Chapter 2—Existing Conditions: Massachusetts Turnpike Ramps

2.1 INTRODUCTION

This chapter presents an analysis of existing transportation conditions for the study area. The traffic conditions for a typical workday were analyzed, with an emphasis on the peak AM and PM commuting hours. The analysis included traffic conditions, crash analyses, and crash patterns for the Massachusetts Turnpike and associated roadways in the study area (shown in Figure 2-1), as well as reviews of transit services, environmental conditions, and land uses.

2.2 TRAFFIC CONDITIONS

Developing a basic knowledge of current traffic conditions fosters an understanding of where congestion occurs as the Massachusetts Turnpike is currently configured and where it likely will occur in the future. The traffic analysis for this study was based on traffic count data collected within the study area. The Massachusetts Department of Transportation's Office of Transportation Planning (OTP) obtained traffic data for the Massachusetts Turnpike between the Allston toll plaza and the Ted Williams Tunnel, and for specific intersections throughout the study area. The traffic volumes used in this analysis are presented in Section 2.2.1.

Section 2.2.2 presents the analysis of the freeway and merge/diverge conditions using these traffic volumes. In addition to the Massachusetts Turnpike, other key intersections and arterials throughout the study area were analyzed (see Sections 2.2.3 and 2.2.4).

2.2.1 Traffic Volumes in 2010

The segment of the Massachusetts Turnpike (I-90) between the Allston toll plaza and the Ted Williams Tunnel, in South Boston, is approximately 4.5 miles in length. The primary focus of this study is the Massachusetts Turnpike in the vicinity of the Back Bay and Fenway neighborhoods. This segment of the Turnpike carries between six and eight lanes of traffic in both directions. West of the Prudential Tunnel, the roadway has eight 11.5-foot lanes (four in each direction, separated by a six-foot-wide median). The left and right shoulders are each two feet wide. East of the Prudential Tunnel, the roadway has six 12-foot lanes, four-foot-wide right shoulders, and three-foot-wide left shoulders, with a six-foot-wide median. The roadway is below grade from Commonwealth Avenue to the east side of the Ted Williams Tunnel, in East Boston, with eight bridges crossing over the roadway west of the Prudential Tunnel and eight bridges crossing over the roadway between the Prudential Tunnel and the I-93 interchange. The Massachusetts Turnpike

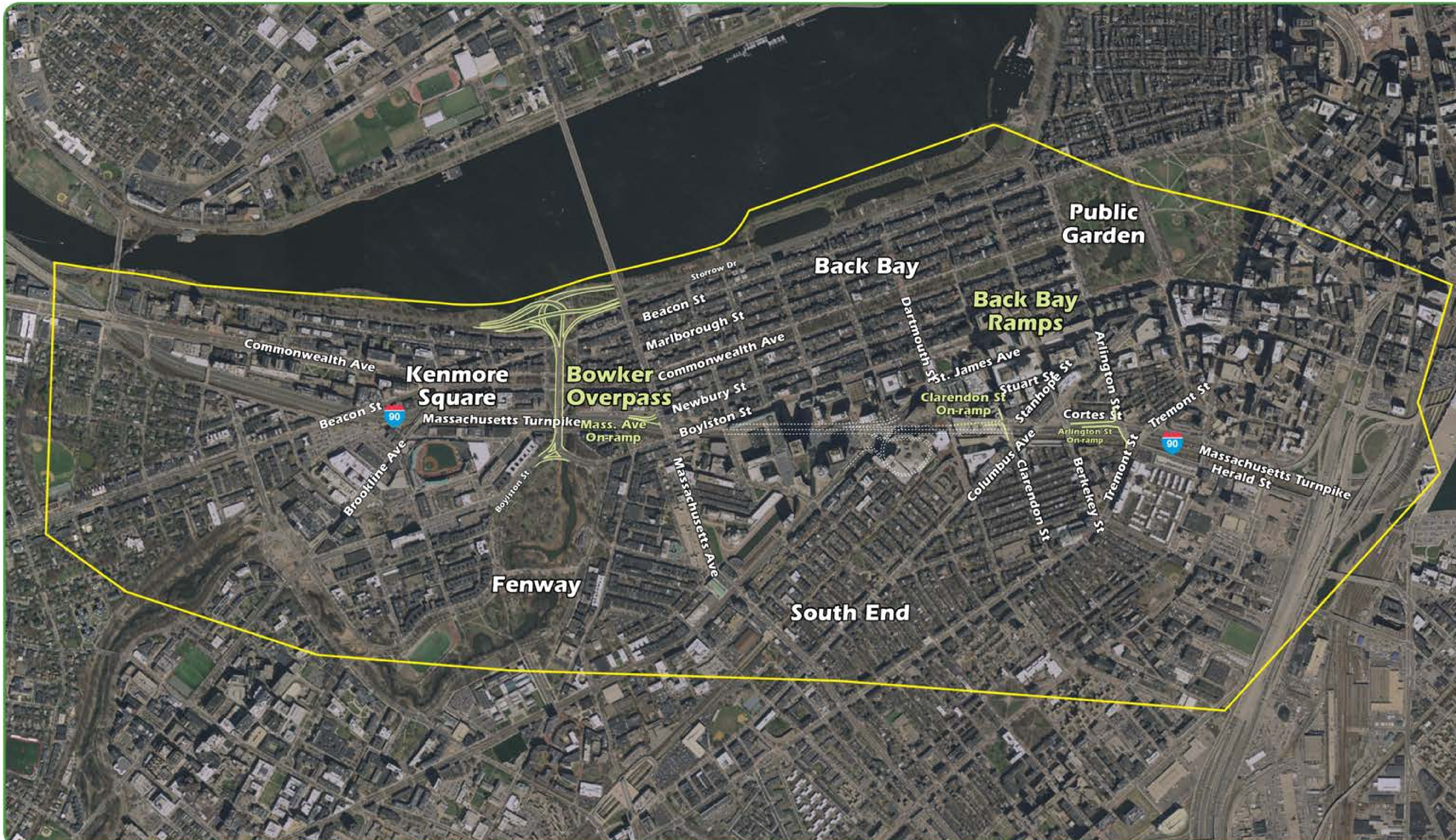


FIGURE 2-1
Massachusetts Turnpike Boston Ramps and Bowker Overpass Study Area

is in a tunnel between the I-93 interchange and the portal in East Boston. There is a section (approximately 875 feet) of the Turnpike in South Boston where the roadway is uncovered before it enters the Ted Williams Tunnel.

The Massachusetts Turnpike is a principal trucking route through the city of Boston. However, trucks carrying hazardous cargo are not permitted on the Turnpike east of the Allston toll plaza because there are many tunnels in that portion of the Turnpike and they are prohibited from traveling through tunnels.

South of the roadway, the Massachusetts Bay Transportation Authority (MBTA) Framingham/Worcester commuter rail line parallels the Turnpike between the Allston toll plaza and the Prudential Tunnel. MBTA express buses travel on the Turnpike during peak periods between the Allston toll plaza and the I-93 interchange, as well as in the Ted Williams Tunnel.

Traffic count data for the Massachusetts Turnpike were obtained using automatic traffic recorders (ATRs) and toll revenue counts. Automatic traffic recorders calculate hourly traffic volumes over the course of several weekdays. This study uses counts taken in 2007 and 2008 at various times of the year. To ensure consistent counts, adjustment factors were applied to compensate for seasonal variations and growth to 2010 in the traffic volumes. Table 2-1 lists the locations of the ATRs that were used for this study.

TABLE 2-1
Massachusetts Turnpike: Automated-Traffic-Recorder Locations

1. I-90 EB exit ramps at Prudential Center
2. I-90 EB mainline just before Exit 24 (I-93)
3. I-90 EB exit ramps at I-93 (Exit 24), including the South Station ramp
4. I-90 EB exit ramp for South Boston
5. I-90 EB on-ramp from I-93 NB
6. I-90 EB mainline just before the South Boston on-ramp
7. I-90 EB on-ramp from South Boston
8. I-90 EB on-ramp from HOV lane
9. I-90 EB off-ramp to Logan Airport
10. I-90 EB mainline just after the Ted Williams Tunnel
11. I-90 WB on-ramp from South Boston
12. I-90 WB on-ramp from I-93 NB
13. I-90 WB on-ramp from I-93 SB
14. I-90 WB mainline just west of Exit 20 (I-93)
15. I-90 WB Arlington Street on-ramp
16. I-90 WB Clarendon Street on-ramp
17. I-90 WB Copley Square on-ramp
18. I-90 WB Massachusetts Avenue on-ramp

In November of 2008, in addition to ATR counts, revenue toll counts were obtained for the interchanges in Allston, the Ted Williams Tunnel, and the Sumner Tunnel over the course of five weekdays, as shown in Table 2-2. Since these counts represent every vehicle that travels past a tollbooth, axle adjustments were not necessary, but the seasonal adjustment was necessary, and was applied before the counts were finalized.

TABLE 2-2
Revenue Toll Counts Collected on Five Weekdays on the Massachusetts Turnpike

1. I-90 EB mainline at Allston
2. I-90 EB on ramp from Cambridge Street
3. I-90 WB off-ramp to Cambridge Street (Exit 20)
4. I-90 U-turn at Allston toll plaza
5. I-90WB mainline at the Ted Williams Tunnel
6. I-90 WB on-ramp from Logan Airport
7. Sumner Tunnel

With two sets of traffic counting methods complete, balanced-volume diagrams were created for the Massachusetts Turnpike. These diagrams include all entry and exit ramps to produce a complete picture of AM (7:00 AM–9:00 AM) and PM (4:00 PM–6:00 PM) peak hours use for the Turnpike. Figures 2-2 and 2-3 show the AM- and PM-peak-hour balanced volumes, respectively, of traffic on the Turnpike between the Allston toll plaza and Ted Williams Tunnel.

Figure 2-2
AM-Peak-Hour Volumes: Massachusetts Turnpike between the Allston Tolls and Ted Williams Tunnel (2010)

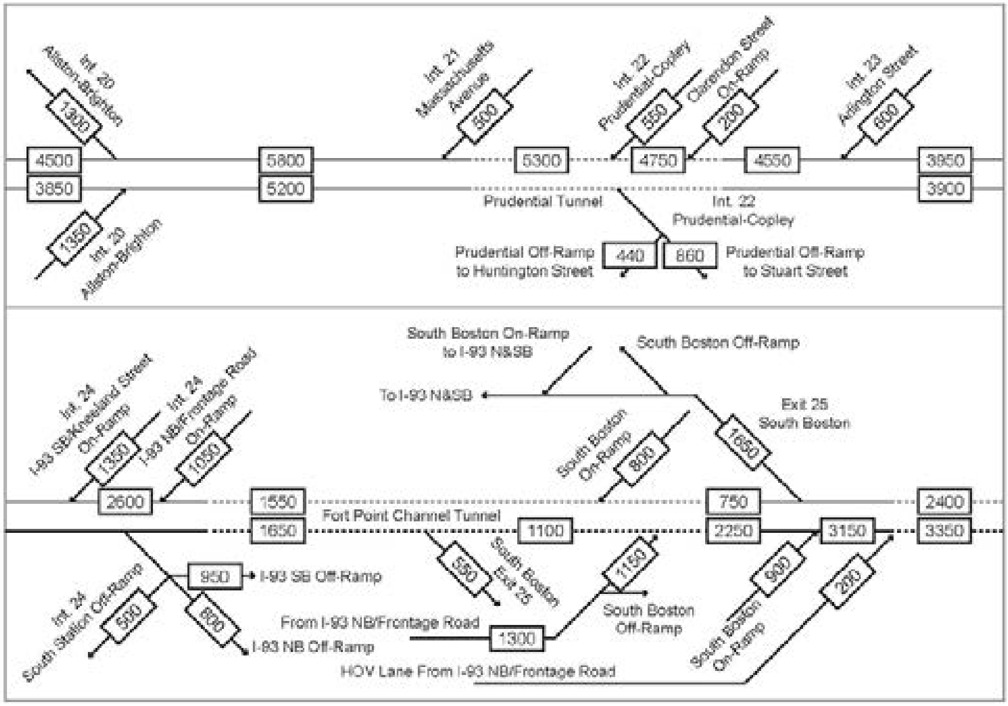
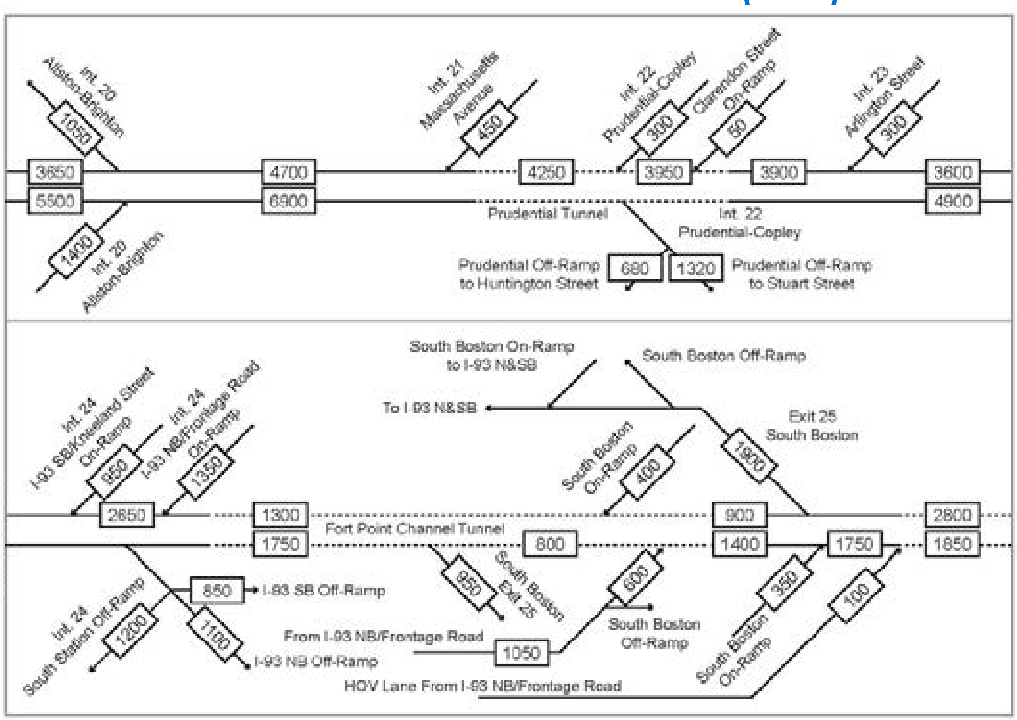


Figure 2-3
PM-Peak-Hour Volumes: Massachusetts Turnpike between the Allston Tolls and Ted Williams Tunnel (2010)



2.2.2 Interchange and Freeway Analysis

The balanced-volume counts were used to perform interchange and freeway analyses using the 2010 Highway Capacity Software™ (HCS). HCS can be used to calculate the traffic density and computed speeds along mainlines and at freeway merges and diverges. These calculations are used for evaluating the performance of a transportation network using the level of service (LOS) as the metric. LOS is graded from A through F, with LOS A representing free-flow conditions and LOS F representing unstable or failing traffic conditions. The remaining grades, B through E, represent gradations of LOS. Table 2-3 provides the LOS criteria for freeway segments and Table 2-4 provides the LOS for ramp merges and diverges. MassDOT considers LOS A, B, C, and D acceptable for urban areas. LOS E and F are considered unacceptable and indicate the need for improvement.

