Long Island Sound Crossing Feasibility Study

Draft Final Report

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WSP

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1 Executive Summary

1.1 INTRODUCTION

There have been many proposals over the past several decades to create a connection across the Long Island Sound. Proposals go back to as early as the 1930s with the initial proposal by Senator Royal S. Copeland. The 1957 Oyster Bay-Rye Bridge Study, spearheaded by former New York State Public Works Commissioner Charles H. Sells, represented the first technical analysis of a Long Island Sound Crossing. Most recently a private developer proposal was initiated in 2008.

1.2 PROJECT PURPOSE AND BENEFITS

The purpose of this study was to perform a high-level feasibility analysis to understand and identify if a Long Island Sound Crossing from the northern shore of Long Island to the northern shore of the Sound could improve the region's overall transportation network. Study goals included (1) Improve regional mobility and connectivity; (2) Promote economic growth; (3) Minimize adverse environmental impacts; and (4) Develop cost-effective transportation options.

The trip between Long Island and Westchester/Connecticut is severely constrained due to the following:

- Congested roadways
- Limited egress
- Long travel times
- Lack of direct connectivity
- Lack of multimodal options

The following feasibility issues were addressed for each alignment option: Community Impacts; Property & Right-of-way Impacts; Cost & Revenue; Major Roadway Connections; Travel Demand; Design/Construction and Environmental Constraints.

A Long Island Sound Crossing would have significant regional benefits:

- Reduced travel time
- Reduced congestion
- Improved air quality
- Access to expanded labor markets
- Improved evacuation egress
- Improved freight movements

The Western Alignment (shown on Figure 1-1) would reduce travel time from Syosset to Rye/Port Chester from 55–100 minutes to approximately 15–20 minutes.

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Figure 1-1: Regional Study Area

Source: WSP

1.3 ALIGNMENT CONCEPT DEVELOPMENT

For this feasibility study, a key framework assumption was to acknowledge the initial concepts considered and establish a representative set of crossing scenarios to focus planning, engineering, environmental and demand modeling resources. Based on the general alignment of historical precedents and the current transportation network, three representative links—Western, Central, and Eastern Alignments—were defined for further analysis.

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Figure 1-2: Alignment Concepts

Source: WSP

1.4 STUDY FINDINGS

This matrix shown in Table 1-1 is a summary of higher level consistency with the key four goals established at the onset of the study—regional mobility, economic potential, minimizing environmental impacts, and creating cost effective options. Based on this evaluation, the recommendation of the study is to move forward the following alignment options for further study:

- Western Alignment – Tunnel Only
- Western Alignment – Bridge/Tunnel Combination
- Central Alignment to Bridgeport – Bridge only
- Central Alignment to Bridgeport – Bridge/Tunnel Combination
- Central Alignment to Devon – Bridge/Tunnel Combination

The alignments and structure types recommended to move forward are highlighted in green.

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Table 1-1: Alignment Concept Evaluation Results

GOAL	Western Alignment			Central Alignment				Eastern Alignment	
	Oyster Bay to Rye/Port Chester			Kings Park to Bridgeport or Devon				Wading River to New Haven or Branford	
	Bridge Only	Tunnel Only	Combo	Bridge Only		Combo		Bridge Only	Combo
				B-port	Devon	B-port	Devon		
1. IMPROVE REGIONAL MOBILITY AND CONNECTIVITY	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟡	🟡
2. PROMOTE ECONOMIC GROWTH	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🔴	🔴
3. MINIMIZE ADVERSE ENVIRONMENTAL IMPACTS	🔴	🟢	🟢	🟡	🔴	🟡	🟡	🟡	🟡
4. DEVELOP COST-EFFECTIVE TRANSPORTATION OPTIONS	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🔴

🟢 = best addresses goal
🟡 = moderately addresses goal
🔴 = does not address goal

= recommended for further study
= not recommended for further study

Source: WSP

Key findings included the following:

- A bridge/tunnel combination and tunnel only would be technically viable option for all alignments.
- Bridge only would be a technically viable alternative for the Central and Eastern Alignments.
- Bridges are less expensive than tunnels, but would result in more environmental impacts.
- Western Alignment would be the only New York to New York option.
- Western and Central Alignments would have highest future demand (Year 2040) and revenue generating potential.
- A Central/Western hybrid connecting Kings Park to Rye/Port Chester would have significantly less demand (31,900 total daily demand with $20 toll) than Central or Western.

Table 1-2 presents the summary statistics for the three representative alignments.

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Table 1-2: Alignment Concept Summary Statistics

	Western Alignment Oyster Bay to Rye/Port Chester	Central Alignment Kings Park to Bridgeport & Devon	Eastern Alignment Wading River to New Haven & Branford
Shoreline Distance	9 Miles	18.5 - 23.5 Miles	21 - 22 Miles
Total Alignment Length	18 Miles	28.5 - 31.5 Miles	31.5 - 32 Miles
Capital Cost (3 Lane)	$31.5B (Tunnel) (2 Lane) $55.4B (Tunnel) (3 Lane) $43.5B (B/T)	$13.0B - $16.5B (Bridge) $22.7B - $31.2B (B/T)	$15.1B - $15.8B (Bridge) $28.2B - $32.0B (B/T)
AM Demand (NB / SB) $20 Toll	13,100 / 16,300	10,800 / 17,600	6,100 / 11,300
AM Demand (NB / SB) Max Toll	11,600 / 14,500 ($25)	6,300 / 11,800 ($45)	3,300 / 6,400 ($50)
Total Daily % Truck	4.3%	1.3%	2%
Total Daily Demand $20 Toll / Max Toll	86,400 / 74,300	87,600 / 54,900	55,500 / 32,150
Annual Toll Revenue (millions) $20 Toll / Max Toll	$520 / $556	$495 / $699	$318 / $464

Source: WSP
Note: B/T=Bridge-Tunnel Combination

A toll sensitivity analysis was conducted to test the maximum revenue achievable for each alignment concept. Table 1-3 highlights the Western alignment demand and revenue for a $20, $25 and $30 auto toll.

Table 1-3: Western Alignment Toll Sensitivity (year 2040)

AUTO TOLL	TOTAL DAILY DEMAND	TOTAL ANNUAL REVENUE
$20	86,400	$520 Million
$25 (Max toll)	74,300	$556 Million
$30	58,800	$530 Million

Source: WSP

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2 Introduction

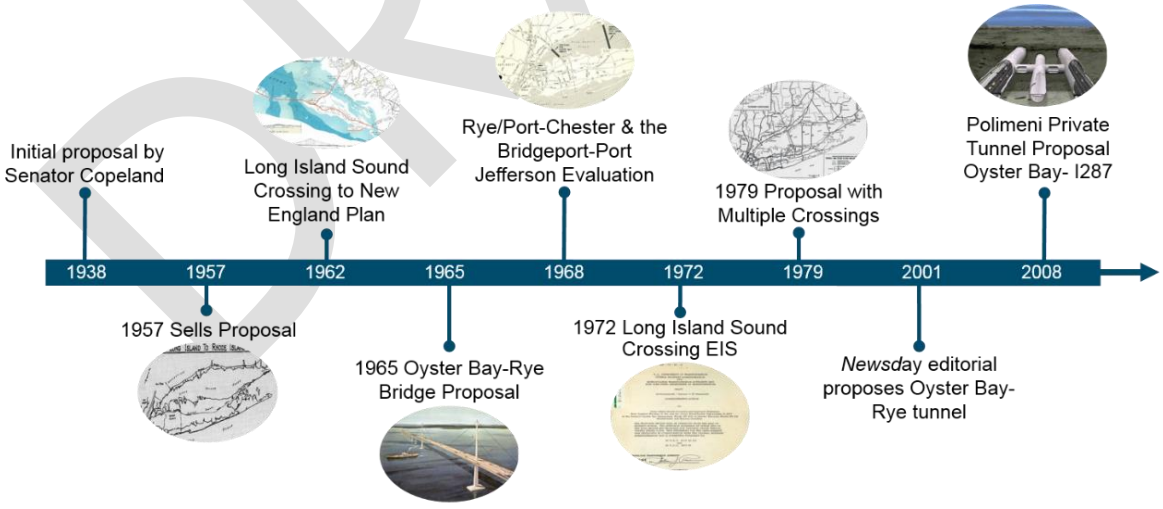
New York State Department of Transportation (NYSDOT) in cooperation with the Governor's Office is conducting a study to examine the feasibility of constructing a crossing between Long Island and Westchester County, NY, Connecticut or Rhode Island. The study scope included the establishment of the purpose and need for the project, identification of goals and objectives, concept development and screening, and demand modeling.

This Draft Feasibility Study Report has been prepared to summarize the feasibility analyses, and provide a framework for decision makers to advance the project likely to include extensive economic assessment, more detailed design, and environmental analysis. This report was prepared in accordance with the NYSDOT Project Development Manual, 17 NYCRR (New York Codes, Rules and Regulations) Part 15, and 23 CFR (Code of Federal Regulations) 771. Transportation needs have been identified, objectives established to address the needs, and cost-effective concepts developed.

2.1 PROJECT HISTORY

As summarized in Figure 2-1 (and detailed in Table 2-1), there have been many proposals to span the Long Island Sound over the past decades. This feasibility study process began with the compilation of a long list of possible concepts and includes a broad range of concepts including those identified by prior studies dating back to the 1930s. The reasons that many of these concepts did not advance ranged from lack of political support, high cost, and community impacts.

Figure 2-1: Project History Timeline



Source: WSP

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Table 2-1: Long Island Crossing Historical Background

PAST PROPOSALS AND STUDIES	POSSIBLE ALIGNMENTS	DETAILS
1938 Long Island to CT or RI Proposal	18-mile bridge from Orient Point to either Groton, CT or Watch Hill, RI	• Proposed and championed by Senator Copeland, Chairman of the Commerce Committee • Engineer surveys began but Copeland died several weeks in and the new chairman had other priorities • World War II was also seen as a reason for failure
1957 Sells Proposal	2 bridges: Oyster Bay- Rye/Port Chester, NY and Orient Point-Watch Hill, RI	• Proposed by Charles H. Sells, former NYS Department of Public Works Superintendent Charles H. Sells and a Port Authority commissioner • Canceled by Gov. Harriman because of its cost and low traffic predictions
1962 General Plan of a Crossing of Long Island Sound to New England	2 bridges: Orient Point- East of New London, CT (18 miles) and Orient Point-Naptree Point, RI (22 miles)	• A 30-mile extension of the Long Island Expressway was required from Riverhead to Orient Point • Both routes would bisect Plum Island and Fort H. G. Wright Military Reservation • Estimated construction cost of a four-lane crossing from Orient Point to the New England shore: $250 to $300 million • Qualitative comparisons with such toll-financed projects as the Mackinac Straits Bridge and the Chesapeake Bay Bridge-Tunnel
1965 Oyster Bay-Rye Bridge Proposal	6.1 mile crossing Oyster Bay-Port Chester, NY	▪ 1966 Madigan-Hyland study commissioned by Robert Moses and the NYS Department of Public Works ▪ $100-150 million ▪ Aimed to create a beltway around NY Metropolitan Area ▪ Governor Rockefeller initially supported it but delayed it because of local opposition, bond issues, and new environmental impact requirements as a result of NEPA Robert Moses's power was waning
1968 An Evaluation of the Rye-Oyster Bay and the Bridgeport-Port Jefferson Long Island Sound Crossings	2 bridges: Oyster Bay-Rye and Bridgeport to Port Jefferson	▪ The purpose of a Long Island Sound Crossing was because of the "Phenomenal increases" that have taken place in the population of Nassau and Suffolk Counties in the early-mid 1900's decades ▪ Both proposed bridges are financially feasible in the long run ▪ The proposed bridges are considered the best means of relieving travel over the existing East River bridges and at the same time will lessen the east-west travel congestion in Nassau and eastern Queens. ▪ Report found that the Rye-Oyster Bay Bridge should be given priority in its construction over the Bridgeport-Port Jefferson Bridge

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Table 2-1: Long Island Crossing Historical Background (continued)

PAST PROPOSALS AND STUDIES	POSSIBLE ALIGNMENTS	DETAILS
1972 Long Island Sound Crossing EIS	16.5-mile alignment from the I-95/I-287 interchange in Rye to the NY 135/NY 25 interchange in Syosset New Rochelle-Sands Point alignment and Rye-Glen Cover alignment were rejected as having too severe impacts on local communities and because they fit in poorly with the regional expressway network	▪ Local opposition continued, both on the North Shore of Long Island and in Rye, causing Gov. Rockefeller to kill the project in 1973
1979 Proposal with Multiple Crossings	5 proposed bridges: Port Jefferson-Bridgeport (14.6m), which was the preferred route based on public input Other alignments included Wading River, NY- East Haven, CT (19.3), Riverhead, NY-Guilford, CT (19.2m), East Marion, NY -Old Saybrook, CT (9.8m), and Orient Point, NY- Watch Hill, RI (24.6m)	▪ Initiated by Gov. Hugh Carey Cost estimated at around $1.4B ▪ Provide employment for 18,000 people (according to NYSDOT) ▪ Projected toll revenue by 1990 calculated to be between $22-27 billion (net revenue less than bond financing) ▪ Report found that a ferry would be preferable to a bridge
2008 Polimeni/Long Island Cross Sound Link (LICSL) Tunnel Proposal	Route from the intersection of Interstates 95 and 287 in Rye to NY Route 135 in Syosset	▪ Initiated by private developer Vincent Polimeni ▪ $10-$13 billion tunnel ▪ 16-mile, three tube, six-lane tunnel ▪ Light rail inclusion mentioned as a possibility ▪ Privately funded through a $25 toll, advertising, and possibility of selling naming rights ▪ Engaged Hatch Mott Macdonald (consulting engineering firm) ▪ Estimated 80,000 users a day ▪ Failed because of lack of state support (although Gov. David Paterson was in favor) and because of the credit crunch

Source: WSP

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3 Alignment Development Process

The feasibility study began with the definition of the study area, establishment of the study's purpose and need and the development of goals and objectives. These were critical first steps in the alignment development process as the they guided the assessment of feasibility and the establishment of an initial list of alignment concepts.

3.1 STUDY AREA

The Long Island Sound Tunnel/Bridge feasibility study encompasses multiple potential Long Island Sound crossing locations. The project study area is broadly defined as being located along the north shore of Nassau and Suffolk Counties on Long Island north of the Long Island Expressway (LIE) and along the north shore of Long Island Sound, including Westchester County in New York as well as Fairfield, New Haven, Middlesex and New London Counties in Connecticut and Washington County in Rhode Island (see Figure 3-1).

Figure 3-1: Project Study Area

Source: WSP

3.2 PURPOSE AND NEED

The trip between Long Island and Westchester/Connecticut is severely constrained due to congested roadways, limited egress, long travel times, lack of direct connectivity and lack of multi-modal options. The purpose of the study is to perform a high-level feasibility analysis to understand and identify if a Long Island Sound Crossing from the northern shore of Long Island to the northern shore of the Sound can alleviate these challenges and improve the region's overall transportation network. A new crossing should effectively promote new opportunities for economic growth in the region.

3.3 GOALS AND OBJECTIVES

Several goals and objectives have been established to guide the planning study, as shown in the following table.

Table 3-1: Goals and Objectives

GOAL	OBJECTIVE
Improve Regional Mobility and Connectivity	▪ Reduce regional travel time ▪ Reduce roadway congestion/air quality emissions ▪ Generate auto and truck demand ▪ Provide additional emergency mobilization
Promote Economic Growth	▪ Connect employment and population hubs ▪ Encourage development opportunities at new interchanges or Project-created sites (i.e., artificial islands built in Long Island Sound for a bridge/tunnel scenario)
Minimize Adverse Environmental Impacts	▪ Minimize impacts to sensitive environmental areas ▪ Minimize residential displacements ▪ Minimize community facility/parklands displacements ▪ Minimize commercial displacements ▪ Minimize air quality, noise and vibration impacts ▪ Minimize visual impacts
Develop Cost-effective Transportation Options	▪ Minimize capital cost ▪ Greatest revenue potential ▪ Minimize operations and maintenance cost ▪ Optimize cost-effectiveness ▪ Utilize existing transportation infrastructure

Source: WSP

3.4 ALIGNMENT CONCEPTS CONSIDERED

The development of the long list of alignment concepts started with the historical/previous proposals, plus additional options that were developed by the study team. Below is the long list of alignment concepts that were initially considered:

- Syosset to Rye/Port Chester, NY
- Oyster Bay to Rye/Port Chester, NY
- Syosset to Bronx, NY
- Kings Park to Bridgeport, CT

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- Port Jefferson to Bridgeport, CT
- Wading River to New Haven, CT
- Riverhead, NY (at easterly terminus of LIE) to New Haven, CT
- Riverhead, NY (at easterly terminus of LIE) to Old Saybrook, CT
- Orient Point to Groton, CT
- Orient Point to Watch Hill, RI

For this feasibility study, a key framework assumption was to acknowledge the initial concepts considered and establish a representative set of crossing scenarios to focus planning, engineering, environmental and demand modeling resources. Based on the general alignment of historical precedents and the current transportation network, three representative links—Western, Central, and Eastern Alignments—were defined for further analysis. In addition to the 10 concepts listed above, several north-south corridors on Long Island—which include the Meadowbrook State Parkway, Wantagh State Parkway, and Rt 231 (Deer Park Avenue)—were all analyzed. However, these corridors are located in dense residential and commercial areas and early findings indicate that major construction would have significant impacts to the surrounding communities and are not advised to be studied further.

The representative Western Alignment concept stretches from Oyster Bay on Long Island to Rye/ Port Chester, NY. There are two Central Alignment concepts, both of which share a common landing on Long Island, located in Kings Park. The first alignment concept extends to Bridgeport, CT, and the second to Devon, CT. Similar to the Central Alignment, the Eastern Alignment also shares a common landing on Long Island. The first Eastern Alignment concept connects Wading River on Long Island to New Haven, CT, and the second connects Wading River to Branford, CT.

A "Hybrid" Alignment was developed. The Hybrid was a combination of the Western and Central Alignments. The alignment stretches from Kings Park on Long Island to Rye/Port Chester, NY. The three representative alignments and the hybrid alignment are highlighted on Figure 3-2.

The purpose of this feasibility study is to determine if one (or more) viable options could be moved forward towards a more formal project development and EIS. Any future EIS would need to reconsider and possibly identify new routes as part of an alternatives analysis but building on the focused orientation from this feasibility study. For example, if the Western Alignment between Oyster Bay to Rye/Port Chester is identified for further analysis, the route and its potential variations (i.e., a different connection within western Long Island or in Westchester or the Bronx) would be subject to additional planning and environmental analysis.

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Figure 3-2: Long List of Alignment Concepts

Source: WSP

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4 Representative Alignment Concepts

The proposed Long Island Sound Crossing is an ambitious, regionally significant project that addresses the needs and challenges in the region. The project would improve regional mobility, connectivity and the possibility to promote economic growth. Three representative alignments were developed for this study: Western, Central and Eastern. A hybrid concept combining the Western and Central alignments was also developed.

The representative alignment concepts were defined as requiring a regional highway connection on either end (LIE or I-95/I-287) and could be considered as a bridge, tunnel, or bridge-tunnel combination.

4.1 WESTERN ALIGNMENT

The Western Alignment (Figure 4-1) is generally consistent with the earliest proposed crossings including the 1965 Oyster Bay–Rye Bridge as well as the most recent 2007 initiative known as the Polimeni Tunnel. The alignment basically represents all the "long list" options that included connections wholly in New York State—from Oyster Bay and westward on the Long Island side and Port Chester and southward on the Westchester County side. Such variations—such as the 1972 alternative of Sands Point to New Rochelle (which was rejected in that study)—and potential connections farther to the south including the Bronx were ruled out for this first-level study since there were no logical connections to the highway network south of Port Chester or in westernmost Nassau County. This alignment captures the most populous area of Nassau County on Long Island and provides a direct link with the central core of Westchester County and southern Fairfield County through a tie into both I-95 as well as I-287, which also serves to tie into the metropolitan region to the west and across the new Gov. Mario M. Cuomo (Tappan Zee) Bridge.

The Western Alignment concept would traverse Oyster Bay, a predominately low-density residential area of Long Island. The alignment passes through the Oyster Bay National Wildlife Refuge and West Harbor onto Centre Island and the Town of Oyster Bay. Additionally, several open space resources are located adjacent to the alignment. These resources are further discussed in Chapter 5. The alignment also traverses into the Rye/Port Chester area of Westchester County. Land uses adjacent to the alignment also include low density residential uses along the waterfront.

The Western Alignment Concept connects the LIE to I-95 in Westchester via Oyster Bay in Nassau County and Rye/Port Chester in Westchester County. As shown in Figure 4-2, this alignment concept takes advantage of the existing partially built right-of-way for the NY 135 corridor that extends north from the Jericho Turnpike (NY 25) Interchange. Because of the dense residential land use in Oyster Bay, the section of the alignment through Long Island would be predominantly in tunnel. The concept would extend the existing Seaford-Oyster Bay Expressway (NY 135) north approximately 0.5 mile into a tunnel portal. The tunnel structure would continue 9 miles north, to beyond the shoreline of Long Island. At that point it would either remain in tunnel to Westchester, or transition to a 6-mile bridge then to a 1-mile tunnel where it would portal in Westchester at the intersection of I 95 and I-287. A tunnel is required in Westchester due to the dense residential land use along the Rye waterfront. Two man-made islands would be constructed, each approximately 1 mile off the Long Island and Westchester shore lines, in order to transition from tunnel to bridge structure.

