I-64 HAMPTON ROADS BRIDGE-TUNNEL

HRBT
Hampton Roads Bridge Tunnel EIS

DRAFT ENVIRONMENTAL IMPACT STATEMENT

and

DRAFT SECTION 4(f) EVALUATION

VDOT
Virginia Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

December 2012

I-64 HAMPTON ROADS BRIDGE-TUNNEL

VDOT PROJECT NUMBER: 0064-965-004, P101; UPC 99037
From: Interstate 664 in the City of Hampton
To: Interstate 564 in the City of Norfolk

DRAFT ENVIRONMENTAL IMPACT STATEMENT
and
DRAFT SECTION 4(f) EVALUATION

Submitted Pursuant to:
42 U.S.C. 4332(2)(c) and 49 U.S.C 303
Submitted by:
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
and
VIRGINIA DEPARTMENT OF TRANSPORTATION

December 12, 2012
Date of Approval

Stephen J. Long, Environmental Administrator
Virginia Department of Transportation

December 12, 2012
Date of Approval

Irene Rico, Division Administrator
Federal Highway Administration

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This Draft Environmental Impact Statement identifies alternatives which address the current and future needs to improve capacity and geometric deficiencies along Interstate 64 from Interstate 664 in the City of Hampton to Interstate 564 in the City of Norfolk, Virginia. The study area extends approximately 12 miles and includes the 3.5-mile long Hampton Roads Bridge-Tunnel. The evaluated alternatives include the No-Build Alternative and three Retained Build Alternatives: the Build-8 Alternative, Build-8 Managed Alternative, and Build-10 Alternative. The potential impacts of these alternatives on the natural and human environment have been assessed.

Comments on this Draft Environmental Impact Statement are due by **February 13, 2013** and should be sent to Ms. Angel Deem at the above address or to the following email address: hrbtcomments@vaprojects.com. Comments also can be submitted by using the online comment form at www.virginiadot.org/projects/hamptonroads/i-64_hrbt_study.asp.

S SUMMARY

S.1 STUDY DESCRIPTION AND LOCATION

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA), is studying the environmental consequences of transportation improvements along Interstate 64 (I-64), including the Hampton Roads Bridge-Tunnel (HRBT), in the Cities of Hampton and Norfolk, Virginia, and the potential environmental consequences of these alternatives. **Figure S-1** shows the study area location and boundaries. The study area extends approximately 12 miles along I-64 from the I-664 interchange in Hampton to the I-564 interchange in Norfolk. This study arose from a need to address inadequate capacity and geometric deficiencies of the existing facilities of I-64 and the HRBT in the study corridor. Funding for this location study was included in the Virginia Six-Year Improvement Program by the Commonwealth Transportation Board.

This document serves as the Draft Environmental Impact Statement (EIS), which is required by the National Environmental Policy Act (NEPA) for all federal projects or actions that are likely to have a significant impact on the environment. This Draft EIS is a tool for VDOT and FHWA to make informed decisions regarding the study alternatives. The document includes the review of a reasonable range of alternatives, their ability to meet the needs of the study, and their likely impacts to the social, cultural, and natural environment. After publication of this Draft EIS and the subsequent public hearing, the Commonwealth Transportation Board (CTB) will identify a preferred alternative from among the alternatives evaluated in the Draft EIS. Once a preferred alternative has been adopted by the CTB, VDOT will prepare a Final EIS that further analyzes the preferred alternative and addresses comments received on the Draft EIS. All technical reports and memoranda referenced in the Draft EIS are available for review on VDOT's study website at www.virginiadot.org/projects/hamptonroads/i-64_hrbt_study.asp.

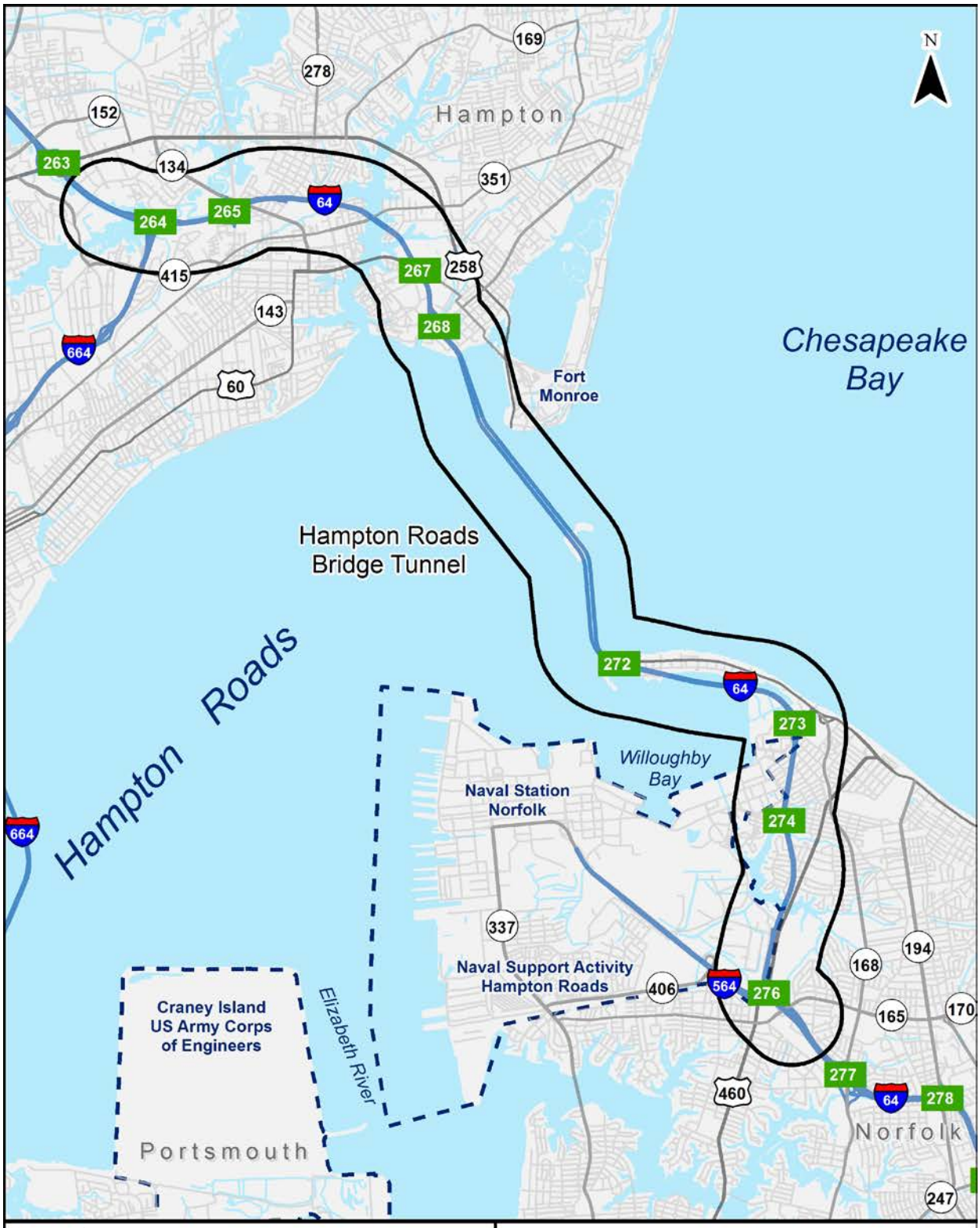
S.2 PURPOSE AND NEED

I-64 and the HRBT provide a critical link in the regional transportation network of the Hampton Roads region, serving multiple travel purposes, e.g., commuting, tourism, military mobility, freight movement and hurricane evacuation. Two principal transportation problems are the subject of this study:

- Inadequate capacity of existing facilities to accommodate existing and forecasted travel demand at acceptable levels of traffic service, operating speeds, and travel times; and
- Geometric deficiencies of the existing facilities that impede operating efficiency and contribute to decreased levels of traffic service.

S.2.1 Inadequate Capacity

Traffic volumes on some sections of I-64 routinely exceed capacity during peak hours. When travel demand exceeds capacity, congestion occurs, characterized by unstable traffic flow, reduced travel speeds, stop-and-go movements, queuing, and travel delays. A 2010 report by the Hampton Roads


N
Hampton
Chesapeake Bay
Fort Monroe
Hampton Roads Bridge Tunnel
Hampton Roads
Willoughby Bay
Naval Station Norfolk
Naval Support Activity Hampton Roads
Craney Island US Army Corps of Engineers
Elizabeth River
Portsmouth
Norfolk
169
278
152
263
134
351
64
265
264
267
258
415
143
268
664
60
272
273
274
337
406
564
276
168
194
165
170
277
460
278
247
Legend
Study Area
123 Interstate Exit
Department of Defense Facility
0 0.5 1 2 Miles
Study Location
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure S-1

Transportation Planning Organization (HRTPO) identifies the HRBT as the most congested freeway in the Hampton Roads Region.[1]

With traffic volumes on all sections of I-64 within the study area expected to grow by 12-26% by 2040, exceedance of capacity during peak periods will become progressively worse. Periods of congestion will become longer, as will the queues resulting from that congestion. Levels of service along I-64 are expected to decline in most sections of the study area as traffic volumes continue to climb. Average travel speeds will decline further, resulting in longer and less reliable travel times. The ability to provide efficient transit services also will be further diminished. Additionally, over time, the continued aging of the tunnel, bridge, and road infrastructure will result in greater maintenance needs. With deficient capacity even now, and with no convenient detour routes, the ability to maintain traffic flow during future maintenance and construction efforts will become increasingly difficult.

S.2.2 Geometric Deficiencies

Several elements of the existing I-64 and HRBT facilities are geometrically deficient in the study area. Deficient components include inadequate shoulder width and substandard vertical tunnel clearance, both of which cause congestion and safety problems. These elements fail to meet VDOT interstate design standards, the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets*, and AASHTO's *Guide Specifications for Bridges Vulnerable to Coastal Storms*. Vertical tunnel clearance in the existing HRBT tunnels is 13'-6" westbound and 14'-6" eastbound, whereas VDOT interstate standards call for a clearance of no less than 16'-6". An average of 80 to 90 over-height trucks per month must be stopped and inspected on the HRBT, causing disruption to traffic flow. Low existing vertical clearance on approach bridges does not meet AASHTO standards. During a storm, water could overtop the bridge, saltwater could contact the bottom of the girders causing deterioration, and a high storm surge could potentially lift the bridge from its bearings.

Safety problems also are associated with congestion, which is expected to continue to increase throughout the HRBT corridor. Crash data from 2006-2008 indicates that congested conditions on the HRBT results in distinctive spikes in the number of crashes as well as the crash rate approaching the HRBT in both directions.

Over time, the bottleneck in the eastbound direction caused by three lanes reducing to two lanes will become progressively worse. Similarly, the height restrictions of the existing tunnels will continue to restrict and impede movements of vehicles that are taller than those limits. The substandard dimensions of the shoulders also will continue to contribute to less efficient movement of traffic. While ongoing maintenance will be conducted as needed to preserve the structural integrity of the existing facilities, the service life of these facilities likely cannot be extended indefinitely without more extensive rehabilitation or reconstruction in the future.

S.3 ALTERNATIVES

A wide range of alternatives was considered initially, based on the identified purpose and need and a comprehensive process that incorporated input from the public as well as local, state, and federal government agencies. A screening process was used to identify alternatives to retain for detailed evaluation based on each prospective alternative's ability to meet the study's purpose and need, and public and agency input. The alternatives carried forward for detailed evaluation include the No-Build Alternative and three Retained Build Alternatives.

[1] HRTPO, Hampton Roads Congestion Management Process 2010 Update, September 2010.

S.3.1 No-Build Alternative

Under the No-Build Alternative, I-64 would remain predominantly three lanes per direction within the Hampton section of the study area. The 3.5-mile HRBT would continue with current operations. Within the Norfolk section of the study, I-64 would remain two lanes per direction, including the I-64 bridges across Willoughby Bay. There would be no rehabilitation or reconstruction of the HRBT; however, VDOT would continue maintenance and repairs of I-64 and the HRBT as needed. There would be no substantial changes to lane management based on tolls or vehicle occupancy. The No-Build Alternative would include those projects funded for construction in HRTPO's *2034 Long Range Transportation Plan*.

S.3.2 Retained Build Alternatives

Three build alternatives, each of which were determined to address the study's purpose and need, were carried forward for detailed evaluation. The Retained Build Alternatives – the Build-8, the Build-8 Managed, and the Build-10 Alternatives – are summarized in **Table S-1**.

S.3.3 Alternatives Eliminated from Detailed Consideration

Except for the No-Build Alternative, alternatives deemed not reasonably capable of meeting the identified purpose and need of increasing capacity and improving geometric deficiencies or deemed too disruptive in comparison to the transportation benefit achieved were not retained for further evaluation. **Table S-2** lists alternatives preliminarily considered but then eliminated from detailed consideration, and the reasons for their elimination.

S.4 ENVIRONMENTAL CONSEQUENCES

Potential environmental consequences of the Retained Alternatives were estimated based on the alternative's limit of disturbance (LOD). The LOD has been estimated for alternative comparison purposes and decision-making during the NEPA process, but would be further refined during final design. **Table S-3** presents the comparative environmental impacts of the alternatives. Values provided include both permanent and temporary impacts.

S.5 COMMENTS AND COORDINATION

VDOT, in cooperation with FHWA, has coordinated with local, state, regional, and federal agencies and conducted a public involvement program that has included two citizen information meetings and solicitation of public comments. Two meetings were held on July 18 and 19, 2011 in Norfolk and Hampton, respectively. The purpose of the meetings was to obtain citizen input for use in defining the scope of the study and input regarding study objectives, ideas for resolving transportation challenges, and important environmental and social issues. A total of 152 citizens signed the attendance logs. Additional citizen information meetings were held on April 18 and 19, 2012 in Hampton and Norfolk, respectively, to provide an update on study activities and to obtain input regarding the study's purpose and need, existing and future traffic, alternatives, and environmental conditions. A total of 93 citizens attended the meetings. A location public hearing will be held approximately 30 days following public availability of this Draft EIS to present the findings of the document and to obtain input and comments from the community.

Table S-1: Retained Build Alternatives

	Build-8 Alternative	Build-8 Managed Alternative	Build-10 Alternative
General Location	Along I-64 between I-564 and I-664	Along I-64 between I-564 and I-664	Along I-64 between I-564 and I-664
Mainline Cross Section	4 lanes each direction with median and shoulders throughout	4 lanes each direction with median and shoulders throughout; and buffer between managed and GP lanes	5 lanes each direction with median and shoulders throughout
Approach Bridges Cross Section	2 existing bridges would carry 4 westbound lanes; new bridge would carry 4 eastbound lanes	2 existing bridges would carry 4 westbound lanes; new bridge would carry 4 eastbound lanes with a buffer between managed and GP lanes	2 existing bridges would carry 4 westbound lanes; new bridge would carry 1 westbound and 5 eastbound lanes with a barrier between westbound and eastbound lanes
Tunnel Cross Section	2 existing tunnels would carry 4 westbound lanes; new tunnel would carry 4 eastbound lanes	2 existing tunnels would carry 4 westbound lanes; new tunnel would carry 4 eastbound lanes with a buffer between managed and GP lanes	2 existing tunnels would carry 4 westbound lanes; new tunnel would carry 1 westbound lane and 5 eastbound lanes. The westbound lane would be physically separated from the eastbound lanes in the new tunnel
Interchanges	I-64 interchanges in the study corridor would be modified to accommodate higher volumes and the widened mainline	I-64 interchanges in the study corridor would be modified to accommodate higher volumes and the widened mainline	I-64 interchanges in the study corridor would be modified to accommodate higher volumes and the widened mainline
Strategy Management	All lanes General Purpose	One or more lanes would be managed based on tolls or occupancy	All lanes General Purpose
Transit Capability	Expanded bus service or bus rapid transit not precluded, would operate with auto traffic	Expanded bus service or bus rapid transit not precluded and could operate in managed lanes	Expanded bus service or bus rapid transit not precluded, would operate with auto traffic
Potential Limit of Disturbance*	360 feet or 425 feet depending on topographic variability and needed width for auxiliary lanes	370 feet or 435 feet depending on topographic variability and needed width for auxiliary lanes	400 feet or 465 feet depending on topographic variability and needed width for auxiliary lanes
Engineering/ Construction Cost **	$4.4 to $5.5 billion	$4.7 to $5.9 billion	$5.3 to $6.7 billion

Abbreviations: GP = General Purpose; HOT = High Occupancy Toll; HOV= High Occupancy Vehicle

* *Environmental consequences of the alternatives were estimated based on these potential limits of disturbance.*

** *Derived using the accepted VDOT planning level cost estimate methodology and standard cost items, and specific cost opinions for non-standard elements.*

Table S-2: Alternatives Not Retained for Detailed Evaluation

Alternative	Basis for Elimination
Transportation System Management / Transportation Demand Management (TSM/TDM)	TSM/TDM improvements maximize the efficiency of the current transportation system or reduce the demand for travel on the system through the implementation of low-cost improvements. Examples of TSM activities include the addition of turn lanes, optimized signalization at intersections, and Intelligent Transportation Systems. Examples of TDM activities include ride sharing, van and carpooling, installation of park and ride facilities, and encouragement of telecommuting. TSM/TDM improvements, by their nature, are minor and therefore would not address inadequate capacity or geometric deficiency needs. Notwithstanding, the Retained Build Alternatives do not preclude TSM/TDM elements.
Rehabilitation or Reconstruction of the Existing HRBT	This alternative would include rehabilitation of the superstructure or reconstruction of the substructure and superstructure of the HRBT approach bridges. Bridge rehabilitation would consist of the removal and replacement of the existing bridge superstructure, crack sealing, repair, jacketing existing piling, replacement of piling, and the replacement of parapets. Reconstruction would consist of complete substructure (piers/foundations) and superstructure replacement, including raising and widening the structures to meet the current design standards. This alternative would not increase roadway capacity to alleviate current or future unacceptable and unreliable levels of traffic service; operating speeds; or travel times. While not a standalone alternative, rehabilitation or reconstruction has been included as a component of the Retained Build Alternatives.
Replacement of the Existing HRBT	This alternative would include complete removal of an existing bridge-tunnel in conjunction with reconstruction of a new crossing facility in the same location. Geometrically deficient roadway infrastructure would be replaced by a new facility that would meet current design standards for shoulder widths, vertical clearance in tunnels, and vertical clearance above water for approach bridges. However, this alternative would not address the identified capacity needs as it only replaces the existing HRBT and would not provide additional capacity. This alternative would result in an unreasonably high level of disruption to regional travel during the construction period.
Reversible Lanes	This alternative would add one or two reversible travel lanes to I-64. Construction of reversible lanes would partially address geometric deficiencies at the existing crossing, because the reversible lanes would be on a new bridge-tunnel that would meet current design standards for shoulders, vertical clearance in tunnels, and vertical clearance above water. However, travel patterns along I-64 through this study area do not allow for effective operation of reversible lanes since there is not a clear directional peak volume. Thus, reversible lanes would add capacity in one direction during any given peak period, but the capacity needs in the opposite direction would not be met.
Build-6 Alternative	This alternative would include construction of two additional lanes of capacity on I-64 at the Hampton Roads crossing and within the Norfolk section of the corridor, so that a continuous six-lane facility would extend from I-664 to I-564. The alternative would include a new two-lane bridge-tunnel at the Hampton Roads crossing. This alternative would partially address geometric deficiencies of existing facilities by constructing a new bridge-tunnel that would meet current design standards for shoulders, vertical clearance in tunnels, and vertical clearance over water. However, two additional lanes of roadway would not provide adequate capacity to alleviate congestion for current or future traffic within the study corridor.
Build-12 Alternative	The Build-12 Alternative would construct six additional lanes of capacity on I-64 within the Hampton portion of the corridor, and eight additional lanes of capacity on I-64 on the Hampton Roads Bridge-Tunnel and within the Norfolk section of the corridor. This expansion would result in a continuous twelve-lane facility that would extend from I-664 to I-564. The alternative would improve capacity and address geometric deficiencies of existing facilities by constructing a new bridge-tunnel that would meet current design standards for shoulders, vertical clearance in tunnels, and vertical clearance above water. However, the Build-12 Alternative would likely result in proportionally greater impacts to right-of-way, wetlands, streams, historic properties, and community facilities compared to the other retained alternatives. The alternative has not been advanced because the Retained Build Alternatives address the transportation needs with less environmental impact.
High Bridge	The high bridge option would involve a new cable-stayed or suspension bridge parallel to the existing HRBT over the Hampton Roads channel. The bridge would be built to carry a sufficient number of lanes of I-64 over Hampton Roads to address the capacity need. This option would fully address the geometric deficiencies of existing facilities by constructing a new bridge that would have full shoulders, no vertical clearance issues, and meet or exceed the minimum height above mean high water (MHW). However, a high bridge creates logistical challenges in terms of shipping and vulnerability, and presents environmental impacts that a tunnel does not. Although a high bridge option over Hampton Roads could be a feasible alternative from an engineering perspective and would address the stated transportation needs, the option creates additional problems that make it unreasonable to retain.

Table S-2: Alternatives Not Retained for Detailed Evaluation

Alternative	Basis for Elimination
Light or Heavy Rail Transit	This alternative would include dedicated light or heavy rail transit on a new structure across Hampton Roads. The existing bridge-tunnels would remain. The Light or Heavy Rail Transit Alternative was not retained for further evaluation because it would not address the geometric deficiency needs identified by this study. The alternative would have limited ability to address capacity on the HRBT given the limited potential ridership. It also would require substantial new rail transit connections on the peninsula and Southside, and it would have limited ability to accommodate existing and future traffic volumes on the HRBT.
Bus Transit	This alternative would include expansion of existing bus transit services within the study corridor and across Hampton Roads. This could be in the form of an increase in bus service, or a dedicated (express bus or bus rapid transit) facility. As a stand-alone alternative, increased bus service or a dedicated bus facility would not involve roadway or bridge-tunnel improvements; therefore, it would not address the identified geometric deficiencies. Expansion of the existing bus transit network alone would not attract enough riders to substantially address the capacity need within the I-64 HRBT corridor based on current and future bus ridership across the HRBT. Further, any increased bus service would also continue to rely on the existing HRBT facility, and its operation would be hampered by current capacity and deficiencies of existing facilities. Although a bus transit option is not a viable stand-alone alternative because it does not address capacity and geometric deficiency needs, it may be considered as a component of the Retained Build Alternatives.
Ferry Service	This alternative would provide a service to carry vehicles across Hampton Roads via water transport (hydrofoil or ferry). This alternative would not address the geometric deficiencies of the existing facilities, because no improvements would be made to the I-64 roadway or existing bridge-tunnel. It also would not address capacity needs because ridership would be expected to range between 600 and 1100 vehicles daily, or approximately one percent of the existing traffic volume and less than one percent of the projected 2040 No-Build volume on the HRBT. Consequently, ferry service does not meet the purpose and need of the study.

Table S-3: Potential Environmental Consequences

Impact Category	No-Build	Build-8	Build-8 Managed	Build-10	Notes
Land use conversions (acres)	0	281	287	304	Land use conversion is measured by amount of right-of-way required. Most conversion in Hampton would be of institutional land; in Norfolk, most conversion would be of military land.
Community facilities	0	11	11	11	Implementation of any of the Retained Build Alternatives would require portions of community facility lands.
Parks and recreational facilities impacted (number/acres)	0/0	14/24.6	14/25.2	14/26.4	Implementation of any of the Retained Build Alternatives would require the acquisition of right-of-way comprising portions of parks and recreational lands. Additional information is available in **Appendix C**.

Table S-3: Potential Environmental Consequences

Impact Category	No-Build	Build-8	Build-8 Managed	Build-10	Notes
Potential residential relocations	0	261	275	315	Right-of-way acquisition and relocation would be in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Encroachment of I-64 into neighborhoods would impact community cohesion.
Potential business displacements	0	16	16	17	Right-of-way acquisition and relocation would be in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended.
Env. Justice Populations impacted (number of Census Tracts with residential displacements)	0	2	2	2	Right-of-way acquisition and relocation would occur within communities with high minority and/or low-income populations.
Stream impacts (No. of crossings/linear feet of stream channel)	0	12/18,200	12/18,300	12/18,500	The Retained Build Alternatives would include the extension of existing bridges and culverts, new HRBT approach bridges with piers, a new tunnel beneath Hampton Roads, and the expansion of existing islands to accommodate tunnel portals.
Water quality	0	Short-term and minor long-term impacts	Short-term and minor long-term impacts	Short-term and minor long-term impacts	Short-term impacts of all Retained Build Alternatives may include increased sedimentation, turbidity, and stormwater-borne pollutants. Minor long-term impacts may include increased quantities of pollutants due to increases in impervious surface.
Wetlands impacts (acres)	0	52	52	53	Information based on field-verified GIS data. Additional minimization efforts would be considered during Section 404 permitting.
Chesapeake Bay Resource Protection Area impacts (acres)	0	536	542	560	Public roads and their associated structures are conditionally exempt from Resource Protection Area regulation provided they are constructed in accordance with the Virginia Erosion and Sediment Control Law.

Table S-3: Potential Environmental Consequences

Impact Category	No-Build	Build-8	Build-8 Managed	Build-10	Notes
Floodplains impacts (acres)	0	419	436	439	The Retained Build Alternatives would not increase flood levels, the probability of flooding, or the potential for property loss. A detailed hydraulic survey and study would be performed during final design.
Sediment Transport, Bank Erosion, Shoaling, and Hydrodynamic Modeling	0	No anticipated impacts	No anticipated impacts	No anticipated impacts	The Retained Build Alternatives would result in a negligible impact on the James River surface current curve, the Elizabeth River tidal prism and eddies, and sedimentation potential near Hampton Flats.
Aquatic Habitat impacts	0	Short-term and minor long-term impacts to 491 acres	Short-term and minor long-term impacts to 497 acres	Short-term and minor long-term impacts to 514 acres	This acreage includes the total width of proposed bridges and tunnels. A more detailed assessment of aquatic habitat impacts would be provided during final design and permitting.
Water Bird Nesting impacts	0	0	0	0	No impact.
Benthic Communities	0	Short-term and minor long-term impacts to 400 acres	Short-term and minor long-term impacts on up to 400 acres	Short-term and minor long-term impacts on up to 415 acres	Limited benthic footprint of the Retained Build Alternatives would limit long-term impacts. In the short term, dredging for tunnel installation and within potential aquatic borrow sites would temporarily result in the disruption of benthic communities.
Essential Fish Habitat, habitat Areas of Particular Concern, and Anadromous Fish Use Areas	0	Short-term impacts on 345 acres	Short-term impacts on 345 acres	Short-term impacts on 360 acres	Short-term impacts due to dredging. Acreage figure is for Anadromous Fish Use Areas only; information on Essential Fish Habitat and Habitat Areas of Particular Concern are not detailed enough to quantify.
Threatened and Endangered Species Habitat	0	Short-term impacts to 400 acres	Short-term impacts to 400 acres	Short-term impacts to 415 acres	Potential short-term impacts may occur to Kemp's Ridley, Hawksbill, Leatherback, Green, and Loggerhead sea turtle habitat, and shortnose and Atlantic sturgeon habitat as a result of disturbance from dredging for tunnel and bridge construction.
Submerged Aquatic Vegetation (SAV) impacts (acres)	0	5.6	5.7	6.2	Any disturbance or removal of SAV would be subject to approval from the Virginia Marine Resources Commission.

Table S-3: Potential Environmental Consequences

Impact Category	No-Build	Build-8	Build-8 Managed	Build-10	Notes
Terrestrial Habitat impacts (acres)	0	290	295	312	Impacts are comprised of developed land and roads. Implementation of the Retained Build Alternatives would disturb a limited amount of vegetated upland habitat.
Historic Architectural Resources impacted (No. of properties/ acres)	0	13/687.6	13/692.7	13/714.2	Impacts to resources would include the removal of residences from historic districts, impacts to Hampton National Cemetery, and the partial acquisition of right-of-way from other resources.
Archaeological Resources	0	Up to 16 sites	Up to 16 sites	Up to 16 sites	Additional archaeological investigations would be conducted pursuant to a Programmatic Agreement.
Air Quality	0	Minor short-term impacts	Minor short-term impacts	Minor short-term impacts	The Retained Build Alternatives meet all applicable air quality conformity requirements. No appreciable increase in air pollutant emissions is expected.
Number of sites impacted by noise	817	1019	1017-1019	1017	Construction activities and increased capacity would result in noise impacts.
Potential Hazardous Material Sites impacted	0	15	15	15	Prior to the acquisition of right-of-way or construction, thorough site investigations would be conducted to determine the existence and extent of any contamination.
Visual impacts	0	Minor to moderate	Minor to moderate	Minor to moderate	The impact of adding lanes to I-64 would be minor to moderate because the existing visual environment already is urban and is characterized by a major interstate.
Energy Requirements and Conservation Potential	Impacts related to vehicle idle time and usage of less direct alternative routes	Minor impacts in terms of energy requirements	Minor impacts in terms of energy requirements	Minor impacts in terms of energy requirements	The impact of the Retained Build Alternatives would be associated with the energy use for maintenance and lighting, which would increase for each lane added.
Farmland and Agricultural/ Forestal Districts	0	0	0	0	There are no farmlands or agricultural and forestal districts located in the study area.

Agencies were contacted early in the study and asked to assist in determining and clarifying issues relative to the study. The public was notified about the study and invited to provide comments about transportation needs, Retained Build Alternatives, and environmental issues throughout the study. The agency and public comments received in response to these coordination efforts were used in defining the purpose and need, potential alternatives, environmental issues and methodologies addressed in the Draft EIS.

FHWA published a Notice of Intent (NOI) to prepare an EIS in the Federal Register on May 20, 2011. Thirty-three federal, state and local governmental agencies and quasi-governmental organizations were contacted by letter and invited to provide scoping comments and attend an agency scoping meeting held in July 2011. Participating agency meetings were also held in November 2011 and April 2012. Input received from these agencies was used to inform the development of the study.

S.6 UNRESOLVED ISSUES

S.6.1 Selection of Alternative

After the location public hearing has been held and comments have been reviewed, the Commonwealth Transportation Board (CTB) would identify a preferred alternative. The preferred alternative may be refined to address comments received from the public and agencies on the Draft EIS and at the public hearing. Responses to substantive comments on the Draft EIS and documentation of the preferred alternative would be presented in a Final EIS. FHWA's alternative selection decision would occur in a Record of Decision (ROD).

S.6.2 Endangered Species Act Section 7 Consultation

During the course of final design, VDOT would continue to conduct Section 7 consultation with the US Fish & Wildlife Service and the National Marine Fisheries Service in order to assess the potential effect to Federally listed species. A Finding of Effect along with any species-specific mitigation measures would be completed at that time. Particular species that would be the subject of continued consultation are the Kemp's Ridley (*Lepidochelys kempii*), Hawksbill (*Eretmochelys imbricate*), Leatherback (*Dermochelys coriacia*), Green (*Chelonia mydas*), and Loggerhead (*Caretta caretta*) sea turtles, and the Short-nose (*Acipenser brevirostrum*) and Atlantic (*Acipenser oxyrinchus*) sturgeon.

S.6.3 Archaeological Investigations/Completion of the National Historic Preservation Act Section 106 Process

Through the selection of a preferred alternative, VDOT would continue to conduct Section 106 consultation with the Virginia Department of Historic Resources and other consulting parties in order to determine effects to historic properties.

It has been determined that implementation of the Retained Build Alternatives would impact two areas where additional archaeological survey work is warranted. An Archaeological Assessment completed by VDOT concluded that additional Phase II level investigation, including close-interval shovel testing as well as larger test units within potential impact areas, is appropriate for these two sites to determine if they are eligible for the National Register of Historic Places (NRHP). Previously identified underwater sites also require additional investigation.

Should a Retained Build Alternative be preferred in the Final EIS, a Programmatic Agreement (PA) would be drafted among FHWA, VDOT, the Virginia Department of Historic Resources (VDHR) and others to ensure that the appropriate level of archaeological investigations are conducted. The PA would include measures for identifying archaeological resources, recommendations for additional studies to be conducted, and present a methodology to assess and address any adverse effects that result from implementation of the preferred alternative.

S.6.4 Clean Water Act Section 404 Compliance

Detailed assessment of potential stream and wetland impacts would be performed following further design and the submittal of a jurisdictional delineation. Impacts to streams and wetlands in the study area would require submittal of a Joint Permit Application to the US Army Corps of Engineers (USACE), the Virginia Department of Environmental Quality (VDEQ) and the Virginia Marine Resources Commission (VMRC). Mitigation for unavoidable stream and wetland impacts would be developed in coordination with these agencies during the permitting process.

S.6.5 Final Section 4(f) Evaluation

Concurrent with Section 106 Consultation and the preparation of the Final EIS, VDOT will revise the Evaluation in compliance with Section 4(f) of the Department of Transportation Act. This evaluation will address the use of publicly owned parks, recreation areas, and wildlife or waterfowl refuges, and historic sites that are included or eligible for the NRHP.

S.6.6 Funding

At this time, there are no identified state or federal funds for the design, right of way acquisition, or construction of any of the Retained Build Alternatives.

S.6.7 HRTPO Action

Should any Retained Build Alternative be proposed for implementation, HRTPO would need to amend or update the Long Range Transportation Plan to include the preferred alternative before FHWA could issue the Record of Decision.

S.7 OTHER FEDERAL ACTIONS AND PERMITS REQUIRED

Federal and state laws require several permits and authorizations before construction can proceed. They include:

- Authorizations from the U.S. Army Corps of Engineers pursuant to Section 404 of the Clean Water Act for discharges of fill material into waters of the United States, including wetlands.
- Authorizations from the Virginia Department of Environmental Quality pursuant to Sections 401 (Virginia Water Protection Permit) and 402 of the Clean Water Act for discharges into waters of the United States.
- Authorizations from the Virginia Marine Resources Commission pursuant to Virginia Water Law for encroachments on subaqueous State-owned stream bottoms.
- Should an alternative be preferred that would adversely affect historic properties, a Programmatic Agreement (PA) to resolve the adverse effects would need to be executed among VDHR, FHWA, VDOT and potentially others. The Federal Advisory Council on Historic Preservation would be given the opportunity to participate in the development of any such PA.
- Because implementation of any of the Retained Build Alternatives would include the construction of a bridge across a navigable waterway of the United States, a Coast Guard Bridge Permit would be required.
- Clearance from the Virginia Department of Conservation & Recreation (VDCR) and from the Cities of Hampton and Norfolk, as appropriate, to construct components of a Retained Build Alternative within the 100-year floodplain.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

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1 PURPOSE AND NEED

1.1 STUDY AREA AND EXISTING ROADWAY

1.1.1 Study Area

The Virginia Department of Transportation (VDOT), in cooperation with the Federal Highway Administration (FHWA), is studying the environmental consequences of transportation improvements along Interstate 64 (I-64) and the Hampton Roads Bridge-tunnel (HRBT). **Figure 1-1** shows the study location, from the I-64 interchange with I-664 in the City of Hampton to the I-64 interchange with I-564 in the City of Norfolk, a distance of approximately 12 miles, including the 3.5-mile-long HRBT. The study area encompasses lands and water bodies within or adjacent to the I-64 corridor that could potentially incur direct or indirect impacts as a result of the proposed study.

The interchanges of I-64 with I-664 on the west and I-564 on the east are both major traffic entry and exit points along I-64 and therefore are logical termini because they show a distinct interchange of volumes between the two facilities at each junction.[2] The listing of the study in the Long-Range Transportation Plan for the Hampton Roads region also identifies I-664 and I-564 as the termini. As such, advancement of this study within these termini is consistent with the overall Long-Range Transportation Plan, but it does not force or preclude the design or implementation of other elements of the regional transportation system.

1.1.2 Existing Roadway

Within the **Hampton** section of the study, I-64 is predominantly three lanes per direction, with auxiliary lanes (acceleration and deceleration lanes) at the interchanges. The posted speed limit is 55 miles per hour (mph). Grades are three percent or less. The typical section along eastbound I-64 changes from three lanes to two lanes at the Settlers Landing Road interchange (Exit 267). In the westbound direction, the two lanes exiting at the tunnel expand to three lanes at the South Mallory Street interchange (Exit 268), which is approximately one mile west of the tunnel portal. The following interchanges are located west of the HRBT:

- Exit 264 – I-664.
- Exit 265 – Route 167/Route 134 – LaSalle Avenue, North Armistead Avenue, and Rip Rap Road.
- Exit 267 – US 60/Route 143 – Settlers Landing Road and Woodland Road.
- Exit 268 – Route 169 – South Mallory Street.

The 3.5-mile HRBT connects the Peninsula (Hampton) to the Southside (Norfolk) by spanning Hampton Roads, the confluence of the James River, Nansemond River, and Elizabeth River. The structure is composed of the 0.6-mile western approach bridges, 1.4-mile-long tunnels, and 1.2-mile eastern approach bridges with 0.15-mile portal islands at the transitions between the bridges and the tunnels.

2 I-64 HRBT Logical Termini Memorandum, September 8, 2011.


N
Hampton
Chesapeake Bay
Fort Monroe
Hampton Roads Bridge Tunnel
Hampton Roads
Willoughby Bay
Naval Station Norfolk
Naval Support Activity Hampton Roads
Craney Island US Army Corps of Engineers
Elizabeth River
Portsmouth
Norfolk
169
278
152
263
134
351
64
264
265
267
258
415
143
268
664
60
272
273
274
337
406
564
276
168
194
165
170
277
460
278
247
Legend
Study Area
123 Interstate Exit
Department of Defense Facility
0 0.5 1 2 Miles
Study Location
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure 1-1

Within the **Norfolk** section of the study, I-64 has two lanes per direction. I-64 is on bridges across Willoughby Bay south of the West Ocean View Avenue/Bayville Street interchange; over wetlands near West Ocean View Avenue/West Bay Avenue; and across Mason Creek south of West Bayview Boulevard where an entrance ramp is provided for Granby Street. The following interchanges are located east of the HRBT:

- Exit 272 – Route 168 – West Ocean View Avenue/Bayville Street.
- Exit 273 – US 60 – 4th View Street.
- Exit 274 – Entrance ramp from eastbound West Bay Avenue to I-64 east and exit ramp from westbound I-64 to westbound West Ocean View Avenue.
- Exit 276 – I-564 and Granby Street (Route 460). Southbound Granby Street cannot be accessed from westbound I-64 and northbound Granby Street is not accessible from eastbound I-64.

In addition, a slip ramp is provided from Granby Street to westbound I-64 just north of Norfolk Naval Station Gate 22 and the Forest Lawn Cemetery.

1.1.3 Travel Demand

Travel demand[3] on I-64 is generated by multiple trip purposes including commuters, freight movements, military mobility, and tourism.

- I-64 and the HRBT provide a vital regional link for commuters traveling to and from large regional employers, such as:
  - Naval Station Norfolk (the largest navy base in the world).
  - Port facilities (second largest on the east coast [by total cargo volume]).
  - Newport News Shipbuilding (the nation's sole-industrial designer, builder, and refueler of nuclear-powered aircraft carriers and one of only two shipyards capable of designing and building nuclear-powered submarines).
- I-64 provides for other general travel for business and personal purposes between and within the Cities of Hampton and Norfolk, including shopping, recreation, and entertainment. I-64 and the HRBT serve as a primary route for the transfer and delivery of local, regional, and international freight movements. As an interstate facility linking most of the urbanized region, I-64 is a conduit for the transport of goods of all kinds, including industrial supplies, building materials, foodstuffs, and business and personal consumables. It is also a key link in transporting international freight to and from the region's shipping ports, including the 648-acre Norfolk International Terminals (NIT) in Norfolk adjacent to the navy base.
- Movements of military personnel and equipment also occur in the corridor. I-64 is part of the Strategic Highway Network (STRAHNET), which is designated by FHWA in coordination with the U.S. Department of Defense as the minimum network of highways that are important to the United States' strategic defense policy, providing access, continuity, and emergency capabilities to important military installations and ports. Among the military installations in the Hampton Roads region are Naval Station Norfolk, Naval Air Station Oceana, Joint Expeditionary Base Little Creek – Fort Story, Fort Eustis, Langley Air Force

[3] Demand for travel is generated by needs and desires for the movement of people and goods. In general, traffic volume on a highway represents the level of aggregate demand of travelers to use that highway as a path from trip origin to trip destination.

Base, Naval Support Activity (NSA) Hampton Roads, and Norfolk Naval Shipyard. There are approximately 120,000 military and civilian personnel at Navy installations in the area.[4] In its 2011 Hampton Roads Military Transportation Needs Study, the Hampton Roads Transportation Planning Organization (HRTPO) reported that transportation congestion on the HRBT may hinder the ability to maintain or bring additional military personnel to the region, increase travel times between military installations during business hours, and detract from mission performance effectiveness and efficiency.

- I-64 is a principal travel route for tourists visiting the attractions and beaches of Hampton Roads, as well as travelers driving through the region to the Outer Banks of North Carolina. Much of the tourist-related traffic is seasonal and related to the beaches, resulting in summertime peaks in traffic volumes that are higher than normal peaks. Tourism attractors include:
  - Virginia Beach's 29 miles of beaches, the nearby historic triangle of Colonial Williamsburg/Jamestown/Yorktown, other historic properties such as Fort Monroe, and numerous museums and other attractions that draw visitors to the region each year.
  - Travelers can take I-64 to Route 168 in the City of Chesapeake to reach the beach destinations on North Carolina's Outer Banks. (Roadway signage currently directs travelers on eastbound I-64 to use the I-664/Monitor Merrimac crossing for North Carolina Outer Banks destinations.)

- I-64 is a designated hurricane evacuation route in the event of a hurricane threatening the Hampton Roads region. I-64 and the HRBT are one of seven roads that the Commonwealth of Virginia has designated as evacuation routes in the Hampton Roads area (use of the HRBT may be restricted based on weather conditions). When an evacuation order is issued, the eastbound lanes can be reversed to increase westbound capacity for evacuating traffic. All traffic will travel west on I-64 from Norfolk to Richmond beginning east of the HRBT in Norfolk (Exit 273) to the I-295 interchange in Richmond (Exit 200); gates that have been installed on interchange ramps can be lowered to prohibit eastbound entry along the evacuation route. The governor also can order a lane reversal of I-64 for other emergency purposes.

Travel demand from the sources noted above resulted in daily traffic volumes on I-64 in 2011 from approximately 115,700 vehicles per day (vpd) east of the I-664 interchange to approximately 77,800 vpd between 4th View Street and West Ocean Avenue, as shown in **Table 1-1**. By 2040, these volumes are forecasted to grow to approximately 130,000 and 88,600, respectively, as shown in **Table 1-2**. The four-lane section of the HRBT and the east (south) approach of I-64 were designed for approximately 70,000 vpd.

1.1.4 Transit Services

Hampton Roads Transit (HRT) provides express bus service through the I-64 HRBT via the Metro Area Express (MAX). The MAX 961 route offers services between downtown Norfolk, Hampton, and Newport News along I-64 from the Granby Street entrance near Patrol Road to Settlers Landing Road (Exit 267) in Hampton and again from Armistead Avenue (Exit 265) to I-664 (Exit 264). On weekdays, service runs from 5:00 AM to 10:15 PM, with headway departures every 30 minutes during peak hours and every

[4] Based on FY 2010 data from Commander, Navy Region Mid-Atlantic Economic Impact Report for the Hampton Roads area: http://www.cnic.navy.mil/navycni/groups/public/@cnrma/documents/document/cnicd_a114713.pdf

Table 1-1: Existing (2011) Traffic Volumes and Levels of Service

Location on I-64	2011 Daily Volumes		2011 Total Two-Way Daily Volumes	2011 AM Peak Volumes and LOS*		2011 PM Peak Volumes and LOS*	
	East-bound	West-bound		East-bound	West-bound	East-bound	West-bound
West of I-664 (Exit 264)	76,100	75,700	151,800	5,440 na	5,285 na	4,285 na	7,235 na
I-664 To LaSalle Ave (Route 167, Exit 265A)	57,400	58,300	115,700	4,675 C	4,575 C	4,270 C	4,705 C
LaSalle Ave To Settlers Landing Road (US 60/Route 143, Exit 267)	42,000	46,300	88,300	3,660 C	3,775 C	3,165 B	4,070 C
Settlers Landing Road To South Mallory Street (Route 169, Exit 268)	42,700	45,500	88,200	3,820 D	3,305 B	2,960 C	3,945 C
South Mallory Street To 15th View Street (Exit 272), Hampton Roads Bridge-Tunnel	44,100	44,600	88,700	3,655 E	3,265 D	3,320 D	3,380 D
15th View Street To 4th View Street (Exit 273)	44,000	44,300	88,300	3,695 D	3,225 D	3,265 D	3,375 D
4th View Street To West Ocean Avenue and West Bay Avenue (Exit 274)	39,300	38,500	77,800	3,315 D	2,865 C	2,985 C	2,840 C
West Ocean/West Bay Avenue To Granby Street (US 460)	45,400	43,300	88,700	3,585 D	3,545 D	4,020 E	2,990 C
Granby Street to I-564 (Exit 276)	50,400	37,500	87,900	3,920 D	3,280 D	4,535 E	2,665 C
East of I-564, Mainline HOV**	62,200 8,000	63,500 8,000	125,700 16,000	3,535 B	6,840 D 700	6,180 C 2,620	3,575 B

** LOS calculated using Highway Capacity Manual methodology.*

*** LOS analysis was not completed for HOV lanes because this roadway section is outside the study limits.*

Table 1-2: Design Year (2040) No-build Traffic Volumes and Levels of Service

Location on I-64	2040 Daily Volumes		2040 Total Two-Way Daily Volumes	2040 AM Peak Volumes and LOS*		2040 PM Peak Volumes and LOS*	
	East-bound	West-bound		East-bound	West-bound	East-bound	West-bound
West of I-664 (Exit 264)	97,900	97,900	195,800	7,025 na	6,875 na	5,525 na	9,225 na
I-664 To LaSalle Ave (Route 167, Exit 265A)	65,000	65,000	130,000	5,250 C	5,150 D	4,800 C	5,275 D
LaSalle Ave To Settlers Landing Road (US 60/Route 143, Exit 267)	55,000	55,000	110,000	4,550 C	4,700 C	3,950 C	5,075 D
Settlers Landing Road To South Mallory Street (Route 169, Exit 268)	53,300	53,300	106,600	4,625 E	4,000 C	3,575 D	4,775 D
South Mallory Street To 15th View Street (Exit 272), Hampton Roads Bridge-Tunnel	56,100	56,100	112,200	4,700 F	4,100 E	4,150 F	4,300 F
15th View Street To 4th View Street (Exit 273)	52,400	53,400	105,800	4,675 F	3,975 E	4,150 E	4,275 E
4th View Street To West Ocean Avenue and West Bay Avenue (Exit 274)	44,300	44,300	88,600	3,775 D	3,275 D	3,400 D	3,225 D
West Ocean/West Bay Avenue To Granby Street (US 460)	50,200	50,200	100,400	4,050 E	4,025 E	4,550 F	3,375 D
Granby Street to I-564 (Exit 276)	55,800	42,700	98,500	4,325 E	3,575 D	5,250 E	2,750 C
East of I-564, Mainline HOV**	66,700 10,000	66,700 10,000	133,400 20,000	4,425 B	8,675 E 650	8,300 D 2,650	4,075 B

** LOS calculated using Highway Capacity Manual methodology.*

*** LOS analysis was not completed for HOV lanes because this roadway section is outside the study limits.*

hour during off-peak hours. Saturday/Sunday service runs from 5:00 AM / 7:00 AM to 9:00 PM with headway departures every hour. All HRT vehicles are equipped with bike racks and are capable of accommodating two bicycles at a time.

1.2 HISTORY

The I-64 HRBT corridor has been the subject of prior studies. Past efforts have led to the initiation of this Environmental Impact Statement (EIS).

- The Final Environmental Impact Statement for the Hampton Roads Crossing Study, approved by FHWA on March 1, 2001, addressed alternatives that involved increasing capacity along the existing I-64 HRBT corridor; however, those alternatives were not preferred in the Record of Decision (ROD).
- VDOT completed the Hampton Roads Bridge-Tunnel Expansion Feasibility Study in 2008, with study limits from I-664 to I-564. The goal of the Feasibility Study was to develop concept-level alternatives, develop estimates of congestion-reduction benefits of the alternatives, and provide policy-level guidance on the feasibility and long-term benefits of the alternatives. The study identified three feasible alternatives that would provide adequate levels of traffic service meeting Federal requirements for interstate facilities.
- The Virginia General Assembly on March 11, 2010 passed a bill requiring VDOT to accept for review under the Public-Private Transportation Act (PPTA) of 1995 (§ 56-556 et seq. of the Code of Virginia) unsolicited proposals to add physical capacity to the HRBT. In late 2010 and early 2011, VDOT received several PPTA proposals. As discussed at the April 20, 2011 Commonwealth Transportation Board workshop, further action on the proposals has been deferred pending completion of this EIS.
- The I-64 HRBT study was included in VDOT's FY2011-2016 Six-year Improvement Program for preliminary engineering study. The study also has been included in the HRTPO 2034 Long-Range Transportation Plan and FY2012-2015 Transportation Improvement Program.

1.3 NEEDS – EXISTING CONDITIONS

1.3.1 Overview

I-64 and the HRBT provide a critical link in the regional transportation network of the Hampton Roads region, serving multiple travel purposes. However, traffic congestion occurs routinely, as represented by deficient levels of service, reduced speeds, and long and unpredictable travel times. Congestion is caused by inadequate capacity to accommodate high travel demand and is compounded by geometric deficiencies of the existing facilities. Within the study limits, daily traffic volumes in 2011 range from 77,800 to 115,700 vpd, as shown in **Table 1-1**. Daily traffic volumes through the HRBT are approximately 88,700 vpd. Peak hour volumes approach or exceed capacity on some sections. The substandard vertical clearances in the tunnels are problematic to trucks that exceed these height restrictions.

1.3.2 Inadequate Capacity

Traffic volumes on some sections of I-64 routinely exceed capacity during peak periods. The generally accepted capacity, or throughput, of a single freeway lane is 2,200 vehicles per hour; however, this volume is reduced when considering factors such as narrow lanes, lack of shoulders, and high truck volumes. The tunnels, because of their constricted horizontal and vertical clearances, provide less capacity than do the bridge trestle approaches and the landside I-64 roadway. HRTPO estimates a

throughput of only 1,600 to 1,700 vehicles per hour per lane through the tunnels.[5] Driver reactions to the tunnel itself, as well as the grades going down into and coming up out of the tunnels lead to braking and reductions in travel speeds, which ripple back through the traffic stream. Additionally, in the eastbound direction, the lane drop from three lanes to two lanes reduces capacity by a third and contributes to the bottleneck.

When travel demand exceeds capacity, congestion occurs. Congestion can be described as a condition characterized by unstable traffic flow, reduced travel speeds, stop-and-go movements, travel delays, and queuing. Congestion within the HRBT corridor occurs in two forms: recurring and nonrecurring. Congestion that occurs on a regular basis at the same general location is known as recurring congestion, which is caused by inadequate capacity to accommodate traffic volumes. Congestion that occurs on an irregular basis at varying times and locations is known as nonrecurring congestion, which is caused by weather events, crashes that obstruct the roadway, or other special events that reduce capacity temporarily. A 2010 report by HRTPO[6] identifies the HRBT as the most congested freeway segment in the Hampton Roads region.

One way of measuring highway congestion is level of service.[7] Interstate highways are usually designed to achieve a level of service "C" in the design year. The design year is identified as the planning horizon for a proposed study. For this study, the design year is 2040. Based on the American Association of State Highway and Transportation Officials' (AASHTO) "Green Book," *A Policy on Geometric Design of Highways and Streets*, as specified in 23 CFR 625.4, in heavily developed urban areas, a level of service "D" may be acceptable if achievement of level "C" is not practical. As shown in **Table 1-1**, existing levels of service are "D" or "E" on several mainline sections of I-64 and at several ramp merge and diverge areas at interchanges. While the capacity analysis results indicate generally acceptable operating conditions under existing conditions, they do not appear to correspond to typical observed conditions of recurring congestion along the corridor. This difference is likely because the Highway Capacity Manual (HCM) methodology does not take into account the effects of downstream bottlenecks and spillback of congestion. In addition, if the analysis at each location is conducted using throughput volumes as opposed to full demand volumes, the LOS results will be understated at the chokepoint as it is not taking into consideration the full demand. Queue lengths approaching the HRBT typically extend 3 to 5 miles long (depending on direction and time of day), which indicates that level of service should be F for the corridor during the peak hours. The chokepoint causes congestion to spill back to upstream locations, thereby reducing throughput at those locations as well.

The HCM methodology does provide factor adjustments for narrow lanes and narrow lateral clearance (i.e., narrow shoulders or walls). However, other factors that affect traffic operations that are not reflected in the HCM methodology but are applicable to the HRBT include the abrupt transition from daylight to dark lighting conditions, limited line-of-sight caused by tunnel structures, and low overhead clearance. These other factors affect driver responses to the roadway; therefore, the actual LOS experienced by the drivers is worse than the results obtained using HCM methodology. Finally, non-recurring congestion, which can be caused by crashes or the need to remove over-height trucks from the traffic stream, reduce capacity of the roadway and impact LOS as well; however, these conditions are also not accounted for in the LOS analysis.

[5] HRTPO, Hampton Roads Congestion Management Process 2010 Update, September 2010.

[6] HRTPO, Hampton Roads Congestion Management Process 2010 Update, September 2010.

[7] Level of service provides a comparative measure of the traffic performance of roads through a grading from A to F. For limited-access highways like interstate routes, level of service A represents free flow traffic operations with almost unimpeded ability to maneuver within the traffic stream, while level of service F represents breakdown in flow and substantial impedance of the ability to maneuver within the traffic stream.

Slower travel speeds and increased travel times are a more comprehensive indicator of the corridor-wide recurring congestion. The April 2012 Hampton Roads Regional Travel Time/Speed Study[8], which summarizes peak period travel time and speed data for 1,300 miles of roadway throughout Hampton Roads, ranked the HRBT as having the third highest delay during the morning peak period (after the Downtown and Midtown Tunnels) and second highest delay during the evening peak period (after the Downtown Tunnel). As documented in the October 28, 2011 *I-64 HRBT Existing Traffic Conditions Final Report*,[9] an analysis of travel speeds in the corridor shows that in the eastbound direction, two pronounced periods with slow traffic occur. On sections west of the tunnel during the AM peak period, speeds fall below 40 MPH as early as 5:15 AM, and they do not exceed 40 MPH again until approximately 10:00 AM. Speeds are at their lowest (below 20 MPH) between 6:00 AM and 8:30 AM. The duration of the PM peak period slowdown on the same sections is somewhat shorter, starting at around 2:30 PM and ending at approximately 6:30 PM. However, speeds still fall below 20 MPH for approximately 2.5 hours during the typical PM peak period.

In the westbound direction, one pronounced period of slow traffic occurs during the PM peak period, starting as early as 1:45 PM and lasting through 6:45 PM. Speeds fall below 20 MPH during a substantial portion of this peak period (2:45 PM to 6:15 PM). The speed reductions occur in two areas: one approaching the HRBT and the other through the I-564 interchange area.

Recurring congestion is also reflected in the queuing of traffic. Although the queue lengths vary by day of the week and season of the year, on average, queues extend for three miles from the HRBT in the eastbound direction during both the morning and evening peak periods and up to five miles from the HRBT in the westbound direction in the evening. Queue lengths sometimes exceed six miles during the summer.[10] Additionally, because transit buses travel along with all other vehicles, the queuing and delays also influence the efficiency and reliability of transit services.

As traffic flows approach and exceed capacity and travel speeds decrease, travel times through the corridor become unpredictable. The higher traffic densities result in vehicles being more closely spaced, increasing the interaction among vehicles and distractions to drivers. The flow becomes unstable and abrupt stop-and-go traffic movements occur. Because of the unstable nature of the traffic flow, the exact onset, severity, and frequency of the congested conditions can be difficult to predict and the actual travel time may vary considerably from the average from one day to the next, especially when crashes or breakdowns result in lane restrictions or closures. Such incidents result in nonrecurring congestion, which compounds normal expected congestion and increases the unreliability of travel times in the corridor. Incident response and management is difficult due to limited space in the tunnels and on the tunnel approach bridges and the lack of viable detour options to maintain traffic flow. Analysis[11] of crash data from 2006 to 2008 shows distinctive spikes in the number of crashes as well as the crash rate approaching the HRBT in both the eastbound and westbound directions. During this period, a total of 872 crashes were reported along eastbound I-64 and 971 crashes along westbound I-64. The crashes were generally concentrated on the eastbound and westbound approaches to the tunnel. The majority of reported crashes were rear-end collisions, which are indicative of congested stop-and-go conditions.

The existing HRBT also does not provide sufficient capacity to allow for efficient maintenance of traffic during routine maintenance or construction activities. In some cases during maintenance or

[8] HRTPO, Hampton Roads Regional Travel Time/Speed Study, April 2012.

[9] VDOT, I-64 HRBT Existing Traffic Conditions Final Report, October 28, 2011.

[10] HRTPO, Hampton Roads Congestion Management Process 2010 Update, September 2010.

[11] VDOT, I-64 HRBT Existing Traffic Conditions Final Report, October 28, 2011.

construction, one of the HRBT spans may need to be reduced to one lane or closed, resulting in two lanes of traffic for the crossing (one lane in each direction on the other span) for an extended period of time without a viable detour. These activities result in substantial nonrecurring congestion and delays beyond the congestion experienced during normal operation.

1.3.3 Geometric Deficiencies of Existing Facilities

Current VDOT interstate design standards (GS-5, from Road Design Manual) call for the following:

- Travel lanes 12 feet wide.
- Right shoulder, 14 feet wide, 12 feet paved.
- Left shoulder, with four lanes total both directions, 8 feet wide, 4 feet paved.
- Left shoulder, with six or more lanes total both directions, 14 feet wide, 12 feet paved.
- Shoulders on bridges, with two lanes in same direction, 12 feet wide right, 6 feet wide left.
- Shoulders on bridges, with three or more lanes in same direction, 12 feet wide right, 12 feet wide left.
- Vertical clearance, 16 feet 6 inches.[12]

Within the Hampton section of the study, where I-64 is predominantly three lanes per direction, travel lanes are 12 feet wide; right shoulders are 12 feet wide; and left shoulders are 4 feet wide. The lane and right shoulder widths meet current interstate design standards; however, the left shoulder width does not meet current interstate design standards. In the eastbound direction, the three lanes are reduced to two lanes (at milepost 267) prior to entering the tunnel, which does not meet lane continuity guidelines in AASHTO's *A Policy on Geometric Design of Highways and Streets*. This lane reduction exacerbates the bottleneck at the tunnel due to reduced capacity.

The bridges between the tunnels and the land-side roadways have 12-foot-wide lanes with 10-foot-wide right shoulders and 4-foot-wide left shoulders. The shoulders do not meet current design standards. Additionally, these approach bridges have a low vertical clearance above the water that does not meet the clearance specifications in AASHTO's *Guide Specifications for Bridges Vulnerable to Coastal Storms*, 2009. During a storm, water could overtop the bridge, the saltwater could contact the bottom of the girders causing deterioration, and a high storm surge could potentially lift the bridge from its bearings.

The westbound tunnel has 12-foot-wide lanes and no shoulders. The vertical clearance is 13'-6" inches, which is substandard. The vertical clearance is problematic for some trucks. An average of 80 to 90 over-height trucks per month must be stopped and inspected on the HRBT,[13] which causes disruption to traffic flow; all traffic is stopped when trucks are pulled from I-64 for inspection and then stopped again to allow trucks to re-enter I-64 following inspection. The eastbound tunnel has 12-foot-wide lanes and no shoulders. The vertical clearance is 14'-6", which is substandard.

Within the Norfolk section of the study, I-64 has two lanes per direction. The travel lanes are 12 feet wide; right shoulders are 12 feet wide; left shoulders vary from 2 to 6 feet wide. The lane and right shoulder widths meet current interstate design standards; however, the left shoulder width does not meet current interstate design standards.

As the tunnel, bridge, and road infrastructure have aged, greater and more frequent maintenance and repair needs are becoming apparent. Although major reconstruction is not yet required, increasing

[12] VDOT, Manual of the Structure and Bridge Division, Volume V, Part 2, Chapter 6, Geometrics.

[13] VDOT, Hampton Roads Bridge-Tunnel Monthly Traffic Stoppage Reports, January 2008 to August 2011.

maintenance activities and the lack of viable detour routes make it increasingly difficult to maintain traffic flow at desirable levels.

1.4 NEEDS – FUTURE CONDITIONS

1.4.1 Overview

The factors contributing to the existing inadequate capacity and geometrically deficient facilities are expected to continue and increase into the future. Population in the Hampton Roads region is projected to grow 32 percent between 2000 and 2034, while employment is projected to grow 26 percent. As this growth in the Hampton Roads region continue into the future, travel demand also will increase and the congested conditions described in **Section 1.3.2** will intensify. Federal law (23 USC 109) suggests that interstate projects should accommodate the types and volumes of traffic anticipated for a 20-year period following approval of the plans, specifications, and estimates for the improvement. The design year has been established as 2040 for this study. Travel forecasting has been conducted to predict future traffic volumes and to identify associated transportation infrastructure needs. The 2040 forecasted volumes on I-64 within the study limits range from 130,000 to 88,600 vpd. **Table 1-2** shows the forecasted traffic volumes and corresponding levels of service along the I-64 HRBT corridor.

1.4.2 Inadequate Capacity

With growing traffic volumes, exceedance of capacity during peak periods will become progressively worse, which is illustrated by the levels of service listed in **Table 1-2**. Periods of congestion will become longer, as will the queues resulting from that congestion. Likewise, average travel speeds will decline further, resulting in longer and less reliable travel times. The ability to provide efficient transit services also will be further diminished. Additionally, over time, the continued aging of the tunnel, bridge, and road infrastructure will result in greater maintenance needs. With deficient capacity even now, and with no viable detour routes, the ability to maintain traffic flow during future maintenance and construction efforts will become increasingly difficult.

1.4.3 Geometric Deficiencies of Existing Facilities

There are no currently planned major improvements to alleviate existing geometric deficiencies. The bottleneck in the eastbound direction caused by three lanes reducing to two lanes will become progressively worse. Similarly, the height restrictions of the existing tunnels will continue to restrict and impede movements of vehicles that are taller than those limits. The substandard dimensions of shoulders also will continue to contribute to less efficient movement of traffic. While ongoing maintenance will be conducted as needed to preserve the structural integrity of existing facilities, the service life of these facilities likely cannot be extended indefinitely without more extensive rehabilitation or reconstruction in the future.

1.5 SUMMARY

Based on the above considerations, the purpose of the I-64 HRBT study is to improve existing and future traffic congestion on the 12-mile section of I-64 between I-664 in the City of Hampton and I-564 in the City of Norfolk. The congestion stems from inadequate capacity of the existing facilities to accommodate the high travel demand. The worst congestion results from the bottleneck posed by the existing tunnels, whose configurations (horizontal and vertical clearances) reduce capacity. As future maintenance needs increase due to ongoing physical deterioration of the existing facilities, the capacity restrictions will limit the ability to maintain traffic flow during any major rehabilitation efforts. Accordingly, the study would address the following specific needs:

- Inadequate capacity of existing facilities to accommodate existing and forecasted travel demand at acceptable levels of traffic service, operating speeds, and travel times.
- Geometric deficiencies of the existing facilities that impede operating efficiency and contribute to decreased levels of traffic service.

2 ALTERNATIVES

2.1 INTRODUCTION

This chapter describes the alternatives development process and screening criteria approach for the I-64 HRBT EIS, including the identification of an initial range of alternatives considered and alternatives retained for detailed evaluation. With the exception of the No-Build Alternative, alternatives that do not address the stated purpose and need (described in **Chapter 1**) were determined to be not reasonable and were not advanced for detailed evaluation. Remaining alternatives have been retained for detailed evaluation and environmental analysis. The analysis was prepared as part of a comprehensive process that incorporated input from the public as well as local, state, and federal government agencies.

This Draft EIS includes analysis of a range of improvement alternatives within the I-64 HRBT study corridor. Based on alternatives screening criteria developed from the purpose and need, four alternatives have been retained. These retained alternatives include the No-Build Alternative and three build alternatives identified as: the Build-8 Alternative, the Build-8 Managed Alternative, and the Build-10 Alternative. Each retained alternative represents a set of improvements that form a stand-alone solution to the identified needs within the study limits. Additional details on alternatives development are provided in the *HRBT Alternatives Development Technical Memorandum*. All referenced technical reports and memoranda that have been completed as part of this study are available for review on VDOT's study website at www.virginiadot.org/projects/hamptonroads/i-64_hrbt_study.asp.

2.2 ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS

2.2.1 Alternatives Development

Alternatives were initially developed using several strategies. These strategies included identification of alternatives from previous studies completed in the area; consideration of public and agency input received during the scoping process; and development of alternatives to address the study's purpose and need using the most current design criteria for interstate highways and structures over tidal waters.

Previous Studies

In 2008, VDOT prepared the *HRBT Expansion Feasibility Study*. This feasibility study assessed six I-64 widening alternatives to address recurring congestion at the HRBT, which included the addition of two or four lanes to I-64 on either a high bridge structure or a combination bridge and tunnel. The goal of the study was to review the six identified alternatives; develop concept-level drawings; develop general construction cost estimates for each alternative; identify potential right-of-way impacts; develop estimates of congestion-reduction benefits of the alternatives through traffic analysis; and provide policy-level guidance on the feasibility and long-term benefits of the alternatives. The final feasibility study was completed following a public comment period in December 2008. The study concluded that:

- Capacity improvements within the HRBT corridor are feasible by widening I-64;
- If the I-64 Hampton Roads crossing is widened, then widening should occur outside of the existing lanes; and
- Three build alternatives were recommended for dismissal because they did not address the recurring congestion in the corridor or presented safety concerns with two-way operations. The dismissed alternatives were:

- Add two additional lanes of bridge-tunnel capacity
- Add two additional lanes of reversible bridge-tunnel capacity
- Add two additional lanes of bridge capacity

The feasibility study was not completed pursuant to the National Environmental Policy Act (NEPA); thus, the conclusions reached by the study were not directly incorporated into this Draft EIS. However, the alternatives analysis in the feasibility study serves as a precursor to alternatives development in this Draft EIS. It also provides a preliminary indication of which alternatives may be reasonable or unreasonable.

In addition, several other studies prepared by VDOT or by other regional transportation agencies were reviewed, including:

- *HRBT High Bridge Technical Memorandum,* VDOT, 2012;
- *HRBT Traffic and Transportation Technical Report,* VDOT, 2012;
- *HRBT Transit Technical Memorandum,* VDOT, 2012;
- *Hampton Roads Bridge/Tunnel Quarterly Tunnel Operations Reports,* VDOT Hampton Roads District, 2010-2011;
- *Hampton Roads Regional Transit Vision Plan,* Hampton Roads Transportation Planning Organization and the Virginia Department of Rail and Public Transportation, 2009 and 2012;
- *Service and Schedule Efficiency Review,* Hampton Roads Transit, 2011; and
- *2034 Long Range Transportation Plan,* Hampton Roads Transportation Planning Organization, 2011.

Scoping

Pursuant to 23 CFR 771.111(a)(1) and 23 CFR 771.123(b), early scoping activities for the HRBT EIS were conducted between May and September 2011. During this time, public and agency comments were solicited regarding the potential range of alternatives to be considered and alternatives analysis methodologies to be used. Additionally, pursuant to 23 CFR 771.111(d), agencies likely to have an interest in the study were invited to formally participate in the development of alternatives and other aspects of the study. In general, public and agency comments generated during the scoping process suggested consideration of the No-Build Alternative; capacity improvements that would address traffic delays and congestion; tolling; alternatives that address current road, bridge, and tunnel conditions; bicycle and pedestrian accommodations; marine navigation accommodations; public transportation facilities; and ferries across Hampton Roads.

In April 2012, Citizen Information Meetings were held to present the range of alternatives considered and alternatives recommended to be retained. Comments received included suggestions to study additional tunnel and lane configurations, rail and transit options, and the high bridge option. Additional comments included the ability for VDOT to finance improvements (using tolls or taxes), residential and community impacts, and truck traffic. Comments received from agencies at this time included suggestions for transit and ferry options, incorporating additional speed and delay studies into the EIS, and addressing navigation issues for each alternative.

A summary of comments received from the public and agencies is included in **Chapter 7** of this Draft EIS.

Purpose and Need

Chapter 1 of this Draft EIS describes in detail the purpose and need for the I-64 HRBT study, which is focused on two primary need items: inadequate capacity and geometric deficiencies of the existing facilities. An alternative must address these needs in order to be retained for detailed evaluation.

Design Criteria

Alternatives were developed using current American Association of State Highway and Transportation Officials (AASHTO) and VDOT roadway design guidelines and structural design parameters. All guidelines were based on the AASHTO *A Policy on the Geometric Design of Highways and Streets, 2004* (Green Book), the VDOT *Road Design Manual*, and the VDOT *Bridge Design Manual*. Structural design parameters guided the development of new structures crossing Hampton Roads and were based on the Port of Virginia's requirements for vertical clearances and channel width for shipping as provided during the scoping process. Roadway geometric design guidelines used in the development of alternatives are presented in **Table 2-1**, and structural design parameters are presented in **Table 2-2**.

Initial Range of Alternatives

Based on the above considerations, an initial range of alternatives was identified for consideration. In general, these alternatives include:

- No-Build
- Transportation Systems Management (TSM)
- Other transportation modes, including transit and ferry
- Construct additional lanes, including new parallel Hampton Roads crossing
- Rehabilitate or replace existing facilities
- Managed lanes (tolls, HOV, HOT)

Detailed information on specific alternatives is provided in the remainder of this chapter.

2.2.2 Screening Approach and Criteria

Following the identification of an initial range of alternatives, the alternatives were then screened for their ability to address the identified purpose and need of the study:

> *Inadequate Capacity:* the alternative should address inadequate capacity of existing facilities to accommodate existing and forecasted travel demand at acceptable levels of traffic service and travel reliability.
>
> *Geometric deficiencies of existing facilities:* the alternative should address geometric deficiencies that currently impede operating efficiency and contribute to decreased levels of traffic service.

Screening criteria were derived from each of the need elements. These screening criteria were used to determine the ability of each build alternative to address the identified needs. Screening criteria are described in the following sections.

Except for the No-Build Alternative, if an alternative was deemed not feasible or reasonably capable of meeting the needs, then consideration of the alternative ceased and the alternative was not retained for detailed evaluation. The remaining alternatives were retained and are described in **Section 2.4**.

Inadequate Capacity

The screening criteria to measure capacity included level of service and travel reliability.

Level of Service

Level of service (LOS) is a measure of the quality of traffic flow, and is one measure of the ratio between roadway capacity and traffic volume. LOS ranges in grade from A to F. LOS A indicates free-flow

Table 2-1: Roadway Design Guidelines

Design Element	Mainline	Interchanges
Functional Classification	Urban Freeway	N/A
Design Speed	Minimum: 60 mph Desired: 70 mph	Directional Ramp: 50 mph Diamond Ramp: 50 mph Loop Ramp: 30 mph
Horizontal Alignment	Minimum Radius: 1,204' (60 mph) Minimum Radius: 1,810' (70 mph)	Directional Ramp Min. Radius: 760' Diamond Ramp Min. Radius: 760' Loop Ramps Minimum Radius: 215'
Vertical Alignment	Minimum Grade: 0.5% Maximum Grade: 4%	Minimum Grade: 0.5% Maximum Upgrade: 5% Maximum Downgrade: 4%
Stopping Sight Distance	Minimum: 570' (60 mph) Minimum: 730' (70 mph)	Directional Ramp Minimum: 425' Diamond Ramp Minimum: 425' Loop Ramp Minimum: 200'
Lane Width	12'	Single lane: 16' Two lanes: 12'
Shoulder Width	Mainline Right: 17' (12' paved); 14' paved with concrete barrier Left (median): 12' paved Tunnel Right: 2' offset from barrier Left (median): 2' offset from barrier Bridge (crossing) Right: 14' Left (median): 6'; 14' with 3 or more lanes	Right: Directional Ramp: 11' (8'paved) Diamond Ramp: 11' (8' paved) Loop Ramp: 11' (8' paved) Left: 9' (4' paved)
Structure Width	Match clear roadway width	Match clear roadway width
Cross Slope / Superelevation	Normal: 2% Maximum: 8%	Normal: 2% Maximum: 8%
Vertical Clearance	Mainline: 16'-6" Tunnel: 16'-6"	16-'6"
Clear Zone Width	30'-34'	Desired: 14' from edge of traveled way to protective barrier Minimum: typical section shoulder width from edge of pavement to face of protective barrier
Roadside Barrier	National Cooperative Highway Research Program (NCHRP) approved Guiderail, Concrete Barrier, End Treatment, and Impact Attenuating Devices	NCHRP approved Guiderail, Concrete Barrier, End Treatment, and Impact Attenuating Devices
Median Barrier	NCHRP approved Concrete Barrier, End Treatment, and Impact Attenuating Devices	N/A
Side Slopes	Desired: 6 Horizontal (H): 1 Vertical (V) or flatter Minimum: 4H:1V w/o barrier 2H:1V w/ barrier	Desired: 6H:1V or flatter Minimum: 4H:1V w/o barrier 2H:1V w/ barrier

Table 2-2.: Structural Design Parameters

Design Parameter	All Bridge Crossing	Bridge-Tunnel Crossing
Clearance Over Channel	250' above mean high water (MHW) across main channel	N/A
Clearance Under Channel	N/A	Desired: 65' to top of tunnel armor from mean low water (MLW) Minimum: 60' to top of tunnel from MLW[2]
Vertical Clearance Above Water for Approach Bridges	Elevation of Bottom of Superstructure: 18' relative to NAVD 88[1]	Elevation of Bottom of Superstructure: 18' relative to NAVD 88[1]
Width of Channel	Minimum: 1,000' (per Port of Virginia) Desired: VDOT Structure and Bridge (S&B) Division requirement based on future hydraulic study	Minimum: 1,000' (per Port of Virginia)[3] Desired: VDOT S&B requirement based on future hydraulic study
Horizontal Offset from Existing Tunnel/Bridge	200' minimum (outside of structure to outside of structure)	200' minimum (outside of structure to outside of structure)

[1] *The 18-foot clearance includes 1 foot of clearance above the 100-year design wave crest elevation (elevation 12 feet relative to North American Vertical Datum [NAVD] plus 1 foot) per AASHTO's Guide Specifications for Bridges Vulnerable to Coastal Storms, 2009, plus an assumed 5 feet for potential sea level rise per VDOT Structure and Bridge Division standard practice.*

[2] *Clearance under channel from existing top of tunnel to MLW is ±55 feet.*

[3] *Width of existing channel between islands is 3,700 feet.*

conditions where the effects of incidents or breakdowns are easily absorbed; traffic operates well below capacity and at or close to free-flow speeds without delay in travel time. Off-peak speed studies through the HRBT showed free-flow speeds of approximately 55 to 60 miles per hour (MPH). LOS F indicates stop-and-go conditions with queues forming behind bottlenecks. Traffic operates at or above capacity and is substantially below free-flow speeds, which subsequently causes a substantial delay in travel time. LOS was determined using Highway Capacity Software (HCS) which is the FHWA-accepted analysis method for evaluating the quality of traffic operations. The LOS standard is LOS C for interstates; however, this LOS may not be attainable in this urban environment. Thus, VDOT has identified LOS D as the screening threshold used for the study alternatives.

Travel Reliability

Alternatives were evaluated and compared for their ability to improve travel reliability. Travel reliability is not a criterion that can be quantitatively measured. However, it is possible to identify factors that impact the reliability of travel conditions, which provides for a qualitative assessment. These factors include the ability to move traffic incidents to the shoulders and out of travel lanes to avoid increased traffic delays; the ability of emergency response providers to reach incident scenes, via adequate shoulders and/or clear zone widths when General Purpose (GP) lanes are queued; adequate overhead clearance to reduce the need for over-height trucks to turn around; and other physical deficiencies. Travel reliability also includes the ability of an alternative to provide predictable service during routine maintenance or construction. The ability of each alternative to address these reliability factors was considered during the alternatives screening process. If an alternative did not address these factors, it was not retained.

Geometric Deficiencies of Existing Facilities

I-64 was originally constructed in the late 1950s in Hampton and in the early 1970s in Norfolk. The westbound lanes of the HRBT were opened to traffic in 1957 and the eastbound lanes of the HRBT were opened to traffic in 1976. The mainline, interchanges, bridges, and tunnels do not meet current design standards. Identified geometric deficiencies include low vertical clearance within the existing tunnels,

low vertical clearance above the water for the approach bridges over Hampton Roads, and narrow median shoulders on the mainline. Additionally, the tunnels do not meet the current National Fire Protection Agency (NFPA) 502 fire and safety codes. The screening criteria derived from the deficiencies need are primarily based on the design guidelines presented in **Tables 2-1 and 2-2**.

Three key issues are representative of the geometric deficiencies of existing facilities in the study corridor and have been identified as screening criteria, specifically: shoulders, vertical clearance in tunnels, and vertical clearance above the water.

Shoulders

In the Hampton section of the study area, left shoulders are generally eight feet wide and do not meet current 12-foot interstate design standards provided by AASHTO in *A Policy on Geometric Design of Highway and Street* (Green Book) and VDOT in the *Road Design Manual*. The bridges between the tunnels and the land-side roadways have ten-foot-wide right shoulders and 4-foot-wide left shoulders that do not meet current design standards as provided by AASHTO and VDOT. The roadways through the tunnels do not have shoulders consistent with current standards. Within the Norfolk section of the study area, right shoulders are 12 feet wide and left shoulders vary from two to four feet wide and do not meet current interstate design standards.

As described in the purpose and need, the lack of adequate shoulder widths result in roadway congestion and management problems during incidents or minor construction/inspection because one or more of the travel lanes must be closed to through traffic. Providing adequate shoulder widths that meet design standards would allow emergency vehicles to use shoulders to access incidents; allow vehicles involved in an incident to pull out of the travel lane; and allow additional roadway width for maintenance of traffic during construction, maintenance, and inspection activities. Thus, each alternative was evaluated for its comparative ability to address existing geometric deficiencies and provide shoulder widths that meet current design standards.

Vertical Clearance in Tunnels

The existing vertical clearance is 13'-6" for the westbound tunnel and 14'-6" for the eastbound tunnel, both of which are substandard. The VDOT *Road Design Manual* establishes a vertical clearance of 16'-6" for interstate facilities. This limited vertical clearance is problematic for some trucks. According to the VDOT *Hampton Roads Bridge/Tunnel Quarterly Tunnel Operations Reports*, an average of 80 to 90 potentially over-height trucks per month must be stopped and inspected prior to entering the tunnel to remove the potentially over-height truck from the roadway. The over-height trucks are removed from traffic and inspected on the tunnel portal islands. If they pass the height inspection, they are returned to the highway. If they do not pass the height inspection, they are diverted to other crossings such as the Monitor-Merrimac Memorial Bridge-Tunnel (I-664) or the James River Bridge (US 17). Regardless of the outcome of the inspection, all traffic in one direction must be stopped to allow the truck to reenter the highway. Stopping traffic two times for each potentially over-height truck causes roadway congestion, delays, and reduced travel reliability. Providing adequate vertical clearance in the tunnel would allow all standard-height trucks to cross the HRBT, eliminating the need to remove potentially over-height vehicles from the traffic stream. Accordingly, alternatives were evaluated for their comparative ability to provide vertical clearances in the tunnel that meet current design standards.

