

# 5

## Evaluation of Alternatives

### 5.1 Introduction

When considered in the context of the existing transportation system and the environmental resources described in Chapter 2, the future travel demands described in Chapter 3, and the conceptual alternatives described in Chapter 4, this chapter provides a comparison of the relative benefits and impacts of each alternative. The chapter describes the methodologies and criteria used in conducting the evaluation, along with results of the evaluation.

### 5.2 Evaluation Criteria

This section describes the criteria used to evaluate the range of alternatives. The section includes a discussion on major components such as addressing the study purpose, meeting the needs of the communities, providing acceptable traffic operations, and other methods and metrics used to determine potential impacts.

#### 5.2.1 Addressing the Study Purpose

As described in Chapter 1, the purpose of this Study is to consider transportation system modifications aimed at addressing *capacity* and *safety* related deficiencies along a 3-mile segment of I-293 at interchanges Exits 6 and 7. Consideration is given to relocating and/or reconfiguring Exit 7 into a full directional interchange. The evaluation of alternatives considers how well each alternative meets this purpose.

#### 5.2.2 Meeting Community Needs

Input received through the public outreach effort, including the Technical Advisory Committee, is clear that an important consideration of the surrounding communities is how the upgrade of the corridor may support the economic well-being of the region. In particular, officials from the City of Manchester and the Town of Goffstown have expressed a strong desire for the relocation of the Exit 7 interchange to the north. Doing so will support the City of Manchester’s Hackett Hill Master Plan and may provide much needed connectivity to the Town of Goffstown’s industrial zoned land. Therefore, the evaluation of the alternatives will consider the benefit this connectivity may have on the economic well-being of the surrounding communities.

#### 5.2.3 Traffic Operational Criteria

As previously discussed in Section 2.3.6, level of service (LOS) is a term used to describe the operational conditions of roadway facilities. Six (6) levels of service are defined that range in letter designation from LOS A to LOS F, with LOS A representing the best operating condition and LOS F representing the worst. In the design of new roadway facilities, the NHDOT generally considers LOS C as desirable and LOS D as minimally acceptable. The NHDOT under certain circumstances may accept LOS E operation. LOS E may encourage multi-modal use and reduce the use of single-occupant vehicles, particularly during the peak hours of the day.

#### 5.2.4 Resource Evaluation Methods

Understanding potential impacts on environmental and social resources is another important element of the Study. To review these issues, an impact analysis of each alternative was conducted.

As described in Chapter 2, available GIS data for the study area were obtained from various state agencies, NHGRANIT, and the municipalities. Existing environmental information was verified and updated in the field based on a reconnaissance-level effort. Information pertaining to ROW and property in the study area was obtained by 2012 GIS parcel mapping, including assessment records provided by the City of Manchester.

Potential impacts were then calculated using a GIS overlay analysis, in which the footprint of each roadway option was overlaid onto the various environmental resources. To evaluate many of the environmental resources (wetland, floodplain, hazardous material, farmland, rare species, ROW, parks, cultural), the project footprint consisted of the preliminary slope limits (area of new fill) engineered for each alternative. For other resources (aquifer and water quality), the amount of new pavement associated with each alternative was used for the project footprint. **Table 5.2-1** summarizes the metrics used to evaluate these resources.

Impacts presented in this study must be interpreted cautiously. First, only direct impacts were considered. However, certain resources (i.e., historic buildings and historic districts) can be affected indirectly. Second, all identified impacts are preliminary estimates because they are based on preliminary rough grading without site-specific survey contours or detailed engineering. Third, resource mapping relies primarily on landscape-level environmental data rather than detailed site-specific studies that would be required during a formal NEPA or permit evaluation. Fourth, the ROW displacement estimates do not quantify any corresponding loss of tax base associated with the acquisition, as it too early in the design phase to quantify this information. The impacts, however, are still useful and appropriate for comparing the relative impacts of each alternative.

Table 5.2-1 Environmental Evaluation Metrics

Resource/Impact	Metric
Wetlands	Acres of Dredge/Fill Number of Stream Crossings
Water Quality	Acres of New Pavement
Floodplains	Acres of New Fill
Aquifer	Acres of New Pavement
Farmland	Acres of Disturbance
Rare, Threatened, Endangered Species/Habitat	# of Federally Listed Populations # of Populations Potentially Impacted
Parkland & Recreation	# of Sites Potentially Impacted
ROW Displacement	# of Parcels Affected #Buildings Impacted by Land use Type Acres of Acquisition
Historic/Archeological Resources	# of Known Archeological Sites # of Historic Above-ground Structures Directly Impacted
Hazardous Waste	# of Potential Sites Impacted
Construction Cost	2013 Dollars

5.3 Alternatives Evaluation

This section summarizes the results of the alternatives evaluation, which include: the No Build alternative, three I-293 mainline alternatives (Alternatives 1, 2, and 3), five Exit 6 alternatives (Alternatives 4, 5, 5A, 6, and 7), and five Exit 7 alternatives (Alternatives 8, 9A, 9B, 10A, and 10B). The results of the evaluation are summarized in **Table 5.3-1**. The table summarizes the impacts and preliminary estimated costs of each alternative. In addition, it summarizes how well each alternative meets the study purpose of addressing the capacity and safety needs of the corridor and how well each meets the needs of the communities, which in this case focus on the potential for supporting economic development. The table uses the colors of green, yellow and red as an indication of the alternative either substantially meeting, moderately meeting, or failing to meet the objectives.

5.3.1 No Build

The No Build alternative reflects the perpetuation of the existing transportation infrastructure within the study area. Therefore, the No Build alternative does not consider any physical alteration to the existing transportation system. However, the alternative does include the same level of traffic growth out to the future design year of 2035 as each of the Build alternatives. The No Build serves as a benchmark to compare the benefits and impacts of the Build alternatives.

The No Build alternative will fail to address the capacity and safety deficiencies identified in the study purpose. Additionally, the No Build alternative will fail to meet the surrounding community’s desire to support the economic well-being of the area.

5.3.2 I-293 Mainline Alternatives 1, 2, and 3

Capacity and Safety

Alternative 1, which maintains the existing two travel lanes per direction along the mainline while upgrading the interchanges, will fail to meet the capacity purpose as the segment between Exits 5 and 6 is projected to operate at LOS E while the segment between Exits 6 and 7 is projected to operate at LOS F. Despite the poor level of service that will result from not providing additional travel lanes, upgrading the configurations of the interchanges suggests that the alternative will moderately meet the purpose of enhancing safety.

Alternatives 2 and 3, expand the mainline to three travel lanes per direction, will substantially meet the capacity purpose as all mainline segments will operate at LOS C or better. The additional capacity, improved alignment, and upgraded interchanges will suggest that both alternatives will substantially meet the purpose of enhancing safety.

**Table 5.3-2** summarizes the levels of service for the I-293 segments under a widening scenario (Alternatives 2 or 3) in combination with the various Exit 6 and Exit 7 interchange alternatives.

