-family residences** along Log Inn Road and E College Parkway located north of U.S. 50/301 and west of the U.S. 50/301/Oceanic Drive interchange. The nearest of these homes is located approximately 200 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 4)

NSA 2-10-B

This NSA represents **single-family residences** along Yorktown Road and Yorktown Manor Court located north of U.S. 50/301 and west of the U.S. 50/301/Oceanic Drive interchange. The nearest of these homes is located approximately 425 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 4)

NSA 2-11-C

This NSA represents **Bay Head Park** located at 1661 Bay Head Road north of U.S. 50/301 and west of the U.S. 50/301/Oceanic Drive interchange. The park contains three multipurpose fields, trails, a playground and picnic areas. The edge of the closest field is located approximately 600 feet north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 4)

NSA 2-12-B

This NSA represents **three single-family residences** along Bay Head Road located north of U.S. 50/301 and west of the U.S. 50/301/Oceanic Drive interchange. The residences are between Bay Head Park and the Revell Downs community. The nearest of these homes is located approximately 200 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Pages 3 and 4)

NSA 2-13-B

This NSA represents **single-family residences** within the Revell Downs community along Revell Downs Drive, Ruffian Court, Foolish Pleasure Court, Secretariat Drive, Cananaro Drive, Cananaro Court, and Sham Court located north of U.S. 50/301 and east of the U.S. 50/301/MD 179 interchange. The nearest of these homes are located approximately 175 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 3)

NSA 2-14-B

This NSA represents **five single-family residences** along Stacey Lane located north of U.S. 50/301 and east of the U.S. 50/301/MD 179 interchange. The nearest of these homes is located approximately 275 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 3)

NSA 2-15-B

This NSA represents **single-family townhomes** within the Courts at Belle Pointe community along Peregoy Park Place, Katheryne Village Square, Anna Marie Court, and Chester Town Circle, north of U.S. 50/301 and east of the U.S. 50/301/MD 179 interchange. The nearest of these homes is located approximately 475 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 3)

NSA 2-16-E

This NSA represents an **office building** located at 73 E College Parkway north of U.S. 50/301 and east of the U.S. 50/301/MD 179 interchange. The closest building is located approximately 125 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 3)

NSA 2-17-B

This NSA represents **single-family condominiums** within the Four Seasons at St. Margarets community along Broadneck Place, Feral Dae Lane, Noah Winfield Terrace, and Enyart Way north of U.S. 50/301 and east of the U.S. 50/301/MD 179 interchange. Each condo has a patio/balcony, and the community has a clubhouse with a swimming pool. The nearest of the condo units is located approximately 150 feet and the clubhouse and pool are located approximately 450 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 3)

6.3.3 Section 3: Chesapeake Bay to Kent Narrows

This portion of the Tier 2 Study corridor is divided into 70 NSAs, which are described in more detail, below.

NSA 3-01-E

This NSA represents the **Bay Bridge Marina**, which contains **Libbey's Coastal Kitchen and Cocktails** restaurant, and the **Chesapeake Bay Beach Club** located at 337 Pier 1 Road south of U.S. 50/301 and west of the U.S. 50/301/MD 8 interchange along the Eastern Shore of the Chesapeake Bay. Both the restaurant and beach club have outdoor usage areas. Libbey's Coastal Kitchen is located approximately 450 feet south of the existing shoulder of U.S. 50/301 and the Chesapeake Bay Beach Club is located approximately 1,200 feet south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 8)

NSA 3-02-E

This NSA represents the **Inn at Chesapeake Bay Beach Club** located at 180 Pier 1 Road south of U.S. 50/301 and west of the U.S. 50/301/MD 8 interchange. The resort has gardens with seating areas located in the central court; the gardens are partially shielded from U.S. 50/301 by the resort building structures. The resort is located approximately 175 feet south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 8)

NSA 3-03-E

This NSA represents the **Stevensville Crab Shack** located at 116 Pier 1 Road south of U.S. 50/301 and west of the U.S. 50/301/MD 8 interchange. The restaurant has an outdoor seating area located on the opposite side of the building from U.S. 50/301, so it is partially shielded from noise from U.S. 50/301. The restaurant is located approximately 650 feet south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-04-E

This NSA represents a **Rita's Italian Ice & Frozen Custard** restaurant located at 210 Kent Landing south of U.S. 50/301 and east of the U.S. 50/301/MD 8 interchange. The restaurant has no formal seating, but there is a small patio with a couple of benches for patrons to use. The restaurant is located approximately 400 feet south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-05-E

This NSA represents three restaurants (**KFC**, **Starbuck's**, and **McDonalds**) in the Thompson Creek Shopping Center located at 350 Thompson Creek Road south of U.S. 50/301 and east of the U.S. 50/301/MD 8 interchange. The KFC and McDonald's do not have an outdoor seating area, but the Starbuck's does have an outdoor seating area that is located on the opposite side of the building from U.S. 50/301, so it is partially shielded from traffic noise. The restaurants are located approximately 175 feet south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-06-E

This NSA represents the **Shore United Bank** located at 408 Thompson Creek Road south of U.S. 50/301 and east of the U.S. 50/301/MD 8 interchange. The bank is located approximately 425 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 9)

NSA 3-07-E

This NSA represents the **Cracker Barrel Old Country Store** restaurant located at 115 Blue Jay Court south of U.S. 50/301 and east of the U.S. 50/301/MD 8 interchange. The restaurant has an outdoor patio with rocking chairs, but no formal outdoor seating area for diners. The restaurant is located approximately 100 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 9)

NSA 3-08-B

This NSA represents **single-family residences** within the Anchorage community along Mainsail Drive, Jib Way, and Creeks End Lane, south of U.S. 50/301 and east of the U.S. 50/301/MD 8 interchange. The nearest residence is located approximately 550 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-09-B

This NSA represents **single-family residences** along Sherman Drive, Anchorage Drive, Harrington Road, and Harbor Drive, south of U.S. 50/301 and west of the U.S. 50/301/Cox Neck Road intersection. The nearest residence is located approximately 100 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 9 and 10)

NSA 3-10-B

This NSA represents **single-family apartments** within the **Kent Island Village Apartment** complex located at 39 Sherman Way south of U.S. 50/301 and west of the U.S. 50/301/Cox Neck Road intersection. There is a playground and picnic area at the western end of the complex, and each apartment is surrounded by a shared lawn space. The nearest apartments are located approximately 150 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-11-C

This NSA represents the **St. Christopher's Church** located at 1861 Harbor Drive south of U.S. 50/301 and west of the U.S. 50/301/Cox Neck Road intersection. There is a playground on the west side of the church. The church is located approximately 550 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-12-B

This NSA represents **single-family apartments** within the Stevensville Village Apartment complex located at 101 Ellicott Drive south of U.S. 50/301 and west of the U.S. 50/301/Cox Neck Road intersection. There is a shared courtyard in the middle of the buildings that is partially shielded from traffic noise. The nearest apartments are located approximately 150 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-13-B

This NSA represents **single-family residences** along Sherman Drive, Anchorage Drive, and Cecil Drive, south of U.S. 50/301 and west of the U.S. 50/301/Cox Neck Road intersection. The nearest residence is located approximately 100 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-14-E

This NSA represents an **office building** located at 102 Postal Road south of U.S. 50/301 and west of the U.S. 50/301/Cox Neck Road intersection. The building is located approximately 75 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 10)

NSA 3-15-C

This NSA represents the **Kent Island United Methodist Church** located at 2739 Cox Neck Road south of U.S. 50/301 and west of the U.S. 50/301/Cox Neck Road intersection. There is a playground on the opposite side of the building from U.S. 50/301 that is partially shielded from traffic noise. The closest portion of the church is located approximately 250 feet from U.S. 50/301, and the area where the playground is located is approximately 650 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-16-B

This NSA represents **single-family residences** along Cox Neck Road, Bridgepointe Drive, and Wesley Lane, south of U.S. 50/301 and east of the U.S. 50/301/Cox Neck Road intersection. The nearest residence is located approximately 300 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-17-B

This NSA represents the newly constructed The Promenade at Rainbow Plaza apartment complex along Postal Road south of U.S. 50/301 and east of the U.S. 50/301/Cox Neck Road intersection. The nearest complex is located approximately 300 feet to the south of the existing shoulder of U.S. 50/301 and is partially shielded from U.S. 50/301 traffic by the Rainbow Plaza shopping center. (See **Appendix A**, Map Page 10)

NSA 3-18-C

This NSA represents the **Bay Area Veterinary Hospital** located at 1520 Postal Road south of U.S. 50/301 and east of the U.S. 50/301/Cox Neck Road intersection. The building is located approximately 350 feet to the south of the existing shoulder of U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 10)

NSA 3-19-E

This NSA represents an **office building** located at 1522 Postal Road south of U.S. 50/301 east of the U.S. 50/301/Cox Neck Road intersection. The building is located approximately 350 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 10)

NSA 3-20-B

This NSA represents **The Village at Chester** single-family apartments at 1540 Postal Road south of U.S. 50/301 and east of the U.S. 50/301/Cox Neck Road intersection. The complex is set back from the road a bit with the nearest building located approximately 550 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-21-B

This NSA represents **single-family residences** along Postal Road south of U.S. 50/301 and east of the U.S. 50/301/Cox Neck Road intersection. The nearest residence was located approximately 350 feet to the south of the existing shoulder of U.S. 50/301, but the residences on these properties have been recently demolished. (See **Appendix A**, Map Page 10)

NSA 3-22-C

This NSA represents the **New United Methodist Church** located at 100 Union Wesley Circle south of U.S. 50/301 and east of the U.S. 50/301/Cox Neck Road intersection. There is a cemetery and paved basketball court on the property. The closest portion of the church is located approximately 550 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-23-E

This NSA represents residential-style structures that are being used as **office buildings** located along Postal Road south of U.S. 50/301 and west of the U.S. 50/301/Main Street overpass. The buildings are located approximately 375 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 10)

NSA 3-24-B

This NSA represents **single-family residences** along Postal Road south of U.S. 50/301 and west of the U.S. 50/301/Main Street overpass. The nearest residence is located approximately 400 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-25-E

This NSA represents residential-style structures that are being used as **office buildings** located along Postal Road south of U.S. 50/301 at the U.S. 50/301/Main Street overpass. The buildings are located approximately 450 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 10)

NSA 3-26-E

This NSA represents three restaurants (**Burger King**, **Taco Bell**, and **Dairy Queen**) in the Kent Towne Market shopping center located south of U.S. 50/301 and east of the U.S. 50/301/Dominion Road intersection. The Burger King and Taco Bell do not have an outdoor seating area, but the Dairy Queen does have an outdoor seating area that is located on the side of the building facing U.S. 50/301. The restaurants are located approximately 75 feet south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-27-E

This NSA represents a **Chick-fil-A** restaurant in the Kent Towne Market shopping center located south of U.S. 50/301 and east of the U.S. 50/301/Dominion Road intersection. The restaurant has an outdoor seating area that is located on the side of the building facing U.S. 50/301. The restaurant is located approximately 75 feet south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-28-B

This NSA represents a residential-style structure that has a **mixed residential and commercial use** located along Main Street south of U.S. 50/301 and west of the U.S. 50/301/South Piney Road intersection. The structure is located approximately 150 feet south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 11)

NSA 3-29-B

This NSA represents residential-style structures that have a **mixed residential and commercial use** located along Main Street south of U.S. 50/301 and west of the U.S. 50/301/South Piney Road intersection. The structures are located approximately 150 feet south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 11)

NSA 3-30-E

This NSA represents **PNC Bank** located at 120 S Piney Road south of U.S. 50/301 at the U.S. 50/301/S Piney Road intersection. The bank is located approximately 150 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 11)

NSA 3-31-B

This NSA represents residential-style structures that have a **mixed residential and commercial use** located along Main Street south of U.S. 50/301 and east of the U.S. 50/301/South Piney Road intersection. The structures are located approximately 150 feet south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 11)

NSA 3-32-E

This NSA represents **Carmine's Pizza** restaurant located in the Red Apple Plaza shopping center south of U.S. 50/301 and east of the U.S. 50/301/S Piney Road intersection. The restaurant is located approximately 150 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 11)

NSA 3-33-E

This NSA represents **Shogun Sushi** restaurant located in the Red Apple Plaza shopping center south of U.S. 50/301 and east of the U.S. 50/301/S Piney Road intersection. The restaurant is located approximately 125 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 11)

NSA 3-34-B

This NSA represents **single-family residences** along Ches Lou Road south of U.S. 50/301 and east of the U.S. 50/301/S Piney Road intersection. These residences are partially shielded from U.S. 50/301 by the buildings in the Red Apple Plaza shopping center and the nearest residence is located approximately 400 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 11)

NSA 3-35-E

This NSA represents five restaurants (**Capriotti's Sandwiches**, **IHOP**, **Five Guys**, **Sweet Frog**, **Adams Grille & Tap House**) located in the Red Apple Plaza shopping center south of U.S. 50/301 and east of the U.S. 50/301/S Piney Road intersection. Capriotti's Sandwiches, IHOP, and Five Guys do not have an outdoor seating area, but Sweet Frog and Adams Grille & Tap House both have an outdoor seating area that is located on the side of the building relative to U.S. 50/301 so they are partially shielded from traffic noise. The restaurants are located approximately 100 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 11)

NSA 3-36-B

This NSA represents **single-family residences** along Dundee Avenue and Sherlock Road south of U.S. 50/301 at the U.S. 50/301/Dundee Avenue intersection. The nearest residence is located approximately 450 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 11)

NSA 3-37-C

This NSA represents the **Kent Island Yacht Club** located at 117 Yacht Club Drive south of U.S. 50/301 and west of the Kent Narrows Bridge. There is a pool on the property, but it is located at the farthest point on the property away from U.S. 50/301. The yacht club is located approximately 1,200 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Pages 11 and 12)

NSA 3-38-C

This NSA represents the **Kent Narrows Public Landing** located at 106 Piney Narrows Road north of U.S. 50/301 and west of the Kent Narrows Bridge. There is a boardwalk and pavilion on the property and fishing is allowed at this location. The boardwalk area is located underneath the Kent Narrows Bridge, so it is partially shielded from direct traffic noise from U.S. 50/301. (See **Appendix A**, Map Page 11)

NSA 3-39-E

This NSA represents the **Dock House** restaurant located at 110 Piney Narrows Road north of U.S. 50/301 and west of the Kent Narrows Bridge. The restaurant has an outdoor seating area that is located on the side of the building and is also located underneath the Kent Narrows Bridge, so it is partially shielded from traffic noise. The restaurant is also located approximately 500 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 11)

NSA 3-40-B

This NSA represents **single-family residences** along Swan Cove Lane north of U.S. 50/301 and west of the Kent Narrows Bridge. The nearest residence is located approximately 1,100 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 11)

NSA 3-41-C

This area represents **undeveloped land** owned by private entities, Queen Anne's County (Piney Creek Nature Area) and is zoned for commercial and agricultural use. This area is located adjacent to Piney Creek, north of U.S. 50/301 between the Chester Station Lane intersection and the Kent Narrows Bridge. Because there are no active outdoor usage areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 11)

NSA 3-42-B

This NSA represents **single-family residences** along Piney Creek Road and Nash Court north of U.S. 50/301 at the Piney Creek Road intersection. The nearest residence is located approximately 375 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 11)

NSA 3-43-B

This NSA represents **single-family residences** in the Gibson's Grant development along Macum Creek Drive, McGuckin Street, John Gibson Drive, Claiborne Street, Arnold Alley, John's Alley, Jacob Alley, Evelyne Street, and Henry Stoupe Way, north of U.S. 50/301 and west of the Piney Creek Road intersection. The nearest residence is located approximately 850 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Pages 10 and 11)

NSA 3-44-B

This NSA represents a **single-family residence** along Piney Creek Road north of U.S. 50/301 and east of the Chester Station Lane intersection. The residence is located approximately 625 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-45-B

This NSA represents a **single-family residence** along Piney Creek Road north of U.S. 50/301 and west of the Chester Station Lane intersection. The residence was located approximately 400 feet to the north of the existing shoulder of U.S. 50/301, but the residence on this property has been recently demolished. (See **Appendix A**, Map Page 10)