TABLE 2-3
Level of Service Criteria for Freeway Merge and Diverge Segments (2010)

Level of Service	Passenger Cars/Mile/Lane (Density)
A	≤ 10
B	> 10-20
C	> 20-28
D	> 28-35
E	> 35
F	Demand exceeds capacity

TABLE 2-4
Level of Service Criteria for Freeway Ramp Merge and Diverge Segments (2010)

Level of Service	Passenger Cars/Mile/Lane (Density)
A	≤ 11
B	> 11-18
C	> 18-26
D	> 26-35
E	> 35-45
F	> 45

The LOS for each ramp's merge/diverge areas, as well as for several mainline locations on the Massachusetts Turnpike between the Allston toll plaza and the Ted Williams Tunnel, was calculated. Figure 2-4 shows the LOS results for the AM peak hour; Figure 2-5 shows the LOS results for the PM peak hour. Letters shaded in green represent uncongested intersections, at LOS A, B, or C; orange represents somewhat congested intersections, at LOS D; and red represents an unacceptable LOS of E or F.

Figure 2-4
AM-Peak-Hour Level of Service: Massachusetts Turnpike between the Allston Toll Plaza and the Ted Williams Tunnel (2010)

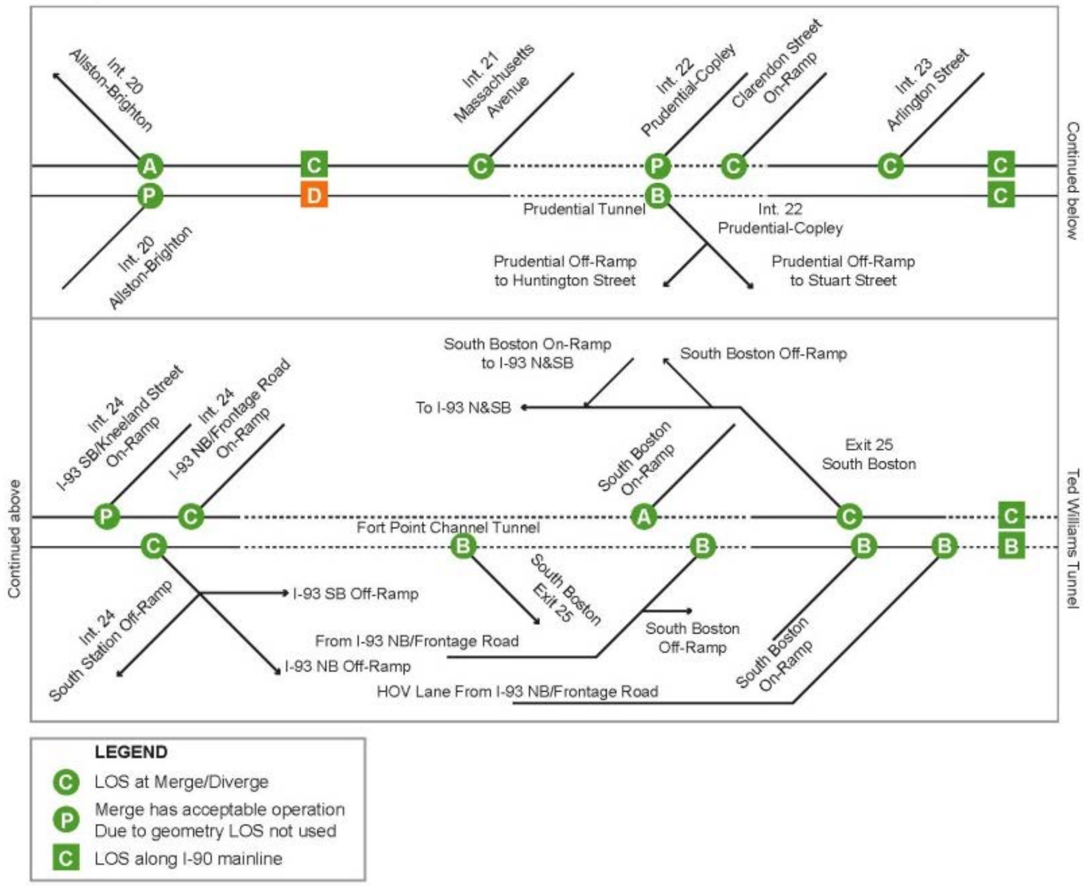
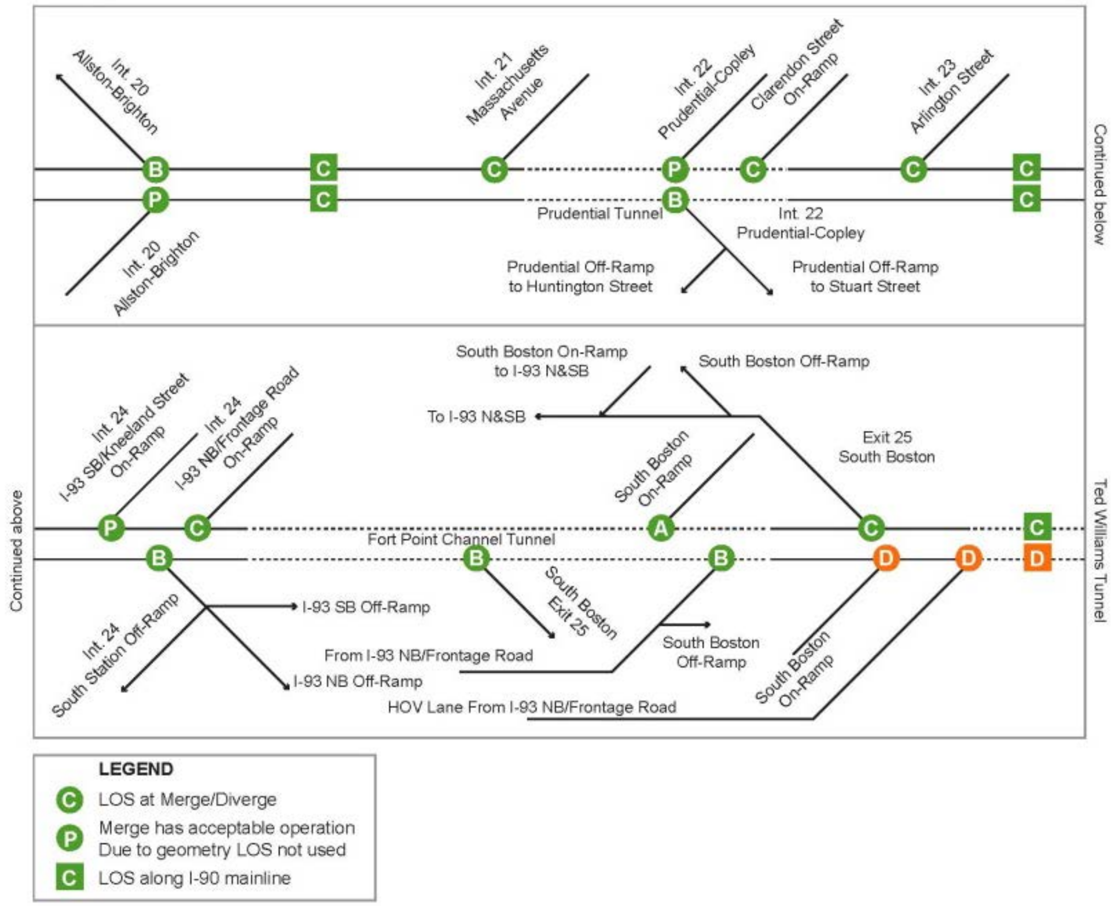


Figure 2-5
PM-Peak-Hour Level of Service: Massachusetts Turnpike between the Allston Toll Plaza and the Ted Williams Tunnel (2010)



Merge/Diverge Analysis

The Highway Capacity Software cannot be used for major merge areas, such as places where an on-ramp merges with a freeway and forms an additional lane on the mainline. This situation occurs at the on-ramp from Cambridge Street to I-90 EB at the Allston I-90 interchange. For this location, the Highway Capacity Manual must be used to determine if a roadway has the capacity to handle the volume for each leg (the mainline before the merge, the mainline after the merge, and the ramp). As long as all three legs show percentages of less than 100 percent, the highway is considered to have enough capacity to handle the volumes and the merge is considered acceptable.

Table 2-5 shows the volume-to-capacity ratio of the major merge from Cambridge Street onto I-90 eastbound. The volume-to-capacity ratios for each leg were all less than 100 percent, with the AM peak hour just over 75 percent and the PM peak hour closer to a 50 percent volume-to-capacity ratio. This indicates that the highway has the capacity to handle traffic entering from the Cambridge Street on-ramp. All of the analysis was based on a free-flow speed of 55 mph.

TABLE 2-5
Analysis of Major Merge Area in Allston (2010)

Location	Volume (veh/hour)	Capacity (veh/hour)	Volume-to-Capacity Ratio (percent of capacity used)
I-90 EB Allston-Brighton On-Ramp (Int. 20) - AM Peak Hour			
Leg 1: I-90 EB before merge	5,500	7,050	78.01%
Leg 2: On-ramp	1,400	4,700	29.79%
Leg 3: I-90 EB after merge	6,900	9,400	71.49%
I-90 EB Allston-Brighton On-Ramp (Int. 20) - PM Peak Hour			
Leg 1: I-90 EB before merge	5,500	7,050	78.01%
Leg 2: On-ramp	1,400	4,700	29.79%
Leg 3: I-90 EB after merge	6,900	9,400	71.49%

Table 2-6 shows the HCS results for the ramp merges and diverges.

TABLE 2-6
Level of Service on Massachusetts Turnpike Ramp Merges and Diverges (2010)

Location	Computed Speeds (mph)	Passenger Cars/Mile/Lane	LOS
AM PEAK PERIOD			
I-90 EB Int. 20 Allston-Brighton			
I-90 EB Int. 22 Prudential-Copley off-ramp*	47.1	19.1	B
I-90 EB Int.24 I-93/South Station off-ramp*	49.1	26.5	C
I-90 EB Exit 25 South Boston off-ramp	48.3	17.6	B
I-90 EB I-93 NB on-ramp	51	14	B
I-90 EB South Boston on-ramp	51	17.5	B
I-90 EB HOV from I-93 on-ramp	51	16.9	B
I-90 WB Exit 25 I-93/South Boston off-ramp	47.2	25	C
I-90 WB South Boston on-ramp	51	9.3	A
I-90 WB Int. 24 I-93 NB on-ramp	50	24.1	C
I-90 WB Int. 24 I-93 SB on-ramp			
I-90 WB Int. 23 Arlington Street on-ramp	57	23	C
I-90 WB Clarendon Street on-ramp	57	22.5	C
I-90 WB Int. 22 Prudential-Copley on-ramp			
I-90 WB Int. 21 Massachusetts Avenue on-ramp	57	21.2	C
I-90 WB Int. 20 Allston-Brighton*	51.6	8.9	A

* Special HCM analysis used for off-ramps where one or more mainline lanes exited at the off-ramp. Only the vehicle density needs to be calculated to determine LOS.

TABLE 2-6 cont.
Level of Service on Massachusetts Turnpike Ramp Merges and Diverges (2010)

Location	Computed Speeds (mph)	Passenger Cars/Mile/Lane	LOS
PM PEAK PERIOD			
I-90 EB Int. 20 Allston-Brighton			
I-90 EB Int. 22 Prudential-Copley off-ramp*	47.9	10.8	B
I-90 EB Int.24 I-93/South Station off-ramp*	50.2	17.7	B
I-90 EB Exit 25 South Boston off-ramp	48.8	16.8	B
I-90 EB I-93 NB on-ramp	51	18.9	B
I-90 EB South Boston on-ramp	50	28.2	D
I-90 EB HOV from I-93 on-ramp	50	28.6	D
I-90 WB Exit 25 I-93/South Boston off-ramp	47.5	21.5	C
I-90 WB South Boston on-ramp	52	7.8	A
I-90 WB Int. 24 I-93 NB on-ramp	50	24.1	C
I-90 WB Int. 24 I-93 SB on-ramp			
I-90 WB Int. 23 Arlington Street on-ramp	56	26.8	C
I-90 WB Clarendon Street on-ramp	56	26.6	C
I-90 WB Int. 22 Prudential-Copley on-ramp			
I-90 WB Int. 21 Massachusetts Avenue on-ramp	57	24.9	C
I-90 WB Int. 20 Allston-Brighton*	51.3	13.0	B

* Special HCM analysis used for off-ramps where one or more mainline lanes exited at the off-ramp. Only the vehicle density needs to be calculated to determine LOS.