Table 5.3-1

I-293 Exits 6 and 7 Transportation Planning Study Evaluation Matrix		Study purpose is to consider transportation system modifications aimed at addressing <b>capacity</b> and <b>safety</b> related deficiencies along the mainline and at the interchanges (Exits 6 and 7) for a 3 mile segment of I-293 including consideration of relocating and reconfiguring Exit 7 into a fully directional interchange. The evaluation is conceptual and should not be interpreted as a conclusive study of impacts.													
		No Build	I-293 Mainline			Exit 6 Interchange					Exit 7 Interchange				
			Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 5A	Alt 6	Alt 7	Alt 8	Alt 9A	Alt 9B	Alt. 10A	Alt 10B
Purpose			Maintain 4-lanes with Interchange Alternative	6-lanes with Interchange Alternative (easterly alignment)	6-lanes with Interchange Alternative (westerly alignment)	Single Point Urban Interchange	Standard Diamond Interchange	Off-Set Diamond Interchange	Diverging Diamond Interchange	Diamond Interchange with Roundabouts	Tight Diamond Interchange at Existing Location	Relocated Interchange with access to Front St and Dunbarton Rd	Relocated Interchange with access to Front St and Dunbarton Rd	Relocated Interchange w/ access to Front St and Goffstown Rd	Relocated Interchange w/ access to Front St and Goffstown Rd
Addresses capacity deficiencies along I-293						N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Addresses safety deficiencies along I-293						N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Adresses capacity deficiencies at interchanges			See interchange alternatives	See interchange alternatives	See interchange alternatives										
Addresses safety deficiencies at interchanges			See interchange alternatives	See interchange alternatives	See interchange alternatives										
Community Needs (Economic Development)															
Supports Hackett Hill Master Plan Connectivity			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
Supports Goffstown/I-293 Connectivity			N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					
Impacts	Metric														
Wetlands	Acres of Impact	0		0.1	0.1	3.4	2.9	3.3	2.9	2.9	2.1	1.6	1.7	1.8	1.9
	Number of Stream Crossings	0		0	0	2	3	3	3	3	4	6	6	7	7
Water Quality	Acres of New Pavement	0		4.9	4.7	11.49	10.7	11.8	9.9	9.7	11.8	19.2	19.2	21.8	21.8
Floodway	Acres of New Fill	0		0	0	0	0	0	0	0	0	0	0	0	0
Floodplain	Acres of New Fill	0		2.8	1.9	2.0	1.8	1.6	1.7	1.8	2.1	0.7	0.4	1.0	0.7
Aquifer	Acres of New Pavement	0		4.9 (U)	4.7 (U)	14.6 (U)	13.9 (U)	15.5 (U)	13.6 (U)	13.4 (U)	12.3 (U)	17 (0.4 - Till, 16.6 - U)	16.9 (0.4 - Till, 16.5 - U)	20 (0.4 - Till, 19.6 - U)	20.1 (0.4 - Till, 19.7 - U)
Farmland	Acres of Disturbance	0		0	0	0	0	0	0	0	4.7	22.3	19.9	22.3	19.9
Rare, Threatened, Endangered Species/Habitat	# of Federally Listed Populations Impacted	0		0	0	0	0	0	0	0	0	0	0	0	0
	# Populations Potentially Impacted	0		4 state listed "T" or "E"	4 state listed "T" or "E"	4 state listed "T" or "E"	4 state listed "T" or "E"	4 state listed "T" or "E"	4 state listed "T" or "E"	4 state listed "T" or "E"	8 (4 state listed "T" or "E", 3 state listed "SC", 1 NHB tracked, not yet added	6 state listed "T" or "E"	6 state listed "T" or "E"	7 state listed "T" or "E"	7 state listed "T" or "E"
Highway Noise	# of Sensitive Receptors	N/A		3	3	78	77	81	78	77	25	16	19	38	41
Public Parks & Recreation	# of Sites Impacted	0		0	0	0	0	0	0	0	0	0	0	0	0
Right-of-Way	# of Parcels Affected	0		8	8	21	21	24	22	21	6	8	10	16	18
	Buildings Impacts by Landuse Type	0		2 Commercial	2 Commerical	7 (2 Single Fam. Res., 1 Multi-Fam. Res., 4 Com.)	9 (3 Single Fam. Res., 2 Multi-Fam. Res., 4 Com.)	11(4 Single Fam. Res.,3 Multi-Fam. Res., 4 Com.)	9 (3 Single Fam. Res., 2 Multi-Fam. Res., 4 Com.)	9 (3 Single Fam. Res., 2 Multi-Fam. Res., 4 Com.)	0	0	1 Single Fam. Res.	2 (1 Single Fam. Res., 1 Multi-Fam. Res.)	4 (2 Single Fam. Res., 1 Multi-Fam. Res, 1 Com.)
	Acres of Acquisition	0		3.6	4.2	1.2	4	5.5	4.6	4	3.6	31.8	31.4	45.2	44.8
Historic/Archaeological Resources	# of Known Historic Properties Directly Impacted	0		Amoskeag Federal House, Amoskeag Millyard Historic District	Amoskeag Federal House, Amoskeag Millyard Historic District	Amoskeag Federal House, Amoskeag Millyard Historic District	Amoskeag Federal House, Amoskeag Millyard Historic District	Amoskeag Federal House, Amoskeag Millyard Historic District	Amoskeag Federal House, Amoskeag Millyard Historic District	Amoskeag Federal House, Amoskeag Millyard Historic District	0	0	0	0	0
	# of Known Archaeological Sites Impacted	0		1	1	2	2	2	2	2	0	0	0	0	0
Hazardous Waste	# of Potential Sites Impacted	0		3	4	7	6	7	6	6	3	4	4	4	4
Construction Cost	2013 Dollars			\$18 - \$20 M	\$8 - \$9 M	\$54 - \$60 M	\$38 - \$42 M	\$37 - \$41 M	\$41 - \$45 M	\$34 - \$37 M	\$33 - \$36 M	\$36- \$40 M	\$37 - \$41 M	\$42 - \$47 M	\$43 - \$48 M

LEGEND



Substantially Meets Objective



Moderately Meets Objective



Minimally or Fails to Meet Objective

Notes:  
(U) = Stratified-drift Undifferentiated  
(T) = Threatened, (E) - Endangered, (SC) - Species of Concern

N/A = Not Applicable

Table 5.3-2 Freeway Capacity Analysis Summary

I-293 (FEET) Freeway Segment	Peak Period	Alternative LOS*		
		4&8	4/5/6/7&9	4&10
I-93 to Exit 7 SB	AM	B	B	B
	PM	B	B	B
Exit 7 to I-93 NB	AM	A	A	A
	PM	C	C	C
Exit 7 to Exit 6 SB	AM	NA	C	C
	PM	NA	B	B
Exit 6 to Exit 7 NB	AM	NA	B	A
	PM	NA	C	C
Exit 6 to Exit 5 SB	AM	C	C	C
	PM	C	C	C
Exit 5 to Exit 6 NB	AM	B	B	B
	PM	C	C	C

\* Freeway Level of Service.