NSA 3-46-C

This NSA represents the **Anne Arundel Medical Center** at 1630 Main Street north of U.S. 50/301 and west of the U.S. 50/301/MD 18 overpass. The medical center has a single picnic table located in some open space outside the facility and is located approximately 125 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-47-E

This NSA represents two restaurants (**McDonald's** and **Sugar Doodles**) located north of U.S. 50/301 at the U.S. 50/301/Castle Marina Road intersection. There are no outdoor use areas associated with this NSA. The McDonald's is located approximately 125 feet from the existing shoulder of WB U.S. 50/301 and Sugar Doodles is located approximately 375 feet from the existing shoulder of WB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 10)

NSA 3-48-E

This NSA represents the **Queenstown Bank of Maryland** located at 1423 Main Street north of U.S. 50/301 at the U.S. 50/301/Castle Marina Road intersection. There are no outdoor use areas associated with this NSA. The bank is located approximately 475 feet from the existing shoulder of WB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 10)

NSA 3-49-E

This NSA represents the **First National Bank** located in Chester Place shopping center at 1245 Shopping Center Drive north of U.S. 50/301 and west of the U.S. 50/301/Castle Marina Road intersection. There are no outdoor use areas associated with this NSA. The bank is located approximately 50 feet from the existing shoulder of WB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 10)

NSA 3-50-E

This NSA represents the **El Jefe** restaurant located in the Chester Place shopping center at 1235 Shopping Center Drive north of U.S. 50/301 and west of the U.S. 50/301/Castle Marina Road intersection. The restaurant has an outdoor seating area that is located in front of the building facing U.S. 50/301 along the parking lot. The restaurant is located approximately 125 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 10)

NSA 3-51-E

This NSA represents two restaurants (**Dunkin** and **Hardee's**) located at 1235 Shopping Center Drive north of U.S. 50/301 and west of the U.S. 50/301/Castle Marina Road intersection. Both restaurants have an outdoor seating area that is located in front of the building facing U.S. 50/301 along the parking lot. The restaurants are located approximately 125 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Pages 9 and 10)

NSA 3-52-E

This NSA represents the **Bank of America** located at 1114 Shopping Center Drive north of U.S. 50/301 and west of the U.S. 50/301/Castle Marina Road intersection. There are no outdoor use areas associated with this NSA. The bank is located approximately 50 feet from the existing shoulder of WB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Pages 9 and 10)

NSA 3-53-E

This NSA represents the **Willis Station office building** located at 232 Shopping Center Road north of U.S. 50/301 and west of the U.S. 50/301/Castle Marina Road intersection. The building is located approximately 500 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Pages 9 and 10)

NSA 3-54-E

This NSA represents two restaurants (**Pupuseria Kent Island** and **Jack Frost Snowball Stand**) located along Shopping Center Drive north of U.S. 50/301 and west of the U.S. 50/301/Castle Marina Road intersection. Both restaurants have an outdoor seating area that are located on the sides of the buildings and are partially shielded from traffic noise. The restaurants are located approximately 550 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-55-C

This NSA represents the **Stevensville Cemetery** at 808 Main Street north of U.S. 50/301 and east of the U.S. 50/301/Duke Street intersection. The closest plots in the cemetery are located approximately 50 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-56-E

This NSA represents two restaurants (**Rams Head Shore House** and **T&T Crabs**) located along Main Street north of U.S. 50/301 and east of the U.S. 50/301/Duke Street intersection. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. The restaurants are located approximately 550 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-57-B

This NSA represents two **single-family residences** along Main Street north of U.S. 50/301 and east of the U.S. 50/301/Duke Street intersection. The residences are located approximately 575 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-58-C

This NSA represents **Stevensville Middle School** located at 610 Main Street north of U.S. 50/301 east of the U.S. 50/301/Duke Street intersection. The school has paved basketball courts and athletic fields, which are located between the school and U.S. 50/301. The closest portion of the basketball courts is located approximately 150 feet to the north of the existing shoulder of U.S. 50/301 with the actual school building located approximately 275 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-59-B

This NSA represents **single-family residences** along Duke Street north of U.S. 50/301 at the U.S. 50/301/Duke Street intersection. The closest of these residences is located approximately 300 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-60-B

This NSA represents **single-family residences** along Main Street north of U.S. 50/301 and west of the U.S. 50/301/Duke Street intersection. These residences are located approximately 550 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-61-E

This NSA represents residential-style structures that are being used as **office buildings** located along Main Street north of U.S. 50/301 and west of the U.S. 50/301/Duke Street intersection. The buildings are located approximately 550 feet from the existing shoulder of WB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 9)

NSA 3-62-B

This NSA represents **single-family residences** along Main Street north of U.S. 50/301 and west of the U.S. 50/301/Duke Street intersection. These residences are located approximately 550 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-63-E

This NSA represents residential-style structures that are being used as **office buildings** located along Main Street north of U.S. 50/301 and west of the U.S. 50/301/Duke Street intersection. The buildings are located approximately 550 feet from the existing shoulder of WB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 9)

NSA 3-64-B

This NSA represents **single-family residences** along Main Street north of U.S. 50/301 and west of the U.S. 50/301/Duke Street intersection. These residences are located approximately 550 feet to the north of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-65-C

This NSA represents the **Love Point Wellness** medical center located at 211/213 Love Point Road north of U.S. 50/301 and east of the U.S. 50/301/MD 8 interchange. There are no outdoor use areas associated with this NSA. The medical center is located approximately 550 feet from the existing shoulder of WB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 9)

NSA 3-66-E

This NSA represents **office buildings** in the Village of Benton's Crossing area located along Main Street north of U.S. 50/301 and east of the U.S. 50/301/MD 8 interchange. The buildings are located approximately 700 feet from the existing shoulder of WB U.S. 50/301 and are partially shielded by several other buildings located between these offices and U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 9)

NSA 3-67-E

This NSA represents the **Stevensville Professional Center** office building located at 130 Love Point Road north of U.S. 50/301 and east of the U.S. 50/301/MD 8 interchange. The building is located approximately 100 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 9)

NSA 3-68-E

This NSA represents a school building that is being used as an **office complex** located along Love Point Road north of U.S. 50/301 and east of the U.S. 50/301/MD 8 interchange. The building is located approximately 550 feet from the existing shoulder of WB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 9)

NSA 3-69-B

This NSA represents **single-family residences** along Cable House Road north of U.S. 50/301 and east of the U.S. 50/301/MD 8 interchange. The residences are located approximately 500 feet from the existing shoulder of WB U.S. 50/301 and are partially shielded by several other buildings located between these residences and U.S. 50/301. (See **Appendix A**, Map Page 9)

NSA 3-70-C

This NSA represents **Terrapin Nature Park** located at 191 Log Canoe Circle north of U.S. 50/301 and west of the U.S. 50/301/MD 8 interchange. The park offers hiking and biking trails and beaches (swimming is prohibited on the beaches) for activities throughout the facility. A portion of the trail extends to within approximately 50 feet of the existing shoulder of WB U.S. 50/301, but a majority of the outdoor activities take place at least 1,200 feet away from U.S. 50/301. The closest portion of the beaches are located approximately 2,500 feet from the existing shoulder and the parking lot and trail head is located approximately 3,700 feet from the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Pages 8 and 9)

6.3.4 Section 4: Kent Narrows to U.S. 50/301 Split

This portion of the Tier 2 Study corridor is divided into 49 NSAs, which are described in more detail, below.

NSA 4-01-E

This NSA represents two restaurants (**The Big Owl** and **The Narrows**) located along Kent Narrows Way South, south of U.S. 50/301 and east of the Kent Narrows Bridge. Both restaurants have an outdoor seating area that is located on the backs of the buildings along the Chesapeake Bay, so they are partially shielded from traffic noise. The restaurants are located approximately 175 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 12)

NSA 4-02-E

This NSA represents the **Hyatt Place Kent Narrows** hotel located at 3028 Kent Narrows Way South, south of U.S. 50/301 and east of the Kent Narrows Bridge. The hotel has an outdoor patio and seating area that is located on the backside of the buildings along the Chesapeake Bay and is partially shielded from traffic noise. The hotel is located approximately 550 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 12)

NSA 4-03-E

This NSA represents four restaurants (**Fisherman's Crab Deck**, **Fisherman's Inn**, **Bridges**, and **The Jetty**) located along Main Street, south of U.S. 50/301 and east of the Kent Narrows Bridge. The restaurants have an outdoor seating area that is located on the backs of the buildings along the Chesapeake Bay, so they are partially shielded from traffic noise. The restaurants are located approximately 175 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 12)

NSA 4-04-E

This NSA represents the **Best Western Kent Narrows** Inn hotel located at 3101 Main Street, south of U.S. 50/301 and east of the Kent Narrows Bridge. The hotel is located approximately 275 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 12)

NSA 4-05-E

This NSA represents the **Hilton Garden Inn Kent Island** hotel located at 3206 Main Street, south of U.S. 50/301 and east of the Kent Narrows Bridge. The hotel has an outdoor patio and seating area that is located on the side of the building along the Chesapeake Bay and is partially shielded from traffic noise. The hotel is located approximately 900 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 12)

NSA 4-06-B

This NSA represents **single-family townhomes** in the **Wells Cove Marina** development along Main Street, south of U.S. 50/301 and east of the Kent Narrows Bridge. The residences are located approximately 700 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 12)

NSA 4-07-B

This NSA represents **multi-family condominium** buildings in the **Oyster Cove** community along Main Street, south of U.S. 50/301 and east of the Kent Narrows Road South intersection. There is a community pool and tennis courts on the premises. The residences are located approximately 750 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 12)

NSA 4-08-B

This NSA represents **single-family residences** in the **Osprey Pointe by the Narrows** community along Main Street, south of U.S. 50/301 and east of the Kent Narrows Road South intersection. The residences are located approximately 700 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 12)

NSA 4-09-B

This NSA represents **two single-family residences** along Main Street, south of U.S. 50/301 and east of the Kent Narrows Road South intersection. The residences are located in a mixed land use area amongst retail facilities and are located approximately 350 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 12)

NSA 4-10-E

This NSA represents the **Queenstown Bank of Maryland** located at 3701 Main Street south of U.S. 50/301 and east of U.S. 50/301 Exit 43A intersection. There are no outdoor use areas associated with this NSA. The bank is located approximately 50 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 13)

NSA 4-11-B

This NSA represents four **single-family residences** along Main Street, south of U.S. 50/301 and east of U.S. 50/301 Exit 43A intersection. The residences are located approximately 200 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-12-B

This NSA represents **single-family residences** along Main Street, Marshy Creek Road, and Coursey Road, south of U.S. 50/301 and east of U.S. 50/301 Exit 43A intersection. The residences are located approximately 200 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-13-C

This NSA represents residential-style structures that are being used as a **medical facility** located along Main Street south of U.S. 50/301 and east of U.S. 50/301 Exit 43A intersection. The closest of the buildings is located approximately 150 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-14-C

This NSA represents the **Grasonville Seventh-day Adventist Church** located along Main Street south of U.S. 50/301 and east of U.S. 50/301 Exit 43A intersection. The church is located approximately 100 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-15-B

This NSA represents **single-family residences** along Main Street, south of U.S. 50/301 and west of the U.S. 50/301/Chester River Beach Road interchange. The closest of the residences are located approximately 500 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-16-E

This NSA represents the **Shore United Bank** located at 202 Pullman Crossing Road south of U.S. 50/301 and west of the U.S. 50/301/Chester River Beach Road interchange. There are no outdoor use areas associated with this NSA. The bank is located approximately 450 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 13)

NSA 4-17-E

This NSA represents **Gill's Seafood Company** located at 111 Scherr Lane south of U.S. 50/301 and west of the U.S. 50/301/Station Lane intersection. There are no outdoor use areas associated with this NSA. The facility is located approximately 600 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 13)

NSA 4-18-B

This NSA represents **single-family residences** along Main Street and Station Lane, south of U.S. 50/301 and west of the U.S. 50/301/Station Lane intersection. The closest of the residences are located approximately 250 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-19-C

This NSA represents the **Eastern Shore Baptist Church** located at 119 Station Lane south of U.S. 50/301 and west of U.S. 50/301/Station Lane intersection. The church is located approximately 250 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 13)

NSA 4-20-B

This NSA represents **single-family residences** along Main Street and Station Lane, south of U.S. 50/301 and east of the U.S. 50/301/Station Lane intersection. The closest of the residences are located approximately 275 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-21-C

This NSA represents the **Chesapeake Church of Christ** located at 405 Drummer Drive south of U.S. 50/301 and east of U.S. 50/301/Station Lane intersection. The church is located approximately 450 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 13)

NSA 4-22-B

This NSA represents **single-family residences** along Drummer Drive, Maple Drive, Oak Drive, Pine Drive, and Evans Avenue, south of U.S. 50/301 and west of the U.S. 50/301/Hess Road intersection. The closest of the residences are located approximately 350 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Pages 13 and 14)

NSA 4-23-C

This NSA represents **Grasonville Elementary School** located at 610 Main Street south of U.S. 50/301 and east of the U.S. 50/301/Hess Road intersection. The school has playgrounds, paved courts and athletic fields which are located between the school and U.S. 50/301. The closest portion of the basketball courts is located approximately 950 feet to the south of the existing shoulder of U.S. 50/301 with the actual school building located approximately 1,200 feet to the south of the existing shoulder of U.S. 50/301. (See **Appendix A**, Map Page 14)

NSA 4-24-B

This NSA represents **single-family residences** along Hess Frontage Road and Wilson Road, south of U.S. 50/301 and east of the U.S. 50/301/Hess Road intersection. The closest of the residences along Hess Frontage Road are located approximately 125 feet from the existing shoulder of EB U.S. 50/301, and the closest residences along Wilson Road are located approximately 400 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 14)

NSA 4-25-C

This NSA represents the **Grasonville Community Center** and **Bryan United Methodist Church** located along Main Street south of U.S. 50/301 and west of the U.S. 50/301/Nesbit Road interchange. The buildings are located approximately 1,600 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 14)

NSA 4-26-B

This NSA represents **multi-family apartment** buildings in the **Village at Slippery Hill** community at 210 Fallen Horse Circle, south of U.S. 50/301 at the U.S. 50/301/Nesbit Road interchange. The complex is under construction and the closest of the building is located approximately 550 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 14)

NSA 4-27-C

This NSA represents the University of **Maryland Shore Emergency Center at Queenstown** located at 125 Shoreway Drive south of U.S. 50/301 at the U.S. 50/301/Nesbit Road interchange. The closest buildings are located approximately 400 feet from the existing shoulder of EB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 14)

NSA 4-28-B

This NSA represents **single-family residences** along Main Street and Slippery Hill Lane, south of U.S. 50/301 and east of the U.S. 50/301/Nesbit Road interchange. The closest of the residences are located approximately 1,000 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 14)

NSA 4-29-B

This NSA represents **single-family residences** along Main Street, Hampton Lane, Taylor Drive and Norman Wilson Lane, south of U.S. 50/301 at the U.S. 50/301 split. The closest of the residences are located approximately 500 feet from the existing shoulder of EB U.S. 50/301. (See **Appendix A**, Map Page 15)

NSA 4-30-C

This NSA represents the Queenstown Harbor **Golf Course** located at 310 Links Lane, north of U.S. 50/301 at the U.S. 50/301 split. Some of the golf holes are located within approximately 400 feet from the existing U.S. 50/301 shoulder, but a majority of the course is located over 1,500 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 14 and 15)

NSA 4-31-B

This NSA represents **single-family residences** along Winchester Creek Road, north of U.S. 50/301 and east of the U.S. 50/301/Nesbit Road interchange. The closest of the residences are located approximately 2,400 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 14)

NSA 4-32-B

This NSA represents **single-family residences** along Bunny Rabbit Lane, north of U.S. 50/301 and east of the U.S. 50/301/Nesbit Road interchange. The closest of the residences are located approximately 3,000 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 14)

NSA 4-33-B

This NSA represents **single-family residences** along Nesbit Road, north of U.S. 50/301 and east of the U.S. 50/301/Nesbit Road interchange. The closest of the residences are located approximately 3,000 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 14)