Freeway Analysis

The 2010 traffic volumes were entered into the HCS software to calculate the LOS for locations on the portions of I-90 and I-93 that are within the study area. Table 2-7 presents the results.

TABLE 2-7
Level of Service of Massachusetts Turnpike Mainline Locations (2010)

Location	Computed Speeds (mph)	Passenger Cars/Mile/ Lane	LOS
AM PEAK PERIOD			
I-90 EB between Prudential Tunnel and Allston toll plaza (Int. 20)	63.3	27.5	D
I-90 WB between Prudential Tunnel and Allston toll plaza (Int. 20)	65.0	18.3	C
I-90 EB between Prudential Tunnel and I-93 exit (Int. 24)	64.1	25.7	C
I-90 WB between Prudential Tunnel and I-93 exit (Int. 24)	65.0	18.6	C
I-90 EB in Ted Williams Tunnel	55.0	17.0	B
I-90 WB in Ted Williams Tunnel	55.0	25.7	C
PM PEAK PERIOD			
I-90 EB between Prudential Tunnel and Allston toll plaza (Int. 20)	65.0	20.2	C
I-90 WB between Prudential Tunnel and Allston toll plaza (Int. 20)	64.9	22.5	C
I-90 EB between Prudential Tunnel and I-93 exit (Int. 24)	65.0	20.2	C
I-90 WB between Prudential Tunnel and I-93 exit (Int. 24)	65.0	20.5	C
I-90 EB in Ted Williams Tunnel	55.0	30.8	D
I-90 WB in Ted Williams Tunnel	55.0	22	C

2.2.3 Arterial Analysis

Several arterials were included in this analysis to represent the key connectors between the Longwood Medical Area/Fenway/Back Bay area, the South Boston Waterfront, and Logan Airport. The selected arterials include bridges crossing the Charles River, tunnels connecting to Logan Airport, and limited-access roadways that parallel the Massachusetts Turnpike. Table 2-8 lists these key arterials.

TABLE 2-8
Key Arterials (2010)

1. Boston University Bridge
2. Harvard Bridge
3. Longfellow Bridge
4. Memorial Drive
5. Storrow Drive
6. Callahan Tunnel and Sumner Tunnel
7. Zakim Bridge (Interstate 93)

The HCS was used to determine the LOS based on vehicle density; the results are provided in Table 2-9. Figures 2-6 and 2-7 show the AM and PM peak-hour existing LOS for each key arterial within the study area.

During both the AM and PM peak hours, traffic conditions on the key arterials ranged from LOS A to LOS D. In the AM peak hour, Storrow Drive operated at LOS D or better, which is acceptable. The segment of Storrow Drive between the Longfellow Bridge and Leverett Circle had the highest traffic density of the three sections analyzed. The three key bridges over the Charles River that are accessible from Storrow Drive—Boston University, Harvard, and Longfellow—all operated at LOS C or better. The Callahan and Sumner tunnels also operated at LOS C, while the Zakim Bridge operated at LOS C or better.

In the PM peak hour, Storrow Drive operated slightly better overall than during the AM peak hour. The three key bridges off of Storrow Drive operated at LOS B or better. The Callahan and Sumner tunnels, as well as the Zakim Bridge, operated at LOS C or better.

TABLE 2-9
Analysis of Key Arterials (2010)

Location	Direction	Computed Speeds (mph)	Passenger Cars/ Mile/Lane	LOS
AM PEAK PERIOD				
Boston University Bridge (Route 2)	NB	45.0	19.6	C
	SB	45.0	12.8	B
Harvard Bridge (Route 2A)	NB	45.0	11.0	A
	SB	45.0	19.0	A
Longfellow Bridge (Route 3)	EB	45.0	9.9	A
	WB	45.0	10.7	A
Memorial Drive between Boston University Bridge and Harvard Bridge (Route 3)	EB	45.0	23.3	C
	WB	45.0	12.3	B
Memorial Drive between Harvard Bridge and Longfellow Bridge (Route 3)	EB	45.0	23.2	C
	WB	45.0	12.4	B
Storrow Drive between Harvard Bridge and Berkeley Street	EB	45.0	28.1	D
	WB	55.0	20.0	C
Storrow Drive between Berkeley Street and Longfellow Bridge (Route 28)	EB	45.0	28.1	D
	WB	55.0	20.0	C
Storrow Drive between Longfellow Bridge and Leverett Circle (Route 28)	EB	45.0	18.5	C
	WB	44.7	33.6	D
Callahan Tunnel	NB	45.0	9.3	A
Sumner Tunnel	SB	45.0	19.1	C
Zakim Bridge (Interstate 93)	NB	65.0	15.9	B
	SB	64.9	22.6	C

TABLE 2-9 cont.
Analysis of Key Arterials (2010)

Location	Direction	Computed Speeds (mph)	Passenger Cars/ Mile/Lane	LOS
PM PEAK PERIOD				
Boston University Bridge (Route 2)	NB SB	45.0 45.0	14.5 17.8	B B
Harvard Bridge (Route 2A)	NB SB	45.0 45.0	13.9 11.7	B B
Longfellow Bridge (Route 3)	EB WB	45.0 45.0	15.5 8.1	B A
Memorial Drive between Boston University Bridge and Harvard Bridge (Route 3)	EB WB	45.0 45.0	12.1 14.6	B B
Memorial Drive between Harvard Bridge and Longfellow Bridge. (Route 3)	EB WB	45.0 45.0	13.4 13.7	B B
Storrow Drive between Harvard Bridge and Berkeley Street	EB WB	45.0 55.0	22.2 23.6	C C
Storrow Drive between Berkeley Street and Longfellow bridge (Route 28)	EB WB	45.0 44.8	24.4 32.7	C D
Storrow Drive between Longfellow Bridge and Leverett Circle (Route 28)	EB WB	45.0 45.0	19.5 29.6	C D
Callahan Tunnel	NB	45.0	19.2	C
Sumner Tunnel	SB	45.0	16.8	B
Zakim Bridge (Interstate 93)	NB SB	65.0 65.0	22.3 17.6	C B

2.2.4 Intersection Analysis

Table 2-10 lists the key signalized intersections that vehicles currently pass through when traveling between the Longwood Medical Area/Fenway/Back Bay area, the South Boston Waterfront, and Logan Airport. These intersections are all signalized and are located on major roadways.

TABLE 2-10
Key Intersections: LMA, Fenway, Back Bay, South Boston Waterfront, and Logan Airport (2010)

1.	Park Drive at Brookline Avenue/Boylston Street
2.	Kenmore Square (Commonwealth Avenue/Brookline Avenue/Beacon Street)
3.	Massachusetts Avenue at Beacon Street
4.	Dartmouth Street at Saint James Avenue
5.	Arlington Street at Beacon Street
6.	Arlington Street at Stuart Street/Columbus Avenue

Using the data and information collected for the AM and PM peak periods, SYNCHRO[1] was used to assess the roadway capacity and quality of traffic flow at the intersections. The analyses were conducted in a manner consistent with the Highway Capacity Manual (HCM) methodologies.[2] HCM software was used to evaluate the driving conditions at signalized and unsignalized intersections in terms of level-of-service (LOS) ratings from A through F. LOS A represents the best operating conditions (little to no delay), while LOS F represents the worst operating conditions (very long delay). LOS E represents the conditions when a roadway is operating at capacity (acceptable delay for urban intersections). Table 2-11 shows the control delays associated with each level of service for signalized and unsignalized intersections, respectively.

TABLE 2-11
Level of Service Criteria for Signalized Intersections (2010)

Level of Service	Control Delay (seconds of delay per vehicle)
A	≤ 10
B	> 10-20
C	> 20-35
D	> 35-55
E	> 55-80
F	> 80

Table 2-12 shows the LOS of each of the key intersections in the AM and PM peak hours. In addition to the LOS, the 50th and 95th percentile queue lengths on each intersection approach were calculated.[3] The 50th percentile queue length reflects average peak-hour condition, while the 95th percentile queue length reflects

[1] Trafficware Inc., Synchro Studio 8, Synchro plus SimTraffic, Build 801, Version 563, Sugar Land, Texas.
[2] Highway Capacity Manual, HCM 2010, Volume 3: Interrupted Flow, Transportation Research Board of the National Academies, Washington DC, December 2010.
[3] A queue consists of the vehicles waiting during a red phase at a traffic signal.

conditions that occur 95% of the time. For simplicity, the total queue length in feet is divided by 20 to reflect the number of vehicles in a queue; this reflects an average length of a vehicle plus buffers between stopped vehicles. The LOS rating represents the intersection delay as a whole, but the queue length determines if designated turn lanes are adequate and if a traffic queue might interfere with an upstream intersection.

During the AM peak hour, the key intersections ranged from LOS C to LOS F, while the LOS of the key arterials ranged from LOS A to LOS D. During the PM peak hour, most of the key intersections operated at LOS D, with the exception of Park Drive at Brookline Avenue/Boylston Street (LOS E) and Dartmouth Street at Saint James Avenue (LOS C). Figure 2-6 and Figure 2-7 show the LOS for key arterials and key intersections in the AM and PM peak hours, respectively.

TABLE 2-12
Analysis of Key Intersections (2010)

Intersection	Overall Delay[4]	Level Of Service	Worst Approach	50th % Queue[5]	95th % Queue[6]
AM PEAK PERIOD					
Park Drive at Brookline Avenue/Boylston Street	76.2	E	Boylston Street southwest direction	Exceeds capacity	Exceeds capacity
Kenmore Square	99.7	F	Beacon Street Northeast direction	3	4
Massachusetts Avenue at Beacon Street	31.8	C	Beacon Street westbound	4	Exceeds capacity
Dartmouth Street at Saint James Avenue	22.2	C	Dartmouth Street northbound	7	9
Arlington Street at Beacon Street	35.1	D	Storrow Drive southbound	Exceeds capacity	Exceeds capacity
Arlington Street at Stuart Street/Columbus Avenue	75.0	E	Arlington Street southbound	Exceeds capacity	Exceeds capacity
PM PEAK PERIOD					
Park Drive at Brookline Avenue/Boylston Street	63.0	E	Boylston Street Southwest direction	Exceeds capacity	Exceeds capacity
Kenmore Square	42.5	D	Commonwealth Avenue eastbound	Exceeds capacity	Exceeds capacity
Massachusetts Avenue at Beacon Street	45.3	D	Massachusetts Avenue southbound	23	Exceeds capacity
Dartmouth Street at Saint James Avenue	24.9	C	Dartmouth Street northbound	9	Exceeds capacity
Arlington Street at Beacon Street	44.5	D	Beacon Street westbound	Exceeds capacity	Exceeds capacity
Arlington Street at Stuart Street/Columbus Avenue	48.1	D	Stuart Street eastbound	Exceeds capacity	Exceeds capacity

[4] Overall delay is measured in seconds of delay per vehicle.
[5] 50th percentile queues are measured in number of vehicles.
[6] 95th percentile queues are measured in number of vehicles.

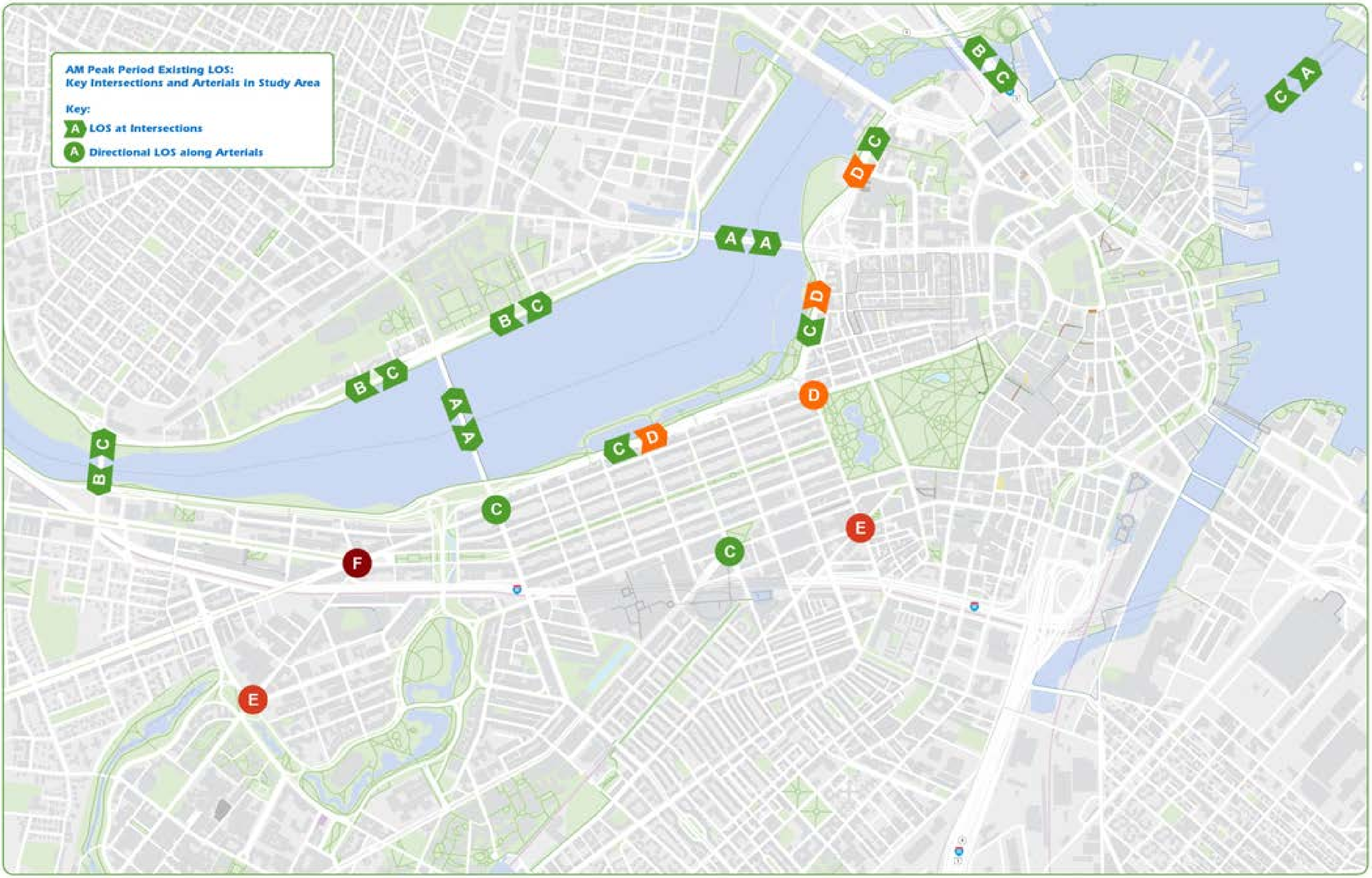


FIGURE 2-6
AM-Peak-Hour Existing LOS
Key Intersections and Arterials in the Study Area