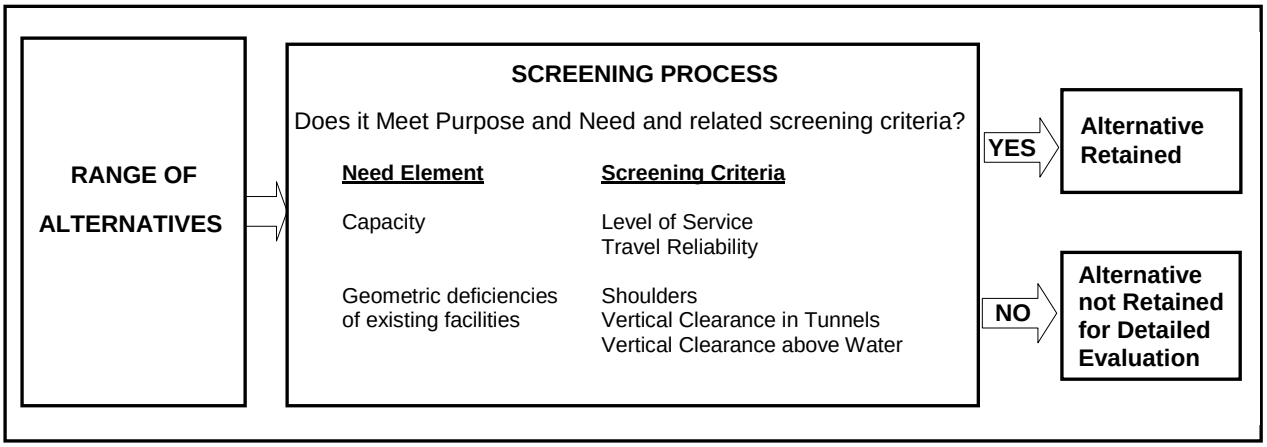
Vertical Clearance above Water

The approach bridges have a vertical clearance above the water that does not meet the clearance specifications in AASHTO's *Guide Specifications for Bridges Vulnerable to Coastal Storms*, 2009. Consequently, during a storm event, the saltwater could contact the bottom of the girders, thus causing

deterioration over time. In more severe storm events, water could overtop the bridge deck and potentially shift the bridge off its bearings. Alternatives were screened for their comparative ability to meet the following AASHTO clearance specifications: "vertical clearance of highway bridges should be sufficient to provide at least 1 foot of clearance over the 100-year design wave crest elevation, which includes the design storm water elevations." It is VDOT Structure and Bridge Division's standard practice to add five feet of additional clearance to account for potential sea level rise.

Summary

The following flowchart illustrates the steps in the alternative development and screening criteria process.



2.3 ALTERNATIVES NOT RETAINED FOR DETAILED EVALUATION

Through the screening process, the following alternatives were not retained for detailed evaluation. Except for the No-Build Alternative, alternatives deemed not reasonably capable of meeting the identified needs, or deemed too disruptive in comparison to the transportation benefit achieved, were not retained for further evaluation. These alternatives and the reasons for not being advanced for further evaluation are discussed below.

2.3.1 Transportation System Management / Transportation Demand Management (TSM/TDM)

TSM/TDM improvements maximize the efficiency of the current transportation system or reduce the demand for travel on the system through the implementation of low-cost improvements. Examples of TSM activities include the addition of turn lanes, optimized signalization at intersections, and Intelligent Transportation Systems (ITS) measures such as active traffic management and enhanced driver information. Examples of TDM activities include ride sharing, van and carpooling, installation of park and ride facilities, and encouragement of telecommuting.

TSM/TDM alternatives, by their nature, do not include the addition of single occupancy vehicle (SOV) lanes and involve minor work outside the existing right-of-way. Therefore, because of the limited scope of these types of improvements, TSM/TDM improvements alone would not address the inadequate capacity or geometric deficiency needs. Thus, as a stand-alone alternative, TSM/TDM has not been retained for further evaluation. Notwithstanding, the Retained Build Alternatives do not preclude TSM/TDM elements, should they be considered in the future.

2.3.2 Rehabilitation or Reconstruction of the Existing HRBT

This alternative would include rehabilitation/upgrade of the existing tunnels to maximize use of their remaining life span of 75-100 years.[14] The alternative also includes either rehabilitation of the approach bridge superstructure or reconstruction of the approach bridge substructure and superstructure.

The rehabilitation would likely include replacement of the wall tiles, wearing surface, and structural slab; upgrades to utilities; upgrades to the ventilation system; and upgrades to the safety system to improve compliance with *NFPA 502: Standard for Road Tunnels, Bridges, and Other Limited Access Highways* (2011). The existing transverse ventilation systems in both existing tunnels would be converted to longitudinal ventilation systems with the addition of jet fans. Installation of the jet fans would involve the removal of the existing ceiling tiles and the upper exhaust air duct to create space for the jet fans, thereby, increasing the vertical clearance. These measures would partially address the geometric deficiencies in the existing tunnels, but it is not likely that increasing the tunnel clearance of 16 feet 6 inches to meet the design criteria would be feasible. Additional detailed tunnel studies would determine the potential increase in vertical clearance. Additionally, NFPA 502 requires upgrades to the fire detection and protection systems, means of egress, and electrical systems. Better compliance with NFPA 502 would improve the safety systems in the tunnels to meet the standards that all new tunnels must meet.

Bridge rehabilitation would consist of the removal and replacement of the existing bridge superstructure, crack sealing, repair, jacketing existing piling, replacement of piling, and the replacement of parapets. Dredging of a ten-foot deep channel for barges would be required outside of both existing structures in areas where the water depth is less than ten feet. Bridge reconstruction would consist of complete substructure (piers/foundations) and superstructure replacement, including raising and widening the structures to meet the current design standards. Bridge reconstruction would require that the ten-foot deep dredged channel include the entire area between the existing approach bridges as well as 150 feet east of the westbound structure and 50 feet west of the eastbound structure.

As a stand-alone alternative, this alternative would not increase roadway capacity to alleviate current or future unacceptable and unreliable levels of traffic service; operating speeds; or travel times. Although the current geometric deficiencies of the existing facilities would be addressed with reconstruction of the approach bridges and rehabilitation/upgrade to the existing tunnels, it would not be feasible to address them with the bridge rehabilitation because replacement of the superstructure would not allow for the height of the approach bridges to be raised nor shoulders to be widened. Travel lanes would need to be taken out of service or replaced with temporary structures during the rehabilitation or reconstruction effort, thus affecting the travel capacity during the construction period which could extend beyond three years. During this time, HRBT traffic would either be detoured or continue to use the HRBT with a reduced number of lanes, resulting in substantial disruption to regional travel patterns. A detour would convey traffic to Hampton Roads crossings such as the Monitor-Merrimac Memorial Bridge-Tunnel (I-664) or James River Bridge (US 17), which provide circuitous routes of more than ten miles through downtown Norfolk to reach destinations served more directly by the HRBT.

Because this alternative would not address the purpose and need of the study, it was not retained for further evaluation as a stand-alone alternative; however, it has been included as a component of the Retained Build Alternatives.

[14] Per meeting with VDOT HRBT Study Team and the Hampton Roads District Structure and Bridge Engineer, August 18, 2011, and VDOT inspection reports from 2003.

2.3.3 Replacement of the Existing HRBT

This alternative would include any improvements that involve complete removal of an existing bridge-tunnel in conjunction with reconstruction of a new crossing facility in the same location. This alternative would not address the identified capacity needs as it only replaces the existing HRBT and would not provide additional capacity. Geometric deficient infrastructure would be replaced by a new facility that would meet current design standards for shoulder widths, vertical clearance in tunnels, and vertical clearance above water for approach bridges. If only one of the existing bridge-tunnels is removed, the remaining bridge-tunnel would have the same geometric deficiencies as the current facility.

Removal of two lanes of the existing bridge-tunnels would be necessary prior to constructing the new facility. The number of lanes crossing the HRBT during construction would be reduced by one half from existing conditions from four lanes to two lanes. This would result in increased delays within the I-64 HRBT corridor for drivers that continue to use the HRBT or additional traffic on other regional routes such as I-664 and the James River Bridge.

This alternative is not reasonable and has not been retained because the existing tunnels have a remaining life span of 75 to 100 years, and it would be less costly to rehabilitate the existing approach bridges and tunnels (estimated at $530 million) than to completely replace them (estimated at $2.7 to $3.3 billion). Additionally, this alternative would result in a high level of disruption to regional travel during the construction period (which could extend beyond three years).

2.3.4 Reversible Lanes

This alternative would include adding one or two reversible travel lanes to I-64. At the HRBT crossing, the additional lanes would be constructed west of the existing crossing to prevent disturbance to the existing bridge-tunnels during construction. However, the reversible lanes would operate in the center of the roadway, and eastbound traffic would use the new lanes. The reversible lanes would connect to the mainline of I-64 west of I-664, and connect to the existing reversible lanes on I-64 east of I-564. The lanes would either be completely barrier separated from both directions of traffic, similar to the reversible lanes east of I-564, or a moveable-barrier system could be used to separate opposing traffic.

Construction of reversible lanes would partially address geometric deficiencies at the existing crossing, because the reversible lanes would be on a new bridge-tunnel that would meet current design standards for shoulders, vertical clearance in tunnels, and vertical clearance above water. However, the existing bridge-tunnels would continue to be used without improvements; therefore, geometric deficiencies at these facilities would not be addressed.

The travel patterns along I-64 through this study area do not allow for effective operation of reversible lanes. Based on the traffic volumes for existing conditions and the No-Build Alternative provided in **Chapter 1** (**Tables 1-1 and 1-2**), there is not a clear directional peak volume. The westbound and eastbound volumes have a defined peak period; however, the volumes in each direction are comparable during those peak periods. Thus, reversible lanes would improve capacity in one direction during any given peak period, but the capacity needs in the opposite direction would not be met. Consequently, this alternative has not been retained for detailed evaluation because it would not meet the minimum LOS standard for both directions. It is also noted that the *2008 HRBT Expansion Feasibility Study* recommended elimination of the reversible lanes alternative for similar reasons.

2.3.5 Build-6 Alternative

This alternative would include construction of two additional lanes of capacity on I-64 at the Hampton Roads crossing and within the Norfolk section of the corridor, so that a continuous six-lane facility would extend from I-664 to I-564. Through the Hampton section of the study corridor, no additional lanes

would be constructed as the corridor currently includes six travel lanes, three in each direction. The existing bridge-tunnels would remain so that the capacity and life span of the facility would be used, and the alternative would include rehabilitation or reconstruction of the HRBT as described in **Section 2.3.2**. The alternative would include a new two-lane bridge-tunnel at the Hampton Roads crossing.

This alternative would partially address geometric deficiencies of existing facilities by constructing a new bridge-tunnel that would meet current design standards for shoulders, vertical clearance in tunnels, and vertical clearance over water. However, two additional lanes of roadway would not provide adequate capacity to alleviate congestion for current or future traffic within the study corridor. In general, LOS E or worse would still occur on the HRBT and its approaches in the future with this alternative. This would not address the capacity need and the LOS screening threshold for this study. This alternative would require two-way traffic to operate on the existing eastbound approach bridges and tunnel. Due to the narrow typical section, a concrete traffic barrier could not be placed between the travel lanes; therefore, there would be no means to minimize potential head-on collisions at highway speeds. Because of this safety concern, the speed limit could be reduced; however, this reduction would further lessen the capacity of this improvement.

Three alternatives that would add two lanes of capacity were evaluated in the *2008 HRBT Expansion Feasibility Study*. Alternative 1 included two additional lanes of bridge-tunnel capacity; Alternative 2 included the addition of two reversible bridge-tunnel lanes throughout the corridor to increase peak hour and evacuation capacity; and Alternative 5 included a high bridge at the Hampton Roads crossing. The *2008 HRBT Expansion Feasibility Study* recommended that each of these alternatives be eliminated from further consideration because they would not meet minimum LOS standards for interstate facilities. Additionally, there were safety concerns associated with operating two-way, high-speed traffic on the approach bridges and in the tunnel without barrier separation. This study confirms that adding only two lanes of capacity is inadequate to meet future traffic demand. Because this alternative would not adequately address the capacity needs of the study, it has not been retained.

2.3.6 Build-12 Alternative

The Build-12 Alternative would construct six additional lanes of capacity on I-64 within the Hampton portion of the corridor, and eight additional lanes of capacity on I-64 on the Hampton Roads Bridge-Tunnel and within the Norfolk section of the corridor. This expansion would result in a continuous twelve-lane facility that would extend from I-664 to I-564. The alternative would include rehabilitation or reconstruction of the HRBT as described in **Section 2.3.2**.

Due to the additional roadway lanes, the Build-12 Alternative would improve capacity for current and future traffic within the study corridor, and result in a better LOS as compared to the Build-8 and Build-10 Alternatives. This alternative would address geometric deficiencies of existing facilities by constructing a new bridge-tunnel that would meet current design standards for shoulders, vertical clearance in tunnels, and vertical clearance above water. However, because I-64 is the most direct route between the Peninsula and Southside populations, additional capacity on the HRBT in the form of a Build-12 Alternative would draw traffic from other Hampton Roads crossings, in particular the Monitor-Merrimac Memorial Bridge-Tunnel (I-664), even though the total traffic volume crossing Hampton Roads would not substantially increase. As a result, capacity on parallel facilities would likely become underutilized in the future.

Because it would have a wider footprint, the Build-12 Alternative would likely result in proportionally greater impacts to right-of-way, wetlands, streams, historic properties, and community facilities compared to the other retained alternatives (described in **Section 2.4**). However, the wider footprint would not equate to a greater ability to address the transportation needs stated in **Chapter 1**. Specifically, as discussed in **Section 2.4.4**, the Build-10 Alternative would provide an average of LOS C

throughout the corridor, including LOS C at 56 percent of all sections, and therefore meets the LOS standard for interstate roadways. The Build-12 Alternative would provide more capacity than the Build-10 Alternative, and would thus provide an average LOS B/C. The additional capacity provided by the Build-12 Alternative would results in an LOS that exceeds the study LOS criteria. The alternative has therefore, not been advanced because the other retained alternatives address the transportation needs with less environmental impacts.

2.3.7 High Bridge

This alternative is similar to the high bridge alternative evaluated in the *2008 HRBT Feasibility Study*. However, as discussed in the *HRBT High Bridge Technical Memorandum* for this study, a high bridge is not considered a stand-alone alternative in this Draft EIS, but rather a component to address the crossing type for the Hampton Roads channel. The option would involve a new cable-stayed or suspension bridge parallel to the existing HRBT. The bridge would be built to carry all lanes of I-64 over Hampton Roads. This option would fully address the geometric deficiencies of existing facilities by constructing a new bridge that would have full shoulders, no vertical clearance issues, and meet or exceed the minimum height above mean high water (MHW). The bridge lanes would be designed to meet the capacity needs for the corridor.

A high bridge would require new piers and new or expanded islands within Hampton Roads. Depending on the bridge type, these new structures or landforms have the potential to infringe on the existing channel. A high bridge would also introduce a height restriction over the shipping channel that does not exist today. A high bridge could be vulnerable to natural hazards and manmade threats, including ships colliding with bridge piers and high winds impacting bridge operations. A high bridge would require 500-foot to 800-foot tall towers that would be obstructions to FAA controlled air space from nearby Chalmers Field and Langley AFB. This anticipated bridge height would also create a visual impact to nearby communities and properties.

Hampton Roads experiences a complex mixing of waters from the Atlantic Ocean, the Chesapeake Bay, and the James, Nansemond, and Elizabeth Rivers. A hydrodynamic model of the mixing of these waters was completed for the 2001 Hampton Roads Crossing FEIS and included an analysis of the impacts that a crossing structure would have on tidal heights, tidal currents, tidal prism (volume of flood or ebb flow entering an enclosed region), salinity, and sedimentation. The analysis inferred that modifications to the existing landforms and structures within and adjacent to Hampton Roads could have an impact on the hydrodynamics within Hampton Roads. Compared to a new tunnel, which would be buried in the Hampton Roads bottom and use expanded islands, the new islands potentially needed for a high bridge could have a greater impact on hydrodynamic characteristics. Additional information on the hydrodynamic model is presented in **Section 4.8.4**.

Although a high bridge option over Hampton Roads could be a feasible alternative from an engineering perspective and would address the stated transportation needs, the option would create the additional problems noted above that make it unreasonable to retain. Additional information on the high bridge option is included in the *HRBT High Bridge Technical Memorandum*.

2.3.8 Light or Heavy Rail Transit

This alternative would include dedicated light or heavy rail transit on a new structure across Hampton Roads. The existing bridge-tunnels would remain; however, rehabilitation of the superstructure or reconstruction of the substructure and superstructure of the approach bridges would be completed. Routine maintenance of the existing tunnels would continue as required. This alternative would not address geometric deficiencies of existing facilities because no improvements would be made to the

existing bridge-tunnel to address current design standards for shoulders, vertical clearance in tunnels, or vertical clearance above water.

There is currently no rail transit service connecting Hampton to Norfolk, nor comprehensive transit service within the larger region. The nearest rail transit service is "The Tide," which is a light rail line located approximately 5.5 miles from the study area and operates on the Southside from Fort Norfolk Station to Newtown Road Station. For a rail transit crossing at the HRBT to be viable, a new rail transit route or system would be necessary on both the Peninsula and the Southside.

The Hampton Roads Transportation Planning Organization (HRTPO) and Virginia Department of Rail and Public Transportation (DRPT) recently completed the *Hampton Roads Regional Transit Vision Plan* (*Vision Plan*). The *Vision Plan* was prepared in two phases. Phase I, the *Transit Vision Plan for Hampton Roads*, was completed in April 2009 by the HRTPO. Phase 2, the *Hampton Roads Regional Transit Vision Plan Final Report*, was completed in February 2011 by DRPT. Together, these two documents provide a strategic approach for the development and implementation of a regional mass transit system. The *Vision Plan* offers short-term recommendations to address current regional transit inadequacies and long-term strategies to achieve the goals of reduced traffic congestion and increased transit use. The *Vision Plan* proposes a dedicated light rail transit connection across Hampton Roads in the long term (beyond 2034), although specific corridor recommendations are not provided. Several alternative locations for this facility are identified, with the preferred potential crossing located approximately four miles west of the HRBT. Potential transit improvements across Hampton Roads are not funded for study, design or construction in the HRTPO's *2034 Long Range Plan*; therefore, they are not reasonably feasible.

Ridership estimates were not included with Phase II of the *Vision Plan*, however, the *Preliminary Cost and Ridership Estimation Report,* prepared as part of Phase I, included estimated 2034 ridership for light rail service across Hampton Roads. These projections provide a reasonable approximation of the potential ridership for the Light or Heavy Rail Passenger Alternative. The projections assume two services: from Naval Station Norfolk to downtown Newport News, and from downtown Hampton to Wards Corner (near the I-64 interchange with I-564). Both services are recommended for implementation after 2035. According to the report, daily ridership is projected to be as much as 4,100 for Naval Station Norfolk to downtown Newport News, and 5,100 for downtown Hampton to Wards Corner.

Currently, approximately 88,000 persons use the HRBT every day; approximately 112,000 are projected to use the HRBT in 2040 under No-Build conditions. Assuming that the potential daily projected ridership for the two proposed rail transit services all uses the HRBT, it would include 9,200 person-trips on the HRBT per day. Thus, rail transit would accommodate approximately ten percent of the existing HRBT users and eight percent of the year 2040 users on the HRBT. Similarly, approximately 22,000 vehicles use each lane of the HRBT today and approximately 28,000 vehicles would use each lane under year 2040 No-Build conditions. Therefore, rail transit would accommodate approximately 42 percent of one existing lane and 33 percent of one of the 2040 lanes.

Based on the discussion above, the Light or Heavy Rail Transit Alternative was not retained for further evaluation because it would not address the roadway deficiency or capacity needs identified by this study. The alternative would require substantial new rail transit connections on the Peninsula and Southside, and it would have limited ability to accommodate existing and future traffic volumes on the HRBT. Further information regarding consideration of light and heavy rail transit is included in the *Alternatives Technical Report*.

2.3.9 Bus Transit

This alternative would include expansion of existing bus transit services within the study corridor and across Hampton Roads. This could be in the form of an increase in bus service, or a dedicated (express bus or bus rapid transit) facility, as recommended for study in the *Vision Plan*. A Bus Transit Alternative could be considered as a stand-alone alternative or in conjunction with other build alternatives. Regardless, the existing bridge-tunnels would remain, however, rehabilitation of the superstructure or reconstruction of the substructure and superstructure of the approach bridges would be completed, and routine maintenance of the tunnels would continue as required.

As a stand-alone alternative, increased bus service or a dedicated bus facility would not involve roadway or bridge-tunnel improvements; therefore, it would not address the identified inadequate capacity and geometric deficiencies of the existing facility. Expansion of the existing bus transit network alone would likely not attract enough riders to substantially address the capacity need within the I-64 HRBT corridor because there is currently a lack of bus ridership across Hampton Roads. This fact is demonstrated by recent recommendations by Hampton Roads Transit (HRT) to eliminate five current weekday trips across HRBT due to low ridership (*Service and Schedule Efficiency Review, HRT, March 2011)*. In 2011, all bus routes across HRBT accommodated approximately 700 passengers per day, and all buses across Hampton Roads accommodated approximately 900 passengers per day. This ridership is less than one percent of the existing HRBT daily traffic volume. Any increased bus service would also continue to rely on the existing HRBT facility, and its operation would be hampered by current capacity and deficiencies of existing facilities. Therefore, expanded bus transit as a stand-alone alternative has not been retained for further evaluation.

Bus transit could be implemented as part of other Retained Build Alternatives. Expanded service could travel more freely within alternatives that provide additional lane capacity and improve capacity for trips across Hampton Roads. Build alternatives that include managed lanes could include bus transit and/or dedicated bus lane as part of the management strategy. Thus, expanded bus transit has been retained for further evaluation as a component of other alternatives.

2.3.10 Ferry Service

During scoping, various public and agency comments suggested consideration of hydrofoil or ferry service as part of the I-64 HRBT Draft EIS. This alternative would provide a service to carry vehicles across Hampton Roads via water transport. The existing bridge-tunnels would remain; however, rehabilitation of the superstructure or reconstruction of the substructure and superstructure of the approach bridges would be completed, and routine maintenance of the tunnels would continue as required.

The Ferry Service Alternative would not address the geometric deficiencies of the existing facilities, because no improvements would be made to the I-64 roadway or existing bridge-tunnel to address current design standards for shoulders, vertical clearance in tunnels, or vertical clearance above water.

Ferries would require that vehicles arrive at least 20 minutes prior to departure to load and would travel at maximum speeds less than 25 miles per hour across Hampton Roads. The total trip length (including loading and unloading) would be approximately 30 minutes across Hampton Roads only. This represents an increase in the travel time across Hampton Roads of approximately 20 minutes compared to the average peak hour travel time across the bridge-tunnel of 9.5 minutes today. In 2040, the travel time across the bridge-tunnel would be greater as a result of increased congestion; nevertheless, the time would likely not approach the length of time required for a ferry crossing. Further, as cited in the *Vision Plan*, total average weekday ferry ridership between downtown Hampton and the Norfolk Naval

Station in the year 2034 are expected to range from 600 to 1100 vehicles, or about one percent of the existing traffic volume and less than 1 percent of the projected 2040 No-Build volume on the HRBT.

A similar study was performed by the Maryland Transportation Authority to evaluate a potential ferry crossing of the Chesapeake Bay to help reduce traffic congestion on the existing Chesapeake Bay Bridge. The study, titled *Task Force on Traffic Capacity across the Chesapeake Bay*, was completed in July 2006. The findings noted that a ferry crossing would accommodate up to 335,000 vehicles per year or less than 1,000 vehicles per day. Further, the study found that the cost of a ferry crossing would be 10 to 15 times higher for passengers per trip then using the existing tolled bridge which extends for a distance of approximately 4.3 miles.

For the reasons cited above, the Ferry Service Alternative would not address geometric deficiencies of the existing facilities or capacity needs of the HRBT, and thus has not been retained for detailed evaluation.

2.4 ALTERNATIVES RETAINED

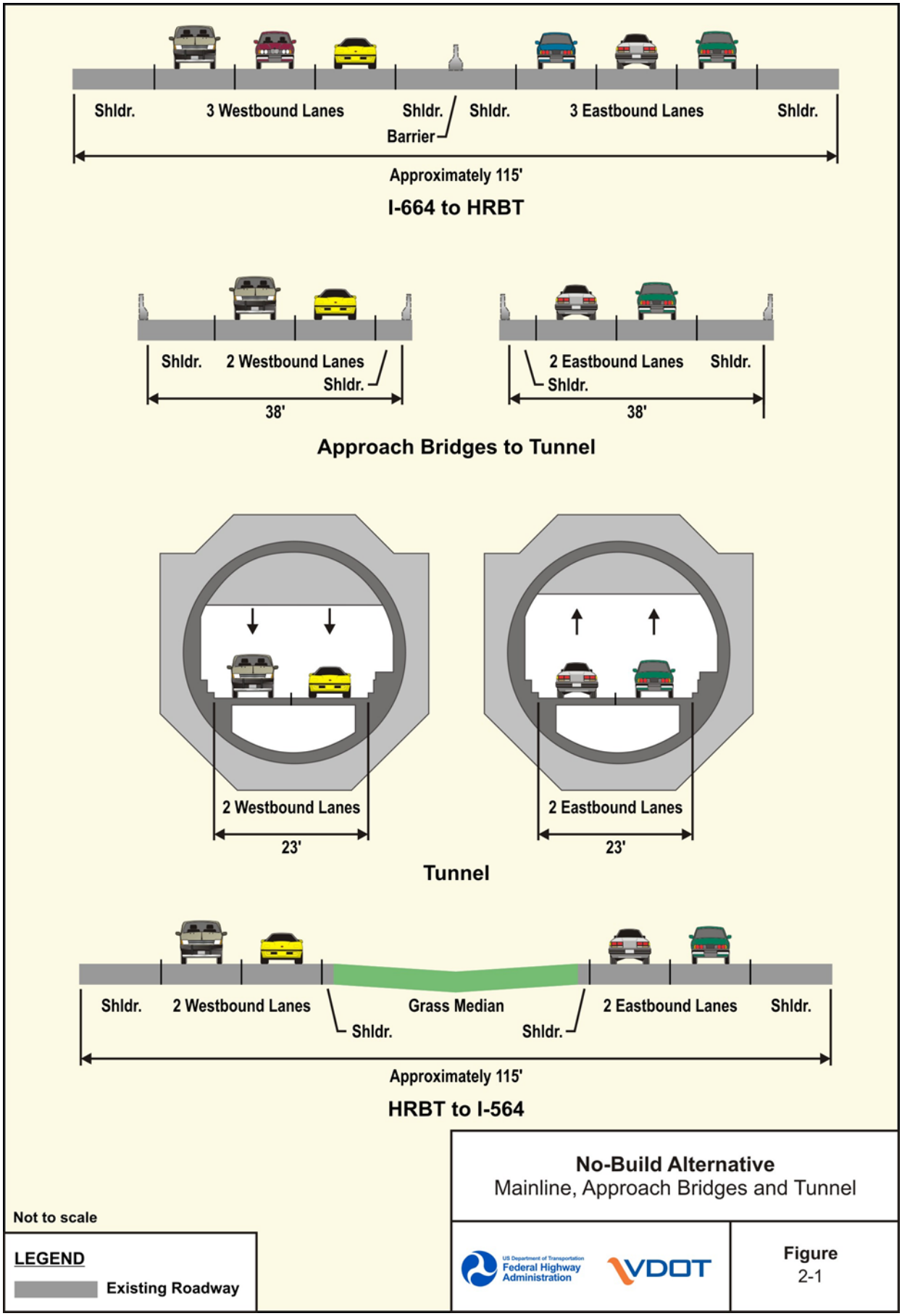
The No-Build Alternative and three build alternatives (the Build-8, Build-8 Managed, and Build-10) met the study screening criteria and were retained for detailed study. These build alternatives are being presented to the public as the current candidate alternatives for a potential proposed action to address the study purpose and need. They received an additional level of evaluation including development of engineering details such as typical sections and traffic analysis. The alternatives retained are also assessed for environmental impacts in **Chapter 4** of this Draft EIS. Each alternative is described in the following sections according to the following elements: mainline, approach bridges, tunnel, interchanges, operational analysis, cost, and ability to address study needs. Additional detail is provided in the *Alternatives Technical Report*.

2.4.1 No-Build Alternative

Under the No-Build Alternative (shown on **Figure 2-1**), I-64 would remain predominantly three lanes per direction within the Hampton section of the study area, with auxiliary lanes (acceleration and deceleration lanes) at the interchanges. The 3.5-mile HRBT would continue with current operations. Within the Norfolk section of the study, I-64 would remain two lanes per direction, including the I-64 bridges across Willoughby Bay. Under the No-Build Alternative, VDOT would continue maintenance and repairs of I-64 and the HRBT as needed, with no substantial changes to lane management. There would be no rehabilitation or reconstruction of the HRBT. The No-Build Alternative would include those projects funded for construction in HRTPO's *2034 Long Range Transportation Plan.*

Traffic forecasts for the No-Build Alternative were developed using the Hampton Roads regional travel demand model. Both daily and peak hour traffic forecasts were developed. Mainline daily and peak hour volumes for the No Build Alternative are provided in **Table 1-2**. Mainline LOS analyses were also performed using the 2010 Highway Capacity Software, which uses the methods outlined in the 2010 Highway Capacity Manual. LOS for the AM and PM peak hours are also provided in **Table 1-2**. With the No-Build Alternative, traffic volumes are projected to increase more than 25 percent compared to existing (2011) volumes. LOS E and F would prevail throughout the study area under the No-Build Alternative. Nine out of 16 mainline sections would operate at an LOS E or worse during the AM peak hour, and six would be LOS E or worse during the PM peak hour.

The No-Build Alternative would not address the purpose and need of the study because routine maintenance of the HRBT corridor and other programmed projects would not improve capacity or address geometric deficiencies of existing facilities. However, it has been retained for detailed evaluation to serve as a benchmark for comparison to other retained alternatives.


Shldr.
3 Westbound Lanes
Shldr.
Barrier
Shldr.
3 Eastbound Lanes
Shldr.
Approximately 115'
I-664 to HRBT
Shldr.
2 Westbound Lanes
Shldr.
38'
2 Eastbound Lanes
Shldr.
Shldr.
38'
Approach Bridges to Tunnel
2 Westbound Lanes
23'
2 Eastbound Lanes
23'
Tunnel
Shldr.
2 Westbound Lanes
Shldr.
Grass Median
Shldr.
2 Eastbound Lanes
Shldr.
Approximately 115'
HRBT to I-564
No-Build Alternative
Mainline, Approach Bridges and Tunnel
Not to scale
LEGEND
Existing Roadway
US Department of Transportation
Federal Highway Administration
VDOT
Figure
2-1

2.4.2 Build-8 Alternative

Mainline

The Build-8 Alternative would provide four continuous mainline lanes in each direction of I-64 throughout the limits of the study. Through the Hampton section of the study, this alternative would require one lane of widening in each direction of I-64. Through the Norfolk section, this alternative would require the addition of two lanes in each direction of I-64. The typical section would include 12-foot travel lanes and shoulders to meet current design criteria, as shown in **Figure 2-2**. The eastbound and westbound directions would be separated by a concrete traffic barrier. The total pavement width of the Build-8 Alternative mainline would be approximately 150 feet and would require outside widening on both sides of the highway through Hampton. In Norfolk, the Build-8 Alternative would require outside widening on both sides of the highway and widening to close in the existing grass median. Through Willoughby Spit, the mainline widening would occur on the south side of the existing roadway only.

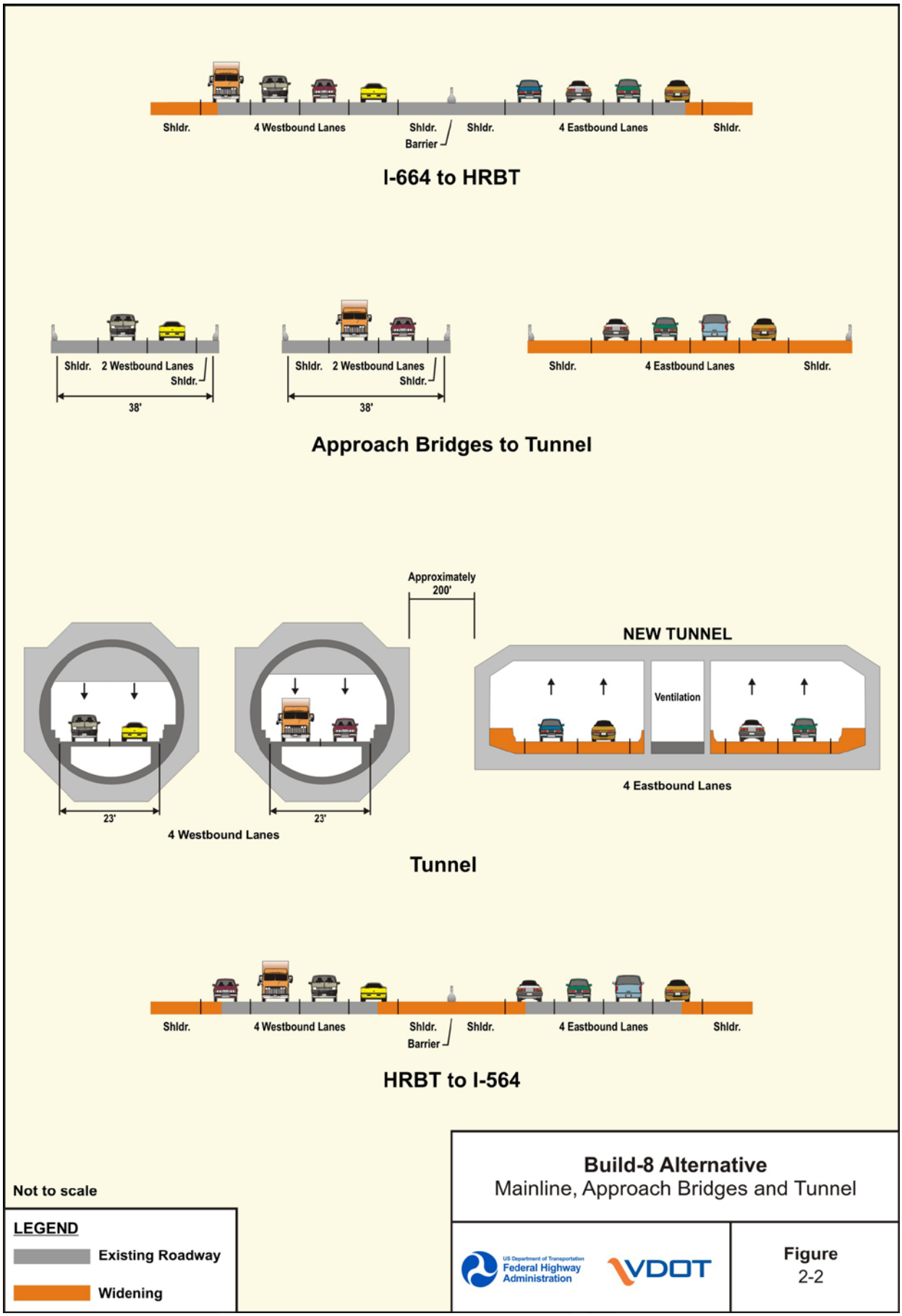
The Build-8 Alternative was assumed to include an open roadside section that would consist of a clear zone; roadside grading to tie the proposed slope to existing ground; and an offset to the LOD to accommodate elements such as drainage, utilities, and stormwater management. Based on the level of detail of this study, a consistent LOD was established for the alternative to ensure that there would be adequate width to accommodate detailed design and construction in the future. Consequently, the resulting potential LOD for the Build-8 Alternative mainline is approximately 360 feet or 425 feet, depending on topographic variability and needed width for auxiliary lanes.

At the western study limit (west of the I-664 interchange), the alternative mainline would tie to the existing mainline typical section of twelve lanes at the Pine Chapel Road Bridge. At the eastern study limit (east of the I-564 interchange), the mainline would tie into the existing I-64 mainline typical section of four lanes. Expanded local/express bus service or bus rapid transit would not be precluded and could be accommodated with this alternative.

Approach Bridges

The existing approach bridges to the existing tunnel currently carry two lanes per direction, as shown in **Figure 2-2**. In the Build-8 Alternative, the eastbound bridge would be modified to carry two westbound lanes. A new four-lane bridge would be constructed approximately 200 feet to the west of the existing bridges to carry the eastbound lanes. To meet current design standards, the new structure would be approximately 76 feet wide and include wider shoulders than the existing bridges (**Figure 2-2)**.

The existing approach bridges would be rehabilitated or reconstructed, similar to the stand-alone rehabilitation or reconstruction alternative described in **Section 2.3.2**. With rehabilitation, only the superstructure of the existing bridge would be replaced. Consequently, the existing lane and shoulder widths could not be modified because the existing substructure could not support additional roadway width. The existing bridges would also not be raised from their existing 15.5 foot elevation to meet the clearance specifications in AASHTO's *Guide Specifications for Bridges Vulnerable to Coastal Storms*, 2009 because the substructure would not be modified. With reconstruction, there would be complete replacement of the substructure and the superstructure of the existing approach bridges; therefore, the lane and shoulder widths would be redesigned to meet current design criteria and address the physical deficiencies on the bridge. Reconstruction would also include the addition of vertical clearance above the water to an elevation of 18 feet to meet the clearance specifications in AASHTO's Guide Specifications for Bridges Vulnerable to Coastal Storms, 2009.


Shldr.
4 Westbound Lanes
Shldr.
Barrier
Shldr.
4 Eastbound Lanes
Shldr.
I-664 to HRBT
Shldr. 2 Westbound Lanes Shldr.
38'
Shldr. 2 Westbound Lanes Shldr.
38'
Shldr.
4 Eastbound Lanes
Shldr.
Approach Bridges to Tunnel
Approximately 200'
NEW TUNNEL
Ventilation
4 Eastbound Lanes
23'
23'
4 Westbound Lanes
Tunnel
Shldr.
4 Westbound Lanes
Shldr.
Barrier
Shldr.
4 Eastbound Lanes
Shldr.
HRBT to I-564
Not to scale
LEGEND
Existing Roadway
Widening
Build-8 Alternative
Mainline, Approach Bridges and Tunnel
US Department of Transportation Federal Highway Administration
VDOT
Figure 2-2

Because Hampton Roads is less than 10 feet deep along most of the approach bridge, both the major rehabilitation and the reconstruction would require a 150-foot wide channel to be dredged adjacent to the bridges to allow adequate width for construction barges.

Tunnel

A new four-lane tunnel would be constructed approximately 200 feet west of the existing tunnel (measured from outside edge of existing tunnel to outside edge of new tunnel). The typical sections are shown in **Figure 2-2.** The proposed tunnel portals would not be located immediately adjacent to the existing tunnel portals; however, the new portals would be close enough to the existing portals to allow for the existing islands to be expanded without creating new islands. The tunnel profile would have a minimum grade of approximately 0.5 percent to a maximum grade of 4.0 percent. It is anticipated that the top of the tunnel armor would be at least 65 feet below the mean low water (MLW) level within the existing 3,700-foot wide Hampton Roads entrance channel.

The existing tunnels would be rehabilitated/upgraded as described for the rehabilitation or reconstruction alternative in **Section 2.3.2**. Per the discussion in that section, it is not feasible to fully address vertical clearance in the existing tunnels.

Interchanges

Preliminary concepts were investigated for the ten interchanges within the study area to accommodate potential modifications to the I-64 mainline. Depending on the interchange, the preliminary concepts include adjustments to ramp gore areas (the area between the mainline and ramp) to tie-in to the wider mainline, addition of lanes to accommodate future traffic volumes, realignment of ramps to meet the current VDOT and AASHTO design standards, and/or the removal of ramps to eliminate mainline weaving areas. The preliminary interchange concepts were considered when the interchange LODs were developed. The LOD at each interchange was either a 600-foot or 800-foot radius around the interchange, as shown in **Appendix A**, depending on the size and scale of the existing interchange and the potential improvements. The consistent radius used for the LOD was intended to provide flexibility during the design stage to accommodate other possible improvements.

Should this alternative be preferred, these concepts would serve as a starting point for further study and more in-depth examination of the needs at each location during the Interchange Modification Report process. Operational and geometric improvements were not considered for the cross roads, but would need to be addressed during design.

The following descriptions summarize the preliminary interchange concepts identified at each location. Additional detail on the interchanges is available in the *HRBT Alternatives Technical Report*.

- I-64/I-664 (Exit 264): Flyover ramps could be reconstructed. Ramp gore areas could be adjusted to accommodate the wider mainline and increased traffic volumes.

- North Armistead Avenue/Route 134, LaSalle Avenue/Route 167, and Rip Rap Road (Exit 265A/B/C): Two loop ramps and five outer/diamond ramps could be modified to accommodate a widened mainline section and the increased traffic volumes.

- Settlers Landing Road/Woodland Road/US 60 and Route 143 (Exit 267): All ramps could be modified to accommodate the widened mainline and increased traffic volumes.

- South Mallory Street (Exit 268): Ramps could be modified to accommodate the widened mainline and increased traffic volumes. Commercial vehicle inspection station along eastbound I-64 could be shifted to accommodate the widened mainline.

- West Ocean View Avenue and Bayville Street (Exit 272): Westbound ramps could be modified to accommodate the widened mainline. Eastbound ramps could be removed or modified to accommodate the widened mainline.

- 4th View Street interchange (Exit 273): Ramps could be adjusted to accommodate the widened mainline.

- West Bay Avenue and West Ocean Avenue interchange (Exit 274): Loop ramp in the northeast quadrant and direct access ramp from eastbound West Bay Avenue to eastbound I-64 could be modified to accommodate the widened mainline and the increased traffic volumes.

- Entrance ramp from Granby Street to westbound I-64 near the Forest Lawn Cemetery: Ramp could be modified to accommodate the widened mainline.

- Entrance ramp from Norfolk Naval Station Gate 22 to eastbound I-64: Ramp could be modified to accommodate the widened mainline.

- I-64/I-564/Granby Street (Exit 276/276A): Ramps could be modified to accommodate the widened mainline and the increased traffic volumes.

Operational Analysis

Traffic forecasts for the Build-8 Alternative were developed using the Hampton Roads regional travel demand model. Both daily and peak hour traffic forecasts were developed. Mainline daily and peak hour volumes for the Build-8 Alternative are provided in **Table 2-3**.

Mainline LOS analyses were performed using the 2010 Highway Capacity Software, which uses the methods outlined in the 2010 Highway Capacity Manual. LOS for the AM and PM peak hours are provided in **Table 2-3**. Traffic analysis shows that expanding the capacity of the HRBT crossing to eight lanes would be projected to attract between 29 and 64 percent more traffic than what is forecasted under the 2040 No-Build conditions.

The capacity analyses show that LOS would improve compared to the No-Build Alternative; however, LOS D is expected on 8 out of 16 mainline sections during the AM and PM peak hours. This would meet the LOS threshold criteria adopted for alternative screening. Failing LOS would occur on the section along eastbound I-64 between Granby Street and the I-564 interchange. This section of I-64 is a weaving section; additional widening or provision of additional ramp lanes would not improve the level of service due to the nature of the traffic movements within this section.

Cost

The preliminary cost estimate was derived using the accepted VDOT planning level cost estimate methodology and standard cost items. Specific costs for non-standard elements, which include rehabilitation and/or reconstruction of approach bridges and tunnel as well as dredging costs, were based on input from VDOT Structure and Bridge staff. This estimated cost of the Build-8 Alternative would range from approximately $4.8 billion to $6.5 billion in 2012 dollars. Refinements to the cost estimate may be developed as part of the Final EIS.

Table 2-3: 2040 Build-8 Alternative Forecasts and Analysis Results

Location along I-64 Mainline		Daily Volumes			AM Peak				PM Peak			
		EB	WB	Total	EB		WB		EB		WB	
To	From				Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]
Pine Chapel Rd.	I-664 (Exit 264)	103,100	103,100	206,200	7,400	--	7,225	--	5,825	--	9,700	--
I-664	LaSalle Ave./Rte. 167 (Exit 265A)	83,700	83,700	167,400	6,775	D[3]	6,625	D[3]	6,175	D[3,5]	6,800	D[3]
LaSalle Ave.	Settlers Landing Rd./ US 60/Rte. 143 (Exit 267)	73,200	73,200	146,400	6,075	C	6,250	C	5,250	C	6,750	D
Settlers Landing Rd.	South Mallory St./Rte. 169 (Exit 268)	75,100	75,100	150,200	6,500	D[3]	5,625	C[3]	5,050	C[3]	6,725	D[3]
South Mallory St.[1]	15th View St. (Exit 272)	75,100	75,100	150,200	6,275	D	5,475	C	5,550	D	5,750	D
15th View St.	4th View St. (Exit 273)	72,800	73,900	146,700	6,300	D	5,450	C	5,575	C	5,775	C
4th View St.	West Ocean Ave. and West Bay Ave. (Exit 274)	70,700	70,700	141,400	6,025	C	5,200	C	5,425	C	5,150	C
West Ocean/West Bay Ave.	Granby St./US 460 (Entrance Ramp)	82,200	82,200	164,400	6,650	D	6,575	D	7,450	D	5,550	C
Granby St.	I-564 (Exit 276)	86,500	73,000	159,500	6,875	F[3]	5,350	C[3]	7,900	D[3]	3,950	B[3]
I-564 Mainline	Tidewater Dr./ Rte. 168 (Exit 277)	78,400	78,400	156,800	4,375	C	8,375	D	7,925	D	3,975	B
I-564, HOV	Tidewater Dr./ Rte. 168 (Exit 277)	10,000	10,000	20,000	na[4]	na[4]	725	--	3,050	--	na[4]	na[4]

[1] *Hampton Roads Bridge-Tunnel crossing*

[2] *LOS calculated using Highway Capacity Manual methodology. "–" indicates that LOS analysis was not completed because this roadway section is outside the study limits.*

[3] *Mainline analyzed as weaving section.*

[4] *Not applicable because HOV does not operate in this direction during this peak period.*

Ability to Address Needs

The Build-8 Alternative would address the capacity needs of the study by providing one additional lane in each direction between the I-664 interchange and the HRBT. Two additional lanes would be provided in each direction between the west side of the HRBT and the I-564 interchange. This would result in an average of LOS D or better throughout the corridor, including LOS C or B on 50 percent of the mainline segments, which meets the minimum LOS threshold. The consistent number of travel lanes through the corridor would eliminate mainline lane drops and minimize reduction of travel speeds and delay. Travel reliability would be addressed with additional width for traffic incidents to be moved to shoulders, allowing traffic flow to continue and providing easier access for emergency vehicles. Furthermore, new tunnels would be designed to meet current height standards, thereby reducing the number of truck turnarounds caused by low vertical clearance in the existing tunnels.

The Build-8 Alternative would address geometric deficiencies of the existing facilities by improving the I-64 roadway and the approach bridges to meet current design standards. Shoulders would be 12 to 14 feet to allow space for breakdowns and incident management. Tunnel clearance for new tunnels would be 16'-6" to meet current VDOT standards. Consistent with VDOT standard practice, vertical clearance above the water would be approximately 18 feet for tunnel approach bridges to reduce the risk of

exposure to storm surges and salt corrosion. Per the above description of improvements to bridge approaches, geometric deficiencies would not be addressed for the approach bridges if they are only rehabilitated. The upgrades to the ventilation system in the existing tunnels would increase the vertical clearance, but additional detailed studies would be needed to determine the increase in vertical clearance.

2.4.3 Build-8 Managed Alternative

Mainline

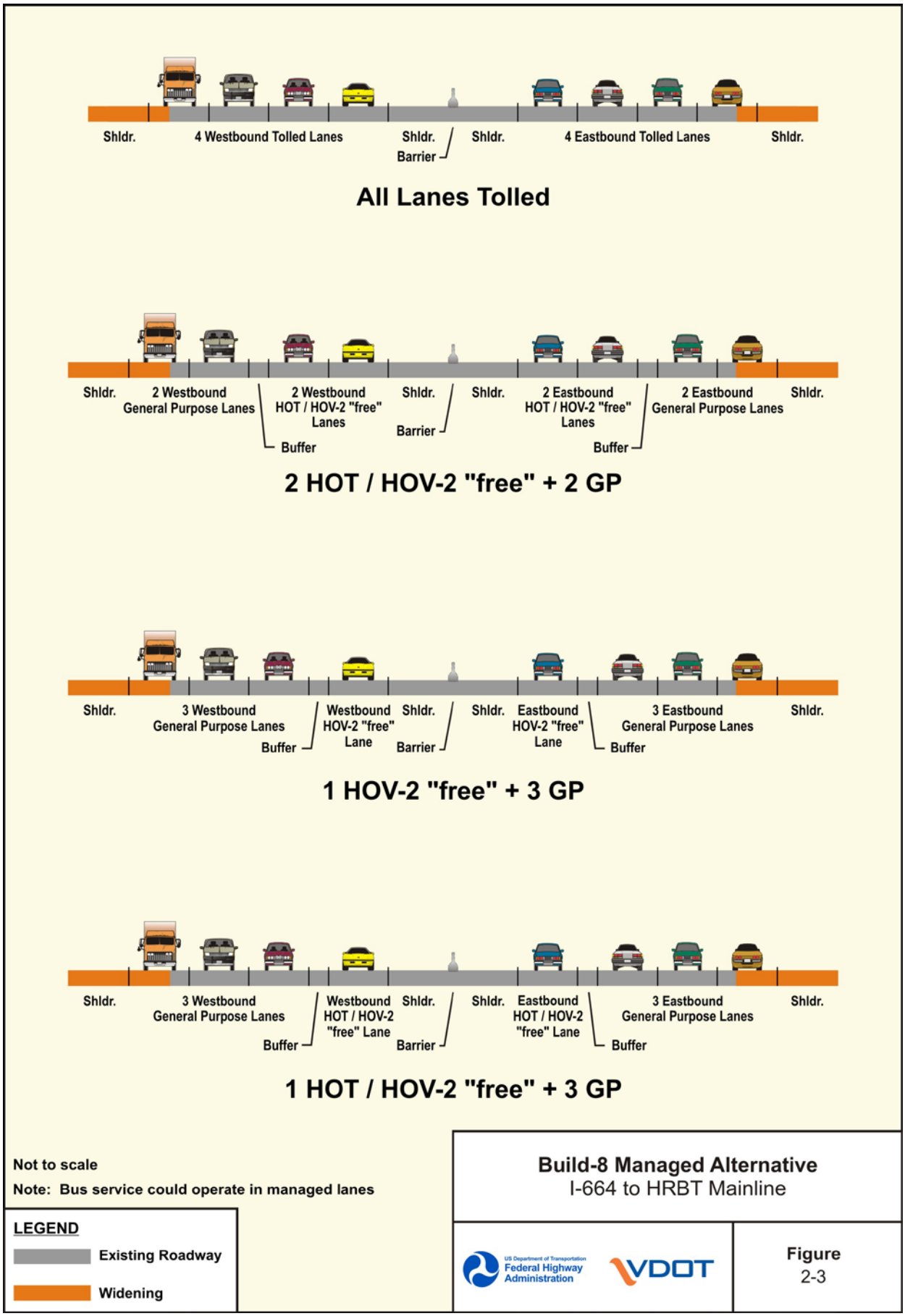
The Build-8 Managed Alternative would be similar to the Build-8 Alternative, providing four continuous mainline lanes in each direction of I-64; however, some or all of the travel lanes would be managed using tolls and/or vehicle occupancy restrictions (HOV, HOT, local bus service, and/or bus rapid transit). As with the Build-8 Alternative, the typical section would include 12-foot travel lanes and shoulders to meet the design criteria. The eastbound and westbound directions would be separated by a concrete traffic barrier. The typical section would also include an approximate four-foot buffer separation between the GP lanes and any managed lanes. The total width of the Build-8 Alternative mainline pavement would be approximately 160 feet, and would require outside widening on both sides of the highway in Hampton. In Norfolk, the Build-8 Managed Alternative would require outside widening on both sides of the highway and would include widening into the existing grass median. The managed lanes would tie to the high occupancy vehicle (HOV) lanes on I-64 on both ends of the study area.

Similar to the Build-8 Alternative, the Build-8 Managed Alternative would provide an open roadside section that would consist of a clear zone; roadside grading to tie the proposed slope to existing ground; and an offset to the LOD to accommodate elements such as drainage, utilities, and stormwater management. Based on the level of detail of this study, a consistent LOD was established for the alternative to ensure that there would be adequate width to accommodate detailed design and construction in the future. Consequently, the resulting potential LOD for the Build-8 Managed Alternative mainline is approximately 370 feet or 435 feet, depending on topographic variability and needed width for auxiliary lanes.

The Build-8 Managed Alternative would have the same mainline alignment through Willoughby Spit as the Build-8 Alternative. The Build-8 Managed Alternative would also have the same connection points to the existing mainline as the Build-8 Alternative. The Build-8 Managed Alternative could include tolling of all I-64 mainline lanes, or a combination of managed and general purpose (GP) lanes, such as high occupancy vehicle lanes where there are 2 or more occupants per vehicle (HOV-2); high occupancy toll (HOT) lanes where HOV users could use the lanes for free, but single occupancy vehicles (SOV) would pay a toll; or express toll lanes, where all traffic in the managed lane would be tolled.

Due to the number of possible managed lane scenarios, there have been no specific operational scenarios identified at this stage of the study. Accordingly, the following four operational scenarios were developed to bracket a sample range of travel demand conditions for this build alternative, as shown in **Figure 2-3**:

- **All lanes tolled:** All HRBT users would have to pay a toll. The tolls could be varied to maintain a desired level of service on the HRBT, with higher tolls during periods of higher demand and lower tolls during periods of lower demand.
- **Two HOT Lanes + Two General Purpose Lanes [2 HOT / HOV-2 "free" + 2 GP]:** This scenario would include two general purpose lanes and two HOT lanes in each direction. The HOT lanes would be restricted to HOV-2 vehicles that would travel for free and SOVs that would pay a toll to use the lane.


Shldr.
4 Westbound Tolled Lanes
Shldr.
Barrier
Shldr.
4 Eastbound Tolled Lanes
Shldr.
All Lanes Tolled
Shldr.
2 Westbound General Purpose Lanes
2 Westbound HOT / HOV-2 "free" Lanes
Buffer
Shldr.
Barrier
Shldr.
2 Eastbound HOT / HOV-2 "free" Lanes
Buffer
2 Eastbound General Purpose Lanes
Shldr.
2 HOT / HOV-2 "free" + 2 GP
Shldr.
3 Westbound General Purpose Lanes
Buffer
Westbound HOV-2 "free" Lane
Shldr.
Barrier
Shldr.
Eastbound HOV-2 "free" Lane
Buffer
3 Eastbound General Purpose Lanes
Shldr.
1 HOV-2 "free" + 3 GP
Shldr.
3 Westbound General Purpose Lanes
Buffer
Westbound HOT / HOV-2 "free" Lane
Shldr.
Barrier
Shldr.
Eastbound HOT / HOV-2 "free" Lane
Buffer
3 Eastbound General Purpose Lanes
Shldr.
1 HOT / HOV-2 "free" + 3 GP
Not to scale
Note: Bus service could operate in managed lanes
LEGEND
Existing Roadway
Widening
Build-8 Managed Alternative
I-664 to HRBT Mainline
US Department of Transportation Federal Highway Administration
VDOT
Figure 2-3

- **One HOV Lane + Three General Purpose Lanes [1 HOV-2 "free" + 3 GP]:** This scenario would include three general purpose lanes and one HOV lane in each direction. The HOV lane would be restricted to HOV-2 vehicles that would travel for free.
- **One HOT Lane + Three General Purpose Lanes [1 HOT / HOV-2 "free" + 3 GP]:** This scenario would include three general purpose lanes and one HOT lane in each direction. The HOT lanes would be restricted to HOV-2 vehicles that would travel for free and SOVs that would pay a toll to use the lane.

Expanded local/express bus service, as well as bus rapid transit, would not be precluded and could be accommodated with this alternative. These services could also utilize the managed lanes in conjunction with the operational scenarios and benefit from improved travel time. The nature of expanded bus service and the potential ridership would be determined by local transit providers. Therefore an operational analysis of potential bus service has not been completed for this Draft EIS.

Approach Bridges

The Build-8 Managed Alternative bridges would be similar to the Build-8 Alternative. However, for the 2 HOT+2 GP, 1 HOV-2 + 3 GP, and 1 HOT + 3 GP operational options, the new structure would be wider to provide the approximately four-foot buffer between the managed and GP lanes for the eastbound lanes.

The westbound managed lane(s) would utilize the existing structure. The existing approach bridges would include the same considerations for rehabilitation or reconstruction as described for the Build-8 Alternative. With rehabilitation, the westbound managed lanes would not be separated from the adjacent westbound GP lanes because there is not adequate width on the existing structures. With reconstruction, sufficient width would be provided to accommodate the approximate four-foot buffer separation.

Tunnel

The Build-8 Managed Alternative tunnel would be similar to the Build-8 Alternative. However, for the 2 HOT+2 GP, 1 HOV-2 + 3 GP, and 1 HOT + 3 GP operational options, the new tunnel would be wider to provide a four-foot buffer between the managed and GP lanes. As described for the Build-8 Alternative, the existing tunnel has a substantial life expectancy and would not be modified; therefore, the westbound managed lane(s) would not include a four-foot buffer separation between the managed lane(s) and the GP lanes. The existing tunnels would be rehabilitated, as described in **Section 2.3.2**. Per the discussion in that section, it is not feasible to fully address vertical clearance in the existing tunnels.

Interchanges

The Build-8 Managed Alternative would be the same as the Build-8 Alternative, except the ramps would be adjusted to accommodate the additional buffer which would separate the managed lanes along both directions of the mainline. As with the Build-8 Alternative, the potential interchange LOD is either a 600-foot or 800-foot radius around each interchange.

Operational Analysis

Traffic forecasts for the Build-8 Managed Alternatives were analyzed using the Hampton Roads regional travel demand model. Both daily and peak hour traffic forecasts were developed. Mainline daily and peak hour volumes are provided in **Tables 2-4** through **2-7**, as well as mainline LOS analyses results for the AM and PM peak hours.

Table 2-4: Build-8 Managed Alternative, All Toll Scenario

2.4.3.1 Location along I-64 Mainline		2.4.3.2 Daily Volumes			2.4.3.3 AM Peak				2.4.3.4 PM Peak			
					EB		WB		EB		WB	
To	From	EB	WB	Total	Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]
Pine Chapel Rd.	I-664 (Exit 264)	97,500	97,450	194,950	7,000	--	6,800	--	5,500	--	9,175	--
I-664	LaSalle Ave./Rte. 167 (Exit 265A)	71,900	71,850	143,750	5,800	C[3]	5,675	C[3]	5,225	B***	5,825	C[3]
LaSalle Ave.	Settlers Landing Rd./US 60/Rte. 143 (Exit 267)	60,900	60,900	121,800	5,050	C	5,175	C	4,300	B	5,625	C
Settlers Landing Rd.	South Mallory St./Rte. 169 (Exit 268)	58,200	58,200	116,400	5,050	C[3]	4,325	B[3]	3,825	B***	5,200	C[3]
South Mallory St.[1]	15th View St. (Exit 272)	55,900	55,900	111,800	4,650	C	4,075	C	4,050	C	4,250	C
15th View St.	4th View St. (Exit 273)	56,750	56,750	113,500	4,850	C	4,075	B	4,175	C	4,325	C
4th View St.	West Ocean Ave. and West Bay Ave. (Exit 274)	54,300	54,300	108,600	4,625	C	3,975	B	4,100	B	3,975	B
West Ocean/West Bay Ave.	Granby St./US 460 (Entrance Ramp)	67,000	67,000	134,000	5,425	C	5,325	C	6,000	C	4,525	C
Granby St.	I-564 (Exit 276)	73,150	54,350	127,500	5,850	F[3]	4,675	C	6,750	E[3]	3,825	B
I-564 Mainline	Tidewater Dr./ Rte. 168 (Exit 277)	69,850	69,850	139,700	3,950	B	7,775	D	6,625	D	4,050	B
I-564, HOV	Tidewater Dr./ Rte. 168 (Exit 277)	9,900	9,900	19,800	na[4]	na[4]	675		3,100		na[4]	na[4]

[1] *Hampton Roads Bridge-Tunnel crossing*
[2] *LOS calculated using Highway Capacity Manual methodology. "–" indicates that no LOS analysis was completed because this roadway section is outside the study limits.*
[3] *Mainline analyzed as weaving section*
[4] *Not applicable because HOV does not operate in this direction during this peak period*

Table 2-5: Build-8 Managed Alternative, 2 HOT / HOV-2 "free" + 2 GP Scenario

Location along I-64 Mainline		Daily Volumes			AM Peak				PM Peak			
		EB	WB	Total	EB		WB		EB		WB	
To	From				Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]
Pine Chapel Rd.	I-664 (Exit 264)	98,300	98,300	196,600	7,050	--	6,825	--	5,550	--	9,200	--
I-664	LaSalle Ave./Rte. 167 (Exit 265A)	76,950	76,950	153,900	6,225	C[3]	6,050	C[3]	5,525	C[3]	6,250	C[3]
Managed Lane		*26,075*	*26,075*	*52,150*	*2,650*	na[4]	*2,050*		*2,275*	na[4]	*3,025*	
LaSalle Ave.	Settlers Landing Rd./US 60/Rte. 143 (Exit 267)	66,550	66,550	133,100	5,525	C	5,650	D	4,625	B	6,125	C
Managed Lane		*24,100*	*24,100*	*48,200*	*2,600*	*C*	*1,925*	*B*	*1,900*	*C*	*2,950*	*C*
Settlers Landing Rd.	South Mallory St./Rte. 169 (Exit 268)	67,550	67,500	135,050	5,850	C[3]	5,025	C[3]	4,375	C[3]	6,050	C[3]
Managed Lane		*23,200*	*23,175*	*46,375*	*2,900*	na[4]	*1,325*	na[4]	*1,650*	na[4]	*2,925*	na[4]
South Mallory St.[1]	15th View St. (Exit 272)	66,350	66,300	132,650	5,525	D	4,825	F	4,725	E	5,050	C
Managed Lane		*17,150*	*17,150*	*34,300*	*2,675*	*C*	*625*	*A*	*1,125*	*A*	*2,425*	*C*
15th View St.	4th View St. (Exit 273)	67,100	67,050	134,150	5,700	C	4,825	E	4,850	D	5,125	C
Managed Lane		*17,350*	*17,350*	*34,700*	*2,775*	*C*	*625*	*A*	*1,150*	*A*	*2,475*	*C*
4th View St.	West Ocean Ave. and West Bay Ave. (Exit 274)	63,850	63,800	127,650	5,425	C	4,700	D	4,750	C	4,650	C
Managed Lane		*20,575*	*20,575*	*41,150*	*2,600*	*C*	*1,025*	*A*	*1,625*	*B*	*2,200*	*C*
West Ocean/West Bay Ave.	Granby St./US 460 (Entrance Ramp)	74,750	74,700	149,450	6,050	D	5,975	F	6,625	E	5,025	C
Managed Lane		*24,100*	*24,075*	*48,175*	*2,900*	*C*	*1,300*	*A*	*2,275*	*C*	*2,375*	*C*
Granby St.	I-564 (Exit 276)	81,700	61,000	142,700	6,525	F[3]	5,250	E	7,475	F[3]	4,275	C
Managed Lane		*24,400*	*18,225*	*42,625*	*3,100*	na[4]	*950*	*A*	*2,325*	na[4]	*2,000*	*B*
I-564 Mainline	Tidewater Dr./ Rte. 168 (Exit 277)	74,250	74,150	148,400	4,225	B	8,325	E	6,950	D	4,300	B
I-564, HOV	Tidewater Dr./ Rte. 168 (Exit 277)	10,650	10,650	21,300	na[5]	na[5]	700	--	3,350	--	na[5]	na[5]

[1] *Hampton Roads Bridge-Tunnel crossing*
[2] *LOS calculated using Highway Capacity Manual methodology. "–" indicates that no LOS analysis was completed because this roadway section is outside the study limits.*
[3] *Mainline analyzed as weaving section*
[4] *LOS not calculated for managed lane weaving sections*
[5] *Not applicable because HOV does not operate in this direction during this peak period*

Table 2-6: Build-8 Managed Alternative, 1 HOV-2 "free" + 3 GP Scenario

Location along I-64 Mainline		Daily Volumes			AM Peak				PM Peak			
		EB	WB	Total	EB		WB		EB		WB	
To	From				Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]
Pine Chapel Rd.	I-664 (Exit 264)	98,700	98,650	197,350	7,075	--	6,850	--	5,575	--	9,250	--
I-664	LaSalle Ave./Rte. 167 (Exit 265A)	78,050	78,000	156,050	6,300	D[3]	6,150	C[3]	5,600	C[3]	6,350	C[3]
Managed Lane		*12,150*	*12,150*	*24,300*	*925*	na[4]	*775*	na[4]	*1,375*	na[4]	*1,525*	na[4]
LaSalle Ave.	Settlers Landing Rd./ US 60/Rte. 143 (Exit 267)	67,750	67,700	135,450	5,600	D	5,775	D	4,700	B	6,250	D
Managed Lane		*11,200*	*11,200*	*22,400*	*600*	*A*	*750*	*B*	*1,100*	*C*	*1,350*	*C*
Settlers Landing Rd.	South Mallory St./Rte. 169 (Exit 268)	69,750	69,700	139,450	6,050	E[3]	5,200	C[3]	4,525	B[3]	6,225	D[3]
Managed Lane		*9,250*	*9,250*	*18,500*	*500*	na[4]	*525*	na[4]	*975*	na[4]	*1,025*	na[4]
South Mallory St.[1]	15th View St. (Exit 272)	69,550	69,500	139,050	5,800	D	5,050	D	4,975	C	5,300	D
Managed Lane		*8,750*	*8,750*	*17,500*	*400*	*A*	*425*	*A*	*975*	*B*	*775*	*B*
15th View St.	4th View St. (Exit 273)	70,150	70,100	140,250	5,975	D	5,025	D	5,075	C	5,325	D
Managed Lane		*8,825*	*8,825*	*17,650*	*400*	*A*	*425*	*A*	*1,000*	*B*	*775*	*B*
4th View St.	West Ocean Ave. and West Bay Ave. (Exit 274)	65,850	65,750	131,600	5,600	D	4,850	C	4,900	C	4,800	C
Managed Lane		*7,850*	*7,850*	*15,700*	*550*	*A*	*350*	*A*	*950*	*B*	*875*	*B*
West Ocean/West Bay Ave.	Granby St./US 460 (Entrance Ramp)	76,750	76,650	153,400	6,200	D	6,125	D	6,800	D	5,175	C
Managed Lane		*9,150*	*9,150*	*18,300*	*600*	*A*	*450*	*A*	*1,300*	*C*	*950*	*B*
Granby St.	I-564 (Exit 276)	83,650	61,200	144,850	6,650	F[3]	5,300	D	7,650	F[3]	4,300	C
Managed Lane		*9,575*	*7,000*	*16,575*	*900*	na[4]	*300*	*A*	*1,425*	na[4]	*950*	*B*
I-564 Mainline	Tidewater Dr./ Rte. 168 (Exit 277)	72,150	72,050	144,200	4,075	B	8,050	D	6,725	D	4,150	B
I-564, HOV	Tidewater Dr./ Rte. 168 (Exit 277)	10,350	10,350	20,700	na[5]	na[5]	700	--	3,275	--	na[5]	na[5]

[1] *Hampton Roads Bridge-Tunnel crossing*

[2] *LOS calculated using Highway Capacity Manual methodology. "–" indicates that no LOS analysis was completed because this roadway section is outside the study limits.*

[3] *Mainline analyzed as weaving section*

[4] *LOS not calculated for managed lane weaving sections*

[5] *Not applicable because HOV does not operate in this direction during this peak period*

Table 2-7: Build-8 Managed Alternative, 1 HOT / HOV-2 "free" + 3 GP scenario

Location along I-64 Mainline		Daily Volumes			AM Peak				PM Peak			
		EB	WB	Total	EB		WB		EB		WB	
To	From				Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]
Pine Chapel Rd.	I-664 (Exit 264)	98,800	98,800	197,600	7,075	--	6,850	--	5,575	--	9,225	--
I-664	LaSalle Ave./Rte. 167 (Exit 265A)	80,100	80,100	160,200	6,475	C[3]	6,300	C[3]	5,725	C[3]	6,500	C[3]
Managed Lane		*14,600*	*14,600*	*29,200*	*1,550*	na[4]	*950*	na[4]	*1,375*	na[4]	*1,625*	na[4]
LaSalle Ave.	Settlers Landing Rd./ US 60/Rte. 143 (Exit 267)	69,500	69,500	139,000	5,750	C	5,925	D	4,800	C	6,400	D
Managed Lane		*13,575*	*13,575*	*27,150*	*1,300*	*C*	*1,000*	*B*	*1,100*	*C*	*1,475*	*C*
Settlers Landing Rd.	South Mallory St./Rte. 169 (Exit 268)	71,000	71,000	142,000	6,150	D[3]	5,325	C[3]	4,600	B***	6,350	D[3]
Managed Lane		*12,850*	*12,850*	*25,700*	*1,500*	*na[4]*	*575*	*na[4]*	*1,025*	*na[4]*	*1,500*	*na[4]*
South Mallory St.[1]	15th View St. (Exit 272)	70,700	70,700	141,400	5,900	D	5,150	D	5,025	C	5,375	D
Managed Lane		*11,975*	*11,975*	*23,950*	*1,425*	*D*	*450*	*A*	*975*	*C*	*1,250*	*C*
15th View St.	4th View St. (Exit 273)	71,350	71,350	142,700	6,075	D	5,150	D	5,150	C	5,425	C
Managed Lane		*12,075*	*12,075*	*24,150*	*1,450*	*C*	*450*	*A*	*1,000*	*C*	*1,275*	*C*
4th View St.	West Ocean Ave. and West Bay Ave. (Exit 274)	67,000	67,000	134,000	5,700	C	4,925	C	4,975	C	4,900	C
Managed Lane		*14,200*	*14,200*	*28,400*	*1,425*	*C*	*850*	*B*	*1,200*	*C*	*1,175*	*C*
West Ocean/West Bay Ave.	Granby St./US 460 (Entrance Ramp)	77,800	77,800	155,600	6,300	D	6,225	D	6,875	D	5,250	C
Managed Lane		*16,475*	*16,475*	*32,950*	*1,575*	*C*	*1,075*	*B*	*1,675*	*D*	*1,275*	*C*
Granby St.	I-564 (Exit 276)	84,800	62,100	146,900	6,775	F[3]	5,375	C	7,750	F[3]	4,375	B
Managed Lane		*16,825*	*12,325*	*29,150*	*1,675*	na[4]	*750*	*B*	*1,825*	na[4]	*1,050*	*B*
I-564 Mainline	Tidewater Dr./ Rte. 168 (Exit 277)	73,550	73,550	147,100	4,125	B	8,175	E	6,825	D	4,250	B
I-564, HOV	Tidewater Dr./ Rte. 168 (Exit 277)	10,500	10,500	21,000	na[5]	na[5]	725	--	3,350	--	na[5]	na[5]

[1] *Hampton Roads Bridge-Tunnel crossing*
[2] *LOS calculated using Highway Capacity Manual methodology. "–" indicates that no LOS analysis was completed because this roadway section is outside the study limits.*
[3] *Mainline analyzed as weaving section*
[4] *LOS not calculated for managed lane weaving sections*
[5] *Not applicable because HOV does not operate in this direction during this peak period*

Implementing tolls would result in lower volumes crossing Hampton Roads compared to the non-tolled Build-8 Alternative. Daily volumes on the HRBT would decrease depending on the rate of the toll. At the limits of the study area (near the I-664 and I-564 interchanges), volume decreases would be less pronounced. Except for the section between Granby Street and I-564 on eastbound I-64, LOS D or better is achieved on all roadway sections.

Of the managed lane scenarios, the 1 HOT / HOV-2 "free" + 3 GP scenario would have the highest total daily traffic volume on the HRBT crossing. While the 2 HOT / HOV-2 "free" + 2 GP scenario would have the most traffic in the managed lanes, it would have the lowest total traffic volume on the HRBT of the four managed lane scenarios. The capacity analyses indicated that among the HOV-2 "free" or HOT managed lane scenarios, both the 1 HOT / HOV-2 "free" + 3 GP and 1 HOV-2 "free" + 3 GP scenarios achieve level of service D or better.

Under the managed lane scenarios that include HOT or HOV lanes, some general purpose lanes would continue to operate at LOS E or F. This indicates that the willingness for drivers to achieve travel time savings by using the managed lane would not outweigh the willingness to pay a toll or form a carpool. In addition, the level of service in the general purpose lanes must be sufficiently poor for HOT/HOV lanes to attract users willing to pay a toll or form a carpool.

Cost

The preliminary cost estimate was derived using the accepted VDOT planning level cost estimate methodology and standard cost items. Specific costs for non-standard elements, which include rehabilitation and/or reconstruction of approach bridges and tunnels as well as dredging costs, were based on input from VDOT Structure and Bridge staff. The estimated cost of the Build-8 Managed Alternative scenarios ranges from approximately $4.8 billion to $6.6 billion. Refinements to the cost estimate may be developed as part of the Final EIS.

Ability to Address Needs

The Build-8 Managed Alternative would address inadequate capacity needs in the corridor by providing one additional travel lane in each direction between the I-664 interchange and the HRBT. Two additional travel lanes would be provided in each direction between the east side of the HRBT and the I-564 interchange. Depending on the management scenario, this improvement would generally result in LOS C or D throughout the corridor, which would meet the LOS criterion and meet the screening threshold for this study. The elimination of mainline lane drops through the corridor would eliminate the need for through lanes to merge, thereby minimizing travel time delay.

Travel reliability would be addressed with additional width for traffic incidents to be moved to shoulders, allowing traffic flow to continue and easier access for emergency vehicles. Similar to the Build-8 Alternative, the Build-8 Managed Alternative would address geometric deficiencies of the existing facilities by improving the I-64 roadway and the HRBT to meet current design standards.

2.4.4 Build-10 Alternative

Mainline

The Build-10 Alternative would provide five continuous mainline lanes in each direction of I-64 throughout the limits of the study. Throughout the Hampton section of the study, this alternative would involve widening both directions of I-64 by two lanes. In the Norfolk section of the study, this alternative would involve widening both directions of I-64 by three lanes. Similar to the Build-8 Alternative, the typical section would include 12-foot travel lanes and shoulders to meet the design criteria, and the eastbound and westbound directions would be separated by a concrete traffic barrier.

The typical section is shown in **Figure 2-4**. The total width of the Build-10 Alternative mainline pavement would be approximately 170 feet, and would require outside widening on both sides of the highway through Hampton. In Norfolk, the Build-10 Alternative would require outside widening on both sides of the highway and widening into the existing grass median. Through Willoughby Spit, the mainline widening would occur on the south side of the existing roadway.

Similar to the Build-8 Alternative, the Build-10 Alternative would provide an open roadside section that would consist of a clear zone; roadside grading to tie the proposed slope to existing ground; and an offset to the LOD to accommodate elements such as drainage, utilities, and stormwater management. Based on the level of detail of this study, a consistent LOD was established for the alternative to ensure that there would be adequate width to accommodate detailed design and construction in the future. Consequently, the resulting potential LOD for the Build-10 Alternative mainline is approximately 400 feet or 465 feet, depending on topographic variability and needed width for auxiliary lanes.

As with the Build-8 Alternative, the mainline would tie into the existing mainline typical section of twelve lanes at the Pine Chapel Road Bridge, and the four-lane typical section at the east end of the study limits. Expanded local/express bus service or bus rapid transit would not be precluded and could be accommodated with this build alternative.

Approach Bridges

The Build-10 Alternative approach bridges would be similar to the Build-8 Alternative. However, the new structure would include one westbound lane and five eastbound lanes with shoulders wider than the existing shoulders. The new approach bridge typical section is provided in **Figure 2-4**. The existing approach bridges would include the same considerations for major rehabilitation and complete reconstruction.

Tunnel

The Build-10 Alternative tunnel would be similar to the Build-8 Alternative. However, the new tunnel would be approximately 150 feet wide and include one westbound lane and five eastbound lanes with shoulders, in three separate tubes. The tunnel typical section is provided in **Figure 2-4.** The existing tunnels would be rehabilitated as described in **Section 2.3.2**. Per the discussion in that section, it is not feasible to fully address vertical clearance in the existing tunnels.

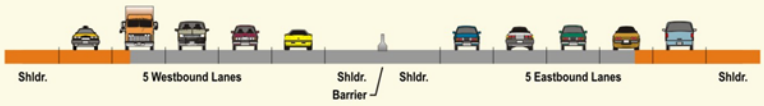
Interchanges

The Build-10 Alternative would be the same as the Build-8 Alternative at most interchanges, except the ramps would be adjusted to accommodate the wider mainline and higher volumes. As with the Build-8 Alternative, the potential LOD is either a 600-foot or 800-foot radius around the interchange.

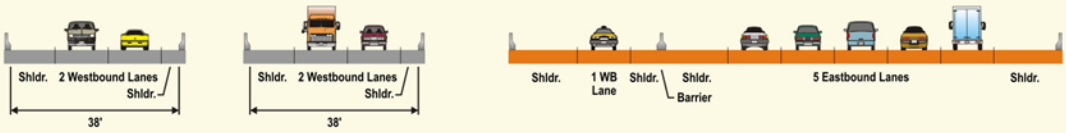
Operational Analysis

Traffic forecasts for the Build-10 Alternative were developed using the Hampton Roads regional travel demand model. Mainline daily and peak hour traffic volumes are provided in **Table 2-8**.

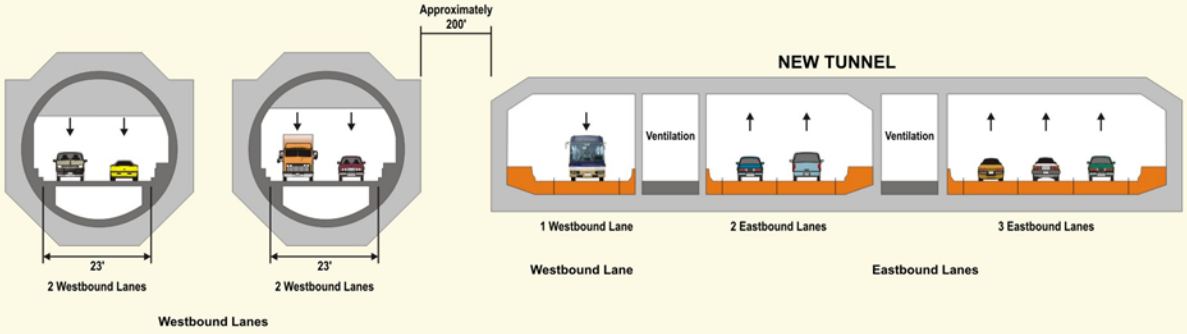
By expanding the capacity of the HRBT crossing to ten lanes, the crossing would attract additional traffic to the facility beyond what is forecasted under all other alternatives retained, with daily and peak hour volumes between 39 and 74 percent higher compared to 2040 No-Build volumes. The largest volume increases compared to the No-Build Alternative would be found on the HRBT crossing, rather than on the Peninsula and Southside, as noted in the Build-8 Alternative.



