NEW JERSEY TURNPIKE AUTHORITY
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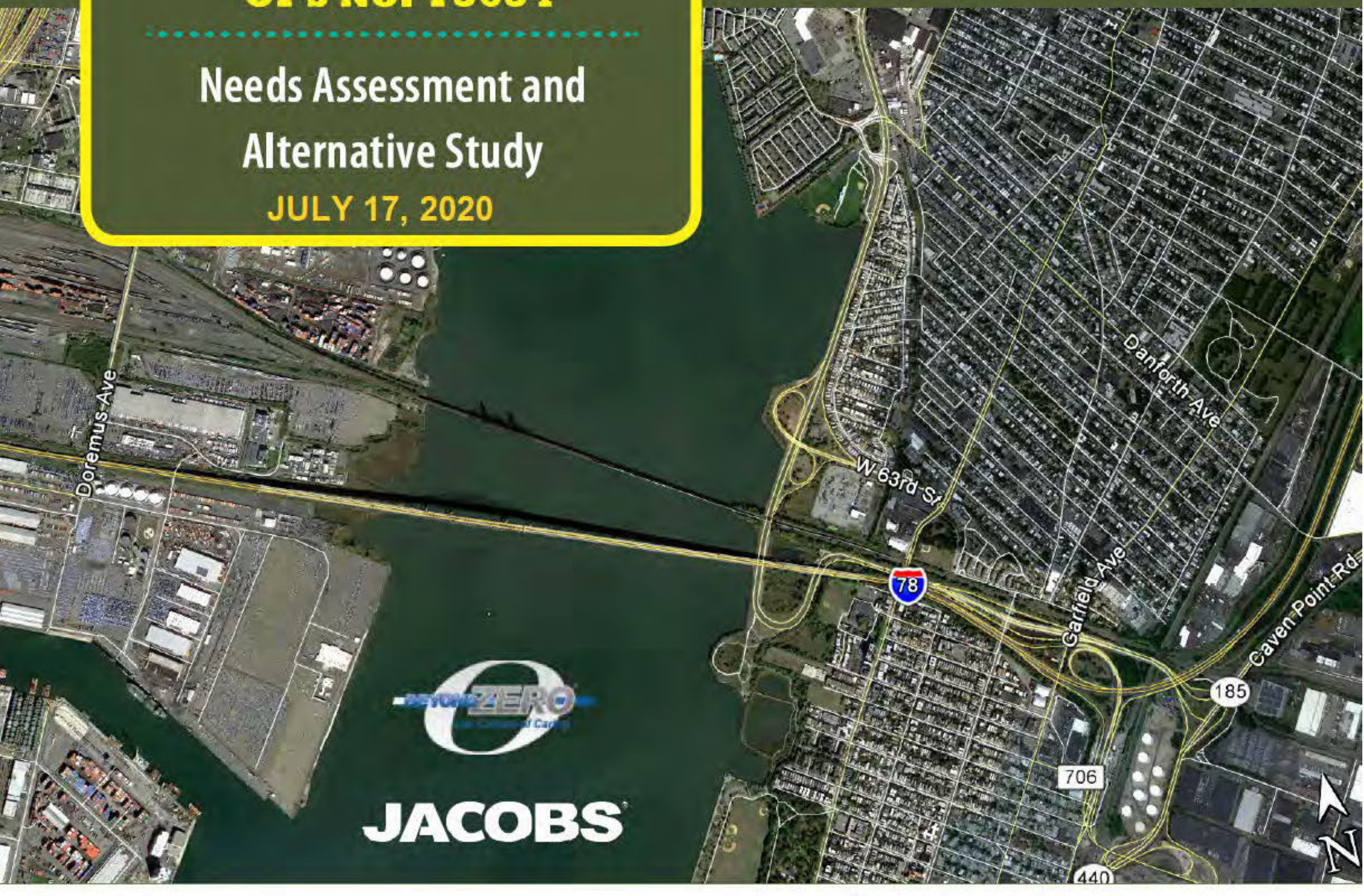
OPS No. T3634

Needs Assessment and Alternative Study

JULY 17, 2020



JACOBS

EXECUTIVE SUMMARY

Purpose and Need

The New Jersey Turnpike Authority (NJTA) has identified that over the next 20 years, anticipated significant increases in commercial vehicular traffic as well as existing and growing passenger vehicle traffic associated with redevelopment in Bayonne and Jersey City will place new travel demands on the entire length of the Newark Bay – Hudson County Extension (NBHCE). The burdens of this additional traffic demand will affect the NBHCE mainline and Interchanges 14A, 14B, 14C, and ties into Jersey City and the Holland Tunnel approaches at the northern terminus.

In addition to the need to accommodate future travel demand, the existing structures, originally constructed circa 1956, are nearing the end of their serviceable life. The increasing volume and weight of trucks traveling on the corridor have resulted in significant wear of the structures requiring investment in repair and rehabilitation.

The Newark Bay Hudson County Extension Study begins the process of identifying and implementing the most efficient improvements necessary to meet future travel demands imposed on the NBHCE as a result of its location in this swiftly redeveloping region of the state.

The Purpose and Need of the Newark Bay-Hudson County Extension Study may therefore be summarized as follows:

Improve the Newark Bay – Hudson County Extension (NBHCE) from Interchange 14 in the City of Newark to its eastern terminus at Jersey Avenue in the City of Jersey City to:

- Provide sufficient travel lanes to reduce congestion and safely and efficiently accommodate existing and future vehicular demand,
- Maintain the integrity of the roadway and major structures for the next 100 years.

Methodology

The NBHCE Study is a concept-level assessment of alternatives developed to meet the study's purpose and need. The engineering and site development analyses conducted included a screening-level examination of project area constraints, including both natural and man-made resources and facilities, structural assessment of the existing NBHCE, consideration of the interaction of the NBHCE and maritime and air traffic, and modeling of existing and projected traffic operations in the project area. Whenever possible, the study used input data developed by the NJTA and its partners through recent and relevant studies in the vicinity of the NBHCE. Although intensive consultation with permitting authorities is typically reserved for preliminary engineering, certain project parameters, such as Federal Aviation Administration (FAA) clearances for Newark Liberty Airport, were necessary during concept development. Where appropriate and critical to the concept development phase, coordination was undertaken to obtain accurate data essential in the development of viable project alternatives. The following sections describe the outcomes of the study in terms of a recommended program of independent projects to advance to preliminary engineering and preparation of environmental documentation

Summary of Study Recommendations

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Table ES-1 – Program Cost Estimate by Project

	PROJECT 1A	PROJECT 1B	PROJECT 2	PROJECT 3	PROJECT 4	TOTAL
Construction (C)	$ 242.10	$ 1,393.30	$ 253.90	$ 163.00	$ 301.50	$ 2,353.70
Demolition (D)	$ 33.20	$ 174.60	$ 50.70	$ 20.90	$ 49.40	$ 328.70
ROW (placeholder)	$ -	$ 35.00	$ 20.00	$ 10.00	$ 20.00	$ 85.00
Env Remediation (placeholder)	$ -	$ 20.00	$ 10.00	$ 5.00	$ 10.00	$ 45.00
MPT (10% of C Costs)	$ 24.20	$ 139.30	$ 25.40	$ 16.30	$ 30.10	$ 235.40
Design & Permitting (10% of C&D Cost)	$ 27.50	$ 156.80	$ 30.50	$ 18.40	$ 35.10	$ 268.20
Construction Services (20% of C&D Cost)	$ 55.10	$ 313.60	$ 60.90	$ 36.80	$ 70.20	$ 536.50
TOTAL	**$ 382.10**	**$ 2,232.50**	**$ 451.30**	**$ 270.30**	**$ 516.20**	**$ 3,852.50**
Escalation to 10yr Program Midpoint (2%/YR)	$ 83.90	$ 488.50	$ 98.70	$ 58.70	$ 112.80	$ 842.60
TOTAL	**$ 466.00**	**$ 2,721.00**	**$ 550.00**	**$ 329.00**	**$ 629.00**	**$ 4,695.10**

The existing bridge currently spans a 550 ft wide navigational channel in Newark Bay. Project 1B costs anticipate the need to construct a long-span bridge to cross the existing navigation channel. This span length precludes to use of a simple span structure and would require construction of an arch, cable stayed or extradosed type structure. The cost estimate for Project 1B in Table ES-1 reflects the cost of a long-span bridge structure.

Supplemental Tasks – Early Action Recommendations

This study presents a recommendation for the replacement of all existing structures, increasing the number of travel lanes to meet future demand and integration of full width inner and outer shoulders to facilitate traffic operations and future maintenance needs. However, there remain a number of questions that require more detailed investigation to allow full definition of the project to be advanced. Some routine project development activities that typically involve longer lead times could be initiated prior to preliminary engineering to minimize delays in the full design process. It is recommended that these Early Action Recommendations be addressed in advance of initiating Preliminary Engineering.

Prepare Navigational Study

Prepare a formal Navigational Study for submission to the USACE and the USCG seeking a narrowing of the existing 550 ft wide navigational channel spanned by the Newark Bay Bridge. Narrowing of the channel to 300 ft would make a number of less costly and more easily maintained simple span bridge type alternatives feasible.

Based upon experience with other bridge design initiatives, the preparation of a full Navigational Study, acceptance by the USCG, and revision of existing legislation defining the channel width would be expected to take up to two years, assuming no significant issues arise with the study requiring multiple iterations and negotiations with the USCG. These activities could be accomplished within the project timeframe since a USCG and USACE permit is required even if replacing in kind.

Develop Planimetric Base Mapping

This study was prepared using aerial photography flown in February 2017. It is recommended that the aerial imagery be developed into 1"=30' topographic mapping and Digital Terrain Mapping ("DTM"). Design level base mapping is necessary to refine the recommended alternative and develop more detailed assessment of critical items such as ROW and property acquisition needs, impacts to cultural and historic resources, contaminated property implications, etc.

Refine Roadway Alignment to Conceptual Design Level Accuracy

Utilizing the design level base mapping, the recommended horizontal alignment can be refined to Conceptual Design Level Accuracy. The refined alignment would allow a fixed determination of the boundary of the project impact area and facilitate a more detailed investigation into issues such as ROW and property acquisition needs, impacts to cultural and historic resources, contaminated property implications, etc.

Refine ROW Acquisition Needs

The concept level assessment of ROW and property acquisition needs identified over 100 potentially affected parcels totaling approximately 55 acres of anticipated property acquisitions. The design level roadway alignment will allow a refinement of this analysis and a more detailed determination of the actual acquisition needs.

Refine Assessment of Affected Contaminated Properties

The effect of construction activities and final infrastructure placement on contaminated properties is a significant concern. Utilizing the planimetric base mapping and the refined roadway alignment, specific properties and the nature and extent of contamination should be evaluated in detail. This assessment will facilitate refinement of the alignment to avoid contaminated properties where possible and advancement of required remediation measures where impacts cannot be easily avoided.

Initiate Coordination with NJ TRANSIT, PANYNJ and Conrail

The recommended alignment would impact rail infrastructure owned and operated by NJ TRANSIT and Conrail. The recommended alignment between Interchange 14C and Grand Avenue requires a realignment of a section of the Hudson Bergen Light Rail and Conrail's National Docks Secondary. The recommended alignment also crosses over the PANYNJ's PATH corridor north of the crossing of Christopher Columbus Drive. Widening of the roadway may require coordination of expanded air rights where the alignment crosses over rail rights of way. Coordination with these owners should be initiated to address areas where existing air rights may require expansion or where the roadway profile could potentially be reduced as it crosses over active rail lines.

Prepare Alternative Project Delivery Benefit/Cost Analysis

Several alternative project delivery and financing strategies have been identified that appear to be viable and potentially beneficial to the NJTA. A detailed economic analysis of these alternatives should be undertaken to quantify the potential savings in both cost and time that could be realized if employed on one or more of the proposed project stages.

1. INTRODUCTION

1.1 Purpose and Need

The NJTA is investing significant resources into the ongoing rehabilitation and maintenance of the Newark Bay – Hudson County Extension (NBHCE). The NBHCE connects Interchange 14 in Newark to Jersey Avenue and the approach to the Holland Tunnel in Jersey City, New Jersey. Spanning about 8 miles, approximately 80% of this corridor is on structure, with the most significant structures consisting of the Newark Bay Bridge and its approach spans, which comprise approximately 9,600 ft (over 22%) of the subject corridor. In addition to the required rehabilitation and maintenance activities, the NJTA recently completed a multi-million dollar major capacity upgrade to Interchange 14A.

These investments are necessary to maintain structures comprising the NBHCE and accommodate recent and future increases in travel demand along the corridor. This increased demand is associated primarily with the new deep water port operations and freight handling facilities along the Bayonne waterfront and redevelopment of major sections of Jersey City and the City of Bayonne. The anticipated increase in commercial vehicular traffic, as well as existing and growing passenger vehicle traffic, will place new travel demands on the entire length of the NBHCE mainline and Interchanges 14A, 14B, and 14C that are critical to accessing Hudson County and New York City.

Traffic conditions and recurring congestion on the NBHCE have been a source of driver frustration for years. Currently, the closure of the eastbound Pulaski Skyway and the resulting use of the NBHCE as an alternate route for access to Jersey City is adding additional strain. Area development, particularly the growth in heavy trucks serving the ports in the region, is expected to continue, further taxing the ability of the existing infrastructure to accommodate demand. Due to the size and complexity of the infrastructure, solutions that will serve the NJTA and its customers well into the future are likely to be quite costly, requiring careful consideration and identification of the optimal solution.

The Project Purpose and Need therefore is summarized by the following:

Improve the Newark Bay – Hudson County Extension (NBHCE) from Interchange 14 in the City of Newark to its eastern terminus at Jersey Avenue in the City of Jersey City to:

- Provide sufficient travel lanes to reduce congestion and safely and efficiently accommodate existing and future vehicular demand; and,
- Maintain the integrity of the roadway and major structures for the next 100 years.

1.2 Study Approach and Objectives

The Newark Bay – Hudson County Extension Study is the initial step in the process of determining roadway and lane requirements and identifying infrastructure needs to accommodate future traffic demand. This concept development process will identify a range of options for providing the needed improvements, constraints to the implementation of each option, and the associated order of magnitude costs associated with those options so that a fully informed, well considered decision on a plan of action for the future can be made.

Key components of this study include:

- Existing Infrastructure Condition - assessment identifying existing roadway design deficiencies and structural conditions (estimate of serviceable life remaining);
- Traffic Operations Analysis - quantifying existing and projected future traffic operations and future lane requirements;
- Constraints Assessment - identifying key constraints to future infrastructure replacement including right of way needs, major utility systems, environmental, and cultural resource constraints that present a challenge to the implementation of a solution;
- Conceptual Alternative Improvements - identification of a range of potential improvements that would meet the anticipated future demand to be placed on the system;
- Screening of Alternatives - evaluation of the impacts and costs associated with the advancement of the considered alternatives;
- Identification of an Initially Preferred Alternative (IPA) – a plan of improvements that meets the overall purpose and need with a minimum of impact and cost.

Examination of existing conditions and screening of alternatives rested heavily on operational analysis and structural considerations. Operational analysis was addressed through simulation modelling of future traffic operations on the NBHCE and surrounding transportation infrastructure. The simulation included both existing conditions and improvements planned by other agencies and entities[1], and developed and evaluated all pertinent aspects of the capacity upgrades needed to meet the projected travel demand to the NBHCE over its entire length. Part of this consideration includes potential future use[2] of the NBHCE as an alternate route during the closure of other roadways in the project area, similar to what is occurring today with the Pulaski Skyway improvements.

The structural considerations focused on the identification of a cost-effective IPA for rehabilitation and/or replacement of the existing Newark Bay Bridge and its approach spans, along with 26 other structures. The structural component of the study sought alternatives to:

- Efficiently accommodate the future vehicular travel demand;
- Minimize environmental impacts;

[1] Data reflecting port expansion traffic came from Global Terminals, a tenant of the Port Authority of NY & NJ (PANYNJ). This data does not include diversions that PANYNJ applies to the data in order for the model for this study to reflect a worst-case scenario for traffic demand.

[2] The study did not investigate the service life remaining on existing highways and infrastructure elements in the project area. The study team instead assessed the existing lane configurations, shoulders, capacity, and operational status of the NBHCE under the Pulaski Improvement conditions and determined that as the worst-case scenario. An IPA that improves overall functionality of the NBHCE and provides standard lane widths and shoulders would be considered sufficient to serve as an alternate route in the future.

- Provide a minimum of 75 years of life expectancy in the maintainable structural elements, and 100 years for major structures;
- Minimize life-cycle maintenance needs and costs;
- Provide flexibility in phased construction; and,
- Accommodate maintenance of a minimum of two travel lanes in each direction during construction throughout the corridor.

Recommendations, including early action items and critical path considerations, are found in Chapter 8 of this report.

2. EXISTING CONDITIONS

2.1. Roadway Geometry and Design Speed

The NJTA Design Manual does not specifically indicate a design speed for the NBHCE. The manual does state that the design speed shall be 60-mph for mainline roadways north of Milepost 97.0. Since the NBHCE is north of Milepost 97.0 and can be considered a mainline roadway, the following evaluation of the existing horizontal and vertical geometry, based upon available as-built information, was performed for a 60-mph design speed. The limits of this evaluation extend from just east of Interchange 14, across the Newark Bay Bridge, to the easterly terminus of the project at the Turnpike's approaches to and from the Holland Tunnel. The following discussion identifies the elements that do not meet the 60-mph design criteria for a mainline, as outlined in the NJTA Design Manual, Section 1A New Jersey Turnpike Geometric Design. It also includes potential remediation measures to increase the design speed and bring select portions of the NBHCE up to a 60-mph design speed. In this Chapter, these measures only address geometric design elements. The potential replacement or rehabilitation of existing structures and the resulting design speed are addressed in Chapter 6 of this report.

2.1.1. Horizontal Geometry

The following narrative describes the horizontal geometry along the NBHCE alignment and geometric characteristics of the road at specific locations:

Newark Viaduct - Structure No. N0.75
East of Interchange 14, the Newark Viaduct (Str. No. N0.75) consists of a reverse curve with radii of 5,000 ft separated by a tangent of 525 ft. The lengths of each curve, respectively, are 741 ft and 735 ft. While these curve lengths do not meet the minimum design value of 1,000 ft for 60-mph, they exceed the absolute minimum curve length of 600 ft. The existing superelevation for both curves is 1.2%, which is less than the NJTA 1.5% cross slope for a normal tangential section. The design superelevation rate for 60-mph is 3.0%. According to NJTA criteria, the minimum tangent distance between reverse curves shall be 1,000 ft or sufficient in length to accommodate the superelevation transition between curves. The 525 ft tangent can accommodate both the existing and desirable design superelevation transitions. For this segment the existing horizontal geometrics meet the criteria for a 50-mph design speed. A design speed of 60-mph can be achieved by upgrading the superelevation.

Newark Bay Bridge - Structure No. N2.01
Continuing eastward after the tangent across the Newark Bay Bridge (Str. No. N2.01), the next segment of the NBHCE evaluated is located between the Newark Bay Bridge and the Southeast Viaduct (Str. No. 3.73). This segment includes three bridges: the NBHCE over Kennedy Boulevard (Str. No. N3.00); the NBHCE over Avenue C (Str. No. N3.24); and, the NBHCE over Broadway (Str. No. N3.39). This segment includes a horizontal curve to the right (looking east) over Kennedy Boulevard (Str. No. N3.00) with a radius of 2,700 ft and a length of 995 ft. The radius of this curve does not meet the minimum design criteria of 3,000 ft for 60-mph design. The length of curve almost meets the minimum design length of 1,000 ft for 60-mph; however, it does exceed the absolute minimum curve length of 600 ft. The existing superelevation for this curve is 2.1%. The design superelevation rate for 60-mph should be 4.4%. The next horizontal curve within this section is to the left (looking east) with a radius of 1,400 ft and a length

of 440 ft. These are substandard geometric elements for a Turnpike mainline. The radius and length of curve do not meet the minimum design radius of 3,000 ft or the absolute minimum curve length of 600 ft. The existing superelevation for this curve is 4.0%. Given the radius of the curve, design speed of 60-mph would require superelevation of 6%, which exceeds NJTA's maximum allowable superelevation of 5% for a mainline segment. The existing geometry allows for a 40-mph design speed. A design speed of 60-mph cannot be realized for the second curve in this section as it would violate current NJTA design criteria. A Design Element Modification would be needed for this curve. A design speed of 50-mph can be achieved by upgrading the superelevation.

Southeast Viaduct – Structure No. N3.73

The Southeast Viaduct (Str. No. N3.73), in the vicinity of Interchange 14A, carries the NBHCE over the interchange ramps, the Hudson-Bergen Light Rail, Route 440 and Conrail. This structure is comprised of a compound horizontal curve to the left (looking east) with radii of 1,700 ft, 2,700 ft, and 4,000 ft. The 1,700 ft curve transitioning into the 2,700-ft curve exceeds NJTA design criteria whereby the ratio of the flatter curve to the sharper curve shall not exceed 1.5 : 1. This substandard compound curve inherently brings a deficient horizontal alignment to bear.

Looking at each curve separately across the Viaduct also reveals substandard elements. Initially, the 1,700 ft radius curve does not meet the minimum design radius of 3,000 ft for 60-mph; however, the length of curve, 980 ft, almost meets the minimum design length of 1,000 ft and does exceed the absolute minimum curve length of 600 ft. The existing superelevation for this curve is in transition across the structure from 4.0% to 2.1%. A design superelevation rate of 4.8% is needed to accommodate a 60-mph design. The 2,700 ft radius curve, with a length of 564 ft, does not meet the minimum design radius of 3,000 ft or the absolute minimum curve length of 600 ft. The existing superelevation for this curve is 2.1%. A design superelevation rate of 5.8% would accommodate a 60-mph design; however, as described previously, this exceeds the NJTA maximum allowable mainline superelevation of 5%. The last curve of the segment, with a radius of 4,000 ft and a length of 2,056 ft, has an existing superelevation of 1.4%. The radius and curve length meet the NJTA criteria; however, the existing cross slope does not meet the minimum cross slope of 1.5% for a tangent alignment. To be adequate for 60-mph, the required superelevation should be 3.6%.

Overall, the existing geometry through this segment meets the criteria for a 30-mph design speed. For this section, a design speed of 60-mph cannot be realistically obtained as it violates current NJTA design criteria. Maintaining the existing geometry and treating each curve individually along with increasing the superelevation, while not standard or recommended practice, can achieve a design speed of 50-mph.

Interchange 14C Toll Plaza

The next portion of the NBHCE evaluated is located east of the Southeast Viaduct through the Interchange 14C Toll Plaza, which includes five bridges: the NBHCE over Linden Avenue (Str. No. N4.12); the NBHCE over Chapel Avenue (Str. No. N4.52); the NBHCE over Bayview Avenue (Str. No. N5.34); the NBHCE over Interchange 14B Ramps LTE; and, the NBHCE over the Central Railroad of New Jersey tracks (Str. No. 5.66). This portion of the NBHCE includes a horizontal curve to the left (looking east) with a radius of 2,700 ft and a length of 995 ft. This is the continuation of the last curve for the above described compound curve across the Southeast Viaduct. This curve and its superelevation transition are carried across the bridge carrying the NBHCE over Linden Avenue (Str. No. N4.12).

Reverse Curve Section East of Chapel Avenue

East of the Chapel Avenue bridge is the first curve in a series of a reverse curves through this segment. The first curve is a curve to the right (looking east) with a radius of 4,000 ft and a length of 2,188 ft. The existing superelevation rate for this curve is 1.4%. While the radius and length meet NJTA design criteria, the radius and length of the curve would require a superelevation rate of 3.6% for 60-mph design speed.

The tangent between this curve and the next is 587 ft, which is adequate to handle both the existing and the required design superelevation transition between the curves. The second horizontal curve in this section is a reverse curve to the left (looking east) with a radius of 3,500 ft and a length of 1,969 ft, which is carried across Bayview Avenue (Str. No. N5.34). These elements exceed the design criteria for 60-mph; however, the superelevation rate for this curve is 1.6%. The design superelevation rate for 60-mph is 3.9%. The tangent between this curve and the next is 732 ft, which is adequate to handle both the existing and required design superelevation transition between the second and third curves. The third and final reverse horizontal curve within this section is a curve to the right (looking east) with a radius of 3,500 ft and a length of 1,215 ft, which is carried across the Central Railroad of New Jersey tracks (Str. No. 5.66). These elements exceed the design criteria for 60-mph, but similar to the other curves, the superelevation is insufficient for 60mph: it is 1.6% and should be 3.9%. The existing geometrics meet the criteria for a 45-mph design speed. A design speed of 60-mph can be achieved for this segment by upgrading the superelevation.

East Viaduct

East of Interchange 14C, the horizontal alignment is tangent approaching the East Viaduct (Str. No. N6.49), which carries the NBHCE over Jersey City local streets and the Hudson Bergen Light Rail. It also includes the eastbound exit Ramp HLE structure to Columbus Drive (Str. No. 6.80E) and the westbound entrance Ramp structure from Merseles Street (Str. No. 6.80W). The East Viaduct is comprised of a series of consecutive horizontal curves to the left (looking east) followed by a tangent of 390 ft from which another series of horizontal curves to the right (looking east) is introduced.

The first horizontal compound curve is comprised of ten broken back curves with various radii that violate the minimum allowable curve radius of 3,000 ft for a mainline. The minimum radius through this series of curves is 1,200 ft with a 3.5% superelevation and a curve length of 352 ft. After the 390 ft tangent, the second horizontal compound curve is comprised of six broken back curves, again with various radii that violate the minimum allowable curve radius of 3,000 ft for a mainline. The minimum radius through this series of curves is 1,600 ft. The existing geometry across this structure is consistent with a design speed of 35-mph. For this section, a design speed of 60-mph cannot be realistically obtained as the existing geometry violates current NJTA design criteria both for minimum radii and broken back curves. The evaluation of substandard broken back geometry by assessing each very short curve individually will not provide a true determination of a design speed; however, increasing the superelevation of the curves to the 5% maximum could increase the design speed to 45-mph for this segment.

West Viaduct

The horizontal alignment of the West Viaduct (Str. No. N7.12) includes the trailing end of the compound curve to the right across the east end of the East Viaduct. The West Viaduct carries the NBHCE over Jersey City local streets as well as a railroad embankment and yard. Primarily on a tangent, the western segment of this structure has a superelevation rate that is in transition as it approaches the tangent section. The existing geometry meets the design criteria for a 50-mph design speed. For this segment a design speed of 60-mph can be realized by upgrading the superelevation transition.

North Terminal Ramps

The North Terminal Ramps are essentially the end of the NBHCE. These ramps are on a tangent horizontal alignment until the exit/entrance ramps for the Holland Tunnel. The "mainline" bridge (Str. No. N7.53) diverges both horizontally and vertically to form the 12th Street Viaduct to the Holland Tunnel (Str. N7.90E/the "Northbound Ramp") and the 14th Street Viaduct from the Holland Tunnel (Str. N7.93W/the "Southbound Ramp"). These structures bring the NBHCE over various Jersey City local streets and rail yards and are in very close proximity to local businesses and schools. The 12th Street Viaduct to the Holland Tunnel (Str. N7.90E/the "Northbound Ramp") is comprised of broken back curves with various radii. While the transitions are standard in terms of approaching radii, the central radius of this compound curve is 500 ft. Considering this section is approaching the terminus of the roadway, it would be appropriate to evaluate this section as a ramp, not a portion of a mainline. Similarly, the 14th Street Viaduct from the Holland Tunnel, (Str. N7.93W/the "Southbound Ramp") is comprised of broken back curves with various radii at the entrance to the NBHCE. While the transitions into and out of this compound curve are standard, the central radius for this compound curve is 550 ft. This segment should also be evaluated as a ramp. The existing geometry of the ramps across these structures allows for a design speed of 35-mph. For this section, a design speed of 60-mph cannot be realistically achieved.

2.1.2. Vertical Geometry

Vertically, the NBHCE is adequate for a 60-mph design speed except for the Newark Bay Bridge (Str. No. N2.01). The existing bridge has a 1,200 ft crest vertical curve connecting tangent grades of +3.00% and -3.00% west to east. This vertical curve provides a K value of 200. A mainline, with a 60-mph design speed, requires a minimum K value of 245 per the design criteria outlined in the NJTA Design Manual. However, the existing stopping sight distance of 656 ft on this particular vertical curve exceeds the minimum value of 570 ft noted in the Design Manual. All other vertical curves along the NBHCE are adequate for a 60-mph design speed.

2.1.3. Summary

The evaluation of the existing horizontal and vertical geometry along the NBHCE indicates that achieving a 60-mph design speed along the entire existing facility in total conformance with NJTA Design criteria is not feasible without significant realignment and structural reconfiguration. The 60-mph design speed can be realized vertically but achieving a 60-mph design speed for the entire NBHCE from Interchange 14 to the 11th Street area would require significant modifications to the current horizontal alignment per NJTA Design criteria. It is anticipated that even if all of the existing structures are replaced there may be some locations where land uses below and adjacent to the NBHCE will constrain right-of-way acquisition and construction staging that will limit significant changes to the alignment. In those locations the choice between extensive realignment and property acquisition to achieve a 60-mph design speed versus designing to a lower design speed is a policy decision to be considered by the NJTA. A Design Speed Analysis of the IPA for the entire length of the NBHCE is presented in Chapter 6 of this report further defining these design options. A comprehensive, supplementary advisory sign program is suggested for the NBHCE to alert motorists to the posted speed limit along this roadway.

2.2. Structures

2.2.1. Objective

The objective of this part of the study was to identify the bridges located along the NBHCE Corridor, review available data regarding each bridge to characterize the current state of physical conditions and live load capacities, and to document the repair history of the bridges. Based on a thorough review of this information, Jacobs offers a recommendation as to the suitability of each bridge for reuse in the future widening program to attain the desired traffic capacities and operational efficiencies.

2.2.2. Summary of Bridge Structures along the NBHCE

As summarized in Table 2.2.1 and illustrated by Figure 2.2.1 and Figure 2.2.2, there are 17 mainline bridges, 10 entrance/exit ramp bridges, and 2 offline bridges (for a total of 29 bridges) on the NBHCE Corridor. The bridges were designed and constructed in 35 separate contract packages as identified in Section 2.2.3 below. Most of the bridges were constructed circa 1955 putting the average age of the bridges at 62 years. The bridges were designed to the 1949 AASHO Standard Specifications for Highway Bridges, predominantly using riveted steel girder superstructures and cast-in-place concrete substructures supported on timber piles. The original design live load for the bridges was H-20-S16-44 (HS 20).

Table 2.2.1: Existing Structures

#	MP	LOCAL NAME	TYPE
1	N 0.16A	Ramp NOH (E) over Turnpike mainline	Ramp
2	N 0.28A	Ramps HXT, HS & TH over Turnpike mainline	Mainline
3	N 0.28C	Ramps HLT & HNO (F&H) over Conrail and Ramps SOT & SIT	Ramp
4	N 0.28D	Ramp SH (G) over Conrail and Ramp SOT	Ramp
5	N 0.75	Newark Viaduct (Pier W93-W45)	Mainline
6	N 2.01W	West Approach to Newark Bay Bridge over Local Roads and Wetlands	Mainline
7	N 2.01	Newark Bay Bridge (Pier W15-E19, Bay Span)	Mainline
8	N 2.01E	East Approach to Newark Bay Bridge over Route 440 and Wetlands	Mainline
9	N 3.00	Ramp TW over Kennedy Boulevard	Mainline
10	N 3.24	Avenue C	Mainline
11	N 3.39	Garfield Avenue	Mainline
12	N 3.53B	Int 14A Ramp WT over Garfield Avenue	Ramp
13	N 3.53C	Int 14A Ramp TW over Garfield Avenue	Ramp
14	N 3.53D	Int 14A Ramp TE over Conrail/Route 440	Ramp
15	N 3.53E *		Offline
16	N 3.53F *	Int 14A Ramps ET & TE over East 52nd Street and Avenue E	Offline
17	N 3.53I *		Offline
18	N 3.73	Int 14A Ramps, Route 440 and Railroad Yards (Southeast Viaduct)	Mainline
19	N 4.12	Linden Avenue	Mainline
20	N 4.52	Chapel Avenue and LVRR	Mainline
21	N 5.34	LVRR, Bayview Avenue & Plant Roads	Mainline
22	N 5.56A	Int 14B Ramp WT & TE	Mainline
23	N 5.56B	Bayview Viaduct	Offline
24	N 5.66	Central Railroad of NJ	Mainline
25	N 6.49	East Viaduct (W Abut - W Viaduct Pier 1)	Mainline
26	N 6.80E	Grand Street Off-Ramp B over Grand Street and Colden Street	Ramp
27	N 6.80W	Grand Street On-Ramp A over Grand Street and Colden Street	Ramp
28	N 7.13	HWE & HEW Roadways over West Viaduct	Mainline
29	N7.52	EB & WB roadways over Jersey City Streets, Conrail and Railroad Yards	Mainline
30	N 7.90E	North Terminal Ramp Section B (EB) over Jersey City Streets, Conrail and RR Yards	Ramp
31	N7.93W	North Terminal Ramp Section B (WB) over Coles Street, Conrail and RR Yards	Ramp

* The Interchange 14A Improvement Project replaced Structure N3.53F and added 2 new structures – N3.53E and N3.53I. These 3 structures are not modified by the recommended alignment.

Figure 2.2.1: Existing Structures

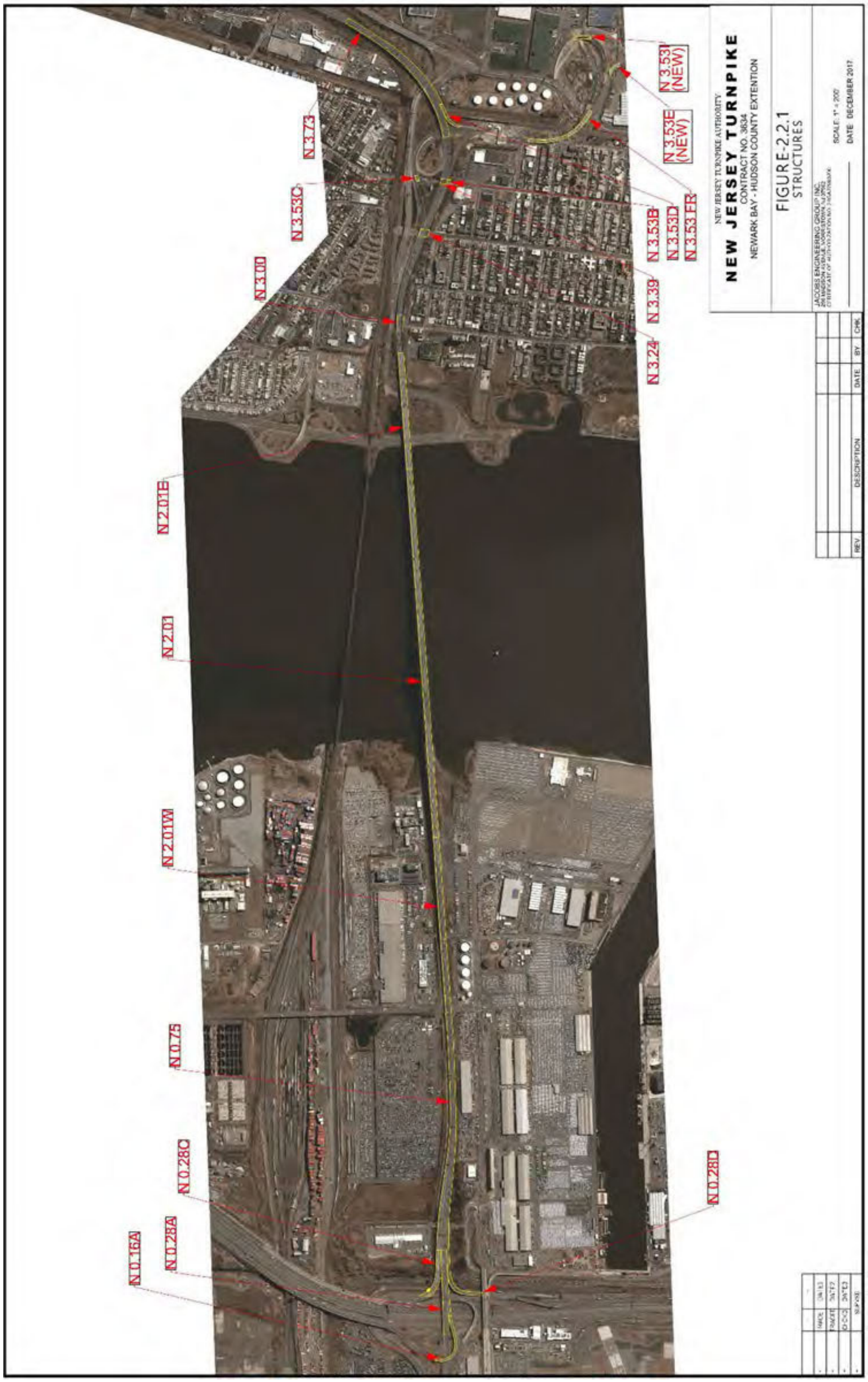
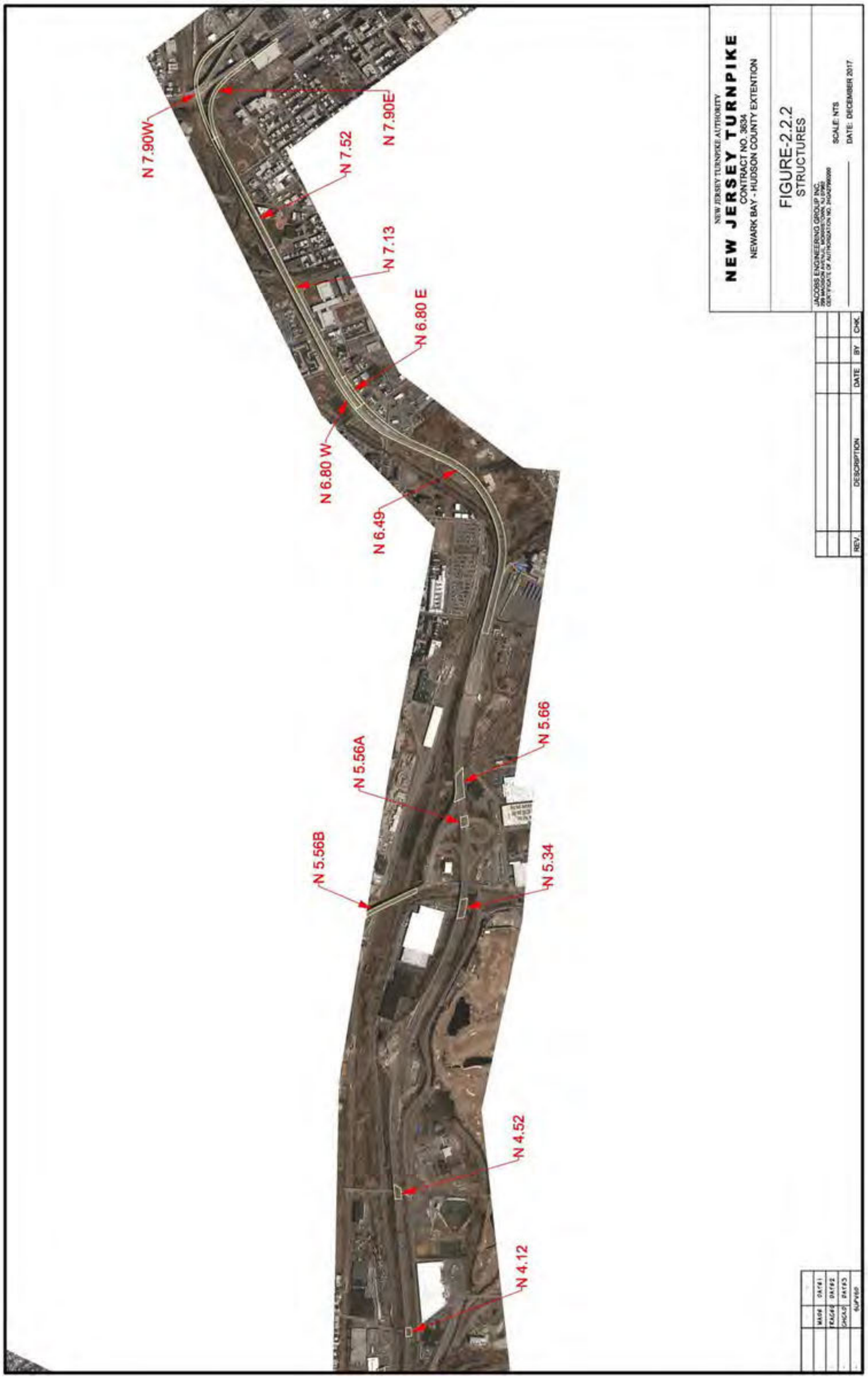


Figure 2.2.2: Existing Structures



2.2.3. Document Collection/Review

A variety of documents obtained from the Authority were reviewed for use in the evaluation of the condition of the existing infrastructure along the NBHCE.

The following is a list of documents/plans/reports shared with Jacobs for use on the project:

- Original bridge plans from Design Contracts N-1, N-2, N-3, N-4, N-5, N-6, N-7, N-8, N-9, N-10A, N-11, N-12, N-13, N-14, N-15, N-16, N-17, N-18A, N-18B, N-18C, N-19, N-20, N-21, N-22, N-23, N-24, N-25, N-25D, N-26A, N-26B, N-26C, N-27A, N-27B, N-30B, and N-34.
- A list of ongoing projects along the NBHCE.
- A copy of the NBHCE Historical Card File.
- A list of Sign Structure Information along the entire NJ Turnpike.
- An Engineering Structure List of all structures along the NJ Turnpike.
- Newark Bay - Hudson County Extension – Master Plan, Version 3.1, 05/10/16.

In addition, the most recent Biennial Bridge Inspection Reports and Bridge Rating Reports for all of the bridges along the NBHCE were obtained and reviewed. A previously-prepared Seismic Vulnerability Study performed by Jacobs for the Authority under OPS A3356 was also reviewed. The NBHCE bridges included in the Seismic Vulnerability Study were N6.49, N6.80E, N6.80W, N7.13, N7.52, N7.90E and N7.93W.

2.2.4. Summary of Existing Conditions

Based on a thorough review of the documents listed above, Jacobs created a Summary of Existing Structural Conditions Matrix containing various pieces of information related to the physical condition of the bridges along the NBHCE (see Table 2.2.2).

Two items of particular note with respect to gauging the overall physical condition of the bridges are the Structural Evaluation Rating and the Sufficiency Rating, as presented in Table 2.2.2. The Structural Evaluation Rating for a given bridge is a National Bridge Inventory (NBI) Appraisal Rating that describes the overall condition of a bridge based on the separately rated conditions of the Superstructure (Item 59), the Substructure (Item 60) and the Inventory Rating (Item 66). As per the NBI Recording and Coding Guide[1] for the Structure Inventory and Appraisal of the Nation's Bridges, Structural Evaluation Ratings can range from 0 (defined as "bridge closed") to 9 (defined as "superior to present desirable criteria"). A Structural Evaluation Rating of 4 "meets minimum tolerable limits to be left in place as is." As shown in Table 2.2.2, seventeen of the bridges (59%) on the NBHCE Corridor have a Structural Evaluation Rating of 4 or less.

The Sufficiency Rating for a given bridge is essentially computed via a formula that evaluates bridge data by calculating four separate factors to obtain a numeric value which is indicative of a bridge's ability to remain in service. The rating is presented as a percentage in which 100% would represent an entirely sufficient bridge and 0% would represent an entirely deficient bridge (see Table 2.2.2).

[1] NBI Coding Guide publication date is 1995, which is the most recent edition. Portions of the coding guide are included in Appendix A of this report.

Table 2.2.2: Existing Structural Condition Ratings

	FROM INSPECTION REPORTS AND SI&A SHEETS																	
BRIDGE NO.	STRUCTURE TYPE	YEAR BUILT	YEAR RECON	NO. OF SPANS	LENGTH	WIDTH	DATE OF INSPECTION	INSPECTION CYCLE NUMBER	OVERALL CONDITION	DECK	SUPER	SUB	STRUCTURAL EVALUATION	DECK GEOMETRY	UNDER CLEARANCE	APPROACH RDWY ALIGN	SUFFICIENCY RATING
N 0.16A	Steel Stringer	1955	---	16	1,018	36	06/17/16	18	Satisfactory	6	6	6	4	9	3	6	66.9
N 0.28A	Steel Stringer	1955	---	12	1,008	80	04/19/16	18	Satisfactory	6	6	6	4	4	4	7	64.2
N 0.28C	Steel Stringer	1955	---	7	519	65.3	06/20/16	16	Fair	5	5	5	5	9	4	8	77.7
N 0.28D	Steel Stringer	1955	---	13	873	42.2	04/07/16	18	Fair	5	5	5	3	7	4	7	53.6
N 0.75	Steel Stringer	1955	---	48	3,563	82	06/03/16	17	Fair	5	6	5	3	9	5	8	43.2
N 2.01	Continuous Cantilever Thru Truss	1955	2013	33	6,170	84.7	06/19/15	16	Fair	7	5	6	3	9	6	8	25.0
N 2.01E	Steel Stringer Continuous	1955	2013	15	1,182	81	06/24/16	18	Satisfactory	7	6	6	6	9	3	8	76.0
N 2.01W	Steel Stringer Continuous	1955	---	30	2,209	82	06/15/16	18	Fair	6	6	5	4	9	6	8	51.8
N 3.00	Steel Stringer Continuous	1955	2015	3	220	88.2	06/10/16	18	Fair	6	6	5	5	9	4	7	67.4
N 3.24	Steel Stringer	1954	2016	1	111	127.2	06/17/16	18	Fair	5	5	6	5	9	4	7	67.5
N 3.39	Steel Stringer	1955	---	1	78	87.7	06/06/16	18	Fair	6	6	5	5	9	6	7	74.7
N 3.53B	Steel Stringer	1955	---	1	78	34	06/07/16	18	Satisfactory	6	6	6	6	3	6	6	74.8
N 3.53C	Steel Stringer	1954	2016	1	79	47	06/07/16	18	Satisfactory	8	6	7	6	9	6	8	96.3
N 3.53D	Steel Stringer	1955	---	12	982	34	06/08/16	18	Fair	5	5	6	4	9	4	7	54.1
N 3.53F	Steel Stringer	1971	---	22	1,484	37.8	06/08/16	18	Fair	6	5	5	5	5	3	7	74.4
N 3.73	Steel Stringer	1955	---	28	2,279	84	06/22/16	17	Fair	5	5	5	3	9	3	7	34.6
N 4.12	Steel Stringer Continuous	1955	---	3	126	84	06/08/16	18	Satisfactory	6	6	6	5	7	4	7	71.6
N 4.52	Steel Stringer Continuous	1955	---	5	378	96	06/09/16	18	Fair	6	5	6	5	9	9	7	61.2
N 5.34	Steel Stringer Continuous	1955	---	6	529	99	06/09/16	18	Fair	6	5	5	2	9	4	6	32.3
N 5.56A	Steel Stringer	1955	---	3	148	112.5	06/09/16	18	Fair	6	5	6	5	9	3	6	58.2
N 5.56B	Steel Stringer Continuous	1955	---	20	1,509	56	03/25/16	18	Fair	6	5	5	3	2	8	7	30.1
N 5.66	Steel Stringer	1955	---	3	434	115.4	06/10/16	17	Fair	6	5	5	5	9	7	6	67.2
N 6.49	Steel Stringer Continuous	1955	2014	44	4,269	110	06/22/16	18	Fair	5	5	5	3	9	4	6	27.5
N 6.80E	Steel Stringer Continuous	1955	2005	8	598	43	06/20/16	18	Satisfactory	6	6	6	3	9	4	8	57.0
N 6.80W	Steel Stringer Continuous	1955	2014	8	739	34	06/21/16	18	Satisfactory	8	6	7	3	9	5	8	51.5
N 7.13	Steel Stringer	1955	2014	26	2,355	84	06/22/16	18	Fair	6	5	6	3	9	3	8	33.4
N 7.52	Steel Stringer Continuous	1955	2012	25	2,042	84	06/03/16	18	Fair	6	5	5	3	9	4	8	39.0
N 7.90E	Steel Stringer Continuous	1955	---	25	2,003	42	05/20/16	18	Fair	5	5	5	4	5	3	7	50.8
N7.93W	Steel Stringer Continuous	1955	2014	27	2,387	42.4	07/06/16	18	Fair	8	5	6	4	2	2	6	52.4

Using the above-mentioned Structural Evaluation Rating and Sufficiency Rating values, Jacobs developed a metric which converted the information into a usable Estimate of Remaining Life value for each bridge. The metric for the Estimate of Remaining Life was submitted to the Authority in May, 2017 and is included as Appendix A to this report. However, the metric developed did not fully address the needs of this project, and after further discussions with the Authority, it was decided that a more effective approach would be to conduct a Structures Workshop with NJTA Structures personnel and the Consultants familiar with the on-going inspection and repair programs taking place along the NBHCE corridor. The overarching purpose of the workshop was to discuss and coalesce as much available information and history about each bridge to help determine the suitability of each bridge for future rehabilitation/widening or complete replacement to accommodate the future widening program. A summary of the discussions and findings of the Structures Workshop is included as Appendix B of this Report.

2.2.5. Summary of Bridge Ratings

Table 2.2.3 summarizes the Load Rating Factors identified in the latest Bridge Rating Reports provided to Jacobs. A Load Rating Factor of 1.00 or above indicates that the structural capacity of the bridge is sufficient to carry the AASHTO truck loading for which it was designed.

The original bridge plans indicate that the design live load used for the bridges was H-20-S16-44 (HS-20). Twelve of the bridges on the NBHCE have a load rating factor that meets or exceeds 1.00 at the inventory level, eight of the bridges do not, and load rating factors for HS-20 were not computed for nine bridges. The significance of this observation is that many of the bridges on the NBHCE have deteriorated to a point at which they no longer have the structural capacity to carry the design loading for which they were originally designed.

The current AASHTO LRFD design live loading is HL-93. Only five of the bridges assessed have a load rating factor that meets or exceeds 1.00 at the inventory level, while twenty-four of the bridges do not. The significance of this observation is that the majority of the bridges on the NBHCE do not have the structural capacity to carry the current AASHTO LRFD design truck loading. Although the load ratings computed in the Bridge Rating Reports were for superstructure elements only (girders, stringers, floor beams, etc.), it is assumed that a structural analysis of the HL-93 live load applied to substructure elements (such as pier caps, abutment walls and footings) would reveal that some of those elements will not meet the minimum 1.00 load rating factor at the inventory level.

Jacobs was provided with an advanced copy of the anticipated NJTA Structures Section of the Design Manual. Due to Weigh-In-Motion (WIM) data collected by NJTA along the NBHCE in Zone 1, coupled with the anticipation of heavier trucks traveling to and from the Global Marine Terminal located off of Interchange 14A, the Structures Manual stipulates that all new bridge construction along the NBHCE shall be designed to accommodate a TP-16 live loading. As described in the manual, the TP-16 loading is 30%-80% heavier than the HL-93 truck loading, depending on span length. With this heavier loading, it is anticipated that the majority of the NBHCE bridges would not meet the minimum 1.00 load rating factor for this new design loading.

Table 2.2.3: Existing Structure Load Rating Factors

			CONTROLLING HL-93 NVENTORY RATING FACTORS		CONTROLLING HL-93 OPERATING RATING FACTORS		CONTROLLING HS-20 INVENTORY RATING FACTORS	CONTROLLING HS-20 OPERATING RATING FACTORS	CONTROLLING TYPE 3 INVENTORY RATING FACTORS		CONTROLLING TYPE 3S2 INVENTORY RATING FACTORS		CONTROLLING TYPE 3-3 INVENTORY RATING FACTORS	
BRIDGE NO.	CONTROLLING ELEMENT	DATE OF RATING REPORT	FLEXURAL (INTERIOR)	FLEXURAL (EXTERIOR)	FLEXURAL (INTERIOR)	FLEXURAL (EXTERIOR)	FLEXURAL (INTERIOR)	FLEXURAL (EXTERIOR)	FLEXURAL (INTERIOR)	FLEXURAL (EXTERIOR)	FLEXURAL (INTERIOR)	FLEXURAL (EXTERIOR)	FLEXURAL (INTERIOR)	FLEXURAL (EXTERIOR)
N0.16A	Stingers/Girders	03/28/13	0.50	0.66	0.65	0.86	1.03	1.72	1.66	2.76	1.12	2.08	1.18	2.34
N0.28A	Stingers/Girders	09/30/14	0.59	0.51	0.76	0.66	---	---	2.21	1.59	1.56	1.12	1.69	1.22
N0.28C	Stingers/Girders	04/02/13	0.88	0.85	1.13	1.10	0.72	1.22	2.54	1.66	1.89	1.40	2.05	1.53
N0.28D	Stingers/Girders	09/19/16	0.54	0.45	0.70	0.59	---	---	1.60	2.13	1.17	1.63	1.28	1.75
N0.75	Stingers/Girders	08/07/13	0.43	0.46	0.56	0.60	1.19	2.00	1.92	1.48	1.41	1.22	1.59	1.64
N2.01	Stingers/Girders	12/24/15	0.20	---	0.26	---	---	---						
N2.01E	Stingers/Girders	02/21/13	0.81	1.21	1.05	1.56	1.00	1.36	3.03	3.30	2.21	2.67	2.47	3.17
N2.01W	Stingers/Girders	03/25/13	0.50	0.77	0.65	1.00	1.00	1.36	2.21	2.13	1.53	1.70	1.65	1.95
N3.00	Stingers/Girders	08/04/14	0.85	1.03	1.10	1.33	---	---	2.93	2.63	2.01	2.08	2.13	2.22
N3.24	Stingers/Girders	08/04/14	0.85	0.87	1.10	1.13	---	---	2.40	2.47	1.77	1.82	1.93	1.98
N3.39	Stingers/Girders	02/13/13	1.36	1.17	1.76	1.52	1.19	2.03	2.77	2.40	2.26	1.96	2.63	2.27
N3.53B	Stingers/Girders	03/27/13	1.30	1.27	1.93	1.45	1.31	2.17	2.64	2.59	2.21	2.17	2.51	2.46
N3.53C	Stingers/Girders	08/04/14	1.28	1.26	1.65	1.64	1.39	2.30	2.59	2.78	2.11	2.26	2.35	2.51
N3.53D	Stingers/Girders	09/04/14	0.52	0.79	0.67	1.02	---	---	2.66	2.86	1.87	2.28	2.40	2.67
N3.53F	Stingers/Girders	01/29/15	1.61	1.38	2.09	1.79	1.72	2.86	3.26	2.70	2.81	2.25	3.33	2.65
N3.73	Rolled Stringers	09/28/15	0.35	0.52	0.46	0.68	---	---	1.65	2.04	1.17	1.51	1.30	1.62
	Plate Girders		0.99	0.72	1.28	0.94								
N4.12	Stingers/Girders	05/14/15	0.73	1.11	0.94	1.44	0.88	1.47	2.03	2.69	1.25	1.91	1.46	2.19
N4.52	Stingers/Girders	05/14/15	0.56	0.28	0.73	0.36	0.67	1.13	1.54	0.97	1.50	0.79	1.76	0.85
N5.34	Stingers/Girders	02/19/16	0.28	0.29	0.36	0.38	0.83	1.38	1.33	1.49	0.93	1.04	1.01	1.13
N5.56A	Stingers/Girders	12/09/15	0.84	0.69	1.09	0.90	0.91	1.51	1.66	1.36	1.51	1.24	1.85	1.68
N5.56B	Stingers/Girders	12/09/15	0.34	0.42	0.45	0.54	1.08	1.80	1.51	1.49	1.12	1.02	1.22	1.09
N5.66	Stingers/Girders	02/22/16	0.87	0.79	1.13	1.03	1.36	2.28	2.34	2.13	1.88	1.73	1.98	2.01
N6.49	Stringers	05/23/16	0.23	0.25	0.30	0.32	---	---	0.51	0.54	0.37	0.40	0.53	0.58
	Floorbeams		0.42	0.72	0.55	0.93	---	---	0.90	1.38	0.90	1.35	1.07	1.75
	Girders		0.50	0.24	0.65	0.30	---	---	1.69	0.63	1.16	0.52	1.20	0.52
	Connections		0.44	---	0.57	---	---	---	0.88	---	0.86	---	1.12	---
N6.80E	Stingers/Girders	02/22/16	0.35	0.57	0.45	0.74	0.75	1.25	1.90	1.75	1.33	1.37	1.45	1.58
N6.80W	Stingers/Girders	02/22/16	0.63	0.22	0.82	0.29	1.02	1.69	2.44	2.24	1.90	1.65	2.20	1.79
N7.13	Stingers/Girders	02/22/16	0.32	0.33	0.42	0.42	---	---	1.71	1.69	1.19	1.18	1.30	1.29
N7.52	Stingers/Girders	02/19/16	0.37	0.50	0.48	0.65	0.99	1.66	1.60	2.21	1.12	1.55	1.22	1.67
N7.90E	Stingers/Girders	02/19/16	1.05	1.04	1.36	1.36	1.00	1.66	2.67	2.00	2.15	1.73	2.29	2.04
N7.93W	Stingers/Girders	12/09/15	0.62	0.60	0.80	0.78	0.94	1.58	2.28	1.90	1.76	1.45	2.01	1.65

2.2.6. Current and Future Construction Contracts on NBHCE

Based on the Master Plan (Version 3.1 – 5/10/16) and the HNTB-authored 'white paper' on the NBHCE provided to Jacobs, Table 2.2.4 presents a summary by bridge of current work being progressed and/or anticipated future work along the NBHCE. This summary list is fluid with the potential for additional contracts to be added in the future. Anticipated contract dates may also be subject to change.

Table 2.2.4: Current and Anticipated Contracts

BRIDGE NO.	DESCRIPTION OF WORK	CONTRACT NO.	DATES
N 0.16A	Full Bridge Replacement	TBD	TBD
N 0.28A	Deck Replacement, Superstructure Strengthening	T100.184	06/18-11/21
N 0.28C	Repair, Strengthen Steel, Replace Deck Slab and Parapets	T100.381	04/17-08/18
N 0.28D	Deck Replacement, Superstructure Strengthening	TBD	TBD
N 0.75	Deck Replacement, Superstructure Strengthening	T100.184	06/18-11/21
	Repair, Strengthen Steel, Reconstruct Shoulder Deck Slab and Parapet (Pier W94 to Pier W66)	T100.381	03/18-02/19
	Repair, Strengthen Steel, Reconstruct Shoulder Deck Slab and Parapet (Pier W66 to Pier W45) (HEW Roadway)	T100.381	07/17-03/18
N 2.01W	Repair, Strengthen Steel, Reconstruct Shoulder Deck Slab and Parapet (Pier W45 to Pier W15) (HEW Roadway)	T100.381	07/16-12/17
	Deck Replacement, Superstructure Strengthening	T100.184	06/18-11/21
N 2.01	Superstructure Tie Plate Repairs Stage 1 (Pier W15 to Pier W2)	A100.196	12/15-10/16
	Superstructure Tie Plate Repairs Stage 2 (Pier W15 to Pier W2)	T100.381	04/17-07/17
	Superstructure Tie Plate Repairs Stage 1 (Pier E2 to Pier E19)	A100.196	12/15-10/16
	Superstructure Tie Plate Repairs Stage 2 (Pier E2 to Pier E19)	T100.381	04/17-07/17
	Security Hardening of Arch	T100.184	06/18-11/21
	Strengthening and Steel Repairs of Fracture Critical Approach Spans, Tie Chord Redundancy	T100.184	06/18-11/21
N 2.01E	Superstructure Strengthening	T100.184	06/18-11/21
N 3.00	Deck Replacement and Widening of Ramp Portion only; no work on mainline	T300.311	02/15-04/18
N 3.24	Deck Replacement and Widening of Ramp Portion only; no work on mainline	T300.311	02/15-04/18
N 3.39	No work identified	-	-
N 3.53B	No work identified	-	-
N 3.53C	Deck Replacement and Widening; full width deck replacement of Ramp TW structure	T300.311	02/15-04/18
N 3.53D	Full Bridge Replacement	T100.XX1	2018+/-
N 3.53E	New Structure	T300.311	02/15-04/18
N 3.53FR	New Replacement Structure	T300.311	02/15-04/18
N 3.53I	New Structure	T300.311	02/15-04/18

Table 2.2.4: Current and Anticipated Contracts (continued)

BRIDGE NO.	DESCRIPTION OF WORK	CONTRACT NO.	DATES
N 3.73	Full Bridge Replacement to Accommodate Future Widening	T100.XX1	2018+/-
	Reconstruct Shoulder Deck Slab and Parapet Stage 1B	T100.381	09/16-03/17
N 4.12	No work identified	-	-
N 4.52	No work identified	-	-
N 5.34	No work identified	-	-
N 5.56A	No work identified	-	-
N 5.56B	No work identified	-	-
N 5.66	Full Bridge Replacement	T100.XX2	2018+/-
N 6.49	Deck Replacement (HEW Direction Only)	T100.125	Complete
	Deck Replacement (HWE Direction Only), Steel Strengthening, Paint and Seismic (Entire Structure)	T100.321	2017-2020
	Future Work	TBD	TBD
N 6.80E	Deck Replacement, Steel Strengthening, Paint and Seismic	T100.321	2017-2020
N 6.80W	Deck Replacement	T100.125	Complete
	Steel Strengthening, Paint and Seismic	T100.321	2017-2020
N 7.13	Deck Replacement (HEW Direction Only)	T100.125B	Complete
	Future Work	TBD	TBD
N7.52	Deck Replacement (HEW Direction Only)	T100.125	Complete
	Future Work	TBD	TBD
N 7.90E	Future Work	TBD	TBD
N 7.93W	Deck Replacement (HEW Direction Only)	T100.125	Complete
	Future Work	TBD	TBD

2.2.7. Seismic Considerations

Jacobs reviewed the findings from OPS A3356 which included seven of the NBHCE bridges in this Seismic Vulnerability Assessment and Concept Retrofit Study: N6.49, N6.80E, N6.80W, N7.13, N7.52, N7.90E and N7.93W. These seven bridges were classified as "Critical" bridges requiring significant seismic retrofitting to address the current structural inadequacies and structural weaknesses identified with respect to the anticipated seismic forces[2]. Some of the recommended retrofitting includes bridge seat lengthening, footing strengthening/additional piles, column jacketing, overlay or replacement, cap beam strengthening with post-tensioning, or section enlargement and bearing replacement.