NA - Not Applicable (see weave operations on Figures 5.3-1 and 5.3-2).

Community Needs (Economic Development)

Although any upgrade of the I-293 mainline will support the economic development needs of the surrounding communities, the focus of the economic development needs relates mostly to the Exit 7 alternatives as these alternatives have the potential to most closely support the City of Manchester’s Hackett Hill Master Plan and the Town of Goffstown’s need for improved connectivity. For this reason, the I-293 mainline alternatives are considered not applicable under the community needs consideration.

Environmental Impacts

Alternatives 2 and 3 will impact an estimated 0.1 acres of Wetland 2, located just south of the Eddy Road southbound on-ramp. It should be noted that top-of bank delineation for the Merrimack River was not performed for this Study. A formal top-of-bank delineation may lead to additional wetland impacts to the Merrimack River under Alternative 3, where the alignment is shifted towards the river.

The primary measure of water quality used in the Study is the area of new impervious surfaces associated with the construction of each alternative measured as the number of acres of new pavement. Alternative 2 has slightly more new impervious surfaces totaling an estimated 4.9 acres in comparison to Alternative 3, which has an estimated 4.7 acres of new impervious surfaces. All Alternative 3 impervious surfaces will be located within a stratified-drift undifferentiated aquifer. Alternative 2, which involves widening the mainline towards the Merrimack River, will also have a greater potential impact on the riparian buffer zone between the highway and the river. It is important to note that this assessment does not account for the stormwater treatment measures that will mitigate and reduce the potential for

water quality impacts. The location of these measures will be identified in the next phase of the project.

Both alternatives will impact the FEMA mapped 100-year floodplain with Alternative 2 resulting in a greater impact on these resources in comparison to Alternative 3. Areas of possible encroachment and impact are along the Merrimack River from south of the Eddy Road on-ramp to just north of the Exit 5 (Granite Street) northbound on-ramp. Neither alternative will impact the Regulatory Floodway as currently mapped by FEMA. The conceptual engineering completed as part of this Study allows for neither calculation of the volume of floodplain fill nor a hydraulic analysis of potential effects on the Merrimack River, which will be completed during the NEPA phase.

Alternatives 2 and 3 may potentially impact four state listed threatened/endangered species associated with the Merrimack River. No federally listed species are located within the study area. The data provided by the NHHNB for the impact analysis does not list the actual species name, only the Federal/State listing status.

Properties with potential hazardous waste sites exist at the former millyard complex located at 194/195 McGregor Street, former millyard at 345 McGregor Street, the Eddy Road PSNH Substation, and a gasoline station (Mobil 15021) on Eddy Road. These properties may be impacted. A notable concern is present at 194/195 McGregor Street, where a plume of chlorinated solvents in the groundwater exists and a Groundwater Management Permit (GMP) has been assigned. Both Alternatives 2 and 3 will require ROW at 194/195 McGregor Street, adjacent to I-293, which will likely warrant further investigation during final design to minimize health and safety risks. Both alternatives require ROW acquisition from the Mobil Station on Eddy Road.

ROW Impacts

Alternatives 2 and 3 may affect eight private parcels and two commercial buildings. The footprint of Alternative 3 will have a slightly larger potential impact on existing commercial properties associated with widening towards the west.

Cultural Resources

NHDHR and cultural resources staff from NHDOT noted that the Amoskeag Falls area is one of the most important archaeological areas in the state, with known deposits occurring several feet below ground. Preliminary information provided by NHDR indicates that one known archaeological site may be affected by both Alternative 2 and 3.

In terms of historic above-ground structures, both Alternative 2 and 3 will impact ROW associated with the National Register-listed Amoskeag Millyard Historic District. Alternative 3 will require more land acquisition due to the westerly alignment associated with this alternative. Both alternatives will also impact the c.1898 Valve House located immediately adjacent to the existing I-293 southbound travel lane. Due to the small footprint of the Valve House, it is anticipated that the Valve House could be relocated within the historic district to preserve the building.



Alternative 3 may also limit the existing commercial use of the former American Cotton Duck and Stark Mills Cotton Storehouse buildings. Specifically, Alternative 3 will require acquiring the parking/loading dock space at the rear of the building (side adjacent to I-293). Additionally, both Alternative 2 and 3 will require ROW acquisition adjacent to the former Mill #12 Annex, Cloth Room, for the purposes of matching into the alignment at Exit 5. It should be noted that the Mill #12 recently received a community grant to make site plan improvements. Future roadway design in this area will attempt to minimize any impacts associated with the site plan improvements to Mill #12.

The Amoskeag Federal House, located at 225 Eddy Road outside of the Amoskeag Historic District, would be impacted by Alternatives 2 and 3. This building has been previously relocated twice, once in the 1950s and again in 1984. A National Register nomination was completed for the house in 1974, but the building was never listed. However, the house is identified as a Local Historic Site.

**Construction Cost Estimate**

The results of a programing construction cost estimate (2013 Dollars) shows an estimated construction cost of \$18 to \$20 million for Alternative 2 and an estimated construction cost of \$8 to \$9 million for Alternative 3. Note that the programming construction cost estimate does not include costs related to utility construction or relocation, right-of-way acquisition or relocation, mitigation, or preliminary and final engineering fees.

signalized intersections of the northbound ramps and the Amoskeag Street intersection under alternatives 5 and 6. The proximity of these two intersections combined with the high volume of traffic shows the potential of traffic queuing back from one intersection into the other. Alternative 5A has potential congestion issues at the Goffstown Road/Front Street intersection.

Alternative 7 (Diamond Interchange with Roundabouts) will substantially meet the safety purpose as properly designed roundabouts have been shown to enhance safety. However, Alternative 7 will fail to meet the capacity purpose. The 2-lane roundabouts will operate at LOS F. Also the proximity of the signalized Amoskeag Street intersection with the roundabout at the northbound ramps will be potentially problematic.

Levels of service for the signalized intersections and ramp junctions associated with the alternatives for Exit 6 are shown in **Figure 5.3-1**.

**Community Needs (Economic Development)**

As was the case for the upgrade of the I-293 mainline, any upgrade of Exit 6 may also support the economic development needs of the surrounding communities. However, the focus of the economic develop need relates primarily to the Exit 7 alternatives as these alternatives have the potential to support the City of Manchester’s Hackett Hill Master Plan and the Town of Goffstown’s need for improved connectivity. For this reason, the Exit 6 alternatives are considered not applicable under the community needs consideration.

**Environmental Impacts**

Nine wetlands (Wetlands 2-10), in addition to Black Brook and the Merrimack River, will be impacted by each alternative at Exit 6. Alternatives 4 and 5A have slightly larger impacts than Alternatives 5, 6, and 7. Wetlands 5, 6, and 7 will be filled in their entirety under each alternative evaluated. Nearly half to up to three quarters of Wetland 8 may be impacted as well by the various alternatives. A small amount of fill slope will impact the Merrimack River south of the existing Exit 6 northbound off-ramp. Black Brook will be impacted by widening of the existing bridge over Black Brook.