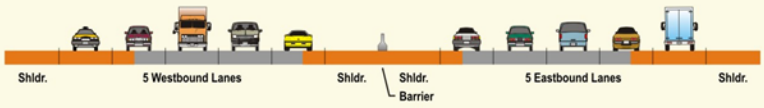
I-664 to HRBT



Approach Bridges to Tunnel



Tunnel



HRBT to I-564

Build-10 Alternative
Mainline, Approach Bridges and Tunnel

Not to scale

LEGEND
- Existing Roadway
- Widening

US Department of Transportation Federal Highway Administration
VDOT

Figure
2-4

Table 2-8: 2040 Build-10 Alternative Forecasts and Analysis Results

2.4.4.1.1 Location along I-64 Mainline		2.4.4.1.2 Daily Volumes			2.4.4.1.3 AM Peak				2.4.4.1.4 PM Peak			
		EB	WB	Total	EB		WB		EB		WB	
To	From				Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]	Volume	LOS[2]
Pine Chapel Rd.	I-664 (Exit 264)	104,400	104,400	208,800	7,475	--	7,300	--	5,900	--	9,625	--
I-664	LaSalle Ave./Rte. 167 (Exit 265A)	92,000	92,000	184,000	7,425	C[3]	7,275	C[3,5]	6,800	C[3]	7,475	C[3]
LaSalle Ave.	Settlers Landing Rd./US 60/Rte. 143 (Exit 267)	78,200	78,200	156,400	6,475	C	6,675	C	5,600	C	7,200	C
Settlers Landing Rd.	South Mallory St./Rte. 169 (Exit 268)	79,400	79,400	158,800	6,875	D[3]	5,950	C[3]	5,325	C[3]	7,100	D[3]
South Mallory St.[1]	15th View St. (Exit 272)	77,700	77,700	155,400	6,500	C	5,675	C	5,750	C	5,950	C
15th View St.	4th View St. (Exit 273)	76,300	76,500	152,800	6,500	C	5,725	C	5,800	C	6,025	C
4th View St.	West Ocean Ave. and West Bay Ave. (Exit 274)	76,400	76,400	152,800	6,500	C	5,625	C	5,875	C	5,575	C
West Ocean/West Bay Ave.	Granby St./US 460 (Entrance Ramp)	89,700	89,700	179,400	7,250	C	7,125	C	8,125	D	6,050	C
Granby St.	I-564 (Exit 276)	93,600	78,000	171,600	7,475	F[3]	5,700	C[3]	8,550	E[3]	4,100	B[3]
I-564, Mainline	Tidewater Dr./ Rte. 168 (Exit 277)	80,900	80,900	161,800	4,525	C	8,575	E	8,125	D	4,075	B
I-564, HOV	Tidewater Dr./ Rte. 168 (Exit 277)	10,000	10,000	20,000	na[4]	na[4]	775	--	3,175	--	na[4]	na[4]

[1] *Hampton Roads Bridge-Tunnel crossing*

[2] *LOS calculated using Highway Capacity Manual methodology*

[3] *Mainline analyzed as weaving section*

[4] *Not applicable because HOV does not operate in this direction during this peak period*

The capacity analyses show that LOS C would be achieved in most mainline locations under the Build 10 scenario. In two locations, the LOS under the Build-10 Alternative would be worse than under the Build-8 Alternative (eastbound I-64 between Settlers Landing Road and Mallory Street, and westbound I-64 between LaSalle Avenue and the I-664 interchange). This reduction in LOS could be attributed to the increase in volume that results from the increased capacity. Thus, while the Build-10 Alternative does provide additional capacity, it is not adequate to accommodate the induced demand resulting from this capacity increase in these two locations.

Cost

The preliminary cost estimate was derived using the accepted VDOT planning level cost estimate methodology and standard cost items. Specific costs for non-standard elements, which include rehabilitation and/or reconstruction of approach bridges and tunnels as well as dredging costs, were based on input from VDOT Structure and Bridge staff. The estimated cost of the Build-8 Alternative ranges from approximately $5.7 billion to $7.9 billion in 2012 dollars. Refinements to the cost estimate may be developed as part of the Final EIS.

Ability to Address Needs

The Build-10 Alternative would address the capacity needs of the study by providing two additional lanes in each direction between the I-664 interchange and the HRBT. Three additional lanes would be provided in each direction between the east side of the HRBT and the I-564 interchange. This improvement would generally result in LOS C throughout the corridor, which would meet the LOS criterion and meet the screening threshold for this study. The elimination of mainline lane drops through the corridor would eliminate the need for through lanes to merge, thereby minimizing travel time delay. Compared to the Build-8 Alternative, LOS would generally be better under the Build-10 Alternative.

Travel reliability would be addressed with additional width for traffic incidents to be moved to shoulders, allowing traffic flow to continue and easier access for emergency vehicles. Furthermore, similar to the Build-8 Alternative, the Build-10 Alternative would address geometric deficiencies of the existing facilities by improving the I-64 roadway and the HRBT to meet current design standards.

3 AFFECTED ENVIRONMENT

3.1 INTRODUCTION / ISSUES IDENTIFICATION

This chapter characterizes the environment potentially impacted directly or indirectly by the Retained Build Alternatives that are described in **Chapter 2**. The discussion in this chapter is limited to data, information, issues, and values that would have a bearing on possible impacts and mitigation measures, and on the selection of an alternative. Less relevant material is summarized, consolidated, or referenced, thereby establishing a context for the environmental consequences analyses presented in **Chapter 4**. Issues were identified from input received from agencies and the public through the scoping process (see **Chapter 7** and **Appendix B**), through review of aerial photos and other mapping, and through field reconnaissance. **Table 3-1** lists environmental issues and summarizes their relevance to the study. The sections following the table provide additional information on principal environmental resources within the study area which is an approximately one-mile-wide corridor along I-64 from the interchange with I-664 in the City of Hampton to the interchange with I-564 in the City of Norfolk, a distance of approximately 12 miles, including the 3.5-mile-long HRBT. The table also identifies supporting technical reports and memoranda which have been completed as part of the study.

3.2 LAND USE

Existing and potential future land uses within the I-64 study area were identified to provide a baseline for analysis of potential impacts due to the implementation of the Retained Build Alternatives. Information and data were compiled from aerial photos, local comprehensive and land use plans, input from local and regional planning officials, Geographic Information System (GIS) databases, and field reconnaissance.

3.2.1 Existing Land Use

Land uses within the I-64 study area are indicative of a developed urban and suburban setting. Aerial photography, field inspections, and local planning information confirm that both Hampton and Norfolk sections are highly developed and include the land uses listed in **Table 3-2** and shown in **Figure 3-1**.

3.2.2 Status of Local Planning

The City of Hampton's current comprehensive plan, the *Hampton Community Plan* (Community Plan), was adopted in 2006. Both I-64 and I-664 continue to be supported as the major routes into and out of the city. The transportation section of the plan states that as "the main artery of moving traffic in and out of Hampton, the health and efficiency of Interstate 64 is vital" (City of Hampton, 2006a).

The *General Plan of Norfolk* (General Plan) was adopted in 1992. The draft *PlaNorfolk 2030* is the most recent update to that 1992 comprehensive plan and is currently undergoing public review through Fall 2012. The key transportation issue identified in the update is to address roadway congestion, particularly at water crossing facilities, which includes facilities such as the HRBT (City of Norfolk, 2011).

Table 3-1: Summary of Environmental Issues

Resource	Discussion
Land Use	The predominant land use within the I-64 study area in the Cities of Hampton and Norfolk is residential. Institutional (e.g., Hampton University) and government (e.g., Naval Station Norfolk) uses also are prevalent within the study area. Commercial and industrial activities also are present. See **Section 3.2** of this Draft EIS and the *Land Use Technical Memorandum*.
Communities	Hampton and Norfolk are well-established cities with numerous distinct communities. I-64 and its interchanges with the local street network serve as a connection between the various communities within and between the individual cities. See **Section 3.3.**
Community Facilities	More than 100 community facilities or services (churches, schools, fire and rescue, police, community service organizations, etc.) are located in the study area. Immediate access to these facilities is primarily provided via the local street network. See **Section 3.3**.
Parks and Recreation Areas	Numerous parks and recreational facilities are located within the study area. See **Section 3.3.3** of this Draft EIS and the *Parks and Recreation Technical Memorandum*.
Section 4(f)	Section 4(f) of the US Department of Transportation Act of 1966 permits the use of land from publicly owned public parks and recreation areas, land from historic properties, or land from publicly owned wildlife and waterfowl refuges only if there is no feasible and prudent alternative and the action includes all possible planning to minimize harm; or the use would have a *de minimis* impact. There are a number of parks and historic properties within the study area from which right-of-way may be required for highway purposes. See **Sections 3.3.3** and **3.8** of this Draft EIS, and the Draft Section 4(f) Evaluation in **Appendix C**.
Section 6(f)	The Land and Water Conservation Fund Act (LWCFA) provides funds for localities to acquire land or develop facilities for recreational purposes. Section 6(f) of the Act requires that conversions of land from areas funded under the Act be replaced with lands of approximately equivalent utility and value. The Willoughby Boat Ramp was developed using LWCFA funds. See **Section 3.3.3**.
Open Space Easements	There are no open space easements within the study area.
Social and Economic Conditions	Population and employment in the Cities of Hampton and Norfolk; have had minor fluctuations in population over the past 20 years. However, both population and employment are expected to grow by the year 2034. Both cities in the study area have minority populations that are greater than 50% of the total population. The population over 65 years of age is just over 10% for the study area. The percent of persons with low-income in the study area is 15%, with Norfolk having a higher percentage than Hampton. The Port of Hampton Roads, tourism, and military installations continue to be the drivers of the regional economy. See **Section 3.4** of this Draft EIS and the *Socioeconomics Technical Report*.
Environmental Justice	There are census tracts within the study area that contain minority and low income populations subject to provisions of Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. See **Section 4.6**.
Farmland, Agricultural, and Forestal Districts	There are no prime or unique farmlands or Agricultural or Forestal Districts within the study area.
Mines and Minerals	There are no mines or mineral resources in the study area.
Air Quality	The Hampton Roads region is designated by the US Environmental Protection Agency (EPA) as in attainment of National Ambient Air Quality Standards (NAAQS) for all criteria pollutants (carbon monoxide, lead, nitrogen dioxide, sulfur dioxide, particulate matter [PM_{10} and $PM_{2.5}$]), and ozone. However, because of its previous designation as nonattainment for ozone (prior to June 1, 2007), the region is subject to maintenance plan requirements and transportation conformity requirements. Federal agencies and Metropolitan Planning Organizations (MPOs) may not approve any transportation project, program, or plan in a nonattainment or maintenance area that does not conform with the approved State Implementation Plan (SIP) for air quality. Accordingly, motor vehicle emission budgets have been established for the region and conformity analyses have been conducted for the region's *2034 Long Range Transportation Plan and the FY 12–15 Transportation Improvement Program*.[15] Additional information is presented in **Section 4.12** of this Draft EIS and the *Air Quality Analysis Technical Report*.

[15] Hampton Roads, Virginia Eight-Hour Ozone Maintenance Area Regional Conformity Analysis for the 2034 Long Range Transportation Plan and the FY 12-15 Transportation Improvement Program, Virginia Department of Transportation Final Report September 2011 (available at http://www.hrtpo.org/TPO_Reports.asp).

Table 3-1: Summary of Environmental Issues

Resource	Discussion
Noise	The I-64 corridor is located in a highly urbanized area with many noise sources and noise-sensitive receptors. Details on existing noise levels are presented in **Section 4.13** to facilitate comparison with future build and no-build condition noise levels. Additional information is also presented in the *Noise Analysis Technical Report*.
Aquifers/Public Water Supply	No sole source aquifers, source protection areas, water supply reservoirs, or wells are located within the study area.
Waters of the US Including Wetlands	Water resources are regulated by the US Environmental Protection Agency (USEPA), the US Army Corps of Engineers (USACE), the State Water Control Board, and the Virginia Department of Environmental Quality (VDEQ) according to the Water Pollution Control Act of 1972 (Clean Water Act), the Water Quality Act of 1987, and the Resource Conservation and Recovery Act as amended in 1984. Approximately 305 acres of wetlands and 110,000 linear feet of streams are located within the study area. See **Section 3.5** and the *Natural Resources Technical Report*.
Navigable Waters	According to the USACE, all tidal waters in the study area are considered to be navigable. Shipping activities related to the Port of Hampton Roads and Naval Station Norfolk are important to the regional economy and national security. The US Coast Guard regulates navigation in the area and issues permits for structures in navigable waters. See **Section 3.5.1**.
Water Quality	I-64 within the study area crosses seven water bodies that have been assessed in compliance with Sections 303(d), 305(b), and 314 of the Federal Clean Water Act and the Safe Drinking Water Act, and that have been found to be impaired. See **Section 3.5.3** of this Draft EIS and the *Natural Resources Technical Report*.
Floodplains	Approximately 3,710 acres of 100-year floodplains, as designated by the Federal Emergency Management Agency, are located within the study area. See **Section 3.5.4** of this EIS and the *Natural Resources Technical Report*.
Chesapeake Bay Preservation Act	Approximately 4,300 acres of Chesapeake Bay Resource Protection Areas (RPAs) are located within the study area. However, under the Chesapeake Bay Preservation Area Designation and Management Regulations, public roads and their associated structures are conditionally exempt from regulation provided they are constructed in accordance with the Erosion and Sediment Control Law (§10.1-560 et seq. of the Code of Virginia) and the Stormwater Management Act (§10.1-603. 1 et seq of the Code of Virginia). See **Section 3.5.3** and the *Natural Resources Technical Report*.
Coastal Zone	Hampton and Norfolk are located within Virginia's designated coastal zone pursuant to the Federal Coastal Zone Management Act and the Virginia Coastal Zone Management Program. Federally licensed, permitted, or assisted activities that have reasonably foreseeable coastal impacts must be consistent with the enforceable policies of the Virginia Coastal Zone Management Programs. Accordingly, **Chapter 4** documents the analysis (which is further expanded upon in the *Natural Resources Technical Report*) of the Retained Build Alternatives in light of established Virginia Coastal Zone Enforceable Regulatory Programs as related to fisheries management, subaqueous lands management, wetlands management, dunes management, nonpoint source pollution control, point source pollution control, shoreline sanitation, air pollution control, and coastal lands management. No coastal barriers as defined in accordance with the Coastal Barrier Resources Act are present within the study area. Per the John H. Chafee Coastal Barrier Resources System (CBRS) maintained by the USFWS, the nearest CBRS unit is located approximately one mile northeast of the study area and is not likely to be impacted by the Retained Build Alternatives. See **Section 3.5.3** of this Draft EIS and the *Natural Resources Technical Report*.
Wildlife and Habitat	Terrestrial habitat within the study area consists largely of highly fragmented urban landscapes vegetated by mowed lawns and ornamental trees and shrubs. Wildlife species (songbirds, small mammals) include those adapted to such urban environments and close presence of human activities. Aquatic habitat includes the Hampton Roads estuary and tidal tributaries that drain the uplands along the corridor. See **Section 3.6** of this Draft EIS and the *Natural Resources Technical Report*.
Anadromous Fish	According to the Virginia Department of Game and Inland Fisheries (VDGIF), anadromous fish are known to use the James River. General restrictions for all in-stream work in Anadromous Fish Use Areas and their tributaries, recommended by VDGIF, are from February 15 through June 30. See **Section 3.6** of this Draft EIS and the *Natural Resources Technical Report*.

Table 3-1: Summary of Environmental Issues

Resource	Discussion
Essential Fish Habitat	Federal agencies are required to consult with the National Marine Fisheries Service (NMFS) on proposed actions that may impact essential fish habitat (waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity). According to mapping produced by the National Oceanic and Atmospheric Administration (NOAA), essential fish habitat exists in the study area for 15 species; one of these also is a habitat area of particular concern (essential fish habitat that is particularly susceptible to human-induced degradation, is especially ecologically important, or is located in an environmentally stressed area). See **Section 3.6** of this Draft EIS and the *Natural Resources Technical Report*.
Submerged Aquatic Vegetation	According to Regulation 4 VAC 20-337-10 et seq. Submerged Aquatic Vegetation (SAV) Transplantation Guidelines, under the authority of the Code of Virginia §§28.2-103 and 28.2-1203, any removal of SAV from State bottom would require prior approval by the Virginia Marine Resources Commission (VMRC 2000). VMRC mapping indicates that there are 67 acres of existing and 7 acres of historic SAV beds located within the study area. See **Section 3.6** of this Draft EIS and the *Natural Resources Technical Report*.
Threatened and Endangered Species	The US Fish and Wildlife Service (USFWS) and the NMFS are responsible for listing, protecting, and managing Federally listed threatened and endangered species under the Endangered Species Act of 1973, as amended. Thirteen Federally and State listed threatened or endangered species are reported to occur or potentially occur within the study area. See **Section 3.7** of this Draft EIS and the *Natural Resources Technical Report*.
Invasive Species	Invasive species are non-native plant, animal, or microbial species that cause, or have the potential to cause, economic or ecological harm or harm to human health (Executive Order 13112, *Invasive Species*). State and local governments have set up several laws and regulations to prevent the spread of noxious weeds and plants deemed to be detrimental to crops, surface waters, including lakes, other desirable plants, livestock, land or other property, or to be injurious to public health or the economy. The I-64 corridor is in an urban area where disturbed ground is subject to colonization by invasive species. Accordingly, Section 3.6 and 4.9.5 of the Draft EIS and the *Natural Resources Technical Report* include information on the impacts of the alternatives with respect to invasive species.
Historic Properties	Pursuant to Section 106 of the National Historic Preservation Act, historic properties (properties that are included in, or eligible for inclusion in, the National Register of Historic Places [NRHP]) have been identified within the area of potential effects (APE). Thirteen architectural historic properties have been identified within the APE. Two of these, the Emancipation Oak (within Hampton Institute) and Fort Monroe, also are designated National Historic Landmarks. As described in **Section 3.8.2**, archaeological surveys conducted for previous studies covered all but a few small portions of the study window. Two archaeological sites identified during previous surveys were recommended as potentially eligible for the NRHP. Additional detailed archaeological work has been deferred pending selection of an alternative. This approach has been coordinated with the Virginia State Historic Preservation Officer (SHPO) and is consistent with Section 106 regulations that permit phasing of identification and evaluation efforts for historic properties (36 CFR 800.4(b)(2)). See **Section 3.8**.
Visual Character	The study area has been divided into five visual assessment units. Views both from and toward I-64 within each unit have been evaluated. The areas within the viewshed of the north and south bridge approaches to the tunnel are the most visually sensitive in the corridor because high value is typically placed on water views. I-64, from where it crosses West Mercury Boulevard in the north to where US Route 60 splits off in the south, is designated by VDOT as a State Scenic Road. There are no National Scenic Byways in the area. Additional information on visual character can be found in **Section 4.15** of this Draft EIS and the *Visual Resources Technical Memorandum*.
Wild and Scenic Rivers	There are no Federally listed wild or scenic rivers, no National Rivers Inventory listed rivers, and no State scenic rivers in the study area.
Hazardous Materials	I-64 is within a highly urbanized area that has numerous facilities that handle hazardous materials or petroleum products. There are 121 sites identified in the study area, most of which either have storage tanks or have had a petroleum release. See **Section 3.9** of this Draft EIS and the *Hazardous Materials Technical Memorandum*.

Table 3-2: Existing Land Use

Land Use/Land Cover Classification	Acres within Study Area	Percent of Total
Commercial	329	7%
Industrial	82	2%
Institutional	928	21%
Military	637	14%
Mixed-Use	108	3%
Parks, Open Space, and Greenways	179	4%
Residential	1,807	40%
Vacant	415	9%
TOTAL	**4,485**	**100%**

Sources: City of Hampton and City of Norfolk Land Use GIS databases.
Note: Acreage in this table does not include water features or roads.

3.2.3 Development Trends/Future Land Use

The *Hampton Community Plan* notes that the City "is over 90% built out"; most land use changes will occur as conversion of one type of land use to another, not induced land use changes (City of Hampton, 2006a). The plan for future land use is to "protect residential neighborhoods, encourage commercial investment in established centers and districts, promote revitalization in strategic areas of the City, and protect environmentally sensitive areas" (City of Hampton, 2006a). Future land use, as defined by the City, is depicted in **Figure 3-2.**

In a manner similar to the City of Hampton, the General Plan for the City of Norfolk states that due to the highly developed nature of the City (95% built), any new development "will take the form of redevelopment or revitalization" (City of Norfolk, 1992). New development in Norfolk is expected to be "either the result of redevelopment or infill" (City of Norfolk, 2011).

3.3 COMMUNITIES AND COMMUNITY FACILITIES

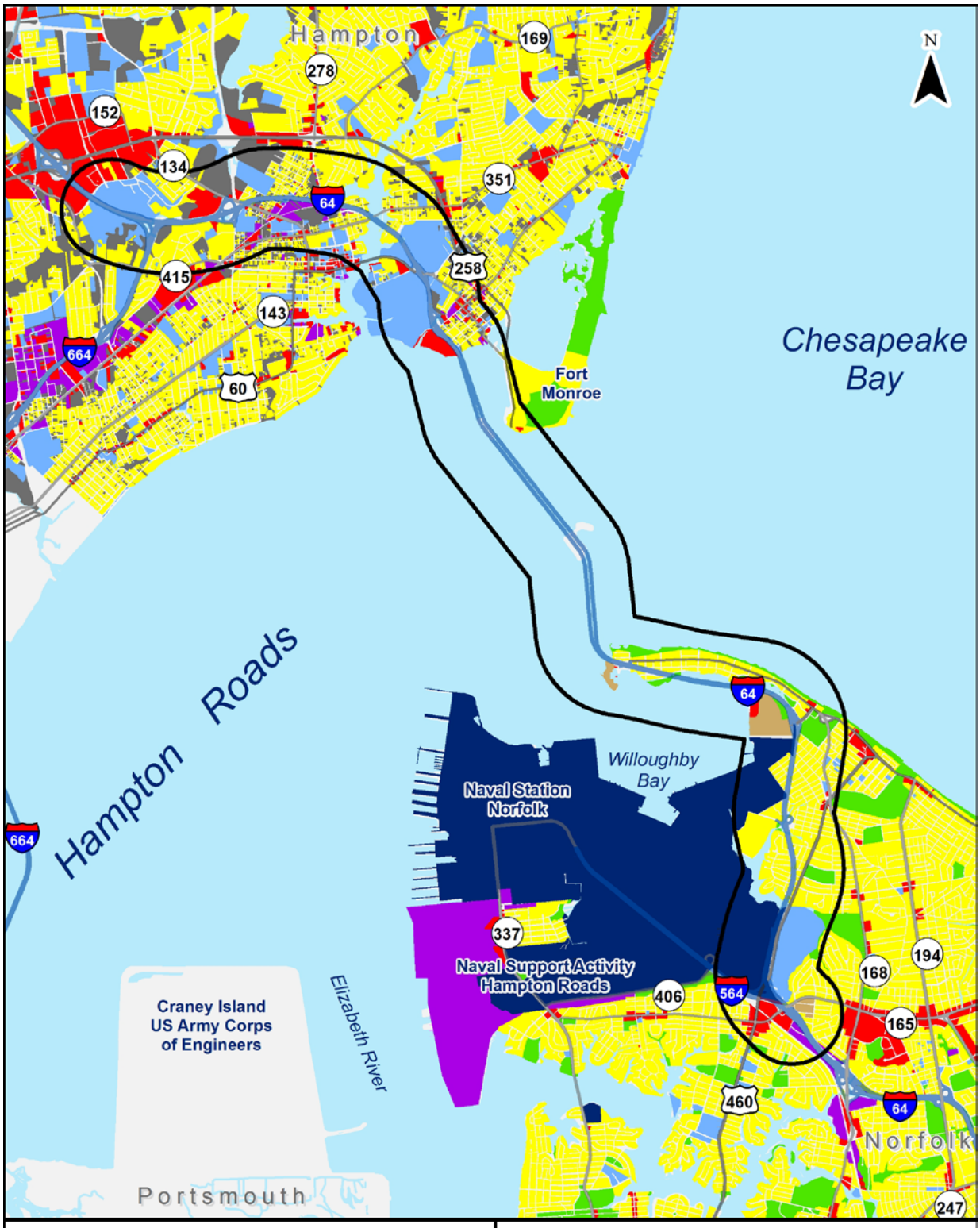
I-64 is a major transportation corridor for communities throughout the Hampton Roads region, particularly the cities of Hampton and Norfolk. As a limited-access roadway, I-64 connects to the communities and neighborhoods through interchanges with local roads.

3.3.1 Communities

The City of Hampton identifies districts of the City as well as neighborhoods within these districts, including Coliseum Central, the North King Street corridor, Downtown Hampton, and Phoebus. Neighborhoods within these larger districts in the study area include Findley Square, Windsor Terrace, Brights Creek, Old Northampton, Olde Hampton, Pasture Point, Downtown Hampton, Hampton University, and Phoebus.

The civic leagues in the City of Norfolk are based on neighborhood boundaries; there are 125 active civic leagues throughout the City (City of Norfolk, 2011). In the study area, these neighborhoods include: Willoughby, Ocean View, Pamlico, Merrimack Park, Commodore Park, Hampton Gardens, Granby Shores, Albemarle, Monticello Village, Denby Park, Daniels Gardens, Suburban Park, Pinehurst, Westmere, Bondale, Sewells Park, and Rose Gardens. Specific plans for some neighborhoods within the study area are included in the draft *PlaNorfolk 2030* (City of Norfolk, 2011).

Demographic data for the cities of Hampton and Norfolk are summarized in **Table 3-3**. Additional information is presented in the *Socioeconomics Technical Report* and in **Section 3.4** of this Draft EIS.



Legend

- Study Area
- Residential
- Commercial
- Industrial
- Military
- Vacant
- Mixed-Use
- Parks, Open Space & Greenways
- Institutional

Source: HRPDC Land Use Database

Miles: 0 0.5 1 2

Existing Land Use

U.S. Department of Transportation Federal Highway Administration

VDOT

Figure 3-1

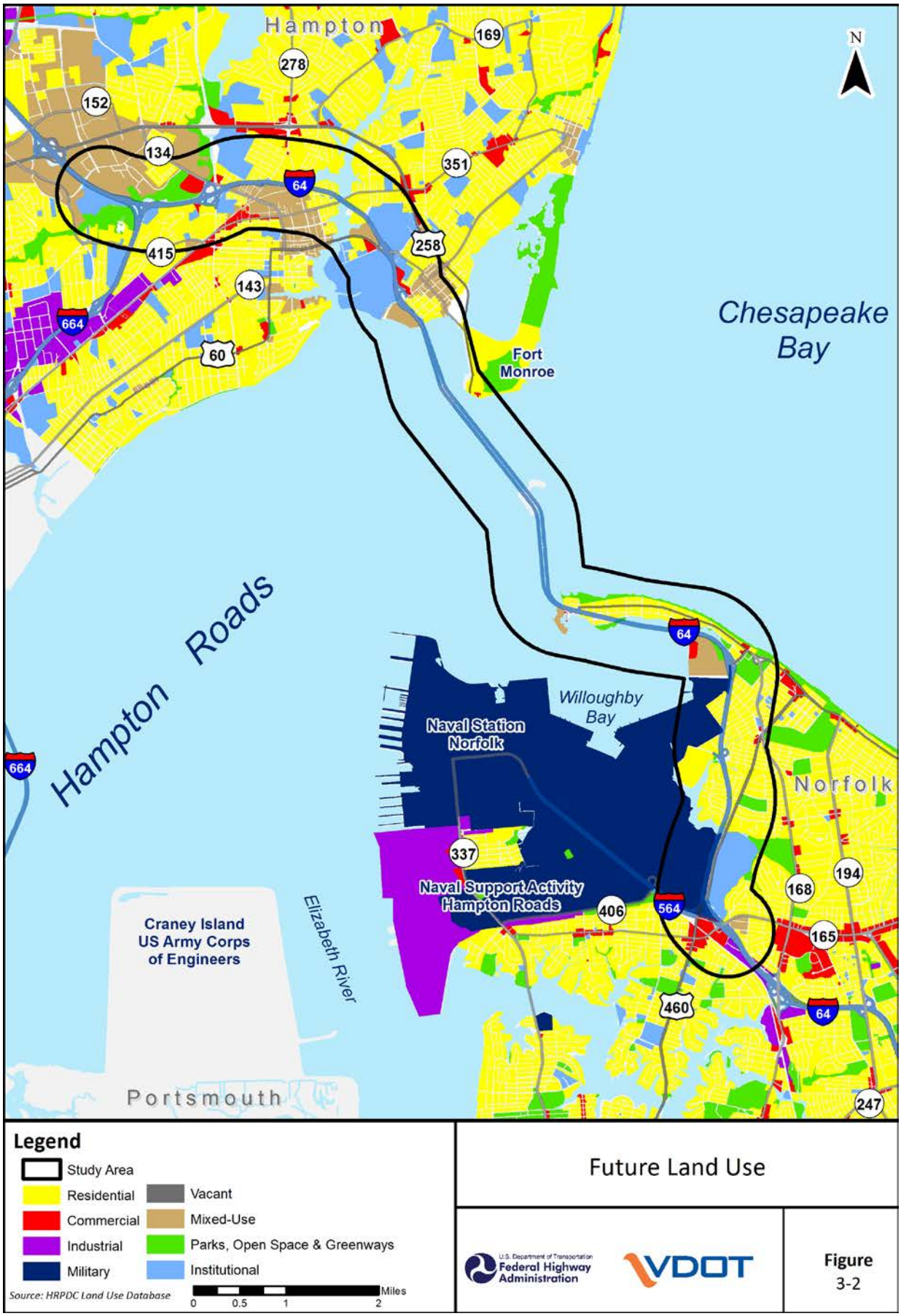

Hampton
Chesapeake Bay
Fort Monroe
Hampton Roads
Willoughby Bay
Naval Station Norfolk
Naval Support Activity Hampton Roads
Craney Island US Army Corps of Engineers
Elizabeth River
Portsmouth
Norfolk
N
169
278
152
134
351
64
258
415
143
664
60
564
406
337
168
194
165
460
247
Legend
Study Area
Residential
Commercial
Industrial
Military
Vacant
Mixed-Use
Parks, Open Space & Greenways
Institutional
Source: HRPDC Land Use Database
Miles
0 0.5 1 2
Future Land Use
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure 3-2

Table 3-3: 2010 Demographic Data

Location	Total Population	Total Minorities (Percent Minorities)	Total Over 65 Years (Percent Over 65 Years)	Total Low-Income (Percent Low-Income)	Total Limited English Proficiency (Percent LEP)
City of Hampton	137,436	81,153 (59.05%)	16,856 (12.26%)	17,040 (12.59%)	2,866 (2.21%)
City of Norfolk	242,803	135,340 (55.74%)	22,796 (9.39%)	36,847 (16.48%)	7,531 (3.35%)
Study Area Cities TOTAL	**380,239**	**216,493 (56.94%)**	**39,652 (10.43%)**	**53,887 (15.01%)**	**10,397 (2.93%)**

Sources: US Census Bureau, 2010, SF1; US Census Bureau, ACS 2006-2010.

3.3.2 Community Facilities

There is a wide range of community facilities located throughout the study area, including schools, churches, and medical facilities. Some of the most notable community facilities include the Hampton Coliseum and Convention Center, Hampton National Cemetery, Hampton University, Hampton Veterans Affairs Medical Center, Norfolk Visitor Information Center, Girl Scouts of the USA's Camp Apasus, and Forest Lawn Cemetery. A tabulation of community facilities within the study area is shown in **Table 3-4**.

There are six identified bike routes in the study corridor: Settlers Landing Road, East Pembroke Avenue, King Street, Rip Rap Road, LaSalle Avenue, and Armistead Avenue. With the exception of Settlers Landing Road, no marked shoulders or separated bike lanes are provided for bicyclists. Settlers Landing Road, East Pembroke Avenue, King Street, and Rip Rap Road have sidewalks that can be used for bike traffic.

Table 3-4: Community Facilities

Facility Type	City of Hampton	City of Norfolk
Cemetery	7	1
Fire Station	2	1
Medical Facility	4	2
Library	1	0
Police Station	1	0
Post Office	2	1
Religious Facility	16	6
School	13	5
Other	12	8
TOTAL	**66**	**36**

Sources: VDOT GIS database; ADC Maps; Field Reviews, September 2011.
*Note: The category "Other" includes resources that did not specifically belong in another category, e.g., the Hampton Coliseum, Norfolk Visitor Information Center, Knights of Columbus, or private child care centers. Refer to **Table 3-5** for parks and recreational facilities.*

3.3.3 Parks and Recreation Areas

Table 3-5 summarizes the location, ownership, and available amenities at park and recreational facilities located within the study area (the locations of these facilities are presented graphically in the *Parks and*

Recreation Technical Memorandum). Existing and proposed park and recreational facilities that are located on public land as well as within Department of Defense boundaries were included for evaluation, as well as all park and recreational facilities identified in the Section 4(f) Evaluation (**Appendix C**). The Hampton Parks and Recreation Department operates the majority of the parks in the City of Hampton, while the Norfolk Department of Recreation, Parks, and Open Space (NRPOS) operates the majority of the park facilities in the City of Norfolk.

Table 3-5: Summary of Park and Recreation Facilities

Facility Name	Location	Ownership	Amenities
City of Hampton			
Newmarket Creek Park and Trail System (proposed)	Along Newmarket Creek north of I-64 opposite I-664 interchange in vicinity of Hampton Coliseum	City of Hampton	Multi-use trail with pocket parks and water access points to be located at several points
Bluebird Gap Farm	60 Pine Chapel Road	City of Hampton	Picnic Shelters, Playgrounds, Nature Trails, Farm, Small Stage
Hampton High School	1491 West Queen Street	City of Hampton	Athletic Fields
Suzanne E. Jones Community Center	1137 LaSalle Ave.	City of Hampton	Community Center with some outdoor areas
Y.H. Thomas Neighborhood Park Complex	1300 Thomas Street	City of Hampton	Football, Baseball/Softball Fields, Basketball Court, Playground, Picnic Shelters
Mary Peake Playground	1306 Thomas Street	City of Hampton	Playground
Proposed Old North Hampton Community Park	Bethel Ave. (north of Mary Peake School)	City of Hampton	N/A
YMCA	1322 LaSalle Ave.	YMCA	Track
Phenix High School	LaSalle Ave.	Hampton Redevelopment and Housing Authority	Baseball Field
Old Hampton Community Center	201 Lincoln Street	City of Hampton	Athletic Fields
Mill Point Park	100 Eaton Street	City of Hampton	Amphitheater, Passive Recreation
River Street Park	River Street	City of Hampton/VDOT	Walkways, Small Craft Boat Launch
Woodlands Golf Course/Woodlands Skate Park/Hampton Tennis Center	9 Woodland Road	City of Hampton	Golf Course
Robert Moton Elementary School	339 Old Buckroe Road	City of Hampton	Playground
L.B. Davis Playground	58 Fulton Street	City of Hampton	Basketball Courts
Kearney Park	N. Mallory Street/County Street	City of Hampton	Passive Recreation
Phoebus Recreation Fields	County Street/Willard Ave.	Phoebus Recreation Association, Inc.	Athletic Fields
Fort Monroe	City of Hampton	Transitioning from Army to National Park Service	National Monument with Historic Buildings, Beaches, Marina
Fort Wool	Hampton Roads Harbor	Leased to City of Hampton by State	Historic Park
City of Norfolk			
Trails End Park	1501 W. Ocean View Ave.	VDOT	Open space
Willoughby Boat Ramp	1305/1309 Bayville Street	City of Norfolk (a 6(f) facility purchased with Land and Water Conservation Funds)	Boat Ramp
Captains Quarters Nature Center and Park	800 Little Bay Ave.	City of Norfolk	Playground, Beach
Sarah Constant Shrine and Beach	300 W. Ocean View Ave.	City of Norfolk	Beach, Monument

Table 3-5: Summary of Park and Recreation Facilities

Facility Name	Location	Ownership	Amenities
Monkey Bottom Wetland Walkway	9401 4th View Street	Norfolk Naval Station	Elevated Walkway
Monkey Bottom Park	9625 Mason Creek Road	City of Norfolk	Playground, Passive Recreation, Open Space
Ocean View Elementary	9501 Mason Creek Road	City of Norfolk	Playground, Baseball Field, Tennis and Basketball Courts
Willoughby Elementary School	9500 4th View Street	City of Norfolk	Playground
Lagoon Pool and Water Park	Bellinger Blvd., Norfolk Naval Station	Norfolk Naval Station	Pool
Maple Avenue Dog Park	176 Maple Ave.	City of Norfolk	Dog Park
Ocean View Golf Course	9548 Norfolk Ave.	City of Norfolk	Golf Course
Merrimac Landing Recreation Center	8809 Monitor Way	Norfolk Redevelopment and Housing Authority	Baseball, Track, Playground
Lenox Wetland Restoration Site	8950 Granby Street	City of Norfolk	Open Space
Northside Middle School, Mary Alcott Elementary School and Norfolk Therapeutic Recreation Center	180 E. Evans Street	City of Norfolk	Baseball, Soccer, Tennis and Basketball Courts
Breezy Point Park	Patrol Road, Norfolk Naval Station	Norfolk Naval Station	Playgrounds, Baseball, Volleyball, Basketball Courts
Camp Apasus	8420 Granby Blvd.	City of Norfolk	Camp Sites, Picnic Area
Northside Park	8400 Tidewater Drive	City of Norfolk	Pool, Playgrounds, Walking Paths, Picnic Shelters, Basketball and Tennis Courts
Navy Athletic Field	Patrol Road near I-564, Norfolk Naval Station	Norfolk Naval Station	Softball Field
Monticello Village Park	8075 West Glen Road	City of Norfolk	Baseball, Playground, Basketball Court
Kaboom Playground	352 San Antonio Blvd.	City of Norfolk	Playground

Source: City of Hampton and City of Norfolk Online GIS Information; Field Reviews, September 2011.

3.4 SOCIOECONOMICS

The total population in the City of Hampton has decreased since 2000 after increasing between 1990 and 2000. The City of Norfolk has experienced the opposite effect, with an increase since 2000, after a decrease between 1990 and 2000, as shown in **Table 3-6**.

Table 3-6: Total Population Over Time

Location	1990	2000	2010	Percent Change 2000-2010
City of Hampton	133,793	146,437	137,436	-6.15%
City of Norfolk	261,229	234,403	242,803	3.58%
Study Area Cities TOTAL	**395,022**	**380,840**	**380,239**	**-0.16%**

Sources: US Census Bureau: 1990, STF1; 2000, SF3; 2010 SF1.

The Hampton Roads region has an economy based primarily on its unique geographical elements: a deepwater port and immediate access to the Chesapeake Bay and Atlantic Ocean. Four Virginia Port Authority freight facilities surround Hampton Roads: Newport News Marine Terminal, Norfolk International Terminals (NIT), Portsmouth Marine Terminals, and the A.P. Maersk Terminal. NIT is located just west of the eastern terminus of the study area. Ships utilizing the port facilities access the

Chesapeake Bay via Hampton Roads. The roadway access to these facilities via I-64 is a key element of their multi-modal capabilities. Naval Station Norfolk similarly benefits from the location and features of the port. Other armed services also have established facilities in the region. Maritime related industries (ship building, repair, and supply) also are key elements of the regional economy. Tourism is the other significant economic sector in the region.

The Hampton Roads Planning District Commission (HRPDC) produced the *2010 Regional Benchmarking Study*, which includes economic and social data at the regional level for Hampton Roads and other similar Metropolitan Statistical Areas (MSA), as well as specific city data, as shown in **Table 3-7**.

Table 3-7: Employment Data for Hampton and Norfolk

Location	Total Employment 2008	Labor Force 2009	Unemployment Rate: Sept. 2011
City of Hampton	81,410	69,807	8.7%
City of Norfolk	223,550	101,847	8.9%

Source: 2010 Regional Benchmarking Study, HRPDC; Community Profiles, Virginia Employment Commission.

3.5 WATER RESOURCES

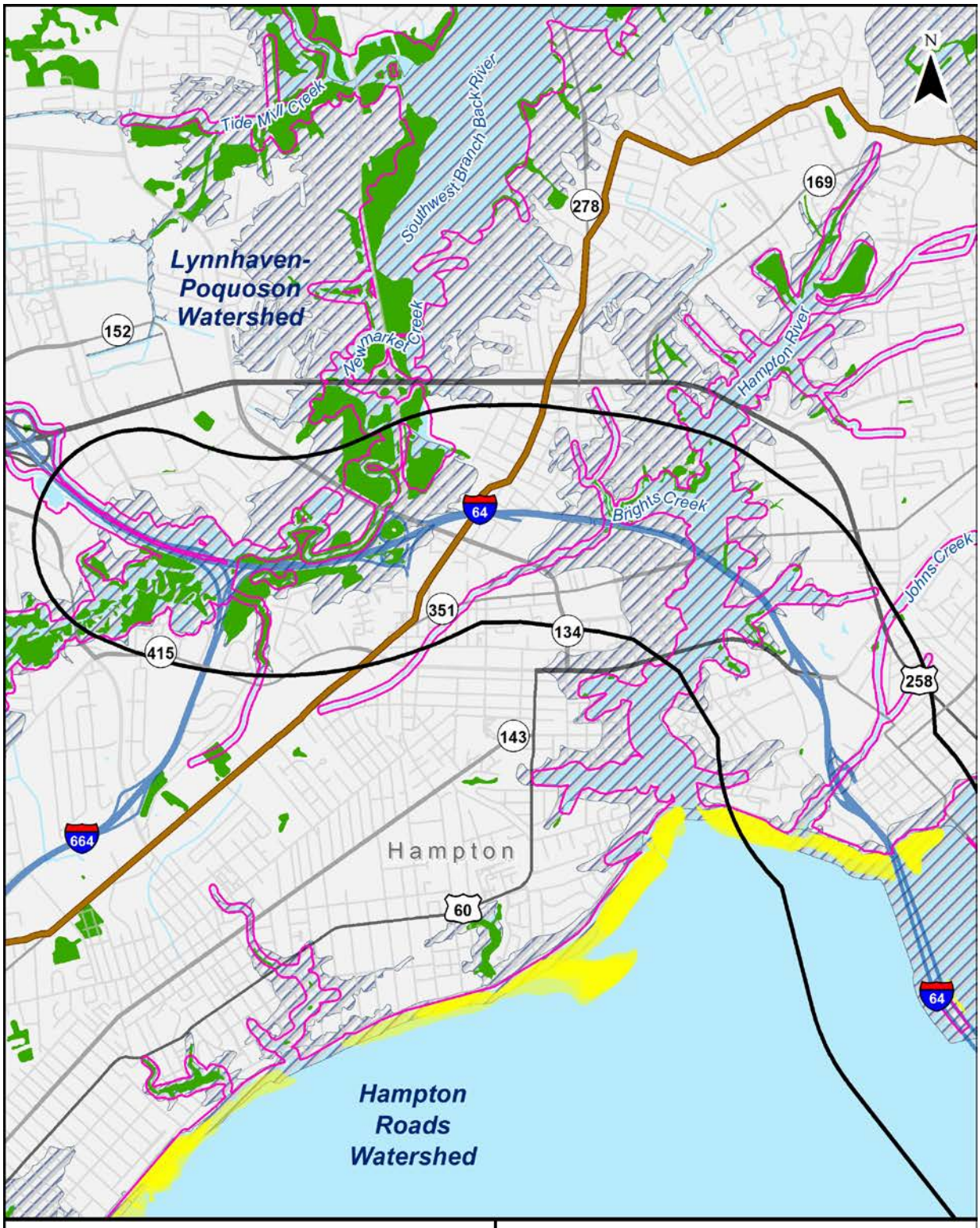
Water resources are regulated by the US Environmental Protection Agency (EPA) and the US Army Corps of Engineers (USACE) according to the Water Pollution Control Act of 1972 (Clean Water Act) and the Water Quality Act of 1987. Section 404 of the Clean Water Act regulates activities impacting Waters of the United States. Waters of the United States include surface waters (streams, lakes, bays, etc.) and their associated wetlands (inundated or saturated areas that support vegetation adapted for life in wet soils). The EPA, the USACE, the US Coast Guard, the Virginia Department of Environmental Quality (VDEQ), and the Virginia Marine Resources Commission all issue permits for various activities in, under, and over waters of the US. Most of the surface waters in the region are considered navigable waters (waters that have been or can be used for interstate or foreign commerce) by the USACE.

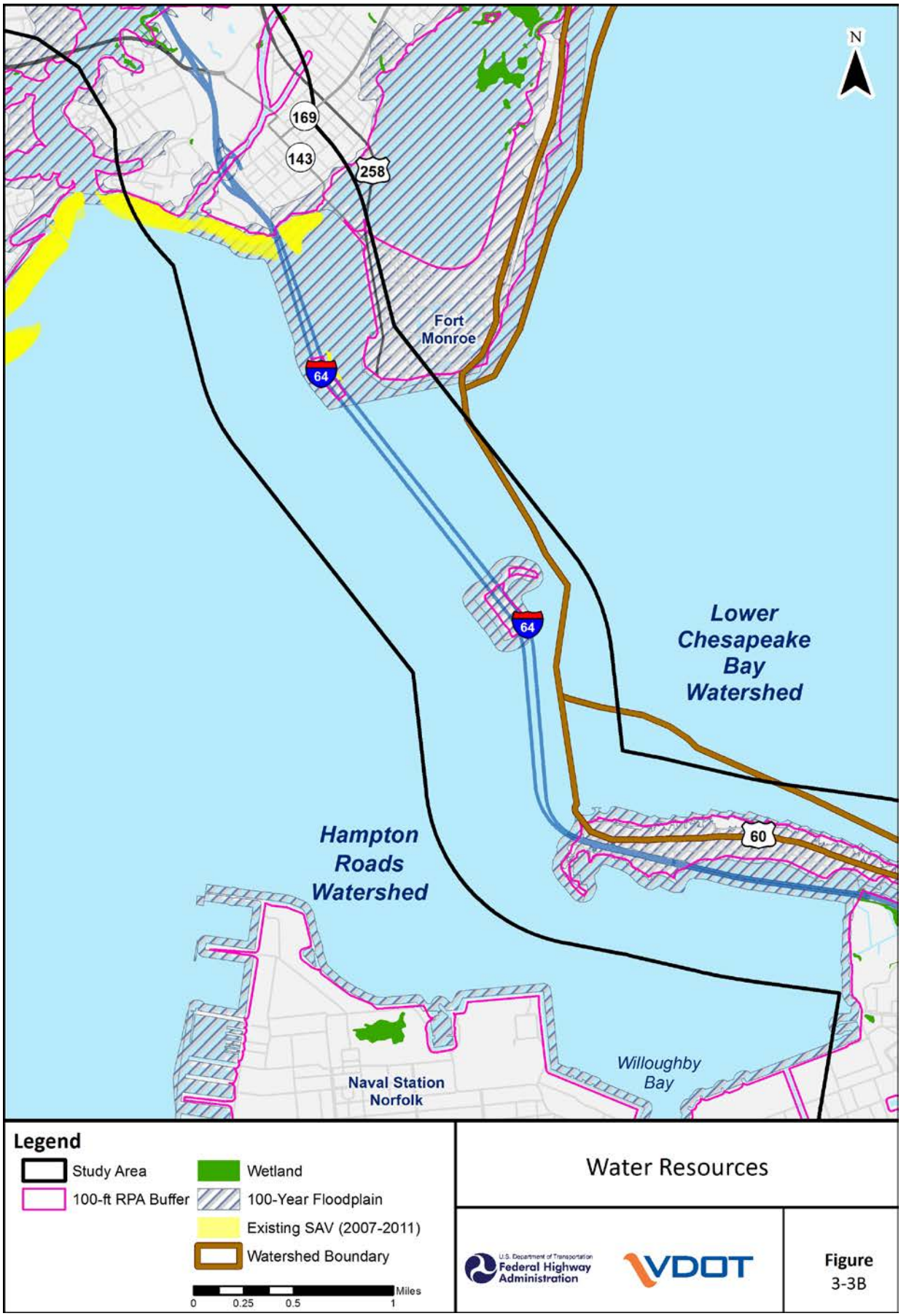
Streams, wetlands, and floodplains within a one-mile-wide corridor along I-64 were identified by reviewing aerial photographs and topographic maps, National Wetlands Inventory (NWI) maps from the US Fish and Wildlife Service (USFWS), National Hydrography Dataset (NHD) maps from the United States Geological Survey (USGS), VDOT GIS data (VDOT, 2012), and Flood Insurance Rate Maps (FIRM) from the Federal Emergency Management Agency (FEMA). Field reconnaissance was then conducted in September 2011 to confirm the existence of streams, wetlands and floodplains within the study corridor. Existing conditions for water resources within the study area, including streams, wetlands, water quality, floodplains, and hydrodynamics, are summarized in the sections below. Additional information is presented in the *Natural Resources Technical Report*.

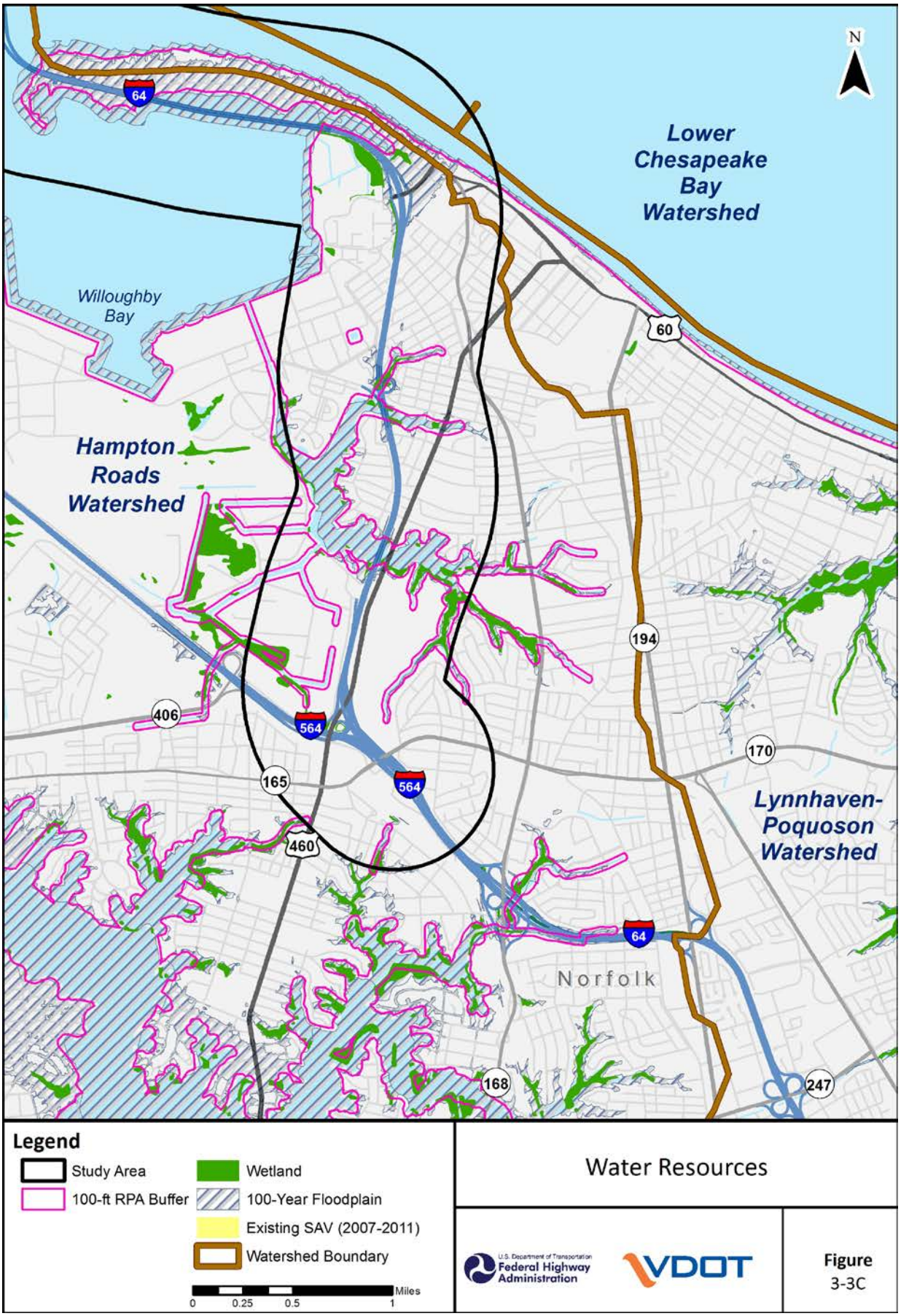
3.5.1 Streams and Navigable Waters

There are 30 named streams or unnamed smaller tributaries spanning 110,000 linear feet within the one-mile-wide study area along I-64, as shown in **Figures 3-3 A-C**. They include: Mason Creek and 12 unnamed tributaries; Oastes Creek and an unnamed tributary; Mill Creek; John's Creek; Hampton River and two unnamed tributaries; Brights Creek and three unnamed tributaries; and Newmarket Creek and five unnamed tributaries. In addition to these stream crossings, the study area traverses the James River where it meets the Chesapeake Bay (also referred to as Hampton Roads).

According to the USACE, all tidal waters and the entire length of the James River are considered to be navigable (USACE, 2010). The Port of Virginia, located just upstream of the study area, is a naturally deep harbor and the James River allows for access to this harbor and several deep water anchorages within and upstream of the study area. According to the Virginia Port Authority, conditions that must be maintained include: James River channel conditions of a 55 foot depth at mean low water (MLW) with a


N
Tide Mill Creek
Southwest Branch Back River
Lynnhaven-
Poquoson
Watershed
Newmarket Creek
Hampton River
Brights Creek
Johns Creek
152
278
169
64
351
134
415
258
143
664
Hampton
60
64
Hampton
Roads
Watershed
Legend
Study Area
100-ft RPA Buffer
Wetland
100-Year Floodplain
Existing SAV (2007-2011)
Watershed Boundary
0
0.25
0.5
1
Miles
Water Resources
U.S. Department of Transportation
Federal Highway Administration
VDOT
Figure
3-3A


N
169
143
258
64
Fort Monroe
64
Lower Chesapeake Bay Watershed
Hampton Roads Watershed
60
Naval Station Norfolk
Willoughby Bay
Legend
Study Area
100-ft RPA Buffer
Wetland
100-Year Floodplain
Existing SAV (2007-2011)
Watershed Boundary
0 0.25 0.5 1 Miles
Water Resources
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure 3-3B


N
Lower Chesapeake Bay Watershed
Willoughby Bay
Hampton Roads Watershed
Lynnhaven-Poquoson Watershed
Norfolk
64
60
194
406
564
165
460
170
168
247
Legend
Study Area
100-ft RPA Buffer
Wetland
100-Year Floodplain
Existing SAV (2007-2011)
Watershed Boundary
Miles
0
0.25
0.5
1
Water Resources
U.S. Department of Transportation
Federal Highway Administration
VDOT
Figure
3-3C

width of 1,000 feet (top of tunnel would need to be a minimum of 60 feet MLW, preferably 65 feet), and the preservation of existing deep water anchorages.

3.5.2 Wetlands

Wetlands are defined by the USACE (33 CFR 328.3[b]) and the EPA (40 CFR 230.3[t]) as:

> Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

There are approximately 220 acres of emergent wetland, 15 acres of scrub-shrub wetland, and 70 acres of forested wetland, for a total of 305 wetland acres within the one-mile-wide study corridor (see **Figures 3-3 A-C** for all mapped wetlands). These wetlands provide valuable habitat for fish and wildlife; improve water quality; perform important hydrologic functions, such as regulating storm flow; and maintain food chain and nutrient cycling functions. The majority of the wetlands include tidal emergent systems that are mainly dominated by monocultures of cordgrass and common reed.

3.5.3 Water Quality

In compliance with Sections 303(d), 305(b), and 314 of the Federal Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA), VDEQ has developed a prioritized list of water bodies that currently do not meet water quality standards. VDEQ monitors streams for a variety of water quality parameters, including temperature, dissolved oxygen, pH, fecal coliform, e. coli, enterococci, total phosphorus, chlorophyll a, benthic invertebrates, metals and toxics in the water column, sediments, and fish tissues. The Section 303(d) list includes those water bodies and watersheds that exhibit levels of impairment requiring investigation and restoration. **Table 3-8** lists impaired water bodies within the one-mile-wide study area along I-64. Not all parameters are monitored at each of the ambient water quality monitoring stations (VDEQ, 2010).

The Chesapeake Bay Preservation Act was enacted by the Virginia General Assembly in 1988 to protect and manage Virginia's "coastal zone." The Act requires local governments to include water quality protection measures in their zoning and subdivision ordinances and in their comprehensive plans. Chesapeake Bay Resource Protection Areas (RPAs) include tidal wetlands, tidal shores, non-tidal wetlands connected by surface flow and contiguous to tidal wetlands or perennial water bodies, and highly erodible soils, as well as a 100-foot vegetated buffer area located adjacent to and landward of these features and along both sides of any water body with perennial flow within the Chesapeake Bay watershed. Approximately 4,300 acres of RPAs are present within the one-mile-wide study corridor.

In addition, Federal actions occurring within, or with the likelihood to impact, any land or water use, or natural resource of a State's coastal zone, including cumulative and secondary impacts, must be consistent with a state's federally approved Coastal Zone Management Program (CZMP) according to Section 307 of the Federal Coastal Zone Management Act of 1972, as amended, and National Oceanic and Atmospheric Administration (NOAA) regulations (15 CFR part 930); and require a consistency determination. Virginia's coastal zone "encompasses the 29 counties, 17 cities, and 42 incorporated towns in 'Tidewater Virginia,' as defined in the Code of Virginia 28.2-100" (VDEQ, 2011b). The entire study area is located within Virginia's coastal zone. As such, any development within this area must be consistent with the applicable Enforceable Regulatory Programs that comprise Virginia's CZMP.

Table 3-8: Impaired Water Bodies

Water Body	Uses Supported	Impairment	Source
Chesapeake Bay	Public Water - N/A* Recreation - X ** Wildlife - X Aquatic Life - No SAV*** - No Shellfishing - Yes Fish Consumption - No	PCB in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges
Newmarket Creek - Upper	Public Water - N/A Recreation - No Wildlife - Yes Aquatic Life - No SAV - No Shellfishing - Yes Fish Consumption - No	Enterococcus, Dissolved Oxygen, Fecal Coliform, PCB in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Discharges from Municipal Separate Storm Sewer Systems (MS4), Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges
Newmarket Creek - Lower	Public Water - N/A Recreation - No Wildlife - Yes Aquatic Life - No SAV - No Shellfishing - No Fish Consumption - No	Enterococcus, Dissolved Oxygen, Fecal Coliform, PCB in Fish Tissue, Aquatic Plants (Macrophytes)	Atmospheric Deposition - Nitrogen, Clean Sediments, Discharges from Municipal Separate Storm Sewer Systems (MS4), Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges
Hampton River	Public Water - N/A Recreation - No Wildlife - Yes Aquatic Life - No SAV - Yes Shellfishing - N/A Fish Consumption - No	Enterococcus, Dissolved Oxygen, PCB in Fish Tissue	Atmospheric Deposition - Nitrogen, Industrial Point Source Discharge, Internal Nutrient Recycling, Loss of Riparian Habitat, Municipal Point Source Discharges, Wet Weather Discharges
Willoughby Bay	Public Water - N/A Recreation - Yes Wildlife - X Aquatic Life - Insufficient Information SAV - Yes Shellfishing - N/A Fish Consumption - No	PCB in Fish Tissue	Source Unknown
Mill Creek	Public Water - N/A Recreation - X Wildlife - X Aquatic Life - Insufficient Information SAV - Yes Shellfishing - N/A Fish Consumption - No	PCB in Fish Tissue	Source Unknown
James River at Hampton Roads Harbor	Public Water - N/A Recreation - Yes Wildlife - Yes Aquatic Life - No SAV - Yes Shellfishing - N/A Fish Consumption - No	Chlorophyll-a, Nutrient/ Eutrophication Biological Indicators, PCB in Fish Tissue	Industrial Point Source Discharge, Municipal Point Source Discharges, Source Unknown, Non-Point Source

Source: VDOT GIS Layers - VDEQ. 2010. 2010 Water Quality Assessment 305(b)/303(d) Integrated Report.
** N/A – Not applicable*
***X – Not assessed*
****SAV – Submerged Aquatic Vegetation*

3.5.4 Floodplains

The National Flood Insurance Act of 1968 established the National Flood Insurance Program, which the FEMA is responsible for administering. FEMA is required to identify and map the nation's flood-prone areas. According to FIRMs produced by the FEMA, approximately 3,710 acres of 100-year floodplains are located within the study area, as shown in **Figures 3-3 A-C**. One-hundred-year floodplains have a one percent chance of flooding in any given year. Mapped floodplains include those associated with:

- Mason Creek
- Oastes Creek
- James River
- Mill Creek
- John's Creek
- Hampton River
- Brights Creek
- Newmarket Creek

Floodplains have a number of natural and beneficial values, including flood flow moderation, water quality maintenance, and wildlife habitat.

3.5.5 Hydrodynamics

A three-dimensional hydrodynamic-sedimentation model was developed in the late 1990s by the Virginia Institute of Marine Science (VIMS). This model was developed to model tides, currents, circulation, salinity, and sedimentation within Hampton Roads and nearby tributaries. Simulations produced by the model were verified by VIMS through field observations of tides and currents. Given that no significant changes have occurred along the Hampton Roads shoreline since the model results were published, the existing conditions provided in the model are assumed to remain valid and are discussed below.

Hampton Roads' tide ranges from approximately -0.5 meters to 0.5 meters above mean water level. Simulated currents south of the northern entrance/exit to the I-64 tunnel were -50 to 50 cm/s near the surface and -15 to 15 cm/s near the bottom.

There are two eddies, or current loops, within the Hampton Roads area. A clockwise surface eddy appears at the entrance of the Elizabeth River near the northeast corner of Craney Island. The eddy only exists during apogean-neap tides (during the smallest tidal range). A large counter-clockwise eddy appears in non-tidal surface currents at the southwest end of Hampton Flats, which is located in Hampton Roads at the mouth of the Hampton River.

According to the VIMS model, salinity ranges from 23 to 30 parts per thousand (ppt) during low river inflow, from 13 to 23 ppt during mean river flow, and from 6 to 22 ppt during high river inflow. An average salinity of 14 to 22 ppt during apogean-neap tides and perigean spring tides exists near I-64.

Sedimentation patterns in the James River show that coarser sandy bottom sediments occur in the channel and northern flank near Hampton Flats and finer muddy bottom sediments occur in the southern flank near Craney Island. Areas of high sedimentation potential are located along the south shore of Hampton Roads, with relatively little along the north shore.

3.6 WILDLIFE AND HABITAT

Table 3-9 summarizes the general habitat types within the study area. Although urban land uses dominate terrestrial portions of the I-64 corridor, there are small areas containing shrubs and patches of

woods that harbor wildlife species adapted to urban and semi-urban conditions. Most of the terrestrial habitat is highly fragmented. Any areas that could be interpreted as "wildlife corridors" generally follow streams that traverse the area. Wooded areas generally are found along waterways. Urban fields include cemeteries, parks, and open undeveloped vegetated fields. Wildlife in developed areas includes species adapted to urban/suburban conditions, such as rabbits, whitetail deer, eastern grey squirrels, red fox, and a number of common bird species.

Table 3-9: Habitat

Habitat	Acres within Study Area
Water	3,720
Urban Field	502
Urban Shrub Area	18
Urban Forest	420
Developed Land	3,222
TOTAL	**7,881**

Sources: City of Hampton and City of Norfolk Land Use GIS databases; aerial imagery; and field verification.
Notes: Acreage in this table does not include roads.
*Difference in total acreage compared to **Table 3-2** (Existing Land Use) results from inclusion of water and different source data.*

Aquatic habitat is dominated by Hampton Roads, an estuarine system linking the James River with the Chesapeake Bay. These waters and their tidal tributaries support many commercially important fish and shellfish species. Among these are benthic organisms like blue crabs, hardshell clams, and oysters, which are sensitive to water quality, sediment conditions, and overharvesting. There are approximately 3,150 acres of benthic habitat within the study area.

Water bird nesting colonies have been recorded along Rip Raps Island (Fort Wool) and the adjacent island that contains the tunnel portals for I-64. Species known to use this area as a nesting site include herring gull, laughing gull, great black-backed gull, black skimmer, gull-billed tern, royal tern, and common tern (VDOT, 2012). According to the Virginia Department of Conservation and Recreation (VDCR) – Division of Natural Heritage, this area has been ranked "B5" (site of general significance) due to the presence of black skimmer (Baird, 2011).

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established a requirement to describe and identify "Essential Fish Habitat" (EFH) and requires all federal agencies to consult with the National Marines Fisheries Service (NMFS) on actions or proposed actions that may impact EFH. EFH includes aquatic ecosystems required for important factors in a fish's life cycle: "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (NOAA, 2011b). NMFS works with the regional fishery management councils to identify the essential habitat for every life stage of each federally-managed species using the best available scientific information. NMFS in coordination with the councils also has identified Habitat Areas of Particular Concern (HAPC). These are considered high priority areas for conservation, management, or research because they are rare, sensitive, stressed by development, or important to ecosystem function (NOAA, 2012). EFH and HAPC areas are mapped in 10 x 10 minute squares, four of which meet near the HRBT. **Table 3-10** lists species that have EFH or HAPC located within those four 10-minute squares.

Anadromous Fish Use Areas are migration pathways, spawning grounds, or nursery areas identified by the Virginia Department of Game and Inland Fisheries (VDGIF) as having been used or have the potential to be used by anadromous fish. Confirmed Anadromous Fish Use Areas are those waters where anadromous fish species have been observed. The James River in the vicinity of the study area is a confirmed Anadromous Fish Use Area for alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), Atlantic sturgeon (*Acipenser oxyrhynchus*), striped bass (*Morone saxatilis*), blueback

herring (*Alosa aestivalis*), yellow perch (*Perca flavescens*), and hickory shad (*Alosa mediocris*) (VDGIF, 2011a; Vaccaro, 2012). There are approximately 2,015 acres of Anadromous Fish Use Area within the study area.

Table 3-10: Essential Fish Habitat and Habitat Areas of Particular Concern

Species	Scientific Name	Known to Occur in the Study Area Vicinity	
		HAPC	EFH
Atlantic Butterfish	*Peprilus triacanthus*	--	All Lifestages
Black Sea Bass	*Centropristis striata*	--	Juveniles, Adults
Bluefish	*Pomatomus saltatrix*	--	Juveniles, Adults
Clearnose Skate	*Raja eglanteria*	--	Juveniles*, Adults*
Cobia	*Rachycentron canadum*	--	All Lifestages
Dusky Shark	*Carcharhinus obscurus*	--	Larvae, Juveniles
Little Skate	*Raja erinacea*	--	Juveniles*, Adults*
King Mackerel	*Scomberomorus cavalla*	--	All Lifestages
Red Drum	*Sciaenops occelatus*	--	All Lifestages
Sandbar Shark	*Carcharhinus plumbeus*	Larvae, Juveniles, Adults	Larvae, Juveniles, Adults
Smooth Dogfish	*Mustelus canis*	--	All Lifestages**
Spanish Mackerel	*Scomberomus maculatus*	--	All Lifestages
Summer Flounder	*Paralichthys dentatus*	--	Larvae, Juveniles, Adults
Windowpane Flounder	*Scophthalmus aquosus*	--	Eggs, Juveniles, Adults
Winter Skate	*Raja ocellata*	--	Juveniles*, Adults*

Source: NOAA, 2012a.
** Skatemaps*
*** Essential Fish Habitat Mapper*

Submerged aquatic vegetation (SAV) species are widely regarded as keystone species and primary indicators of water quality conditions in the Chesapeake Bay. According to Regulation 4 VAC 20-337-10 et seq. Submerged Aquatic Vegetation (SAV) Transplantation Guidelines, under the authority of the Code of Virginia §§28.2-103 and 28.2-1203, any removal of SAV would require prior approval by the Virginia Marine Resources Commission (VMRC, 2000). According to historic SAV mapping provided by the VIMS SAV monitoring program, approximately 67 acres of existing (2007-2011) SAV beds and an additional seven acres of historic (1971-2006) SAV beds occur within the study area. Existing SAV beds are depicted in **Figures 3-3 A-C**.

Invasive species are non-native plant, animal, or microbial species that cause, or have the potential to cause, economic or ecological harm or harm to human health (Executive Order 13112, Invasive Species). State and local governments have enacted several laws and regulations to prevent the spread of noxious weeds and plants deemed to be detrimental to crops, surface waters, including lakes, or other desirable plants, livestock, land, or other property, or to be injurious to public health or the economy. The study corridor is in an urban area where disturbed ground is subject to colonization by invasive species.

3.7 THREATENED AND ENDANGERED SPECIES

The USFWS and the NMFS are responsible for listing, protecting, and managing Federally listed threatened and endangered species under the Endangered Species Act of 1973, as amended. The USFWS defines an endangered species as one that is in danger of extinction throughout all or in a significant portion of its range. A threatened species is one that is likely to become endangered in the foreseeable future.

The 13 Federally and State listed threatened or endangered species in **Table 3-11** are reported to occur or potentially occur within the vicinity of the study area according to species habitat requirements and information gathered from the VDOT, NMFS, VDCR, Virginia Fish and Wildlife Information Service (VaFWIS), and VDGIF. Additional information regarding species occurring in the area and key habitat

requirements for these species is presented in **Section 4.10** of this Draft EIS and the *Natural Resources Technical Report*.

Table 3-11: Federal and State-Listed Threatened and Endangered Species

Species	Scientific Name	Federal Status	State Status
Kemp's Ridley Sea Turtle	*Lepidochelys kempii* [1,4]	Endangered	Endangered
Hawksbill Sea Turtle	*Eretmochelys imbricata* [3]	Endangered	Endangered
Leatherback Sea Turtle	*Dermochelys coriacea* [1,4]	Endangered	Endangered
Short-nose Sturgeon (fish)	*Acipenser brevirostrum* [5]	Endangered	Endangered
Atlantic Sturgeon (fish)	*Acipenser oxyrinchus* [1,3,4]	Endangered	--
Green Sea Turtle	*Chelonia mydas* [1,4]	Threatened	Threatened
Loggerhead Sea Turtle	*Caretta caretta* [1,4]	Threatened	Threatened
Piping Plover (bird)	*Charadrius melodus* [1,2]	Threatened	Threatened
Bald Eagle	*Haliaeetus leucocephalus* [1]	Species of Concern	Threatened
Canebrake Rattlesnake	*Crotalus horridus* [1]	--	Endangered
Peregrine Falcon	*Falco peregrines* [1]	--	Threatened
Gull-Billed Tern	*Sterna nilotica* [1]	--	Threatened
Mabee's Salamander	*Ambystoma mabeei* [1]	--	Threatened

[1] VDOT GIS layer - 2009 Endangered Species GIS data databases including VDGIF biologists and permittees, USFWS/USGS/Audubon Society monitoring programs, trained volunteers, surveys from the Center for Conservation Biology at William and Mary, university researchers, and others.
[2] VDCR listed Natural Heritage Species (VDCR, 2011).
[3] VaFWIS Listed Species (VDGIF, 2011a).
[4] NOAA species indicated (Vaccaro, 2012).
[5] VaFWIS Species Information (VDGIF, 2011b).

3.8 HISTORIC PROPERTIES

Pursuant to Section 106 of the National Historic Preservation Act, historic properties within the Area of Potential Effects (APE) have been identified and evaluated. This process was completed by conducting background research, GIS-based assessments, predictive modeling, field investigations of archaeological sites and architectural resources, and by consulting with the Virginia State Historic Preservation Officer (SHPO) and other consulting parties (as identified in **Section 7.2.3**). In Virginia, the Director of the Department of Historic Resources (DHR) serves as the SHPO.

3.8.1 Architectural Resources

The *Phase I Architectural Survey, Hampton Roads Bridge Tunnel, Cities of Hampton and Norfolk, Virginia* (DHR Review #2011-0804) included review of previously recorded properties and field inspection of properties greater than 45 years in age that have not been previously listed in or evaluated for the National Register of Historic Places (NRHP). Based on the reconnaissance survey, eleven architectural historic properties were identified as included in the NRHP, or previously determined eligible for the NRHP. The previously identified historic properties are:

- VDHR # 114-0002 Fort Monroe Historic District (NHL)
- VDHR # 114-0006 Hampton Institute (University) (Includes Hampton Institute NHL)
- VDHR # 114-0021 Old Point Comfort Lighthouse (Fort Monroe Lighthouse)
- VDHR # 114-0041 Fort Wool (Fort Calhoun)
- VDHR # 114-0101 Hampton Veterans Affairs Medical Center Historic District
- VDHR # 114-0114 Chamberlin Hotel
- VDHR # 114-0118 Pasture Point Historic District
- VDHR # 114-0148 Hampton National Cemetery
- VDHR # 114-5002 Phoebus Historic District
- VDHR # 114-5471 Battle of Hampton Roads
- VDHR # 122-5426 Battle of Sewell's Point

The reconnaissance also identified 495 properties over 45 years of age that had not been previously evaluated. Of these, 489 were determined not eligible for the NRHP by VDOT because they do not meet any of the eligibility criteria.[16] The remaining six would require additional evaluation to determine their NRHP eligibility. VDOT completed a Phase II *Architectural Evaluation* in Summer 2012 and determined that two additional properties are eligible for the NRHP:

- VDHR #122-0531 Forest Lawn Cemetery
- VDHR #122-5434 Merrimack Park (Merrimack Landing) Historic District

DHR concurred with these determinations of eligibility in October 2012.

3.8.2 Archaeological Resources

An *Archaeological Assessment* was completed in Summer 2012. The study window for Archaeology included 150-250 feet on either side of the existing pavement of I-64. A majority of the study window had been previously surveyed during an archaeological study conducted in 1999. Two sites, 44HT0009 (also recorded as 44HT0089) and 44HT0090, were recommended as potentially eligible for listing on the NRHP, and appear to have suffered little additional disturbance since that survey. The survey also identified twelve underwater targets and three American Battlefield Protection Program (ABPP)-defined battlefield resources within the present HRBT study window. However, the potential for archaeological deposits associated with the battlefield resources within the HRBT study window is extremely low.

The *Archaeological Assessment* also identified areas where further survey work may be warranted, and found that there is a low potential for the identification of new archaeological sites that would be considered important for reasons other than information potential. DHR concurred with these findings in August 2012.

3.9 HAZARDOUS MATERIALS

The Federal government and Commonwealth of Virginia, primarily through the US Environmental Protection Agency (EPA) and the Virginia Department of Environmental Quality (VDEQ), respectively, regulate hazardous materials under multiple statutes. Two statutes that regulate materials of primary concern include the Resource Conservation and Recovery Act of 1976 (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and their respective amendments.

Due to the highly urbanized nature of the cities of Hampton and Norfolk, hazardous materials handlers, such as gas stations, dry cleaners, and businesses in light industrial areas, are prevalent throughout the study area (see **Table 3-12**). There are 121 hazardous materials sites/facilities within the study area. Some of the facilities have two types of attributes; for example, they are both hazardous waste generators and house above ground storage tanks (AST) or underground storage tanks (UST). Therefore, the total number of sites in **Table 3-12** (133) is larger than 121.

The majority of the sites are either Petroleum Registered Facilities, which are developments or installations that deal in, store, or handle oil and house ASTs or USTs, or Petroleum Release Sites, which means that a release of some kind of petroleum has occurred at the location. There are sixteen

[16] Eligibility criteria: (a) associated with events that have made a significant contribution to the broad patterns of our history; (b) associated with the lives of persons significant in our past; (c) embody distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; (d) has yielded, or may be likely to yield, information important in prehistory or history, 36 CFR 63.

Hazardous Waste Activity sites. These are small quantity generators (SQG) of hazardous waste or conditionally exempt small quantity generators (CESQG). Both of these types of facilities are regulated under RCRA.

Table 3-12: Hazardous Materials Sites within Study Area

Facility Type	City of Hampton	City of Norfolk
Brownfields	6	0
Field Identified	16	7
Petroleum Registered Facility	56	26
Petroleum Release Site	3	2
Sewer Point	1	0
SQG and CESQG	11	5
TOTAL*	**93**	**40**

Sources: VDOT GIS database; Field Reviews, September 2011.
CESQG=Conditionally Exempt Small Quantity Generator of Hazardous Waste
SQG=Small Quantity Generator

There are six brownfields sites in Hampton, including the industrial area east of Rip Rap Road and at the eastern terminus of the CSX rail tracks, just south of I-64. Brownfields sites are facilities that are previous industrial sites that have been remediated to a standard where only industrial development can continue on the property. There is a site recorded as an SQG in Phoebus with multiple designations: Maida Development Corporation. This facility makes electronic capacitors and is currently in compliance with the EPA. It is also listed on the Toxic Release Inventory due to the nature of the substances used in the manufacture of electronic capacitors.

3.10 VISUAL RESOURCES

Visual resources are those physical features that comprise the visual landscape, including land, water, vegetation, and man-made elements. These elements are the stimuli upon which a person's visual experience is based. The I-64 HRBT corridor encompasses a mix of residential, commercial, government/military, and open space land uses. Viewsheds vary greatly, from limited suburban type views with the interstate visible to large expansive water views of the Chesapeake Bay and Hampton Roads in the bridge/tunnel area. Sound walls limit the view from the interstate in many areas along the corridor. Notable distinct viewer groups in the area include community residents; business owners, employees, and customers; regular motorists; occasional motorists and tourists; and park and recreation area visitors. Additional information on the existing visual environment is presented in the *Visual Resources Technical Memorandum*.

4 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter describes the potential environmental consequences of the No-Build, Build-8, Build-8 Managed, and Build-10 Alternatives on the impacted environment (as described in **Chapter 3**). The three Retained Build Alternatives each represent a set of improvements that form a stand-alone solution to the identified needs within the study limits. The No-Build Alternative has been retained to serve as a baseline for alternatives comparison and includes only committed construction projects in the 2034 Hampton Roads Long Range Transportation Plan: I-64 interchange at LaSalle Avenue and the I-564 Intermodal Connector. Details on all alternatives are included in **Chapter 2** and the *Alternatives Development Technical Memorandum*. Impacts analyses relied on methods and assumptions detailed in the associated technical memoranda and reports that are referenced throughout **Chapter 3** and this chapter.

Impacts are quantified and described based on the LOD associated with the implementation of each of the Retained Build Alternatives. The LODs have been estimated for planning purposes and decision-making during the NEPA process. Each is wide enough to encompass minor variations in actual alignments and roadway features which would be determined during the design phase, should a Retained Build Alternative be preferred. For purposes of the impacts analysis, it is assumed that the entire area within each Retained Build Alternative LOD would be impacted; thus, the impacts illustrate the maximum potential impact. The LOD would be further refined during design as additional information becomes available. All efforts would be made to avoid or minimize impacts to environmental resources within the LODs of the Retained Build Alternatives.

Because the LODs, or impact areas, for the Retained Build Alternatives vary by only 40 feet, the figures in this section show the LOD for the Build-10 Alternative only. Thus the figures graphically represent the largest potential impact of the Retained Build Alternatives. The text and tables discuss the potential impact of all Retained Build Alternatives in comparison to the No-Build Alternative. More detailed aerial photo mapping showing the LOD for each of the Retained Build Alternatives is included in **Appendix A**.