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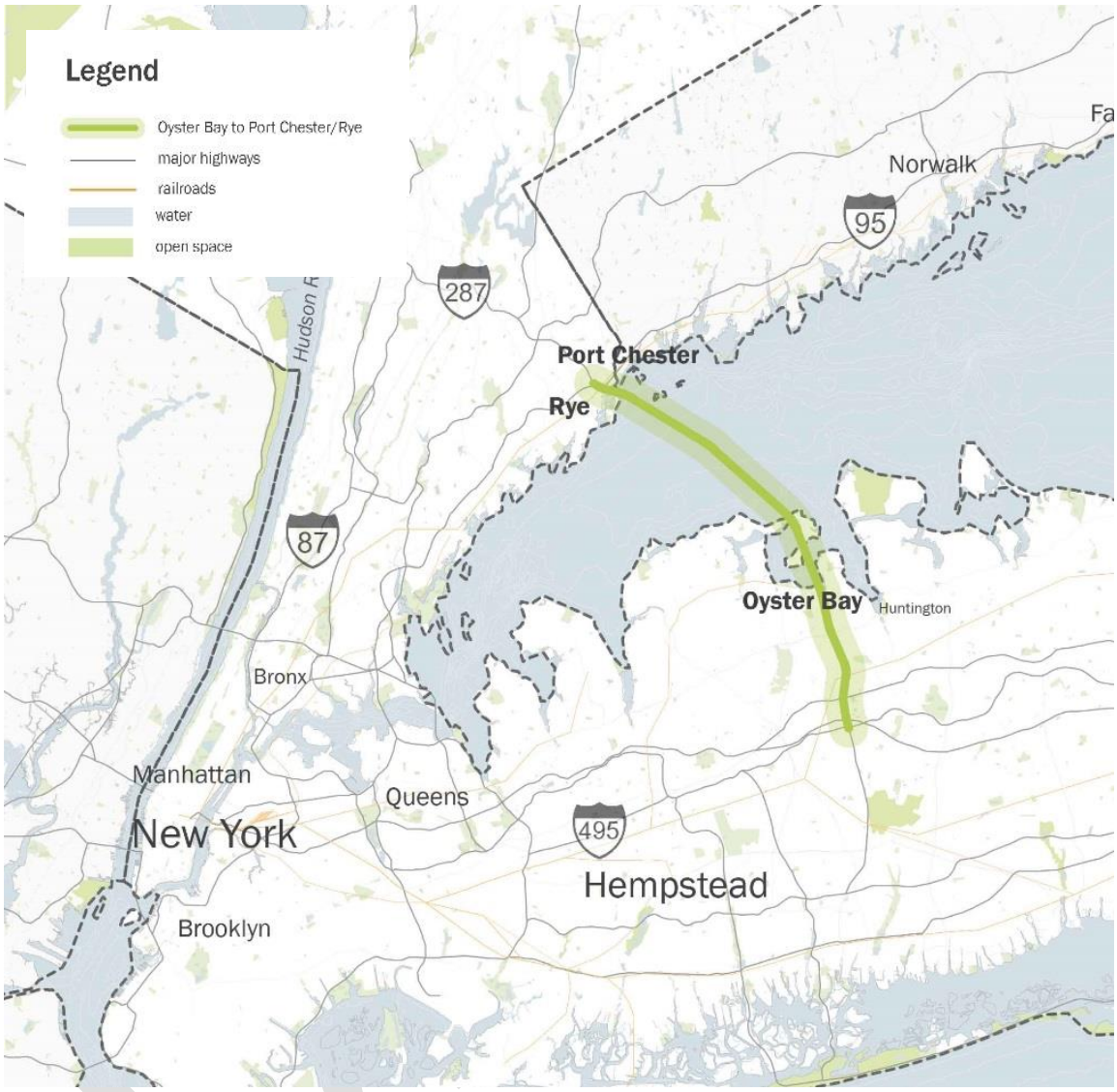
Figure 4-1: Western Alignment Concept (Oyster Bay to Port Chester/Rye)



Source: WSP

Figure 4-2: Western Alignment Concept (Oyster Bay Landing)

Source: WSP

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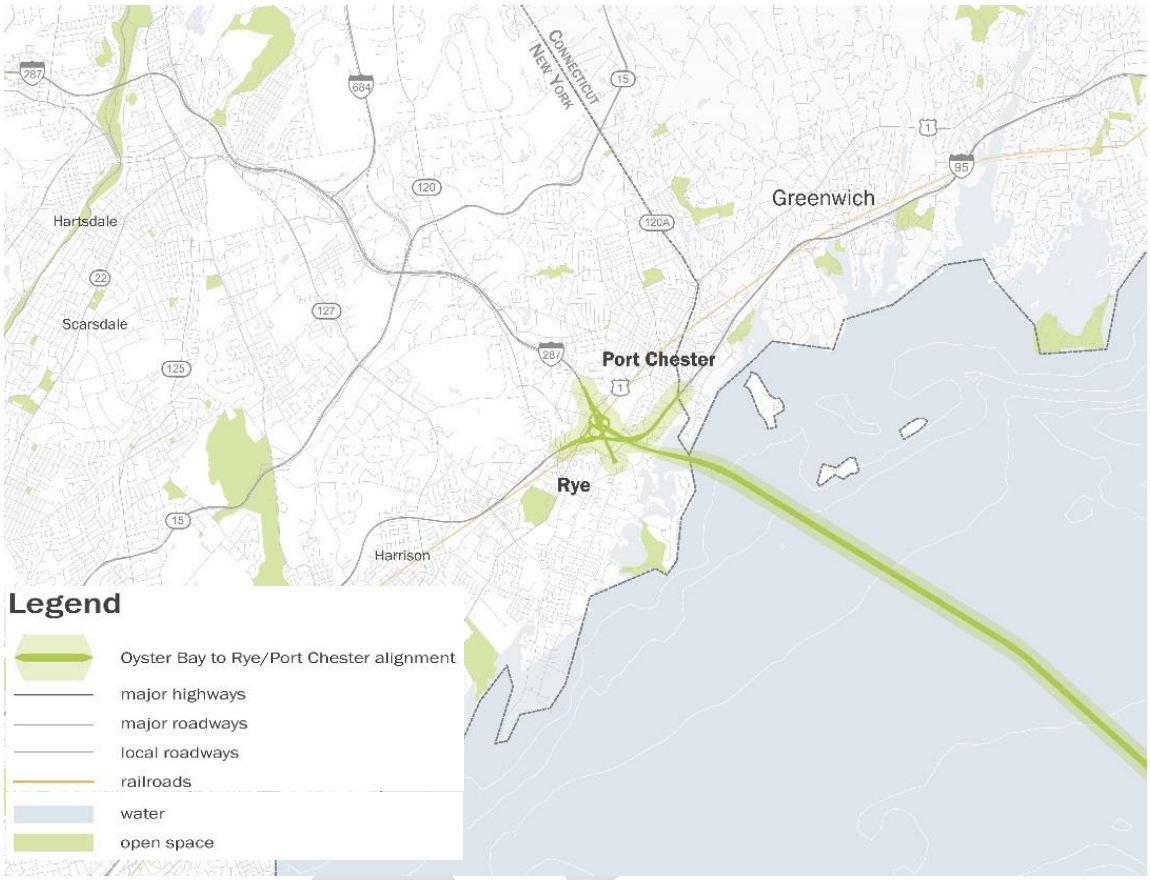
Figure 4-3: Western Alignment Concept (Port Chester/Rye Landing)



Source: WSP

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4.2 CENTRAL ALIGNMENT

The Central Alignment (Figure 4-4) is generally delineated to capture a mid-Long Island to Bridgeport, CT, crossing that is currently served by the Port Jefferson to Bridgeport Ferry service and had been considered a viable crossing location in a 1979 evaluation of multiple bridge locations. This representative alignment uses a single Long Island location taking advantage of the existing north-south Sunken Meadow Parkway but examines two landing spots in Connecticut based on two viable interchange locations within Bridgeport and further to the east. This alignment captures the center of Long Island population and commercial areas where Nassau and Suffolk Counties meet and ties into the center of Connecticut's economic core of Fairfield and New Haven Counties.

Figure 4-4: Central Alignment Concept (Kings Park to Bridgeport/Devon)

Source: WSP

The Central Alignment (Kings Park to Bridgeport) concept would traverse Kings Park, Long Island. Land uses adjacent to this alignment would include open space, in particular, Sunken Meadow State Park. Land uses adjacent to the Bridgeport crossing would include open space, transportation,

industrial, and commercial offices uses. The alignment would traverse Great Meadows Marsh. The alignment would run adjacent to Sikorsky Memorial Airport as well as industrial and commercial office uses along Lordship Boulevard.

For the Central Alignment (Kings Park to Devon), land uses adjacent to the Devon crossing would include residential uses, commercial, open space, and community facility uses. There are currently commercial uses along Bridgeport Avenue. The alignment is also adjacent to Jonathan Law High School, a community facility use.

4.2.1 Kings Park to Bridgeport

The Central Alignment Concept crossing connects the LIE to I-95 via Kings Park, NY, and Bridgeport, CT. The potential crossing of about 20 miles could consist of a bridge structure or a bridge-tunnel combination. Because of the connections on both ends of the alignment concept utilizing infrastructure from existing highway routes in close proximity to the shoreline, there is a better opportunity for a bridge-only connection. In any scenario, the alignment concept would extend the existing Sagtikos State Parkway at the interchange with I-495 to the Sunken Meadow Parkway north approximately 8.5 miles to a causeway structure between the Sunken Meadow Park and the Alfred E. Smith Golf Course (Figure 4-5). The bridge structure would continue northeast as a causeway approximately 18.5 miles across Long Island Sound with a long span navigational clearance section near the center of the structure. The existing Sunken Meadow Parkway is classified as a parkway in its current configuration and does not allow commercial vehicles. All of the existing bridge structures have non-standard commercial vehicle clearance. These would require replacement reconstruction to create the clearance required for a commercial traffic route and State legislative action to change the classification.

On the Connecticut side, a connection would be made to the existing State Route 113, immediately adjacent to the western edge of Sikorsky Airport in Stratford, CT, and utilize the existing 113/I-95 interchange (Figure 4-6). The current CT Route 113 already operates as a commercial arterial but would need widening and reconstruction to accommodate the additional lane requirements for the Interchange connection. For the bridge/tunnel option, one man-made island would be constructed approximately one mile off the Connecticut shoreline in order to transition from tunnel to bridge structure.

4.2.2 Kings Park to Devon

A second option for the Central Alignment utilizes the same Long Island connection point but would have a Connecticut connection that is located to the east of Bridgeport in Devon, CT. Here, the crossing would transition to a tunnel approximately one mile prior to the Connecticut shoreline where a tunnel portal connection would be made at the existing Route 1/I-95 interchange (Figure 4-7). There would be a need for infrastructure improvements at the Route 1 intersection in order to provide the additional capacity.

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Figure 4-5: Central Alignment Concept (Kings Park Landing)

Source: WSP

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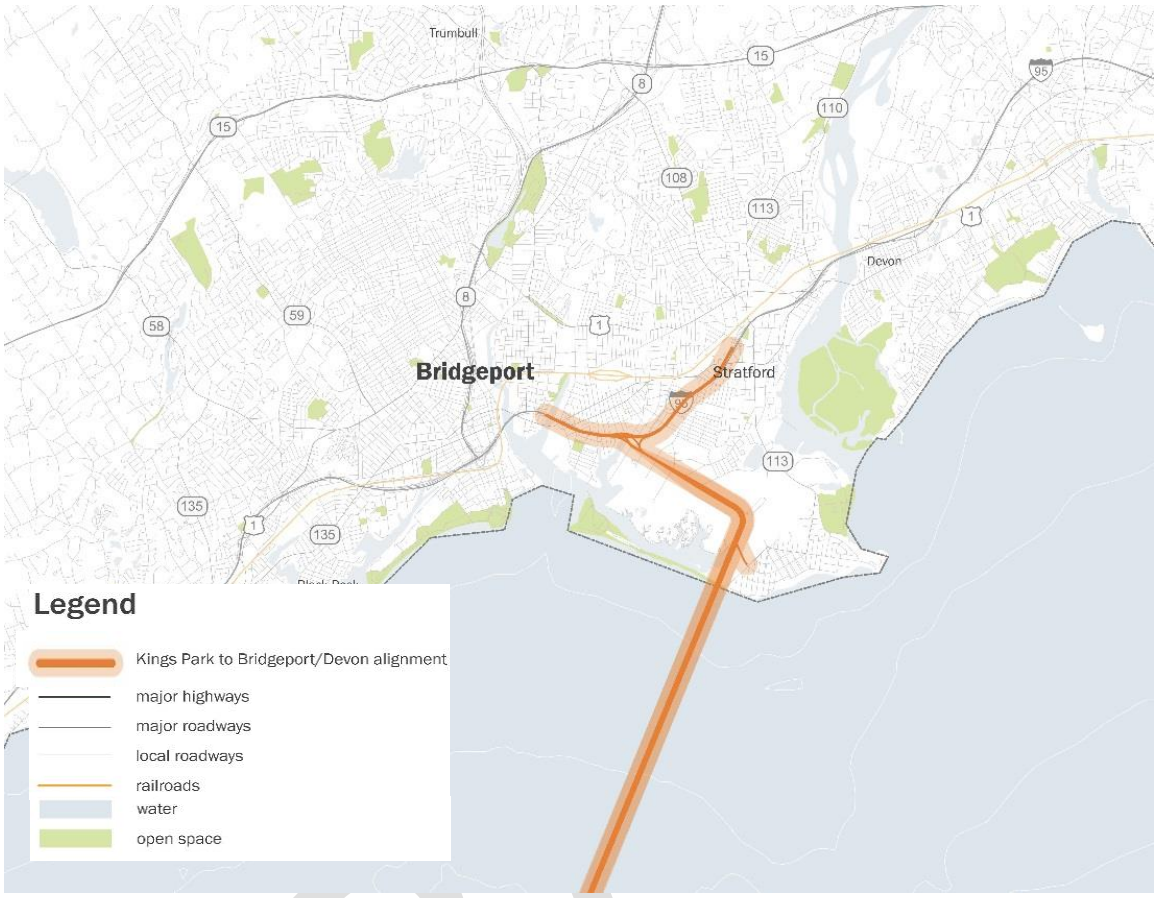
Figure 4-6: Central Alignment Concept (Bridgeport Landing)



Source: WSP

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Figure 4-7: Central Alignment Concept (Devon Landing)

Source: WSP

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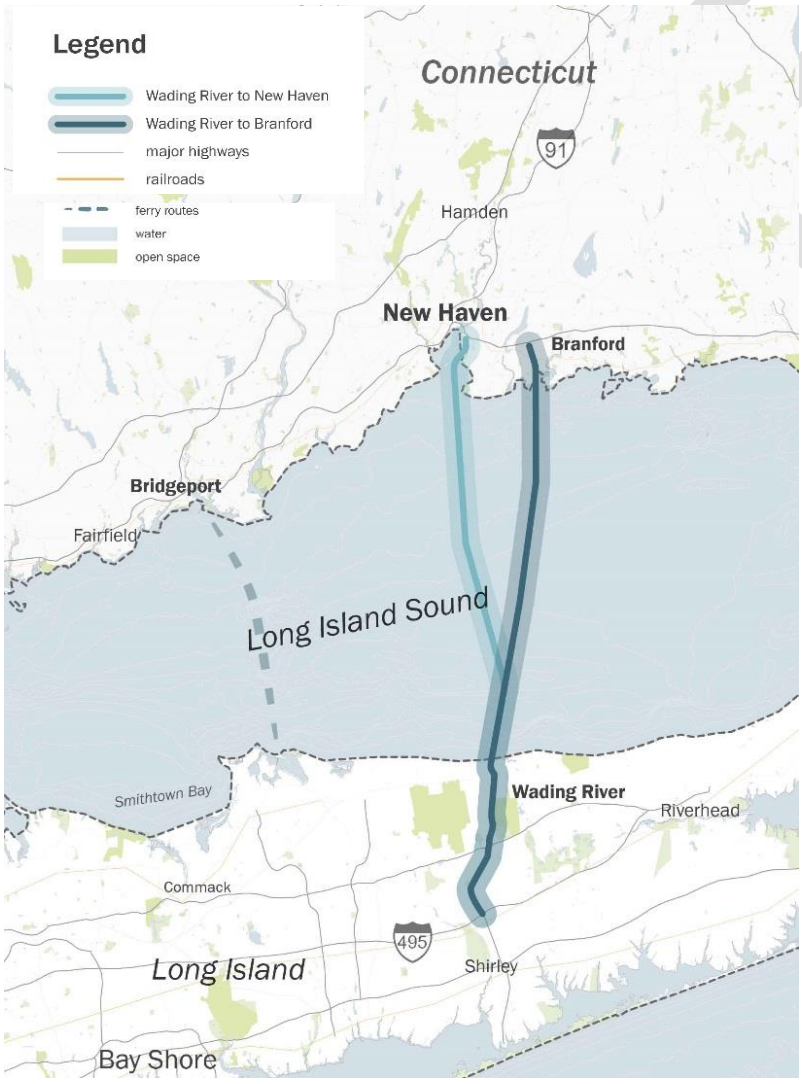
4.3 EASTERN ALIGNMENT

The Eastern Alignment (Figure 4-8) has been defined to represent mid- to Eastern-Long Island east of Port Jefferson, NY, to a Connecticut or Rhode Island connection, east of New Haven, CT. Various historical proposals—most notably the Copeland proposal from 1936—included connections with New Haven or Guilford, CT, and as far east as Watch Hill, RI. Current ferry service also exists from Orient Point, NY, to New London, CT. This representative alignment has a single location at Shorham/Wading River on Long Island in order to utilize the existing north-south William Floyd Parkway and looks at two potential connection locations in Connecticut—one in New Haven and one further to the east. Based on the diminishing population and commercial centers east of about Ronkonkoma on Long Island and New Haven in Connecticut, the alignment for this study was defined to capture the most potential demand for an eastern crossing in order to initially evaluate its overall feasibility.

Figure 4-8: Eastern Alignment Concept (Wading River to New Haven/Branford)



Source: WSP

The Eastern Alignment concept (Wading River to New Haven) would traverse Wading River, Long Island. Open space resources around the alignment are predominately made up of open space and low density residential uses. Land uses adjacent to the New Haven crossing would include open space and transportation uses. The alignment crosses over East Shore Park and the Port of New Haven. For the Eastern Alignment concept (Wading River to Branford), land uses adjacent to the Branford alignment include low-density residential and commercial uses.

4.3.1 Wading River to New Haven

The Eastern Alignment Concept New Haven option connects the LIE to I-95 via the William Floyd Parkway in Brookhaven, NY and the Annex Interchange in New Haven, CT. The approximately 23-mile crossing could consist of a bridge structure or a combination tunnel/bridge though it is assumed that the Long Island connection would be a bridge in all scenarios. As shown in Figure 4-9, the alignment concept would extend the existing William Floyd Parkway (Suffolk County CR-46) at the interchange with NY-25A approximately one mile to a causeway structure between the Shoreham Country Club and the Wading River Boat Ramp. The bridge structure would continue northeast as a causeway approximately 22 miles across the Long Island Sound with a long-span navigational clearance section near the center of the structure. There would be significant improvements required along the William Floyd Parkway, as the current configuration has at-grade intersections and residential street access to the parkway. The developed concept would provide a three-lane north-south limited access expressway from the existing LIE up to the bridge causeway or tunnel portal. The existing grade access to the William Floyd Parkway can be maintained via northbound/southbound service roads that would run parallel to the expressway and provide connection at key interchanges.

On the Connecticut side, the crossing would extend into New Haven as either a bridge or a tunnel and would be integrated into the commercial Connecticut Avenue and the existing I-95/Route 1 Interchange (Figure 4-10). Connecticut Ave would require widening and reconstruction in order to accommodate the new traffic lanes and expanded interchange. For the Connecticut tunnel connection, a man-made island would be constructed about two miles offshore in order to transition from bridge to tunnel structure and to avoid maritime traffic in New Haven Harbor.

4.3.2 Wading River to Branford

This Eastern Alignment Concept connects the LIE to I-95 via Brookhaven, NY and Branford, CT. On Long Island, the alignment concept would have the same configuration and bridge transition as described above but would utilize a bridge-tunnel combination on the Connecticut side to connect with the existing I-95/ Route 1 and Service Area interchanges in Branford, CT (Figure 4-11). New infrastructure improvements would be required at the interchange of Route 1 and I-95 and new ramps and structures from I-95 would need to be constructed around the I-95 Branford Service Plazas. Local ramp access to Route 1 would also need to be maintained.

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Figure 4-9: Eastern Alignment Concept (Wading River Landing)

Source: WSP

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Figure 4-10: Eastern Alignment Concept (New Haven Landing)

Source: WSP

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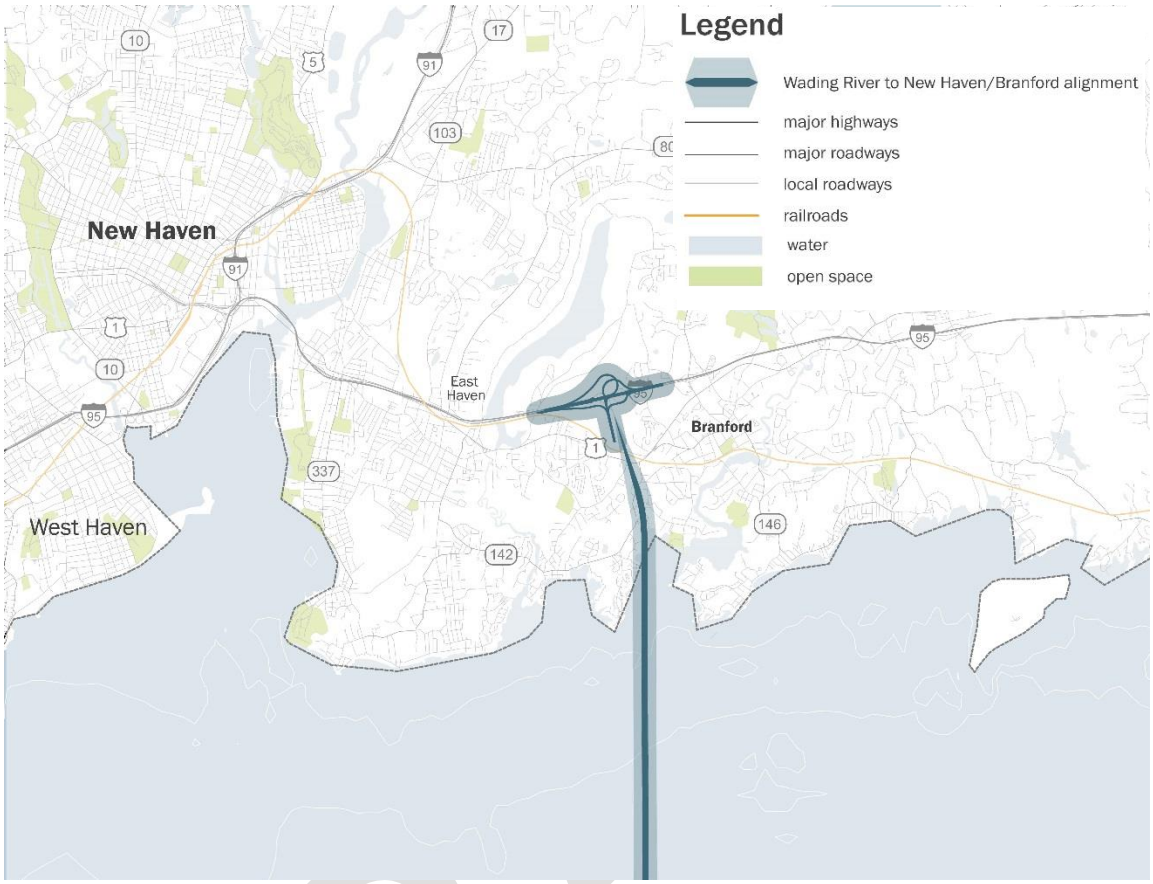
Figure 4-11: Eastern Alignment Concept (Branford Landing)



Source: WSP

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5 Engineering Considerations

A highway connection across Long Island sound will be one of the longest such crossings in the world. It will require state-of-the art construction technology that may include large-diameter tunnel boring machines, deep water bridge pilings, and high-capacity ventilation systems. Its design and construction will require in depth planning and analysis, but it is anticipated that the challenges can be met using existing technology.

The structure types considered most appropriate for the representative alignments are a bridge, tunnel, or bridge-tunnel combination.

5.1 DESIGN STANDARDS

An initial list of design and planning assumptions were made at the outset of the study to define each of the concepts at this conceptual phase. The initial design and planning assumptions are listed below.

5.1.1 Design Assumptions

- Two or three lanes in each direction, suitable for interstate traffic
- Open Road Tolling (ORT)
- Direct connection to I-495 on south end and I-95 on north end
  - Connecting roadway capacity was not analyzed in this study; additional interchange capacity and traffic studies would be required to assess the impacts to roadways/ramps, geometry and LOS.
- BRT/HOV is not precluded from bridge or tunnel design
  - Fixed rail is not included in this feasibility study; additional analysis will be required to identify if rail can be accommodated in the proposed tunnel, bridge or tunnel/bridge combination configuration.
- Options will include a bridge only or a bridge-tunnel combination (a tunnel only option was evaluated for the Western Alignment based on its specific characteristics)
- Accommodation for bicycle/pedestrian access (bridge options only)
- Incorporate maintenance facilities and recreational features into any artificial islands
- Resiliency features to be incorporated– designed to accommodate flooding and sea level rise
- Provision for emergency egress and ventilation
- Provision for commercial utilities
- Assume at least 2 ventilation plants for tunnels, with locations to be determined
- Tunnel Boring Machines and/or Immersed Tube technology to be considered
- Bored Tunnel – Assume one diameter depth under bottom of seabed

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- Land tunnel overhead clearances – use various mitigation methods to avoid impacts to building foundations, such as underpinning, ground improvements or adequate depth to avoid mitigation

5.1.2 Planning Assumptions

- Various toll levels considered:
  - A $20 toll each way (auto) (with a secondary assessment of a lower-priced $7.50 tolling strategy) was derived by analyzing the tolls of surrounding crossings in the New York Metropolitan area
  - A range of tolls and resulting revenues was assessed to determine the maximum revenue toll
- Consider embedded technology for Connected and Automated Vehicles
- Consider signature bridge option

5.2 ROADWAY/CIVIL DESIGN

Alignment options were selected to build or expand existing transportation corridors already in place in Long Island, Westchester or in Connecticut. All alignment and interchange concepts were designed to connect the LIE (I-495) in Long Island to the New England Thruway (I-95) in Westchester or the Governor John Davis Lodge Turnpike (I-95) in Connecticut, thereby creating an interstate-to-interstate integrated highway network.