From a water quality perspective, Alternative 7 will create the least amount of new impervious area at an estimated 9.7 acres compared to the largest amount of new impervious of 11.8 acres generated by Alternative 5A. Alternatives 4, 5 and 6 will result in an estimated 11.5, 10.7 and 9.9 acres of new impervious area, respectively.

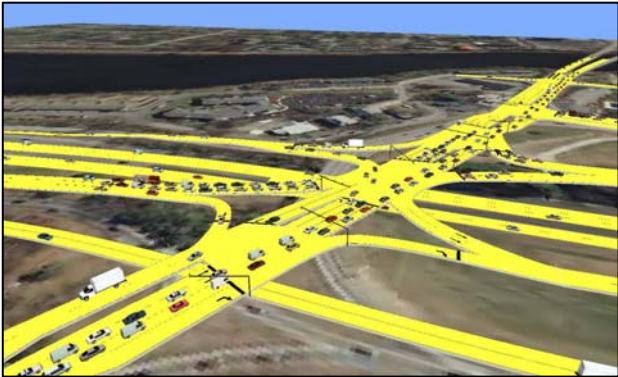
All of the alternatives will impact a portion of the Zone AE floodplain associated with the Merrimack River, and Zone A floodplain associated with Black Brook. Potential floodplain impacts range from 1.6 acres (Alternative 7) to 2.0 acres (Alternative 4), with Alternatives 5, 5A, and 6 impacting 1.8, 1.7, and 1.8 acres respectively.

Aquifer impacts for each of the five alternatives are similar, but because Alternative 5A (Offset Diamond Interchange) requires more infrastructure than the other alternatives, a larger amount of aquifer will be impacted. Alternative 7 (Diamond Interchange with Roundabouts) will impact the least amount of aquifer.