4.2 LAND USE

This section presents the land use conversions necessary to implement each Retained Build Alternative, and the associated compatibility with local land use and transportation planning in Hampton and Norfolk. The Build-8 Alternative requires the least amount of land (approximately 280 acres) and the Build-10 Alternative requires the most (approximately 310 acres). The Build-8 Managed Alternative requires approximately 290 acres of land. Additional information is presented in the *Land Use Technical Memorandum*.

4.2.1 Land Use Conversions

The No-Build Alternative requires no right-of-way acquisition and therefore requires no land use conversion and has no direct impacts on land use.

The Retained Build Alternatives impact many different types of land use (**Table 4-1**). The transition of these land uses to transportation use is a direct impact of construction of a Retained Build Alternative. However, the conversion would be an expansion of the existing adjacent transportation land use and is

consistent with the area. The Build-10 Alternative is wider and therefore requires more right-of-way and transitions more land use from its existing use to transportation use. The most land use required under all three Retained Build Alternatives in the Hampton section is currently in institutional uses. The most land use required under the Retained Build Alternatives in the Norfolk section is in military use (Naval Station Norfolk). The Bluebird Gap Farm, Woodlands Golf Course, Hampton University, and the Hampton National Cemetery in Hampton are classified by the City as public institutional uses due to their ownership. However, Willoughby Elementary School in Norfolk is classified as Parks, Open Space because the City maintains only one category for Educational, Recreational, Cultural, Open Space, and Environmentally Sensitive land uses.

Table 4-1: Land Use Impacts

Land Use/Land Cover Classification	Build-8 Acres (% of Total)	Build-8 Managed Acres (% of Total)	Build-10 Acres (% of Total)
City of Hampton Total	**134 (100%)**	***137 (100%)***	**145 (100%)**
Commercial	25 (19%)	25 (18%)	26 (18%)
Industrial	8 (6%)	8 (6%)	9 (6%)
Institutional	61 (46%)	62 (45%)	64 (44%)
Military	0	0	0
Mixed-Use	0	0	0
Parks, Open Space, and Greenways	0	0	0
Residential	25 (18%)	26 (19%)	29 (20%)
Vacant	15 (12%)	16 (12%)	17 (12%)
City of Norfolk Total	**147 (100%)**	***150 (100%)***	**159 (100%)**
Commercial	4 (3%)	4 (3%)	4 (3%)
Industrial	0	0	0
Institutional	6 (4%)	6 (4%)	6 (4%)
Military	66 (45%)	67 (45%)	69 (43%)
Mixed-Use	15 (10%)	15 (10%)	16 (10%)
Parks, Open Space, and Greenways	12 (8%)	12 (8%)	13 (8%)
Residential	45 (30%)	46 (31%)	51 (32%)
Vacant	0	0	0
Alternative Total	**281**	**287**	**304**
Commercial	29 (10%)	30 (10%)	31 (10%)
Industrial	8 (3%)	8 (3%)	9 (3%)
Institutional	67 (24%)	68 (24%)	70 (23%)
Military	66 (24%)	67 (23%)	69 (23%)
Mixed-Use	15 (5%)	15 (5%)	16 (5%)
Parks, Open Space, and Greenways	12 (4%)	12 (4%)	13 (4%)
Residential	70 (25%)	72 (25%)	80 (26%)
Vacant	15 (6%)	16 (6%)	17 (6%)

Note: Land use coverage does not include water or roads.

4.2.2 Compatibility with Local Land Use and Transportation Planning

Both the City of Hampton and the City of Norfolk have directly addressed the importance of I-64 to local and regional mobility in their respective comprehensive planning processes. Both cities have also recognized the importance of I-64 to residents, local businesses, regional connections, and economic vitality. The 2006 *Hampton Community Plan* notes that both I-64 and I-664 should continue to be supported as the major routes to the City. The transportation section in the 2006 Community Plan states that as "the main artery of moving traffic in and out of Hampton, the health and efficiency of Interstate 64 is vital" (City of Hampton, 2006a). The *General Plan of Norfolk* was adopted in 1992. The key transportation issue identified in *PlaNorfolk 2030* is to address "roadway congestion, particularly at water crossing facilities", which includes facilities such as the HRBT (City of Norfolk, 2011). Two other water crossings, the Midtown Tunnel and Patriots Crossing, are identified in that Plan as the highest future priorities for the City of Norfolk. The widening of the Midtown Tunnel is currently under construction and the Patriots Crossing is undergoing an update of the NEPA process. Due to the limited

number of crossings of waterways, particularly in Norfolk, the existing crossings are important for regional, social, and economic well-being.

4.3 COMMUNITIES AND COMMUNITY FACILITIES

The No-Build Alternative would have no physical impact on communities, but continued congestion along the I-64 corridor and on the HRBT would increasingly hamper community mobility. This section presents the potential impacts to communities and community facilities from the implementation of the Retained Build Alternatives. Each of the Retained Build Alternatives would result in impacts to community cohesion and potentially impact up to eleven community facilities, not including parks and recreation areas, which are discussed in **Section 4.4**. The potential impacts are based on the estimated LOD for the Retained Build Alternatives. Should a build alternative be preferred, additional details regarding impacts to communities and community facilities would be refined during design.

4.3.1 Communities

Under the Retained Build Alternatives, impacts in the form of residential displacements potentially would occur in the communities of Carver Court, Pasture Point, and Phoebus in Hampton, and Willoughby Spit, Ocean View, Commodore Park, and Granby Shores in Norfolk. Although these communities have grown and developed around I-64, the encroachment of I-64 further into the individual neighborhoods and the relocation of residents could have an impact on the cohesion of the individual communities.

The Carver Court (north of Armistead Avenue and west of Rip Rap Road) and Pasture Point neighborhoods are currently bisected by I-64. However, relocations in these areas would require further encroachment of the interstate into the neighborhood. Relocations in west Phoebus at the I-64 interchange with Mallory Street would occur on the edge of the community and would have less impact on community cohesion compared to neighborhoods bisected by I-64.

In Norfolk, the community of Willoughby Spit would experience encroachment from the interstate into the community, particularly south of I-64 where construction of any of the Retained Build Alternatives would displace residences and marinas south of I-64. West Ocean View was previously bisected by I-64. The residential areas on both sides of the interstate would experience cohesion impacts from the Retained Build Alternatives due to residential displacements. In north Commodore Park, the Retained Build Alternatives would potentially displace the residences between Commodore Drive and I-64. In south Commodore Park, the community was bisected by the construction of I-64 and is also bordered by Granby Street to the east. Some of the residences between these two facilities would potentially be relocated.

Implementation of the Retained Build Alternatives would provide benefits to communities in the study area through reduced congestion and improved mobility. Additional capacity would ease spillover congestion that currently occurs in these communities and improve mobility to and from nearby communities.

4.3.2 Community Facilities

The No-Build Alternative would have no direct impact to community facilities in the study area. The Retained Build Alternatives would potentially impact community facilities (**Table 4-2**). The potential use of parks and recreation facilities is discussed in **Section 4.4** and the *Draft Section 4(f) Evaluation* in **Appendix C**.

Under the Retained Build Alternatives, portions of several community facilities would potentially be impacted. These community facilities include: Hampton National Cemetery, the Veterans Affairs

Medical Center (VAMC) – Hampton, Hampton YMCA, and Hampton University in Hampton, and Forest Lawn Cemetery, the Norfolk Visitor Information Center, and Willoughby Elementary School in Norfolk. Minor amounts of impact on the extreme edge of the parcels would be required from Hampton University, the VAMC-Hampton, and Forest Lawn Cemetery, where approximately 50-75 gravesites would be impacted. The impact to the Hampton YMCA is discussed further in **Section 4.4**.

Four churches are within the LODs of all of the Retained Build Alternatives and would potentially be impacted: ZEM Temple and Zion Baptist Church in Hampton and First View Baptist and Wesley Memorial Methodist Church in Norfolk.

The Retained Build Alternatives would not impact existing bike routes.

The Retained Build Alternatives would potentially require acquisition of land owned by the US Navy which is part of Naval Station Norfolk. This would include land adjacent to the south and west side of I-64 in Norfolk, except for privately-owned land in Willoughby Spit, West Ocean View, Merrimack Landing, and Commodore Park.

Table 4-2: Community Facilities Impacted

Facility Type	Build-8 Alternative	Build-8 Managed Alternative	Build-10 Alternative
Cemeteries	2	2	2
Fire Stations	0	0	0
Medical Facility	1	1	1
Library	0	0	0
Police stations	0	0	0
Post Office	0	0	0
Religious Facility	4	4	4
Schools/Universities	2	2	2
Other	2	2	2
TOTAL	**11**	**11**	**11**

Sources: VDOT GIS database; ADC Maps; field reviews, September, 2011.
Note: Facility designations are being kept with the designations that were identified in Chapter 3. The two Other facilities that may be impacted include the Norfolk Visitor Information Center and Hampton YMCA.
Refer to Table 4-3 for impacts to parks and recreational facilities.

4.4 PARKS AND RECREATIONAL FACILITIES

The No-Build Alternative would have no impacts to park or recreational resources in the study area.

Fourteen parks and recreational facilities would potentially be impacted by the Retained Build Alternatives; seven are located in the City of Hampton and seven are located in the City of Norfolk. All Retained Build Alternatives would impact the same park facilities although the extent of impact differs by alternative. As described in **Section 3**, existing and proposed park and recreational facilities that are located on public land as well as within Department of Defense boundaries were included for evaluation, as well as all park and recreational facilities identified in the Draft Section 4(f) Evaluation (**Appendix C**). Additional information is presented in the *Parks and Recreation Technical Memorandum*.

Table 4-3 provides a summary of the use of park and recreational facilities for each Retained Build Alternative. Each facility is described in detail herein and is shown in **Figures 4-1 A-C**. Only those parks potentially impacted by one of the Retained Build Alternatives are listed. No acreage of impact is available for the Newmarket Creek Park Trail or for the facilities on the Navy base as these facilities do not have defined boundaries.

Table 4-3: Impacts to Park and Recreation Facilities

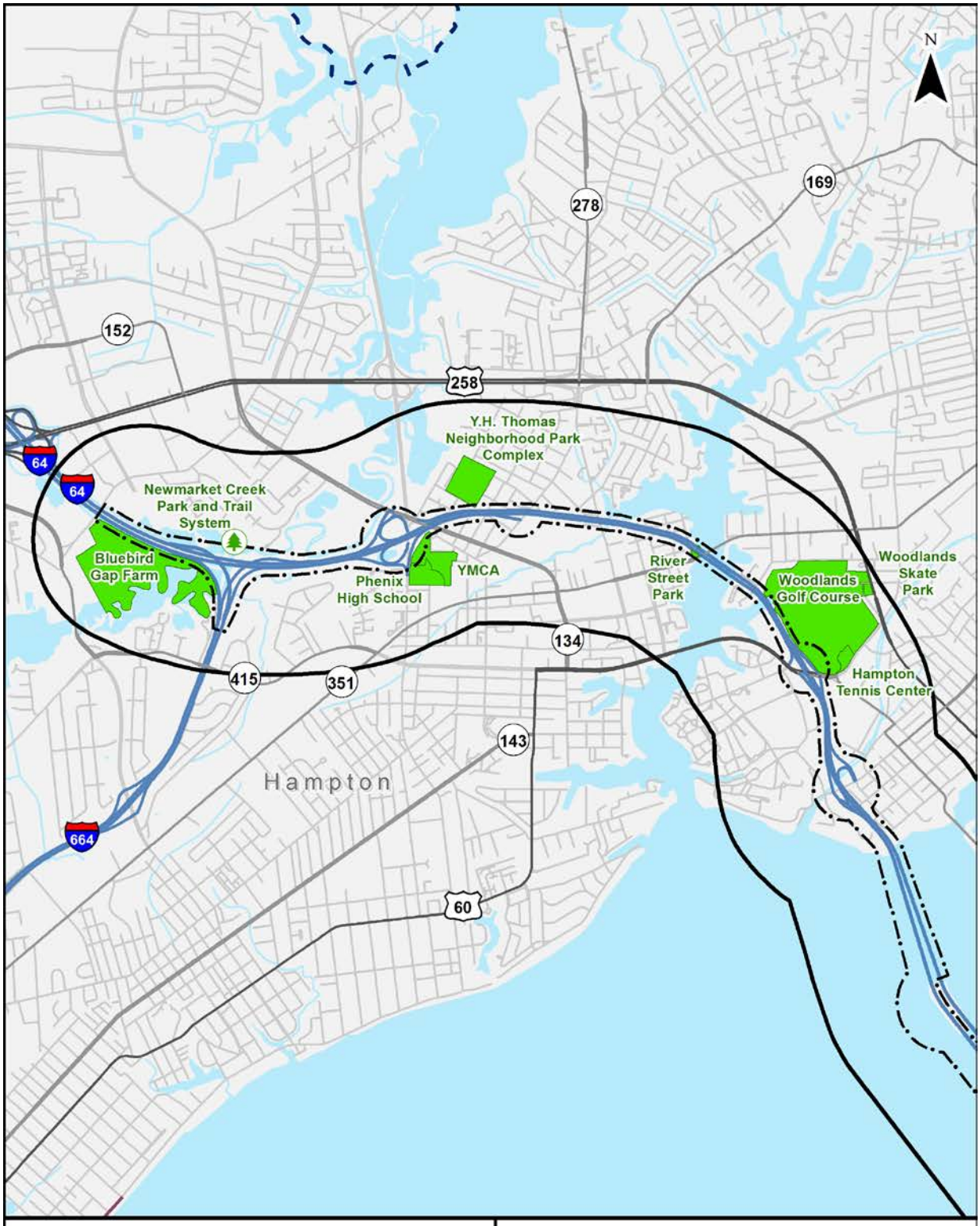
Facility Name	Public Ownership and Accessibility	Build-8 Alternative (acres)	Build-8 Managed Alternative (acres)	Build-10 Alternative (acres)
City of Hampton				
Newmarket Creek Park and Trail System (proposed)	Public ownership and accessibility is anticipated upon completion of the trail facility	750 linear feet	750 linear feet	750 linear feet
Bluebird Gap Farm	Public Ownership and Accessibility	7.6	7.8	8.1
Y.H. Thomas Neighborhood Park Complex	Public Ownership and Accessibility	< 0.1	0.1	0.1
YMCA	Privately owned, Building accessibility is limited to those with YMCA membership. The athletic fields to rear of property are accessible to the public.	3.2	3.3	3.3
Phenix High School	Public Ownership and Accessibility to athletic fields on property	0.2	0.2	0.2
River Street Park	Public Ownership and Accessibility	0.4	0.5	0.5
Woodlands Golf Course	Public Ownership and Accessibility	8.9	9.0	9.6
City of Norfolk				
Trails End Park	Public Ownership and Accessibility	1.1	1.1	1.2
Willoughby Boat Ramp	Public Ownership and Accessibility	1.2	1.2	1.3
Captains Quarters Nature Center and Park	Public Ownership and Accessibility	0.2	0.2	0.3
Monkey Bottom Wetland Walkway	Public Ownership and Accessibility	N/A	N/A	N/A
Willoughby Elementary School	Public Ownership and Accessibility outside of school hours	1.7	1.8	1.8
Breezy Point Park	Public Ownership, Accessibility limited to military	N/A	N/A	N/A
Navy Athletic Field	Public Ownership, Accessibility limited to military	N/A	N/A	N/A
TOTAL		**24.6**	**25.2**	**26.4**

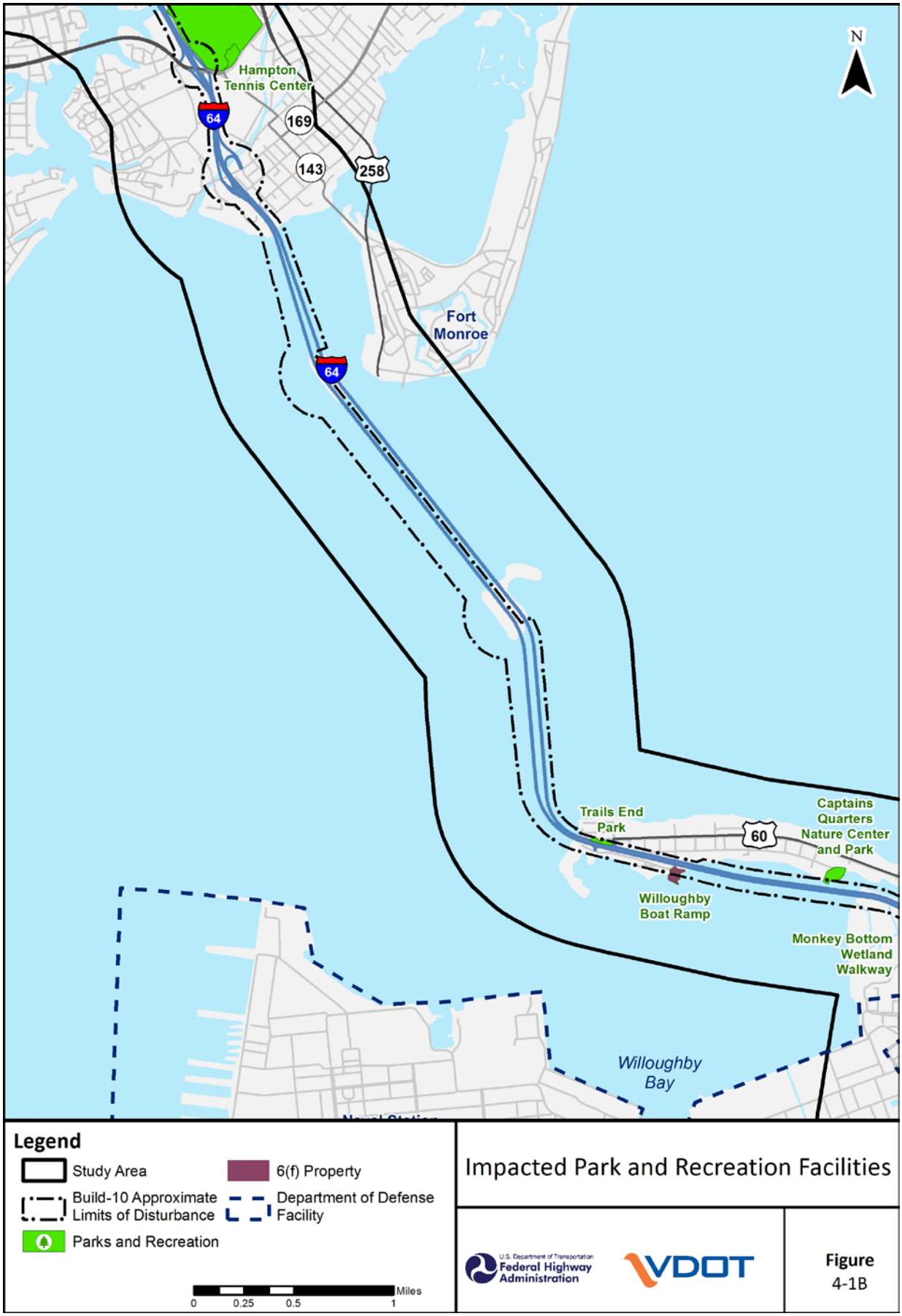
N/A: These properties have no defined boundary, therefore, the area of impact cannot be defined.
*Refer to the Draft Section 4(f) Evaluation (**Appendix C**) for minimization of impacts to Section 4(f) properties.*

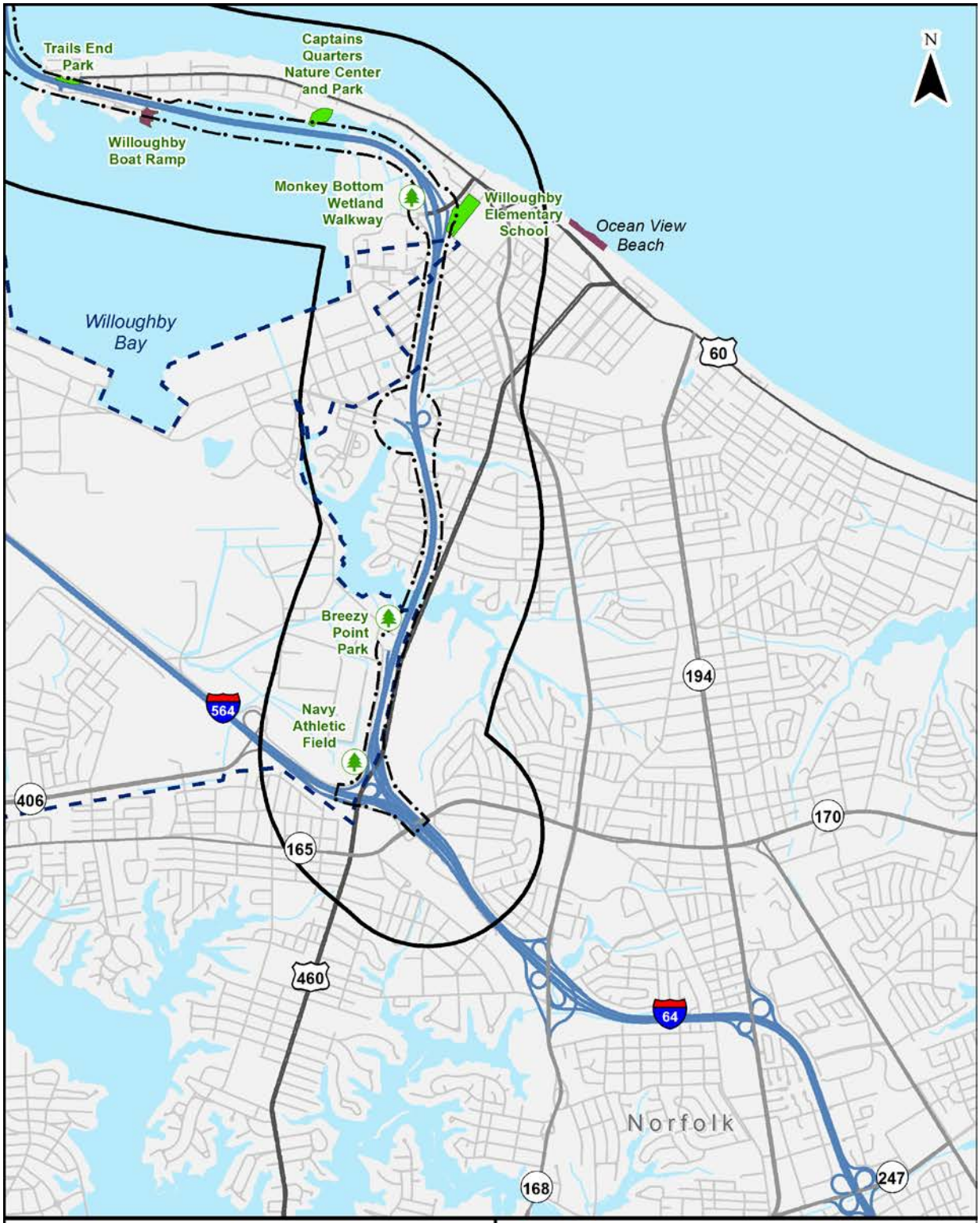
The ***Proposed Newmarket Park Creek and Trail System*** would potentially be impacted by all Retained Build Alternatives. Short segments of the proposed trail would be impacted but trail alignment changes would be considered as needed to keep the trail continuous. This proposed park and trail is subject to Section 4(f).

Bluebird Gap Farm would be potentially impacted by all Retained Build Alternatives. This farm encompasses both a park/zoo type area and some natural lands. Acquisition would potentially be needed from both the park and natural areas along I-64 and I-664. Some facility buildings would be impacted. This park is subject to Section 4(f).

Y.H. Thomas Neighborhood Park Complex would potentially be impacted at the southern corner of the property. No structures or park facilities would be impacted. This park is subject to Section 4(f).


N
169
278
152
258
64
64
Y.H. Thomas
Neighborhood Park
Complex
Newmarket Creek
Park and Trail
System
Bluebird
Gap Farm
Phenix
High School
YMCA
River
Street
Park
Woodlands
Golf Course
Woodlands
Skate
Park
134
415
351
Hampton
Tennis Center
143
664
60
Hampton
Legend
Study Area
6(f) Property
Build-10 Approximate
Limits of Disturbance
Department of Defense
Facility
Parks and Recreation
Miles
0
0.25
0.5
1
Impacted Park and Recreation Facilities
U.S. Department of Transportation
Federal Highway
Administration
VDOT
Figure
4-1A


N
Hampton Tennis Center
64
169
143
258
Fort Monroe
64
Trails End Park
60
Captains Quarters Nature Center and Park
Willoughby Boat Ramp
Monkey Bottom Wetland Walkway
Willoughby Bay
Legend
Study Area
6(f) Property
Build-10 Approximate Limits of Disturbance
Department of Defense Facility
Parks and Recreation
Miles
0
0.25
0.5
1
Impacted Park and Recreation Facilities
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure 4-1B


Trails End Park
Captains Quarters Nature Center and Park
Willoughby Boat Ramp
Monkey Bottom Wetland Walkway
Willoughby Elementary School
Ocean View Beach
Willoughby Bay
Breezy Point Park
Navy Athletic Field
N
60
194
564
406
165
170
460
64
168
247
Norfolk
Legend
Study Area
6(f) Property
Build-10 Approximate Limits of Disturbance
Department of Defense Facility
Parks and Recreation
0
0.25
0.5
1
Miles
Impacted Park and Recreation Facilities
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure 4-1C

The ***YMCA*** property would potentially be impacted by all three Retained Build Alternatives. While the YMCA building itself would potentially be displaced, the recreational area located to the rear of the property would not be impacted. The YMCA building is not subject Section 4(f).

The ***Phenix High School*** property would potentially be impacted by all three Retained Build Alternatives. The site currently houses office space and is owned by the Hampton Redevelopment and Housing Authority. The recreational facilities to the rear of the property are open for public use and are subject to Section 4(f); however, these would not be impacted by any of the Retained Build Alternatives.

River Street Park is located under existing I-64. Impacts to the facility would potentially result from each of the Retained Build Alternatives. Similar to the current layout, park uses would continue under I-64 with any of the three Retained Build Alternatives. This park is subject to Section 4(f).

The ***Woodlands Golf Course*** would potentially be impacted by all three Retained Build Alternatives. The golf course is subject to Section 4(f).

Trails End Park would potentially be impacted by all three Retained Build Alternatives. The park is an open space area adjacent to I-64. The park is not subject to Section 4(f) because it is located within existing highway right-of-way.

Willoughby Boat Ramp would potentially be impacted by all three Retained Build Alternatives. All Retained Build Alternatives would impact the parking lot and could potentially result in relocation of the boat ramps. This boat ramp is subject to Section 4(f). The property is also subject to Section 6(f) of the Land and Water Conservation Fund (LWCF). Section 6(f) of the LWCF Act prohibits the conversion of property acquired or developed with these grants to a non-recreational purpose without the approval of the Department of the Interior's National Park Service (NPS) and requires that replacement lands of equal value, location, and usefulness are provided as conditions to such conversions.

Captains Quarters Nature Center and Park would potentially be impacted by all three Retained Build Alternatives. The southern tip of the property would be impacted. This park is subject to Section 4(f).

The ***Monkey Bottom Wetland Walkway*** would potentially be impacted by all three Retained Build Alternatives; the adjacent parking and the majority of the walkway facility would be impacted. Since this facility is located on Naval Station Norfolk, there are no defined park boundaries. This facility is located adjacent to the Norfolk Visitor Information Center and, although located on Navy property, it is outside of the gates and open to the general public. The property is not subject to Section 4(f) because the primary purpose of the land is not recreational.

Recreational fields associated with ***Willoughby Elementary School*** would potentially be impacted by all three Retained Build Alternatives***.*** The open space/recreational area south of the school that is open for public use during off-school hours would potentially be impacted. The outdoor recreational areas of this facility are subject to Section 4(f).

Breezy Point Park would potentially be impacted by all three Retained Build Alternatives. Since this facility is located on Naval Station Norfolk, there are no defined park boundaries. Impacts would be primarily limited to the forested park buffer between the roadway and open area/recreational fields. It is on publicly owned land but only accessible to those with military identification; therefore, the property is not subject to Section 4(f).

The ***Navy Athletic Field*** at Naval Station Norfolk would potentially be impacted by all three Retained Build Alternatives. The Retained Build Alternatives skirt the eastern perimeter of this ball field, and would impact the current access to the facility. Since this facility is located on Naval Station Norfolk,

there are no defined park boundaries. It is on publicly owned land but only accessible to those with military identification; thus, the property is not subject to Section 4(f).

4.5 RELOCATIONS

The No-Build Alternative requires no right-of-way acquisition and therefore requires no relocations. The estimated number of residential relocations within the LODs of the Retained Build Alternatives is presented in **Table 4-4**. These quantities represent potential relocations based upon the preliminary level of information available for this study. Thus, for the purposes of this assessment, it is assumed that the entire area within each Retained Build Alternative LOD would be impacted. The impacts provided in **Table 4-4** therefore represent the maximum potential relocations. The LOD would be further refined during design as additional information becomes available. All efforts would be made to avoid or minimize relocations. Additional parcels or parts of parcels that do not require relocation of a residence, business, or other structure may be required for of any of the Retained Build Alternatives. Additional information is presented in the *Right of Way and Relocation Technical Memorandum*.

Table 4-4: Potential Residential Relocations

Location	Build-8	Build-8 Managed	Build-10	Persons Per Household	Owner-Occupied Housing Units	Renter-Occupied Housing Units
City of Hampton	107	115	130	2.42	58.1%	41.9%
City of Norfolk	154	160	185	2.43	45.4%	54.6%
TOTAL	**261**	**275**	**315**	**2.42**	**50.3%**	**49.7%**

Sources: City Tax Assessment Databases; field reviews, September, 2011.
Note: This table does not include the total number of units for multi-family residences.

There appear to be adequate housing replacement sites within the study area based on current real estate listings; additional information is presented in the *Right of Way and Relocation Technical Memorandum.* VDOT has the ability and, if necessary, is willing to provide housing of last resort, including the purchase of land or dwellings; repair of existing dwellings to meet decent, safe, and sanitary conditions; relocation or remodeling of dwellings purchased by VDOT; or construction of new dwellings. Assurance is given that all displaced families and individuals will be relocated to suitable replacement housing; all replacement housing will be fair housing available to all persons without regard to race, color, religion, sex, or national origin; and all replacement housing will be within the financial means of the displacees. Each person will be given sufficient time to negotiate for and obtain possession of replacement housing. No residential occupants will be required to move from property needed for the Retained Build Alternatives until comparable decent, safe, and sanitary replacement dwellings have been made available to them.

The acquisition of right-of-way and the relocation of displacees will be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Assurance is given that relocation resources will be available to all residential, business, farm, and nonprofit displacees without discrimination.

4.6 ENVIRONMENTAL JUSTICE

Title VI of the Civil Rights Act of 1964 states that "No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." Title VI bars intentional discrimination as well as disparate impact discrimination (i.e., a neutral policy or practice that has an unequal impact on protected groups). Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations", states that each Federal agency "shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects

of its programs, policies, and activities on minority populations and low-income populations." The FHWA implemented EO 12898 via FHWA Order 6640.23, "FHWA Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." As defined by guidance for implementing EO 12898, minority persons include citizens or lawful permanent residents of the U.S. who are African-American, Hispanic or Latino, Asian-American, American Indian, Native Alaskan, Native Hawaiian or other Pacific Islander. Low-income persons are defined as those whose median household income is below the US Department of Health and Human Services poverty guidelines.

The No-Build Alternative would have no physical impacts to minority and low-income populations. However, continued congestion along I-64 and the HRBT would reduce mobility for the all residents of the study area, including minority and low-income persons.

Demographic data for the Cities of Hampton and Norfolk were analyzed to determine whether the Retained Build Alternatives would have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. The Retained Build Alternatives have the potential to require relocations within two low-income or minority populations (Tracts 105.02 and 106.02), as shown in **Table 4-5**. Those census tracts that have populations of minorities or low-income persons ten percent higher than the study area as a whole have been highlighted in italics and underlining in the table respectively. These tracts would potentially be subject to disproportionately high and adverse impacts to those populations. For this study, a threshold of ten percent greater than the study area average has been used for identification of minority and low-income populations. The ten percent threshold represents a percent population that is meaningfully greater[17] than the study area minority and low-income population percentages.

Table 4-5: Residential Relocations by Census Tract

Location	Build-8 Alternative	Build-8 Managed Alternative	Build-10 Alternative
City of Hampton Total	**107**	**114**	**130**
Tract 105.01	*0*	*0*	*0*
Tract 105.02	*2*	*2*	*2*
Tract 106.01	*0*	*0*	*0*
Tract 106.02	*37*	*43*	*52*
Tract 108	24	26	31
Tract 112	0	0	0
Tract 113	44	44	45
Tract 114	*0*	*0*	*0*
City of Norfolk Total	**154**	**160**	**185**
Census Tract 3	0	0	0
Census Tract 4	32	31	41
Census Tract 5	76	82	89
Census Tract 8	46	46	54
Census Tract 9.02	0	1	1
Census Tract 55	0	0	0
Census Tract 57.01	*0*	*0*	*0*
TOTAL	**261**	**275**	**315**

Sources: City Tax Assessment Databases; field reviews, September, 2011; US Census Bureau, 2010, SF1; US Census Bureau, ACS 2006-2010.
Note: This table does not include the total number of units for multi-family residences.
Census tracts with minority populations which are more than 10% above the study area percentage are italicized. Census tracts with low-income populations more than 10% above the study area percentage are underlined.

[17] The use of a "meaningfully greater" percentage is appropriate pursuant to Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.*

The Retained Build Alternatives would impact minority and low-income populations through displacement of residences within predominantly minority and low-income census tracts. The majority of potential impacts would be in Census Tracts 106.02 in Hampton. Impacts to the minority and low-income populations identified in Census Tracts 105.02 and 106.02 would be proportionate to impacts to all communities along the corridor. Relative to the total number of potential relocations under all of the Retained Build Alternatives (261 residences under the Build-8 Alternative; 275 residences under the Build-8 Managed Alternative; and 315 residences under the Build-10 Alternative), no disproportionate relocation impacts to minority and low-income populations are expected. Additional information, including percent minority and low-income for the each census tract, is available in the *Socioeconomic Technical Report*.

The I-64 HRBT corridor is a major regional highway; minority and low-income populations which reside both inside and outside of the study area use the corridor. Should the facility be tolled, as proposed under some scenarios of the Build-8 Managed Alternative (see **Section 2.4.3**), there is the potential that low-income persons may not have the financial means to frequently use the facility. Improvements proposed with this alternative could therefore have greater benefit to those who can afford to use the facility on a regular basis. Furthermore, tolls under the Build-8 Managed Alternative could impact transportation mobility between Hampton and Norfolk for low-income persons, who may choose to travel less frequently on the HRBT. The relative tendency of low-income populations to use the HRBT has not been established with quantitative precision, thus the extent of these potential impacts is not known.

Although they may impact low-income populations, the transportation benefits (e.g., reduced congestion) of the Retained Build Alternatives would nevertheless be borne by all users of the facility, including with the Build-8 Managed Alternative. Under this alternative, drivers would pay to use a toll facility or lanes; however, the toll would be priced so as to not preclude usage by lower income drivers. Further, under scenarios in which some lanes would be tolled and others would not (i.e., the Two HOT Lanes + Two General Purpose Lanes and One HOT Lane + Three General Purpose Lanes scenarios), the toll lanes would draw some traffic away from the untolled lanes, and help decrease congestion in those lanes. In that instance, while the most direct advantage of congestion-reduced toll lanes would likely be experienced by those who pay to use them, their impact to traffic on all lanes of the HRBT would be beneficial. Thus, a benefit would be conferred on all users, and not solely those who can or choose to pay to use the tolled lanes. Furthermore, the increased capacity of any of the Retained Build Alternatives would reduce congestion for I-64 and all study area roads, including those roads within minority and low-income communities.

Under the all lanes tolled scenario of the Build-8 Managed Alternative, all users of the HRBT would pay a toll in order to use the facility. Implementation of an across-the-board toll on all lanes of the HRBT amounts to a regressive fee insofar as the amount of the fee is not scaled to the income of the user or any other socioeconomic factor. In that sense, low-income users would pay a greater percentage of their income on the toll, per use, than higher income users.

Untolled routes crossing Hampton Roads are available. Any user not wanting to pay a toll at the HRBT could use an alternative crossing such as the Monitor-Merrimac Memorial Bridge-Tunnel. However, depending on the user's origin and destination, an alternative crossing may require a more circuitous route than the HRBT.

4.7 ECONOMICS

The No-Build Alternative would have no direct impacts on the economic environment in terms of business relocations. The Retained Build Alternatives would result in economic benefits resulting from decreased congestion and improved mobility within the study area. Improved mobility would enable employees and patrons to more efficiently reach local businesses and places of employment.

The Retained Build Alternatives would have direct impacts on the economy through business relocations, as shown in **Table 4-6**.

The general commercial businesses within the LODs include fast food restaurants, a gas station, and office buildings. The warehousing businesses are storage facilities. There is one manufacturing facility in Hampton adjacent to I-64. There are two marinas in Norfolk within the LODs. The other facilities that potentially would be relocated include a radio tower.

As with residential relocations, the acquisition of right-of-way and the relocation of displacees would be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Assurance is given that relocation resources would be available to all residential, business, farm, and nonprofit displacees without discrimination.

Table 4-6: **Business Relocations**

Location/Business Type	Build-8 Alternative	Build-8 Managed Alternative	Build-10 Alternative
City of Hampton Total	***12***	***12***	***13***
General Commercial	5	4	5
Warehousing	4	4	4
Manufacturing	1	1	1
Other	2	3	3
City of Norfolk Total	***4***	***4***	***4***
General Commercial	1	1	1
Warehousing	0	0	0
Manufacturing	0	0	0
Other	3	3	3
TOTAL	**16**	**16**	**17**

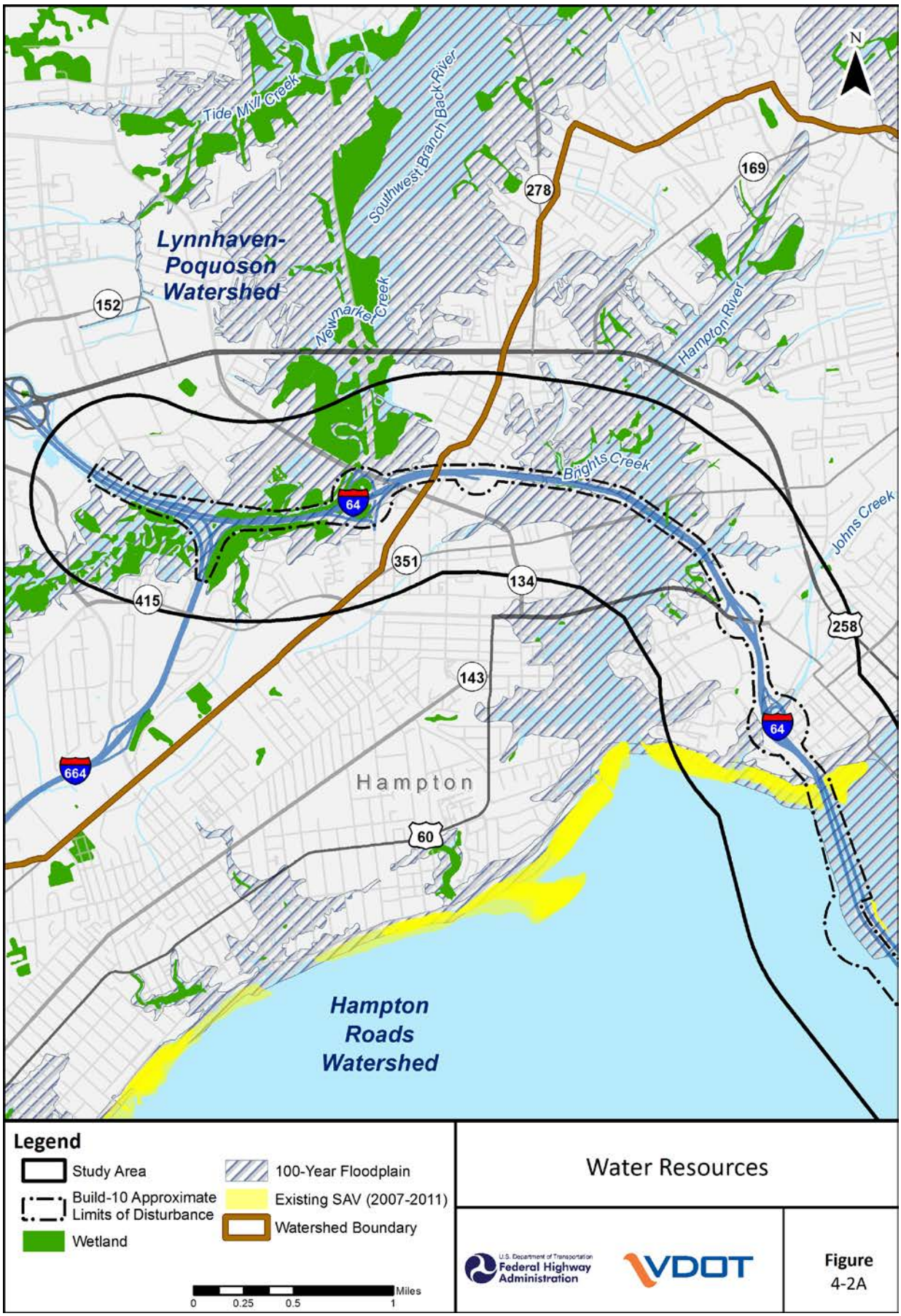
Sources: City Tax Assessment Databases, *VDOT GIS database; ADC Maps; field reviews, September, 2011.*

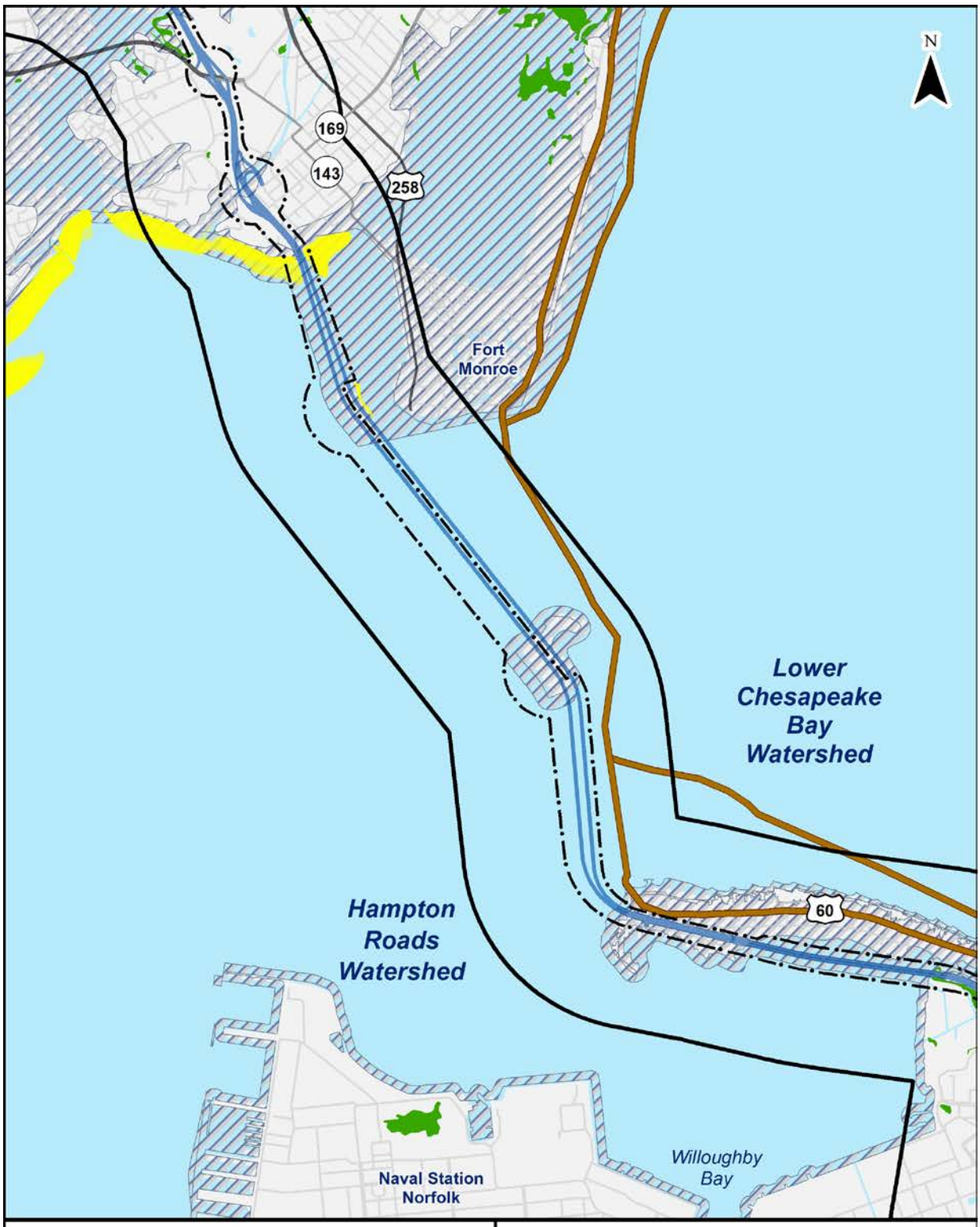
4.8 WATER RESOURCES

Water resources are regulated by the EPA and the USACE through Section 404 of the Clean Water Act and the Water Quality Act of 1987. Section 404 of the Clean Water Act regulates the discharge of dredge and fill materials into Waters of the United States. To comply with Section 404, it is necessary to avoid impacts to Waters of the United States wherever practicable, minimize impacts where unavoidable, and compensate for impacts as required.

Under the No-Build Alternative, VDOT would continue maintenance and repairs of the existing I-64 mainline, tunnels, and bridges as needed. No direct impacts to streams and wetlands are anticipated with the No-Build Alternative. Existing factors that impact water quality, such as impervious pavement surfaces and pollutants washed from the existing road surface into receiving water bodies, would continue with the No-Build Alternative. No changes to floodplains or hydraulic conditions are anticipated with the No-Build Alternative.

Water resources that are potentially impacted by the Retained Build Alternatives are shown in **Figures 4-2 A-C**. Anticipated impacts of the Retained Build Alternatives on streams, wetlands, water quality, and floodplains are discussed below. Impacts have been quantified based on the resource mapping described in **Section 3.5** and the potential LOD for each Retained Build Alternative. As with the LOD, the resource impacts are preliminary estimates that would be refined during design and are provided herein for comparison of impacts among alternatives. Due to the large-scale nature of the maps in this section, figures have been presented showing the LOD for the Build-10 Alternative. Impacts, however, have been calculated for each of the Retained Build Alternatives. Additional information is presented in the *Natural Resources Technical Report*.


N
Tide Mill Creek
Southwest Branch Back River
Lynnhaven-
Poquoson
Watershed
Newmarket Creek
Hampton River
Brights Creek
Johns Creek
Hampton
Hampton
Roads
Watershed
152
278
169
64
351
134
415
258
143
664
60
Legend
Study Area
Build-10 Approximate Limits of Disturbance
Wetland
100-Year Floodplain
Existing SAV (2007-2011)
Watershed Boundary
0
0.25
0.5
1
Miles
Water Resources
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure
4-2A

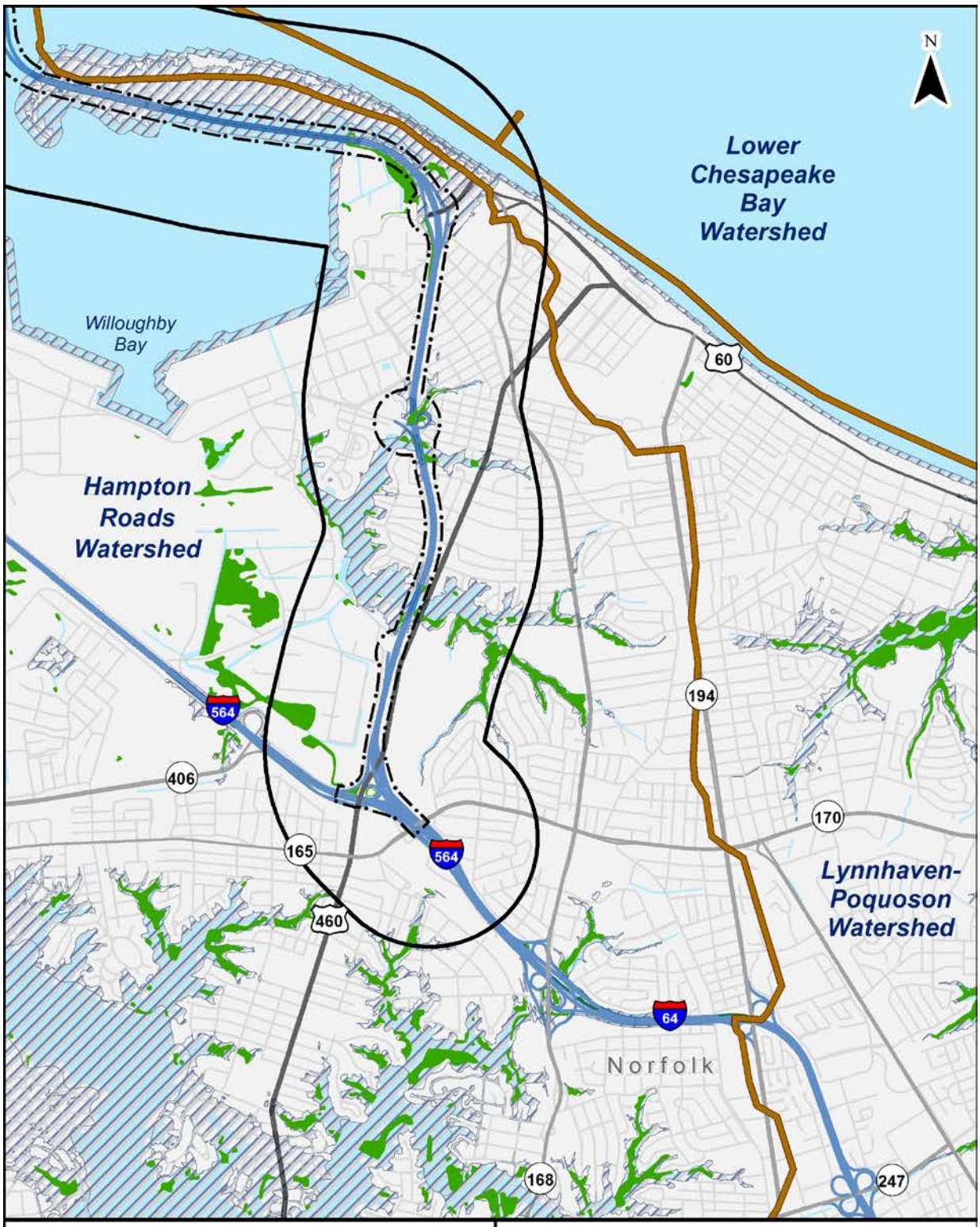


Water Resources

U.S. Department of Transportation Federal Highway Administration

VDOT

Figure 4-2B


N
Lower Chesapeake Bay Watershed
Willoughby Bay
Hampton Roads Watershed
Lynnhaven-Poquoson Watershed
Norfolk
60
194
170
406
165
460
564
564
64
168
247
Legend
Study Area
Build-10 Approximate Limits of Disturbance
Wetland
100-Year Floodplain
Existing SAV (2007-2011)
Watershed Boundary
0
0.25
0.5
1
Miles
Water Resources
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure 4-2C

4.8.1 Streams, Navigable Waters, and Wetlands

In order to accommodate facilities proposed as part of the Retained Build Alternatives, the mainline would be widened and proposed bridges and tunnels would be constructed parallel to the existing bridges and tunnels that cross Hampton Roads. Approximately 12 named streams or unnamed smaller tributaries would be crossed by the Retained Build Alternatives. They include: Mason Creek; Oastes Creek and an unnamed tributary; John's Creek; Hampton River and an unnamed tributary; Brights Creek and an unnamed tributary; and Newmarket Creek and three unnamed tributaries. In addition to these stream crossings, the Retained Build Alternatives traverse the James River where it meets the Chesapeake Bay (also referred to as Hampton Roads).

Stream crossings within the mainline would require extensions of existing bridges and culverts. With the Retained Build Alternatives, the proposed approach bridges would require construction of piers within the James River. The tunnel would be placed below the bottom of the James River and would require expansion of the existing islands to accommodate the tunnel portals. Channel conditions within the James River would be maintained in accordance with Virginia Port Authority requirements, including a 55-foot depth at mean low water (MLW) with a width of 1,000 feet (top of tunnel would be 60 to 65 feet MLW), and the preservation of existing deep water anchorages.

Estimated impacts to streams and wetlands for each of the Retained Build Alternatives at this stage of project development are presented in **Table 4-7**. These estimates are based on an assumption that each stream crossing would be a permanent impact rather than spanned via a bridge. A more detailed assessment of stream and wetland impacts and avoidance and minimization efforts would be performed following a formal jurisdictional delineation and further design. As shown in **Table 4-7**, the extent of impacts to wetlands in the study area is very similar between the Retained Build Alternatives. The lengths of stream crossings, however, vary with the increased width of the typical section associated with each alternative.

Table 4-7: Estimated Impacts to Water Resources from the Retained Build Alternatives

Resource	Build-8 Alternative	Build-8 Managed Alternative	Build-10 Alternative
Streams			
Number of Crossings	12	12	12
Length (Linear Feet)	18,200	18,300	18,500
Wetlands			
EEM* (Acres)	36	36	38
PEM* (Acres)	8	8	8
PSS* (Acres)	2	2	2
PFO* (Acres)	6	6	6
Total Acres	52	52	53
RPAs (Acres)	536	542	560
Floodplains (Acres)	419	436	439

Sources: National Wetlands Inventory, National Hydrography Dataset, Flood Insurance Rate Maps, *and field reconnaissance, 2011.*
**Abbreviations: estuarine emergent wetland (EEM), palustrine emergent wetland (PEM), palustrine scrub-shrub wetland (PSS), palustrine forested wetland (PFO)*

Study area impacts to streams and wetlands would require submittal of a Joint Permit Application to the USACE, VDEQ, and VMRC. Due to the linear nature and size of this study, impacts are anticipated with each of the Retained Build Alternatives. Should a build alternative be selected, efforts would be made to avoid and minimize stream and wetland impacts to the extent practicable during design. Mitigation for unavoidable stream and wetland impacts would be developed in coordination with the aforementioned agencies during the permitting process and could include onsite or offsite wetland and/or stream creation, restoration, or enhancement activities, use of credits from an approved mitigation bank, or payments to the Virginia Aquatic Resources Trust Fund. Stream mitigation

requirements vary depending on existing stream conditions and level of disturbance. Wetland mitigation requirements vary by wetland type: EEM/PEM (1:1), PSS (1:1.5), and PFO (1:2). These ratios are typical; however, compensation is approved on a case-by-case basis and requirements may vary.

4.8.2 Water Quality

Under the Clean Water Act, a permit is necessary to discharge any pollutant from a point source into Waters of the United States through EPA's National Pollutant Discharge Elimination System program, including pollutants carried by stormwater discharges. The permits contain industry-specific, technology-based, and/or water quality-based limits and establish pollutant monitoring and reporting requirements. Water quality-based limits and monitoring and reporting requirements could be stricter for those streams that currently do not meet water quality standards (on the Section 303[d] list) and already have regulated total maximum daily loads of pollutants.

The Retained Build Alternatives would potentially result in short-term impacts to water quality such as increased sedimentation, increased turbidity from in-stream work, and possible spills or non-point source pollutants entering groundwater or surface water from stormwater runoff. Dredging for bridge and tunnel construction would result in generation of suspended solids and a release of nutrients and potential contaminants within overlying waters. To minimize these impacts, appropriate erosion and sediment control practices would be implemented in accordance with the Virginia Erosion and Sediment Control Regulations, the Virginia Stormwater Management Law and regulations, and VDOT's Road and Bridge Specifications. Implementation of best management practices, including compliance with VDOT's Erosion ad Sediment Control Handbook, use of silt curtains, and limitation of overflow from dredging equipment, would minimize increases in turbidity of waters downstream of dredging activities. Pre-construction sediment quality assessments and water quality monitoring during construction may be conducted to address potential re-suspension of contaminants and nutrients into overlying water.

These specifications also prohibit contractors from discharging any contaminant that may impact water quality. In the event of accidental spills, the contractor is required to immediately notify all appropriate local, state, and federal agencies and to take immediate action to contain and remove the contaminant. Additionally, the requirements and special conditions of any required permits for work in and around surface waters would be incorporated into construction contract documents, so that the contractor would be required to comply with such conditions.

Minor long-term water quality impacts could occur as a result of increases in impervious surfaces, increases in traffic volumes, and consequent increases in pollutants washed from the road and bridge surface into receiving water bodies. Stormwater management measures, including detention basins, vegetative controls, and other measures, would be implemented to minimize water quality impacts. These measures would reduce or detain discharge volumes and remove pollutants, thus avoiding substantial further degradation of impaired water bodies in the study area vicinity.

The Chesapeake Bay Preservation Act RPAs are subject to local Chesapeake Bay Preservation Act requirements to minimize land disturbance, preserve indigenous vegetation, minimize impervious surfaces, control stormwater runoff, and implement erosion and sediment control plans for land disturbances. Over 500 acres of Chesapeake Bay Resource Protection Areas (RPAs) are within the LOD of the Retained Build Alternatives (see **Table 4-7**). Given that public roads and their associated structures are conditionally exempt from the Chesapeake Bay Preservation Area Designation and Management Regulations and that the Retained Build Alternatives would be constructed in accordance with the Erosion and Sediment Control Law (§10.1-560 et seq. of the Code of Virginia) and the Stormwater Management Act (§10.1-603. 1 et seq of the Code of Virginia), the Retained Build Alternatives would be consistent with the Chesapeake Bay Preservation Act and its implementing regulations.

Additionally, as presented in the *Natural Resources Technical Report*, the Retained Build Alternatives would be designed to be consistent with the established Virginia Coastal Zone Enforceable Policies as related to fisheries management, subaqueous lands management, wetlands management, dunes management, nonpoint source pollution control, point source pollution control, shoreline sanitation, air pollution control, and coastal lands management. With implementation of proposed mitigation measures, the Retained Build Alternatives would not impair resources protected by the Virginia Coastal Zone Enforceable Policies, including wetlands, dunes, and aquatic animals. The Retained Build Alternatives would be designed and constructed in accordance with the Virginia Erosion and Sediment Control Law and the terms and conditions of water quality permits required by the USACE, VDEQ, VMRC, and VDCR.

4.8.3 Floodplains

Executive Order 11988 (Floodplain Management) requires federal agencies to avoid to the extent possible the short and long-term adverse impacts associated with the occupancy and modification of floodplains. To accomplish this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities".

As indicated in **Table 4-7**, each of the Retained Build Alternatives would impact over 400 acres of 100-year floodplain. The floodplain encroachment would not be a “significant encroachment” (as defined in 23 CFR 650.105[q]) because of the following reasons:

- ***It would pose no significant potential for interruption or termination of a transportation facility which is needed for emergency vehicles or provides a community's only evacuation route.*** The HRBT is one of three evacuation routes serving the Hampton Roads region. A Maintenance of Traffic Plan would be established under the Retained Build Alternatives which would avoid significant interruption of emergency vehicle access or interference with the community’s evacuation route. Once built, the Retained Build Alternatives would enhance emergency vehicle access and community evacuation.
- ***It would not pose a significant flooding risk.*** The design of the Retained Build Alternatives would be consistent with procedures for the location and hydraulic design of highway encroachments on floodplains contained in 23 CFR 650 Subpart A. Accordingly, the Retained Build Alternatives would not increase flood levels, the probability of flooding, or the potential for property loss and hazard to life.
- ***It would not have significant adverse impacts on natural and beneficial floodplain values.*** Avoidance and minimization efforts including spanning floodplains where practicable and minimizing wetland impacts would be made during design to avoid or minimize adverse impacts on natural and beneficial floodplain values.

As discussed in **Section 4.2**, the Retained Build Alternatives are consistent with local land use plans and are not projected to either encourage or accelerate any growth or changes in land use that are not already expected within Hampton Roads and Norfolk. Therefore, the Retained Build Alternatives would not encourage, induce, allow, serve, support, or otherwise facilitate incompatible base floodplain development.

Sections 107 and 303 of VDOT’s specifications require the use of stormwater management practices to address issues such as post-development storm flows and downstream channel capacity. These standards require that stormwater management be designed to reduce stormwater flows to preconstruction conditions for up to a 10-year storm event. As a part of these regulations, the capture and treatment of the first half inch of run-off in a storm event is required, and all stormwater

management facilities must be maintained in perpetuity. During final design, a detailed hydraulic survey and study would evaluate specific impacts in terms of stormwater discharges. This evaluation would adhere to the aforementioned specifications. Stormwater management practices would be developed in accordance with Sections 107 and 303 of VDOT's specifications to prevent substantial increases of flood levels.

4.8.4 Sediment Transport, Bank Erosion, Shoaling, and Hydrodynamic Modeling

The VIMS three-dimensional hydrodynamic model described in **Section 3.5.5** simulated tides, currents, circulation, salinity, and sedimentation on four test cases. One of the scenarios compares the Base Case (existing conditions) to an expansion of the I-64 HRBT which is similar to the Retained Build Alternatives. The modeled scenario includes the addition of a third tunnel, two tunnel islands, and two bridges on pilings connecting Hampton and Norfolk across the entrance to the James River.

The VIMS model shows that there is no difference between the No-Build and the I-64 HRBT expansion scenario with regard to tidal heights, tidal range, river inflow, high and low water times and heights, and currents and salinity within the James River tidal front system. Based on the model results, it is anticipated that the No-Build and Retained Build Alternatives would have no impact on tidal height or range, river inflow, currents, or salinity within the James River.

Implementation of the I-64 HRBT expansion scenario, and presumably any of the Retained Build Alternatives, would result in a negligible impact on the James River surface current curve, the Elizabeth River tidal prism and eddies, and sedimentation potential near Hampton Flats. The slight increase in residual water volume at the entrance of the Elizabeth River over the No-Build Alternative could increase dissolved or suspended material transport in and out of the basin. A slight increase in sedimentation in the northeast corner of Hampton Flats could increase the necessity of dredging nearby marinas and the Hampton River Entrance Channel. The model found, however, that changes due to extremes in river inflow conditions strongly outweigh any changes due to the addition of structures into the model, so it is expected that the Retained Build Alternatives would have a negligible impact on material transport or sedimentation in the study area.

As described in **Section 3.5.5**, the VIMS model remains valid. The model indicates that no substantial changes would occur to hydrodynamic conditions within Hampton Roads. Thus, update of the model is not required for this Draft EIS. Should a build alternative be preferred, an update to the model may be appropriate to identify impacts of the preferred alternative based on future hydrodynamic conditions in Hampton Roads and design of the HRBT bridges and tunnel.

As a part of the EPA and NOAA joint Climate Change Science Program, studies of historic tidal data for the Mid-Atlantic Region have noted that sea level rise has occurred in the past from both the increase in the volume of sea water due to ocean warming and transfer of water from land reservoirs of ice and water to oceans. When combined with subsidence of some coastal regions, the total rise can be higher, such as in Hampton Roads where the total sea level rise between 1927 and 1999 has been 4.42 millimeters per year. The Climate Change Science Program has recommended that a total of 1 meter in sea level rise by the year 2100 should be considered for long-term planning purposes, such as the planning of major infrastructure.

4.8.5 Dredging and Disposal of Dredged Material

The No-Build Alternative would require no dredging of Hampton Roads, Willoughby Bay or Hampton River. The Retained Build Alternatives would require dredging of these waterways for rehabilitation or reconstruction of the existing bridges, construction of new approach bridges, and construction of a new tunnel. Based on readily available bathymetric data from NOAA navigation charts, the Build-8 and Build-8 Managed Alternatives would potentially require approximately 400 acres of dredge area and removal

of 3.4 million cubic yards of bottom material. The Build 10 Alternative would potentially require approximately 415 acres of dredge area and removal of 4.1 million cubic yards of bottom material.

Dredging would result in permanent changes to the morphology (i.e., form and structure) of the river bottom and bathymetry (i.e., water depths) in the study area. As described in **Section 4.8.2**, dredging would also impact water quality resulting from increased turbidity and potential release of nutrients and sediments. Loss of bottom substrate (benthic) habitat would occur from dredging, as described in **Sections 4.9.2** and **4.9.3**.

Any dredged material would be appropriately disposed of through close coordination with EPA and USACE. Should a Retained Build Alternative be preferred, a site search of potential disposal sites will be conducted. Aerial imagery will be used to identify sites that are large enough to handle the anticipated volume of dredged material. Beneficial uses of the dredged material would also be considered, including beach nourishment and creation of reefs or berms to enhance fisheries. Potential sites will be evaluated using criteria such as:

- Size and capacity for stockpiling material and dewatering prior to upland disposal;
- Logistics of transporting the material to the site;
- Treatment requirements at the site;
- Environmental impacts associated with the use of the site; and
- Costs.

At this time no specific dredged material disposal site has been identified. An example of the methods which could be used for addressing dredge disposal is provided by the Downtown Tunnel/Midtown Tunnel/MLK Extension Project in the South Hampton Roads area, a project which is similar to the Retained Build Alternatives. It is anticipated that the majority of dredged materials from that project would be deposited within the approved offshore Norfolk Ocean Dredged Material Deposit Site (Norfolk ODMDS) managed jointly by the EPA and USACE, with the remaining material placed in an approved upland disposal site. The Norfolk ODMDS has an area of approximately 50 square nautical miles (EPA and USACE, 2009) and may be suitable to receive material from the Retained Build Alternatives. A determination of dredged material suitability for ocean disposal would be considered in the site evaluation. Should an ocean disposal site be preferred, disposal would be documented in a Marine Protection, Research, and Sanctuaries Act (MPRSA) Section 103 evaluation, which requires approval by EPA Region III.

4.9 WILDLIFE AND HABITAT

No impacts to upland or aquatic habitats, including water bird nesting areas, benthic communities, EFH, HAPC, Anadromous Fish Use Areas, and SAV, or spread of invasive species are anticipated under the No-Build Alternative.

Table 4-8 summarizes the general habitat types within the LOD of each of the Retained Build Alternatives. The majority of the LOD for all of the Retained Build Alternatives includes either developed lands or aquatic habitats. A very limited amount of vegetated upland habitat would be disturbed by the Retained Build Alternatives. Disturbance or loss of these upland habitats would not result in substantial impacts to wildlife due to the widespread availability of such habitats within the study area and the region. Anticipated impacts of the Retained Build Alternatives on water bird nesting and aquatic habitats are discussed below. Additional information is presented in the *Natural Resources Technical Report*.

4.9.1 Water Bird Nesting

Proposed expansion of the islands to accommodate the proposed tunnel portals under each of the Retained Build Alternatives would require direct disturbance of beaches used as nesting areas by water birds. While placing fill material on the existing beaches may make these areas temporarily unsuitable for nesting water birds, the total beach area would be increased with expansion of the island providing an opportunity to increase the amount of suitable nesting habitat on the islands.

Construction activities for the expansion of the islands and installation of the proposed tunnel would be conducted outside of the nesting season for these species to avoid potential direct or indirect impacts (i.e., noise) on nesting birds. Construction of new beach areas would include materials, e.g., sand and stones, which provide suitable conditions for water bird nesting habitat. Specific time restrictions and the appropriate materials for beach construction would be developed in coordination with the VDGIF.

Table 4-8: Acres of Habitat Impacted

Habitat	Build-8 Alternative	Build-8 Managed Alternative	Build-10 Alternative
Water	491*	497*	514*
Urban Field	18	18	20
Urban Shrub Area	2	2	2
Urban Forest	54	55	58
Developed Land	216	220	232
Study Area TOTAL	**781**	**793**	**826**

Sources: City of Hampton and City of Norfolk Land Use GIS databases; aerial imagery; and field verification.
Notes: Acreage in this table does not include roads.
Difference in total acreage shown in Table 4-1 Land Use Impacts due to inclusion of water and a difference in data source.
** The LOD includes the total width of Retained Build Alternative bridges and tunnels, including areas of permanent and temporary impact. A more detailed estimate and breakdown of areas of permanent versus temporary disturbance would be provided during final design and permitting.*

4.9.2 Benthic Communities

The Retained Build Alternatives would involve disturbance of benthic communities; however, no substantial permanent or long-term impacts on these communities are anticipated because of the limited footprint of the bridge piers and because the tunnels would be submerged below the bottom of Hampton Roads. While benthic communities would be impacted by laying down rock and sediment for expansion of the islands for the proposed tunnel portals, the availability of tidal habitat would ultimately increase with expansion of the islands. As discussed in **Section 4.8.4**, no substantial changes in hydrodynamic and hydrologic conditions are anticipated with implementation of the Retained Build Alternatives.

Dredging for tunnel installation and within potential aquatic borrow sites would temporarily result in the disruption of benthic communities and generation of suspended solids and release of nutrients and potential contaminants within overlying waters. The disruption of benthic communities for construction of the Retained Build Alternatives is not expected to impact the sustainability of commercially important species including oysters, blue crabs, or clams within Hampton Roads. No harvestable oyster populations are present within the LOD for the Retained Build Alternatives. The Retained Build Alternatives would result in minimal loss or disturbance of SAV beds that provide important nursery habitat for blue crabs. The potential temporary impact to benthic communities within the LOD is approximately 400 acres for the Build-8 and Build-8 Managed Alternatives and 415 acres for the Build 10 Alternative. Mitigation measures for SAV impacts described in **Section 4.9.4** would restore impacted blue crab nursery habitat. Hardshell clam would be the most vulnerable of the three species to dredging

impacts; however, clams would be expected to re-establish following construction due to the extensive presence of benthic habitat within the study area (approximately 3,150 acres).

Suspended solids may be deposited within benthic communities downstream of dredging activities. The aerial extent of suspended solids is expected to be limited due to the coarse sandy texture of sediments within Hampton Roads. Implementation of best management practices, including compliance with VDOT's Erosion and Sediment Control Handbook, use of silt curtains, and limiting overflow from dredging equipment, would minimize increases in turbidity of waters downstream of dredging activities. Pre-construction sediment quality assessments and water quality monitoring during construction may be conducted to address potential re-suspension of contaminants and nutrients into overlying water.

4.9.3 Essential Fish Habitat, Habitat Areas of Particular Concern, and Anadromous Fish Use Areas

The Retained Build Alternatives would potentially impact EFH HAPC, and Anadromous Fish Use Areas. However, much of the impact would be temporary given the limited footprint of the bridge piers and because the tunnels would be submerged below the bottom of Hampton Roads. Limited permanent impact would result from expansion of the islands for the tunnel portals and the installation of bridge piers for each of the Retained Build Alternatives. The potential impact (temporary and permanent) to Anadromous Fish Use Areas is approximately 345 acres for the Build-8 and Build-8 Managed Alternatives and 360 acres for the Build-10 Alternative; information on EFH and HAPCs is not available to quantify. The potential impact (temporary and permanent) to overall estuarine habitat is approximately 400 acres for the Build-8 Alternative and Build-8 Managed Alternative, and 415 acres for the Build-10 Alternative. The total area of estuarine habitat within the study area is 3,150 acres.

As discussed in **Section 4.9.2**, dredging required for Retained Build Alternatives and within potential aquatic borrow sites would temporarily result in the disruption of benthic communities that provide food sources for fish. The temporary loss of benthic communities would have minimal impacts on prey availability given the limited area of disturbance and widespread availability of benthic habitat within the study area and foraging habitat throughout Hampton Roads and the southern Chesapeake Bay.

Temporary increases in turbidity and releases of nutrients and potential contaminants from dredging activities are not expected to substantially impact juvenile or adult fish because of their mobility and because construction would be spread out over time and would occur within discrete areas. Eggs and larvae, however, would be more vulnerable to these impacts.

Time-of-year restrictions would be implemented to avoid or minimize impacts on fish during early life stages. VDGIF typically recommends restrictions on all in-stream work within Anadromous Fish Use Areas and their tributaries between February 15 and June 30. Exact restrictions may vary depending on the species, type of work, and location. In addition, erosion and sediment control measures described in **Section 4.8.2** would minimize potential impacts to water quality during construction. Specific measures for avoidance, minimization, and mitigation of impacts to aquatic wildlife would be developed in consultation with VDGIF and NMFS.

4.9.4 Submerged Aquatic Vegetation

According to the Virginia Administrative Code (VAC), 4 VAC 20-337-10 et seq. SAV Transplantation Guidelines, any removal of SAV from State bottom would require prior approval by VMRC (VMRC, 2000). Construction of any of the Retained Build Alternatives would require temporary disturbance of and/or permanent removal of SAV. Temporary disturbance of SAV would be required to construct the bridge approaches. Permanent loss of SAV would be limited to the footprint of the bridge piers. The estimated total acreage of SAV impact is:

- 5.6 acres for the Build-8 Alternative,
- 5.7 acres for the Build-8 Managed Alternative, and
- 6.2 acres for the Build-10 Alternative.

The amount of SAV foraging habitat impacted by the Retained Build Alternatives represents approximately 10 percent of total SAV foraging habitat within the one-mile-wide study area. Furthermore, additional SAV beds are present upstream of the study area. Areas of temporary disturbance to SAV would be replanted. A request to remove SAV from or plant SAV upon State bottom would be submitted with a Joint Permit Application to the VMRC. The application must include specific information that is critical to properly evaluate the probabilities of transplantation success, with minimization of impacts to established donor bed populations. In determining whether or not to grant approval for SAV removal or planting, the Commission shall be guided by §28.2-1205 of the Code of Virginia and the SAV Transplantation Guidelines, or any new and improved methodologies as approved by the Commission.

Erosion and sediment control measures described in **Section 4.8.2** would minimize potential impacts to water quality within adjacent SAV areas. Construction within or adjacent to SAV areas would avoid the growing season for representative plant species to the extent practicable. Further efforts to avoid and/or minimize disturbance and removal of SAV would be made during final design. Mitigation for SAV loss would be developed in coordination with VMRC and may include enhancement or restoration of SAV beds.

4.9.5 Invasive Species

The Retained Build Alternatives could increase the spread of invasive species. Construction equipment used in the study area could carry seeds or propagative plant parts from other construction projects or infested areas. Removal of sediment and soil to offsite locations could spread invasive species and placement of fill from borrow sites could introduce invasive species to the study area. Exposed soil also allows invasive species to spread, which could contribute to encroachment of invasive species on vegetation communities adjacent to the LOD.

In accordance with Executive Order 13112, *Invasive Species*, the potential for the establishment of invasive animal or plant species during construction of any of the Retained Build Alternatives would be minimized by following provisions in VDOT's *Road and Bridge Specifications*. These provisions require prompt seeding of disturbed areas with seeds that are tested in accordance with the Virginia Seed Law and VDOT's standards and specifications to ensure that seed mixes are free of noxious species. In addition, in order to prevent the introduction of new invasive species and to prevent the spread of existing populations, best management practices would be followed, including washing machinery before it enters the area, minimizing ground disturbance, and reseeding of disturbed areas. While the right-of-way is vulnerable to colonization by invasive plant species from adjacent properties, implementation of the stated provisions would reduce the potential for the establishment and proliferation of invasive species within highway right-of-way.

4.10 THREATENED AND ENDANGERED SPECIES

No adverse effects on federally listed threatened or endangered species that may be present within the study area are anticipated for the No-Build Alternative.

Information regarding sensitive resources that may be affected by the Retained Build Alternatives was requested from the USFWS via the Information, Planning, and Conservation (IPaC) system. The IPaC results indicated that one species, the Federally threatened piping plover, may be impacted by the Retained Build Alternatives. Additional research and agency input regarding threatened and

endangered species indicated that the Retained Build Alternatives also could potentially impact five species of Federally endangered and/or threatened turtles and two species of Federally endangered fish. Potential impacts of the Retained Build Alternatives are discussed below for each of these three groups of species. Additional coordination would be conducted with the USFWS and NMFS pursuant to Section 7 of the Endangered Species Act of 1973, as amended, for potential impacts to Federally listed species prior to implementation of a build alternative. Additional information is presented in the *Natural Resources Technical Report*.

4.10.1 Sea Turtles

The Retained Build Alternatives would have potential impact to sea turtle habitat within Hampton Roads, including both benthic (bottom) and estuarine (water) habitat. However, much of the impact would be temporary given the limited footprint of the bridge piers and because the tunnels would be submerged below the bottom of Hampton Roads. Permanent impact would be limited to expansion of the islands for the proposed tunnel portals and the installation of bridge piers for each of the Retained Build Alternatives. The total (permanent and temporary) potential impact to sea turtle habitat would be approximately 400 acres for the Build-8 Alternative and the Build-8 Managed Alternative, and 415 acres for the Build-10 Alternative. The potential total sea turtle habitat within the study area is 3,150 acres.

The temporary and localized disruption of benthic communities would have minimal impacts on the availability of turtle foraging habitat given the potential for recolonization of benthic habitat, and the widespread availability of foraging habitat throughout Hampton Roads and the southern Chesapeake Bay.

SAV areas also provide foraging habitat for turtles. As discussed in **Section 4.9.4**, temporary and permanent loss of SAV areas would potentially result from construction of the proposed bridge approaches to Hampton and expansion of the northernmost tunnel portal island under each of the Retained Build Alternatives. The amount of SAV foraging habitat impacted by the Retained Build Alternatives represents approximately 10 percent of total SAV foraging habitat within the one-mile-wide study area.

Temporary increases in turbidity and release of nutrients and potential contaminants from dredging activities is not expected to adversely affect sea turtles because of their mobility and because construction would be spread out over time and would affect only a small percentage of Hampton Roads at any one time. Erosion and sediment control measures described in **Section 4.9.2** would minimize potential impacts to water quality within sea turtle foraging habitat.

Construction activities for the expansion of the islands and installation of the new tunnel will be conducted outside of the nesting season for these species to avoid potential direct or indirect impacts (i.e. noise) on nesting turtles. Specific time restrictions for beach construction will be developed in coordination with USFWS and NMFS.

4.10.2 Sturgeon

Sturgeon are anadromous species, and thus the areas that comprise their habitat are classified as Anadromous Fish Use Areas. The Retained Build Alternatives would have potential impacts (temporary and permanent) to these areas. Much of the impact would be temporary given the limited footprint of the bridge piers and because the tunnels would be submerged below the bottom of Hampton Roads. Permanent impact would be limited to expansion of the islands for the proposed tunnel portals and the installation of bridge piers for each of the Retained Build Alternatives. The potential impact to Anadromous Fish Use Areas is approximately 345 acres for the Build-8 Alternative and the Build-8

Managed Alternative, and 360 acres for the Build-10 Alternative. The area impacted by these proposed facilities is small in relation to total estuarine habitat within the study area, which is 3,150 acres.

As indicated in **Section 4.8.4** and **Section 4.9.3**, construction of proposed facilities as part of the Retained Build Alternatives would involve minimal permanent loss of aquatic habitats within Hampton Roads; and no long-term changes in hydrodynamic and hydrologic conditions are anticipated.

Temporary increases in turbidity and release of nutrients and potential contaminants from dredging activities are not expected to substantially impact juvenile or adult sturgeon because of their mobility and because construction would be spread out over time. Eggs and larvae, however, would be more vulnerable to these impacts.