NSA 4-34-B

This NSA represents **single-family residences** along Hissey Road, north of U.S. 50/301 at the U.S. 50/301/Hissey Road intersection. The closest of the residences are located approximately 2,000 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 14)

NSA 4-35-B

This NSA represents **single-family residences** along Homeport Drive, Port Drive, and Port Court, north of U.S. 50/301 at the U.S. 50/301/Hissey Road intersection. The closest of the residences are located approximately 1,200 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 13 and 14)

NSA 4-36-B

This NSA represents **single-family residences** along Winchester Creek Road and Winchester Avenue, north of U.S. 50/301 and east of the U.S. 50/301/VFW Avenue intersection. The closest of the residences are located approximately 100 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-37-B

This NSA represents **single-family residences** along Mousley Road, Clevenger Lane, VFW Avenue, and Radcliffe Road, north of U.S. 50/301 at the U.S. 50/301/VFW Avenue intersection. The closest of the residences are located approximately 300 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-38-C

This NSA represents **VFW Post 7464** located at 203 VFW Avenue, north of U.S. 50/301 at the U.S. 50/301/VFW Avenue intersection. The facility has a large open field with horseshoe pits where outdoor activities take place and is located on the front side of the property, approximately 300 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-39-E

This NSA represents the **Quality Inn** hotel located at 101 VFW Avenue, north of U.S. 50/301 at the U.S. 50/301/VFW Avenue intersection. The hotel has an outdoor patio and swimming pool that is located at the backside of the building and is partially shielded from traffic noise. The hotel is located approximately 200 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-40-E

This NSA represents a **Denny's** restaurant located at 131 VFW Avenue north of U.S. 50/301 and west of the U.S. 50/301/VFW Avenue intersection. The restaurant is located approximately 100 feet from the existing shoulder of WB U.S. 50/301. Because there are no outdoor use areas associated with this NSA, further consideration of this NSA is not required. (See **Appendix A**, Map Page 13)

NSA 4-41-B

This NSA represents **single-family residences** within the Winchester Community located north of U.S. 50/301 and west of the U.S. 50/301/Chester River Beach Road interchange. The closest of the residences are located approximately 1,200 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-42-B

This NSA represents **single-family residences** within the Beach Harbor Camper's Co-Op at 111 Beach Harbor Road north of U.S. 50/301 and west of the U.S. 50/301/Chester River Beach Road interchange. The closest of the residences are located approximately 300 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 13)

NSA 4-43-C

This NSA represents **Long Point Park** located at 107 Jackson Creek Road, north of U.S. 50/301 at the U.S. 50/301/Jackson Creek Road intersection. The park has a walking trail and contains the Cross Island Trail trailhead. This trail extends westward from the park to Terrapin Nature Park along the Chesapeake Bay. Approximately 3 miles of the Cross Island Trail are directly adjacent to U.S. 50/301 from Long Point Park extending westward to Piney Creek Road. The park is located approximately 100 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 12 and 13)

NSA 4-44-B

This NSA represents **single-family residences** along Jackson Creek Road, Perry's Road, Creek Court, and Jackson Creek Lane north of U.S. 50/301 and west of the U.S. 50/301/Jackson Creek Road intersection. The residences are located along the shore of the Chesapeake Bay with the closest residences approximately 600 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 12 and 13)

NSA 4-45-B

This NSA represents **multi-family townhomes** within the Bayview at Kent Narrows Community along Long Point Road north of U.S. 50/301 and west of the U.S. 50/301/Jackson Creek Road intersection. The community has a pool that is located approximately 250 feet from the existing shoulder of U.S. 50/301, but the closest residences are located approximately 400 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 12)

NSA 4-46-E

This NSA represents the **Holiday Inn Express Annapolis East – Kent Island** hotel located at 1020 Kent Narrows Road, north of U.S. 50/301 and east of the Kent Narrows Bridge. The hotel has an outdoor patio and swimming pool that is located at the backside of the building and is partially shielded from traffic noise. The hotel is located approximately 300 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 12)

NSA 4-47-B

This NSA represents **multi-family townhomes** within the Narrows Pointe Community along Narrows Pointe Drive north of U.S. 50/301 and east of the Kent Narrows Bridge. The residences are located along the shore of the Chesapeake Bay with the closest residences approximately 1,200 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 12)

NSA 4-48-C

This NSA represents the **Safe Harbor Narrows Point and Resort** located at 428 Kent Narrow Way, north of U.S. 50/301 and east of the Kent Narrows Bridge. The resort has an outdoor patio and swimming pool and is located approximately 1,000 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 12)

NSA 4-49-E

This NSA represents two restaurants (**Harris Crab House** and **Red Eye's Dock Bar**) located along Kent Narrow Way, north of U.S. 50/301 and east of the Kent Narrows Bridge. The restaurants have an outdoor patio along the Chesapeake Bay and are located approximately 750 feet from the existing shoulder of WB U.S. 50/301. (See **Appendix A**, Map Page 12)

6.4 Non-Noise Sensitive Areas

Like the NSAs, the non-NSAs were also defined by their corresponding FHWA land use activity category. The land use letter is added to the beginning of the designation (unlike the NSAs, where it is added to the end of the designation) and each group is numbered independently (e.g. F-301 and G-301). Category F land use indicates an area excluded from the validation due to its non-noise sensitive activity. Category G land uses consist of non-permitted undeveloped land.

6.4.1 Section 1: Severn River to MD 179

This portion of the Tier 2 Study corridor contains 14 non-NSAs, which are described in more detail below.

F-1-01

This area represents several car dealerships (**Land Rover Annapolis**, **Jaguar Annapolis**, **Sheehy Lexus of Annapolis**, **Sheehy Infiniti of Annapolis**) located along Ferguson Road, south of U.S. 50/301 and west of the Bay Dale Drive interchange. (See **Appendix A**, Map Page 1 and 2)

F-1-02

This area represents the **High's convenience store and gas station** located along Old Mill Bottom Road South, south of U.S. 50/301 and east of the Bay Dale Drive interchange. (See **Appendix A**, Map Page 2)

F-1-03

This area represents **Exxon** and **Wawa** gas stations and the **Volvo Cars Annapolis** car dealership located along Buschs Frontage Road, south of U.S. 50/301 and west of the MD 179 interchange. (See **Appendix A**, Map Page 3)

F-1-04

This area represents a **water tank** owned by Anne Arundel County located along Buschs Frontage Road, south of U.S. 50/301 and west of the MD 179 interchange. (See **Appendix A**, Map Page 3)

F-1-05

This area represents the **U.S. Army Reserve Center** located along Benson Lane, north of U.S. 50/301 and west of the MD 179 interchange. (See **Appendix A**, Map Page 3)

F-1-06

This area represents a **Crown** gas station and **Bay Mart** convenience store located along Old Mill Bottom Road, north of U.S. 50/301 and east of the Bay Dale Drive interchange. (See **Appendix A**, Map Page 2)

F-1-07

This area represents three car dealerships (**BMW of Annapolis**, **Mini of Annapolis**, **BMW Collision Center**) and the **Extra Space** storage facility located along Old Mill Bottom Road, north of U.S. 50/301 and west of the Bay Dale Drive interchange. (See **Appendix A**, Map Page 2)

F-1-08

This area represents an **84 Lumber** retail outlet and an Extra Space storage facility located along Baltimore Annapolis Boulevard, north of U.S. 50/301 and east of the MD 2 interchange. (See **Appendix A**, Map Page 1)

G-1-01

This area represents **undeveloped land** owned by Asbury Broadneck United Methodist Church. This area is located along Broadneck Drive, north of U.S. 50/301 and west of the MD 179 interchange. (See **Appendix A**, Map Page 3)

G-1-02

This area represents **undeveloped land** that is privately owned and zoned for residential use. This area is located along Broadneck Drive, north of U.S. 50/301 and west of the MD 179 interchange. (See **Appendix A**, Map Page 3)

G-1-03

This area represents **undeveloped land** that is privately owned and zoned for residential use. This area is located along Middletown Road, north of U.S. 50/301 and east of the Bay Dale Drive interchange. (See **Appendix A**, Map Page 2 and 3)

G-1-04

This area represents **undeveloped land** owned by a self-storage company and zoned for commercial use. This area is located between Leyland Lane and Annapolitan Assisted Living, north of U.S. 50/301 and east of the Bay Dale Drive interchange. (See **Appendix A**, Map Page 2)

G-1-05

This area represents **undeveloped land** that is privately owned and zoned for residential use. This area is located between Old Bottom Road and Old Sturbridge Road, north of U.S. 50/301 and west of the Bay Dale Drive interchange. (See **Appendix A**, Map Page 1 and 2)

G-1-06

This area represents **undeveloped land** owned by the nearby homeowner's association and zoned for residential use. This area is located adjacent to Sam Ryder Road, north of U.S. 50/301 and west of the Bay Dale Drive interchange. (See **Appendix A**, Map Page 1)

6.4.2 Section 2: MD 179 to the Chesapeake Bay

This portion of the Tier 2 Study corridor contains 10 non-NSAs, which are described in more detail, below.

F-2-01

This area represents the **Anglers Sport Center** and **Verizon** retail outlets located along Whitehall Road, south of U.S. 50/301 and east of the MD 179 interchange. (See **Appendix A**, Map Page 3)

F-2-02

This area represents the **Jemal's Bay 50 Shopping Center** retail outlet located along Whitehall Road, south of U.S. 50/301 and east of the MD 179 interchange. (See **Appendix A**, Map Page 4)

F-2-03

This area represents a **used car lot** and retail outlet located along Skidmore Drive, south of U.S. 50/301 and west of the U.S. 50/301/Oceanic Drive interchange. (See **Appendix A**, Map Page 4)

F-2-04

This area represents an **agricultural field** between Whitehall Road and Colbert Road, located along Skidmore Drive, south of U.S. 50/301 and west of the U.S. 50/301/Oceanic Drive interchange. (See **Appendix A**, Map Page 4)

F-2-05

This area represents the **Maryland Transit Police Station** and **MDTA maintenance yard** along Old Ferry Slip Road, south of U.S. 50/301 and east of the U.S. 50/301/Oceanic Drive interchange. (See **Appendix A**, Map Page 5)

F-2-06

This area represents the **MDTA EZ Pass Center** along U.S. 50/301, north of U.S. 50/301 and east of the U.S. 50/301/Oceanic Drive interchange. (See **Appendix A**, Map Page 5)

F-2-07

This area represents an **electrical substation**, a **7-Eleven** gas station, and several **retail outlets** located along East College Parkway, north of U.S. 50/301 and east of the MD 179 interchange. (See **Appendix A**, Map Page 3)

G-2-01

This area represents **undeveloped land** that is owned by private entities and Anne Arundel County and is zoned for commercial, agricultural, and residential use. This area is located along Holly Drive, south of U.S. 50/301 and east of the MD 179 interchange. (See **Appendix A**, Map Page 3)

G-2-02

This area represents **undeveloped land** that is privately owned and zoned for residential use. This area is located along Ridout Lane, south of U.S. 50/301 and east of the MD 179 interchange. (See **Appendix A**, Map Page 4)

G-2-03

This area represents **undeveloped land**. The western lot is privately owned and zoned for residential use, and the eastern lot, part of **Holly Beach Farm**, is owned by a non-profit conservation organization. The existing residences have been included in NSA 2-06-B. This area is located along Skidmore Drive, south of U.S. 50/301 at the U.S. 50/301/Oceanic Drive interchange. (See **Appendix A**, Map Pages 4 and 5)

6.4.3 Section 3: Chesapeake Bay to Kent Narrows

This portion of the Tier 2 Study corridor contains 35 non-NSAs, which are described in more detail, below.

F-3-01

This area represents an electrical substation located along Pier 1 Road, south of U.S. 50/301 and west of the MD 8 interchange. The lot between the Bay Bridge Marina and the Inn at the Chesapeake Bay Beach has recently been developed into the **Bay Manor Shops and Apartments**. The first floor of this complex is commercial and there does not appear to be any outdoor usage, however the apartments in the upper floors all have balconies that would be a Category B land use and require analysis. Impacts and mitigation measures will be analyzed in the final EIS document at this location. (See **Appendix A**, Map Pages 8 and 9)

F-3-02

This area represents the **Stevensville Park and Ride** lot located along Thompson Creek Road, south of U.S. 50/301 and east of the MD 8 interchange. (See **Appendix A**, Map Page 9)

F-3-03

This area represents retail outlets in the **Kent Landing shopping center** located along Kent Landing, south of U.S. 50/301 and east of the MD 8 interchange. (See **Appendix A**, Map Page 9)

F-3-04

This area represents retail outlets in the **Thompson Creek shopping center** located along Thompson Creek Road, south of U.S. 50/301 and west of the Thompson Creek Road intersection. (See **Appendix A**, Map Page 9)

F-3-05

This area represents **Sunoco** and **Shell** gas stations and the **Dash In** convenience store located along Thompson Creek Road, south of U.S. 50/301 at the Thompson Creek Road intersection. (See **Appendix A**, Map Page 9)

F-3-06

This area represents retail outlets in **The Shoppe's at Chesapeake** shopping center located along Thompson Creek Road, south of U.S. 50/301 and east of the Thompson Creek Road intersection. (See **Appendix A**, Map Page 9)

F-3-07

This area represents a gas station, retail outlets in **Rainbow Plaza shopping center**, and a shipyard located along Postal Road, south of U.S. 50/301 and east of the Cox Neck Road intersection. (See **Appendix A**, Map Page 10)

F-3-08

This area represents retail outlets and **Exxon** gas station located along Dominion Road, south of U.S. 50/301 at the Dominion Road intersection. (See **Appendix A**, Map Page 10)

F-3-09

This area represents a gas station and retail outlets in the **Kent Towne Market shopping center** located along Main Street, south of U.S. 50/301 and west of the South Piney Road intersection. (See **Appendix A**, Map Page 10 and 11)

F-3-10

This area represents a storage facilities and retail outlets in the **Red Apple Plaza shopping center** located along Main Street, south of U.S. 50/301 and east of the Dominion Road intersection. (See **Appendix A**, Map Page 11)

F-3-11
This area represents **agricultural fields** located along Main Street, south of U.S. 50/301 and west of the Kent Narrows Bridge. (See **Appendix A**, Map Page 11)

F-3-12
This area represents a **marina** located along Main Street, south of U.S. 50/301 and west of the Kent Narrows Bridge. (See **Appendix A**, Map Page 11)

F-3-13
This area represents a **marina** and retail service and sales facilities primarily used as a marina and boat storage located along Piney Narrows Road, north of U.S. 50/301 and west of the Kent Narrows Bridge. (See **Appendix A**, Map Page 11)

F-3-14
This area represents the **Kent Narrows Center** retail outlets located along Piney Narrows Road, north of U.S. 50/301 and west of the Kent Narrows Bridge. (See **Appendix A**, Map Page 11)

F-3-15
This area represents an **Exxon** gas station and the **Wye River Marine** boat yard along Piney Creek Road, north of U.S. 50/301 at the Piney Creek Road intersection. (See **Appendix A**, Map Page 11)

F-3-16
This area represents an **Exxon** gas station along Chester Station Lane, north of U.S. 50/301 at the Piney Creek Road intersection. (See **Appendix A**, Map Page 10)

F-3-17
This area represents a boat yard, **Advantage Self Storage facility**, and a water tower utility along Piney Creek Road, north of U.S. 50/301 at the Piney Creek Road intersection. (See **Appendix A**, Map Page 10)

F-3-18
This area represents a **retail outlet** and **agricultural fields** along Piney Creek Road, north of U.S. 50/301 and west of the Piney Creek Road intersection. (See **Appendix A**, Map Page 10)

F-3-19
This area represents the **Kent Island Volunteer Fire Department** and a couple of retail outlets along Main Street and Castle Marina Road, north of U.S. 50/301 and east of the Castle Marina Road intersection. (See **Appendix A**, Map Page 10)

F-3-20
This area represents **Shell** and **Friendly's** gas stations and a couple of retail outlets along Island Professional Park, north of U.S. 50/301 and west of the Castle Marina Road intersection. (See **Appendix A**, Map Page 10)