**5.3.3 Exit 6 Interchange Alternatives 4, 5, 5A, 6, and 7**

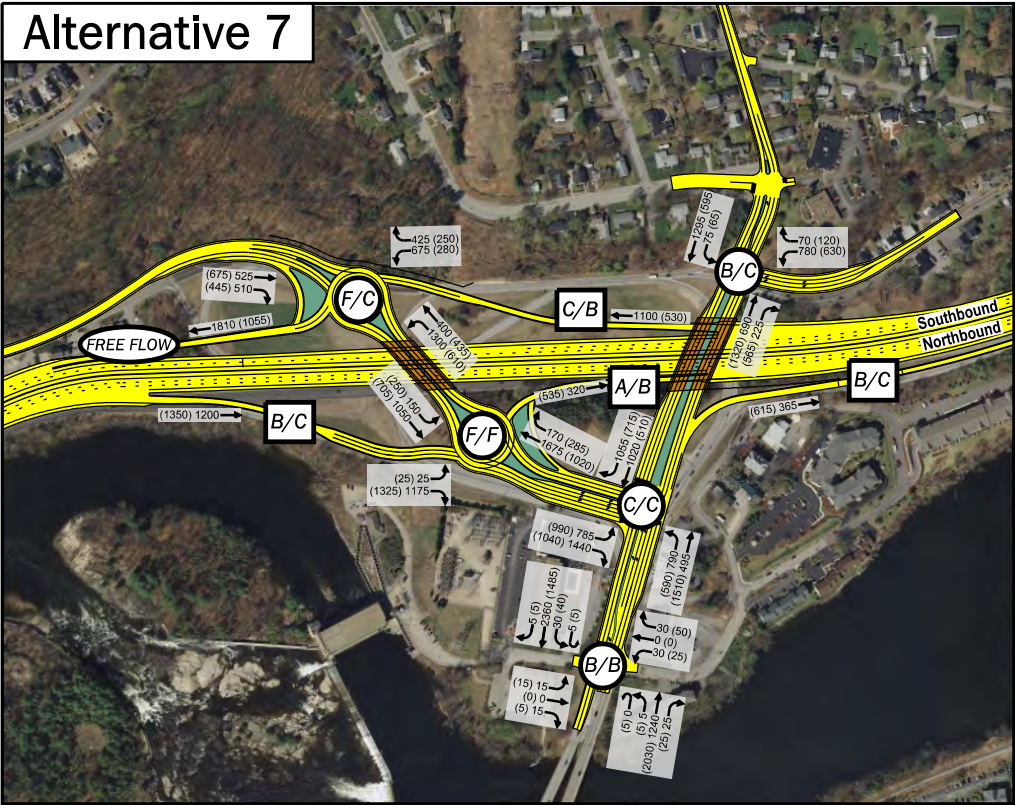
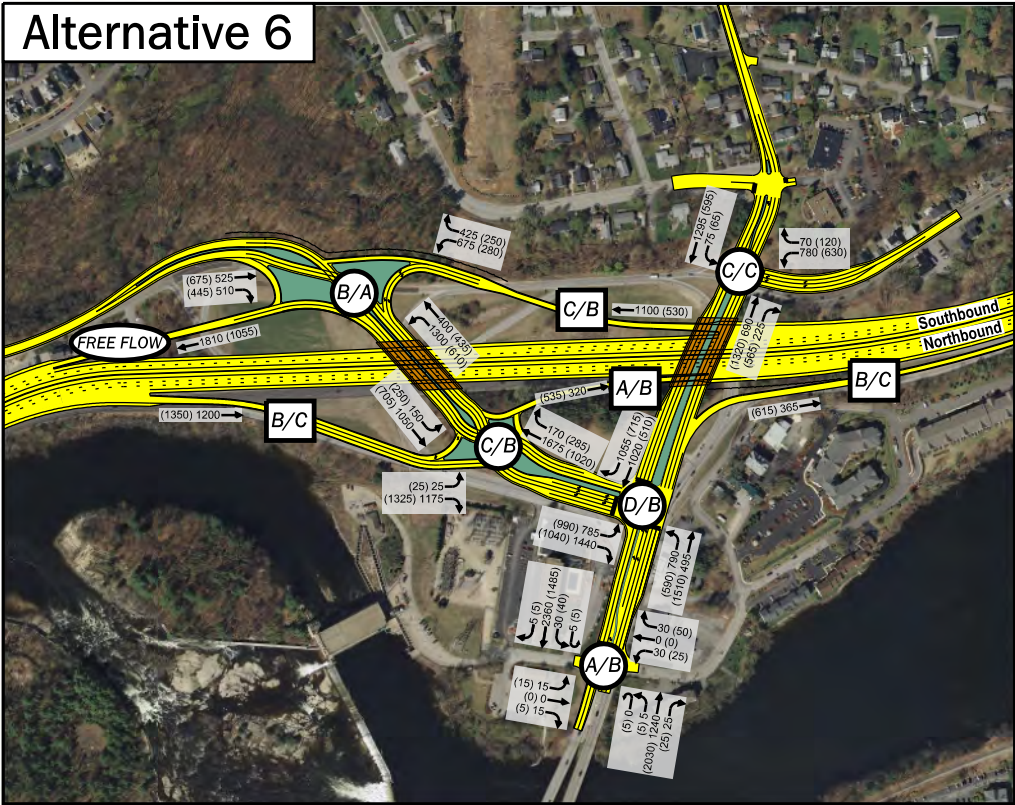
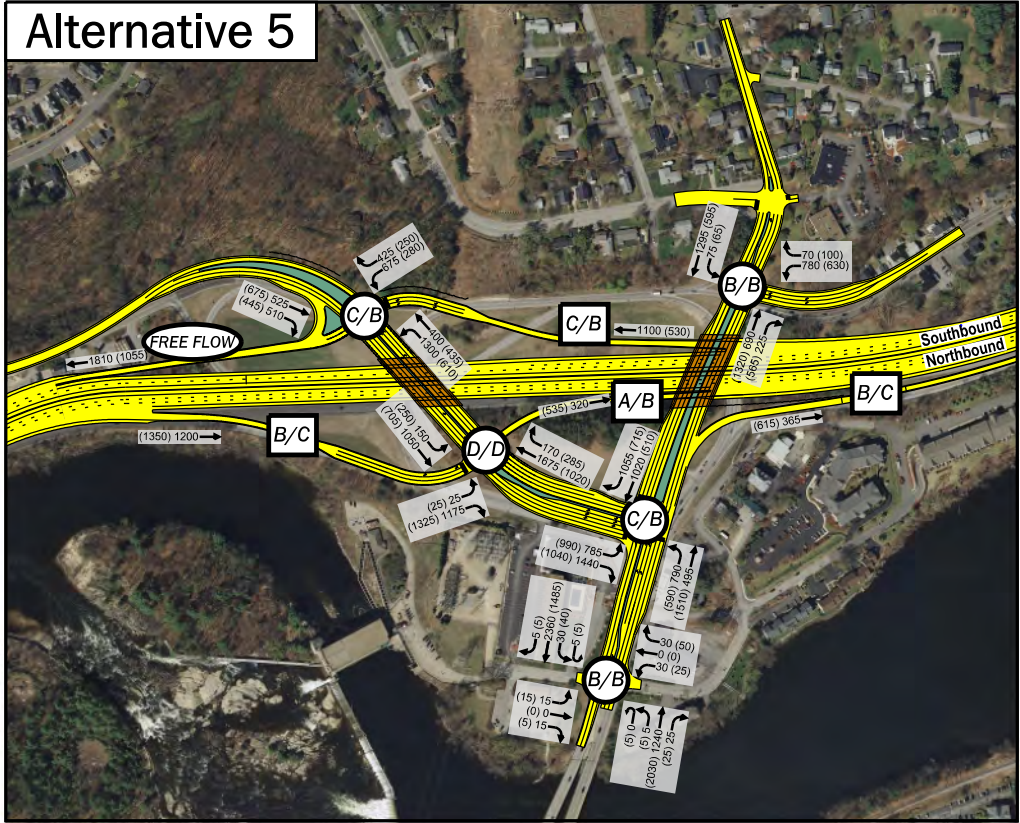
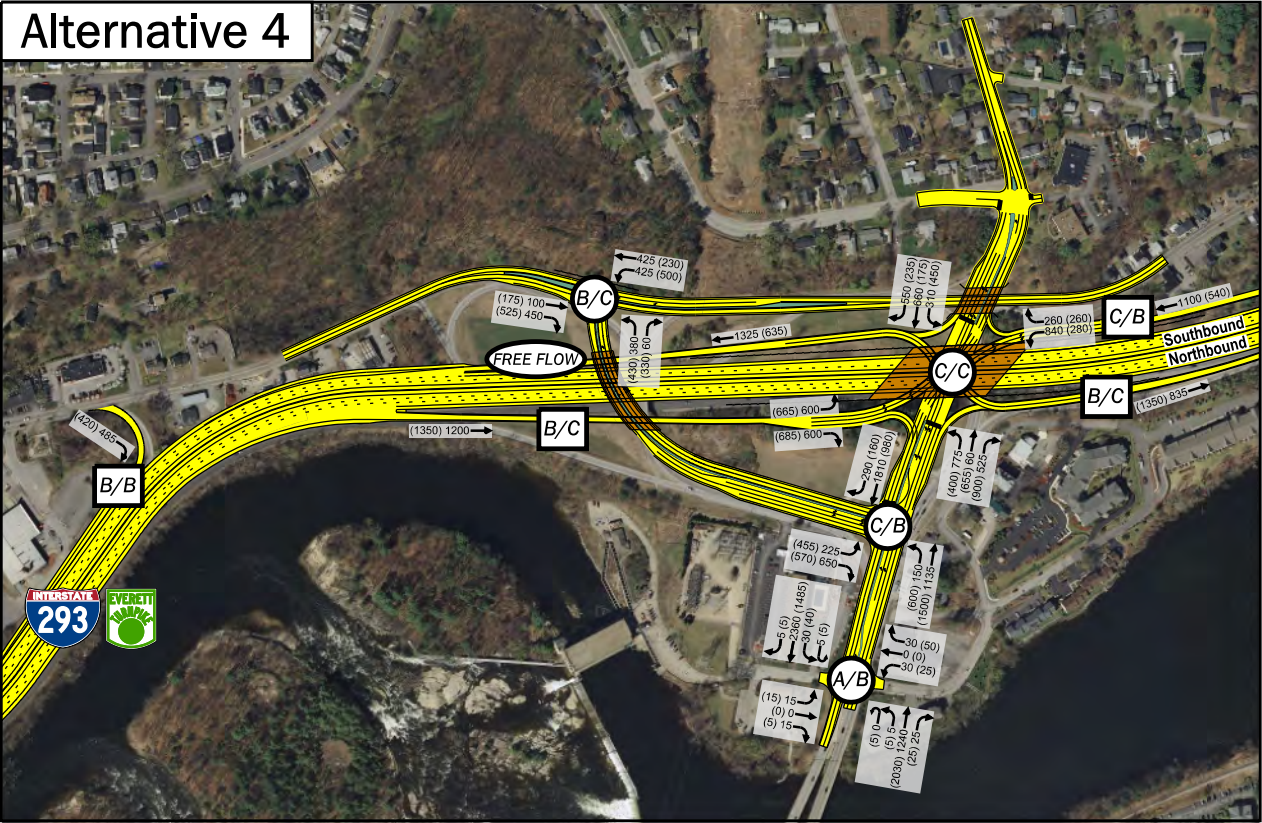
**Capacity and Safety**

Alternative 4 (SPUI) will substantially meet both the capacity and safety purpose. Each of the signalized intersections will operate at LOS C or better, while all of the ramp movements will similarly operate at LOS C or better. This alternative will also distribute traffic well as all traffic entering and exiting I-293 is accommodated at the SPUI while the Goffstown Road/Eddy Road/Front Street intersection is reconfigured so that Eddy Road and Front Street connect to Amoskeag Street by a separate bridge over I-293 rather than passing through the SPUI. By separating this intersecting traffic, the conflicts and congestion adjacent to the SPUI interchange are eliminated allowing, safer and more efficient traffic flow at the SPUI.