2.2.8. Conclusions and Recommendations

[redacted]

[redacted]

[redacted]

[redacted]

[2] Based on seismic considerations, since all of the NBHCE bridges feed into Structure N2.01 (which is critical), then all of the bridges on the NBHCE are also deemed critical.

2.3. Traffic Operations

Recurring congestion on the NBHCE has been and continues to be a source of driver frustration, especially in recent years due to the temporary closure of the eastbound Pulaski Skyway. The NBHCE is currently being used as an alternative eastbound route for access to Jersey City and New York City (via the Holland Tunnel) which adds additional strain on the already burdened operations. To accommodate the diverted Pulaski Skyway traffic, the eastbound NBHCE shoulder has been temporarily converted into a third lane during peak hours (6-10AM and 3-7PM weekdays, and as needed for events or incidents.) Based on previous analysis conducted by NJTA and HNTB, the NBHCE, specifically on the Newark Bay Bridge, cannot geometrically or structurally accommodate a permanent third travel lane. The anticipated significant increase in commercial vehicular traffic and passenger vehicle traffic associated with redevelopments in Bayonne and Jersey City will place new travel/capacity demands on the entire length of the NBHCE mainline as well as interchanges associated with the NBHCE.

Presently, there are many inter-related circumstances that are responsible for the traffic congestion and queuing on the NBHCE. Assessment of the existing processed traffic volume, speed, and delay indicates that lane drops and lane merges in the vicinity of entrance and exit ramps and toll plaza operations work together to reduce the efficiency of traffic movement on the NBHCE. In particular, heavy congestion and queuing is experienced at the I-95 eastbound entrance ramps (Ramps NH, SIH and SOH), the Interchange 14A westbound entrance Ramp TW, the Interchange 14C toll plaza, and the Merceles Street westbound entrance ramp.

Chapter 4 provides an in-depth discussion of the assessment methodology applied to establish existing operational conditions, the No Build 2045 scenario, and test the potential build alternatives.

3. CONSTRAINTS

3.1. Aerial Mapping

Identifying a preferred alternative that is feasible, constructible and meets the project purpose and need requires an understanding of the numerous constraints that would make implementing an infrastructure improvement more time consuming, complex and costly than necessary. While aerial imagery is generally available for this area, continuous changes in area infrastructure and land development suggested the need to prepare current aerial imagery upon which constraints could be mapped and improvement alternatives developed. Figure 3.1.1 depicts the primary focus area for which aerial imagery was assembled. The flights were conducted and the imagery assembled to create design level base mapping and digital terrain models used to identify constraints as well as overall improvement concepts that would be constructible. It is important to note that the findings derived from this analysis are concept-level appropriate. A more detailed analysis of critical constraints and potential conflict issues would be undertaken in the preliminary engineering phase of project development.

Figure 3.1.1: Primary Study Area Aerial Mapping Limits

3.2. Existing Environmental and Constraint Context

The environmental screening for the NBHCE Project occurred in two phases: an early project area context screening and then a refined assessment focused on the proposed alignment of the IPA. The context screening, the subject of this section of the report, provided an assessment of existing conditions and constraints within the maximum reasonable extents that could be affected by a realignment of the NBHCE. The categories of impact examined were those common to a NEPA analysis as NEPA provides a comprehensive framework for environmental assessment that is the basis of comparable studies conducted throughout the nation, regardless of the project sponsor or funding mechanism. The analysis used GIS data and other spatial analysis resources along with regulatory review to provide a desktop assessment of these NEPA constraints. The categories of potential impact included:

- Community Resources and Demographics (Environmental Justice/Title VI)
- Wetlands
- Threatened and Endangered Species
- Flood Hazard Areas
- Open Space and Parklands
- Noise and Air Quality
- Hazardous Materials and Historic Fill
- Cultural Resources
- Aquatic Resources

3.2.1. Analysis Buffer

The project area context screening established a large buffer area on either side of the existing NBHCE alignment. The purpose of the context screening was to consider the extent of the land potentially involved in all reasonably possible solutions to the project and, through use of the data described above, determine whether an environmental constraint representing a fatal flaw was likely to be present in this area. This information was shared with the design team in the early phases of the consideration of project options.

Initially, the buffer was a uniform 3,000 ft in width (1,500 ft on either side of the NBHCE) from Interchange 14 to the Holland Tunnel entrance. However, analysis of the development context north of Montgomery Street in Jersey City indicated that the 3,000-ft buffer was unrealistic in this area, as existing residential and commercial development abuts the NBHCE. Community preservation, environmental justice, existing infrastructure interdependencies (such as the Holland Tunnel alignment) and project cost control mandated that proposed alternative alignments avoid to the greatest extent possible significant changes and direct impact to existing development, particularly residential development.

As a result, the 3,000-ft buffer would have had the study team assessing properties and resources that in all practicality were never going to be disturbed by the project. The larger buffer also could have suggested to the community that more community resources were at risk or that the NJTA was considering a drastic realignment that would have had serious impacts to the character of that portion of Jersey City. As graphic representations of project data are more readily disseminated and at-risk for out-of-context interpretations, it was determined that reducing the buffer north of Montgomery Street was reasonable. As a result, the buffer through the portion of the project area between Montgomery Street and the Holland Tunnel was reduced to 300 ft on each side of the NBHCE.

The following sections describe the project context environmental screening for each of the resource disciplines listed above. The narratives describe the purpose of analyzing for the particular constraint, the data sources used, the methodology applied, and the results of this broader screening, identified in the narrative as "Findings and Implications."

3.2.2. Community Profile and Environmental Justice/Title VI

Purpose

The goal of identifying the project's community composition is to identify Environmental Justice and Title VI communities so that impacts associated with the project are not disproportionately distributed and the public outreach plan is fair and inclusive.

The community profile presents not only demographic data, but information on transportation and community resources whose presence helps define the character of the community. Identifying these resources is an important component of the community profile, as impacts to these resources is likely to be met with community opposition.

Methodology and Scope of Screening

Data Sources

Community facilities were determined through review of resources provided online by the municipality, county, and state. The location of resources was verified through mapping tools such as Google Maps and Google Earth.

Demographic data was obtained from the US Census American Community Survey 2015 (ACS 2015), US Census American Community Survey 2009 (ACS 2009) and updated US Census Tracts made available through the NJ GIS data clearinghouse. Data sets obtained from the US Census and used in this analysis included the following:

- S0501: Selected Characteristics of the Native and Foreign-Born Populations
- DP03: Selected Economic Characteristics
- S0501: Populations
- S0103: Population 65 Years and Over in the United States
- S1601: Language Spoken at Home
- S17001: Poverty Status in the Past 12 Months
- B02001: Race

- B03003: Hispanic or Latino Origin
- B01001H: Sex by Age (White Alone, not Hispanic or Latino)
- B16004: Age by Language Spoken

Analysis Methodology

For this assessment, "minority" constitutes the population that self identifies as any of the US Census racial groups or combination of racial groups and/or Hispanic or Latino. In other words, an individual who self-identifies as one race and white but also Latino or Hispanic would be considered a minority. Non-minority is restricted to those who self-identify as being of one race, white, and neither Hispanic nor Latino.

The screen-level review of the community demographics considered the socio-economic composition of the community in comparison to state, county, and municipality statistics and then examined the project area Census Tracts in more detail. The "project tracts" are the 21 Census Tracts located within the 300 to 1,500 ft study area buffer along the Newark Bay Extension on the east side of Newark Bay. Although the Newark Bay Extension project is located in the City of Newark in Essex County, the City of Bayonne in Hudson County, and the City of Jersey City in Hudson County, the analysis focused exclusively on the portion of the project area located to the east of the Newark Bay Bridge as the section to the west of the bridge within Newark primarily consists of industrial and commercial uses.

Smaller geographic Census data areas such as "Block Groups" or "Blocks" were not used in this analysis. The tract-level data is sufficient to provide a screening-level assessment of the study area's socioeconomic character and identify areas of Environmental Justice concern. A finer level of review involving the 320 Census blocks comprising the study area can be undertaken in later phases of the project should targeted public outreach and coordination needs arise.

Findings and Implications

Community Facilities & Resources

Within the project area, there are a number of community facilities and resources including schools, houses of worship and active use recreational facilities. Many of the community facilities are located adjacent to the NBHCE.

Community Facilities

From Newark Bay heading east towards the Interchange 14A Toll Plaza, there are several schools. Most notably, the outdoor facilities of Marist High School in Bayonne, a large private catholic high school are situated directly adjacent to the NBHCE. Additional community facilities in this area include Mercer Park and the Dig It Community Garden located on Garfield Avenue.

Between Interchange 14A and Montgomery Street in Jersey City there are critical housing resources, cultural, and recreational resources. Multiple low income housing developments owned by the Jersey

City Housing Authority are located near the intersection of NBHCE and Grand Street. East of the NBHCE is a combination of industrial and open spaces including the Jersey City Recreation Affairs, Liberty National Golf Course, Hudson River Waterfront Walk, and the Liberty State Park complex as well as the Liberty Science Center. Adjacent to the westbound lanes of the NBHCE are the Historic Jersey City & Harsimus Cemetery and the William L Dickinson High School. Adjacent to the east of the NBHCE are the James J Ferris High School, Mary Benson Park, and Jones Park.

North of Montgomery Street the NBHCE runs on structure. Certain portions of the leveled area beneath the structure are used as a parking facility for the adjacent users. In the past, this use of the land under the NBHCE was allowable and helped to optimize land use in the project area; presently, however, public access under components of major infrastructure is strongly discouraged by the United States Department of Homeland Security. Parking also complicated maintenance of the elevated structure. The NJTA would need to consider whether continuing the parking use under the NBHCE is allowable, and if not, engage the owners of the properties used for parking as part of the larger right-of-way acquisition effort. Loss of surface parking in densely developed areas can lead to parking shortages, which would be an adverse effect of the proposed action. Mitigation of lost parking capacity may be an analysis required during the preliminary design phase.

Transit Resources

Several transit routes operate through the project area, including NJ TRANSIT bus, private bus, and the Hudson-Bergen Light Rail.

In the western portion of the study area (from Bayonne to Montgomery Street in Jersey City), NJ TRANSIT provides multiple bus lines, including Route 1, Route 6, Route 10, Route 81, and Route 110 . Route 1 provides service between Newark Penn Station in the City of Newark and the Journal Square Transportation Center as well as Exchange Place in Jersey City, with stops along Grand Street. Route 6 provides service between the Journal Square Transportation Center and the City of Bayonne; it has stops mainly along Ocean Avenue in addition to the Lafayette Loop which has stops along Communipaw Avenue, Garfield Avenue, Johnston Avenue, and Pacific Avenue. The 10 connects Bayonne to Jersey City. Route 81 connects Bayonne with Exchange Place in Jersey City via Avenue C, Ocean Avenue, and Old Bergen Road. During rush hour, NJ TRANSIT also provides bus Route 81X which travels on the NBHCE from Exit 14A to Jersey Avenue in Jersey City. Route 110 connects Bayonne to New York City terminating at the Port Authority Bus Terminal. There is also a local shopping bus service provided by Broadway Bus from Kennedy Boulevard, traveling along Broadway, to Avenue C. The privately owned A&C Bus Corp also provides multiple bus routes throughout the project area, including Line 4 which serves Jersey City along both Pacific Avenue and Grand Street. The Hudson Bergen Light Rail (HBLR) operates parallel to the NBHCE along the westbound lanes in the north-south running portion of the study area. The three HBLR stations are the Danforth Avenue Station, the Richard Street Station, and the Liberty State Park Station which also includes a commuter Park and Ride facility.

North of Montgomery Street, NJ TRANSIT provides bus service via the 80, 82, and 86 which all have stops along Newark Avenue. The 80 provides service within Jersey City between the Journal Square Transportation center and the downtown business district. The 82 provides service between Exchange

Place and Union City. The 86 provides service between Union City, Weehawken and Jersey City. The privately owned A&C Bus Corp provides bus service along Montgomery Street to the Newport Mall as well as the Grove Street PATH station and the Exchange Place PATH station during the weekday. Jitneys, which are a private local shuttle, provide additional transportation service in the area between the Journal Square Transportation Center and the Newport Mall via the "Newport Mall to George Washington Bridge Line" which runs along Newark Avenue.

Bicycle and Pedestrian

Major roads within the project area are identified as "Least to Moderately Suitable" bicycle routes by the New Jersey Department of Transportation (NJDOT). However, a section along Newark Avenue within the project area is also a part of the East Coast Greenway Route. Bicycling is therefore not recommended within the project area along major routes with the exception of the NJDOT designated bike route.

On June 15, 2018, the North Jersey Transportation Planning Authority published the Morris Canal Greenway Corridor Study, laying out a vision for connecting Phillipsburg, NJ with Jersey City, NJ with a 111-mile long bicycle and pedestrian friendly Greenway. A portion of the envisioned alignment runs along the NBHCE adjacent to Structure N3.73 near Interchange 14A. The initially envisioned route may conflict with the recommended alignment of the NBHCE, requiring coordination and collaboration in the planning and design of future improvements.

Community Demographics

Table 3.2.1 summarizes the comparative socioeconomic data. The following sections describe the numerical data in more detail and summarize some of the implications of these findings.

Racial and Ethnic Composition

As illustrated in Table 3.2.1, the percentage of study area residents self-identifying as a minority is comparable to Jersey City and Hudson County and significantly higher than that of the City of Bayonne and the State of New Jersey. The minority percentages for Hudson County, Jersey City, and the Census Tracts are at a minimum 70% and higher which is nearly twice that of the State.

Limited English Proficiency (LEP)

More than half of the study area's residents report that they are proficient in English. Those who do not speak English primarily communicate in Spanish and to a lesser extent Indo-European languages, Asian languages, and other languages. As a result, targeted outreach for non-English speaking populations may be appropriate. Consultation with local officials will be instrumental in identifying the specific languages and dialects predominantly spoken in the area and essential in effective outreach to LEP communities.

Poverty

The poverty rate within the project area and surrounding geographic regions are comparable. However, the poverty rate for the project area Census Tracts is twice that of the average poverty rate for the State.

Table 3.2.1: Project Area Demographic Data

State of NJ				
Percentage of Population Self-Identifying as a Minority	42.8%			
Percentage of Population Living at or Below the Federal Poverty Line	10.8%			
Project Area	**Hudson County**	**City of Bayonne**	**Jersey City**	**Census Tracts**
Racial and Ethnic Composition				
White	55.6%	70.8%	35.4%	38.9%
Black or African-American	12.7%	10.9%	25.1%	32.4%
Native American/Alaskan Native	0.3%	0.3%	0.4%	0.4%
Asian	14.6%	8.9%	25.1%	12.3%
Pacific Islander	0.1%	0.2%	0.0%	0.0%
Other Race Not Specified	13.6%	6.4%	11.2%	14.6%
Two or More Races	3.0%	2.6%	2.8%	1.3%
Hispanic/Latino of Any Race	42.8%	23.5%	27.7%	26.9%
Once Race, White, Not Hispanic/Latino	29.4%	55.6%	21.5%	27.9%
Total Minority Percentage	70.6%	44.4%	78.5%	72.1%
Percentage of Population Living at or Below the Federal Poverty Line	17.5%	14.8%	19.3%	18.1%
Language Proficiency				
Speak only English	40.8%	56.6%	47.4%	59.0%
Speak Spanish	38.4%	20.7%	22.5%	22.3%
Speak other Indo-European languages	10.7%	9.7%	14.1%	9.9%
Speak Asian and Pacific Island languages	6.9%	5.3%	11.8%	6.3%
Speak other languages	3.1%	7.7%	4.1%	2.5%
Percentage of Population 65 and Older	10.6%	13.0%	9.8%	9.6%

Senior Population

The project area Census Tracts, Jersey City, City of Bayonne, and Hudson County have a fairly comparable portion of the population over the age of 65, ranging from 9% to 13%. Although the percentages are low, consideration for the senior population will also be a factor in outreach. Public meeting locations, meeting times, and methods for providing feedback should allow for the capabilities and comfort level of this population (i.e. social media may not be effective for reaching these residents).

Considerations for Alternatives Development

The densely developed, urbanized setting of the project will necessitate outreach and coordination with local officials and stakeholders to ensure that the alternatives proposed present the least disruption to the community both during construction and in the final condition. Providing for the continuation of access to transit service, schools, and other community facilities, including parkland and open space, is an important consideration in areas that include substantial disadvantaged populations whose transportation options are limited and whose employment hours are often rigidly fixed.

Targeted analysis would likely be required if a project alternative were to require the acquisition of a community facility, substantial alteration to a transit route, or realignment of a roadway such that a neighborhood may be bisected. These actions could represent environmental justice impacts, incite strong community and political opposition, and result in costly mitigation measures.

3.2.3. Wetlands Screening

Purpose

The goal of screening for known mapped wetlands within the project area is to identify a constraint that, if impacted, will result in additional project costs and schedule time. Wetlands in New Jersey are regulated by the New Jersey Department of Environmental Protection (NJDEP). In certain circumstances, including the NJ Meadowlands and up to and including the mean high water line, the USACE retains jurisdiction. Impacts to wetlands under the USACE jurisdiction also require a NJDEP permit. Permit processing can take more than six months, and also triggers subordinate processes, such as cultural resources evaluations and approval.

Wetlands mitigation can be costly, as well, requiring either the purchase of credits in a wetlands bank or the restoration and monitoring of restored wetlands within the project area. The method of mitigation is typically left to the discretion of the regulatory agency, and all mitigation plans require approval.

As a consequence, it is beneficial to the project to avoid wetlands impacts whenever possible, and minimize those that are unavoidable.

Methodology and Scope of Screening

Data Sources

Wetlands data was obtained from the NJDEP's Bureau of GIS. "Wetlands by land use/land cover" (2012) and "wetlands by watershed" data were both reviewed.

Analysis Methodology

The context constraints map represents desktop-level reconnaissance using data made available by the resource agencies with jurisdiction over the resource. Field reconnaissance has not been performed to verify the spatial analysis findings, as it is typically not warranted until preliminary engineering when the most viable alternatives are developed in more detail.

NJDEP data was displayed on an aerial basemap of the project area. The land use-based data was compared to the watershed data to determine if any appreciable difference existed between the two data sets. No substantial difference was found.

The buffer was then superimposed on the wetlands data to determine if known wetlands areas are potentially subject to impact as the result of the project alternatives.

Findings and Implications

Figure 3.2.1 illustrates the findings of the wetlands screening.

Linear wetlands are found along both the northern and the southern side (westbound and eastbound lanes) of the NBHCE from Interchange 14 to the bank of Newark Bay. These wetlands form a buffer between I-78 and the industrial uses to the north and south of the highway. East of Newark Bay, wetlands are found between the edge of the Bay and JFK Boulevard, adjacent to both the eastbound and westbound lanes of the NBHCE. Additional wetland areas are also found in the infield of Route 440.

Mapped wetlands are also found throughout the Liberty National Golf Course, located east of the NBHCE. Isolated pockets of wetlands are found north of Chapel Avenue, on the west side of the NBHCE. A large natural area, part of Liberty State Park is found between the managed portion of Liberty State Park and the Liberty Science Center. This natural area wraps around the Liberty Science Center and extends to the NBHCE in the vicinity of Audrey Zapp Drive. Pockets of wetlands are mapped within this area, but given the topography and setting, it is likely that the actual area of wetlands is greater than that which is shown on the NJDEP mapping. The NBHCE in this area is more than 3,000 ft from the edge of water, and to encroach within the USACE area would necessitate impact to intervening development, such as the Liberty Science Center; consequently, wetland impacts in the vicinity of the Liberty Science Center are unlikely, and if necessary, would involve NJDEP, not the USACE.

Considerations for Alternatives Development

Field reconnaissance is required to confirm the presence of wetlands identified using the GIS analysis described above and to identify any new areas not mapped by NJDEP.

Wetlands are found adjacent to the NBHCE on both sides of Newark Bay. Adjustment to the alignment of the NBHCE, the development of new or reconfigured ramps, and other changes that alter the footprint of the existing roadway will, with certainty, impact wetlands between Interchange 14 and JFK Boulevard. Wetlands impacts in the Jersey City portion of the project may be more easily avoided as there are fewer areas of concern overall and fewer immediately adjacent to the NBHCE.

Construction activity in this area will also impact wetlands. It should be noted that impacts lasting six months or less are considered “temporary” and do not require mitigation; however, any disturbance greater than six months is considered permanent and requires mitigation, even if in the Build condition, the area will be restored to pre-construction conditions.

NJDEP will require wetland mitigation for any impacts of 0.10 of an acre or greater. Mitigation can be performed through purchasing credits from an NJDEP approved mitigation bank, creating wetlands on site or offsite within the same watershed, or through a monetary contribution to NJDEP if the other options are not feasible. Credit cost ranges from $300,000.00 to $1,100,000.00 per acre of mitigation required; in Hudson County the cost trends to the higher end of the range.

Figure 3.2.1: Wetlands

3.2.4. Threatened and Endangered Species Screening

Purpose

The goal of screening for threatened and endangered species is to determine whether portions of the study area will require special consideration, either through avoidance or mitigation, in order to limit adverse impacts on state and federally-listed species (listed species). Impact to listed species is generally not permitted without extensive review and permitting, but impact can typically be avoided through the timing of construction activities and/or through the mitigation of affected habitat areas. Both of these options, however, increase the cost of the project and extend the construction schedule.

Methodology and Scope of Screening

Data Sources

Threatened and endangered species data was obtained from NJDEP through their Landscape 3.1 data set. Landscape 3.1 is a dynamic geodatabase that is regularly updated with confirmed sightings of individuals of threatened and endangered species and habitat details. Data used in this screening is the most recent available (updated at the end of 2016.)

Analysis Methodology

The context constraints map represents desktop-level reconnaissance using data made available by the resource agencies with jurisdiction over the resource. Field reconnaissance has not been performed to verify the spatial analysis findings. Field reconnaissance is recommended during preliminary engineering.

NJDEP data was displayed on an aerial basemap of the project area. The project buffer was then superimposed on the Landscape 3.1 data to determine if listed species were known to occur within the project area.

Findings and Implications

As a result of the densely developed and urbanized nature of the study area, NJDEP data indicates that threatened and endangered species are confined to the project area water bodies and associated wetland areas (see Figure 3.2.2). Specifically, state threatened and endangered species are known to occur in Newark Bay and the wetland areas associated with Rutkowski Park in Bayonne and in Liberty State Park and Liberty National Golf Course in Jersey City. These species are migratory and wading birds including herons, egrets, and the Peregine falcon. Two federally-listed species, the short-nosed sturgeon and the Atlantic sturgeon, are known to occur in the Hudson River.

Table 3.2.2 below lists the species known to occur in the project area and identifies their federal and state status. Several species are listed as "Species of Conservation Concern," which is a federal designation for species whose populations are not considered threatened or endangered at the moment, but for whom species health indicators are not positive for the long-term outlook. The table includes fish species monitored by the National Marine Fisheries Service (NMFS), a unit of the National Oceanographic and Atmospheric Administration. The species in the NMFS list occur exclusively within Newark Bay.

Table 3.2.2: Threatened and Endangered Species in the Study Area

Scientific Name	Common Name	Federal Status	State Status
Avian			
Sternula antillarum	Least tern	Species of Conservation Concern	Endangered
Haematopus palliates	American oystercatcher	Species of Conservation Concern	
Rynchops niger	Black skimmer	Species of Conservation Concern	Endangered
Falco peregrinus	Peregrine falcon	Species of Conservation Concern	Endangered
Botaurus lentiginosus	American bittern	Species of Conservation Concern	Threatened
Haliaeetus leucocephalus	Bald eagle	Species of Conservation Concern	Endangered
Coccyzus erythropthalmus	Black-billed cuckoo	Species of Conservation Concern	
Vermivora pinus	Blue-winged warbler	Species of Conservation Concern	
Wilsonia canadensis	Canada warbler	Species of Conservation Concern	
Dendroica cerulea	Cerulean warbler	Species of Conservation Concern	
Passerella iliaca	Fox sparrow	Species of Conservation Concern	
Vermivora chrysoptera	Golden-winged warbler	Species of Conservation Concern	Endangered
Gelochelidon nilotica	Gull-billed tern	Species of Conservation Concern	
Limosa haemastica	Hudsonian godwit	Species of Conservation Concern	
Oporornis formosus	Kentucky warbler	Species of Conservation Concern	
Ixobrychus exilis	Least bittern	Species of Conservation Concern	
Lanius ludovicianus	Loggerhead shrike	Species of Conservation Concern	Endangered
Podilymbus podiceps	Pied-billed grebe	Species of Conservation Concern	Endangered
Dendroica discolor	Prairie warbler	Species of Conservation Concern	
Calidris maritima	Purple sandpiper	Species of Conservation Concern	
Euphagus carolinus	Rusty blackbird	Species of Conservation Concern	
Ammodramus caudacutus	Saltmarsh sparrow	Species of Conservation Concern	
Ammodramus maritimus	Seaside sparrow	Species of Conservation Concern	
Asio flammeus	Short-eared owl	Species of Conservation Concern	Endangered
Egretta thula	Snowy egret	Species of Conservation Concern	
Bartramia longicauda	Upland sandpiper	Species of Conservation Concern	Endangered
Empidonax traillii	Willow flycatcher	Species of Conservation Concern	
Hylocichla mustelina	Wood thrush	Species of Conservation Concern	
Helmitheros vermivorum	Worm eating warbler	Species of Conservation Concern	
Nycticorax nycticorax	Black-crowned night-heron		Threatened
Bubulcus ibis	Cattle egret		Threatened
Plegadis falcinellus	Glossy ibis		Special Concern

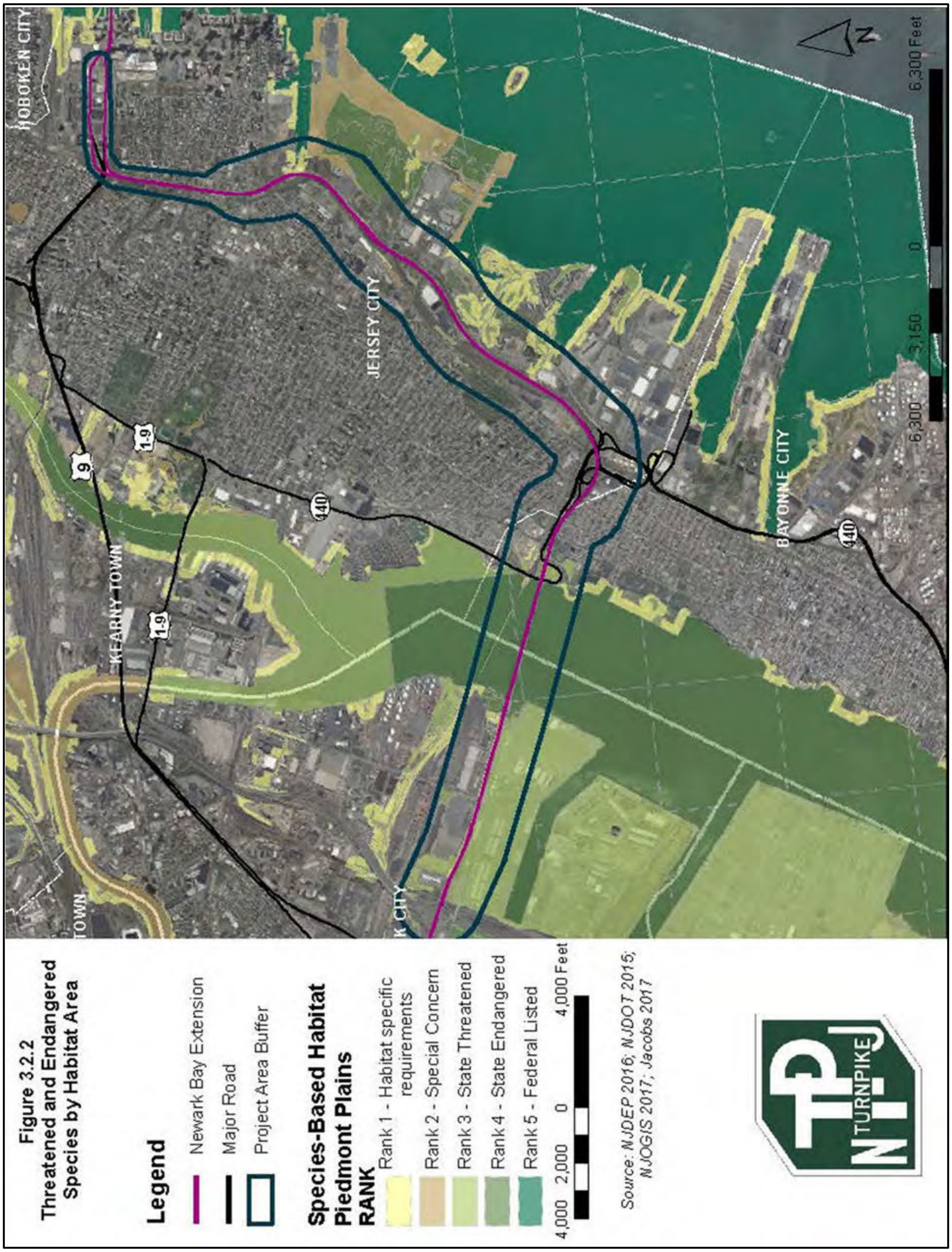
Table 3.2.2: Threatened and Endangered Species in the Study Area, continued

Scientific Name	Common Name	Federal Status	State Status
Egretta caerulea	Little blue heron		Special Concern
Passerculus sandwichensis	Savannah sparrow		Threatened
Egretta tricolor	Tricolored heron		Special Concern
Fish – NMFS Federally Managed Essential Habitat Species			
Urophycis chuss	Red hake		
Pseudopleuronectes americanus	Winter flounder		
Scophthalmus aquosus	Windowpane flounder		
Clupea harengus	Atlantic sea herring		
Pomatomus saltatrix	Bluefish		
Perprilus triacanthus	Atlantic butterfish		
Scomber scombrus	Atlantic mackerel		
Paralichthys dentatus	Summer flounder		
Stenotomus chrysops	Scup		
Centropristis striata	Black sea bass		
Scomberomorus cavalla	King mackerel		
Scomberomorus maculatus	Spanish mackerel		
Rachycentron canadum	Cobia		
Carcharias taurus	Sand tiger shark		
Carcharhinus plumbeus	Sandbar shark		
Acipenser oxyrhynchus	Atlantic sturgeon	Endangered	
Acipenser brevirostrum	Shortnose sturgeon	Endangered	Endangered

Considerations for Alternatives Development

Construction timing is typically implemented to reduce the potential for disturbing threatened and endangered species during critical times in their lifecycle, such as nesting. For example, dredging activity in the Hudson River may be restricted between April and November to protect spawning activity of Atlantic sturgeon. Activities that may affect avian species are restricted for species-specific periods within a timeframe that spans from March 1st to August 31th. For example, if Least Terns are found in the area of impact, construction activity is restricted between May 1st and August 31. Peregrine falcons are vulnerable between March 1st and July 15th. Impacts to habitats that support these species would be addressed through wetlands permitting. These permits, addressed in the wetlands screening, would include conditions related to construction timing.

Figure 3.2.2: Threatened and Endangered Species by Habitat Area



3.2.5. Flood Hazard Area Screening

Purpose

The goal of screening for flood hazard areas (FHAs) is to identify those sections of the study area that would be subject to design flood elevations that could consequently affect the overall design and cost of project alternatives.

Flood hazard areas are locations that are within the Federal Emergency Management Agency's (FEMA) 100-year flood zone, or Flood Zone A. Improvements constructed in FHAs are subject to NJDEP's FHA rules and design flood standards, which requires that all improvements be constructed at the elevation equal to FEMA's design flood elevation (DFE) plus one foot. The DFE elevation varies based on topography, and for a large project area, there may be multiple DFEs.

Methodology and Scope of Screening

Data Sources

Flood hazard data was obtained from FEMA and represents 2012 data, which is post-Superstorm Sandy.

Analysis Methodology

It is important to note that FEMA and NJDEP frequently update FHA data and design standards; consequently, during preliminary engineering, FHA data should be confirmed.

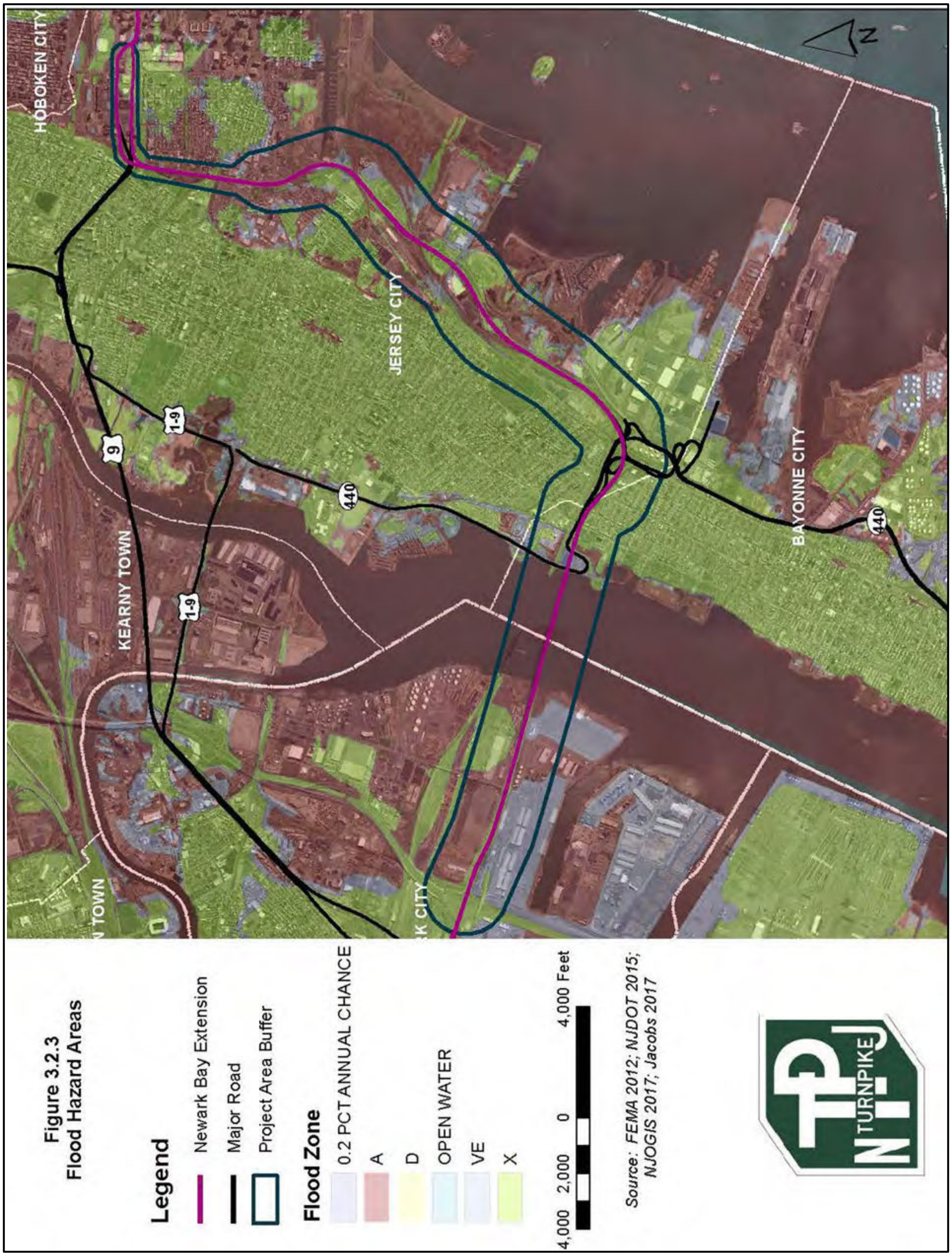
FEMA FHA data was displayed on an aerial basemap of the project area. The project buffer was then superimposed on the FHA data to determine which portions of the study area are located within FHAs.

Findings and Implications

The study area is influenced by two tidal waterbodies: Newark Bay and the Lower Hudson River. As a consequence, there are three shorelines within the study area requiring consideration in regard to flood hazard: both the east and west shores of Newark Bay and the western shore of the Hudson River (see Figure 3.2.3).

Between Interchange 14A and JFK Boulevard, the study area is located within Flood Zone X, the minimal flood risk zone not subject to DFE. The study area west of JFK Boulevard, including portions in Bayonne and Newark (on the west shore of Newark Bay) are within the 100-year flood zone with pockets of 0.2% change (500-year) zones. This area would be subject to DFE.

Figure 3.2.3: Flood Hazard Areas



From Interchange 14A to Linden Avenue, both sides of the NBHCE are located within Zone X. North of Linden Avenue, the eastbound side of the NBHCE is located within Zone A, with some encroachment of Zone A onto the westbound side. North of Bayview Avenue, and continuing to the Holland Tunnel, both the eastbound and westbound sides of the NBHCE are located within Zone A, with some pockets of Zone X intermixed, reflecting the varied topography in the area. As a consequence, alternative design through this area would be subject to the DFE.

Considerations for Alternatives Development

Given the changeable nature of FHA mapping and regulation, review of prevailing mapping and design guidelines during preliminary engineering is strongly recommended. Much of the NBHCE is already on structure, elevated well above the DFE; however, any changes to the alignment in areas not on structure and currently below DFE would require increased elevation or other forms of FHA mitigation.

3.2.6. Open Space and Recreational Resources Screening

Purpose

The goal of screening for open space and recreational resources in the project area is to identify a constraint that, if impacted, will result in additional project costs and schedule time, and require more extensive coordination with local jurisdictions and public engagement.

In New Jersey, all projects, regardless of funding source, are potentially subject to NJDEP's Green Acres rules. Green Acres applies to a parcel of open or recreational space if the public entity that owns it accepted Green Acres funding for any park, open space, or recreational project within their jurisdiction. Consequently, a municipal ball field may not be included on the NJDEP Recreational and Open Space Inventory (ROSI), but if the municipality accepted Green Acres funding for the development of a resource elsewhere within the township, the municipal ball field becomes encumbered by Green Acres, as if it were itself deed restricted.

The use of Green Acres land, in whole or part, for non-recreational and open space uses is called a "diversion" or "disposal." The diversion/disposal process takes approximately one year to complete, requires public hearings and NJ State House Approval. Additionally, mitigation for diversions and disposals requires, at a minimum, acre-for-acre compensation in the form of a suitable parcel to develop as parkland or open space. In some instances, payment can be made to the local jurisdiction, but this approach requires an appraisal and the ratio for payment is always greater than the one-to-one acre value. It can also be the case that Green Acres compensation ratio and requirements were established by the mechanism that funded the preservation of the parkland, which may be more restrictive than the Green Acres regulations. This information is not always readily apparent and requires research and consultation with Green Acres.

Other regulations applicable to parkland and open space resources depend on the funding source for a project. These regulations are in addition to the NJDEP Green Acres requirements. Projects funded by USDOT are subject to Section 4(f) of the USDOT Act of 1966. Section 4(f) requires the project sponsor to prove that there is no prudent and feasible alternative to the use of a Section 4(f) property. A 4(f) property is defined as any park, recreational resource, open space resource, or wildlife refuge that is publicly owned and available for public use. There are different levels of impact, or "use," attributable to a Section 4(f) impact, depending on the extent of the use and its effect on the character-defining features of the resource. For example, taking a corner of a parking lot for additional right-of-way is considered a less substantial use than taking an entire playground or boat launch. The more burdensome reviews of Section 4(f) evaluations, which are those associated with uses that affect the character-defining features of the resource, require an alternatives analysis and public comment, even if the overall project is otherwise exempt from formal public comment under the National Environmental Policy Act (NEPA).

Impacts to parks and open space resources can also be considered an environmental justice impact when viewed in the context of the project area's socioeconomic character and the occurrence of similar impacts elsewhere in the project area. It can be the case that operationally and from a design perspective, the use of a Green Acres or 4(f) resource is feasible and prudent, but it fails the environmental justice test. Consequently, it is best to avoid the take of parkland whenever possible.

Methodology and Scope of Screening

Data Sources

Preserved open space for both the counties and the state was obtained from the NJDEP's Bureau of GIS. Data used in this screening is the most recent available (updated at the end of 2016.) The NJDEP data did not include parcels that are not specifically deed-restricted by NJDEP. As described above, however, should one deed-restricted parcel occur in a public jurisdiction, all public open space in the jurisdiction is considered encumbered by Green Acres. Google Earth Imagery was used to identify parkland resources within the project area that could be encumbered by Green Acres and also likely subject to 4(f), but not specifically preserved.

Analysis Methodology

The context constraints map represents desktop-level reconnaissance using data made available by the resource agencies with jurisdiction over the resource. Field reconnaissance has not been performed to verify the spatial analysis findings. Field reconnaissance is recommended during preliminary engineering.

NJDEP data was displayed on an aerial basemap of the project area. The project buffer was then superimposed on the parklands and open space data to determine if deed restricted open space areas would be potentially subject to impact as the result of project alternatives. Google Earth was then used to identify parkland and recreational resources that were not deed restricted. These were determined through identification of visual features, such as baseball diamonds, and with the assistance of the "Places" feature on Google Earth, which identified passive use parks that are lacking obvious recreational amenities. Ownership of the resources was screened using internet search engines to determine whether the ownership was public or private. As Section 4(f) and Green Acres applies only to public resources, ball fields attached to public and charter schools were considered constrained resources, but private resources, such as ball fields associated with private religious schools and the Liberty National Golf Course, were not considered in the analysis.

Additionally, while cemeteries provide some amenities similar to passive use parks, they are typically owned privately and not subject to Section 4(f) or Green Acres, and therefore not included in this screening. The Jersey City and Harsimus Cemetery is a historic resource included in the cultural resources constraints screening.

Findings and Implications

Table 3.2.3 summarizes the parkland and open space resources found within the study area buffer. Resource locations are illustrated on Figure 3.2.4, Figure 3.2.5, Figure 3.2.6, and Figure 3.2.7.

Table 3.2.3: Study Area Parkland and Open Space Resources

Location	Park Name	Facility Type	Deed Restricted
Hackensack River Walk, Bayonne	Richard A. Rutkowski Park	Passive Open Space	No
JFK Boulevard, Jersey City	Mercer Park	Ball Fields	Yes
Chapel Ave, Jersey City	Jersey City Recreation Affairs	Ball Fields	No
Between Garfield Ave and the HBLR, Jersey City	Bayside Park	Ball Fields	No
Audrey Zapp Drive	Liberty State Park	Passive Open Space	Yes
Grand Street, Jersey City	BelovED School ball fields	Ball Fields	No
Columbus Drive, Jersey City	Ferris HS Ball Fields	Ball Fields	No
Merseles St., Jersey City	Mary Benson Park	Ball Fields	No
8th Street, Jersey City	Jones Park	Ball Fields	No

Mercer Park, located adjacent to an existing freight rail line that parallels the westbound lanes of the NBHCE in Jersey City, is an active use park facility that includes ball fields. The facility is deed restricted as preserved open space by Hudson County. Further south, near the southern boundary of the project study area in Bayonne is Richard A. Rutkowski Park, a passive use facility with walking paths. Rutkowski Park is not deed restricted, but because Mercer Park is deed restricted, Rutkowski Park is subject to Green Acres as well as Section 4(f).

Marist High School is located north of Rutkowski Park, adjacent to the eastbound lanes of the NBHCE. The high school is private and therefore not subject to Green Acres or Section 4(f). It is noted in this analysis because the ball fields connect via a greenway to Rutkowski Park and represent a large tract of undeveloped land at the point where the NBHCE touches down in Bayonne. It should therefore be noted that the land, though apparently open, is a combination of encumbered open space and unencumbered but actively-used recreational land.

The Jersey City Reactional Affairs facility, Liberty State Park, and the BelovED School ball fields abut the eastbound lanes of the NBHCE. Bayside Park is adjacent to the west of the Hudson-Bergen Light Rail tracks. Note that Liberty National Golf Course is adjacent to Liberty State Park, but the golf course is a private resource not subject to Green Acres or Section 4(f).

Ferris HS Ball Fields, Mary Benson Park, and Jones Park are adjacent to the eastbound lanes of the NBHCE, which is on structure.

Considerations for Alternatives Development

Field reconnaissance and additional research and coordination with local and county officials are required to confirm the presence of recreational resources as well as future plans for such resources within the project area. The screening and conclusions are based only on the desktop reconnaissance.

Hudson County is densely developed with little available land for compensatory mitigation for the loss of parkland. The study area also generally represents an environmental justice community for which access to open space and recreational resources is important, and impacts to parkland are likely to be subject to public scrutiny and opposition. Should project alternatives advanced to preliminary engineering affect parks (which includes changes to access to the park and aesthetic impacts), early coordination with the municipal and county officials and Green Acres would be prudent in order to anticipate and address local and programmatic concerns, particularly regarding mitigation and approval processing.

Figure 3.2.4: Parklands and Preserved Open Space

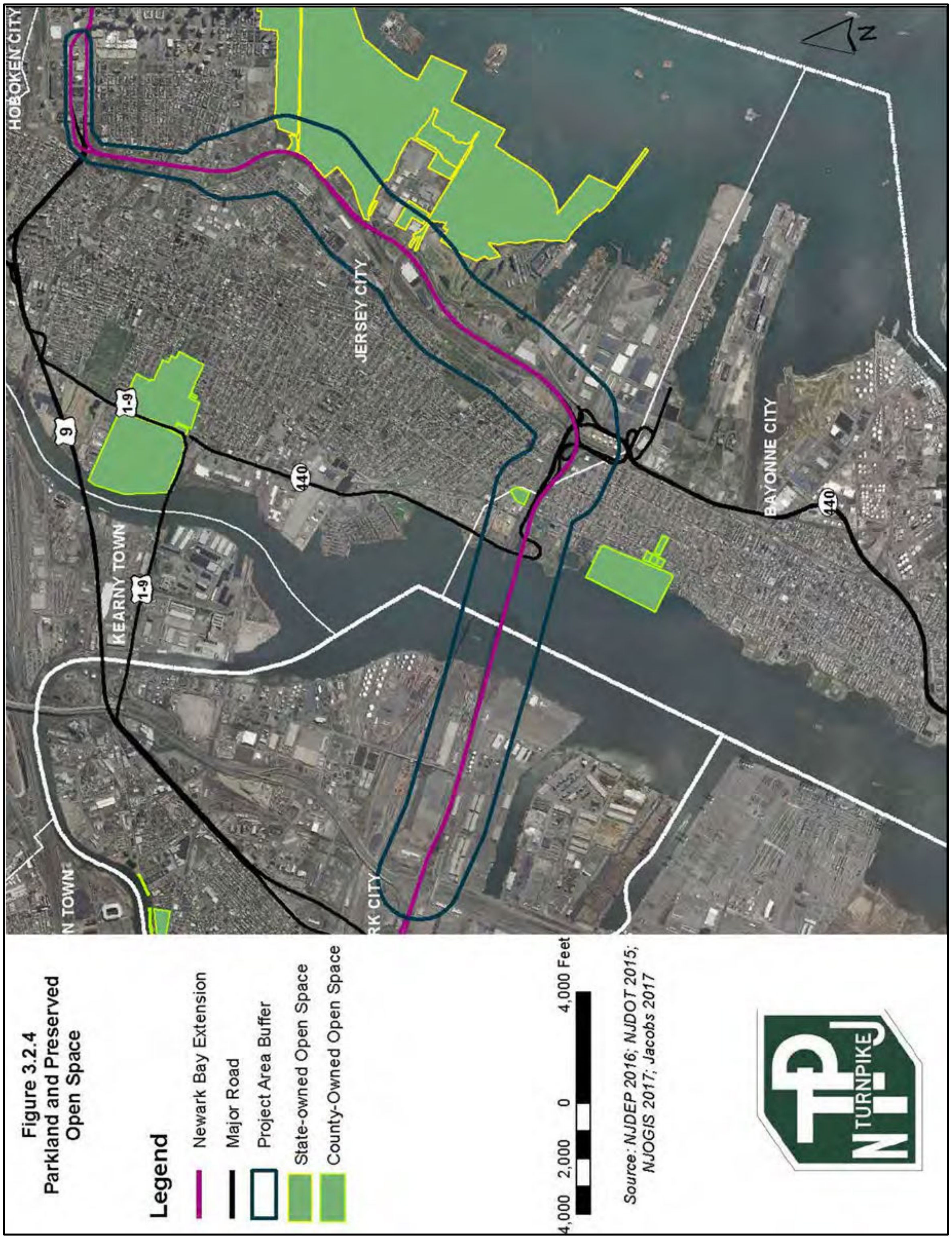


Figure 3.2.5: Parklands and Preserved Open Space

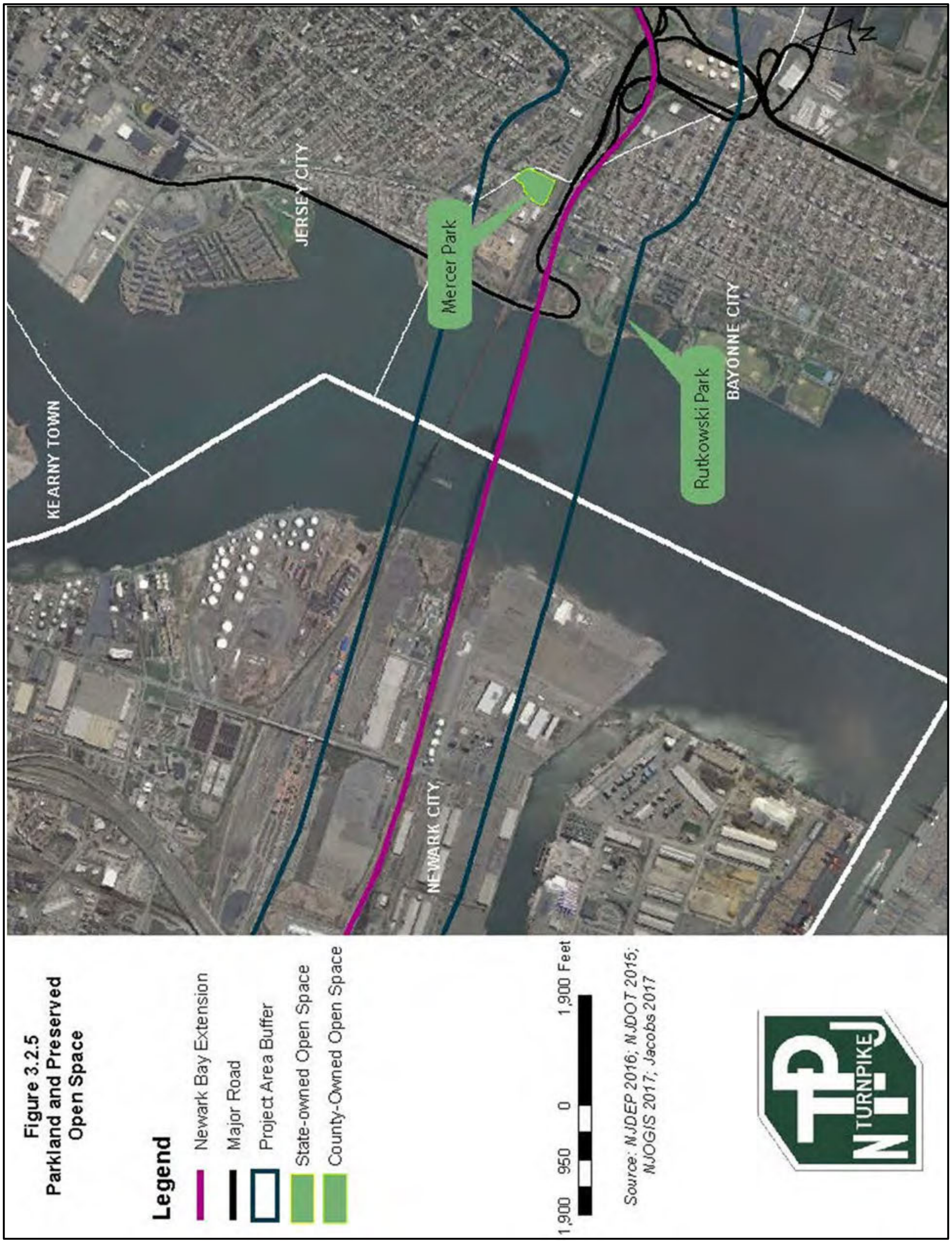


Figure 3.2.6: Parkland and Preserved Open Space

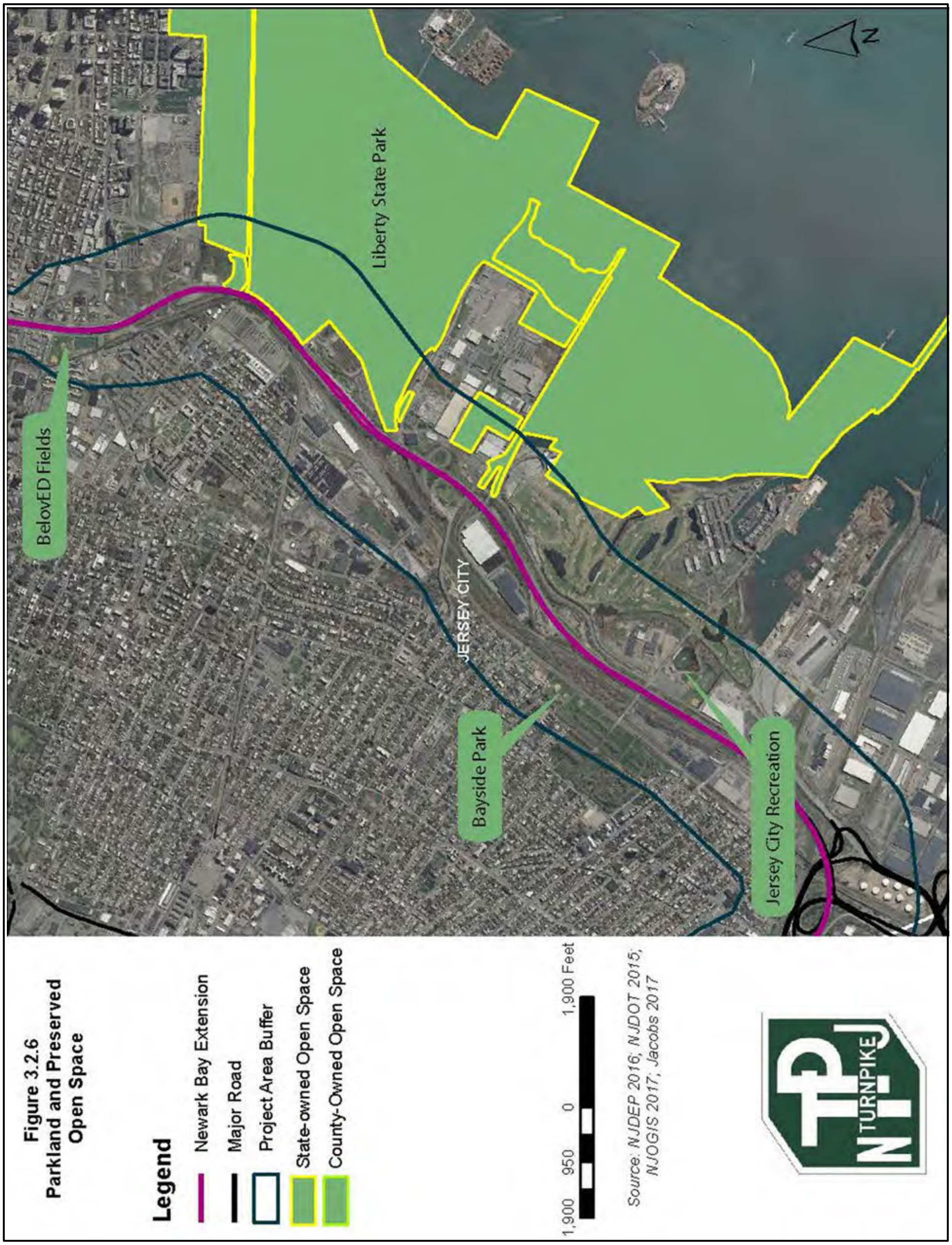
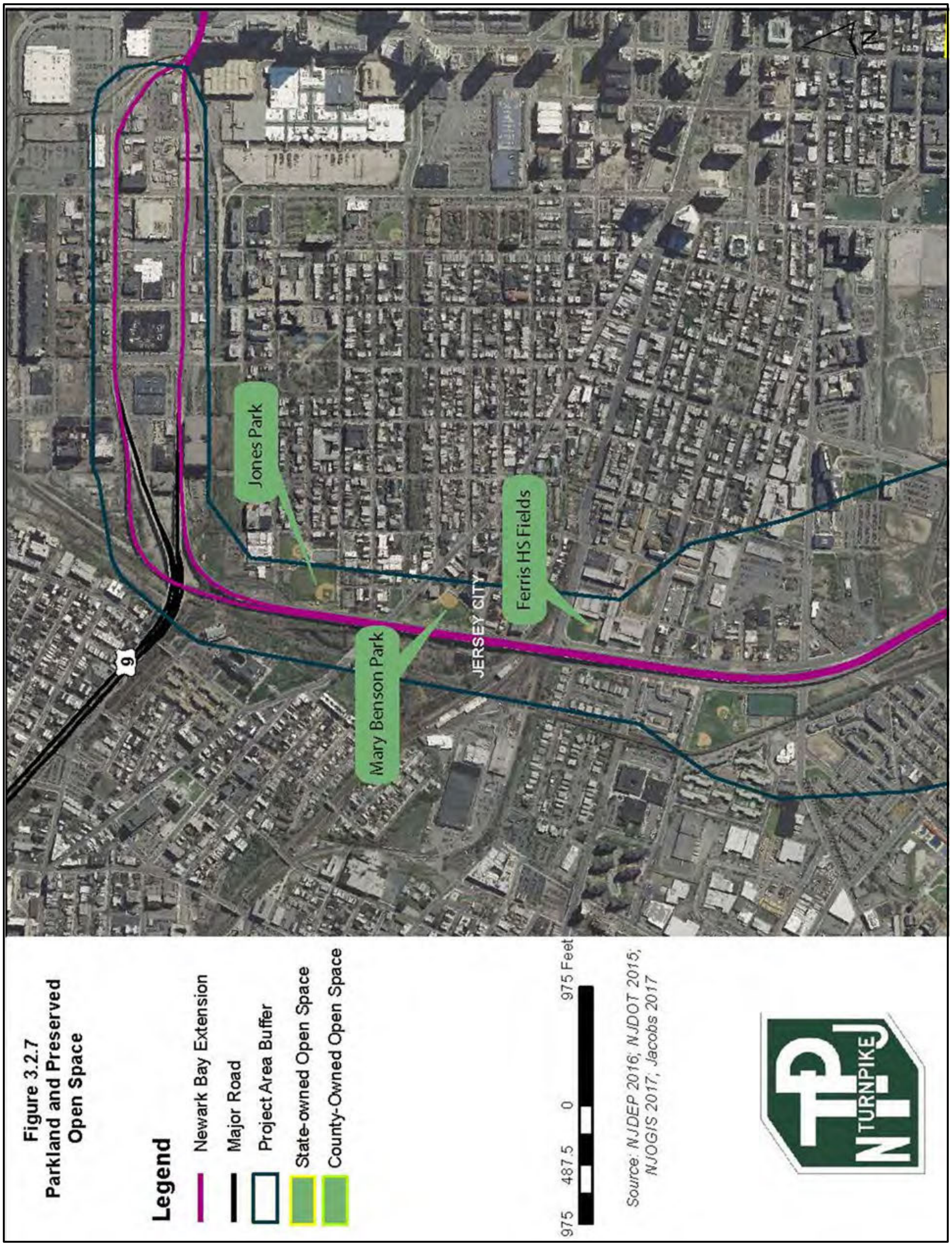


Figure 3.2.7: Parkland and Preserved Open Space



3.2.7. Air Quality and Noise Screening

Purpose

In the context of the NBHCE project, air quality and noise are two environmental categories that are less associated with impacts to existing resources than conformance with prevailing regulations and the implications of those regulations on the design of project alternatives. This screening therefore describes those regulations and considerations recommended to be incorporated into the development of project alternatives.

Methodology and Scope of Screening

National air quality standards are established by the United States Environmental Protection Agency (USEPA), which publishes its "Green Book" on air quality conformance. The Green Book identifies states, counties, and regions within the United States where the levels of criteria air pollutants exceed the National Ambient Air Quality Standards (NAAQS) levels. Under the Clean Air Act (CAA), the U.S. Environmental Protection Agency (USEPA) developed primary and secondary NAAQS for six criteria pollutants considered to be harmful to public health and the environment. These pollutants have both public health-based (i.e., primary) and public welfare-based (i.e., secondary) air quality standards. The six pollutants are:

- Carbon Monoxide (CO)
- Lead (Pb)
- Nitrogen Dioxide (NO_2)
- Ozone (O_3)
- Particulate Matter (PM)
- Sulfur Dioxide (SO_2)

The USEPA classifies the air quality in a geographic region according to whether the concentrations of criteria pollutants in ambient air exceed the NAAQS. Areas are designated as either "attainment," "nonattainment," "maintenance," or "unclassified" for each of the six criteria pollutants. Attainment means that the air quality is better than the NAAQS; nonattainment indicates that criteria pollutant levels exceed NAAQS; maintenance indicates that an area was previously designated nonattainment but is now attainment; and an unclassified air quality designation means that there is not enough information to appropriately classify the area, so the area is considered attainment. Projects that could potentially contribute additional criteria pollutants are closely scrutinized and required to adopt control measures to help reduce the generation of these pollutants.

The federal CAA amendments of 1977 and 1990 require federal agencies and metropolitan planning organizations to demonstrate that all transportation projects conform to the approved air quality State Implementation Plans (SIPs), which is defined as "conformity to a SIP's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards (NAAQS)" (Federal Register, 1993, p. 62188).

Noise standards are established by the Federal Highway Administration (FHWA), a unit of the United States Department of Transportation (USDOT). Federally funded projects are required to comply with noise abatement measures if a project will increase ambient noise levels above FHWA's standards, which vary depending on the affected use and the time of day.