- Western Alignment – Expansion of the existing Seaford - Oyster Bay Expressway (NYS Rt. 135) from LIE in Oyster Bay, NY to the existing interchange of the Cross-Westchester Expressway (I-287) and the New England Thruway (I-95) in Rye/Port Chester, NY.
- Central Alignment – Expansion of the existing Sunken Meadow Parkway/Sagtikos State Parkway from the LIE in Commack, NY and Kings Park, NY to the existing interchange of Connecticut Route 113 (Lordship Blvd) and Governor John Davis Lodge Turnpike (I-95) in Bridgeport/Stratford, CT. A second conceptual Central Alignment landing was developed for Connecticut, connecting the same Long Island location to I-95 further to the east at Interchange 34 in Devon, CT.
- Eastern Alignment – Expansion of the existing William Floyd Parkway (Suffolk County Rt. 46) from the LIE in Brookhaven NY to the existing Annex Interchange of the Governor John Davis Lodge Turnpike (I-95) in New Haven, CT. A second conceptual landing was developed connecting the same Long Island location to I-95 further to the east at Interchange 53 in Branford, CT.

Each alignment was identified to expand and connect into existing transportation infrastructure and all connections were designed to be full Interchanges with I-495 (EB and WB) and I-95 (NB and SB). While identifying potential alignments, transportation and commercial land use was prioritized over residential in order to minimize potential real estate acquisition of sensitive land uses and to maximize economic development opportunities. Minimum highway configuration included two lanes of traffic in each direction and single lane connection ramps. Three lanes each way was identified as being preferred for future growth in transportation demand, and for being beneficial during incident (e.g. vehicle breakdown) management.

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5.3 BRIDGE DESIGN

All bridge components assumed that the majority of the span would consist of low-/medium-level causeway with spans of 250 feet throughout, providing approximately 30-foot clearance above mean high water (MHW). To accommodate navigation, each bridge would also contain a one main long span, possibly a signature type bridge, assumed to be a cable stayed bridge with a 1,500-foot main span and 750-foot side spans, providing 140-foot clearance above MHW, located approximately in the middle of the Sound. All bridge segments are assumed to be constructed to accommodate three lanes in each direction plus full shoulders. The incremental cost of providing a third and lane shoulder each way on a bridge is significantly lower than proving them in a tunnel (discussed below).

Bridges could be built directly connecting to the onshore highway by using spans of varying length and height to connect the causeway. It is assumed that an additional higher level semi-main bridge would be provided near each shoreline to accommodate local commercial navigation, pleasure boats and ferries, with a clearance above MHW of approximately 55 to 60 feet.

For the causeway, continuous steel girder spans of 250 feet supporting a reinforced concrete deck (per NYSDOT Standards) on concrete piers are considered in estimating foundation requirements (longer steel spans are possible, but the 250-foot spans can also accommodate pre-stressed concrete girders). Loading for conceptual design considers HL-93 trucks for vertical loading as well as estimated lateral loads for foundation design.

5.4 TUNNEL DESIGN

A tunnel (or tunnels) would likely be constructed using tunnel boring machines (TBMs). Multiple TBMs would excavate through the soil and rock, and would install precast concrete panels to form the structure of the tunnels. Due to the long lengths of the tunnels, it is expected that the machines would mine from each side of the Long Island Sound and meet in the middle.

An alternative approach would be to construct sections of tunnel in the middle of the Sound using immersed tube technology. This would require the sections to be cast in a dry dock and towed to the tunnel location. The sections would be sunk into a previously excavated trench. If used in conjunction with TBMs, this could be the quickest method to build the tunnel, but would likely face significant environmental hurdles, and could have a similar cost to using TBM only. Bored tunnels near the shores would minimize the impact on the sensitive shoreline ecology and neighborhoods.

The traffic volume that would use the tunnels would be strongly influenced by the amount of the toll charged. This would be particularly true for the Western Alignment due to the proximity of the Throgs Neck and Bronx-Whitestone Bridges. A preliminary demand model estimated that maximum revenue of the Western Alignment would be achieved with a $25 toll each way (see Section 8.3). The projected demand during the year 2040 morning peak would almost equal the capacity provided by two lanes. There would be some excess capacity outside of peak periods and in the opposite direction. After 2040, peak demand would be expected to exceed capacity, particularly if there is no increase in the toll.

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Two lanes each way could be accommodated in a single large-diameter (approximately 58 feet) tunnel with a two-over-two arrangement (Figure 5-1). Four foot shoulders would be provided. Three lanes each way could be accommodated in two large tunnels (Figure 5-2), with each tube being equivalent in size to that required for a two-over-two arrangement. Advantages of constructing two tunnels would include higher capacity, easier operations and maintenance (using access below the roadway), and simpler ventilation. However, the cost of providing two tubes approaches twice that of a single tube.

Figure 5-1. One Tube with Two Lanes per Level

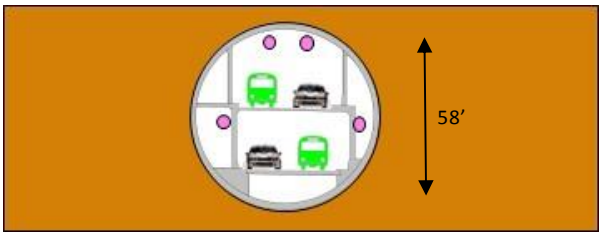
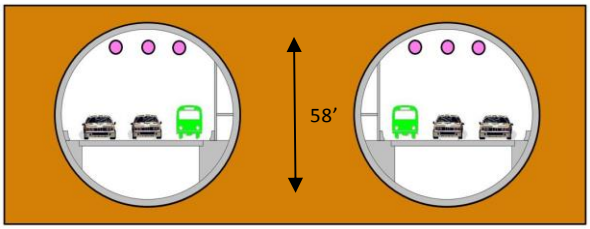


Figure 5-2. Two Tubes with Three Lanes per Tube



At 58', the diameter would equal the largest diameter tunnel boring machine in existence, which was recently used for the Alaskan Way tunnel in Seattle. The Alaskan Way tunnel was much shorter distance than proposed for any alignment of the Sound Crossing. An alternative would be to use two 42' diameter tunnels, with two lanes in each, but this is expected to cost more than a single tube with stacked roadways. At each portal, the stacked configuration requires longer transitions, which will require detailed study, particularly in Westchester and Connecticut where space is limited.

The Western Alignment tunnel would be approximately 18 miles long. A bored tunnel would be the only viable solution for the southern half, which would be located beneath the communities and coastal inlets of Long Island. Subsurface easements would be required for the tunnel to pass below private property and minimal surface property takings would be required near the portals.

The tunnel ventilation requirements will need to be studied in detail, to ensure breathable air during normal operations and safe conditions during a fire/smoke event. Historically, long tunnels have required intermediate ventilation shafts. For example, the 5.9-mile Trans-Tokyo-Bay Tunnel has an intermediate ventilation island. However, since it opened in 1997, vehicle emissions have reduced, and ventilation technology has improved. The currently planned 11-mile-long Fehmarn Belt Tunnel between Denmark and Germany is being designed without any intermediate intake/exhaust. It is expected that the Western Alignment tunnel would ventilations plants at each portal, and one or more intermediate intake/exhaust shafts. It may be possible to locate a ventilations shaft on the shoreline on Long Island. The ventilation system would be designed to ensure that the areas close to the ventilation shaft and the portal areas meet air quality requirements.

For Bridge-Tunnel combinations, an off-shore tunnel to bridge connection would be made through a tunnel portal created by the development of an artificial island (such as used for the Chesapeake Bay Bridge-Tunnel). These islands would contain the transition portal and would accommodate emergency evacuation, maintenance, ventilation, as well as potential tourism and recreational amenities. Tunnels in Bridge-Tunnel combinations would likely be single level with multiple tubes, rather than stacked decks. This could result in slightly smaller islands, and would permit direct transition onto single-level bridges.

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Bored tunnels are assumed to be the preferred tunnel construction option to minimize impacts to heavily populated residential areas as well as environmentally sensitive areas since their impact is limited to the tunnel portal and ventilation structure locations.

Regular egress paths to a place of safety would be provided along the tunnel. The configuration could vary, but for a stacked tunnel would likely be stairs between the decks. For a large diameter tunnel, slides could be provided from the roadway deck to a safe space under the deck (sized for rescue vehicles). For two or more smaller tunnels, cross passages could be provided.

Safety considerations in a tunnel-only concept could include the following design options to reduce vertigo/claustrophobic effects: constructing a slightly larger tunnel cross section; providing short turn-outs to allow people to pull off in an emergency; and constructing a curved alignment with colored lighting to avoid monotony while driving through such a long tunnel.

5.5 OPTIMIZED CONSTRUCTION METHODS FOR EACH ALIGNMENT

While each alignment retains a cost estimate for a bridge-only design option, the development of alignment concepts—in consideration of the goals and objectives as well as the preliminary alignment planning—results in optimized approach per alignment:

- Western Alignment - Bridge-tunnel combination with a bored tunnel extending from the highway interchanges to an off-shore transition to a bridge for both the Long Island and Westchester connections. A tunnel only option is also a viable option for the western alignment.
- Central Alignment - Bridge-only between Long Island and Bridgeport, CT and a bridge-tunnel combination between Long Island and Devon, CT. A bridge-tunnel combination is also a viable option for the Bridgeport connection. In either scenario, it is assumed that the Long Island connection would be a bridge.
- Eastern Alignment - Bridge-only between Long Island and New Haven, CT and a bridge-tunnel combination between Long Island and Branford, CT. A bridge-tunnel combination is also a viable option for the New Haven connection. In either scenario, it is assumed that the Long Island connection would be a bridge.

5.6 UTILITIES

Utility investigations were performed along each alignment (Western, Central and Eastern) as well as within the Long Island Sound. The investigation area was a 400-foot-wide area centered on each of the following alignment concepts:

- Western: Oyster Bay to Port Chester/Rye, NY
- Central Alignment Concept 1: Kings Park to Bridgeport, CT
- Central Alignment Concept 2: Kings Park to Devon, CT
- Eastern Alignment Concept 1: Wading River to New Haven, CT
- Eastern Alignment Concept 2: Wading River to Branford, CT

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Each of these conceptual alignments will have various utility impacts; however, none of the conflicts are significant enough to eliminate any of the conceptual alignments from further consideration.

5.7 GEOTECHNICAL

A high-level review of the geology along each alignment concept (Western, Central and Eastern) including the Long Island Sound was conducted to evaluate potential subsurface conditions that may impact the constructability of the potential project. Bedrock is generally at or within 50 feet of the surface along the northern shoreline of Long Island Sound. Bedrock slopes to the south reaching a depth of greater than 800 feet beneath Long Island. Bedrock along the north shore of Long Island Sound includes metamorphic gneisses and schists as well as sedimentary sandstone. Unconsolidated material above the bedrock along the north shore of Long Island Sound consists of thick wedges of deep unconsolidated sediments associated with glacial deposits including silty clay, glauconitic sandy clay, sand and gravel. Shallow materials include marsh deposits rich in organics and imported fill materials.

The sea floor of Long Island Sound consists of reworked glacial till and includes silty clays that grade to sand and gravel near the shorelines. The thickness of unconsolidated material above bedrock increases from north to south from less than 50 feet at the north shore of Long Island Sound to greater than 400 feet along the southern shore.

The termini for each alignment concept are located at interchanges that include bridges. As the project progresses, an evaluation of the geotechnical information prepared for the construction of the bridges will be included in the overall geotechnical study required for the chosen alternative. The presence of imported fill materials will require investigation to determine if the fill material will have a negative impact on foundations constructed in these areas. The marsh deposits along the Central Alignment Concept 1: Kings Park, NY to Bridgeport, CT, present potential stability issues that should be further evaluated if this alignment concept is progressed further.

5.8 PROPERTY IMPACTS

Potentially affected properties were defined as any parcel completely or partially within 200 feet to either side of the center of the alignment (400-foot-wide corridor). Property data was obtained through digital tax maps and publicly available property databases. Property takings were assumed for design options which contained an on-land bridge, which could permanently affect properties. For example, under an all bridge design option for the Western Alignment, this scenario would involve property takings for Westchester and Nassau Counties. Property easements were assumed for design options that contained a tunnel, which would only have subsurface disturbances to individual properties. For example, under an all tunnel or bridge/tunnel design option for the Central Alignment's Kings Park to Devon alignment concept, property takings would occur in Suffolk County whereas property easements would take place in New Haven County. Depending on where the tunnel portal is located in Devon (New Haven County), additional property takings may occur. In addition, construction impacts may require additional, but temporary, property disturbance, which could require easements.

Table 5-1 through Table 5-3 present the number of affected properties for each alignment concept and design options for the Western, Central, and Eastern Alignments.

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Table 5-1: Number of Affected Properties – Western Alignment

LANDING	AFFECTED PROPERTIES
Westchester County (Rye/Port Chester)	45
Nassau County (Oyster Bay)	214

Source: WSP

Note: The number of impacted properties is dependent on the design option chosen; the number of impacted properties were defined as any parcel completely or partially within 200 feet to either side of the center of the alignment (400-foot-wide corridor)

Table 5-2: Number of Affected Properties – Central Alignment

LANDING	AFFECTED PROPERTIES
New Haven County (Devon)	222
Fairfield County (Bridgeport)	53
Suffolk County (Kings Park)	5

Source: WSP

Note: The number of impacted properties is dependent on the design option chosen; the number of impacted properties were defined as any parcel completely or partially within 200 feet to either side of the center of the alignment (400-foot-wide corridor)

Table 5-3: Number of Affected Properties – Eastern Alignment

LANDING	AFFECTED PROPERTIES
New Haven County (New Haven)	14
New Haven County (Branford)	122
Suffolk County (Wading River)	139

Source: WSP

Note: The number of impacted properties is dependent on the design option chosen; the number of impacted properties were defined as any parcel completely or partially within 200 feet to either side of the center of the alignment (400-foot-wide corridor)

5.8.1 Property Impacts – Western Alignment

The Western Alignment concept which traverses Oyster Bay on Long Island is predominantly a low-density residential area. Under the tunnel or bridge/tunnel combo scenario(s) on Long Island, the properties affected may require an easement depending on the final engineered alignment. However, there approximately 150-200 apartments/condominiums that may be affected because they are adjacent to the tunnel transition (on either side of the tunnel portal) and lie within 200 ft. of the centerline.

On the northern landing, the alignment traverses the Rye/Port Chester area of Westchester. Similar to the southern end of the alignment, the properties affected under the tunnel or bridge/tunnel combo scenario(s) include low density residential uses.

Table 5-4: Affected Properties - Western Alignment (Tunnel or Combo)

Land Use	Oyster Bay		Rye/Port Chester	
	Above Ground Acquisition	Below Ground Easement	Above Ground Acquisition	Below Ground Easement
Residential	0	377	1	14
Commercial	0	2	2	0
Industrial	0	0	0	0
Public	0	50	4	2
Other	0	1	0	0

* Approximately 150 condo units are adjacent to the tunnel transition. This will need to be further evaluated in detailed design.

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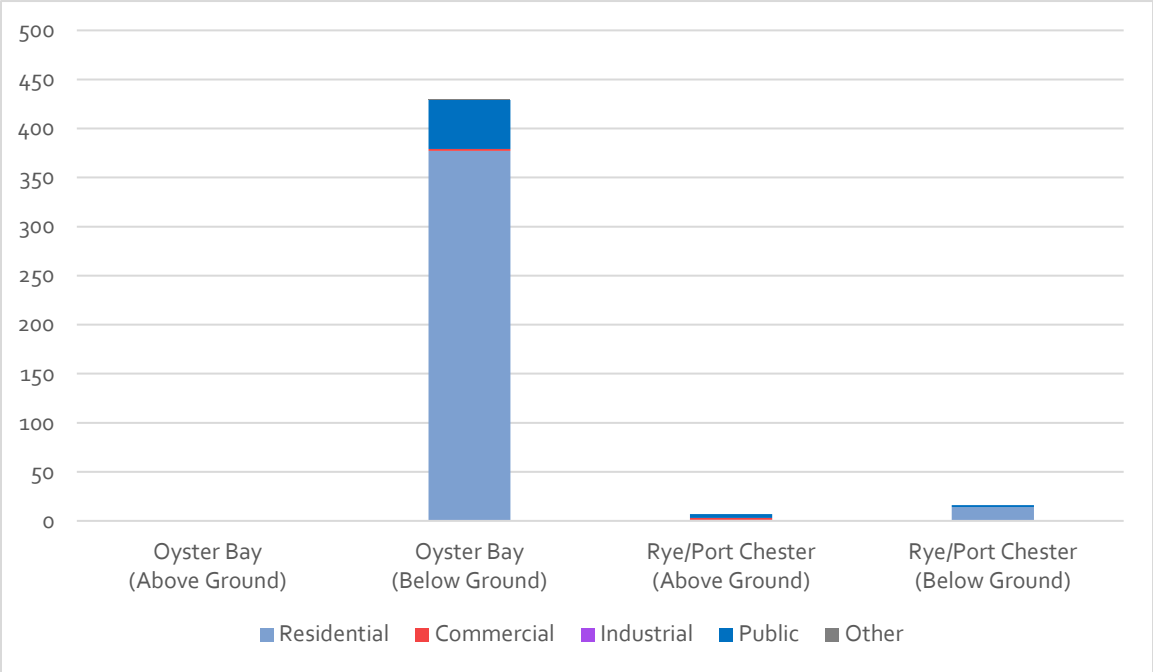
Figure 5-3: Affected Properties by Land Use – Oyster Bay to Rye/Port Chester (Tunnel or Combo)



5.8.2 Property Impacts – Central Alignment

There are two Central Alignment concepts, both of which share a common Long Island landing that traverses Kings Park. In Kings Park there are only four properties that would be affected in both a bridge and/or bridge/tunnel combo. The four properties affected are public/state owned properties. Most notably, the alignment bisects the Sunken Meadow State Park, and would result in a partial property acquisition.

In Bridgeport, CT, land uses and properties that are adjacent to the Bridgeport crossing primarily include public/open space, transportation, industrial, and a few residential and commercial office uses. The majority of the affected properties would occur due to the widening of Lordship Boulevard (CT113).

In Devon, CT, the affected properties are primarily residential and public/open space, however there are a few commercial properties. Under the bridge scenario, the alignment would bisect nearly 190 residential properties, many of which are single family households. The alignment would also affect Johnathan Law High School and several businesses just south of the I-95 interchange. Similarly, under the bridge-tunnel combo scenario, the Johnathan Law High School and several businesses south of the I-95 interchange where the alignment would tie into would need to be acquired. However, there would not be a need for any residential properties to be acquired due to the location of the tunnel portal.

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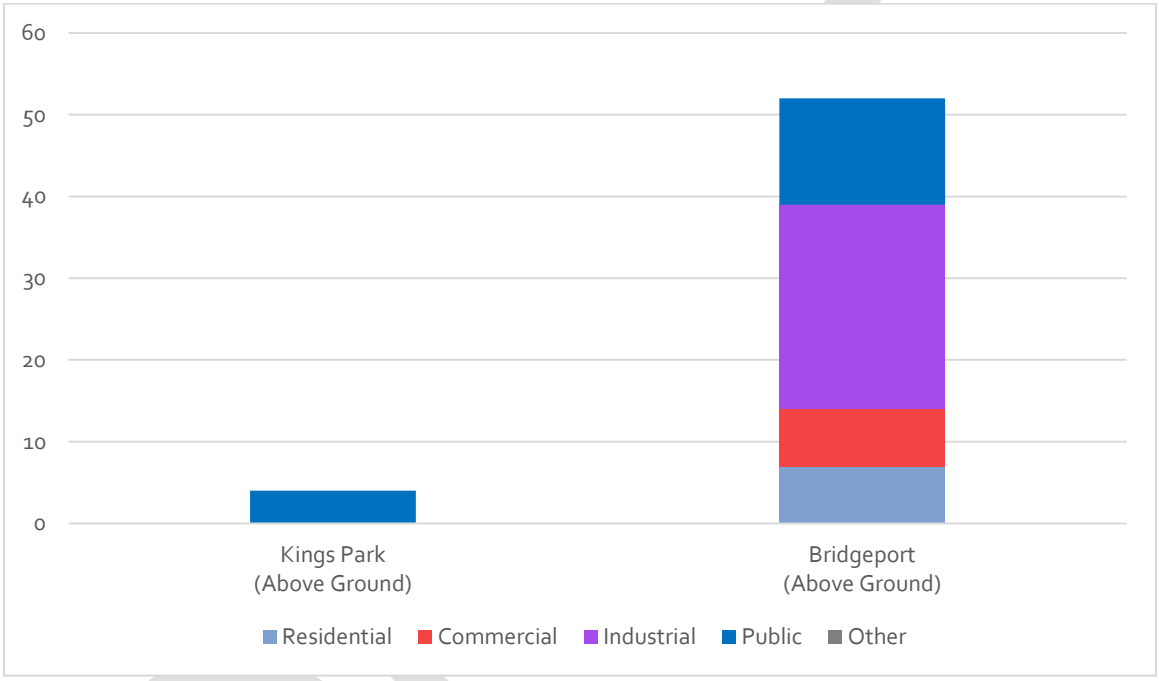
Table 5-5: Affected Properties - Central Alignment (Kings Park to Bridgeport) (Bridge)

	Kings Park		Bridgeport	
Land Use	Above Ground Acquisition	Below Ground Easement	Above Ground Acquisition	Below Ground Easement
Residential	0	N/A	7	N/A
Commercial	0	N/A	7	N/A
Industrial	0	N/A	25	N/A
Public	4	N/A	13	N/A
Other	0	N/A	0	N/A

Source:

Figure 5-4: Affected Properties by Land Use – Kings Park to Bridgeport (Bridge)