Alternatives 5, 5A, and 6 moderately meet the capacity purpose while substantially meeting the safety purpose. Each of the alternatives has at least one signalized intersection that will operate at LOS D. However, of greater concern is the queuing that occurs between the





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**(B/B)** - Intersection Level of Service AM / PM

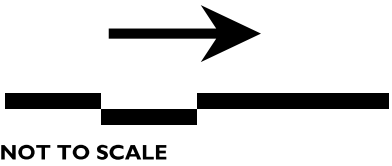
**[B/B]** - Ramp Merge/Diverge Level of Service AM / PM

←xxxx (xxxx) - AM (PM) Peak Hour Volumes

**Yellow** - Pavement

**Orange** - Bridge

**Green** - Median / Grass Panel



**VHB** Vanasse Hangen Brustlin, Inc.

Manchester 16099

FEET/I-293, Exit 6-7 Planning Study

Figure 5.3-1

Exit 6 Alternatives Level of Service

Manchester, NH

New Hampshire  
**DOT**  
Department of Transportation



Each of the five Exit 6 interchange alternatives will potentially impact four state listed or endangered species as identified by NHNHBB. These species are associated with habitat found along the banks of the Merrimack River.

Given the urbanized landscape surrounding Exit 6, a large number of known properties with hazardous material concerns exist in the study area. Each of the five alternatives requires acquisition of land between Eddy Road and I-293, between the Exit 6 southbound off-ramp and the Eddy Road on-ramp. Two gasoline stations (Mobil Station 15021 located at 210 Eddy Road and Shell Station 100012 located at 245 Eddy Road) are located in this acquisition area. More serious concerns are associated with Shell Station due to a prior gasoline release at the property prompting the implementation of a Groundwater Management Zone (GMZ). Each alternative will also have slope impacts on the Amoskeag Sunoco gasoline station located at 49 Amoskeag Street. Additional slope impacts may occur on several other properties with hazardous material concerns by each alternative, but it is expected that additional research will determine that most of them pose no substantial risk.

### ROW Impacts

Expected impacts to private property are similar across all five alternatives, ranging from 21 to 24 parcels potentially impacted. Similar to other resource impacts, Alternative 5A, with the larger project footprint, will potentially have the largest impact on private property, totaling 24 parcels and 11 buildings. Alternatives 4, 5, and 7 will impact the fewest parcels (21); however, Alternative 4 will require substantially less. Alternative 6 will impact 22 parcels.

### Cultural Resources

Similar to the Mainline Alternatives, Exit 6 is sensitive for archaeological resources given the proximity to the Merrimack River. Based on preliminary mapping from NHDHR, it anticipated that two known archaeological sites may be impacted by the footprint of each alternative.

The Amoskeag Federal House will be impacted by proposed Exit 6 southbound improvements under each alternative. As discussed previously, the House has been relocated twice and is not integral to its current location on Front Street. A small amount of ROW in the northern section of the National Register-listed Amoskeag Millyard Historic District will also be impacted. However, no structures within the historic district will be impacted. Although no other documented above-ground historic resources are anticipated to be directly impacted, all of the alternatives require realigning a portion of Front Street north of Goffstown Road. In consultation with NHDHR and the preliminary field-reconnaissance effort, it is anticipated that once surveyed, at least one local historic district and several historic properties may be identified in this area along Front Street.

### Construction Cost Estimate

The results of a programming construction cost estimate (2013 Dollars) shows an estimated construction cost of \$54 to \$60 million for Alternative 4, \$38 to \$42 million for Alternative 5, \$37 to \$41 million for Alternative 5A, \$41 to \$45 million for Alternative 6, and \$34 to \$37 million for Alternative 7. Note that the programming construction cost estimate does not

include costs related to utility construction or relocation, right-of-way acquisition or relocation, mitigation, or preliminary and final engineering fees.

## 5.3.4 Exit 7 Interchange Alternatives 8, 9A, 9B, 10A, and 10B

### Capacity and Safety

Alternative 8, which involves reconfiguring Exit 7 at its current Front Street location, will moderately meet both the capacity and safety purposes. Although the two signalized intersections at the northbound and southbound ramps will operate at LOS C, the existing capacity and safety related deficiencies are related to the proximity of the interchange with the Exit 6 interchange. The Exit 6 northbound on-ramp and the Exit 7 northbound off-ramp will be separated by approximately 1,400 feet. The proximity of the interchanges results in the need to provide an additional weaving lane (a fourth lane) in each direction on I-293 for the short distance between the ramps. This additional widening will result in additional property impacts. The northbound weaving movement will operate at LOS D.

Alternatives 9A, 9B, 10A, and 10B all will substantially meet both the capacity and safety purpose. The ramp movements will all operate at LOS C or better. The signalized intersections at the interchange and at Front Street will operate at LOS C or better for Alternative 9A and 9B and at LOS D or better for Alternatives 10A and 10B. Relocating Exit 7 to the north will also benefit operations at Exit 6 as some motorists who currently travel to/from the west into Goffstown and to/from the north on I-293 will divert to Exit 7.

Levels of service for the signalized intersections and ramp junctions associated with the alternatives for Exit 7 are shown in **Figure 5.3-2**.

### Community Needs (Economic Development)

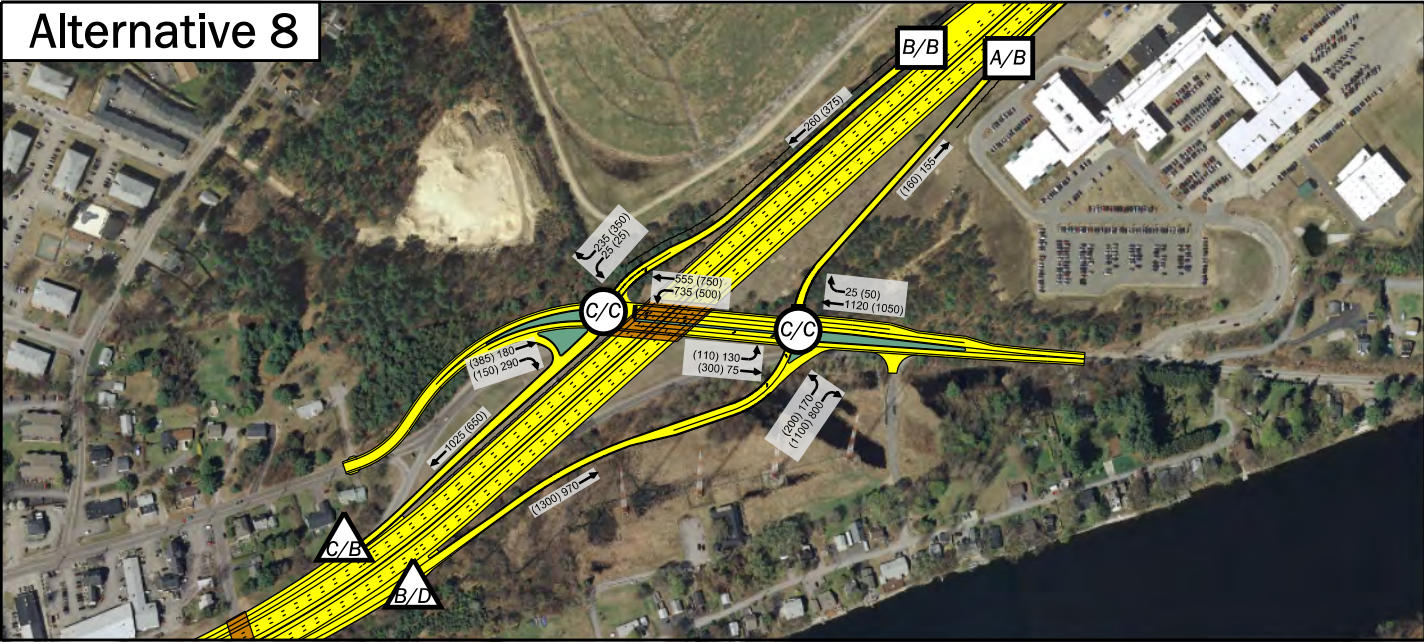
Alternative 8 fails to meet both Manchester’s need for improved connectivity to the Hackett Hill area and Goffstown’s need for improved connectivity to I-293. To meet these needs will necessitate the relocation of the interchange to a location north of the Manchester Community College.