Not all projects require noise analysis. Projects that change the elevation of a roadway, move an alignment closer to noise-sensitive receptors, add lanes, and result in similar substantial changes require noise studies. Projects that do not result in substantial physical alteration of a highway do not require study. It is important to note that if a noise study is required, FHWA's rules mandate that a project mitigate even pre-existing noise impacts. That is, it can be the case that a noise study is warranted because the project results in a change in elevation of a roadway. The noise study may find that the project itself will not change the noise environment, but if the noise levels measured in the existing condition exceed FHWA's thresholds, the project must mitigate that existing sound level.

Noise from vehicles on public roadways are exempt from the New Jersey Statewide Noise Control Code (NJAC 7:29-1.5). The New Jersey Statewide Noise Control Code (NJAC 7:29) does not regulate noise from construction activities; however, the Statewide Noise Code includes a provision allowing municipalities to adopt a noise control ordinance, provided that the ordinance is more stringent than, or otherwise consistent with, NJAC 7:29.

Vehicular noise is regulated by the NJDOT. The NJDOT Traffic Noise Management Policy and Noise Wall Design Guidelines, Effective July 1, 2011, was developed in conformance with and in response to the FHWA Final Rule; "Procedures for Abatement of Highway Traffic Noise and Construction Noise" published July 13, 2010 and effective July 13, 2011. Noise impact studies are required for projects with new roadways and significant improvements to existing roadways (Type I projects) and projects with existing roadways being studied to improve the quality of life, where no transportation improvement project is planned (Type II projects). However, projects that do not alter the noise environment to a significant degree (Type III projects), such as projects consisting of paving, bridge reconstruction and replacement and projects that no not change the roadway alignment substantially, do not require a noise impact study.

As the project is located within the Cities of Newark (Essex County), Bayonne (Hudson County), and Jersey City (Hudson County), it will be subject to compliance with applicable local noise ordinances.

Findings and Implications

Air Quality

Currently, in the State of New Jersey, Essex and Hudson Counties are designated in non-attainment with the NAAQS for 8-hour O_3 and maintenance for CO and 24-hour $PM_{2.5}$. Therefore, the project corridor is in non-attainment with the NAAQS for 8-hour O_3 and maintenance for CO and 24-hour $PM_{2.5}$.

The proposed project is not yet included in the New Jersey Fiscal Year (FY) 2016-2025 Statewide Transportation Improvement Program (TIP). As a new highway project within nonattainment and maintenance areas for the NAAQS, an air quality conformity determination would be required for transportation-related criteria pollutants for which the area is designated nonattainment (8-hour O_3) and for which the area has maintenance plan (CO and 24-hour $PM_{2.5}$).

Noise

As stated above, if the project would result in substantial physical alteration of the New Jersey Turnpike, a noise analysis may be required, as per the FHWA and NJDOT.

In addition, the proposed action will be subject to compliance with applicable local noise ordinance(s). The City of Bayonne has adopted the New Jersey Statewide Noise Control Code (NJAC 7:29), which as stated above, does not specifically regulate noise from vehicles on public roadways or construction noise. In April 2019 the City of Bayonne passed an ordinance to limit noise from construction activities near residential areas. The City of Bayonne imposed restrictions on noise generated by Interchange 14A construction activities. It is reasonable to expect that similar restrictions will be enforced to control noise during the construction of improvements to the NBHCE. The cities of Newark and Jersey City each have local ordinances controlling noise as summarized below:

City of Newark

The Noise Control Ordinance of the City of Newark (Title XX Offenses, Miscellaneous, Chapter 3 Noise) qualitatively regulates loud or unnecessary noise from individual from motor vehicles and motorcycles, specifically their mufflers, horns and signal devices, and idling times. However, the City of Newark does not regulate overall noise from vehicles on public roadways. Construction noise is regulated by the Noise Control Ordinance of the City of Newark (§20-3-13). Operation of tools or equipment used in construction, drilling, demolition or similar work between the hours of 8:00 PM and 7:00 AM the following day on weekdays or Saturday and at anytime on Sunday or legal holidays except for emergency work, or by special variance, or when the resulting sound level does not exceed the applicable limit set in Table I of § 20:3-7.

Jersey City

The noise ordinance of Jersey City (Chapter 222) qualitatively regulates loud or unnecessary noise from individual from motor vehicles and motorcycles, specifically their mufflers, music amplification, horns and signal devices, and idling times. However, the noise ordinance does not apply to the exceptions listed at N.J.A.C. 7:29-1.5 including noise from public roadways. Construction noise is regulated by the noise ordinance of Jersey City (§ 222-9). Excluding emergency work, construction and demolition activity shall not be performed between the hours of 6:00 PM and 7:00 AM on weekdays, or between the hours of 6:00 PM and 9:00 AM on weekends and federal holidays, unless such activities can meet the limits in Tables I, II or III of § 222-7. At all other times the limits in Tables I, II, or III of § 222-7 do not apply. All motorized equipment used in construction and demolition activity shall be operated with a muffler and/or sound reduction device.

Considerations for Alternatives Development

Air Quality

As the proposed project seeks to improve the efficiency of traffic movement on the Turnpike Extension, this is generally considered an air quality improvement method. However, the proposed project is located within area of non-attainment with the NAAQS for 8-hour O_3 and maintenance for CO and 24-hour $PM_{2.5}$The principal concern for the effect on air quality is related to project-level conformity determinations for projected future mobile sources of emissions to confirm the project would not cause or contribute to any new local violations, increase the frequency or severity of any existing violations, or delay timely attainment of any NAAQS, emission reductions or other milestones. Additionally, the mobile source-related air quality would need to be assessed, in relation to sensitive land uses, including public open spaces—including sidewalks, playgrounds, athletic fields, outdoor sports facilities, and public parks—residential buildings, educational facilities, and health facilities. A project-level conformity determination is required, which may include hot-spot air quality modeling. The air quality modeling would be necessary to determine the design alternatives that would lead to less exhaust emissions and would not have any adverse impacts to air quality.

Noise

Much of the proposed project is located on a viaduct and abutted by a numerous sensitive land uses, including residential uses and quiet park settings, such as the historic Jersey City and Harsimus Cemetery (see Cultural Resources mapping in Section 6 for the location of the Harsimus Cemetery.)

To analyze the design alternatives, noise monitoring should be performed at key representative noise-sensitive receptors to identify the most noise-sensitive areas to noise level increases based on current noise levels in the corridor. This information would be used to generate traffic noise impact screening contours to determine the distance to the location where traffic noise impacts are no longer predicted to occur. For each design alternative, affected noise-sensitive receptors will be identified and counted using the traffic noise impact screening contours to identify the design alternatives that would create greater noise levels and potential significant adverse noise impacts. In this way, design alternatives that would avoid and/or minimize encroachment of the highway closer to sensitive receptors can be determined.

In addition, construction for the proposed project would need to comply with the local noise ordinances of the Cities of Newark, Jersey City and Bayonne. Therefore, the general type of equipment for the design alternatives and its associated noise level would have to be assessed to determine which design alternatives would result in greater construction noise levels.

3.2.8. Hazardous Materials Screening

Purpose

The goal of screening for known hazardous materials is to determine whether construction of the project has the potential to expose construction personnel and the community to hazardous materials, including heavy metals, volatile compounds, water contaminants, and related materials presenting health safety risks and increased project costs. These contaminated materials are potentially present in soil, groundwater, sediment, or surface water. There are numerous regulations regarding these contaminants at the federal and state level. This summary will be used to determine if portions of the proposed project study area have to be avoided or remediated due to environmental concerns or restrictions identified in the review of available government databases.

Methodology and Scope of Screening

Data Sources

Data on known or potential contaminated sites was obtained from Envirosite Corporation and from NJDEP. An Envirosite Government Records Report was generated on 22 March 2017 for a one-mile buffer around the proposed alignment. The Envirosite report searched various government environmental databases for known or potential contaminated sites to identify sites within the buffer area. Additional environmental sites were obtained from NJDEP through the following Geographic Information System (GIS) layers: Known Contaminated Sites List (KCSL) (2016), Chromate Sites (2006), Deed Notice Area (2016), Classification Exception Area (CEA) (2016), and Historic Fill (2006). Data used in this screening was the most recent NJDEP GIS layers available.

Analysis Methodology

The Envirosite and NJDEP data was imported into ArcMap 10.3.1, a GIS mapping system, to visually present the data. The data was then refined to a 250 ft buffer of the proposed alignment to show sites that were most probable to be impacted by the proposed alignment. Surrounding parcels were screened to create a list of affected parcels that were also evaluated. A list of sites that fell within the buffer area and the affected parcels was created. The list developed through this evaluation was created based on a desktop-level reconnaissance of available government databases. This review did not include field reconnaissance or any additional site-specific government file reviews.

Findings and Implications

The industrial heritage of the project area has resulted in numerous known contaminated sites, ranging from leaking underground storage tanks to chromate contamination. The Envirosite databases identified 448 sites within the 250 ft buffer of the proposed alignment and the affected parcels. The NJDEP databases identified 30 KCSL sites, 10 Chromate sites, 18 Deed Notice Areas, and 10 CEAs within the area evaluated. Impacts to contaminated sites would be addressed through the NJDEP Linear Construction Project (LCP) program. The Authority would enroll the project as a LCP in accordance with the NJDEP Linear Construction Technical Guidance (dated January 2012) by assigning a Licensed Site Remediation Professional (LSRP) for the project. As per the LCP guidance, a person conducting a LCP project is not required to delineate or remediate contamination outside the limit of the excavation area within the linear construction corridor. However, remediation may be required if the Authority purchases any properties with known environmental issues as part of project construction. In addition, properties identified as having been remediated may be disturbed during construction. This circumstance would require coordination with the property owner or other responsible party regarding the proposed activity and potential for adverse effects on remediation measures and controls. To avoid delays in the project schedule, these environmental issues should be resolved before construction begins so that required permits are obtained, contaminated materials management practices are in-place, and other potential environmental issues are addressed.

3.2.9. Cultural Resources

Purpose

The goal of screening for cultural resources is to identify the presence of known resources in the project area that may be affected by the project. Impacts to cultural resources, which include archaeological and historic architectural resources, can take the form of direct physical action or contextual changes. Demolition of a resource in whole or part would be an example of a direct effect. A change in the setting of a resource, such as the introduction of a new, modern structure in the viewshed of an existing resource, is a contextual or indirect impact.

Depending on funding sources and sponsoring agencies, this project may require cultural resource review on both the state and federal levels. Section 106 of the National Historic Preservation Act of 1966, as amended, requires federal agencies to consider the effects of their actions on any properties listed on or determined eligible for listing on the National Register of Historic Places (NR). Properties listed on or eligible for the NR include archaeological resources and historic architectural resources. The National Environmental Policy Act (NEPA) also requires such consideration. To streamline the NEPA and Section 106 process, review and public outreach requirements under Section 106 can be conducted in coordination with analyses and the public outreach process conducted for NEPA. In addition, archaeological resources listed on or eligible for the NR, and that warrant preservation in place, are protected from adverse effects by Section 4(f) of the Department of Transportation Act of 1966.

The project may also require State-level Freshwater Wetlands (FW) (N.J.A.C. 7:7A) and/or Waterfront Development (WD) (N.J.S.A. 12:5-3) permits which necessitate consideration of the project's potential impacts on archaeological, historical, and architectural resources eligible for listing in the NR. Additionally, impacts to historic resources listed in the New Jersey Register of Historic Places (State Register or SR) would trigger review under the New Jersey Register of Historic Places Act (N.J.A.C. 7:4-7.1).

Cultural resources in New Jersey are regulated by the New Jersey Historic Preservation Office (NJHPO). Consistent with the above regulations, the analysis of project effects on archaeological and architectural resources will be conducted in coordination with the NJHPO and other consulting parties as part of the environmental review process. Cultural resources mitigation can be costly, requiring the mitigation of impacts on those resources for which the project has effects, the method of mitigation is typically determined in consultation between the project sponsor and the NJHPO.

Methodology and Scope of Screening

Data Sources

Cultural resource data was obtained from the NJHPO, the New Jersey State Museum (NJSM), the National Resource Conservation Service (NRCS), and master plans of the cities within which the project exists. For archaeological resources, the cultural resources screening included background research at the NJSM where archaeological site forms for registered archaeological sites within or adjacent to the project alignment were reviewed. For historic architectural resources, the cultural resources screening included background research at the NJHPO to identify properties that are listed in or eligible for the SR and NR. In addition, New Jersey Historic Bridge Survey forms were examined, the master plans for Jersey City, Newark, and Bayonne were reviewed for information on locally-identified historic sites (City of Bayonne 2000; City of Jersey City 2000; City of Newark 2012), and previously conducted local historic sites inventories for Bayonne, Newark, and Jersey City on file at the NJHPO were reviewed to identify surveyed properties.

Analysis Methodology

The cultural resources screening is divided into archaeological research and historic architectural research. The historic architectural research is divided into the description of NR listed and eligible properties, the description of New Jersey Historic Bridge and Roadway Surveys, and the description of master plans.

Archaeology

Maps available at the NJSM were utilized to identify known and registered archaeological sites within the project area. As locational data associated with known archaeological sites are sensitive, this information is listed in tabular form only and not included on the constraints maps.

Architectural

The development of the constraints maps for historic architectural resources presents desktop-level screening using data made available by the NJHPO for known architectural resources eligible for or listed in the SR or NR and data derived from the Historic Preservation elements of master plans for Newark, Bayonne, and Jersey City. The NJ Turnpike is not eligible for the NR and is not included in any of the constraints mapping.

Historic preservation master plan elements from the cities of Bayonne, Jersey City, and Newark were examined to determine if any locally identified resources are present. Locally identified resources do not have an NJHPO Opinion of Eligibility and are not listed on the SR or NR.

Findings and Implications

There are 110 listed or eligible individual historic properties, 10 historic districts, and 11 locally-identified resources in the study area buffer. The NBHCE itself is not identified as a historic resource, but the railroad rights-of-way that cross through the study area are.

It is likely that given the proximity of cultural resources to the existing NBHCE, some effect on cultural resources will occur as a result of the project. These impacts are likely unavoidable. The determination of the extent of the impact and potential mitigation depends on multiple factors ultimately dependent upon the horizontal and vertical alignment of the preferred alternative.

3.3. Utilities

A key consideration in the development and construction of any major infrastructure project are the existing utilities within and proximate to the project limits.

The following owners of utility infrastructure within and proximate to the study area were contacted with a request to provide information related to the location and type of infrastructure they owned:

- IMTT
- Colonial Pipeline Company
- Williams Gas Pipeline-Transco
- BP Marine Americas Inc.
- Buckeye Partners
- Spectra Energy
- PSE&G Gas
- PSE&G Electric - Bergen County
- PSE&G Electric - Passaic County
- Suez NJ
- City of Bayonne Water and Sewer
- City of Newark Water and Sewer Utilities
- Passaic Valley Water Commission
- Jersey City Municipal Utilities Authority
- Passaic Valley Sewerage Commission
- North Hudson Sewerage Authority
- Verizon
- Cablevision
- Spectrum (Formerly Time Warner Cable)
- Level 3
- Sprint
- Zayo Group (old MFN & First Telecom Services)
- Century Link
- AT&T Local
- AT&T Core

Information received from the utility owners as well as more detailed information extracted from as-built plans in the area and other sources was layered onto the aerial mapping to allow identification of locations to avoid in the development of infrastructure improvement concept alternatives.

In addition, during preliminary design, NJ TRANSIT will be included in coordination activities to identify potential impacts to their HBLR service, including traction power concerns, and to bus services.

3.4. Geotechnical Conditions

The project site is located in Hudson County New Jersey, specifically the southern to central portion including Bayonne and Jersey City. The general surface topography of the county includes extensive tidal marsh areas, many of which have been filled over the years, and a broad ridge running down the eastern portion of the county, which is part of the Palisades.

The site is located within the Piedmont Plateau Geographical Province. According to the Rutgers University Engineering Soil Survey Reports, the majority of the soils are mapped as man-placed fill over stratified drift, while the southern portion of the project includes glacial ground moraine over relatively shallow bedrock. The existing NBHCE traverses closely to the boundary between these two mapped soil types. The stratified drift material is primarily composed of sand with varying fractions of silt to gravel sized particles. These materials were deposited by waters flowing within or from the Wisconsin Glacier. In areas where the stratified drift abuts the area mapped as ground moraine, the ground moraine can be found below the drift materials. The ground moraine soil is an unstratified mix of clay to gravel size particles deposited during the Wisconsin glaciation, including occasional cobbles and boulders. Frequent pockets of silt can be expected.

With the proximity to the tidal marsh areas, additional strata of silt and clay should be expected, with layers of organics and peat material originating near the original historic ground surface, now filled and/or submerged. These layers tend to be very compressible and exhibit low shear strength.

Near the northern/eastern portion of the project site (Palisades Ridge), the underlying bedrock formations consist of red shale and diabase found at depths ranging from 10 to 40 ft. The western/southern portions of the project include diabase as the underlying rock formation. Diabase in this location can range from depths of 10 to 20 ft. In other sections of the project closer to the marsh areas bedrock was encounter from 60 to more than 100 ft deep.

Geology described above was confirmed during the review of several as-built construction contracts performed along the length of the NBHCE, dating from the 1950's to recent times. Starting with the main bridge over Newark Bay, there are many overpass bridge and viaduct structures along the length of the roadway. With the wide range of soil conditions and depths to bedrock, the foundation types for the structures vary accordingly. Spread footing foundations were utilized in areas with shallow competent soils and shallow bedrock. Deep foundations consisting of steel pipe and H-piles, and drilled shafts were to support structures in areas of deep soft, compressible soils. It could be anticipated that proposed structures would be founded on similar type foundation systems to accommodate the different soil conditions found throughout the project limits.

Logs of recent borings in close proximity to the project area are presented in Appendix C.

3.5. Newark Bay Bridge – Vertical and Horizontal Controls

There are numerous constraints that must be carefully considered when developing and advancing a preferred alternative to meet the overall goals and objectives of the project. Beyond initial construction costs and environmental impact considerations, three (3) key constraints exist that limit the physical space within which a replacement structure for the Newark Bay Bridge (Structure No. N2.01) may be constructed:

- Height limitations of 246 ft and 287 ft, respectively, imposed by the approach and departure surfaces mandated by the FAA for airplanes arriving and departing from Newark Liberty International Airport on Runway 29;
- Span Length requirements related to the minimum width of the maritime navigational channel mandated by the USACE;
- Minimum Vertical navigational channel clearance that must be maintained beneath the bridge as mandated by the USCG.

The first two constraints limit the feasible structural types that may be employed in the construction of the main spans of a replacement bridge, which in turn affects the NBHCE alignment in the vicinity of the channel crossing and the cost of construction and the ease / cost of future maintenance activities. The third constraint exacerbates the first constraint, further limiting the feasible structural types that may be employed.

These considerations invite the questions:

- Are there sufficient potential cost savings to warrant undertaking an effort to narrow the navigation channel width, thereby shortening the length of the main span over the bay and making other more cost effective structural types feasible?
- Is there sufficient potential cost savings to warrant undertaking an effort to reduce the vertical clearance beneath the bridge, thereby reducing the grades of the approach spans and reducing the cost of the bridge piers?

The following sections summarize the implications of these key constraints and their effect on feasible bridge types and associated costs.

3.5.1. Vertical Challenge – FAA Height Restrictions

A key constraint to constructing a replacement bridge relates to the FAA-defined Newark Liberty International Airport (EWR) aircraft departure and approach surfaces. These surfaces are designed to promote air safety and the efficient use of the navigable airspace. Due to the location of the Newark Bay Bridge, the surfaces defined for EWR Runway 29 are of critical concern.

1. The Departure Surface generally extends at a slope of 34:1 from a point 200 ft from the end of the runway. FAA seeks to keep the space below this surface clear of buildings, towers, etc. that pose a safety risk to departing aircraft.
2. The Approach Surface generally extends at a slope of 40:1 from a point 200 ft from the end of the runway. FAA seeks to keep the space below this surface clear of buildings, towers, etc. that pose a safety risk to arriving aircraft.

FAA is generally agreeable to granting waivers of the departure surface provided non-standard departure instructions are applied to the runway. However, approaching aircraft have less flexibility in adjusting their approach glide path. Therefore, it is imperative that any replacement bridge constructed does not penetrate the approach surface.

The FAA conducts aeronautical studies of proposed construction based on information provided by proponents of the construction. Requests for an aeronautical study addressing the planned bridge replacement were filed with the FAA (Form 7460-1, Notice of Proposed Construction or Alteration).

The studies determined that the No Exceed Height (NEH) at the existing eastern bridge pier is defined at 296 Above Mean Sea Level (AMSL). The NEH at the existing western bridge pier is defined at 265 AMSL. In summary, these represent the maximum heights of any structures placed as part of the Newark Bay Bridge replacement.

Copies of the formal findings of these studies are presented in Appendix D.

In addition to the FAA maximum height restrictions, the USCG dictates the minimum vertical navigation channel clearances needed to accommodate the passage of maritime vessels. The existing required vertical navigation channel clearance, which the existing bridge meets, is 135 ft above M.H.W. El 2.7 ft. Based upon a recent USCG determination for the Wittpenn Vertical Lift Bridge crossing the Hackensack River nearly 4 miles north of the Newark Bay Bridge, it is considered highly unlikely that the existing clearance beneath the Newark Bay Bridge can be reduced.

Figure 3.5.1: Newark Airport Surface Analysis Map

3.5.2. Horizontal Challenge – USACE Navigational Channel Restrictions

The USACE maintains the horizontal clearances within defined navigation channels required to accommodate the passage of maritime vehicles. The existing bridge maintains 550 ft of horizontal clearance for the navigation channel spanned by the 670 ft long main span of the bridge. Depending on the proximity of the new bridge to the existing, a main span of 670 ± ft will be required for the replacement bridge to meet the 550 ft clearance to accommodate pier protection (fender) systems. Main span lengths in excess of the 500 ± ft limit the types of bridges that can be considered economical to overhead type structures, i.e. structures supporting the deck from above, such as cable-stayed bridges, truss, and arch. Overhead type structures may exceed the FAA defined NEH of 265 ft, so the height of structure above the deck would have to be limited accordingly.

Spans shorter than 500 ± ft can be achieved economically with deck type structures, i.e. structures supporting the deck from below such as girder bridges. A minimum main span length of 475 ± ft will be required to accommodate a reduced navigation channel width of 400 ft. Girder bridges present no issue with the FAA height restrictions; however their deeper structural depth will likely require raising the vertical profile of the existing bridge in order to meet the USCG minimum vertical channel clearance of 135 ft.

A preliminary meeting was held on July 12, 2017 with the Harbor Operations Steering Committee to present an overview of the project and to engage their input on the likelihood that narrowing the navigation channel width beneath the bridge from 550 ft to approximately 300 ft would be permitted. The non-official feedback received from the Steering Committee was that a reduction to 300 ft would not be viewed favorably, but a lesser reduction to approximately 400 ft may be considered. The submission of a formal Navigational Study and permit application for a channel width modification will be required if a formal determination is desired.

The potential initial construction cost savings to the project for reducing the navigation channel needs to be weighed against the time and cost required to submit a full Navigational Study and a formal request for a narrowing of the channel. Based upon experience with other bridge design initiatives, the preparation of a full Navigational Study, acceptance by the USCG, and revision of existing legislation defining the channel width would be expected to take up to two years, assuming no significant issues arise with the study requiring multiple iterations and negotiations with the USCG. These activities could be accomplished within the project timeframe as a USCG and USACE permit is required even if replacing in kind.

4. TRAFFIC CONDITIONS AND NEEDS ASSESSMENT

4.1. Introduction

The purpose of this analysis is to identify roadway capacity deficiencies, assess roadway infrastructure needs, and test various alternatives that would address the needs of both passenger car traffic as well as commercial operations along the NBHCE. Advancing major capital improvement projects is a lengthy process requiring significant time and financial investment for planning studies, design, and construction. As a result of the future increase in traffic demand associated with the port operations and freight handling facilities along the Bayonne waterfront, the NJTA has already invested significant resources into the ongoing rehabilitation of the NBHCE bridges from Interchange 14 to 14A and Interchange 14C to Jersey Avenue to improve their structural condition as well as a major capacity upgrade to Interchange 14A.

As described in Chapter 2, congestion on the NBHCE is a source of driver frustration, exacerbated recently by the use of the NBHCE as an alternative eastbound route for access to Jersey City and New York City (via the Holland Tunnel) during the Pulaski Skyway project. Even when the Pulaski project ends, congestion will remain, and based on previous analysis conducted by NJTA and HNTB, the NBHCE, specifically on the Newark Bay Bridge, cannot geometrically or structurally accommodate a permanent third travel lane. The anticipated increase in commercial vehicular traffic and passenger vehicle traffic associated with redevelopments in Bayonne and Jersey City will place new travel/capacity demands on the entire length of the NBHCE mainline as well as interchanges associated with the NBHCE.

Given these challenges, the NJTA is seeking to identify potential alternatives that would accommodate future traffic demands and improve future traffic operations along the NBHCE. This chapter presents the analysis results for a 2045 No-Build Scenario (with existing geometry and configurations) as a baseline for developing and evaluating potential improvement alternatives. The 2045 horizon year was selected for development of future travel demand forecasts in consultation with the NJTA to be consistent with the North Jersey Regional Transportation Model Enhancement (NJRTME).

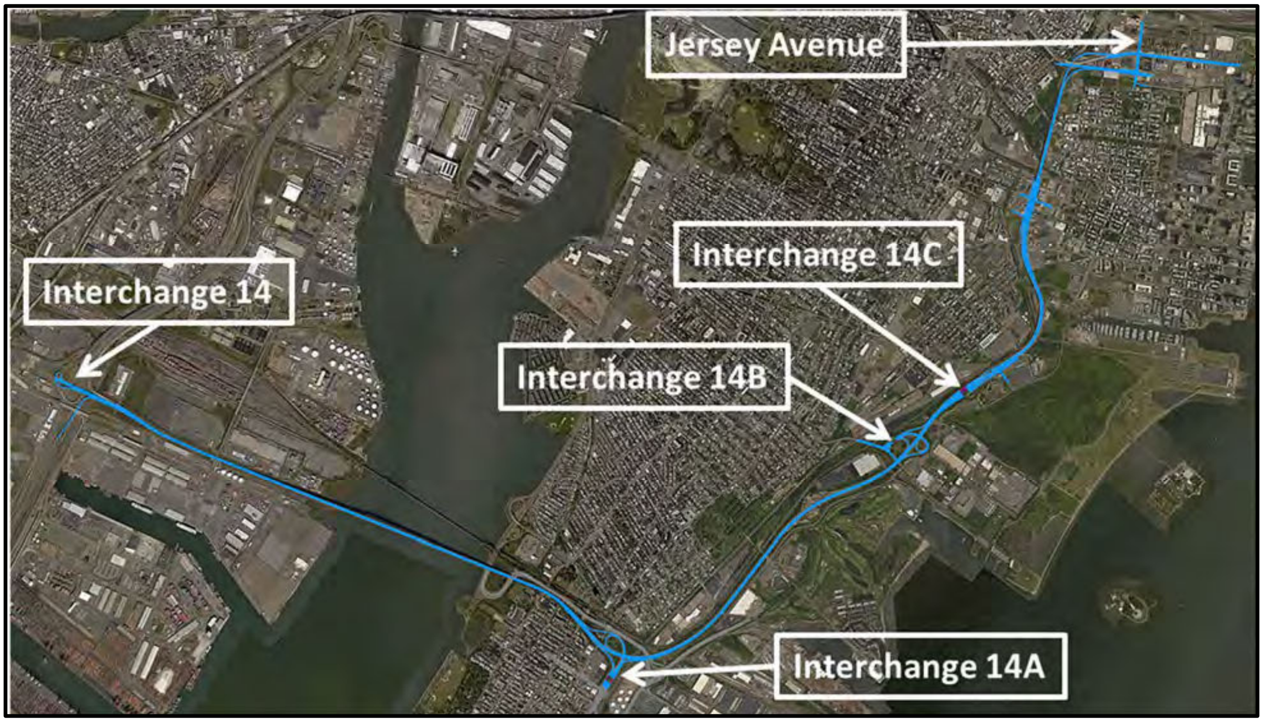
4.2. Traffic Study Area

This analysis focuses on the NBHCE from its western terminus at Interchange 14 to its eastern terminus at Jersey Avenue before the entrance to the Holland Tunnel. The study area primarily consists of the NBHCE mainline (Interstate 78), ramps (Interchanges 14, 14A, 14B, 14C), and the connection to the Holland Tunnel.

Interstate 78 connects to the New Jersey Turnpike mainline at Interchange 14 and continues east as the NBHCE crossing the Newark Bay Bridge, continuing to Jersey City and connecting to New York City via the Holland Tunnel. Within the study area, the NBHCE typically provides two travel lanes in each direction with full width right shoulders (no left shoulders). To accommodate traffic diversions resulting from the Pulaski Skyway rehabilitation project, the eastbound shoulder on the NBHCE has been temporarily converted into a third travel lane during the during peak hours (6-10 AM and 3-7 PM weekdays, and as needed for events or incidents for a total of five lanes (three eastbound, two westbound). This use of the NBHCE, which began in 2014, is anticipated to conclude in 2018. The posted speed limit along the NBHCE mainline is not consistent along the entire corridor, but is generally 50 mph. During the Pulaski construction period, the speed has been reduced to 45 mph during the AM peak hour and 50 mph during all other times[1].

Figure 4.2.1 depicts the traffic study area modeled for this analysis.

Figure 4.2.1: Traffic Study Area



For purposes of detailed operational analysis, the NBHCE was divided into five segments, each with its own unique geometric and travel demand characteristics. These analysis segments are described below.

[1] Note that the 45 mph speed limit is in effect only until the Pulaski Skyway opens and the additional shoulder lane is closed/converted back to a shoulder.

4.2.1. Traffic Analysis Segment 1 – Interchange 14

The first segment, depicted on Figure 4.2.2 begins at Interchange 14 and extends eastward along the NBHCE to Doremus Avenue. As previously mentioned, Interchange 14 is the western terminus of the NBHCE and the beginning of concurrency with I-78. Interchange 14 provides connections to I-78 west, US 1-9, US 22, and New Jersey Turnpike/I-95 as well as the Newark Airport, the City of Newark, and the surrounding areas. The toll plaza at Interchange 14 lies to the west of the New Jersey Turnpike/I-95 corridor.

Figure 4.2.2: Traffic Analysis Segment 1

4.2.2. Traffic Analysis Segment 2 – Interchange 14A

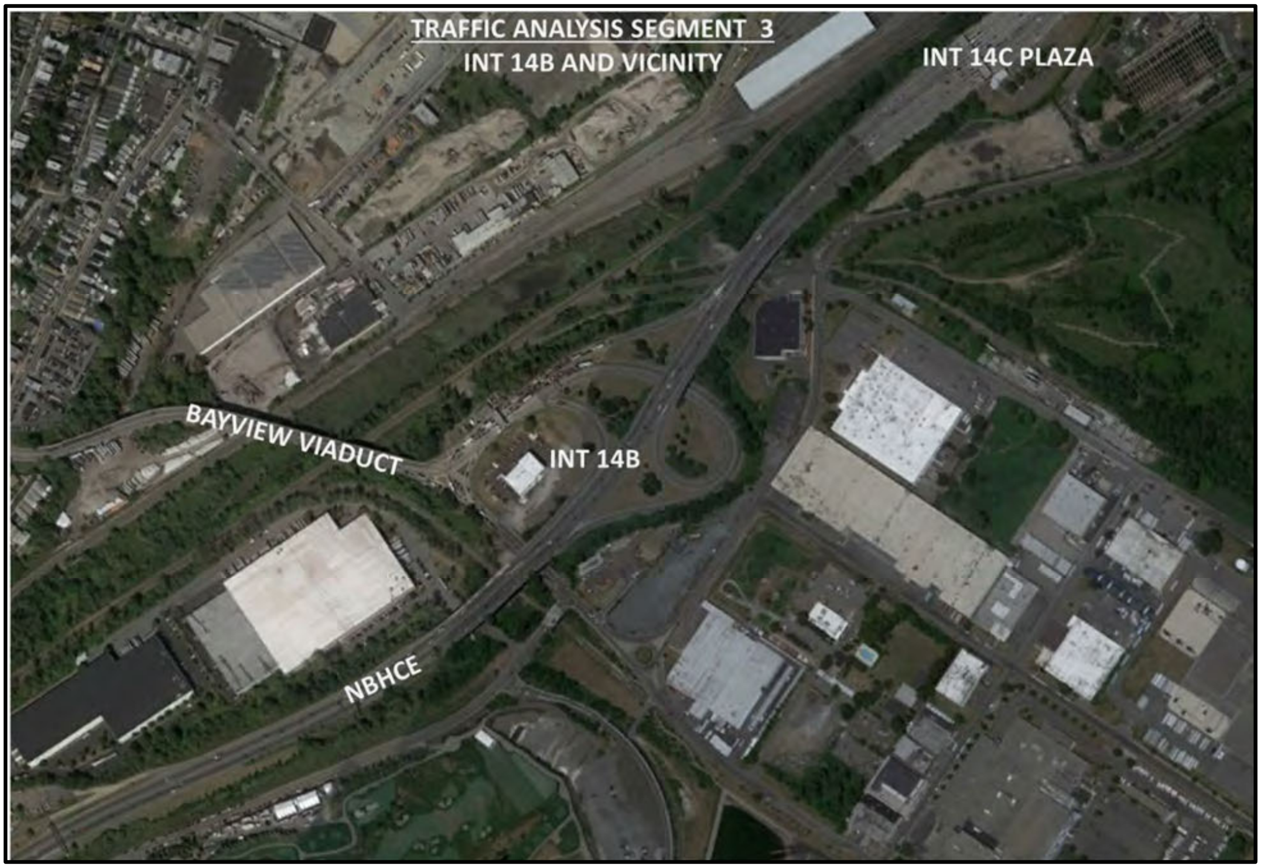
Segment 2, depicted on Figure 4.2.3 continues east of Segment 1, beginning at Doremus Avenue (just to the west of the Newark Bay Bridge) to Bayview Avenue (right before the beginning of Interchange 14B.) Interchange 14A connects NBHCE/I-78 to the City of Bayonne and Route 440. It also serves as a critical access point for the adjacent industrial and commercial areas, specifically the Global Container Terminal and the Peninsula at Bayonne Harbor. Currently, major improvements to Interchange 14A are under construction (anticipated to continue through 2018) which modify geometry (e.g. new roundabout) and provide new connections and ramps to Route 440 and Port Jersey Boulevard. The toll plaza at Interchange 14A lies to the south of the NBHCE. This segment also includes the Newark Bay Bridge, which carries the NBHCE over Newark Bay and connects the cities of Newark and Bayonne.

Figure 4.2.3: Traffic Analysis Segment 2

4.2.3. Traffic Analysis Segment 3 – Interchange 14B

The third segment, depicted on Figure 4.2.4 focuses primarily on Interchange 14B, beginning near Bayview Avenue just before Interchange 14B and continuing to just after Interchange 14B. The toll plaza at Interchange 14B lies to the west of the NBHCE and provides connections to Bayview Avenue, Liberty State Park, and Jersey City.

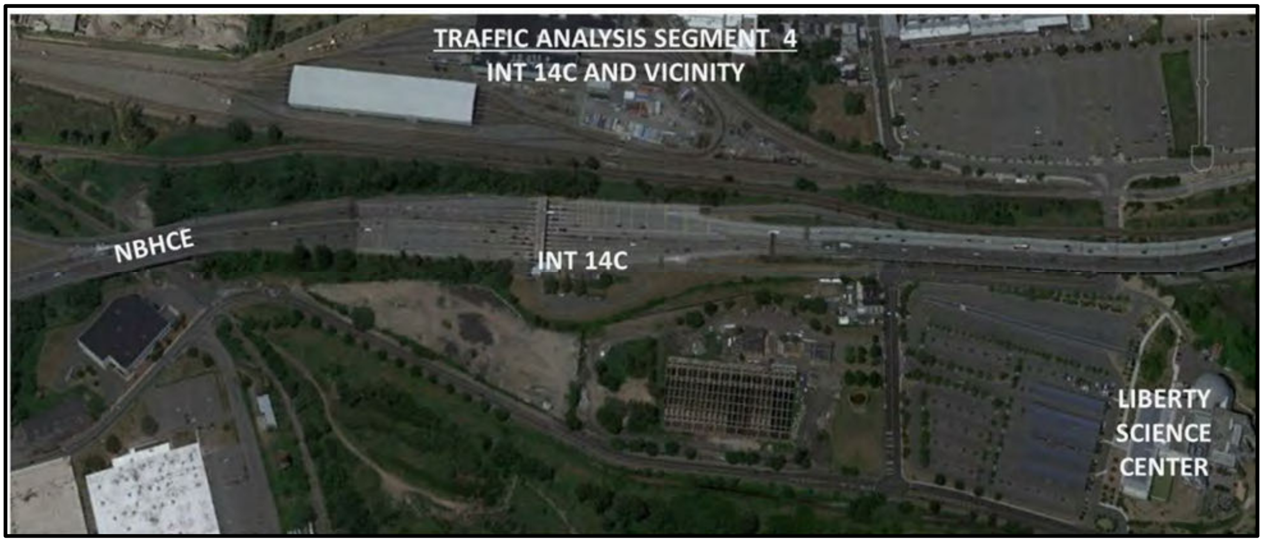
Figure 4.2.4: Traffic Analysis Segment 3



4.2.4. Traffic Analysis Segment 4 – Interchange 14C

Segment 4, depicted on Figure 4.2.5 focuses primarily on Interchange 14C and the toll plaza associated with Interchange 14C, beginning at the entrance and exit ramps for Interchange 14B and extending approximately to Jersey City Boulevard. This barrier toll plaza is located directly on the NBHCE mainline. Interchange 14C is the last toll plaza of the NBHCE and provides connections to the Liberty Science Center, Hudson-Bergen Light Rail Park and Ride, and Jersey City via ramps to and from Jersey City Boulevard immediately north (east) of the plaza.

Figure 4.2.5: Traffic Analysis Segment 4



4.2.5. Traffic Analysis Segment 5 – Interchange 14C to Jersey Avenue

Segment 5, depicted on Figure 4.2.6 begins near Jersey City Boulevard and extends to Jersey Avenue which serves as the eastern terminus of the NBHCE. This section of the NBHCE provides connections to Jersey City via Columbus Drive and New York City via the Holland Tunnel. There are no toll plazas within this segment of the study corridor.

Figure 4.2.6: Traffic Analysis Segment 5

4.3. Operations Analysis Methodology

As a tool for developing a detailed analysis of existing and future traffic operations and testing of alternative improvement concepts, a microsimulation model was developed utilizing VISSIM Version 8.00 software. This model utilized the NJTA Interchange 14A VISSIM model as a starting point. This model had been previously calibrated and vetted for use as a tool for evaluation of Interchange 14A improvement concepts. The portion of the NBHCE from Interchange 14 to Linden Avenue was extracted from the Interchange 14A model and expanded upon to include the remaining section of the NBHCE not covered within the Interchange 14A model, as well as connections to the local street network in Jersey City and the City of Bayonne.

4.3.1. Existing Traffic Data and Conditions

A variety of historical data sources were utilized in order to develop pre-Pulaski[2] existing traffic volumes. The temporary closure of the northbound Pulaski Skyway and use of the NBHCE as a detour route for traffic destined to Jersey City alters the regional traffic circulation patterns and volumes, rendering a more traditional process of using current ground counts to develop existing condition traffic volume networks infeasible. At the time of this analysis, reconstruction of the Pulaski Skyway was anticipated to be completed in the Spring of 2018. While every effort was made to replicate what existing traffic demand would be as if the Pulaski Skyway were fully operational, it is recommended that as an initial task in the next phase of project design, a comprehensive ground count program be conducted with the simulation model calibration validated and revised as necessary.

Data sets provided by the NJTA for expansion of the Interchange 14A model consisted primarily of 2014 toll transaction data. These data sets were supplemented by traffic volume data extracted from the Port Authority of NY & NJ's (PANYNJ's) Global Container Terminal Access Study to generate a comprehensive traffic volume network for the entire NBHCE. Existing condition traffic volumes utilized in this analysis are presented in Appendix E.

4.3.2. Model Development & Calibration

The traffic model was calibrated and adjusted in accordance with Federal Highway Administration (FHWA) guidelines for microsimulation modeling.

The basic components of the VISSIM model include the following:

- Network (number of lanes, lane width, type of facility, and desired speed)
- Controllers (signals, stop signs and yield signs)
- Traffic (composition and fleet)

The network and controller characteristics constitute the supply side of the equation whereas the traffic corresponds to the demand. In the case of this analysis, the NBHCE does not have typical controllers but instead the multiple lane drops and merge sequencings associated with the various ramps and toll plazas result in congestion, much like traditional controllers (traffic signals) cause on other corridors.

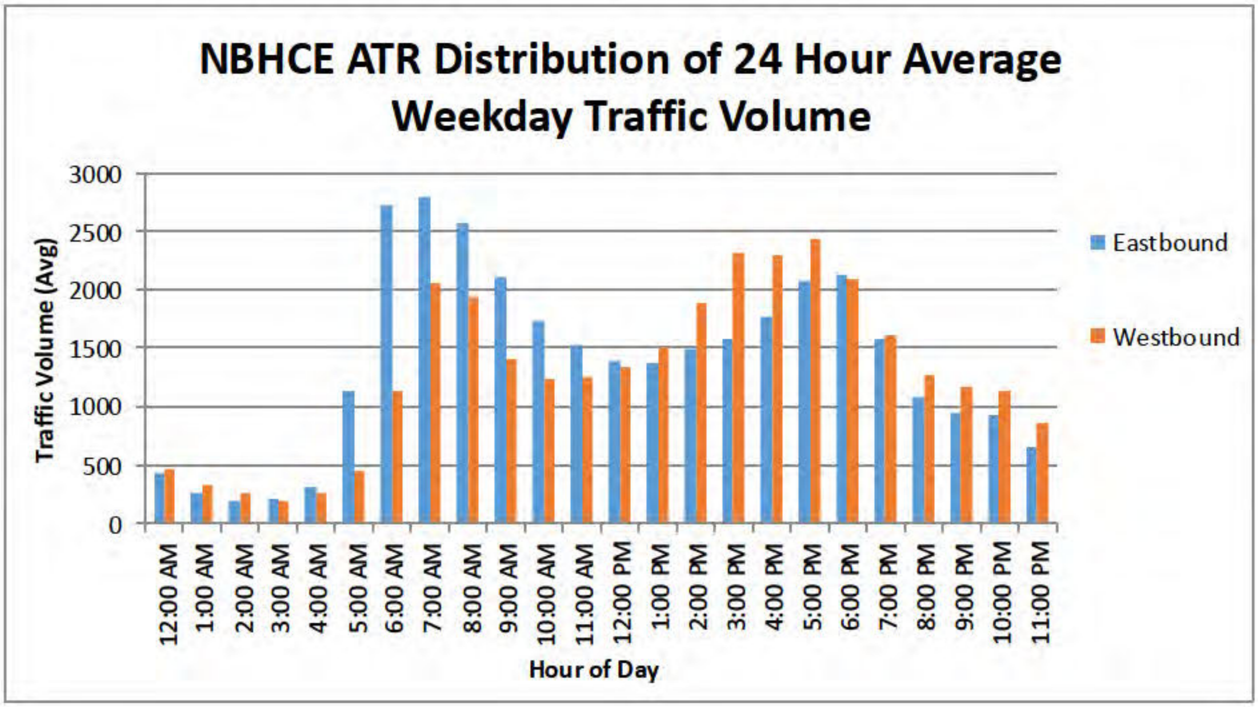
[2] "Pre-Pulaski" means existing traffic volumes prior to closure of the northbound Pulaski Skyway.

Traffic model inputs including items such as number of lanes, speed limits, intersection geometry, and permitted traffic movements were obtained primarily using satellite imagery of the study area, site visits, and previously identified models/studies.

Peak Analysis Periods

The calibration of the model was based upon both the weekday AM and PM peak hour travel demand. The peak hours selected for analysis were based on the temporal distribution of travel demand on the NBCHE between the eastbound ramp to Jersey City Boulevard and the eastbound ramp to Columbus Drive. Figure 4.3.1 depicts the typical hourly volumes in both the eastbound and westbound directions over a 24-hour weekday period. As shown, peak travel demand occurs during the 7:00 to 8:00 AM and 5:00 to 6:00 PM hours.

Figure 4.3.1 Temporal Distribution of Traffic



Speeds

In VISSIM, a vehicle's desired speed—or the speed at which a vehicle travels unhindered by other vehicles—is stochastically assigned based upon a defined distribution. Desired speed distributions can be defined by vehicle type and a variety of speed conditions. Each vehicle type within the vehicle composition is assigned a desired speed distribution. In general, the posted speed limit along the NBHCE mainline is 50 mph with the exception of the eastbound direction which has a speed limit of 45 mph during the AM peak period.

Based on the posted speed limits, the desired speed distributions generated in VISSIM are shown in Table 4.3.1 AM and PM Speed Distributions

Table 4.3.1 AM and PM Speed Distributions

Speed Distribution	Speed Zone	Min	Max	15%	85%
1	25 mph	20	35	25	30
2	30 mph	25	40	30	35
2	35 mph	30	45	35	40
3	40 mph	35	50	40	45
4	45 mph	40	55	45	50
5	50 mph	45	60	50	55
6	55 mph	50	65	55	60
7	60 mph	55	70	60	65

Desired speed distributions can be assigned to two network objects: desired speed decisions and reduced speed areas. Reduced speed areas are used to model sections with a temporary change in speeds (e.g., curves, turns, reduced speed zones). When encountering a reduced speed area, each vehicle begins to decelerate in advance to reach the lower desired speed as it enters the defined area. After leaving the reduced speed area, the vehicle returns to its actual desired speed. The reduced speed areas coded in the model correspond to merges and approaches to toll plazas. Reduced speed areas vary depending on the vehicle type, roadway geometry and turn movement.

Traffic

In VISSIM, vehicles are categorized by vehicle types which share common vehicle performance attributes. These attributes include model type, minimum and maximum acceleration, minimum and maximum deceleration, weight, power, and length. With the exception of model type and length, all other attributes are controlled by user-defined probabilistic distributions.

Two main vehicle types were used for the purpose of this model: cars and trucks. The vehicle composition (total cars and total trucks [Heavy Goods Vehicles]) was determined based upon the classification counts at all the entry locations within the study area and distributed based on several sources including: the Interchange 14A model, data from NJTA toll plazas, and data from traffic studies for developments in the cities adjacent to the NBHCE.

The following Table 4.3.2 details the truck/heavy vehicle percentages originating from each of the entry points/input locations.

Table 4.3.2 Peak Period Volumes and Truck Percentages

Segment	Veh. Type	Existing				Future				Delta			
		AM		PM		AM		PM		AM		PM	
		EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
Interchange 14	Sm. Veh.	3146	3047	3143	4063	4013	3973	3958	5664	867	926	815	1601
	Trucks	326	271	203	286	513	343	254	346	187	72	51	60
	HV%	9%	8%	6%	7%	11%	8%	6%	6%	18%	7%	6%	4%
Interchange 14A	Sm. Veh.	2892	2175	2070	3780	3850	2764	2803	4924	958	589	733	1144
	Trucks	169	107	143	80	289	149	187	116	120	42	44	36
	HV%	6%	5%	6%	2%	7%	5%	6%	2%	11%	7%	6%	3%
Interchange 14B	Sm. Veh.	2875	2208	2024	3845	3836	2787	2749	4806	961	579	725	961
	Trucks	161	119	135	83	277	157	182	111	116	38	47	28
	HV%	5%	5%	6%	2%	7%	5%	6%	2%	11%	6%	6%	3%
Interchange 14C	Sm. Veh.	2418	2175	1980	3672	3222	2736	2707	4535	804	561	727	863
	Trucks	132	119	132	80	228	155	182	104	96	36	50	24
	HV%	5%	5%	6%	2%	7%	5%	6%	2%	11%	6%	6%	3%
Interchange 14C to Jersey Ave	Sm. Veh.	1148	1623	1408	2637	1575	2041	1777	3208	427	418	369	571
	Trucks	66	106	89	47	104	132	122	64	38	26	33	17
	HV%	5%	6%	6%	2%	6%	6%	6%	2%	8%	6%	8%	3%

Calibration

Based on traffic data established in the study area, vehicle inputs are placed at the model's entry links. These vehicle inputs are used to generate vehicles that are then routed appropriately through the network by means of the routing decisions.

The routing decisions feature assigns vehicles to different routes using percentages or on actual volumes which VISSIM calculates stochastically to distribute the volume to individual routes. Once a vehicle completes a given route (i.e., it clears the mainline, ramp or an intersection), another routing decision - if required - creates further paths. This process is repeated until the vehicle leaves the network.

For this study, the calibrated VISSIM simulation models were developed for both AM and PM peak hours. To start extracting useful quantitative information (performance measures) from the model, the network should be preloaded with vehicles to avoid biasing the results with a semi-empty network. Therefore, an additional period was included to account for the initial 15 minute interval to the actual simulation period. In the same way, for the PM peak hour, an additional 15 minute interval period was included. These additional periods are commonly known as warm-up, seeding or shoulder periods.

During this iterative process, model parameters affecting driving behavior were fine-tuned in order to replicate the traffic volumes and travel times measured in the field. When necessary, the default car-following and lane-change behavior parameters were adjusted to calibrate the model. In order to associate external influences on the corridor that interfere with traffic flow, reduced speed areas were used to regulate vehicle movement. A model is considered reasonably calibrated when it is able to reproduce the field observed traffic conditions within the criteria and measures provided by the Federal Highway Administration (FHWA).

To ensure satisfactory calibration of the model is achieved, standards were used to establish targets regarding traffic flows and travel times. The targets of this calibration effort were set at the values included in Traffic Analysis Toolbox Volume III – Guidelines for Applying Traffic Microsimulation Modeling Software published by the FHWA shown in Table 4.3.3.

Table 4.3.3: Guidelines for Applying Traffic Microsimulation Modeling Software

Criteria & Measures	Calibration Acceptance Targets
Hourly Flows, Model Versus Observed	
Individual Link Flows	
Within 15%, for 700 veh/h < Flow < 2,700 veh/h	> 85% of cases
Within 100 veh/h for Flow < 700 veh/h	> 85% of cases
Within 400 veh/h for Flow > 2,700 veh/h	> 85% of cases
Sum of All Link Flows	Within 5% of all link counts
GEH Statistic < 5 for Individual Link Flows	> 85% of cases
GEH Statistic for Sum of All Link Flows	GEH < 4 for sum of all link counts
Travel Times, Model Versus Observed	
Journey Times, Network	
Within 15% (or 1 minute, if higher)	> 85% of cases
Visual Audits	
Individual Link Speeds	
Visually Acceptable Speed-Flow Relationship	To Analyst's Satisfaction
Bottlenecks	
Visually Acceptable Queuing	To Analyst's Satisfaction

Most of the criteria included in Table 4.3.3 are self-explanatory, with the possible exception of the GEH Statistic. This measure is a formula used in traffic modeling to compare two sets of traffic volumes (Observed and Modeled). While its mathematical formulation is similar to the Chi-Square test, it is not a true statistical test, but rather an empirical formula. The formulation for the GEH Statistic is as follows:

$$GEH = \sqrt{\frac{2 * (M - O)^2}{(M + O)}}$$

Where M represents model estimate volume and O represents field counts.

The GEH calibration/validation statistics calculated for the model are identified below. These statistics exceed the acceptable GEH threshold for all peak periods.

- AM Peak – 97%
- PM Peak – 98%

Volume Calibration

As mentioned previously, a variety of historical data sources were utilized to synthesize the existing volume network. The data was reviewed for reasonableness and any identified outliers were discarded. The comparative traffic data was averaged and balanced at each of the 5 analysis segments along the corridor in the eastbound and westbound direction to develop a final set of existing traffic volumes for the AM and PM peak hours.

Travel Time Calibration

The average travel times calculated from field data were utilized in the calibration process to compare actual travel times to those observed in the model. Actual travel times for the study corridor were compiled from a series of travel time runs driven on different roadway segments along the study corridor during both peak periods. The collected travel time data was used to develop average travel times which were referenced during the model calibration process.

The field-collected travel time data was post processed and the study corridor was divided as follows:

1. EB – Interchange 14 to Interchange 14A
2. WB – Interchange 14A to Interchange 14

During a given run, VISSIM can evaluate average travel times, if travel time “sections” have been defined in the network and selected as part of the evaluation files. For this model, starts and destinations (i.e., the travel time sections) were coded consistently with the beginning and end of the field travel time runs performed as part of the data collection effort. VISSIM determines the average travel time (including waiting or dwell times) that it takes a vehicle to cross the first (start) and second (destination) travel time bar. Travel times were collected in VISSIM for the peak hour (3,600 seconds) from 15 minutes (900 seconds within the simulation were counted as warm-up time) until the end of the run.

As with the other performance measures, the travel time results from VISSIM were successively compared with field collected data during the calibration process. The comparison was conducted using an average of three multiple runs with different random seeds. The model parameters were adjusted, as necessary, through several iterations until the model travel times were within 15% (or one minute, if higher) of the observed (field collected) travel time for more than 85% of the cases.

Number of Runs

As a standard practice and for this study corridor, the output results during both the AM and PM peak hours were extracted after the model ran for three multiple simulation runs as per FHWA guidelines. Any differences, discrepancies, or suspicious outlying results are therefore due purely to randomness in the data and not systemic errors.

Given the findings, the VISSIM analysis results from the three multiple simulation runs are sufficiently robust to be comparable with those collected in the field. As a result, the VISSIM microsimulation models for the study corridor are reasonably calibrated and provide a testing tool based on the gathered data to compare multimodal options and their impacts to the study corridor. The calibrated AM and PM peak period models satisfy all of the volume and travel time calibration thresholds and appear to reasonably reproduce real-world traffic conditions.

4.3.3. Measures of Effectiveness

VISSIM Version 8 microsimulation platform utilizes Measures of Effectiveness (MOEs) to quantify relative performance between conditions and scenarios. MOEs considered in this analysis include the following:

- Travel Time
- Average Speed
- Delay
- Demand Volume (DV)
- Processed Volume (PV)
- Difference between DV and PV

Processed traffic volume is considered a good measure of relative performance between scenarios as it shows the amount of traffic processed through the model compared to the actual traffic demand. The difference between processed traffic volumes and traffic demand could be attributed to traffic conditions that would either prevent vehicles from entering or leaving the model such as roadway congestion, queuing, heavy delays, etc.

4.4. Existing Condition Operational Analysis

The above listed MOEs for key origin / destination pairs were extracted from the calibrated existing conditions model as a baseline for comparing future operations and identification of points of congestion and inefficient operation to be addressed in the development of alternative improvement concepts. This extraction was performed for each of the NBHCE Traffic Analysis Segments described in Section 4.2.

4.4.1. Traffic Analysis Segment 1 – Interchange 14

As previously stated, heavy congestion and queuing is presently experienced at the I-95 ramps (Ramps NH and SH) to the eastbound NBHCE. Segment 1 under the Existing Scenario experiences moderate to heavy levels of congestion during the weekday AM and PM peak hours primarily caused by the merging of the NJTP/I-95 northbound ramp (Ramp SH) onto the eastbound NBHCE. Ramp SH is currently a two-lane segment that merges down to one-lane before entering the eastbound Mainline. This lane reduction results in heavy queuing along Ramp SH which regularly spills back onto the NJTP/I-95 northbound mainline, particularly during the AM peak hour.

Figure 4.4.1 illustrates the congestion along the NBHCE Mainline. As a result of the merge, 218 vehicles during the weekday AM peak period are unable to enter the VISSIM model at the NJTP/I-95 northbound entrance onto the NBHCE Mainline. The average speed is significantly lower than the posted speed limit in the eastbound direction during the AM peak hour for this segment. The low processed volume in the westbound direction can be attributed to the vehicles not progressing efficiently in the model downstream of Segment 1. The results are summarized in Table 4.4.1 and Table 4.4.2.

Figure 4.4.1: 2015 Existing Segment 1 Congestion – AM Peak

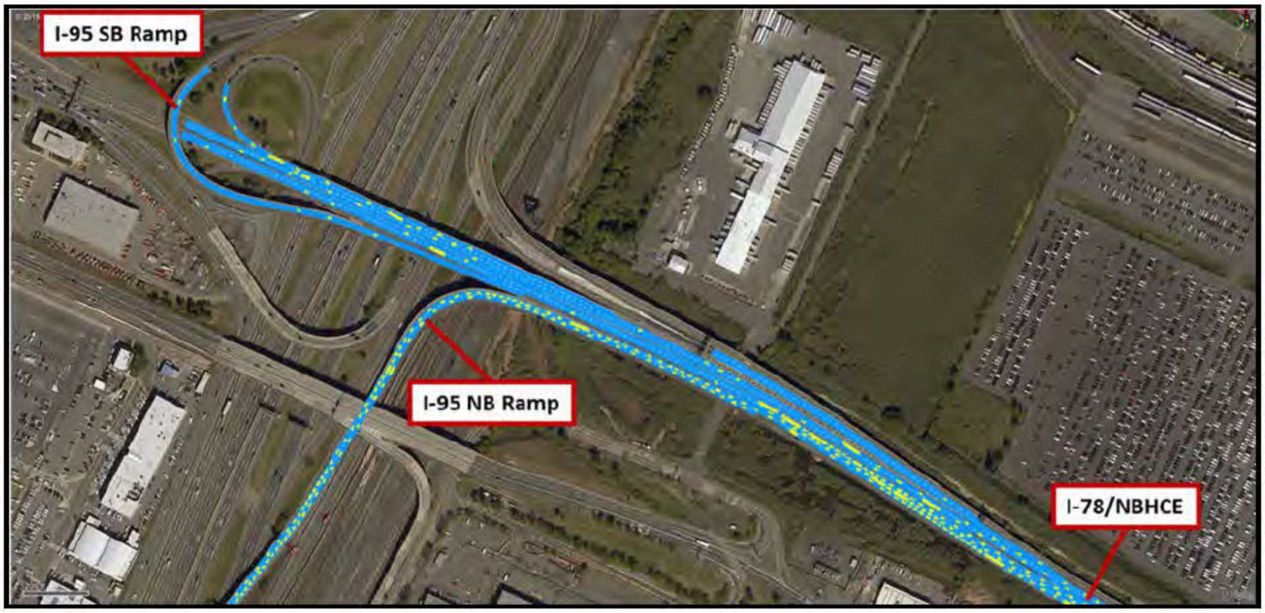


Table 4.4.1: AM Peak Period - 2015 Existing Scenario MOEs at Segment 1

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	104	30	36	1194	1166	28
I-95 SB-78 EB	125	28	46	472	460	12
I-95 NB-78 EB	214	17	134	1922	1704	218
78 WB-78 WB	65	47	5	1731	1664	67
78 WB-I-95 NB	42	48	3	476	469	7
78 WB-I-95 SB	70	47	6	1196	1131	65

Table 4.4.2: PM Peak Period - 2015 Existing Scenario MOEs at Segment 1

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	63	50	3	1997	1980	17
I-95 SB-78 EB	103	34	27	382	376	6
I-95 NB-78 EB	64	44	3	958	931	27
78 WB-78 WB	66	47	6	2554	2388	166
78 WB-I-95 NB	43	48	3	590	559	31
78 WB-I-95 SB	71	46	8	1493	1361	132

4.4.2. Traffic Analysis Segment 2 – Interchange 14A

Congestion is routinely experienced on the Interchange 14A westbound entrance ramp (Ramp TW). Segment 2 analysis focuses on Interchange 14A which connects the NBHCE Mainline to the City of Bayonne and Route 440. The congestion issues throughout this segment primarily stem from traffic on the ramps to and from the west, much of which may be attributed to heavy trucks traveling to and from the Global Marine Terminal. As a result, 126 vehicles in the weekday AM peak period and 101 vehicles in the weekday PM peak period are unable to merge onto NBHCE WB Mainline at the Interchange 14A westbound on-ramp. Congestion on Segment 2 is shown on Figure 4.4.2 and the results are summarized in Table 4.4.3 and Table 4.4.4 below.

Figure 4.4.2: 2015 Existing Segment 2 Congestion – PM Peak

Table 4.4.3: AM Peak Period - 2015 Existing Scenario MOEs at Segment 2

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	376	40	85	2675	2291	384
78 EB-14A Toll Plaza	270	33	71	913	821	92
78 WB-78 WB	478	31	118	2020	1738	282
78 WB-14A Toll Plaza	309	25	79	284	260	24
14A Toll Plaza-78 WB	272	34	59	1382	1256	126
14A Toll Plaza-78 EB	164	40	22	535	481	54

Table 4.4.4: PM Peak Period – 2015 Existing Scenario MOEs at Segment 2

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	317	47	25	1932	1746	186
78 EB-14A Toll Plaza	246	37	63	1405	1291	114
78 WB-78 WB	444	34	145	3508	2970	538
78 WB-14A Toll Plaza	269	29	86	575	504	71
14A Toll Plaza-78 WB	265	35	59	1129	1028	101
14A Toll Plaza-78 EB	148	44	7	318	285	33

4.4.3. Traffic Analysis Segment 3 – Interchange 14B

Segment 3 focuses on Interchange 14B which provides connections to Bayview Avenue, Liberty State Park, and Jersey City. This segment experiences minor congestion on the NBHCE WB entrance ramp (Ramp TW) at Interchange 14B. The average delay on this ramp is 55 seconds per vehicle during the weekday PM peak hour. The heavy traffic volume along westbound NBHCE constraining the ability of vehicles to merge from the ramp is the primary cause of this delay. The congestion on the NBHCE in the westbound direction is shown on Figure 4.4.3. Segment 3 analysis results are summarized in Table 4.4.5 and Table 4.4.6 below.