massDOT
Massachusetts Department of Transportation

Massachusetts Turnpike Boston Ramps and Bowker Overpass Study

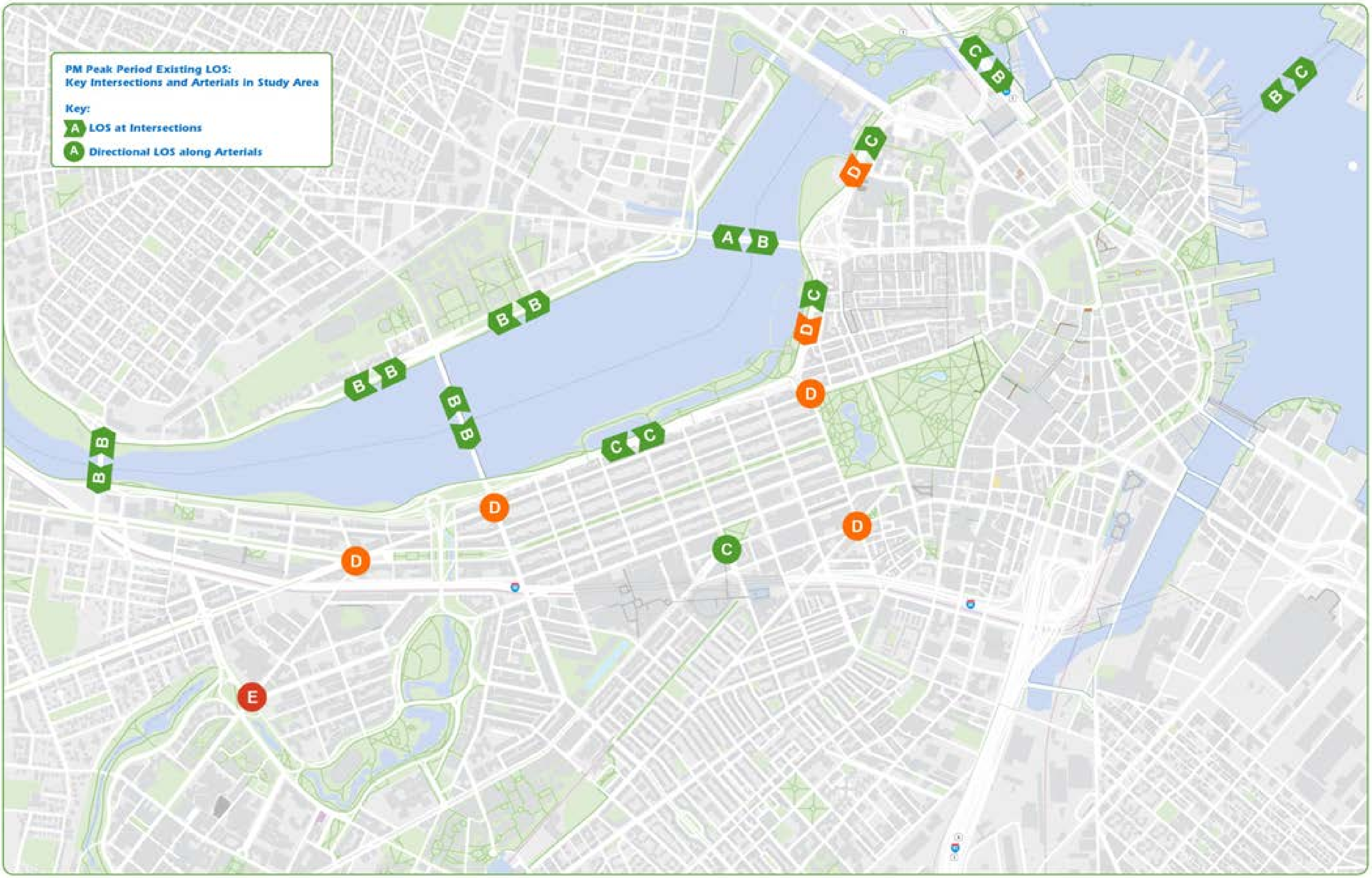


FIGURE 2-7
PM-Peak-Hour Existing LOS
Key Intersections and Arterials in the Study Area

massDOT
Massachusetts Department of Transportation
Massachusetts Turnpike Boston Ramps and Bowker Overpass Study

2.3 CRASH DATA

The existing crash data for the study area were reviewed using the crash report database created by MassDOT's Registry of Motor Vehicles (RMV) Division. However, the number of crashes may be underreported because only operator crash reports were provided to the RMV by the City of Boston.

2.3.1 Massachusetts Turnpike Crash Data

Crash data were obtained for all of the crashes that occurred on the Massachusetts Turnpike, in both directions combined, between the Allston toll plaza and East Boston from 2006 to 2010. The database contained a total of 520 crash reports; they included the crash date, location, roadway junction type, weather conditions, crash severity, type, and amount of ambient lighting. The "weather conditions" category indicates if there was precipitation or fog at the time of the crash or if it was a cloudy day. The crash severity data indicate whether the crash involved property damage, injuries, or fatalities. The categories of crash type are rear-end, sideswipe, angle, and single-vehicle. The "ambient lighting" category indicates the natural lighting conditions at the time of the crash—daylight, dusk, night, and dawn—and whether or not the roadway had artificial lighting.

The crash data summaries are displayed in Table 2-13 (the crash severity and weather conditions); Table 2-14 (the crash type and weather conditions); Table 2-15 (the crash severity and crash type); and Table 2-16 (the crash type and ambient light).

Most of the crashes—56 percent—occurred under clear conditions, while 26 percent of the crashes occurred when there was precipitation (rain, snow, or mixed precipitation). The most common crash type was rear-end, and weather did not appear to have been a factor in the majority of those crashes. However, rain was indicated as a contributing factor in single-vehicle crashes. Based on these data it would appear that with the majority of the crashes being rear-end with property damage, the predominant cause can be assumed to be attributed to congested conditions.

Viewing the data on crash severity and crash type together (Table 2-15) indicates which crash type results in the most property damage (non-injury) or injuries. According to the data, rear-end crashes accounted for the majority of crashes (41 percent), while single-vehicle crashes accounted for 30 percent and angle crashes accounted for 11 percent. Of the rear-end crashes, 75 percent were non-injury property damage, and 21 percent involved an injury. Of the single-vehicle crashes, 70 percent were non-injury property damage, and 26 percent involved an injury.

TABLE 2-13
Crash Severity and Weather Conditions

Crash Severity	Weather Conditions								
	Clear	Cloudy	Fog	Mixed Precipitation	Not Reported	Other	Rain	Severe Crosswinds	Snow
Fatal injury	2								
Non-fatal injury	60	18		2	5		22		5
Not reported	14	2					3		1
Property damage only (none injured)	213	54		4	8	5	84		14
Unknown	2	2							
Total	291	76		6	13	5	109		20

TABLE 2-14
Crash Type and Weather Conditions

Crash Type	Weather Conditions								
	Clear	Cloudy	Fog	Mixed Precipitation	Not Reported	Other	Rain	Severe Crosswinds	Snow
Angle	28	6		2	1		16		4
Head-On	2								1
Not reported	3				1	1	1		
Rear-end	144	32		2	2	2	29		3
Rear-to-rear	1								
Sideswipe, same direction	48	14			3	2	11		4
Single-vehicle crash	64	24		2	6		51		8
Unknown	1						1		
Total	291	76		6	13	5	109		20

As can be seen in Table 2-15, 61 percent of the crashes occurred during the day and 32 percent occurred at night. Most of the daylight crashes were rear-end, and most of the night-time crashes were rear-end or single-vehicle. Crashes that occurred during daylight included single-vehicle (24 percent), sideswipe (18 percent), and angle (13 percent) crashes.

Using the crash database's longitude and latitude coordinates, CTPS geocoded each crash to determine whether there were any crash patterns at the crash location. The findings indicated that there were crash clusters between the St. Mary's Street and Beacon Street overpasses, in the Prudential Tunnel, and approaching the I-93 interchange from both directions.

There were 96 crashes between Saint Mary's Street and Beacon Street (Figure 2-8), most of which were rear-end and single-vehicle crashes. Within the Prudential Tunnel (Figure 2-9), the preponderance of crashes were rear-end, single-vehicle, and sideswipe. The approaches to I-93 from the eastbound and westbound Turnpike (Figure 2-10) experienced mostly rear-end and angle crashes. Figures 2-8, 2-9, and 2-

10 show the geocoded crash locations in the west, central, and eastern portions of the study area, with the number of crashes of each type indicated separately.

Based on the geocoded crashes, eastbound crashes are most likely caused by the congested conditions and lane changes associated with the traffic destined for the Prudential Tunnel off-ramp. In the westbound direction, the crashes most likely are occurring because of the westbound on-ramps because there are forced-merge areas at three of the four on-ramps—only the Dartmouth Street on-ramp provides an additional lane for entering vehicles.

TABLE 2-15
Crash Severity and Crash Type

	Crash Type							
Crash Severity	Angle	Head -On	Not Reported	Rear-End	Rear-to-Rear	Sideswipe, Same Direction	Single –Vehicle Crash	Unknown
Fatal injury		1					1	
Non-fatal injury	12			44		15	41	
Not reported	4		2	6		3	5	
Property damage only (none injured)	41	2	4	160	1	64	108	2
Unknown				4				
Total	57	3	6	214	1	82	155	2

TABLE 2-16
Crash Type and Ambient Lighting Conditions

Crash Type	Ambient Lighting Conditions							
	Dark-Lighted Roadway	Dark-Roadway Not Lighted	Dark Unknown Roadway Lighting	Dawn	Daylight	Dusk	Not Reported	Other
Angle	11	2		1	40	3		
Head-on	2				1			
Not reported	2				3		1	
Rear-end	56	6	1	2	138	8	1	2
Rear-to-rear					1			
Sideswipe, same direction	17	2		2	58	1	2	4
Single-vehicle crash	58	8	3	3	77	2		
Unknown					1	1		
Total	146	18	4	8	319	15	4	6