Alternatives 9A and 9B, which relocate the interchange to the north, both substantially meet the objective of supporting connectivity to Hackett Hill, but fail to meet Goffstown’s need for improved connectivity. The reason for this is that Alternatives 9A and 9B extend westerly only to Dunbarton Road and do not extend across Black Brook to Goffstown Road.

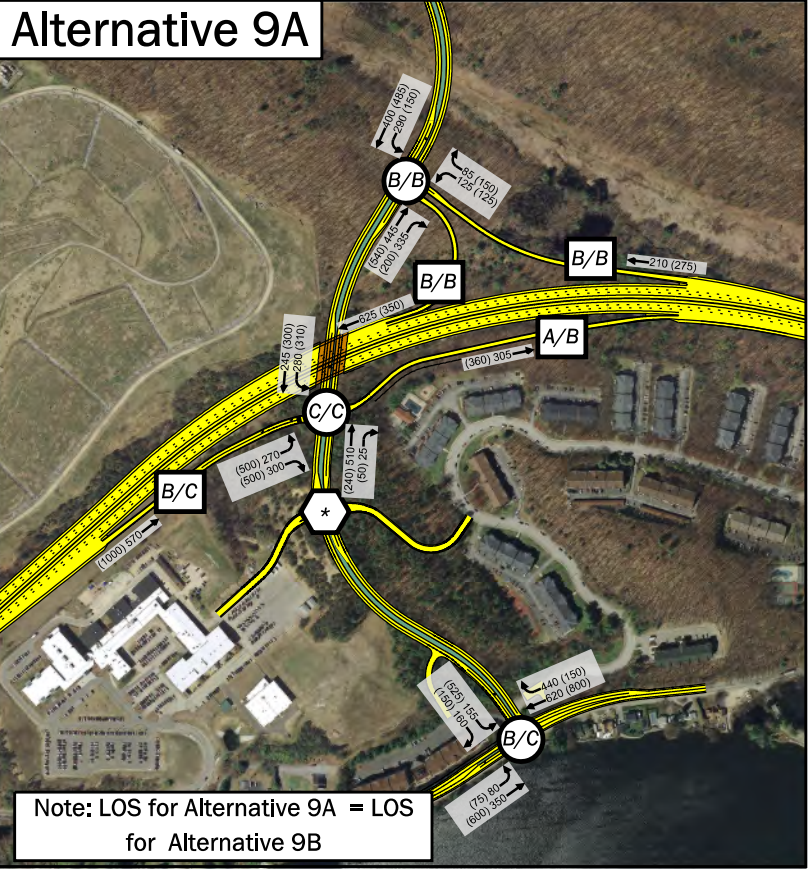
Alternatives 10A and 10B, which involve both relocating the interchange to the north and extending the westerly connection across Black Brook to Goffstown Road, will substantially meet the objective of supporting connectivity to Hackett Hill and will substantially meet the objective of improving connectivity between Goffstown and I-293. This improved access is expected to enhance economic opportunities for the Town of Goffstown.



Alternative 8



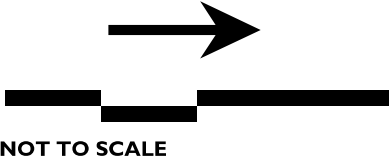
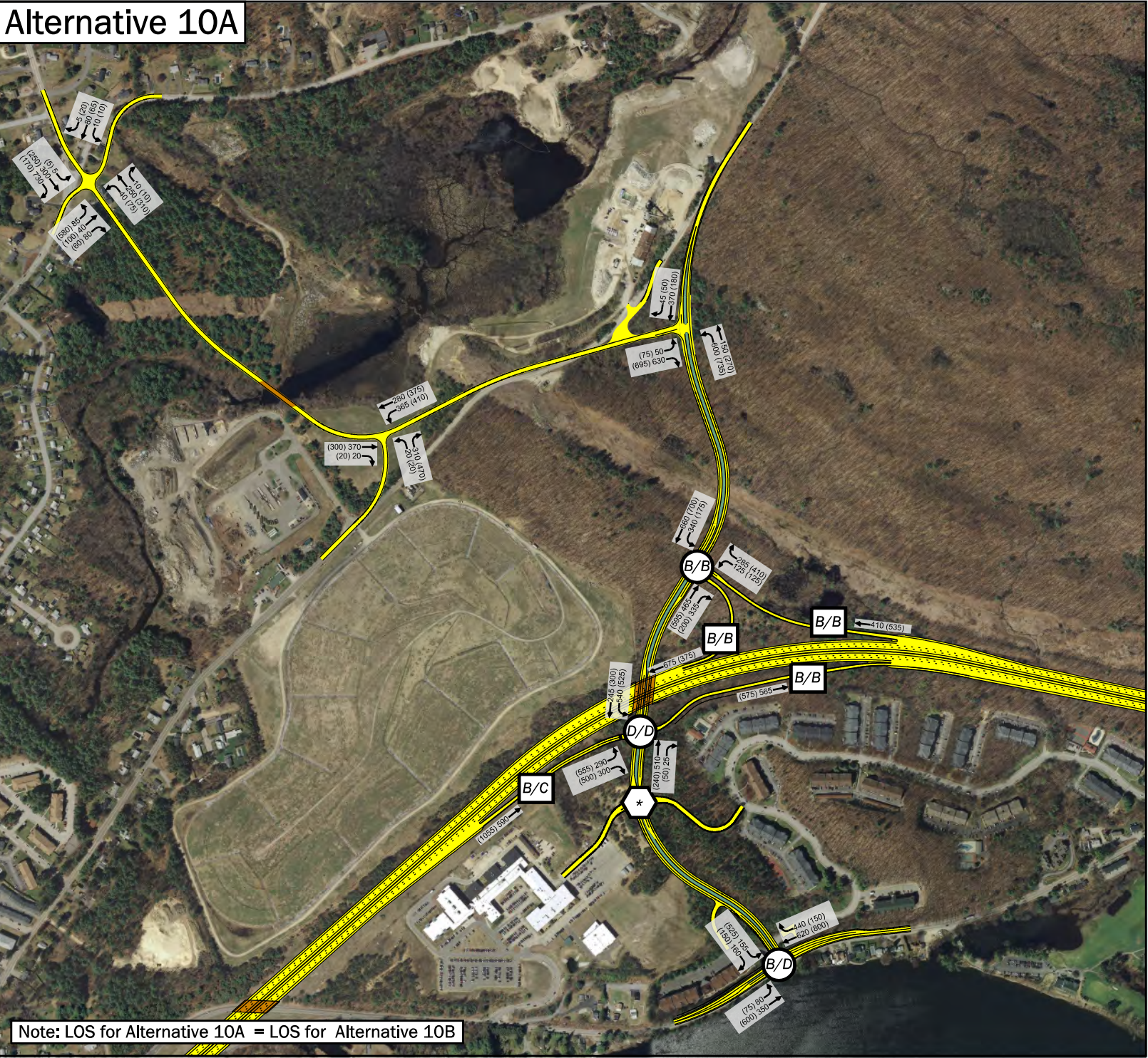
Alternative 9A