F-3-21

This area represents **retail outlets** at the **Chester Place shopping center** located at 1235 Shopping Center Drive, north of U.S. 50/301 and west of the U.S.50/Castle Marina Road intersection. (See **Appendix A**, Map Page 10)

F-3-22

This area represents **retail outlets** and a **shipyard** located along Shopping Center Drive, north of U.S. 50/301 at the U.S.50/Shopping Center Drive intersection. (See **Appendix A**, Map Page 9)

F-3-23

This area represents **retail outlets** along Duke Street, north of U.S. 50/301 at the U.S.50/Duke Street intersection. (See **Appendix A**, Map Page 9)

F-3-24

This area represents the **Last Stop** gas station and retail outlets along Duke Street, north of U.S. 50/301 at the U.S.50/Duke Street intersection. (See **Appendix A**, Map Page 9)

F-3-25

This area represents a **Caliber Collison** retail outlet along Love Point Road, north of U.S. 50/301 and east of the U.S.50/MD 8 interchange. (See **Appendix A**, Map Page 9)

F-3-26

This area represents **retail outlets** along Love Point Road, north of U.S. 50/301 and east of the U.S.50/MD 8 interchange. (See **Appendix A**, Map Page 9)

F-3-27

This area represents the **Queen Anne's County Sanitary District** sewage treatment plant along Bateau Drive, north of U.S. 50/301 and west of the U.S.50/MD 8 interchange. (See **Appendix A**, Map Page 8)

G-3-01

This area represents **undeveloped land** that is privately owned and zoned for commercial use. This area is located along the Pier 1 Road, south of U.S. 50/301 and west of the MD 8 interchange. (See **Appendix A**, Map Pages 8 and 9)

G-3-02

This area represents **undeveloped land**. The lot adjacent to U.S. 50/301 is zoned as marshland, and the lot adjacent to Mainsail Drive is owned by a homeowner's association and zoned for residential use, however no plans were found to construct more residences. This area is located along the west shore of Cox Creek, south of U.S. 50/301 and east of the Thompson Creek Road intersection. (See **Appendix A**, Map Page 9)

G-3-03

This area represents **undeveloped land** that is privately owned and zoned for commercial and agricultural use. This area is located along Piney Creek, south of U.S. 50/301 and west of the Kent Narrows Bridge. (See **Appendix A**, Map Page 11)

G-3-04

This area represents **undeveloped land** owned by the Chesapeake Wildlife Heritage and is zoned for commercial and agricultural use. This area is located adjacent to Piney Creek, north of U.S. 50/301 between Piney Creek and the Kent Narrows Bridge. (See **Appendix A**, Map Page 11)

G-3-05

This area represents **undeveloped land** owned by private entities and is zoned for commercial, agricultural, and residential use. This area is located adjacent to Macum Creek and Piney Creek, north of U.S. 50/301 between the Chester Station Lane intersection and the Kent Narrows Bridge. (See **Appendix A**, Map Pages 10 and 11)

G-3-06

This area represents **undeveloped land** that is privately owned and zoned for commercial use. This area is located adjacent to the Chester Place shopping center along Main Street, north of U.S. 50/301 and west of the U.S. 50/301/Castle Marina Road intersection. (See **Appendix A**, Map Pages 9 and 10)

G-3-07

This area represents **undeveloped land** owned by Queen Anne's County and zoned for commercial use. This area is located along Love Point Road, north of U.S. 50/301 and east of the U.S. 50/301/MD 8 interchange. (See **Appendix A**, Map Page 9)

G-3-08

This area represents **undeveloped land** owned by Queen Anne's County and zoned for commercial use. This area is located along MD 8, north of U.S. 50/301 and east of the U.S. 50/301/MD 8 interchange. (See **Appendix A**, Map Page 9)

6.4.4 Section 4: Kent Narrows to U.S. 50/301 Split

This portion of the Tier 2 Study corridor contains 37 non-NSAs, which are described in more detail, below.

F-4-01

This area represents a **shipyard** and **retail outlet** located along Kent Narrow Way South, south of U.S. 50/301 and east of the Kent Narrows Bridge. (See **Appendix A**, Map Page 12)

F-4-02

This area represents a **shipyard** and **retail outlet** located along Main Street, south of U.S. 50/301 and east of the Kent Narrows Bridge. (See **Appendix A**, Map Page 12)

F-4-03

This area represents a **retail outlet** located along Wells Cove Road, south of U.S. 50/301 and east of the Kent Narrows Bridge. (See **Appendix A**, Map Page 12)

F-4-04

This area represents a **parking facility** located along Main Street, south of U.S. 50/301 and west of the U.S.50/Kent Narrows Road intersection. (See **Appendix A**, Map Page 12)

F-4-05

This area represents a **water tower** utility facility along Main Street, south of U.S. 50/301 and west of the U.S.50/Kent Narrows Road intersection. (See **Appendix A**, Map Page 12)

F-4-06

This area represents a **shipyard** along Main Street, south of U.S. 50/301 and east of the U.S.50/Kent Narrows Road intersection. (See **Appendix A**, Map Page 12)

F-4-07

This area represents an **electrical substation** utility facility along Main Street, south of U.S. 50/301 and east of the U.S.50/Kent Narrows Road intersection. (See **Appendix A**, Map Page 12)

F-4-08

This area represents **retail outlets** along Main Street, south of U.S. 50/301 at the Main Street intersection. (See **Appendix A**, Map Pages 12 and 13)

F-4-09

This area represents a **storage facility**, **Patriot Fire** facility, **retail outlets** and a **7-Eleven** gas station along Pullman Crossing Road, south of U.S. 50/301 and west of the U.S. 50/301/Chester River Beach Road interchange. (See **Appendix A**, Map Pages 13)

F-4-10

This area represents **agricultural fields** along Main Street, and **NAPA Auto Parts** and **Shore Distributors** retail outlets along Station Lane, south of U.S. 50/301 and west of the U.S. 50/301/Station Lane interchange. (See Appendix A, Map Page 13)

F-4-11

This area represents a **retail outlet** and **shipyard** along Station Lane, Rental Lane, and Main Street, south of U.S. 50/301 and east of the U.S. 50/301/Station Lane intersection. (See **Appendix A**, Map Page 13)

F-4-12

This area represents **retail outlets** and **shipyard** along Drummer Drive and Evans Avenue, south of U.S. 50/301, at the U.S. 50/301/Evans Avenue intersection. (See **Appendix A**, Map Pages 13 and 14)

F-4-13

This area represents **retail outlets** and **shipyard** along Hess Road, south of U.S. 50/301, at the U.S. 50/301/Hess Road intersection. (See **Appendix A**, Map Page 14)

F-4-14

This area represents **agricultural fields** along Winchester Creek Road, Blackbeard Road, Bunny Rabbit Lane, and Nesbit Road, north of U.S. 50/301, from west of Nesbit Road to west of the U.S. 50/301 split. (See **Appendix A**, Map Page 14)

F-4-15

This area represents a **Wawa** gas station and storage facility along Hissey Road, north of U.S. 50/301 and west of the Hissey Road intersection. (See **Appendix A**, Map Page 14)

F-4-16

This area represents a **shipyard** along Winchester Creek Road, north of U.S. 50/301, at the U.S. 50/301/Winchester Creek Road intersection. (See **Appendix A**, Map Page 13 and 14)

F-4-17

This area represents a **retail outlet** along Winchester Creek Road, north of U.S. 50/301 and west of the U.S. 50/301/Winchester Creek Road intersection. (See **Appendix A**, Map Page 13)

F-4-18

This area represents **retail outlets** along VFW Avenue, north of U.S. 50/301, at the U.S. 50/301/VFW Avenue intersection. (See **Appendix A**, Map Page 13)

F-4-19

This area represents a **retail outlet** and **shipyard** along Saddler Road, north of U.S. 50/301 and west of the Chester River Beach Road interchange. (See **Appendix A**, Map Page 13)

F-4-20

This area represents **retail outlets** and a **Royal Farms** gas station along Saddler Road, north of U.S. 50/301 and east of the U.S. 50/301/Jackson Creek Road intersection. (See **Appendix A**, Map Page 13)

F-4-21

This area represents a **retail outlet** and **boat landing** along Jackson Creek Road, north of U.S. 50/301, at the U.S. 50/301/Jackson Creek Road intersection. (See **Appendix A**, Map Page 13)

F-4-22

This area represents a county owned **utility building** and a **storage yard** along Long Point Road, north of U.S. 50/301 and west of the U.S. 50/301/Jackson Creek Road intersection. (See **Appendix A**, Map Page 12)

F-4-23

This area represents a **marina** and **shipyard** along Kent Narrows Way, north of U.S. 50/301 and east of the Kent Narrows Bridge. (See **Appendix A**, Map Page 12)

G-4-01

This area represents **undeveloped land** that is privately owned and zoned for commercial and marsh land use. This area is located adjacent to Kent Narrows Road South, south of U.S. 50/301 at the U.S. 50/301/Kent Narrows Road South intersection. (See **Appendix A**, Map Page 12)

G-4-02

This area represents **undeveloped land** that is privately owned and zoned for commercial and residential use. This area is located along the waterfront adjacent to Marshy Creek, south of U.S. 50/301 and east of the U.S. 50/301/Kent Narrows Road South intersection. (See **Appendix A**, Map Page 12)

G-4-03

This area represents **undeveloped land** that is privately owned and zoned for commercial and residential use. This area is located along the waterfront adjacent to Marshy Creek, south of U.S. 50/301 and east of the U.S. 50/301/Main Street intersection. (See **Appendix A**, Map Page 12 and 13)

G-4-04

This area represents **undeveloped land** that is privately owned and zoned for commercial use. This area is located at the end of Pullman Crossing Road, south of U.S. 50/301 and west of the U.S. 50/301/Chester River Beach interchange. (See **Appendix A**, Map Page 13)

G-4-05

This area represents **undeveloped land** that is privately owned and zoned for commercial use. This area is located along Chester Beach Road, south of U.S. 50/301 and east of the U.S. 50/301/Chester River Beach interchange. (See **Appendix A**, Map Page 13)

G-4-06

This area represents **undeveloped land** that is privately owned and zoned for commercial use. This area is located between Evans Avenue and Hess Road, south of U.S. 50/301 and west of the U.S. 50/301/Hess Road intersection. (See **Appendix A**, Map Page 14)

G-4-07

This area represents **undeveloped land** that is privately owned and zoned for commercial and residential use. This area is located between Wilson Road and Nesbit Road, south of U.S. 50/301 and west of the U.S. 50/301/Nesbit Road interchange. (See **Appendix A**, Map Page 14)

G-4-08

This area represents **undeveloped land** that is privately owned and zoned for agricultural use. This area is located south of U.S. 50/301, between Nesbit Road and the U.S. 50/301 split. (See **Appendix A**, Map Pages 14 and 15)

G-4-09

This area represents **undeveloped land** that is privately owned and zoned for agricultural, commercial, and residential use. This area is located north of U.S. 50/301, between Winchester Creek and Nesbit Road. (See **Appendix A**, Map Pages 13 and 14)

G-4-10

This area represents **undeveloped land** that is privately owned and zoned for commercial use. This area is located along Winchester Creek, north of U.S. 50/301 and east of the VFW Avenue intersection. (See **Appendix A**, Map Page 13)

G-4-11

This area represents **undeveloped land** that is privately owned and zoned for commercial use. This area is located between Loblolly Way, Saddler Road, and Chester River Beach Road, north of U.S. 50/301 and east of the Chester River Beach Road interchange. (See **Appendix A**, Map Page 13)

G-4-12

This area represents **undeveloped land** that is privately owned and zoned for commercial use. This area is located adjacent to Jackson Creek, between Jackson Creek Road and Saddler Road, north of U.S. 50/301 and east of the U.S. 50/301/Jackson Creek Road intersection. (See **Appendix A**, Map Page 13)

G-4-13

This area represents **undeveloped land** that is privately owned and zoned for commercial use. This area is located at 310 Long Point Road, north of U.S. 50/301 and west of the U.S. 50/301/Jackson Creek Road intersection. (See **Appendix A**, Map Page 12)

G-4-14

This area represents **undeveloped land** that is privately owned and zoned as marsh land. This area is located adjacent to Muddy Creek, between Kent Narrows Road and Long Point Road, north of U.S. 50/301 and east of the U.S. 50/301/Kent Narrows Road intersection. (See **Appendix A**, Map Page 12)

6.5 Noise Measurement Data

Measurement of ambient noise levels is used to validate the computer model against field-observed conditions. This ensures the accuracy and reliability of the computer predictions of future noise conditions.

Noise monitoring along U.S. 50/301 was conducted between September 2023 and December 2023. During this period, seventeen Traffic Monitoring Sessions (TMS) were conducted with a total of 136 short-term noise measurements for the purposes of TNM validation. To obtain an accurate picture of the average traffic noise levels along the roadway, 15 minutes of data were collected for each monitoring session. The 15-minute traffic counts are multiplied by four to develop the hourly volumes for use in TNM.

The validation process utilizes off-peak noise monitoring to ensure that free-flow travel conditions would be present on U.S. 50/301 and other roadways within the Tier 2 Study corridor. Free-flow travel conditions provide ideal observed noise levels for validating the noise model. Traffic counts on noise-contributing roadways were taken concurrent to the monitoring periods to assist in the determination of their traffic noise influence on the individual sites. Additionally, video cameras recorded traffic flow during the monitoring periods, and traffic from those periods was subsequently tabulated remotely. Validated noise models are used to predict noise levels during any future design traffic conditions (i.e., peak or non-peak, seasonal travel times).

Other relevant information on non-traffic noise “events” were recorded during the monitoring sessions (e.g., aircraft fly-overs and construction equipment noise). Data collected during these periods which were affected by non-traffic noise was identified and evaluated to determine the appropriateness of its inclusion in the traffic noise-level calculation. Prior to calculating the Leq(h),

the short-term monitoring data was examined for outlier values typical of non-traffic noise sources. If these outlier values were verified through corresponding field notes and/or additional evidence from the collected data (such as an atypical instantaneous "peak" level), those periods experiencing non-traffic noise influences were removed from the aggregate data used to calculate the field-observed equivalent noise level.

All highway noise measurements were performed in conformance with FHWA's *Noise Measurement Handbook* (FHWA-HEP-18-065 September 2017)

6.6 TNM Validation

All noise prediction modeling was performed using FHWA's Traffic Noise Model (TNM) v2.5. The TNM seeks to simulate the noise environment by considering variable inputs for traffic (including autos, medium trucks, heavy trucks, buses, and motorcycles), variable inputs of traffic speed for each vehicle type, variable inputs for roadway design (including roadway width, horizontal and vertical alignment), variable inputs for terrain lines and propagation features (such as building rows, ground zones, and tree zones), and inclusion of traffic control measures, including stop lights and stop signs.

The TNM validation determines the effectiveness of the Noise Analysis by evaluating the model's ability to reproduce the measured noise levels. Measured noise levels correspond to ambient measurements taken in conjunction with highway traffic counts.

Noise has been measured and/or modeled at selected points distributed throughout the Tier 2 Study limits referred to as 'receptors.' Receptors have been labeled with an 'M' prefix as shown on the NSA mapping in **Appendix A** to indicate the receptors were both measured in the field and modeled.

After the noise measurements and traffic counts were obtained, a TNM was developed for the Tier 2 Study by inputting all pertinent roadways, terrain, and structural elements necessary for adequately characterizing the Tier 2 Study corridor's noise environment. Each noise measurement receptor was accurately represented in the model by a TNM receptor. The model was then validated by testing it under each of the traffic conditions encountered during the traffic monitoring sessions. A TNM is properly validated when the modeled noise levels are within ±3 dB(A) of the measured noise levels for most of the receptors. In order to bring the model into validation, modeling assumptions were refined, as necessary, by inputting additional pertinent and relevant features (such as terrain and structural elements) in an orderly sequence of TNM runs, with each new model revision, or "Case" being re-tested until the validation criteria met SHA criteria.

Table 6-1 presents the TNM validation results for noise study area Section 1.