Figure 4.4.3: 2015 Existing Segment 3 Congestion – PM Peak

Table 4.4.5: AM Peak Period - 2015 Existing Scenario MOEs at Segment 3

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	42	48	3	3022	2826	196
78 EB-14B Toll Plaza	37	51	0	188	179	9
78 WB-78 WB	61	26	18	2106	2060	46
78 WB-14B Toll Plaza	28	31	5	230	227	3
14B Toll Plaza-78 EB	80	26	3	190	185	5
14B Toll Plaza-78 WB	64	18	22	198	198	0

Table 4.4.6: PM Peak Period - 2015 Existing Scenario MOEs at Segment 3

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	41	49	2	2054	1990	64
78 EB-14B Toll Plaza	66	29	3	197	194	3
78 WB-78 WB	41	39	10	3811	3713	98
78 WB-14B Toll Plaza	29	30	2	181	174	7
14B Toll Plaza-78 EB	78	27	3	140	140	0
14B Toll Plaza-78 WB	91	13	55	272	263	9

4.4.4. Traffic Analysis Segment 4 – Interchange 14C

Congestion is routinely experienced on the westbound approach to the Interchange 14C toll plaza, particularly during the PM peak period. During the AM peak period, the congestion in the eastbound direction emanates from a point downstream of the Interchange 14C Toll Plaza. While Figure 4.4.4 depicts minimal queuing in the eastbound direction, the model results are skewed by the downstream bottleneck effect described above.

During the weekday PM peak hour, vehicles traveling in the westbound direction entering the Interchange 14C Toll Plaza experience moderate queuing as illustrated in Figure 4.4.4. As a result, 86 vehicles during the weekday PM peak period are unable to process though the Interchange 14C Toll Plaza in the westbound direction. Segment 4 results are summarized in Table 4.4.7 and Table 4.4.8 below.

Figure 4.4.4: 2015 Existing Segment 4 Congestion – PM Peak

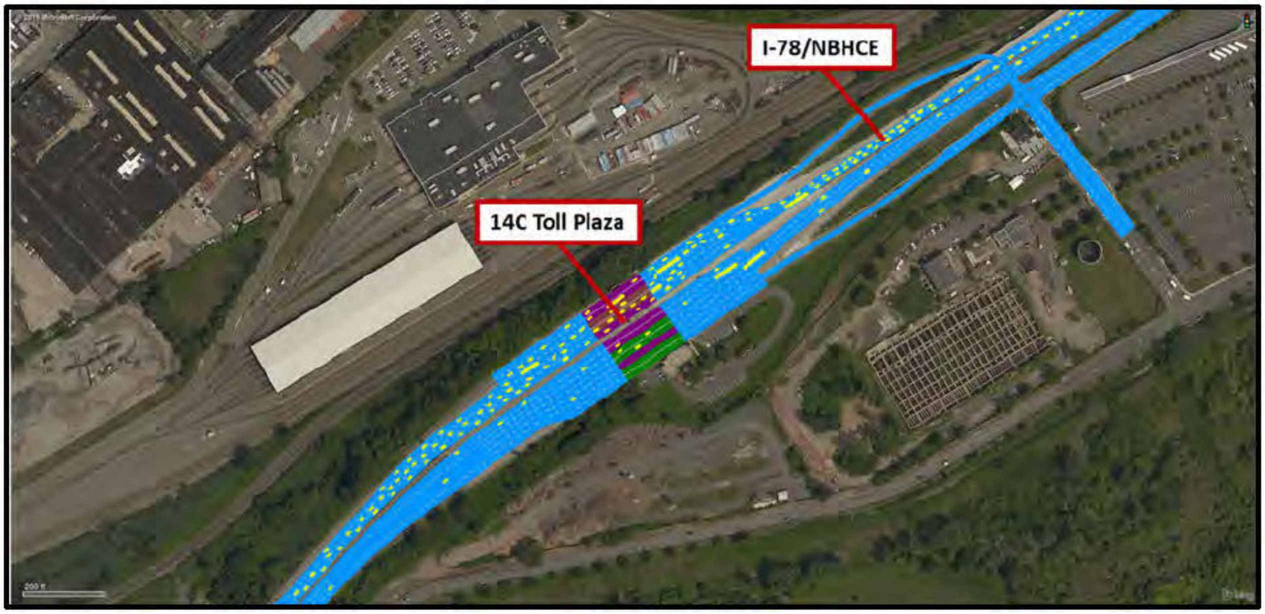


Table 4.4.7: AM Peak Period - 2015 Existing Scenario MOEs at Segment 4

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	38	42	6	2675	2526	149
78 EB-Jersey City Blvd	34	32	12	538	484	54
78 WB-78 WB	60	26	18	2293	2257	36
Jersey City Blvd-78 WB	72	25	3	43	39	4

Table 4.4.8: PM Peak Period - 2015 Existing Scenario MOEs at Segment 4

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	51	31	6	2153	2082	71
78 EB-Jersey City Blvd	45	23	6	41	43	-2
78 WB-78 WB	58	26	14	3764	3678	86
Jersey City Blvd-78 WB	81	23	9	229	218	11

4.4.5. Traffic Analysis Segment 5 – Interchange 14C to Jersey Avenue

Congestion is routinely experienced during the PM peak period on the Columbus Drive entrance ramp to the westbound NBHCE. During the AM and PM peak periods, Segment 5 experiences heavy congestion in the eastbound direction due to the signalized intersection of the NBHCE EB and Jersey Avenue, aggravated by additional vehicle queuing at the Holland Tunnel approach plaza. The average delay on NBHCE EB is 199 and 134 seconds per vehicle during the weekday AM and PM peak hours, respectively.

During the weekday PM peak hour, minor queueing occurs on the NBHCE WB on-ramp starting from Merseles Street as a result of the merging of the westbound on-ramp onto NBHCE WB. A delay of 20 seconds per vehicle occurs on the NBHCE WB on-ramp beginning from Merseles Street during the weekday PM peak hour and is shown on Figure 4.4.5. Segment 5 results are summarized in Table 4.4.9 and Table 4.4.10 below.

Figure 4.4.5: 2015 Existing Segment 5 Congestion – PM Peak

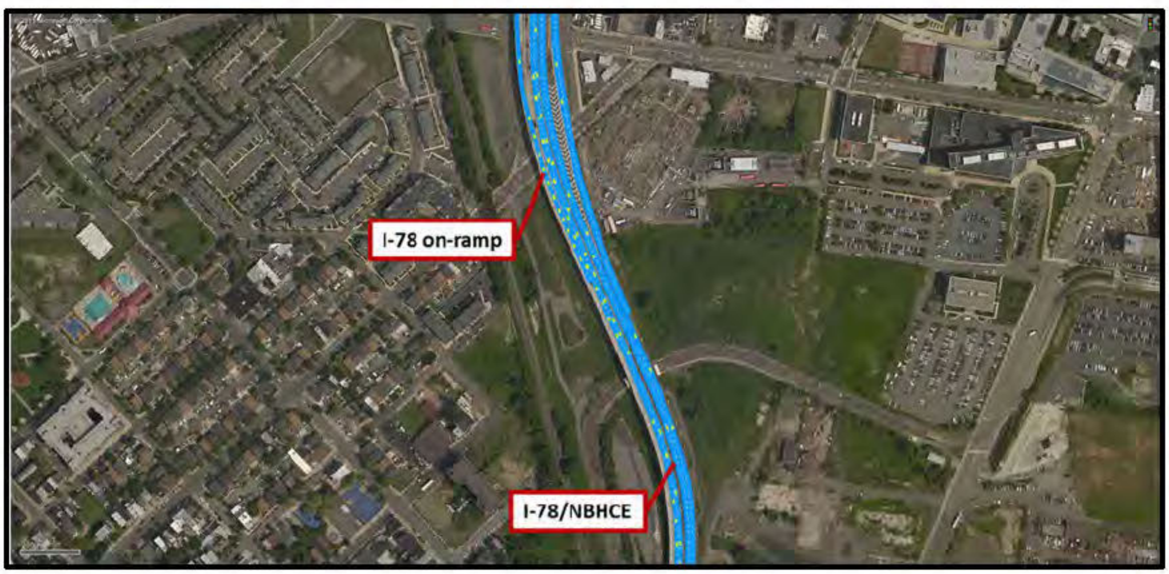


Table 4.4.9: AM Peak Period - 2015 Existing Scenario MOEs at Segment 5

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-12th Street	343	20	199	1280	1055	225
78 EB-Columbus Dr	91	33	29	1394	1290	104
14th Street-78 WB	244	29	78	1738	1607	131
Merseles St-78 WB	98	25	9	555	533	22

Table 4.4.10: PM Peak Period - 2015 Existing Scenario MOEs at Segment 5

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-12th Street	274	25	134	1516	1358	158
78 EB-Columbus Dr	90	34	6	637	602	35
14th Street-78 WB	156	46	14	2695	2569	126
Merseles St-78 WB	71	35	20	1069	1051	18

4.5. 2045 No-Build Scenario

The 2045 No-Build Scenario reflects future traffic operations along the NBHCE in the year 2045 with future traffic volumes projected to be generated primarily by land development in Jersey City and the City of Bayonne, as well as growth in activity at the Global Marine Terminal. Traffic operational analysis under this scenario served to identify locations along the corridor where vehicle capacity improvements are needed.

In order to determine future traffic operations, proposed/approved new developments adjacent to the project area and existing infrastructure improvements, such as improvements at Interchange 14A were accounted for in the 2045 No-Build Traffic Model Scenario. In addition, an annual growth rate was applied to the existing volumes.

4.5.1. No-Build Traffic Volume Forecast

Forecasting of the future 2045 traffic volumes incorporated the following factors and assumptions:

- Annual growth rate of 1% per year for the first 5 years (from 2015 to 2020), and a 0.5% for the remaining 5 years was applied to the Global Container Terminal existing network volumes to forecast traffic to year 2025, consistent with the annual growth rate utilized in the Global Container Terminal Access Study for the PANYNJ. An annual growth rate of 0.8% per year was then applied to forecast volumes from 2025 to build year 2045, consistent with the Jersey City Master Plan's anticipate growth rate for the area.

- Completion of all Interchange 14A improvements.

- Growth attributed to new development in the local Bayonne area (along NJ Route 440). These developments included a commercial and retail mixed-use facility at The Peninsula at Bayonne Harbor (former Military Ocean Terminal at Bayonne), Port Jersey Peninsula (Global Container Terminal), and additional developments in the Constable Hook area and south along the Route 440 corridor.

It is important to note that the background growth from the redevelopment of Global Container Terminal may be overly conservative due to the implementation of PANYNJ's future appointment system which would meter truck traffic into and out of the terminal by assigning specific travel windows for trucks. The system, which would significantly decrease the number of AM and PM peak hour trips, was not included in this analysis so that a worst-case scenario (conservative assessment) could be modeled. Future 2045 Traffic Volumes are presented in Appendix E.

4.5.2. No-Build Traffic Operations

Generally, traffic operations along the NBHCE are expected to experience increased delays in the 2045 No-Build Scenario due to the projected increase in traffic compared to the 2015 Existing Scenario. Results of the modeling analysis clearly indicate that without additional travel lanes and improvements to ramp merge configurations, the existing NBHCE will be unable to accommodate future travel demand, with increased congestion and delays for all vehicles traveling on the corridor. Improvements such as merge sequencing at on-/off-ramps, an increase in the number of lanes, and the implementation of high-speed E-ZPass lanes at the Interchange 14C Toll Plaza along the NBHCE could mitigate these inefficient traffic operational conditions in the future.

Traffic Analysis Segment 1 – Interchange 14

Similar to the Existing Scenario, the merging of the NJTP/I-95 northbound ramp (Ramp SH) onto the NBHCE EB in Segment 1 will continue to be a source of congestion and delay under 2045 conditions during the weekday AM and PM peak hours. The 2045 No-Build Scenario analysis indicates congestion and queuing will also occur on the NJTP/I-95 southbound ramp (Ramp NOH) onto the NBHCE EB. The anticipated future traffic volumes exceed the capacity along NBHCE EB two-lane roadway resulting in congestion and queuing along the NBHCE Mainline.

As a result of the congestion along the NBHCE Mainline, 1,065 vehicles during the weekday AM peak period and 326 vehicles during the weekday PM peak period are unable to enter the VISSIM model at the NJTP/I-95 northbound merge onto the NBHCE Mainline. Moreover, 200 vehicles during the weekday AM peak period and 484 vehicles during the weekday PM peak period are unable to enter the model at the NJTP/I-95 southbound merge onto the NBHCE Mainline. Additionally, the low processed volume in the westbound direction can be attributed to the vehicles not progressing efficiently in the model downstream of Segment 1 due to future traffic volumes exceeding the roadway capacity. The results are summarized in Table 4.5.1 and Table 4.5.2.

Table 4.5.1: AM Peak Period - 2045 No-Build Scenario MOEs at Segment 1

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	422	8	346	1508	1049	459
I-95 SB-78 EB	646	6	529	596	396	200
I-95 NB-78 EB	342	8	276	2430	1365	1065
78 WB-78 WB	69	48	5	2322	1934	388
78 WB-I-95 NB	51	48	4	661	540	121
78 WB-I-95 SB	78	43	9	1661	1375	286

Table 4.5.2: PM Peak Period - 2045 No-Build Scenario MOEs at Segment 1

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	163	20	99	2102	2011	91
I-95 SB-78 EB	1388	3	1179	603	119	484
I-95 NB-78 EB	292	10	224	1513	1187	326
78 WB-78 WB	71	47	6	3361	2245	1116
78 WB-I-95 NB	50	49	3	840	557	283
78 WB-I-95 SB	79	43	10	2124	1408	716

Traffic Analysis Segment 2 – Interchange 14A

The congestion and queuing identified in the existing condition analysis on the NBHCE to westbound entrance ramp (Ramp TW) at Interchange 14A is projected to continue and worsen under the 2045 conditions. The projected future traffic volumes will exceed the carrying capacity along the westbound NBHCE. The average delay for vehicles traveling from the Interchange 14A toll plaza towards the westbound NBHCE WB is projected to be 237 and 205 seconds per vehicle during the weekday AM and PM peak hours, respectively. As a result of the congestion, the average travel speed is projected to be significantly less than the posted speed limit. The low processed NBHCE mainline volume in the eastbound and westbound directions can be attributed to the vehicles not progressing efficiently in the model upstream and downstream of Segment 1. Segment 2 results are summarized in Table 4.5.3 and Table 4.5.4 below.

Table 4.5.3: AM Peak Period - 2045 No-Build Scenario MOEs at Segment 2

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	413	36	120	3380	1946	1434
78 EB-14A Toll Plaza	316	28	125	1154	749	405
78 WB-78 WB	343	44	52	2553	2320	233
78 WB-14A Toll Plaza	186	42	12	359	331	28
14A Toll Plaza-78 WB	443	21	237	2034	1261	773
14A Toll Plaza-78 EB	158	41	22	903	592	311

Table 4.5.4: PM Peak Period - 2045No-Build Scenario MOEs at Segment 2

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	394	38	101	2442	1558	884
78 EB-14A Toll Plaza	293	30	108	1778	1575	203
78 WB-78 WB	699	21	371	4433	2455	1978
78 WB-14A Toll Plaza	410	19	218	727	426	301
14A Toll Plaza-78 WB	406	23	205	1893	1359	534
14A Toll Plaza-78 EB	151	43	14	655	495	160

Traffic Analysis Segment 3 – Interchange 14B

Under the 2045 No-Build Scenario, Segment 3 is expected to experience congestion throughout with the exception of the NBHCE WB entrance ramp (Ramp TW) at Interchange 14B during the weekday PM peak hour. The delay on this ramp is projected to average 52 seconds per vehicle during the weekday PM peak hour. Future operational analysis results for Segment 3 are summarized in Table 4.5.5 and Table 4.5.6 below.

Table 4.5.5: AM Peak Period - 2045 No-Build Scenario MOEs at Segment 3

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	43	47	4	4044	2601	1443
78 EB-14B Toll Plaza	67	28	4	239	176	63
78 WB-78 WB	33	49	2	2661	2616	45
78 WB-14B Toll Plaza	28	31	3	306	305	1
14B Toll Plaza-78 EB	79	27	4	242	235	7
14B Toll Plaza-78 WB	53	22	17	251	251	0

Table 4.5.6: PM Peak Period - 2045 No-Build Scenario MOEs at Segment 3

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	41	49	2	2846	2069	777
78 EB-14B Toll Plaza	66	29	4	250	183	67
78 WB-78 WB	85	19	52	4815	3150	1665
78 WB-14B Toll Plaza	29	29	2	230	158	72
14B Toll Plaza-78 EB	78	27	3	178	178	0
14B Toll Plaza-78 WB	85	14	52	345	335	10

Traffic Analysis Segment 4 – Interchange 14C

Similar to the operations under existing conditions, the bottleneck condition downstream of the Interchange 14C Toll Plaza in the eastbound direction continues to result in skewed model results under the 2045 No-Build Scenario.

Significant queuing is projected to occur for vehicles traveling in the westbound direction entering the Interchange 14C Toll Plaza during the weekday PM peak hour similar to the 2015 Existing Scenario. The anticipated future traffic volumes exceed the Interchange 14C Toll Plaza capacity in the westbound direction, resulting in an average delay of 90 seconds per vehicle during the weekday PM peak hour. Additionally, only 64%of the projected demand volume would be processed during the PM peak hour due to the NBHCE WB queue. Segment 4 operational analysis results are summarized in Table 4.5.7 and Table 4.5.8 below.

Table 4.5.7: AM Peak Period - 2045 No-Build Scenario MOEs at Segment 4

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	56	29	13	3602	2393	1209
78 EB-Jersey City Blvd	42	23	9	684	447	237
78 WB-78 WB	54	29	11	2913	2843	70
Jersey City Blvd-78 WB	74	25	4	54	51	3

Table 4.5.8: PM Peak Period - 2045 No-Build Scenario MOEs at Segment 4

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	54	30	10	2972	2207	765
78 EB-Jersey City Blvd	39	25	5	52	37	15
78 WB-78 WB	134	11	90	4754	3043	1711
Jersey City Blvd-78 WB	141	13	69	291	269	22

Traffic Analysis Segment 5 – Interchange 14C to Jersey Avenue

In the future, Segment 5 will continue to experience significant congestion in the eastbound direction due to the signalized intersection of the NBHCE EB and Jersey Avenue, exacerbated by the queuing at the approach to the Holland Tunnel. The average delay on NBHCE EB is projected to reach 430 and 323 seconds per vehicle during the weekday AM and PM peak hours, respectively. During the weekday PM peak hour, queueing occurs on the NBHCE WB on-ramp starting from Merseles Street as a result of the backup from the Interchange 14C Toll Plaza approach. The model projects that 561 of the total demand volume could not be processed as the demand volumes exceed the handling capacity of the roadway, resulting in a an average delay of 135 seconds per vehicle along the NBHCE WB on-ramp beginning from Merseles Street during the weekday PM peak hour. Segment 5 operational analysis results are summarized in Table 4.5.9 and Table 4.5.10 below.

Table 4.5.9: AM Peak Period - 2045 AM No-Build Scenario MOEs at Segment 5

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-12th Street	590	12	430	1831	940	891
78 EB-Columbus Dr	94	32	11	1771	1173	598
14th Street-78 WB	151	47	9	2208	2073	135
Merseles St-78 WB	59	41	10	705	705	0

Table 4.5.10: PM Peak Period - 2045 PM No-Build Scenario MOEs at Segment 5

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-12th Street	475	14	323	2163	1380	783
78 EB-Columbus Dr	88	35	5	809	593	216
14th Street-78 WB	538	13	373	3396	2187	1209
Merseles St-78 WB	188	13	135	1358	797	561

5. ALTERNATIVES

5.1. Newark Bay Bridge – Feasible Bridge Types vs. Channel Width

The various constraints described in Section 3 informed the evaluation of bridge types and served as input to the order-of-magnitude initial construction costs for the bridge types considered. The evaluation was based on the following assumptions:

1. Existing arch is at El 263 ft, occurring at the midpoint of the channel span, and located approximately 9,530 ft from the ground point of the Newark Liberty International Airport (200 ft from the end of Runway 29).
2. Findings of the FAA Aeronautical Studies (Chapter 3 and Appendix D) defined a structural "No Exceed Height" of 265 ft at the existing western pier of the main span and 295 ft at the existing eastern pier of the main span.
3. Mean High Water (MHW) = El 2.7 ft (from as-built drawings).
4. Allowing for a potential 100-year Sea Level Rise (SLR) of 2.1 ft results in Design MHW El 4.8 ft.
5. A vertical clearance of 135 ft above the Design MHW is to be maintained.
6. The westernmost main river pier will be critical point in elevation if a cable-stayed or extradosed bridge is considered.
7. The midpoint of the channel span will be critical point in elevation if truss, arch or girder bridges are considered.

Key details related to alternate structure types and span lengths are summarized in Table 5.1.1. Sketches and narratives describing the bridge type options follow the table.

Table 5.1.1 Alternative Bridge Types

Bridge Type and Main Span Length	FAA Surfaces Penetrated?			Cost ($M)		
	Max Structure Height (ft)	No Exceed Height ("NEH") (ft)	Penetration Above NEH (ft)	Construction	Demolition	Maintenance Needs
670-ft Span Length						
Cable Stayed - Twin Bridges	295.2	265	-30.2	$735	$105	Moderate
Reduced Tower Height Cable Stayed - Twin Bridges	265	265	0	$745	$105	Moderate
Network Arch - Twin Bridges *	273	280	7	$712	$105	Moderate
475-ft Span Length						
Extradosed Concrete - Twin Bridges	210.8	265	54.2	$695	$105	Lower
Precast Segmental Box Girder - Twin Bridges	163.8	265	101.2	$664	$105	Lower
Haunched Steel I-Girder - Twin Bridges	159.8	265	105.2	$624	$105	Lower

* NEH Measured at center of span for network arch structure
(red) Not Feasible - Penetrates FAA Defined Approach Surface
(green) Feasible - No FAA Surface Penetration

Construction costs shown in Table 5.1.1 were developed based upon the following assumptions:

1. Full replacement of existing bridge and approach spans with twin bridges, each carrying four travel lanes in each direction and full width inside and outside shoulders.
2. Total length of Newark Bay Structure = 9,600 ft measured from abutment to abutment (Existing Bridge Nos. N2.01W, N2.01, and N2.01E).
3. The first bridge will be constructed off-line, immediately adjacent the existing bridge. Traffic to be shifted to the newly-constructed bridge, with the existing bridge demolished and the twin bridge constructed on-line.
4. For cable-stayed, arch, and haunched I-girder estimates, approach spans are comprised of steel plate girders and the low level approach spans of prestressed concrete girders.
5. For extradosed and precast segmental box girder, approach spans are comprised of precast segmental box girders built using the span by span method of construction.
6. Bridges will be designed for a minimum 100-year service life.
7. Estimates are limited to structural cost only.
8. Estimates are based on 2017 Dollars.

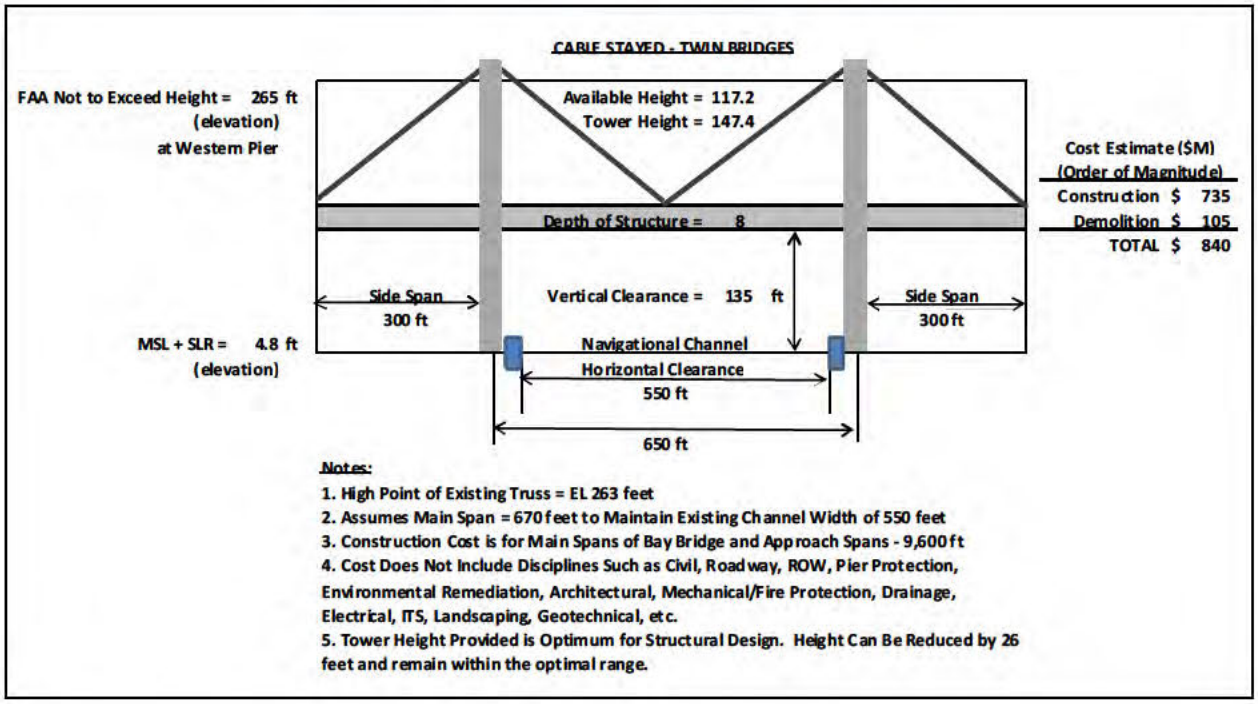
Although each of the bridge types discussed above will be designed for a 100-year service life, there are several anticipated maintenance items associated with each. These anticipated maintenance items and their approximate maintenance intervals include the following:

1. Cast-in-place deck slab (at 35 and 70 years).
2. Deck wearing surface (at 30, 60, and 90 years).
3. Paint metallized steel at expansion joints (at 75 years).
4. Bearings (at 40 and 80 years).

5. Expansion joints (at 25, 50 and 75 years).
6. Bridge barriers (at 60 years).
7. Drainage system (at 60 years).
8. Mechanical/electrical (at 25, 50 and 75 years).
9. Stay-cables (at 75 years), hanger cables (at 50 years).

5.1.1. Alternatives Maintaining the Existing 550 Ft Navigational Channel Width

Figure 5.1.1: Long Span Alternative – Cable Stayed



This option considers a three-span steel composite cable-stayed bridge for the main span over the Newark Bay, flanked by steel plate girders and prestressed concrete girders for the high level and low level approach spans respectively. The cable-stayed bridge would utilize a streamlined, lightweight steel grillage comprised of longitudinal edge girders with transverse floorbeams made composite with precast concrete deck panels. The cable-stayed bridge would be built by balanced cantilever. Several cable-stayed bridges have been constructed in the NY/NJ area over the last few years so there is good local experience and the size of project would likely attract national contractors.

The optimal tower height for a cable-stayed bridge is in the range of 20% to 22% of the main span length. Assuming tower height of 22% of the main span length, the FAA-defined approach surface would be penetrated by approximately 16 ft. The height of the east tower above the deck would be designed to match the height of the west tower. While the FAA-defined departure surface would be violated even with reduced height towers, there is a strong potential that FAA would grant a waiver as the tower heights will still be below the maximum height of the existing bridge. A key consideration in the granting of a waiver is the fact that the tower is near the outer edge of the FAA-defined surface limits (9,200 ft of the 10,000 ft outer surface edge).

The superstructure for cable-stayed bridges is considered a non-replaceable component and as such it must be designed for a minimum service life that corresponds to the specified service life of the bridge, i.e. 100 years. Replaceable components such as cables, bearings, expansion joints, etc. are designed for a reduced service life.

The Designer of these types of structures is typically required to provide along with the Bridge Design Criteria document a detailed Corrosion Protection Plan that details the selection of materials, design details and all other necessary provisions for achieving the specified service life.

Advantages include:

- Would accommodate the existing 550 ft navigation channel width
- Efficient use of structural steel
- High degree of redundancy as bridge will be designed to sustain the loss of any cable without failure of the bridge
- Lightweight superstructure resulting in reduced foundation costs
- Visually appealing

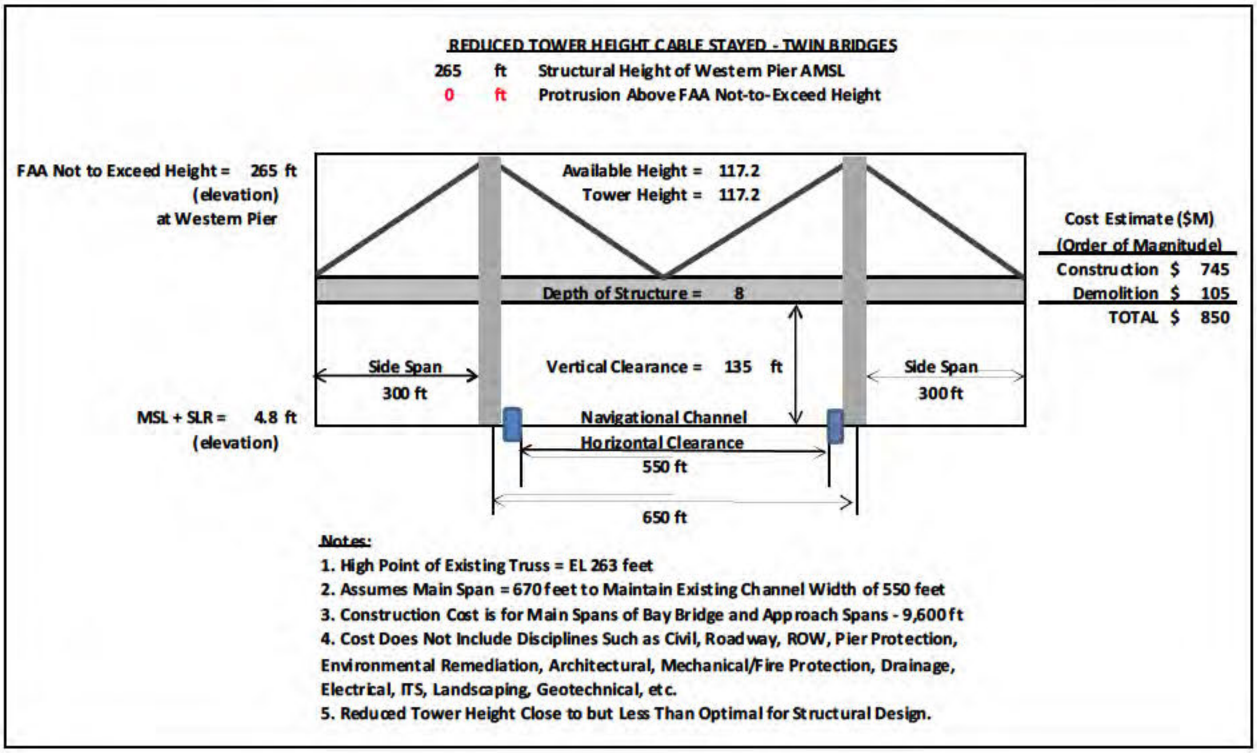
Disadvantages Include:

- High initial cost
- Moderate maintenance costs
- Longer construction duration
- Deck is not readily replaceable. A 2 inch pavement overlay must be replaced every 25 to 30 years.

Inspectability:

A full length catwalk can be incorporated on the underside of bridge providing access to inspect floorbeams and interior faces of edge girders. Inspection of exterior faces of edge girders may be accomplished using a snooper truck. The exterior faces of the towers above the deck and stay-cables can be inspected via man-lift or snooper truck working from deck level. The inspection can also be performed by climbers rappelling down the towers or cables using assisted free climbing equipment. Typically, major bridge design includes preparation of detailed inspection procedures as part of a project specific Inspection and Maintenance Manual.

Figure 5.1.2: Long Span Alternative – Modified Cable Stayed

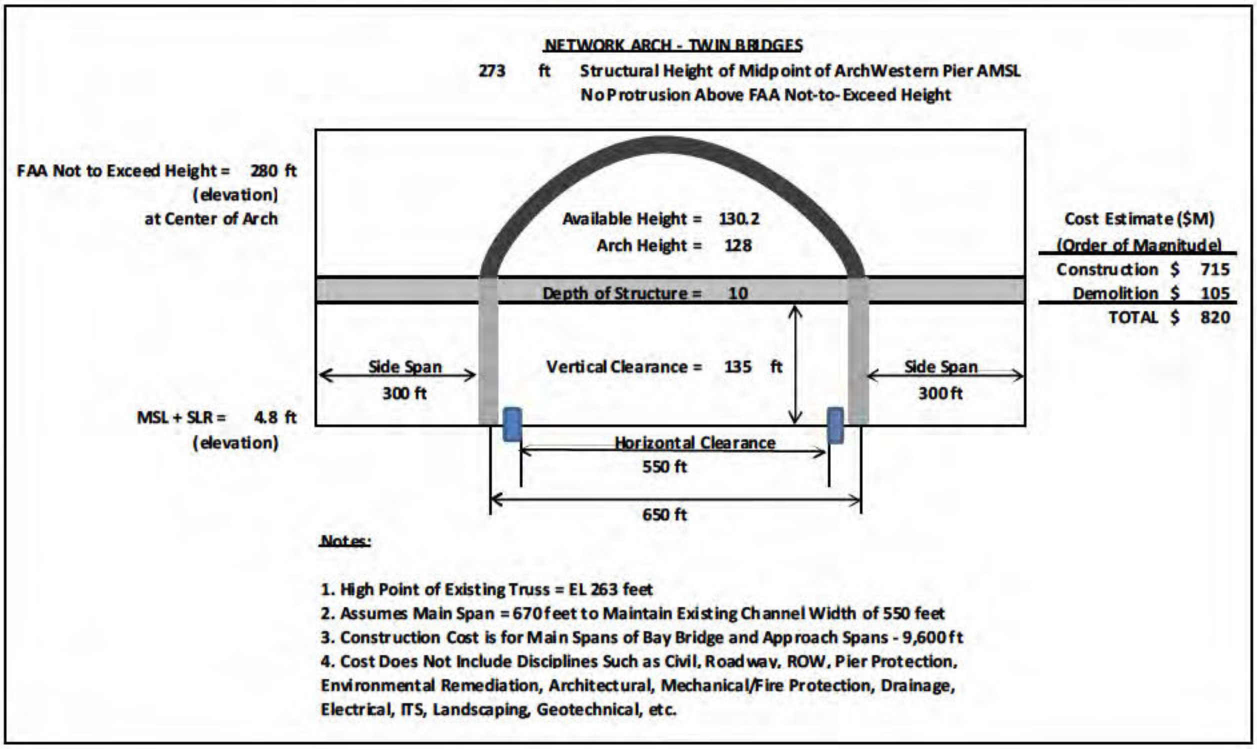


The reduced tower height cable-stayed option would avoid penetration of the FAA-defined approach surface by reducing the height of the western pier tower by approximately 17 ft. The ratio of tower height to span length would be in the range of 19.5%, which is very close to the optimal range of 20% to 22%. Accordingly, there would be minimal increase in the construction cost for the reduced height alternative. While not strictly required, it is assumed the height of the eastern pier tower would be similarly reduced for purposes of symmetry. While the FAA-defined departure surface would be violated even with reduced height towers, there is a strong potential that FAA would grant a waiver. A key consideration in the granting of a waiver is the fact that the tower is near the outer edge of the FAA-defined surface limits (9,200 ft of the 10,000 ft outer surface edge).

As with the taller tower option, the superstructure for reduced height cable-stayed bridges is considered a non-replaceable component and as such it must be designed for a minimum service life that corresponds to the specified service life of the bridge, i.e. 100 years. Replaceable components such as cables, bearings, expansion joints, etc. are designed for a reduced service life.

The advantages and disadvantages of a modified cable stayed bridge are generally identical to those of a standard cable stayed bridge, with the exception of construction cost and duration. A cable stayed bridge with tower heights that are less than optimal would require additional costs in the design and construction of the cabling and associated support members.

Figure 5.1.3 Long Span Alternative – Network Arch



This option considers a main channel simple span tied arch with a network hanger cable arrangement and internally redundant box tie girders supporting a composite precast deck. Hangers are stay-cables for replaceability and corrosion protection. HPS steel would be utilized for tie girders and arch ribs. Steel plate girders and prestressed concrete girders would be utilized in the high level and low level approach spans respectively.

A network steel tied arch bridge would not violate the critical FAA-defined approach surface, but it would extend approximately 22 ft above the FAA-defined departure surface. As with the cable-stayed structure tower height, there is a strong potential that FAA would grant a waiver. A key consideration in the granting of a waiver is the fact that the center of the arch would be near the outer edge of the FAA-defined surface limits (9,530 ft of the 10,000 ft outer surface edge).

Advantages Include:

- Enhanced redundancy and safety
- Replaceable deck
- Accommodates the existing 550 ft navigation channel width
- Visually appealing

Disadvantages Include:

- High initial cost
- Moderate construction duration

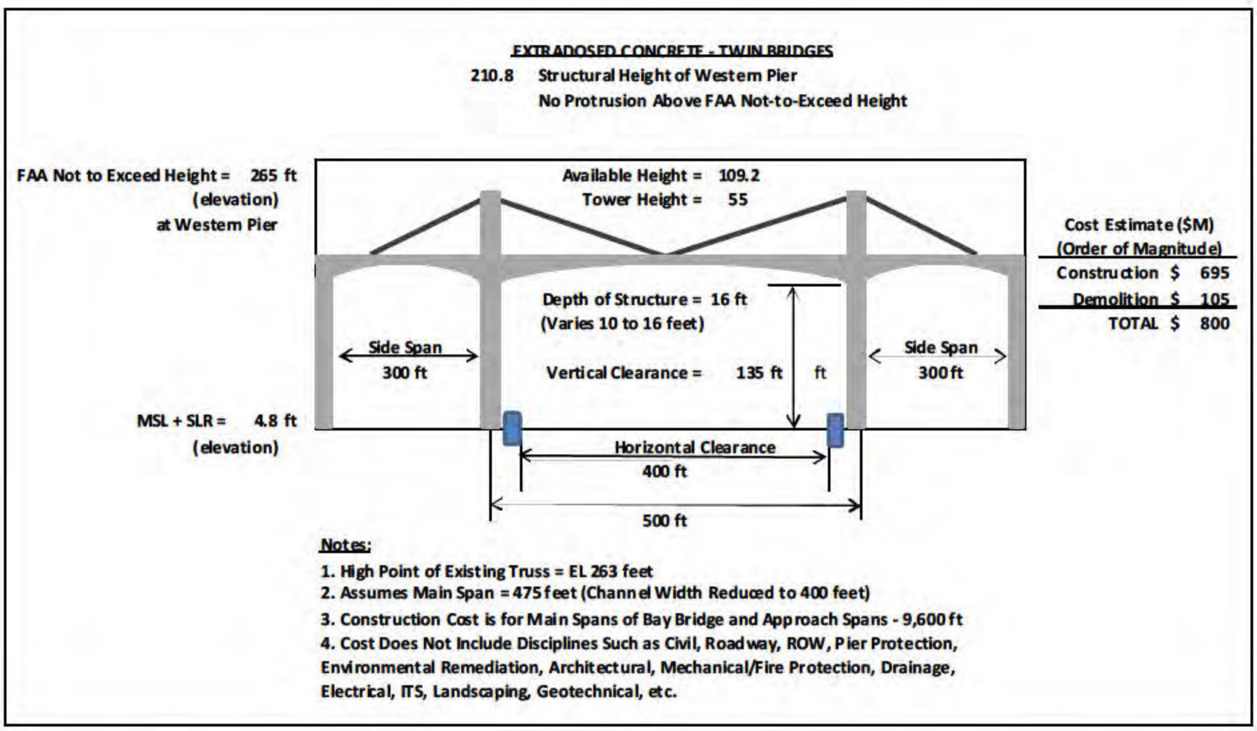
- Moderate maintenance costs
- Complex fabrication and construction for arch span
- Float in construction may not be viable due to height above water line
- Construction of arch will require combination of tie-backs and temporary bents.

Inspectability:

A full length catwalk may be provided on the underside of arch span to inspect floorbeams, steel girders and tie girders. Access to inspect the interior of box tie girders would be provided via access openings at each end. Inspection of arch ribs and hanger cables would be accomplished through use of a snooper truck. Detailed Inspection procedures would be addressed in a project specific Inspection and Maintenance Manual. The Manual would include schematic procedures for deck replacement and hanger cable replacement.

5.1.2. Alternatives for 400 Ft Navigational Channel Width

Figure 5.1.4: Short Span Alternative – Extradosed Concrete



This option is similar to a cable-stayed bridge but uses a stiff box girder superstructure and low towers. Extradosed precast concrete segmental box girder bridges are typically built by balanced cantilever for the main span unit (3-span) over the river and by span-span method of construction for the precast segmental box girder approach spans using a self-launching gantry. Piers are typically precast HPC concrete. Several segmental and cable-stayed bridges have been constructed in the NY/NJ area over the last 5 years so there is good local experience and size of the project would likely attract national contractors.

An extradosed bridge is typically feasible for span lengths in the range of 400 to 600 ft and employs a structural system which combines the main characteristic elements of both a box girder bridge and a cable-stayed bridge. It allows the use of shorter towers than a typical cable-stayed bridge but requires a deeper superstructure depth. Construction of this bridge type would not violate any of the FAA-defined surface elevations, but would require obtaining approval from the USCG and USACE to reduce the navigation channel width to approximately 400 ft. Achieving this approval requires a navigational clearance study and comprehensive outreach and coordination with the maritime community.

The superstructure for extradosed bridges is considered a non-replaceable component and as such it is designed for a minimum service life that corresponds to the specified service life of the bridge, i.e. 100 years. Replaceable components such as cables, bearings, expansion joints, etc. are designed for a reduced service life.

The Designer of these types of structures is typically required to provide along with the Bridge Design Criteria document a detailed Corrosion Protection Plan that details the selection of materials, design details and all other necessary provisions for achieving the specified service life.

Advantages Include:

- Use of precast segmental construction results in high degree of initial quality from precasting segments in casting yard as well as superior long term durability as deck is in compression in both the longitudinal and transverse direction
- High degree of redundancy
- Low maintenance costs due to precompression of deck and use of HPC
- Moderate weight of superstructure
- Visually appealing

Disadvantages Include:

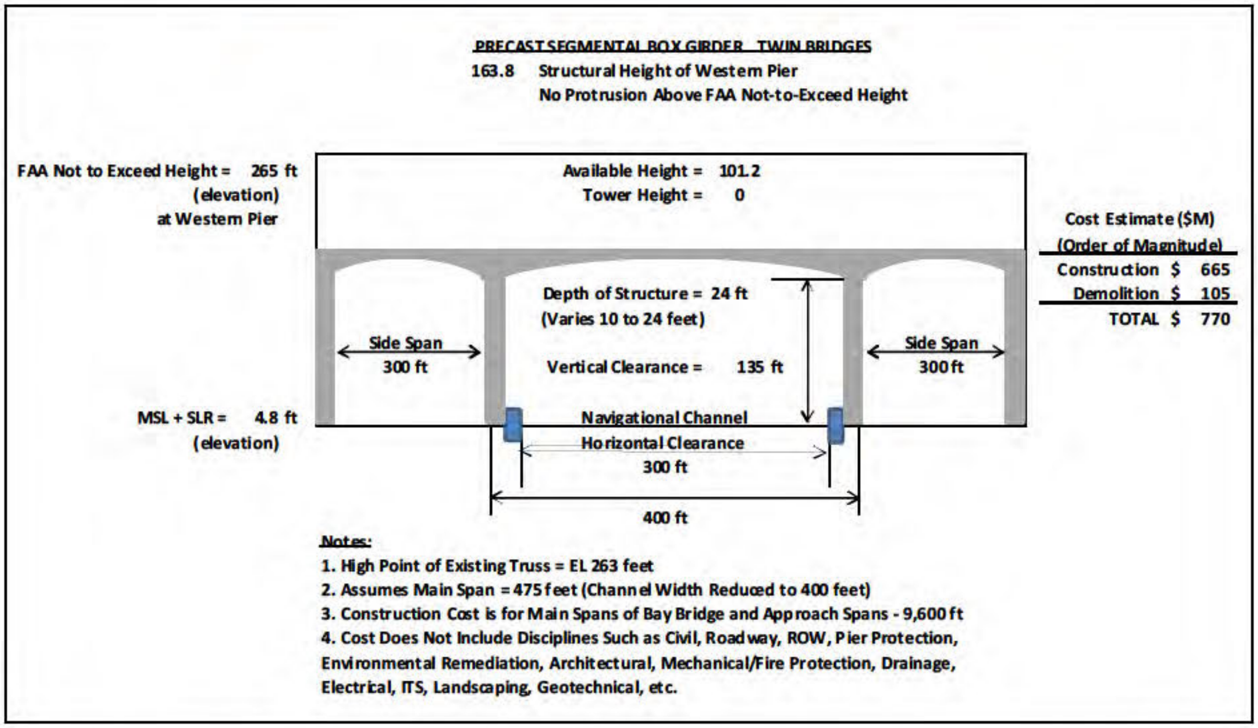
- Moderate construction cost
- Longer construction duration
- Would require reduction in the existing 500 ft channel width to approximately 400 ft. Longer channel span would push alternative outside optimum span range and result in higher construction costs
- As the deck is not readily replaceable, a 2” overlay must be replaced every 25 to 30 years

Inspectability:

Access to and inspection of the box girder interiors is relatively direct and straight forward. Use of a snooper truck would be required to inspect the towers, cables and exterior surfaces of the superstructure. Detailed Inspection procedures are typically addressed in the design process as part of a project specific Inspection and Maintenance Manual.

5.1.3. Alternatives for 300 Ft Navigational Channel Width

Figure 5.1.5: Short Span Alternative – Precast Segmental Box Girder



This option employs precast segmental double-cell box girders built by balanced cantilever for the main span unit over the river and by span-span method of construction for the approach spans. Construction would generally be performed from atop with a self-launching gantry. The main channel span would be comprised of variable depths along its length, while the approach spans would be of constant depth. Piers would be precast concrete, with HPC utilized in both the superstructure and substructure.

A precast segmental box girder is viable for spans approaching 400 ft, but would require obtaining approval to reduce the channel clearance to approximately 300 ft. FAA-defined surfaces would not be violated. This alternate will require raising the vertical profile of the replacement bridge as compared to the existing bridge.

The superstructure for segmental bridges is considered a non-replaceable component and as such it is designed for a minimum service life that corresponds to the specified service life of the bridge, i.e. 100 years. Replaceable components such as cables, bearings, expansion joints, etc. are designed for a reduced service life.

The Designer of these types of structures is typically required to provide along with the Bridge Design Criteria document a detailed Corrosion Protection Plan that details the selection of materials, design details and all other necessary provisions for achieving the specified service life.

Advantages Include:

- Lower initial construction cost compared with other alternatives
- Shortest construction duration as a result of precasting superstructure and substructure and use of self-launching gantry
- Use of precast segmental construction provides a high degree of initial quality from precasting segments in casting yard as well as superior long term durability as deck is in compression in both the longitudinal and transverse direction
- Lower maintenance costs due to precompression of deck and use of HPC. Maintenance procedures are typically developed in the design process as part of a project specific Inspection and Maintenance Manual. Manual would include schematic procedures for deck replacement if and when necessary
- Several segmental bridges have been constructed in the NY/NJ area over the last 5 years so there is good local experience and size of project would likely attract national contractors.

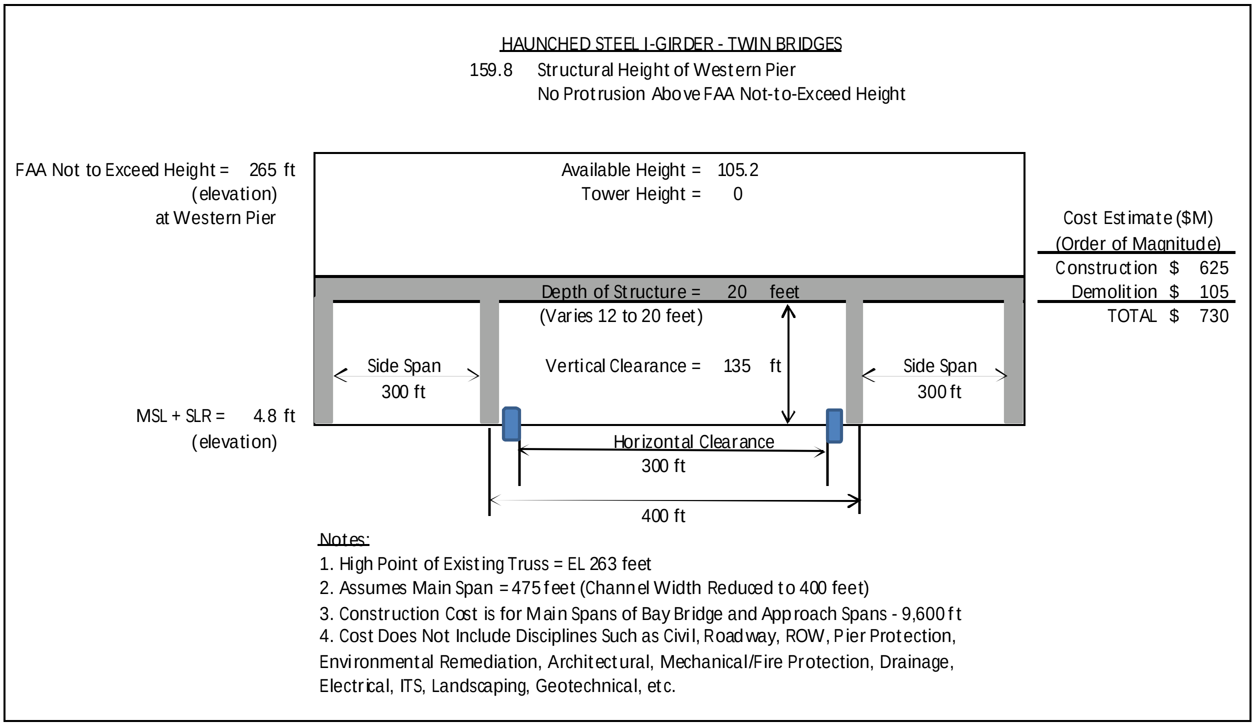
Disadvantages Include:

- Heaviest superstructure requires larger foundations
- As the deck is not readily replaceable, a 2" overlay must be replaced every 25 to 30 years
- Deep girder section over main channel span will require raising vertical profile
- Required narrowing of the existing navigation channel width to approximately 300 ft
- Even with the reduced channel width, the longer channel span will push this alternative outside the optimum span range and result in additional construction costs
- Less visually appealing

Inspectability:

Access to and inspection of the box girder interiors is relatively direct and straight forward. Use of a snooper truck would be required to inspect exterior surfaces of the superstructure. Detailed Inspection procedures are typically addressed in the design process as part of a project specific Inspection and Maintenance Manual.

Figure 5.1.6: Short Span Alternative – Haunched Steel I-Girder



This option utilizes a combination of a haunched steel I-Girder main span unit over Newark Bay and constant depth steel plate girders and prestressed concrete girders for the high level and low level approach spans respectively.

Of the alternative structure types investigated, a haunched steel I-girder structure appears to be the least expensive alternative for a span of 400 ft. FAA-defined surfaces would not be penetrated; however, similar to the extradosed and box girder alternatives, this type of bridge would require obtaining approval to reduce the channel clearance to approximately 300 ft. This alternative will require raising the vertical profile of the replacement bridge as compared to the existing bridge.

Advantages Include:

- Lowest initial construction cost
- Shortest construction duration
- Moderate maintenance costs
- High degree of redundancy
- Deck readily replaceable
- Significant local contractor familiarity with this type of structure

Disadvantages Include:

- Deep girder section over main channel span will require raising vertical profile
- Requires reduction in the width of the existing navigational channel to approximately 300 ft

- Less visually appealing

Inspectability:

Due to the anticipated bridge width, catwalks will likely be required to facilitate inspection activities.

5.1.4. Recommendations

[redacted]

5.2. Newark Bay Bridge - Demolition vs. Rehabilitation

A key consideration in the identification of a preferred option for addressing both the traffic operations and structural needs of the NBHCE is the question of rehabilitation and reuse of the existing bridge versus demolition and replacement of the existing structure and approach spans.

5.2.1. Demolition

The cost of demolition for the entire Newark Bay Bridge (Structures N2.01W, N2.01 and N2.01E) is estimated to be $110M. This cost was estimated by taking the average square ft demolition costs of several recent major bridge demolition projects with complexities similar to that of the Newark Bay Bridge. The square foot demolition cost estimates are summarized in Table 5.2.1.

Table 5.2.1 Bridge Demolition Cost Estimates

BRIDGE NAME	DEMOLITION COST	TOTAL AREA (SF)	AVG. UNIT COST
Tappan Zee Bridge	$150M	1,378,080	$108.85/SF
San Francisco-Oakland Bay Bridge	$271M	813,120	$333.28/SF
Long Island Bridge (Quincy, MA)	$20.6M	105,600	$195.08/SF
Champlain Bridge (I-10, Montreal)	$400M	960,000	$416.67/SF
Goethals Bridge*	$22M	400,000	$55.00/SF

* Cost estimate from VE Study, not actual bid or contract costs. [1]

All of the bridges used for comparison span major bodies of water and consist of steel truss spans over active navigation channels similar to the Newark Bay Bridge. The average unit cost of demolition of the four bridges is approximately $265/SF. This unit cost ($265/SF) was used as the baseline cost for the demolition of the truss spans on the Newark Bay Bridge. The truss spans are the most complicated portions of the bridge, consisting of twin steel tied arch trusses, floorbeams and stringers. These spans also have the tallest piers. Reduced square foot costs of $145/SF and $75/SF were used for the girder spans and stringer spans, respectively, as the simpler framing and shorter piers are less labor intensive to demolish. The overall average unit cost for the demolition of the entire Newark Bay Bridge is $140/SF.

The breakdown and backup for the derivation of the demolition costs used for this study is presented in Appendix F.

5.2.2. Rehabilitation

As an option to demolition, the cost for rehabilitating and maintaining the existing bridge as part of the program was evaluated. The cost for rehabilitating the Newark Bay Bridge is estimated to be $260M. This cost is a program level cost used to establish an order of magnitude for the rehabilitation of the Newark Bay Bridge for the Alternative Analysis portion of the Study. The following major work items were factors contributing to the rehabilitation cost:

- Repair/replacement of structural steel
- Demolition and reconstruction of the entire Newark Bay Bridge deck slab, which includes the deck of Structure Nos. N2.01W, N2.01 and N2.01E
- Installation of all new deck joints
- Installation of all new (seismic isolation) bearings
- Cleaning and painting of all structural steel throughout the bridge
- Reconstruction of bearing pads/pedestals
- Repair of substructure cracks in piers
- Repair of substructure spalls (above and below water line) in piers
- Repointing of stone masonry facing on piers
- Installing rip rap at pier locations

In addition to the repair items identified above, a $50M contingency ($25M superstructure and $25M substructure) was included to account for miscellaneous work items not identified.

The above repair measures address the majority of the deficiencies identified in the Biennial Inspection Reports and, when completed, should render the existing structure in a condition that will be free of major rehabilitation for 40+ years beyond the completion of the program, as stipulated during Scoping

[1] Costs of the Goethals Bridge demolition were not averaged into the other demolition costs. The costs were obtained from a Value Engineering Study and were substantially lower than the actual contract costs for demolition of the other structures considered.

meetings. It should be noted that the repairs contemplated for the structural steel would eliminate current deficiencies due to deterioration and would maintain the HS-20 design load rating. This level of rehabilitation would not significantly improve the overall live load capacity of the existing structural members not compromised by deteriorated physical conditions. This level of rehabilitation would not increase the live load capacity to the current HL-93 standard.

From the Biennial Inspection Reports, the truss spans appear to have the greatest number of structural issues reported, followed by the girder/floorbeam spans and the stringer spans. Therefore, for estimating purposes, 25%, 10%, and 5% of the total structural steel weight for the truss spans, girder/floorbeam spans and stringer spans, respectively, was used to estimate the approximate quantity of replacement steel required for repairs in those respective spans. A unit cost of $15/lb, $10/lb, and $6/lb was used for the cost of repair steel for the truss spans, girder/floorbeam spans and stringer spans, respectively, to reflect the complexities of framing details and accessibility in each type of span. It is assumed that the deteriorated tie-chord members will be replaced during the rehabilitation.

It is anticipated that this major rehabilitation would be performed after traffic has been relocated to a portion of the new structure built adjacent to the existing structure, helping to reduce the cost and expedite the rehabilitation schedule versus performing said repairs under traffic. With the deck slab completely removed, repair/replacement of structural steel and bearings will be easier to perform. Without additional study and analysis, it cannot be determined whether installation of seismic isolation bearings alone will bring the structure into full compliance with current AASHTO seismic criteria.

The breakdown and backup for the costs associated with the rehabilitation of the existing structure are presented in Appendix F.

5.2.3. Recommendation

[redacted]

5.3. Development of Alternative Alignments for the NBHCE Mainline

The following segments of the NBHCE Mainline, from Interchange 14 to the eastern terminus approaching the Holland Tunnel, were studied and alternative horizontal alignments were developed based on existing physical and environmental constraints as well as traffic maintenance requirements during construction and in the final configurations. Upon completion of the Pulaski Skyway rehabilitation, shoulder use as a temporary travel lane during peak periods of traffic is expected to cease, and two lanes of mainline traffic in each direction must be maintained at all times (during all peak hours of traffic) during reconstruction of the entire length of the NBHCE under this program.

Traffic demand as projected by this study has identified the need for four travel lanes in each direction from Interchange 14 east through Interchange 14A. From east of Interchange 14A to east of the Interchange 14C toll plaza at the eastbound exit to Columbus Drive, three travel lanes are needed in each direction. East of this point, based upon the future traffic operations simulation models and recognition that the Holland Tunnel would continue to represent a significant downstream bottleneck, it was determined that two lanes in each direction on the NBHCE Mainline will meet the project need; however, full-width shoulders, not currently present, would be required. These lane requirements during and after construction have been incorporated into the development of alternative alignments that can be constructed while meeting traffic needs during replacement of expansive lengths of bridges, interchange ramps, and sections of roadway on embankment. A standard 26 ft wide median between the NBHCE EB and WB Mainlines is proposed from the Interchange 14 area to the vicinity of Interchange 14C. East of the Interchange 14C, existing development on both sides of the roadway constrains development; consequently, a standard 7 ft wide median is proposed to minimize impacts in this segment of the project.

To develop the mainline alternative alignments with respect to traffic management, the study area was broken into six sections, or segments. These segments are not synonymous with potential construction contract breakdown as suggested elsewhere in this report. They are based on constraints unique to each segment regarding alignment shifts to the east or west of the existing NBHCE Mainline to accommodate new construction while maintaining traffic as required. The sections are listed below, and the following discussion describes the reasoning leading to recommended alignments in each section. Key design elements and other considerations are discussed as well. Graphic representations of each alternative discussed are presented in Appendix G.

- Section 1 – Newark Bay Bridge (including approach and main span structures)
- Section 2 – Interchange 14 Area
- Section 3 – Interchange 14A area (vicinity Structure No. N3.00 to N4.12)
- Section 4 – Interchange 14B Area (vicinity structure No. N4.12) to Interchange 14C (Liberty Science Center Ramps)
- Section 5 – Interchange 14C to the 11th Street Area
- Section 6 – 11th Street Area to Jersey Avenue

5.3.1. Section 1 - Newark Bay Bridge

A range of alternative typical cross-sections were considered in evaluating the methodology of replacing or repairing and retaining the Newark Bay Steel Arch Bridge and its approach spans (Structure Numbers N0.75, N2.01W, N2.01 and N2.01E). These typical sections, illustrated in Appendix G, include the following:

Cross Section Alternative 1

As shown in Figure CS-1, this alternative would create new two-lane NBHCE EB and WB roadways on structure, rehabilitating and re-using the existing bridge for passenger car use only. This concept was considered as a means of extending the life of the existing structure through rehabilitation and lightened live loading (restriction of heavy trucks to the new NBHCE EB and WB structures which will be designed for HL-93 loading). This concept proposes four lanes eastbound and westbound in the final configuration as two lanes in each direction would be maintained on the new outer structures while the existing structures are rehabilitated and reinforced. This concept represents a wide “footprint” on the approaches and over the Newark Bay (approximately 204 ft in width). Staging of this concept would be relatively simple as the new structures would be configured clear of the existing structures.

Cross Section Alternative 2

As shown in Figure CS-2, this alternative would demolish the existing structures in their entirety and create new four-lane NBHCE EB and WB structures. This concept provides ease of staged construction, using the existing structures to maintain traffic while the new eastbound and westbound structures would be built clear of the existing structures. New Interchange 14 Ramps NOH, SH, and HNO would be tied into the new outer roadways in sequenced construction. This concept represents one of the widest “footprints” of alternatives considered (approximately 266 ft in width).

Cross Section Alternative 3

As shown in Figure CS-3, this alternative would create new four-lane NBHCE EB and WB structures. Two lanes in each direction would be constructed and opened to traffic, and the third and fourth inner lanes would be constructed following demolition of the existing structures. This concept accommodates two lanes of traffic in each direction during construction and results in a narrower “footprint” of the final configuration (approximately 198 ft in width) as compared to CS-2. Construction staging would be similar to that of CS-2.

Cross Section Alternative 4

As shown in Figure CS-4, this alternative would create a new NBHCE EB four-lane structure and rehabilitate the existing structure for four-lane NBHCE WB. This concept represents an “over-build” of the new NBHCE EB structure to accommodate two lanes of traffic in each direction during the rehabilitation, reinforcement and seismic retrofitting of the existing structures. Upon establishment of the final traffic configuration, four lanes in each direction would be realized. This concept represents a “footprint” of reduced width (approximately 180 ft in width) versus the previously described concepts.

Staged construction of this configuration would be straightforward, with new structures built clear of the existing structures and the maintenance of two lanes of traffic in each direction during rehabilitation and reinforcement activities on the existing structures. The new eastbound Ramps SH and NOH would be tied into the new outer roadway in sequenced construction.

As a sub-alternative, this concept could be considered with the new structures proposed on the north side of the existing structures to accommodate final westbound traffic and with eastbound traffic utilizing the existing structures.