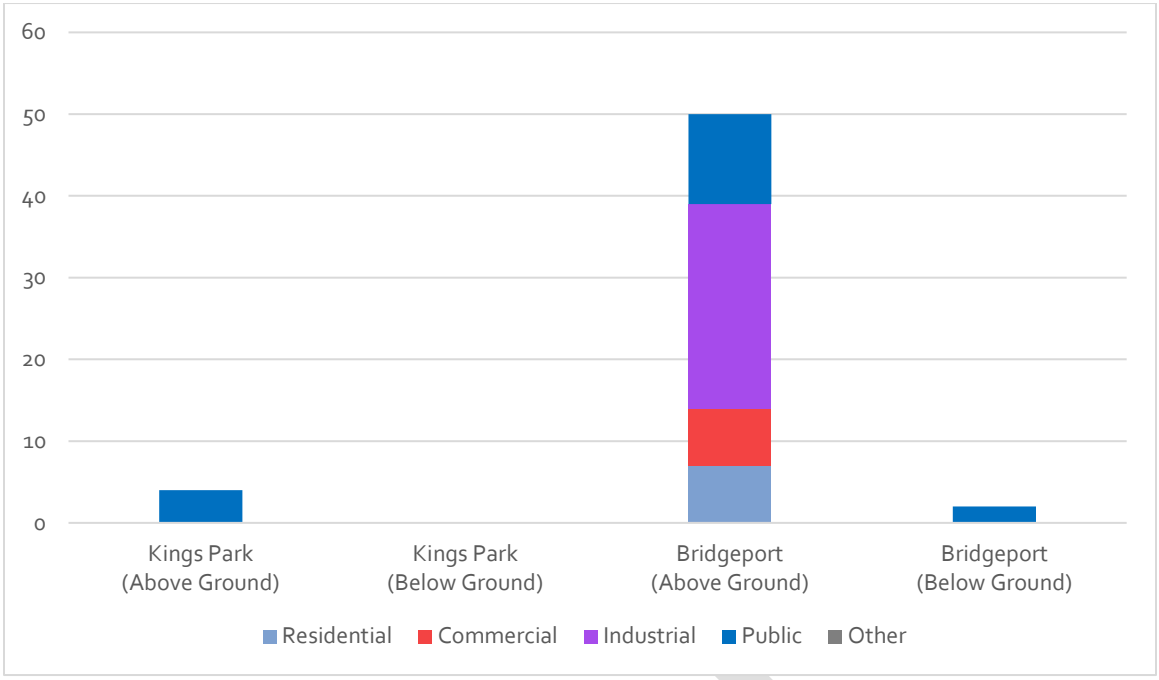


Source:

Table 5-6: Affected Properties - Central Alignment (Kings Park to Bridgeport) (Combo)

Land Use	Kings Park		Bridgeport	
	Above Ground Acquisition	Below Ground Easement	Above Ground Acquisition	Below Ground Easement
Residential	0	0	7	0
Commercial	0	0	7	0
Industrial	0	0	25	0
Public	4	0	11	2
Other	0	0	0	0

Figure 5-5: Affected Properties by Land Use – Kings Park to Bridgeport (Combo)



Source:

Table 5-7: Affected Properties - Central Alignment (Kings Park to Devon) (Combo)

Land Use	Kings Park		Devon	
	Above Ground Acquisition	Below Ground Easement	Above Ground Acquisition	Below Ground Easement
Residential	0	0	0	188
Commercial	0	0	3	7
Industrial	0	0	1	1
Public	4	0	2	18
Other	0	0	0	0

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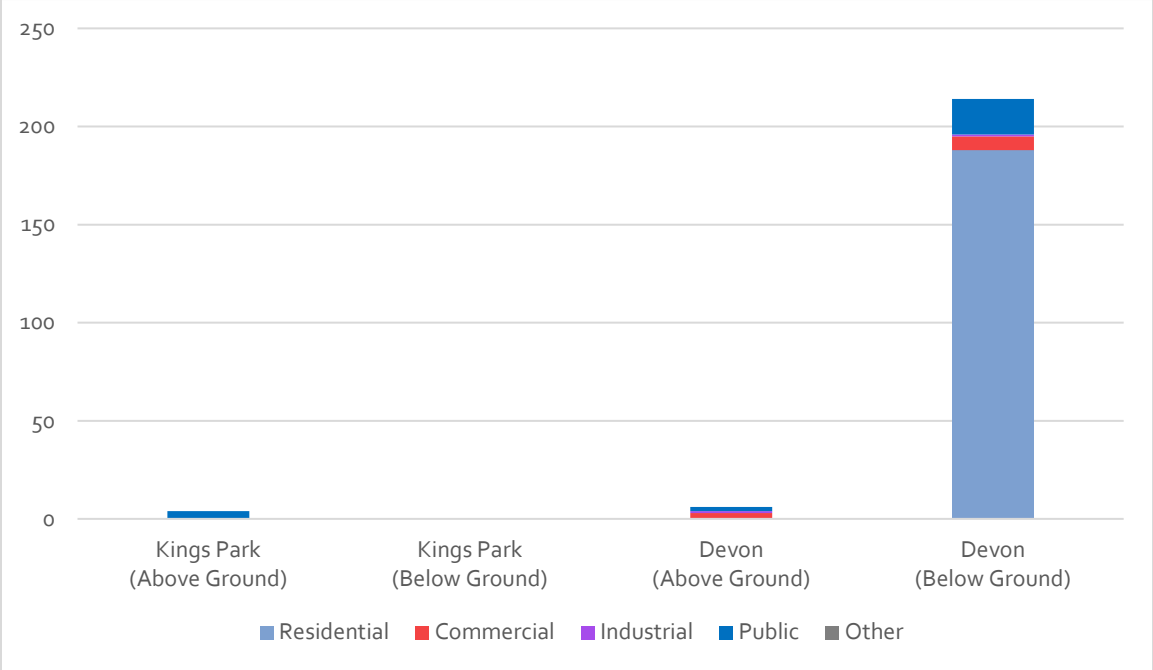
Figure 5-6: Affected Properties by Land Use – Kings Park to Devon (Combo)



Source: WSP

5.8.3 Property Impacts – Hybrid Alignment

As discussed earlier, the Hybrid (bridge) alignment is a combination between the Western and Central Alignments. The alignment stretches from Kings Park on Long Island to Rye/Port Chester, NY. In Kings Park, there are only four properties that would be affected, most notably the Sunken Meadow State Park. On the northern landing, the alignment traverses the Rye/Port Chester area of Westchester. The properties affected in this alignment are primarily low density residential uses.

Table 5-8: Affected Properties - Hybrid Alignment (Kings Park to Rye/Port Chester) (Bridge)

	Kings Park		Rye/Port Chester	
Land Use	Above Ground Acquisition	Below Ground Easement	Above Ground Acquisition	Below Ground Easement
Residential	0	N/A	15	N/A
Commercial	0	N/A	2	N/A
Industrial	0	N/A	0	N/A
Public	4	N/A	6	N/A
Other	0	N/A	0	N/A

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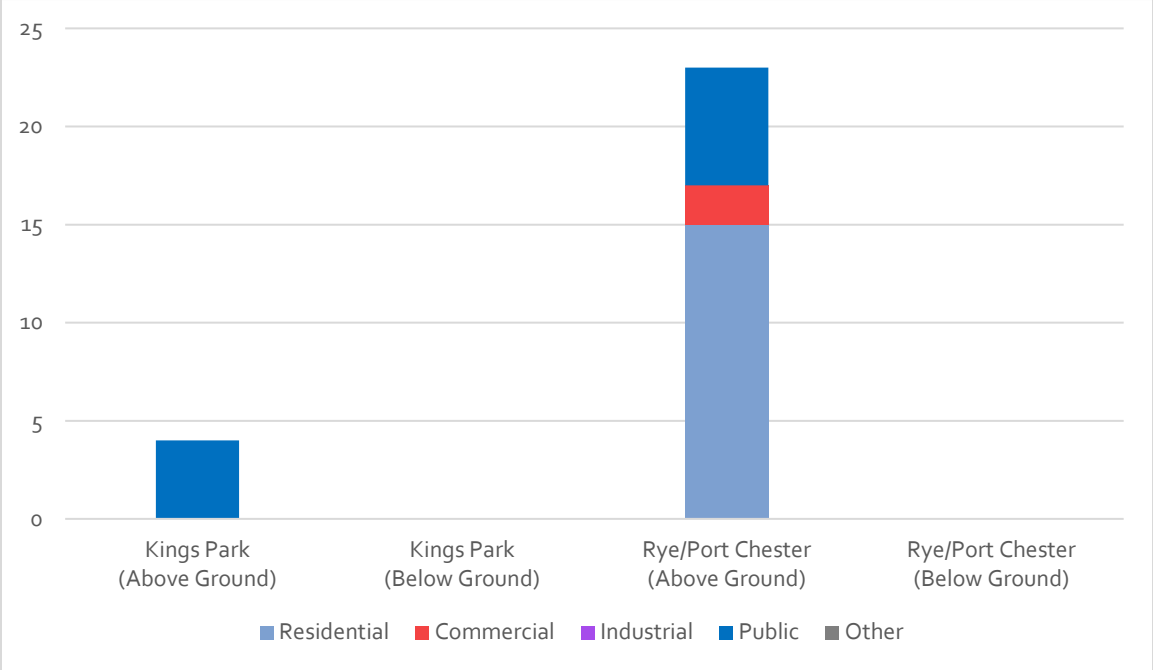
Figure 5-7: Affected Properties by Land Use – Kings Park to Rye/Port Chester (Bridge)



Source: WSP

Table 5-9: Affected Properties - Hybrid Alignment (Kings Park to Rye/Port Chester) (Combo)

	Kings Park		Rye/Port Chester	
Land Use	Above Ground Acquisition	Below Ground Easement	Above Ground Acquisition	Below Ground Easement
Residential	0	0	7	0
Commercial	0	0	7	0
Industrial	0	0	25	0
Public	4	0	11	2
Other	0	0	0	0

Source: WSP

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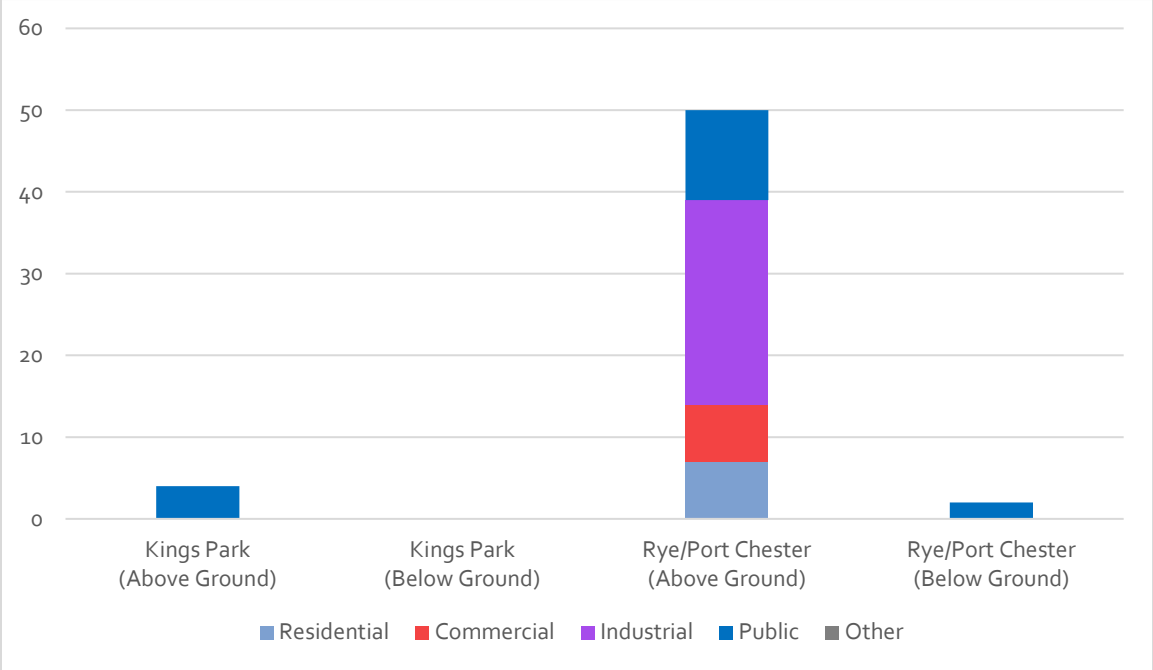
Figure 5-8: Affected Properties by Land Use – Kings Park to Rye/Port Chester (Bridge)



Source: WSP

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6 Environmental Considerations

6.1 INTRODUCTION

A high level environmental assessment was performed for the three alignment concepts. The following 20 environmental categories were analyzed for potential impacts:

- Wetlands
- Surface Waterbodies and Watercourses
- Wild, Scenic, and Recreational Rivers
- Navigable Waters
- Floodplains
- Coastal Resources
- Groundwater Resources, Aquifers & Reservoirs
- Stormwater Management
- General Ecology and Wildlife Resources
- Critical Environmental Areas
- Historic and Cultural Resources
- Parks and Recreational Resources
- Visual Resources
- Farmlands
- Air Quality
- Energy
- Climate Change
- Noise
- Asbestos
- Hazardous Waste & Contaminated Materials

Based on the preliminary findings presented in this Draft Feasibility Study Report, a more detailed environmental analysis will be necessary during a later point in the design period for a majority of the aforementioned environmental categories.

The purpose of this chapter is to outline typical existing environmental conditions that are present in the immediate vicinity of the Western, Central, and Eastern Alignments. Environmental conditions and resources were examined to determine the potential for environmental sensitivity based on the initial conceptual alignments. A 200-foot buffer around the alignment centerlines was used to determine the potential total disturbance in acres for each alignment concept. The information presented herein represents a preliminary desktop study of existing environmental conditions. If and when an alignment is advanced and design options are identified, more specific information related to each environmental category will be researched and documented. In addition, as part of the environmental review process, it is anticipated that this project will undergo federal and state environmental assessments under the National Environmental Policy Act (NEPA), New York State Environmental Quality Review Act (SEQRA), and, as necessary, the Connecticut Environmental Policy Act (CEPA).

6.2 WETLANDS

Based on a draft feasibility study, the following wetland acreage was obtained from the National Wetland Inventory (NWI), the New York State Department of Environmental Conservation (NYSDEC), and Connecticut Department of Energy and Environmental Protection (DEEP). The NYSDEC Environmental Resource Mapper and the U.S. Fish and Wildlife Services (FWS) Wetland Mapper, two online mapping programs, were referenced to confirm the accuracy of shapefiles used to

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quantify wetland impacts. At this preliminary level of the feasibility assessment, wetlands were analyzed for level of potential effect by calculating the acres of state and federal freshwater and tidal wetlands within a 200-foot radius of the alignment centerline. Summary tables that document the freshwater and tidal wetland types for each alignment concept are provided in Appendix A.

6.2.1 State Freshwater Wetlands

6.2.1.1 Western Alignment

The Western Alignment directly traverses New York State (NYS)-regulated freshwater wetlands on Long Island and could affect approximately 8.3 acres of freshwater wetlands. If a bored tunnel option were considered, the alignment would be well below the surface and would likely have no direct effect on freshwater wetlands.

Therefore, any future potential alignment could require a NYSDEC Article 24 Freshwater Wetlands Permit, pursuant to 9 NYCRR 578, for proposed work in the State-regulated wetland or regulated adjacent area (100 feet). If required, permit would be sought from NYSDEC once the location and extent of the impacts are ascertained.

6.2.1.2 Central Alignment

The Central Alignment does not directly traverse any NYS-regulated freshwater wetlands. To the extent that online mapping of freshwater wetlands was available for Connecticut, minimal, if any, impacts to State-regulated freshwater wetlands is anticipated. A further impact assessment would be undertaken if and when an alignment is identified for further consideration.

6.2.1.3 Eastern Alignment

The Eastern Alignment directly traverses NYS-regulated freshwater wetlands on Long Island and would impact approximately 7.3 acres of freshwater wetlands. To the extent that online mapping of freshwater wetlands was available for Connecticut, minimal, if any, impacts to State-regulated freshwater wetlands is anticipated. A further impact assessment would be undertaken if and when an alignment is identified for further consideration.

Therefore, a future potential alignment would likely require a NYSDEC Article 24 Freshwater Wetlands Permit, pursuant to 9 NYCRR 578, for proposed work in the state-regulated wetland or regulated adjacent area (100 feet). If required, a permit would be sought from NYSDEC once the location and extent of the impacts are ascertained.

6.2.2 State Tidal Wetlands

6.2.2.1 Western Alignment

The Western Alignment directly traverses NYS-regulated tidal wetlands and could impact approximately 16.7 acres of tidal wetlands on Long Island and in Rye/Port Chester. A bored tunnel option would be well below the surface under these tidal wetlands and would not have a direct impact. In addition to this acreage, the Western Alignment traverses wetlands that are present in the Littoral Zone (LZ), Adjacent Area (AA), and Hole Area (HL) that are present within the Long Island Sound and on Long Island.

6.2.2.2 Central Alignment

The Central Alignment directly traverses NYS-regulated and Connecticut-regulated tidal wetlands. Both alignment concepts would impact approximately 4.1 acres of NYS-regulated tidal wetlands on

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Long Island. The Kings Park to Bridgeport alignment concept would impact approximately 45.5 acres of Connecticut-regulated tidal wetlands. A bored tunnel option would be well below the surface under these tidal wetlands and would not have a direct impact. In addition to this acreage, the Central Alignment traverses wetlands that are present in the Littoral Zone (LZ), Adjacent Area (AA), and Hole Area (HL) that are present within the Long Island Sound and on Long Island.

6.2.2.3 Eastern Alignment

The Eastern Alignment directly traverses Connecticut-regulated tidal wetlands. The Wading River to Branford alignment concept would impact 0.2 acre of tidal wetlands. The Wading River to New Haven alignment concept would impact 0.1 acre of Connecticut-regulated tidal wetlands. A bored tunnel option would be well below the surface under these tidal wetlands and would not have a direct impact. In addition to this acreage, the Eastern Alignment traverses wetlands that are present in the Littoral Zone (LZ), Adjacent Area (AA), and Hole Area (HL) that are present within the Long Island Sound and on Long Island.

6.2.3 Federal Jurisdiction Wetlands

The proposed alignment locations have been reviewed for wetlands in accordance with the criteria defined in the 1987 US Army Corps of Engineers Wetland Delineation Manual. It has been determined the project will impact tidal wetlands listed on the NWI.

6.2.3.1 Western Alignment

The Western Alignment directly traverses NWI freshwater and tidal wetlands on Long Island and in Westchester, New York. The Western Alignment would impact approximately 2 acres of freshwater wetlands, which include Freshwater Forested/Shrub Wetlands and Freshwater Ponds. In addition, the Western Alignment would impact approximately 7.5 acres of tidal wetlands, which include Estuarine and Marine wetlands and Riverine wetlands. A bored tunnel option would be well below the surface under these tidal wetlands and would not have a direct impact. The Western Alignment also traverses Estuarine and Marine Deepwater wetlands that are present within the Long Island Sound.

6.2.3.2 Central Alignment

The Central Alignment directly impacts NWI freshwater and tidal wetlands on Long Island and in Connecticut. The Kings Park to Bridgeport alignment concept would impact approximately 0.8 acre of freshwater wetlands, which include Freshwater Emergent Wetlands, Freshwater Forested/Shrub Wetlands, and Freshwater Ponds. In addition, this concept would impact approximately 53 acres of tidal wetlands, which include Estuarine and Marine wetlands and Riverine wetlands. The Kings Park to Devon alignment concept would impact approximately 0.4 acre of freshwater wetlands, which includes Freshwater Forested/Shrub Wetlands. In addition, this concept would impact approximately 9.3 acres of tidal wetlands, which include Estuarine and Marine wetlands and Riverine wetlands. A bored tunnel option would be well below the surface under these tidal wetlands and would not have a direct impact. Both Central Alignment concepts would impact Estuarine and Marine Deepwater wetlands that are present within the Long Island Sound.

6.2.3.3 Eastern Alignment

The Eastern Alignment directly impacts freshwater and tidal wetlands on Long Island and in Connecticut. The Wading River to New Haven alignment concept would not impact freshwater wetlands, but would impact approximately 2.1 acres of tidal wetlands, which include Estuarine and Marine wetlands. The Wading River to Branford alignment concept would impact approximately

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0.6 acres of freshwater wetlands, which include Freshwater Emergent Wetlands and Freshwater Forested/Shrub Wetlands. In addition, this alignment concept would impact approximately 2.1 acres of tidal wetlands, which include Estuarine and Marine wetlands. A bored tunnel option would be well below the surface under these tidal wetlands and would not have a direct impact. Both Eastern Alignment concepts would impact Estuarine and Marine Deepwater wetlands that are present within the Long Island Sound.

6.2.4 Executive Order 11990

If any of future alignment is advanced, an Executive Order 11990 Wetland Finding would need to be approved by Federal Highway Administration (FHWA) stating and supporting that (1) there are no practicable alternatives to construction in the wetland(s), and (2) the proposed action includes all practicable measures to minimize harm to the wetland(s) which may result from such use.

6.2.5 Mitigation Summary

This report is a draft feasibility study; therefore, a summary of mitigation measures would not be determined until alignment concepts and designs have been identified for further consideration.

6.3 SURFACE WATERBODIES AND WATERCOURSES

6.3.1 Surface Waters

The project activities involve excavation in and/or the discharge of dredged or fill material into waters of the U.S. However, because this is a draft feasibility study, permits anticipated for construction will be determined when alignment concepts have been identified for further consideration.

6.3.2 Surface Water Classification and Standards

If and when Long Island Sound crossing options are advanced and alignments are identified, the NYSDEC would be consulted to determine any restrictions to construction activities due to fish spawning seasons or other water quality concerns. Agency correspondence would be conducted when the alignment concept and design option have been finalized.

6.3.3 Stream Bed and Bank Protection

Based upon a review of the NYSDEC Environmental Resource Mapper, there are regulated streams in the general area of all potential alignments; however, none of these are protected streams

6.3.4 Airport and Airway Improvement

The Central Alignment's Kings Park to Devon alignment concept crosses into the Sikorsky Memorial Airport in Stratford, Connecticut. The Eastern Alignment's Wading River to New Haven alignment concept is adjacent to the Tweed New Haven Airport in New Haven, Connecticut.

6.3.5 Mitigation Summary

This report is a draft feasibility study; therefore, a summary of mitigation measures will be determined if and when alignment concepts have been identified for further consideration.

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6.4 WILD, SCENIC, AND RECREATIONAL RIVERS

Based on a preliminary desktop study, the following information was obtained from the National Wild and Scenic Rivers Story Map, which is a series of interactive maps showing management, classification, and river values. Based on the information obtained from this database, the project activities do not involve activities near national or state-regulated wild, scenic, or recreational rivers as described below.

6.4.1 State Wild, Scenic and Recreational Rivers

There are no NYSDEC-designated, study, or inventory state wild, scenic, or recreational rivers within or adjacent to the proposed project site. Therefore, no further review is required.

6.4.2 National Wildlife Refuge

The Western Alignment is located within a wildlife and waterfowl refuge, the Oyster Bay National Wildlife Refuge. A bored tunnel option would be well below the surface in this area and would not directly affect the refuge. A further impact assessment would be undertaken if and when an alignment is identified for further consideration.

6.4.3 Section 4(f) Involvement

Section 4(f) involvement would be determined if and when alignments are identified and evaluated in detail.

6.4.4 Mitigation Summary

This report is a draft feasibility study; therefore, a summary of mitigation measures would not be determined until alignment concepts and designs have been identified for further consideration.

6.5 NAVIGABLE WATERS

All potential alignments considered would involve construction in state-regulated navigable waters. However, because this is a draft feasibility study, specific impacts related to the construction and operation within navigable waters would be discussed when alignment concepts and designs have been identified for further consideration.

6.5.1 State-Regulated Waters

State navigable waters include lakes, rivers, and other waterways and water bodies on which water vessels with a capacity of one or more persons are operated or can be operated. A Protection of Waters Permit is required for the Long Island Sound, state regulated navigable waters, located within the all the potential alignment areas. These waterways are used for boating, fishing, tourism, and swimming. The project work would potentially require placement of fill in these waters. In turn, the navigability of the waters could potentially be affected depending on the design option chosen. A NYSDEC Protection of Waters Permit for Excavation or Placement of Fill in Navigable Waters would likely be required, pursuant to ECL Article 15, Title 5. If so, the permit would be sought once the location and extent of the impacts are ascertained.