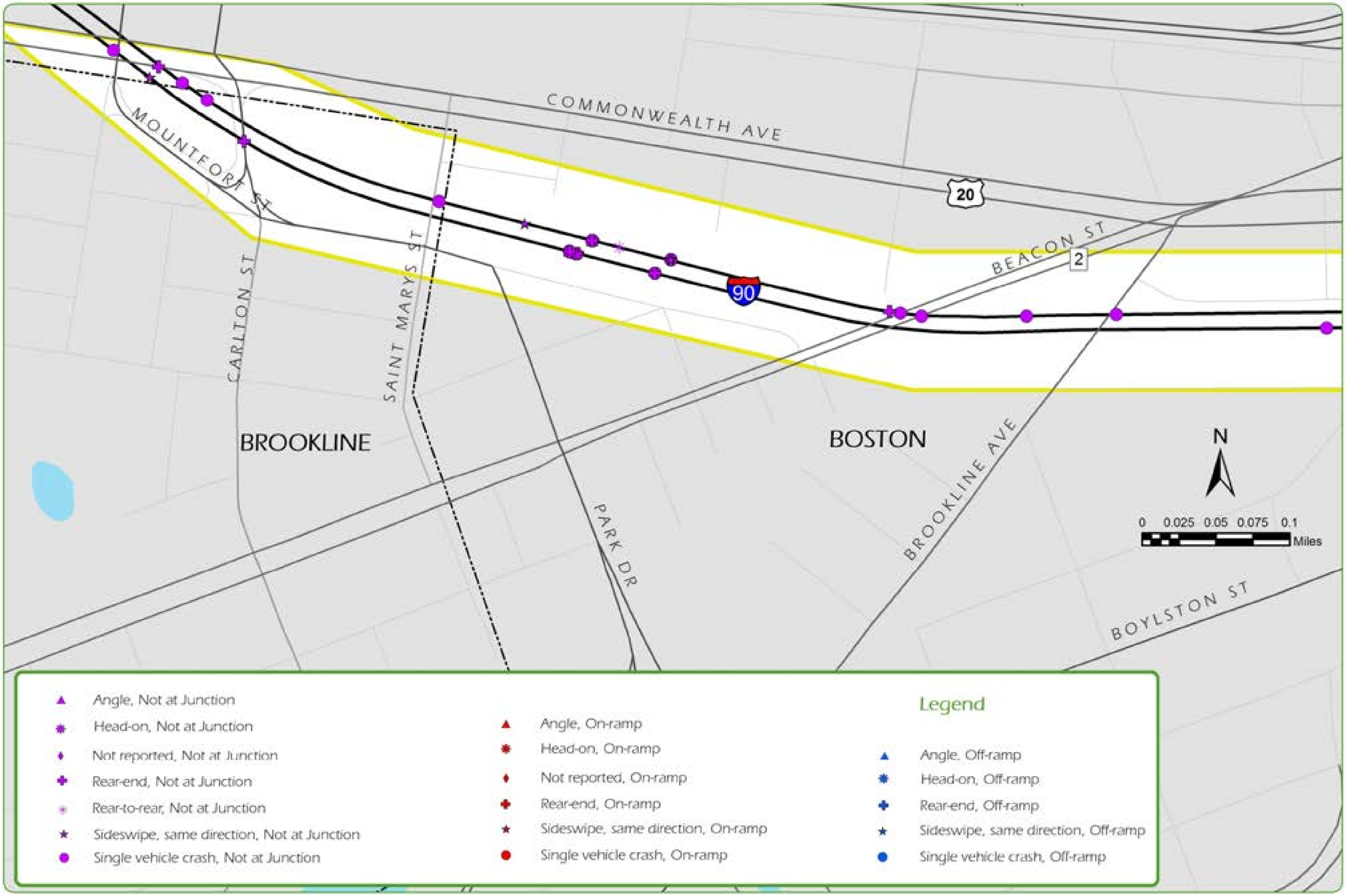


FIGURE 2-8
2006–2010 Crashes by Type and Roadway Junction

FIGURE 2-9
2006–2010 Crashes by Type and Roadway Junction

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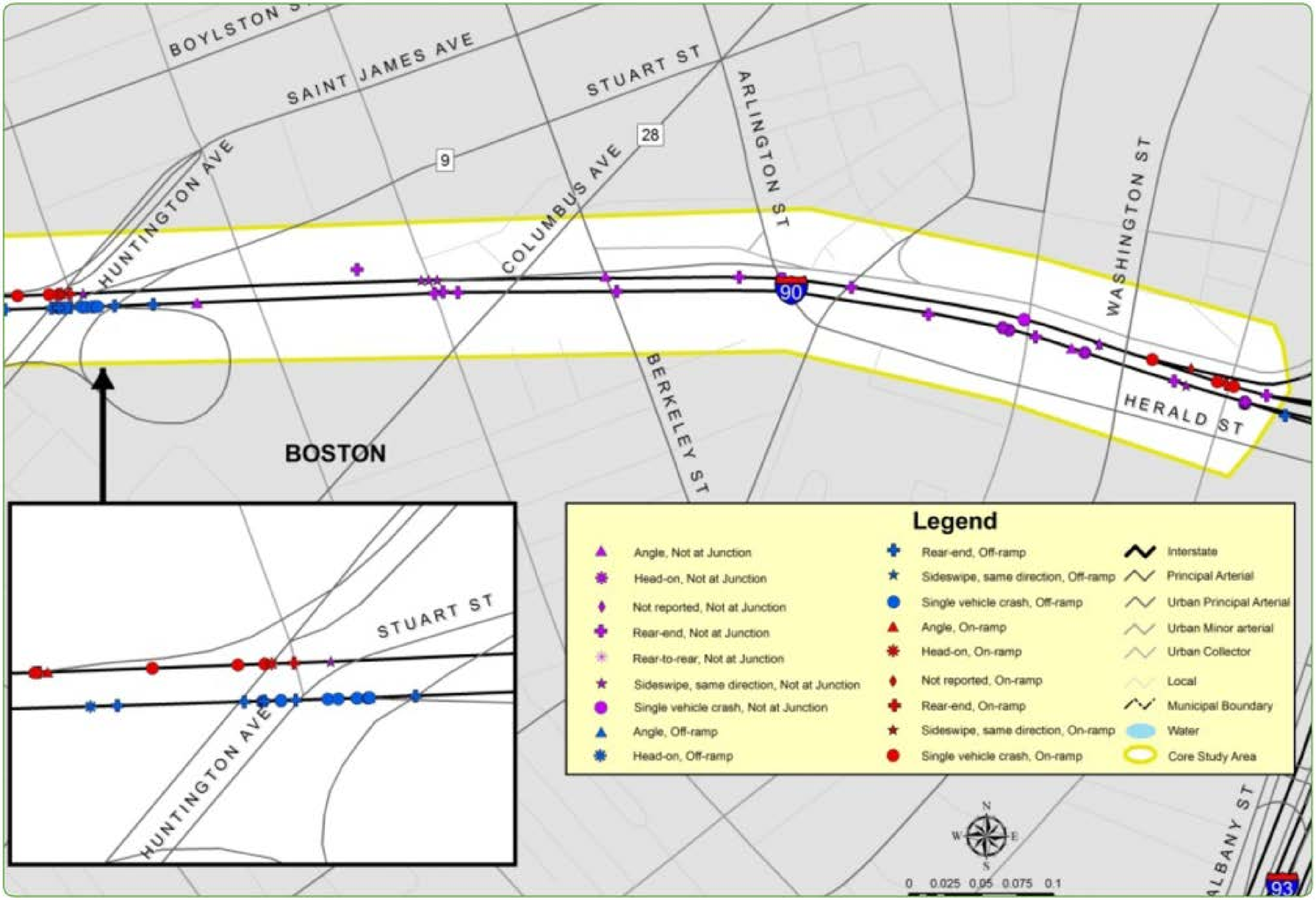

FIGURE 2-10
2006–2010 Crashes by Type and Roadway Junction

2.4 TRANSIT DATA

Within the study area, the Massachusetts Bay Transportation Authority (MBTA) operates three rapid transit lines, one commuter rail line (with multiple commuter rail lines converging at Back Bay Station), and 55 bus routes, with Amtrak also providing passenger service in this area. Boarding information was collected by the MBTA. The data presented in this section were current as of the spring of 2014.

2.4.1 Rapid Transit Lines

The Silver, Orange, and Green lines provide transit service in the study area. The MBTA collects daily weekday passenger boarding information using CharlieCard and CharlieTicket data. For the aboveground stations, visual counts of passenger boardings were taken. Using counts taken from 2007 to 2012, daily average and AM and PM peak-period passenger boardings were calculated. Tables 2-17, 2-18, and 2-19 summarize boardings by transit line.

The Silver Line is split into two parts—an aboveground bus rapid transit route between South Station, Downtown Crossing, and Dudley Square (Routes SL 4 and SL5) and several bus rapid transit routes originating at South Station that are destined for Logan Airport and the South Boston Waterfront (Routes SL 1 and SL2). The SL5 route has 10 stops within the study area and provides service between Roxbury, the South End, Bay Village, and downtown Boston via Washington Street. The 10 stops had more than 8,750 daily weekday boardings, with 2,019 boardings during the AM peak period (7:00 AM–9:00 AM) and 1,518 boarding during the PM peak period (4:00 PM–6:00 PM).

The SL1 and SL2 routes connect South Station with Logan Airport and South Boston via a tunnel under Fort Point Channel; the Ted Williams Tunnel; and local Boston roadways. The Federal Courthouse and World Trade Center stations lie within the study area and provide access to the South Boston Waterfront and the Boston Convention and Exposition Center. The two stations had a combined total nearly 3,100 average weekday boardings, with 110 boardings during the AM peak period (7:00 AM–9:00 AM) and 1,262 boardings during the PM peak period (4:00 PM–6:00 PM).

The Orange Line provides north–south heavy rail transit service between Oak Grove Station in Malden and Forest Hills Station in Jamaica Plain, with five stations serving destinations in the study area. The Ruggles, Massachusetts Avenue, Back Bay, Tufts Medical Center, and Chinatown stations provide access to Chinatown, Bay Village, South End, Back Bay, and the Longwood Medical Area. This subway line had slightly more than 46,000 passengers boarding on an average weekday, with 5,664 boarding during the AM peak period and 11,860 boarding during the PM peak period. More than twice as many passengers boarded the Orange Line during the evening peak period as during the morning peak period.

The Green Line provides light rail service, with multiple branches serving Boston, Cambridge, Brookline, and Newton. There are 13 stations that serve the study area. The Boylston, Arlington, Copley, Hynes, Kenmore, Prudential (E Branch), and Symphony (E Branch) underground stations and the Longwood (D Branch), Fenway (D Branch), Northeastern (E Branch), Museum of Fine Arts (E Branch), Longwood Medical Area (E Branch), and Brigham Circle (E Branch) aboveground stations provide access to Chinatown, Back Bay, Fenway, and the Longwood Medical Area. In total, slightly more than 60,000 passengers boarded the Green Line on an average weekday, with 5,300 passengers boarding during the AM peak period and almost 14,000 boarding during the PM peak period.

Table 2-17
Silver Line Boardings: Weekday and AM and PM Peak Periods

Stations	Weekday Daily Boardings		
	AM Peak Period	PM Peak Period	Average Weekday
World Trade Center[1] – SL1, SL2, SL Waterfront	38	368	2,156
Courthouse[1] – SL1, SL2, SL Waterfront	72	894	931
Washington Street at Essex Street[2] – SL4, SL5	44	83	430
Washington Street at Tufts Medical Centert[2] – SL4, SL5	517	422	2,472
Washington Street at Herald Street[2] – SL4, SL5	70	118	575
Washington Street at East Berkeley Street[2] – SL4, SL5	244	232	1,374
Washington Street at Union Park[2] – SL4, SL5	315	292	1,561
Washington Street at East/West Newton Street[2] – SL4, SL5	282	323	1,570
Washington Street at Worcester Street[2] – SL4, SL5	213	131	817
Washington Street at Massachusetts Avenue[2] – SL4, SL5	206	143	1,142
Washington St at Lenox Street[2] – SL4, SL5	99	65	508
Washington Street at Melnea Cass Boulevard[2] – SL4, SL5	68	79	466
TOTAL	2,129	2,780	11,844

[1] Source: Fiscal Year 2012 automated fare collection (no noninteraction).
[2] Source: Fall 2012 automatic passenger counters.

Table 2-18
Orange Line Boardings: Weekday and AM and PM Peak Periods

Stations	Weekday Daily Boardings		
	AM Peak Period	PM Peak Period	Average Weekday
Ruggles	1,183	2,483	10,070
Mass Ave	1,009	1,196	6,148
Back Bay	2,739	4,876	17,778
Tufts Medical Center	483	1,774	5,966
Chinatown	251	1,530	6,154
TOTAL	5,664	11,860	46,116

Source: Fiscal Year 2012 automated fare collection (no noninteraction).

Table 2-19
Green Line Boardings: Weekday and AM and PM Peak Periods

Stations	Weekday Daily Boardings		
	AM Peak Period	PM Peak Period	Average Weekday
Boylston[1]	276	1,495	6,727
Arlington[1]	367	2,678	8,337
Copley Square[1]	1,306	3,267	14,789
Hynes[1]	927	1,796	9,330
Kenmore Square[1]	927	1,683	9,340
Longwood (D Line)[2]	240	927	2,719
Fenway (D Line)[2]	371	786	3,488
Prudential[1]	298	754	3,614
Symphony[1]	295	239	1,725
Northeastern (E Line)[3]	235	412	2,625
Museum of Fine Arts (E Line) [3]	116	401	1,676
Longwood Medical (E Line) [3]	224	996	3,793
Brigham Circle (E Line)[4]	266	770	2,535
TOTAL	5,306	13,940	61,436

[1] Source: Fiscal Year 2012 Automated Fare Collection (no noninteraction).

[2] Source: CTPS counts, 2011.

[3] Source: CTPS counts, 2010.

[4] Source: CTPS counts, 2007.

2.4.2 Commuter Rail Line

The Framingham/Worcester commuter rail line travels through the study area, stopping at Yawkey Station and Back Bay Station. In the spring of 2014, upgrades to Yawkey Station were completed. The upgrades to the station, tracks, and platforms included making the station accessible to people with disabilities and allowing both tracks to be used. (Previously, only one of the two tracks had been usable at Yawkey Station for passengers; the other track could only be used by trains passing through the station.) When the second track became available, service was increased on the Framingham/ Worcester Line.

This line runs parallel to the Massachusetts Turnpike through the study area, with a small portion curving away from the Turnpike at Back Bay Station. This increased gap between the commuter rail line and the Turnpike provided the necessary space for the eastbound Copley Square exit ramp to diverge from the Turnpike, rise in elevation, cross the commuter rail tracks, and loop around to connect with Huntington Avenue and Stuart Street. As of June 2015, there were nine inbound trains (to Boston) during the AM peak period (6:30 AM–9:30 AM) and eight outbound trains during the PM peak period (4:00 PM–7:00 PM) on the Framingham/Worcester Line.

Based on the most recent data collected for the commuter rail lines (MBTA 2008), the inbound AM peak-period trains were averaging 5,200 daily passengers, and the seven outbound trains carried 4,700 passengers out of the city each day. Therefore, there are a total of almost 10,000 peak-period passengers per day, which is 77.7 percent of the total average weekday ridership. The average percentage of directional weekday ridership that occurred during the AM inbound and PM outbound peak periods was 81.1 percent and 74.3 percent, respectively. Table 2-20 summarizes the commuter rail ridership volumes by train.