Cross Section Alternative 5

As shown in Figure CS-5, this alternative would create new NBHCE EB and WB mainlines with four lanes in each direction, and demolition of the existing structures. This concept accommodates maintenance of two lanes of traffic in each direction on the existing structure during construction and new bridge with four lanes of traffic in each direction with no “overbuild” of the new structures required. Staging of new connecting ramps at Interchange 14 and 14A would be sequenced requiring the use of the existing structures for maintenance of all ramp movements that would skew across the existing structure. Temporary structures would be needed to some extent until new ramp connections are completed. This concept represents a narrow final “footprint” (approximately 152 ft in width), considering that the footprint of the existing structures are outside of the new NBHCE EB and WB Mainline and would be demolished.

As a sub-alternative, this concept could be considered with the new NBHCE Mainline structures proposed on the north side of the existing structure.

Cross Section Alternative 6

As shown in Figure CS-6, this alternative would create new NBHCE EB and WB Mainlines, initially constructed to accommodate two lanes of traffic in each direction during demolition of the existing structures and four lanes of traffic in each direction upon final construction. This concept “overlaps” the new NBHCE Mainline with the existing NBHCE Mainline and represents a narrow final footprint (approximately 152 ft in width). This concept minimizes the extent of “new” and “existing footprint” on the approaches to and in Newark Bay. Staging would be similar to CS-5. This concept is limited to short spans with a reduced navigational channel width as long span options cannot be stage-constructed.

As a sub-alternative, this concept could be considered with the new NBHCE Mainline structures proposed on the south side of the existing structure.

Cross Section Alternative 7

As shown in Figure CS-7, this alternative would create new NBHCE EB and WB Mainlines, initially constructed to accommodate two lanes of traffic in each direction during demolition of the existing structures and four lanes of traffic in each direction upon final construction. Due to the potential that the narrowing of the navigational channel beneath the bridge is not possible, a long-span alternative will be required. Any cable-stayed or extradosed type structure will require separation between the spans to accommodate the towers and provide space for construction. This concept still "overlaps" the new NBHCE Mainline with the existing NBHCE Mainline, but represents a wider final footprint (approximately 181 ft in width). Staging would be similar to CS-5.

Cross Section Alternatives 8 and 9

Figures CS-8 and CS-9 are included as possible "re-purposing" of the existing structures in the above concepts that involve rehabilitation and reinforcement of the existing structures. However, due to the additional cost of rehabilitation versus replacement of the existing structure, these alternatives are not recommended for advancement as the IPA.

Recommendation

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

5.3.2. Section 2 - Interchange 14 Area

This interchange requires reconfiguration due to the need to replace structures N0.28A and N0.28G while maintaining traffic during construction as well as addressing congestion on ramps merging onto the NBHCE mainline. Alternative ramp alignments and merge scenarios have been developed (see Figures N-1 and N2 in the appendix of this report) and evaluated.

Vertical Design Considerations

Ramp SH represents a challenge in vertical design. The critical clearance point for the new alignment crossing over the service road and rail tracks immediately to the east side of Ramp SH would move approximately 100 ft to the south of the current critical point for the existing ramp alignment. The current Ramp SH gradient is an upgrade of 5.05% based on as-built plans. Because of the shifted critical clearance point for the new Ramp SH alignment, a 7% upgrade will be required, which is the absolute maximum allowable gradient per NJTA Design Criteria. Based on an approximate tangent length of 200 ft from the north fascia of the Port Street Bridge to the new critical clearance point for the new Ramp SH alignment, reconstruction of Ramp SH to a 7% gradient would gain between 3 ft and 4 ft of additional vertical clearance at the new crossing. This is expected to provide the required clearances since the roadway and tracks below are not likely to significantly increase in elevation in 100 ft distance. More detailed survey and design would be required to better determine the vertical design of Ramp SH. This investigation would occur in preliminary engineering.

Staging of Ramp SH construction is difficult because of the confined corridor of existing Ramp SH. The reconstruction of the two lane tangent segment of the ramp while maintaining traffic would require reduction to one lane on the left while the new shoulder and new right lane are constructed at increased elevation to meet the new curved structure over the service road and rail corridor. Staging will require sheeting in areas where walls are to be reconstructed to higher elevation and where vertical differential will be developed between the existing and new Ramp SH pavement.

Reduction of Ramp SH to one lane of traffic can be accomplished by merging the ramp from the New Jersey Turnpike's mainline Outer Roadway with the one lane ramp from the Inner Roadway. However, traffic impact on these heavily traveled ramps is likely to be undesirable. In addition to the temporary ramp merge, traffic from all points south destined for the NBHCE could be advised via signing to use the Inner Roadway only, which may serve to better distribute traffic into the temporary one lane until the initial stage of construction is complete and two lanes can be opened, using the shoulder as a temporary travel lane.

Based upon available as-built data, the proposed new Ramp NOH can be accomplished by employing up-grade and down-grade gradients of less than 5% while providing standard 15 ft clearances over the proposed Loop Ramp (Ramp HS) and the NBHCE eastbound and westbound mainline roadways. Ramp NOH can be vertically designed to exceed 35 mph design speed at its exit termini with the southbound outer ramps and 30 mph at the central horizontal curve of the 280 ft radius. The new Ramp HS can be vertically designed to 25 mph and at a down gradient under 5% to meet clearance requirements under the new overpassing Ramp NOH and under the new NBHCE eastbound and westbound mainline roadways.

Staging of these ramps is uncomplicated with construction and opening of the new Ramp HS occurring first. The second phase would include construction of the new Ramp NOH and connection to the partially-built new NBHCE eastbound roadway. The final phase would be to open the new Ramp NOH, remove existing Ramp NOH, and complete the NBHCE eastbound mainline roadway in this section.

The need to replace Structure Numbers N0.16A, N0.28A, N0.28D, N0.28C and portions of N0.75 (see Figure N-1 in Appendix G) within Interchange 14 while maintaining traffic presents a challenge. However, the following sequence of construction staging will facilitate accomplishing ramp replacements in an efficient manner in a configuration that can tie into either the long span or the short span alternatives for the replacement bridge.

First, the replacement of Ramp NOH and Ramp SH must be accomplished. Ramp NOH staging is straightforward as it is proposed on a new alignment; however, Ramp SH is more complicated. As described in the vertical design discussion above, Ramp SH must be constructed by reducing from two lanes to one lane of traffic and reconstructed in multiple phases. A raised profile of 7% upgrade is required to clear roadway and rail infrastructure below. Ramps NOH and SH design speeds will meet or exceed existing ramps being replaced. These new ramps would join with a subsequent lane drop to connect with the new NBHCE eastbound mainline as shown in Figure N-1. The two new NBHCE eastbound lanes would be constructed to the south and clear of the existing NBHCE mainline. Heading further east, the new NBHCE eastbound roadway would temporarily meet with the existing NBHCE eastbound mainline for maintenance of eastbound traffic, while the new NBHCE eastbound and WB mainline is under construction (Structure Number N0.75, N2.01W, N2.01 and N2.01E replacements), as described in the following section of this report.

The existing Ramp HS does not meet the NJTA's desirable minimum radius of 150 ft (current radius is 125 ft); therefore, realignment of Ramp NOH affords the opportunity to replace the existing Ramp HS with an alignment that meets the minimum design criteria. Initial study indicates that the profile of Ramp NOH and the new Ramp HS can be designed well within the NJTA's desirable standards. This new Ramp HS alignment passes under the new Ramp NOH structure and can be constructed via typical staging. The new Ramp HS would diverge from the newly constructed NBHCE westbound roadway as shown in Figure N-1. The new NBHCE westbound roadway is proposed clear of and north of the existing NBHCE Mainline. Section A-A, located on Figure N-1 and depicted on Figure Section A-A in Appendix G conveys the proposed configurations of the new NBHCE eastbound and westbound roadways on structure.

Alternative Ramp Alignments

An alternative was considered for reconstruction of Ramp SH where the merged Ramp NOH and NBHCE eastbound Mainline would cross over Ramp SH. This configuration would enable a vertical upgrade of less than 7% for the new Ramp SH; however, this configuration would result in an undesirable left side merge of Ramp SH with the NBHCE eastbound Mainline. This concept was not pursued further.

Another alternative alignment for Ramp NOH was developed (Figure N-2). This alignment did not pass over the new Ramp HS but was aligned to the west. The alignment required the relocation of adjacent ramps that lead to the Interchange 14 toll plaza and also required a wall along Ramp NOH to avoid the need for right-of-way. This configuration resulted in the ramps entering the toll plaza approach to be skewed to the longitudinal centerline of plaza resulting in a curved alignment on the approach to the plaza and striped ramp noses moving closer to the barrier plaza, thereby reducing the desired 1/2-length of plaza approach. This reduction in 1/2-length was considered undesirable for traffic operations in the plaza and this alternative was not developed in greater detail for presentation in this report.

Horizontal Design Elements

The proposed NBHCE eastbound and westbound Mainline alignments are set to be constructed to the south and north of and clear of the existing NBHCE Mainline to facilitate staged construction (see Section A-A). The alignments of the NBHCE eastbound and westbound roadways that tie into the Interchange 14 toll plaza approach are set parallel to Structure Number N0.28 and begin their reversed curve alignment just west of the abutment of the structure. The reversed curve alignment will meet the 60 mph design speed or could be designed to a lower speed into the toll plaza approach, if appropriate. Alternatively, speed can be reduced in this section through posting of advisory speed limit signs.

The alignments of the new Loop Ramp NOH will meet the NJTA's minimum of a 150 ft central radius. The new Ramp HS and Ramp NOH will meet appropriate design speeds of 25 mph and 30 mph respectively.

Traffic operational analysis as presented in Chapter 6 resulting in the optimal ramp merge and sequencing of lane additions as shown on Figure N-1. The layout of the successive merges of Ramp NOH and Ramp SH with the eastbound NBHCE Mainline should meet AASHTO's 1,000 ft minimum separation of 'like points' for ramp entrance termini. This layout is proposed to add the one lane Ramp NOH as a third lane to the two-lane NBHCE eastbound Mainline. The two-lane Ramp SH would enter to form a five lane section, with the right lane merging over a 1,200 ft length, resulting in a four lane eastbound NBHCE Mainline heading east.

The layout of Ramps HNO and HLT in the westbound direction incorporates a standard single deceleration lane of 1,200 ft length, and the Ramps HNO and HT split is set to meet the AASHTO 1,000 ft 'like point' distance from the mainline deceleration lane nose on the mainline. Ramps HNO and HT geometry meet 30 to 35 mph design speeds (see Figure N-1 for central radii).

Recommendation

[redacted]

5.3.3. Section 3 - Interchange 14A Area

This section of the NBHCE Mainline includes Structure Numbers N3.00, N3.24, N3.39C, N3.39, N3.53B, N3.53D, and the expansive N3.53D. All but N3.53C require complete replacement while maintaining two lanes of traffic in each direction on the NBHCE Mainline and maintenance of all ramp movements at Interchange 14A during construction.

Study of alternatives in this interchange included evaluations of impacts associated with providing enough new structural width on the main line to maintain two lanes of traffic in each direction during demolition of existing structures and completion of new structures. Initial alignments were developed for a new main line configured to the north and to the south of the existing NBHCE Mainline. It became apparent that any alignment to the north would severely encroach upon and impact Ramps TW and ET of Interchange 14A. The central radius of existing Ramp ET is 150 ft and any attempt to realign the ramp to the north while meeting the minimum 150 ft central radius criteria would have severe impacts on Ramp TW, the Route 440 Mainline, and associated ramps to Route 440. Existing rail lines would also be impacted as they are adjacent to Route 440. These impacts were considered extensive and "last resort," and further development of a north side alignment was discontinued.

Subsequent study of the less disruptive south side mainline alignment became the focus of our conceptual alternative alignment for development and presentation.

Vertical Design Considerations

The proposed shift of the NBHCE Mainline to the south of the existing alignment (see Figure 14A-1 in Appendix G) requires the reconstruction of Ramp TE. This ramp can be slightly realigned and re-profiled to maintain clearance over the adjacent light rail by employment of a 7% upgrade and a reduction of design speed to 20 mph at the divergence from the toll plaza. This reduction is practical considering plaza speed is limited to 15 mph (EZ Pass lane speed) and the close proximity of the Ramp TE terminal to the barrier plaza (approximately 275 ft). The existing Ramp TE divergence terminal profile exhibits a sag vertical curve of 45mph K value and an upgrade of 6.27%. By reducing the terminal sag curve to a 20 mph K value, increasing the upgrade to absolute maximum of 7% and minimizing the depth of new bridge over the light rail, proposed realignment of Ramp TE appears viable. The reduction in K value of sag curve at the Ramp TE terminal is not controlled by headlight sight distance since the plaza and ramps are lighted; therefore, the 20 mph terminal speed would be appropriate.

Staging of Ramp TE reconstruction can be accomplished in three phases by reducing existing ramps to one lane without shoulder and construction of the new Ramp TE shoulder and partial lane to accommodate one traffic lane to the east of the existing ramp, and employing sheeting to address grade difference along the interface of existing and new facilities. The new curved bridge over the light rail and ramp tie into the shifted eastbound mainline would be completed. The new Ramp TE tangent segment from the toll plaza would tie into the new shifted NBHCE eastbound mainline and open to one lane of traffic from the toll plaza. The remainder of new Ramp TE would be completed including walls along the plaza approach and the new bridge over the light rail.

Consideration of Alternative Mainline Alignments

As previously noted, the north side alignment alternative for the NBHCE mainline was not considered viable, with the south side alignment being advanced. Section C-C of Figure 14A-1 in Appendix G (also shown in detail on Figure Section C-C) illustrates the proposed NBHCE Mainline alignment and indicates that enough of the new structure and roadway can be constructed clear of the existing mainline to accommodate two lanes of traffic in each direction during demolition of the Structure Number 3.53D. However, construction of a new structure over the historic Morris Canal presents challenges in the placement of foundations to support the new structure. New Ramp TE presents a challenging vertical design as described. New Ramp WT can be staged via straightforward sequencing. New Ramps TW and ET can be staged using segments of the existing mainline structures while the final new ramps are constructed to meet the completed NBHCE mainline.

The north side alignment of the NBHCE Mainline in the Newark Bay section would need to transition to the south side alignment in the Interchange 14A Area Section. This crossover by the new NBHCE Mainline across the existing NBHCE Mainline would be accomplished east of the Newark Bay Structure Number N2.01E abutment, in the area between Structure Numbers N3.00 and N3.39. This crossover can be accomplished mostly on embankment between these structures. The replacement of Structure Numbers N3.00, N3.24, and N3.39 would be staged in sequence with the NBHCE Mainline staging in up to three stages as required. The new Ramp TE would be constructed to maintain one lane of traffic at all times and be connected to the new NBHCE EB roadway in the final configuration during the demolition of the existing mainline structures and the existing Ramp TE structure. Refer to the vertical design section of this report for a further description of Ramp TE replacement sequencing.

Horizontal Design Elements

Replacement of the existing NBHCE Mainline on the south side will result in larger radii than the existing alignment. The approximate horizontal curves proposed for the new alignment and provision of the superelevation in conformance with current standards will not fully meet the 60 mph desired design speed if NJTA design criteria is strictly adhered to. Speeds through this curve can be reduced through posting of advisory speed limit signs as needed. Refer to Figure 14A-1 for the approximate central radii for the horizontal curves and tangent lengths of the section. Tangent lengths exceed the minimum lengths for superelevation runout between reverse curves.

Alternative Ramp WT

This alternative ramp alignment (Figure 14A-2 in Appendix G) is proposed as an alternate to existing Ramp WT only in the event that the expansion of trucking activities on the peninsula exceeds current projections. Most heavy trucks will access the Global Terminal and other existing and potential new warehousing/shipping facilities from points west via Ramp WT. Should increases in truck traffic obstruct traffic flow into the plaza (Ramp WT terminal distance to the barrier plaza is approximately 225 ft), Alternative Ramp WT could be employed to provide a plaza approach length of over 600 ft, which is in excess of the desirable ½ plaza length of 500 ft per NJTA standards.

Conceptual evaluation of horizontal and vertical design of Alternative Ramp WT indicates an NBHCE EB ramp terminal speed of 40 mph and ramp proper speed of 35 mph is viable. Gradients can be 4% or less and vertical clearances of 15 ft over and under the NBHCE Mainline and over Garfield Avenue can be easily achieved.

Staging of Alternate Ramp WT is straightforward. The only areas requiring phased construction are the ramp divergence from the NBHCE EB Mainline (overlaps with the existing Ramp WT terminal) and the tie into the plaza approach. Staging to maintain one lane of traffic at all times in these areas would be routine.

Alternative Ramps to the Bayonne Waterfront

In the process of developing modifications to Interchange 14A to address the circumstances that future freight activities exceed current projections, two alternatives are offered for consideration. Alternate Ramp WT, as described earlier, in combination with either of these alternatives would significantly divert traffic from Interchange 14A. The diverted traffic would include heavy truck traffic as well as passenger vehicles of those employed or destined for freight terminals such as Greenville Yard and Global Container Terminal. Both of these alternatives require a toll plaza separate from Interchange 14A and could be candidates for all electronic toll plazas (AET's). The direct access to the NBHCE provided by these alternatives for freight operations in the Bayonne waterfront area presents a case for a cost share arrangement with freight service providers as a suggested funding strategy.

The additional sub-options to supplement the improvement in this section provide access from the eastbound and westbound NBHCE Mainline to the vicinity of the Global Container Terminal. As shown on Figure 14A-3, this concept consists of four direct connection ramps that provide full access to and from the NBHCE EB and WB Mainline and a new toll plaza east of the mainline roadway. New distribution roads would be required east of the toll plaza based on terminal needs.

This sub-alternative requires no building displacements although new right-of-way would be required. Vertical design must be studied and developed along with the new weaves created with Ramp ET in the WB direction. Ramps TE in the EB direction require additional evaluation to assess viability of this concept. As a further sub-option of the recommended improvement option for the Interchange 14A area, only the ramps to and from the west would be constructed since the vast majority of heavy trucking is to and from the west. Access to and from the east would continue to use Interchange 14A.

Figure 14A-4 in Appendix G depicts another alternative for providing direct connections into the Global Marine Terminal. While similar to the option depicted in Figure 14A-3, direct connection ramps are provided to and from the east and entering the NBHCE to the west. A long viaduct structure would be constructed to accommodate eastbound exiting vehicles destined for Global marine terminal. This option also requires a separate toll plaza (or AET sensors). Additionally, this option would have significant impacts on the existing Jersey City Department of Public Works facilities.

Recommendation

[redacted]

5.3.4. Section 4 – Interchange 14B to Interchange 14C

This section of the NBHCE Mainline is bordered on the west side by industrial/commercial facilities and intermittent freight rail and light rail tracks. The east side is bordered by Jersey City's Caven Point Park and athletic fields/facilities, Liberty National Golf Club, the Liberty Science Center/Liberty State Park, and industrial/commercial facilities near the Communipaw Avenue exit ramps. The public properties along the east side of the NBHCE Mainline are protected by NJDEP Green Acres program and would require costly and hard to find mitigation if impacted. Potential wetland areas along the east side would also require permitting and mitigation. Initial study of an alignment to the east versus to the west of the existing NBHCE Mainline yielded the substantial advantages of proposing the replacement alignment along the west side in this section and became of the focus of our study (Figure B/C-1 in Appendix G).

The need to maintain two lanes of traffic in each direction for the NBHCE Mainline while minimizing impacts and need for right-of-way along the west side led to the development of a three phase sequence of staged construction as conveyed in Figure Section D-D. Additionally, because the Interchange 14A area new mainline alignment is proposed along the east (or south) side of the existing NBHCE Mainline and this section of the new alignment is proposed along the west side, a mainline alignment crossover area must occur. This crossover is proposed to be accomplished in the segment of roadway that is mostly on embankment. Structure Numbers N4.12 and N4.52 would be staged in three phases in sync with the roadway sequencing.

Relocation of a short section of light rail, replacement of the freight rail bridge over Johnston Avenue and relocation a length of freight rail along the west side of the NBHCE Mainline would be required (see Appendix I – Recommended Alternative Figures 11 and 12). Although rail relocations are often difficult to achieve, light rail is a publicly-owned facility which should help expedite this relocation. The freight line bridge appears to be in poor condition and bridge replacement along with new track may serve to encourage CSX (the freight rail provider) cooperation regarding the relocation of its facilities. It is also important to note that minor right-of-way may be required from the existing warehouse property just southwest of Interchange 14B, along Bayview Avenue, but provision of a wall along NJTA new right-of-way would avoid any need to impact that facility's parking lot operation. No impact on this property's critical infrastructure is anticipated.

The former service area located just south of Interchange 14B is currently being used by NJTA for storage. The proposed alignment for the NBHCE Mainline would require some re-arrangement of storage activities, internal driveways and lots on the west side of the facility. Auxiliary lanes to and from the facility are proposed to be upgraded to current standards as part of this program of improvements to facilitate a possible re-activation of the service area or re-use for other purposes.

Traffic analysis indicates that the provision of Express E-ZPass lanes in both the eastbound and westbound direction through the Interchange 14C barrier toll plaza would significantly improve traffic capacity and operation of the NBHCE Mainline. As shown in Figure B/C-1 (Appendix G), two lane eastbound and westbound Express E-ZPass lanes have been proposed. Traffic demand requires three lanes in both directions on the NBHCE Mainline west of the Christopher Columbus Avenue exit and entrance ramps. In the eastbound direction, the two Express E-ZPass lanes would join with two lanes from the eastbound barrier plaza to form a four-lane NBHCE EB Mainline and one lane from the barrier plaza would exit to Communipaw Avenue. The four-lane eastbound mainline is proposed to continue east to the Columbus Avenue exit where two lanes would exit and a two-lane NBHCE EB Mainline would continue east.

In the westbound direction, the two-lane Express E-ZPass lanes would continue westbound and the westbound barrier plaza traffic would merge into two lanes with the outer lane becoming an "exit only" lane to Interchange 14B. Because of the close proximity of the Interchange 14B westbound exit ramp terminal to the toll plaza, it is proposed to extend the Express E-ZPass lanes divider that separates the lanes from the barrier plaza to prohibit exiting to Interchange 14B from the Express E-ZPass lanes. Signing well in advance of the toll plaza would be required directing all Interchange 14B exiting traffic to use the barrier plaza only.

Consideration of Alternative Alignments

The number of environmentally sensitive properties bordering the east side of the NBHCE Mainline and the likely impacts on these facilities by an easterly alignment resulted in a westerly concept plan becoming our focus of study and has been developed for presentation. The affected properties, types of impacts and other factors have led to the recommendation of the westerly alignment as the IPA for this section. An easterly alignment has not been developed; however, application of Section D-D with the same sequence of staged construction but on the east side of the NBHCE Mainline enabled assessment of impact on sensitive infrastructure and environmental areas. Development of a Concept Plan of Improvements to the east was not pursued.

Horizontal Design Elements

Significant deviation from the existing mainline alignment is not proposed because of adjacent infrastructure and sensitive environmental features bordering the existing NBHCE Mainline. This section consists of a series of reversed curves separated by a long tangent on the west and shorter tangents to the east. Applying a desirable design speed of 60 mph indicates that the mainline radii are adequate and tangent lengths are adequate to accommodate superelevation rates upgraded to current NJTA standards for the new NBHCE Mainline alignments. Tangent lengths will accommodate the NJTA's absolute minimum criteria required for superelevation run out between curves. An analysis of the achievable design speed for the recommended alternative is presented in Chapter 6. Regardless, it is recommended that advisory signing be posted to reduce travel speeds approaching the Interchange 14C toll plaza and reduce differences in speed between vehicles utilizing the express E-ZPass and the barrier tolls.

Recommendation

[redacted]

5.3.5. Section 5 - Interchange 14C to 11th Street

This section exhibits substantial commercial, industrial, institutional, and residential development along both the east and west sides of the existing NBHCE Mainline from the vicinity of Grand Street to Columbus Drive. North of Columbus Drive, sensitive properties exist primarily along the east side, including Green Acres protected athletic fields and infrastructure, while the west side is bordered by mostly vacant property with some segments of freight rail line service. Because of the development that borders the NBHCE Mainline on both sides of the existing NBHCE Mainline south of Columbus Drive, new conceptual alignments were studied both to the east and to the west sides.

For a new alignment proposed to the east side and the need to maintain two lanes of mainline traffic in both directions at all times during construction, a three phase sequence of staging south of the Center Street area has been developed as shown in Figure COL-1 in Appendix G. This easterly alignment proposes to configure the NBHCE Mainline over a re-aligned Center Street/Columbus Drive to avoid taking of right-of-way and properties east of the existing Center Street roadway (Figure Section E-E East Side Alignment in Appendix G). This concept would maintain the two-lane eastbound exit movement to Columbus Drive and the one-lane westbound entrance movement from Columbus Drive via reconstructed ramps.

Staging of the easterly alignment in the Center Street area would be complex, requiring multiple phases involving construction and opening of the new eastbound exit ramp and the NBHCE EB Mainline first, followed by demolition of the existing NBHCE EB structure (partial removal of Structure Number N6.80E), construction and opening of the new westbound entrance ramp and demolition the existing ramp, and finally construction and opening of the new NBHCE WB Mainline and demolition of the existing NBHCE WB Mainline. Several temporary ramp – mainline connections would be required as this segment is entirely on structure.

A westerly alignment was also developed and evaluated as shown in Figure COL-2. This alignment proposes to configure the new NBHCE WB Mainline over a re-aligned Merseles Street from Columbus Drive to the vicinity of Bright Street, where it would shift from beneath the new NBHCE WB Mainline and lead to a new westbound entrance ramp south of Pacific Avenue. This concept would require complex staged construction similar to that described above for the easterly alignment but with sequencing reversed from west to east (Figure Section E-E West Side Alignment in Appendix G).

Both the easterly and westerly alignments encroach on existing adjacent development although neither would require right-of-way or acquisition of buildings or infrastructure. Both sides exhibit environmentally sensitive properties including contamination and low income housing.

Moving to the north of Columbus Drive, the constraints and sensitive properties that exist along the east side led to the identification of a westerly alignment as the focus of the study. A Conceptual Plan was developed for this segment as shown in Section F-F, Figure COL-2, and an easterly alignment was not pursued based on application of a typical cross-section and potential impacts on sensitive properties.

Consideration of Alternative Mainline Alignments

Based upon the west side alignment of IPA of Section 4, and the segment north of Columbus Drive also proposed to the west of the existing mainline, the advantages of the west side alignment from vicinity of 14C to Columbus Drive became apparent. By aligning the new NBHCE Mainline to the west, the need for two areas of mainline cross-over can be eliminated. These cross-overs, associated with the transitioning from a west side to an east side and back to a west side alignment, would be across the existing Structure Numbers N7.13 and N7.52, requiring temporary structures at both cross-over areas where new mainline viaducts would skew across the existing viaducts maintaining two lanes of two directional traffic at all times. A westerly alignment throughout this Section 5 eliminates the need for these costly temporary structures and the complex staging associated with their construction.

Horizontal Design Elements

Section 5 consists of reversed curves separated by a short tangent and followed by a long tangent leading to curves to 11th Street and 14th Street. The radii for central curves are shown in Figure COL-2 and with appropriate superelevation can meet the desirable 60 mph design speed. The tangent length will accommodate the superelevation run-out distance required by the absolute minimum NJTA criteria, incorporating upgraded superelevation on the new alignment curves as required. The long tangent leading to 11th Street and 14th Street will accommodate a normal crown section in both eastbound and westbound directions until superelevation transitions are introduced for the curves to the east in the next Section 6 for 11th Street and 14 Street area connections. An analysis of the achievable design speed for the recommended alternative is presented in Chapter 6.

Although the west fascia of the new NBHCE Mainline moves closer to development along the west side, the realigned Merseles Street under the new westbound structure would create more space for a potential buffer at ground level. This coupled with sound attenuation on the west fascia parapet may soften impacts. Based on the equivalency of the operational improvement that would result from either alignment considered and the relative ease of mitigating the impacts associated with the western alignment, the alignment depicted on Figure COL-2 is recommended for advancement as the IPA for this section.

Vertical Design Considerations

The NBHCE crosses over several passenger and freight rail corridors. West of the eastbound exit ramp to Columbus Drive, the NBHCE crosses over NJ Transit's Hudson Bergen Light Rail Line. Along the north side of Columbus Drive, the NBHCE crosses over tracks owned by the PANYNJ. Conrail previously held an easement from the PANYNJ for the two freight tracks that run beneath the NBHCE in this location. However, in 2015, Conrail released the easement back to the PANYNJ. The Valuation Map defining this easement is presented in Appendix H.

While this is not currently an active through line, the portion of the track beneath the NBHCE is utilized for equipment and material storage, thus requiring full access be maintained along this line. Further east the NBHCE crosses over Conrail's National Docks Secondary Line in two locations generally in line with 9th Street and 11th Street. This is an active line moving freight between the ports and rail terminals to the south and the CSX River Line which runs north to New York State and provides a major freight connection to the national freight rail network.

Conrail maintains a policy of requiring a minimum of 23 ft of vertical clearance from the top of rail to the low point of any structure passing overhead. A copy of the policy is presented in Appendix H. This is the desirable clearance to allow the movement of double-stacked shipping containers. While this minimum clearance must be maintained in the future, the potential exists to substantially lower the existing profile of the NBHCE along this section. A lowering of the profile would yield economic efficiencies in construction of the proposed replacement structures.

Early coordination with the rail owners, Conrail and NJ TRANSIT, is recommended to define the final profile of the NBHCE corridor prior to initiation of the next stage of project design.

5.3.6. Section 6 - 11th Street to Jersey Avenue

This section is complex in that it includes a dense mixture of urban development uses (residential, commercial, industrial, and transportation) and infrastructure that imposes constraints on alternative alignments, particularly in the eastbound direction leading to the Holland Tunnel. In the westbound direction, reconstruction of Structure Number N7.90W is relatively straight forward, employing a typical three-phase construction staging sequence that shifts the alignment to the west but closely follows the alignment of the current NBHCE WB roadway.

The following describes the nine alternatives studied in the eastbound direction as depicted on Figures EAST-1 through EAST-9.

Alternative Alignments

Alternative EAST-1

This alternative proposes the replacement of the NBHCE EB Mainline and merges with Route 139 with a new eastbound mainline viaduct that would be elevated over the existing Route 139 and NBHCE as they exist in the 12th Street corridor (see Figure EAST-1 in Appendix G). The eastbound mainline would remain elevated to the crossing of Jersey Avenue where it would shift to the west of the 12th Street corridor and descend to meet ground level at the signalized Erie Street intersection, adjacent to the current multi-lane approach to the Holland Tunnel. This concept requires new right-of-way, one building acquisition, relocation of a segment of 12th Street, parking displacement on the west side of

12th Street between Erie Street and Marin Boulevard, and new signalization at the Erie, Grove, and Marin intersections.

Staging of this Alternative would be complex. With the new NBHCE Mainline proposed to be aligned to the west of existing, traffic would be maintained on the existing NBHCE eastbound structure while the new eastbound mainline is constructed at the raised elevation adjacent to existing. A new eastbound viaduct would be constructed above the existing NBHCE EB roadway and the Route 139 roadway in the 12th Street corridor. Because of the tight clearance at the Cold Storage building, construction of an elevated viaduct for the new NBHCE eastbound mainline would be challenging to accomplish with traffic maintained below. Columns for the viaduct would need to penetrate the existing NBHCE eastbound roadway and the Route 139 structures below while maintaining the integrity of the bridges carrying traffic during construction. Upon completion of the viaduct and NBHCE EB Mainline, eastbound traffic would be shifted to the new viaduct and the existing NBHCE eastbound roadway would be abandoned. An advantage of this concept is that upon completion of the NBHCE eastbound roadway, the existing roadway could be demolished, leaving room for NJDOT expansion of the Route 139 approach in the 12th Street Corridor to the Holland Tunnel.

Alternative EAST-2

This alternative (see Figure EAST-2) is similar to Alternative EAST-1 but proposes the segregation of NBHCE EB traffic bound for local streets from traffic headed to the Holland Tunnel. The local street connector would tie to the 11th Street corridor at ground level and new signalized intersections would be provided at Monmouth Street, Coles Street, and Jersey Avenue intersections with a new connector extended to serve as access to the Newport Center. Two-way traffic is proposed east of Monmouth Street. Staging and impacts of the new 12th Street NBHCE viaduct would be similar to Alternative EAST-1.

Alternative EAST-3

This alternative (see Figure EAST-3) proposes segregation of local eastbound traffic from Holland Tunnel bound traffic as does Alternative EAST-2. However, the new NBHCE EB roadway would connect to the existing NBHCE eastbound roadway and run parallel with Route 139 in its current alignment. Replacement of Structure Number N7.90E in the 12th Street corridor would require diversion of traffic to local streets via the new connector that is part of this concept via Columbus Drive. The proposed connector to local streets would pass below the Route 139 corridor structures and connect to Monmouth Street at a new intersection, as shown in Figure EAST-3. The divergence point of the new NBHCE EB Mainline and the new connector road must be moved to the south to provide enough distance to the Route 139 underpass for vertical grade to be accomplished at the maximum allowable 5% downgrade. Impacts to existing infrastructure and right-of-way requirements are minimal for this concept; however, the local street connection to Monmouth Street is a change in Jersey City traffic circulation in this area. The skewed crossing of the new connector road under the Route 139 westbound viaduct may require reconstruction of part of the Route 139 viaduct to relocate piers that would obstruct the under-passing connector road.

Alternative EAST-4

This alternative (see Figure EAST-4) is similar to Alternative EAST-3; however, the connector road to Monmouth Street is aligned to cross under the Route 139 viaduct at the existing Monmouth Street underpass. This eliminates the potential pier relocation and Route 139 viaduct reconstruction of Alternative EAST-3. Reconfiguration of local traffic patterns may be of concern to Jersey City as in Alternative EAST-3 as mentioned above.

Alternative EAST-5

This alternative (see Figure EAST-5) proposes a new local street connection to the 10th Street corridor via a new traffic signal at Monmouth Street and replacement of Structure Number N7.90E in its current 12th Street alignment. The proposed connector road would provide two-way traffic east of Monmouth Street and would increase traffic along 10th Street that is currently the site of a new residential development between Jersey Avenue and Coles Street, the front of which is on 10th Street. The two adjacent blocks to the west also appear to be under development. The replacement of Structure Number N7.90E would require diversion of traffic during construction, as described above for Alternative EAST-3 via temporary connection of the existing NBHCE eastbound to the new connector road and Columbus Drive.

Alternative EAST-6

This alternative (see Figure EAST-6) proposes the provision of a new connector to local roads aligned in the 11th Street corridor similar to that described in Alternative EAST-2. The proposed NBHCE eastbound roadway would require replacement of Structure Number N7.90E in its current alignment, which would also require diversion of traffic via Columbus Drive and staging of this new local road connector as described for Alternative EAST-3.

Alternative EAST-7

This alternative (see Figure EAST-7) proposes a new NBHCE EB Mainline constructed to occupy the 11th Street corridor. The existing NBHCE EB structure would be demolished. This concept proposes a ground level, three-lane, one-way roadway with the third lane provided for turning and/or for storage capacity as well as a connection to Jersey Avenue and Newport Center. This alternative would run behind the new and ongoing residential developments facing the 10th Street corridor and provide access to new parking lots associated with that development and the Monmouth Street and Coles Street intersections. Access to the Cold Storage facility would be maintained as it exists.

Alternative EAST-8

This alternative (see Figure EAST-8) is similar in horizontal alignment to EAST-7; however, the new NBHCE EB roadway would be elevated to cross over Monmouth Street and Coles Street. On the east end of the alignment, the roadway would curve to the north and descend to meet Jersey Avenue at ground level and a new realigned approach to the Holland Tunnel. The existing NBHCE EB roadway in the 12th Street Corridor would be abandoned or demolished.

This concept would not provide access to the parking areas of the new development between the 10th Street and 11th Street corridor; however, this access could be maintained via Monmouth Street and Coles Street. Access to the east side of the Cold Storage building would require reconfiguration based on conference with and needs of the owner. Minor encroachment on parking and access would need to be negotiated and resolved.

For a number of reasons, this alternative is considered a very viable alternative and is recommended for advancement as part of the Initially Preferred Alternative. Construction of an eastbound exit along the 11th Street corridor is considered in the Circulation Element of the Master Plan of the City of Jersey City. This alternative provides three lanes on the approach to Jersey Avenue and the Holland Tunnel Plaza, similar to the configuration that exists today, increasing vehicle storage space for queuing at the approach to Jersey Avenue. No additional at-grade intersections would be created and no modification to existing at-grade intersections would be required, thus maintaining the existing traffic patterns on the local street network.

This alternative avoids the need to acquire the Cold Storage facility and frees up the existing alignment for rehabilitation and use as a detour route during periods of maintenance or reconstruction. Alternatively, NJDOT may have an interest in utilizing a portion of this vacated right of way for improvements to Route 139, allowing discussion of some level of cost sharing to defray the cost of the new construction along 11th Street.

This alternative is expected to be less costly than the options that contemplate elevated structures above the existing alignment or above Route 139, and also avoids impacts to existing land uses along the 12th Street corridor.

Staging of construction would be similar to that of Alternative EAST-3.

Alternative EAST-9

This alternative (see Figure EAST-9) proposes a new NBHCE EB elevated roadway aligned directly to the Holland Tunnel approach. The proposed NBHCE EB roadway could be elevated over or meet at ground level with Monmouth Street and Coles Street pending traffic circulation studies and Jersey City preference. This most direct alignment would require the acquisition of the Cold Storage facility, most likely in its entirety, along with substantial private right-of-way. However, this alignment affords creation of vacated property along 11th Street that may be made available for new development. Staging of construction would be similar to that of Alternative EAST-3.

Horizontal Design Elements of the IPA

Based on NJTA Interchange Ramp Design criteria, all of the considered new alignments of the NBHCE eastbound roadway will exceed the 40 mph mainline speed (minimum radius of 485 ft), and the reversed curves approaching Jersey Avenue would be designed to a reduced design speed of 30 mph with minimum radii of 450 ft. These reversed curves would be designed to AASHTO Urban Road Criteria and not require superelevation, but be designed to normal crown standards to discourage high speeds on green lights through the signalized intersection with Jersey Avenue. Based on more detailed traffic analysis, the new two-lane NBHCE EB roadway would widen to three lanes for storage at a point along the alignment approaching the Holland Tunnel.

Recommendation

[redacted]

6. INITIALLY PREFERRED ALTERNATIVE

6.1. Recommendation of an Initially Preferred Alternative

As detailed in Chapter 5, a number of alternatives were developed and evaluated to address the need for long-term load carrying capacity, operational improvements to relieve congestion, queuing and vehicle delay per vehicle along the NBHCE. A series of improvement alternatives were evaluated with the selection of an IPA. It is important to note that this IPA was developed based upon an operational needs assessment and an understanding of the serviceable life remaining on the existing structures along the corridor. Operational MOEs included the ratio of served traffic volumes to demand traffic volumes, average speed versus design speed, and average delay per vehicle.

A more detailed assessment will be required to refine these concepts as part of the Preliminary Engineering phase of this project. **Appendix I presents the recommended improvements to be advanced as the Initially Preferred Alternative into the Preliminary Engineering phase of project development.**

6.2. Future Traffic Operations

In addition to the 2045 No-Build Scenarios (see section 4.5), an analysis was performed for each segment of the NBHCE to refine the alternative concept components recommended for advancement as the IPA. These refinements focused upon varying scenarios of ramp configurations at the interchanges and the locations and sequencing of merge points and lane drops. Iterative analyses were performed to optimize future traffic operating conditions. These modifications and refinements, while seemingly minor in nature, will affect the footprint of the future roadway and structures, and therefore alter the nature and extent of any anticipated environmental impacts, ROW acquisition requirements and conflicts with other infrastructure in the area.

At interchange 14, design refinements were evaluated in relation to the sequencing of merging of Ramps NOH and SH when joining the eastbound NBHCE through lanes, as well as Ramp TW at Interchange 14A to minimize queuing on the ramp and prevent spillback into the toll plaza area. A design refinement was addressed as part of the Interchange 14C toll plaza expansion. Due to the proximity of the termini of the ramps to and from the Liberty Science Center and Columbus Avenue, a divider is proposed separating the Express E-ZPass lanes from other toll lanes to avoid last-second lane changes and improve safety. This refinement is incorporated into the IPA as depicted in Appendix I.

6.2.1. Segment 1 – Interchange 14

Scenario 1

Scenario 1 reflects new lane configurations along the merge sections of northbound and southbound NJTP/I-95 entrance ramps (Ramps SH and NOH) to the eastbound NBHCE, in addition to the NBHCE westbound exit ramp to northbound NJTP/I-95 (Ramp HNO). The NJTP/I-95 southbound entrance ramp (Ramp NOH) merge would create an additional lane on the NBHCE eastbound before tapering back down to a two-lane segment along NBHCE eastbound. The NJTP/I-95 northbound entrance ramp (Ramp

SH) would have a two-lane entry onto the NBHCE eastbound, which would form the four-lane NBHCE eastbound. This ramp experiences significant volumes during the weekday AM peak hour and this lane modification would provide a 273 second reduction in delay per vehicle. By creating an extended additional lane, delay was significantly reduced by 526 seconds per vehicle in the AM weekday peak hours and 1176 seconds in the PM peak hours, when compared to the 2045 No-Build Scenario. In addition, the average speed and processed volume would increase significantly in the eastbound direction when compared to the 2045 No-Build Scenario. The NBHCE westbound exit ramp (Ramp HNO) to NJTP/I-95 northbound is currently a two-lane exit. Under Scenario 1, the exit ramp would be reduced from two lanes to one lane due to the relatively low volume that utilizes the ramp. No significant increase to travel time or delay per vehicle occurred as a result of the reduction in the number of exit ramp lanes. Scenario 1 is depicted on Figure 6.2.1 and the operational analysis results are summarized Tables 6.2.1 and 6.2.2.

Figure 6.2.1: Segment 1 - Scenario 1

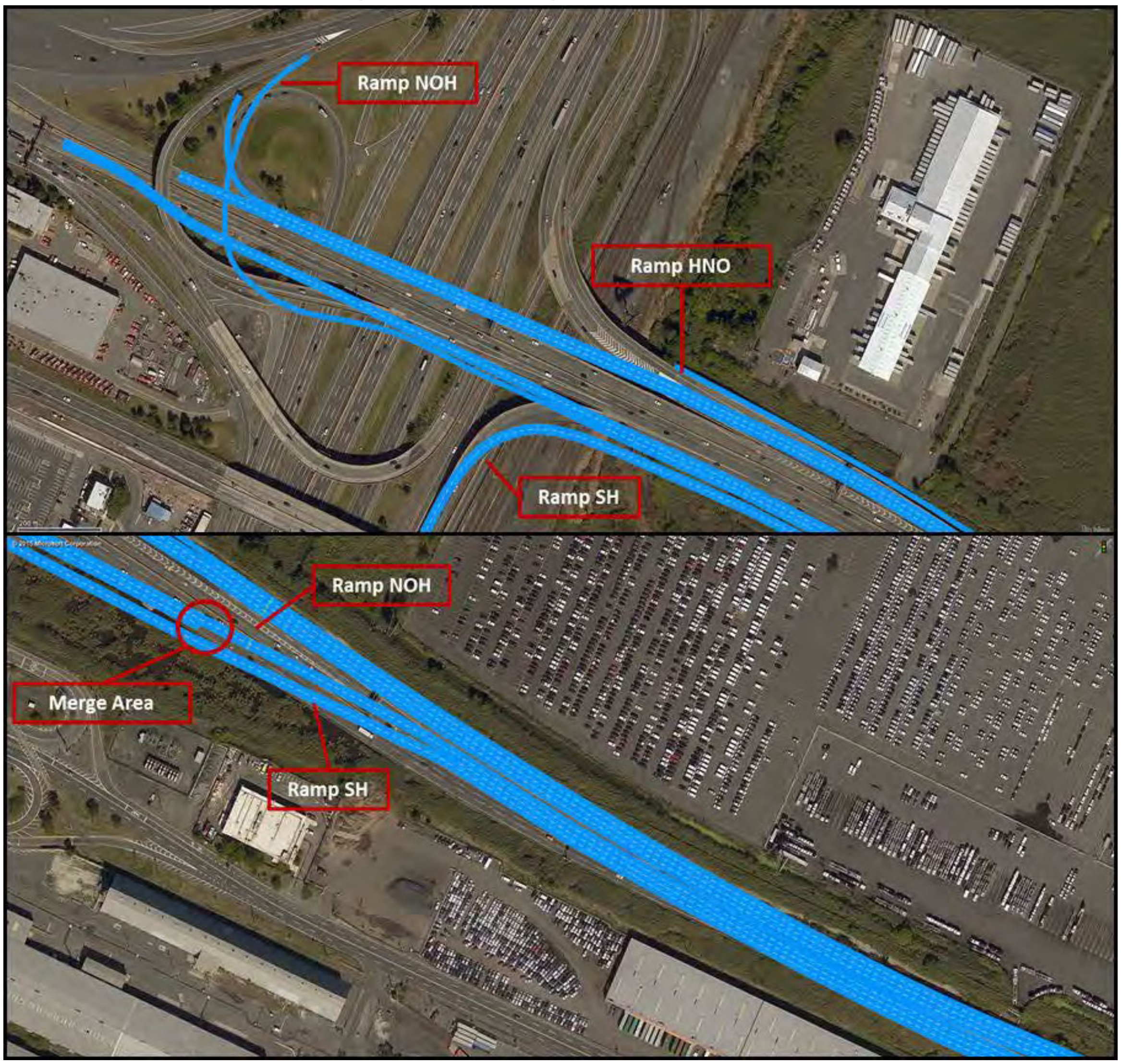


Table 6.2.1: AM Peak Period - 2045 Scenario 1 MOEs at Segment 1

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	71	45	2	1508	1486	22
I-95 SB-78 EB	81	44	3	596	594	2
I-95 NB-78 EB	60	48	3	2430	2361	69
78 WB-78 WB	72	46	4	2322	2131	191
78 WB-I-95 NB	50	49	3	661	595	66
78 WB-I-95 SB	89	38	16	1661	1514	147

Table 6.2.2: AM Peak Period - 2045 Scenario 1 MOEs at Segment 1

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	70	46	2	2102	2079	23
I-95 SB-78 EB	80	44	3	603	600	3
I-95 NB-78 EB	59	49	2	1513	1462	51
78 WB-78 WB	78	43	9	3361	3130	231
78 WB-I-95 NB	50	49	2	840	773	67
78 WB-I-95 SB	99	34	27	2124	1941	183

Multiple iterations of Segment 1 were tested before finalizing the IPA (Scenario 2). The existing NJTP/I-95 southbound entrance ramp merge was analyzed along with the proposed two-lane NJTP/I-95 northbound entrance ramp merge. This alternative was dismissed due to excessive queuing on the NJTP/I-95 southbound entrance ramp.

Scenario 2

Under Scenario 2, the NJTP/I-95 southbound entrance ramp (Ramp NOH) would provide an additional third lane on its mainline and the right lane would drop to form the four-lane NBHCE eastbound. The NJTP/I-95 northbound entrance ramp (Ramp SH) would tie in to the NBHCE to provide a five-lane segment which would reduce to a four-lane segment further downstream. The elimination of the existing NJTP/I-95 southbound entrance ramp (ramp NOH) merge would reduce the number of merge points prior to the NJTP/I-95 northbound entrance ramp (Ramp SH). Although this modification would yield only minor improvements in travel time, average speed, delay or processed volume for this segment when compared to Scenario 1, reducing the number of merge points in this section would decrease potential conflict between vehicles on the mainline and those entering from the NJTP/I-95 southbound entrance ramp. Scenario 2 is recommended for incorporation into the IPA for Segment 1. Scenario 2 is depicted on Figure 6.2.2 and the operational analysis results are summarized in Tables 6.2.3 and 6.2.4.

Figure 6.2.2: Segment 1, Scenario 2 Schematic

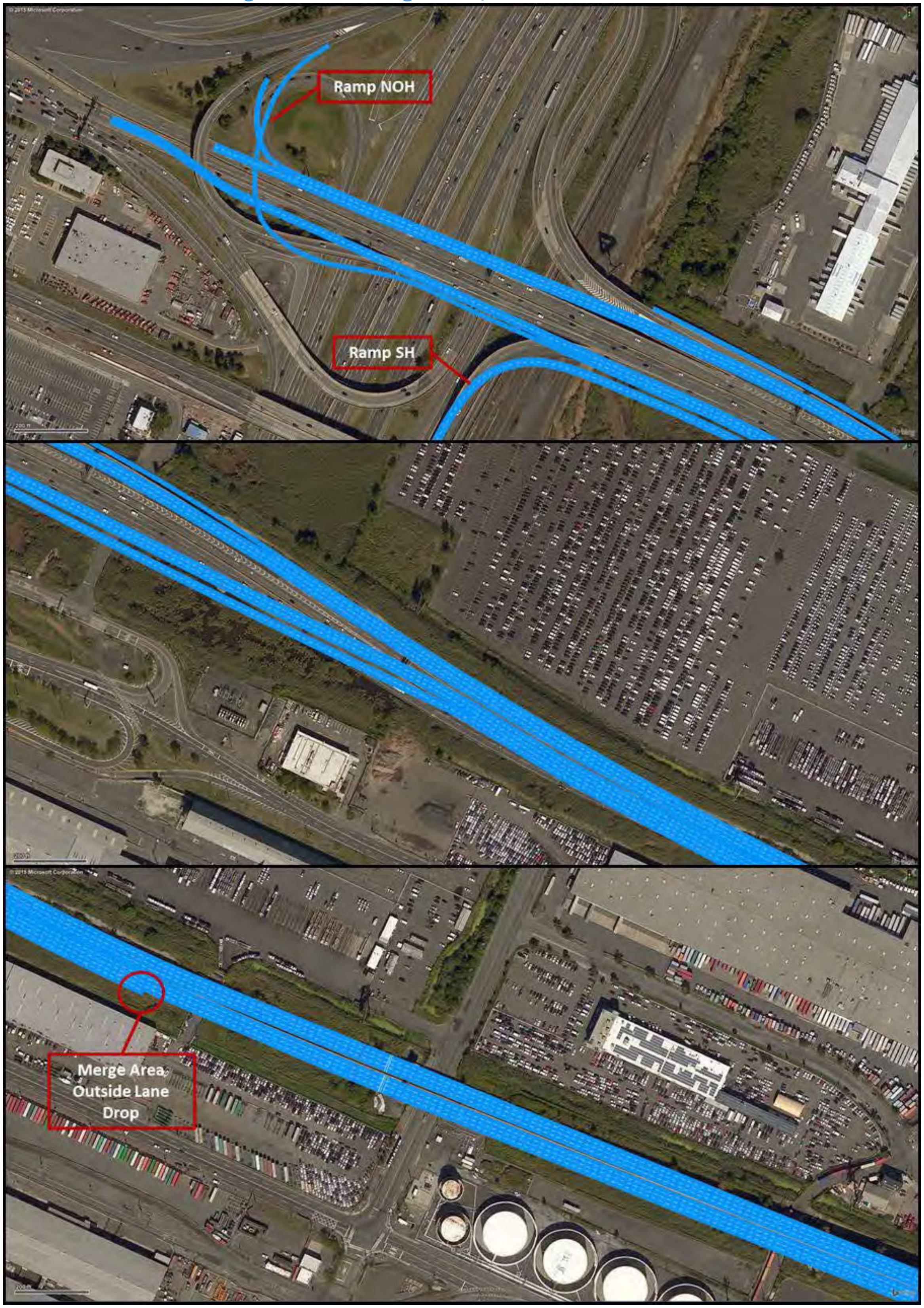


Table 6.2.3: AM Peak Period - 2045 Scenario 2 MOEs at Segment 1

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	71	46	2	1508	1486	22
I-95 SB-78 EB	80	45	2	596	594	2
I-95 NB-78 EB	68	42	11	2430	2358	72
78 WB-78 WB	72	46	3	2322	2127	195
78 WB-I-95 NB	50	49	3	661	595	66
78 WB-I-95 SB	89	38	15	1661	1510	151

Table 6.2.4: PM Peak Period - 2045 Scenario 2 MOEs at Segment 1

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	69	47	1	2102	2080	22
I-95 SB-78 EB	80	45	2	603	600	3
I-95 NB-78 EB	59	48	2	1513	1463	50
78 WB-78 WB	83	40	14	3361	3140	221
78 WB-I-95 NB	50	49	2	840	776	64
78 WB-I-95 SB	103	33	31	2124	1946	178

6.2.2. Segment 2 – Interchange 14A

Scenario 1

Scenario 1 modifies the number of lanes on the NBHCE between the Interchange 14A entrance and exit ramps in both the eastbound and westbound directions. Multiple iterations of the model were analyzed with various numbers of lanes between the Interchange 14A ramps to determine the optimal lane configuration for this segment of the NBHCE. In Scenario 1, the NBHCE Mainline provides three lanes in the eastbound direction and three lanes in the westbound direction between Interchange 14A exit and entrance ramps.

In addition, Scenario 1 updates the NBHCE westbound entrance ramp at Interchange 14A by providing two travel lanes with a right lane drop on the NBHCE westbound mainline in order to better accommodate future traffic growth. This modification would alleviate congestion/queuing and significantly reduce delay by 227 and 192 seconds per vehicle during the weekday AM and PM peak hours, respectively, when compared to the 2045 No-Build Scenario. Moreover, the average speed would also significantly increase on the NBHCE WB entrance ramp when compared to the 2045 No-Build Scenario. Scenario 1 is depicted by

Figure 6.2. and operational analysis results are summarized in Table 6.2.5 and Table 6.2.6.

Modifications under Scenario 1 would provide significant improvements to traffic operations and produce less than 22 seconds of delay for each origin-destination analyzed; therefore, Scenario 1 is the IPA for this segment.

Figure 6.2.3: Segment 2, Scenario 1 Schematic

Table 6.2.5: AM Peak Period - 2045 Scenario 1 MOEs at Segment 2

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	282	53	13	3380	3115	265
78 EB-14A Toll Plaza	196	46	22	1154	1079	75
78 WB-78 WB	272	55	8	2553	2386	167
78 WB-14A Toll Plaza	172	45	9	359	335	24
14A Toll Plaza-78 WB	186	50	10	2034	1658	376
14A Toll Plaza-78 EB	143	46	15	903	728	175

Table 6.2.6: PM Peak Period - 2045 Scenario 1 MOEs at Segment 2

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB	277	54	8	2442	2236	206
78 EB-14A Toll Plaza	190	47	19	1778	1688	90
78 WB-78 WB	277	54	13	4433	4022	411
78 WB-14A Toll Plaza	175	44	11	727	666	61
14A Toll Plaza-78 WB	190	49	13	1893	1585	308
14A Toll Plaza-78 EB	138	47	11	655	534	121

6.2.3. Segment 3 – Interchange 14B

Scenario 1

Scenario 1, recommended for advancement as part of the IPA, modifies the merge section from the NBHCE westbound entrance ramp at Interchange 14B to provide an additional lane from the ramp onto the NBHCE Mainline. As a result, the vehicles from the Interchange 14B Toll Plaza would no longer have to yield to the NBHCE westbound through traffic. As compared to the 2045 No-Build Scenario, queuing at the Interchange 14B westbound entrance ramp would be reduced significantly and delay would be reduced by 50 seconds per vehicle during the weekday PM peak hour. In the eastbound direction, three lanes would be carried through the interchange between the exit and entrance ramps. Scenario 1 is depicted Figure 6.3.4 and operational analysis results are summarized in Tables 6.2.7 and 6.2.8.

Figure 6.2.4: Segment 3, Scenario 1

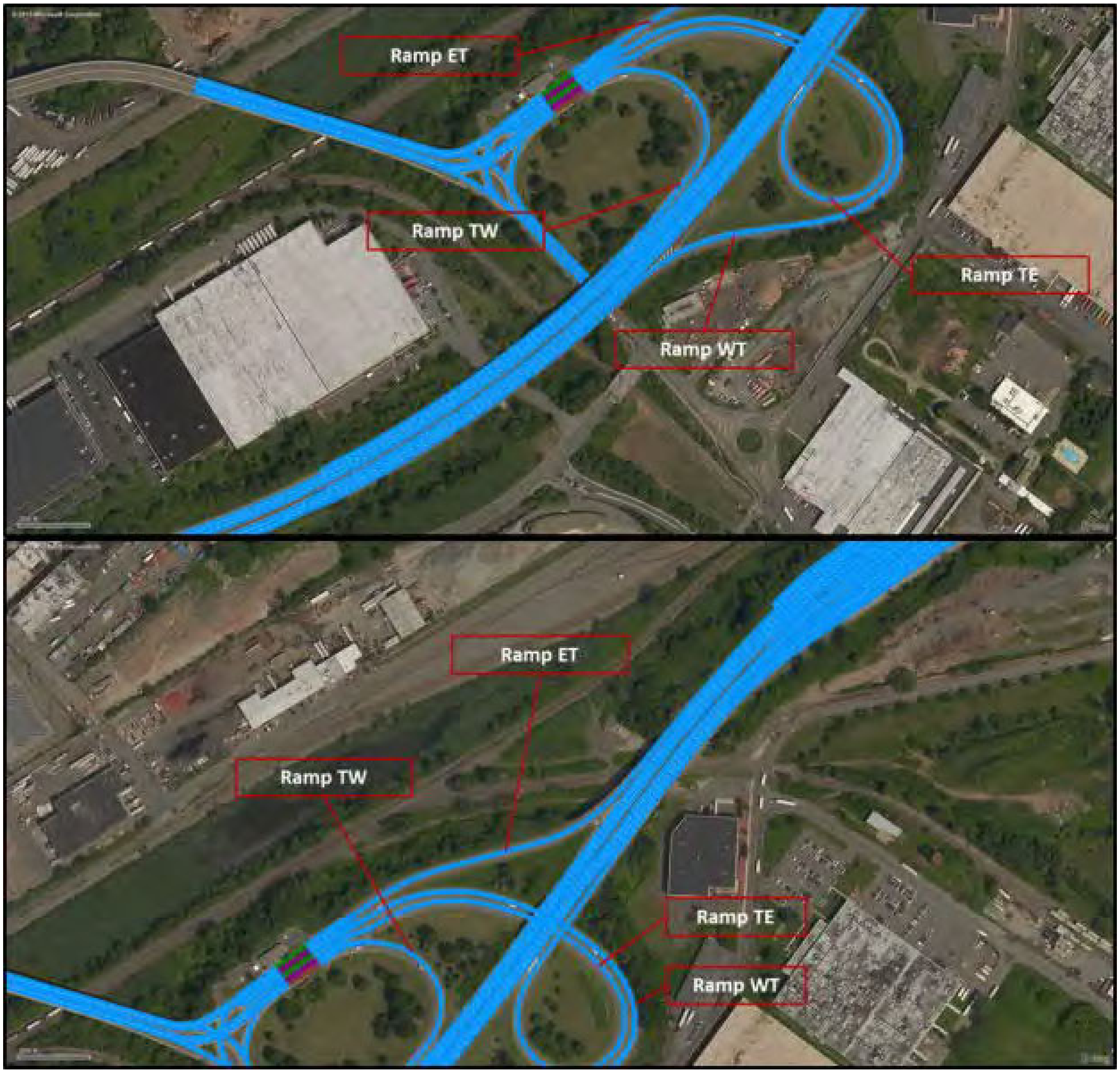


Table 6.2.7: AM Peak Period - 2045 Scenario 1 MOEs at Segment 3

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB (Express E-ZPass Lanes)	37	55	1	2647	2675	-28
78 EB-78 EB (Traditional Toll Lanes)	40	50	5	1397	1096	301
78 EB-14B Toll Plaza	66	29	5	239	251	-12
78 WB-78 WB	29	55	1	2661	2628	33
78 WB-14B Toll Plaza	28	30	4	306	284	22
14B Toll Plaza-78 EB (Express E-ZPass Lanes)	77	28	5	183	180	3
14B Toll Plaza-78 EB (Traditional Toll Lanes)	76	28	5	59	55	4
14B Toll Plaza-78 WB	37	31	1	251	258	-7

Table 6.2.8: PM Peak Period - 2045 Scenario 1 MOEs at Segment 3

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-78 EB (Express E-ZPass Lanes)	36	55	1	2014	1960	54
78 EB-78 EB (Traditional Toll Lanes)	37	54	2	832	757	75
78 EB-14B Toll Plaza	65	29	4	250	233	17
78 WB-78 WB	29	54	1	4815	4647	168
78 WB-14B Toll Plaza	27	31	3	230	225	5
14B Toll Plaza-78 EB (Express E-ZPass Lanes)	75	28	4	157	161	-4
14B Toll Plaza-78 EB (Traditional Toll Lanes)	83	25	3	21	21	0
14B Toll Plaza-78 WB	37	31	2	345	344	1

Modifications under Scenario 1 would provide significant improvements to traffic operations and produce less than 10 seconds of delay for each origin-destination analyzed, therefore, Scenario 1 is the IPA for this segment.

6.2.4. Segment 4 – Interchange 14C

Scenario 1

Scenario 1 modifications include the addition of E-ZPass fast lanes for both the NBHCE eastbound and NBHCE westbound at the Interchange 14C Toll Plaza. The eastbound configuration would be modified to include two E-ZPass Express lanes and four Traditional Toll lanes. The westbound configuration would be modified to include two E-ZPass Express lanes and five Traditional Toll lanes. As previously mentioned in the 2045 No-Build Scenario, there was a bottleneck effect further downstream of the Interchange 14C

Toll Plaza in the eastbound direction that was limiting the amount of vehicles that could be processed at this location. Under the Build Scenario, the bottleneck would dissipate as a result of the proposed E-ZPass Express lanes and extension of four lanes on the NBHCE eastbound to the Columbus Drive exit, allowing the Interchange 14C Toll Plaza to process more vehicles.

During the weekday AM peak hour, the Interchange 14C Toll Plaza would process 95% of vehicles in the eastbound direction and 98% of vehicles in the westbound direction. During the weekday PM peak hour, the Interchange 14C Toll Plaza would process 96% of vehicles in the eastbound direction and 96% of vehicles in the westbound direction. It is important to note that under Scenario 1, vehicles on the NBHCE westbound exiting at Interchange 14B would be able to use the E-ZPass Express lanes (see Figure 6.2.5). Operational analysis results from the modified Interchange 14C toll booth plaza under Scenario 1 are summarized in Table 6.2.9 and Table 6.2.10.