Time-of-year restrictions would be considered to avoid or minimize impacts on sturgeon during early life stages. VDGIF typically recommends restrictions on all in-stream work within Anadromous Fish Use Areas and their tributaries between February 15 and June 30. Exact restrictions may vary depending on the species, type of work, and location. In addition, erosion and sediment control measures described in **Section 4.8.2** would minimize potential impacts to water quality within sturgeon foraging and spawning habitat. Further efforts to avoid and/or minimize disturbance and removal of sturgeon habitat would be made during final design. Specific measures for avoidance, minimization, and mitigation of impacts to sturgeon would be developed in consultation with VDGIF and NMFS.

4.10.3 Piping Plover

Piping plovers are uncommon breeders on the west side of the lower Chesapeake Bay and have been absent from typical nesting sites within the Hampton Roads vicinity (i.e., Craney Island in Portsmouth and Grandview Beach in Hampton) for over a decade (Cairns and McLaren, 1980; VDOT, 2001; USACE, 2006). These areas are believed to be no longer suitable for nesting piping plovers due to the presence of predators and human disturbance.

No impacts to this species are anticipated because no suitable piping plover nesting habitat occurs within or adjacent to the LOD of the Retained Build Alternatives.

4.11 HISTORIC PROPERTIES

The No-Build Alternative would have no effect to historic properties. The discussion in this section describes the potential effect from implementation of the Retained Build Alternatives. Additional details regarding historic properties subject to Section 4(f) of the US Department of Transportation Act are included in the Draft Section 4(f) Evaluation (**Appendix C**).

4.11.1 Historic Architectural Properties

A preliminary evaluation of effect was completed for the thirteen historic architectural properties located within the APE. The preliminary evaluation provides a basis for comparing the Retained Build Alternatives. Potential effects to historic architectural resources are shown in **Table 4-9** and described in the following paragraphs. Direct effects within the LODs of the Retained Build Alternatives are also shown in **Appendix A**.

At this time, an effect determination pursuant to Section 106 of the National Historic Preservation Act (36 CFR Part 800.5) has not been made for the Retained Build Alternatives. The effect determination will be made once the preferred alternative has been identified. VDOT and FHWA will apply the criteria of adverse effect to determine if the undertaking may alter, directly or indirectly, any of the characteristics of a historic property which qualify it for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or

association. The determination will be made for the undertaking in consultation with the Virginia Department of Historic Resources (VDHR), other consulting parties and the public. Based on the preliminary evaluation it is likely that each of the Retained Build Alternatives would result in an adverse effect to historic properties.

Pasture Point Historic District (VDHR No. 114-0118): The Retained Build Alternatives would have a direct effect to between 12.6 and 13.9 acres of the Pasture Point Historic District. The direct effect would include displacement of properties which contribute to the district such as individual residences, ancillary buildings, and yards. The alternatives would cause visual elements of I-64 to be further within the district. Noise would also increase in the district, however, noise abatement would be considered as described in **Section 4.13**. The direct and indirect effects would potentially diminish the integrity of character defining features which qualify the district for the NRHP.

Table 4-9: Potential Effect to Historic Architectural Properties

Historic Property	Build-8 Alternative		Build-8 Managed Alternative		Build-10 Alternative	
	Effect (acres)[1]	Diminished NRHP Integrity[2]	Effect (acres)[1]	Diminished NRHP Integrity[2]	Effect (acres)[1]	Diminished NRHP Integrity[2]
Pasture Point Historic District[3] (VDHR No. 114-0118)	12.6 *a v*	✓	12.9 *a v*	✓	13.9 *a v*	✓
Hampton Institute (NRHP)[4, 5] (VDHR No. 114-0006)	16.8 *a v*	✓	17.1 *a v*	✓	18.1 *a v*	✓
Hampton National Cemetery (VDHR No. 114-0148)	0.3 *a v*	✓	0.3 *a v*	✓	0.4 *a v*	✓
Hampton Veterans Affairs Medical Center H. D.[3] (VDHR No. 114-0101)	3.6 *a v*		3.6 *a v*		3.6 *a v*	
Phoebus Historic District[3] (VDHR No. 114-5002)	11.0 *a v*	✓	11.1 *a v*	✓	11.3 *a v*	✓
Fort Monroe Historic District (VDHR No. 114-0002)	0.0 *a v*		0.0 *a v*		0.0 *a v*	
Chamberlin Hotel (VDHR No. 114-0114)	0.0 *a v*		0.0 *a v*		0.0 *a v*	
Old Point Comfort Lighthouse (VDHR No. 114-0021)	0.0 *a v*		0.0 *a v*		0.0 *a v*	
Fort Wool (VDHR No. 114-0041)	0.0 *a v*		0.0 *a v*		0.0 *a v*	
Battle of Hampton Roads (VDHR No. 114-5471)	378		381		393	
Battle of Sewell's Point (VDHR No. 122-5426)	253		255		262	
Merrimack Park (Landing)[3] (VDHR No. 122-5434)	7.0 *a v*	✓	7.0 *a v*	✓	7.0 *a v*	✓
Forest Lawn Cemetery (VDHR No. 122-0531)	0.2 *a v*		0.2 *a v*		0.4 *a v*	

[1] *Indirect effects include introduction of audible or visual elements. Noise abatement would be considered as described in Section 4.13. (a=Audible, v=Visual)*

[2] *The effects have the potential to diminish the integrity of the historic property's location, design, setting, materials, workmanship, feeling, or association (36 CFR 800.5).*

[3] *Includes the total area of impact within the historic district, including contributing and non-contributing resources.*

[4] *Direct effects would also potentially include 0.3 acres of the Hampton Institute National Historic Landmark. Refer to the Draft Section 4(f) Evaluation in **Appendix C** for a summary of minimization measures at the Hampton Institute property.*

Hampton Institute (University) (VDHR No. 114-0006): The Retained Build Alternatives would potentially require a strip of right-of-way from Hampton Institute along I-64, as well as additional right-of-way around the Settlers Landing Road interchange with I-64, totaling 16.8 to 18.1 acres. The Emancipation

Oak, part of the Hampton Institute National Historic Landmark (NHL), is within the LOD of the Retained Build Alternatives. The Retained Build Alternatives would also have a direct effect on areas outside of the NHL, including a vegetated buffer, open field, roadway, and parking lot. The alternatives would cause visual elements of I-64 to be further within the property. Noise would also increase on the property, however, noise abatement would be considered as described in **Section 4.13**. The Draft Section 4(f) Evaluation (**Appendix C**) describes measures that would avoid the Emancipation Oak and minimize effects to Hampton Institute. The direct and indirect effects would potentially diminish the integrity of character defining features which qualify the property for the NRHP.

Hampton National Cemetery (VDHR No. 114-0148): The Retained Build Alternatives would have a potential direct effect to 0.3 to 0.4 acres of the west end of Hampton National Cemetery. Within this area is a portion of the perimeter wall and approximately 40 grave markers. The alternatives would cause visual elements of I-64 to be further within the property. Noise would also increase on the property, however, noise abatement would be considered as described in **Section 4.13**. The direct and indirect effects would potentially diminish the integrity of character defining features which qualify the property for the NRHP.

Hampton Veterans Affairs Medical Center Historic District (VDHR No. 114-0101): The Retained Build Alternatives would have a potential direct effect to approximately 3.6 acres of the east end of the Hampton Veterans Affairs Medical Center Historic District. This area consists of elements which do not contribute to the historic district, such as a parking lot, peripheral landscaping, and fencing. The Retained Build Alternatives would not have a direct effect on elements which contribute to the district. The alternatives would cause visual elements of I-64 to be further within the district. Noise would also increase in the district, however, noise abatement would be considered as described in **Section 4.13**. The direct and indirect effects are not expected to diminish the integrity of character defining features which qualify the district for the NRHP.

Phoebus Historic District (VDHR No. 114-5002): The Retained Build Alternatives would have a potential direct effect to between 11.0 and 11.3 acres of the district, including twenty-eight contributing residential properties. The direct effects would include displacement of properties which contribute to the district such as individual residences, ancillary buildings, and yards. The alternatives would also cause visual elements of I-64 to be further within the district. Noise would increase in the district, however, noise abatement would be considered as described in **Section 4.13**. The direct and indirect effects would potentially diminish the integrity of character defining features which qualify the district for the NRHP.

Fort Monroe Historic District (VDHR No. 114-0002), Chamberlin Hotel (VDHR No. 114-0114), Old Point Comfort Lighthouse (Fort Monroe Lighthouse) (VDHR No. 114-0021), Fort Wool (VDHR No. 114-0041): With the exception of Old Point Comfort Lighthouse, these historic properties are located within the APE, but outside the LOD for the Retained Build Alternatives. No direct effect would occur to the properties. The Retained Build Alternatives would result in indirect visual effects from construction of a proposed bridge-tunnel parallel to the existing HRBT; however, the effect would be tempered because the HRBT already exists within visual range of the properties. Furthermore, the Retained Build Alternatives would be constructed on the opposite side of the HRBT from these historic properties. There would be no audible indirect effects. The indirect effects are not expected to diminish the integrity of character defining features which qualify the properties for the NRHP.

Battle of Hampton Roads (VDHR # 114-5471) and Battle of Sewell's Point (VDHR No. 122-5426): The northeast portions of the Battle of Hampton Roads and Battle of Sewell's Point are crossed by the Retained Build Alternatives. The battlefields comprise large areas that would require an intensive survey to determine NRHP eligibility. For the purposes of this study, it is anticipated that the battlefields would be determined eligible for the NRHP.

The Retained Build Alternatives would have a direct effect to the properties with construction of a proposed bridge-tunnel parallel to the existing HRBT. This would potentially result in 378 to 393 acres of direct effects to the Battle of Hampton Roads, and 253 to 262 acres to the Battle of Sewell's Point. The alternatives would also introduce additional bridge and tunnel visual elements within the district. Noise would increase in areas of the properties that are close to the Retained Build Alternatives. Nevertheless, the battlefield areas have already been altered by the existing HRBT, and the Retained Build Alternatives would be in close proximity to the existing HRBT. Thus, the effects are not expected to diminish the integrity of character defining features which qualify the properties for the NRHP.

Merrimack Park / Merrimack Landing Historic District (VDHR No. 122-5434): The Retained Build Alternatives would have a potential direct effect on approximately 7.0 acres of this historic district. The direct effects would include potential demolition of thirteen buildings which contribute to the historic district. The alternatives would also cause visual elements of I-64 to be further within the district. Noise would increase in the district, however, noise abatement would be considered as described in **Section 4.13**. The direct and indirect effects would potentially diminish the integrity character defining features which qualify the district for the NRHP.

Forest Lawn Cemetery (VDHR No. 122-0531): The Retained Build Alternatives would have a potential direct effect to between 0.2 and 0.4 acres of Forest Lawn Cemetery. The potential effect would include approximately 50 to 75 graves, vegetated buffer, and the cemetery roadway in the southwest portion of the property. There would be no direct effects to buildings or gates. The alternatives would cause visual elements of I-64 to be closer to and within the property. Noise would also increase on the property, however, noise abatement would be considered as described in **Section 4.13**. Based on the potential effects, the Retained Build Alternatives are not expected to diminish the integrity of character defining features which qualify the property for the NRHP.

4.11.2 Archaeological Resources

The No-Build Alternative would result in no effect to Archaeological resources. The Retained Build Alternatives would have a direct effect on sites 44HT0009 (also recorded as 44HT0089) and 44HT0090. The Retained Build Alternatives would also have a potential effect on the two areas where additional Archaeological survey work is warranted. Based on the *Archaeological Assessment* completed by VDOT, additional Phase II level investigation, including close-interval shovel testing as well as larger test units within areas of potential direct effect, is appropriate for these two sites to determine if they are eligible for the NRHP. The first site is located in Hampton on the north side of I-64 within the Pasture Point Historic District, west of Pembroke Avenue; the second site is within open land on the east side of the I-64/I-564 interchange in Norfolk, west of the Forest Lawn Cemetery. Maps showing the location of Archaeological sites within the study area are provided in the *Archaeological Assessment*.

The Retained Build Alternatives would have an effect on the twelve previously identified underwater targets (described in **Section 3.8.2**) which would require additional investigation.

Should a Retained Build Alternative be preferred in the Final EIS, a Programmatic Agreement (PA) may be developed among FHWA, VDOT, DHR, and other consulting parties to resolve potential adverse effects to Archaeological historic properties. The PA would include measures for identifying Archaeological resources and present a methodology to assess and address any adverse effects that result from the undertaking.

4.12 AIR QUALITY ANALYSIS

The No-Build Alternative would not adversely impact air quality, but also would not confer air quality benefits. The Retained Build Alternatives would impact air quality as discussed in the following sections.

The Retained Build Alternatives also would result in benefits in terms of air quality, insofar as they would reduce congestion and, consequently, vehicle idling time. A reduction in idling time would reduce concentrations of air pollutants along the I-64 corridor and the HRBT.

The following sections summarize the air quality project level analysis that was conducted for carbon monoxide (CO), particulate matter (PM), and Mobile Source Air Toxics (MSATs) for the No-Build and Retained Build Alternatives. Also included herein is a discussion of air quality within the tunnel and potential construction emissions. Details of the methodologies and analysis for each pollutant are presented in the *Air Quality Analysis Technical Report*. The methodologies and assumptions for addressing the type of analysis for each pollutant is consistent with the EPA and FHWA guidance along with the latest version of the VDOT Consultant Guide, Air Quality Project-Level Analysis, Revision 18 (May 2009). Concentrations of air pollutants potentially resulting from implementation of any of the alternatives are assessed against the National Ambient Air Quality Standard (NAAQS) criteria, which set a limit on how much of a given "criteria" pollutant can be present without creating public health impacts.

4.12.1 Carbon Monoxide

Roadway CO Assessment. A Memorandum of Understanding (MOU) between FHWA and VDOT, issued on February 27, 2009, sets traffic and related criteria at which project-level air quality analyses should be conducted for CO. An air quality impact assessment of CO traffic emissions was conducted as part of the HRBT study because the projected average daily traffic is estimated to be above the VDOT and FHWA quantitative hot spot criteria. The analysis examines ground-level CO impacts due to traffic flow in the immediate vicinity of a study area intersection/interchange. CO is used in microscale studies to indicate roadway pollutant levels as it is the most abundant pollutant emitted by motor vehicles and can result in so-called "hot spot" (i.e., high concentration) locations around congested intersections. NAAQS standards do not allow ambient CO concentrations to exceed 35 parts per million (ppm) for a one-hour averaging period and 9 ppm for an eight-hour averaging period more than once per year at any location.

The air quality study utilized the traffic assessment conducted by the design team for the 2011 base year, 2020 interim year, and the 2040 design year conditions. For the air quality analysis, the relevant traffic components utilized from the traffic study were the LOS, ADT, congested speeds, turning movements, and signal timing data for each alternative. A total of thirteen intersections were studied along with seven mainline interchanges. A review of the LOS, peak traffic volumes and delay time for each alternative and analysis year determined that the five worst-case intersections and interchanges for inclusion in the CO Hot-Spot analysis were:

- North Armistead Avenue at LaSalle Avenue
- I-64 westbound ramps at South Mallory Street
- I-64 at I-664
- I-64 at LaSalle Avenue
- I-64 at West Ocean Avenue

It is assumed that if these intersections/interchanges show ground-level concentrations below the CO NAAQS, then all other intersections included in the traffic study should also be below the NAAQS.

Emissions of CO were estimated using the FHWA Easy Mobile Inventory Tool (EMIT) interface software package which incorporates the EPA MOBILE6.2 emissions generating model. Ambient concentrations at sensitive receptor locations were estimated using the EPA CAL3QHC dispersion model and added to appropriate background concentrations for comparison to the CO NAAQS.

For the modelling analysis, receptor locations were placed in the vicinity of the five intersections/ interchanges at public access locations such as sidewalks, property lines, and parking lots. Each of the receptor locations was subject to one-hour and eight-hour CO concentrations analysis for comparison to the NAAQS.

The CO assessment was conducted consistent with the procedures identified in the VDOT Consultant Guide and the EPA modelling guidelines.[18]

Table 4-10 shows that the predicted concentrations results are well below the one-hour NAAQS standard of 35 ppm for the existing conditions and Retained Build, and No-Build Alternatives. The one-hour concentrations were then scaled to generate eight-hour values for comparison to the NAAQS. These concentrations also are well below the eight-hour NAAQS standard of 9 ppm. The receptor locations referenced in **Table 4-10** along with a detailed discussion of the roadway CO assessment can be found in the *Air Quality Analysis Technical Report*.

Table 4-10: CAL3QHC Modeling Results for Each Intersection/Interchange

Intersection/ Interchange	Averaging Period	Existing 2011[1,2]		2020[1,2]				2040[1,2]				
				No-Build		Build		No-Build		Build		
		Peak AM (ppm)	Peak PM (ppm)	Peak AM (ppm)	Peak PM (ppm)	Peak AM (ppm)	Peak PM (ppm)	Peak AM (ppm)	Peak PM (ppm)	Peak AM (ppm)	Peak PM (ppm)	NAAQS (PPM)
N. Armistead Ave at LaSalle Ave	1-hour	8.1 (17)	8.9 (16)	8.1 (16)	8.3 (16)	8.1 (16)	8.3 (16)	7.4 (16)	7.6 (16)	7.6 (16)	7.6 (16)	35
	8-hour	5.7 (17)	6.2 (16)	5.7 (16)	5.8 (16)	5.7 (16)	5.8 (16)	5.2 (16)	5.3 (16)	5.3 (16)	5.3 (16)	9
I-64 WB Ramps at S. Mallory Street	1-hour	5.6 (2)	5.5 (2)	5.3 (3)	5.3 (3)	5.3 (3)	5.3 (17)	5.7 (17)	5.6 (3)	5.8 (15)	5.3 (10)	35
	8-hour	3.9 (2)	3.8 (2)	3.7 (3)	3.7 (3)	3.7 (3)	3.7 (17)	4.0 (17)	3.9 (3)	4.0 (15)	3.7 (10)	9
I-64 and I-664	1-hour	9.1 (21)	8.7 (21)	7.8 (21)	7.7 (21)	8.6 (21)	7.9 (21)	8.2 (21)	7.8 (21)	8.7 (21)	8.4 (10)	35
	8-hour	6.4 (21)	6.1 (21)	5.4 (21)	5.4 (21)	6.0 (21)	5.5 (21)	5.7 (21)	5.4 (21)	6.1 (21)	5.9 (10)	9
I-64 and LaSalle Ave	1-hour	6.5 (18)	6.5 (18)	6.3 (1)	6.2 (18)	7.2 (1)	7.4 (18)	6.2 (18)	6.2 (18)	7.2 (18)	7.3 (18)	35
	8-hour	4.5 (18)	4.5 (18)	4.4 (1)	4.3 (18)	5.0 (1)	5.2 (18)	4.3 (18)	4.3 (18)	5.0 (18)	5.1 (18)	9
I-64 and West Ocean Ave	1-hour	6.1 (3)	6.1 (7)	5.6 (10)	5.6 (10)	6.9 (10)	6.9 (10)	5.6 (10)	5.6 (7)	7.6 (10)	7.3 (10)	35
	8-hour	4.3 (3)	4.3 (7)	3.9 (10)	3.9 (10)	4.8 (10)	4.8 (10)	3.9 (10)	3.9 (7)	5.3 (10)	5.1 (10)	9

[1] *Total concentration is the sum of the modelled concentration plus background concentrations.*

[2] *Number in parenthesis represents the modelled receptor number of maximum modelled concentration. Please refer to Figures 2 through 6 of the Air Quality Analysis Technical Report.*

Tunnel CO Assessment. The Retained Build Alternatives include the construction of one new tunnel under Hampton Roads. The proposed tunnel would be approximately 7,760 feet long (1.47 miles) and equipped with a longitudinal jet fan ventilation system to move the air either during peak hour conditions or in the event of an accident or emergency. It is assumed that the ventilation system within the tunnel would be designed consistent with the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) Handbook, Chapter 13, Enclosed Vehicular Facilities - Tunnels. The ventilation system design is based on controlling the level of emissions to acceptable concentrations

[18] "Guidelines for Modeling Carbon Monoxide from Roadway Intersections", EPA-454/R-92-005, US EPA, 1992.

inside the tunnel during normal operations along with the capacity to remove smoke and gases during emergencies. It is also designed to assure both the traveling public as well as highway worker/emergency personal safety that air quality within the tunnel would be consistent with normal ventilation air quantities, as described in the referenced ASHRAE standard.

The methodology and assumptions for assessing the tunnel air quality analysis were consistent with the most recent FHWA/EPA guidelines for CO concentrations in tunnels. According to the ASHRAE standard, tests and operating experience have shown that when CO is adequately controlled, the other vehicle emission pollutants are likewise adequately controlled. Therefore, the analysis must demonstrate that the one-hour CO NAAQS of 35 ppm along with the FHWA/EPA 15-minute exposure level of 120 ppm would be met inside the tunnel. The analysis was conducted for two worst case scenarios: 1) peak-hour conditions in order to address the worst-case conditions associated with routine peak hour traffic operations; and 2) an incident (idling) that stops traffic such as an accident or vehicle breakdown. The results of the analysis show that CO levels are estimated to be below the one-hour CO NAAQS of 35 ppm and below the 15-minute FHWA/EPA guideline level of 120 ppm for both the peak hour and incident (idling) condition. For the peak hour condition, the estimated CO concentration is 29.9 ppm and is 85 percent of the CO NAAQS and 25 percent of the FHWA/EPA guideline level. For the incident idling condition, the estimated CO concentration is 33.0 ppm and is 93 percent of the CO NAAQS and 27 percent of the FHWA/EPA guideline level. The calculation includes the VDOT one-hour CO ambient background level of 3.6 ppm assumed to exist in the tunnel ventilation air supply.

A detailed discussion of the methodologies and assumptions used in the CO tunnel analysis is presented in the *Air Quality Analysis Technical Report*.

4.12.2 Particulate Matter

The cities of Hampton and Norfolk are designated by EPA as an attainment area for particulate matter with particles less than 2.5 micrometers in diameter ($PM_{2.5}$), and is in compliance with the NAAQS; therefore, a $PM_{2.5}$ hot spot analysis was not required for conformity. The EPA has established a list of criteria (40 CFR 93.123(b) (1)) in determining whether a project is of "air quality concern." The applicable criterion for the HRBT study is the level of diesel truck traffic.

The total estimated 2040 diesel truck ADT under the Build-10 Alternative is expected to be approximately 8,350, well below the EPA 10,000 diesel truck threshold for considering an action a "project of air quality concern." Therefore, none of the Retained Build Alternatives are considered to be a "project of air quality concern" for particulate matter and would not cause or contribute to a violation of the PM NAAQS. A detailed discussion on $PM_{2.5}$ is included in the *Air Quality Analysis Technical Report*.

4.12.3 Mobile Source Air Toxics

In September of 2009, FHWA issued interim guidance regarding MSAT impacts and the levels of analysis required to address MSATs in NEPA analysis. The levels addressed were for projects with no meaningful MSAT effects, low potential MSAT effects, and high potential MSAT effects. A qualitative analysis is required for projects that meet the low potential MSAT effects criteria while a quantitative analysis is required for projects meeting the high potential MSAT effects criteria. The Retained Build Alternatives' daily volumes along I-64 in the 2040 design year are expected to be above the 140,000 to 150,000 threshold for projects with high potential MSAT effects; as such, a quantitative analysis was required for this study.

MSAT Quantitative Analysis. The MSAT quantitative analysis was conducted consistent with the latest guidance developed by FHWA[19]. The "affected network" was defined as the geographic area that surrounds the study corridor that might see realized differing traffic volumes as a result of implementation of any of the Retained Build Alternatives and extends approximately 30 miles to the east and west and 26 miles to the north and south. The network includes the cities of Hampton and Norfolk, with the HRBT approximately located in the middle. Within the network, only those links that experience a five percent or greater increase or decrease between the Retained Build and No-Build Alternatives were evaluated in the MSAT inventory. Air toxic emission rates were estimated using the FHWA EMIT program for acrolein, benzene, 1,3-butadiene, diesel PM, formaldehyde, naphthalene, and polycyclic organic matter (POM).

The results of the MSAT quantitative analysis are presented in **Table 4-11** and show that MSAT emissions are expected to decline for all Retained Build Alternatives compared to the No-Build. In general, the results show that for most MSAT pollutants, emissions are expected to decline during the interim and design year when compared to the existing conditions (i.e. 2011).

Table 4-11: Projected Annual MSAT Emissions in tons per year (TPY) on "Affected Network"

Year	Condition	Vehicle Miles Travelled (VMT)	Acrolein (TPY)	Benzene (TPY)	1,3 Butadiene (TPY)	Diesel PM (TPY)	Formaldehyde (TPY)	Naphthalene (TPY)	Polycyclic Organic Matter (TPY)
2011	Existing	14,384,650	3.14	158.38	20.89	86.75	61.64	4.37	0.342
2020 Interim Year	Build	14,759,990	2.21	108.88	14.53	19.05	44.13	3.44	0.322
	No-Build	14,905,098	2.42	119.72	15.79	19.52	48.21	3.76	0.330
	Difference (Build-No Build)	-145,108	-8.7%	-9.0%	-8.0%	-2.4%	-8.5%	-8.5%	-2.44%
	Difference (Build-Existing)	2.6%	-29.6%	-31.2%	-30.5%	-78.0%	-28.4%	-21.3%	-5.9%
2040 Design Year	Build	49,684,507	2.54	123.87	16.61	10.75	51.39	4.13	0.390
	No-Build	49,727,723	2.99	147.92	19.37	11.17	60.40	4.85	0.398
	Difference (Build-No Build)	-43,216	-15.0%	-16.3%	-14.3%	-3.8%	-14.9%	-14.9%	-2.0%
	Difference (Build-Existing)	71.1%	-19.1%	-21.8%	-20.5%	-87.7%	-16.6%	-5.5%	14.0%

More specifically, MSAT emissions for the Retained Build Alternatives are expected to decline between 2.4 percent and 9 percent during the 2020 interim year and between 2.0 percent and 16.3 percent during the 2040 design year when compared to the respective No-Build Alternative. The reduction in MSAT emissions is mainly attributed to the regional reduction in congestion associated with the Retained Build Alternatives, although a small percentage of VMT is expected to decrease due to the more efficient movement of vehicles from the Monitor Memorial Bridge-Tunnel (MMBT) to the HRBT. The HRBT alternatives are expected to attract traffic from the MMBT where the total traffic may increase with the widening of the HRBT; however, the individual trip lengths are expected to be shorter, thus possibly accounting for the slight decrease in VMT under the Retained Build Alternatives.

[19] *FHWA Web Conference on Project-Level Mobile Source Air Toxics (MSAT) Analysis* (August 20, 2008)

Therefore, with more efficient movement of vehicles, the Retained Build Alternatives are expected to improve congestion and vehicle speed which should result in lower MSAT emissions compared to the No-Build Alternative.

In addition, all MSAT emissions for both the Retained Build and No-Build Alternatives during the interim year are predicted to be lower than existing conditions. MSAT emissions for the interim build condition are expected to decrease between 5.9 percent and 78.0 percent compared to the existing conditions, even though a small increase in VMT is anticipated on the "affected network" which includes all roadway links that are expected to experience a change in VMT by 5% or more as a result of the Retained Build Alternatives. In addition, with the exception of POM, all MSAT emissions in the Build Alternative for the 2040 design year are expected to be lower than the existing condition even though the VMT on the "affected network" is expected to increase more than threefold. Other than for POM, MSAT emissions for the Build Alternative in the 2040 design year are expected to decrease between 5.5 percent and 87.7 percent compared to existing conditions. A small increase is predicted in POM emissions for the Build Alternative when compared to existing conditions, although this is mainly attributable to the growth in VMT on the "affected network" and is therefore not considered meaningful, especially when compared to regional emission levels. Of most significance is that the Retained Build Alternatives are expected to show reductions in all MSATs compared to the No-Build Alternative for all conditions in both the interim and design years.

Overall, the results of the MSAT analysis are consistent with the national MSAT emission trends predicted by MOBILE6.2 from 1999 to 2050 and indicate that no meaningful increases in MSATs have been identified and that the Retained Build Alternatives are not expected to cause an adverse effect on human health. Additional information on the methodology, input parameters, affected network, and MSATs and health effects are presented in the *Air Quality Analysis Technical Report*.

4.12.4 Conformity

In accordance with EPA's transportation conformity rule, ozone is addressed on a regional scale by Metropolitan Planning Organizations (MPO) and at the statewide level in the State Implementation Plan (SIP). Federal agencies may not approve any transportation project, program, or plan in a nonattainment area (where the concentration of a criteria pollutant exceeds the NAAQS) or maintenance area (formerly designated as nonattainment that now meets air quality standards) that does not conform with the approved SIP for air quality. For regions designated nonattainment or maintenance for ozone, MPOs conduct conformity analyses of their transportation plans and programs to ensure that they conform to the SIP for attainment and maintenance of the NAAQS for ozone.

The Hampton Roads region is designated by the EPA as in attainment of NAAQS for all criteria pollutants (carbon monoxide, lead, nitrogen dioxide, sulfur dioxide, particulate matter [PM_{10} and $PM_{2.5}$]) and the 2008 eight hour ozone standard. However, because of its previous designation as nonattainment for 1997 eight hour ozone standard, the region is subject to maintenance plan requirements and transportation conformity requirements. This Hampton Roads Bridge-Tunnel Study was included in the HRTPO FY 2012-2015 Transportation Improvement Program and the 2034 Long Range Transportation Plan for Preliminary Engineering only. Therefore, it was not included in the fiscally constrained regional emissions analysis. Once funding is identified through the Construction Phase cost estimates, the preferred Alternative can be added to the Long Range Transportation Plan to meet the fiscal constraint requirements and included in the regional transportation conformity analysis, consistent with the SIP.

4.12.5 Construction Emissions

The temporary air quality impacts from construction activities would not be expected to be significant. Construction activities would be performed in accordance with VDOT's current Road and Bridge

Specifications. The specifications conform to the State Implementation Plan (SIP) and require compliance with all applicable local, state, and federal regulations.

The study is located in an EPA designated maintenance area for ozone. The following VDEQ air pollution regulations would be adhered to during the construction: 9 VAC 5-130 et seq., Open Burning restrictions; 9 VAC 5-45, Article 7 et seq., Cutback Asphalt restrictions; and 9 VAC 5-50-60 et seq., Fugitive Dust precautions.

4.12.6 Mitigation

The study has been assessed for potential air quality impacts and conformity would all applicable air quality regulations and requirements and indicates that the alternatives meet all applicable conformity requirements. Additionally, the alternatives are not expected to cause or contribute to any new violation of any standard, increase the frequency or severity of any existing violation, or delay timely attainment of any standard.

4.13 NOISE ANALYSIS

The *Noise Analysis Technical Report* provides more details on noise and noise impact analyses, including details on modeling methods, computed sound levels, and tables of the existing and future traffic data. Construction noise provisions are also summarized in the technical report, as contained in Section 107.16(b)3 Noise of the 2007 VDOT Road and Bridge Specifications.

Impacts for the Build-8 Managed Alternative were not computed explicitly as part of the noise analysis; it was determined that the Build-8 Managed improvements would be very likely to generate noise levels in the surrounding community between those generated by the Build-8 and Build-10 Alternatives, for which findings are summarized herein.

4.13.1 Noise Model, Data, and Results

Noise Prediction Model. All traffic noise computations for this study were conducted using the latest version of the FHWA Traffic Noise Model (FHWA TNM 2.5).[20] The FHWA TNM incorporates state-of-the-art sound emissions and sound propagation algorithms, based on well-established theory or on accepted international standards. The acoustical algorithms contained within the FHWA TNM have been validated with respect to carefully conducted noise measurement programs, and show excellent agreement in most cases for sites with and without noise barriers.

Plans for the Retained Build Alternatives, topographic contours, and building information were used to create a three-dimensional model in the TNM of the geometry of the existing and future design roadway configurations and the surrounding terrain and buildings. The noise modeling also accounted for such factors as propagation over different types of ground (acoustically soft and hard ground), elevated roadway sections, significant shielding effects from local terrain and structures, distance from the road, traffic speed, and hourly traffic volumes including percentage of medium and heavy trucks. To fully characterize existing and future noise levels at all noise-sensitive land uses in the study area, hundreds of noise prediction receivers (also called “receptors” and “sites”) were added to the measurement sites in the TNM model.

[20]Anderson, G.S., C.S.Y. Lee, G.G. Fleming, and C.W. Menge, “FHWA Traffic Noise Model, Version 1.0 User’s Guide”. Federal Highway Administration Report No. FHWA-PD-96-009, January 1998.

As required by VDOT, validation of the noise modeling assumptions was conducted using the traffic counted on nearby roadways simultaneously with the noise measurement at each site as input to the noise prediction model. Computed noise levels based on the counted traffic were compared to the measured noise levels to confirm the assumptions about aspects of the TNM model, such as the acoustical shielding provided by intervening terrain and existing noise barriers. The modeling assumptions were refined as necessary to obtain appropriate agreement between the computed and measured values. The validated modeling assumptions at the measurement sites and for the existing geometry were then extended to the design-year alternatives and applied at prediction locations where no measurements were made. Computed noise levels at each of the 30 measurement sites using the counted traffic as input to the model were on average slightly higher by 0.2 decibels when compared to the measured noise levels. The excellent agreement between measured and modeled sound levels suggests confidence in the modeling assumptions, and confirms that traffic is the dominant source of noise at these sites.

Traffic Data for Noise Prediction. The traffic data used in the noise analysis must produce sound levels representative of the loudest (or "worst") hour of the day, per FHWA and VDOT policy. Hour-by-hour vehicle volumes, truck percentages, and speeds were developed. Hourly VDOT "ENTRADA" traffic data were provided for determining the loudest-hour conditions based on hourly volumes and speeds on the I-64 mainline segments. The AM peak period traffic volumes and speeds produced the loudest-hour noise levels for all segments of I-64 under all alternatives between I-664 and I-564, except for one segment in the No-Build Alternative. Therefore, the AM peak period traffic data were selected as most representative of the worst-hour conditions.

The *Noise Analysis Technical Report* provides tables of the existing and future traffic data used in the noise model for all roadways in the network.

Noise Level Results. The study area includes much residential and recreational land use adjacent to study area roadways. To fully characterize existing and future noise levels at all noise-sensitive land uses in the study area, approximately 1800 additional noise prediction receptors (also called "receivers" and "sites") were added in the TNM model to the measurement sites. Each of these receptors represented exterior noise-sensitive land use, including the balconies on all floors of multi-family housing. The receptors are located out to distances of approximately 500 feet from the edge of the existing roadways and ramps, and those set forth in the Retained Build Alternatives. Receptors are grouped into "Common Noise Environments" (CNEs) per current guidance from FHWA and VDOT. Each of these areas has similar sources of noise and similar land uses within it. For this report, the ranges of noise levels and the projected noise impact are summarized by Common Noise Environment.

All predicted noise levels were the A-weighted equivalent sound level, or Leq, in dBA. Worst-hour noise levels were predicted for the existing conditions and the design-year 2040 No-Build, Build-8 and Build-10 Alternatives. **Table 4-12** presents the range of predicted noise levels at the receptors within each of the CNEs for each of the alternatives evaluated. The table provides a description of location and land use of each CNE. The *Noise Analysis Technical Report* provides a figure showing the locations of the CNEs and tables that list the predicted sound levels at each of the individual receptors for each alternative.

Predicted noise levels range from 44 to 75 dBA Leq (exterior) for the existing conditions and from 45 to 76 dBA Leq (exterior) for the No-Build Alternative for all receivers. On average, sound levels are predicted to increase from existing to future no-build conditions by approximately one decibel. This is due to projected increases in traffic in the area in general.

Predicted sound levels at receptors under the Retained Build Alternatives are different from the future No-Build Alternative noise levels for a variety of reasons. First, some receptors represent properties that would be acquired under the Retained Build Alternatives. No sound levels are predicted and no

Table 4-12: Ranges of Predicted Worst-Hour Leq Noise Levels, dBA

CNE ID	Area Land Use and Description	Range of predicted Worst-hour Leq exterior noise levels, dBA			
		Existing	No-Build	Build 8	Build 10
Hampton					
1	Single-family residences on Pine Chapel Rd.	61 - 62	62 - 63	62 - 63	62 - 63
2	Bluebird Gap Farm Recreation Area	59 - 72	60 - 73	61 - 73	62 - 73
3	Residences along Waterside Drive and Green Hill Drive, Hampton Coliseum	60 - 69	61 - 70	61 - 69	61 - 70
4	Residences on W Queen Street SB side I-664	51 - 70	52 - 71	51 - 71	50 - 70
5	Single-family residences on Allison Sutton Dr.	56 - 63	57 - 64	57 - 63	56 - 61
6	Single-family residences along Red Robin Turn	60 - 67	61 - 67	62 - 68	63 - 70
7	Multi-family residences in Horizon Plaza	59 - 67	60 - 68	61 - 62	63 - 63
8	Single-family residences near I-64 WB off-ramp to N Armistead Avenue	57 - 66	58 - 67	62 - 68	62 - 67
9	Single-family residences near I-64 EB on-ramp from LaSalle Avenue, Perfecting Saints Church	60 - 67	61 - 68	63 - 68	63 - 68
10	Single-family residences between N Armistead Avenue and Rip Rap Road, south of I-64	61 - 73	62 - 74	64 - 74	65 - 73
11	Residences between Thomas Street and Spanish Trail, north of I-64	44 - 71	45 - 72	47 - 72	48 - 71
12	Single-family residences between Creek Avenue and River Street, north of I-64	55 - 64	56 - 65	62 - 72	63 - 72
13	Single-family residences between Eaton Street and E Pembroke Avenue, south of I-64	57 - 67	58 - 68	60 - 70	61 - 71
14	River Street Park	53 - 68	54 - 69	N/A	N/A
15	Single-family residences between E Pembroke Avenue and S Boxwood Street, east of I-64	61 - 67	62 - 68	62 - 67	62 - 66
16	Single-family residences between Brough Lane and S Boxwood Street, west of I-64	56 - 68	57 - 69	58 - 68	58 - 69
17	Woodlands Golf Course	60 - 68	60 - 69	62 - 68	63 - 69
18/19/23	Flemmie Kittrell Hall Benches and Hampton University Baseball Stadium	56 - 69	57 - 70	62 - 72	63 - 73
20	Hampton National Cemetery	58 - 75	59 - 75	61 - 72	62 - 72
21	Single-family residence buildings on Hampton University property, west of I-64	70 - 74	70 - 74	73 - 74	73 - 73
22	Single-family residences along Cameron Street	56 - 65	56 - 66	60 - 68	60 - 68
24	Commercial outdoor land use near I-64 WB on-ramp from Mallory Street	62 - 62	63 - 63	N/A	N/A
25	Single-family residences south of Mallory Street, east of I-64	51 - 66	52 - 67	58 - 73	59 - 71
25A	Marina and residences in Fort Monroe area	55 - 57	55 - 57	57 - 59	57 - 59
Norfolk					
25B	Fort Wool Historic Site park area	55 - 55	56 - 56	57 - 57	57 - 57
26	Beach area at west end of Willoughby Spit, north of I-64	65 - 70	66 - 70	65 - 67	65 - 67
26A	Willoughby Harbor Marina	58 - 68	58 - 68	N/A	N/A
27	Residences west of 15th View Street, north of I-64	58 - 70	59 - 70	59 - 70	59 - 70

Table 4-12: Ranges of Predicted Worst-Hour Leq Noise Levels, dBA

28	Residences between 15th View Street and 13th View Street, north of I-64	58 - 75	58 - 76	59 - 72	59 - 72
29	Residences on Willoughby Spit south of I-64	60 - 73	61 - 73	63 - 71	65 - 73
30	Residences between 13th View Street and the end of Little Bay Avenue, north of I-64	56 - 72	57 - 73	58 - 70	58 - 70
31	Captain's Quarters Nature Center and Park	64 - 69	65 - 70	64 - 67	65 - 67
32	Residences between the end of Little Bay Avenue and 4th View Street, north of I-64	56 - 65	57 - 66	57 - 69	57 - 69
33	Willoughby Elementary School	61 - 61	62 - 62	63 - 63	63 - 63
34	Commercial outdoor land use at Norfolk Visitor's Center	63 - 63	64 - 64	N/A	N/A
35	Residences at Willoughby Bay military housing complex	58 - 65	58 - 66	62 - 68	62 - 68
36	Baseball field at Ocean View Elementary School	52 - 58	53 - 58	55 - 61	55 - 62
37	Residences between W Government Avenue and Mace Arch, east of I-64	52 - 68	53 - 69	60 - 72	61 - 72
38	Residences from Orange Avenue to Ridgewell Avenue, west of I-64	59 - 73	59 - 73	61 - 72	62 - 72
39	Residences between 1st View Street and W Bay Avenue and First View Baptist Church, west of I-64	52 - 68	53 - 69	59 - 65	60 - 66
40	Residences from Mace Arch to along W Bay Avenue, east of I-64	53 - 70	53 - 71	56 - 68	57 - 68
41	Residences on W Bay Avenue EB, west of I-64	50 - 64	50 - 64	57 - 65	58 - 66
42	Residences from Commodore Drive to W Bayview Boulevard, west of I-64	52 - 66	53 - 67	64 - 75	64 - 74
43	Residences from W Chester Street to E Bayview Boulevard, east of I-64, First Church of God – Anderson	55 - 67	56 - 69	65 - 74	66 - 74
44	Residences from W Bayview Boulevard to the south end of Executive Drive, west of I-64	56 - 70	56 - 71	64 - 70	64 - 71
45	Residences from E Bayview Boulevard to the I-64 WB on-ramp from Granby Street, east of I-64	60 - 69	61 - 71	63 - 72	63 - 72
46	Military baseball fields along Patrol Road near on-ramp to I-64 EB, west of I-64	59 - 65	59 - 66	61 - 68	62 - 68
47	Forest Lawn Cemetery	60 - 68	61 - 70	62 - 71	63 - 72
48	Military baseball field along Patrol Road near I-564 interchange, west of I-64	60 - 66	60 - 66	62 - 68	63 - 68
49	Residences and Wesley United Baptist Church between W Glen Road & E Little Creek Road, east of I-64	60 - 71	61 - 72	63 - 69	64 - 69
50	Residences south of E Little Creek Rd, east of I-64	60 - 65	60 - 66	64 - 69	64 - 69

noise impact is assessed at these properties. Second, it is assumed that all of the existing noise barriers would be removed under the Retained Build Alternatives. As a result of the barrier removals and also the acquisition and elimination of some buildings adjacent to the study corridor in some areas, the existing noise shielding provided by the barriers and buildings would be reduced, and predicted noise levels from I-64 traffic would potentially increase at the remaining receptors without abatement. While VDOT policy is to replace existing noise barriers, the Retained Build Alternatives sound levels shown in T**able 4-12** reflect the future conditions without construction of replacement barriers. The replacement barriers are addressed in the Noise Abatement Measures section, below. A third primary reason that

sound levels are different under the Retained Build Alternatives relative to the No-Build Alternative is that traffic volumes would increase with the addition of through travel lanes. Finally, sound levels are predicted to decrease in some areas because new roadways are moving traffic farther from some locations, and because in some cases, the edges of the new roadways provide increased noise shielding relative to the existing roadways.

Table 4-12 shows that worst-hour Leq sound levels are predicted to range from 47 dBA to 75 dBA under the Build-8 Alternative and from 48 dBA to 74 dBA for the Build-10 Alternative. The receptors evaluated for the Retained Build Alternatives are the same as those for the No-Build Alternative, except that none of the properties that would be acquired under the Retained Build Alternatives are included in the noise evaluation for those alternatives. Within each CNE, the greatest increases in the highest predicted sound levels at receptors are generally due to reduced noise shielding associated with the removal of existing noise barriers and in some cases, buildings that provide some noise shielding. For example, in CNEs 12, 25, 37, 42, 43 and 50, the removal of both existing barriers and buildings would contribute to noticeably increased sound levels at some of the adjacent properties.

At some individual receptors, where loss of shielding from existing noise barriers and buildings would potentially be substantial, Retained Build Alternative predicted sound levels without abatement would be 10 dBA or more higher than the existing noise levels, resulting in noise impact due to a "substantial increase" in existing noise. However, as discussed in **Section 4.13.3**, VDOT is committed to replacing existing noise barriers, so substantial increases in noise due to the removal of existing walls would be mitigated.

In other areas under the Retained Build Alternatives, the highest predicted sound levels at noise-sensitive receptors are expected to potentially decrease by as much as four decibels. The decreases in some areas such as CNEs 26, 27 and 28 on Willoughby Spit are mostly because the roadway noise sources would be moved somewhat farther away from the nearby homes. In other areas such as CNEs 2, 7, 28 and 39, the highest predicted sound levels at noise-sensitive sites are lower because the properties closest to the roadway that are currently exposed to the highest noise levels would be acquired under implementation of the Retained Build Alternatives, so no noise levels are reported for them for those alternatives.

4.13.2 Noise Impact Assessment

The potential noise impact of the Retained Build Alternatives was assessed according to FHWA and VDOT noise assessment guidelines. In summary, noise impacts would occur under the Retained Build Alternatives wherever Design-year 2040 noise levels are predicted to approach within one decibel or exceed 67 dBA, Leq outdoors at noise-sensitive land uses in Activity Categories B (residential) and C (recreational) during the loudest hour of the day. For Category D (noise-sensitive institutional) land uses such as schools and church buildings, noise impact would occur where predicted interior noise levels due to the Retained Build Alternatives approach or exceed 52 dBA Leq during the loudest hour of the day. For Category E (commercial) land use, noise impact is assumed to occur where predicted exterior noise levels approach or exceed 72 dBA, Leq. Noise impacts also would occur wherever implementation of the Retained Build Alternatives would cause a substantial noise level increase over existing noise levels—VDOT considers an increase of 10 dB or more substantial. FHWA and VDOT policy also requires evaluations of undeveloped lands if they are considered "permitted," that is, when there is a definite commitment to develop land with an approved specific design of land use activities as evidenced by the issuance of at least one building permit. There is limited undeveloped land in this heavily-developed corridor. Potential noise impacts in permitted undeveloped land would be assessed as the information becomes available, and would be addressed in the Final EIS.

The figures in **Appendix A** show the locations of individual receptors where noise impacts would occur under the Build-8 and Build-10 Alternatives.

Table 4-13 presents a summary of projected noise impacts for the existing conditions and for the 2040 No-Build and Retained Build Alternatives. The impacts are summarized for the entire study area and separated by Activity Category and by type of impact. For each Activity Category, noise impact is first given as dwelling or recreational units that approach or exceed the NAC. This is the only type of impact that occurs for the No-Build Alternative. For the Retained Build Alternatives, NAC impact is listed first, followed by substantial increase impact, and followed by total noise impact. As the table indicates, substantial increase impact counts include those receptors where NAC impact is also projected and those where it is not. Therefore, the totals are not necessarily the sum of the two impact counts, since properties with both types of impact are not counted twice.

Table 4-13: Potential Noise Impact Summary

Land Use	Activity Cate-gory	Existing	No-Build	Build 8				Build 10			
		NAC*	NAC*/ Total	NAC* Only	Subst. Incr. Only	Both**	Total	NAC* Only	Subst. Incr. Only	Both**	Total
Residential	B	572	681	624	62	151	837	589	57	172	818
Recreational	C	105	136	182	0	0	182	199	0	0	199
Interior	D	0	0	0	0	0	0	0	0	0	0
Commercial	E	0	0	0	0	0	0	0	0	0	0
TOTAL	n/a	677	817	806	62	151	1019	788	57	172	1017

** NAC – Represents the number of units that would be impacted because noise levels are expected to approach within one decibel or exceed the Noise Abatement Criteria for that Activity Category.*
*** Both – Indicates the number of units where both NAC and Substantial Increase impact is predicted.*

Overall, residential impacts would be approximately four times higher than the numbers of impacted recreational units under all alternatives. Under existing conditions, total noise impact is 677 units, 572 of which are residential, whereas under the No-Build Alternative, 681 residential units and a total of 817 units would be impacted. The Build-8 Alternative would potentially have a total of 1019 impacted units, 837 of which would be residential. Of those, sound levels would potentially approach or exceed the NAC at 775 dwellings, and 213 dwellings would be exposed to substantial increases in existing noise levels. The Build-10 Alternative would potentially result in a total of 1017 impacted units, 818 of which would be residential. At 761 of those dwellings, sound levels would approach or exceed the NAC, and 229 would be exposed to substantial increases in existing noise levels.

Table 4-14 presents a listing of projected potential noise impacts by Common Noise Environment for each alternative. In this table, the impact totals are for residential and recreational units combined.

As described in more detail above, in some areas, potential increased noise levels predicted under the Retained Build Alternatives due to the removal of existing barriers and buildings would be offset by the greater distances the remaining noise-sensitive properties are from study area roadways, resulting in little change in projected impact between the No-Build and Retained Build Alternatives. In other areas, such reduced shielding results in a noticeable increase in projected impacts. As stated above, it is VDOT's policy to replace existing noise barriers with equivalent protection where barriers must be removed for the construction of a roadway project. However, the noise impact assessment does not include such replacement barriers; proposed barriers are discussed in the Noise Abatement section that follows.

Table 4-14: Potential Noise Impact by Common Noise Environment

CNE ID	Area Land Use and Description	Dwelling or Recreational Units Impacted by Noise			
		Existing	No-build	Build 8	Build 10
Hampton					
1	Single-family residences on Pine Chapel Rd.	0	0	0	0
2	Bluebird Gap Farm Recreation Area	18	18	19	20
3	Residences along Waterside Drive and Green Hill Drive, Hampton Coliseum	16	30	37	36
4	Residences on W Queen Street SB side I-664	6	7	5	3
5	Single-family residences on Allison Sutton Dr.	0	0	0	0
6	Single-family residences along Red Robin Turn	7	9	14	15
7	Multi-family residences in Horizon Plaza	8	8	0	0
8	Single-family residences near I-64 WB off-ramp to N Armistead Avenue	3	5	3	2
9	Single-family residences near I-64 EB on-ramp from LaSalle Avenue, Perfecting Saints Church	1	3	3	5
10	Single-family residences between N Armistead Avenue and Rip Rap Road, south of I-64	20	22	16	18
11	Residences between Thomas Street and Spanish Trail, north of I-64	19	24	59	64
12	Single-family residences between Creek Avenue and River Street, north of I-64	0	0	18	21
13	Single-family residences between Eaton Street and E Pembroke Avenue, south of I-64	10	15	22	29
14	River Street Park	3	3	0	0
15	Single-family residences between E Pembroke Avenue and S Boxwood Street, east of I-64	5	8	4	2
16	Single-family residences between Brough Lane and S Boxwood Street, west of I-64	7	11	13	17
17	Woodlands Golf Course	15	25	20	21
18/19/23	Flemmie Kittrell Hall Benches and Hampton University Baseball Stadium	5	5	7	8
20	Hampton National Cemetery	10	12	18	22
21	Single-family residence buildings on Hampton University property, west of I-64	4	4	2	1
22	Single-family residences along Cameron Street	0	2	4	6
24	Commercial outdoor land use near I-64 WB on-ramp from Mallory Street	0	0	0	0
25	Single-family residences south of Mallory Street, east of I-64	1	1	27	29
25A	Marina and residences in Fort Monroe area	0	0	0	0
Norfolk					
25B	Fort Wool Historic Site park area	0	0	0	0
26	Beach area at west end of Willoughby Spit, north of I-64	5	7	5	5
26A	Willoughby Harbor Marina	5	8	0	0
27	Residences west of 15th View Street, north of I-64	55	57	57	45

Table 4-14: Potential Noise Impact by Common Noise Environment

CNE ID	Area Land Use and Description	Dwelling or Recreational Units Impacted by Noise			
		Existing	No-build	Build 8	Build 10
28	Residences between 15th View Street and 13th View Street, north of I-64	121	122	97	69
29	Residences on Willoughby Spit south of I-64	45	46	23	23
30	Residences between 13th View Street and the end of Little Bay Avenue, north of I-64	121	150	88	75
31	Captain's Quarters Nature Center and Park	4	4	4	4
32	Residences between the end of Little Bay Avenue and 4th View Street, north of I-64	0	6	25	25
33	Willoughby Elementary School	0	0	0	0
34	Commercial outdoor land use at Norfolk Visitor's Center	0	0	0	0
35	Residences at Willoughby Bay military housing complex	0	6	6	6
36	Baseball field at Ocean View Elementary School	0	0	0	0
37	Residences between W Government Avenue and Mace Arch, east of I-64	14	15	81	91
38	Residences from Orange Avenue to Ridgewell Avenue, west of I-64	34	38	35	31
39	Residences between 1st View Street and W Bay Avenue and First View Baptist Church, west of I-64	24	34	0	4
40	Residences from Mace Arch to along W Bay Avenue, east of I-64	4	5	3	6
41	Residences on W Bay Avenue EB, west of I-64	0	0	0	4
42	Residences from Commodore Drive to W Bayview Boulevard, west of I-64	3	3	69	67
43	Residences from W Chester Street to E Bayview Boulevard, east of I-64, First Church of God – Anderson	4	5	50	48
44	Residences from W Bayview Boulevard to the south end of Executive Drive, west of I-64	28	28	24	25
45	Residences from E Bayview Boulevard to the I-64 WB on-ramp from Granby Street, east of I-64	13	13	8	8
46	Military baseball fields along Patrol Road near on-ramp to I-64 EB, west of I-64	0	1	7	7
47	Forest Lawn Cemetery	35	45	92	100
48	Military baseball field along Patrol Road near I-564 interchange, west of I-64	1	3	7	9
49	Residences and Wesley United Baptist Church between W Glen Road & E Little Creek Road, east of I-64	3	4	5	4
50	Residences south of E Little Creek Rd, east of I-64	0	5	42	42
Hampton Totals		**158**	**212**	**291**	**319**
Norfolk Totals		**519**	**605**	**728**	**698**
Grand TOTAL		**677**	**817**	**1019**	**1017**

Reduced noise impact from the Retained Build Alternatives would be projected for the Willoughby Spit area (CNEs 26 through 30) primarily because roadways would be located farther from the residential areas than under the No-Build and existing conditions.

4.13.3 Noise Abatement Measures

In general, noise abatement measures can include alternative measures (traffic management, the alteration of horizontal and vertical alignment, and low-noise pavement) in addition to the construction of noise barriers.

Section 6.2.6 of VDOT policy states that when an existing noise barrier is physically impacted and/or relocated as part of a highway widening or major reconstruction project, the same level of protection must be provided, without consideration of cost. Further, if additional noise impacts are associated with the Retained Build Alternatives, additional noise barrier height or length would be subject to VDOT's cost-reasonableness criteria.

Alternative Noise Abatement Measures. Traffic management measures normally considered for noise abatement include reduced speeds and truck restrictions. Reduced speeds would not be an effective noise mitigation measure since a substantial decrease in speed is necessary to provide a significant noise reduction. A 10-mph reduction in speed would result in only a two decibel decrease in noise level. Restricting truck usage on I-64 is not practical, as truck traffic is a primary function of this Interstate highway, and diversion of truck traffic to other roadways would increase noise levels in those areas. The alteration of the horizontal or vertical alignment of I-64 would not be practical because the roadway already exists, and also, the road would have to be shifted significantly to make the measure effective. Such shifts would require right-of-way acquisitions and would likely create new noise impact.

Additionally, the Noise Policy Code of Virginia (HB 2577, as amended by HB 2025) "[r]equires that whenever the Commonwealth Transportation Board or the Department plan for or undertake any highway construction or improvement project and such project includes or may include the requirement for the mitigation of traffic noise impacts, first consideration should be given to the use of noise reducing design and low noise pavement materials and techniques in lieu of construction of noise walls or sound barriers. Vegetative screening, such as the planting of appropriate conifers, in such a design would be utilized to act as a visual screen if visual screening is required." Consideration would be given to these measures during the final design stage as necessary.

Noise Barriers. The only remaining abatement measure investigated was the construction of noise barriers. The feasibility of noise barriers was evaluated in locations where noise impact would occur under the Retained Build Alternatives, and where no barrier existed previously. Where the construction of noise barriers was found to be physically practical, barrier noise reduction was estimated based on roadway, barrier, and receiver geometry as described below.

To be constructed, noise barriers identified in this document in areas without existing barriers must satisfy final feasibility and cost reasonableness criteria. Therefore, the noise barrier design parameters and cost identified in this document are preliminary. Final design parameters, feasibility, and cost reasonableness cannot be determined, as the noise barrier cost estimate must be based upon an approved road design alignment and include all required materials and installation costs. If a Retained Build Alternative is preferred, and a noise barrier is determined to be feasible and reasonable, the impacted public would be given an opportunity to decide whether they are in favor of construction of the noise barrier.

Feasibility and Reasonableness. FHWA and VDOT require that noise barriers be both "feasible" and "reasonable" to be recommended for construction.

To be feasible, a barrier must be effective, i.e., it must reduce noise levels at noise sensitive locations by at least five decibels, thereby "benefiting" the property. VDOT requires that at least fifty percent (50%) of the impacted receptors receive five decibels or more of insertion loss from the proposed barrier for it to be feasible.

A second feasibility criterion is that it must be possible to design and construct the barrier. Factors that enter into constructability include safety, barrier height, topography, drainage, utilities, maintenance of the barrier, and access to adjacent properties. VDOT has a maximum allowable height of 30 feet for noise barriers.

Barrier reasonableness is based on three factors: cost-effectiveness, ability to achieve VDOT's insertion loss design goal, and views of the benefited receptors. To be "cost-effective," a barrier cannot require more than 1,600 square feet per benefited receptor (SF/BR). VDOT's maximum barrier height of 30 feet figures into the assessment of benefited receptors. Where multi-family housing includes balconies at elevations above that of a 30-ft high barrier, or terrain lifts ground-based receptors above the elevation of a 30-ft barrier, these receptors would not be assessed for barrier benefits and are thereby are not included in the computation of the barrier's reasonableness.

The second reasonableness criterion is VDOT's noise reduction design goal of seven decibels. This goal must be achieved for at least one of the impacted receptors for the barrier to be considered reasonable.

The third reasonableness criterion relates to the views of the owners and residents of potentially benefited properties. A majority of benefited receptors must favor the barrier for it to be considered reasonable. Community views are surveyed in the final design phase of projects.

Details of Replacement and Potential Barriers. Details of each of the evaluated barriers are given in **Table 4-15**. The table includes both "Replacement" barriers that would be constructed where existing barriers would be removed, and "Potential" barriers that would be warranted and were evaluated for feasibility and reasonableness. The table and narratives describe the barrier type, the CNE in which they would be located, the Retained Build Alternative to which they apply, the range of noise reduction they would provide, the length, height, surface area and estimated cost at $37 per square foot, the number of dwelling units and recreational receptor units that would benefit from five decibels of noise reduction from the barrier, and the resulting square footage of barrier per benefited receptor (SF/BR). As long as seven decibels of noise reduction can be achieved at one impacted receptor, which is usually achievable, the SF/BR is the primary determining factor in whether barriers would be reasonable (cost-effective). If barriers could not be developed that were both feasible and reasonable, the best attempt at developing a reasonable barrier is shown in the table, and the SF/BR value that resulted is given. For Replacement barriers, the table shows "Net" square footage and SF/BR in addition to "Total" values for the barrier. The Net values subtract the square footage of the existing barrier, and are used for the cost-reasonableness determination of the Replacement barrier. The locations of the Replacement and Potential barriers along the roadway are generally opposite the CNEs. In addition, the *Noise Analysis Technical Report* provides plan graphics showing the locations of the Existing, Replacement, and Potential barriers. In the analysis and modeling, barriers were placed adjacent to the existing and/or proposed study area roadways, both mainline and ramps, as appropriate. All barriers were assumed to be located on VDOT right of way.

The barrier analysis for this Draft EIS examined two potential barrier heights – 15 feet and 30 feet (VDOT's maximum barrier height). This processing does not allow for fine-tuning of the SF/BR value with a variety of barrier heights, which would be carried out in a noise abatement final design analysis. As a result, this analysis gives initial impressions of the potential cost-effectiveness of barriers for each CNE, but should not be construed as definitive findings about the eventual reasonableness of any of the noise barriers evaluated. All noise-sensitive areas adjacent to the study corridor would be reevaluated

for noise abatement in a much more detailed manner during the design phase if a Retained Build Alternative is preferred. The barrier analysis was largely conducted separately for each CNE, unless the receptors in two adjacent CNEs clearly needed to be combined for a barrier evaluation.

Table 4-15: Replacement and Potential Noise Barriers

Barrier No. & Type (R / P)*	CNE	Build Alt.	Barrier Data					Benefited Dwellings & Recreational Receptors Total (Impacted)	Surface Area of Barrier per Benefited Receptor (SF/BR)*
			Noise Reduction Range (dBA)	Length (ft)	Height Range (ft)	Surface Area* (sq ft)	Estimated Cost at $37/sq ft		
Hampton									
1P	1,2	8	5-12	1,914	15	28,704	$1,062,048	37 (19)	776
		10	5-12	1,916	15	28,741	$1,063,417	35 (20)	821
2P	3	8	5-7	2,545	15-30	39,982	$1,479,334	50 (36)	800
		10	5-7	2,545	15-30	39,982	$1,479,334	43 (36)	930
3P	4	8	5-10	1,709	15-30	31,429	$1,162,873	72 (5)	437
		10	5-10	1,709	15-30	31,429	$1,162,873	72 (3)	437
4P	6	8	5-7	1,931	15	28,970	$1,071,890	17 (14)	1,701*
		10	5-7	1,694	15	25,406	$940,022	16 (15)	1588
5R/P	8	8	5-8	1,788	15	26,839 T 17,136 N	$993,043	25 (3)	1,074 T 685 N
		10	5-10	2,116	15-30	34,547 T 24,844 N	$1,278,239	24 (2)	1,439 T 1,035 N
6P	9,10	8	5-11	2,747	15	41,198	$1,524,326	32 (18)	1,287
		10	5-12	2,837	15	42,550	$1,574,350	32 (23)	1,330
7R	11	8	5-12	3,563	15	53,514 T 43,811 N	$1,980,018	104 (54)	515 T 421 N
		10	5-12	3,564	15	53,530 T 43,827 N	$1,980,610	101 (58)	530 T 434 N
8R	12	8	6-12	2,259	15	33,918 T 13,887 N	$1,254,966	41 (18)	827 T 339 N
		10	7-12	2,448	15	36,735 T 16,704 N	$1,359,195	36 (21)	1,020 T 464 N
9P	13	8	6-11	3,004	15	45,058	$1,667,146	48 (22)	939
		10	6-12	2,999	15	45,005	$1,665,185	47 (29)	958
10P	15,17	8	5-9	4,941	15	74,059	$2,740,183	69 (22)	1,073
		10	5-10	4,708	15	70,595	$2,612,015	66 (21)	1,070
11P	16	8	5-10	1,980	15	29,684	$1,098,308	38 (13)	781
		10	5-10	1,977	15	29,682	$1,098,234	44 (17)	675
12P	19	8	5-9	1,174	15	17,606	$651,422	8 (7)	2,201*
		10	5-9	1,174	15	17,606	$651,422	8 (8)	2,201*
13P	20	8	5-11	1,837	15	27,546	$1,019,202	36 (22)	765
		10	5-11	1,837	15	27,546	$1,019,202	36 (22)	765
14P	21	8	10-12	785	15	11,766	$435,342	2 (2)	5,883*
		10	10	785	15	11,766	$435,342	1 (1)	11,766*
15P	22	8	5-11	2,128	15	31,896	$1,180,152	26 (4)	1,227
		10	5-11	2,128	15	31,896	$1,180,152	26 (4)	1,227

Table 4-15: Replacement and Potential Noise Barriers

Barrier No. & Type (R / P)*	CNE	Build Alt.	Barrier Data					Benefited Dwellings & Recreational Receptors Total (Impacted)	Surface Area of Barrier per Benefited Receptor (SF/BR)*
			Noise Reduction Range (dBA)	Length (ft)	Height Range (ft)	Surface Area* (sq ft)	Estimated Cost at $37/sq ft		
16R/P	25	8	5-14	3,550	15	53,267 T 35,268 N	$1,970,879	56 (25)	951 T 630 N
		10	5-12	3,499	15	52,482 T 34,483 N	$1,941,834	57 (29)	921 T 605 N
Norfolk									
17P	26,27	8	5-13	4,636	15	69,516	$2,572,092	108 (58)	644
		10	6-12	4,454	15	66,786	$2,471,082	112 (50)	596
18P	28	8	5-12	1,871	15	28,055	$1,038,035	188 (97)	149
		10	5-12	1,870	15	28,043	$1,037,591	161 (69)	174
19P	29	8	6-10	1,809	15	27,117	$1,003,329	23 (23)	1,179
		10	6-12	1,626	15	24,344	$900,728	24 (23)	1,014
20P	30,31	8	6-12	4,518	15	67,762	$2,507,194	261 (92)	260
		10	7-13	4,336	15	65,025	$2,405,925	246 (79)	264
21P	32	8	6-11	3,336	15	50,029	$1,851,073	154 (25)	325
		10	6-11	3,339	15	50,073	$1,852,701	154 (25)	325
22P	35,38	8	7-11	3,431	15	51,491	$1,905,167	93 (41)	592
		10	5-11	3,429	15	51,452	$1,903,724	80 (37)	643
23R	37	8	5-11	5,340	15	80,116 T 28,835 N	$2,946,292	125 (81)	641 T 231 N
		10	5-10	5,338	15	80,053 T 28,772 N	$2,961,961	123 (91)	651 T 234 N
24P	40	8	8-11	1,264	15	18,965	$701,705	64 (3)	296
		10	8-10	1,137	15	17,061	$631,257	64 (6)	267
25R	42,44	8	5-11	4,914	15-22	96,265 T 23,832 N	$3,561,805	107 (93)	900 T 223 N
		10	5-11	4,914	15-22	96,265 T 23,832 N	$3,561,805	104 (92)	926 T 229 N
26R	43	8	5-12	3,357	15-22	66,583 T 15,501 N	$2,463,571	38 (38)	1,752 T 408 N
		10	5-11	3,173	15-22	63,837 T 12,755 N	$2,361,969	28 (28)	2,280 T 456 N
27P	46	8 & 10	6-8	1,808	15	27,121	$1,003,477	25 (7)	1,085
28R/P	47,49, 50	8	5-9	7,908	15-25	126,072 T 98,881 N	$4,664,664	106 (139)	1,189 T 933 N
		10	5-7	7,998	15-25	134,800 T 107,609 N	$4,987,600	74 (138)	1,822 T* 1,454 N*
29P	48	8	5-10	3,314	15	49,716	$1,839,492	18 (7)	2,762*
		10	5-7	3,315	15	49,715	$1,839,455	5 (5)	9,943*

** Notes: Barrier type R is Replacement, type P is Potential.*
Replacement barriers show T = Total surface area and SF/BR, and N = Net surface area and SF/BR, which excludes the existing barrier surface area.
Where Net SF/BR exceeds VDOT's maximum of 1600, a barrier would not be considered cost-reasonable.
Barrier 28R/P for Build 10 technically not feasible because fewer than 50% of impacted receptors not benefited. Further refinement during design would likely make this barrier feasible.

In summary, up to approximately 15 miles of replacement and warranted barriers would be potentially feasible and reasonable under the Build-8 Alternative, which would benefit up to about 980 impacted receptors, and 1925 receptors in total. This length of replacement and warranted barriers is also approximately 15 miles with the Build-10 Alternative; those barriers would benefit up to about 975 impacted receptors and a total of 1830 receptors. Total barrier construction costs for these barriers are estimated to be in the range of $40 million to $50 million.

4.14 HAZARDOUS MATERIALS

The No-Build Alternative would have no impact to any hazardous material sites. **Table 4-16** shows that the Retained Build Alternatives would potentially impact the same number and types of hazardous materials sites within their respective LODs. The estimated number of facilities is based on the number of parcels within the LODs of the Retained Build Alternatives that may contain hazardous materials or wastes. Because only part of any of these parcels may lie within the LODs, the hazardous materials on these parcels may lay outside of the LODs. In such cases, no hazardous materials impacts would occur, and hence this analysis of impacts represents a worst-case situation. Additional information is presented in the *Hazardous Materials Technical Memorandum*.

Table 4-16: Hazardous Materials Sites within the Retained Build Alternatives

Facility Type	Build-8 Alternative	Build-8 Managed Alternative	Build-10 Alternative
Brownfields	1	1	1
Petroleum Registered Facility	14	14	14
Petroleum Release Site	3	3	3
SQG and CESQG	3	3	3
TOTAL Parcels	**21**	**21**	**21**

Sources: VDOT GIS database; field reviews, September, 2011.
Note: SQG=Small Quantity Generator of Hazardous Waste. CESQG= Conditionally-Exempt SQG.

As stated in **Chapter 3** of this Draft EIS, the total number of sites by type is greater than the number of facilities/parcels potentially impacted because some of the facilities have two types of attributes, e.g., they are both hazardous waste generators and house ASTs/USTs.

Prior to the acquisition of right-of-way and construction, thorough site investigations would be conducted to determine whether any of the sites are actually contaminated, and, if so, the nature and extent of that contamination would be assessed. Any additional hazardous material sites discovered during construction of a Retained Build Alternative or demolition of existing structures would be removed and disposed of in compliance with all applicable federal, state, and local regulations. All necessary remediation would be conducted in compliance with applicable federal, state, and local environmental laws and would be coordinated with the EPA, DEQ, and other federal or state agencies as necessary.

4.15 VISUAL IMPACTS

The visual impact of each alternative is determined by assessing the visual resource change due to that alternative and predicting viewer response to that change. Visual resource change is the total change in visual character and visual quality. The first step in determining visual resource change is to assess the compatibility of the proposed study with the existing visual character of the landscape. The second step is to compare the visual quality of the existing resources with the projected visual quality after the implementation of each Retained Build Alternative. Viewer response to the changes is the sum of viewer exposure and viewer sensitivity to the Retained Build Alternatives. The resulting level of visual impact is determined by combining the severity of resource change with the degree to which people are

likely to oppose the change. Additional information on the visual analysis is presented in the *Visual Resources Technical Memorandum*.

The No-Build Alternative would maintain existing visual character along the I-64 corridor. Since this alternative does not address congestion issues along I-64, it would result in an increase in views of traffic by motorists and nearby residences and businesses. This alternative would not result in any temporary construction impacts to visual and aesthetic resources.

The visual assessment units (see **Figure 4-3**) and visual changes associated with the Retained Build Alternatives are detailed below. Although the Build-8 Managed Alternative has the same number of travel lanes as the Build-8 Alternative, the impacts would be slightly greater due to an approximately 4-foot wide increase in roadway width and the potential addition of vertical structures. The Build-10 Alternative would have a slightly greater impact than the Build-8 Alternative due to the additional travel lanes proposed.

Visual Assessment Unit 1: I-664 southeast through South Willard Avenue. The Retained Build Alternative would entail the widening of the I-64 mainline, displacing buildings and potentially resulting in the placement or replacement of sound barriers throughout the unit. This could result in a more direct view of I-64 or of the associated sound barriers from nearby residences, businesses, or parks and community facilities. The views for motorists within the area would change as a result of an increased amount of roadway pavement and potentially the location of sound barriers. Though the Retained Build Alternatives would alter the landscape, the resulting overall landscape would remain in character with the existing visual environment of Visual Assessment Unit 1, which already features the existing I-64 and some associated sound barriers. Due to the existing developed viewshed, overall visual impacts from the Retained Build Alternatives are considered minor for each viewer type within this unit.

Visual Assessment Unit 2: South Willard Avenue (north end of bridge) through eastbound tunnel entrance. The Retained Build Alternative entails the construction of the proposed bridge approximately 200 feet west of the existing I-64 bridge, the potential expansion of the existing HRBT north portal island, and a potential noise barrier along the east side of I-64 near Willard Avenue. The Retained Build Alternatives could impact views from Fort Monroe and result in a more direct view of I-64 or of the associated sound barrier and a potential increase of land visibility over the water due to the expansion of the portal island. The views for motorists within the area would change as a result of an increased amount of roadway pavement and potentially the location of sound barriers. Though the Retained Build Alternatives would alter the landscape, the resulting overall landscape would still remain in character with the existing visual environment of Visual Assessment Unit 2, which already features the existing I-64, the HRBT north approach bridge, and north tunnel portal island. Since the bridge could be seen as encroaching upon a more natural viewshed, visual impacts from the Retained Build Alternatives are considered moderate for each viewer type within this unit.

Visual Assessment Unit 3: Existing Tunnel. The Retained Build Alternative would entail the construction of the proposed submerged tunnel and the expansion of the existing HRBT south portal island. The Retained Build Alternatives would impact views from Fort Wool and result in a more direct view of I-64 or of the potential increase in land associated with the south portal island that is visible over the water. The views for motorists within the area would change slightly, with the Retained Build Alternatives increasing the amount of surrounding pavement and lanes visible within the eastbound tunnel. Though the Retained Build Alternatives would alter the landscape, the resulting overall landscape would still remain in character with the existing visual environment of Visual Assessment Unit 3, which already features the existing I-64 and associated tunnel and portal island. Since the only over-water construction within this unit would be the potential expansion of the south portal island, visual impacts from the Retained Build Alternatives are considered minor for each viewer type within this unit.

Visual Assessment Unit 4: Westbound tunnel entrance through 4th View Street interchange. The Retained Build Alternative would entail construction of the proposed south approach bridge approximately 200 feet to the west of the existing I-64 bridge, and the widening of the I-64 mainline within the unit. This expansion would displace buildings and potentially result in the placement of sound barriers through the Willoughby Spit area, resulting in a more direct view of I-64 or of associated sound barriers from nearby residences, businesses, or parks and community facilities. The views for motorists within the area would change slightly, with the Retained Build Alternatives increasing the amount of surrounding pavement and potentially the number of sound barriers. Though the Retained Build Alternatives would alter the landscape, the resulting overall landscape would remain in character with the existing visual environment of Visual Assessment Unit 4, which already features the existing I-64 and the HRBT south approach bridge. Since the bridge could be seen as encroaching upon a more natural viewshed, overall visual impacts of the Retained Build Alternatives are considered moderate for each viewer type within this unit.

Visual Assessment Unit 5: 4th View Street interchange south to I-564/I-64 interchange. The Retained Build Alternative would entail the widening of the I-64 mainline, displacing buildings and potentially resulting in the placement or replacement of sound barriers throughout the unit. This may result in a more direct view of I-64 or of associated sound barriers from nearby residences, businesses, or parks and community facilities. The views for motorists within the area would change slightly, with the Retained Build Alternatives increasing the amount of surrounding pavement and potentially the number and location of sound barriers. Though the Retained Build Alternatives would alter the landscape, the resulting overall landscape would remain in character with the existing visual environment of Visual Assessment Unit 5, which already features the existing I-64 and associated sound barriers. Due to the existing developed viewshed, visual impacts of the Retained Build Alternatives are considered minor for each viewer type within this unit.

Since additional lanes would be added adjacent to the existing interstate facility and the surrounding area is urban in nature, the visual impact of the Retained Build Alternatives ranges from minor to moderate. As mentioned previously, the Build-8 Managed and Build-10 Alternatives would have a slightly greater visual impact than the Build-8 Alternative, but they would generally be in character with the existing visual environment. Temporary visual impacts, such as visibility of disturbed soil, construction materials, barges, and equipment, would also occur during construction with any Retained Build Alternative. Mitigation measures to lessen the visual impact of improvements would be considered as appropriate. Vegetation removal would be minimized and additional landscaping may be incorporated. Aesthetic treatments would be considered for proposed noise walls determined necessary along the interstate.

4.16 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Energy use for transportation projects is related to the amount of fuel used, both for vehicular operation and construction activities. Energy from vehicular operation is a function of traffic volume, speed, distance traveled, and vehicle and fuel type. Energy consumed during construction is a function of the scale of the transportation infrastructure being constructed.

A qualitative assessment of the study's impacts on energy resources was performed involving a comparison of the No-Build Alternative to the Retained Build Alternatives. This was based on vehicle miles traveled and congestion experienced as indicated by LOS (operational energy), and the relative construction scale for each Retained Alternative (construction energy).


N
Hampton
Unit 1
Unit 2
Unit 3
Unit 4
Unit 5
Chesapeake Bay
Fort Monroe
Hampton Roads
Willoughby Bay
Naval Station Norfolk
Naval Support Activity Hampton Roads
Craney Island US Army Corps of Engineers
Elizabeth River
Portsmouth
Norfolk
169
278
152
134
351
64
415
143
664
60
258
564
337
406
165
460
194
170
168
247
Legend
Study Area
Visual Assessment Units
Department of Defense Facility
0
0.5
1
2
Miles
Visual Assessment Units
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure 4-3

4.16.1 Operational Energy

As described in **Chapter 1**, the I-64 Hampton Roads Bridge-Tunnel crossing experiences high traffic volumes during peak commuting hours and during seasons of high tourism-related travel. Under the No-Build Alternative, these high volumes would continue; annual vehicles miles traveled would be approximately 481 million. LOS E and F would also prevail throughout the study area. Nine out of 16 mainline sections would operate at an LOS E or worse during the AM peak hour and six would be LOS E or worse during the PM peak hour. During peak travel periods, drivers would be expected to spend a significant amount of time idling or at significantly reduced speeds, which would result in additional fuel burned and increased emissions during vehicular trips. Additionally, due to the constraints of the tunnel and bridge approaches, accidents and disabled vehicles would continue to cause major delays. The Monitor-Merrimac Bridge-Tunnel would continue to provide an alternate but less direct route to many destinations, therefore, use of this alternate route would result in additional vehicle miles traveled and additional fuel consumption. Operational energy consumption for the No-Build-Alternative would therefore be relatively high compared to the Retained Build Alternatives.

In design year 2040, vehicle miles traveled would be approximately 673 million for the Build-8 Alternative, 463-638 million for the Build-8 Managed Alternative, and 712 million for the Build-10 Alternative. VMT for the Build-8 Managed Alternative would be related to whether a toll scenario is implemented. Nevertheless, as described in **Section 2.4**, the LOS for all Retained Build Alternatives would improve compared to the No-Build Alternative. Each Retained Build Alternative would have an average of LOS D or better throughout the corridor, including LOS C or better on 50 percent of the mainline segments. The consistent number of travel lanes through the corridor and improved geometric conditions would reduce delays and allow for higher travel speeds. Therefore, operational energy used by the Retained Build Alternatives would overall be less than the No-Build Alternative.

Vehicular energy consumption is expected to be mitigated by improvements to the region's vehicle fleet. Over time, older and less fuel-efficient vehicles are expected to be replaced with more fuel-efficient vehicles, including hybrid and electric vehicles.

4.16.2 Construction Energy

The No-Build Alternative would result in no energy expended associated with adding capacity to the HRBT corridor. However, there would be energy consumption for maintenance of the existing roadway, tunnels, and bridges. This energy consumption would be minimal compared to construction energy consumed by the Retained Build Alternatives.

Under the Retained Build Alternatives, construction energy would be expended to build the expanded mainline, approach bridges, tunnel, and interchanges. Accurate construction energy costs cannot be determined given the uncertainty of field variables at this point in the study. However, construction energy factors include the amount of energy to extract raw materials, manufacture and fabricate construction materials, transport materials to the study area, and complete construction. In addition, temporary vehicle delays could be experienced resulting in additional energy usage and fuel consumption. Additional energy usage also would be incurred due to maintenance of the expanded facilities. The construction energy used for the Retained Build Alternatives would therefore be greater than construction energy usage for the No-Build Alternative. The Build-8 and Build-8 Managed Alternatives would require slightly less energy than the Build-10 Alternative due to the smaller scale of these alternatives. No long-term impacts would be anticipated to result from construction-related energy use.