Table 6-1: Severn River to MD 179 TNM Model Validation Summary

NSA	Receptor	Measurement Date and Time	Measured Noise Level dB(A)	Modeled Noise Level dB(A)	Difference dB(A)	Validating Model Point? (Yes) or (No)		Notes	Traffic Monitoring Session
1-01-B	M-101	10-04-2023 1240-1255	64	65	1	Y			TMS01
1-01-B	M-102	10-04-2023 1240-1255	62	64	2	Y			TMS01

NSA	Receptor	Measurement Date and Time	Measured Noise Level dB(A)	Modeled Noise Level dB(A)	Difference dB(A)	Validating Model Point? (Yes) or (No)		Notes	Traffic Monitoring Session
1-01-B	M-103	10-04-2023 1240-1255	63	63	0	Y			TMS01
1-01-B	M-104	10-04-2023 1240-1255	59	61	2	Y			TMS01
1-01-B	M-105	10-04-2023 1140-1155	59	60	1	Y			TMS02
1-04-B	M-106	10-04-2023 1140-1155	52	54	2	Y			TMS02
1-04-B	M-107	10-04-2023 1140-1155	61	63	2	Y			TMS02
1-04-B	M-108	10-04-2023 1140-1155	63	63	0	Y			TMS02
1-04-B	M-109	10-05-2023 1357-1412	59	59	0	Y			TMS03
1-04-B	M-110	10-05-2023 1357-1412	47	50	3	Y			TMS03
1-06-B	M-111	10-05-2023 1254-1309	50	53	3	Y			TMS04
1-06-B	M-112	10-05-2023 1254-1309	62	65	3	Y			TMS04
1-06-B	M-113	10-05-2023 1254-1309	67	69	2	Y			TMS04
1-06-B	M-114	10-05-2023 1254-1309	63	65	2	Y			TMS04
1-06-B	M-115	10-05-2023 1140-1455	59	58	-1	Y			TMS05
1-07-C	M-116	10-05-2023 1140-1455	62	61	-1	Y			TMS05
1-06-B	M-117	10-05-2023 1140-1455	55	54	-1	Y			TMS05
1-06-B	M-118	10-05-2023 1037-1052	61	63	2	Y			TMS06
1-06-B	M-119	10-05-2023 1037-1052	52	53	1	Y			TMS06
1-09-C	M-120	10-05-2023 1037-1052	51	52	1	Y			TMS06
1-11-B	M-121	10-05-2023 1037-1052	58	60	2	Y			TMS06
1-10-C	M-122	10-05-2023 1037-1052	69	70	1	Y			TMS06
1-11-B	M-123	10-05-2023 1037-1052	65	66	1	Y			TMS06
1-11-B	M-124	10-05-2023 1140-1455	54	54	0	Y			TMS05
1-11-B	M-125	10-05-2023 1140-1455	53	53	0	Y			TMS05
1-11-B	M-126	10-05-2023 1140-1455	61	61	0	Y			TMS05
1-14-B	M-127	10-05-2023 1140-1455	53	52	-1	Y			TMS05
1-12-C	M-128	10-05-2023 1254-1309	64	63	-1	Y			TMS04
1-13-B	M-129	10-05-2023 1254-1309	67	67	0	Y			TMS04
1-14-B	M-130	10-05-2023 1254-1309	53	56	3	Y			TMS04
1-14-B	M-131	10-05-2023 1254-1309	54	56	2	Y			TMS04
1-15-E	M-132	10-05-2023 1254-1309	75	74	-1	Y			TMS04
1-15-E	M-133	10-05-2023 1254-1309	60	60	0	Y			TMS04
1-18-B	M-134	10-05-2023 1357-1412	58	58	0	Y			TMS03
1-18-B	M-135	10-05-2023 1357-1412	69	72	3	Y			TMS03
1-19-B	M-136	10-05-2023 1357-1412	62	60	-2	Y			TMS03
1-19-B	M-137	10-04-2023 1140-1155	65	65	0	Y			TMS02
1-19-B	M-138	10-04-2023 1140-1155	61	64	3	Y			TMS02
1-19-B	M-139	10-04-2023 1140-1155	60	62	2	Y			TMS02
1-20-C	M-140	10-04-2023 1140-1155	64	64	0	Y			TMS02

NSA	Receptor	Measurement Date and Time	Measured Noise Level dB(A)	Modeled Noise Level dB(A)	Difference dB(A)	Validating Model Point? (Yes) or (No)		Notes	Traffic Monitoring Session
1-21-B	M-141	10-04-2023 1140-1155	59	61	2	Y			TMS02
1-21-B	M-142	10-04-2023 1140-1155	62	59	-3	Y			TMS02
1-21-B	M-143	10-04-2023 1240-1255	61	59	-2	Y			TMS01
1-21-B	M-144	10-04-2023 1240-1255	64	62	-2	Y			TMS01
1-21-B	M-145	10-04-2023 1240-1255	55	58	3	Y			TMS01
1-21-B	M-146	10-04-2023 1240-1255	69	70	1	Y			TMS01
Non-Validating Model Points							**0**		

Of the 46 validating receptors, 25 over-predicted, 10 under-predicted, and 11 had zero difference between measured and modeled levels. No receptors were non-validating.

Table 6-2 presents the TNM validation results for noise study area Section 2.

Table 6-2: MD 179 to the Chesapeake Bay TNM Model Validation Summary

NSA	Receptor	Measurement Date and Time	Measured Noise Level dB(A)	Modeled Noise Level dB(A)	Difference dB(A)	Validating Model Point? (Yes) or (No)		Notes	Traffic Monitoring Session
2-01-B	M-201	10-05-2023 1037-1052	54	55	1	Y			TMS06
2-04-B	M-202	11-14-2023 1200-1215	69	66	-3	Y			TMS07
2-05-B	M-203	11-14-2023 1301-1316	57	56	-1	Y			TMS08
2-05-B	M-204	11-14-2023 1301-1316	55	54	-1	Y			TMS08
2-05-B	M-205	11-14-2023 1301-1316	60	59	-1	Y			TMS08
2-06-B	M-206	10-04-2023 1353-1408	71	74	3	Y			TMS09
2-06-B	M-207	10-04-2023 1353-1408	57	62	5		N[1]		TMS09
2-06-B	M-208	10-04-2023 1353-1408	61	64	3	Y			TMS09
2-06-B	M-209	10-04-2023 1353-1408	62	63	1	Y			TMS09
2-08-C	M-210	12-20-2023 1049-1104	68	67	-1	Y			TMS09a
2-08-C	M-211	12-20-2023 1049-1104	64	63	-1	Y			TMS09a
2-08-C	M-211a[2]	12-20-2023 1049-1104	59	60	1	Y			TMS09a
2-09-B	M-212	10-04-2023 1353-1408	61	62	1	Y			TMS09
2-09-B	M-213	10-04-2023 1353-1408	75	76	1	Y			TMS09
2-10-B	M-214	11-14-2023 1301-1316	59	58	-1	Y			TMS08
2-10-B	M-215	11-14-2023 1301-1316	63	65	2	Y			TMS08
2-10-B	M-216	11-14-2023 1301-1316	52	53	1	Y			TMS08
2-10-B	M-217	11-14-2023 1301-1316	59	57	-2	Y			TMS08
2-11-C	M-218	11-14-2023 1200-1215	50	53	3	Y			TMS07
2-12-B	M-219	11-14-2023 1200-1215	63	65	2	Y			TMS07
2-13-B	M-220	11-14-2023 1200-1215	63	66	3	Y			TMS07
2-13-B	M-221	11-14-2023 1200-1215	65	65	0	Y			TMS07
2-13-B	M-222	11-14-2023 1200-1215	59	60	1	Y			TMS07
2-13-B	M-223	11-14-2023 1200-1215	62	63	1	Y			TMS07
2-13-B	M-224	11-14-2023 1200-1215	63	66	3	Y			TMS07
2-13-B	M-225	11-14-2023 1200-1215	66	67	1	Y			TMS07

NSA	Receptor	Measurement Date and Time	Measured Noise Level dB(A)	Modeled Noise Level dB(A)	Difference dB(A)	Validating Model Point? (Yes) or (No)		Notes	Traffic Monitoring Session
2-13-B	M-226	11-14-2023 1200-1215	59	58	-1	Y			TMS07
2-14-B	M-227	10-05-2023 1037-1052	57	59	2	Y			TMS06
2-17-B	M-228	10-05-2023 1037-1052	71	72	1	Y			TMS06
2-17-B	M-229	10-05-2023 1037-1052	60	63	3	Y			TMS06
Non-Validating Model Points							**1**		

Notes:
1. Tree canopy at this location appears to be providing additional shielding that model isn't able to replicate; consequently, it could not be validated.
2. Receptor M-211a was added as an additional monitoring site during a subsequent round of noise measurements, to avoid renaming receptors the (a) was used for this location.

Of the 29 validating receptors, 19 over-predicted, 9 under-predicted, and 1 had zero difference between measured and modeled levels. One receptor was non-validating. A determination has been made during the impact analysis (See **Section 7**) of whether the non-validating receptor is critical. Receptors are deemed "critical" when the measured levels approach or exceed the NAC and the modeled levels are substantially lower than the NAC. This could lead to any build condition model that utilizes elements from the validation models to also indicate levels below the NAC when there may actually be a measured impact. Since a measured level above the NAC would generally supersede a lower modeled level, further noise analysis may be required to adequately assess this area.

Table 6-3 presents the TNM validation results for noise study area Section 3.

Table 6-3: Chesapeake Bay to Kent Narrows TNM Model Validation Summary

NSA	Receptor	Measurement Date and Time	Measured Noise Level dB(A)	Modeled Noise Level dB(A)	Difference dB(A)	Validating Model Point? (Yes) or (No)		Notes	Traffic Monitoring Session
3-01-E	M-301	9-20-2023 1300-1345	60	60	0	Y			TMS10
3-01-E	M-302	9-20-2023 1300-1345	62	65	3	Y			TMS10
3-04-E	M-303	9-20-2023 1300-1345	60	61	1	Y			TMS10
3-08-B	M-304	9-20-2023 1215-1235	57	59	2	Y			TMS11
3-09-B	M-305	9-20-2023 1215-1235	61	61	0	Y			TMS11
3-09-B	M-306	9-20-2023 1215-1235	66	68	2	Y			TMS11
3-09-B	M-307	9-20-2023 1215-1235	71	72	1	Y			TMS11
3-09-B	M-308	9-20-2023 1215-1235	58	60	2	Y			TMS11
3-13-B	M-309	9-20-2023 1110-1125	55	57	2	Y			TMS12
3-10-B	M-310	9-20-2023 1110-1125	68	71	3	Y			TMS12
3-13-B	M-311	9-20-2023 1110-1125	71	72	1	Y			TMS12
3-13-B	M-312	9-20-2023 1110-1125	56	57	1	Y			TMS12
3-13-B	M-313	9-20-2023 1110-1125	65	68	3	Y			TMS12
3-15-C	M-314	9-20-2023 1110-1125	55	57	2	Y			TMS12
3-16-B	M-315	9-20-2023 1110-1125	56	59	3	Y			TMS12
3-18-C	M-316	9-20-2023 1110-1125	63	62	-1	Y			TMS12
3-26-E	M-317	9-20-2023 1021-1036	73	72	-1	Y			TMS13
3-28-B	M-318	9-20-2023 1021-1036	59	59	0	Y			TMS13

NSA	Receptor	Measurement Date and Time	Measured Noise Level dB(A)	Modeled Noise Level dB(A)	Difference dB(A)	Validating Model Point? (Yes) or (No)		Notes	Traffic Monitoring Session
3-34-B	M-319	9-20-2023 1021-1036	56	59	3	Y			TMS13
3-36-B	M-320	9-20-2023 1021-1036	62	63	1	Y			TMS13
3-36-B	M-321	9-20-2023 1021-1036	58	60	2	Y			TMS13
3-39-E	M-322	9-19-2023 1402-1417	57	59	2	Y			TMS14
3-41-B	M-323	9-20-2023 1021-1036	61	64	3	Y			TMS13
3-43-B	M-324	9-20-2023 1021-1036	62	63	1	Y			TMS13
3-45-C	M-325	9-20-2023 1110-1125	67	70	3	Y			TMS12
3-50-E	M-326	9-20-2023 1215-1235	73	72	-1	Y			TMS11
3-53-E	M-327	9-20-2023 1215-1235	58	61	3	Y			TMS11
3-54-C	M-328	9-20-2023 1215-1235	68	71	3	Y			TMS11
3-56-B	M-329	9-20-2023 1215-1235	69	71	2	Y			TMS11
3-54-C	M-330	9-20-2023 1215-1235	56	59	3	Y			TMS11
3-58-B	M-331	9-20-2023 1300-1345	59	62	3	Y			TMS10
3-59-B	M-332	9-20-2023 1300-1345	55	55	0	Y			TMS10
3-63-B	M-333	9-20-2023 1300-1345	59	59	0	Y			TMS10
3-68-B	M-334	9-20-2023 1300-1345	53	54	1	Y			TMS10
3-69-C	M-335	9-20-2023 1300-1345	71	73	2	Y			TMS10
Non-Validating Model Points							**0**		

Of the 35 validating receptors, 27 over-predicted, 3 under-predicted, and 5 had zero difference between measured and modeled levels. No receptors were non-validating.

Table 6-4 presents the TNM validation results for noise study area Section 4.

Table 6-4: Kent Narrows to U.S. 50/301 Split TNM Model Validation Summary

NSA	Receptor	Measurement Date and Time	Measured Noise Level dB(A)	Modeled Noise Level dB(A)	Difference dB(A)	Validating Model Point? (Yes) or (No)		Notes	Traffic Monitoring Session
4-01-E	M-401	9-19-2023 1402-1417	65	65	0	Y			TMS14
4-06-B	M-402	9-19-2023 1402-1417	61	63	2	Y			TMS14
4-07-B	M-403	9-19-2023 1402-1417	63	61	-2	Y			TMS14
4-08-B	M-404	9-19-2023 1252-1307	70	69	-1	Y			TMS15
4-12-B	M-405	9-19-2023 1252-1307	64	65	1	Y			TMS15
4-11-B	M-406	9-19-2023 1252-1307	68	67	-1	Y			TMS15
4-14-C	M-407	9-19-2023 1252-1307	64	64	0	Y			TMS15
4-20-B	M-408	9-19-2023 1143-1158	64	62	-2	Y			TMS16
4-21-C	M-409	9-19-2023 1143-1158	59	59	0	Y			TMS16
4-22-B	M-410	9-19-2023 1143-1158	62	60	-2	Y			TMS16
4-24-B	M-411	9-19-2023 1143-1158	74	71	-3	Y			TMS16
4-24-B	M-412	9-19-2023 1143-1158	59	60	1	Y			TMS16
4-26-B	M-413	9-19-2023 1143-1158	61	56	-5		N[1]		TMS16
4-29-B	M-414	9-19-2023 1047-1102	61	60	-1	Y			TMS17
4-29-B	M-415	9-19-2023 1047-1102	57	59	2	Y			TMS17

NSA	Receptor	Measurement Date and Time	Measured Noise Level dB(A)	Modeled Noise Level dB(A)	Difference dB(A)	Validating Model Point? (Yes) or (No)		Notes	Traffic Monitoring Session
4-29-B	M-416	9-19-2023 1047-1102	59	60	1	Y			TMS17
4-36-B	M-417	9-19-2023 1143-1158	67	68	1	Y			TMS16
4-37-B	M-418	9-19-2023 1143-1158	62	63	1	Y			TMS16
4-39-E	M-419	9-19-2023 1143-1158	61	63	2	Y			TMS16
4-38-C	M-420	9-19-2023 1143-1158	59	59	0	Y			TMS16
4-42-B	M-421	9-19-2023 1252-1307	63	66	3	Y			TMS15
4-42-B	M-422	9-19-2023 1252-1307	56	59	3	Y			TMS15
4-43-C	M-423	9-19-2023 1252-1307	67	70	3	Y			TMS15
4-44-B	M-424	9-19-2023 1252-1307	58	60	2	Y			TMS15
4-45-B	M-425	9-19-2023 1252-1307	61	64	3	Y			TMS15
4-46-E	M-426	9-19-2023 1402-1417	68	65	-3	Y			TMS14
Non-Validating Model Points							**1**		

Notes:
1. This receptor is likely receiving reflected noise from the nearby structure, which resulted in a higher measured noise level; consequently, it could not be validated.