Figure 6.2.5: Segment 4, Scenario 1

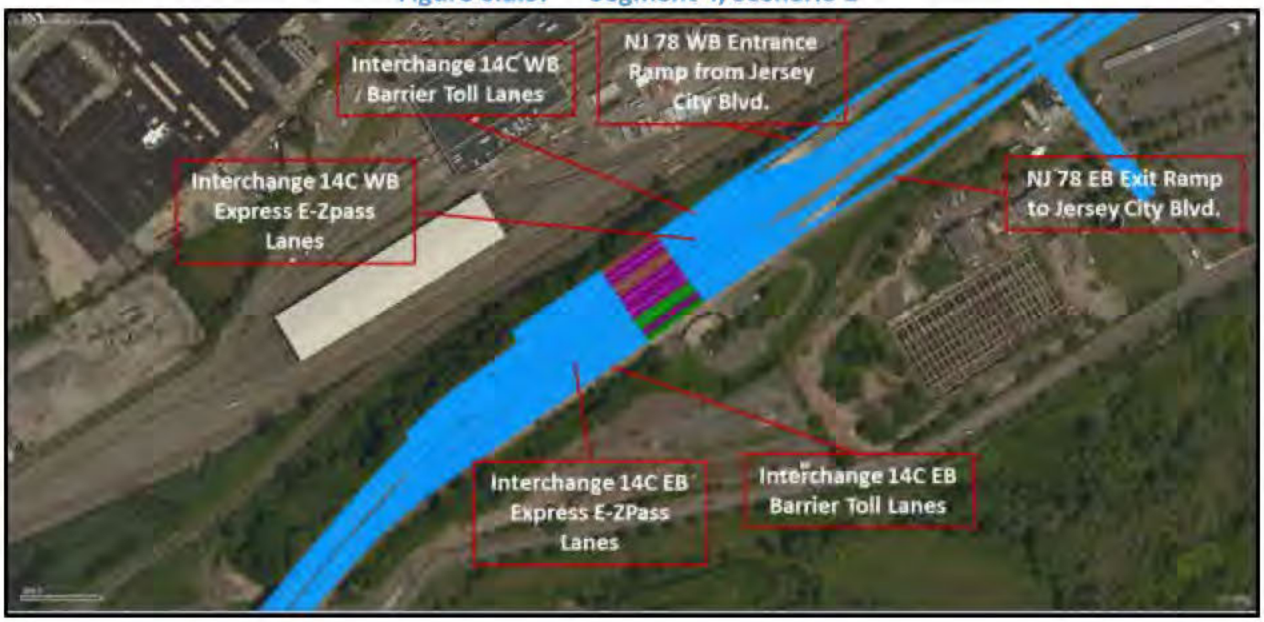


Table 6.2.9: AM Peak Period - 2045 Scenario 1 MOEs at Segment 4

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB (E-ZPass Fast Lanes)-78 EB	30	54	1	3030	2866	164
78 EB (E-ZPass Shared Lanes)-78 EB	61	26	16	572	557	15
78 EB (E-ZPass Shared Lanes)-Jersey City Blvd	46	21	12	684	646	38
78 WB (E-ZPass Fast Lanes)-78 WB	28	55	1	2351	2322	29
78 WB (E-ZPass Shared Lanes)-78 WB	57	27	8	562	543	19
Jersey City Blvd-78 WB	71	26	2	54	51	3

Table 6.2.10: PM Peak Period - 2045 Scenario 1 MOEs at Segment 4

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB (E-ZPass Fast Lanes)-78 EB	29	55	1	2171	2123	48
78 EB (E-ZPass Shared Lanes)-78 EB	71	23	25	801	730	71
78 EB (E-ZPass Shared Lanes)-Jersey City Blvd	39	25	5	52	46	6
78 WB (E-ZPass Fast Lanes)-78 WB	28	55	1	2483	2397	86
78 WB (E-ZPass Shared Lanes)-78 WB	54	28	12	2271	2158	113
Jersey City Blvd-78 WB	75	25	5	291	278	13

Scenario 2

Scenario 2 modifies the NBHCE WB lane merge upstream of the Interchange 14C Toll Plaza to restrict vehicles from utilizing the E-ZPass Express lanes to exit at Interchange 14B due to potential weaving issues. The curbed nose separating the E-ZPass Express lanes from the E-ZPass/Ticket shared lanes would be extended to enforce this restriction. Although this modification would not decrease delay, the extension of the curved nose would reduce weaving in this section thereby decreasing potential conflict between vehicles on the mainline and those exiting to Interchange 14B. Scenario 2, illustrated on Figure 6.2.6 is the IPA for segment 4. Operational analysis results from Scenario 2 are summarized in Table 6.2.11 and Table 6.2.12.

Figure 6.2.6: Segment 4, Scenario 2

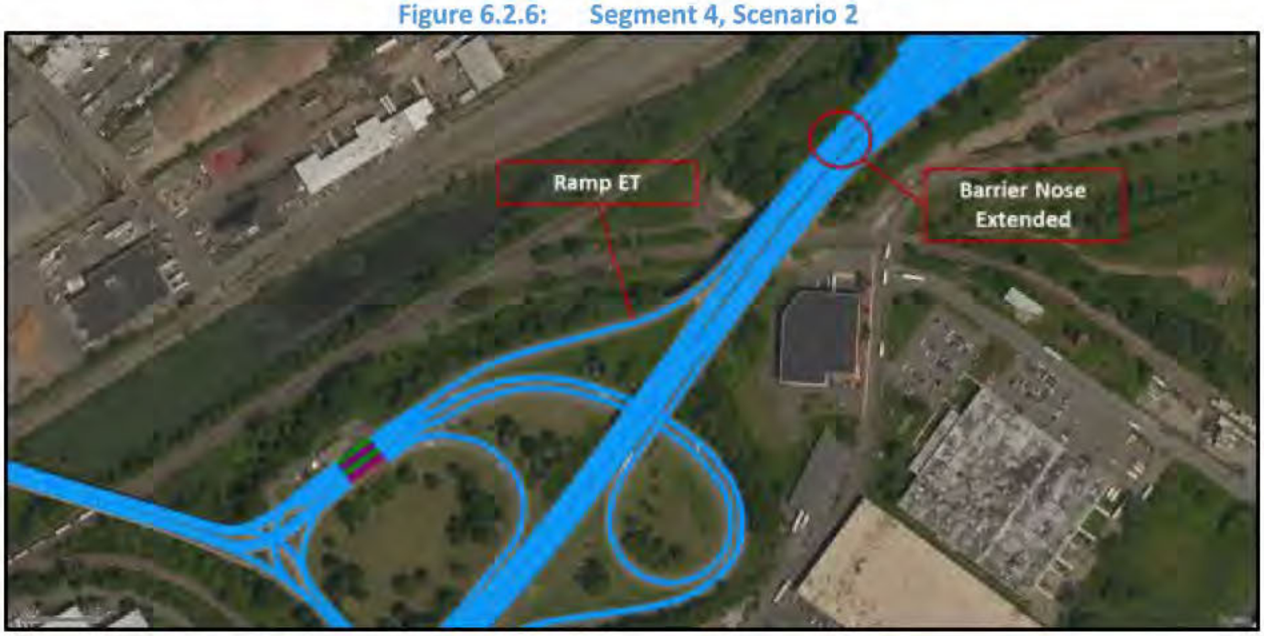


Table 6.2.11: AM Peak Period - 2045 Scenario 2 MOEs at Segment 4

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB (E-ZPass Fast Lanes)-78 EB	30	54	1	3030	2864	166
78 EB (E-ZPass Shared Lanes)-78 EB	61	26	15	572	556	16
78 EB (E-ZPass Shared Lanes)-Jersey City Blvd	46	21	13	684	645	39
78 WB (E-ZPass Fast Lanes)-78 WB	28	55	1	2351	2324	27
78 WB (E-ZPass Shared Lanes)-78 WB	57	27	8	562	545	17
Jersey City Blvd-78 WB	72	26	2	54	51	3

Table 6.2.1: PM Peak Period - 2045 Scenario 2 MOEs at Segment 4

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB (E-ZPass Fast Lanes)-78 EB	29	55	1	2171	2121	50
78 EB (E-ZPass Shared Lanes)-78 EB	72	23	25	801	732	69
78 EB (E-ZPass Shared Lanes)-Jersey City Blvd	38	25	6	52	46	6
78 WB (E-ZPass Fast Lanes)-78 WB	27	55	1	2483	2413	70
78 WB (E-ZPass Shared Lanes)-78 WB	60	25	18	2271	2161	110
Jersey City Blvd-78 WB	79	24	9	291	278	13

6.2.5. Segment 5 – Interchange 14C to Jersey Avenue

Scenario 1

Scenario 1 modifies the merge section from the NBHCE westbound entrance ramp starting from Merseles Street to form the start of the third westbound lane from the ramp terminal onto the NBHCE Mainline (Figure 6.2.7). As a result, the vehicles from Merseles Street would no longer have to wait for a gap to merge onto the NBHCE WB. As compared to the 2045 No-Build Scenario, delay would be reduced by 131 seconds per vehicle and an additional 553 vehicles would be processed during the weekday PM peak hour. Congestion in the eastbound direction is directly associated with the signal at NBHCE eastbound and Jersey Avenue and the congestion and queuing from the Holland Tunnel. Potential mitigation measures on the local roadway network should be investigated in the next phase of design after completion of the comprehensive traffic data collection and model calibration validation. The operational analysis results for Scenario 1 are summarized in Table 6.2.13 and Table 6.2.14.

Scenario 1 would provide significant improvements to traffic operations and would produce 10 or less seconds of delay per vehicle for the westbound origin-destination sections analyzed; therefore, Scenario 1 is the IPA for this segment. A supplement to this alternative would be the inclusion of a split in the new ramp to also provide a direct connection to Jersey Avenue at the intersection with the Newport

Mall Driveway. This connection would draw traffic destined for points south in Jersey City away from the Holland Tunnel approach plaza.

Figure 6.2.7: Segment 5, Scenario 1

Table 6.2.2: AM Peak Period - 2045 Scenario 1 MOEs at Segment 5

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-Local Jersey City	334	20	195	1831	1502	329
78 EB-Columbus Dr	99	31	18	1771	1647	124
Local Jersey City-78 WB (E-ZPass Fast Lanes)	139	51	5	1782	1683	99
Local Jersey City-78 WB (E-ZPass Shared Lanes)	139	51	5	426	398	28
Merseles St-78 WB (E-ZPass Fast Lanes)	48	49	1	569	570	-1
Merseles St-78 WB (E-ZPass Shared Lanes)	48	50	1	136	141	-5

Table 6.2.3: PM Peak Period - 2045 Scenario 1 MOEs at Segment 5

Origin-Destination	Travel Time (sec.)	Average Speed (mph)	Delay (sec.)	Demand Volume	Processed Volume	Delta
78 EB-Local Jersey City	465	15	322	2163	1698	465
78 EB-Columbus Dr	94	32	13	809	741	68
Local Jersey City-78 WB (E-ZPass Fast Lanes)	140	51	6	1817	1690	127
Local Jersey City-78 WB (E-ZPass Shared Lanes)	145	50	10	1579	1453	126
Merseles St-78 WB (E-ZPass Fast Lanes)	50	49	2	666	671	-5
Merseles St-78 WB (E-ZPass Shared Lanes)	52	47	4	692	679	13

6.3. Design Speed Analysis of Recommended Alignment

The conceptual design study included an assessment of the anticipated design speeds and posted speed limits for concept improvements to the NBHCE from Interchange 14 to the eastern terminus at Jersey Avenue in Jersey City. While the concept study is limited in detail, employing uncontrolled aerial mapping at a scale of 1”=100’ as the basis for the development of alignment alternatives, the available basemap was sufficient to prepare an initial assessment of the geometric elements affecting design speed and posted speed limits for the IPA.

The following describes an assessment of design speed of the IPA, segment by segment, based on the unique characteristics of each segment. A summary is also provided to address design speed and potential posted speed limits based on corridor considerations including interchange toll plazas and local street networks. Final determination of design speeds and posted speed limits to be applied in segments of the NBHCE would require policy decisions by NJTA engineering and operations staff regarding the strict adherence to NJTA design standards versus application of AASHTO design standards.

6.3.1. Alignment in the Vicinity of Interchange 14 to Doremus Avenue

NBHCE - Westbound

Heading west from station 5100+00±, a series of compound curves to the right, all of which are greater than 6,000 ft which exceeds the 3,000 ft minimum radius for 60 mph Design Speed (DS) as prescribed by NJTA criteria, would be followed by compound curves to the left, each also exceeding 3,000 ft minimum radius. These reverse curves would be separated by a tangent of approximately 500 ft, less than the desirable 1,000 ft minimum tangent as per NJTA criteria, but sufficient to accomplish superelevation transition in conformance with NJTA absolute minimum criteria for 60 mph DS. The tangent section west of these curves would support a 60 mph DS with a suggested posted speed (PS) of less than 55 mph approaching the toll plaza in the westbound direction.

NBHCE - Eastbound

Heading east from the Interchange 14 toll plaza to the NBHCE roadway, a single curve of 8,000 ft radius is proposed that would conform to NJTA criteria for a DS and PS of 60 and 55 mph, respectively. It is recommended that mainline criteria be applied following the merge of the NBHCE eastbound roadway with ramps NOH and SH. Following the merge of these ramps, the NBHCE eastbound roadway is proposed on a tangent until becoming concentric with the NBHCE westbound alignment in the vicinity of 3500+00 to the vicinity of 5100+00.

Summary and Conclusion: Alignment in the Vicinity of Interchange 14 to Doremus Avenue

Both the NBHCE westbound and eastbound alignments would satisfy NJTA design criteria for 60 MPH DS applying absolute minimum allowable tangent length criteria, 6,000 ft curve radii and 600 ft absolute minimum curve length. Curve ratios in compound configurations would require refinement in the next phase of design to meet 1:1-1/2 curve ratio criteria which is expected to be attainable.

It should be noted that these geometric conditions would apply to a short-span bridge, with the main Newark Bay crossing bridges on a tangent. In the event that the width of the navigational channel spanned by the bridge cannot be narrowed sufficiently to accommodate a short-span structure, a flat reversed curve alignment may be required on the westerly approach spans to create space to accommodate the towers of a cable stayed or extradosed structure. These curves would exceed 3,000 ft radius and would continue to allow for a 60 mph DS. More detailed development of this alignment is required in the next phase of design.

6.3.2. Alignment in the Vicinity of Route 440 Crossing (Bayfront) to Linden Avenue Crossing

NBHCE – Eastbound and Westbound

A long tangent across the bay would lead into this segment of the NBHCE. In this segment of mainline roadway, the eastbound and westbound alignments would be concentric curves and parallel tangents separated by the proposed 26 ft standard desirable median as per NJTA design criteria. The existing reversed curve configuration is proposed to be generally replicated in the IPA in this segment. As described in Section 2.1 – Roadway Geometry and Design Speed of the NJTA's Design Manual, the existing mainline curves in the vicinity of Interchange 14A do not conform to NJTA design criteria for a 60 mph DS. However, the proposed replacement of Bridge No. 3.73 affords an opportunity to realign the mainline employing a compound curve configuration of approximately 1,920 ft radius with a 3,050 ft radius. Staging for this section of roadway construction proposes constructing two lanes in each direction to the south of the existing bridge along a new alignment independent of the existing alignment. However, the 1,920 ft radius would not meet the NJTA desirable 3,000 ft minimum radius for 60 mph DS, and curve lengths would both exceed the 600 ft minimum desirable length. Further west, the proposed 4,000 ft radius curve in the vicinity of the Kennedy Boulevard crossing and the approximately 1,000 ft long tangent separating the reversed curves of this segment would exceed NJTA design criteria for a 60 MPH DS.

As NJTA criteria does not address design speeds for a mainline curve less than 3,000 ft in radius, reference to the AASHTO Policy on Geometric Design of Highways and Streets, 2011 6th edition (the Green Book) was made to determine the safe design speed for a 1,920 ft radius curve with full 5% superelevation per NJTA criteria. Per Table 3.9 – Minimum Radii for Design Superelevation Rates, Design Speeds and e-max = 6% (page 3-45), the minimum radii for a DS of 55 and 60 mph, respectively are 1,890 ft and 2,330 ft assuming 5% superelevation. Accordingly, the proposed radius of 1,920 ft meets the criteria for 55 mph DS. Increased superelevation would exceed the 55 mph DS.

Summary and Conclusion: Alignment in the Vicinity of Route 440 Crossing Bayfront to Linden Avenue Crossing

The proposed reverse curve configuration of this segment of roadway does not totally conform to NJTA's 60 mph design criteria. The following options are available for consideration in the determination of DS and PS in the next phase of design:

a. Post this segment at 50 mph, 5 mph below the DS.
b. Post this segment at 55 mph, equal to the DS.
c. Provide a superelevation rate of 5.6% on the 1,920 ft radius curve to provide a 60 mph DS per AASHTO criteria and post this segment at 55 mph, 5 mph below the design speed.

A waiver of NJTA criteria would be required to attain a 60 mph DS.

6.3.3. Alignment in the Vicinity of Chapel Avenue to the Interchange 14C Toll Plaza

NBHCE – Eastbound and Westbound

In this segment of mainline roadway, the eastbound and westbound alignments would be concentric curves and parallel tangents with the exception of the Interchange 14C toll plaza approach. The typical 26 ft wide center median is proposed, tapering to a 7 ft wide median east of the toll plaza.

Heading east from the vicinity of the Linden Avenue crossing, a long tangent exceeding 2,800 ft in length would lead to a curve to the right of approximately 3,940 ft radius and exceeding 600 ft in length. The tangent and curve would be adequate for a 60 mph DS per NJTA criteria. This curve would be followed by a tangent of approximately 700 ft and a curve to the left of approximately 3,440 ft radius, forming a reverse curve configuration. This tangent would be adequate for a 60 mph DS applying NJTA absolute minimum allowable criteria. The curve would also be adequate for a 60 mph DS, exceeding the 3,000 ft minimum radius criteria and the 600 ft minimum length criteria.

Heading east to the Interchange 14C toll plaza approach, a tangent of approximately 700 ft length would lead to a curve to the right of 2,500 ft radius forming another reversed curve alignment configuration. This tangent length would not satisfy the NJTA's desired 1,000 ft length between reversed curves but would be adequate for 60 mph applying the absolute minimum allowable criteria for superelevation runoff between reverse curves. The 2,500 ft radius curve approaching the toll plaza would be adequate for 60 mph DS at 5% superelevation per AASHTO standards and would exceed 600 ft in length, but a reduced posted speed via advisory signs through the E-ZPass lanes in both the eastbound and westbound directions may be warranted.

Heading east, the 2,500 ft radius curve to the right would be followed by a tangent of approximately 400 ft in length leading to a flat curve to the left of approximately 60,000 ft radius and 600 ft length in the immediate area of the barrier plaza. This arrangement would form a reversed curve configuration. Proceeding east, a 1,500 ft tangent would then form a broken-back curve configuration with the next 1,330 ft radius curve to the left. This reversed curve and broken-back configuration could attain a 60 mph DS by application of 5% superelevation to the 2,500 ft radius curve, a normal crown on the 60,000 ft radius curve and the 1,500 ft tangent between the same direction curves (the NJTA's absolute minimum acceptable tangent length between same direction curves). It is noted that the reversed curve and broken-back alignment could potentially be eliminated by a single long tangent extending through the plaza area from the 2,500 ft radius curve to the 1,330 ft radius curve. This should be investigated in detail in the next phase of project design.

Summary and Conclusion: Alignment in the Vicinity of Chapel Avenue to the Interchange 14C Toll Plaza

This segment of mainline roadway would conform to the 60 mph DS criteria provided absolute minimum allowable criteria for tangent lengths between reverse curves is acceptable to NJTA, and AASHTO criteria is applied to the 2,500 ft radius curve. The posted speed limit for the E-ZPass lanes in both directions would also be a decision to be made by the NJTA. This determination may be influenced by the DS considerations described in the next section, as well as a desire to reduce speeds approaching and departing the toll plaza.

6.3.4. Alignment in the Vicinity of Interchange 14C Toll Plaza to Christopher Columbus Drive

NBHCE – Eastbound and Westbound

Heading east from the Interchange 14C toll plaza, a long tangent from the plaza would lead to a curve to the left of approximately 1,330 ft radius, a tangent section of 500 ft and a series of compound curves, the least radius of which would be approximately 1,610 ft. This reversed curve configuration would closely follow the existing roadway alignment to minimize impacts on sensitive infrastructure including the Liberty Science Center, a multi-unit housing development, protected parklands / athletic fields and other commercial and residential properties. However, the initial section of two-lane, two-directional viaduct to the west of the existing viaduct (see Sections D-D and E-E) would be independent of the existing viaduct and could be aligned in conformance with current design standards.

The first curve of 1,330 ft radius would be adequate for 45 mph DS if superelevated to 5%, as per AASHTO standards. If superelevated to 6%, a DS of 60 mph could be attained. Because the curve is on the approach to the Interchange 14C toll plaza, a DS and PS of 50 and 45 mph respectively may be desirable.

The tangent separating the reverse curves would be approximately 500 ft in length and would be adequate for runout of superelevation employing NJTA absolute minimum allowable criteria. It is anticipated that the compound curves east of this tangent could be refined in the next phase of design to satisfy the 1:1-1/2 curve ratio criteria with the least radius in the series of curves being 1,610 ft. Employing AASHTO criteria, this curve could attain a 50 mph DS at 5% superelevation and a 60 mph DS at 6% superelevation.

Summary and Conclusion: Alignment in the Vicinity of Interchange 14C Toll Plaza to Christopher Columbus Drive

This segment of mainline roadway cannot meet NJTA criteria for DS of 60 mph; however, if AASHTO criteria were to be applied and 6% superelevation is provided, 60 mph DS would be attainable. If 5% superelevation is provided per NJTA design criteria, 50 mph DS would be attainable.

The following options are available for consideration and application in determination of DS and PS in the next phase of design.

a. Limit superelevation to a maximum of 5% and attain a limited DS of 45 mph on the approaches to and from the Interchange 14C toll plaza. Heading east, a DS of 50 mph can be attained at 5% superelevation.
b. Employ 6% superelevation on the reverse curves of this segment to attain a 60 mph DS.

Considering this segment of roadway is framed by the Interchange 14C toll plaza to the west and the 14th Street and 11th Street viaduct curves to the east, a DS of less than 60 mph and a PS of less than 55 mph may be desirable. As described in the following section, the 14th Street and the 11th Street viaducts curves are proposed to employ ramp criteria and as such would attain lower DS and PS than the NBHCE mainline. The long tangent leading to these ramp curves may require advisory speed signing to discourage high speed operation in this area.

Any combination of options (a) and (b) above may be applied in this reversed curve segment of roadway. The selection of the preferred option is dependent on a waiver of the NJTA design standards and application of AASHTO criteria, which would be a policy decision for NJTA.

6.3.5. Alignment in the Vicinity of Christopher Columbus Drive to Jersey Avenue

NBHCE – Eastbound and Westbound

In this segment of mainline roadway, a long tangent beginning in the vicinity of Christopher Columbus Drive would lead to separate curves connecting to 11th Street in the eastbound direction and 14th Street in the westbound direction.

In the eastbound direction a simple curve of 485 ft radius is proposed to tie to the tangent section in the 11th Street corridor. Applying NJTA ramp design criteria, this curve could attain a 40 mph DS at full 6% superelevation (NJTA's maximum allowable superelevation on ramps). This 40 mph DS and a PS of 35 mph may be appropriate considering the need to impose reduced speeds as the NBHCE transitions from a freeway to ramps that tie into signalized arterial and local streets leading to the Holland Tunnel and the Jersey City local street network. The proposed roadway alignment in the 11th Street corridor would terminate at Jersey Avenue with a reversed curve alignment leading to the intersection. The tie in point with Jersey Avenue would be in the same location as the existing tie in, thereby avoiding project-induced changes in the local street network circulation patterns. The reverse curve alignment would employ local/urban street design criteria and attain a DS and PS of 35 and 30 mph, respectively.

In the westbound direction, the NBHCE would diverge from the 14th Street/Route 139 alignment and is proposed to generally replicate the existing roadway alignment but shifted to the west to accommodate staged construction while maintaining westbound traffic on the existing alignment. This westbound curve of 740 ft radius could attain a 45 mph DS with a superelevation of 6% employing NJTA ramp design criteria.

Summary and Conclusion: Alignment in the Vicinity of Christopher Columbus Drive to Jersey Avenue

This segment of mainline roadway may be a candidate for a DS less than 60 mph and a PS of less than 55 mph given the influence of the Interchange 14C toll plaza and the 11th Street and 14th Street ties into the local street network and the Holland Tunnel plaza approach. Depending on NJTA decisions on the application of superelevation rates for the curves of the preceding segment of roadway, a DS and PS of 50 and 45 mph may be appropriate from Interchange 14C through the long tangent heading west. Lower speeds would be appropriate on the 14th Street and 11th Street curves and to the east per application of ramp and urban street design criteria.

6.3.6. Summary and Conclusion

[redacted]

[redacted]

6.4. Potential for Lowering of Vertical Profile

As discussed in Chapter 2, the NBHCE crosses over active rail lines owned by NJ TRANSIT and Conrail at several locations. Conrail maintains a policy requiring a minimum of 23 ft of vertical clearance from the top of rail for any infrastructure crossing the rail right of way. Existing clearance above these crossings, particularly in the section between Structure N6.49 and Structures N7.90 E and W appear to be well in excess of the minimum required 23 ft. The potential for lowering the existing profile and reducing the size and cost of required foundations and substructure should be investigated in the preliminary engineering phase of project development.

6.5. Staging and Construction Costs

The segmentation of the full corridor replacement into a series of discrete projects used similarities in traffic operational needs to describe the various operational contexts of the NBHCE. Similar contexts were grouped together as “Projects” and defined as those areas of the project with similar traffic operations and that begin and end at a junction between two individual structures. Each project can be constructed and operate independently of the other projects that make up the full corridor replacement program. An Early Action project was similarly identified based solely upon the findings of the structural condition evaluation and the need to replace certain discrete structures in the immediate future. The discrete projects are as follows:

- Project 1A- Interchange 14A Structures N3.53D and N3.73 and Interchange 14 Structure 16A Replacements (this is also the Early Action element of Project 1B)
- Project 1B – Interchange 14 to East Side of Interchange 14A
- Project 2 – East Side of Interchange 14A to Interchange 14B and Bayview Viaduct Rehabilitation
- Project 3 – Columbus Drive to Holland Tunnel Plaza
- Project 4 – Interchange 14B to Columbus Drive Ramps/Interchange 14C Toll Plaza Expansion

The sections that follow describe the staging and construction costs for each Project in detail.

6.5.1. Project 1A (Early Action) - Interchange 14 Structure N0.16A and Interchange 14A Structures N3.53D and N3.73 Replacement

It was determined through review of the recent structural inspection reports that several of the existing structures along the Hudson County Extension have a limited remaining service life. This is not to say that they are in imminent danger of failure, but that maintenance requirements and costs are becoming excessive, warranting full replacement of these structures. The replacement structures are to be designed and constructed in consideration of the full corridor replacement as part of the preliminary engineering of Project 1B – Replacement of the Newark Bay Bridge and approach spans. Due to the critical structural need to replace these structures, final design should be advanced while the environmental documentation is being completed as part of Project 1B so that construction of these ramp replacements can commence upon securing of the environmental permits for the full Program.

Several discrete structures were identified where the remaining service life and the recurring maintenance costs warrant near term replacement. These structures include Structures N3.53D and N3.73 within the Interchange 14A area and Structure N0.16A within the Interchange 14 area. It is recommended that replacement of these structures be advanced as an early action element of Project 1B, with the replacement structures constructed consistent with the full corridor improvement plan depicted in the IPA. **Error! Reference source not found.** summarizes the estimated construction cost.

Table 6.5.1: Project 1A Construction Costs

	DEMOLITION				CONSTRUCTION					
	EXIST. AREA (SF)	DEMO. TYPE	DEMO. UNIT COST (PER/SF)	DEMO. COST	RET. WALL LENGTH (LF)	AREA (SF)	RECONSTR. TYPE	CONSTRUCTION UNIT COST (PER/SF)	CONSTRUCTION COST	TOTAL COST
BRIDGES										
N 0.16A	32,632	EC	$125.00	$4,079,000	-	50,918	EC	$600	$30,551,000	$34,630,000
N 3.53D	35,244	C	$100.00	$3,524,000	-	32,578	C	$500	$16,289,000	$19,813,000
N 3.73	205,010	EC	$125.00	$25,626,000	-	324,456	EC	$600	$194,674,000	$220,300,000
Retaining Walls	-	-	-	-	458	5,496	-	$100	$550,000	$550,000
Roadway	-	-	-	-	-	-	-	$30	-	-
									$242,064,000	**$275,293,000**

U **Uncomplicated -** Conventional framing with relatively uncomplicated access and staging requirements
C **Complicated -** Complicated framing or complicated staging requirements or difficult assess
EC **Extremely Complicated reconstruction**- Complicated framing, difficult access and complicated staging requirements
NBD **Newark Bay Bridge Demolition** - Demolition of entire Newark Bay Bridge (2.01W, 2.01 & 2.01E)
NBMSR **Newark Bay Bridge Main Spans Reconstruction**- Reconstruction of Main Spans over Shipping Channel

6.5.2. Project 1B - Interchange 14 to West Side of Interchange 14A

It is recommended that the replacement of the Newark Bay Bridge be undertaken as the first full project of the program (**Error! Reference source not found.**). Due to operational and ramp configuration requirements, it is recommended that all of the associated improvements from Interchange 14 to and through Interchange 14A (Project 1A and Project 1B) be undertaken concurrently.

Table 6.5.2: Project 1B Construction Costs

	DEMOLITION				CONSTRUCTION					
	EXIST. AREA (SF)	DEMO. TYPE	DEMO. UNIT COST (PER/SF)	DEMO. COST	RET. WALL LENGTH (LF)	AREA (SF)	RECONSTR. TYPE	CONSTRUTION UNIT COST (PER/SF)	CONSTRUCTION COST	TOTAL COST
BRIDGES										
N 0.28A	110,625	C	$100.00	$11,063,000	-	123,464	C	$500	$61,732,000	$72,795,000
N 0.28C	40,271	C	$100.00	$4,027,000	-	33,671	C	$500	$16,836,000	$20,863,000
N 0.28D	38,443	EC	$125.00	$4,805,000	-	68,152	EC	$600	$40,891,000	$45,696,000
N 0.75	436,687	C	$100.00	$43,669,000	-	903,603	C	$500	$451,801,000	$495,470,000
N 2.01W	327,508	NBD	$140.00	$45,851,000	-	575,655	C	$500	$287,828,000	$333,679,000
N 2.01	112,439	NBD	$140.00	$15,741,000	-	186,451	NBMSR	$1,000	$186,451,000	$202,192,000
N 2.01E	332,633	NBD	$140.00	$46,569,000	-	584,391	C	$500	$292,196,000	$338,765,000
N 3.00	17,981	U	$65.00	$1,169,000	-	36,094	U	$400	$14,438,000	$15,607,000
N 3.24	13,884	U	$65.00	$902,000	-	21,718	U	$400	$8,687,000	$9,589,000
N 3.39	6,221	U	$65.00	$404,000	-	14,021	U	$400	$5,609,000	$6,013,000
N 3.53B	2,233	U	$65.00	$145,000	-	7,012	U	$400	$2,805,000	$2,950,000
N 3.53C	3,149	U	$65.00	$205,000	-	6,167	U	$400	$2,467,000	$2,672,000
Retaining Walls	-	-	-	-	6,079	72,948	-	$100	$7,295,000	$7,295,000
Roadway	-	-	-	-	-	475,308	-	$30	$14,259,000	$14,259,000
									$1,393,295,000	**$1,567,845,000**

U **Uncomplicated -** Conventional framing with relatively uncomplicated access and staging requirements
C **Complicated -** Complicated framing or complicated staging requirements or difficult assess
EC **Extremely Complicated reconstruction**- Complicated framing, difficult access and complicated staging requirements
NBD **Newark Bay Bridge Demolition** - Demolition of entire Newark Bay Bridge (2.01W, 2.01 & 2.01E)
NBMSR **Newark Bay Bridge Main Spans Reconstruction**- Reconstruction of Main Spans over Shipping Channel

6.5.3. Project 2 – Columbus Drive to Holland Tunnel Plaza

The remainder of the corridor from Interchange 14A to the Holland Tunnel Plaza may be constructed as 3 discrete projects, with no operations-based recommendation as to the order of construction. However, considering the potential for Open Road Tolling in the future and the critical structural need for replacement of the structures east of structure N7.13, it would appear reasonable to construct the section from the Columbus Drive ramps to the Holland Tunnel Plaza as the second project. The final cross section of the corridor proximate to the Interchange 14C toll plaza will likely be significantly reduced without the need to maintain a toll plaza in the future (**Error! Reference source not found.**).

Table 6.5: Project 2 Construction Costs

	DEMOLITION				CONSTRUCTION					
	EXIST. AREA (SF)	DEMO. TYPE	DEMO. UNIT COST (PER/SF)	DEMO. COST	RET. WALL LENGTH (LF)	AREA (SF)	RECONSTR. TYPE	CONSTRUTION UNIT COST (PER/SF)	CONSTRUCTION COST	TOTAL COST
BRIDGES										
N 7.13	197,850	C	$100.00	$19,785,000	-	217,556	C	$500	$108,778,000	$128,563,000
N 7.52	171,618	C	$100.00	$17,162,000		140,762	C	$500	$70,381,000	$87,543,000
N 7.90E	58,960	C	$100.00	$5,896,000	-	52,166	C	$500	$26,083,000	$31,979,000
N 7.93W	78,469	C	$100.00	$7,847,000	-	97,298	C	$500	$48,649,000	$56,496,000
Retaining Walls	-	-	-	-	-	-	-	$100	-	-
Roadway	-	-	-	-	-	-	-	$30	-	-
									$253,891,000	**$304,581,000**

U **Uncomplicated -** Conventional framing with relatively uncomplicated access and staging requirements
C **Complicated -** Complicated framing or complicated staging requirements or difficult assess
EC **Extremely Complicated reconstruction**- Complicated framing, difficult access and complicated staging requirements
NBD **Newark Bay Bridge Demolition** - Demolition of entire Newark Bay Bridge (2.01W, 2.01 & 2.01E)
NBMSR **Newark Bay Bridge Main Spans Reconstruction**- Reconstruction of Main Spans over Shipping Channel

6.5.4. Project 3 – East Side of Interchange 14A to Interchange 14B and Bayview Viaduct Rehabilitation

The third discrete project of the improvement program would not only continue the replacement of the existing infrastructure in a sequential manner progressing eastward along the corridor, it would provide additional off-line improvements to facilitate the potential rerouting of traffic during construction of the sections further east (**Error! Reference source not found.**). It is anticipated that by the time the later projects of the program are undertaken, the Jersey Avenue Extension will be complete. This alternate route connecting Interchange 14B with downtown Jersey City, combined with the rehabilitation of the Bayview Viaduct would provide alternate travel paths to accommodate traffic if travel lanes on the main corridor are restricted to facilitate construction.

Table 6.5.4: Project 3 Construction Costs

	DEMOLITION				CONSTRUCTION					
	EXIST. AREA (SF)	DEMO. TYPE	DEMO. UNIT COST (PER/SF)	DEMO. COST	RET. WALL LENGTH (LF)	AREA (SF)	RECONSTR. TYPE	CONSTRUTION UNIT COST (PER/SF)	CONSTRUCTION COST	TOTAL COST
BRIDGES										
N 4.12	10,592	U	$65.00	$688,000	-	15,345	U	$400	$6,138,000	$6,826,000
N 4.52	33,706	U	$65.00	$2,191,000	-	50,334	U	$400	$20,134,000	$22,325,000
N 5.34	55,148	U	$65.00	$3,585,000	-	79,922	U	$400	$31,969,000	$35,554,000
N 5.56A	16,819	U	$65.00	$1,093,000	-	22,775	U	$400	$9,110,000	$10,203,000
N 5.56B	87,808	C	$100.00	$8,781,000	-	87,808	C	$500	$43,904,000	$52,685,000
N 5.66	69,629	U	$65.00	$4,526,000	-	55,058	U	$400	$22,023,000	$26,549,000
Retaining Walls	-	-	-	-	3,454	41,448	-	$100	$4,145,000	$4,145,000
Roadway	-	-	-	-	-	851,766	-	$30	$25,553,000	$25,553,000
									$162,976,000	**$183,840,000**

U **Uncomplicated -** Conventional framing with relatively uncomplicated access and staging requirements
C **Complicated -** Complicated framing or complicated staging requirements or difficult assess
EC **Extremely Complicated reconstruction**- Complicated framing, difficult access and complicated staging requirements
NBD **Newark Bay Bridge Demolition** - Demolition of entire Newark Bay Bridge (2.01W, 2.01 & 2.01E)
NBMSR **Newark Bay Bridge Main Spans Reconstruction**- Reconstruction of Main Spans over Shipping Channel

6.5.5. Project 4 - Interchange 14B to Columbus Drive Ramps / Interchange 14C Toll Plaza Expansion

Table 6.5.3: Project 4 Construction Costs

	DEMOLITION				CONSTRUCTION					
	EXIST. AREA (SF)	DEMO. TYPE	DEMO. UNIT COST (PER/SF)	DEMO. COST	RET. WALL LENGTH (LF)	AREA (SF)	RECONSTR. TYPE	CONSTRUTION UNIT COST (PER/SF)	CONSTRUCTION COST	TOTAL COST
BRIDGES										
N 6.49	464,623	C	$100.00	$46,462,000	-	518,612	C	$500	$259,306,000	$305,768,000
N 6.80E	22,504	U	$65.00	$1,463,000	-	17,374	U	$400	$6,950,000	$8,413,000
N 6.80W	22,504	U	$65.00	$1,463,000	-	39,052	U	$400	$15,621,000	$17,084,000
Retaining Walls	-	-	-	-	3,235	38,820	-	$100	$3,882,000	$3,882,000
Roadway	-	-	-	-	-	523,140	-	$30	$15,694,000	$15,694,000
									$301,453,000	**$350,841,000**

U **Uncomplicated -** Conventional framing with relatively uncomplicated access and staging requirements
C **Complicated -** Complicated framing or complicated staging requirements or difficult assess
EC **Extremely Complicated reconstruction**- Complicated framing, difficult access and complicated staging requirements
NBD **Newark Bay Bridge Demolition** - Demolition of entire Newark Bay Bridge (2.01W, 2.01 & 2.01E)
NBMSR **Newark Bay Bridge Main Spans Reconstruction**- Reconstruction of Main Spans over Shipping Channel

The above costs summarized in **Error! Reference source not found.** represent the demolition of existing structures, construction of replacement structures, retaining walls and non-structured roadway segments. There are significant additional costs associated with any infrastructure construction project, including, but not limited to preliminary and final design, permitting, ROW acquisition, environmental remediation and Maintenance of Traffic during construction. **Error! Reference source not found.** summarizes the order of magnitude construction costs for each independent project and applies a percentage of construction costs to represent these other items. Assuming the projects would be completed over the next 20 years, an annual escalation factor of 2.0% per year was applied to the current-dollar estimates to project full future costs.

Table 6.5.4: Projected Project Costs (millions)

	PROJECT 1A	PROJECT 1B	PROJECT 2	PROJECT 3	PROJECT 4	TOTAL
Construction (C)	$ 242.10	$ 1,393.30	$ 253.90	$ 163.00	$ 301.50	$ 2,353.70
Demolition (D)	$ 33.20	$ 174.60	$ 50.70	$ 20.90	$ 49.40	$ 328.70
ROW (placeholder)	$ -	$ 35.00	$ 20.00	$ 10.00	$ 20.00	$ 85.00
Env Remediation (placeholder)	$ -	$ 20.00	$ 10.00	$ 5.00	$ 10.00	$ 45.00
MPT (10% of C Costs)	$ 24.20	$ 139.30	$ 25.40	$ 16.30	$ 30.10	$ 235.40
Design & Permitting (10% of C&D Cost)	$ 27.50	$ 156.80	$ 30.50	$ 18.40	$ 35.10	$ 268.20
Construction Services (20% of C&D Cost)	$ 55.10	$ 313.60	$ 60.90	$ 36.80	$ 70.20	$ 536.50
TOTAL	**$ 382.10**	**$ 2,232.50**	**$ 451.30**	**$ 270.30**	**$ 516.20**	**$ 3,852.50**
Escalation to 10yr Program Midpoint (2%/YR)	$ 83.90	$ 488.50	$ 98.70	$ 58.70	$ 112.80	$ 842.60
TOTAL	**$ 466.00**	**$ 2,721.00**	**$ 550.00**	**$ 329.00**	**$ 629.00**	**$ 4,695.10**

* ROW Cost assumes approx. $1.5M per acre

** Environmental Remediation Cost TBD

6.6. ROW Impacts

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

6.7. Environmental Impacts

The findings of the Study Area Context Screening described previously in Section 3 were provided to the design team in order to familiarize them with the overall constraint scenario in the study area. This early introduction to the physical and regulatory constraints provided awareness of critical factors, such as preserved passive recreational land, that otherwise may have been interpreted as undeveloped candidate sites for realignment of the NBHCE.

Given the intensely developed study area, its industrial heritage, and its natural environmental setting, including constraints that themselves were created as a result of the presence of the NBHCE in its current alignment, it was impossible to develop an alternative that avoided all impacts. The following sections describe the methodology for focusing the context assessment on the IPA and the results of this refinement in terms of resources likely affected and the permits and/or mitigation measures potentially required to construct the project.

6.7.1. Methodology

The previous context screening narrowed the consideration of environmental constraints to a buffer centered on the existing NBHCE and ranging from 300 ft to 3000 ft in total width. The refined screening used the same environmental input data (mapped wetlands, flood hazard area, hazardous materials, etc.), but considered these resources relative to the parcels most likely affected by the preferred alignment. Parcels were identified by superimposing the alternative alignment on the parcel data sets for Essex and Hudson County, as described above in the right-of-way impacts section.

Parcel data was important for use in this refined screening because it provides the ownership of the property potentially affected by the proposed alternative. While many sections of the proposed alignment are located within areas identified as existing NJTA right-of-way, others are not. During preliminary engineering, field sampling, survey, and delineation may also be required. These activities require owner permission and/or entry permits to access these properties.

The following sections use the parcel data to describe the more specific potential for impact to the environmental categories investigated in the context analysis discussion, above. The discussion is organized by project to assist in developing subsequent phases of project development.

6.7.2. Project 1A

Community Profile/Environmental Justice

The improvements associated with Project 1A in Newark would not represent an environmental justice issue as the adjacent land uses are industrial. Realignment and expansion of the NBHCE along the westbound lanes would move the alignment closer to an existing industrial use (freight rail.) The improvements in Jersey City may result in the alignment moving closer to sensitive residential noise receptors, but for an impact to be considered an environmental justice issue, the impact must be high and disproportionate when compared to the impacts on non-EJ communities within the project area. The entirety of the NBHCE between Interchange 14 and the Holland Tunnel is being redesigned to accommodate modern traffic volume needs and ensure public safety by replacing infrastructure elements that have reached the end of their useful life or are otherwise deficient or functionally obsolete by modern standards. The design of the preferred alternative has taken into consideration the alignment's proximity to important community resources, such as parks and other open space and recreational resources and has sought to avoid impacts to these resources. The improved efficiency of traffic movement on the redesigned and enhanced NBHCE is anticipated to reduce congestion and associated noise and air quality impacts, which are a net benefit to the adjacent community. Additionally, a robust public involvement effort would be undertaken by the project team to ensure adequate participation in project decision-making by the affected community. The demographic data developed as part of the context analysis will be used to guide the public engagement program, including methods and materials developed to ensure the participation of residents and stakeholders who may be linguistically isolated or otherwise disadvantaged in terms of their ability to participate in traditional outreach programs. Consequently, environmental justice impacts are not anticipated in association with Project 1A.

Wetlands

Freshwater emergent wetlands vegetated with common reed (*Phragmites australis*) are present along the northern edge of existing Interchange 14 (see Figure 6.7.1). The infield area of the interchange may include wetland areas that were not mapped, particularly given the presence of wetlands surrounding the interchange. Field reconnaissance is recommended to verify that there are no additional wetland areas in the vicinity of the proposed ramp. There are no other wetlands areas associated with Project 1A.

Wetlands and wetland transition areas are regulated by NJDEP, and, in this project area, USACE may also have jurisdiction. A letter of interpretation from NJDEP is necessary to determine the resource value of wetlands within this area and the size of the transitional area. This additional information will facilitate the estimation of impacts and mitigation requirements under the NJDEP freshwater and/or coastal wetlands regulations.

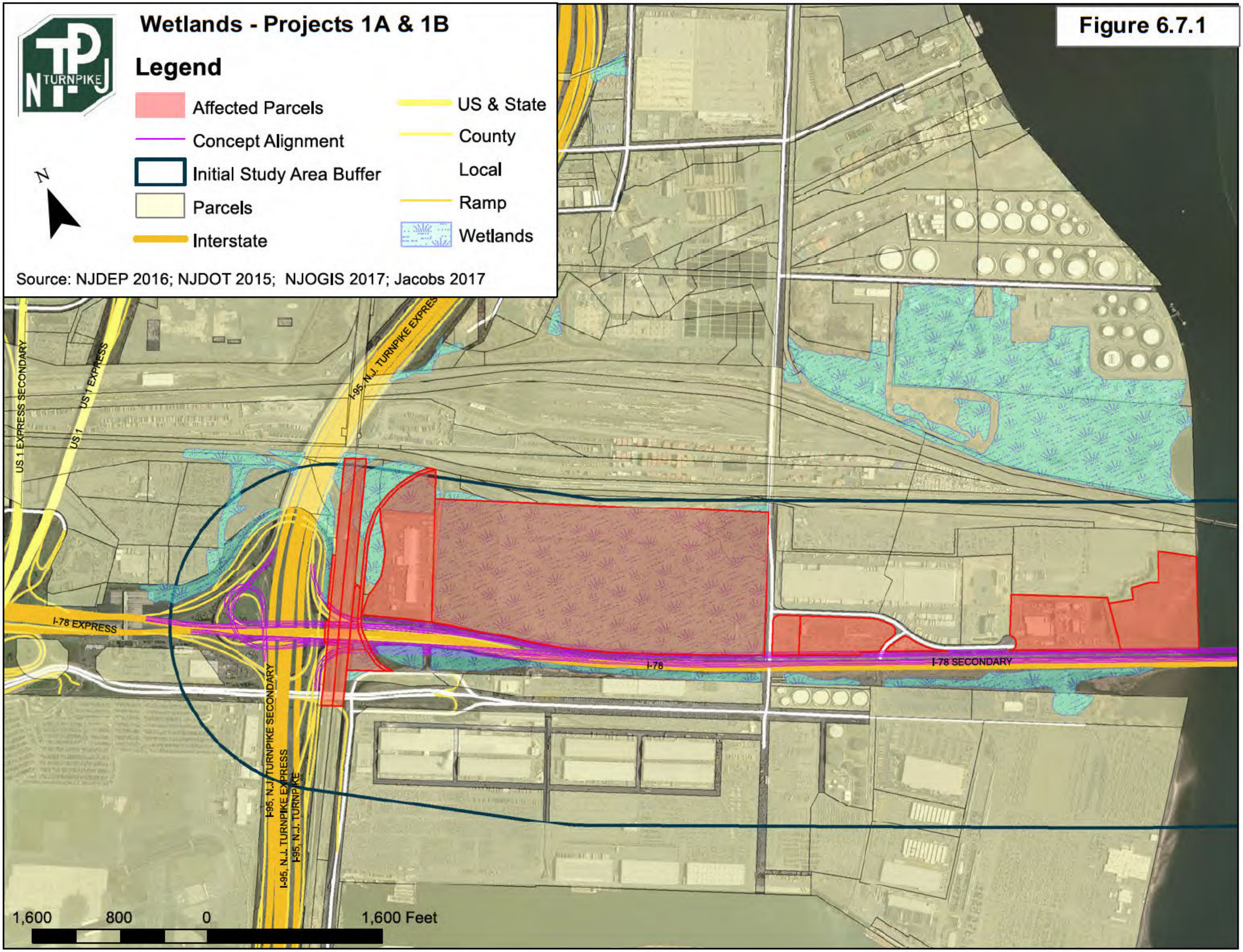


Figure 6.7.1
Wetlands - Projects 1A & 1B
NJ TURNPIKE
Legend
Affected Parcels
Concept Alignment
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
Wetlands
N
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
I-95, N.J. TURNPIKE EXPRESS
I-78 EXPRESS
I-78
I-78 SECONDARY
I-95, N.J. TURNPIKE SECONDARY
I-95, N.J. TURNPIKE EXPRESS
I-95, N.J. TURNPIKE
US 1 EXPRESS SECONDARY
US 1 EXPRESS
US 1
1,600
800
0
1,600 Feet

Threatened and Endangered Species

No federally-listed species are known to occur along the NBHCE in this project area. In the Newark portion of Projects 1A and 1B, habitat for state threatened species is found immediately east of the proposed ramp. Refer to Table 3.2.2 in Section 3.2 for the list of federal species of conservation concern and state listed species. Avian species listed in Table 3.2.2 may occur within the Project 1A and Newark portion of Project 1B areas. There is no habitat for NMFS fish species in Project 1A; therefore, none of the fish species listed in Table 3.2.2 would occur in Project 1A area 1.

Similar to the findings with NJDEP mapped wetlands, no data is provided for the infield portions of Interchange 14, and given the character of the surrounding land, it is likely that if wetlands are found in the infield, habitat for these species would be considered to be present, as well. Consultation with NJDEP and a habitat field survey are recommended. The presence of threatened or endangered species habitats would result in construction timing restrictions.

Flood Hazard Area

The Newark portion of Project 1A is not within any mapped flood hazard area. The Jersey City portion (Structures N3.53D and N3.73) are within Zone X, which are areas of minimal flood risk and not subject to the DFE.

Open Space and Recreational Resources

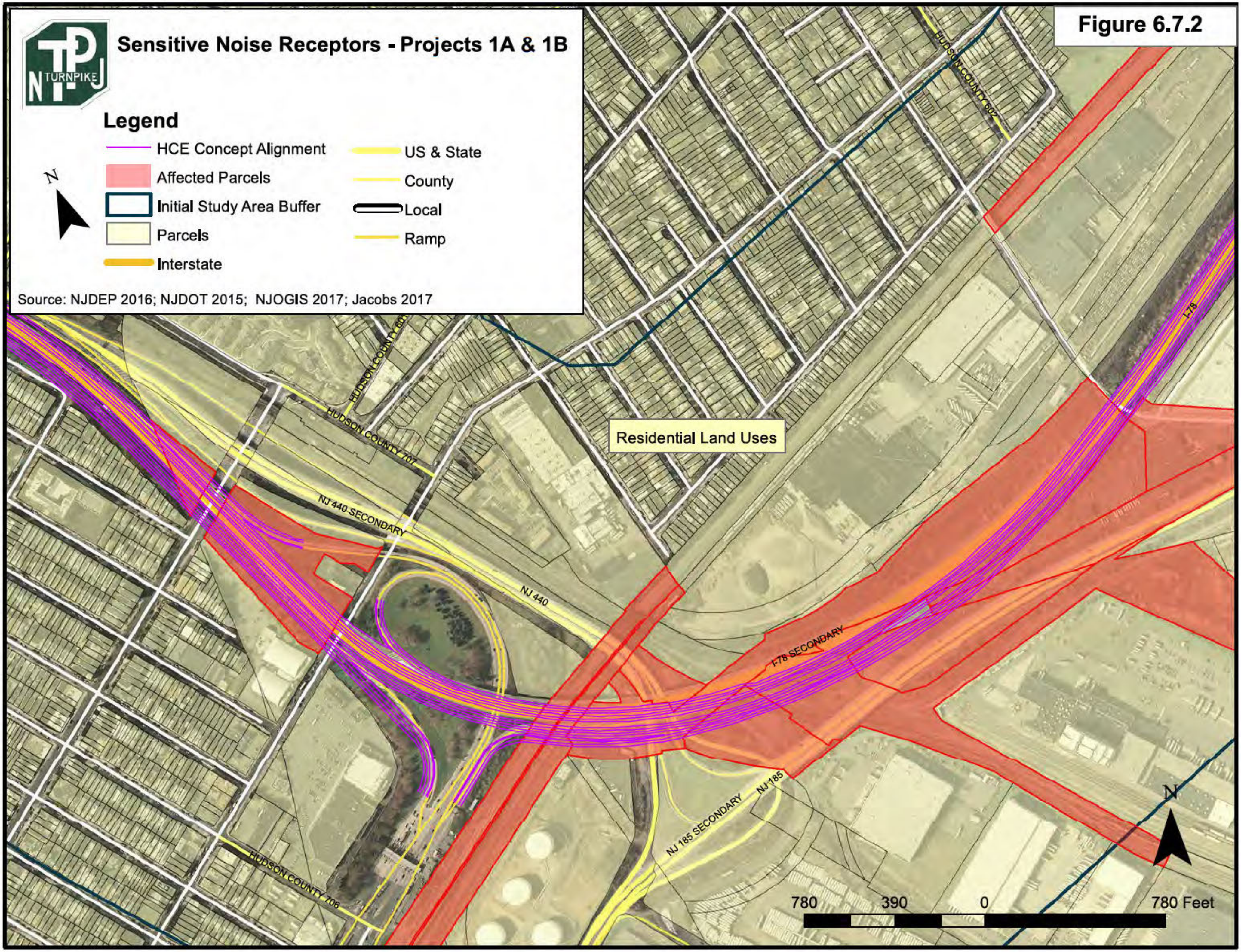
There are no open space or recreational resources in the Newark portion of the project area. No resources are present in the vicinity of Structures N3.53D and N3.73 in Jersey City. The proposed improvements would not affect the access to or otherwise indirectly affect the use and enjoyment of resources. No impacts to parkland or recreational resources are anticipated to result.

Air Quality and Noise

The improved efficiency of traffic movement on the redesigned and enhanced NBHCE is anticipated to reduce congestion and associated air quality impacts, which is a net benefit to the adjacent community.

Realignment of the NBHCE in Newark does not represent a noise impact as the adjacent industrial land uses are not defined as sensitive receptors. The portions of Project 1B in Jersey City; however, may result in noise impacts (see Figure 6.7.2). A noise study is recommended, and, should the existing conditions exceed FHWA noise thresholds, noise mitigation would be required along the entirety of the alignment where sensitive receptors are present.

Figure 6.7.2



Sensitive Noise Receptors - Projects 1A & 1B
TURNPIKE
Legend
HCE Concept Alignment
Affected Parcels
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
N
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
Residential Land Uses
HUDSON COUNTY 602
HUDSON COUNTY 707
HUDSON COUNTY 706
NJ 440 SECONDARY
NJ 440
I-78
I-78 SECONDARY
NJ 185
NJ 185 SECONDARY
780
390
0
780 Feet

Hazardous Materials

The hazardous materials screening identified the following parcels in Projects 1A and 1B as being potentially affected by hazardous materials or related enforcement or remediation activity (see Table 6.7.1). Further investigation of these parcels is recommended. Two of the three parcels are publicly-owned rights of way. The remaining parcel is owned by Conrail (see Figure 6.7.3). Appendix I describes the status of the remedial or enforcement activities for each parcel in detail.

Table 6.7.1: Hazardous Materials: Projects 1A & 1B

Block	Lot	Municipality	County	Owner	Database Identified
27401	29	Jersey City	Hudson	NJDOT	SPILLS-NJ, RCRA-LQG, FRS, ECHO, UST-NJ, BRS, NJEMS
30306	4	Jersey City	Hudson	Conrail	Deed Notice, KCSL
30303	TURN	Jersey City	Hudson	NJTA	Chromate Site

Note:
NJEMS: New Jersey Environmental Management System
FRS: Facility Registry Systems
ISRA: Industrial Site Recovery Act
AFS: Air Facility Systems
ECHO: Enforcement and Compliance History Online
HIST HWS-NJ: Historical Hazardous Waste Sites
SHWS: Hazardous Waste Sites
RCRA-LQG: Resource Conservation and Recovery Act Large Quantity Generator
UST: Underground Storage Tank
BRS: Reporting of hazardous waste generation and management from LQGs

Impacts to contaminated sites would be addressed through the NJDEP Linear Construction Project (LCP) program. The Authority would enroll the project as a LCP in accordance with the NJDEP Linear Construction Technical Guidance (dated January 2012) by assigning a Licensed Site Remediation Professional (LSRP) for the project. As per the LCP guidance, a person conducting a LCP project is not required to delineate or remediate contamination outside the limit of the excavation area within the linear construction corridor. However, remediation may be required if the Authority purchases any properties with known environmental issues as part of project construction. To avoid delays in the project schedule, these environmental issues should be resolved before construction begins so that required permits are obtained, contaminated materials management practices are in-place, and other potential environmental issues are addressed.

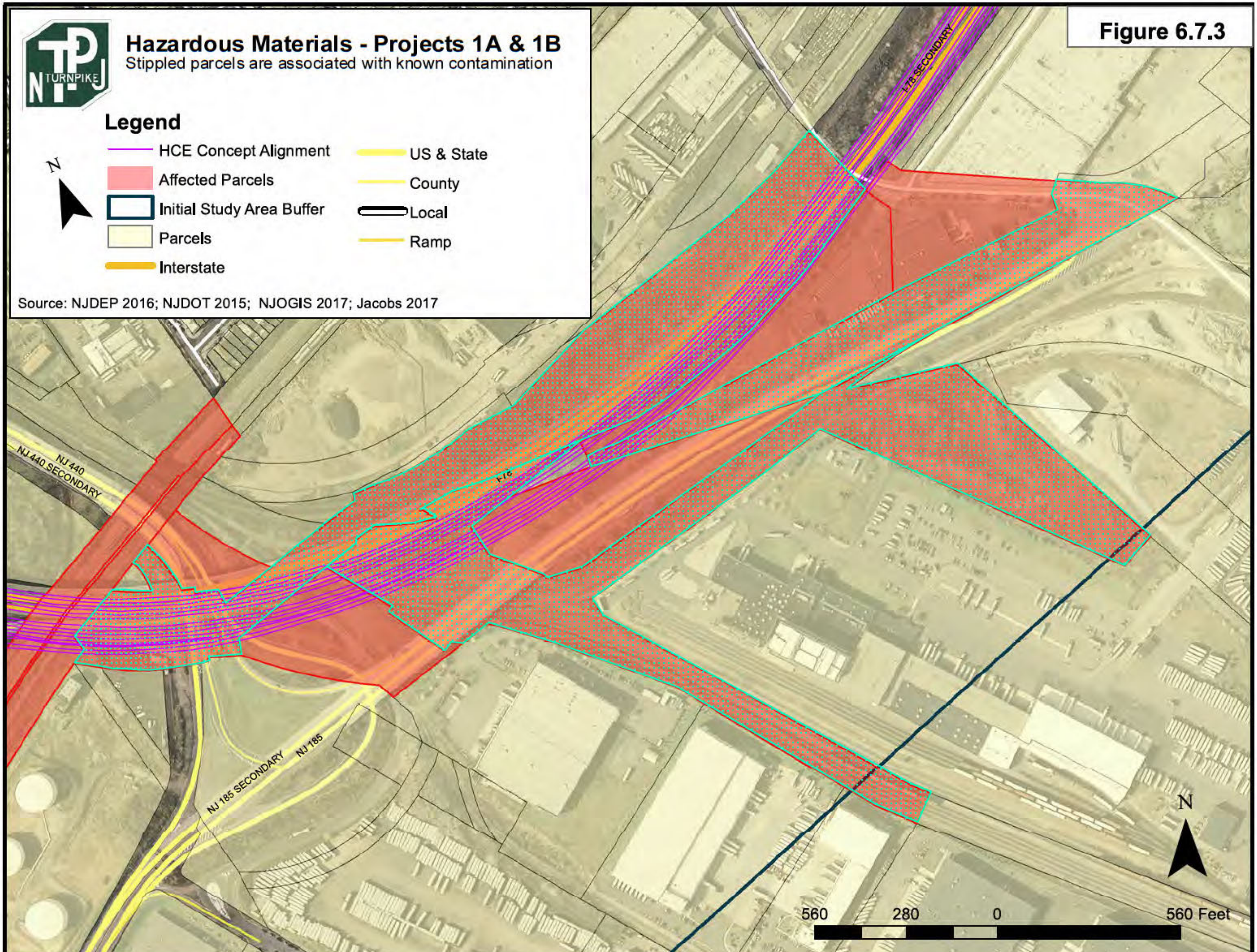


Figure 6.7.3
Hazardous Materials - Projects 1A & 1B
Stippled parcels are associated with known contamination
Legend
HCE Concept Alignment
Affected Parcels
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
N
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
I-78 SECONDARY
I-78
NJ 440
NJ 440 SECONDARY
NJ 185
NJ 185 SECONDARY
560
280
0
560 Feet

Cultural Resources

Cultural resources in the study area included areas of land, historic transportation corridors, and discrete structures. Some areas and corridors extend across multiple project areas. In the tables that follow, a resource associated only with one project area is grouped under the heading "Project X." A resource that affects more than one project is listed under a heading that names all affected projects in order to provide more context in the next steps of cultural resources assessment and processing. Detailed descriptions of the resources are found in Appendix J.

Field reconnaissance is required to confirm the presence of historic properties identified using the GIS analysis described above and to identify any new historic properties not mapped by the NJHPO.

Archaeological resources are sensitive and not mapped, as explained in Chapter 3. Historic architectural resources are listed in Table 6.7.2 to Table 6.7.4 and illustrated on Figure 6.7.4 through Figure 6.7.7.