LEGEND

- Intersection Level of Service AM / PM
- Ramp Merge/Diverge Level of Service AM / PM
- Weave Level of Service AM / PM
- Signal Not Warranted
- AM (PM) Peak Hour Volumes
- Pavement
- Bridge
- Median / Grass Panel

Alternative 10A





## Environmental Impacts

Reconfiguring Exit 7 at its current location to a tight diamond interchange (Alternative 8) will result in greater wetlands impacts in comparison to Alternatives 9A, 9B, 10A and 10B, which relocate Exit 7 further to the north. The majority of the wetland impacts associated with Alternative 8 will be caused by the proposed northbound off-ramp, impacting the western boundary of Wetland 1.

Relocating Exit 7 north of Manchester Community College and constructing the Dunbarton Connector Road (Alternatives 9A and 9B) will result in fewer wetland impacts than other alternatives. Alternatives 9A and 9B impact nine wetlands (Wetlands 19, 20, 21, 27, 29, 31, 32, 33, and 37). Several of these wetlands (27, 28, 31, and 37) are noted as potential vernal pools during the field-reconnaissance. Many of the wetlands in this area are hydrologically connected by intermittent streams.

Intermittent streams are jurisdictional areas and will need to be delineated in future phases of the Study.

Alternatives 10A and 10B are identical to Alternatives 9A and 9B except for the Goffstown Connector Road. The Goffstown Connector Road will add a wetland impact associated with crossing Black Brook. Impacts to Black Brook have been minimized in the design by almost entirely spanning Black Brook and its associated wetlands.

Alternative 8 will produce the least amount of new impervious area at an estimated 11.8 acres, whereas Alternatives 9A and 9B will result in an estimated 19.2 acres and Alternatives 10A and 10B would result in 21.8 acres of new impervious area. Much of the additional impervious area associated with Alternatives 9 (A&B) and 10 (A&B) is located in the Black Brook watershed due to the proposed Dunbarton Road and Goffstown Connector Roads to the west of the existing Exit 7 interchange.

All five Exit 7 alternatives will impact FEMA 100-year floodplain associated with the Merrimack River, Black Brook, and Milestone Brook. Alternative 8 will impact a larger area in comparison to the other four alternatives. Floodplain impacts for Alternative 8, 9A and 9B are associated with the Merrimack River and Milestone Brook. Alternative 9B would impact the least amount of floodplain. The Goffstown Connector Road associated with Alternative 10A and 10B, will increase impacts. As discussed in Section 2, no hydraulic analysis has been completed for either Black Brook or Milestone Brook. The hydraulic analysis will need to be completed in future phases of the Study.

Similar to the Mainline and Exit 6 alternatives, the Exit 7 alternatives occur in an area mapped as an aquifer. Alternative 8 has the smallest project footprint and will therefore have less impact on the aquifer.

Farmland soils underlie portions of the Exit 7 interchange improvement areas. Specifically, Alternatives 9A and 10A, will impact prime farmland soil and farmland soil of local importance. Alternative 8 will impact the least area of farmland soil, all of which is classified

as farmland soil of local importance. Alternatives 10A and 10B have similar farmland soil impacts as Alternatives 9A and 9B, but impact slightly less area. As discussed in Section 2, the farmland soils primarily occur in forested areas, with no active farms in the study area.

The surrounding landscape at Exit 7 is not as developed as areas to the south and includes a large forested tract of land associated with the Hackett Hill area. All five alternatives may impact identified habitat of rare, threatened, or endangered species associated with the Merrimack River, Black Brook and Milestone Brook. In terms of state-listed species, Alternatives 9 (A&B) and 10 (A&B) potentially impact six and seven state-listed species respectively. Alternative 8 may impact four state-listed species, three species of statewide concern, and one exemplary natural community. Due to proximity of the Hackett Hill area and the Manchester Cedar Swamp, NHDHR expressed concern for the potential for Atlantic White Cedar habitat in the wetlands west of I-293. These concerns will need to be addressed in future phase of the Study when a formal wetland delineation is completed.

The Manchester Municipal Landfill is the primary hazardous waste concern in the area. Groundwater resources in this area have been impacted by landfill leachate, which is in direct contact with the groundwater. Although none of the alternatives will directly impact the landfill, all the footprints will occur in the established Groundwater Management Zone (GMZ). Other known properties with hazardous waste concerns exist in the area, but are limited to above-ground storage tanks. Future research may determine that most of them pose no substantial risk. Additional research of these sites is necessary to confirm this preliminary expectation.

## ROW Impacts

Relocating Exit 7 will require a substantial amount of new ROW, approximately 31 acres for Alternatives 9A and 9B, and approximately 45 acres for Alternatives 10A and 10B. Alternative 9B, 10A, and 10B may impact one, two, and three buildings, respectively. The building impact associated with 9B will occur to a single family residence located on Delia Drive. Buildings impacts associated with Alternatives 10A and 10B include the building on Delia Drive and one single family residence and one multi-family residence impact in the vicinity of the intersection Goffstown Road/Straw Road.

## Cultural Resources

No known archaeological sites or above-ground historic structures will be impacted by any of the alternatives. However, NHDHR has stated that the Black Brook area has the potential for archaeological sensitivity. Further study will need to occur during the NEPA phase.

## Construction Cost Estimate

The results of a programming construction cost estimate (2013 Dollars) shows an estimated construction cost of \$33 to \$36 million for Alternative 8, \$36 to \$40 million for Alternative 9A, \$37 to \$41 million for Alternative 9B, \$42 to \$47 million for Alternative 10A, and \$43 to \$48 million for Alternative 10B. Note that the programming construction cost estimate does not include costs related to utility construction or relocation, right-of-way acquisition or relocation, mitigation, or preliminary and final engineering fees.