Of the 25 validating receptors, 13 over-predicted, 8 under-predicted, and 4 had zero difference between measured and modeled levels. One receptor was non-validating. A determination has been made during the impact analysis (See **Section 7**) of whether the non-validating receptor is critical. Receptors are deemed “critical” when the measured levels approach or exceed the NAC and the modeled levels are substantially lower than the NAC. This could lead to any build condition model that utilizes elements from the validation models to also indicate levels below the NAC when there may actually be a measured impact. Since a measured level above the NAC would generally supersede a lower modeled level, further noise analysis may be required to adequately assess this area.

7 PREDICTED NOISE LEVELS AND IMPACT ANALYSIS

7.1 Introduction

This section documents the future predicted noise levels resulting from the entire project for each Noise Sensitive Area (NSA) and assesses whether the NSA is impacted and warrants a barrier analysis. Impacts were identified based upon the following criteria:

- Projected 2045 design year noise levels approach or exceed the FHWA Noise Abatement Criteria (NAC) for the intended land use. (See **Table 4-2**)
- Projected 2045 design year noise levels that result in a substantial increase (i.e., 10 dB(A) or more) in noise over existing levels for the affected land use/activity categories.

No NSAs will experience a substantial increase as a result of the build alternatives evaluated in the Tier 2 Study. Noise impact analysis will be re-evaluated based on the Selected Alternative.

All noise prediction modeling was performed using FHWA's TNM v2.5 by applying the 2045 loudest-hour traffic data to the TNM noise barrier analysis models. During field noise monitoring, a 50 dB(A) background noise level was observed due to the setting of the noise study area.

7.2 Traffic Data

Noise level predictions are based on loudest-hour traffic conditions, so a determination was made for which traffic condition produces the loudest-hour traffic condition. Both non-summer weekday commuter traffic and weekend summer traffic conditions, which were the only two conditions considered in the travel demand model due to the seasonal nature of travel along the corridor, have been considered when determining the loudest-hour conditions. LOS 'C/D' traffic flow theoretically produces the worst-case noise scenario. The 2011 FHWA *Highway Traffic Noise: Analysis and Abatement Guidance* states that the "worst hourly traffic noise impact" occurs at a time when truck volumes and vehicle speeds are the greatest, typically when traffic is free-flowing and at or near LOS C conditions. According to the Transportation Research Board's *Highway Capacity Manual*, as the volume approaches the LOS C/D border, vehicle speeds are affected by the surrounding traffic, and average speeds begin to drop below free-flow speeds. Vehicle speeds were calculated for each hour of the traffic projections using volume delay functions for the weekday and weekend traffic conditions. The hourly speed, volume data, and roadway typical sections were input into the SHA Noise Abatement Design & Analysis team's "loud hour" workbook tool, which concluded that the weekend summer traffic conditions on Sunday at noon resulted in the loudest-hour for each of the build alternatives.

See **Appendix C** for the loudest-hour volumes, speeds, and truck percentages for the Tier 2 Study.

7.3 Section 1: Severn River to MD 179

7.3.1 Relocation of Existing Noise Barriers

Any existing noise barrier or portion of barrier falling within the LOD for the build alternatives is assumed to be demolished and relocated during construction to accommodate roadway widening and/or SWM facilities, drainage, grading, and construction activities. In cases where an existing barrier is modified or relocated, the new barrier will be constructed with the goal of no net loss of

noise protection for the previously benefited residences. The build alternative noise models were developed under the baseline assumption that all proposed widening of U.S. 50/301 ties back into the existing roadway east of the MD 2/MD 450 interchange, therefore the existing noise barriers west of that interchange will not require relocation with the build alternatives.

7.3.2 Predicted Noise Level Results

Twenty (20) of the twenty-one (21) NSAs within Section 1 were evaluated for impacts along U.S. 50/301 on the Western Shore of the noise study area. Nine (9) NSAs contained impacts resulting from the build alternatives. Detailed predicted noise level results for each modeled receptor are found in **Table E-1**, in **Appendix E**.

Table 7-1 presents the Section 1 NSAs impacted by the build alternatives.

Table 7-1: Impacted NSAs in Section 1

NSA	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
1-01-B	X	X	X	X	X	X
1-04-B	X	X	X	X	X	X
1-05-C	X	X	X	X	X	X
1-06-B	X	X	X	X	X	X
1-10-C			X	X	X	X
1-13-B	X	X	X	X	X	X
1-15-E	X	X	X	X	X	X
1-18-B	X	X	X	X	X	X
1-21-B	X	X	X	X	X	X

7.3.3 Summary of Impact Assessment and Noise Abatement Warrants

While nine (9) NSAs contain impacts, only the following two (2) NSAs currently warrant further consideration of new noise abatement measures due to the construction of any of the build alternatives: 1-05-C and 1-06-B. At NSAs 1-04-B, 1-10-C and 1-18-B there are less than three impacted residences. At NSA 1-13-B the development under construction has areas of frequent human use shielded by berm and proposed building, and at NSA 1-15-E the current development does not contain outdoor facilities for frequent human use. Due to these factors at these five (5) NSAs, as described in Section 8.2, noise abatement is not reasonable and further analysis is not required. In communities with existing barriers at NSAs 1-01-B and 1-21-B, the existing barrier will not require relocation, and the noise analysis has demonstrated that design goals as described in Section 8.5 continue to be met.

7.4 Section 2: MD 179 to the Chesapeake Bay

7.4.1 Predicted Noise Level Results

Fourteen (14) of the seventeen (17) NSAs within Section 2 were evaluated for impacts along U.S. 50/301 on the Western Shore of the noise study area. Seven (7) NSAs contained impacts resulting from the build alternatives. Detailed predicted noise level results for each modeled receptor are found in **Table E-2**, in **Appendix E**.

Table 7-2 presents the Section 2 NSAs impacted by the build alternatives.

Table 7-2: Impacted NSAs in Section 2

NSA	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
2-06-B	X	X	X	X	X	X
2-08-C	X	X	X	X	X	X
2-09-B	X	X	X	X	X	X
2-10-B	X	X	X	X	X	X
2-12-B			X	X	X	X
2-13-B	X	X	X	X	X	X
2-17-B	X	X	X	X	X	X

7.4.2 Summary of Impact Assessment and Noise Abatement Warrants

The following six (6) NSAs currently warrant further consideration of new noise abatement measures due to the construction of the proposed highway improvements: 2-06-B, 2-09-B, 2-10-B, 2-12-B, 2-13-B, and 2-17-B. At NSA 2-08-C only a limited portion of the beach along with a rock jetty used for fishing are impacted. Based on the linear frontage of the usage area and applying a use-time percentage adjustment, the equivalent residences that are impacted at this location is fewer than three. Due to these factors at this NSA, as described in Section 8.2 noise abatement is not reasonable and further analysis is not required.

7.5 Section 3: Chesapeake Bay to Kent Narrows

7.5.1 Predicted Noise Level Results

Fifty-two (52) of the seventy (70) NSAs within Section 3 were evaluated for impacts along U.S. 50/301 on the Eastern Shore of the noise study area. Fourteen (14) NSAs contained impacts resulting from the build alternatives. Detailed predicted noise level results for each modeled receptor are found in **Table E-3**, in **Appendix E**.

Table 7-3 presents the Section 3 NSAs impacted by the build alternatives.

Table 7-3: Impacted NSAs in Section 3

NSA	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
3-02-E						X
3-09-B	X	X	X	X	X	X
3-10-B	X	X	X	X	X	X
3-12-B	X	X	X	X	X	X
3-13-B	X	X	X	X	X	X
3-16-B			X	X	X	X
3-26-E			X	X	X	X
3-46-C	X	X	X	X	X	X
3-51-E	X	X	X	X	X	X
3-55-C	X	X	X	X	X	X
3-57-B	X	X	X	X	X	X
3-58-C	X	X	X	X	X	X
3-59-B					X	X
3-70-C	X	X	X	X	X	X

7.5.2 Summary of Impact Assessment and Noise Abatement Warrants

While Fourteen (14) NSAs contain impacts, only the following four (4) NSAs currently warrant further consideration of new noise abatement measures due to the construction of the build alternatives: 3-09-B, 3-10-B, 3-12-B, and 3-13-B. At NSAs 3-16-B, 3-26-E, 3-46-C, 3-51-E, 3-57-B, and 3-59-B there are less than three impacted residences. In addition, at NSA 3-46-C based on exterior usage and structure components, no interior noise impacts would occur. At NSAs 3-55-C and 3-58-C the outdoor noise sensitive use is not of sufficient frequency and duration. At NSA 3-70-C the usage within the park adjacent to U.S 50/301 includes a trail with no gathering or stationary outdoor recreation areas and at NSA 3-02-E the areas of frequent human use are shielded by the existing building. Due to these factors at these ten (10) NSAs, as described in Section 8.2, noise abatement is not reasonable and further analysis is not required.

7.6 Section 4: Kent Narrows to the U.S. 50/301 Split

7.6.1 Predicted Noise Level Results

Forty (40) of the forty-nine (49) NSAs within Section 4 were evaluated for impacts along U.S. 50/301 on the Eastern Shore of the noise study area. Nine (9) NSAs contained impacts resulting from the build alternatives. Detailed predicted noise level results for each modeled receptor are found in **Table E-4**, in **Appendix E**.

Table 7-4 presents the Section 4 NSAs impacted by the build alternatives.

Table 7-4: Impacted NSAs in Section 4

NSA	Alt. B	Alt. C	Alt. D	Alt. E	Alt. F	Alt. G
4-08-B			X	X	X	X
4-14-C	X	X	X	X	X	X
4-24-B	X	X	X	X	X	X
4-29-B	X	X	X	X	X	X
4-36-B			X	X	X	X
4-37-B					X	X
4-42-B			X	X	X	X
4-43-C	X	X	X	X	X	X
4-45-B	X	X	X	X	X	X

7.6.2 Summary of Impact Assessment and Noise Abatement Warrants

While Nine (9) NSAs contain impacts, only the following three (3) NSAs currently warrant further consideration of new noise abatement measures due to the construction of the build alternatives: 4-36-B, 4-37-B, and 4-42-B. At NSAs 4-08-B, 4-14-C, 4-24-B, 4-29-B, and 4-45-B there are less than three impacted residences. At NSA 4-43-C the usage is transient in nature. At NSA 4-45-B the impacted area is located where there are no outdoor activities, and the residential properties at NSA 4-45-B are set further back away from the roadway. Due to these factors at these six (6) NSAs, as described in Section 8.2 noise abatement is not reasonable and further analysis is not required.

8 BARRIER ANALYSIS

8.1 Introduction

Federal regulation (23 CFR Part 772) and the SHA *Highway Noise Abatement Planning and Engineering Guidelines* (2020) require that noise abatement be investigated at all NSAs where the build traffic noise levels approach or exceed the FHWA NAC for the defined land use category, or where there are substantial increases (10 dB(A) or more) over peak ambient noise levels. Where noise abatement was warranted for consideration, additional criteria were examined to determine if the abatement is feasible and reasonable.

This section discusses the SHA Highway Noise Policy barrier feasibility and reasonableness criteria, defines key noise barrier design terms, and outlines the noise barrier conceptual design process and performance objectives. It also documents the results for each of the barrier systems[2] that were studied. When applicable, it details the existing barrier assessment procedure and documents the evaluation of each existing barrier, studying barrier extensions or modifications, and including any recommendations as necessary. This analysis determines only the required length and acoustic height of the abatement to meet criteria; these parameters can then be applied to any berm or berm/barrier combination using a projection of the same barrier profile. Additional forms of abatement are typically evaluated during final design.

Planting trees and shrubs provides visual screening, privacy, or aesthetic treatment, but is not effective as traffic noise abatement. In some cases, the roadway grade can be adjusted to provide some shielding, but since the build alternatives in this study involve road widening, that option is limited. Landscaping opportunities will be explored during final design for any build alternative selected.

8.2 Feasibility and Reasonableness Criteria

Several factors for evaluating and determining the feasibility and reasonableness of Noise Abatement as defined in the SHA *Highway Noise Abatement Planning and Engineering Guidelines* (2020) are listed below.

8.2.1 Feasibility

The assessment of noise abatement feasibility, in general, focuses on whether it is physically possible to build an abatement measure (i.e. noise barrier) that achieves a minimally acceptable level of noise reduction. Barrier feasibility considers three primary factors: acoustics, safety & access, and site constraints.

Acoustic Considerations

- A modeled reduction of projected noise levels must be at least 5 dB(A) at 70 percent of impacted sites to be considered feasible.
- Implementation of a noise barrier may not be feasible where external noise sources exist (such as near aircraft flight paths or a major rail freight line), if those sources significantly limit the effectiveness of the proposed abatement measure.

[2] A barrier system refers to a single barrier or group of barriers analyzed together to protect one or more NSAs.

Safety and Access Considerations

- Noise abatement may not be feasible in areas where driveway access needs to be maintained, where local street access exists, or if pedestrian access would be restricted.
- Noise abatement measures that would create adverse safety conditions, such as limiting sight distance or reduction of a vehicle recovery area, will not be considered feasible.

Site Constraints

Site constraints are circumstances or conditions associated with a potential noise barrier site that would require additional engineering solutions or expenditures in order to support the construction of the barrier. This assessment determines whether it is physically possible to construct an abatement measure in the necessary location. Possible site constraints include:

- Topography
- Drainage (i.e., the barrier reduces or eliminates the effectiveness of a drainage system)
- Utilities (i.e., the barrier displaces major utilities)
- Maintenance (i.e., the barrier allows for necessary maintenance and inspection operations)

If a site constraint is present, avoidance and minimization efforts are explored to allow for the placement of the barrier. If it is determined that the barrier construction will require excessive atypical extra costs, an extra-cost assessment (ECA) must be completed.

8.2.2 Reasonableness

The assessment of noise abatement reasonableness, in general, focuses on whether it is practical to build an abatement measure. Barrier reasonableness considers three primary factors: viewpoints of benefited property owners and residents; noise abatement design goal; and cost effectiveness. All three reasonableness factors must collectively be achieved for a barrier to be considered reasonable.

Viewpoints of Benefited Property Owners and Residents

This factor is often unknown during early analysis stages, where it is generally assumed that there is no significant opposition. If opposing viewpoints are received from any impacted and benefited residents within an NSA, a voting process will be administered. However, a voting process will not be administered based solely on the request of a non-impacted and benefited resident. The voting process requires that more than 50 percent of benefited residents be opposed to the noise abatement measure for it to be deemed not reasonable.

Benefited Residences and Design Goal

The total number of benefited and equivalent benefited residences is used in the determination of the reasonableness of an abatement measure such as a barrier. This includes the sum of the impacted and non-impacted residences that receive a 5 dB(A) or greater noise reduction. This sum also includes any impacted and non-impacted benefited equivalent residences (ER), which have been calculated for outdoor noise sensitive use areas of sufficient duration, frequency, or permanence based on the subject Land Use Activity Category and intensity of use.

Common use areas identified within a Category B area that would be typically available for use by residents of the entire multifamily property/facility/complex would be weighted based upon the total potential users and with consideration given, as appropriate, to the overall capacity and extent of use of the subject common area. The equivalent residences for category C, D, and E land uses are based on either the total linear frontage of property along the subject highway where 125 feet of linear frontage is equivalent to one (1) residence, or the capacity of the use, as detailed in Appendix D of the SHA *Highway Noise Abatement Planning and Engineering Guidelines* (2020).

At least three (3) individual or 50 percent (whichever is greater) of impacted residences must receive at least a 7 dB(A) reduction from the proposed abatement in order for the abatement to be considered reasonable. This is the MDTA Noise Reduction Design Goal. While this goal is deemed the minimum acceptable, the MDTA also considers a desirable goal of 10 dB(A) that will be pursued where practical, in the spirit of the explicit FHWA guidance to provide substantial noise reduction in the consideration of noise abatement and to maintain consistency with past SHA design practice.