6.5.2 New York State Office of General Services (NYSOGS) Lands and Navigable Waters

Long Island Sound is located within the potential project area and the work will require the use of underwater NYSOGS holdings in the Sound. If an alignment is advanced, NYSOGS will be contacted

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and requirements for an easement will be determined once the location and extent of the impacts are ascertained.

6.5.3 Rivers and Harbors Act – Section 9

All the potential alignments would involve the construction of a bridge, tunnel, or a combination of bridge and tunnel over or within navigable water of the United States, the Long Island Sound. The Sound is used primarily for recreational traffic, including fishing, boating, and tourism. The construction of any of these conceptual alignments has the potential to reduce the existing vertical clearance or affect the navigability of the river. If an alignment is advanced for further consideration, the U.S. Coast Guard will be consulted and a USCG Section 9 Permit Application Package may be assembled and submitted for approval once the location and extent of the impacts are ascertained.

6.5.4 Rivers and Harbors Act – Section 10

The jurisdiction of the Rivers and Harbors Act of 1899 includes all navigable waters of the United States which are defined as, "those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible to use to transport interstate or foreign commerce." This jurisdiction extends seaward to include all ocean waters within a zone three nautical miles from the coast line.

All the potential alignments involve the construction of a bridge, tunnel, or combination of bridge and tunnel over or within navigable water of the United States, the Long Island Sound. The construction will necessitate dredging and/or the discharge of fill into the river, and will require a USACOE Section 10 Permit. If an alignment concept is identified, a permit application would be submitted to the USACOE once the extent of the impacts is fully ascertained, and a permit would be sought prior to the commencement of work.

6.6 FLOODPLAINS

Based on a preliminary desktop study, the following floodplain information was obtained through the Federal Emergency Management Agency (FEMA) for the potential Western, Central, and Eastern Alignment concepts. FEMA flood maps for each alignment concept can be found in Appendix A.

6.6.1 State Flood Insurance Compliance Program

All the proposed alignments areas are predominately located within the 100-year floodplain of the Long Island Sound, as indicated through the FEMA flood maps.

If an alignment option is advanced for further consideration, a floodplain hydraulic analysis will be performed by the New York State Department of Transportation (NYSDOT) Regional Hydraulics Engineer during the advance detail plan phase.

6.6.2 Executive Order 11988

In order to comply with EO 11988, there will be an evaluation of potential effects of any actions taken within the floodplain, and alternatives to avoid any adverse effects shall be considered. If future project alternatives require the use of a floodplain, there will be an attempt to minimize potential impacts, and consistent with the regulations issued in accord with Section 2(d) of this Order,

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the Department will prepare and circulate a notice containing an explanation of why the action is proposed to be located within the floodplain.

6.7 COASTAL RESOURCES

All the potential alignments considered involve construction within and adjacent to coastal resources. However, because this is a draft feasibility study, specific impacts related to the construction and operation within or adjacent to a coastal area will be discussed when alignment concepts and designs have been identified for further consideration

6.7.1 State Coastal Zone Management Program

The Western, Central, and Eastern Alignment concepts are all located within the New York State and/or Connecticut Coastal Zone Management Program Area.

Oyster Bay and Cold Spring Harbor are defined by the New York State Department of State (NYSDOS) Division of Coastal Resources and Waterfront Revitalization as a Significant Coastal Fish and Wildlife Habitat under the Western Alignment; Herod Point Shoals is defined by the NYSDOS Division of Coastal Resources and Waterfront Revitalization as a Significant Coastal Fish and Wildlife Habitat under the Eastern Alignment. Policy 7 of New York's Coastal Management Program provides guidance regarding the potential for impact to this habitat. If a project is pursued (only for tunnel), consistency with Policy 7 would be further analyzed once the location and extent of the impacts are ascertained. At this time, no further action is required.

6.7.2 State Coastal Erosion Hazard Area

Based on the preliminary desktop study, none of the potential alignments are located in or near a Coastal Erosion Hazard Area. However, due to the alignments location along the Long Island and Connecticut shorelines, the alignment that is identified for further consideration may be susceptible to coastal erosion and would be further analyzed once alignment concepts are identified for further consideration.

6.7.3 Waterfront Revitalization and Coastal Resources Program

All three of the potential alignments are located within the boundaries of an approved Local Waterfront Revitalization Program (LWRP) area through NYSDOS and the Coastal Management Area through DEEP. Any alignment considered further would likely affect one or more of the policies or purposes of an approved LWRP. Affected policies would be identified once alignment concept and design options have been identified for further consideration. Pursuant to 19 NYCRR 600.4(c), the Department has the potential to determine that there are no reasonable alternatives that would permit the action to be taken without hindering these LWRP purposes. During the design phase, the Department will identify and pursue any practicable ways to minimize adverse effects on the LWRP. If the future project was approved, some impacts would likely be unavoidable. It is assumed that regulatory agencies would find that there would be an overriding statewide benefit for New York and Connecticut.

6.7.4 Federal Coastal Barrier Resources Act (CBRA) and Coastal Barrier Improvement Act (CBIA)

The Western and Central Alignment concepts are located in or near protected coastal areas under the jurisdiction of the CBRA, including Centre Island and Sunken Meadow, respectively.

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6.8 GROUNDWATER RESOURCES, AQUIFERS, AND RESERVOIRS

All three of the potential alignments (including bridge and tunnel options) could impact groundwater and aquifer resources. If and when conceptual alignments are identified for further assessment, information related to groundwater resources, aquifers, and reservoir information would be obtained and potential impacts evaluated. Information would be gathered through the U.S. Environmental Protection Agency (EPA) and NYSDEC.

6.8.1 Aquifers

A review of the EPA-designated Sole Source Aquifer Areas Federal Register Notices, Maps, and Fact Sheets will take place once alignment concepts have been identified for further consideration in order to locate whether the project is in a Sole Source Aquifer Project Review Area. It will be determined at that time whether federal review and/or approvals are required pursuant to Section 1424(e) of the Safe Drinking Water Act.

6.8.2 Drinking Water Supply Wells (Public and Private Wells) and Reservoirs

If and when potential alignments are identified for further assessment, measures to avoid, minimize, or mitigate adverse impacts to the Sole Source Aquifer would be identified. Best Management Practices (BMPs) to protect the aquifer would be employed, including erosion and sediment control, stormwater management, and construction chemical storage and handling.

6.9 STORMWATER MANAGEMENT

Erosion and sedimentation control plans would be developed and incorporated into any alignment concepts considered for further assessment.

6.10 GENERAL ECOLOGY AND WILDLIFE RESOURCES

Any of the potential alignments would involve construction within and/or near ecologically sensitive areas. However, because this is a draft feasibility study, specific impacts related to the construction and operation on wildlife and ecological resources would be discussed when alignment concept and design options have been identified for further consideration.

6.10.1 Fish, Wildlife, and Waterfowl

A first review indicates that there are special habitat or breeding area for certain species of plants or animals that could be affected by all three of the potential alignments. Information gathered through this preliminary desktop study is presented in below and in Appendix A.

If and when alignments are identified for further consideration, NYSDOT would consult with FWS, NYSDEC, and DEEP to conduct an assessment of possible impacts to such species, habitats, or areas, and identify measures to mitigate them. Agency correspondence would take place once the alignment concept and design option have been finalized.

6.10.2 Habitat Areas, Wildlife Refuges, and Wildfowl Refuges

The Western Alignment is located within a national wildlife refuge, the Oyster Bay National Wildlife Refuge, although the bored tunnel option would be well below the surface and would not have a

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direct effect on the refuge. If and when an alignment is identified for further assessment, a more detailed assessment would be undertaken.

6.10.3 Endangered and Threatened Species

According to the NYSDEC GIS information database, there is a possibility that a state-protected, threatened and/or endangered plant or animal species are located in or near all three potential alignment areas. A preliminary desktop study using the FWS Information for Planning and Conservation (IPaC) database was conducted. The following endangered and threatened species were identified based on the Western, Central, and Eastern Alignments' concept locations.

6.10.3.1 Birds

- Piping Plover (Charadrius melodus) – Threatened
- Red Knot (Calidris canutus rufa) – Threatened
- Roseate Tern (Sterna dougallii dougallii) – Endangered

6.10.3.2 Flowering Plants

- Sandplain Gerardia (Agalinis acuta) – Endangered
- Seabeach Amaranth (Amaranthus pumilus) – Threatened

6.10.3.3 Mammals

- Northern Long-eared Bat (Myotis septentrionalis) – Threatened

If and when alignment concepts are identified for further assessment, NYSDEC would be contacted to identify the species and a site species assessment would be performed to confirm their presence. NYSDOT would take appropriate measures during design and construction to ensure that impacts to it are avoided or minimized.

Agency correspondence will be performed once the alignment and design concept have been finalized. The preliminary list of threatened and/or endangered species that was generated by IPaC is presented in Appendix A.

6.10.4 Invasive Species

If and when alignments are identified for further assessment, a review of the existing corridor would take place during a detailed environmental analysis of the chosen alignment and design concept. Because this is a preliminary desktop study, the presence of known invasive species within the right-of-way is unknown at this time. Precautions would be taken to prevent the introduction of invasive species during project design and construction.

6.10.5 Roadside Vegetation Management

Existing roadside vegetation consists primarily of maintained lawn areas, parks, and wooded areas. If and when alignments were identified for further assessment, efforts would be made to replace wildlife-supporting vegetation that is removed in the course of construction.

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6.11 CRITICAL ENVIRONMENTAL AREAS (CEAS)

Based on a preliminary desktop study, using information obtained from the NYSDEC Environmental Resource Mapper, Connecticut DEEP GIS Data, and Connecticut Environmental Conditions Online mapping portal, all three potential alignments would involve construction within CEAs. However, because this is a draft feasibility study, specific impacts related to the construction and operation within CEAs would be analyzed if and when alignment and design concepts have been identified for further assessment.

6.11.1 State Critical Environmental Areas (CEAs)

6.11.1.1 Western Alignment

The Western Alignment is located directly within the Special Groundwater Protection Area (SGPA) and Long Island Sound CEA. The Western Alignment concept impacts approximately 136 acres of the SGPA CEA and approximately 12 acres of the Long Island Sound CEA. The bored tunnel options would be located well below the surface under these CEAs and no direct effects would be anticipated. There are no critical habitats located within or adjacent to the alignment boundaries.

6.11.1.2 Central Alignment

The Central Alignment is located directly within the Great Meadows Critical Habitat in the Bridgeport area of Connecticut. The Kings Park to Bridgeport alignment concept would impact approximately 58 acres of the Great Meadows Critical Habitat. The bored tunnel options would be located well below the surface under these CEAs and no direct effects would be anticipated. Under the Kings Park to Devon alignment concept, there are no critical habitats or CEAs located within or adjacent to either crossings.

6.11.1.3 Eastern Alignment

The Eastern Alignment concept is located directly within the SGPA CEA. Both Eastern Alignment concepts would impact approximately 291 acres of the SGPA Critical Environmental Area. The bored tunnel options would be located well below the surface under these CEAs and no direct effects would be anticipated. There are no critical habitats located within or adjacent to the Wading River, New Haven, or Branford crossings.

6.11.2 New York State Significant Natural Communities

6.11.2.1.1 Western Alignment

The Western Alignment concept could impact the Coastal Oak – Laurel Forest, a significant natural community. The bored tunnel options would be located well below the surface and no direct effects would be anticipated for this significant natural community.

6.11.2.1.2 Central Alignment

Under the Central Alignment concept, the alignment concept would impact the Low Salt Marsh, a tidal wetland and NYS-regulated significant natural communities on Long Island.

6.11.2.1.3 Eastern Alignment

Maritime dunes, Coastal Oak – Heath Forest, and High Salt Marsh are significant natural community adjacent to the Eastern Alignment on Long Island.

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6.11.3 State Forest Preserve Lands

According to information obtained from NYSDEC, none of the potential alignments would involve work in or near state forest preserve lands.

6.12 HISTORIC AND CULTURAL RESOURCES

All of the potential alignments could involve construction within and adjacent to historic and cultural resources. Identification of historic resources was done through the New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP) Cultural Resource Information System (CRIS). However, because this is a draft feasibility study, specific impacts related to the construction and operation within or adjacent to historic resources would be analyzed only when alignment concept and design options have been identified for further consideration.

6.12.1 National Heritage Areas Program

None of the potential alignments would impact areas identified as National Heritage Areas.

6.12.2 National Historic Preservation Act – Section 106 / State Historic Preservation Act – Section 14.09

According to the National Register of Historic Places (NR), there are no historic properties eligible, or listed, within the potential alignment's area of potential effect.

6.12.3 Architectural Resources

The Western, Central, and Eastern Alignment concepts are all within archaeologically sensitive areas on Long Island and Westchester County as determined by the NYSOPRHP. Archeological surveys would be conducted to determine the presence of archeological resources once alignment concept and design options have been identified for further assessment. At this point archaeological resources for Connecticut would be assessed through correspondence with the Connecticut State Historic Preservation Office (CTSHPO). In addition, all three alignments would traverse the Long Island Sound where offshore archaeological resources could be present.

6.12.3.1 Western Alignment

The Western Alignment would run directly through the Schenck-Mann House, a listed property on the State and National Register (S/NR) of Historic Places. The bored tunnel option would be located well below the surface under this resource and no direct effects would be anticipated.

Correspondence with NYSOPRHP would take place once an alignment concept and design option has been identified for further consideration.

6.12.3.2 Central Alignment

According to the NR, there are no historic properties eligible, or listed, within the potential alignment.

6.12.3.3 Eastern Alignment

According to the NR, there are no historic properties eligible, or listed, within the potential alignment.

6.12.4 Historic Bridges

There are no bridges over 50 years old or listed in Connecticut or on NYSDOT's Historic Bridge Inventory that are located within any of the three potential alignments.

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6.12.5 Historic Parkways

None of the three potential alignments would have a potential to impact any Historic Parkways.

6.12.6 Native American Involvement

As this is a draft feasibility study, the proposed project would follow the Section 106 Process of the National Historic Preservation Act (36 CFR 800) in the future if and when alignment options are identified for further consideration. This would ensure compliance with this Archaeological Resources Protection Act. In addition, site visits, and archaeological investigations during a later phase in the design process will document places or artifacts of religious importance to Native Americans within the project impact area.

6.12.7 Section 4(f) Involvement

If and when future alignment concept and design options are identified for further assessment, NYSDOT would determine the need for Section 4(f) involvement and implement the coordination and completion of the Section 4(f) process.

6.13 PARKS AND RECREATIONAL RESOURCES

Parks and open space resources were identified using ArcGIS mapping; shapefiles were obtained through the NYSDEC GIS Clearinghouse and DEEP GIS Data inventory. Alignment concepts were then overlaid to determine any potential direct or indirect effects on open space resources.

6.13.1 Parks and Open Space

6.13.1.1 Western Alignment

The Western Alignment would traverse approximately 4.9 acres of the Tiffany Creek Preserve, a Nassau County-regulated open space resource. The bored tunnel option would be well below the surface of the preserve and there would be no direct impact on the open space resource. There are no open space resources near the Rye/Port Chester crossing.

6.13.1.2 Central Alignment

The Central Alignment would directly traverse approximately 124 acres of the Alfred E. Smith Sunken Meadow, a New York State-regulated park, on Long Island. Under the Kings Park to Bridgeport and Kings Park to Devon alignment concepts, there are no open space resources near the Bridgeport or Devon landings.

6.13.1.3 Eastern Alignment

The Eastern Alignment would run adjacent to Brookhaven State Park on Long Island. In addition, under the Wading River to New Haven concept, the alignment would directly traverse approximately 23.4 acres of East Shore Park in Connecticut. The bored tunnel options would be well below the surface and would have no direct impact on these open space resources. There are no open space resources near the Branford crossing that would be impacted under the Wading River to Branford alignment concept.

6.13.2 State Heritage Area Program

All three alignments run through the Long Island North Shore Heritage Area, which preserves and guides development for this area of Long Island. If and when alignment concept and design options

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are identified for further consideration, the effects on this Heritage Area would be evaluated. There were no Connecticut State Heritage Areas identified near the three alignments.

6.13.3 National Heritage Areas Program

None of the proposed alignments would affect National Heritage Areas.

6.13.4 National Registry of Natural Landmarks

There are no listed nationally significant natural areas within, or adjacent to, any of the three potential alignments.

6.13.5 Section 4(f) Involvement

If and when future alignment concept and design options are identified for further assessment, NYSODT would determine the need for Section 4(f) involvement and implement the coordination and completion of the Section 4(f) process.

6.13.6 Section 6(f) Involvement

The proposed alignment concepts are located adjacent to several public parks and preserves that may have been partially or fully federally funded through the Land and Water Conservation Act. If and when future alignment concept and design options are identified for further assessment, NYSDOT would determine the need for Section 6(f) involvement and implement the coordination and completion of the Section 6(f) process.

6.13.7 Section 1010 Involvement

The proposed alignment concepts are located adjacent to several public parks and preserves to which Urban Park and Recreation Recovery Program funds may have been applied. If and when future alignment concept and design options are identified for further assessment, NYSDOT will determine the need for Section 1010 involvement.

6.14 VISUAL RESOURCES

As this is a draft feasibility study, once alignment concept and design options are identified for further consideration, a visual resources assessment will be conducted in order to determine how the tunnel and/or bridge would impact the surrounding area.

6.15 FARMLANDS

6.15.1 State Farmland and Agricultural Districts

Based on a preliminary review of the NYS Agricultural District Maps for Nassau County and Suffolk County and a search for state farmland and agricultural districts in Connecticut, none of the three potential alignments are located in or adjacent to an Agricultural District. State farmland identification for Connecticut was collected through Connecticut DEEP GIS Data. Based on this data, the Eastern Alignment's Wading River to Branford alignment concept would intersect with Statewide Important Farmland Soils and would be located adjacent to Prime Farmland Soils in Connecticut. The Central Alignment's Kings Park to Bridgeport alignment concept intersects with Prime Farmland Soils and Statewide Important Farmland Soils in Connecticut. Therefore, if and when future alignment

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concept and design options are identified for further assessment, an assessment of impacts on Connecticut farmland would be conducted.

6.15.2 Federal Prime and Unique Farmland

Any of the three potential alignments could potentially convert prime or unique farmland, or farmland of state or local importance, as defined by the USDA Natural Resources Conservation Service, to a non-agricultural use.

6.16 AIR QUALITY

There is a direct correlation between air quality emissions and vehicle miles traveled (VMT). Based on the percent change in vehicle miles travelled (Table X), there is a 1 percent overall increase in VMT. The Eastern Alignment concept is the only concept to not see an increase in regional VMT and emissions, but only for the base assumption of a $20 automobile tolling scenario.

It is noted that the Western and Central Alignment concepts would shift traffic to less congested facilities in less dense areas; there would be a decrease in VMT within the five boroughs and an increase in VMT in the less congested areas on Long Island and in Westchester and Connecticut. This could result in a reduction in overall vehicle hours traveled (VHT) and delay. Consequently, even though there would be an overall increase in emissions, there could be some air quality benefits for New York City and Westchester.

If and when alignment concept and design options are identified for further consideration, a detailed air quality analysis would need to be performed for construction and operations.

6.17 ENERGY

An assessment of energy consumption would be addressed for any future alignment that is proposed. If and when alignment concept and design options are identified for further consideration, an assessment of energy consumption would be prepared.

6.18 CLIMATE CHANGE

If and when alignment concept and design options are identified for further consideration, an assessment of climate change would be addressed under the analysis of greenhouse gas emissions from construction and operations. The effect of climate change on the proposed project in terms of sea level rise and the need for resiliency measures in the future would also be addressed.

6.19 NOISE

Any of the three potential alignments would involve construction and operations within a populated area and, potentially, through protected open spaces or conservation areas. As this is a draft feasibility study, noise measurements were not conducted. However, a preliminary desktop study was conducted in order to assess the location of sensitive receptors. Sensitive receptors are defined as residential areas, schools and community facility uses, and open space. Specific impacts and potential mitigation related to the construction and operation within or adjacent to sensitive receptor

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locations would be analyzed if and when alignment concepts and options are identified for further consideration.

6.19.1 Western Alignment

The Western Alignment contains sensitive receptors that could be affected by construction and/or operational noise, including residential communities surrounding the Oyster Bay and Rye/Port Chester crossings as well as the Tiffany Creek Preserve and the Oyster Bay National Wildlife Refuge. The bored tunnel option would remove the potential for direct impacts by locating the alignment well below these sensitive receptors.

6.19.2 Central Alignment

The Central Alignment contains sensitive receptors that could be affected by construction and/or operational noise including sensitive open space resources on Long Island Alfred E. Smith Sunken Meadow Park) as well as the Great Meadows Critical Habitat and Long Beach/Pleasure Beach for the Bridgeport connection. The Kings Park to Devon alignment concept could have the potential to impact a residential neighborhood in Connecticut as well as community facility uses including West Shore Recreation facilities and Jonathan Law High School and athletic facilities near the Devon connection. The bored tunnel option would largely remove the potential for direct impacts by locating the alignment well below these sensitive receptors.

6.19.3 Eastern Alignment

The Eastern Alignment contains sensitive receptors that could be affected by construction and/or operational noise, including Brookhaven State Park on Long Island, East Shore Park on the New Haven connection, and residential neighborhoods near the Branford connection in Connecticut. The bored tunnel option would largely remove the potential for direct impacts by locating the alignment well below these sensitive

6.20 ASBESTOS

An asbestos screening was not performed as part of this draft feasibility study.

6.21 HAZARDOUS WASTE AND CONTAMINATED MATERIALS

A hazardous waste and contaminated materials site screening was not conducted as part of this draft feasibility study.

6.22 SOCIAL

Not applicable at this working stage of analysis. To be updated in later project phases.

6.23 ECONOMIC

Not applicable at this working stage of analysis. To be updated in later project phases.

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6.24 CONSTRUCTION EFFECTS

Not applicable at this working stage of analysis. To be updated in later project phases.

6.25 INDIRECT AND SECONDARY EFFECTS

Not applicable at this working stage of analysis. To be updated in later project phases.

6.26 CUMULATIVE EFFECTS

Not applicable at this working stage of analysis. To be updated in later project phases.

6.27 SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Not applicable at this working stage of analysis. To be updated in later project phases.

6.28 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Not applicable at this working stage of analysis. To be updated in later project phases.

6.29 ADVERSE ENVIRONMENTAL IMPACTS THAT CANNOT BE AVOIDED OR ADEQUATELY MITIGATED

Not applicable at this working stage of analysis. To be updated in later project phases.

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7 Capital Cost

7.1 METHODOLOGY

Order-of-magnitude capital costs were developed for each representative alignment concept in current year 2016 dollars. Highway/civil costs include all new paved road and structure that are required for the interchange connections beyond the proposed tunnel portal or proposed bridge anchorages/ approaches depending on if it is for a cross sound tunnel or bridge at the shoreline. All costs are developed based on square footage of new pavement or square footage of new structure. All costs were generated based on linear length of alignment.