Table 6.7.2: Archaeology: Project 1A

Project 1A						
Site Number	**Site Name**	**Period**	**Type**	**Distance to project alignment**	**Distance/ Direction to Water Source**	**Reference**
28-Hd -3	Greenville	Woodland	Unknown	Approx. 100 ft.	Abuts western shore of Hudson River	Skinner and Schrabisch 1913:42; ISS:6
28-Hd -17	Jersey City, Eastern Shore (Site #10)	Prehistoric	Unknown	Approx. 2400 ft.	Approx. 1500 ft. from western shore of Hudson River	ISS:6
28-Hd -45	Jersey Eagle	Woodland, 18^{th} -20^{th} century	Multi-component	Approx. 0-50 ft.	Abuts western shore of Hudson River	Public Archaeology Laboratory, Inc. 2010, 2011, 2013

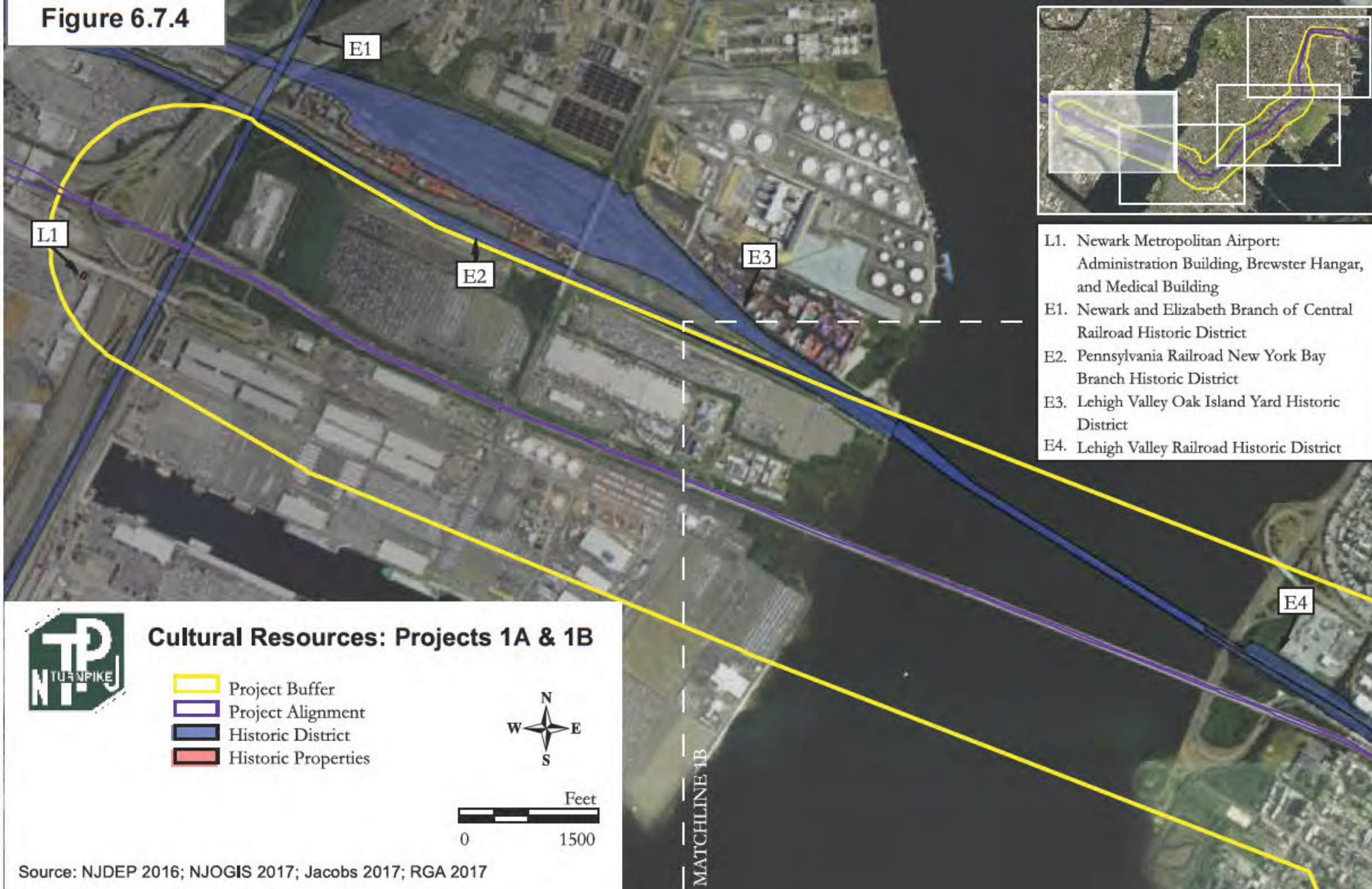
Table 6.7.3: Historic Architecture: Listed and Eligible Resources: Projects 1A, 1B & 3

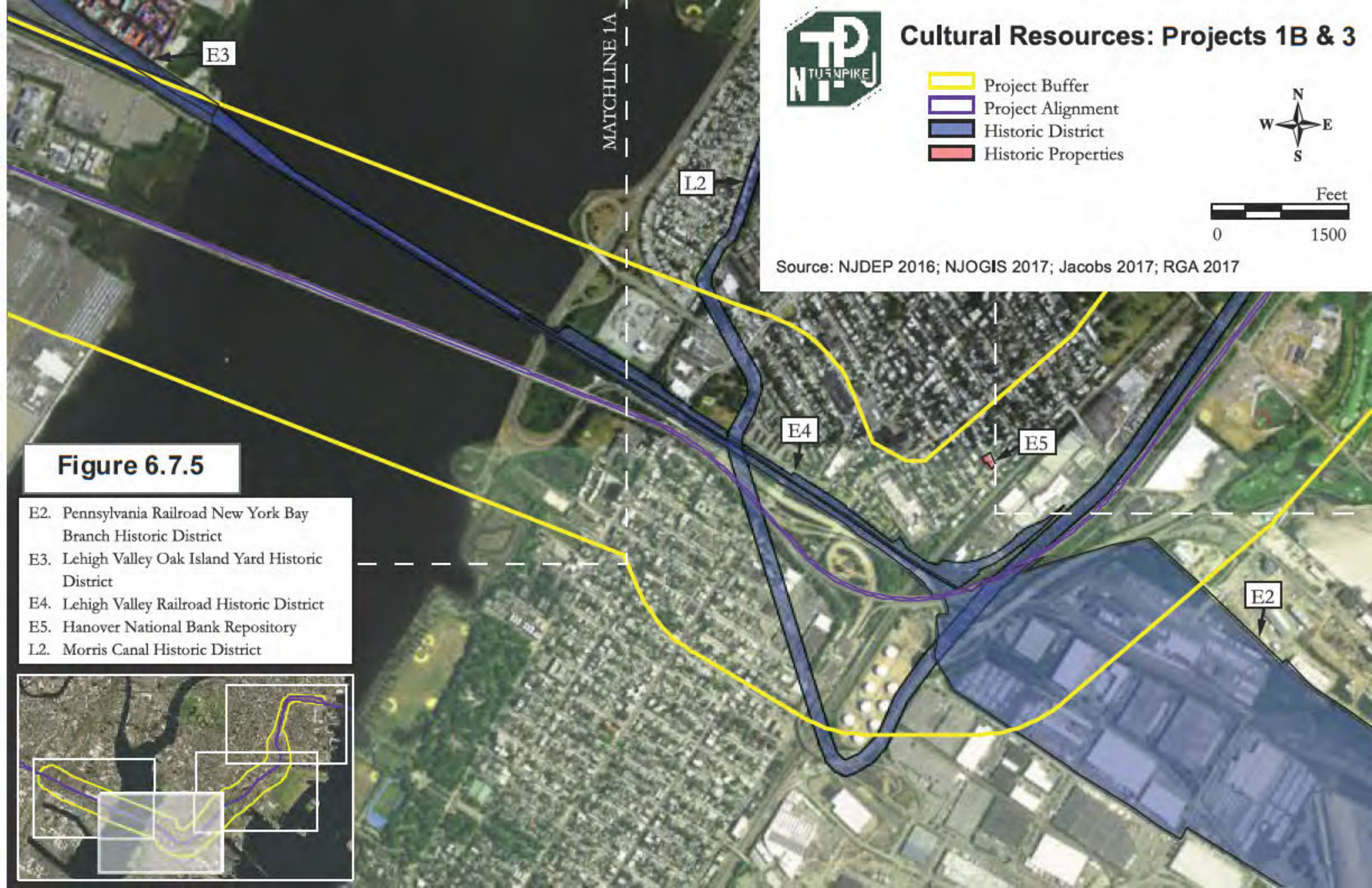
RGA#	Resource	Municipality	Status
Project 1A			
L1	Newark Metropolitan Airport: Administration Building, Brewster Hangar, and Medical Building	Newark	Listed (SR: 6/25/1980; NR: 12/12/1980)
Projects 1A & 1B			
E1	Newark and Elizabeth Branch of the Central Railroad of New Jersey Historic District	Multiple	Eligible (NJHPO: 8/30/2000)
Projects 1A, 1B and 3			
E2	Lehigh Valley Railroad Oak Island Yard Historic District	Newark	Eligible (NJHPO: 1/14/1997)
E4	Lehigh Valley Railroad Historic District	Multiple	Eligible (NJHPO: 3/15/2002)
E5	Hanover National Bank Repository	Jersey City	Eligible (COE: 5/18/2006)

Table 6.7.4: Historic Architecture: Locally Identified Resources: Projects 1A & 1B

RGA#	Resource Name	Municipality	Source
Projects 1A & 1B			
I2	1040-1042 Broadway	Bayonne	"Identified"- City of Bayonne Reconnaissance-Level Historic Sites Survey (CRCG 2000)
I3	1044 Broadway	Bayonne	"Identified"- City of Bayonne Reconnaissance-Level Historic Sites Survey (CRCG 2000)
I4	1053 Broadway	Bayonne	"Identified"- City of Bayonne Reconnaissance-Level Historic Sites Survey (CRCG 2000)
I5	1066-1068 Broadway	Bayonne	"Identified"- City of Bayonne Reconnaissance-Level Historic Sites Survey (CRCG 2000)

Figure 6.7.4


E1
E2
E3
E4
L1
MATCHLINE 1B
L1. Newark Metropolitan Airport: Administration Building, Brewster Hangar, and Medical Building
E1. Newark and Elizabeth Branch of Central Railroad Historic District
E2. Pennsylvania Railroad New York Bay Branch Historic District
E3. Lehigh Valley Oak Island Yard Historic District
E4. Lehigh Valley Railroad Historic District
Cultural Resources: Projects 1A & 1B
Project Buffer
Project Alignment
Historic District
Historic Properties
N
W
E
S
Feet
0
1500
Source: NJDEP 2016; NJOGIS 2017; Jacobs 2017; RGA 2017



Cultural Resources: Projects 1B & 3
Project Buffer
Project Alignment
Historic District
Historic Properties
N
W
E
S
Feet
0
1500
Source: NJDEP 2016; NJOGIS 2017; Jacobs 2017; RGA 2017
MATCHLINE 1A
E2
E3
E4
E5
L2
Figure 6.7.5
E2. Pennsylvania Railroad New York Bay Branch Historic District
E3. Lehigh Valley Oak Island Yard Historic District
E4. Lehigh Valley Railroad Historic District
E5. Hanover National Bank Repository
L2. Morris Canal Historic District

Figure 6.7.6

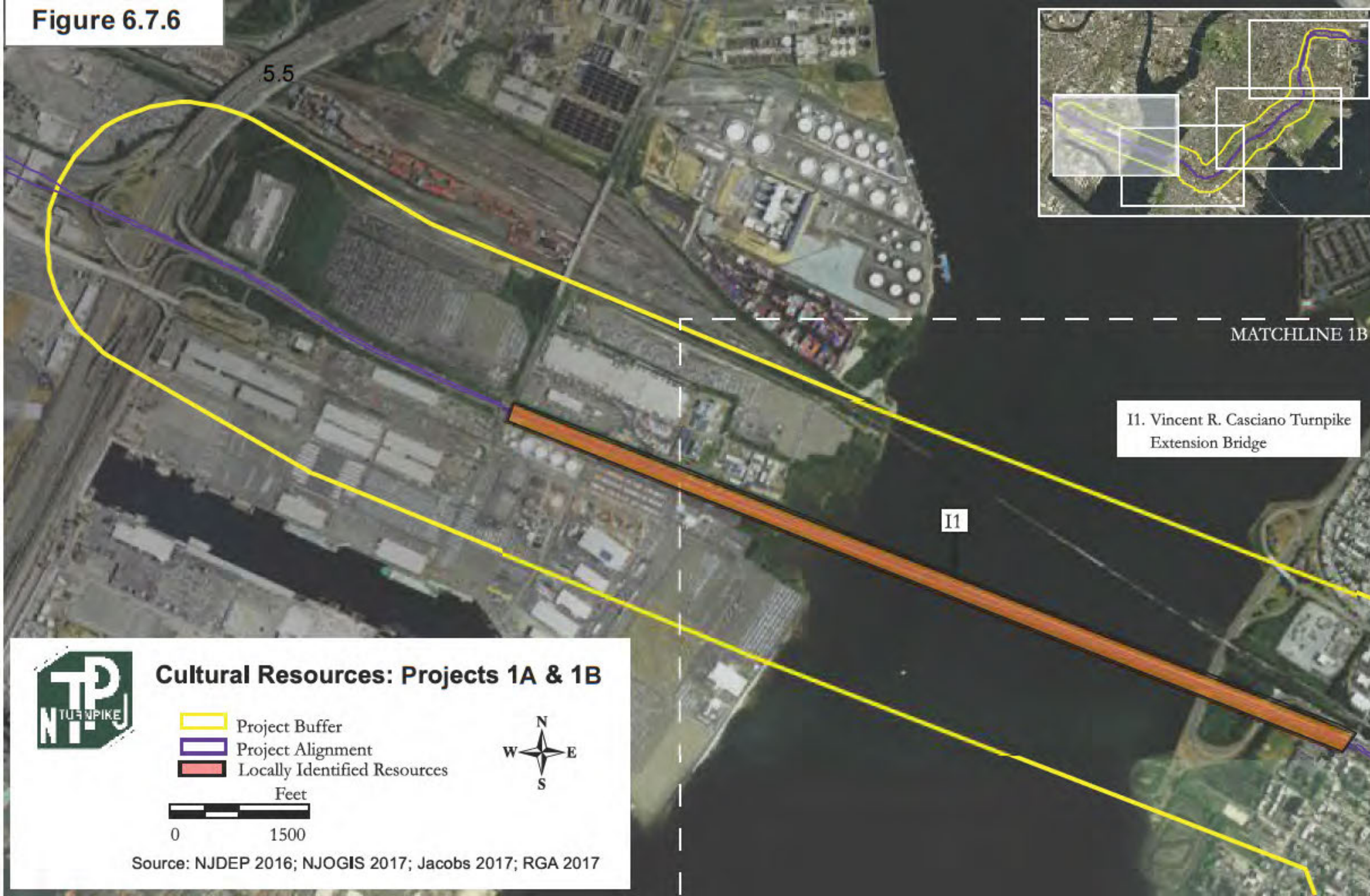

5.5
MATCHLINE 1B
I1. Vincent R. Casciano Turnpike Extension Bridge
I1
Cultural Resources: Projects 1A & 1B
Project Buffer
Project Alignment
Locally Identified Resources
N
W
E
S
Feet
0
1500
Source: NJDEP 2016; NJOGIS 2017; Jacobs 2017; RGA 2017

Figure 6.7.7
MATCHLINE 1A
MATCHLINE 2
I1
I2
I3
I4
I5
I6
I7
I8
I1. Vincent R. Casciano Turnpike Extension Bridge
I2. 1040-1042 Broadway
I3. 1044 Broadway
I4. 1053 Broadway
I5. 1066-1068 Broadway
I6. 232 Garfield Avenue
I7. 30 Linden Avenue
I8. 500 Bayside Park Drive
NJ TURNPIKE
Cultural Resources:
Projects 1B & 3
Project Buffer
Project Alignment
Locally Identified Resources
N
W
E
S
Feet
0
1500
Source: NJDEP 2016; NJOGIS 2017; Jacobs 2017; RGA 2017

6.7.3. Project 1B

Community Profile/Environmental Justice

The improvements proposed for Project 1B are confined primarily to existing right-of-way areas and industrial land from which a small area not central to the facility's operation would be required. The implications of widening the NBHCE through residential areas are the same as described for Project 1A. The use of retaining walls instead of embankment through Block 16 in Bayonne would eliminate the need for residential property acquisition. Acquisition of community facilities or residential development is not proposed, and access to existing facilities would not be altered as a result of the proposed improvements. Neighborhood cohesion is not affected by this project as all improvements are confined to the vicinity of the existing NBHCE. The outreach effort and community benefits of the project are the same as described for Project 1A, and as a result, no impacts to Environmental Justice communities are anticipated.

Wetlands

Realignment and widening of the NBHCE is proposed to occur along the westbound lanes of the existing NBHCE. Estuarine herbaceous (emergent) wetlands are found on Block 5082, Lot 10 in Newark. The NJDEP mapping indicates that the entire parcel is affected; however, the majority of the parcel is paved and in use as a parking lot/auto storage facility associated with the adjacent railroads (the parcel is owned by Conrail). Wetlands are likely confined to the periphery of the parcel. These resource areas would be impacted by the widening of the NBHCE (see Figure 6.7.1 in Project 1A).

Wetlands areas are also found adjacent to the eastbound lanes of the NBHCE from Newark Bay to Interchange 14. The preliminary alternative design would not directly impact these areas; however, work within the transition area of the wetland is also regulated by NJDEP. As the transition area width is determined by the functional value of the wetland area, field reconnaissance is recommended to identify the boundaries of the wetland areas and their functional value. However, at this preliminary stage, it can be determined from visual inspection that wetlands are also dominated by common reed (*Phragmites australis*) monocultures providing little resource value to the local ecology as an invasive species that limits biodiversity of the wetlands. Common reed marshes are typical of highly degraded and modified wetlands common in New Jersey.

Newark Bay is designated as an estuarine and marine deepwater wetland in the NWI and NJDEP mapping below the Newark Bay Bridge section of the project.

On the east side of Newark Bay, estuarine emergent wetlands are found between the edge of Newark Bay and JFK Boulevard, adjacent to both the eastbound and westbound lanes of the NBHCE Bayonne, only, within Block 8, Lots 3, 4 and 5 (see Figure **6.7.8**). These parcels are owned by the NJTA and NJDOT and represent the infield areas where Route 440 passes under the NBHCE. As with other areas where mapped wetlands were identified, field reconnaissance is recommended to verify the presence of the wetland area and its boundary.

Wetlands and wetland transition areas are regulated by NJDEP, and, in this project, USACE has jurisdiction. A letter of interpretation from NJDEP is necessary to determine the resource value of wetlands within this area and the size of the transitional area. This additional information will facilitate the estimation of impacts and mitigation requirements under the NJDEP freshwater and/or coastal wetlands regulations.

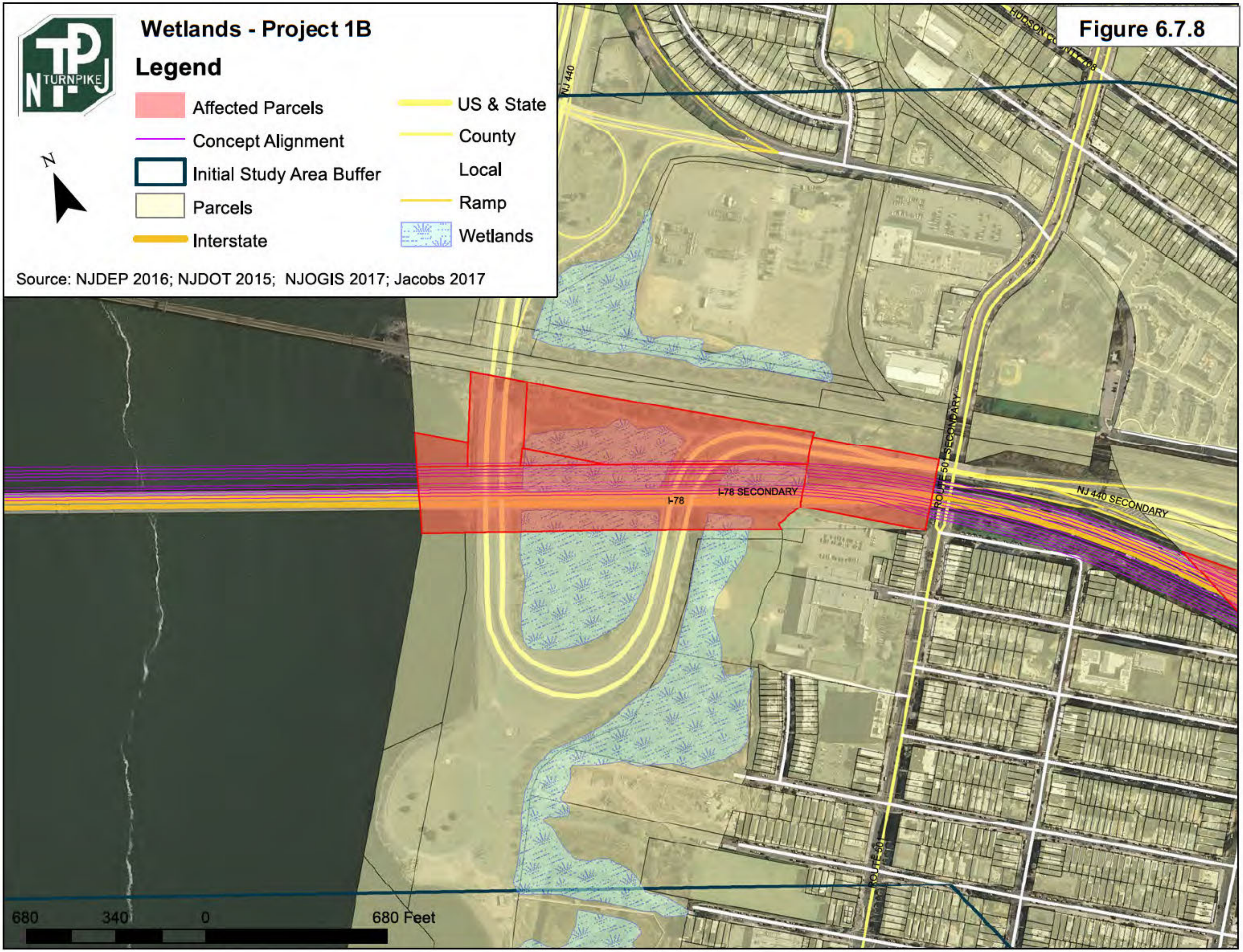


Figure 6.7.8
Wetlands - Project 1B
Legend
Affected Parcels
Concept Alignment
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
Wetlands
N
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
680
340
0
680 Feet
NJ 440
I-78
I-78 SECONDARY
ROUTE 501 SECONDARY
NJ 440 SECONDARY
ROUTE 501

Threatened and Endangered Species

Project 1B comprises the largest area with wetlands present, including the freshwater and estuarine wetlands found along both approaches of Newark Bay Bridge, and the estuarine/marine deepwater of Newark Bay. This project represents the highest potential for threatened and endangered species to be present within the project corridor, owing to the wetland habitats and the Bay itself. Similar to the wetlands and threatened and endangered species recommendations, a focused design review is recommended in this area to avoid and refine aquatic resource habitat impacts to the extent practical.

Habitat for state threatened species is found along both the eastbound and westbound lanes of the existing NBHCE, from Interchange 14 to Newark Bay. The species found are wading birds (herons and similar) that inhabit wetland areas. Consequently, impacts to wetlands areas would have an effect on state threatened species habitat. Field reconnaissance undertaken by a qualified habitat specialist is recommended to determine whether nesting sites are present in the area of potential impact. This step would occur during preliminary engineering when the limits of disturbance are defined with greater certainty.

Near the NBHCE bridge over Newark Bay, the species rank listing for the NBHCE changes from state threatened to state endangered as peregrine falcons, which are state endangered, are known to roost on large pieces of elevated urban infrastructure and buildings. Falcons have been identified in the area, resulting in the listing in NJDEP Landscape data set. Impacts to construction would involve timing restrictions based on the falcon's breeding season and on the presence of nests along the bridge.

Table 6.7.5 below lists managed and listed fish species that are unique to Project 1B, as this project involves interaction with the Bay.

Table 6.7.5: Fish – NMFS Federally Managed Essential Habitat Species

Scientific Name	Common Name	Federal Status	State Status
Urophycis chuss	Red hake		
Pseudopleuronectes americanus	Winter flounder		
Scophthalmus aquosus	Windowpane flounder		
Clupea harengus	Atlantic sea herring		
Pomatomus saltatrix	Bluefish		
Perprilus triacanthus	Atlantic butterfish		
Scomber scombrus	Atlantic mackerel		
Paralichthys dentatus	Summer flounder		
Stenotomus chrysops	Scup		
Centropristis striata	Black sea bass		
Scomberomorus cavalla	King mackerel		
Scomberomorus maculatus	Spanish mackerel		
Rachycentron canadum	Cobia		
Carcharias taurus	Sand tiger shark		
Carcharhinus plumbeus	Sandbar shark		
Acipenser oxyrhynchus	Atlantic sturgeon	Endangered	
Acipenser brevirostrum	Shortnose sturgeon	Endangered	Endangered

Habitat areas on the Bayonne side of Project 1B are confined to the areas coterminous with the NJDEP mapped wetlands and the interface between the shoreline and Newark Bay. The species found to inhabit these areas are the same as found on the Newark side. The construction implications would be the same.

Flood Hazard Area

Flood Zone A, which represents the 100-year storm, is adjacent to the existing alignment of the NBHCE in Newark. This area is prone to flooding and would need to incorporate design flood standards. The same considerations apply in Bayonne, west of JFK Boulevard. The remainder of Project 1B is in Flood Zone X, which represents areas of minimal flood risk

Open Space and Recreational Resources

The open space resources identified in Bayonne in the context screening would not be affected by the proposed improvements to the NBHCE in Project 1B. The proposed improvements would not affect the access to or otherwise indirectly affect the use and enjoyment of resources. No impacts to parkland or recreational resources are anticipated to result.

Air Quality and Noise

The improved efficiency of traffic movement on the redesigned and enhanced NBHCE is anticipated to reduce congestion and associated air quality impacts, which is a net benefit to the adjacent community.

Sensitive land uses within Project 1B include residential areas, community facilities, and open space/recreational areas mainly on the eastern portion of the section (see Figure 6.7.9). Resources are listed in Table 6.7.6.

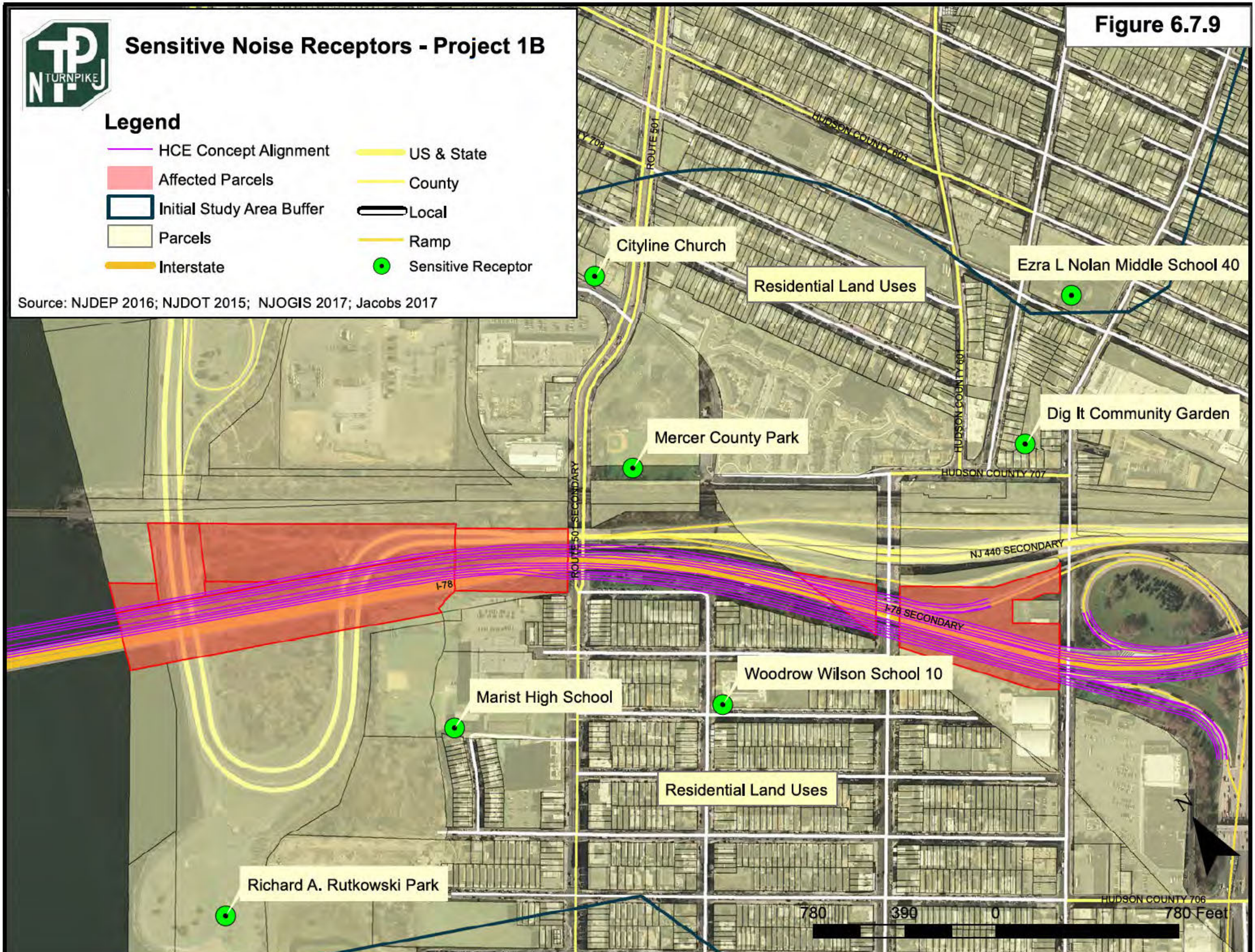
Table 6.7.6: Sensitive Noise Receptors: Project 1B

Project	Sensitive Land Use Name
Project 2	Cityline Church
	Dig It Community Garden
	Ezra L Nolan Middle School 40
	Marist High School
	Mercer County Park
	Richard A. Rutkowski Park
	Woodrow Wilson School 10

From Newark Bay heading east towards the Interchange 14A Toll Plaza, there are several schools, including: Marist High School in Bayonne and its outdoor facilities are directly adjacent to the Newark Bay Extension. The Woodrow Wilson School 10 in Bayonne is one block south of the Newark Bay Extension. The Ezra L. Nolan Middle School 40 in Jersey City is also located near the area of Project 1B, about one-quarter mile north of the Newark Bay Extension. Additional community facilities within this Project include Mercer County Park and the Dig It Community Garden located on Garfield Avenue. Mercer County Park, located adjacent to an existing freight rail line that parallels the westbound lanes of the NBHCE in Jersey City, is an active use park facility that includes ball fields. Further south, in Bayonne is the Richard A. Rutkowski Park, a passive use facility with walking paths. Lastly, Cityline Church in Jersey City is located about one-quarter mile north of the Newark Bay Extension Project 1B. A noise study is recommended, and, should the existing conditions exceed FHWA noise thresholds, noise mitigation would be required along the entirety of the alignment where sensitive receptors are present.

Figure 6.7.9

Sensitive Noise Receptors - Project 1B



Hazardous Materials

The hazardous materials screening identified the following parcels in Project 1B as being potentially affected by hazardous materials or related enforcement or remediation activity (see Figure 6.7.10 and Figure 6.7.11). Further investigation of these parcels is recommended. Three of the five parcels are owned by public agencies, as listed in Table 6.7.7.

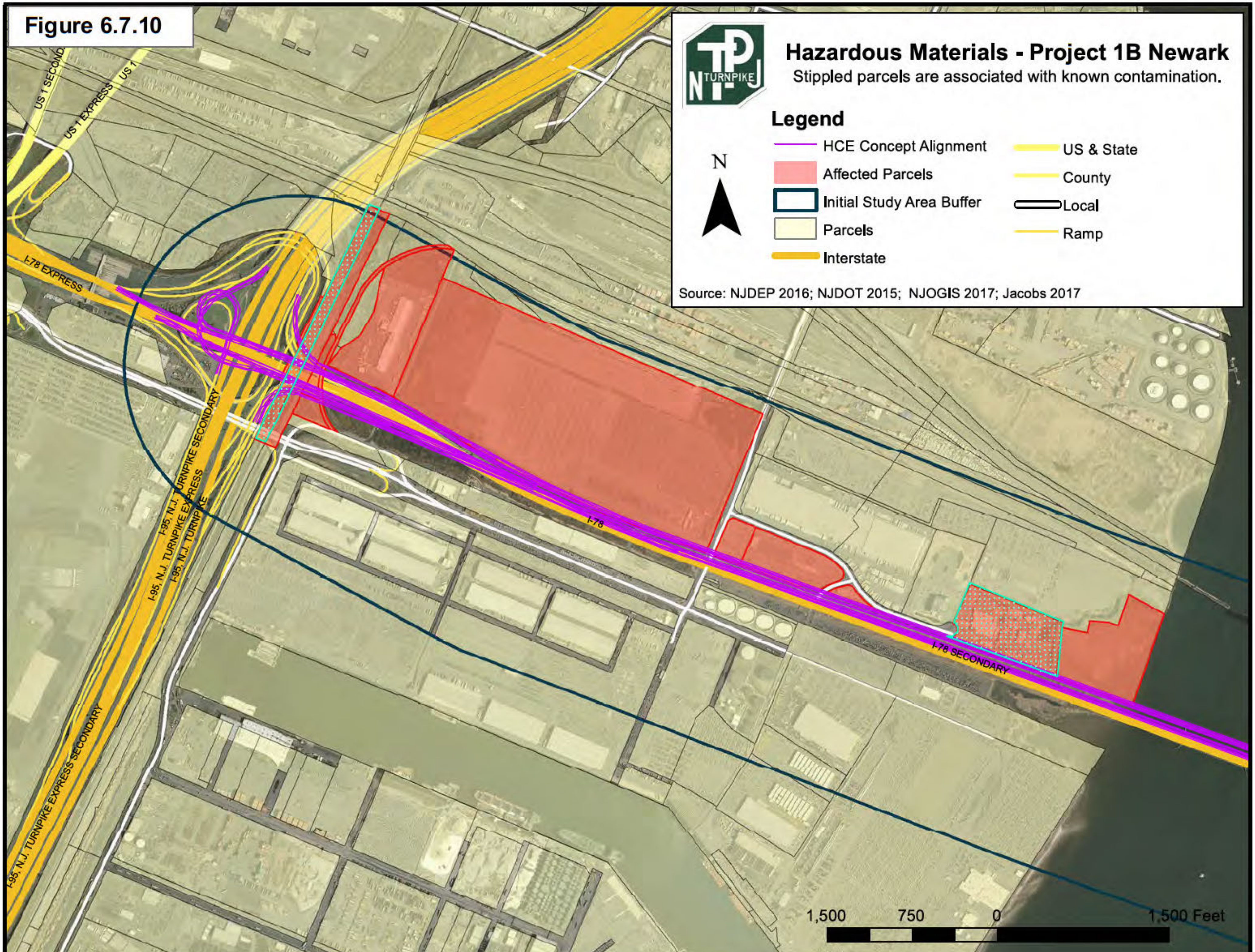
Table 6.7.7: Hazardous Materials: Project 1B

Block	Lot	Municipality	County	Owner	Database Identified
5084	100	Newark	Essex	Conrail	NJEMS, KCSL
5078	90	Newark	Essex	Chem-Fleur Urban Renewal Corp	FRS
11	2	Bayonne	Hudson	NJTA	Chromate Site
8	3	Bayonne	Hudson	NJTA	FRS, Spills, and NJEMS
8	6	Bayonne	Hudson	NJDOT (Rt. 440)	FRS, NJEMS, and KCSL

Note:
NJEMS: New Jersey Environmental Management System
FRS: Facility Registry Systems
ISRA: Industrial Site Recovery Act
AFS: Air Facility Systems
ECHO: Enforcement and Compliance History Online
HIST HWS-NJ: Historical Hazardous Waste Sites
SHWS: Hazardous Waste Sites
RCRA-LQG: Resource Conservation and Recovery Act Large Quantity Generator
UST: Underground Storage Tank
BRS: Reporting of hazardous waste generation and management from LQGs

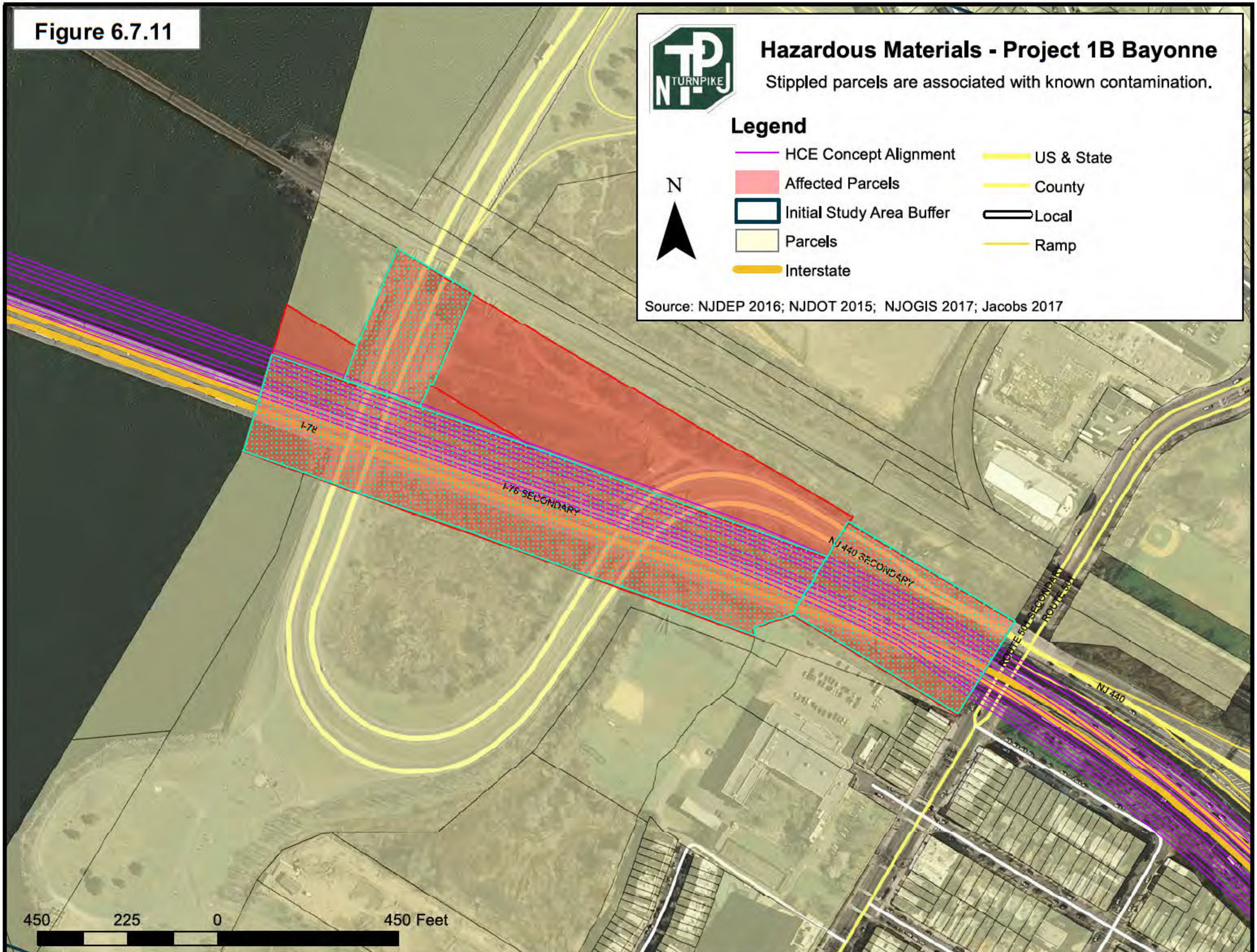
Impacts to contaminated sites would be addressed through the NJDEP Linear Construction Project (LCP) program. The Authority would enroll the project as a LCP in accordance with the NJDEP Linear Construction Technical Guidance (dated January 2012) by assigning a Licensed Site Remediation Professional (LSRP) for the project. As per the LCP guidance, a person conducting a LCP project is not required to delineate or remediate contamination outside the limit of the excavation area within the linear construction corridor. However, remediation may be required if the Authority purchases any properties with known environmental issues as part of project construction. To avoid delays in the project schedule, these environmental issues should be resolved before construction begins so that required permits are obtained, contaminated materials management practices are in-place, and other potential environmental issues are addressed.

Figure 6.7.10



Hazardous Materials - Project 1B Newark
Stippled parcels are associated with known contamination.
Legend
HCE Concept Alignment
Affected Parcels
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
N
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
I-78 EXPRESS
I-78
I-78 SECONDARY
US 1 SECONDARY
US 1 EXPRESS
US 1
I-95, N.J. TURNPIKE SECONDARY
I-95, N.J. TURNPIKE EXPRESS
I-95, N.J. TURNPIKE
I-95, N.J. TURNPIKE EXPRESS SECONDARY
1,500
750
0
1,500 Feet

Figure 6.7.11


Hazardous Materials - Project 1B Bayonne
Stippled parcels are associated with known contamination.
NJ TURNPIKE
Legend
HCE Concept Alignment
Affected Parcels
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
N
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
I-78
I-78 SECONDARY
NJ 440 SECONDARY
ROUTE 501 SECONDARY
ROUTE 501
NJ 440
450
225
0
450 Feet

Cultural Resources

Cultural resources in the study area included areas of land, historic transportation corridors, and discrete structures. Some areas and corridors extend across multiple project areas. In the tables that follow, a resource associated only with one project is grouped under the heading "Project X." A resource that affects more than one project is listed under a heading that names all affected projects in order to provide more context in the next steps of cultural resources assessment and processing. Detailed descriptions of the resources are found in the Appendix J.

Field reconnaissance is required to confirm the presence of historic properties identified using the GIS analysis described above and to identify any new historic properties not mapped by the NJHPO.

Archaeological resources are sensitive and not mapped, as explained in Chapter 3. Historic architectural resources are listed on Table 6.7.8 through Table 6.7.10 and illustrated on Figure 6.7.4 through Figure 6.7.7, included previously with Project 1A.

Table 6.7.8: Archaeology: Project 1B

Project 1B						
Site Number	**Site Name**	**Period**	**Type**	**Distance to project alignment**	**Distance/ Direction to Water Source**	**Reference**
28-Hd-12	Jersey City, Western Shore (Side #5a)	Prehistoric	Unknown	Approx. 200 ft.	Approx. 1500 ft. from Newark Bay	ISS:6

Table 6.7.9: Historic Architecture: Listed and Eligible Resources: Projects 1A & 1B

RGA#	**Resource**	Municipality	Status
Projects 1A & 1B			
E1	Newark and Elizabeth Branch of the Central Railroad of New Jersey Historic District	Multiple	Eligible (NJHPO: 8/30/2000)
Projects 1A, 1B & 3			
E2	Lehigh Valley Railroad Oak Island Yard Historic District	Newark	Eligible (NJHPO: 1/14/1997)
E4	Lehigh Valley Railroad Historic District	Multiple	Eligible (NJHPO: 3/15/2002)
E5	Hanover National Bank Repository	Jersey City	Eligible (COE: 5/18/2006)
Project 2			
E3	Pennsylvania Railroad New York Bay Branch Historic District	Multiple	Eligible (NJHPO: 9/10/2014)

Table 6.7.10: Historic Architecture: Locally Identified Resources: Projects 1A & 1B

RGA#	Resource Name	Municipality	Source
Projects 1A & 1B			
I2	1040-1042 Broadway	Bayonne	"Identified"- City of Bayonne Reconnaissance-Level Historic Sites Survey (CRCG 2000)
I3	1044 Broadway	Bayonne	"Identified"- City of Bayonne Reconnaissance-Level Historic Sites Survey (CRCG 2000)
I4	1053 Broadway	Bayonne	"Identified"- City of Bayonne Reconnaissance-Level Historic Sites Survey (CRCG 2000)
I5	1066-1068 Broadway	Bayonne	"Identified"- City of Bayonne Reconnaissance-Level Historic Sites Survey (CRCG 2000)
Project 1B			
I1	Vincent R. Casciano Turnpike Extension Bridge (Newark Bay Bridge)	Bayonne-Newark	"Identified"- City of Bayonne Reconnaissance-Level Historic Sites Survey (CRCG 2000)

6.7.4. Project 2

Community Profile/Environmental Justice

The alignment of the NBHCE between the existing Cold Storage Warehouse and the residential development under construction requires further assessment regarding the type of housing, and if lower-income housing is included, the distribution of those units within the new housing building. For example, if all lower income qualifying units were to be located along the northern edge of the building, adjacent to the proposed eastbound lanes of the realigned NBHCE, an environmental justice impact may be determined to result (see **Error! Reference source not found.**). If the proposed alignment runs along a mixture of market-rate and affordable units, then lower-income residents could not be said to be disproportionately affected by the proposed action. Otherwise, the outreach effort and community benefits of the project are the same as described for Projects 1A and 1B.

Wetlands

There are no NJDEP mapped wetlands within or adjacent to the identified parcels and existing right-of-way areas in the Project 2 area; however, there is a small deciduous wooded wetland is mapped by the NJDEP immediately north of Newark Avenue on the western side of the NBHCE on a parcel presently identified as existing road right-of-way and therefore not included in the affected parcel screening. This isolated freshwater wetland is bounded by a railway and pedestrian park area. Field reconnaissance is nonetheless recommended as impervious surfaces in urbanized areas can create isolated linear wetlands as a result of stormwater runoff and ponding. Visual assessment should be sufficient to determine whether field delineation would be required.

Threatened and Endangered Species

NJDEP Landscape data did not find any state or federally-listed species habitats were found in Project 2.

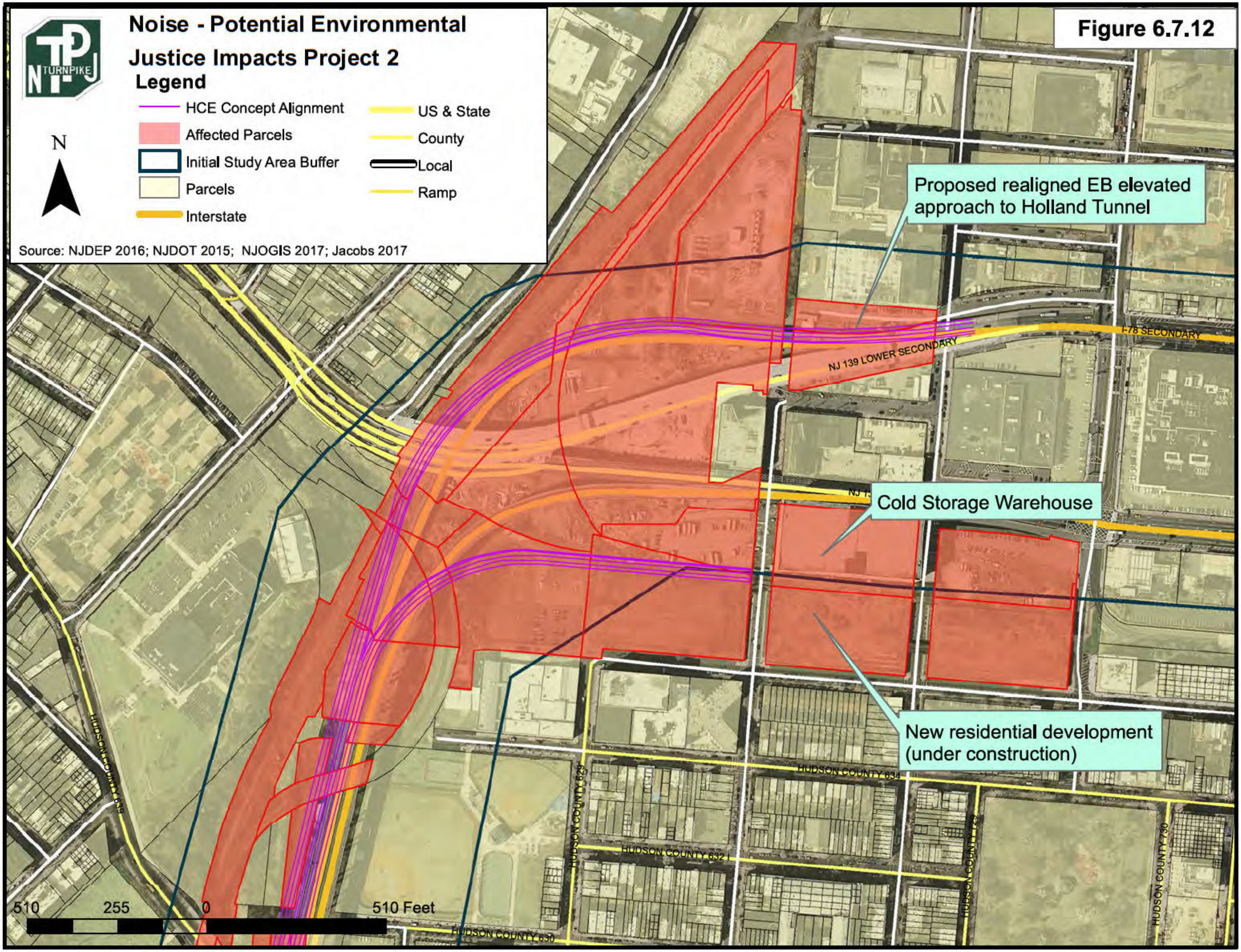
Flood Hazard Area

Project 2 is within Flood Zone A through the majority of the alignment. Flood Zone A represents the 100-year storm. Although the NBHCE would be on structure through this project, consideration should be given to design approaches that would not worsen flooding conditions for areas beneath the elevated roadway.

Open Space and Recreational Resources

The athletic fields associated with the BeLOVEd Charter School (Block 13703, Lot 3) and Mary Benson Park (Block 10901, Lot 124 and 127) are crossed by the NBHCE alignment, which is on structure in this area (see **Error! Reference source not found.** and **Error! Reference source not found.**). The final design of the alignment will determine whether the widened elevated roadway encroaches upon these resources. Green Acres may interpret an air-rights acquisition as a diversion or disposal of Mary Benson Park, and a Section 4(f) evaluation would be required if the project were to seek federal funding assistance. The Green Acres diversion/disposal process typically takes one year and requires multiple public hearings and the provision of mitigation in the form of a land swap sized in accordance with the ratio applicable to the impact (1:1, 2:1, or greater). Cash mitigation may also be acceptable in some instances; regardless, impacts to parkland should therefore be avoided if at all possible to reduce overall project cost and schedule. This is a constraint to examine in more detail as the project advances.

Figure 6.7.12



Noise - Potential Environmental
Justice Impacts Project 2
Legend
HCE Concept Alignment
Affected Parcels
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
N
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
Proposed realigned EB elevated approach to Holland Tunnel
Cold Storage Warehouse
New residential development (under construction)
I-78 SECONDARY
NJ 139 LOWER SECONDARY
HUDSON COUNTY 634
HUDSON COUNTY 632
HUDSON COUNTY 630
HUDSON COUNTY 629
HUDSON COUNTY 730
510
255
0
510 Feet

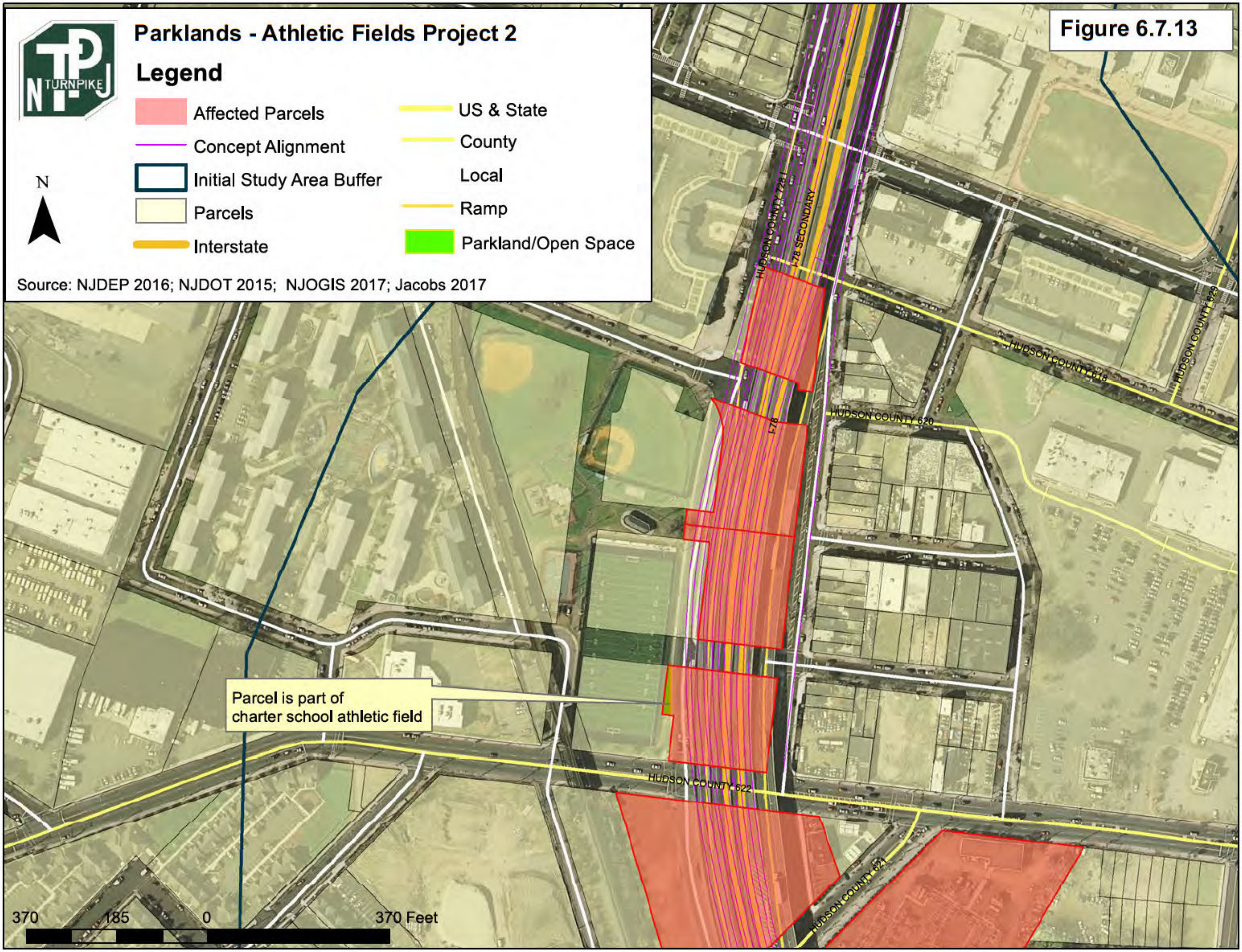
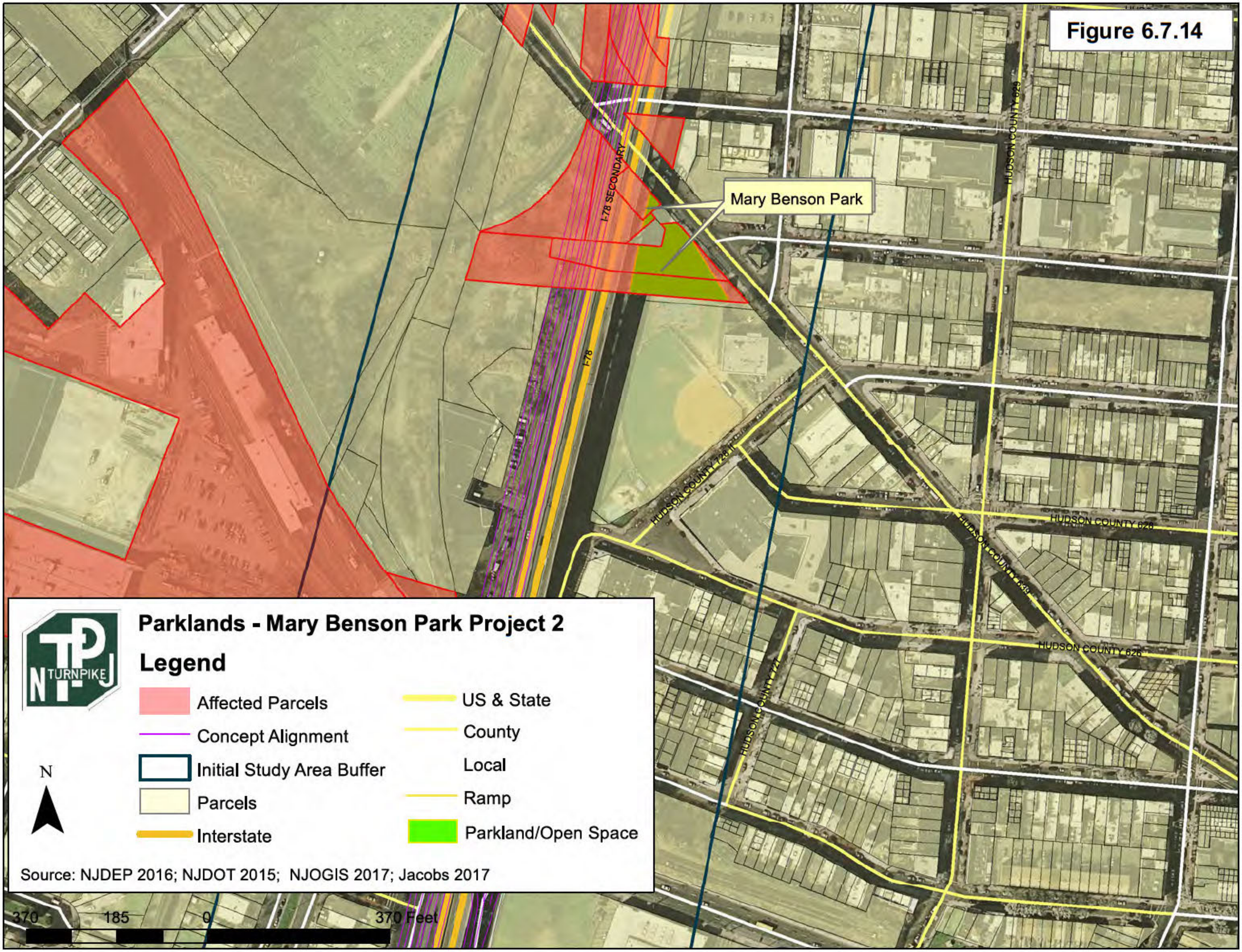


Figure 6.7.13
Parklands - Athletic Fields Project 2
Legend
Affected Parcels
Concept Alignment
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
Parkland/Open Space
N
NJ TURNPIKE
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
HUDSON COUNTY 728 1
I-78 SECONDARY
I-78
HUDSON COUNTY 618
HUDSON COUNTY 629
HUDSON COUNTY 620
HUDSON COUNTY 622
HUDSON COUNTY 621
Parcel is part of
charter school athletic field
370
185
0
370 Feet

Figure 6.7.14



Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017

Air Quality and Noise

The improved efficiency of traffic movement on the redesigned and enhanced NBHCE is anticipated to reduce congestion and associated air quality impacts, which is a net benefit to the adjacent community.

Project 2 would realign the NBHCE in an urbanized, mixed-use area of northern Jersey City. The realignment of the eastbound approach to the Holland Tunnel would bring the alignment closer to residential development, although the elevation of the roadway may have a mitigating effect on the noise environment at the level of the existing residences. New residential development, however, is under construction immediately south of the proposed realignment, such that the alignment would abut the residential use. The residential development will likely be occupied before the NBHCE project commences construction, and as a result, the realignment would present a noise impact to the new residential use, which is presently buffered from the existing eastbound approach by the Cold Storage Warehouse. Environmental justice impacts (discussed previously) may also result if the residential development includes affordable housing units and these are located on the north side of the building or otherwise distributed such that the lower-income units are exposed to more noise than the market-rate units. This is a constraint situation that will require additional consideration and outreach as the project advances.

In addition, sensitive land uses within Project 2 include open spaces and community facilities (**Error! Reference source not found.** and **Error! Reference source not found.**).