Cost Effectiveness

Noise barriers that are determined to be feasible are also evaluated for reasonable cost. SHA considers the quantity (square footage) of noise barrier material as a measure of reasonableness as opposed to a cost-based metric since material costs fluctuate over time and there are regional variations in prices. Specifically, reasonableness is assessed in terms of the total number of benefited residences. The total square-footage of the barrier system is divided by the total number of benefited residences, including any equivalent residences, to yield a square-footage per residence (SF-p-r). Evaluating the SF-p-r eliminates the issue of variable costs, while maintaining a cap on barrier quantity.

SHA sets the appropriate barrier quantity caps (evaluation threshold) based on the degree and extent that the subject Type I highway project changes the existing noise environment. The threshold can increase from a baseline allowance of 700 SF-p-r up to a maximum possible allowance of 2,700 SF-p-r as shown in **Table 8-1**.

Table 8-1: Cost Reasonableness Evaluation Thresholds

Baseline – applies to **ALL** Type I Projects	**NONE** of the conditions is present	700 SF-p-r
Condition • The project increases through capacity.	Only **ONE** of the conditions is present	1,700 SF-p-r
• The project increases noise levels by a minimum of 3 dB(A) from existing to future build conditions. • The project results in noise levels at or above 75 dB(A)	**TWO OR MORE** of the conditions are present	2,700 SF-p-r

The evaluation threshold is independently determined for each proposed barrier system based upon the project characteristics affecting the noise environment. If a studied barrier system

protects areas that fall under different conditions, the analysis uses the higher evaluation threshold in the assessment of barrier reasonableness. The maximum allowance of 2700 SF-p.r also can apply when improvement details are generally vague or unknown for a project in the early planning stages. The development of a finalized project scope of work may result in an analysis revision.

FHWA requires that state agencies make every feasible and reasonable effort to provide substantial noise reduction when highway traffic noise impacts occur. An atypical extra cost assessment (ECA) is triggered when it is determined that there are circumstances or conditions associated with a potential noise barrier site that would require the expenditure of substantial additional funds, which would be considered beyond the scope and extent of that associated with a "typical" noise barrier installation. Examples of typical noise barrier installation costs include:

- Post, panel and foundation (i.e., materials costs)
- Grading, excavation, fill material
- Maintenance of Traffic
- Reseeding, landscaping
- Right-of-way for construction and maintenance

8.3 Noise Barrier Design Terms

Background Noise

A noise barrier is only designed to reduce highway traffic noise levels. Each noise study area is also subjected to background noise. Background noise comprises all sources of noise in the environment such as rustling leaves, children playing, local traffic, dogs barking, aircraft flyovers, lawn mowing, etc. For the Tier 2 Study, a 50 dB(A) background noise level was selected based on relatively consistent noise level observations within the study area made during the noise measurement phase.

Background noise can impose a limit on the perceived effectiveness of a noise barrier, especially for receptors more distant from the highway where overall noise levels from the project are lower. Thus, TNM Output undergoes a background noise level adjustment so that a barrier's effectiveness is not unrealistically overstated.

Critical Sensitive Receptors

Generally, only critical sensitive (CS) receptors are used to govern barrier design. CS receptors are typically defined as first row, ground level sites (5 feet above ground, as per standard industry practice), where worst case noise impacts are found. Noise reduction at second row receptors or other locations not directly adjacent to the barrier is considered a secondary benefit. Elevated receptors to represent multi-story balconies are also used to govern the barrier design, if they are impacted or as appropriate.

Limit Receptors

Limit receptors may be used in conjunction with CS receptors to more fully develop a barrier design. These receptors may have noise levels just below the NAC or may lie just outside of a particular property or NSA. Their use helps ensure adequate protection is provided to the full extent of a targeted area when CS receptors alone could leave gaps in the coverage.

Performance Objectives

The performance objectives established by SHA are used to guide the noise barrier conceptual design process. These objectives, which maintain consistency with past SHA design practice, are primarily focused on impacted properties with the aim to comprehensively eliminate all impacts. Accordingly, objectives consider multiple factors simultaneously, rather than being based on a single criterion. These objectives are:

- Blocking line-of-sight (l-o-s) – Acoustically, when a barrier blocks the l-o-s between a CS or limit receptor and the stack height of a Heavy Truck, typically 12-feet above pavement level, the noise reduction achieved will usually be around 5 dB(A). Psychologically, residents are more apt to be dissatisfied with a noise abatement measure if traffic can be seen. Regardless of the actual abatement provided, the reduction will be perceived as less effective. Because of its vital importance, establishing the minimum l-o-s heights is foundational to all noise barrier designs.
- Eliminating impacts – Achieving the design goal noise reduction of 7 dB(A), or desired goal of 10 dB(A) at impacted receptors may not eliminate all impacts where the predicted noise levels are higher than 72 dB(A). Consequently, a greater noise reduction between 8 and 15 dB(A)[3] shall be pursued for higher noise levels. The objective for these receptors with higher levels is to reach a with-barrier noise level of 64 dB(A) or less, which should be perceptibly distinct from the Category B NAC.
- Minimizing "hot-spots" – In order to prevent "hot-spots", the with-barrier uniformity range for neighboring properties within an NSA, ideally, should be 3 dB(A) or less. This means that one property's with-barrier levels should not be perceptibly different from an adjacent property. Establishing a maximum with-barrier level, such as 64 dB(A), for the CS and limit receptors usually is sufficient in accomplishing this objective.
- Considering profile aesthetics – SHA's Level-Top barrier analysis methodology allows for the acoustic profile to be modeled as the barrier Top of Wall with level elevation changes (steps) per panel along the alignment. This means that aesthetic and engineering considerations can be incorporated into the noise barrier design. If the minimum l-o-s heights indicate a 3-foot elevation change between panels, then this difference would need to be reduced to at least 1.5 feet (by raising the height of the lower panel) to meet current barrier design standards. Other aesthetic considerations could warrant even smaller steps.

The objectives are interdependent; the acoustic profile is established by blocking l-o-s with aesthetic step considerations while attempting to eliminate impacts and minimize "hot-spots".

In seeking to accomplish these performance objectives, the noise analysis can better incorporate "what does it take" to achieve an optimum barrier design, as well as identify where objectives cannot be reasonably met. This information helps direct any subsequent profile modifications, so that deviations from meeting the objectives can be minimized or at least documented[4]. This "top-down" approach could continue until a reasonable barrier is found or until only the bare minimum policy criteria are met, whichever occurs first. The policy criteria define the minimally acceptable

[3] TNM Output is capped at 15 dB(A) as part of the background noise level adjustment process, because it is nearly impossible to realize higher noise reduction when the barrier is constructed.

[4] Engineering judgment is used, or an agency consensus is sought, when significant objectives cannot be met or would need to be relaxed to achieve reasonable abatement.

design, which should only be pursued if it is the one remaining solution that would be feasible and reasonable[5].

8.4 Noise Barrier Concept Design Process

The noise barrier concept design process typically includes the following steps:

1. Identifying issues (such as access) that would make a barrier system not feasible.
2. Establishing the noise barrier alignment(s) for study while avoiding or minimizing site constraints where possible.
3. Modeling receptors with enough density to understand the extent of the impacts within an NSA and the benefits generated by the studied barrier system.
4. Checking l-o-s and setting appropriate noise reduction goals for CS and limit receptors.
5. Testing various Top of Wall (ToW) profiles to see how well performance objectives can be achieved after background noise level adjustments are applied. All noise results presented in this section have been adjusted using a 50 dB(A) background noise level.
6. Preparing the barrier analysis results graphically and in tabular form to determine if the noise barrier design is feasible and reasonable.

The noise barrier design results for each barrier system studied are presented below. The NSAs warranting a barrier analysis and the studied barriers are depicted in the exhibits of **Appendix F**.

8.5 Noise Barrier Design Goals

The acoustic profiles for the noise barriers were analyzed using Alternatives F and G alignments. Since the profile is similar for all the build alternative alignments, the same acoustic profile will yield similar results for each build alternative. Upon selection of a Preferred Alternative, a detailed reanalysis of each applicable barrier system will be conducted. The barrier design is governed primarily by the goal of 7 dB(A) noise reduction at the CS receptors. CS receptors are typically defined as first-row, ground level sites, where worst-case noise impacts are found. Noise attenuation at second-row receptors, elevated receptors, or other locations not directly adjacent to the proposed barrier are considered a secondary benefit. The receptors shown may represent more than one residence, therefore the total benefits may be larger than the number of representative receptors in the table.

8.6 Section 1: Severn River to MD 179

8.6.1 Barrier System WEST-1: NSAs 1-05-C & 1-06-B

This barrier system is comprised of one barrier and provides abatement to NSAs 1-05-C and 1-06-B. The cost-reasonableness evaluation threshold for this barrier system is 2,700 SF-p-r. The majority of the impacted residences are predicted to receive at least a 7 dB(A) noise reduction and l-o-s is effectively blocked.

[5] A “bottom-up” approach that started with a “minimum” barrier would fail to consider much of these performance objectives and could result in design decisions that cannot be readily defended. For example: Why is only 50 percent of the impacted NSA protected and how was that 50 percent prioritized?

The predicted barrier insertion losses, noise levels and benefits are shown in **Table 8-2**. The barrier location and benefit locations are shown on Map No. 1 for Alternatives F & G in **Appendix F**.

Due to the resulting SF-p-r, a noise barrier is considered feasible but is not reasonable for NSAs 1-05-C and 1-06-B.

Table 8-2: Barrier Performance, NSAs 1-05-C & 1-06-B

Receptor Number[1,2]	2045 Build Alt F&G Predicted Noise Level	2045 Build Barrier Alt F&G Noise Reduction	2045 Build Barrier Alt F&G Predicted Noise Level
R-115a	71	65	6
M-111	49	49	0
R-114	51	51	0
R-115	58	56	2
M-112	66	62	4
M-113	70	61	9
R-116	63	57	6
M-114	67	62	5
R-117	58	56	2
R-118	53	52	0
R-119	52	52	0
R-120	52	52	0
M-115	59	59	0

LEGEND

Bold	**Critical Sensitive Receptors**
	Effective Noise Reduction[3] at Critical Sensitive Receptor

Benefits[4]	Alt F & G
Number of Impacted, Benefited Residences	3
Number of Non-Impacted, Benefited	2
Total Number of Benefited Locations	5
SF per Benefited Residence	3,231

1. A Receptor Number beginning with "M" represents a measured and modeled location and a Receptor Number beginning with "R" represents a modeled receptor only.
2. A receptor may represent more than 1 equivalent residence.
3. Barrier Effectiveness is based on minimum Noise Reduction of 7 to 10 dB(A).

Table 8-3 provides a breakdown of the noise barrier quantities by barrier type.

Table 8-3: NSAs 1-05-C & 1-06-B Noise Barrier Design Summary

NSAs 1-05-C & 1-06-B - Alts F & G	Length (ft.)	Ave. Height (ft.)	Area (ft^2)
Total barrier	1,424	11.35	16,156

8.7 Section 2: MD 179 to the Chesapeake Bay

8.7.1 Barrier System WEST-2: NSA 2-06-B

This barrier system is comprised of one barrier and provides abatement to NSA 2-06-B. The cost-reasonableness evaluation threshold for this barrier system is 2,700 SF-p-r. The majority of the impacted residences are predicted to receive at least a 7 dB(A) noise reduction and l-o-s is effectively blocked.

The predicted barrier insertion losses, noise levels and benefits are shown in **Table 8-4**. The barrier location and benefit locations are shown on Map No. 1 for Alternatives F & G in **Appendix F**.

Due to the resulting SF-p-r, a noise barrier is considered feasible but is not reasonable for NSA 2-06-B.

Table 8-4: Barrier Performance, NSA 2-06-B

Receptor Number[1,2]	2045 Build Alt F&G Predicted Noise Level	2045 Build Barrier Alt F&G Noise Reduction	2045 Build Barrier Alt F&G Predicted Noise Level
M-206	76	67	9
M-207	65	59	6
R-237	60	57	3
M-208	68	61	7
R-238	63	57	6
M-209	66	59	7
R-239	58	54	4
R-240	60	57	3
R-241	60	58	2

LEGEND

Bold	**Critical Sensitive Receptors**
	Effective Noise Reduction[3] at Critical Sensitive Receptor

Benefits[4]	Alt F & G
Number of Impacted, Benefited Residences	5
Number of Non-Impacted, Benefited	2
Total Number of Benefited Locations	7
SF per Benefited Residence	4,440

1. A Receptor Number beginning with "M" represents a measured and modeled location and a Receptor Number beginning with "R" represents a modeled receptor only.
2. A receptor may represent more than 1 equivalent residence.
3. Barrier Effectiveness is based on minimum Noise Reduction of 7 to 10 dB(A).

Table 8-3 provides a breakdown of the noise barrier quantities by barrier type.
provides a breakdown of the noise barrier quantities by barrier type.

Table 8-5: NSA 2-06-B Noise Barrier Design Summary

NSAs 2-06-B - Alts F & G	Length (ft.)	Ave. Height (ft.)	Area (ft^2)
Total barrier	2,736	11.36	31,083

8.7.2 Barrier System WEST-3: NSAs 2-09-B & 2-10-B

This barrier system is comprised of one barrier and provides abatement to NSAs 2-09-B and 2-10-B. The cost-reasonableness evaluation threshold for this barrier system is 2,700 SF-p-r. The majority of the impacted residences are predicted to receive at least a 7 dB(A) noise reduction and l-o-s is effectively blocked.

The predicted barrier insertion losses, noise levels and benefits are shown in **Table 8-6**. The barrier location and benefit locations are shown on Map No. 1 for Alternatives F & G in **Appendix F**.

Due to the resulting SF-p-r, a noise barrier is considered feasible but is not reasonable for NSAs 2-09-B and 2-10-B.

Table 8-6: Barrier Performance, NSAs 2-09-B & 2-10-B

Receptor Number[1,2]	2045 Build Alt F&G Predicted Noise Level	2045 Build Barrier Alt F&G Noise Reduction	2045 Build Barrier Alt F&G Predicted Noise Level
R-250	61	60	1
M-212	65	63	2
R-251	72	62	10
R-252	72	63	9
M-213	78	68	10
M-214	61	55	6
R-253	61	55	6
M-215	68	60	8
M-216	57	54	3
M-217	59	55	4
R-254	58	55	3
R-255	54	54	0
R-256	55	54	1
R-257	55	54	1
R-258	55	54	1
LEGEND			
Bold	**Critical Sensitive Receptors**		
	Effective Noise Reduction[3] at Critical Sensitive Receptor		
Benefits[4]		**Alt F & G**	

Receptor Number[1,2]	2045 Build Alt F&G Predicted Noise Level	2045 Build Barrier Alt F&G Noise Reduction	2045 Build Barrier Alt F&G Predicted Noise Level
Number of Impacted, Benefited Residences		6	
Number of Non-Impacted, Benefited		3	
Total Number of Benefited Locations		9	
SF per Benefited Residence		5,042	

1. A Receptor Number beginning with "M" represents a measured and modeled location and a Receptor Number beginning with "R" represents a modeled receptor only.
2. A receptor may represent more than 1 equivalent residence.
3. Barrier Effectiveness is based on minimum Noise Reduction of 7 to 10 dB(A).

Table 8-7 provides a breakdown of the noise barrier quantities by barrier type.

Table 8-7: NSAs 2-09-B & 2-10-B Noise Barrier Design Summary

NSAs 1-05-C & 1-06-B - Alts F & G	Length (ft.)	Ave. Height (ft.)	Area (ft^2)
Total barrier	3,360	13.51	45,381

8.7.3 Barrier System WEST-4: NSAs 2-12-B & 2-13-B

This barrier system is comprised of one barrier and provides abatement to NSAs 2-12-B and 2-13-B. The cost-reasonableness evaluation threshold for this barrier system is 2,700 SF-p-r. The majority of the impacted residences are predicted to receive at least a 7 dB(A) noise reduction and l-o-s is effectively blocked.

The predicted barrier insertion losses, noise levels and benefits are shown in **Table 8-8**. The barrier location and benefit locations are shown on Map No. 1 for Alternatives F & G in **Appendix F**.