4.16.3 Summary

Compared to the No-Build Alternative, the energy consumption from construction and maintenance of the Retained Build Alternatives would be offset by reduction in vehicle congestion. Each Retained Build Alternative would result in more vehicle miles traveled, but additional travel lanes and improvements to geometric deficiencies would reduce delays that lead to additional energy usage and fuel consumption.

4.17 INDIRECT EFFECTS

Indirect effects are defined as those effects "which are caused by an action and are later in time or farther removed in distance [than direct effects], but are still reasonably foreseeable" (40 CFR 1508.8(b)). These effects may include growth induced effects or other effects on the natural, social, or physical environments due to changes in land use or population growth. Indirect effects may also occur if the action changes the extent, pace, and/or location of development and if this change affects environmental resources. These effects may include growth induced effects or other effects on the natural, social, or physical environments due to changes in land use or population growth. In the case of this study, growth induced effects within the study area are controlled by the cities of Hampton and Norfolk through zoning regulations and land use plans. Additional information on indirect effects is available in the *Indirect and Cumulative Effects Technical Memorandum*.

A review of development patterns within the study area and vicinity was used as a foundation upon which to conduct an assessment of the study's potential indirect. The development pattern was analyzed to determine the potential indirect effects to each environmental resource that would potentially be directly affected by implementation of the Retained Build Alternatives. The boundary developed for the study extends approximately one mile in each direction from the I-64 corridor.

4.17.1 Land Use

Indirect effects often hinge on induced development leading to land use changes. The No-Build Alternative does not convert any land to a different land use. One long-term indirect effect of the No-Build on land use is the projected continued increase in congestion. Intensified congestion, particularly along the HRBT itself, could influence commuters to move closer to places of employment. Any shifts in population, however, are not expected to convert existing land uses to other uses.

Implementation of the Retained Build Alternatives would occur in an area where medium and high density development already exist and are anticipated to continue. Any developable land that may exist in the study area already has access to the existing transportation system and, as such, can presently be developed consistent with existing land use plans. Limited future changes in land uses and infill development are planned in the cities and are expected to occur regardless of whether any of the Retained Build Alternatives are constructed. Because I-64 already traverses the study area, the Retained Build Alternatives would not provide new access to developable lands in the study area, be a catalyst for inducing development, or introduce a substantial change to local or regional travel patterns. Also, construction of one of the Retained Build Alternatives is not expected to either encourage or accelerate any changes in land use that are not already planned by either city. As a result, indirect effects from the Retained Build Alternatives would be minor.

4.17.2 Parks and Recreational Facilities

No indirect effects on parklands are anticipated with the No-Build Alternative. Implementation of the Retained Build Alternatives would not be expected to induce conversion of parklands. However, there could be a change in patronage to facilities in the area due to the elimination or reduction of park lands. For example, both River Street Park and Willoughby Boat Ramp currently offer dedicated public access to the water for residents of Hampton and Norfolk, respectively, and would be directly impacted by the

Retained Build Alternatives. Similar facilities such as Sunset Creek Boat Ramp (Hampton), Ridgeway Park (Hampton), and Haven Creek Boat Ramp (Norfolk) would serve patrons who now use River Street Park and Willoughby Boat Ramp. The resulting potential increase in patronage would be an indirect effect of the Retained Build Alternatives. The increased usage of other facilities, however, is anticipated to be minimal.

4.17.3 Economics

The No-Build Alternative could have potential indirect effects on the economy of the individual cities and the region. Under the no-build condition, traffic volumes are anticipated to increase by 2040. Associated travel time delay and congestion both affect commuters, freight, tourists, and local daily travel. In the long-term, businesses could decide to relocate to avoid the congestion at the HRBT, both for their employees and for freight movement. In addition, some businesses may avoid locating in the area due to the travel time delays and congestion. Intensified congestion, particularly at the HRBT itself, also could also influence commuters to move closer to places of employment or change their employment to closer locations, thereby resulting in changes to regional economic patterns. The likelihood of this indirect effect, however, is anticipated to be minimal.

With implementation of the Retained Build Alternatives, more reliable travel times and less congestion would improve travel for commuters, freight, and tourists, thus providing indirect effects that are beneficial to the local and regional economy. These benefits could include an increase in patronage to the area, potentially resulting in an increase in or demand for additional commercial and residential development in the area. Since this also is supported by city planning documents, this indirect effect would be anticipated to have an overall minor effect on economic conditions.

4.17.4 Water Quality

No indirect effects on water quality are anticipated with the No-Build Alternative. The potential indirect effects of the Retained Build Alternatives on water quality could include downstream effects of runoff into study area waterways and groundwater. These impacts would be minimized by incorporating appropriate erosion and sediment control measures and stormwater best management practices during design and construction, thereby removing pollutants from runoff before it is discharged into receiving bodies of water such as the Hampton River, Hampton Roads, or Mason Creek.

4.17.5 Wildlife and Habitat

No indirect effects to wildlife and habitat are anticipated under the No-Build Alternative. Indirect impacts of the Retained Build Alternatives potentially would be comprised of degradation of aquatic habitat downstream of the study area, resulting from runoff into study area waterways. These impacts would be minimized by incorporating appropriate erosion and sediment control measures and stormwater best management practices during design and construction, thereby removing pollutants from runoff before it is discharged into receiving bodies of water such as the Hampton River, Hampton Roads, or Mason Creek.

4.18 CUMULATIVE EFFECTS

Cumulative effects are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions… [and] can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR 1508.7). The Council on Environmental Quality (CEQ) has written guidance documents for identifying and assessing these impacts. The understanding of what are past, present, and reasonably foreseeable future actions is key to the assessment of these impacts.

The affected environment or existing conditions in the study area reflects the collective impacts of all past actions, e.g., the growth and development of Hampton and Norfolk surrounding the Hampton Roads. Present impacts include those caused by current, ongoing construction of any projects in the area, public or private. Reasonably foreseeable future impacts include those caused by one of the Retained Build Alternatives, other planned and programmed transportation projects, and other planned development that is likely to occur in the area. These impacts are relevant to this assessment if they impact the same resources as those directly affected by the Retained Build Alternatives. Additional information regarding other planned projects in the study area is presented in the *Indirect and Cumulative Effects Technical Memorandum*.

Cumulative effects are assessed through review of the impacts caused the action within the context of all impacts to the same resource resulting from all actions. Thus, an action can only have a cumulative effect on an environmental resource if it has a direct or indirect effect on that same resource. The scope of cumulative effect issues associated with the Retained Build Alternatives is therefore based on the social, natural, and physical environmental consequences described previously in this chapter when considered in conjunction with other development actions. The geographic scope for the analysis is the study area described in **Section 4.17**. The time frame for the analysis is the design year, 2040.

4.18.1 Land Use

City plans propose increasing commercial, residential, and recreational development around the I-64 corridor. The plans also include road rehabilitation, widening, and streetscaping efforts. Completion of the Patriot's Crossing and the Intermodal Connector projects would also impact land use within the I-64 corridor.

Implementation of the No Build Alternative would not contribute to cumulative effects on land use. The cumulative effects associated with the Retained Build Alternatives include impacts caused by the transition of land uses to transportation use when considered with other development projects which result in land use changes. The Retained Build Alternatives would convert existing land uses to a new land use (transportation) as a direct effect. Other than Patriot's Crossing, this study would have the largest contribution to cumulative impacts on land use. However, overall, changes in land use over time in the study area are expected to be minimal because of the built-out nature of the cities of Hampton and Norfolk, and because existing zoning regulations and land use plans control land use changes. Furthermore, the Retained Build Alternatives would cause land use changes that are consistent with past land use changes in the study area which, over time, have resulted in the urbanized setting now present in both Hampton and Norfolk. Thus, although the implementation of the Retained Build Alternatives would contribute to cumulative impacts to land use, those impacts overall would be minor given the limited amount of space for new development, and would be reflective of past and existing land use trends.

4.18.2 Parks and Recreational Facilities

The following community plans propose increasing the amount of parkland or recreational facilities in the I-64 corridor:

- Coliseum Central Master Plan
- Downtown Hampton Master Plan
- Fort Monroe Master Plan
- Greater Wards Corner Comprehensive Plan
- Hampton Community Plan
- Newmarket Creek Park and Trail System Master Plan
- North King Street Master Plan

- Phoebus Master Plan
- plaNorfolk 2030

The No-Build Alternative would not contribute to cumulative effects to parks and recreational facilities. The Retained Build Alternatives would contribute to cumulative impacts to parks and recreational facilities. Future transportation projects may impact a currently unknown amount of parkland, but given the scale of other identified projects, these impacts would likely be minimal compared to the impacts of the Retained Build Alternatives. Overall, cumulative impacts would be minimized by the increase in parkland which is also proposed in the study area.

4.18.3 Environmental Justice

City plans and proposed projects are focused on revitalizing areas around the I-64 corridor. These plans could lead to the displacement or relocation of minority and low-income populations (as defined in Executive Order 12898 and Department of Transportation Order 5610.2a) while potentially improving the quality of life and housing values of minority and low-income populations that are not displaced or relocated. Implementation of the Retained Build Alternatives would be expected to contribute to both adverse and beneficial impacts to environmental justice populations because of residential and business property impacts and improvements to community mobility in the study area.

The No-Build Alternative, along with other reasonably foreseeable future projects, would contribute to increasing congestion along the I-64 corridor and the HRBT in the study area. Cumulatively, increased congestion would impact environmental justice populations.

Beneficial effects to minority and low-income populations are anticipated with any of the Retained Build Alternatives. Together with other transportation projects, the Retained Build Alternatives would contribute to decreased congestion in the environmental justice communities within the study area, thereby improving mobility. The contribution of the Retained Build Alternatives to beneficial cumulative effects would be substantial given the importance of I-64 and the HRBT to mobility within communities in the study area.

Other development projects in the study area may impact environmental justice populations and result in a change to surrounding land use, impacts to property, and/or relocations. Relative to other projects, the Retained Build Alternatives would present a larger contribution to cumulative effects on these communities due to the number of potential relocations involved. These effects would be minimized through adherence to statutes, regulations and policies governing relocations as described in **Sections 4.5 and 4.6**.

4.18.4 Socioeconomics

City plans and proposed projects are focused on revitalizing areas around the I-64 corridor. These plans could lead to the displacement or relocation of residents while potentially improving the quality of life and housing values of residents that are not displaced or relocated. Reasonably foreseeable transportation initiatives would ease congestion in the cities and increase economic opportunities.

The No-Build Alternative, along with reasonably foreseeable future projects, would contribute to increasing congestion along the I-64 corridor and the HRBT in the study area. Increased congestion and the inadequate infrastructure that causes it could stifle socioeconomic activity.

Like the Retained Build Alternatives, other planned transportation infrastructure projects in the study area would reduce congestion and improve mobility, and thus have a beneficial impact in terms of economics. The contribution of the Retained Build Alternatives to cumulative economic effects would be substantial given the importance of I-64 and the HRBT to the regional transportation network.

Like the Retained Build Alternatives, other development projects in the study area may also result in a change to surrounding land use, impacts to property, and/or relocations. The contribution of Retained Build Alternatives to cumulative socioeconomic impacts would be large in comparison to other planned projects due to the smaller scope of those projects. Socioeconomic impacts resulting from right-of-way acquisition and relocations would be minimized through adherence to statutes, regulations and policies governing relocations.

4.18.5 Wetlands and Waters of the US

City plans and present and future development projects include transportation, development, and natural resources management projects along various waterways in the I-64 corridor. The specific extent of impacts of reasonably foreseeable future projects to wetlands and Waters of the US is uncertain, however it is expected that the contribution of these projects to cumulative impacts would be small in comparison to that of the Retained Build Alternatives.

The No-Build Alternative would not contribute to cumulative impacts to wetlands and Waters of the US. The Retained Build Alternatives, along with past and present projects also would have substantial impacts on these resources, and it is anticipated that reasonably foreseeable future projects would impact the same resources. Future construction projects are required to be implemented in accordance with the Virginia Erosion and Sediment Control Regulations and the Virginia Stormwater Management Law and regulations. These regulations minimize the cumulative effects of construction projects on water quality through implementation of minimization measures and stormwater best management practices, which would reduce or detain discharge volumes and remove pollutants and thus avoid substantial further degradation of impaired water bodies in the study area and its vicinity. Direct impacts of the Retained Build Alternatives and other development projects to streams and wetlands also would be mitigated through compensation in coordination with the USACE, VDEQ, and VMRC during permitting, thereby reducing the overall cumulative impacts of these actions.

4.18.6 Water Quality

The poor water quality of the waterways in the study area is indicative of the incremental impact of past actions within the study area. City plans and proposed projects include management projects designed to improve water quality in the I-64 corridor.

The No-Build Alternative would not contribute to cumulative impacts to water quality. The Retained Build Alternatives and future roadway and other development actions would impact water quality by increasing impervious surfaces and roadway pollutants. Though the Retained Build Alternatives could contribute substantially to cumulative impacts to water quality, the total cumulative impacts would be minimized through implementation of local, state, and federal regulations and mitigation requirements.

4.18.7 Wildlife and Habitat

The majority of city plans and proposed projects would increase the amount of parkland in the I-64 corridor, creating potential habitat. Planned development projects as well as anticipated future infill development would convert habitat to other uses, but considering the limited amount of habitat available, the amount of conversion would be minimal. A substantial amount of aquatic habitat also is still present. City plans and development projects could affect riparian and aquatic habitat.

The No-Build Alternative would not contribute to impacts to wildlife and habitat. The Retained Build Alternatives potentially would impact Submerged Aquatic Vegetation, upland and riparian habitat along the I-64 corridor and the species is supports, and benthic communities of Hampton Roads, which support commercially important fish, shellfish, and anadromous species. Other development projects, such as Patriot's Crossing, could have similar effects to wildlife and habitat. Thus, the Retained Build

Alternatives would contribute to cumulative effects on these resources. However, implementation of required minimization strategies coordinated with the US Army Corps of Engineers, Virginia Department of Environmental Quality, Virginia Marine Resources Commission, and other regulatory agencies would reduce the cumulative impacts on sensitive habitats and the species that they support. These agencies also could require mitigation for the loss of specific habitat types.

4.18.8 Historic Properties

City plans and proposed projects could impact Hampton University, Fort Monroe, Phoebus, the Battle of Hampton Roads, and the Battle of Sewell's Point. The proposed development at Fort Monroe will convert the fort from a military installation to a National Monument. The development in Phoebus is planned to retain and support the historic buildings and character of the area. The Battle of Hampton Roads and the Battle of Sewell's Point would be impacted by Patriot's Crossing. Since most projects are still in the development phase, the full extent of architectural or archaeological resource impacts is uncertain.

The No-Build Alternative would not contribute to cumulative impacts to historic properties. Past projects have substantially impacted the same historic resources that would be impacted by the Retained Build Alternatives. However, reasonably foreseeable future projects are not expected to impact the same historic properties as the Retained Build Alternatives, with the exception of the naval battle sites. Thus, there would be minimal cumulative effects to these specific historic properties.

Through implementation of minimization strategies coordinated with the Virginia Department of Historic Resources and Section 106 consulting parties the direct and therefore cumulative impacts on historic resources attributable to implementation of the Retained Build Alternatives would be reduced. Similar strategies may be developed for other projects that affect historic properties, such as Patriot's Crossing.

A previous archaeological survey conducted in 1999 recommended two sites located within the study window as potentially eligible for listing on the NRHP. However, the work associated with verifying this eligibility will not be conducted unless a Retained Build Alternative is preferred. At that time, additional survey work to identify any other NRHP-eligible archaeological sites will be conducted. Therefore, the potential cumulative effects on archaeological resources are not currently known.

4.18.9 Noise Impact

Past, present and reasonably foreseeable future actions have and will continue to increase noise levels throughout the study area. The No-Build Alternative would contribute to cumulative noise impacts by failing to ameliorate congestion along the I-64 corridor and the HRBT. The Retained Build Alternatives would contribute to cumulative noise impacts by potentially increasing noise levels, both in the short-term through construction impacts, and over the long-term through impacts associated with additional lanes of roadway. Their contribution to cumulative impacts to these receptors would be minimized through the use of the mitigation techniques described in the *Noise Technical Report*.

City plans and proposed projects are focused on revitalizing areas around the I-64 corridor. Actions associated with these plans and projects would minimize the noise impacts of existing roadways and other reasonably foreseeable future projects which cumulatively contribute to noise within the study area.

4.18.10 Visual Impacts

Past, present and reasonably foreseeable future actions have changed and will continue to change the visual character of the study area. Cumulative effects to visual resources include the impacts from the

transition of other land uses to transportation use. As discussed under the land use section, city plans propose increasing commercial, residential, and recreational development around the HRBT corridor. The plans also include road rehabilitation, widening, and streetscaping efforts. These plans and projects would beautify the area and lead to a more positive viewer experience. Patriot's Crossing and the Intermodal Connector also would impact land use within the I-64 corridor, leading to a more developed viewshed, which could detrimentally affect viewer experience in the area.

The No-Build Alternative would not contribute to cumulative impacts to visual resources. Like other reasonably foreseeable future projects, the Retained Build Alternatives would convert existing land uses to a new land use (transportation), thereby changing the existing viewshed. The visual changes resulting from that conversion of land use is consistent with past and present urbanization trends within the study area. Because of the extent of past and present development, the substantial amount of reasonably foreseeable future development, and the consistency of the Retained Build Alternatives with the visual changes that have occurred and will occur in the study area over time, the Retained Build Alternatives would have only a minor contribution to cumulative impacts to visual resources.

4.18.11 Hazardous Materials

Past, present and reasonably foreseeable future actions have deposited or disturbed and will continue to disturb hazardous materials. Although the specific impacts to hazardous materials from other development projects is not known, the scale of potential impact is related to the scale of the development project.

The No-Build Alternative would not contribute to cumulative impacts to any hazardous material sites. Because so little is currently known about the extent to which reasonably foreseeable future actions will impact hazardous materials sites, it is not possible to state with certainty the contribution that the Retained Build Alternatives would make to cumulative impacts. However, prior to the acquisition of right-of-way and construction, thorough site investigations would be conducted to determine whether any of the sites are actually contaminated, and, if so, the nature and extent of that contamination. Any additional hazardous material sites discovered during construction of a Build Alternative or demolition of existing structures will be removed and disposed of in compliance with all applicable federal, state, and local regulations. All necessary remediation would be conducted in compliance with applicable federal, state, and local environmental laws and would be coordinated with the EPA, DEQ, and other federal or state agencies as necessary. Thus, any contribution that the Retained Build Alternatives make to cumulative impacts to hazardous materials sites is expected to be minor.

4.19 SHORT-TERM IMPACTS/LONG-TERM BENEFITS

This section provides qualitative measure of the short-term impacts that would result from implementation of the Retained Build Alternatives, and the long-term benefits that would be created by that implementation. With any infrastructure development, temporary impacts are necessary in order to achieve benefits in the future. These short-term, temporary impacts to the environment typically result from construction activity. Analysis of long-term benefits relates to the lifespan of the facility.

4.19.1 Short-Term Impacts

Short-term construction impacts of the Retained Build Alternatives would result in temporary changes to access of some properties in the construction zone, so as to accommodate the logistics of construction equipment and materials movement. Construction also would result in the removal of vegetation and disturbance of soil within the LOD, which in turn would lead to increased soil erosion. This erosion would be minimized through the use of erosion and sediment control practices. The use of construction vehicles and heavy equipment, along with reduced travel speeds within construction zones,

would create temporary noise level increases, as well as air quality impacts related to emissions and to fugitive dust. Local water resources would realize temporary increased use for construction activities such as the mixing of aggregates, road wetting, fugitive dust control and landscaping.

Construction impacts of the Retained Build Alternatives also could cause travelers to use alternate routes in order to avoid the construction area. Use of alternate routes would increase congestion along other area roadways, and in particular at the other Hampton Roads crossings. This displaced congestion potentially would impact the travel times of those individuals who customarily utilize these other crossings. The use of alternate, less direct routes likely would increase gasoline consumption. Further, the shunting away of traffic from the study area would result in a temporary decline in the patronage of local businesses patronage may decline.

4.19.2 Long-Term Benefits

The long-term benefits of implementing the Retained Build Alternatives would begin upon completion of construction, and would endure for the lifespan of the facility. These benefits are associated with the purpose and need of this study, as set forth in Chapter 1 of this DEIS. The primary benefits include increased roadway capacity and the resultant decreased congestion, and improved operating efficiency and level of service that would be achieved by addressing the existing facility's geometric deficiencies. Benefits also would include decreased travel times, which would result in quicker commutes and emergency response times, and decreased use of gasoline. Decreased congestion also would be expected to draw traffic from neighborhoods, thereby increasing safety and decreasing noise levels and air emissions within these communities. Decreased traffic on local roadways also would improve access to local businesses.

4.20 IRREVERSIBLE/IRRETRIEVABLE COMMITMENT OF RESOURCES

Construction of any of the Retained Build Alternatives would entail the expenditure of labor, money, roadway construction materials, electricity, fossil fuel and other natural resources such as land. Once these resources are expended, they would be irretrievable.

Construction of the Retained Build Alternatives would require the irreversible, irretrievable use of an appreciable amount of labor, and money to pay for that labor. Money would also be used for roadway construction materials such as aggregates, asphalt, bituminous pavement, cement, gravel and sand. The manufacturing of these materials requires fuel, electricity and labor, which also would be irretrievable. As of the time of the writing of this document, construction materials are not in short supply. Their use would not have an impact on the availability of such materials for other projects.

Construction of the Retained Build Alternatives also would result in the conversion of land into roadway. The land conversion is considered permanent. The use of land in connection with the construction of the Retained Build Alternatives also would require the displacement of structures that currently comprise a small fraction of the tax base of the City of Hampton and the City of Norfolk. Following implementation of the Retained Build Alternatives, these structures would be irreversibly removed from the tax base. Given the large size of the tax bases of the Cities of Hampton and Norfolk, however, the irreversible impact to those tax bases would be minor, and would correlate to the reduced demand for municipal services resulting from the displacement.

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Kenneth Leitz, L.S.	Coursework in land surveying; 29 years land surveying experience, including geodetic, boundary, route, topographic, and construction surveys	Task Leader, Surveying
Bill Walke	28 years land surveying experience, including boundary, GPS control, route, topographic, construction stakeout, site development, and land title surveys;	CADD Drafting/Research

6 DISTRIBUTION LIST

The following agencies and organizations were provided copies of this Draft Environmental Impact Statement. Cooperating and participating agencies are defined as follows and noted next to each agency as applicable:

(1) Cooperating Agencies: as defined in 40 CFR 1508.5, Council on Environmental Quality regulations implementing the National Environmental Policy Act.

(2) Participating Agencies: as defined in 23 CFR 771.107, Federal Highway Administration regulations, Environmental Impact and Related Procedures.

Agencies and organizations that are not one of the above are considered scoping agencies or non-governmental organizations with a potential interest in the study.

6.1 FEDERAL AGENCIES

The Advisory Council on Historic Preservation, Office of Federal Agency Programs

Federal Railroad Administration

Federal Transit Administration

National Marine Fisheries Service, Habitat Conservation Division

Natural Resources Conservation Service, Chesapeake Office

U.S. Coast Guard, Fifth Coast Guard District (1,2)

U.S. Department of Housing and Urban Development

U.S. Department of the Interior, Fish and Wildlife Service

U.S. Department of the Interior, Office of Environmental Project Review

U.S. Department of Veterans Affairs

U.S. Environmental Protection Agency, Region III, Environmental Programs Branch (1,2)

U.S. Army Corps of Engineers, Norfolk District (1,2)

Naval Station Norfolk (2)

Naval Support Activity Hampton Roads

6.2 COMMONWEALTH OF VIRGINIA AGENCIES

Virginia Department of Agriculture and Consumer Services

Virginia Department of Conservation and Recreation (2)

Virginia Department of Environmental Quality

Virginia Department of Game and Inland Fisheries (2)

Virginia Department of Health, Office of Drinking Water Programs

Virginia Department of Historic Resources (2)

Virginia Department of Housing and Community Development

Virginia Department of Mines, Minerals, and Energy

Virginia Department of Rail and Public Transportation (2)

Virginia Department of Transportation – Hampton Roads District

Virginia Department of Transportation – Accomack Residency

Virginia Department of Transportation – Franklin Residency

Virginia Department of Transportation – Williamsburg Residency

Virginia Economic Development Partnership

Virginia Marine Resources Commission (2)

Virginia Outdoors Foundation

Virginia Port Authority (2)

6.3 COUNTY AND CITY AGENCIES

City of Hampton (2)

City of Newport News

City of Norfolk (2)

Hampton Roads Planning District Commission

Hampton Roads Transit (2)

Norfolk Public Library – Pretlow Anchor Branch

Hampton Public Library – Main Library

Hampton Public Library – Phoebus Branch

Hampton Public Library – George Wythe Law Library

6.4 OTHER ORGANIZATIONS

East Coast Greenway Alliance

Hampton University

7 COMMENTS AND COORDINATION

7.1 INTRODUCTION

VDOT, in cooperation with FHWA, has coordinated extensively with local, state, regional, and federal agencies and conducted an inclusive public involvement program. A *Coordination Plan* was developed at the initiation of the study to outline the agencies and Section 106 consulting parties invited to participate, present a preliminary schedule of public and agency meetings, and identify coordination points throughout the course of the project to solicit input and comments.

Agencies were contacted early in the study and asked to assist in determining and clarifying issues relative to the study. The public was notified about the study and invited to provide comments about transportation needs, potential build alternatives, and environmental issues during multiple public meetings through the development of the study. The agency and public comments received in response to these coordination efforts were instrumental in defining the purpose and need, potential alternatives, environmental issues and methodologies addressed in the draft EIS.

7.2 AGENCY COORDINATION

7.2.1 Scoping

Pursuant to 40 CFR 1501.7, FHWA published a Notice of Intent to prepare an EIS in the Federal Register on May 20, 2011[21]. In the notice, FHWA invited input as part of the scoping process to assist in determining and clarifying issues relative to the study. No responses to the notice were received by FHWA.

The following agencies were contacted directly by letter and invited to provide scoping comments and also invited to attend an agency scoping meeting held on July 18, 2011:

- Advisory Council on Historic Preservation
- Federal Railroad Administration
- Federal Transit Administration
- U.S. Army Corps of Engineers
- U.S. Coast Guard, Fifth Coast Guard District
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Department of Housing and Urban Development
- U.S. Department of Interior, Fish and Wildlife Service, Virginia Field Office
- U.S. Department of Interior, Office of Environmental Project Review
- U.S. Department of Veterans Affairs
- U.S. Environmental Protection Agency, Virginia Field Office
- U.S. Navy, Naval Station Norfolk
- U.S. Navy, Naval Support Activity Hampton Roads
- National Marine Fisheries Service

[21] Federal Register Doc. 2011-12419. Available at https://www.federalregister.gov/articles/2011/05/20/2011-12419/environmental-impact-statement-interstate-64-hampton-roads-bridge-tunnel-corridor-virginia#p-7

- Virginia Department of Agricultural and Consumer Services
- Virginia Department of Conservation and Recreation
- Virginia Department of Environmental Quality – Director
- Virginia Department of Game and Inland Fisheries
- Virginia Department of Health, Office of Drinking Water Programs
- Virginia Department of Historic Resources
- Virginia Department of Housing and Community Development
- Virginia Department of Mines, Minerals, and Energy
- Virginia Department of Rail and Public Transportation
- Virginia Marine Resources Commission
- Virginia Outdoors Foundation
- Virginia Port Authority
- City of Newport News, City Manager
- City of Norfolk, City Manager
- Hampton Roads Planning District Commission
- Hampton Roads Transit
- Hampton University
- Virginia Economic Development Partnership

The following issues were mentioned in the responses from the agencies or during discussions at the agency scoping meeting:

- Impacts to wetlands and waters of the U.S.
- Impacts to wildlife, threatened and endangered species, and cultural resources that are present in the study area
- Integration of bicycle and pedestrian facilities for all potential alternatives
- Need for public transportation as an integral component to all improvements
- *Hampton Roads Regional Transit Vision Plan* recommends dedicated transit facilities be included in any harbor crossing proposal
- Transportation District Commission of Hampton Roads passed Resolution 11-2008, Endorsing Transit as a Component of Any Major Transportation Link in Hampton Roads
- Analysis of tolling, including rate, location of toll booths, and minimizing toll diversion on the local roadway network
- Impacts of recurring traffic delays on local roadway network and transit route times
- Impacts, including right-of-way needs, to adjacent neighborhoods including Naval Station Norfolk, the National Cemetery, the Phoebus Historic District, Hampton University, and the Woodlands public golf course
- Effects on waterway navigation, during construction and after improvement
- Consideration of port needs and clearance heights during analysis of alternatives
- Continued coordination and consistency with agency guidelines and permitting requirements

Additional information on the scoping process and issues identified by the scoping agencies is presented in the *Scoping Technical Memorandum* in **Appendix B**.

7.2.2 Participating Agencies

Pursuant to 23 CFR 771.111(d) local, state, regional, and federal agencies expected to have an interest in the study were invited to serve as "participating agencies." Participating agencies provide advice over

the course of the studies regarding purpose and need, potential alternatives, environmental issues, and study methodologies. They also review and comment on environmental documentation to reflect the views and concerns of their respective agencies. Many participating agencies were involved in the scoping process (see **Section 7.2.1**) and attended the scoping meeting on July 18, 2011. Participating agency meetings were held in November 2011 and April 2012:

- The November 2011 meeting was held to provide a study update, receive comments on the draft purpose and need statement, and provide early input on the alternatives screening process. Key discussion items included: bicycle and pedestrian facilities, freight movement in the corridor, military access to Willoughby Bay and the Hampton Roads, and comments on purpose and need, particularly transit, other projects in the area, travel demand, capacity, and physical and geometric deficiencies.
- The April 2012 meeting was held to discuss: the revised purpose and need, No-Build Alternative conditions, the initial build alternatives, and the schedule. Key discussion items included: comments on, changes to, and the detail provided in the purpose and need; quantifying delay and congestion at the HRBT; transit analysis; potential tolling of a build alternative; and review of the DEIS prior to publication. Comments were received from the USACE regarding consideration of impacts to navigation (both temporary and permanent), elimination of alternatives before a toll analysis, and elimination of viable alternatives (Build-6 and Dedicated Transit).

7.2.3 Section 106 Consulting Parties

Pursuant to Section 106 of the National Historic Preservation Act as implemented through 36 CFR 800.3(f), VDOT, in cooperation with FHWA, initiated invitations to consulting parties to participate in the identification of historic properties and evaluation of effects on such properties. The consulting parties include:

- U.S. Department of Veterans Affairs
- Virginia Council on Indians
- Virginia Department of Historic Resources
- Citizens for a Fort Monroe National Park
- City of Hampton
- City of Norfolk
- Fort Monroe Authority
- Hampton University
- Norfolk Preservation Alliance
- Phoebus Improvement League

Consulting parties have reviewed and commented on study documents including the *Phase I Architectural Survey Management Summary*, the *Phase II Architectural Intensive Level Survey*, and the *Archaeological Assessment.* These documents included the identification of historic properties. Consulting parties will be provided further opportunity to comment on the likely effects to historic properties, and they will be involved in the preparation of a Memorandum of Agreement (MOA) or Programmatic Agreement (PA), should one be prepared at the conclusion of the Section 106 process.

7.3 PUBLIC INVOLVEMENT

7.3.1 Citizen Information Meetings

VDOT held scoping citizens information meetings (public scoping meetings) on July 18 and 19, 2011 in Norfolk and Hampton, respectively. The purpose of the meetings was to obtain citizen input for use in defining the scope of the study as well as input on transportation challenges and study objectives, ideas for resolving transportation challenges, and important environmental and social issues. At the meeting, the study team presented maps and displays describing the study process, transportation challenges, environmental considerations, and other study information. Comment forms distributed at the meeting and made available on the project website included twelve questions. Respondents answered questions about use of I-64 and the HRBT; locations, types, and times of congestion on the corridor; other issues to be examined; problems to be considered; and general comments on the corridor. The public also noted human, natural, and cultural resources in the study area that should be considered as part of the transportation improvements. A variety of transportation options were also identified by the public to be considered in the study process. The following issues were identified during the public scoping process, as detailed in the *Scoping Technical Memorandum* in **Appendix B**:

- Concerns over substantial congestion within the corridor
- Consideration of bicycle and pedestrian uses
- HRBT improvements are not required if Patriots/Third Crossing is completed
- Implementation of minor improvements to manage congestion, such as signage, lighting, technology, and driver education
- Tolling/financing concerns and ideas
- Consideration of transit/ferry options within the corridor
- Minimization of impacts to residential and community facilities
- Consideration of tourism, port vitality, and military in all alternatives

VDOT held additional citizen information meetings on April 18, and April 19, 2012 in Hampton and Norfolk, respectively, to provide an update on study activities and to obtain input on the purpose and need, existing and future traffic, alternatives, and environmental conditions. At the meeting, the study team exhibited presentation boards displaying: components of purpose and need; current and projected traffic conditions; alternatives proposed for elimination; an explanation of the EIS process; and the study schedule. Comment forms distributed at the meeting and made available on the project website included eleven questions. Respondents answered questions about whether improvements are needed; travel patterns; potential frequency of use of alternatives proposed; the alternatives presented; concerns regarding the improvements; and identification of environmental resources, including historic properties. Ninety-five percent of respondents agreed that transportation improvements were needed in the HRBT corridor; however, the following issues were identified regarding the proposed alternatives development and potential I-64 HRBT improvements:

- Timing of approval and construction
- Need to fast-track the study
- Status of Patriots Crossing and association with HRBT study
- Need of area-wide expansion of rail (local and regional), bus, ferry, and HOV
- Tolls/financing concerns including opposition of local tolls; cost; and possibility to use gas or sales tax to remove tolls
- Traffic impacts including increased congestion due to toll booths, and impacts on the proposed capacity due to increased use

- Impacts to and mitigation of loss of property, damage to property values, and impact on regional function and character
- Need to address port expansion and associated truck traffic
- Consideration of emergency services
- Further identification and analysis of alternatives, and ideas for new tunnel/lane options

7.3.2 Location Public Hearing

A location public hearing will be held to present the findings of this Draft EIS, to provide a discussion forum between the public and the study team, and to obtain input and comments from the community. All comments received during the location public hearing and the public comment period will be considered, and all substantive comments will be addressed in the Final EIS.

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NDh Petroleum facilities registered with the Virginia Department of Environmental Quality. Virginia Department of Environmental Quality (VDEQ), and internally by VDOT. http://gisweb.deq.virginia.gov/. GIS layer name: SDE_VDEQ_PETRO_REGISTER_FACIL.

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DRAFT ENVIRONMENTAL IMPACT STATEMENT
and
DRAFT SECTION 4(f) EVALUATION

Appendix A

Alternatives Mapping

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4(f) PARKS
- NOISE IMPACTS

SCALE IN FEET
0 300 600 1200

STUDY LIMIT

COLISEUM DRIVE
PINE CHAPEL ROAD
134
Windsor Terrace
NORTH ARMISTEAD AVENUE
Chapel Village
LASALLE AVENUE
Y.H. Thomas Neighborhood Park
N
Matchline - See Sheet 2
Exit 265B
Hampton Convention Center
COLISEUM DRIVE
Lake Hampton
Hampton Coliseum
New Market
Coliseum Lake
64
Creek Trail
Exit 264
Bluebird Gap Farm
Exit 264
Southwest Branch Back River
Exit 265A
YMCA Athletic Fields
167
CSX Transportation
351
Exit 1A-B
664
West Hampton
415

pHD-0001Noise_Build8-11x17-600sc.dgn

I-64 Hampton Roads Bridge-Tunnel Environmental Impact Statement

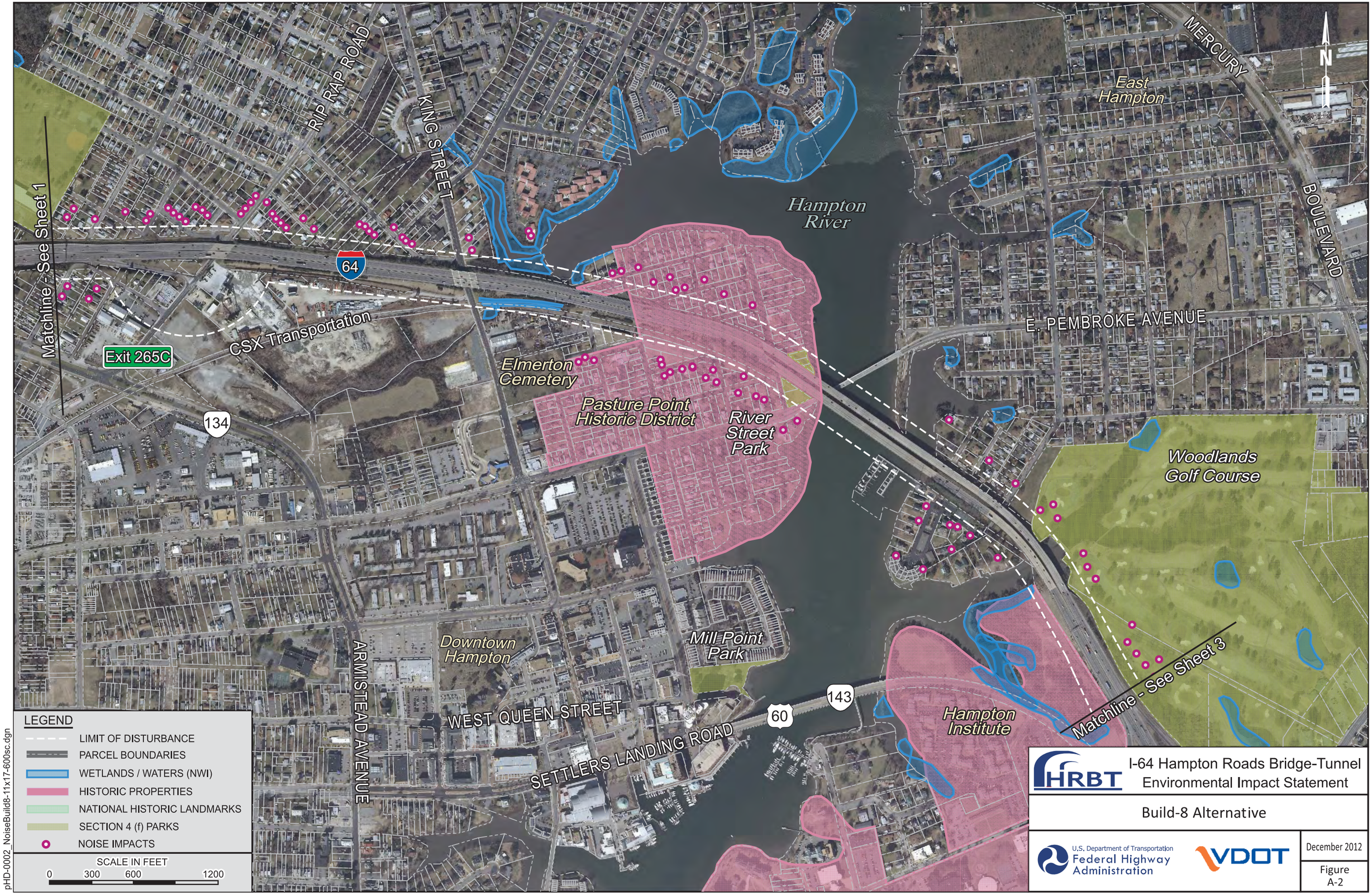
Build-8 Alternative

U.S. Department of Transportation Federal Highway Administration

VDOT

December 2012

Figure A-1



pHD-0002_NoiseBuild8-11x17-600sc.dgn

I-64 Hampton Roads Bridge-Tunnel Environmental Impact Statement

Build-8 Alternative

U.S. Department of Transportation Federal Highway Administration

VDOT

December 2012

Figure A-2

WOODLAND ROAD
LIBBY STREET
S. MALLORY STREET
258
Fort Monroe Historic District NHL/ National Monument
Woodlands Golf Course
143
W. COUNTY STREET
E. MELLEN STREET
143
McNAIR DRIVE
Exit 267
Hampton National Cemetery
Phoebus Historic District
Old Point Comfort Marina
169
DOWNES STREET
Matchline - See Sheet 2
Emancipation Oak
60
64
HAMPTON ROADS BRIDGE-TUNNEL
Hampton Institute
Exit 268
Strawberry Banks
ROAD
SHORE
Hampton National Cemetery
Hampton Veterans Affairs Medical Center Historic District
Battle of Hampton Roads
Matchline - See Sheet 4
Battle of Sewell's Point

LEGEND
- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4 (f) PARKS
- NOISE IMPACTS

SCALE IN FEET
0 300 600 1200

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HRBT
I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-8 Alternative

U.S. Department of Transportation
Federal Highway Administration
VDOT

December 2012

Figure
A-3

Fort Monroe
Historic District NHL/
National Monument

Old Point
Comfort Light

Chamberlin
Hotel

Fort Wool
(Fort Calhoun)

64

HAMPTON ROADS BRIDGE-TUNNEL

Matchline - See Sheet 3

Matchline - See Sheet 5

DEEPWATER ANCHORAGE

Hampton
Roads

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4 (f) PARKS
- NOISE IMPACTS

SCALE IN FEET
0 300 600 1200

pHD-0004_NoiseBuild8-11x17-600sc.dgn

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I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-8 Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A-4

N

Matchline - See Sheet 4

Matchline - See Sheet 6

HAMPTON ROADS BRIDGE-TUNNEL

64

W. OCEAN VIEW AVENUE

Willoughby Spit

Willoughby Boat Ramp

Willoughby Bay

Exit 272

Willoughby Harbor Marina

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4 (f) PARKS
- NOISE IMPACTS

SCALE IN FEET

0 300 600 1200

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I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-8 Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A-5

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4(f) PARKS
- NOISE IMPACTS

SCALE IN FEET
0 300 600 1200

N

W. OCEAN VIEW AVENUE
4th VIEW STREET
Willoughby Elementary School
Ocean View Elementary School
WEST GOVERNMENT AVENUE
60
West Ocean View
MASON CREEK ROAD
Exit 273
O'CONNER
Willoughby Family Housing
RIPPARD AVENUE
RIDGEWELL AVENUE
Matchline - See Sheet 7
64
Captain's Quarters Park
Willoughby Spit
Willoughby Bay
Naval Station Norfolk
Matchline - See Sheet 5

pHD-0006_NoiseBuild8-11x17-600sc.dgn

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I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-8 Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A-6

Matchline - See Sheet 6

WEST OCEAN AVENUE

Oastes Creek

Northside

460

Northside Middle School

Exit 274

EAST BAYVIEW BOULEVARD

Northside Park

GRANBY STREET

Entrance Ramp

Forest Lawn Cemetery

WEST BAY AVENUE

Merrimack Landing Historic District

Mason Creek

64

PATROL ROAD

IRONMONGER ROAD

Entrance Ramp

Matchline - See Sheet 8

Bluewater Yachting Center

Naval Station Norfolk

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4 (f) PARKS
- NOISE IMPACTS

SCALE IN FEET

0 300 600 1200

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I-64 Hampton Roads Bridge-Tunnel Environmental Impact Statement

Build-8 Alternative

U.S. Department of Transportation Federal Highway Administration

VDOT

December 2012

Figure A-7

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4(f) PARKS
- NOISE IMPACTS

SCALE IN FEET
0 300 600 1200

N

SIMONS DRIVE
EAST LITTLE CREEK ROAD
168
TIDEWATER DRIVE
Oakdale Farms
Forest Lawn Cemetery
WEST GLEN ROAD
BILTMORE ROAD
165
GALVESTON BOULEVARD
STUDY LIMIT
64
Matchline - See Sheet 7
CSX Transportation
VIRGINIAN DRIVE
Suburban Acres
THOLE STREET
Naval Station Norfolk
Exit 276
564
GRANBY STREET
460

pHD-0008_NoiseBuild8-11x17-600sc.dgn

I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-8 Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A-8

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4(f) PARKS

SCALE IN FEET
0 300 600 1200

N

STUDY LIMIT

COLISEUM DRIVE
PINE CHAPEL ROAD
134
Windsor Terrace
NORTH ARMISTEAD AVENUE
Chapel Village
LASALLE AVENUE
Y.H. Thomas Neighborhood Park
Matchline - See Sheet 2
Exit 265B
Lake Hampton
Hampton Convention Center
COLISEUM DRIVE
Hampton Coliseum
New Market Creek Trail
Coliseum Lake
64
Exit 264
Bluebird Gap Farm
Exit 264
Southwest Branch Back River
Exit 1A-B
664
West Hampton
Exit 265A
YMCA Athletic Fields
167
CSX Transportation
351
415

I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-8 Managed Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure A-9

pHD-0001_NoiseBuild8Managed-11x17-600sc.dgn

RIP RAP ROAD
KING STREET
MERCURY BOULEVARD
East Hampton
Hampton River
Matchline - See Sheet 1
64
CSX Transportation
Exit 265C
Elmerton Cemetery
Pasture Point Historic District
River Street Park
E. PEMBROKE AVENUE
134
Woodlands Golf Course
Downtown Hampton
Mill Point Park
ARMISTEAD AVENUE
WEST QUEEN STREET
SETTLERS LANDING ROAD
60
143
Hampton Institute
Matchline - See Sheet 3

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4 (f) PARKS

SCALE IN FEET
0 300 600 1200

pHD-0002_NoiseBuild8Managed-11x17-600sc.dgn

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I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-8 Managed Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A-10

WOODLAND ROAD
LIBBY STREET
S. MALLORY STREET
258
Fort Monroe Historic District NHL/ National Monument
Woodlands Golf Course
143
Exit 267
W. COUNTY STREET
E. MELLEN STREET
McNAIR DRIVE
Hampton National Cemetery
Phoebus Historic District
169
DOWNES STREET
Old Point Comfort Marina
Matchline - See Sheet 2
Emancipation Oak
60
64
HAMPTON ROADS BRIDGE-TUNNEL
Hampton Institute
Exit 268
Strawberry Banks
ROAD
SHORE
Hampton National Cemetery
Hampton Veterans Affairs Medical Center Historic District
Battle of Hampton Roads
Matchline - See Sheet 4
Battle of Sewell's Point

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4 (f) PARKS

SCALE IN FEET
0 300 600 1200

pHD-0003_NoiseBuild8Managed-11x17-600sc.dgn

HRBT
I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-8 Managed Alternative

U.S. Department of Transportation
Federal Highway Administration
VDOT

December 2012

Figure
A-11

Fort Monroe
Historic District NHL/
National Monument

Old Point
Comfort Light

Chamberlin
Hotel

Fort Wool
(Fort Calhoun)

64

HAMPTON ROADS BRIDGE-TUNNEL

Matchline - See Sheet 3

Matchline - See Sheet 5

DEEPWATER ANCHORAGE

Hampton
Roads

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4 (f) PARKS

SCALE IN FEET
0 300 600 1200

pHD-0004_NoiseBuild8Managed-11x17-600sc.dgn

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I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-8 Managed Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A-12

N

Matchline - See Sheet 6

Matchline - See Sheet 4

HAMPTON ROADS BRIDGE-TUNNEL

64

W. OCEAN VIEW AVENUE

Willoughby Spit

Willoughby Boat Ramp

Willoughby Bay

Exit 272

Willoughby Harbor Marina

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4 (f) PARKS

SCALE IN FEET

0 300 600 1200

pHD-0005_NoiseBuild8Managed-11x17-600sc.dgn

HRBT

I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-8 Managed Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A-13

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4(f) PARKS

SCALE IN FEET
0 300 600 1200

N

W. OCEAN VIEW AVENUE
4th VIEW STREET
Willoughby Elementary School
Ocean View Elementary School
60
WEST GOVERNMENT AVENUE
West Ocean View
MASON CREEK ROAD
Exit 273
O'CONNER
Willoughby Family Housing
RIPPARD AVENUE
RIDGEWELL AVENUE
Matchline - See Sheet 7
64
Captain's Quarters Park
Willoughby Spit
Willoughby Bay
Naval Station Norfolk
Matchline - See Sheet 5

pHD-0006_NoiseBuild8Managed-11x17-600sc.dgn

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I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-8 Managed Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A-14

Matchline - See Sheet 6

WEST OCEAN AVENUE

Oastes Creek

Northside

460

Northside Middle School

Exit 274

EAST BAYVIEW BOULEVARD

Northside Park

GRANBY STREET

Entrance Ramp

Forest Lawn Cemetery

WEST BAY AVENUE

Merrimack Landing Historic District

Mason Creek

64

PATROL ROAD

IRONMONGER ROAD

Entrance Ramp

Matchline - See Sheet 8

Bluewater Yachting Center

Naval Station Norfolk

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4 (f) PARKS

SCALE IN FEET

0 300 600 1200

pHD-0007_NoiseBuild8Managed-11x17-600sc.dgn

HRBT

I-64 Hampton Roads Bridge-Tunnel Environmental Impact Statement

Build-8 Managed Alternative

U.S. Department of Transportation Federal Highway Administration

VDOT

December 2012

Figure A-15

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4(f) PARKS

SCALE IN FEET
0 300 600 1200

N

SIMONS DRIVE
EAST LITTLE CREEK ROAD
168
TIDEWATER DRIVE
Oakdale Farms
WEST GLEN ROAD
Forest Lawn Cemetery
BILTMORE ROAD
165
GALVESTON BOULEVARD
STUDY LIMIT
64
Matchline - See Sheet 7
CSX Transportation
VIRGINIAN DRIVE
Suburban Acres
THOLE STREET
Naval Station Norfolk
Exit 276
564
GRANBY STREET
460

pHD-0008_NoiseBuild8Managed-11x17-600sc.dgn

HRBT

I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-8 Managed Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A- 16

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4(f) PARKS
- NOISE IMPACTS

SCALE IN FEET
0 300 600 1200

N

STUDY LIMIT

COLISEUM DRIVE
PINE CHAPEL ROAD
134
Windsor Terrace
NORTH ARMISTEAD AVENUE
Chapel Village
LASALLE AVENUE
Y.H. Thomas Neighborhood Park
Lake Hampton
Hampton Convention Center
COLISEUM DRIVE
Exit 265B
Matchline - See Sheet 2
Hampton Coliseum
New Market
64
Coliseum Lake
Creek Trail
Exit 264
Bluebird Gap Farm
Exit 264
Exit 265A
YMCA Athletic Fields
Southwest Branch Back River
Exit 1A-B
CSX Transportation
167
351
West Hampton
664
415

HRBT

I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-10 Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure A-17

pHD-0001_NoiseBuild10-11x17-600sc.dgn

RIP RAP ROAD
KING STREET
MERCURY
BOULEVARD
East Hampton
Hampton River
N
Matchline - See Sheet 1
64
CSX Transportation
Exit 265C
Elmerton Cemetery
Pasture Point Historic District
River Street Park
E. PEMBROKE AVENUE
Woodlands Golf Course
134
ARMISTEAD AVENUE
Downtown Hampton
Mill Point Park
WEST QUEEN STREET
SETTLERS LANDING ROAD
60
143
Hampton Institute
Matchline - See Sheet 3

LEGEND
- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4(f) PARKS
- NOISE IMPACTS

SCALE IN FEET
0 300 600 1200

pHD-0002_NoiseBuild10-11x17-600sc.dgn

HRBT
I-64 Hampton Roads Bridge-Tunnel Environmental Impact Statement

Build-10 Alternative

U.S. Department of Transportation Federal Highway Administration
VDOT

December 2012

Figure A-18

WOODLAND ROAD
LIBBY STREET
S. MALLORY STREET
258
Fort Monroe Historic District NHL/ National Monument
Woodlands Golf Course
143
W. COUNTY STREET
E. MELLEN STREET
143
McNAIR DRIVE
Exit 267
Hampton National Cemetery
Phoebus Historic District
169
DOWNES STREET
Old Point Comfort Marina
Matchline - See Sheet 2
Emancipation Oak
60
64
HAMPTON ROADS BRIDGE-TUNNEL
Hampton Institute
Exit 268
Strawberry Banks
ROAD
SHORE
Hampton National Cemetery
Hampton Veterans Affairs Medical Center Historic District
Battle of Hampton Roads
Battle of Sewell's Point
Matchline - See Sheet 4

LEGEND
- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4(f) PARKS
- NOISE IMPACTS

SCALE IN FEET
0 300 600 1200

pHD-0003_NoiseBuild10-11x17-600sc.dgn

HRBT
I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-10 Alternative

U.S. Department of Transportation
Federal Highway Administration
VDOT

December 2012

Figure A-19

Fort Monroe
Historic District NHL/
National Monument

Old Point
Comfort Light

Chamberlin
Hotel

Fort Wool
(Fort Calhoun)

64

HAMPTON ROADS BRIDGE-TUNNEL

Matchline - See Sheet 3

Matchline - See Sheet 5

DEEPWATER ANCHORAGE

Hampton
Roads

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4(f) PARKS
- NOISE IMPACTS

SCALE IN FEET
0 300 600 1200

pHD-0004_NoiseBuild10-11x17-600sc.dgn

HRBT

I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-10 Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A-20

N

Matchline - See Sheet 4

Matchline - See Sheet 6

HAMPTON ROADS BRIDGE-TUNNEL

64

W. OCEAN VIEW AVENUE

Willoughby Spit

Willoughby Boat Ramp

Willoughby Bay

Exit 272

Willoughby Harbor Marina

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4 (f) PARKS
- NOISE IMPACTS

SCALE IN FEET

0 300 600 1200

pHD-0005_NoiseBuild10-11x17-600sc.dgn

HRBT

I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-10 Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A-21

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4(f) PARKS
- NOISE IMPACTS

SCALE IN FEET

0 300 600 1200

W. OCEAN VIEW AVENUE

4th VIEW STREET

Willoughby Elementary School

Ocean View Elementary School

WEST GOVERNMENT AVENUE

60

West Ocean View

MASON CREEK ROAD

Exit 273

O'CONNER

Willoughby Family Housing

RIPPARD AVENUE

RIDGEWELL AVENUE

Matchline - See Sheet 7

64

Captain's Quarters Park

Willoughby Spit

Willoughby Bay

Naval Station Norfolk

Matchline - See Sheet 5

pHD-0006_NoiseBuild10-11x17-600sc.dgn

HRBT

I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

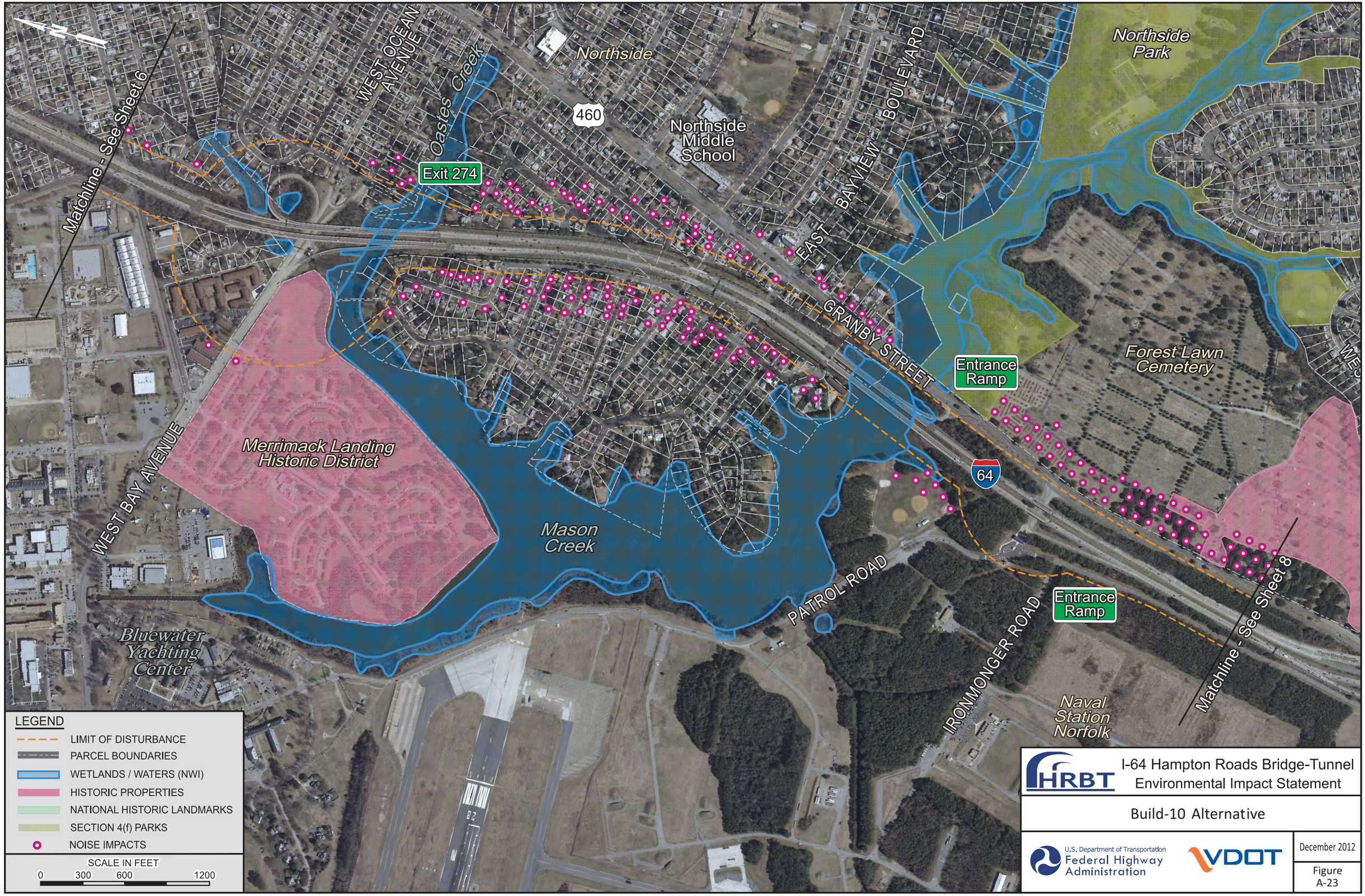
Build-10 Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A-22


Matchline - See Sheet 6
WEST OCEAN AVENUE
Oastes Creek
Northside
460
Northside Middle School
Exit 274
EAST BAYVIEW BOULEVARD
Northside Park
GRANBY STREET
Entrance Ramp
Forest Lawn Cemetery
64
Merrimack Landing Historic District
WEST BAY AVENUE
Mason Creek
PATROL ROAD
IRONMONGER ROAD
Entrance Ramp
Bluewater Yachting Center
Naval Station Norfolk
Matchline - See Sheet 8
LEGEND
LIMIT OF DISTURBANCE
PARCEL BOUNDARIES
WETLANDS / WATERS (NWI)
HISTORIC PROPERTIES
NATIONAL HISTORIC LANDMARKS
SECTION 4(f) PARKS
NOISE IMPACTS
SCALE IN FEET
0 300 600 1200
I-64 Hampton Roads Bridge-Tunnel Environmental Impact Statement
Build-10 Alternative
U.S. Department of Transportation Federal Highway Administration
VDOT
December 2012
Figure A-23
pHD-0007_NoiseBuild10-11x17-600sc.dgn

LEGEND

- LIMIT OF DISTURBANCE
- PARCEL BOUNDARIES
- WETLANDS / WATERS (NWI)
- HISTORIC PROPERTIES
- NATIONAL HISTORIC LANDMARKS
- SECTION 4(f) PARKS
- NOISE IMPACTS

SCALE IN FEET
0 300 600 1200

N

SIMONS DRIVE
EAST LITTLE CREEK ROAD
168
TIDEWATER DRIVE
Oakdale Farms
WEST GLEN ROAD
Forest Lawn Cemetery
BILTMORE ROAD
165
GALVESTON BOULEVARD
STUDY LIMIT
Matchline - See Sheet 7
64
CSX Transportation
VIRGINIAN DRIVE
Suburban Acres
THOLE STREET
Naval Station Norfolk
Exit 276
564
GRANBY STREET
460

pHD-0008_NoiseBuild10-11x17-600sc.dgn

HRBT

I-64 Hampton Roads Bridge-Tunnel
Environmental Impact Statement

Build-10 Alternative

U.S. Department of Transportation
Federal Highway Administration

VDOT

December 2012

Figure
A-24

I-64 HAMPTON ROADS
BRIDGE-TUNNEL

HRBT
Hampton Roads Bridge Tunnel EIS

DRAFT ENVIRONMENTAL IMPACT STATEMENT
and
DRAFT SECTION 4(f) EVALUATION

Appendix B

Scoping Report

SCOPING TECHNICAL MEMORANDUM

I-64 HAMPTON ROADS BRIDGE TUNNEL ENVIRONMENTAL IMPACT STATEMENT

From: Interstate 664 in the City of Hampton
To: Interstate 564 in the City of Norfolk

State Project: 0064-965-004, P101; UPC 99037
Federal Project: NHS-064-3(465), P101

Revised
September 12, 2011

Contents

Attachments:
A – List of Agencies Contacted
B – Agency Scoping Meeting Summary
C – Public Scoping Meeting Summary

I. Executive Summary. This Memorandum summarizes the agency and public coordination activities undertaken by the Virginia Department of Transportation (VDOT) in cooperation with the Federal Highway Administration (FHWA) to help establish the scope of the Environmental Impact Statement (EIS) for potential transportation improvements in the Interstate 64 (I-64) Hampton Roads Bridge Tunnel (HRBT) corridor. A summary of major issues identified through these activities is provided. These issues will be addressed as appropriate in the EIS and supporting technical documentation.

The federal, state, and local agencies listed in Attachment A were invited to provide input to the scope of studies and some were also invited to serve as cooperating agencies and/or participating agencies. The agencies also were invited to attend an agency scoping meeting on July 18, 2011, which is summarized in Attachment B. At the meeting, information about the study was presented and comments and suggestions were solicited. Written responses were received from 19 agencies.

Public scoping meetings were held in the City of Norfolk on July 18, 2011 and in the City of Hampton on July 19, 2011. Informational brochures and display boards were provided at the meetings and comment sheets were used to solicit comments and suggestions. A total of 152 people attended the two public scoping meetings.

At both the agency and the public scoping meetings, input was explicitly solicited regarding the need for transportation improvements, the potential range of alternatives to be considered, significant environmental issues, and analysis methodologies to be used.

II. What is Scoping? "Scope" refers to "the range of actions, alternatives, and impacts to be considered in an environmental impact statement."[1] A scoping process consisting of a series of data collection and agency and public coordination activities used to determine that scope.

[1] 40 CFR 1508.25.

In a broad sense, the scope of any EIS is mandated by statutory and regulatory requirements. The National Environmental Policy Act (NEPA, 42 USC 4332) requires that EISs identify the environmental impacts of proposed federal actions,[2] any adverse environmental impacts that cannot be avoided should the proposed action be implemented, and alternatives to the proposed action. The Council on Environmental Quality (CEQ) regulations (40 CFR 1500-1508) implementing NEPA (which apply to all federal agencies) require consideration of the no-action alternative; other reasonable alternatives to the proposed action; mitigation measures; and environmental impacts that may be direct, indirect, or cumulative. The CEQ regulations further direct that only significant issues need be analyzed in depth in the EIS, thus focusing discussion on those issues most important to the decision (40 CFR 1501.7). In addition, the CEQ regulations suggest a standard format for organizing the content of the EIS:

a) Cover Sheet
b) Summary
c) Table of Contents
d) Purpose of and Need for Action
e) Alternatives
f) Affected Environment
g) Environmental Consequence
h) List of Preparers
i) List of Agencies, Organizations, and Persons to Whom Copies of the Statement Are Sent
j) Index
k) Appendices (if any)

A host of other environmental laws and regulations impose separate requirements specific to individual resources (e.g., air, water, wetlands, endangered species, and historic properties). To the extent practical, compliance with these requirements also is achieved and documented under the umbrella of NEPA. The scoping process helps identify applicable environmental review and consultation requirements so that required analyses and studies can be conducted concurrently with, and integrated into, the EIS.

In the narrower, project-specific sense, the scope is determined by the context of the project and the views of public agencies, interest groups, and citizens. The identification of transportation needs and the range of possible alternatives to meet those needs relies on defining existing and expected future transportation conditions, as well as existing and projected land use and development patterns. Specific environmental resources present in the study area guide the focus of data collection and impact analysis efforts. Input from agencies and citizens suggest the level of importance attached to those resources.

FHWA regulations (23 CFR 771) implementing NEPA require that a scoping process be used early in the project studies to identify the range of alternatives and impacts and the significant issues to be discussed in the EIS. This process includes a variety of outreach efforts to ensure that the views of, and information provided by, affected or interested public agencies, interest groups, and citizens are taken into account. Agencies with special expertise or jurisdiction by

[2] The potential federal funding via FHWA to implement a preferred alternative, as well as approvals required from FHWA involving the interstate highway system, invokes the "federal action" link.

law may be invited to become cooperating agencies. Other agencies having an interest in the action may be invited to serve as participating agencies. Section III describes the scoping activities undertaken for this study; Sections IV and V summarize the issues identified as a result of the scoping process.

III. Scoping Activities. On May 20, 2011, FHWA published in the Federal Register a Notice of Intent to Prepare an Environmental Impact Statement. The notice invited "input as part of the scoping process to assist in determining and clarifying issues relative to the study." On June 14, 2011, FHWA invited the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency (EPA), and the U.S. Fish and Wildlife Service to serve as cooperating agencies.[3] The Corps and EPA accepted; the Fish and Wildlife Service declined. The U.S. Coast Guard also offered to serve as a cooperating agency. On June 17, 2011, VDOT sent letters to 20 federal, state, and local agencies inviting them to serve as participating agencies;[4] 13 of them accepted. VDOT also sent letters to 13 additional agencies inviting them to provide scoping[5] comments. All agencies to which letters were sent also were invited to attend the agency scoping meeting. The agency scoping meeting was held on July 18, 2011 with federal, state, and local agencies to provide a project overview and to receive comments regarding the scope of the EIS. Handouts included the agenda, project location map, power point presentation, Draft Coordination Plan, citizen information meeting brochure, comment sheet, and agency coordination status form. Agencies were requested to provide comments by August 1, 2011.

Citizen information meetings were held on July 18, 2011 in Norfolk and July 19, 2011 in Hampton. The meetings were advertised in local newspapers and on VDOT's project website. At the meetings, informational brochures, displays, and a continuously running video were provided to inform the public about elements of the study and potential issues to be addressed. VDOT representatives were present to answer questions and to discuss the study with attendees. Comment sheets were provided to facilitate input and a recorder was available for recording oral comments. Attendees were requested to provide comments by August 1, 2011.

IV. Principal Issues from the Agency Scoping Process. Table 1 summarizes the key issues identified and comments received through the agency scoping process. These issues are not meant to be all-inclusive; rather, based on the available information and comments received, they appear to be the issues most relevant to the decision to be made in terms of environmental resources that are most sensitive or most likely to be affected, alternatives to be considered, and areas of potential controversy. Under NEPA, issues generally refer to relationships between actions and environmental resources; in other words, one examines cause and effect

[3] Cooperating agencies are federal agencies other than the lead agency that have jurisdiction by law or special expertise with respect to environmental impacts involved in a major federal action significantly affecting the quality of the human environment. 40 CFR 1508.5, Council on Environmental Quality regulations implementing the National Environmental Policy Act.

[4] Participating agencies are federal, state, local, or federally-recognized Indian tribal governmental units that may have an interest in the proposed project and have accepted an invitation to be a participating agency, or, in the case of a federal agency, has not declined the invitation. 23 CFR 771.107, Federal Highway Administration regulations, Environmental Impact and Related Procedures. [Note: agencies not initially invited to be participating agencies may request during the course of the study to become participating agencies.]

[5] Other scoping agencies and organizations are government agencies that may have only a tangential interest in the project, or nongovernmental organizations with a potential interest in the project.

relationships, not voluminous background data or other material that has no bearing on the environmental impacts. One looks at consequences that may arise from implementation of alternatives. Under this approach, the EIS will address substantive comments only, while acknowledging personal opinions, unsubstantiated topics, general statements of support or nonsupport, and vague generalities.

Table 1. Principal Issues from Agency Scoping Responses

Commenter	EIS Issues
US Army Corps of Engineers – Norfolk District	▪ Impacts to wetlands and waters regulated by USACE – Section 404 and/or Section 10 permit(s) will likely be required ▪ Navigation ▪ The location for disposal of dredging materials will most likely be an off-shore ocean dumping site or an upland site (Craney Island cannot be used); applicable ocean disposal criteria and information on bottom material in the HRBT vicinity available from other studies will be forwarded to the study team
US Coast Guard – Fifth Coast Guard District	▪ Navigation
US Navy – Naval Station Norfolk	▪ Potential impacts to Naval Station Norfolk
VA Dept of Conservation & Recreation – Division of Natural Heritage	▪ Located within Hampton Roads Bridge Tunnel Conservation Site, ranked B5 (site of general significance) due to the presence of *Rynchops niger* (Black Skimmer) ▪ *Sternula antillarum* (Least Tern) has been documented on the south shore of the study area ▪ Anadromous fish waters
VA Dept of Conservation & Recreation – Division of Planning & Recreational Resources	▪ U.S. DOT's policy statement on bicycling and walking recommends "integrating bicycle and pedestrian accommodation on new, rehabilitated, and limited access bridges" and bicyclists in the Hampton Roads region have expressed a great interest in a river crossing connecting Hampton and Norfolk ▪ A facility for bicyclists and pedestrians in this corridor could be an important part of the public health infrastructure for Hampton Roads and consideration should be given to including facilities for bicyclists and pedestrians in this bridge crossing
VA Dept of Environmental Quality	▪ Virginia Coastal Zone Management Program (VCP) consistency certification; DEQ recommends providing this as part of the EIS to enable a single review process ▪ VCP Enforceable Regulatory Programs include: Fisheries, Subaqueous lands, Wetlands and Dunes management Non-point source and point source pollution control Shoreline sanitation Air pollution control Coastal lands management ▪ EIS should include a USGS topo map
VA Dept of Game and Inland Fisheries	▪ Complete Initial Project Assessment Report so that Virginia Fish and Wildlife Information Service can respond – report should include conservation concerns, project location map, description of project scope, and photos, as well as stream crossing table if stream/wetland impacts are proposed
VA Dept of Historic Resources	▪ Section 106
VA Marine Resources Commission	▪ VMRC has jurisdiction on any encroachments in, on, or over the beds of the bays, ocean, rivers, streams, or creeks that are the property of the Commonwealth; a subaqueous bed permit for impacts to state-owned bottom will likely be required on this project

Commenter	EIS Issues
VA Department of Rail and Public Transportation (DRPT)	▪ DRPT views public transportation as an integral component to improvements and recommends that it be included in the consideration of transportation alternatives ▪ Ridership estimation methodology should be consistent with Federal Transit Administration (FTA) guidelines ▪ Capital and operational cost estimates should be based on FTA cost guidelines or national experience ▪ The *Hampton Roads Regional Transit Vision Plan* (Feb 2011), which recommends that dedicated transit facilities be included in any harbor crossing proposals, should be referenced to conceptualize the future regional rapid transit network envisioned by DRPT, Hampton Roads Transportation Planning Organization, Hampton Roads Transit, and Williamsburg Area Transit Authority
VA Port Authority	▪ As alternatives are developed, consider the following: Air Draft: bridge alternatives will require a minimum 250-foot air draft (vertical clearance above the water) 55-foot Channel Authorization: the minimum acceptable depth for any proposed tunnel structure is 60 feet to allow for maintenance dredging of the 55-foot channel Channel Width and Bridge Pier Placement: improvements to the HRBT should allow for future widening and deepening of the channel Deep Water Anchorage: improvements should not impact or result in elimination of the existing anchorages
Hampton Roads Transit	▪ Congestion on the HRBT creates lengthy delays and unreliable travel times for HRT's bus service between the Peninsula and Southside ▪ Transportation District Commission of Hampton Roads passed Resolution 11-2008, *Endorsing Transit as a Component of Any Major Transportation Link in Hampton Roads, Virginia*; therefore, HRT requests that the HRBT EIS include the consideration of alternatives for a fixed guideway, transit-only lane, and/or transit connection
City of Hampton	▪ Concerned about recurring AM peak, PM peak, incident, and seasonal delays ▪ When delays occur, spillover occurs on City surface streets ▪ During worst conditions, eastbound backups from the HRBT queue past the interchange between I-64 and I-664 so motorists cannot access the alternate route; the Bowers Hill interchange and High Rise bridge on I-64 are also choke points on the alternate route ▪ Need a comprehensive look at tolling, including the rate and the location of toll booths; minimize toll diversion to City streets ▪ Minimize potential right-of-way impacts to adjacent neighborhoods, the National Cemetery, the Phoebus Historic District, Hampton University, and the Woodlands public golf course ▪ Examine interchange ramp modifications, with and without proposed improvements, including safety on the surface streets adjacent to the ramps at the Armistead/LaSalle interchange, the partial interchange at Rip Rap Road, and more direct access into downtown Hampton with a new full interchange at King Street ▪ Clearance height for LaSalle Avenue, Rip Rap Road, and Armistead Avenue under I-64 is less than ideal
VA Dept of Agriculture & Consumer Services	▪ Minimize impacts to farm and forest land (although it is unlikely the project will affect any state-designated agricultural lands) ▪ Contact local governments to determine if any local Agricultural or Forest Districts are in the study area

V. Principle Issues from Public Scoping Process. A total of 152 people attended the two public scoping meetings held for the project (94 people attended the Norfolk meeting and 58 attended the Hampton meeting). Each attendee was provided a comment sheet to fill out and submit that day or mail by August 1, 2011. The comment sheet included questions regarding frequency of usage of the HRBT, travel patterns of HRBT users, opinions on congestion and improvements, and it requested input on environmental issues within the study area. A verbatim recorder also was available at both meetings to record oral comments. The following is a tally of all comments received during the comment period:

- Comment Forms submitted at the meeting or before August 1, 2011 – 65
- Electronic Comment Forms (submitted via project website) – 13
- Letters – 2
- E-mails – 4
- Oral Comments – 8

A concise summary of the comments is included as Attachment C; however, following is a general list (not in ranked order) of the ten most frequent comments received from the public:

- Consider bicycle and pedestrian uses in the corridor;
- Concerns over substantial congestion within the corridor;
- HRBT improvements are not required if Patriots / Third Crossing is completed;
- Toll / financing concerns and ideas;
- Implement timely minor enhancements to manage congestion (signage, lighting, Intelligent Transportation Systems [ITS], driver education);
- Tourism, economics, port vitality, and military are important considerations;
- Minimize residential and/or community impacts;
- Concerns over bridge structure and roadway conditions;
- Consider transit / ferry options within corridor / crossing; and
- General support for the project.

In addition, responses to one question in particular (#8) on the comment sheet summarize the relative importance of environmental resources to the public. This question stated "*This study will examine potential impacts to environmental resources that exist within the corridor. In your opinion, rate the relative importance of resources within the study area, with "1" being the highest importance for this study.*" Table 2 provides the responses received to this question, arranged in order according to number of responses in the "1" category.

Resource Type	1	2	3	4	5
Economic Conditions	32	8	12	3	6
Land Use	27	11	13	8	7
Historic / Archeological Resources	26	11	11	6	9
Wetlands / Streams / Tidal Waters	26	12	16	3	6
Air Quality	20	15	17	8	3
Social / Community Resources	18	14	16	8	6
Noise Levels	14	15	14	9	8
Parks and Recreation Areas	13	13	15	8	8
Threatened & Endangered Species	13	14	11	11	9

While most of the categories received comparable ranking, "Economic Conditions" received the most "1" ratings, which reinforces the continuing concern about the impacts of congestion and delays in the I-64 HRBT corridor on commuters, businesses, and military operations within the area.

VI. Summary and Conclusion. The EIS will cover all relevant issues mandated by statute or regulation and all substantive issues identified during the scoping process. When completed, the Draft EIS will be made available to the public, interest groups, and applicable public agencies for review and comment. A Location Public Hearing will be held to present information to the public and to receive additional input on relevant issues. A Final EIS then will be prepared to incorporate revisions arising from substantive comments on the Draft EIS.

ATTACHMENT A
LIST OF AGENCIES CONTACTED

ATTACHMENT B
AGENCY SCOPING MEETING SUMMARY

[Note: Copies of the meeting materials (brochure, displays, etc.) are not included for purposes of this Scoping Technical Memorandum. Copies of actual agency letters and emails also are not included.]

ATTACHMENT C
PUBLIC SCOPING MEETING SUMMARY

[Note: Copies of the meeting materials (brochure, displays, comment sheet, etc.) are not included for purposes of this Scoping Technical Memorandum. Copies of actual comment sheets, emails, letters, and oral transcripts also are not included.]

HRBT
Hampton Roads Bridge Tunnel EIS

DRAFT ENVIRONMENTAL IMPACT STATEMENT
and
DRAFT SECTION 4(f) EVALUATION

Appendix C

Draft Section 4(f) Evaluation

December 2012

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
and
VIRGINIA DEPARTMENT OF TRANSPORTATION

DRAFT SECTION 4(f) EVALUATION

I-64 Hampton Roads Bridge-Tunnel EIS

Cities of Hampton and Norfolk
State Project: 0064-965-004, P-101; UPC: 99037
Federal Project: NHS-064-3(465)

TABLE OF CONTENTS

List of Figures

List of Tables

1. INTRODUCTION

Section 4(f) of the U.S. Department of Transportation Act of 1966 as amended (49 USC Section 303) stipulates that the U.S. Department of Transportation (USDOT), including the Federal Highway Administration (FHWA), cannot approve the use of land from a publicly owned park, recreation area, wildlife or waterfowl refuge, or public or private historic site unless the following conditions apply:

- The FHWA determines that there is no feasible and prudent avoidance alternative to the use of land from the property, and the action includes all possible planning to minimize harm to the property resulting from such use (23 CFR 774.3(a)); or

- The FHWA determines that the use of the Section 4(f) properties, including any measures to minimize harm (such as avoidance, minimization, mitigation, or enhancement measures) committed to by the applicant, will have a de minimis impact on the property (23 CFR 774.3(b)).

This Draft Section 4(f) Evaluation describes Section 4(f) lands within the study area, potential use of the lands, avoidance alternatives to use of the land, preliminary identification of the alternative with the least overall harm, and a discussion of all possible planning to minimize harm.

This Draft Section 4(f) Evaluation also provides notification of FHWA's intent to pursue de minimis impact findings for some park and historic properties. Such de minimis findings would be based upon the potential level of impacts of the Retained Build Alternatives, and are pending coordination with relevant officials with jurisdiction that is concomitant with distribution of this draft evaluation. Any final de minimis impact determinations would be based on impacts associated with the preferred alternative, which currently has not been identified. Pursuant to 23 CFR 774.5(b)(2), all potential Section 4(f) de minimis impacts finding on parks and recreation areas will be presented for public review and comments with the Draft Environmental Impact Statement (DEIS), in compliance with the requirements of the National Environmental Policy Act (NEPA).

2. PROPOSED ACTION

2.1. Description of Action

For the purposes of this Draft Section 4(f) Evaluation, the proposed action consists of the three build alternatives which are being retained for detailed study in the DEIS: the Build-8 Alternative, the Build-8 Managed Alternative, and the Build-10 Alternative (hereafter referred to as the Retained Build Alternatives). All of the Retained Build Alternatives follow similar alignments along existing Interstate 64 (I-64) from its interchange with Interstate 664 (I-664) in the City of Hampton to its interchange with Interstate 564 (I-564) in the City of Norfolk. **Figure 1** and **Figure 1a** show the Limits of Disturbance (LOD) for the Retained Build Alternatives.