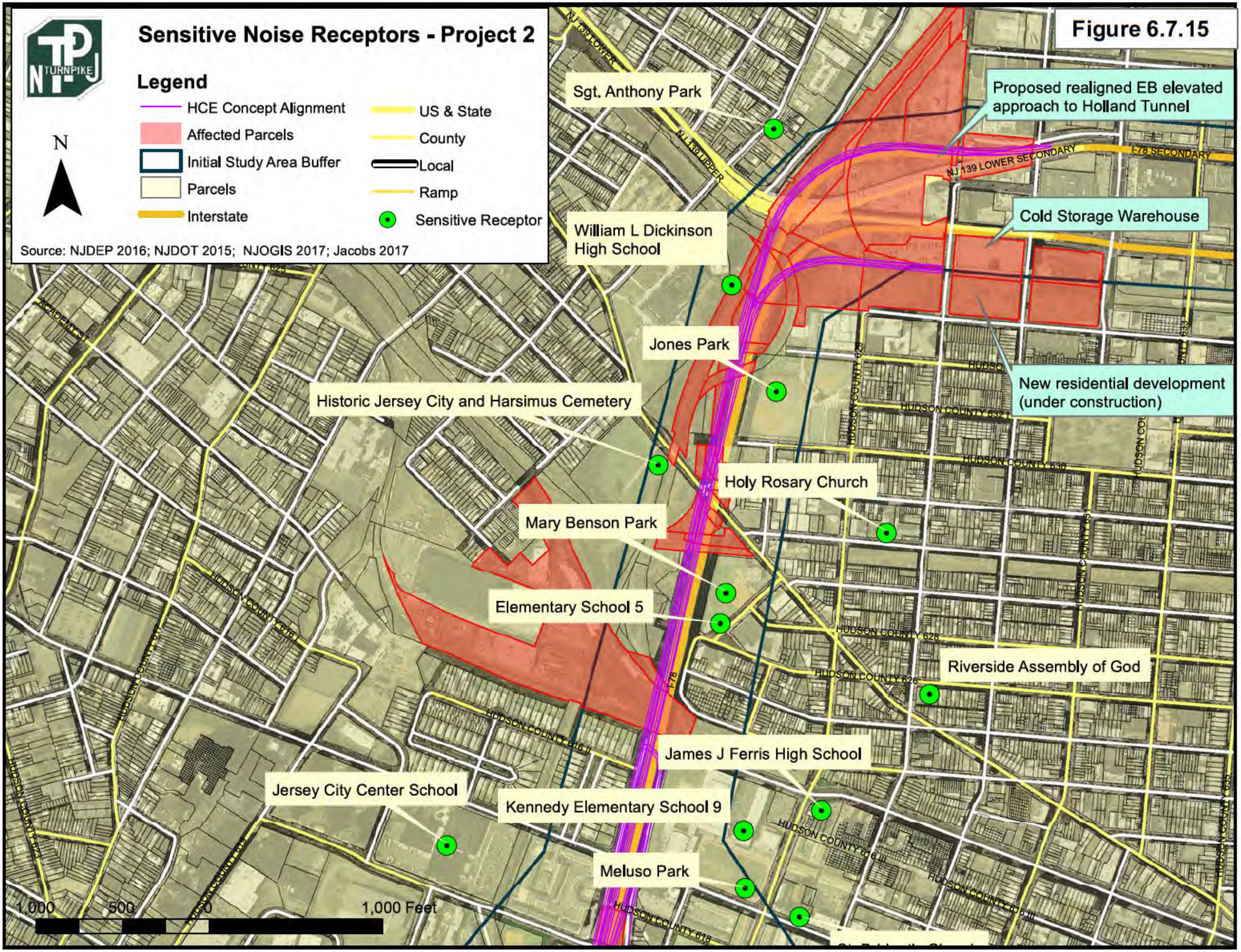
Table 6.7.11: Sensitive Receptors: Project 2

Project	Sensitive Land Use Name
Project 2	Elementary School 5
	Historic Jersey City and Harsimus Cemetery
	Holy Rosary Church
	James J Ferris High School
	Jones Park
	Kennedy Elementary School 9
	Mary Benson Park
	Meluso Park
	Riverside Assembly of God
	Sgt. Anthony Park
	William L Dickinson High School

Individual sensitive land uses immediately adjacent to Project 2 include the Historic Jersey City and Harsimus Cemetery, William L Dickinson High School, and the Sgt. Anthony Park. Along the east side of Project 2 is the James J Ferris High School, the Kennedy Elementary School 9, Elementary School 5, Holy Rosary Church, Riverside Assembly of God, Mary Benson Park, Meluso Park, and Jones Park.

Figure 6.7.15

Sensitive Noise Receptors - Project 2



Hazardous Materials

The hazardous materials screening identified the following parcels in Project 2 as being potentially affected by hazardous materials or related enforcement or remediation activity. Further investigation of these parcels is recommended. All four of the affected parcels are privately owned (see **Error! Reference source not found.** and **Error! Reference source not found.**).

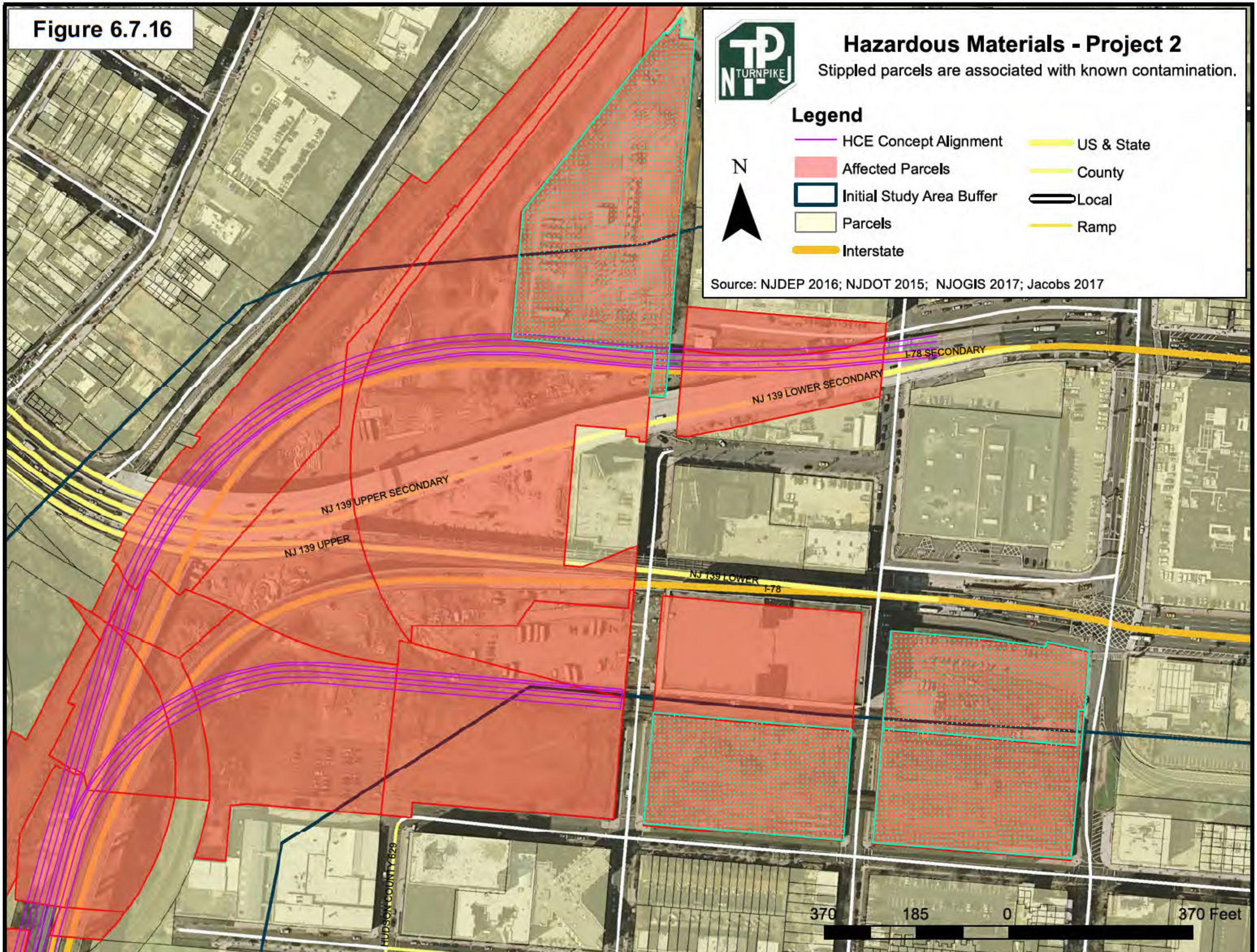
Table 6.7.12: Hazardous Materials: Project 2

Block	Lot	Municipality	County	Owner	Database Identified
6902	23	Jersey City	Hudson	Newport City Development C/O LeFrak	KCSL
8602	2	Jersey City	Hudson	Embankment Property LLC	CEA, KCSL
8601	2	Jersey City	Hudson	25 Columbus Circle #59B, LLC	CEA, KCSL
8602	1	Jersey City	Hudson	Jersey City Reality Corp	KCSL

Note:
NJEMS: New Jersey Environmental Management System
FRS: Facility Registry Systems
ISRA: Industrial Site Recovery Act
AFS: Air Facility Systems
ECHO: Enforcement and Compliance History Online
HIST HWS-NJ: Historical Hazardous Waste Sites
SHWS: Hazardous Waste Sites
RCRA-LQG: Resource Conservation and Recovery Act Large Quantity Generator
UST: Underground Storage Tank
BRS: Reporting of hazardous waste generation and management from LQGs

Mitigation considerations are the same as described for Projects 1A & 1B.

Figure 6.7.16


Hazardous Materials - Project 2
Stippled parcels are associated with known contamination.
Legend
HCE Concept Alignment
Affected Parcels
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
N
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
I-78 SECONDARY
NJ 139 LOWER SECONDARY
NJ 139 UPPER SECONDARY
NJ 139 UPPER
NJ 139 LOWER
I-78
HUDSON COUNTY 629
370
185
0
370 Feet

Cultural Resources

Cultural resources in the study area included areas of land, historic transportation corridors, and discrete structures. Some areas and corridors extend across multiple project areas. In the tables that follow, a resource associated only with one project is grouped under the heading "Project X." A resource that affects more than one project is listed under a heading that names all affected projects in order to provide more context in the next steps of cultural resources assessment and processing. Detailed descriptions of the resources are found in the Appendix J.

Field reconnaissance is required to confirm the presence of historic properties identified using the GIS analysis described above and to identify any new historic properties not mapped by the NJHPO.

Archaeological resources are sensitive and not mapped, as explained in Chapter 3. Historic architectural resources are illustrated on **Error! Reference source not found.**. No locally-identified resources are found in Project 2.

Table 6.7.13: Archaeology - Project 2

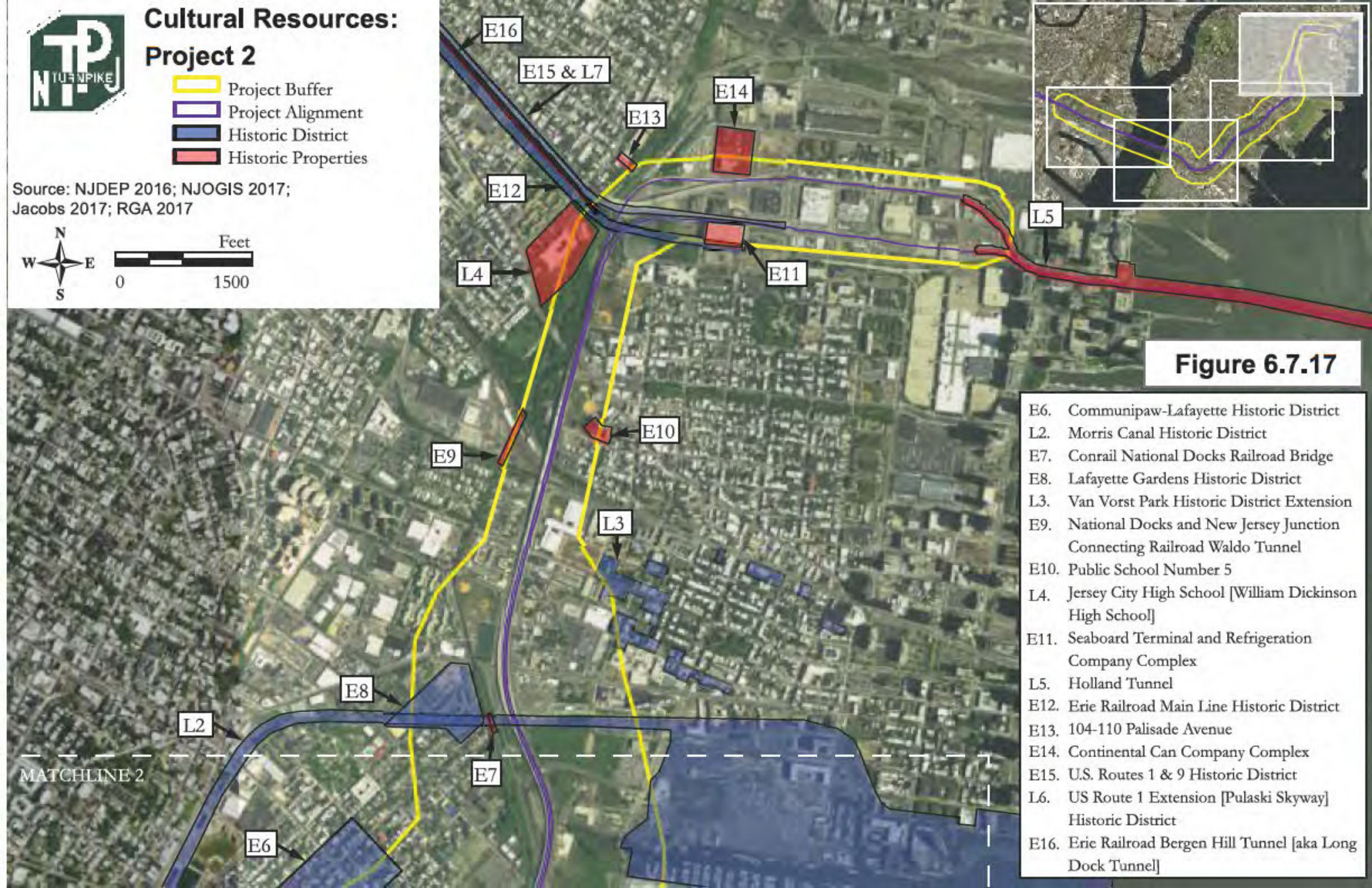
Project 2						
Site Number	**Site Name**	**Period**	**Type**	**Distance to project alignment**	**Distance/ Direction to Water Source**	**Reference**
28-Hd -15	Jersey City, Interior Points (Site #6)	Prehistoric	Unknown	Approx. 100 ft	Within 500 ft. of western shore of Hudson River	ISS:6
28-Hd -18	Jersey City, Eastern Shore (Site #11)	Prehistoric	Unknown	Approx. 0-50 ft.	Abuts western shore of Hudson River	ISS:6
28-Hd -49	Jersey Central Railroad Roundhouse North	1914 – 1950	Railroad roundhouse and terminal	Approx. 0-50 ft.	Within 500 ft. of western shore of Hudson River	Public Archaeology Laboratory, Inc. 2010, 2012
28-Hd -51	Mill Creek Retaining Wall	Mid-19th c.	Retaining Wall	Approx. 700 ft	Within 500 ft. of western shore of Hudson River	RGA, Inc. 2015
28-Hd -52	Mill Creek Plank Board	Ca. 1880 – early 20th c.	Possible bridge	Approx. 700 ft.	Abuts western shore of Hudson River	RGA, Inc. 2015

Table 6.7.14: Historic Architecture: Listed and Eligible Resources - Project 2

RGA#	Resource	Municipality	Status
Project 2			
L3	Van Vorst Park Historic District Extensions	Jersey City	Listed (SR: 8/21/1984; NR: 10/11/1984)
L4	Jersey City High School [William Dickinson High School]	Jersey City	Listed (SR: 12/23/1981; NR: 6/1/1982)
L5	Holland Tunnel	Jersey City	Listed (NHL 11/3/1993; NR: 11/4/1993; SR: 10/13/1995)
L6	US Route 1 Extension [Pulaski Skyway] Historic District	Multiple	Listed (SR: 6/13/2005; NR: 8/12/2005)
E9	National Docks and New Jersey Junction Connecting Railroad Waldo Tunnel	Jersey City	Eligible (NJHPO: 2/28/2009)
E10	Public School Number 5	Jersey City	Eligible (NJHPO: 2/28/1991)
E11	Seaboard Terminal and Refrigeration Company Complex	Jersey City	Eligible (NJHPO: 5/30/1997)
E12	Erie Railroad Main Line Historic District	Multiple	Eligible (NJHPO: 2/20/2003)
E13	104-110 Palisade Avenue	Jersey City	Eligible (NJHPO: 2/28/1991)
E14	Continental Can Company Complex	Jersey City	Eligible (NJHPO: 5/30/1997)
E15	US Routes 1 & 9 Historic District	Multiple	Eligible (NJHPO: 3/8/1996)
E16	Erie Railroad Bergen Hill Tunnel [aka Long Dock Tunnel]	Jersey City	Eligible (NJHPO: 4/27/2000)

Table 6.7.15: Historic Architecture: Locally Identified Resources: Project 2

RGA#	Resource Name	Municipality	Source
Project 2			
No Locally-Identified Resources			


Cultural Resources:
Project 2
Project Buffer
Project Alignment
Historic District
Historic Properties
Source: NJDEP 2016; NJOGIS 2017; Jacobs 2017; RGA 2017
N
W
E
S
Feet
0
1500
E16
E15 & L7
E13
E14
E12
L4
E11
L5
E10
E9
L3
E8
L2
E7
E6
MATCHLINE 2
Figure 6.7.17
E6. Communipaw-Lafayette Historic District
L2. Morris Canal Historic District
E7. Conrail National Docks Railroad Bridge
E8. Lafayette Gardens Historic District
L3. Van Vorst Park Historic District Extension
E9. National Docks and New Jersey Junction Connecting Railroad Waldo Tunnel
E10. Public School Number 5
L4. Jersey City High School [William Dickinson High School]
E11. Seaboard Terminal and Refrigeration Company Complex
L5. Holland Tunnel
E12. Erie Railroad Main Line Historic District
E13. 104-110 Palisade Avenue
E14. Continental Can Company Complex
E15. U.S. Routes 1 & 9 Historic District
L6. US Route 1 Extension [Pulaski Skyway] Historic District
E16. Erie Railroad Bergen Hill Tunnel [aka Long Dock Tunnel]

6.7.5. Project 3

Community Profile/Environmental Justice

The improvements proposed for Project 3 are confined primarily to existing right-of-way areas and industrial land from which a small area not central to the facility's operation would be required. Acquisition of community facilities or residential development is not proposed, and access to existing facilities would not be altered as a result of the proposed improvements. Neighborhood cohesion is not affected by this project as all improvements are confined to the vicinity of the existing NBHCE. Widening of the NBHCE along the westbound lanes would involve railroad property that buffers existing non-industrial development from the NBHCE. The outreach effort and community benefits of the project are the same as described for Project 1A and 1B and as a result, no impacts to Environmental Justice communities are anticipated.

Wetlands

Several mapped wetland areas are found within the Project 3 boundaries; however, most of these known resources are located on the eastern/southern side of Caven Point Road (see Figure 6.7.18). These wetland areas are more than 200 ft from the NBHCE. Work on the NBHCE is therefore unlikely to directly affect the wetlands but may impact associated transition areas. Field reconnaissance and delineation is recommended.

Block 24303, Lot 17 includes a mapped wetland area that abuts the westbound lanes of the NBHCE in the vicinity of Structure N5.34. The NJDEP mapping conflicts with existing aerial photography that shows the site developed with an Asian foods supermarket and indoor go-kart facility. Field reconnaissance and delineation is recommended to verify the presence of the wetland area.

Wetlands and wetland transition areas in this project are regulated by NJDEP. A letter of interpretation from NJDEP is necessary to determine the resource value of wetlands within this area and the size of the transitional area. This additional information will facilitate the estimation of impacts and mitigation requirements under the NJDEP freshwater and/or coastal wetlands regulations.

Threatened and Endangered Species

No federally-listed species are known to occur along the NBHCE in this project. State threatened species are found along the eastbound lanes of the NBHCE in the vicinity of Liberty National Golf Course and Liberty State Park, associated with the wetlands at both locations. The species are the same as those found in Projects 1A and 1B in the wetland areas of Newark and Bayonne. Timing restrictions and requirements for habitat and nesting surveys would also be identical. Refer to Table 3.2.2 in Section 3.2 for the list of federal species of conservation concern and state listed species. Avian species listed in Table 3.2.2 may occur within Project 3. There is no habitat for NMFS fish species in Project 3; therefore, none of the fish species listed in Table 3.2.2 would occur in Project 3.

Flood Hazard Area

Portions of the low-lying areas adjacent to both the eastbound and westbound lanes through Project 3 are mapped as Flood Zone A, the 100-year storm zone that is subject to design flood standards.

Open Space and Recreational Resources

The open space resources identified in Jersey City in the context screening would not be affected by the proposed improvements to the NBHCE in Project 3. The proposed improvements would not affect the access to or otherwise indirectly affect the use and enjoyment of resources. No impacts to parkland or recreational resources are anticipated to result.

Air Quality and Noise

The improved efficiency of traffic movement on the redesigned and enhanced NBHCE is anticipated to reduce congestion and associated air quality impacts, which is a net benefit to the adjacent community.

The sensitive land uses within Project 3 include residential parcels northwest of the project area and community facilities (see Figure 6.7.19 and Table 6.7.16).

Table 6.7.16: Sensitive Receptors: Project 3

Project	Sensitive Land Use Name
Project 3	Bay View-New York Bay Cemetery
	Bayside Park
	Hudson River Waterfront Walk
	Jersey City Recreation Affairs
	Liberty National Golf Course
	Liberty State Park
	Spectrum Health - Rehabilitation Center
	St Mary's Byzantine Catholic Church

To the east, several open space properties existing, including the Jersey City Recreation Affairs, Liberty National Golf Course, Hudson River Waterfront Walk, and part of the Liberty State Park complex. To the west is Bayside Park, Spectrum Health Rehabilitation Center, St Mary's Byzantine Catholic Church, and the Bay View-New York Bay Cemetery.

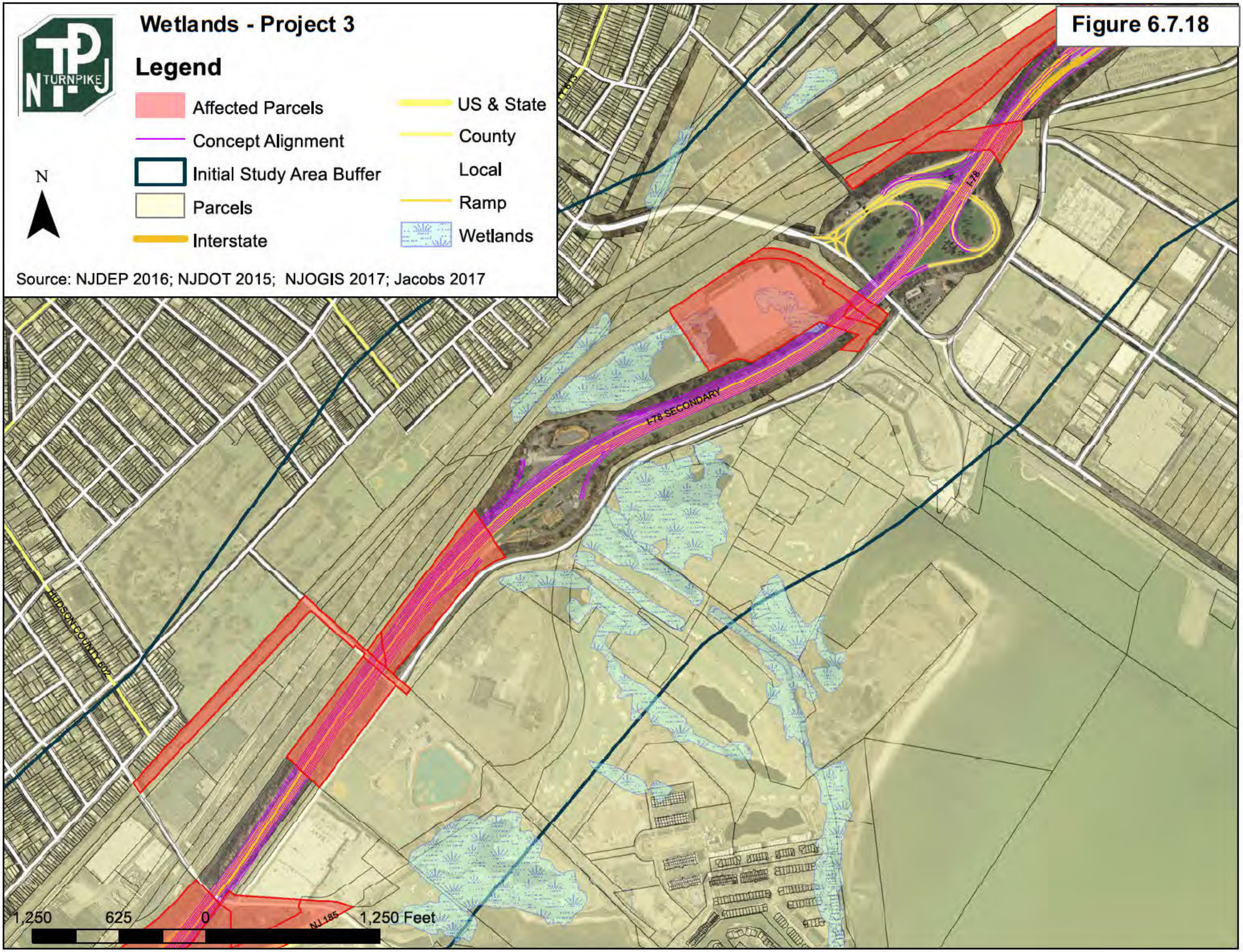


Figure 6.7.18
Wetlands - Project 3
TURNPIKE
NJ
Legend
Affected Parcels
Concept Alignment
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
Wetlands
N
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
I-78
I-78 SECONDARY
HUDSON COUNTY 602
NJ 185
1,250
625
0
1,250 Feet

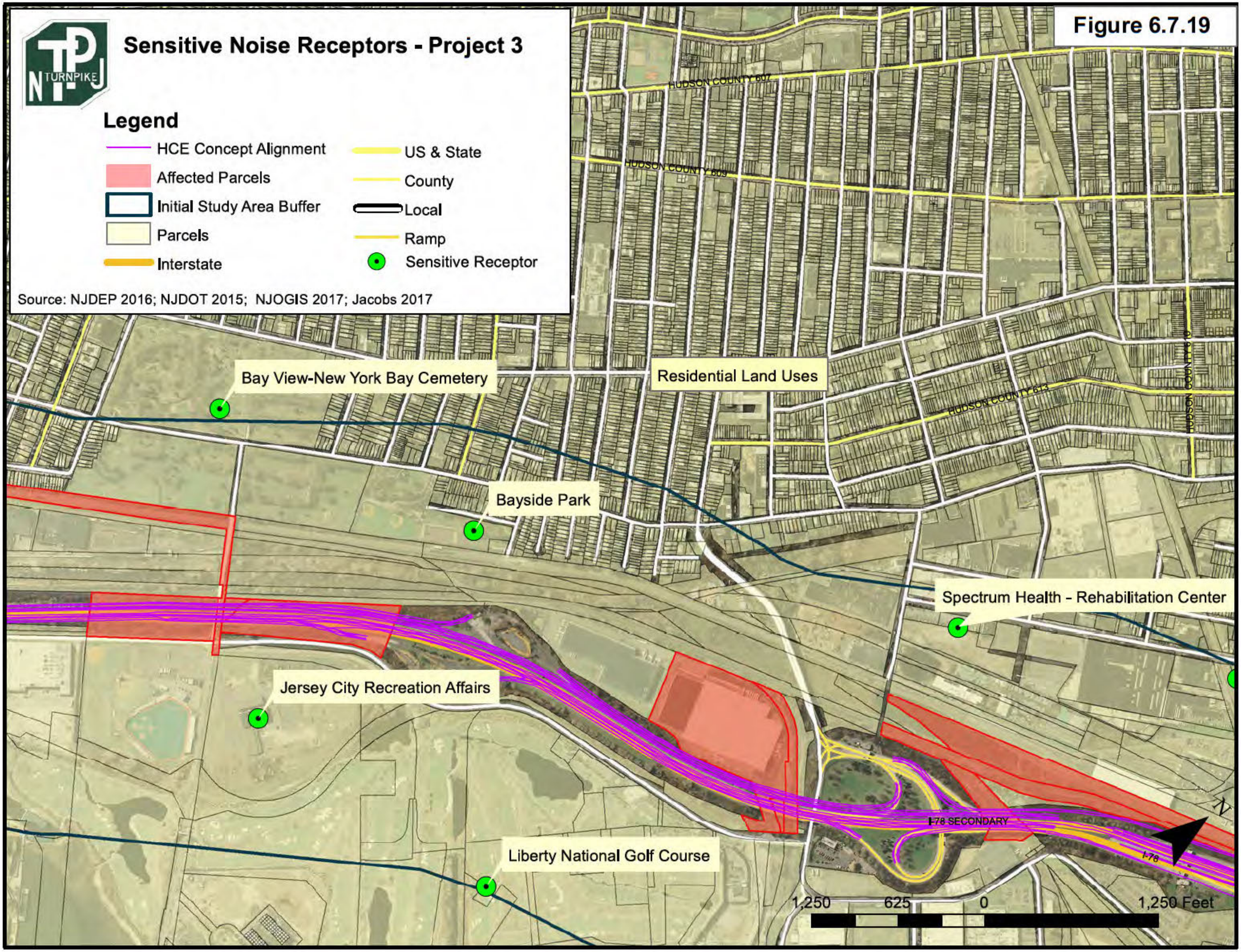


Figure 6.7.19
Sensitive Noise Receptors - Project 3
NJ TURNPIKE
Legend
HCE Concept Alignment
Affected Parcels
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
Sensitive Receptor
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
HUDSON COUNTY 607
HUDSON COUNTY 609
HUDSON COUNTY 613
Bay View-New York Bay Cemetery
Residential Land Uses
Bayside Park
Spectrum Health - Rehabilitation Center
Jersey City Recreation Affairs
Liberty National Golf Course
I-78 SECONDARY
I-78
N
1,250
625
0
1,250 Feet

Hazardous Materials

The hazardous materials screening identified the following parcels in Project 3 as being potentially affected by hazardous materials or related enforcement or remediation activity (see Table 6.7.17 and Figure 6.7.20). Further investigation of these parcels is recommended. All four of the parcels are privately owned.

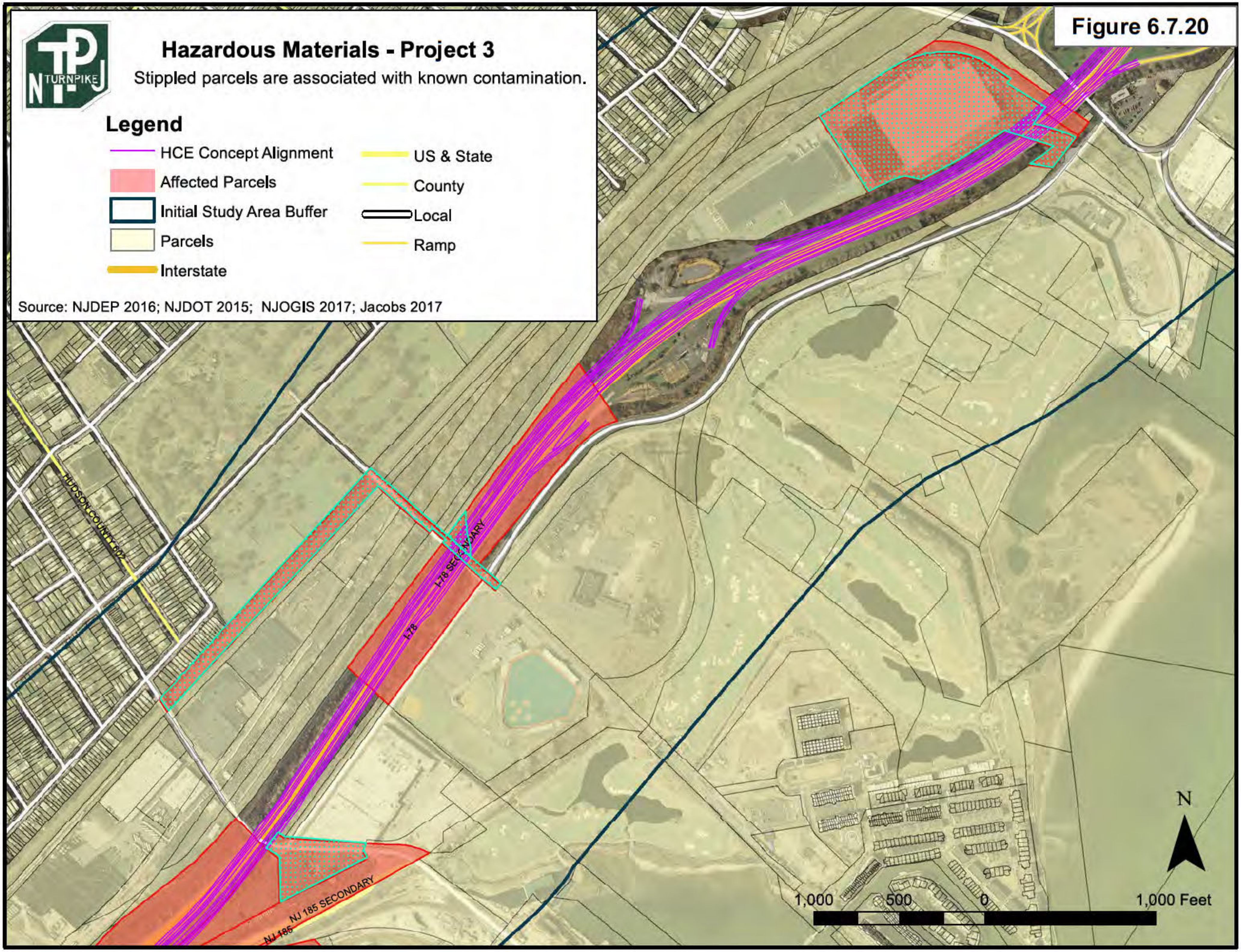
Table 6.7.17: Hazardous Materials: Project 3

Block	Lot	Municipality	County	Owner	Database Identified
24303	17	Jersey City	Hudson	Claremont Urban Renewal Corporation	SPILLS, Deed Notice, KCSL, Chromate Site
27401	1	Jersey City	Hudson	Conrail	ISRA, NJEMS, SPILLS, FRS, Financial Assurance, AFS, Manifest, ECHO, Brownfields, HIST HWS-NJ, Deed Notice, Release, SHWS
27401	9	Jersey City	Hudson	Conrail	SPILLS-NJ, RCRA-LQG, FRS, ECHO, UST-NJ, BRS, NJEMS
27401	30	Jersey City	Hudson	A-B Holdings for Jersey City, LLC	FRS, ECHO, Brownfields, HIST HWS-NJ

Note:
NJEMS: New Jersey Environmental Management System
FRS: Facility Registry Systems
ISRA: Industrial Site Recovery Act
AFS: Air Facility Systems
ECHO: Enforcement and Compliance History Online
HIST HWS-NJ: Historical Hazardous Waste Sites
SHWS: Hazardous Waste Sites
RCRA-LQG: Resource Conservation and Recovery Act Large Quantity Generator
UST: Underground Storage Tank
BRS: Reporting of hazardous waste generation and management from LQGs

Mitigation considerations are the same as described for Projects 1A and 1B.

Figure 6.7.20


Hazardous Materials - Project 3
Stippled parcels are associated with known contamination.
Legend
HCE Concept Alignment
Affected Parcels
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
I-78 SECONDARY
I-78
NJ 185 SECONDARY
NJ 185
N
1,000
500
0
1,000 Feet

Cultural Resources

Cultural resources in the study area included areas of land, historic transportation corridors, and discrete structures. Some areas and corridors extend across multiple projects of the proposed project. In the tables that follow, a resource associated only with one project is grouped under the heading "Project X." A resource that affects more than one project is listed under a heading that names all affected projects in order to provide more context in the next steps of cultural resources assessment and processing. Detailed descriptions of the resources are found in the Appendix J.

Field reconnaissance is required to confirm the presence of historic properties identified using the GIS analysis described above and to identify any new historic properties not mapped by the NJHPO.

Archaeological resources are sensitive and not mapped, as explained in Chapter 3. Historic architectural resources are illustrated on Table 6.7.18 through Table 6.7.20 and Figure 6.7.21 and Figure 6.7.22.

Table 6.7.18: Archaeology: Projects 1B & 3

Project 1B & 3						
Site Number	**Site Name**	**Period**	**Type**	**Distance to project alignment**	**Distance/ Direction to Water Source**	**Reference**
28-Hd -3	Greenville	Woodland	Unknown	Approx. 100 ft.	Abuts western shore of Hudson River	Skinner and Schrabisch 1913:42; ISS:6
28-Hd -15	Jersey City, Interior Points (Site #6)	Prehistoric	Unknown	Approx. 100 ft.	Within 500 ft. of western shore of Hudson River	ISS:6
28-Hd -16	Jersey City, Eastern Shore (Site #9)	Prehistoric	Unknown	Approx. 1750 ft.	Within 500 ft. of western shore of Hudson River	ISS:6
28-Hd -17	Jersey City, Eastern Shore (Site #10)	Prehistoric	Unknown	Approx. 500 ft.	Approx. 1500 ft. from western shore of Hudson River	ISS:6

Table 6.7.19: Historic Architecture: Listed and Eligible Resources: Projects 1A, 1B & 3

RGA#	Resource	Municipality	Status
Projects 1A, 1B & 3			
E2	Lehigh Valley Railroad Oak Island Yard Historic District	Newark	Eligible (NJHPO: 1/14/1997)
E4	Lehigh Valley Railroad Historic District	Multiple	Eligible (NJHPO: 3/15/2002)
E5	Hanover National Bank Repository	Jersey City	Eligible (COE: 5/18/2006)

Table 6.7.20: Historic Architecture: Locally Identified Resources: Project 3

RGA#	Resource Name	Municipality	Source
Project 3			
I6	232 Garfield Avenue	Jersey City	"Identified" - Phase 2 Survey, Ward A, Jersey City (Mary B. Dierickx Architectural Preservation Consultants 1985)
I7	30 Linden Avenue	Jersey City	"Identified" - Phase 2 Survey, Ward A, Jersey City (Mary B. Dierickx Architectural Preservation Consultants 1985)
I8	500 Bayside Park Drive	Jersey City	"Identified" - Phase 2 Survey, Ward A, Jersey City (Mary B. Dierickx Architectural Preservation Consultants 1985)

Figure 6.7.21
MATCHLINE 3
MATCHLINE 1B
E6
L2
L2
N
W
E
S
Feet
0
1500
L2. Morris Canal Historic District
E6. Communipaw-Lafayette Historic District
Cultural Resources:
Project 3
Project Buffer
Project Alignment
Historic District
Historic Properties
Source: NJDEP 2016; NJOGIS 2017; Jacobs 2017; RGA 2017

Figure 6.7.22


Cultural Resources: Project 3
Project Buffer
Project Alignment
Locally Identified Resources
N
W
E
S
Source: NJDEP 2016; NJOGIS 2017; Jacobs 2017; RGA 2017
Feet
0
1500
MATCHLINE 3
MATCHLINE 1B
I7
I8
I9
I7. 30 Linden Avenue
I8. 500 Bayside Park Drive
I9. 287 Communipaw Ave

Project 4

Community Profile/Environmental Justice

The improvements proposed for Project 4 are confined primarily to existing right-of-way areas and industrial land from which a small area not central to the facility's operation would be required. Acquisition of community facilities or residential development is not proposed, and access to existing facilities would not be altered as a result of the proposed improvements. Neighborhood cohesion is not affected by this project as all improvements are confined to the vicinity of the existing NBHCE. The outreach effort and community benefits of the project are the same as described for Projects 1A and 1B, and as a result, no impacts to Environmental Justice communities are anticipated.

Wetlands

A small, ponded area and a freshwater emergent wetland is found within Block 15802, Lot 11 in Jersey City, associated with a stream that appears to pass under the NBHCE, via Structure N6.49. Assessor's data indicates that this parcel is owned by NJDOT (see Figure 6.7.23). The Liberty Science Center is located within the parcel. This parcel is also enrolled in the Green Acres program (Liberty State Park) and subject to Section 4(f). Field delineation is required to establish the boundary of the wetland area and determine whether construction activity would directly affect the resource or its transition area.

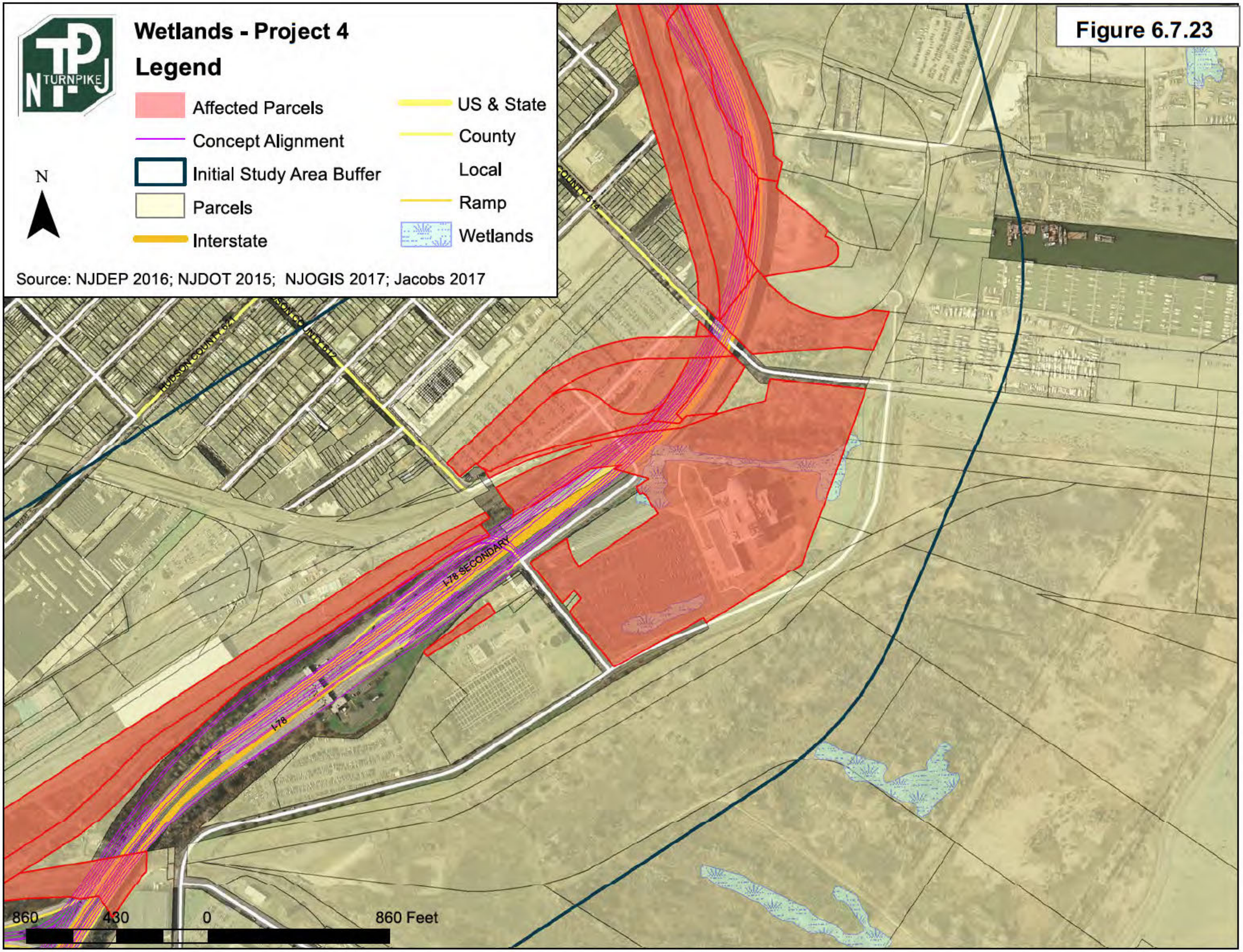
Threatened and Endangered Species

No federally-listed species are known to occur along the NBHCE in this project area. Land within Liberty State Park provides habitat for many of the same bird species identified in Newark and Bayonne, in addition to harriers and bobolinks. The habitat areas are confined to land adjacent to the eastbound lanes of the NBHCE and do not extend under the NBHCE or affect the railroad properties along the westbound lanes. Construction timing restrictions may still apply, however, as the habitat areas are in close proximity to the work area where noise and construction lighting may interfere with certain lifecycle activities of these species. Consultation with NJDEP would identify the appropriate means of mitigation these potential impacts. Refer to Table 3.2.2 in Section 3.2 for the list of federal species of conservation concern and state listed species. There is no habitat for NMFS fish species in Project 4; therefore, none of the fish species listed in Table 3.2.2 would occur in Project 4.

Flood Hazard Area

All of Project 4 is within or adjacent to Flood Zone A, which represents the 100-year storm. Portions of this project are at grade and would be susceptible to flooding. The design flood elevation will be a factor in the design of this project.

Figure 6.7.23



Wetlands - Project 4
Legend
Affected Parcels
Concept Alignment
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
Wetlands
N
TURNPIKE
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
HUDSON COUNTY 621
I-78 SECONDARY
I-78
860
430
0
860 Feet

Open Space and Recreational Resources

Liberty State Park is located east of the existing NBHCE and proposed widening improvements would occur along the westbound lanes. This approach would avoid impact to the character-defining features of Liberty State Park; however, Block 15802, Lot 11 includes the parking lot for the Liberty Science Center and extends under the NBHCE to the west side of the roadway. Impact to the western portion of Lot 11 may be considered a Green Acres and Section 4(f) impact, depending on how the boundaries of the parkland are described (see Figure 6.7.24). Section 4(f) typically does not draw distinctions within a parcel: if part of a lot is parkland, then the entire lot is considered parkland and subject to Section 4(f). Green Acres drafts specific metes and bounds descriptions for the resources enrolled in their program. This level of analysis is beyond the scope of the concept development screening. Additional research will be conducted during preliminary engineering when the concept alignment is refined and potential impacts are more certain.

Air Quality and Noise

The improved efficiency of traffic movement on the redesigned and enhanced NBHCE is anticipated to reduce congestion and associated air quality impacts, which is a net benefit to the adjacent community.

Land uses adjacent to Project 4 are similar to those adjacent to Project 3, and include residential areas, open spaces, and community facilities (see Figure 6.7.25 and Table 6.7.21).

Table 6.7.21: Sensitive Receptors: Project 4

Project	Sensitive Land Use Name
Project 4	All Saints Assumption School
	BelovED Community Charter School
	Cornerstone Church of Christ
	Fountain of Salvation Church
	Gateway Park
	Jersey City Center School
	Jersey City Medical Center
	Lafayette Park and Pool
	Liberty Humane Society - Animal Shelter
	Liberty Science Center
	St. Bridget's Church
	St. John Ame Church
	The Children's Hospital of Hudson County

The Liberty Humane Society (Animal Shelter) and the Liberty Science Center situated directly adjacent to the project alignment. East and west of Project 4, there are multiple schools, houses of worship, and active recreational uses situated within a densely populated residential and commercial area further west. There are also multiple low income housing developments owned by the Jersey City Housing Authority near the intersection of Newark Bay Extension and Grand Street. The Lafayette Park and Pool, Gateway Park, St. Bridget's Church, St. John Ame Church, Fountain of Salvation Church, Cornerstone Church of Christ, All Saints Assumption School, Jersey City Center School, The Children's Hospital of Hudson County, Jersey City Medical Center, and the BelovED (sic) Community School and its outdoor facilities are also located to the east and west of Project 4. Noise monitoring is recommended.

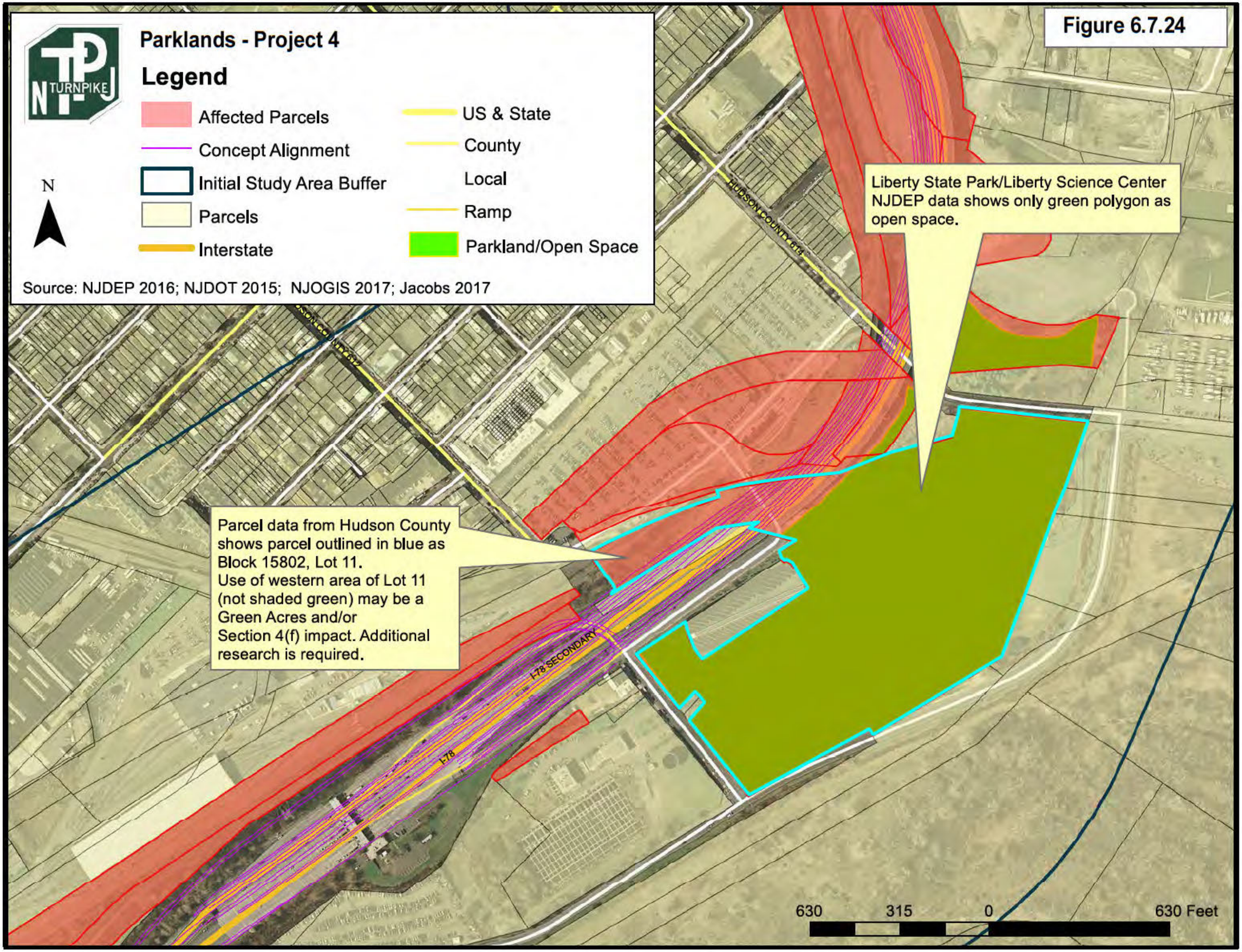
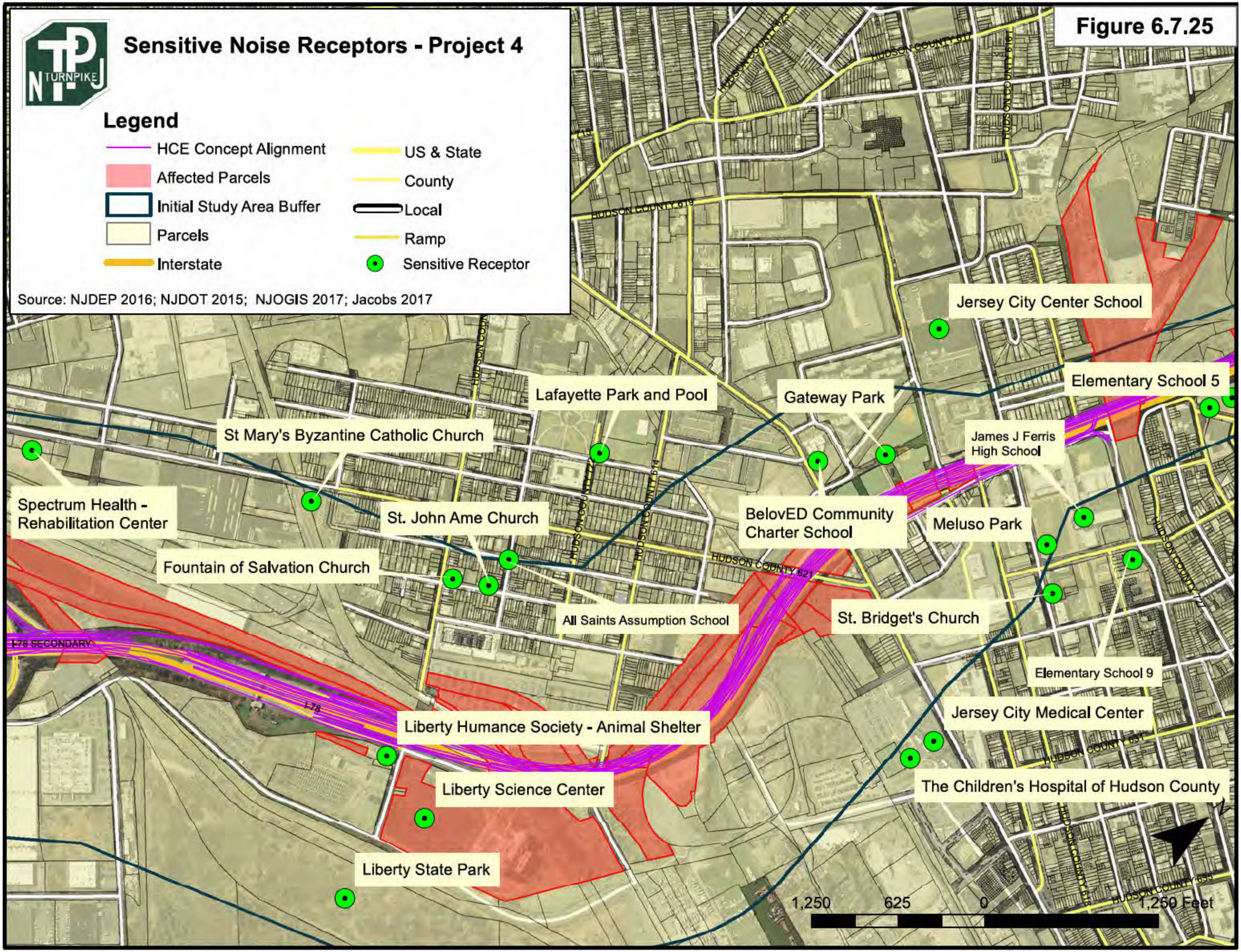


Figure 6.7.24
Parklands - Project 4
Legend
Affected Parcels
Concept Alignment
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
Parkland/Open Space
N
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
Liberty State Park/Liberty Science Center NJDEP data shows only green polygon as open space.
Parcel data from Hudson County shows parcel outlined in blue as Block 15802, Lot 11.
Use of western area of Lot 11 (not shaded green) may be a Green Acres and/or Section 4(f) impact. Additional research is required.
HUDSON COUNTY 614
I-78 SECONDARY
I-78
630
315
0
630 Feet

Figure 6.7.25



Sensitive Noise Receptors - Project 4
TURNPIKE
Legend
HCE Concept Alignment
Affected Parcels
Initial Study Area Buffer
Parcels
Interstate
US & State
County
Local
Ramp
Sensitive Receptor
Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017
Jersey City Center School
Elementary School 5
James J Ferris
High School
Gateway Park
Lafayette Park and Pool
St Mary's Byzantine Catholic Church
Spectrum Health -
Rehabilitation Center
St. John Ame Church
Fountain of Salvation Church
BelovED Community
Charter School
Meluso Park
All Saints Assumption School
St. Bridget's Church
Elementary School 9
Jersey City Medical Center
The Children's Hospital of Hudson County
Liberty Humance Society - Animal Shelter
Liberty Science Center
Liberty State Park
HUDSON COUNTY 619
HUDSON COUNTY 621
HUDSON COUNTY 614
I-78
I-78 SECONDARY
1,250
625
0
1,250 Feet

Hazardous Materials

The hazardous materials screening identified the following parcels in Project 4 as being potentially affected by hazardous materials or related enforcement or remediation activity (see Figure 6.7.26). Further investigation of these parcels is recommended. Two of the seven parcels are owned privately. The remainder are owned by NJ TRANSIT or PSE&G. Ownership of Block 15802, Lot 9 requires additional investigation as the GIS data identifies the parcel but the Assessor's records do not.

Table 6.7.22: Hazardous Materials: Project 4

Block	Lot	Municipality	County	Owner	Database Identified
15702	8	Jersey City	Hudson	PSE&G	Deed Notice, KCSL
15702	6	Jersey City	Hudson	PSE&G	Deed Notice
21503	3	Jersey City	Hudson	NJ TRANSIT	NJ Release, FRS, and KCSL
15802	9	Jersey City	Hudson	No Records	Chromate Site
15801	76	Jersey City	Hudson	Johnston View Owner, LLC C/O Argent, LLC	CEA, KCSL
15801	65	Jersey City	Hudson	NJ TRANSIT	Chromate Site
15801	1	Jersey City	Hudson	CONRAIL	NJEMS, KCSL, Chromate Site

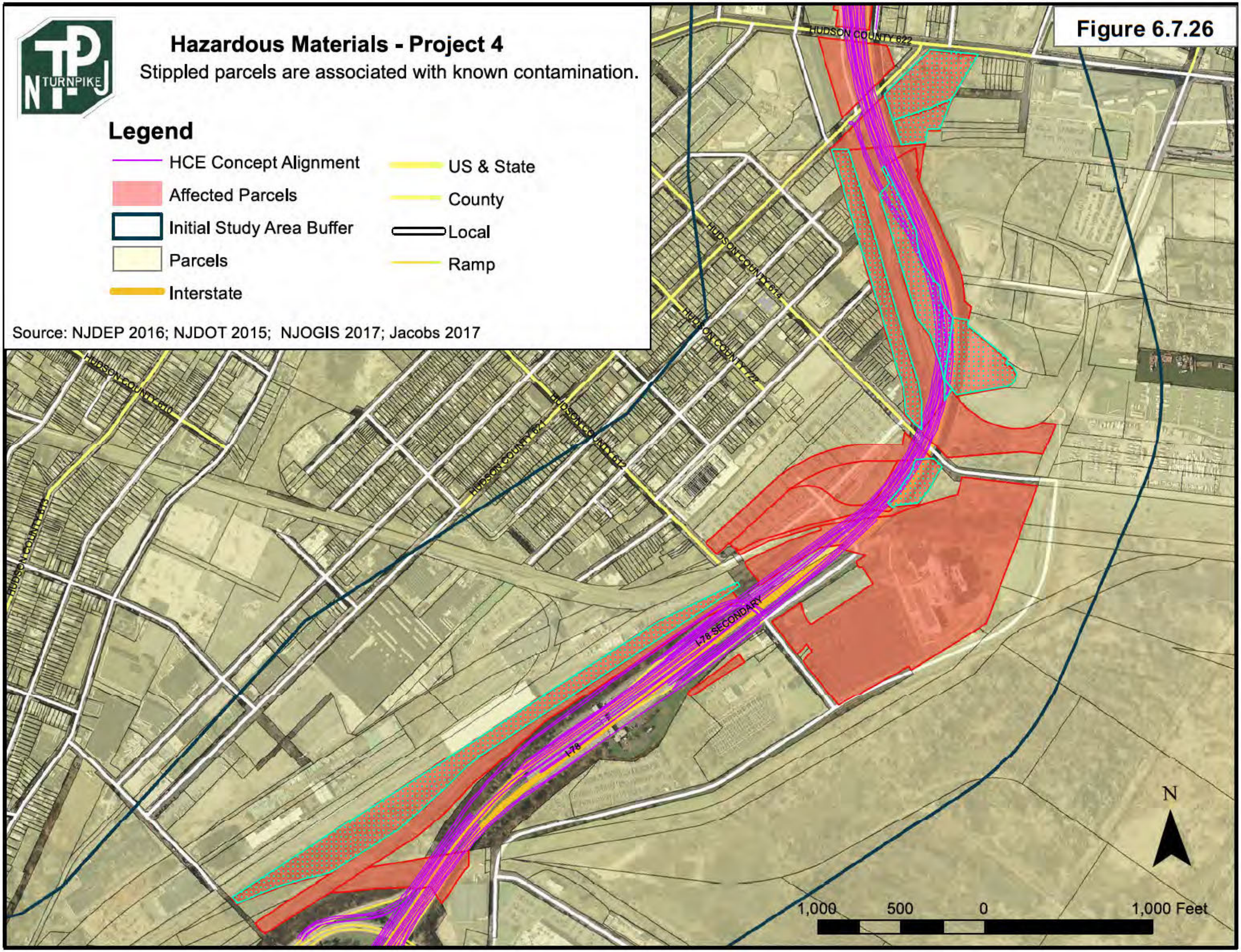
Note:
NJEMS: New Jersey Environmental Management System
FRS: Facility Registry Systems
ISRA: Industrial Site Recovery Act
AFS: Air Facility Systems
ECHO: Enforcement and Compliance History Online
HIST HWS-NJ: Historical Hazardous Waste Sites
SHWS: Hazardous Waste Sites
RCRA-LQG: Resource Conservation and Recovery Act Large Quantity Generator
UST: Underground Storage Tank
BRS: Reporting of hazardous waste generation and management from LQGs

Mitigation considerations are the same as described for Projects 1A and 1B.

Figure 6.7.26

Hazardous Materials - Project 4

Stippled parcels are associated with known contamination.



Source: NJDEP 2016; NJDOT 2015; NJOGIS 2017; Jacobs 2017

Cultural Resources

Cultural resources in the study area included areas of land, historic transportation corridors, and discrete structures. Some areas and corridors extend across multiple projects of the proposed project. In the tables that follow, a resource associated only with one project is grouped under the heading "Project X." A resource that affects more than one project is listed under a heading that names all affected projects in order to provide more context in the next steps of cultural resources assessment and processing. Detailed descriptions of the resources are found in the Appendix J.

Field reconnaissance is required to confirm the presence of historic properties identified using the GIS analysis described above and to identify any new historic properties not mapped by the NJHPO.

Archaeological resources are sensitive and not mapped, as explained in Chapter 3. Historic architectural resources are listed on Table 6.7.23 through Table 6.7.25, and illustrated on Figure 6.7.21, Figure 6.7.22, and **Error! Reference source not found.**, included previously with Projects 2 and 3.

Table 6.7.23: Archaeology: Project 4

Project 4						
Site Number	Site Name	Period	Type	Distance to project alignment	Distance/ Direction to Water Source	Reference
The NJSM files and published references do not define any registered archaeological sites within Project 4.						

Table 6.7.24: Historic Architecture: Listed and Eligible Resources: Project 4

RGA#	Resource	Municipality	Status
Project 4			
E6	Communipaw-Lafayette Historic District	Jersey City	Eligible (NJHPO: 2/17/1995)
E7	Conrail National Docks Railroad Bridge	Jersey City	Eligible (NJHPO: 10/26/1995)
E8	Lafayette Gardens Historic District	Jersey City	Eligible (NJHPO: 8/8/2001)

Table 6.7.25: Historic Architecture: Locally Identified Resources: Project 4

RGA#	Resource Name	Municipality	Source
Project 4			
I9	287 Communipaw Avenue	Jersey City	"Identified" - Phase 2 Survey, Ward F, Jersey City (Foss 1985)

7. Alternative Project Delivery Methods

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8. SUMMARY OF RECOMMENDATIONS

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