Table 2-20
Commuter Rail Ridership
Volumes by Train: Summary

	AM Inbound (6:30 AM-9:30 AM)	
	Arrival Time	Passenger Volume
AM Inbound (6:30 AM-9:30 AM)		
P500	6:31 AM	264
P502	7:08 AM	746
P504	7:46 AM	752
P506	8:11 AM	847
P508	8:23 AM	1,179
P510	8:56 AM	596
P512	9:08 AM	621
P514	9:36 AM	224
Total Boardings		*5,229*
PM Outbound (4:00 PM-7:00 PM)		
P519	4:05 PM	632
P521	4:27 PM	407
P523	5:00 PM	1,062
P525	5:15 PM	673
P527	5:35 PM	829
P529	6:15 PM	718
P531	6:30 PM	389
Total Boardings		*4,710*

2.4.3 MBTA Bus Routes

The MBTA operates numerous bus routes in the study area, providing local, crosstown, and express service. Seven of those bus routes (Routes 501, 504, 505, 553, 554, 556, and 558) use the Massachusetts Turnpike; they serve commuters traveling from Waltham, Watertown, Newton, and Brighton to downtown Boston. There are local bus routes that serve the Kenmore Square area (Routes 8, 19, 57, 60, and 65), and other local bus routes that serve the study area, such as the busy bus Route 1 on Massachusetts Avenue. Some of the other local routes that serve the study area are

Routes CT1, 9, 10, 39, 43, and 55. Table 2-21 summarizes bus passenger boarding by bus route type.

Table 2-21
Bus Route AM- and PM-Peak-Period Boardings: Summary

Description	AM Peak Period		PM Peak Period		Daily Total	
	Boardings	Percent	Boardings	Percent	Boardings	Percent
Frequent-Service Bus Routes (Routes 8, 9, 39, 57, 60)	21,503	81.76%	24,277	86.51%	134,068	90.90%
Special-Destination Routes (Routes 10, 19, 43, 55, 65)	509	1.94%	123	0.44%	735	0.50%
Express Bus Routes (Routes 501, 504, 505, 553, 554, 556)	3,187	12.12%	2,568	9.15%	8,337	5.65%
Crosstown Bus Routes (Route CT1)	1,101	4.19%	1,096	3.91%	4,353	2.95%
TOTAL	26,300		28,064		147,493	

Based on the passenger boarding counts, almost 147,493 passengers traveled on buses within and through the study area. The AM and PM peak periods have comparable ridership counts, with 26,300 passengers traveling by bus in the AM peak period and 28,064 in the PM peak period.

2.5 ENVIRONMENTAL CONDITIONS

Using data from the Massachusetts Office of Geographic Information (MassGIS), maps showing environmental constraints and open space restrictions in the study area were produced. These maps are important for determining the feasibility of permitting, designing, and constructing proposed transportation improvements. The maps also ensure that the connectivity of open spaces and bicycle and pedestrian accommodations is being addressed. They are also useful for identifying any potential environmental impacts that might increase the cost, require mitigation, or make the construction of a proposed improvement infeasible.

2.5.1 Environmental Constraints

Figure 2-11 shows the existing environmental constraints in the study area based on environmental data from MassGIS. There are four types of environmental constraints in the study area: underground storage tanks, anadromous (migrating) fish, historic places, and wetlands.

Underground Storage Tanks

The underground storage tanks, many of which store fuel for existing service stations, are located along principal arterials (Commonwealth Avenue, Boylston Street, Saint James Street, Columbus Avenue, and Marginal Road) in Boston.

Anadromous Fish

An anadromous fish is born in fresh water, spends most of its life in the sea, and returns to fresh water to spawn. Anadromous fish are present at the Charles River Dam next to the Museum of Science on Route 28; it is within the study area but not near the Massachusetts Turnpike.

Wetlands

Wetlands are areas either inundated or saturated for varying periods during the growing season, resulting in the development of specially adapted plants that promote the development of adaptable wetland plants. As required by Section 404 of the federal Clean Water Act of 1977, impacts to wetlands must be avoided or minimized, or the damaged wetland area must be replaced.[7] State law dictates that the Department of Environmental Protection enforce Massachusetts General Law Chapter 131 Section 40 of the Wetlands Protection Act to ensure that public interests will be protected; the law deals with issues such as drinking water, groundwater, pollution prevention, flood control, fisheries, and wildlife habitat. Figure 2-12 shows that within the study area, part of the Muddy River, which is an inland wetland, travels from the Fens and flows under the Massachusetts Turnpike.

Historic Places

There are four buildings and six historic districts located within the study area that are listed on the Massachusetts State Register of Historic Places (SRHP). There are two historic preservation laws that protect historic places from inappropriate alterations, demolition, or any other adverse impact. The federal National Historic Preservation Act, Section 106, mandates a review of all locations that are included in or might be eligible for the National Register of Historic Places. Such a review would be required for any new

[7] Philip J. Quarterman (Senior Wetland Biologist, W&H Pacific Inc.) and Michael W. Shippey (Wetland Specialist, ODOT Environ. Services), "AASHTO's Wetland Manual for Transportation Designers," Conference Proceeding Paper presented to the American Association of State Highway and Transportation Officials, September 1996.

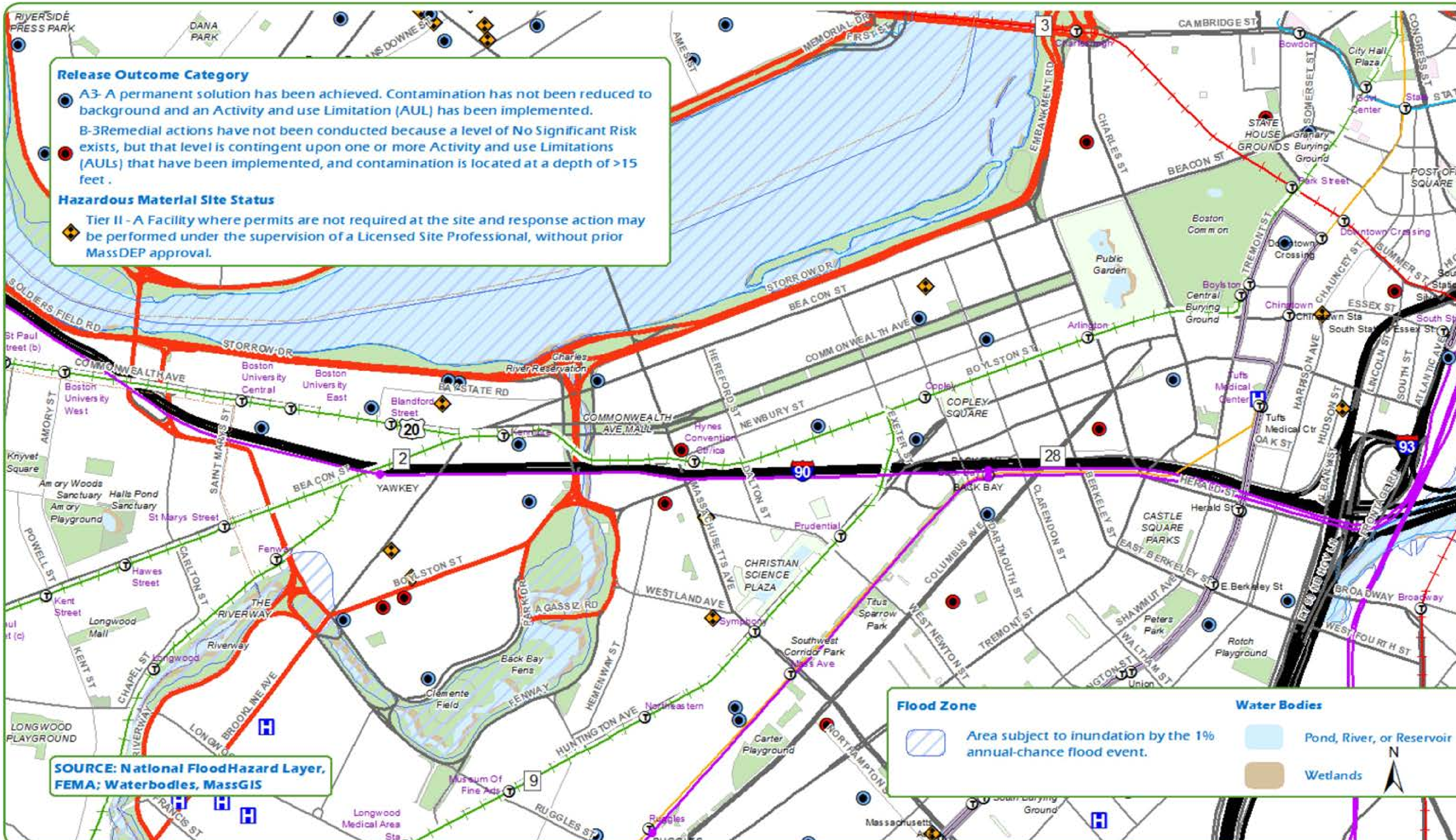

FIGURE 2-11
Back Bay Environmental Constraints and Flood Area

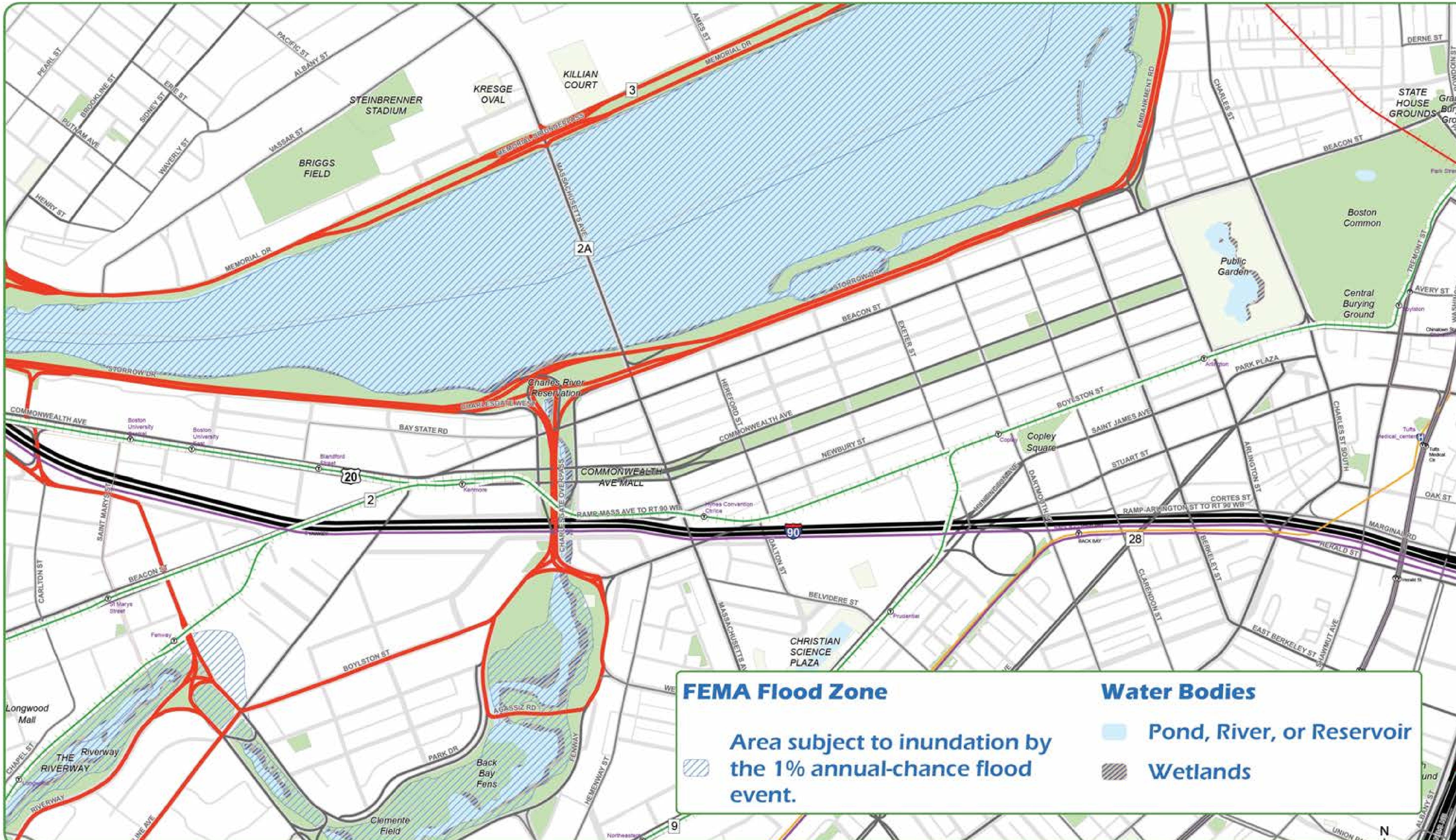

FIGURE 2-12
Back Bay Wetland Areas

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access ramps to or from I-90. State law dictates that the Massachusetts Historic Commission identify, evaluate, and protect important historic assets by maintaining an inventory of historic assets in the SRHP. As required under Massachusetts General Law Chapter 9, Sections 26-27C, as amended by Chapter 254 of the Acts of 1988 (950 CMR 71.00), any potential impacts on places listed on the SRHP must be reported early in the planning process and would need to eventually be reviewed by the Massachusetts Historical Commission under this law.

Figure 2-13 shows four buildings on the SRHP that are within the study area, including the Peter Fuller Building at the intersection of Commonwealth Avenue and the Boston University Bridge, the Fenway Studios along Ipswich Street between Charlesgate East and Boylston Street, the Youth's Companion Building at the corner of Columbus Avenue and Berkeley Street, and One Bay Street at the corner of Tremont Street and Marginal Road. It also shows the six districts that are located within the core study: the Bay Village Historic District, the South End Landmark District, the South End Historic District, the Back Bay Historic District, the Back Bay Architectural District, and the Olmsted Park System.