Costs were distributed into the following disciplines of work:

Civil	▪ Pavement Reconstruction (concrete base, asphalt top course) ▪ Utility Construction / Relocation (20% of Reconstruction and Striping) ▪ Surface Drainage (catch basins, manholes and piping as a function of roadway length) ▪ Structure Drainage (scuppers, downspouts and water control, as a function of structure length) ▪ Toll Plaza construction (fixed cost on either end) ▪ ITS conduit/cameras (function of roadway length)
Traffic	▪ Striping (lane markings, as a function of roadway length and number of lanes) ▪ Traffic Signals (fixed cost per intersection) ▪ Overhead Sign Structures (fixed cost per structure)
Electrical	▪ Lighting fixtures and conduit (as a function of roadway length)
Structural	▪ Bridge superstructure, substructure and geotechnical (as a function of square footage of structure) ▪ Tunnel Portals (Each) ▪ North Bored Tunnel – Land Portion (Rock) (LF of Tunnel) ▪ North Bored Tunnel – Water Portion (Rock) (LF of Tunnel) ▪ North Bored Tunnel – Water Portion (Soil) (LF of Tunnel) ▪ South Bored Tunnel – Water Portion (Soil) (LF of Tunnel) ▪ South Bored Tunnel – Land Portion (Soil) (LF of Tunnel) ▪ Tunnel Boring Machine Cost (Each) ▪ Temporary Islands (Each) ▪ Tunnel Ventilation, Life/Safety (LF of Tunnel) ▪ Bridge Causeway Foundations (LF of Bridge) ▪ Bridge Causeway Superstructure (LF of Bridge) ▪ Bridge High Level Approach Foundations (LF of Bridge) ▪ Bridge High Level Approach Superstructure (LF of Bridge) ▪ Main Span Bridge Pylon Foundations (Each) ▪ Bridge Main Span Superstructure (LF of Bridge)

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Costs were developed based on preliminary layouts and quantity takeoffs. When multiple concepts and approaches were analyzed, only the more complex concept was quantified and costed for the above summary. Detailed capital cost backup can be found in Appendix B.

7.2 RESULTS

Table 7-1 through Table 7-3 present the capital cost estimates for the Western, Central, and Eastern Alignment concepts.

Table 7-1. Capital Cost – Western Alignment (billion 2016$)

Cost Item		Bridge Only to Rye/Port Chester	Tunnel Only to Rye/Port Chester (2 x 2 lanes, 1 tube)	Tunnel Only to Rye/Port Chester (2 x 3 lanes, 2 tubes)	Bridge/Tunnel to Rye/Port Chester
Construction					
Tunnel		$0.00	$19.67	$36.37	$23.45
Islands		$0.00	$0.53	$0.53	$2.57
Bridges		$5.01	$0.00	$0.00	$2.56
Highway/Civil		$0.17	$0.17	$0.17	$0.17
Total Construction		**$5.18**	**$20.37**	**$37.07**	**$28.75**
Soft Costs					
Design (PE/FD/PM)	15%	$0.78	$1.50	$1.50	$1.50
Construction Inspection	6%	$0.31	$1.34	$2.22	$1.73
Construction Support Services	2%	$0.10	$0.41	$0.74	$0.58
Insurance, Legal, Permits, Review Fees	3%	$0.16	$0.61	$1.11	$0.86
Total Soft Costs		**$1.35**	**$3.86**	**$5.57**	**$4.67**
Contingency (Design & Construction)	30%	$1.96	$7.27	$12.79	$10.03
Total (billions) 2016 $		**$8.49**	**$31.50**	**$55.43**	**$43.45**

Source: WSP

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Table 7-2. Capital Cost – Central Alignment (billion 2016$)

Cost Item		Bridge Only to Bridgeport	Bridge/Tunnel to Bridgeport	Bridge Only to Devon*	Bridge/Tunnel to Devon
Construction					
Tunnel		$0.00	$6.87	$0.00	$11.35
Islands		$0.00	$0.95	$0.00	$0.95
Bridges		$7.51	$6.16	$9.52	$7.58
Highway/Civil		$0.41	$0.41	$0.55	$0.41
Total Construction		**$7.92**	**$14.39**	**$10.07**	**$20.29**
Soft Costs					
Design (PE/FD/PM)	15%	$1.19	$1.50	$1.51	$1.50
Construction Inspection	6%	$0.47	$0.86	$0.60	$1.22
Construction Support Services	2%	$0.16	$0.29	$0.20	$0.41
Insurance, Legal, Permits, Review Fees	3%	$0.24	$0.43	$0.30	$0.61
Total Soft Costs		**$2.06**	**$3.08**	**$2.61**	**$3.74**
Contingency (Design & Construction)	30%	$2.99	$5.24	$3.83	$7.21
Total (billions) 2016 $		**$12.97**	**$22.71**	**$16.51**	**$31.24**

Source: WSP

* Costs were generated based on linear length of alignment

Table 7-3. Capital Cost – Eastern Alignment (billion 2016$)

Cost Item		Bridge Only to New Haven	Bridge/Tunnel to New Haven	Bridge Only to Branford*	Bridge/Tunnel to Branford
Construction					
Tunnel		$0.00	$11.56	$0.00	$9.32
Islands		$0.00	$0.95	$0.00	$0.95
Bridges		$9.08	$7.78	$8.70	$7.40
Highway/Civil		$0.55	$0.55	$0.50	$0.55
Total Construction		**$9.63**	**$20.84**	**$9.20**	**$18.22**
Soft Costs					
Design (PE/FD/PM)	15%	$1.44	$1.50	$1.38	$1.50
Construction Inspection	6%	$0.58	$1.25	$0.55	$1.09
Construction Support Services	2%	$0.19	$0.42	$0.18	$0.36
Insurance, Legal, Permits, Review Fees	3%	$0.29	$0.63	$0.27	$0.55
Total Soft Costs		**$2.50**	**$3.79**	**$2.38**	**$3.50**
Contingency (Design & Construction)	30%	$3.64	$7.39	$3.50	$6.52
Total (billions) 2016 $		**$15.77**	**$32.02**	**$15.08**	**$28.24**

Source: WSP

The Hybrid alignment concept connects the LIE to I-95 via Kings Park, NY and Rye/Port Chester in Westchester County. The potential crossing of about 26 miles (shoreline to shoreline) could consist of

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a bridge structure or a bridge-tunnel combination. In any scenario, the alignment concept would extend the existing Sagtikos State Parkway at the interchange with I-495 to the Sunken Meadow Parkway north approximately 8.5 miles to a causeway structure between the Sunken Meadow Park and the Alfred E. Smith Golf Course. The bridge structure would continue northwest as a causeway approximately 24 miles across the Long Island Sound with a long span navigational clearance section near the center of the structure. The existing Sunken Meadow Parkway is classified as a parkway in its current configuration and does not allow commercial vehicles. All the existing bridge structures have non-standard commercial vehicle clearance. These would require replacement reconstruction to create the clearance required for a commercial traffic route and State legislative action to change the classification.

Although a bridge only concept is possible, it is recommended that when approaching Rye/Port Chester, the alignment transition into a tunnel structure (roughly 1 mile off shore) due to the dense residential land use along the Rye waterfront. The proposed tunnel would then portal to grade close to the existing I-95/I-287 interchange.

Order-of-magnitude capital costs were developed for each representative alignment concept in current year 2016 dollars. Highway/civil costs include all new paved road and structure that are required for the interchange connections beyond the proposed tunnel portal or proposed bridge anchorages/ approaches depending on if it is for a cross sound tunnel or bridge at the shoreline. All costs are developed based on square footage of new pavement or square footage of new structure.

Table 7-4: Capital Cost – Hybrid Alignment (billion 2016$)

Cost Item		Kings Park to Rye/Port Chester Bridge Only	Kings Park to Rye/Port Chester Bridge/Tunnel
Tunnel		$0.00	$6.87
Islands		$0.00	$0.95
Bridges		$10.28	$9.21
Highway/Civil		$0.41	$0.41
Total Construction		**$10.69**	**$17.44**
Design (PE/FD/PM)	15%	$1.60	$1.50
Construction Inspection	6%	$0.64	$1.05
Construction Support Services	2%	$0.21	$0.35
Insurance, Legal, Permits, Review Fees	3%	$0.32	$0.52
Total Soft Costs		**$2.78**	**$3.42**
Contingency (Design & Construction)	30%	$4.04	$6.26
Total (billions) 2016 $		**$17.50**	**$27.11**

Source:

7.3 COST BENCHMARKING

A cost benchmarking exercise was conducted to compare the alternatives developed for this study to other projects in the region and U.S. Table 7-5 and 7-6 outline recent bridge and tunnel infrastructure cost estimates. Recent bridge projects include the Mario M. Cuomo (Tappan Zee) Bridge and the Kosciuszko Bridge. The first span of the Mario M. Cuomo Bridge was completed in 2017, and the second span is expected to be completed in 2018. Similarly, the Kosciuszko Bridge completed Phase 1 of the project in 2017; however, the project is not expected to be completed until in 2019. The comparative tunnel projects include the proposed Gateway Tunnel, the Port of Miami Tunnel, and the Alaskan Way Viaduct Replacement Tunnel. Construction for the proposed

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Gateway Tunnel has not started, however it is expected to be completed by 2026. The Port of Miami Tunnel opened to traffic in 2014. The Alaskan Way Viaduct Replacement Tunnel began construction in 2011 and is expected to be completed in 2023. The cost estimates are intended to create a high-level benchmark comparison with costing estimates for the Long Island Sound scenarios.

Table 7-5: Capital Costs – Bridge Projects

Bridge	Length (mi)	Capital Cost	Cost per Mile
Mario M. Cuomo Bridge	3.0	$4.0 B	$1.3 B
Kosciuszko Bridge	1.9	$0.9 B	$0.5 B
Hybrid Alignment	26.0	$17.5 B	$0.7 B

Table 7-6: Capital Cost Comparison – Western Alignment

TUNNEL PROJECT NAME	LENGTH (MI)	CAPITAL COST (BILLION $)	COST PER MILE (BILLION $)
Gateway Tunnel	4.5	$12.7	$2.8
Port of Miami Tunnel	0.8	$1.2	$1.5
Alaska Way Viaduct	2.0	$3.2	$1.6
Western Alignment (3 lanes each way/2 tubes)	**18.0**	**$55.4**	**$3.1**
Western Alignment (2 lanes each way/1 tube)	**18.0**	**$31.5**	**$1.8**

Source: WSP

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8 Demand and Tolling

8.1 METHODOLOGY

The demand analysis utilizes the latest version of NYMTC's regional travel demand model, the New York Best Practices Model (NYBPM) 2010. The NYBPM simulates trips made by auto, transit, and commercial modes on an average weekday. It covers 28 counties in the tri-state area, and includes external components to model travel that originates or is destined outside of the region. The model simulates the production and geographic distribution of trips, as well as the choice of mode and assignment to paths on the regional highway network. This allows the NYBPM to capture the potential effects of a LI Sound Crossing facility in terms of both shifts in destinations and routing.

This means that people who would not have considered crossing the LI Sound without the Crossing facility may now choose to cross it because of the reduced travel time. For example, although very few residents of Westchester, Fairfield, and New Haven Counties commute to Long Island now, the model estimates how many people would possibly decide to commute to Long Island with the improved travel times due to the Crossing facility. This is captured through a destination choice model that accounts for both the availability of destinations (e.g. total employment, for work trips, retail employment for shopping/discretionary trips, etc.) and the time and cost required to reach them.

The travel demand model was run for a 2040 forecast year for three alignment scenarios – Western, Central, and Eastern, as previously described. For each scenario, a link was added into the NYBPM highway network to represent the Crossing facility, with three lanes in each direction. Bi-directional tolls were analyzed at two levels (Table 8-1). The first toll scenario was chosen as a likely toll value for a facility of this size (for comparison, the Chesapeake Bay Bridge currently charges a toll for autos of either $13 or $15 depending on the season). The second toll scenario was run as a test to represent the Crossing as an analog to the nearest existing facilities, the Throgs Neck and Bronx Whitestone Bridges, and to estimate an upper limit on the potential demand for the facility. The medium and heavy truck toll rates were calculated relative to the auto tolls, based on similar ratios from other regional facilities.

Table 8-1: Two Concept Tolling Scenarios (by Vehicle Class)

TOLL SCENARIO	AUTO	MEDIUM TRUCK	HEAVY TRUCK
Toll Scenario 1 ($20)	$20	$40	$80
Toll Scenario 2 ($7.50)	$7.50	$15	$30

Source:

For each alignment and toll concept, the model was run for three global iterations, feeding level of service (travel time and cost) information back into the core demand models. This feedback process allows the transportation system to reach an equilibrium with demand, as changes in the distribution of trip origins and destination impact congestion levels and travel times, and vice-versa. This represents people's long-term decision-making and travel behavior, and the impacts that would be seen on a long-time scale. This makes the equilibrated model results appropriate to represent the 2040 model forecast year.

Additionally, the Crossing facility was added to the national-level highway network, which is used to predict personal and commercial travel from areas external to the 28-county NYBPM region. The

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final output of the demand model includes traffic volumes by vehicle class (including a breakdown of autos and trucks), as well as congested travel times, on each highway network link.

8.2 RESULTS

The travel demand model predicts both the potential volume of traffic on the Crossing facility as well as regional mobility impacts. Note that in this section, the tolling scenarios are referenced by the auto toll value ($20 or $7.50).

8.2.1 Crossing Volumes

The demand model predictions of the year 2040 volumes on the Long Island Sound Crossing are shown in Table 8-2. For the $20 tolling scenario, the Western and Central Alignments are predicted to carry daily volumes of about 87,000 vehicles. Under the lower tolling scenario, the Crossing is expected carry a maximum of about 113,000 daily vehicles, in the Western Alignment. These trips contain a combination of existing trips and new trips generated from a new crossing. Further from most major Long Island employment centers, the Eastern Alignment sees less than two-thirds of the traffic volume that is predicted for the Western and Central Alignments. In all scenarios, the peak direction of travel in the AM period is southbound, meaning that more people use the Crossing to commute from Connecticut and Westchester or other Upstate NY counties to Long Island than the reverse. However, this is more balanced under the Western Alignment and most prevalent under the Eastern Alignment, where the northbound AM peak traffic is just over half of the southbound traffic.

Table 8-2. Demand Model Predictions of 2040 Bi-Directional Crossing Traffic Volumes

	Western $20	Western $7.50	Central $20	Central $7.50	Eastern $20	Eastern $7.50
Daily Auto Flow	82,681	106,927	86,430	106,946	54,347	67,809
Daily Truck Flow	3,679	6,032	1,162	1,472	1,126	1,310
Daily Total Flow	**86,359**	**112,959**	**87,593**	**108,418**	**55,473**	**69,119**
AM Period (6 – 10am) Ratio of NB to SB Traffic	0.80	0.88	0.61	0.65	0.54	0.55

The demand model predictions of the year 2040 volumes for the Throgs Neck Bridge and the Bronx Whitestone Bridge are shown in Table 8-3. The volumes for both bridges compared to Western and Central alignments are slightly higher, but significantly higher than the Eastern. Similarly, there is a higher percentage of daily truck flow when compared to each of the Long Island Sound crossings.

Table 8-3. Demand Model Predictions of 2040 Bi-Directional Throgs Neck Bridge & Bronx Whitestone Bridge Volumes (No Long Island Sound Crossing)

	Throgs Neck Bridge ($7.50)	Bronx Whitestone Bridge ($7.50)
Daily Auto Flow	117,730	130,004
Daily Truck Flow	19,436	24,368
Daily Total Flow	137,167	154,372
AM Period (6 – 10am) Ratio of NB to SB Traffic	0.72	1.05

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8.2.2 Aggregate Travel Measures

The demand model output was also analyzed in terms of more aggregate impacts, such as vehicle miles traveled (VMT), vehicle hours travelled (VHT), and vehicle hours of delay (VHD). Because the Crossing facility attracts traffic from the areas around its end points, VMT generally increases in the counties nearest the starting and ending points of each alignment (Table 8-4). Because this traffic is being diverted from other parts of the region, other counties see reductions in VMT, and the overall impact (including Manhattan, Queens, Bronx, Brooklyn, Nassau, Suffolk, Westchester, Fairfield, and New Haven Counties) is expected to be a 1% or less increase in VMT.

Table 8-4. Percentage Change in Vehicle Miles Traveled

%Diff: VMT	Western $20	Western $7.5	Central $20	Central $7.5	Eastern $20	Eastern $7.5
Manhattan	-1%	-1%	-1%	-1%	-1%	-1%
Queens	-1%	-1%	-1%	-1%	-1%	-1%
Bronx	-2%	-2%	-2%	-3%	-2%	-2%
Brooklyn	-1%	-1%	-1%	-1%	-1%	-1%
Nassau	6%	8%	0%	0%	0%	0%
Suffolk	1%	1%	8%	10%	5%	6%
Westchester	1%	2%	-2%	-3%	-2%	-2%
Fairfield	1%	1%	-2%	-3%	-2%	-2%
New Haven	0%	0%	1%	1%	1%	1%
Total	**1%**	**1%**	**1%**	**1%**	**0%**	**1%**

Source:

VHT and VHD follow similar patterns, with increases in the counties nearest the ends of the facility, where an increase in vehicle miles traveled is expected. Unlike VMT, however, the overall change in VHT (Table 8-5) and VHD (Table 8-6) is a net decrease. Thus, while overall VMT increases, traffic has shifted to less congested facilities in less dense areas, so the overall VHT and delay see a small decrease.

Table 8-5. Percentage Change in Vehicle Hours Traveled

%Diff: VMT	Western $20	Western $7.5	Central $20	Central $7.5	Eastern $20	Eastern $7.5
Manhattan	-3%	-4%	-3%	-3%	-3%	-3%
Queens	-3%	-3%	-2%	-2%	-2%	-3%
Bronx	-7%	-8%	-5%	-6%	-5%	-5%
Brooklyn	-2%	-2%	-2%	-2%	-2%	-2%
Nassau	3%	5%	0%	1%	-1%	0%
Suffolk	1%	1%	5%	8%	3%	5%
Westchester	1%	2%	-3%	-4%	-2%	-3%
Fairfield	1%	2%	-2%	-3%	-2%	-3%
New Haven	0%	0%	1%	2%	2%	2%
Total	**-1%**	**0%**	**0%**	**0%**	**-1%**	**-1%**

Table 8-6. Percentage Change in Vehicle Hours of Delay

%Diff: VMT	Western $20	Western $7.5	Central $20	Central $7.5	Eastern $20	Eastern $7.5
Manhattan	-7%	-7%	-6%	-6%	-6%	-6%
Queens	-5%	-6%	-4%	-4%	-4%	-5%

Bronx	-14%	-17%	-10%	-12%	-8%	-10%
Brooklyn	-3%	-4%	-3%	-3%	-3%	-3%
Nassau	1%	4%	0%	1%	-1%	-1%
Suffolk	2%	2%	6%	11%	3%	4%
Westchester	2%	6%	-10%	-12%	-8%	-10%
Fairfield	6%	7%	-10%	-12%	-8%	-11%
New Haven	0%	1%	3%	4%	6%	7%
Total	**-3%**	**-3%**	**-3%**	**-2%**	**-3%**	**-3%**

8.2.3 Mobility Indicators

The demand model also provides indicators of increased mobility between different points in the metropolitan region. For example, point-to-point travel times can be compared with and without the Crossing facility (Table 8-7). The Western Alignment Crossing facility has the capability to reduce the travel time between Stamford and either Republic or MacArthur Airports from over 2 hours to 70 to 80 minutes. The Central and Eastern Alignments with a $20 toll reduce the travel time between New Haven and the Long Island Airports by more than half.

Table 8-7. Travel Time (minutes) Between Stamford/New Haven and Republic/MacArthur Airport

			Western		Central		Eastern	
Origin	Destination	No Build	$20	$7.5	$20	$7.5	$20	$7.5
Stamford	Republic Airport	137	69	79	105	120	130	129
	MacArthur Airport	145	78	88	98	113	117	122
New Haven	Republic Airport	193	124	134	95	112	105	110
	MacArthur Airport	201	134	143	88	105	71	76

These reductions in travel times represent the Crossing's potential to link areas that are now largely inaccessible to one another. This can be visualized through isochrones maps, which show the areas accessible within bands of travel time from a selected point. Figure 8-1 through Figure 8-4 show selected isochrones for the Long Island employment centers that see the largest increase in commuter sheds under each of the potential crossing alignments. Appendix C includes a complete set of isochrone maps for 9 employment centers in Connecticut and Long Island, under all six alignment and tolling assumptions, compared to a "no build" condition without the Crossing.

For example, Figure 8-2 compares the areas that can reach the Route 110 Corridor on Long Island within different travel time bands, with and without the Crossing, under the Western Alignment with a $20 toll. Areas in Westchester and Connecticut that were previously over two hours' drive from Route 110 are now within 60 minutes of the corridor. This results in over 350,000 additional workers being able to access the Route 110 corridor within 60 minutes, expanding the labor market of this key Long Island employment center.

Similarly, Figure 8-3 show the cross-sound travel time impacts of the Central Alignment, for access to Ronkonkoma. These improvements in accessibility to Ronkonkoma correspond to an addition of 600,000 workers to the potential labor force within a 90-minute drive, though this is considered beyond a typical commute and would not influence new trip-making to the same extent.