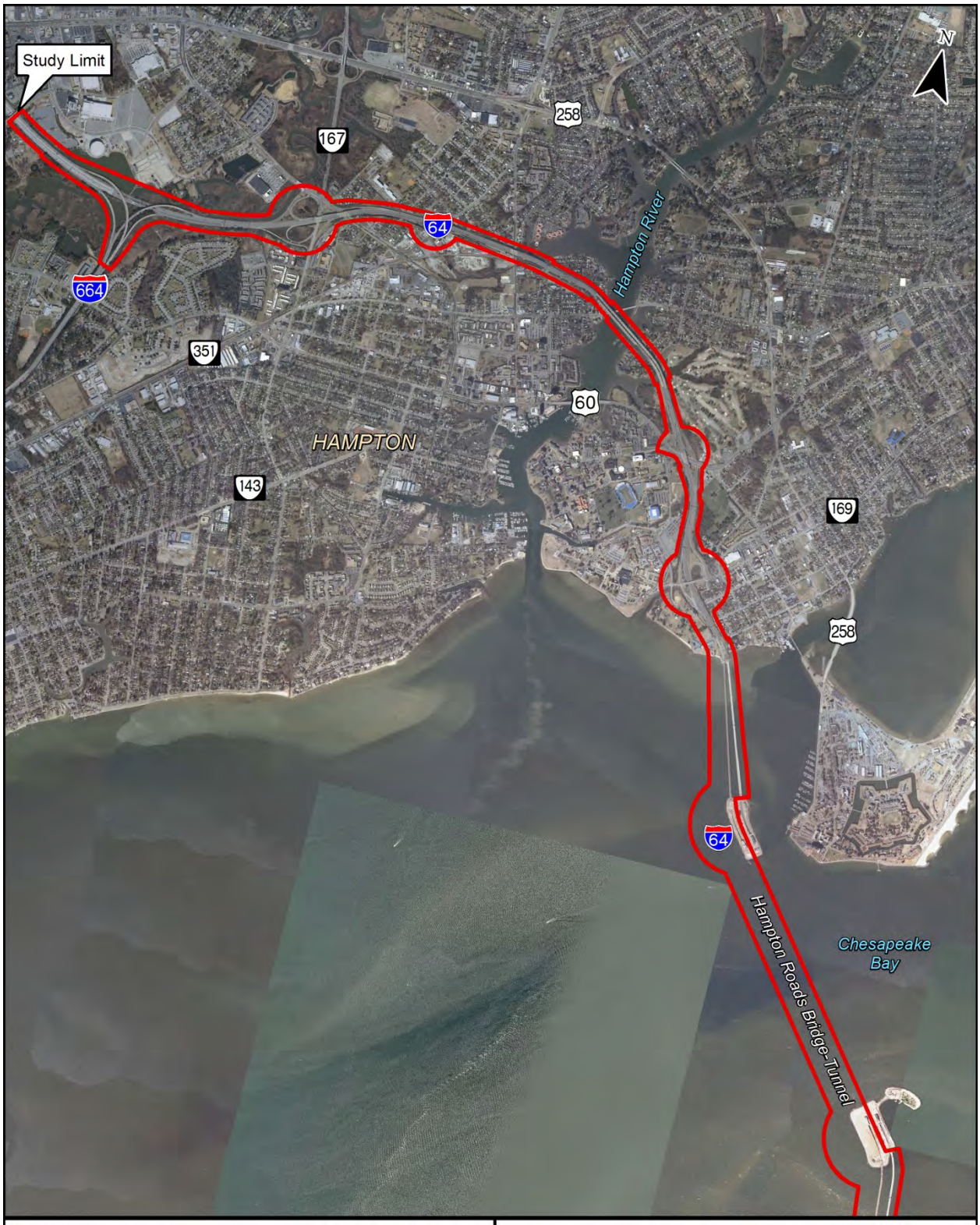
2.1.1. Build-8 Alternative

The Build-8 Alternative would provide four continuous mainline lanes in each direction of I-64 throughout the limits of the study area. Through the Hampton section of the study area, this alternative would require one lane of widening in each direction of I-64. Through the Norfolk section, this alternative would require the addition of two lanes in each direction of I-64. The typical section would include 12-foot travel lanes and shoulders. The eastbound and westbound directions would be separated by a concrete traffic barrier. The total pavement width of the Build-8 Alternative mainline would be approximately 150 feet and would require outside widening on both sides of the highway through the Hampton section. In the Norfolk section, the Build-8 Alternative would require outside widening on both sides of the highway and widening to close the existing grass median.

The Build-8 Alternative would provide an open roadside section that would include a clear zone, roadside grading to tie the proposed slope to existing ground, and an offset to the LOD to accommodate elements such as drainage, utilities, and stormwater management. The offset from the outside edge of shoulders to the LOD would be approximately 90 feet. Based on the level of detail of this study, a consistent LOD was established for the alternative to ensure that there would be adequate width to accommodate detailed design and construction in the future. Consequently, the resulting potential LOD for the Build-8 Alternative mainline is 360 feet or 425 feet, depending on topographic variability and needed width for auxiliary lanes. Through the Willoughby Spit, the mainline widening would occur on the south side of the existing roadway only.

At the western study limits west of the I-664 interchange, the alternative mainline would tie to the existing mainline typical section of twelve lanes at the Pine Chapel Road Bridge. At the eastern study limits east of the I-564 interchange, the mainline would tie into the existing I-64 mainline typical section of four lanes.

The existing approach bridges currently carry two lanes per direction. In the Build-8 Alternative, the eastbound bridge would be modified to carry two westbound lanes. Additionally, a new four-lane bridge would be constructed to the south of the existing bridges to carry the eastbound lanes. A new four-lane tunnel would be constructed 200 feet west of the existing tunnel. The proposed tunnel portals would not be located immediately adjacent to the existing tunnel portals; however, the new portals would be close enough to the existing portals to allow for the existing islands to be expanded without creating new islands.



Legend

Limit of Disturbance for Retained Build Alternatives

Source: VDOT, 2010

0 0.25 0.5 1 Miles

Retained Build Alternatives - Hampton

U.S. Department of Transportation Federal Highway Administration

VDOT

Figure 1

Legend

Limit of Disturbance for Retained Build Alternatives

Source: VDOT, 2010

0 0.25 0.5 1 Miles

Retained Build Alternatives - Norfolk

U.S. Department of Transportation Federal Highway Administration

VDOT

Figure 1a

Interchanges within the corridor would be modified to accommodate the widened mainline section. Some interchanges would require elimination, reconstruction, realignment and/or lengthening of ramps, or similar modifications to surface streets, to meet geometric requirements per the American Association of State Highway and Transportation Officials (AASHTO) design criteria.

2.1.2. Build-8 Managed Alternative

The Build-8 Managed Alternative would be similar to the Build-8 Alternative, providing four continuous mainline lanes in each direction of I-64. However, the Build-8 Managed Alternative would provide separation between managed (e.g., toll, high occupancy toll (HOT), or high occupancy vehicle (HOV)) and general purpose lanes. The Build-8 Managed Alternative could include tolling all of the I-64 mainline lanes or a combination of managed and general purpose lanes, such as HOT lanes where HOV users could use the lanes for free but single occupancy vehicles (SOV) would be required to pay a toll. Potential managed lane approaches would include providing two general purpose and two managed lanes in each direction or providing three general purpose lanes and one managed lane in each direction.

As with the Build-8 Alternative, the typical section would include 12-foot travel lanes and shoulders, and the eastbound and westbound directions would be separated by a concrete traffic barrier. The total width of the Build-8 Alternative mainline would be approximately 160 feet, and would require outside widening on both sides of the highway in the Hampton section. In the Norfolk section, the Build-8 Managed Alternative would require outside widening and inside widening into the existing grass median. The managed lanes would tie to the HOV lanes on I-64 on both ends of the study area.

Like the Build-8 Alternative, the Build-8 Managed Alternative would provide an open roadside section with a clear zone, roadside grading to tie to the existing ground, and an offset to the LOD, resulting in a total offset from the outside edge of shoulders of approximately 90 feet. A consistent LOD was established for the alternative to ensure that there would be adequate width to accommodate detailed design and construction in the future. The resulting potential LOD for the Build-8 Managed Alternative mainline is 370 feet or 435 feet, depending on topographic variability and needed width for auxiliary lanes.

The Build-8 Managed Alternative would have the same mainline alignment through Willoughby Spit as the Build-8 Alternative. The Build-8 Managed Alternative would also have the same tie points to the existing mainline as the Build-8 Alternative.

The Build-8 Managed Alternative bridges and tunnel also would be similar to the Build-8 Alternative. However, the new eastbound structures would be wider to provide a four-foot buffer between the managed and general purpose lanes. The westbound lanes would not include a four-foot buffer separation between the managed lane and the general purpose lane because the existing tunnels would not be modified. Interchanges would be the same as the Build-8 Alternative, except the ramps would be further adjusted to accommodate the buffer that would separate the managed lanes along both directions of the mainline.

2.1.3. Build-10 Alternative

The Build-10 Alternative would provide five continuous mainline lanes in each direction of I-64 throughout the limits of the study area. Throughout the Hampton section, the Build 10 Alternative would require widening both directions of I-64 by two lanes. In the Norfolk section, the Build 10 Alternative would require widening both directions of I-64 by three lanes. Similar

to the Build-8 Alternative, the typical section would include 12-foot travel lanes and shoulders, and the eastbound and westbound directions would be separated by a concrete traffic barrier. The total width of the Build-10 Alternative mainline would be approximately 170 feet and would require outside widening on both sides of the highway through the Hampton section. In the Norfolk section, the Build-10 Alternative would require outside widening on both sides of the highway and widening into the existing 36-foot grass median.

Like the Build-8 Alternative, the Build-10 Alternative would provide an open roadside section that would include a clear zone, roadside grading to tie to existing ground, and an offset to the LOD. In total, the offset from the outside edge of shoulders to the LOD would be approximately 90 feet. A consistent LOD was established for the alternative to ensure that there would be adequate width to accommodate detailed design and construction in the future. The resulting potential LOD for the Build-10 Alternative mainline is 400 feet or 465 feet, depending on topographic variability and needed width for auxiliary lanes.

Through the Willoughby Spit, the mainline widening would occur on the south side of the existing roadway. As with the Build-8 Alternative, the mainline would tie into the existing mainline typical section of twelve lanes at the Pine Chapel Road Bridge, and the four lane typical section at the east end of the study limits.

The Build-10 Alternative bridges would be similar to the Build-8 Alternative. However, the new structure would include one westbound lane with shoulders and five eastbound lanes with shoulders. The tunnel would be approximately 150 feet wide and include one westbound lane with shoulders and five eastbound lanes with shoulders, in two separate tubes. Interchanges would be the same as the Build-8 Alternative at most interchanges, except the ramps would be adjusted to accommodate the wider mainline.

2.2. Purpose and Need

2.2.1. Study Area and Existing Roadway

Study Area

The Virginia Department of Transportation (VDOT), in cooperation with FHWA, is studying the environmental consequences of transportation improvements along I-64 and the Hampton Roads Bridge-Tunnel (HRBT). The study area extends from the I-64 interchange with I-664 in the City of Hampton to the I-64 interchange with I-564 in the City of Norfolk, a distance of approximately 12 miles, including the 3.5-mile-long HRBT. The study area encompasses lands and water bodies within or adjacent to the I-64 corridor that could potentially incur direct or indirect impacts as a result of the proposed study.

The interchanges of I-64 with I-664 on the west and I-564 on the east are both major traffic entry and exit points along I-64 and therefore are logical termini because they show a distinct interchange of volumes between the two facilities at each junction.[1] The listing of the study in the Long-Range Transportation Plan for the Hampton Roads region also identifies I-664 and I-564 as the termini. As such, advancement of this study within these termini is consistent with the overall Long-Range Transportation Plan, but it does not force or preclude the design or implementation of other elements of the regional transportation system.

[1] I-64 HRBT Logical Termini Memorandum, September 8, 2011.

Existing Roadway

Within the Hampton section of the study, I-64 is predominantly three lanes per direction, with auxiliary lanes (acceleration and deceleration lanes) at the interchanges. The posted speed limit is 55 miles per hour (mph). Grades are three percent or less. The typical section along eastbound I-64 changes from three lanes to two lanes at the Settlers Landing Road interchange (Exit 267). In the westbound direction, the two lanes exiting at the tunnel expand to three lanes at the South Mallory Street interchange (Exit 268), which is approximately one mile west of the tunnel portal. The following interchanges are located west of the HRBT:

- Exit 264 – I-664.
- Exit 265 – Route 167/Route 134 – LaSalle Avenue, North Armistead Avenue, and Rip Rap Road.
- Exit 267 – US 60/Route 143 – Settlers Landing Road and Woodland Road.
- Exit 268 – Route 169 – South Mallory Street.

The 3.5-mile HRBT connects the Peninsula (Hampton) to the Southside (Norfolk) by spanning Hampton Roads, the confluence of the James River, Nansemond River, and Elizabeth River. The structure is composed of the 0.6-mile western approach bridges, 1.4-mile-long tunnels, and 1.2-mile eastern approach bridges with 0.15-mile portal islands at the transitions between the bridges and the tunnels. Within the Norfolk section of the study, I-64 has two lanes per direction. I-64 is on bridges across Willoughby Bay south of the West Ocean View Avenue/Bayville Street interchange; over wetlands near West Ocean View Avenue/West Bay Avenue; and across Mason Creek south of West Bayview Boulevard where an entrance ramp is provided for Granby Street. The following interchanges are located east of the HRBT:

- Exit 272 – Route 168 – West Ocean View Avenue/Bayville Street.
- Exit 273 – US 60 – 4th View Street.
- Exit 274 – Entrance ramp from eastbound West Bay Avenue to I-64 east and exit ramp from westbound I-64 to westbound West Ocean View Avenue.
- Exit 276 – I-564 and Granby Street (Route 460). Southbound Granby Street cannot be accessed from westbound I-64 and northbound Granby Street is not accessible from eastbound I-64.

In addition, a slip ramp is provided from Granby Street to westbound I-64 just north of Norfolk Naval Station Gate 22 and the Forest Lawn Cemetery.

Travel Demand

Travel demand[2] on I-64 is generated by multiple trip purposes including commuters, freight movements, military mobility, and tourism.

- I-64 and the HRBT provide a vital regional link for commuters traveling to and from large regional employers, such as:
    - Naval Station Norfolk (the largest navy base in the world).
    - Port facilities (second largest on the east coast [by total cargo volume]).

[2] Demand for travel is generated by needs and desires for the movement of people and goods. In general, traffic volume on a highway represents the level of aggregate demand of travelers to use that highway as a path from trip origin to trip destination.

  - Newport News Shipbuilding (the nation's sole-industrial designer, builder, and refueler of nuclear-powered aircraft carriers and one of only two shipyards capable of designing and building nuclear-powered submarines).
- I-64 provides for other general travel for business and personal purposes between and within the Cities of Hampton and Norfolk, including shopping, recreation, and entertainment. I-64 and the HRBT serve as a primary route for the transfer and delivery of local, regional, and international freight movements. As an interstate facility linking most of the urbanized region, I-64 is a conduit for the transport of goods of all kinds, including industrial supplies, building materials, foodstuffs, and business and personal consumables. It is also a key link in transporting international freight to and from the region's shipping ports, including the 648-acre Norfolk International Terminals (NIT) in Norfolk adjacent to the navy base.
- Movements of military personnel and equipment also occur in the corridor. I-64 is part of the Strategic Highway Network (STRAHNET), which is designated by FHWA in coordination with the U.S. Department of Defense as the minimum network of highways that are important to the United States' strategic defense policy, providing access, continuity, and emergency capabilities to important military installations and ports. Among the military installations in the Hampton Roads region are Naval Station Norfolk, Naval Air Station Oceana, Joint Expeditionary Base Little Creek – Fort Story, Fort Eustis, Langley Air Force Base, Naval Support Activity (NSA) Hampton Roads, and Norfolk Naval Shipyard. There are approximately 120,000 military and civilian personnel at Navy installations in the area.[3] In its 2011 Hampton Roads Military Transportation Needs Study, the Hampton Roads Transportation Planning Organization (HRTPO) reported that transportation congestion on the HRBT may hinder the ability to maintain or bring additional military personnel to the region, increase travel times between military installations during business hours, and detract from mission performance effectiveness and efficiency.
- I-64 is a principal travel route for tourists visiting the attractions and beaches of Hampton Roads, as well as travelers driving through the region to the Outer Banks of North Carolina. Much of the tourist-related traffic is seasonal and related to the beaches, resulting in summertime peaks in traffic volumes that are higher than normal peaks. Tourism attractors include:
  - Virginia Beach's 29 miles of beaches, the nearby historic triangle of Colonial Williamsburg/Jamestown/Yorktown, other historic properties such as Fort Monroe, and numerous museums and other attractions that draw visitors to the region each year.
  - Travelers can take I-64 to Route 168 in the City of Chesapeake to reach the beach destinations on North Carolina's Outer Banks. (Roadway signage currently directs travelers on eastbound I-64 to use the I-664/Monitor Merrimac crossing for North Carolina Outer Banks destinations.)
- I-64 is a designated hurricane evacuation route in the event of a hurricane threatening the Hampton Roads region. I-64 and the HRBT are one of seven roads that the Commonwealth of Virginia has designated as evacuation routes in the Hampton Roads area (use of the HRBT may be restricted based on weather conditions). When an evacuation order is issued, the eastbound lanes can be reversed to increase westbound capacity for evacuating traffic. All traffic will travel west on I-64 from

[3] Based on FY 2010 data from Commander, Navy Region Mid-Atlantic Economic Impact Report for the Hampton Roads area: http://www.cnic.navy.mil/navycni/groups/public/@cnrma/documents/document/cnicd_a114713.pdf

Norfolk to Richmond beginning east of the HRBT in Norfolk (Exit 273) to the I-295 interchange in Richmond (Exit 200); gates that have been installed on interchange ramps can be lowered to prohibit eastbound entry along the evacuation route. The governor also can order a lane reversal of I-64 for other emergency purposes.

Travel demand from the sources noted above resulted in daily traffic volumes on I-64 in 2011 from approximately 115,700 vehicles per day (vpd) east of the I-664 interchange to approximately 77,800 vpd between 4th View Street and West Ocean Avenue, as shown in **Table 1.** By 2040, these volumes are forecasted to grow to approximately 130,000 and 88,600, respectively, as shown in **Table 2**. The four-lane section of the HRBT and the east (south) approach of I-64 were designed for approximately 70,000 vpd.

Table 1: Existing (2011) Traffic Volumes and Levels of Service

Location on I-64	Daily Volumes		Total Two-Way Daily Volumes	AM Peak Volumes and LOS*		PM Peak Volumes and LOS*	
	East-bound	West-bound		East-bound	West-bound	East-bound	West-bound
West of I-664 (Exit 264)	76,100	75,700	151,800	5,440 na	5,285 na	4,285 na	7,235 na
I-664 To LaSalle Ave (Route 167, Exit 265A)	57,400	58,300	115,700	4,675 C	4,575 C	4,270 C	4,705 C
LaSalle Ave To Settlers Landing Road (US 60/Route 143, Exit 267)	42,000	46,300	88,300	3,660 C	3,775 C	3,165 B	4,070 C
Settlers Landing Road To South Mallory Street (Route 169, Exit 268)	42,700	45,500	88,200	3,820 D	3,305 B	2,960 C	3,945 C
South Mallory Street To 15th View Street (Exit 272), Hampton Roads Bridge-Tunnel	44,100	44,600	88,700	3,655 E	3,265 D	3,320 D	3,380 D
15th View Street To 4th View Street (Exit 273)	44,000	44,300	88,300	3,695 D	3,225 D	3,265 D	3,375 D
4th View Street To West Ocean Avenue and West Bay Avenue (Exit 274)	39,300	38,500	77,800	3,315 D	2,865 C	2,985 C	2,840 C
West Ocean/West Bay Avenue To Granby Street (US 460)	45,400	43,300	88,700	3,585 D	3,545 D	4,020 E	2,990 C
Granby Street to I-564 (Exit 276)	50,400	37,500	87,900	3,920 D	3,280 D	4,535 E	2,665 C
East of I-564, Mainline HOV	62,200 8,000	63,500 8,000	125,700 16,000	3,535 B	6,840 700 D	6,180 2,620 C	3,575 B

** LOS calculated using Highway Capacity Manual methodology.*

Table 2: Design Year (2040) No-Build Traffic Volumes and Levels of Service

Location on I-64	Daily Volumes		Total Two-Way Daily Volumes	AM Peak Volumes and LOS*		PM Peak Volumes and LOS*	
	East-bound	West-bound		East-bound	West-bound	East-bound	West-bound
West of I-664 (Exit 264)	97,900	97,900	195,800	7,025 na	6,875 na	5,525 na	9,225 na
I-664 To LaSalle Ave (Route 167, Exit 265A)	65,000	65,000	130,000	5,250 C	5,150 D	4,800 C	5,275 D
LaSalle Ave To Settlers Landing Road (US 60/Route 143, Exit 267)	55,000	55,000	110,000	4,550 C	4,700 C	3,950 C	5,075 D
Settlers Landing Road To South Mallory Street (Route 169, Exit 268)	53,300	53,300	106,600	4,625 E	4,000 C	3,575 D	4,775 D
South Mallory Street To 15th View Street (Exit 272), Hampton Roads Bridge-Tunnel	56,100	56,100	112,200	4,700 F	4,100 E	4,150 F	4,300 F
15th View Street To 4th View Street (Exit 273)	52,400	53,400	105,800	4,675 F	3,975 E	4,150 E	4,275 E
4th View Street To West Ocean Avenue and West Bay Avenue (Exit 274)	44,300	44,300	88,600	3,775 D	3,275 D	3,400 D	3,225 D
West Ocean/West Bay Avenue To Granby Street (US 460)	50,200	50,200	100,400	4,050 E	4,025 E	4,550 F	3,375 D
Granby Street to I-564 (Exit 276)	55,800	42,700	98,500	4,325 E	3,575 D	5,250 E	2,750 C
East of I-564, Mainline HOV	66,700 10,000	66,700 10,000	133,400 20,000	4,425 B	8,675 650 E	8,300 2,650 D	4,075 B

** LOS calculated using Highway Capacity Manual methodology.*

Transit Services

Hampton Roads Transit (HRT) provides express bus service through the I-64 HRBT via the Metro Area Express (MAX). The MAX 961 route offers services between downtown Norfolk, Hampton, and Newport News along I-64 from the Granby Street entrance near Patrol Road to Settlers Landing Road (Exit 267) in Hampton and again from Armistead Avenue (Exit 265) to I-664 (Exit 264). On weekdays, service runs from 5:00 AM to 10:15 PM, with headway departures every 30 minutes during peak hours and every hour during off-peak hours. Saturday/Sunday service runs from 5:00 AM / 7:00 AM to 9:00 PM with headway departures every hour. All HRT vehicles are equipped with bike racks and are capable of accommodating two bicycles at a time.

2.2.2. History

The I-64 HRBT corridor has been the subject of prior studies. Past efforts have led to the initiation of an Environmental Impact Statement (EIS). This Section 4(f) Evaluation is being prepared concurrently with the EIS.

- The Final Environmental Impact Statement (FEIS) for the Hampton Roads Crossing Study, approved by FHWA on March 1, 2001, addressed alternatives that involved increasing capacity along the existing I-64 HRBT corridor; however, those alternatives were not selected in the Record of Decision (ROD).
- VDOT completed the Hampton Roads Bridge-Tunnel Expansion Feasibility Study in 2008, with study limits from I-664 to I-564. The goal of the Feasibility Study was to develop concept-level alternatives, develop estimates of congestion-reduction benefits of the alternatives, and provide policy-level guidance on the feasibility and long-term benefits of the alternatives. The study identified three feasible alternatives that would provide adequate levels of traffic service meeting federal requirements for interstate facilities.
- The Virginia General Assembly on March 11, 2010 passed a bill requiring VDOT to accept for review under the Public-Private Transportation Act (PPTA) of 1995 (§ 56-556 et seq. of the Code of Virginia) unsolicited proposals to add physical capacity to the HRBT. In late 2010 and early 2011, VDOT received several PPTA proposals. As discussed at the April 20, 2011 Commonwealth Transportation Board workshop, further action on the proposals has been deferred pending completion of the EIS.
- The I-64 HRBT study was included in VDOT's FY2011-2016 Six-year Improvement Program for preliminary engineering study. The study also has been included in the HRTPO *2034 Long-Range Transportation Plan* and *FY2012-2015 Transportation Improvement Program*.

2.2.3. Needs – Existing Conditions

Overview

I-64 and the HRBT provide a critical link in the regional transportation network of the Hampton Roads region, serving multiple travel purposes. However, traffic congestion occurs routinely, as represented by deficient levels of service, reduced speeds, and long and unpredictable travel times. Congestion is caused by inadequate capacity to accommodate high travel demand and is compounded by geometric deficiencies of the existing facilities. Within the study limits, daily traffic volumes in 2011 range from 77,800 to 115,700 vpd, as shown in **Table 1**. Daily traffic volumes through the HRBT are approximately 88,700 vpd. Peak hour volumes approach or exceed capacity on some sections. The substandard vertical clearances in the tunnels are problematic to trucks that exceed these height restrictions.

Inadequate Capacity

Traffic volumes on some sections of I-64 routinely exceed capacity during peak periods. The generally accepted capacity, or throughput, of a single freeway lane is 2,200 vehicles per hour; however, this volume is reduced when considering factors such as narrow lanes, lack of shoulders, and high truck volumes. The tunnels, because of their constricted horizontal and vertical clearances, provide less capacity than do the bridge trestle approaches and the landside I-64 roadway. HRTPO estimates a throughput of only 1,600 to 1,700 vehicles per hour per lane through the tunnels.[4] Driver reactions to the tunnel itself, as well as the grades going down into and coming up out of the tunnels lead to braking and reductions in travel speeds, which ripple back through the traffic stream. Additionally, in the eastbound direction, the lane drop from three lanes to two lanes reduces capacity by a third and contributes to the bottleneck.

[4] HRTPO, Hampton Roads Congestion Management Process 2010 Update, September 2010.

When travel demand exceeds capacity, congestion occurs. Congestion can be described as a condition characterized by unstable traffic flow, reduced travel speeds, stop-and-go movements, travel delays, and queuing. Congestion within the HRBT corridor occurs in two forms: recurring and nonrecurring. Congestion that occurs on a regular basis at the same general location is known as recurring congestion, which is caused by inadequate capacity to accommodate traffic volumes. Congestion that occurs on an irregular basis at varying times and locations is known as nonrecurring congestion, which is caused by weather events, crashes that obstruct the roadway, or other special events that reduce capacity temporarily. A 2010 report by HRTPO[5] identifies the HRBT as the most congested freeway segment in the Hampton Roads region.

One way of measuring highway congestion is level of service.[6] Interstate highways are usually designed to achieve a level of service "C" in the design year. The design year is identified as the planning horizon for a proposed study. For this study, the design year is 2040. Based on AASHTO's "Green Book," *A Policy on Geometric Design of Highways and Streets*, as specified in 23 CFR 625.4, in heavily developed urban areas a level of service "D" may be acceptable if achievement of level "C" is not practical. As shown in **Table 1**, existing levels of service are "D" or "E" on several mainline sections of I-64 and at several ramp merge and diverge areas at interchanges. While the capacity analysis results indicate generally acceptable operating conditions under existing conditions, they do not appear to correspond to typical observed conditions of recurring congestion along the corridor. This difference is likely because the *Highway Capacity Manual* (HCM) methodology does not take into account the effects of downstream bottlenecks and spillback of congestion. In addition, if the analysis at each location is conducted using throughput volumes as opposed to full demand volumes, the LOS results will be understated at the chokepoint as it is not taking into consideration the full demand. Queue lengths approaching the HRBT typically extend 3 to 5 miles long (depending on direction and time of day), which indicates that level of service should be F for the corridor during the peak hours. The chokepoint causes recurring congestion to spill back to upstream locations, thereby reducing throughput at those locations as well.

The HCM methodology does provide factor adjustments for narrow lanes and narrow lateral clearance (i.e., narrow shoulders or walls). However, other factors that affect traffic operations that are not reflected in the HCM methodology but are applicable to the HRBT include the abrupt transition from daylight to dark lighting conditions, limited line-of-sight caused by tunnel structures, and low overhead clearance. These other factors affect driver responses to the roadway; therefore, the actual LOS experienced by the drivers is worse than the results obtained using HCM methodology. Finally, non-recurring congestion, which can be caused by crashes or the need to remove over-height trucks from the traffic stream, reduce capacity of the roadway and impact LOS as well; however, these conditions are also not accounted for in the LOS analysis.

Slower travel speeds and increased travel times are a more comprehensive indicator of the corridor-wide recurring congestion. The April 2012 Hampton Roads Regional Travel Time/Speed Study[7], which summarizes peak period travel time and speed data for 1,300 miles of

[5] HRTPO, Hampton Roads Congestion Management Process 2010 Update, September 2010.

[6] Level of service provides a comparative measure of the traffic performance of roads through a grading from A to F. For limited-access highways like interstate routes, level of service A represents free flow traffic operations with almost unimpeded ability to maneuver within the traffic stream, while level of service F represents breakdown in flow and substantial impedance of the ability to maneuver within the traffic stream.

[7] HRTPO, Hampton Roads Regional Travel Time/Speed Study, April 2012.

roadway throughout Hampton Roads, ranked the HRBT as having the third highest delay during the morning peak period (after the Downtown and Midtown Tunnels) and second highest delay during the evening peak period (after the Downtown Tunnel). As documented in the October 28, 2011 I-64 HRBT Existing Traffic Conditions Final Report,[8] an analysis of travel speeds in the corridor shows that in the eastbound direction, two pronounced periods with slow traffic occur. On sections west of the tunnel during the AM peak period, speeds fall below 40 MPH as early as 5:15 AM, and they do not exceed 40 MPH again until approximately 10:00 AM. Speeds are at their lowest (below 20 MPH) between 6:00 AM and 8:30 AM. The duration of the PM peak period slowdown on the same sections is somewhat shorter, starting at around 2:30 PM and ending at approximately 6:30 PM. However, speeds still fall below 20 MPH for approximately 2.5 hours during the typical PM peak period.

In the westbound direction, one pronounced period of slow traffic occurs during the PM peak period, starting as early as 1:45 PM and lasting through 6:45 PM. Speeds fall below 20 MPH during a substantial portion of this peak period (2:45 PM to 6:15 PM). The speed reductions occur in two areas: one approaching the HRBT and the other through the I-564 interchange area. Recurring congestion is also reflected in the queuing of traffic. Although the queue lengths vary by day of the week and season of the year, on average, queues extend for three miles from the HRBT in the eastbound direction during both the morning and evening peak periods and up to five miles from the HRBT in the westbound direction in the evening. Queue lengths sometimes exceed six miles during the summer.[9] Additionally, because transit buses travel along with all other vehicles, the queuing and delays also influence the efficiency and reliability of transit services.

As traffic flows approach and exceed capacity and travel speeds decrease, travel times through the corridor become unpredictable. The higher traffic densities result in vehicles being more closely spaced, increasing the interaction among vehicles and distractions to drivers. The flow becomes unstable and abrupt stop-and-go traffic movements occur. Because of the unstable nature of the traffic flow, the exact onset, severity, and frequency of the congested conditions can be difficult to predict and the actual travel time may vary considerably from the average from one day to the next, especially when crashes or breakdowns result in lane restrictions or closures. Such incidents result in nonrecurring congestion, which compounds normal expected congestion and increases the unreliability of travel times in the corridor. Incident response and management is difficult due to limited space in the tunnels and on the tunnel approach bridges and the lack of viable detour options to maintain traffic flow. Analysis[10] of crash data from 2006 to 2008 shows distinctive spikes in the number of crashes as well as the crash rate approaching the HRBT in both the eastbound and westbound directions. During this period, a total of 872 crashes were reported along eastbound I-64 and 971 crashes along westbound I-64. The crashes were generally concentrated on the eastbound and westbound approaches to the tunnel. The majority of reported crashes were rear-end collisions, which are indicative of congested stop-and-go conditions.

The existing HRBT also does not provide sufficient capacity to allow for efficient maintenance of traffic during routine maintenance or construction activities. In some cases during maintenance or construction, one of the HRBT spans may need to be reduced to one lane or closed, resulting in two lanes of traffic for the crossing (one lane in each direction on the other

[8] VDOT, I-64 HRBT Existing Traffic Conditions Final Report, October 28, 2011.

[9] HRTPO, Hampton Roads Congestion Management Process 2010 Update, September 2010.

[10] VDOT, I-64 HRBT Existing Traffic Conditions Final Report, October 28, 2011.

span) for an extended period of time without a viable detour. These activities result in substantial nonrecurring congestion and delays beyond the congestion experienced during normal operation.

Geometric Deficiencies of Existing Facilities

Current VDOT interstate design standards (GS-5, from Road Design Manual) call for the following:

- Travel lanes 12 feet wide.
- Right shoulder, 14 feet wide, 12 feet paved.
- Left shoulder, with four lanes total both directions, 8 feet wide, 4 feet paved.
- Left shoulder, with six or more lanes total both directions, 14 feet wide, 12 feet paved.
- Shoulders on bridges, with two lanes in same direction, 12 feet wide right, 6 feet wide left.
- Shoulders on bridges, with three or more lanes in same direction, 12 feet wide right, 12 feet wide left.
- Vertical clearance, 16 feet 6 inches.[11]

Within the Hampton section of the study, where I-64 is predominantly three lanes per direction, travel lanes are 12 feet wide; right shoulders are 12 feet wide; and left shoulders are 4 feet wide. The lane and right shoulder widths meet current interstate design standards; however, the left shoulder width does not meet current interstate design standards. In the eastbound direction, the three lanes are reduced to two lanes (at milepost 267) prior to entering the tunnel, which does not meet lane continuity guidelines in AASHTO's A Policy on Geometric Design of Highways and Streets. This lane reduction exacerbates the bottleneck at the tunnel due to reduced capacity.

The bridges between the tunnels and the land-side roadways have 12-foot-wide lanes with 10-foot-wide right shoulders and 4-foot-wide left shoulders. The shoulders do not meet current design standards. Additionally, these approach bridges have a low vertical clearance above the water that does not meet the clearance specifications in AASHTO's Guide Specifications for Bridges Vulnerable to Coastal Storms, 2009. During a storm, water could overtop the bridge, the saltwater could contact the bottom of the girders causing deterioration, and a high storm surge could potentially lift the bridge from its bearings.

The westbound tunnel has 12-foot-wide lanes and no shoulders. The vertical clearance is 13 feet 6 inches, which is substandard. The vertical clearance is problematic for some trucks. An average of 80 to 90 over-height trucks per month must be stopped and inspected on the HRBT,[12] which causes disruption to traffic flow; all traffic is stopped when trucks are pulled from I-64 for inspection and then stopped again to allow trucks to re-enter I-64 following inspection. The eastbound tunnel has 12-foot-wide lanes and no shoulders. The vertical clearance is 14 feet 6 inches, which is substandard.

Within the Norfolk section of the study, I-64 has two lanes per direction. The travel lanes are 12 feet wide; right shoulders are 12 feet wide; left shoulders vary from 2 to 6 feet wide. The lane

[11] VDOT, Manual of the Structure and Bridge Division, Volume V, Part 2, Chapter 6, Geometrics.

[12] VDOT, Hampton Roads Bridge-Tunnel Monthly Traffic Stoppage Reports, January 2008 to August 2011.

and right shoulder widths meet current interstate design standards; however, the left shoulder width does not meet current interstate design standards.

As the tunnel, bridge, and road infrastructure have aged, greater and more frequent maintenance and repair needs are becoming apparent. Although major reconstruction is not yet required, increasing maintenance activities and the lack of viable detour routes make it increasingly difficult to maintain traffic flow at desirable levels.

2.2.4. Needs – Future Conditions

Overview

The factors contributing to the existing inadequate capacity and roadway deficiency problems are expected to continue and increase into the future. Population in the Hampton Roads region is projected to grow 32 percent between 2000 and 2034, while employment is projected to grow 26 percent. As this growth in the Hampton Roads region continue into the future, travel demand also will increase and the congested conditions described in Chapter 1.3.2 will intensify. Federal law (23 USC 109) suggests that interstate projects should accommodate the types and volumes of traffic anticipated for a 20-year period following approval of the plans, specifications, and estimates for the improvement. The design year has been established as 2040 for this study. Travel forecasting has been conducted to predict future traffic volumes and to identify associated transportation infrastructure needs. The 2040 forecasted volumes on I-64 within the study limits range from 130,000 to 88,600 vpd, as shown in **Table 2**.

Inadequate Capacity

With growing traffic volumes, exceedance of capacity during peak periods will become progressively worse, which is illustrated by the levels of service listed in **Table 2**. Periods of congestion will become longer, as will the queues resulting from that congestion. Likewise, average travel speeds will decline further , resulting in longer and less reliable travel times. The ability to provide efficient transit services also will be further diminished. Additionally, over time, the continued aging of the tunnel, bridge, and road infrastructure will result in greater maintenance needs. With deficient capacity even now, and with no viable detour routes, the ability to maintain traffic flow during future maintenance and construction efforts will become increasingly difficult.

Geometric Deficiencies of Existing Facilities

There are no currently planned major improvements to alleviate existing geometric deficiencies. The bottleneck in the eastbound direction caused by three lanes reducing to two lanes will become progressively worse. Similarly, the height restrictions of the existing tunnels will continue to restrict and impede movements of vehicles that are taller than those limits. The substandard dimensions of shoulders also will continue to contribute to less efficient movement of traffic. While ongoing maintenance will be conducted as needed to preserve the structural integrity of existing facilities, the service life of these facilities likely cannot be extended indefinitely without more extensive rehabilitation or reconstruction in the future.

2.2.5. Summary

Based on the above considerations, the purpose of the I-64 HRBT study is to improve existing and future traffic congestion on the 12-mile section of I-64 between I-664 in the City of Hampton and I-564 in the City of Norfolk. The congestion stems from inadequate capacity of the existing facilities to accommodate the high travel demand. The worst congestion results from the bottleneck posed by the existing tunnels, whose configurations (horizontal and vertical

clearances) reduce capacity. As future maintenance needs increase due to ongoing physical deterioration of the existing facilities, the capacity restrictions will severely limit the ability to maintain traffic flow during any major rehabilitation efforts. Accordingly, the study would address the following specific needs:

- Inadequate capacity of existing facilities to accommodate existing and forecasted travel demand at acceptable levels of traffic service, operating speeds, and travel times.
- Geometric deficiencies of the existing facilities that impede operating efficiency and contribute to decreased levels of traffic service.

3. SECTION 4(f) PROPERTIES

Coordination was undertaken with the City of Hampton and the City of Norfolk to identify any publicly owned parks, recreation areas, and wildlife and waterfowl refuges within the study area. Consultation was initiated with the Virginia Department of Historic Resources (VDHR) and other consulting parties pursuant to Section 106 of the National Historic Preservation Act to identify historic sites of national, state or local significance within the study area. There are sixteen Section 4(f) properties that would be used by the Retained Build Alternatives included for detailed study in the DEIS. **Figure 2** shows the Section 4(f) properties along the study corridor in the Hampton section, and **Figure 2a** shows the Section 4(f) properties in the Norfolk section. The properties include eight public park and recreation areas and eight historic sites:

Public Parks and Recreation Areas:

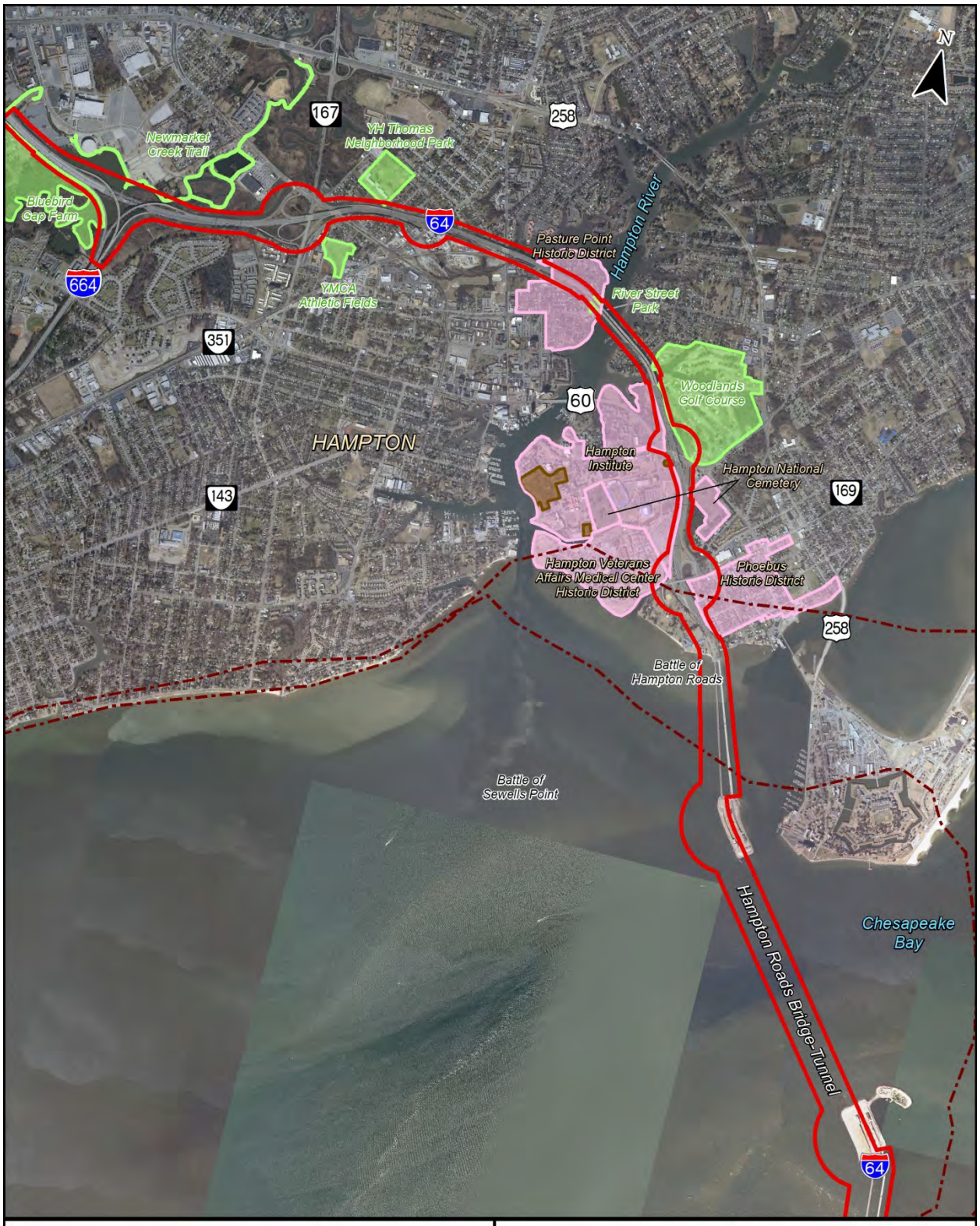
- Bluebird Gap Farm
- Newmarket Creek Park Trail
- Y.H. Thomas Park
- River Street Park
- Woodlands Golf Course
- Willoughby Boat Ramp
- Captain's Quarters Park
- Willoughby Elementary School Recreational Fields

Historic Sites:

- Pasture Point Historic District
- Hampton Institute
- Hampton National Cemetery
- Phoebus Historic District
- Battle of Hampton Roads
- Battle of Sewell's Point
- Merrimack Landing Historic District
- Forest Lawn Cemetery

Descriptions of these Section 4(f) properties are included in the following sections. Five additional park and recreation properties would be impacted by the Retained Build Alternatives which either are not Section 4(f) properties or would not incur a Section 4(f) use as defined in 23 CFR 774(17). These properties include the Peninsula Metropolitan Young Men's Christian Association (YMCA), the Hampton Veterans Affairs Medical Center District, the Hampton Roads Bridge-Tunnel, the Monkey Bottom Wetland Walkway, and Trail's End Park.

The YMCA, located adjacent to the LaSalle Avenue interchange with I-64, is on land owned by both the YMCA and the City of Hampton Redevelopment and Housing Authority. The City-owned land consists of athletic fields which feature a track, tennis courts, a baseball field, and a soccer field. The facilities are used by the general public and by the City of Hampton Parks & Recreation Department as a venue for youth baseball. Only the City-owned athletic fields are subject to Section 4(f). The Retained Build Alternatives would impact the YMCA property, but would not impact the athletic fields. Therefore, the Retained Build Alternatives would not result in a Section 4(f) use of the YMCA property since it is not publicly owned.



Legend

- National Historic Landmark
- Historic Properties
- Parks
- Historic Battlefields
- Limit of Disturbance Retained Build Alternatives

Source: VDOT, 2010

0 0.25 0.5 1 Miles

Section 4(f) Properties in Hampton

U.S. Department of Transportation Federal Highway Administration

VDOT

Figure 2


N
Chesapeake Bay
Battle of Sewells Point
Trails End Park
168
Willoughby Boat Ramp
Captain's Quarters Park
Battle of Hampton Roads
Willoughby Elementary School
Monkey Bottom Wetland Walkway
Willoughby Bay
64
NORFOLK
Merrimack Landing
460
168
194
564
Forest Lawn Cemetery
406
165
Battle of Sewells Point
Legend
National Historic Landmark
Historic Properties
Parks
Historic Battlefields
Limit of Disturbance Retained Build Alternatives
Source: VDOT, 2010
Miles
0
0.25
0.5
1
Section 4(f) Properties in Norfolk
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure 2a

The Hampton Veterans Affairs Medical Center Historic District (114-0101), located west of I-64 near Mallory Street in Hampton, is a historic site eligible for the National Register of Historic Places. The Historic District is comprised of approximately 266 acres of land on a peninsula adjacent to Hampton Institute. The site is owned and administered by the US Department of Veterans Affairs and is the country's fourth oldest military-run hospital, having begun operations in 1872. Although a portion of the district would be impacted by the Retained Build Alternatives, there would be no impact to any architectural properties within the district or any contributing properties constructed during the District's period of significance (1854-1944). In accordance with FHWA guidance on historic districts provided in FHWA's *Section 4(f) Policy Paper* (July 20, 2012), Section 4(f) only applies to properties within historic districts that are considered contributing to the eligibility of the district. Therefore, there would be no Section 4(f) use of the Hampton Veterans Affairs Medical Center Historic District.

The Hampton Roads Bridge-Tunnel (VDHR 114-5440) and the HRBT Administration Building are elements of the Interstate Highway System. Per 23 USC 103(c)(5), the Interstate System shall not be considered to be a historic site under Section 4(f). Therefore, although these properties are potentially eligible for the National Register, they are exempt from Section 4(f) consideration and further evaluation is not necessary.

The Monkey Bottom Wetland Walkway, located on US Navy property southwest of the existing I-64 at the Norfolk information center on Willoughby Bay, is an elevated wooden boardwalk and observation platform that extends 100 feet into a wetland created by the Navy as a compensatory project. Although the site is publicly owned and available for public use, its primary purpose is not as a park. Rather, the site is part of the tourist center to which it is appurtenant. It is not a part of the Norfolk park system, and has not been formally designated a park. Therefore, pursuant to 23 CFR 774.17and as described in under Question 1A of the FHWA *Section 4(f) Policy Paper*, the site is not considered a Section 4(f) property and further evaluation is not necessary.

Trail's End Park is an undeveloped open space park located on the western end of Willoughby Spit in Norfolk. It is not on the Norfolk Recreation, Parks and Open Space Department's list of parks, and is entirely within the I-64 right-of-way. The site has been formally reserved for a future transportation facility and constitutes a temporary recreational occupancy or use of a highway right-of-way. Therefore, pursuant to 23 CFR 774.11(h) and as described under Question 27 of the *Section 4(f) Policy Paper*, it is not subject to Section 4(f) and further evaluation is not necessary.

3.1. Public Park and Recreation Areas

3.1.1. Bluebird Gap Farm

Relationship

Figure 2 shows the relationship of the Bluebird Gap Farm property to the study corridor.

Area

Bluebird Gap Farm is comprised of approximately 60 acres.

Ownership

The Bluebird Gap Farm property is owned by the City of Hampton and maintained by the City of Hampton Parks & Recreation Department.

Activities
Bluebird Gap Farm is comprised of an animal farm/petting zoo that hosts various domestic and wild animal species that visitors are able to view and feed. Interactive experiences, such as hayrides sheep shearing, and horseshoeing demonstrations, also are offered. The Farm provides a shelter with picnic tables and additional picnic areas throughout the property. Several farm activity-related structures, such as a pig sty, are found on the property. The site also contains the Hampton Master Gardeners' Display Garden and Arboretum, a playground, a nature trail, and a stage with seating for special events and activities. The original Hampton train station and an old cemetery bearing Davis family graves dating to 1835 also are located at the Farm.

Access
Bluebird Gap Farm is accessed by vehicle via a driveway entrance from Pine Chapel Road.

Similarly Used Lands
There are other properties in the study area that have similar amenities as Bluebird Gap Farm, though the mix of amenities differs by facility. For example, the Virginia Living Museum in Newport News offers botanical gardens and indoor and outdoor animal displays. The Sandy Bottom Nature Park in Hampton has nature trails, picnicking, and a nature center. The Norfolk Botanical Garden in Norfolk has gardens viewable from pedestrian trails, train, and boat, but has none of the other elements that Bluebird Gap Farm possesses. Other properties in the general vicinity offer such amenities as nature trails and picnicking without the same experiential opportunities as Bluebird Gap Farm.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the property with respect to transportation improvements.

Unusual Characteristics
There are no unusual characteristics associated with the Bluebird Gap Farm.

3.1.2. Newmarket Creek Park and Trail System

Relationship
Figure 2 shows the relationship of the Newmarket Creek Park and Trail System to the study corridor.

Area
The Newmarket Creek Park and Trail System would be approximately 12 miles long.

Ownership
Within the study area, the Newmarket Creek Park and Trail System is proposed on land that is currently owned by the City of Hampton. The property is proposed to be administered by the City of Hampton Parks & Recreation Department. The City of Hampton identified the facility in their correspondence with VDOT on November 2, 2011. The Park and Trail have been formally designated for recreation purposes in the 2007 Newmarket Creek Park and Trail System Master Plan. The property meets the criteria for planned facilities described in the FHWA *Section 4(f) Policy Paper*.

Activities
The Newmarket Creek Park and Trail System is a planned facility that will perform a primarily recreational function. The system will support walking, bicycling, boating, and fishing. The trail will be available for pedestrian and other nonmotorized use. Three lakes (Bass Pro Lake, Coliseum Lake, and Lake Hampton) along the trail, as well as Newmarket Creek, are available for fishing and nonmotorized boat use. Boat access to these waters will be provided from the property. The 2007 Newmarket Creek Park and Trail System Master Plan sets forth the need for and the intent to provide improved trail facilities and water access, as well as interpretive/educational signage.

Access
The property would be accessed from various points, including the Bass Pro Shops parking lot, Pine Chapel Road, Coliseum Drive, the Hampton Coliseum parking lot, Freeman Drive, Armistead Avenue North, and the Air Power Park & Museum driveway off of Mercury Boulevard.

Similarly Used Lands
The Matteson Trail is a 3-mile nature/fitness trail that follows the circumference of The Hamptons Golf Course in Hampton. The trail provides no boating access or fishing. Other trail systems and other boating access exist within the general vicinity, but the Newmarket Creek Park and Trail System would be unique within the City boundary because of its length, mix of uses, and accessibility.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the property with respect to transportation improvements.

Unusual Characteristics
There are no unusual characteristics associated with the Newmarket Creek Park and Trail System.

3.1.3. Y.H. Thomas Neighborhood Park

Relationship
Figure 2 shows the relationship of the Y.H. Thomas Neighborhood Park to the study corridor.

Area
The Y.H. Thomas Neighborhood Park contains approximately 19 acres of land.

Ownership
The Y.H. Thomas Neighborhood Park is owned by the City of Hampton and administered by the City of Hampton Parks & Recreation Department.

Activities
The Y.H. Thomas Neighborhood Park features a basketball court, a football field, a softball field, a youth baseball field, a playground, open play areas, and two picnic shelters. The park facilities are used by the general public and by the City of Hampton Parks & Recreation Department as a venue for youth sports league activities.

Access
The Y.H. Thomas Neighborhood Park is accessed from on-street parking on Rowe Street, from a parking lot off of Bassette Street associated with the Thomas Jr. High School, and from a parking lot off of Thomas Street associated with the Peake School.

Similarly Used Lands
There are other similar properties in the vicinity. The City of Hampton has an abundance of neighborhood parks in nearby neighborhoods, including Aberdeen, Armstrong, Booker, Burbank, Cary, Jane Bryan, Machen, River Street, and Tucker Capps. Facilities and amenities may vary from park to park, but the general recreation functions are common. Many athletic fields also exist within the City.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the Y.H. Thomas Park regarding transportation improvements.

Unusual Characteristics
There are no known unusual characteristics associated with the Y.H. Thomas Park.

3.1.4. River Street Park

Relationship
Figure 2 shows the relationship of River Street Park to the study corridor. A portion of the park is situated directly under the elevated structure of I-64.

Area
The River Street Park property contains approximately 0.7 acres of land.

Ownership
River Street Park is located on five parcels of land. Two of these parcels are owned by the Commonwealth of Virginia (VDOT) and three are owned by the City of Hampton. The park is administered by the City of Hampton Parks & Recreation Department.

Activities
The property serves as a public urban park facility, containing benches and landscaping, with a view of the Hampton River. The park also provides access to the Hampton River for kayakers.

Access
River Street Park is accessed via River Street or East Pembroke Avenue.

Similarly Used Lands
There are other similar neighborhood parks in the vicinity, including Aberdeen, Armstrong, Booker, Burbank, Cary, Jane Bryan, Machen, Tucker Capps, and Y.H. Thomas.

Clauses Affecting Ownership
There are no known clauses affecting ownership of River Street Park regarding transportation improvements.

Unusual Characteristics
The River Street Park property is unusual in that much of it is located under an interstate highway.

3.1.5. Woodlands Golf Course

Relationship
Figure 2 shows the relationship of Woodlands Golf Course to the study corridor.

Area
The Woodlands Golf Course property contains approximately 120 acres of land.

Ownership
Woodlands Golf Course is owned by the City of Hampton and administered by the City Parks & Recreation Department. As a golf course that is owned, operated, and managed by the City of Hampton for the primary purpose of public recreation, the property is subject to Section 4(f) requirements.

Activities
Woodlands Golf Course is an 18-hole, 5,400-yard golf course open to the general public. Golf-related amenities including a pro shop, snack bar/restaurant, meeting room and practice putting green are located on the property. The facility also includes seven tennis courts.

Access
Access to Woodlands Golf Course is available from Woodland Road.

Similarly Used Lands
There are other similar properties in the vicinity. The City of Hampton also owns and administers The Hamptons Golf Course, a 27-hole championship course with a pro shop, full service restaurant and snack bar, practice putting green, driving range and fitness center. Other municipal courses in the area include the Ocean View Golf Course and the Lake Wright Golf Course in Norfolk; there also many private golf courses in the area.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the Woodlands Golf Course property regarding transportation improvements.

Unusual Characteristics
There are no known unusual characteristics associated with the Woodlands Golf Course property.

3.1.6. Willoughby Boat Ramp

Relationship
Figure 2a shows the relationship of the Willoughby Boat Ramp to the study corridor.

Area
The Willoughby Boat Ramp property is comprised of approximately two acres of land.

Ownership
Willoughby Boat Ramp is owned by the City of Norfolk and administered by the City of Norfolk Department of Recreation, Parks & Open Space.

Activities
The property provides a public boat ramp for motorized and non-motorized boats seeking access to Hampton Roads and the Chesapeake Bay. A marina building is located adjacent to I-64 and houses equipment for a cell tower that is located on the property.

Access
The Willoughby Boat Ramp is accessed via Bayville Street and 13th View Street.

Similarly Used Lands
There are other similar properties in the vicinity. The City of Norfolk owns and administers the Haven Creek Boat Ramp, which has facilities similar to those found at the Willoughby Boat Ramp. Privately owned boat ramps and marinas are also located nearby.

Clauses Affecting Ownership
The Willoughby Boat Ramp was formerly named the Norfolk Boat Ramp. The property was established using a grant from the Land and Water Conservation Fund (LWCF), and thus is subject to Section 6(f) of the LWCF Act.

Unusual Characteristics
There are no known unusual characteristics associated with the Willoughby Boat Ramp property.

3.1.7. Captain's Quarters Park

Relationship
Figure 2a shows the relationship of Captain's Quarters Park to the study corridor.

Area
The Captain's Quarters Park property comprises approximately 2.3 acres of land.

Ownership
Captain's Quarters Park is owned by the City of Norfolk and administered by the Norfolk Department of Recreation, Parks & Open Space.

Activities
The property is the site of an indoor recreation center, a sand beach, a playground, and a non-motorized boat launch facility, all of which are used in conjunction with youth recreation programs including a summer camp.

Access
Captain's Quarters Park is accessed via Little Bay Avenue.

Similarly Used Lands
There are other properties in the vicinity that serve similar functions. The City of Norfolk operates summer camps in other locations, but Captain's Quarters Park is the only City-run camp site that focuses on outdoor recreation. The City also operates seventeen additional recreation centers, and a multitude of beaches, playgrounds, and places that offer water access for boating exist within the vicinity.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the Captain's Quarters Park property regarding transportation improvements.

Unusual Characteristics
There are no known unusual characteristics associated with the Captain's Quarters Park property.

3.1.8. Willoughby Elementary School

Relationship
Figure 2a shows the relationship of the Willoughby Elementary School to the study corridor.

Area
The Willoughby Elementary School property contains approximately 8.5 acres of land. The school and associated recreational fields are located on three parcels. Only the recreation facilities, which comprise approximately 4.5 acres, are subject to Section 4(f).

Ownership
The Willoughby Elementary School is owned by the City of Norfolk and administered by Norfolk Public Schools.

Activities
The recreational fields are comprised of an open field, a playground and six basketball courts used in conjunction with school activities. Communication with Norfolk Recreation, Parks & Open Space Department staff has indicated that the facilities also are used by recreational baseball, soccer, and football leagues managed by that department and the public.

Access
The Willoughby Elementary School and recreation fields are accessed via 3rd View Street or Staten Street, both of which offer entry into the school parking lot. The basketball courts are adjacent to the parking lot, and the open field is behind the school building.

Similarly Used Lands
There are other similar properties in the vicinity. The Willoughby Elementary School is adjacent to the Ocean View Elementary School, which has more extensive recreational fields. Norfolk Public Schools administers thirty-three elementary, eight middle, and six high schools, all of which have recreational facilities. Other public parks and privately owned facilities also offer recreational fields for public use.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the Willoughby Elementary School property regarding transportation improvements.

Unusual Characteristics
There are no known unusual characteristics associated with the Willoughby Elementary School property.

3.2. Historic Sites

3.2.1. Pasture Point Historic District (VDHR No. 114-0118)

Relationship
Figure 2 shows the relationship of the Pasture Point Historic District and its contributing properties to the study corridor.

Area

The Pasture Point Historic District is comprised of 64 acres of land bounded by the Hampton River to the east, Bright's Creek to the north, Wine Street to the west and Syms Street to the south. There are 189 properties which are considered contributing to the eligibility of the district, located throughout the area.

Ownership

The Pasture Point Historic District is eligible for the National Register of Historic Places (NRHP). Six properties located within to the potential limits of disturbance for the Retained Build Alternatives are contributing properties to the Historic District. All of these properties are privately owned. The contributing properties include:

- 200 Cooper Street
- 202 Cooper Street
- 415 Colbert Avenue
- 421 Colbert Avenue
- 442 East Pembroke Avenue
- 623 River Street

Activities

The contributing properties within the study corridor are single-family dwellings. Some of the dwellings have associated garages or sheds which may also be contributing properties to the district. The Pasture Point Historic District is a cohesive neighborhood dating to the late 19th century. The District is characterized by a mix of Queen Anne and Italianate Victorian and turn of the century architectural styles that have been largely preserved.

Access

The Pasture Point Historic District is accessed from East Pembroke Avenue, which is the main thoroughfare through the Historic District, as well as from Syms Street, Eaton Street, and Washington Street. I-64 bisects the District but does not provide access.

Similarly Used Lands

There are other similarly used lands to the Historic District. The Phoebus Historic District (112-5002), dating to approximately the same time as the Pasture Point Historic District, also is located in the City of Hampton. Like Pasture Point, Phoebus contains structures of a mix of Victorian and turn of the century architectural styles.

Clauses Affecting Ownership

There are no known clauses affecting ownership of the Pasture Point Historic District regarding transportation improvements.

Unusual Characteristics

There are no known unusual characteristics associated with the Pasture Point Historic District. Only properties that contribute to the District are subject to Section 4(f).

3.2.2. Hampton Institute (VDHR No. 114-0006)

Relationship

Figure 2 shows the relationship of the Hampton Institute to the study corridor.

Area
The Hampton Institute historic property is listed on the NRHP and includes approximately 220 acres. Fifteen acres of the property, including the Emancipation Oak, also are also a National Historic Landmark.

Ownership
The Hampton Institute property is owned by Hampton University.

Activities
The property is located on the grounds of Hampton University and still serves as an institution of secondary education. Hampton Institute was the first historically black college in the United States, tracing its origins to 1861 when the American Missionary Association offered its first class to escaping slaves. The Institute also offered a Native American education program starting in 1878. The property is the site of the Emancipation Oak, under which Mary Peake, in 1861, taught children of slaves freed pursuant to the outset of the Civil War, and where the first southern reading of President Lincoln's Emancipation Proclamation took place.

Access
The Hampton Institute is accessed via East Tyler Street from Settlers Landing Road and I-64, Marshall Avenue from Emancipation Drive, and Shore Road from Emancipation Drive and Martin Luther King Jr. Boulevard.

Similarly Used Lands
There are no other similar historic properties within the study area.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the Hampton Institute property regarding transportation improvements.

Unusual Characteristics
Within the 220-acre NRHP boundary are three areas totaling 15 acres that have been designated as a National Historic Landmark. These areas include a portion of campus along the Hampton River containing many of the historic campus structures, the college cemetery, and the Emancipation Oak.

3.2.3. Hampton National Cemetery (VDHR No. 114-0148)

Relationship
Figure 2 shows the relationship of the Hampton National Cemetery to the study corridor.

Area
The Hampton National Cemetery property consists of two separate parcels, one on either side of I-64, totaling 27.1 acres of land. The parcel located adjacent to I-64 is approximately 15 acres. The existing I-64 right-of-way boundary is adjacent to the cemetery property; the cemetery wall is less than 10 feet from the I-64 guard rail.

Ownership
The Hampton National Cemetery is listed on the NRHP and is owned and administered by the US Department of Veterans Affairs.

Activities
The property serves as an active cemetery. The property was created from land set aside for a cemetery to be associated with the Hampton Military Hospital at Fort Monroe during the Civil War, and is significant because of its association with the war. The cemetery is designed in the Georgian Revival architectural style.

Access
The Hampton National Cemetery parking lot has access points on Woodland Road and West County Street.

Similarly Used Lands
The nearest military cemetery is the Naval Medical Center Cemetery in Portsmouth.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the Hampton National Cemetery property regarding transportation improvements.

Unusual Characteristics
There are no known unusual characteristics associated with the property.

3.2.4. Phoebus Historic District (VDHR No. 114-5002)

Relationship
Figure 2 shows the relationship of the study corridor to the Phoebus Historic District and its contributing properties.

Area
The Phoebus Historic District is comprised of 86 acres of land bounded by I-64, Mallory Street, East County Street, and Willard Avenue. There are 259 properties which are considered contributing to the eligibility of the District, located throughout the area.

Ownership
The Phoebus Historic District is listed on the NRHP. Twenty-eight properties located within the study corridor are contributing properties to the Historic District. Twenty-seven of these properties are privately owned residences. Contributing properties include:

- 248 Bickford Street
- 251 Bickford Street
- 18 Downes Street
- 22 Downes Street
- 26 Downes Street
- 5 Home Place
- 211 National Avenue
- 6 Segar Street
- 22 Segar Street
- 23 Segar Street
- 112 Segar Street
- 114 Segar Street
- 116 Segar Street
- 118 Segar Street
- 308 South Hope Street
- 310 South Hope Street
- 311 South Hope Street
- 312 South Hope Street
- 313 South Hope Street
- 316 South Hope Street
- 318 South Hope Street
- 321 South Hope Street
- 322 South Hope Street
- 323 South Hope Street
- 404 South Hope Street
- 406 South Hope Street
- 408 South Hope Street
- 413 South Hope Street

Activities
Twenty-seven of the 28 contributing properties within the study corridor are single family residences, and one is used as a pump station by the Hampton Roads Sanitation District. The approximately 442 structures in the Phoebus Historic District comprise a cohesive neighborhood dating to the late 19th century. This neighborhood is characterized by a mix of Romanesque, Queen Anne and Italianate Victorian and turn of the century architectural styles that have been largely preserved.

Access
The Phoebus Historic District is accessed via North Hope Street, Mallory Street, North Willard Avenue, North Curry Street, and West County Street.

Similarly Used Lands
There are other lands similar to the Phoebus Historic District with in the study corridor. The Pasture Point Historic District (114-0118), dating to approximately the same time as the Phoebus Historic District, also is located in the City of Hampton. Like Phoebus, Pasture Point contains structures of a mix of Victorian and turn of the century architectural styles.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the Phoebus Historic District property regarding transportation improvements.

Unusual Characteristics
There are no known unusual characteristics associated with the District. Only properties that contribute to the District are subject to Section 4(f).

3.2.5. Battle of Hampton Roads (VDHR No. 114-5471)

Relationship
Figures 2 and 2a show the relationship of the Battle of Hampton Roads historic site to the study corridor.

Area
The Battle of Hampton Roads historic site is comprised of undetermined acreage in Hampton Roads between the Chesapeake Bay and the mouth of the James River.

Ownership
The Battle of Hampton Roads site is located within the waters of the Commonwealth of Virginia.

Activities
The Battle of Hampton Roads, which occurred on March 9, 1862, was the world's first battle between steam-powered ironclad warships, the CSS Virginia and the USS Monitor. Although the battle ended in a draw, it marked a critical historic juncture in the evolution of naval warfare. The resources that contribute to the site's eligibility for inclusion in the NHRP, i.e., the ships that took part in the battle, are no longer located within the study area. The site currently exists as a commercial and recreational waterway. The property is likely eligible for listing on the NRHP; however, an evaluation has not been completed. For the purposes of this evaluation, the site is assumed to be eligible for NRHP listing so that potential impacts to the property may be appropriately assessed.

Access
The Battle of Hampton Roads site is accessed via watercraft. It is easily accessible from Hampton, Newport News, and Norfolk.

Similarly Used Lands
There are other similarly used lands in the study area, including the Battle of Sewell's Point (122-5426), which occurred in May 1861.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the Battle of Hampton Roads site regarding transportation improvements.

Unusual Characteristics
The Battle of Hampton Roads site is unusual in that the battlefield is comprised of a large offshore area. Although the property has not been evaluated for listing on the NRHP, it is assumed to be eligible for the purposes of this evaluation and thus is considered a historic site.

3.2.6. Battle of Sewell's Point (VDHR No. 122-5426)

Relationship
Figures 2 and 2a show the relationship of the Battle of Sewell's Point site to the study corridor.

Area
The battle site is comprised of undetermined acreage both within Hampton Roads and at Sewell's Point, Norfolk.

Ownership
The Battle of Sewell's Point site has mixed ownership. The Hampton Roads portion of the site is within the waters of the Commonwealth of Virginia. The Sewell's Point portion of the site is located within the Norfolk Naval Base, and is owned and administered by the United States Navy.

Activities
The Battle of Sewell's Point was an inconclusive naval battle between Union and Confederate naval forces at the outset of the Civil War. It was among the first naval battles in the war (May 1861). The Hampton Roads portion of the site serves as a commercial and recreational waterway. The Sewell's Point portion of the site is part of an active naval base. The property is likely eligible for listing on the NRHP; however, an evaluation has not been completed. For the purposes of this evaluation, the site is assumed to be eligible for NRHP listing so that potential impacts to the property may be appropriately assessed.

Access
The Hampton Roads portion of the site is accessed via watercraft. It is easily accessible from Hampton, Newport News, and Norfolk. The Sewell's Point portion of the site is accessed through the Norfolk Naval Base, which is located off of Interstate 564, and Bellinger Boulevard in Norfolk.

Similarly Used Lands
Other naval battle sites also exist in the vicinity, including the Battle of Hampton Roads (114-5471), which occurred in March 1862.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the Battle of Sewell's Point site regarding transportation improvements.

Unusual Characteristics
There are no known unusual characteristics associated with the site. Although the property has not been evaluated for listing on the NRHP, it is assumed to be eligible for the purposes of this evaluation, and thus is considered a historic site.

3.2.7. Merrimack Landing Historic District (VDHR No. 122-5434)

Relationship
Figure 2a shows the relationship of Merrimack Landing to the study corridor.

Area
The Merrimack Landing Historic District contains approximately 56.3 acres of land.

Ownership
The Merrimack Landing Historic District is located on a single parcel of land. The property is eligible for listing on the NRHP and is owned by the Norfolk Redevelopment and Housing Authority. All 13 residential structures on the property which are within the study corridor are contributing properties to the Historic District. These properties include:

- 8930/8932 Potomac Place
- 8934/8936 Potomac Place
- 8938 Potomac Place/269 Congress Avenue
- 8941 Potomac Place/273 Congress Avenue
- 8944 Potomac Place/270 Congress Avenue
- 8945 Potomac Place/272 Congress Avenue
- 266/268 Congress Avenue
- 265 Congress Avenue
- 262/264 Congress Avenue
- 263 Congress Avenue
- 258/260 Congress Avenue
- 259 Congress Avenue
- 254/256 Congress Avenue

Activities
The property serves as a residential apartment complex. Merrimack Landing was designed by the Norfolk Association of Architects and constructed in 1941. The design of the structures incorporates French Eclectic influences and has retained its integrity in the 70 years since its construction.

Access
Merrimack Landing is located on Monitor Way and is accessed from Interstate 64 and points east via West Bay Avenue. From the northeast, it is accessible from 1st View Street.

Similarly Used Lands
There are other similar apartment complexes in the vicinity. Several apartment complexes in the study area, particularly in Norfolk in the vicinity of the Naval Base, were constructed around the same time, for the same purpose, and in the same general style as Merrimack Landing.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the Merrimack Landing property regarding transportation improvements.

Unusual Characteristics
There are no known unusual characteristics associated with the property. Only structures that contribute to the District are subject to Section 4(f).

3.2.8. Forest Lawn Cemetery (VDHR No. 122-0531)

Relationship
Figure 2a shows the relationship of Forest Lawn Cemetery to the study corridor.

Area
The Forest Lawn Cemetery property contains approximately 92 acres of land.

Ownership
Forest Lawn Cemetery is eligible for listing on the NRHP, is owned by the City of Norfolk and administered by the Norfolk Bureau of Cemeteries.

Activities
Forest Lawn Cemetery, established circa 1906, is a curvilinear cemetery with an historic gate house and mausoleum, all of which reflect the ideals of the nineteenth century "rural" cemetery movement. It embodies the design of an age when formal cemetery planning and landscape architecture in combination with economics and the science of proper caretaking and maintenance of cemeteries was in its formative years. The property retains a high degree of integrity of design, association, and feeling.

Access
Forest Lawn Cemetery is accessed via Granby Street (Route 460).

Similarly Used Lands
There are other similar properties in the vicinity. The Norfolk Bureau of Cemeteries administers eight public cemeteries; numerous private cemeteries exist in the vicinity as well. All other Norfolk public cemeteries are older than Forest Lawn Cemetery and one, West Point Cemetery, is on the National Register of Historic Places. Other arboretums exist within the vicinity, including the 75-acre Norfolk Botanical Garden.

Clauses Affecting Ownership
There are no known clauses affecting ownership of the property regarding transportation improvements.

Unusual Characteristics
There are no known unusual characteristics associated with the Forest Lawn Cemetery property.

4. IMPACTS ON SECTION 4(f) PROPERTY

Each of the three Retained Build Alternatives would potentially require the use of Section 4(f) property, as described in this chapter. Properties and their associated impacts have been divided into two groups: those which would potentially incur a de minimis impact, and those which require an avoidance alternatives evaluation and least overall harm analysis.

At this stage of project development, Section 4(f) requires a greater level of detail as well as a greater level of minimization than other laws during the preparation of the environmental document. Thus, the impacts described in this chapter include minimization measures and are reduced from those presented in the DEIS.

4.1. Potential De Minimis Impacts

Most properties would incur only minor impacts from the proposed retained build alternatives. For these properties, FHWA intends to make a Section 4(f) de minimis impacts finding. As such, FHWA, in cooperation with VDOT, proposes to notify the official with jurisdiction (the Hampton Parks & Recreation Department; the Norfolk Department of Recreation, Parks, & Open Space; Norfolk Public Schools; the Virginia Department of Conservation and Recreation; or VDHR) and invite their written concurrence that, pursuant to 23 CFR 774.3(b), the Retained Build Alternatives would not adversely affect the activities, features, or attributes that make the property eligible for Section 4(f) protection (for park properties), or that the property will not incur an adverse effect pursuant to 36 CFR Part 800 (for historic sites). Should the official with jurisdiction concur, FHWA may then issue a finding of de minimis impacts on an individual property basis. An evaluation of avoidance alternatives and an analysis of least overall harm would not be required for de minimis impacts findings for these 4(f) properties, and therefore has not been developed in this Draft Section 4(f) Evaluation. If a Section 4(f) de minimis impacts determination is not practicable for a particular property, then an evaluation of avoidance alternatives and analysis of least overall harm would be conducted.

4.1.1. Bluebird Gap Farm

The Retained Build Alternatives would result in a Section 4(f) use of the Bluebird Gap Farm because they would entail the acquisition of a narrow strip of right-of-way along the existing I-64 alignment. The impacted part of the property consists of a vegetated buffer and a small amount of open field, which would be converted to a transportation use. A pig sty and a small shed would be relocated on the farm property. The impact to the property would constitute a minor use (6.7 acres for the Build-8 Alternative, 6.9 acres for the Build-8 Managed Alternative, and 6.9 acres for the Build-10 Alternative).

4.1.2. Newmarket Creek Park and Trail System

The Retained Build Alternatives would result in a Section 4(f) use of the planned Newmarket Creek Park and Trail System because they would entail the acquisition of a small sliver of right-of-way along the existing I-64 alignment where the planned trail crosses I-64 on Pine Chapel Road and in two other locations where the trail runs roughly parallel to the existing I-64 alignment. Minor rerouting of the planned trail would be necessary. The potential impact to the property would constitute a minor use (750 linear feet for the Build-8 Alternative, 750 linear feet for the Build-8 Managed Alternative, and 750 linear feet for the Build-10 Alternative).

4.1.3. Y.H. Thomas Neighborhood Park

The Retained Build Alternatives would result in a Section 4(f) use of the Y.H. Thomas Neighborhood Park because they would entail the acquisition of a small portion of right-of-way

along the existing I-64 alignment. The potential impacted part of the property consists of a small amount of open field that is not used for recreational purposes. The potential impact to the property would constitute a minor use (less than 0.1 acre for the Build-8 Alternative, less than 0.1 acre for the Build-8 Managed Alternative, and 0.1 acre for the Build-10 Alternative).

4.1.4. River Street Park

The Retained Build Alternatives would result in a Section 4(f) use of the River Street Park; however much of the associated improvements would be on elevated structure above the park. According to the FHWA *Section 4(f) Policy Paper*, Section 4(f) applies to bridging a Section 4(f) property if piers or other appurtenances are physically located in the Section 4(f) property, requiring an acquisition of land from the property. Thus, construction occurring above the park would not constitute a Section 4(f) use. Only the minor amount of right-of-way that would be required for the placement of new piers or the expansion of existing piers would be considered a Section 4(f) use. The potential impact to the property would be less than 0.1 acres for all retained alternatives; however, the exact area of use cannot be determined until design of the bridge structure has been completed.

4.1.5. Woodlands Golf Course

The Retained Build Alternatives would result in a Section 4(f) use of the Woodlands Golf Course because they would entail the acquisition of a narrow strip of right-of-way along the existing I-64 alignment. Four maintenance buildings and the roadway used to access these buildings would be impacted. The proposed impacted part of the property also consists of removal of some vegetated buffer along I-64 and impact to a small corner of one golf hole, including a sand trap. The ability for golfers to use the hole would not be compromised. The potential impact to the property would therefore constitute a minor use (7.6 acres for the Build-8 Alternative, 7.7 acres for the Build-8 Managed Alternative, and 8.3 acres for the Build-10 Alternative).

4.1.6. Willoughby Boat Ramp

The Retained Build Alternatives would result in a Section 4(f) use of the Willoughby Boat Ramp. The alternatives would require the acquisition of a strip of right-of-way along the existing I-64 alignment. The structure and associated communications tower appurtenant to the property would be removed as well as a portion of the parking lot. The structure is not used for purposes associated with the recreation function of the property. The potential impact to the property would constitute a minor use (0.7 acre for the Build-8 Alternative, 0.8 acre for the Build-8 Managed Alternative, and 0.9 acre for the Build-10 Alternative).

4.1.7. Captain's Quarters Park

The Retained Build Alternatives would result in a Section 4(f) use of Captain's Quarters Park because they would entail the acquisition of a small area of right-of-way along the existing I-64 alignment. The potential impacted part of the property consists of a vegetated area and a small area of sand beach located adjacent to the I-64 bridge over Willoughby Bay. The potential impact to the property would constitute a minor use (less than 0.1 acre for the Build-8 Alternative, less than 0.1 acre for the Build-8 Managed Alternative, and 0.1 acre for the Build-10 Alternative.

4.1.8. Willoughby Elementary School Recreational Fields

The Retained Build Alternatives would result in a Section 4(f) use of the Willoughby Elementary School Recreational Fields because they would entail the acquisition of a small portion of right-

of-way along the existing I-64 alignment. Although nearly the entire recreational field is located within the study corridor, minimization measures would ensure that only vegetated buffer and a small portion of open field would be impacted. The ability to use the property for recreational purposes would not be affected. The potential impact to the property would therefore constitute a minor use (1.7 acres for the Build-8 Alternative, 1.8 acres for the Build-8 Managed Alternative, and 1.9 acres for the Build-10 Alternative).

4.1.9. Battle of Hampton Roads and Battle of Sewell's Point

The Battle of Hampton Roads and the Battle of Sewell's Point sites both encompass a large area through which the Retained Build Alternatives would pass. The battlefields are currently awaiting an intensive survey to determine NRHP eligibility. For the purposes of this evaluation, it is anticipated that the battlefields will be determined eligible for the NRHP. However, the battlefield areas through which the Retained Build Alternatives pass have been altered. Construction of additional capacity along I-64 and the HRBT crossing would not diminish the character defining features of the sites, particularly given the existing presence of the HRBT. Thus, following consultation pursuant to Section 106 of the National Historic Preservation Act, FHWA may determine that the historic characteristics which make the property likely eligible for the National Register would not be diminished. Section 4(f) de minimis impact findings may therefore be appropriate.