A noise barrier is considered feasible and is considered reasonable for NSAs 2-12-B and 2-13-B.

Table 8-8: Barrier Performance, NSAs 2-12-B & 2-13-B

Receptor Number[1,2]	2045 Build Alt F&G Predicted Noise Level	2045 Build Barrier Alt F&G Noise Reduction	2045 Build Barrier Alt F&G Predicted Noise Level
M-219	68	60	8
R-264	70	61	9
R-265	64	58	6
R-266	56	54	2
R-267	66	59	7
M-220	69	59	10
R-268	66	60	6
M-221	67	61	6
R-269	69	60	9
M-223	66	58	8
R-270	59	55	4
R-271	67	59	8
M-224	69	60	9
R-272	67	59	8
M-225	69	63	6
R-273	64	59	5
M-226	61	56	5
R-274	63	57	6
R-275	61	56	5
R-276	60	56	4
M-222	62	58	4
R-277	61	58	3
R-278	58	55	3
R-279	59	55	4
R-280	63	58	5
R-281	60	56	4

LEGEND

Bold	**Critical Sensitive Receptors**
	Effective Noise Reduction[3] at Critical Sensitive Receptor

Benefits	Alt F & G
Number of Impacted, Benefited Residences	25
Number of Non-Impacted, Benefited	13
Total Number of Benefited Locations	38
SF per Benefited Residence	1,246

1. A Receptor Number beginning with "M" represents a measured and modeled location and a Receptor Number beginning with "R" represents a modeled receptor only.

2. A receptor may represent more than 1 equivalent residence.

3. Barrier Effectiveness is based on minimum Noise Reduction of 7 to 10 dB(A).

Table 8-9 provides a breakdown of the noise barrier quantities by barrier type.

Table 8-9: NSAs 2-12-B & 2-13-B Noise Barrier Design Summary

NSAs 2-12-B & 2-13-B - Alts F & G	Length (ft.)	Ave. Height (ft.)	Area (ft^2)
Total barrier	3,312	14.30	47,351

8.7.4 Barrier System WEST-5: NSA 2-17-B

This barrier system is comprised of one barrier and provides abatement to NSA 2-17-B. The cost-reasonableness evaluation threshold for this barrier system is 2,700 SF-p-r. The majority of the impacted residences are predicted to receive at least a 7 dB(A) noise reduction and l-o-s is effectively blocked.

The predicted barrier insertion losses, noise levels and benefits are shown in **Table 8-10**. The barrier location and benefit locations are shown on Map No. 1 for Alternatives F & G in **Appendix F**.

A noise barrier is considered feasible and is considered reasonable for NSA 2-17-B.

Table 8-10: Barrier Performance, NSA 2-17-B

Receptor Number[1,2]	2045 Build Alt F&G Predicted Noise Level	2045 Build Barrier Alt F&G Noise Reduction	2045 Build Barrier Alt F&G Predicted Noise Level
M-228	73	62	11
R-287	72	65	7
M-229	65	60	5
R-288	55	55	0
R-289	63	60	3
R-290	50	50	0
R-291	63	59	4
R-292	43	43	0
R-293	46	46	0

LEGEND

Bold	**Critical Sensitive Receptors**
	Effective Noise Reduction[3] at Critical Sensitive Receptor

Benefits	Alt F & G
Number of Impacted, Benefited Residences	20
Number of Non-Impacted, Benefited	10
Total Number of Benefited Locations	30
SF per Benefited Residence	636

1. A Receptor Number beginning with "M" represents a measured and modeled location and a Receptor Number beginning with "R" represents a modeled receptor only.
2. A receptor may represent more than 1 equivalent residence.
3. Barrier Effectiveness is based on minimum Noise Reduction of 7 to 10 dB(A).

Table 8-11 provides a breakdown of the noise barrier quantities by barrier type.

Table 8-11: NSA 2-17-B Noise Barrier Design Summary

NSA 2-17-B - Alts F & G	Length (ft.)	Ave. Height (ft.)	Area (ft^2)
Total barrier	1,216	15.68	19,072

8.8 Section 3: Chesapeake Bay to Kent Narrows

8.8.1 Barrier System EAST-1: NSAs 3-09-B, 3-10-B, 3-12-B, 3-13-B

This barrier system is comprised of one barrier and provides abatement to NSAs 3-09-B, 3-10-B, 3-12-B, and 3-13-B. The cost-reasonableness evaluation threshold for this barrier system is 2,700 SF-p-r. The majority of the impacted residences are predicted to receive at least a 7 dB(A) noise reduction and l-o-s is effectively blocked.

The barrier predicted insertion losses, noise levels and benefits are shown in **Table 8-12.** The barrier location and benefit locations are shown on Map No. 1 for Alternatives F & G in **Appendix F**.

A noise barrier is considered feasible and is considered reasonable for NSAs 3-09-B, 3-10-B, 3-12-B, and 3-13-B.

Table 8-12: Barrier Performance, NSAs 3-09-B, 3-10-B, 3-12-B, 3-13-B

Receptor Number[1,2]	2045 Build Alt F&G Predicted Noise Level	2045 Build Barrier Alt F&G Noise Reduction	2045 Build Barrier Alt F&G Predicted Noise Level
M-305	66	60	6
M-306	71	61	10
M-307	72	63	9
M-308	63	58	5
R-307	63	58	5
R-308	65	58	7
R-309	66	58	8
R-310	71	62	9
R-311	74	63	11
R-312	69	60	9
R-313	72	63	9
R-314	72	63	9
R-315	72	63	9
R-316	71	63	8
R-317	72	63	9
R-318	71	63	8
R-319	72	63	9
R-320	71	62	9
R-321	62	57	5
R-322	64	58	6
R-323	64	58	6

Receptor Number[1,2]	2045 Build Alt F&G Predicted Noise Level	2045 Build Barrier Alt F&G Noise Reduction	2045 Build Barrier Alt F&G Predicted Noise Level
R-324	64	59	5
R-325	64	58	6
R-326	63	58	5
R-327	63	58	5
R-328	62	58	4
R-329	62	58	4
R-330	62	58	4
R-331	62	58	4
M-310	71	61	10
R-332	71	62	9
R-333	70	61	9
R-334	70	61	9
R-335	61	56	5
R-336	59	55	4
R-337	61	56	5
R-338	70	61	9
R-339	69	61	8
R-340	53	53	0
R-341	54	54	0
M-309	58	56	2
M-311	72	63	9
M-312	59	57	2
M-313	69	61	8
R-342	71	62	9
R-343	71	61	10
R-344	71	61	10
R-345	71	62	9
R-346	71	62	9
R-347	71	62	9
R-348	71	62	9
R-349	71	62	9
R-350	72	62	10
R-351	71	63	8
R-352	67	63	4
R-353	65	58	7
R-354	62	58	4
R-355	60	57	3
R-356	58	56	2
R-357	58	55	3
R-358	59	56	3
R-359	58	56	2
R-360	58	56	2

Receptor Number[1,2]	2045 Build Alt F&G Predicted Noise Level	2045 Build Barrier Alt F&G Noise Reduction	2045 Build Barrier Alt F&G Predicted Noise Level
R-361	59	56	3
R-362	59	56	3
R-363	60	57	3
R-364	60	56	4
R-365	60	56	4

LEGEND

Bold	**Critical Sensitive Receptors**
	Effective Noise Reduction[3] at Critical Sensitive Receptor

Benefits	Alt F & G
Number of Impacted, Benefited Residences	33
Number of Non-Impacted, Benefited	13
Total Number of Benefited Locations	46
SF per Benefited Residence	894

1. A Receptor Number beginning with "M" represents a measured and modeled location and a Receptor Number beginning with "R" represents a modeled receptor only.
2. A receptor may represent more than 1 equivalent residence.
3. Barrier Effectiveness is based on minimum Noise Reduction of 7 to 10 dB(A).

Table 8-13 provides a breakdown of the noise barrier quantities by barrier type.

Table 8-13: NSAs 3-09-B, 3-10-B, 3-12-B, 3-13-B Noise Barrier Design Summary

NSAs 3-09-B, 3-10-B, 3-12-B, 3-13-B - Alts F & G	Length (ft.)	Ave. Height (ft.)	Area (ft^2)
Total barrier	3,390	12.14	41,145

8.9 Section 4: Kent Narrows to U.S. 50/301 Split

8.9.1 Barrier System EAST-2: NSAs 4-36-B & 4-37-B

This barrier system is comprised of one barrier and provides abatement to NSAs 4-36-B & 4-37-B. The cost-reasonableness evaluation threshold for this barrier system is 2,700 SF-p-r. The majority of the impacted residences are predicted to receive at least a 7 dB(A) noise reduction and l-o-s is effectively blocked.

The predicted barrier insertion losses, noise levels and benefits are shown in **Table 8-14**. The barrier location and benefit locations are shown on Map No. 1 for Alternatives F & G in **Appendix F**.

Due to the resulting SF-p-r, a noise barrier is considered feasible but is not reasonable for NSAs 4-36-B & 4-37-B.

Table 8-14: Barrier Performance, NSAs 4-36-B & 4-37-B

Receptor Number[1,2]	2045 Build Alt F&G Predicted Noise Level	2045 Build Barrier Alt F&G Noise Reduction	2045 Build Barrier Alt F&G Predicted Noise Level
M-417	72	60	12
R-463	72	60	12
R-464	72	60	12
R-465	73	61	12
R-466	74	62	12
R-467	73	62	11
R-468	73	65	8
R-469	64	60	4
M-418	66	58	8
R-470	63	58	5
R-471	64	58	6
R-472	66	58	8
R-473	62	58	4
R-474	62	58	4

LEGEND

Bold	**Critical Sensitive Receptors**
	Effective Noise Reduction[3] at Critical Sensitive Receptor

Benefits	Alt F & G
Number of Impacted, Benefited Residences	6
Number of Non-Impacted, Benefited	1
Total Number of Benefited Locations	7
SF per Benefited Residence	3,757

1. A Receptor Number beginning with "M" represents a measured and modeled location and a Receptor Number beginning with "R" represents a modeled receptor only.
2. A receptor may represent more than 1 equivalent residence.
3. Barrier Effectiveness is based on minimum Noise Reduction of 7 to 10 dB(A).

Table 8-3 provides a breakdown of the noise barrier quantities by barrier type.

Table 8-15 provides a breakdown of the noise barrier quantities by barrier type.

Table 8-15: NSAs 4-36-B & 4-37-B Noise Barrier Design Summary

NSA 4-36-B & 4-37-B - Alts F & G	Length (ft.)	Ave. Height (ft.)	Area (ft^2)
Total barrier	1,824	14.42	26,301

8.9.2 Barrier System EAST-3: NSA 4-42-B

This barrier system is comprised of one barrier and provides abatement to NSA 4-42-B. The cost-reasonableness evaluation threshold for this barrier system is 2,700 SF-p-r. The majority of the

impacted residences are predicted to receive at least a 7 dB(A) noise reduction and l-o-s is effectively blocked.

The predicted barrier insertion losses, noise levels and benefits are shown in **Table 8-16.** The barrier location and benefit locations are shown on Map No. 1 for Alternatives F & G in **Appendix F**.

A noise barrier is considered feasible but is not reasonable for NSA 4-42-B.

Table 8-16: Barrier Performance, NSA 4-42-B

Receptor Number[1,2]	2045 Build Alt F&G Predicted Noise Level	2045 Build Barrier Alt F&G Noise Reduction	2045 Build Barrier Alt F&G Predicted Noise Level
M-421	67	59	8
M-422	61	57	4
R-476	59	55	4
R-477	59	55	4
R-478	60	56	4
R-479	65	57	8
R-480	66	59	7
R-482	67	59	8
R-483	66	59	7
R-484	66	59	7
R-485	66	59	7
R-486	65	58	7
R-487	66	60	6
R-488	66	60	6
R-489	65	60	5
R-490	64	59	5
R-491	60	56	4
R-492	61	57	4
R-493	61	57	4
R-494	60	56	4
R-495	60	56	4

LEGEND

Bold	**Critical Sensitive Receptors**
	Effective Noise Reduction[3] at Critical Sensitive Receptor

Benefits	Alt F & G
Number of Impacted, Benefited Residences	6
Number of Non-Impacted, Benefited	1
Total Number of Benefited Locations	7
SF per Benefited Residence	3,420

1. A Receptor Number beginning with "M" represents a measured and modeled location and a Receptor Number beginning with "R" represents a modeled receptor only.
2. A receptor may represent more than 1 equivalent residence.
3. Barrier Effectiveness is based on minimum Noise Reduction of 7 to 10 dB(A).

Table 8-17 provides a breakdown of the noise barrier quantities by barrier type.

Table 8-17: NSA 4-42-B Noise Barrier Design Summary

NSA 4-42-B - Alts F & G	Length (ft.)	Ave. Height (ft.)	Area (ft^2)
Total barrier	1,696	14.12	23,940

8.10 Coordination with Local Officials

Local land use and zoning processes can prevent noise-sensitive land uses from being located adjacent to state highways and high traffic noise areas. The control of highway noise, if it is to be effective and comprehensive, must be done in partnership between the MDTA and local land use planning officials. The MDTA will furnish the results of all highway traffic noise analyses to local government officials and will encourage local communities and developers to practice noise compatible development. Local coordination will specifically be accomplished through the distribution of highway project environmental documents and noise technical reports.

For undeveloped land (Category G) that is not permitted for development by the date of public knowledge, FHWA regulations require the assessment and reporting of future noise levels. The results must be documented in the noise analysis report. This requires the determination of the distance – measured from the proposed edge of the traveled way – to the NAC for all exterior land use categories. Any noise abatement for such lands shall not be eligible for future Federal-aid participation for Type II projects. These results have been provided in **Table 8-18.** The results have been presented as the typical distances, based on land that is roughly the same elevation as the adjacent roadway that have been identified along U.S. 50/301 on the Western and Eastern Shore, site specific distances need to be determined if any undeveloped lands become permitted for development.

Table 8-18: Land Use Activity Category G Areas, Typical NAC Distances

Land Use Activity Category G Area	Distance from Nearest Edge of Shoulder to the MDOT SHA Approach NAC 71 dB(A) [Category E] (feet)	Distance from Nearest Edge of Shoulder to the MDOT SHA Approach NAC 66 dB(A) [Category B & C] (feet)	Notes
Western Shore	110	200	[1]
Eastern Shore	125	300	[1]
1. Distances shown are based on typical conditions along each roadway.			

8.11 Construction Noise

Land uses that are sensitive to vehicular noise would also be sensitive to construction noise. FHWA's *Construction Noise Handbook* contains criteria for determining the extent and type of analysis appropriate to address construction noise impacts and evaluate and implement techniques to effectively mitigate construction noise. Although highway construction is a short-term phenomenon, it can cause perceptible noise impacts. Additionally, it is possible that some

construction may occur at night to avoid severe traffic impacts. The extent and severity of the noise impact would depend upon the phase of construction and the noise characteristics of the construction equipment in use. Construction would have a direct impact on the receptors located close to the construction site and would have an indirect impact on receptors located near roadways where traffic flow characteristics are altered due to the re-routing of vehicles from the construction area.

Areas around the construction site are likely to experience varied periods and degrees of noise impact. This type of project would likely employ the following types of construction equipment that would be sources of construction noise:

- Bulldozers and earth movers
- Graders
- Front-end Loaders
- Cranes
- Tugboats
- Dumps and other diesel trucks
- Compressors

In general, sensitive land use located near construction zones (within approximately 100 feet) may experience noise levels between 78 dB(A) and 83 dB(A).

Maintenance of construction equipment will be regular and thorough to minimize noise emissions due to inefficiently tuned engines, poorly lubricated moving parts, poor to ineffective muffling/exhaust systems, etc.

In addition, several mitigation procedures can be followed to assist in minimizing the temporary impacts of construction noise. Adjustments to the equipment, provision of temporary noise barriers, construction of permanent noise barriers first where possible, alteration of construction activity areas to redistribute noise events, public involvement, and financial incentives to contractors are alternatives to decrease temporary noise impacts. These mitigation measures will be considered during final design to minimize public exposure to short-term noise impacts.

9 REFERENCES

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