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Figure 8-1. Crossing Alignments and Selected Points for Travel Time Analysis

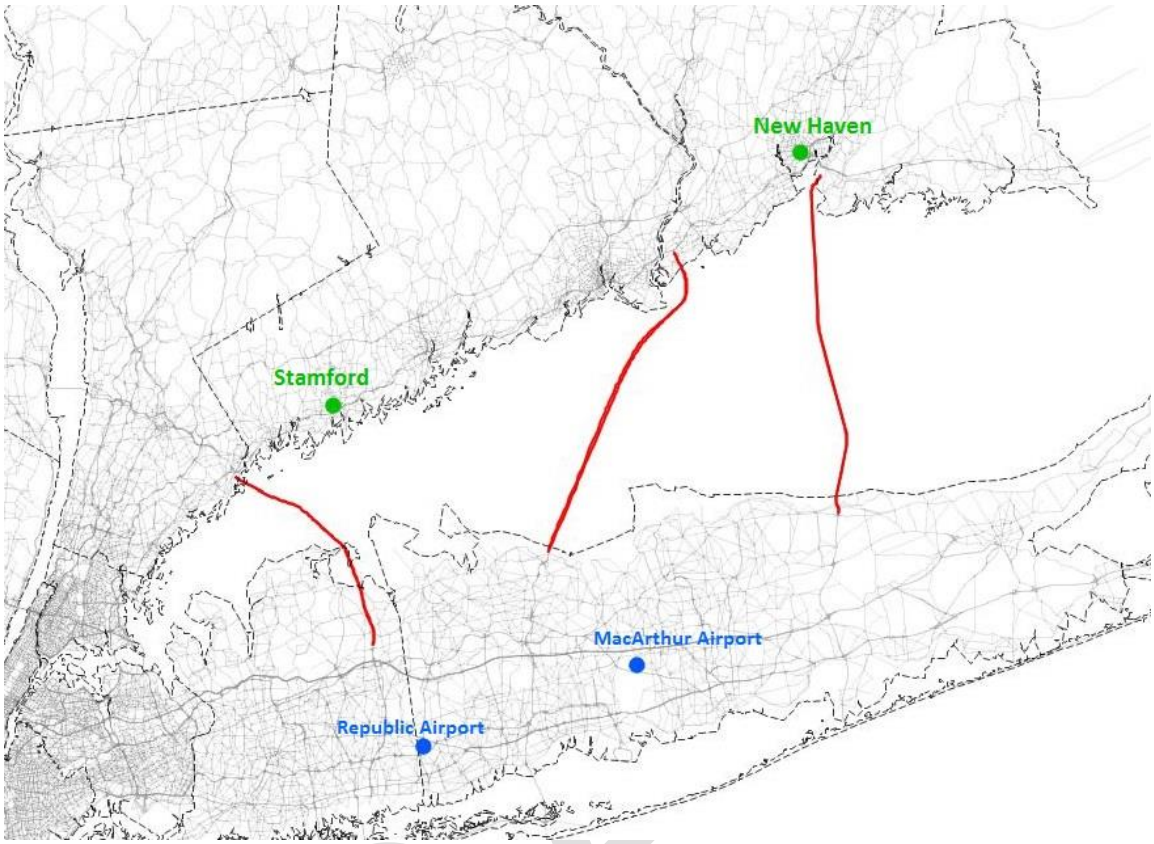

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Figure 8-2. Isochrone Map of Travel Times to Route 110 Corridor with and without the Western Crossing

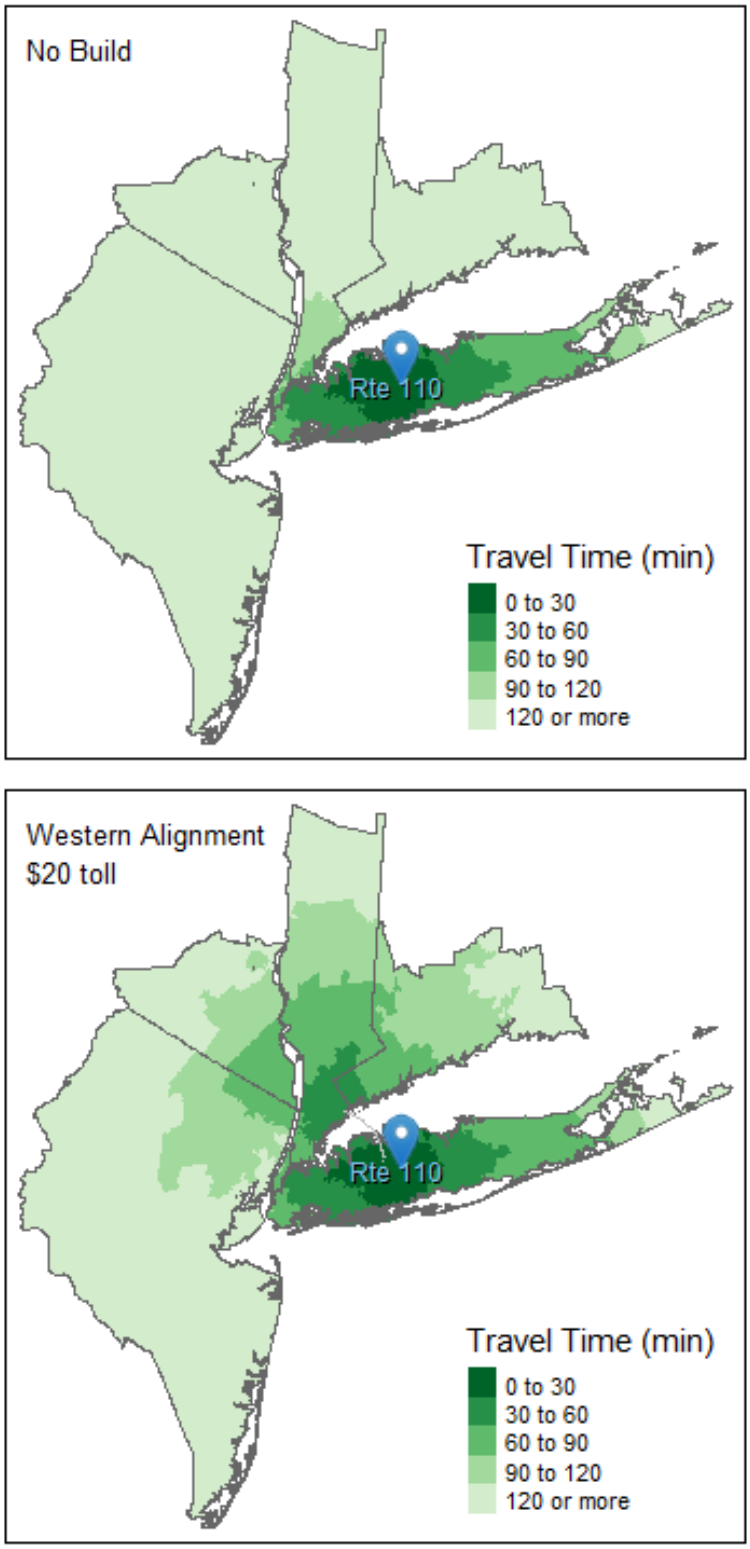


Figure 8-3. Isochrone Map of Travel Times to Ronkonkoma with and without the Central Crossing

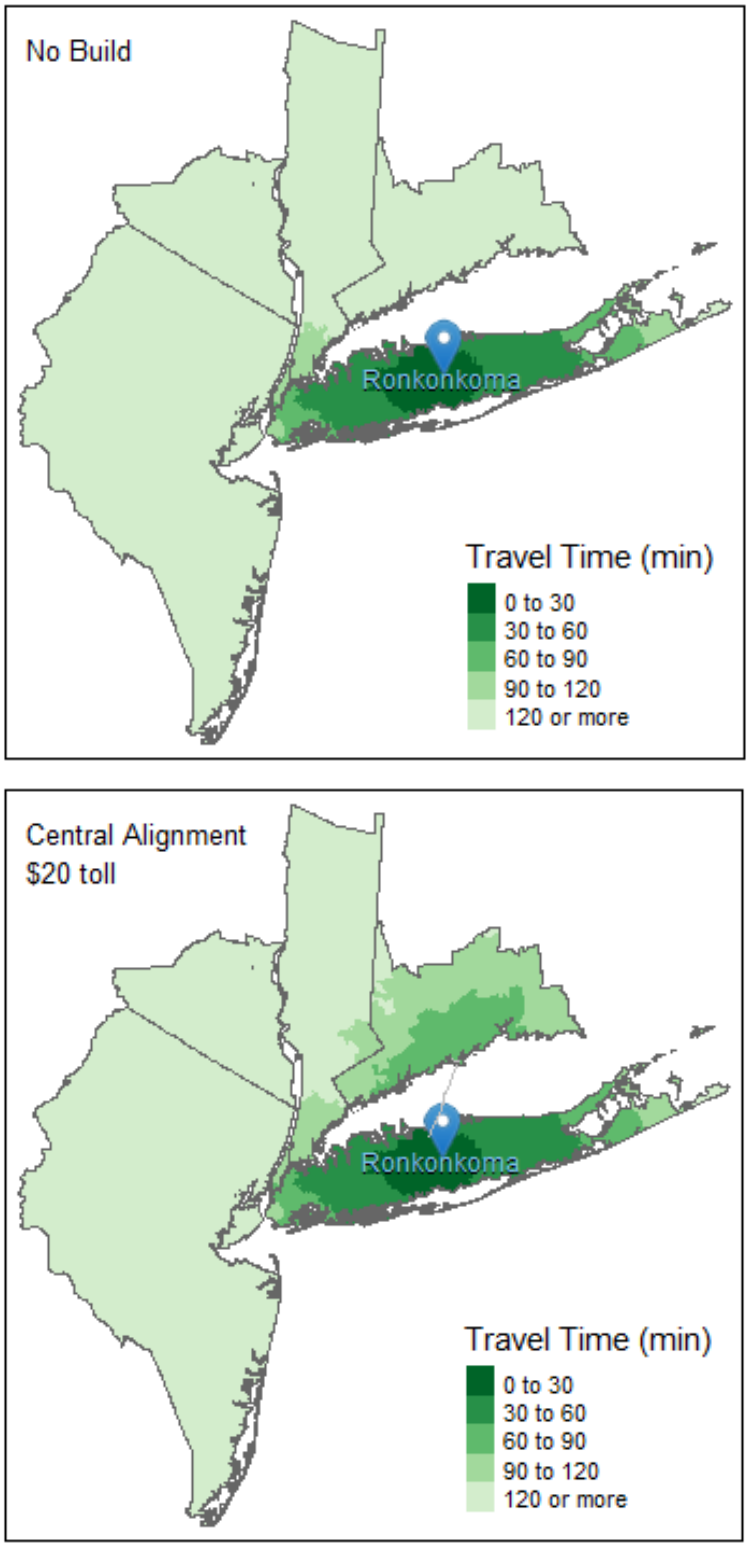
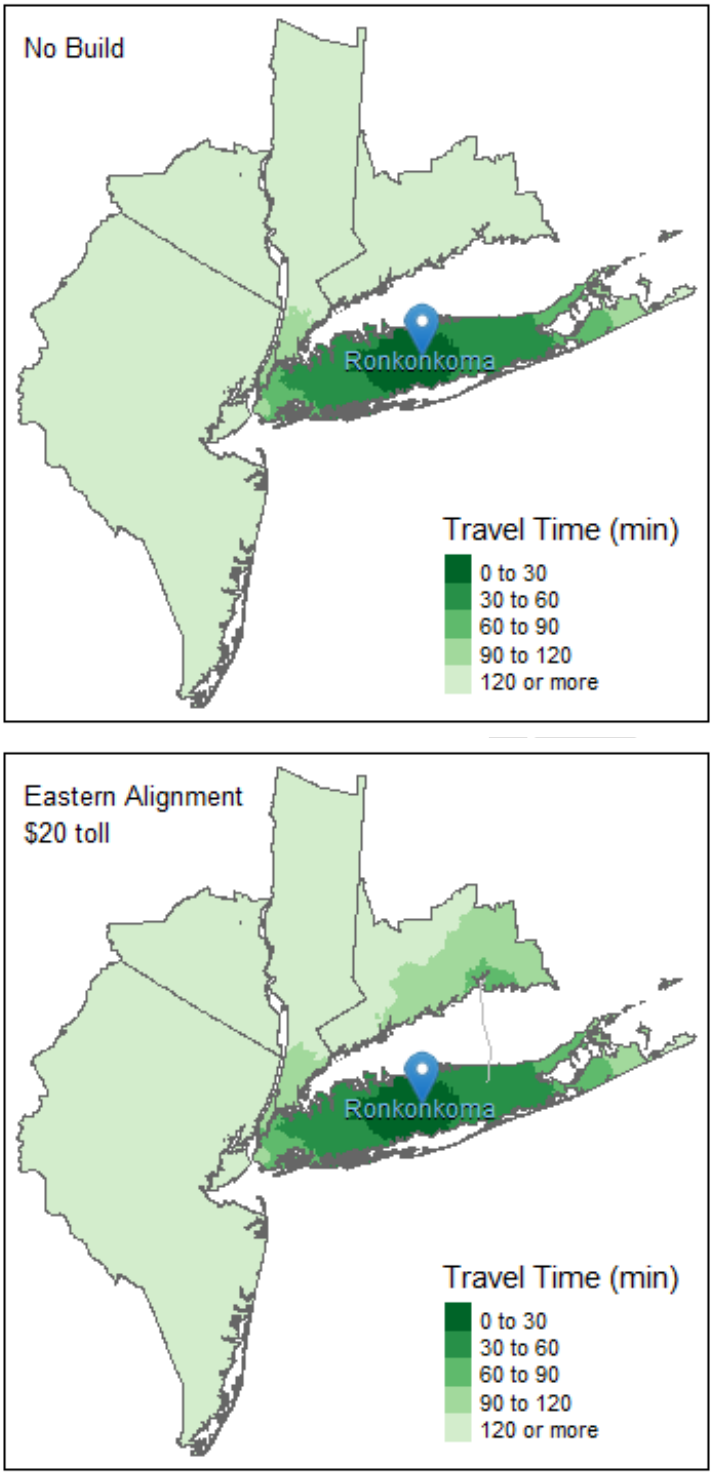


Figure 8-4. Isochrone map of Travel Times to Ronkonkoma with and without the Eastern Crossing



8.3 SUPPLEMENTAL REVENUE ANALYSIS

The regional travel demand model (the latest 2010 base year version of NYMTC's New York Best Practices Model, or NYBPM) was used to analyze toll revenues for various crossing alternatives. The NYBPM simulates the production and geographic distribution of trips, as well as the choice of mode and assignment to paths on the regional highway network. This allows the model to capture the potential effects of a LI Sound Crossing facility in terms of both shifts in destinations and routing. This means that people who would not have considered crossing the LI Sound without the crossing facility may now choose to cross it because of the reduced travel time.

The travel demand model was run for a 2040 forecast year for four alignment scenarios – Western, Central, Eastern, and Hybrid. In the original analysis, a $7.50 and a $20 toll were analyzed for each alignment. For this supplemental analysis, a wide range of toll values was analyzed to estimate the revenue maximizing average toll. This is the point where the trade-off between losses in traffic due to increase in cost causes the total revenue to drop. This gives an idea of the maximum possible revenue that can be collected based on the demand for travel on each alignment.

Because autos are by far the dominant mode using the crossing facility, the average toll in each scenario is close to the auto toll value. For most scenarios, medium and heavy trucks are charged higher tolls, based on similar ratios from other regional facilities.

The figures in this section show the rise and fall of annual revenue and steady decline in daily traffic as the toll value increases. Each revenue graph is accompanied by a table that provides the detailed toll assumptions and results from each modeled scenario. The table also includes the AM Southbound Volume Over Capacity (VOC) ratios for a 2-lane or 3-lane facility, at the predicted level of traffic demand. While the Daily Traffic is reported in vehicles, the VOC is calculated by physical car equivalent (PCE), which accounts for the additional roadway space taken up by trucks. The AM Southbound direction is expected to be the peak period and direction of traffic on the crossing. This information is included for reference, to indicate whether a two-lane facility would be sufficient to handle the predicted 2040 traffic demand.

The results of this analysis indicate that the Western and Central alignments have substantially higher revenue-generating potential than the Eastern or Hybrid alignments. The Western alignment, which is closer to the lower-priced Throgs Neck and Bronx Whitestone Bridges, logically has a revenue maximum point at a lower toll value than the other alignments, because it competes more directly with the existing lower-tolled bridges. The Central alignment, on the other hand, serves a market of new Cross-Sound demand, which is less sensitive to increased toll values. The Eastern alignment proves to be even less toll sensitive, because of the extreme travel time and distance of traveling between the two regions without the Eastern crossing. However, because the Eastern traffic demand is substantially lower to begin with, due to lower population and employment in the vicinity of the facility landings, it does not provide optimal revenue streams.

The Hybrid alignment shows lower traffic demand than the other alternatives. Although it links the northern landing of the Western crossing with the southern landing of the Central crossing, it does not provide as direct a linkage between population and employment centers. Residents of the Rye area can reach employment centers on Long Island (i.e. along the Route 110 corridor) in similar travel times via the Throgs Neck Bridge as they would via the Hybrid crossing. For Westchester residents in the vicinity of the northern Hybrid landing, New York City employment centers are more easily accessible than those reachable via the crossing. In contrast, the Western alignment provides

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a faster linkage to Long Island employment centers, and the Central alignment improves access to jobs for residents who already may have to travel longer to reach major employment centers.

The Central alignment shows the greatest potential for drawing revenue, with a maximum annual revenue of almost $700 million predicted with an auto toll of $45. This corresponds to an average weekday traffic volume of about 55,000 vehicles, in both directions. In the AM Southbound direction, a two-lane facility would provide sufficient capacity to carry this level of traffic at a reasonably good level of service (C).

Table 8-8: Revenue vs. Toll Detail – Western Alignment

Auto Toll	Med. Truck Toll	Heavy Truck Toll	Avg Toll	Daily Revenue	Annual Revenue	Daily Traffic (NB + SB)	AM SB Traffic	
							2 lanes VOC*	3 lanes VOC*
$7.50	$15.00	$30.00	$8.39	$947,000	$260,000,000	112,959	1.28	0.85
$20.00	$40.00	$80.00	$21.91	$1,891,000	$520,000,000	86,359	1.09	0.73
$25.00	$50.00	$100.00	$27.25	$2,024,000	$556,000,000	74,307	0.98	0.65
$30.00	$60.00	$120.00	$32.84	$1,929,000	$530,000,000	58,768	0.83	0.55
$75.00	$75.00	$75.00	$75.00	$752,000	$207,000,000	10,039	0.23	0.16
$100.00	$100.00	$100.00	$100.00	$657,000	$180,000,000	6,577	0.17	0.11

* Assuming 2000 veh/lane capacity

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Figure 8-5: Revenue vs. Toll Grap – Western Alignment

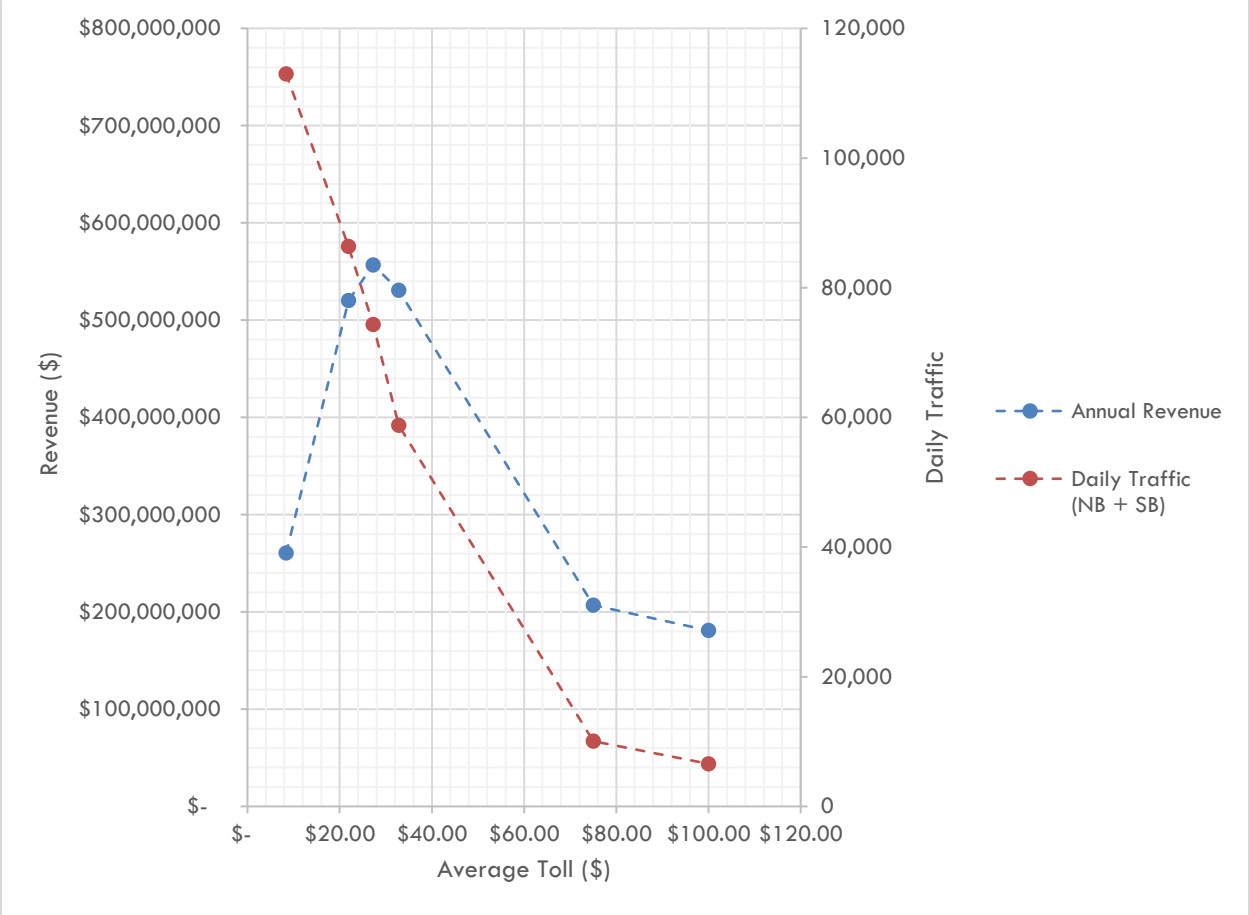

Table 8-9: Revenue vs. Toll Detail – Central Alignment

Auto Toll	Med. Truck Toll	Heavy Truck Toll	Avg Toll	Daily Revenue	Annual Revenue	Daily Traffic (NB + SB)	AM SB Traffic	
							2 lanes VOC*	3 lanes VOC*
$7.50	$15.00	$30.00	$7.72	$836,989	$230,172,107	108,418	1.29	0.86
$20.00	$40.00	$80.00	$20.57	$1,801,440	$495,396,076	87,593	1.11	0.74
$35.00	$70.00	$140.00	$36.11	$2,411,966	$663,290,765	66,798	0.88	0.59
$45.00	$90.00	$180.00	$46.34	$2,543,059	$699,341,340	54,879	0.75	0.50
$50.00	$100.00	$200.00	$51.46	$2,501,157	$687,818,042	48,604	0.66	0.44
$75.00	$75.00	$75.00	$75.00	$1,511,961	$415,789,227	20,159	0.29	0.19

* Assuming 2000 veh/lane capacity

Figure 8-6: Revenue vs. Toll Graph – Central Alignment

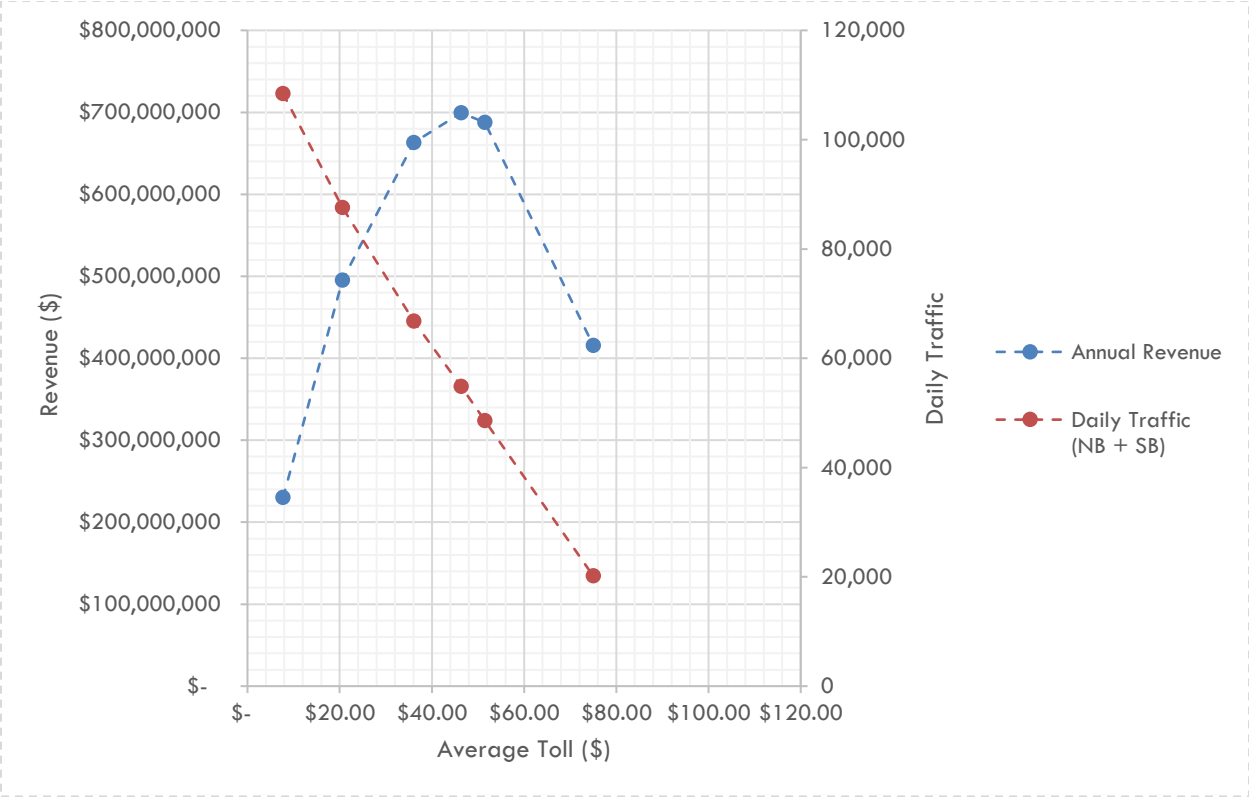

Table 8-10: Revenue vs. Toll Detail – Eastern Alignment

Auto Toll	Med. Truck Toll	Heavy Truck Toll	Avg Toll	Daily Revenue	Annual Revenue	Daily Traffic (NB + SB)	AM SB Traffic	
							2 lanes VOC*	3 lanes VOC*
$7.50	$15.00	$30.00	$7.80	$538,786	$148,166,209	69,119	0.90	0.60
$20.00	$40.00	$80.00	$20.83	$1,155,618	$317,794,838	55,473	0.72	0.48
$50.00	$100.00	$200.00	$52.52	$1,688,430	$464,318,165	32,149	0.41	0.27
$75.00	$75.00	$75.00	$75.00	$1,442,383	$396,655,415	19,232	0.25	0.17
$100.00	$100.00	$100.00	$100.00	$946,478	$260,281,479	9,465	0.12	0.08