4.1.10. Forest Lawn Cemetery

The Retained Build Alternatives would result in a Section 4(f) use of Forest Lawn Cemetery because they would entail the acquisition of a narrow strip of right-of-way along the existing I-64 alignment. The potential impacted part of the property consists of a small number of graves, vegetated buffer, and a small portion of cemetery roadway. No gates or structures would be impacted. The potential impact to the property would constitute a minor use (less than 0.1 acre for the Build-8 Alternative, less than 0.1 acre for the Build-8 Managed Alternative, and 0.1 acre for the Build-10 Alternative). Thus, following consultation pursuant to Section 106 of the National Historic Preservation Act, FHWA may determine that the historic characteristics which make the property likely eligible for the National Register would not be diminished. A Section 4(f) de minimis impact finding may therefore be appropriate.

4.2. Impacts Requiring Avoidance Alternatives Evaluation and Least Overall Harm Analysis

It is assumed that the following properties would incur impacts that would not be considered de minimis. The avoidance alternative evaluation and least harm analysis presented in Chapters 5 and 6 of this Draft Section 4(f) Evaluation have been prepared for these properties. The impacts include the minimization measures described in Chapter 7, and thus are reduced from those impacts presented in the DEIS.

4.2.1. Pasture Point Historic District

The Retained Build Alternatives would potentially result in a Section 4(f) use of the Pasture Point Historic District as shown in **Table 3** and displayed on **Figure 3**. The use would result from displacement of properties within the study area which contribute to the historic district. The remainder of the contributing properties in the Historic District would be not be impacted.

Table 3: Potential Use of Pasture Point Historic District Contributing Resources

Local Address	Use (Acres)			Residence Displaced
	Build-8 Alternative	Build-8 Managed Alternative	Build-10 Alternative	
200 Cooper St.	0.25	0.25	0.25	✓
202 Cooper St.	0.14	0.14	0.14	✓
415 Colbert Ave.	0.18	0.18	0.18	✓
421 Colbert Ave.	0.01	0.01	0.16	✓ (Build 10 only)
442 East Pembroke Ave.	0.02	0.03	0.04	
623 River St.	0.23	0.23	0.23	✓
TOTAL USE	0.83	0.84	1.00	n/a

4.2.2. Hampton Institute

The Retained Build Alternatives would result in a Section 4(f) use of the Hampton Institute because they would entail the acquisition of a strip of right-of-way along I-64 (8.7 acres for the Build-8 Alternative, 9.0 acres for the Build-8 Managed Alternative, and 10.1 acres for the Build-10 Alternative). The impacted part of the property consists of vegetated buffer, open field, roadway, and parking lot. The remainder of the property would not be impacted, including the Emancipation Oak. The potential impacts to the Hampton Institute are shown on **Figure 4**.

4.2.3. Hampton National Cemetery

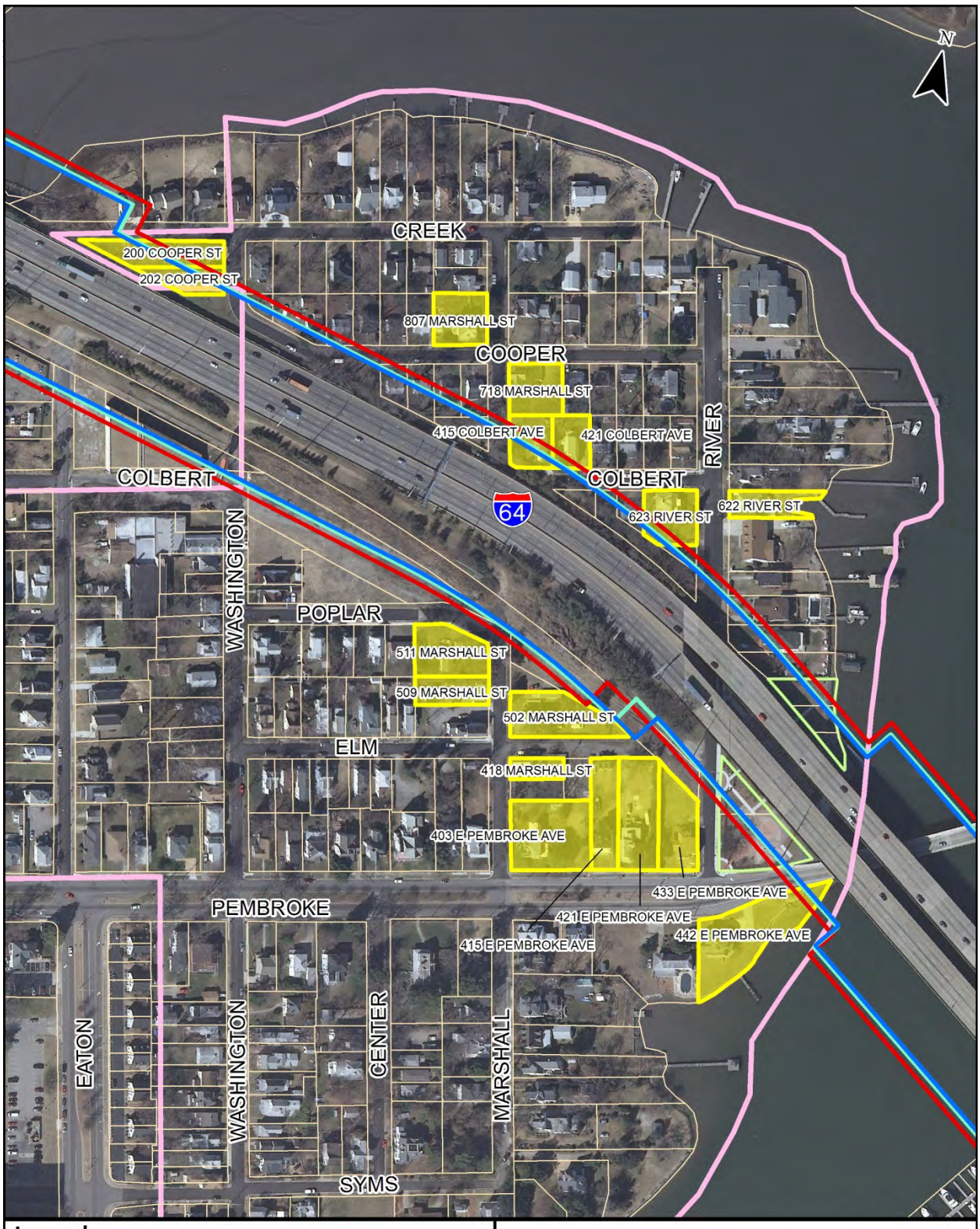
The Retained Build Alternatives would result in a Section 4(f) use of contributing resources of the northern parcel of the Hampton National Cemetery because they would entail the acquisition of a small portion (0.1 acre for the Build-8 Alternative, 0.1 acre for the Build-8 Managed Alternative, and 0.2 acres for the Build-10 Alternative) of right-of-way along the existing I-64 alignment. The contributing resources to be used would be a portion of the granite stone rubble perimeter wall and approximately 42 graves and grave markers. The remainder of the property would not be used. The potential impacts to Hampton National Cemetery are shown on **Figure 5**.

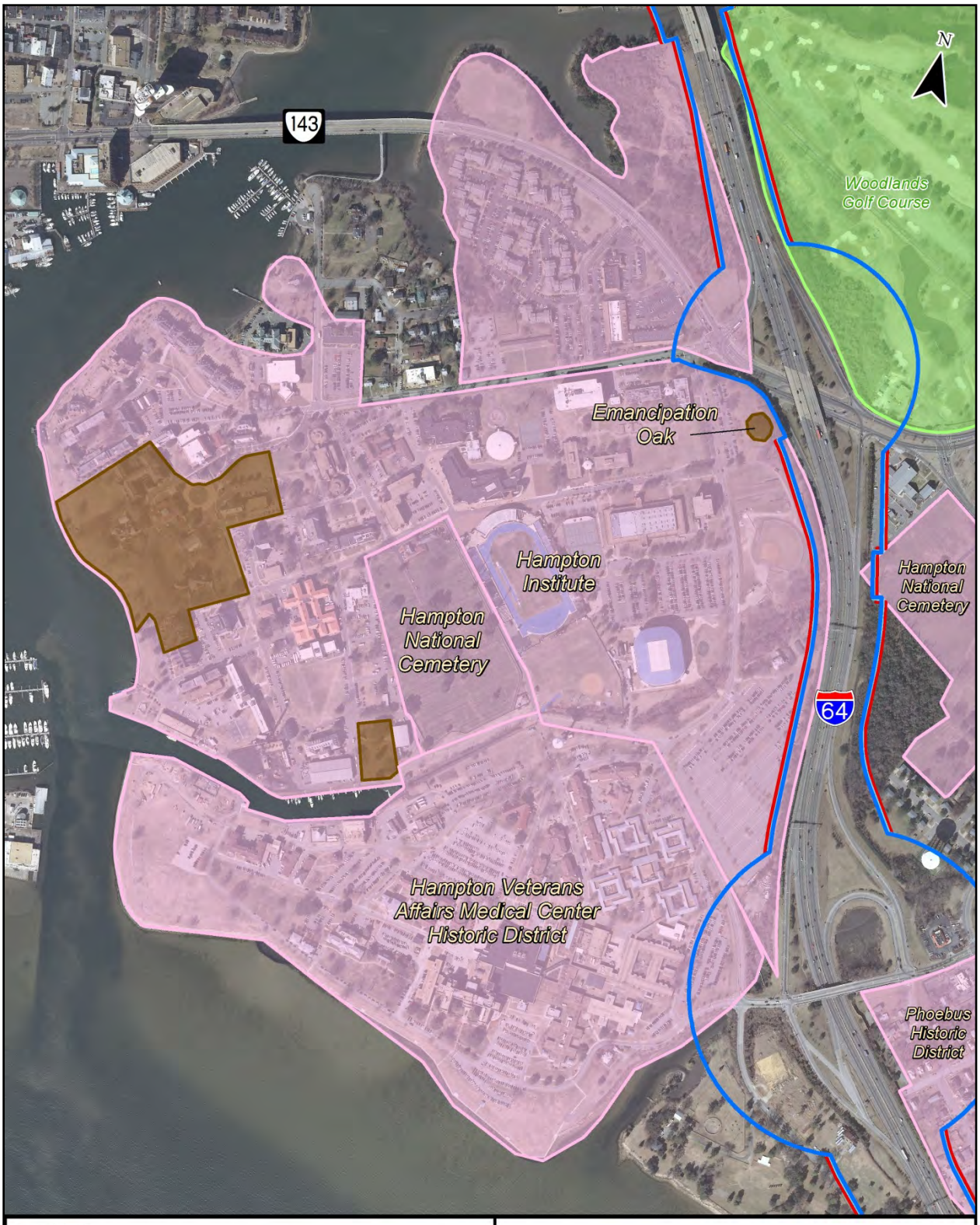
4.2.4. Phoebus Historic District

The Retained Build Alternatives would potentially require the Section 4(f) use of the Phoebus Historic District, as shown in **Table 4**. The use would result from displacement of properties within the study area which contribute to the historic district. The total acquisition of right-of-way within the district would potentially range from 0.83 to 1.0 acres for each the Retained Build Alternative. The remainder of the district would not be used. The potential impacts to contributing properties within the Phoebus Historic District are shown on **Figure 6**.

4.2.5. Merrimack Landing Historic District

Each of the Retained Build Alternatives would potentially require a Section 4(f) use of Merrimack Landing resulting from displacement of approximately thirteen buildings which contribute to the Historic District. This includes all of the buildings described in Chapter 3.2.7. The total acquisition of right-of-way within the Historic District would potentially be 7.0 acres for each Retained Build Alternative. The remainder of the property would not be used. The potential impacts to the property are shown on **Figure 7**. **Table 5** summarizes the potential use of Section 4(f) properties caused by the Retained Build Alternatives.


N
CREEK
200 COOPER ST
202 COOPER ST
807 MARSHALL ST
COOPER
718 MARSHALL ST
415 COLBERT AVE
421 COLBERT AVE
RIVER
COLBERT
COLBERT
623 RIVER ST
622 RIVER ST
64
WASHINGTON
POPLAR
511 MARSHALL ST
509 MARSHALL ST
502 MARSHALL ST
ELM
418 MARSHALL ST
403 E PEMBROKE AVE
433 E PEMBROKE AVE
421 E PEMBROKE AVE
442 E PEMBROKE AVE
415 E PEMBROKE AVE
PEMBROKE
EATON
WASHINGTON
CENTER
MARSHALL
SYMS
Legend
Limit of Disturbance Build - 8 Alternative
Limit of Disturbance Build - 8 Managed Alternative
Limit of Disturbance Build - 10 Alternative
District Contributing Properties
Pasture Point Historic District
Parks
Source: VDOT, 2010
0 100 200 400 Feet
Pasture Point Historic District
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure 3



Legend

- National Historic Landmark
- Historic Properties
- Parks
- Limit of Disturbance Build - 8 Alternative
- Limit of Disturbance Build - 8 Managed Alternative
- Limit of Disturbance Build - 10 Alternative

Source: VDOT, 2010

0 350 700 1,400 Feet

Hampton Institute

U.S. Department of Transportation Federal Highway Administration

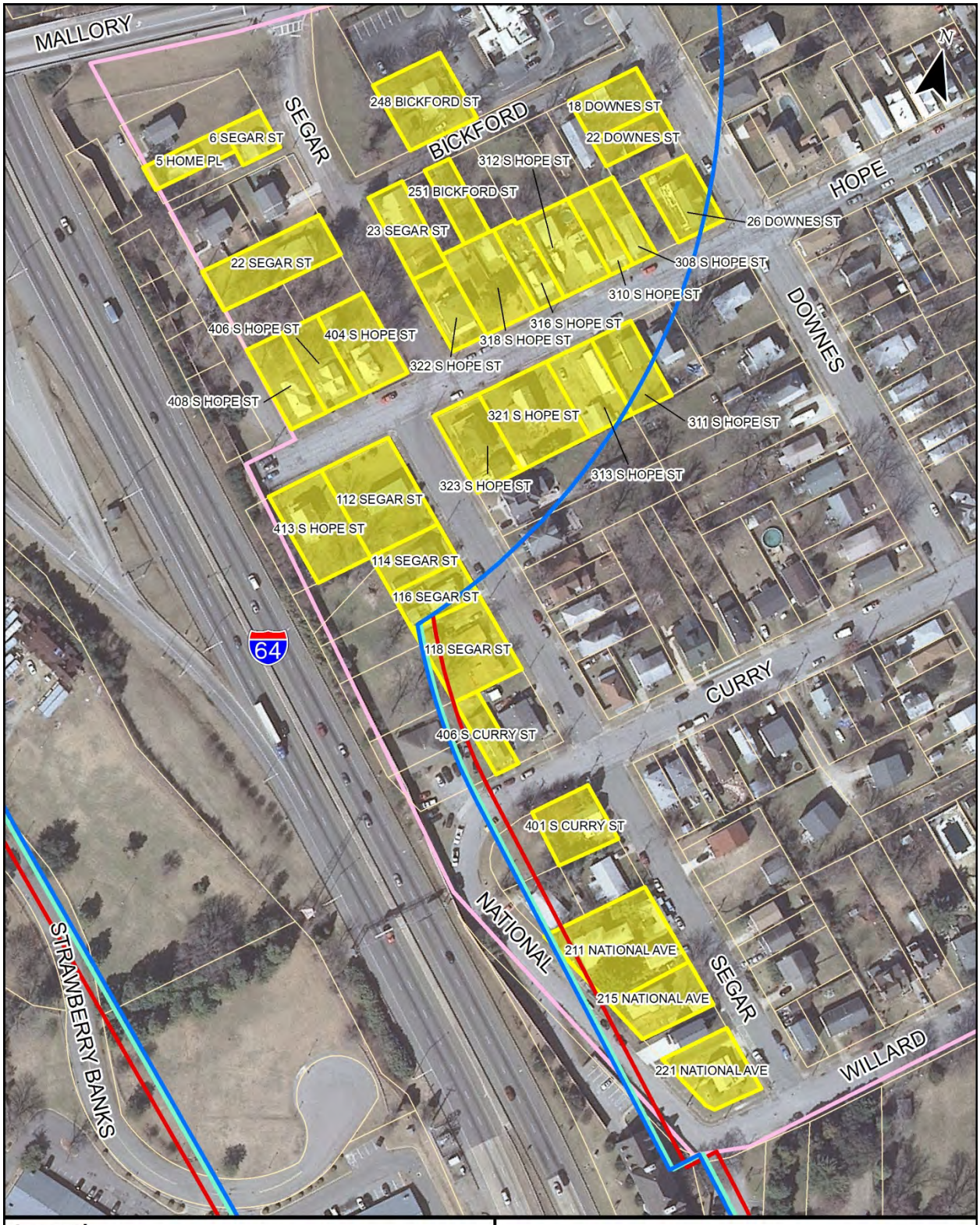
VDOT

Figure 4


N
FRISSELL
143
COUNTY
Hampton National Cemetery
64
BAINBRIDGE
CAMERON
LIBBEY
Legend
National Historic Landmark
Historic Properties
Parks
Limit of Disturbance Build - 8 Alternative
Limit of Disturbance Build - 8 Managed Alternative
Limit of Disturbance Build - 10 Alternative
Source: VDOT, 2010
0
100
200
400
Feet
Hampton National Cemetery
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure 5

Table 4: Potential Use of Phoebus Historic District Contributing Resources

Local Address	Use (Acres)			Residence Displaced
	Build-8 Alternative	Build-8 Managed Alternative	Build-10 Alternative	
6 Segar St.	0.06	0.06	0.06	✓
22 Segar St.	0.19	0.19	0.19	✓
23 Segar St.	0.12	0.12	0.12	✓
112 Segar St.	0.25	0.25	0.25	✓
114 Segar St.	0.10	0.10	0.10	✓
116 Segar St.	0.10	0.10	0.10	✓
118 Segar St.	0.01	0.01	0.03	
5 Home Pl.	0.08	0.08	0.08	✓
211 National Ave.	0.01	0.01	0.30	✓ (Build-10 only)
248 Bickford St.	0.18	0.18	0.18	✓
251 Bickford St.	0.08	0.08	0.08	✓
18 Downes St.	0.11	0.11	0.11	✓
22 Downes St.	0.07	0.07	0.07	✓
26 Downes St.	0.12	0.12	0.12	✓
308 South Hope St.	0.07	0.07	0.07	✓
310 South Hope St.	0.07	0.07	0.07	✓
311 South Hope St.	0.12	0.12	0.12	✓
312 South Hope St.	0.07	0.07	0.07	✓
313 South Hope St.	0.14	0.14	0.14	✓
316 South Hope St.	0.09	0.09	0.09	✓
318 South Hope St.	0.17	0.17	0.17	✓
321 South Hope St.	0.22	0.22	0.22	✓
322 South Hope St.	0.10	0.10	0.10	✓
323 South Hope St.	0.15	0.15	0.15	✓
404 South Hope St.	0.16	0.16	0.16	✓
406 South Hope St.	0.12	0.12	0.12	✓
408 South Hope St.	0.12	0.12	0.12	✓
413 South Hope St.	0.20	0.20	0.20	✓
TOTAL USE	3.18	3.18	3.49	n/a



Legend

- Limit of Disturbance Build - 8 Alternative
- Limit of Disturbance Build - 8 Managed Alternative
- Limit of Disturbance Build - 10 Alternative
- District Contributing Properties
- Phoebus Historic District

Source: VDOT, 2010

0 75 150 300 Feet

Phoebus Historic District

U.S. Department of Transportation Federal Highway Administration

VDOT

Figure 6

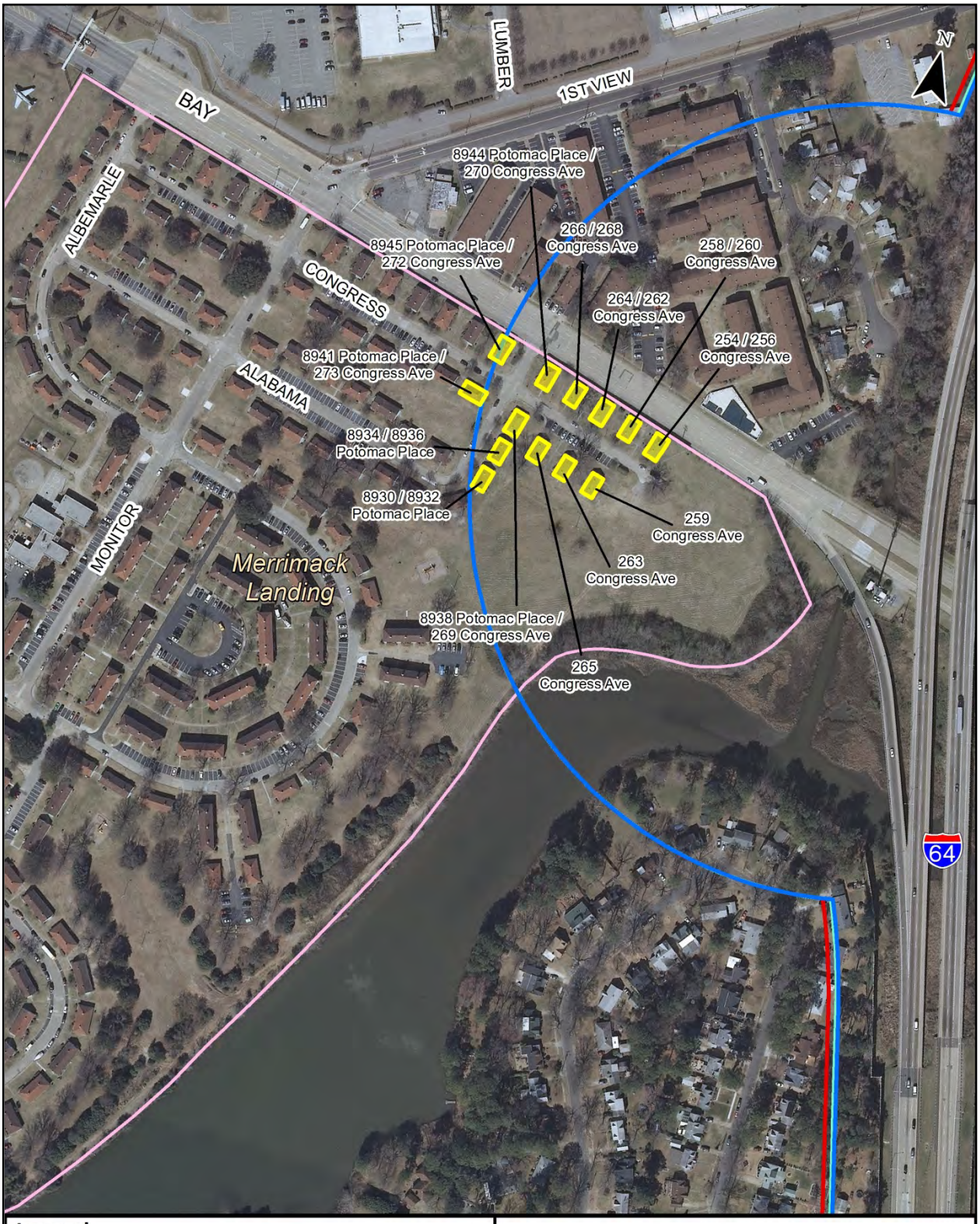

BAY
LUMBER
1ST VIEW
N
ALBEMARLE
CONGRESS
ALABAMA
MONITOR
8944 Potomac Place / 270 Congress Ave
8945 Potomac Place / 272 Congress Ave
266 / 268 Congress Ave
258 / 260 Congress Ave
264 / 262 Congress Ave
254 / 256 Congress Ave
8941 Potomac Place / 273 Congress Ave
8934 / 8936 Potomac Place
8930 / 8932 Potomac Place
259 Congress Ave
263 Congress Ave
Merrimack Landing
8938 Potomac Place / 269 Congress Ave
265 Congress Ave
64
Legend
National Historic Landmark
Merrimack Landing Historic District
Parks
District Contributing Buildings
Limit of Disturbance Build - 8 Alternative
Limit of Disturbance Build - 8 Managed Alternative
Limit of Disturbance Build - 10 Alternative
Source: VDOT, 2010
0
130
260
520
Feet
Merrimack Landing
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure 7

Table 5. Section 4(f) Use

Section 4(f) Property	Use from Build-8 Alternative*	Use from Build-8 Managed Alternative*	Use from Build-10 Alternative*	Intent to Pursue de Minimis (All Alternatives)
Bluebird Gap Farm	6.7 acres	6.9 acres	6.9 acres	✓
Newmarket Creek Park and Trail	750 linear feet	750 linear feet	750 linear feet	✓
Y.H. Thomas Neighborhood Park	Less than 0.1 acre	Less than 0.1 acre	0.1 acre	✓
River Street Park	Less than 0.1 acre	Less than 0.1 acre	Less than 0.1 acre	✓
Woodlands Golf Course	7.6 acres	7.7 acres	8.3 acres	✓
Willoughby Boat Ramp	0.7 acre	0.8 acre	0.9 acre	✓
Captain's Quarters Park	Less than 0.1 acre	Less than 0.1 acre	0.1 acre	✓
Willoughby Elementary School Recreational Fields	1.7 acres	1.8 acres	1.9 acres	✓
Pasture Point Historic District (VDHR No. 114-0118)	0.8 acres**	0.8 acres**	1.0 acres**	
Hampton Institute (VDHR No. 114-0006)	8.7 acres	9.0 acres	10.1 acres	
Hampton National Cemetery (VDHR No. 114-0148)	0.1 acre	0.1 acre	0.2 acre	
Phoebus Historic District (VDHR No. 114-5002)	3.2 acres**	3.2 acres**	3.5 acres**	
Battle of Hampton Roads (VDHR No. 114-5471)	376.9 acres	380.7 acres	392.2 acres	✓
Battle of Sewell's Point (VDHR No. 122-5426)	252.9 acres	255.2 acres	262.1 acres	✓
Merrimack Landing (VDHR No. 122-5434)	7.0 acres	7.0 acres	7.0 acres	
Forest Lawn Cemetery (VDHR No. 122-0531)	Less than 0.1 acre	Less than 0.1 acre	0.1 acre	✓

*Section 4(f) requires a greater level of detail as well as a greater level of minimization than other laws during the preparation of the entire environmental document. Therefore, the minimization measures described in Chapter 7 have been incorporated and these impacts are reduced from those presented in the DEIS.

**Includes the sum use of contributing properties in these districts, based on the information in Tables 3 and 4.

5. AVOIDANCE ANALYSIS

5.1. Avoidance Alternatives

5.1.1. Total Avoidance Location Alternatives

Because there are multiple Section 4(f) properties located along the study corridor, alternatives that avoid all Section 4(f) properties have been evaluated. Seven total avoidance alternatives, including two total avoidance alternatives along new alignments (Avoidance Alternatives A and B) and the No-build Alternative, are discussed below. The avoidance alternatives are analyzed in accordance with the definition of *feasible and prudent avoidance alternative* found in 23 CFR 774.17. Avoidance alternatives A and B are shown on **Figures 8 and 8a**.

Avoidance Alternative A (Northeast)

Avoidance Alternative A would add four new travel lanes to I-64 between the I-664 interchange and the I-564 interchange. The four new lanes would become the westbound travel lanes, and the existing lanes of I-64 (six lanes in Hampton and four lanes in Norfolk) would become the eastbound travel lanes. The four new lanes would follow the existing I-64 alignment except between Rip Rap Road and the existing HRBT alignment where I-64 would split. From Rip Rap Road, the new lanes would follow a new alignment which would travel northeast to a new bridge across the Hampton River. The new alignment would continue through the neighborhoods of East Hampton and, nearing Phoebus High School, would curve to the southeast and be supported on a bridge structure over Mill Creek along the Hampton shoreline. The Avoidance Alternative would then rejoin the Retained Build Alternatives on a new Bridge-Tunnel west of the existing Bridge-Tunnel. In the Norfolk section, Avoidance Alternative A would follow the alignment of the Retained Build Alternatives, except that the new lanes of I-64 would be constructed north of the existing I-64 alignment on Willoughby Spit to avoid Willoughby Boat Ramp, and east of the existing I-64 alignment near Ocean Avenue and Bayview Boulevard to avoid Merrimack Landing.

By creating a new northeastern alignment, Avoidance Alternative A would avoid all Section 4(f) properties identified in the study corridor. The alternative would provide four lanes of additional capacity for traffic through the City of Hampton and across Hampton Roads. It therefore would alleviate some of the congestion that would be expected on I-64 in Hampton under the No-Build Alternative. Similar to the Retained Build Alternatives, Avoidance Alternative A also would include rehabilitation of the existing HRBT. Thus, it would meet the study purpose and need by addressing capacity issues and roadway deficiencies in the corridor.

Avoidance Alternative A would be approximately three times more expensive than the Retained Build Alternatives through Hampton. The considerable difference is primarily due to the 3.3 miles of improvements over land on new alignment, 110 additional acres of right-of-way required through urban areas compared to the Retained Build Alternatives, and the construction of multiple bridge structures totaling approximately 3.2 miles over the Hampton River, Hampton Roads and Willoughby Bay.

Avoidance Alternative A would result in impacts to residences, businesses, and institutions through a large swath of densely populated East Hampton and Willoughby Spit. The siting of the avoidance alternative would necessitate displacement of an additional 340 properties compared to the Retained Build Alternatives. As a result, Avoidance Alternative A would have severe impacts to established communities and neighborhoods.


N
Newmarket Creek Trail
YH Thomas Neighborhood Park
Bluebird Gap Farm
YMCA Athletic Fields
Hampton River
Pasture Point Historic District
River Street Park
Woodlands Golf Course
Hampton Institute
Hampton National Cemetery
HAMPTON
Hampton Veterans Affairs Medical Center Historic District
Phoebus Historic District
Battle of Hampton Roads
Battle of Sewells Point
Hampton Roads Bridge-Tunnel
Chesapeake Bay
258
167
64
664
351
60
143
169
Legend
National Historic Landmark
Historic Properties
Parks
Historic Battlefields
Baseline for Alternatives Carried Forward
Avoidance Alternatives
Alternative A
Alternative B
Source: VDOT, 2010
0 0.25 0.5 1 Miles
Avoidance Alternatives in Hampton
U.S. Department of Transportation Federal Highway Administration
VDOT
Figure 8

Avoidance Alternatives in Norfolk

U.S. Department of Transportation Federal Highway Administration

VDOT

Figure 8a

According to 2000 and 2010 US Census data, the Avoidance Alternative A alignment would impact minority and low-income populations. The alignment passes through Census Tract 106.02, which has a minority population of 86.1 percent and 19.6 percent of the population living below the poverty level, and Census Tract 109, which a minority population of 82.2 percent and 23.1 percent of the population living below the poverty level. By comparison, the City of Hampton has a 57.3 percent minority population and 11.3 percent of the population living below the poverty level. Thus, Avoidance Alternative A would likely result in a disproportionately high and adverse impact on these populations.

Further, Avoidance Alternative A would have severe impacts to other environmental resources protected by Federal statutes. This includes approximately 3.2 miles of new bridge over wetlands and waterways associated with the Hampton River, Hampton Roads, and Willoughby Bay which are protected by Section 404 of the Clean Water Act.

Although Avoidance Alternative A would avoid impacts to all Section 4(f) resources identified in the study corridor, it is not prudent because it would 1) result in additional construction, maintenance, and operational costs of an extraordinary magnitude; and 2) after reasonable mitigation, it would still cause severe social, economic, and environmental impacts; severe disruption to established communities; likely impacts to minority or low income populations; and severe impacts to environmental resources protected under other Federal statutes, such as wetlands and waterways (protected by the Clean Water Act and the Rivers and Harbors Act). Avoidance Alternative A is therefore not feasible and prudent because it causes other severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) properties.

Avoidance Alternative B (Southwest)

Like Avoidance Alternative A, Avoidance Alternative B would add four new lanes to I-64 between I-664 and I-564. However, unlike Avoidance Alternative A, the four new lanes would become the eastbound travel lanes, and the existing lanes of I-64 (six lanes in Hampton and four lanes in Norfolk) would become the westbound travel lanes. The four new lanes would follow the existing I-64 alignment except between Rip Rap Road and the existing HRBT alignment where I-64 would split. From Rip Rap Road, the new lanes would follow a new alignment which would travel southeast through urban downtown Hampton and along the Hampton River west of Hampton University to the mouth of the river at Hampton Roads. The proposed new alignment would continue on a bridge over Hampton Roads adjacent to the Hampton shoreline south of the Veterans Administration Medical Center. The proposed alignment would then connect to the western portal island of the existing HRBT tunnels and be similar to the Build-8 Alternative, and include a new Bridge-Tunnel west of the existing HRBT. In the Norfolk section, I-64 would be the same as the Build-8 Alternative, except that it would follow a new alignment over Willoughby Bay south of the existing alignment to avoid the Willoughby Boat Ramp and rejoin the existing I-64 alignment near 4th View Street. To avoid the Merrimack Landing Historic District, the interchange at Bay Avenue would not be modified from existing conditions.

Avoidance Alternative B would avoid all Section 4(f) properties identified in the study corridor. The alternative would provide four lanes of additional capacity for traffic through the City of Hampton and across Hampton Roads. It therefore would alleviate some of the congestion that would be expected on I-64 in Hampton under the No-Build Alternative. Similar to the Retained Build Alternatives, Avoidance Alternative B also would include rehabilitation of the existing

HRBT. Thus, it would meet the study purpose and need by addressing capacity issues and roadway deficiencies in the corridor.

Avoidance Alternative B would be approximately two times more expensive than the estimated cost for the Retained Build Alternatives. The considerable difference is primarily due to an additional 1.1 miles of improvements over land on new alignment and 20 additional acres of right-of-way required through urban areas compared to the Retained Build Alternatives, as well as multiple bridge structures totaling approximately 4.2 miles over the Hampton River, Hampton Roads, and Willoughby Bay.

The Avoidance Alternative B would result in impacts to residences, businesses, and institutions in the dense urban area of downtown Hampton. The proposed alignment would necessitate the acquisition and relocation of approximately 135 residential, commercial, and public properties and would bisect an established community. These displacements and the siting of an interstate highway through the middle of the residential neighborhoods and commercial areas of downtown Hampton would severely impact community cohesion and disrupt the continuity of neighborhoods that have existed in Hampton since it was first settled in the 1600s. Further, according to 2000 and 2010 Decennial US Census data, Avoidance Alternative B would impact minority and low-income populations. The alignment passes through Census Tract 106.01, which has a minority population of 80.2 percent and 26.2 percent of the population living below the poverty level. It also passes through Census Tract 106.02, which has a minority population of 86.1 percent and 19.6 percent living below the poverty level. Thus, Avoidance Alternative B would likely result in severe disproportionate impacts to these populations.

Also like Avoidance Alternative A, Avoidance Alternative B would have severe impacts to other environmental resources protected by Federal statutes. This includes approximately 4.2 miles of new bridge over wetlands and waterways associated with the Hampton River, Hampton Roads, and Willoughby Bay which are protected by Section 404 of the Clean Water Act.

Although Avoidance Alternative B would avoid impacts to all Section 4(f) resources identified in the study corridor, it is not prudent because it would 1) result in additional construction, maintenance, and operational costs of an extraordinary magnitude; and 2) after reasonable mitigation, it would still cause severe social, economic, and environmental impacts; severe disruption to established communities; severe disproportionate impacts to minority or low income populations; and severe impacts to environmental resources protected under other Federal statutes, particularly wetlands and waterways. Avoidance Alternative B is therefore not feasible and prudent because it causes other severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) properties.

5.1.2. Other Total Avoidance Alternatives

The following total avoidance alternatives are identified in the DEIS and would not require an alignment on new location.

<u>Rehabilitate or Replace Existing HRBT</u>

Rehabilitation of the existing HRBT would include rehabilitation/upgrade of the existing tunnels to maximize use of their remaining life span of 75-100 years. The alternative also includes either rehabilitation of the approach bridge superstructure or reconstruction of the approach bridge substructure and superstructure. The rehabilitation would likely include replacement of the wall tiles, wearing surface, and structural slab; upgrades to utilities; upgrades to the ventilation system; and upgrades to the safety system. The existing transverse ventilation systems in both

existing tunnels would be converted to longitudinal ventilation systems with the addition of jet fans. Installation of the jet fans would involve the removal of the existing ceiling tiles and the upper exhaust air duct to create space for the jet fans, thereby, increasing the vertical clearance.

Replacement would include any improvements that involve complete removal of an existing bridge-tunnel in conjunction with reconstruction of a new crossing facility in the same location. This alternative would not address the identified capacity needs as it only replaces the existing HRBT and would not provide additional capacity. Geometric deficient roadway infrastructure would be replaced by a new facility that would meet current design standards for shoulder widths, vertical clearance in tunnels, and vertical clearance above water for approach bridges. If only one of the existing bridge-tunnels is removed, the remaining bridge-tunnel would have the same geometric deficiencies as the current facility. Removal of two lanes of the existing bridge-tunnels would be necessary prior to constructing the new facility. The number of lanes crossing the HRBT during construction would be reduced by one half from existing conditions from four lanes to two lanes. This would result in increased delays within the I-64 HRBT corridor for drivers that continue to use the HRBT or additional traffic on other regional routes such as I-664 and the James River Bridge.

Both the rehabilitation and replacement alternatives would avoid all Section 4(f) properties by improving the existing HRBT facility only, with no improvements to I-64 in Hampton or Norfolk. However, neither rehabilitation nor replacement would increase roadway capacity to alleviate current and future unacceptable and unreliable levels of traffic service, operating speeds, and travel times. As a result of these issues, the rehabilitation alternative is not prudent because it would be unreasonable to proceed with the alternative in light of the stated purpose and need. This avoidance alternative therefore causes other severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) properties.

Bus Transit

This alternative would include expansion of existing bus transit services within the study corridor and across Hampton Roads. This could be in the form of an increase in bus service, or consideration of a dedicated (express bus or bus rapid transit) facility. A Bus Transit Alternative could be considered as a stand-alone alternative or in conjunction with other alternatives. The alternative does not include any other capacity improvements to I-64 within the study corridor, and no facility improvements which would cause impacts to Section 4(f) properties.

As a stand-alone alternative, increased bus service or a dedicated bus facility would not result in any roadway or bridge-tunnel improvements, and therefore it would not address the identified capacity and roadway deficiency needs. In addition, expansion of the existing bus transit network alone would likely not attract enough riders to significantly address the capacity need within the I-64 HRBT corridor. The current lack of bus ridership potential across Hampton Roads is demonstrated by recent recommendations by HRT to eliminate five current weekday trips across HRBT due to low ridership (*Service and Schedule Efficiency Review, HRT, March 2011).* All bus routes across Hampton Roads accommodated approximately 700 passengers per day in 2011, which is less than one percent of the existing HRBT daily traffic volume. Any increased bus service would also continue to rely on the existing HRBT facility, and its operation would be hampered by current capacity and deficiencies of existing facilities.

As a result of these issues, the bus transit alternative is not prudent because it would be unreasonable to proceed with the alternative in light of the stated purpose and need. This avoidance alternative therefore causes other severe problems of a magnitude that substantially

outweighs the importance of protecting the Section 4(f) properties. However, the Build-8 Managed Alternative could include bus transit as well as a dedicated bus lane as part of the management strategy. Thus, expanded bus transit has been retained for further evaluation as a component of other alternatives.

Ferry Service

This alternative would provide a service to carry vehicles across Hampton Roads via water transport. The existing bridge-tunnels would remain, however, rehabilitation of the superstructure or reconstruction of the substructure and superstructure of the approach bridges would be completed, and routine maintenance of the tunnels would continue as required. The alternative would avoid all Section 4(f) properties because there would be no improvements to I-64, and right-of-way requirements could be limited to docks and terminal buildings away from parks and recreational and historic properties.

The Ferry Service Alternative would not address the deficiencies of the existing facilities, because no improvements would be made to the I-64 roadway or existing bridge-tunnel to address current design standards for shoulders, vertical clearance in tunnels, or vertical clearance above water.

Ferries would require that vehicles arrive at least 20 minutes prior to departure to load and would travel at speeds no greater than 40 miles per hour. This speed may not be reasonable across Hampton Roads where ferries would have to traverse shipping lanes and adhere to speed restrictions. The total trip length (including loading and unloading) would be approximately 30 minutes across Hampton Roads, thereby extending travel times compared to the existing bridge-tunnel and making ferry travel less desirable. Further, as cited in the HRT *Hampton Roads Regional Transit Vision Plan* (2011), total average weekday ferry ridership between downtown Hampton and the Norfolk Naval Station in the year 2034 would range from 600 to 1100 vehicles, or about one percent of the existing volume and less than 1 percent of the projected 2040 No-Build volume on the HRBT.

A similar study was recently convened by the Maryland Transportation Authority for a potential ferry crossing of the Chesapeake Bay to help reduce traffic congestion on the existing Chesapeake Bay Bridge. The study findings noted that a ferry crossing would only be able to accommodate up to 335,000 vehicles per year or less than 1,000 vehicles per day. Further, the study found that the cost of a ferry crossing would be 10 to 15 times higher for passengers per trip then using the existing tolled bridge.

For the reasons cited above, the Ferry Service Alternative would not address deficiencies of the existing facilities or capacity needs of the HRBT. The ferry service alternative is therefore not prudent because it would be unreasonable to proceed with the alternative in light of the stated purpose and need. Thus, the alternative is being eliminated because it causes other severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) properties.

Transportation System Management / Transportation Demand Management (TSM / TDM)

The TSM/TDM alternative would maximize the efficiency of the current transportation system or reduce the demand for travel on the system through the implementation of low-cost improvements. Examples of TSM activities include the addition of turn lanes, signalization at intersections, and Intelligent Transportation Systems (ITS) measures such as active traffic management and traffic signal optimization. Examples of TDM activities include ride sharing,

van and carpooling, installation of park and ride facilities, and encouragement of telecommuting. These activities would avoid Section 4(f) properties because they generally would not require any right-of-way.

TSM/TDM alternatives, by their nature, do not include the addition of roadway capacity, and could not address the large-scale roadway deficiencies present within the study corridor. Therefore, because of the limited scope of these types of improvements, TSM/TDM improvements alone would not address the capacity or roadway deficiency needs. The TSM/TDM alternative is therefore not prudent because it would be unreasonable to proceed with the alternative in light of the stated purpose and need. Thus, the alternative is not prudent because it causes other severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) properties.

5.1.3. No-Build

Under the No-Build Alternative, I-64 would remain predominantly three lanes per direction within the Hampton section of the study area. The 3.5-mile HRBT would continue with current operations. Within the Norfolk section of the study, I-64 would remain two lanes per direction, including the I-64 bridges across Willoughby Bay. Under the No-Build Alternative, VDOT would continue maintenance and repairs of I-64 and the HRBT as needed, with no acquisition of right-of-way and no substantial changes to current management activities. The No-Build Alternative includes all projects funded for construction in HRTPO's *2034 Long Range Transportation Plan*.

The No-Build Alternative does not meet the purpose and need of the study because routine maintenance of the study corridor and other programmed projects would not adequately improve capacity or roadway deficiencies. Therefore, although the No-Build Alternative would not result in use of any Section 4(f) properties, the alternative is not prudent because it would be unreasonable to proceed with the alternative in light of the stated purpose and need. Thus, the alternative is not prudent and causes other severe problems of a magnitude that substantially outweighs the importance of protecting the Section 4(f) properties.

5.2. Avoidance Analysis Summary

Based on the evaluation presented in this chapter, there is no feasible and prudent avoidance alternative to the use of land from Section 4(f) property.

6. LEAST OVERALL HARM

Pursuant to 23 CFR 774.3(c), if the avoidance analysis determines that there is no feasible and prudent avoidance alternative, then only the alternative that causes the least overall harm to Section 4(f) properties may be approved. Since the previous discussion demonstrates that there is no feasible and prudent avoidance alternative, all remaining alternatives are evaluated to determine which alternative would cause the least overall harm to Section 4(f) properties. This chapter evaluates those alternatives, including alternatives that would avoid or reduce the use of individual Section 4(f) properties.

There are seven factors to be considered in identifying the alternative that would cause the least overall harm (see 23 CFR 774.3(c)(1)). **Table 6** (located at the end of this document) presents a comparison of the alternatives by each factor. The cost of each Alternative is stated as a comparison to the Build-10 Alternative, which is used as a baseline for this purpose.

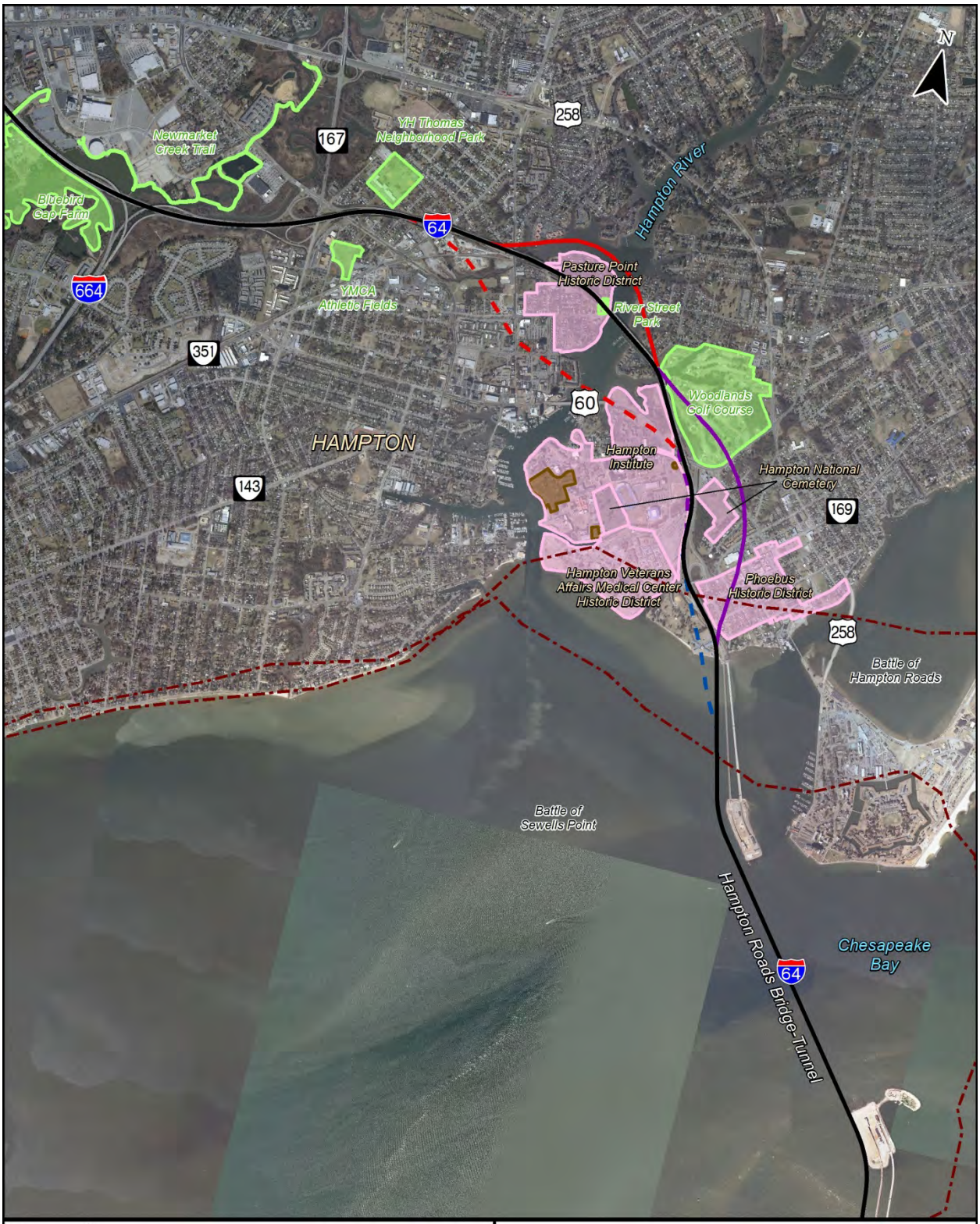
6.1. Location Avoidance Alternatives for Individual Section 4(f) Properties

The following discussion describes location alternatives which would avoid Section 4(f) use of individual Section 4(f) properties. Each alternative assumes that the Retained Build Alternatives would be modified in order to avoid a specific Section 4(f) property. Alternatives were developed which would avoid Pasture Point Historic District, Hampton National Cemetery, Hampton Institute, Phoebus Historic District (**Figure 9**), and Merrimack Landing. In general, these avoidance alternatives to individual Section 4(f) properties would result in additional use of other Section 4(f) properties, or a severe magnitude of adverse impacts to properties not subject to Section 4(f). The alternatives primarily follow the alignment of the Retained Build Alternatives in the Draft EIS, but incorporate alignment shifts to avoid the specified individual Section 4(f) properties. Because they are incorporated into the Retained Build Alternatives, each would meet the study purpose and need.

6.1.1. Pasture Point Historic District

Alternative C would include relocating westbound I-64 to the north to avoid the Pasture Point Historic District. This alternative would require roadway on new alignment, resulting in approximately 40 residential displacements and a new bridge crossing of the Hampton River adjacent to the shoreline of Pasture Point, causing approximately 20 acres of impact to the Hampton River. The length of the proposed alignment shift also would result in a higher cost (approximately two times higher) than the Retained Build Alternatives in this portion of the study area.

Alternative D would include relocating eastbound I-64 to the south to avoid the Pasture Point Historic District. This alternative would require roadway on new alignment, which would result in additional impacts to the Hampton Institute including the use of the Emancipation Oak and a new bridge crossing of the Hampton River, which would be constructed over approximately four acres of the river. This relocation also would require approximately 130 residential and commercial displacements in downtown Hampton. The alternative would result in a higher cost (approximately two times higher) than the Retained Build Alternatives in this portion of the study area.



Minimization Alternatives in Hampton

U.S. Department of Transportation Federal Highway Administration

VDOT

Figure 9

6.1.2. Hampton National Cemetery

Alternative E would include relocating westbound I-64 to the north to avoid the Hampton National Cemetery. This alternative would require roadway on new alignment resulting in an additional impact to the Woodlands Golf Course and the Phoebus Historic District. This also would require approximately 105 residential and commercial displacements, including properties located in Phoebus. The length of the alignment shift and the amount of right of way required (25 acres) results in an approximate cost in the Hampton section that is three times higher than the Retained Build Alternatives in the DEIS.

Alternative F would provide all roadway widening on the south side of I-64 to avoid the Hampton National Cemetery. This alternative would require a realignment of the centerline of I-64 and south side widening that would result in additional impacts to the Hampton Institute, including impacts to the Emancipation Oak, which is a National Historic Landmark. National Historic Landmarks are nationally significant historic places designated by the Secretary of Interior. The estimated cost of the alternative would be similar to the Retained Build Alternatives.

6.1.3. Hampton Institute

Hampton Institute would be avoided with an alignment shift of I-64 to the north. In addition, improvements to the eastbound-serving (south side) ramps of the I-64 interchanges with Settlers Landing Road and Mallory Street would not be included with the Retained Build Alternatives. However, the alignment shift would require additional impact to the Woodlands Golf Course and Hampton National Cemetery.

Hampton Institute could also be avoided by relocating the I-64 eastbound lanes to south. This alternative would require a substantial realignment of I-64 that would be the same as Avoidance Alternative B, discussed in Chapter 5. The proposed alternative would result in impacts to approximately 60 residences and businesses in the Hampton section, and result in an approximate cost in Hampton that is two times higher than the Retained Build Alternatives in the DEIS.

6.1.4. Phoebus Historic District

The Phoebus Historic District could be avoided by relocating the I-64 westbound lanes to east. This alternative would require a dramatic realignment of I-64 that would be the same as Avoidance Alternative A, discussed in Chapter 5. The proposed alternative would result in impacts to approximately 170 residences and businesses in Hampton, and result in an approximate cost in Hampton that is three times higher than the Retained Build Alternatives in the DEIS.

Alternative G would provide roadway widening on the south side of I-64 to avoid the Phoebus Historic District. This alternative would require a realignment of the centerline of I-64 and south side widening that would impact the Hampton Institute historic property and Hampton University facilities in the Strawberry Banks area. The estimated cost of the alternative would be similar to the Retained Build Alternatives.

6.1.5. Merrimack Landing

Locating the proposed alignment to the east to avoid Merrimack Landing would be similar to Avoidance Alternative A, and require the full relocation of the I-64 interchange with West Bay Avenue. This could displace approximately 135 residences to the east of the existing

interchange. This location also would necessitate the construction of new crossings of Oastes Creek and Mason Creek, resulting in approximately 1.5 acres of additional impact to those waterways and their associated wetlands.

There are two options for avoiding Merrimack Landing by modifying the eastbound side of the Retained Build Alternatives. The first would be constructing a new alignment for the eastbound lanes through Naval Station Norfolk. This alternative would require substantial right-of-way from the base, displacing more than 30 base housing structures and requiring a new crossing of Mason Creek. The alternative would also result in disruption to the base's primary runway, Runway 28. The second option would be to make no improvements to the eastbound-serving (west side) ramps at the Bay Avenue interchange. This would limit improvement to the eastern side of the interchange and would not accommodate the mainline improvements resulting from the Retained Build Alternatives.

6.2. Alternatives Not Retained for Detailed Evaluation in the Draft Environmental Impact Statement

Multiple build alternatives have been developed and evaluated in this Draft Section 4(f) Evaluation and the DEIS that could result in less harm to Section 4(f) properties. A summary of the characteristics of these alternatives and a comparison of overall harm to the Section 4(f) properties is presented in **Table 6** with the individual property avoidance alternatives. The Build-12 Alternative would have a larger footprint than the Retained Build Alternatives and would have greater impacts to Section 4(f) properties; however, it is included in **Table 6** for comparison purposes. The following alternatives would have a smaller footprint than the Retained Build Alternatives and thus would have smaller impacts to Section 4(f) properties.

6.2.1. Build-6 Alternative

This alternative would include construction of two additional lanes of capacity on I-64 at the Hampton Roads crossing and within the Norfolk section of the corridor, so that a continuous six-lane facility would extend from I-664 to I-564. Through the Hampton section of the study corridor, no additional lanes would be constructed as the corridor currently includes six travel lanes, three in each direction. The existing bridge-tunnels would remain so that the capacity and life span of the facility would be used, and the alternative would include rehabilitation or reconstruction of the HRBT as described in Chapter 5.1.2. The alternative would include a new two-lane bridge-tunnel at the Hampton Roads crossing.

This alternative would partially address deficiencies of existing facilities by constructing a new bridge-tunnel that would meet current design standards for shoulders, vertical clearance in tunnels, and vertical clearance over water. However, two additional lanes of roadway capacity would not provide adequate congestion relief for current or future traffic within the study corridor. In general, LOS E or worse would still occur on the HRBT and its approaches in the future with this alternative. This would not meet the capacity requirement from the purpose and need. Additionally, this alternative would require two-way traffic to operate on the existing eastbound approach bridges and tunnel. Due to the narrow typical section, a concrete traffic barrier could not be placed between the travel lanes; therefore, there would be no measures to guarantee the minimization of head-on collisions at highway speeds. Due to safety concerns, the speed limit could be reduced to address this issue; however, this reduction would further lessen the capacity of this improvement.

This alternative would not meet minimum Level of Service standards for interstate facilities, and would not meet future traffic demand. Because it would not adequately address capacity, this alternative does not meet the study purpose and need.

6.2.2. Reversible Lanes

This alternative would include adding one or two reversible travel lanes to the middle of I-64. At the HRBT crossing, the additional lanes would be constructed west of the existing crossing to prevent disturbance to the existing Bridge-Tunnels during construction. However, the reversible lanes would operate in the center of the roadway, and eastbound traffic would use the newly constructed roadway lanes. The reversible lanes would connect to the mainline of I-64 west of I-664, and connect to the existing reversible lanes on I-64 east of I-564. The lanes would either be completely barrier separated from both directions of traffic, similar to the reversible lanes east of I-564, or a moveable-barrier system could be used to separate opposing traffic. Use of Section 4(f) properties would be minimized because the facility would likely require a smaller area than the Retained Build Alternatives.

Construction of reversible lanes would partially address deficiencies at the existing crossing, because the reversible lanes would be on a new bridge-tunnel that would meet current design standards for shoulders, vertical clearance in tunnels, and vertical clearance above water. However, the existing bridge-tunnels would continue to be used without improvements; therefore, deficiencies at these facilities would not be addressed.

The travel patterns along I-64 through this study area do not allow for effective operation of reversible lanes. Based on the traffic volumes for existing conditions and the No-Build Alternative, there is not a clear directional peak volume. The westbound and eastbound volumes have a defined peak period; however, the volumes in each direction are comparable during those peak periods. Thus, reversible lanes would increase capacity in one direction during any given peak period, but the capacity needs in the opposite direction would not be met. Consequently, this alternative would not meet the minimum Level of Service standards for both directions and would not meet the study purpose and need.

6.2.3. Stacked Alternative

This alternative would involve constructing the new travel lanes above the existing I-64 roadway and approach bridges. Ramps would be constructed to carry users to and from the upper structure. These ramps would be constructed to minimize permanent use of Section 4(f) resources.

Because construction cannot take place over flowing traffic, the temporary roadways would need to be constructed on either side of existing I-64, thus resulting in similar temporary impacts to Section 4(f) properties relative to the permanent impacts of the Retained Build Alternatives. Regardless, this alternative would require a lengthy construction period during which congestion in the I-64 corridor would be greatly exacerbated. Therefore, it would not address the capacity or roadway deficiency needs for the corridor to the same degree as the Retained Build Alternatives. The alternative would also be approximately three times more expensive than the Retained Build Alternatives in terms of both construction costs and maintenance costs.

6.2.4. Light or Heavy Rail

This alternative would include a new dedicated passenger light or heavy railway either as part of the existing roadway structure or on a separate structure across Hampton Roads. Use of Section

4(f) properties would be minimized because the facility would likely require a smaller area than the Retained Build Alternatives.

This alternative would not address roadway deficiencies of existing facilities. No improvements would be made to the existing bridge-tunnel to address current design standards for shoulders, vertical clearance in tunnels, or vertical clearance above water.

There is currently no rail transit service connecting Hampton to Norfolk, nor comprehensive transit service within the larger region. The nearest rail transit service is "The Tide," which is a light rail line located approximately 5.5 miles from the study area and operates on the Southside from Fort Norfolk Station to Newtown Road Station. For a rail transit crossing at the HRBT to be viable, a new rail transit route or system would be necessary on both the Peninsula and the Southside.

The Preliminary Cost and Ridership Estimation Report, prepared as part of Phase I of the *Hampton Roads Regional Transit Vision Plan*, included estimated 2034 ridership for light rail service across Hampton Roads. These projections provide a reasonable approximation of the potential ridership for the Light or Heavy Rail Passenger Alternative. The projections assume two services: from Naval Station Norfolk to downtown Newport News, and from downtown Hampton to Wards Corner (near the I-64 interchange with I-564). Both services are recommended for implementation after 2035. According to the report, daily ridership is projected to be as much as 4,100 for Naval Station Norfolk to downtown Newport News, and 5,100 for downtown Hampton to Wards Corner.

Currently, approximately 88,000 persons use the HRBT every day; approximately 112,000 are projected to use the HRBT in 2040 under No-Build conditions. Assuming that the potential daily projected ridership for the two proposed rail transit services all uses the HRBT, it would include 9,200 person-trips on the HRBT per day. Thus, rail transit would accommodate approximately ten percent of the existing HRBT users and eight percent of the year 2040 users on the HRBT. Similarly, approximately 22,000 vehicles use each lane of the HRBT today and approximately 28,000 vehicles would use each lane under year 2040 No-Build conditions. Therefore, rail transit would accommodate approximately 42 percent of one existing lane and 33 percent of one of the 2040 lanes.

Based on the discussion above, the Light or Heavy Rail Transit Alternative would not address the roadway deficiency or capacity needs. The alternative would require substantial new rail transit connections on the Peninsula and Southside, and it would have limited ability to accommodate existing and future traffic volumes on the HRBT. The alternative also would not address current roadway deficiencies. Therefore, the alternative does not meet the purpose and need for the study.

7. ALL POSSIBLE PLANNING TO MINIMIZE HARM

"All possible planning" as defined in 23 CFR 774.17 includes all reasonable measures to minimize harm and mitigate for adverse impacts and effects. The location avoidance alternatives discussion in Chapter 6.1 considers relatively broad-scale alignment shifts that would minimize the use of Section 4(f) properties. The retained alternatives described in this evaluation also incorporate measures that minimize harm to Section 4(f) property. As a result, impact values presented in Chapter 3 are reduced from those presented in the DEIS. Minimization measures considered include side slopes of varying steepness, guardrails, and retaining walls. This has resulted in an assumed distance of 50 feet from the edge of pavement to the LOD for the length of the impacted Section 4(f) property. The distance from edge of pavement is approximately 90 feet for the LOD reported in the DEIS.

At this stage of the study, the Retained Build Alternatives have not been refined to the extent that additional minimization measures can be appropriately included. Future planning to minimize harm may entail consideration of the following potential measures:

- Minor alignment shifts
- Bridging over resources
- Depressed roadway
- Visual barriers/plantings
- Documentation/signage
- Property improvement/land transfer
- Other mitigation measures that address adverse effects

For Section 4(f) uses that cannot be avoided or further minimized, mitigation would be considered. The level of mitigation would be considered commensurate with the severity of the impact on the Section 4(f) property. Mitigation would be determined through consultation with the officials having jurisdiction over each resource and presented in the Final Section 4(f) Evaluation.

Mitigation for the Section 4(f) use of the historic sites would be specified in a Programmatic Agreement (PA) or Memorandum of Agreement (MOA) if a preferred alternative is chosen which results in an adverse effect pursuant to 36 CFR Part 800. Potential mitigation measures would be developed in coordination with the State Historic Preservation Officer (VDHR), consulting parties as appropriate, and the Advisory Council on Historic Preservation (ACHP).

All minimization and mitigation measures will be documented in the Final Section 4(f) Evaluation. FHWA will make a final determination of whether all possible planning has occurred based on the Final Section 4(f) Evaluation, after consideration of comments on the Draft Section 4(f) Evaluation.

Pursuant to 23 CFR 774.17, a Section 4(f) de minimis impacts determination inherently includes the requirement for all possible planning to minimize harm because impacts have already been reduced to a de minimis level. Therefore, additional planning to minimize harm is not required for those properties where a de minimis impact finding is made.

8. COORDINATION

Department of Interior (DOI) – This Draft Section 4(f) Evaluation will be provided to the Department of Interior for comment.

Officials with jurisdiction – There are five officials with jurisdiction over park and historic properties in the study area: The City of Hampton Department of Parks and Recreation; the City of Norfolk Department of Recreation, Parks, and Open Space; Norfolk Public Schools; the Virginia Department of Conservation and Recreation; and the Virginia Department of Historic Resources. This draft evaluation is being circulated to the officials with jurisdiction. Preliminary coordination has also occurred with the following:

- City of Hampton Parks & Recreation Department: Contacted via letter in October 2011; information provided to VDOT regarding public parks in the study area. Further coordination with the City Department of Public Works occurred in Spring 2012 to identify characteristics of River Street Park.

- City of Norfolk Department of Recreation, Parks, & Open Space: Contacted via letter in October 2011; information provided to VDOT regarding public parks in the study area.

- Virginia Department of Conservation and Recreation: Coordination and materials received in August 2012 regarding a grant pursuant to the Land and Water Conservation Fund Act which was used to develop Willoughby Boat Ramp.

- Virginia DHR: VDHR is the Virginia State Historic Preservation Officer. Coordination has included identification of the Area of Potential Effect and identification of historic properties pursuant to 36 CFR Part 800. To date, DHR has reviewed three study documents: the Archeological Assessment, the Phase I Architectural Survey, and the Phase II Intensive Level Architecture Survey. DHR concurred with the identification of historic properties in December 2011 and October 2012. Additional coordination per the Section 106 process will continue through the development of the EIS.

- US Department of Veterans Affairs (VA): The Department administers the Hampton National Cemetery. The VA was contacted in August 2011 and in August 2012 for review of the Archeological Assessment, the Phase I Architectural Survey, and the Phase II Intensive Level Architecture Survey. Additional coordination per the Section 106 process will continue through the development of the EIS.. Consultation is ongoing.

In addition, the Secretary of Interior will be notified of the study's involvement with a National Historic Landmark (Hampton Institute / the Emancipation Oak).

ACHP – As appropriate, the ACHP will be notified following a determination of effect to historic properties pursuant to 36 CFR Part 800.

Locality – the study is located within the Cities of Hampton and Norfolk. Representatives from both cities have participated in study scoping in accordance with NEPA. Both cities will receive copies of this draft evaluation and the DEIS for review and comment.

Public – The public will have an opportunity to review and comment on the Draft Section 4(f) Evaluation concurrently with the DEIS. Comments from the public related to the Section 4(f) analysis will be responded to in the Final Section 4(f) Evaluation.

Table 6. Least Overall Harm Analysis

Factors for Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)							
Alternative	**i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)**	**ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection**	**iii. The relative significance of each Section 4(f) property[1]**	**iv. The views of the official(s) with jurisdiction over each Section 4(f) property**	**v. The degree to which each alternative meets the purpose and need for the project**	**vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)**	**vii. Substantial differences in costs among the alternatives**
Retained Build Alternatives							
Build-8	The Retained Build Alternatives have equal ability to mitigate impacts.	Approximately equal relative harm given the similarity of physical footprint among the Retained Build Alternatives. Harm would occur to the properties described in Chapter 4.	The Emancipation Oak is considered more significant than other Section 4(f) properties because it is a National Historic Landmark. Each of the Retained Build Alternatives would avoid the Emancipation Oak.	The officials with jurisdiction have not provided views regarding the Retained Build Alternatives. Opportunity to provide views will occur during the review period of this draft Section 4(f) Evaluation and DEIS.	All the Retained Build Alternatives meet the purpose and need.	Adverse impacts to wetlands and waterways, including Hampton Roads; displacement of residences and businesses; impacts to wetlands and waters.	The Build-8 Alternative would cost approximately $4.8 billion to $6.5 billion.
Build-8 Managed							The Build-8 Managed Alternative would cost approximately $4.8 billion to $6.6 billion.
Build-10							The Build-10 Alternative would cost approximately $5.7 billion to $7.9 billion. .
Location Avoidance Alternatives							
Pasture Point Historic District: **Alternative C (North Avoidance)**	Similar to the Retained Build Alternatives except no mitigation for the Pasture Point Historic District.	Similar harm to all properties described in Chapter 4 compared to the Retained Build Alternatives; except no harm to the Pasture Point Historic District or River Street Park.	This alternative would not use the Emancipation Oak.	The officials with jurisdiction have not provided views regarding the avoidance and least harm alternatives. Opportunity to provide views will occur during review of this draft Section 4(f) Evaluation and DEIS.	This alternative would be a component of the Retained Build Alternatives, and therefore would meet the purpose and need.	Adverse impacts to wetlands and waterways, including Hampton Roads and the Hampton River; displacement of residences and businesses; impact to minority and low-income communities.	Alternative C would cost approximately two times more than the Build-10 Alternative in this portion of the alignment.

Table 6. Least Overall Harm Analysis

Factors for Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)							
Alternative	**i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)**	**ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection**	**iii. The relative significance of each Section 4(f) property[1]**	**iv. The views of the official(s) with jurisdiction over each Section 4(f) property**	**v. The degree to which each alternative meets the purpose and need for the project**	**vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)**	**vii. Substantial differences in costs among the alternatives**
Pasture Point Historic District: **Alternative D (South Avoidance)**	Similar to the Retained Build Alternatives except no mitigation for the Pasture Point Historic District and additional mitigation consideration for Hampton Institute.	Similar harm to all properties described in Chapter 4 compared to the Retained Build Alternatives; except no harm to the Pasture Point Historic District or River Street Park, and greater harm to Hampton Institute.	This alternative would require use of the Emancipation Oak.	The officials with jurisdiction have not provided views regarding the avoidance and least harm alternatives. Opportunity to provide views will occur during review of this draft Section 4(f) Evaluation and DEIS.	These alternatives would each be a component of the Retained Build Alternatives, and therefore would meet the purpose and need.	Adverse impacts to wetlands and waterways, including Hampton Roads and the Hampton River; displacement of residences and businesses; impact to minority and low-income communities.	Alternative D would cost approximately two times more than the Build-10 Alternative in this portion of the alignment.
Hampton National Cemetery: **Alternative E (North Avoidance)**	Similar to the Retained Build Alternatives, except no mitigation for the Hampton National Cemetery, and additional mitigation consideration for Woodlands Golf Course and Phoebus Historic District.	Similar harm to all properties described in Chapter 4 compared to the Retained Build Alternatives, except no harm to Hampton National Cemetery or Hampton Institute, and greater harm to Woodlands Golf Course and Phoebus Historic District.	This alternative would avoid use of the Emancipation Oak.			Similar impacts to wetlands and waterways compared to the Retained Build Alternatives; displacement of residences and businesses in East Hampton.	Alternative E would be approximately three times more than the Build-10 Alternative in this portion of the alignment.
Hampton National Cemetery: **Alternative F (South Avoidance)**	Similar to the Retained Build Alternatives, except no mitigation for the Hampton National Cemetery, and additional mitigation consideration for Hampton Institute.	Similar harm to all properties described in Chapter 4 compared to the Retained Build Alternatives, except no harm to Hampton National Cemetery, and greater harm to Hampton Institute.	This alternative would require use of the Emancipation Oak.			No additional impacts to properties not protected by Section 4(f) compared to the Retained Build Alternatives.	Alternative F would be approximately equal in cost to the Build-10 Alternative in this portion of the alignment.

Table 6. Least Overall Harm Analysis

Factors for Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)							
Alternative	**i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)**	**ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection**	**iii. The relative significance of each Section 4(f) property[1]**	**iv. The views of the official(s) with jurisdiction over each Section 4(f) property**	**v. The degree to which each alternative meets the purpose and need for the project**	**vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)**	**vii. Substantial differences in costs among the alternatives**
Hampton Institute: **Alignment Shift North (North Avoidance)**	Similar to the Retained Build Alternatives, except no mitigation for the Hampton Institute, and additional mitigation consideration for Woodlands Golf Course and Hampton National Cemetery.	Similar harm to all properties described in Chapter 4 compared to the Retained Build Alternatives, except no harm to Hampton Institute, and greater harm to Woodlands Golf Course and Hampton National Cemetery.	These alternatives would not use the Emancipation Oak.	The officials with jurisdiction have not provided views regarding the avoidance and least harm alternatives. Opportunity to provide views will occur during review of this draft Section 4(f) Evaluation and DEIS.	These alternatives would each be a component of the Retained Build Alternatives, and therefore would meet the purpose and need.	No additional impacts to properties not protected by Section 4(f) compared to the Retained Build Alternatives.	This alternative would be approximately equal in cost to the Build-10 Alternative in this portion of the alignment.
Hampton Institute: **Portion of Alternative B (South Avoidance)**	Similar to the Retained Build Alternatives, except no mitigation for the Hampton Institute.	Similar harm to all properties described in Chapter 4 compared to the Retained Build Alternatives, except no harm to Hampton Institute.				Substantial additional adverse impacts to wetlands and waterways compared to the Retained Build Alternatives, including Hampton Roads and Hampton River; displacement of residences and businesses.	This portion of Alternative B would cost approximately two times as much as the Build-10 Alternative.
Phoebus Historic District: **Portion of Alternative A (North Avoidance)**	Similar to the Retained Build Alternatives, except no mitigation for Pasture Point Historic District, Phoebus Historic District, or Hampton National Cemetery.	Similar harm to all properties described in Chapter 4 compared to the Retained Build Alternatives, except no harm to any Section 4(f) properties in Hampton.					This portion of Alternative A would cost approximately three times as much as the Build-10 Alternative.
Phoebus Historic District: **Alternative G (South Avoidance)**	Similar to the Retained Build Alternatives, except no mitigation for Phoebus Historic District.	Similar harm to all properties described in Chapter 4 compared to the Retained Build Alternatives, except no harm to Phoebus Historic District.				Additional impacts to the Strawberry Banks portion of Hampton University compared to the Retained Build Alternatives.	This alternative would be comparable in cost to the Build-10 Alternative in this portion of the alignment.

Table 6. Least Overall Harm Analysis

Factors for Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)							
Alternative	**i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)**	**ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection**	**iii. The relative significance of each Section 4(f) property[1]**	**iv. The views of the official(s) with jurisdiction over each Section 4(f) property**	**v. The degree to which each alternative meets the purpose and need for the project**	**vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)**	**vii. Substantial differences in costs among the alternatives**
Willoughby Boat Ramp: **Portion of Alternative A (North Avoidance)**	Similar to the Retained Build Alternatives, except no mitigation for Willoughby Boat Ramp.	Similar harm to all properties described in Chapter 4 compared to the Retained Build Alternatives, except no harm to Willoughby Boat Ramp, and more harm to Captain's Quarters Park.	These alternatives would not use the Emancipation Oak.	The officials with jurisdiction have not provided views regarding the avoidance and least harm alternatives. Opportunity to provide views will occur during review of this draft Section 4(f) Evaluation and DEIS.	These alternatives would each be a component of the Retained Build Alternatives, and therefore would meet the purpose and need.	Compared to the Retained Build Alternatives, this alternative would result in similar impacts to wetlands, waterways, and businesses, but would result in additional residential displacements on Willoughby Spit.	This alternative would be comparable in cost to the Build-10 Alternative in this portion of the alignment.
Willoughby Boat Ramp: **Portion of Alternative B (South Avoidance)**	Similar to the Retained Build Alternatives, except no mitigation for Willoughby Boat Ramp.	Similar harm to all properties described in Chapter 4 compared to the Retained Build Alternatives, except no harm to Willoughby Boat Ramp.				Compared to the Retained Build Alternatives, this alternative would result in greater impacts to wetlands and waterways, including additional bridge over Willoughby Bay; additional residential displacements on Willoughby Spit and greater impacts to the Willoughby Harbor Marina.	This portion of Alternative B would be comparable in cost to the Build-10 Alternative in this area.
Merrimack Landing: **Portion of Alternative A (East Avoidance)**	Similar to the Retained Build Alternatives, except no mitigation for Merrimack Landing.	Similar harm to all properties described in Chapter 4 compared to the Retained Build Alternatives, except no harm to Merrimack Landing.				Compared to the Retained Build Alternatives, this alternative would result in similar impacts to wetlands and waterways; it would also result in additional residential displacements.	This potion of Alternative A would cost approximately two times more than the Build-10 Alternative.

Table 6. Least Overall Harm Analysis

Factors for Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)							
Alternative	**i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)**	**ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection**	**iii. The relative significance of each Section 4(f) property[1]**	**iv. The views of the official(s) with jurisdiction over each Section 4(f) property**	**v. The degree to which each alternative meets the purpose and need for the project**	**vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)**	**vii. Substantial differences in costs among the alternatives**
Merrimack Landing: Modified Eastbound I-64	Similar to the Retained Build Alternatives, except no mitigation for Merrimack Landing.	Similar harm to all properties described in Chapter 4 compared to the Retained Build Alternatives, except no harm to Merrimack Landing.	This alternative would not use the Emancipation Oak.	The officials with jurisdiction have not provided views regarding the avoidance and least harm alternatives. Opportunity to provide views will occur during review of this draft Section 4(f) Evaluation and DEIS.	These alternatives would each be a component of the Retained Build Alternatives, and therefore would meet the purpose and need.	Compared to the Retained Build Alternatives, this alternative would result in greater adverse impacts to wetlands and waterways; it would also result in additional residential displacements and impacts to Naval Station Norfolk.	The off-alignment option for this alternative would cost approximately two times more than the Build-10 Alternative in this portion of the alignment.
Alternatives not Retained for Detailed Evaluation in the Draft EIS							
Build-6	Slightly less ability to mitigate compared to the Retained Build Alternatives.	Slightly less harm to all Section 4(f) properties compared to the Retained Build Alternatives due to smaller disturbance area.	This alternative would likely avoid the Emancipation Oak.	The officials with jurisdiction have not provided views regarding the avoidance and least harm alternatives. Opportunity to provide views will occur during review of this draft Section 4(f) Evaluation and DEIS.	Does not meet purpose and need as well as the Retained Build Alternatives. Does not meet need for additional capacity along I-64.	Slightly less impact to properties not protected by Section 4(f) compared to the Retained Build Alternatives.	This alternative would cost less than the Build-10 Alternative.
Build-12	Slightly greater ability to mitigate compared to the Retained Build Alternatives.	Slightly more harm to all Section 4(f) properties compared to the Retained Build Alternatives due to a larger disturbance area.	This alternative would likely use the Emancipation Oak.		Would meet purpose and need.	Slightly greater impact to properties not protected by Section 4(f) compared to the Retained Build Alternatives, due to a larger disturbance area.	This alternative would cost more than the Build-10 Alternative.

Table 6. Least Overall Harm Analysis

Factors for Evaluation of Least Overall Harm per 23 CFR 774.3(c)(1)							
Alternative	**i. The ability to mitigate adverse impacts to each Section 4(f) property (including any measures that result in benefits to the property)**	**ii. The relative severity of the remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection**	**iii. The relative significance of each Section 4(f) property[1]**	**iv. The views of the official(s) with jurisdiction over each Section 4(f) property**	**v. The degree to which each alternative meets the purpose and need for the project**	**vi. After reasonable mitigation, the magnitude of any adverse impacts to properties not protected by Section 4(f)**	**vii. Substantial differences in costs among the alternatives**
Stacked Roadway	Similar ability to mitigate compared to the Retained Build Alternatives.	Similar harm to Section 4(f) properties because of requirements for temporary roadway during construction.	These alternatives would likely use the Emancipation Oak.	The officials with jurisdiction have not provided views regarding the avoidance and least harm alternatives. Opportunity to provide views will occur during review of this draft Section 4(f) Evaluation and DEIS.	Would meet purpose and need.	Similar impact compared to the Retained Build Alternatives because of requirements for temporary roadway during construction.	This alternative would cost approximately three times more than the Build-10 Alternative.
Light or Heavy Rail	Less mitigation potential due to less impact to Section 4(f) properties.	Less harm to Section 4(f) properties due to smaller footprint			Does not address capacity need or roadway deficiency need.	Less impact compared to the Retained Build Alternatives due to smaller limit of disturbance.	This alternative would cost more than the Build-10 Alternative.
Reversible Lanes							This alternative would cost less than the Build-10 Alternative.
DRAFT ANALYSIS RESULTS	All build alternatives provide similar opportunities for mitigation, with the Build-12 Alternative offering the most opportunity for mitigation.	Each alternative generally has similar severity of remaining harm to Section 4(f) properties; however, degree of harm to each property varies	The Hampton Institute Alignment Shift North, Phoebus Historic District Alternative A (North Avoidance) and Hampton National Cemetery Alternative E would avoid the Emancipation Oak.	Because the officials with jurisdiction have not yet provided views, this factor does not differentiate the alternatives.	The Retained Build Alternatives, the Build-12 Alternative, the Stacked Roadway alternative, and the Location Avoidance Alternatives meet the purpose and need; the other alternatives do not.	The Retained Build Alternatives, the Build-6 Alternative, and the Hampton National Cemetery Alternative F (South Avoidance) alternatives would have the least impact to other properties.	The Build-6 Alternative and the Reversible Lanes would have the lowest cost among the alternatives in the least harm analysis.

[1] Because the Emancipation Oak is a National Historic Landmark pursuant to 36 CFR Part 65, this property is considered more significant than other Section 4(f) properties in the study corridor.