2.5.2 Open Space Restrictions

The term "open space" refers to lands owned by federal, state, county, municipal, or nonprofit enterprises that are protected from development. Figure 2-14 shows the locations in the study area where there are existing open space restrictions. There are several types of open space restrictions in federal legislation: agriculture, recreation or conservation, historical or cultural, recreational, water supplies, and "other." Under the US Department of Transportation Act, Section 4(f), the federal government cannot approve the use (to construct new highway ramps, for example) of these publicly owned parks or recreation areas unless there is no feasible alternative and the design minimizes the harm to the open space. In addition, the Massachusetts Executive Office of Energy and Environmental Affairs preserves and protects open space through Article 97of the Massachusetts Constitution in order to ensure that there is no net loss of protected open space.

There is a mix of recreation, historic, conservation, and other uses in the study area and its environs. The open space areas near the Bowker Overpass are part of the Olmsted Park System and are protected by both state and federal law as National Historic Parkland. This mix of uses provides opportunities to ensure the connectivity of open spaces and of bicycle and pedestrian paths and routes. While it may be possible to mitigate open space restrictions, the mitigation would result in increased costs and environmental permitting delays.

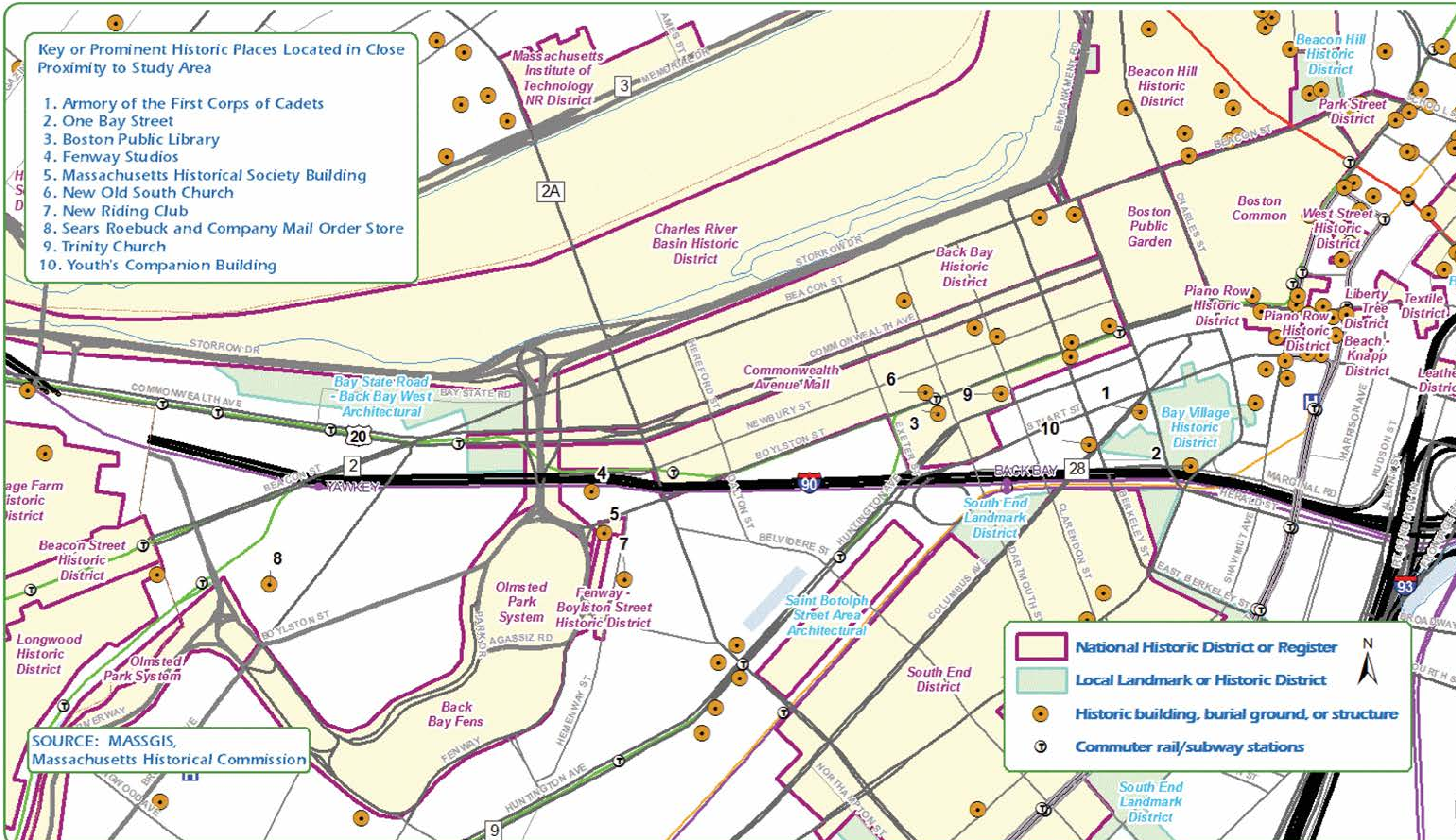


FIGURE 2-13
Back Bay Historic Districts

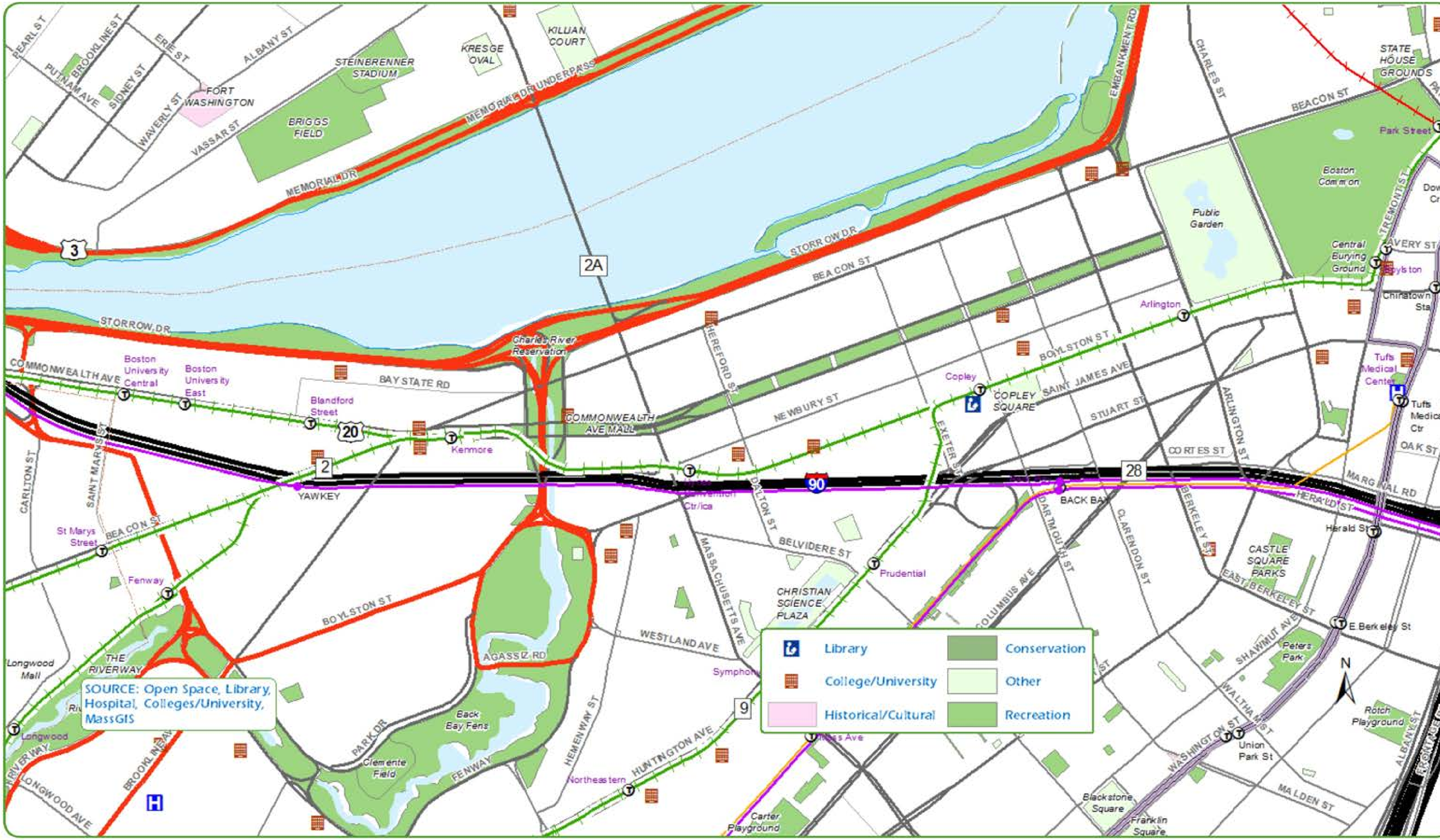


FIGURE 2-14
Back Bay Parks and Open Spaces

2.5.3 Terrain Constraints

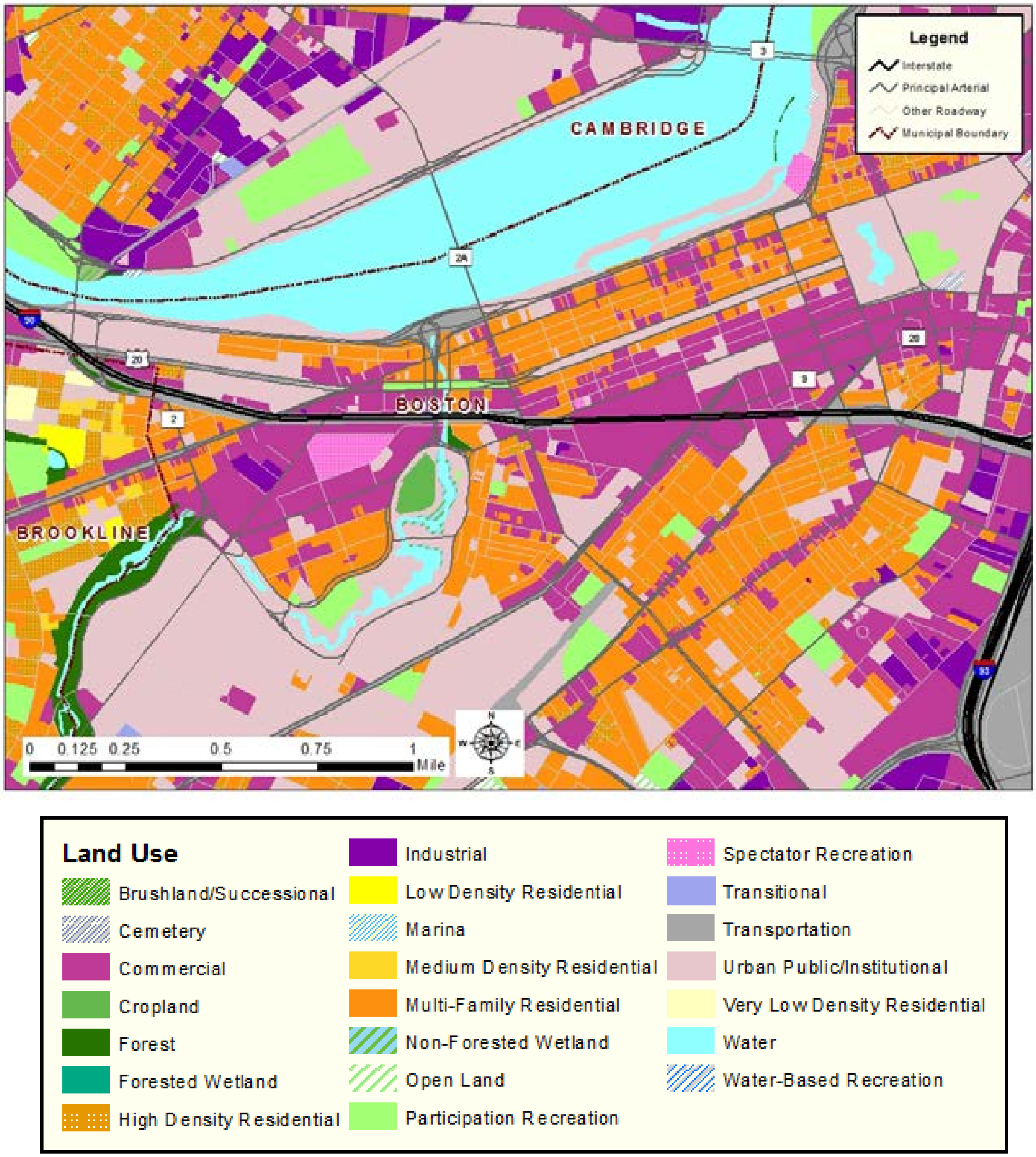
The study area is mostly level and ranges from nine to 29 feet above sea level. The maximum height is the land above the Massachusetts Turnpike as it travels through the Prudential Tunnel.

2.6 LAND USE

The primary land use in the study area is commercial, followed by residential, urban institutional, and recreational land uses. Other uses, such as open space and transportation, are scattered throughout the study area. The land use data are shown in Figure 2-15 and includes 22 categories of existing conditions.

The Massachusetts Turnpike is bordered primarily by commercial, residential, and urban institutional land uses. The urban institutional use along the Turnpike is the Boston University campus, and the commercial areas along the Turnpike are in the Fenway, Back Bay, and Chinatown business districts. The residential land uses are located near Audubon Circle in Brookline, in the Back Bay near Massachusetts Avenue, in Bay Village, in Chinatown, and along the northern edge of the South End.

Figure 2-15
Land Use in the Study Area



2.6.1 Massachusetts Turnpike Air Rights

In addition to the land uses on either side of the Turnpike, the air space above the highway is organized in parcels numbered sequentially from 1 through 23 (Figure 2-16). These parcels are located from just west of the Commonwealth Avenue overpass to the I-93 overpass. Since the area above the Prudential Tunnel is owned by the Prudential Insurance Company, no parcel numbers were assigned to that area, causing a small gap in the air rights parcels between numbers 15 and 16.