* Assuming 2000 veh/lane capacity

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Figure 8-7: Revenue vs. Toll Graph – Eastern Alignment

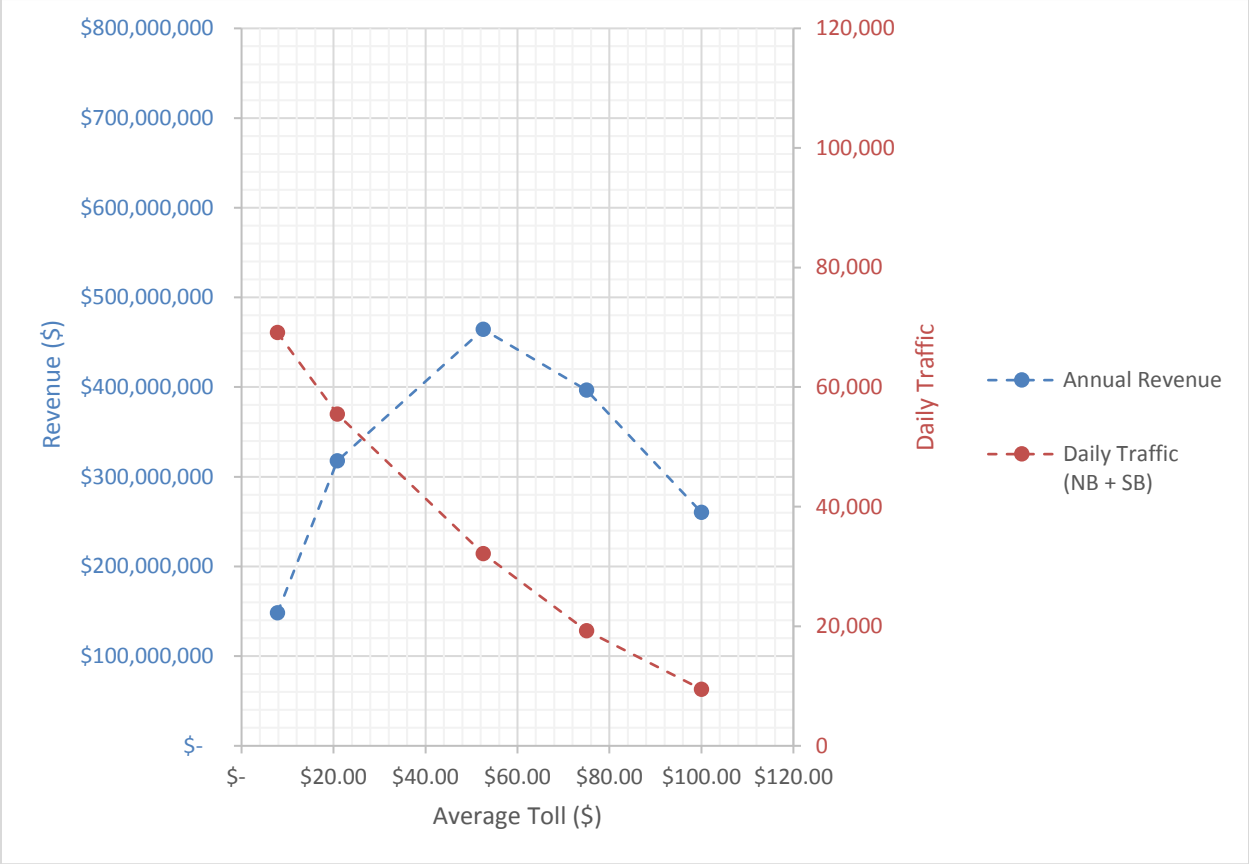
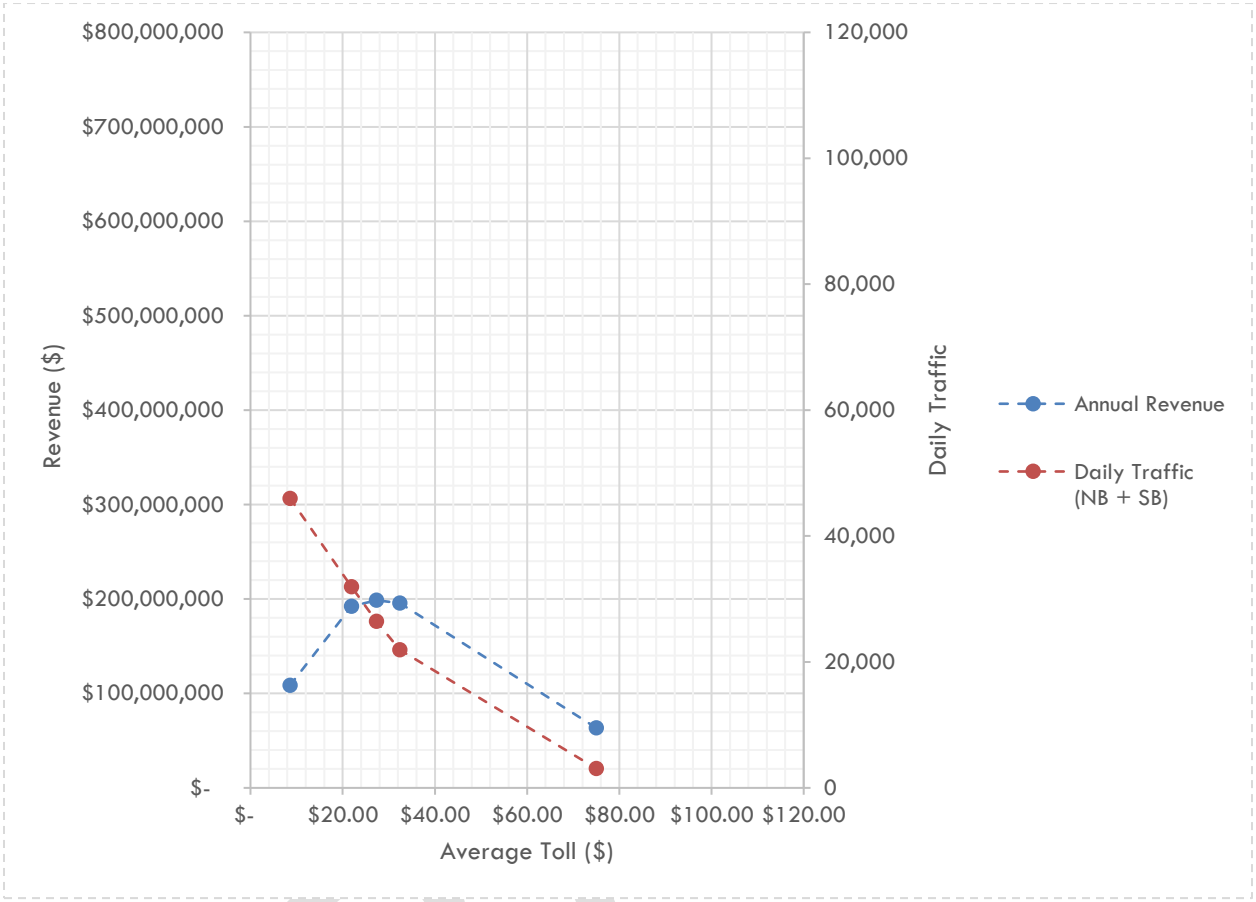


Table 8-11: Revenue vs. Toll Detail – Hybrid Alignment

Auto Toll	Med. Truck Toll	Heavy Truck Toll	Avg Toll	Daily Revenue	Annual Revenue	Daily Traffic (NB + SB)	AM SB Traffic 2 lanes VOC*	AM SB Traffic 3 lanes VOC*
$7.50	$15.00	$30.00	$8.58	$394,665	$108,532,999	45,993	0.49	0.33
$20.00	$40.00	$80.00	$21.89	$698,870	$192,189,332	31,927	0.33	0.22
$35.00	$70.00	$140.00	$27.30	$722,372	$198,652,273	26,457	0.28	0.19
$45.00	$90.00	$180.00	$32.41	$711,165	$195,570,340	21,944	0.23	0.16
$75.00	$75.00	$75.00	$75.00	$231,100	$63,552,414	3,081	0.07	0.05

* Assuming 2000 veh/lane capacity

Figure 8-8: Revenue vs. Toll Graph – Hybrid Alignment



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9 Economic Benefits

A new crossing would provide economic benefits on both sides of the Long Island Sound, providing access to and from key Long Island/Westchester employment corridors and residential/commercial hubs (Figure 9-1). It would provide access to a greater pool of workers to support employment opportunities on either end of a new Western Alignment crossing. For example, employers in the Route 110 corridor would be able to attract a broader workforce within a reasonable commuting time. The dark purple on the maps in Figure 9-1 show travel to/from Rt. 110 under one hour for existing and future conditions. The Western Alignment would provide expanded access to Rt. 110, with a new employment base well into Westchester and Fairfield Counties.

Figure 9-1: Key Study Area Corridors and Hubs

Source: WSP

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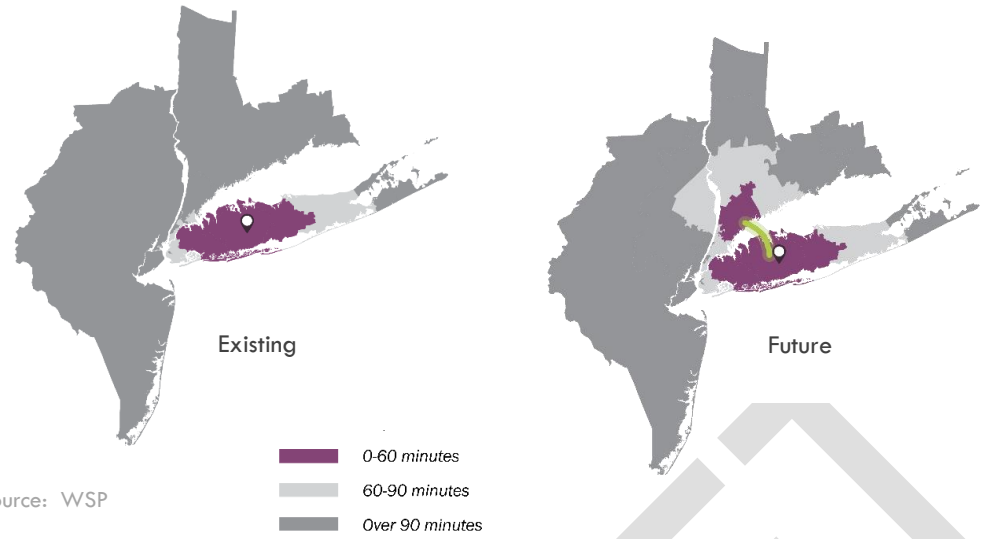
Figure 9-2: Existing and Future Travel to/from Route 110



Source: WSP

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10 Financial and Funding Considerations

10.1 ASSESSMENT OF PUBLIC-PRIVATE CONSIDERATIONS

As noted above, there is a maximum revenue opportunity based on balancing the highest possible toll with the highest possible volume before any increased toll results in a drop-off in demand that reduces overall revenue potential. The Central Alignment has the greatest revenue potential at about $699 million, followed by the Western Alignment at about $556 million and the Eastern Alignment at about $464 million. These revenues certainly can offset annual operating costs and some portion of the annualized cost to build a proposed crossing. This section summarizes how this might affect a Public Private Partnership (P3) or other alternative approach to engage private development and/or capital in a Long Island Sound Crossing initiative.

As shown in Table 10-1 through Table 10-3, considering industry norms and typical applications, this is a very large project and while it has the potential for P3 participation, its total cost would essentially preclude a fully privatized response. For the Western Alignment, if a private entity could raise sufficient capital to build the roughly $40 to $50 billion facility (which would be unlikely) and could retain all the toll revenue from bridge operations, that revenue would only cover a small portion of the annual carrying costs through a debt service period. For a simplified example, if a $40 billion bond at 4 percent over 40 years could be obtained, it would yield an annual carrying cost of about $2 billion of which toll revenue could possibly represent about 25 percent coverage of the debt service.

More practically, private development partnership would be "availability" based where the private equity investment is only a part of the total financing and other revenues for construction and operation are made available through public sources. WSP Advisory Services has provided guidance and implementation strategies for a variety of large-scale P3 projects around the country. Their experience indicates that the private sector has a $1 billion to $1.5 billion ceiling on debt tolerance which typically requires the additional availability of debt and capital finance across a wide array of public sources, including federal grants, federal loans such as Transportation Infrastructure Finance and Innovation Act (TIFIA), state and local agency contributions, and other opportunities. Leveraging some portion of cost through private equity or privately held debt, as well as the ability to take advantage of private design, build, operate contracts may provide enough incentives for both the public and private sectors to consider P3 approaches.

Debt service expenditures on a $1.5 billion bond would be about $75 million over a 40-year period. In the Western Alignment example, this means that toll revenues dedicated to private debt service would be about 12 to 15 percent of the annual toll revenue, allowing toll revenues to serve for annual operations and maintenance (about $20 million per year based on a rough estimate of $1 million per mile) as well as other bonded debt service for TIFIA loans or other agency bonds. To that end, it is noted that the MTA does have specific reference to a Long Island bridge like this study's Central Alignment that provides direction on use of MTA bond and other revenue sources, namely, that it would require partnership with Connecticut; the MTA guidance specifically requires that similar authorization would be required from the state and that all toll revenues be evenly divided between the states.

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Table 10-1: Revenue to Potential Debt Service Analysis – Western Alignment

Annual Cost	Western Tunnel ($ millions)	Western Tunnel Pct Rev Cover	Western Combo ($ millions)	Western Combo Pct Rev Cover
Max Debt Service (90%, 4%, 40-year bond)	$2,507	22.2%	$2,006	27.7%
O&M ($1million/mile)	$18	N/A	$18	N/A
Total	**$2,525**	**22.0%**	**$2,024**	**27.5%**
Maximum Revenue	**$556**	**100.0%**	**$556**	**100.0%**

Table 10-2: Revenue to Potential Debt Service Analysis – Central Alignment

Annual Cost	Central Bridge ($ millions)	Central Bridge Pct Rev Cover	Central Combo ($ millions)	Central Combo Pct Rev Cover
Max Debt Service (90%, 4%, 40-year bond)	$602	116.1%	$1,404	49.8%
O&M ($1million/mile)	$29	N/A	$32	N/A
Total	**$631**	**110.9%**	**$1,436**	**48.7%**
Maximum Revenue	**$699**	**100.0%**	**$699**	**100.0%**

Table 10-3: Revenue to Potential Debt Service Analysis – Hybrid Alignment

Annual Cost	Hybrid Bridge ($ millions)	Hybrid Bridge Pct Rev Cover	Hybrid Combo ($ millions)	Hybrid Combo Pct Rev Cover
Max Debt Service (90%, 4%, 40-year bond)	$802	24.8%	$1,254	15.9%
O&M ($1million/mile)	$35	N/A	$35	N/A
Total	**$837**	**23.8%**	**$1,289**	**15.4%**
Maximum Revenue	**$199**	**100.0%**	**$199**	**100.0%**

10.2 FUNDING AND DELIVERY OPTIONS

For the Western Alignment, if a private entity could raise sufficient capital to build the roughly $50 billion facility and could retain all the toll revenue from tunnel operations, that revenue would cover only a small portion of the annual carrying costs through a debt repayment period. For a simplified example, if a $50 billion bond at a 4 percent interest rate over 40 years could be obtained, it would yield an annual carrying cost of about $2.5 billion, of which toll revenue ($556 million) could possibly represent about 22 percent coverage of the annual debt service. Given the magnitude of debt financing needs and inherent project delivery risks, it is likely that the capital markets would demand a higher interest rate for the bonds.

PUBLIC-PRIVATE PARTNERSHIP (P3) POTENTIAL

The greatest potential for P3 would be a combination of private sector with public sector support. Examples of these types of projects include:

- Tappan Zee Bridge Replacement
- Goethals Bridge Replacement
- Alaskan Way Viaduct
- Grand Parkway (Houston, Texas)

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More practically, public-private partnership (P3) would be "availability" based, where a combination of tolls and public sector based tax and/or appropriation sources would secure capital debt to support construction and operation. Recent experience shows the private sector has a $1 billion to $1.5 billion ceiling on debt/equity tolerance, which typically requires the additional availability of debt and capital finance supported by a wide array of public sources, including federal grants, state and local agency contributions, and other opportunities. Leveraging some portion of revenues through federal loans such as Transportation Infrastructure Finance and Innovation Act (TIFIA) loans, private equity or privately held debt, as well as the ability to take advantage of private design-build-operate contracts could yield project and financing efficiencies and could provide enough incentives for both the public and private sectors to consider P3 approaches.

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11 Alignment Concept Evaluation

The three representative alignments examined as part of this feasibility study address the project goals and objectives differently and have varying levels of impact and cost (Table 11-1). Overall, the Western and Central Alignments have favorable results while the Eastern Alignment shows a greatly diminished demand. As a result, it is recommended that all Eastern Alignment concept (bridge only and bridge/tunnel combination) be eliminated from further study. The Western Alignment presents three different alignment concepts: a bridge only, a tunnel only, and a bridge/tunnel combination. The tunnel only and bridge/tunnel combination share similar capital costs. Each of these concepts were designed to limit the impacts to the environment and community. Although the bridge only concept is significantly less cost, the concept would require numerous property takings and result in significant shoreline, environmental and community impacts. As a result, it is recommended that the Western Alignment bridge-only concept is eliminated from further study. Similarly, the Central Alignment bridge-only concept to Devon should be eliminated from further study because of the significant and less optimal environmental and community impacts associated with this concept.

Table 11-1: Alignment Evaluation Summary

GOAL / OBJECTIVE	Western Alignment			Central Alignment				Eastern Alignment	
	Oyster Bay to Rye/Port Chester			Kings Park to Bridgeport or Devon				Wading River to New Haven or Branford	
	Bridge Only	Tunnel Only	Combo	Bridge Only		Combo		Bridge Only	Combo
				B-port	Devon	B-port	Devon		
1. IMPROVE REGIONAL MOBILITY AND CONNECTIVITY									
Reduce travel time	●	●	●	●	●	●	●	◐	◐
Reduce congestion and air quality	◐	◐	◐	◐	◐	◐	◐	○	○
Number of daily auto/truck trips	◐	◐	◐	○	○	○	○	○	○
Provide additional emergency mobilization	●	●	●	●	●	●	●	●	●
2. PROMOTE ECONOMIC GROWTH									
Connect employment and population hubs	●	●	●	●	●	●	●	○	○
Encourage economic development opportunities	●	●	●	●	●	●	●	●	●
3. MINIMIZE ADVERSE ENVIRONMENTAL IMPACTS									
Minimize environmental impacts	○	●	●	○	○	◐	◐	○	◐
Minimize displacements (Residential, Parklands, Commercial)	○	●	●	◐	○	●	●	◐	●
Minimize air quality, noise, and vibration impacts	○	●	●	◐	○	◐	◐	◐	◐
Minimize visual impacts	○	●	●	○	○	●	●	○	●
4. DEVELOP COST-EFFECTIVE TRANSPORTATION OPTIONS									
Minimize capital cost	●	◐	◐	◐	◐	◐	◐	○	○
Greatest revenue potential	●	●	●	●	●	●	●	○	○
Optimize cost-effectiveness	◐	◐	◐	◐	◐	◐	◐	◐	◐
Utilize existing transportation infrastructure	●	●	●	●	●	●	●	●	●

● = best addresses objective
◐ = moderately addresses objective
○ = does not address objective

= recommended for further study

= not recommended for further study

Source: WSP

Table 11-1 highlights (in green) the alignment concepts to be advanced to the next phase of technical and environmental analysis:

- Western Alignment – tunnel only and bridge/tunnel combination
- Central Alignment to Bridgeport – bridge only and bridge/tunnel combination
- Central Alignment to Devon – bridge/tunnel combination

The table also highlights (in yellow) the alignment concepts that should not be advanced to the next phase of technical and environmental analysis:

- Western Alignment – bridge only
- Central Alignment to Devon – bridge only
- Eastern Alignment to New Haven and Branford – bridge only and bridge/tunnel combination

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12 Next Steps

The next evaluation steps include a five-year environmental process that includes two-years for Scoping, two-years for a Draft Environmental Impact Statement (DEIS), and one-year for a Final Environmental Impact Statement (FEIS) and Record of Decision (ROD). Final design and construction would follow thereafter.

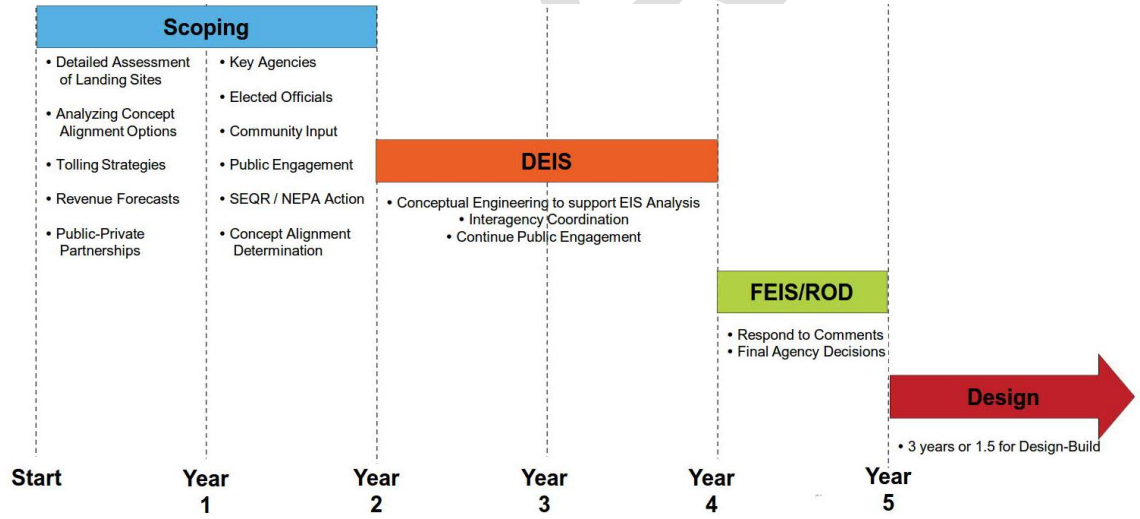
The scoping phase would further define the recommended alignment options, and would include an initial public outreach process that would include meeting with key agencies and elected officials, as well as the community/public. Key efforts during scoping would include collaboration and coordination with the State of Connecticut and the formation of a single-purpose authority. Conceptual engineering to support the EIS analysis would take place during the DEIS phase. The design phase is assumed to be 3 years; however, under a Design-Build scenario, the design could be reduced to 1.5 years.

ESTABLISHING A SINGLE PURPOSE AUTHORITY

Projects managed by newly created authorities include the following:

- Hudson Yards Development Corp. (HYDC) – 7 Line Extension and Hudson Yards Development
- Gateway Program Development Corp.
- Chesapeake Bay Bridge and Tunnel Authority

Figure 12-1: Next Steps



Source: WSP

A preliminary estimate of construction duration suggests that the crossing could open approximately 8 years after the start of construction.