Before the Massachusetts Turnpike Authority (MTA)[8] solicited bids for the development of the Prudential Insurance Company parcels, the City of Boston spearheaded an effort to develop a plan for the air rights area. The plan, entitled "The Civic Vision for Turnpike Air Rights in Boston," was completed in 2000 and adopted in 2001 by the City of Boston and the MTA, with the goal of guiding the development for each parcel or group of parcels, including the unnumbered parcel owned by the Prudential Insurance Company. Since the adoption of the air-rights plan, MassDOT has solicited proposals, and developers have responded by submitting plans for various parcels (Figure 2-17). Table 2-22 provides a summary of the status of each parcel.

The existing Copley Place and Hancock Garage (next to Back Bay Station) properties each feature preliminary plans for high-rise expansions. The Copley Place expansion would include expanded retail and residential uses. The construction drawings for the proposal were under review as of August 2015. The Hancock Garage owners recently executed a new lease that allows for future development of up to three high-rise buildings, which are anticipated to feature retail, office, and residential uses, as well as modifications to the existing garage.

[8] Before the consolidation of Massachusetts transportation agencies in November 2009, the MTA was an independent authority.

Figure 2-16
Massachusetts Turnpike Air-Rights Parcels in the Study Area

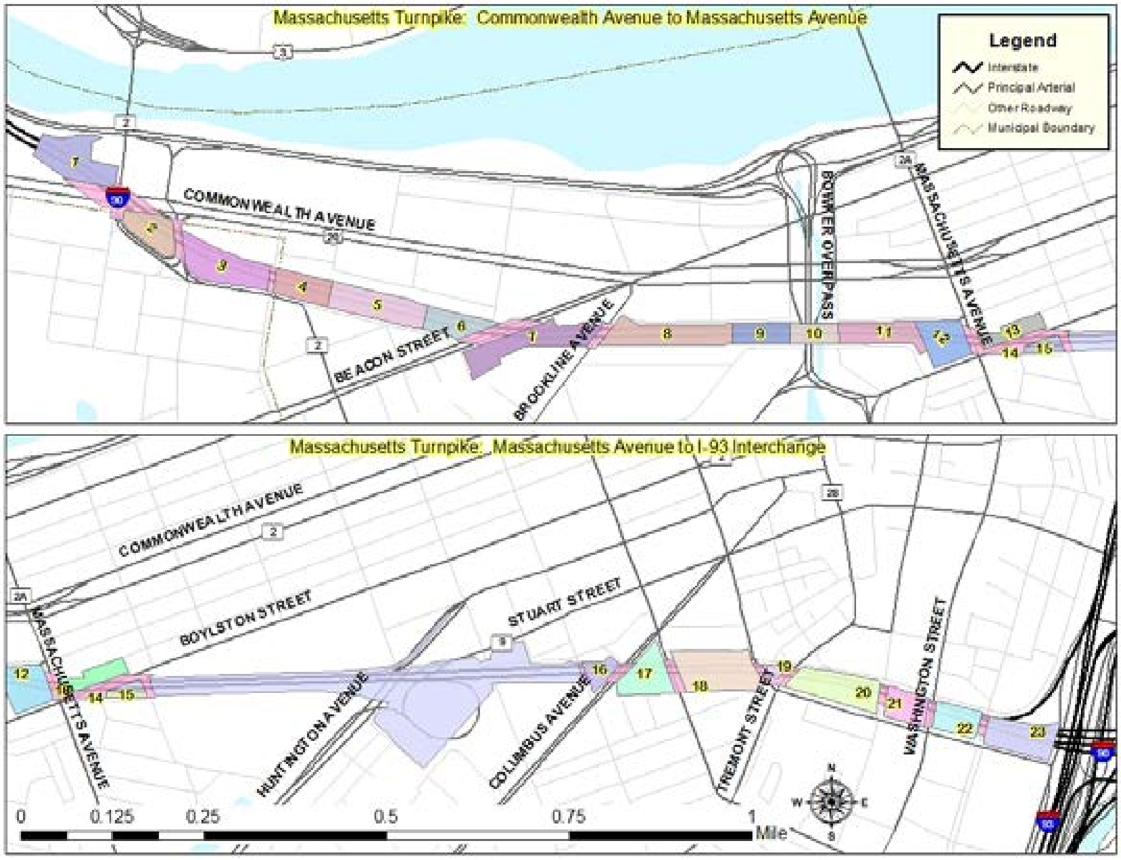
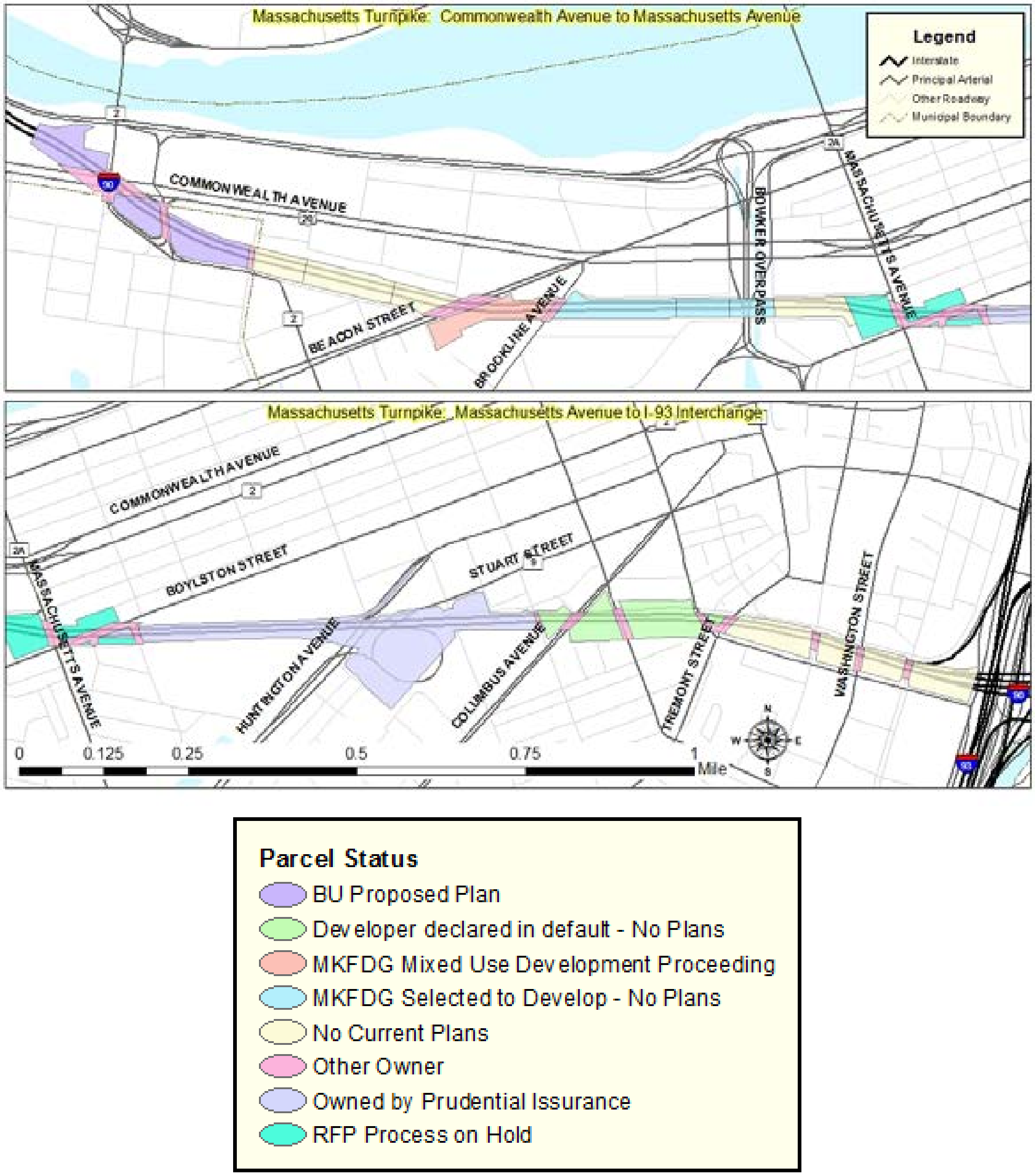


Table 2-22
Proposed Air-Rights Developments

Parcel Number	Status	Proposed Land Use
Parcels 1-3	Boston University proposed plan; no disposition or current activity	Education
Parcels 4-6	No current plans	
Parcel 7	Meredith Kenmore/Fenway Development Group mixed use; awaiting developer action	Residential, Commercial, Retail, and
Parcels 8-10	Meredith Kenmore/Fenway Development Group selected to develop; disposition discontinued; no current activity	Parking
Parcel 11	Unlikely to be developed	
Parcels 12 & 15	Weiner-Samuels selected and under agreement	
Parcel 13	The Peebles Corporation designated as developer; negotiations underway	Residential, Retail, Hotel, and Parking
Parcel 14	Undevelopable independently	Residential, Retail, Hotel, and Parking;
Parcels 16-19	No current plans	Hynes Station rehabilitation
Parcels 20-23	No current plans	

Figure 2-17
Proposed Use of Massachusetts Turnpike Air-Right Parcels in the Study Area



2.6.2 Other Development Proposals

In addition to the air-rights parcels, the City of Boston is reviewing proposed developments for other areas near the Massachusetts Turnpike. As required by Article 80 of the Boston Zoning Code, the Boston Redevelopment Authority (BRA) must follow a public review process.

Numerous developments that require a BRA review are located in the four main neighborhoods covered by this study: Fenway, Longwood Medical Area, Back Bay, and the South Boston Waterfront. The developments range from around 50,000 to more than 1,500,000 square feet. The South Boston Waterfront has the greatest number of proposed developments in the study area with more than a dozen, more than seven of which would be larger than 650,000 square feet. The impacts of future proposed developments on vehicular movements in the study area were estimated using the Boston Region MPO's regional travel demand computer model. Figure 2-18 shows the proposed developments in the study area.

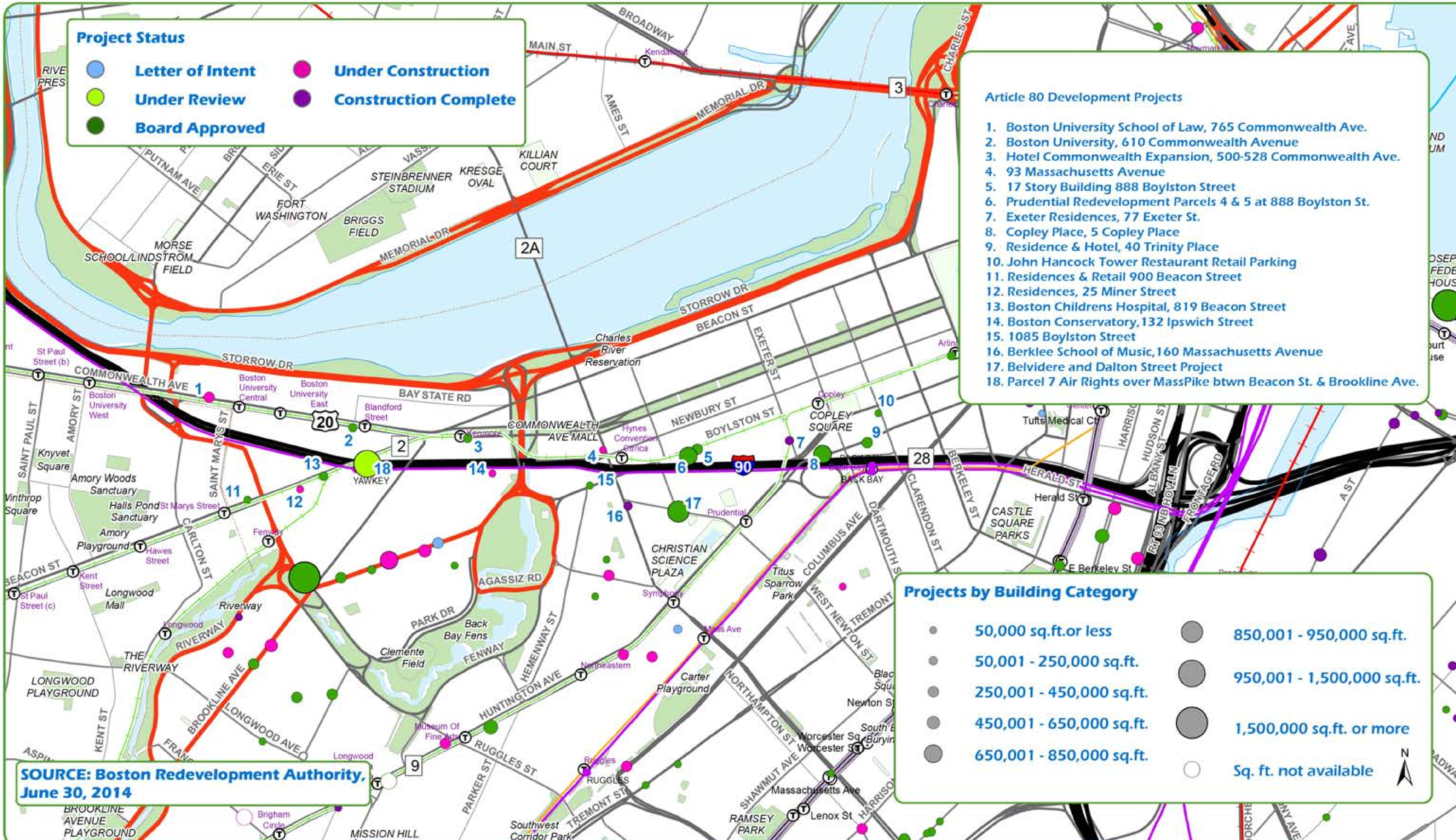


FIGURE 2-18
Back Bay BRA Projects