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Green Line Extension Project: Systemwide Stats and SUMMIT Results

Transit Statistic	Base Year	2030					
	Existing Conditions	No-Build	Difference w/Existing Cond.	Updated Baseline	Difference w/No-Build	Proposed Action	Difference w/No-Build
Key Operating Characteristics	Green E ends at Lechmere Green D ends at Gov't. Center Route 80: Arlington to Lechmere Existing Lechmere Station	Green E ends at Lechmere Green D ends at Gov't. Center Route 80: Arlington to Lechmere Existing Lechmere Station		Green E ends at Lechmere Green D ends at Lechmere Enhanced Route 80 to Lechmere Route 80: Arlington to Lechmere Union Square Shuttle Existing Lechmere Station		Green E ends at Union Square Green D ends at College Ave Relocated Lechmere Station	
Linked Transit Trips	849,400	993,700	144,300	996,000	2,300	1,001,200	7,500
Unlinked Transit	1,180,670	1,349,910	169,240	1,354,960	5,050	1,348,140	-1,770
Red Line	231,400	244,280	12,880	241,480	(2,800)	233,730	-10550
Blue Line	62,400	68,900	6,500	68,600	(300)	69,340	440
Green Line	221,600	251,600	30,000	261,100	9,500	277,570	25970
Orange Line	170,200	195,310	25,110	190,410	(4,900)	188,970	-6340
CRR	104,770	122,280	17,510	122,310	30	122,360	80
BRT	25,600	53,970	28,370	54,090	120	54,460	490
Local Bus	353,400	401,300	47,900	404,700	3,400	389,440	-11860
Ferry	4,500	4,730	230	4,730	-	4,730	0
SUMMIT (hrs daily)							
Relative to Baseline	N/A	N/A		N/A		7,549	

Green Line Extension Project: Station Level Boardings and Alightings

Anticipated Station Level Weekday Boardings and Alightings			Base Year		No-Build (2030)		Proposed Action (2030)	
			Boardings	Alightings	Boardings	Alightings	Boardings	Alightings
Key Operating Characteristics			• Green E ends at Lechmere • Green D ends at Government Center • Rte 80: Arlington to Lechmere • Existing Lechmere Station		• Green E ends at Lechmere • Green D ends at Government Center • Rte 80: Arlington to Lechmere • Existing Lechmere Station		• Green E ends at Union Sq. • Green D ends at College Avenue • Relocated Lechmere Station	
System		Station						
Existing	Green Line	North Station	8,700	8,700	12,640	12,640	13,610	13,610
	Green Line	Science Park Station	800	800	1,790	1,790	2,150	2,150
	Green Line	Existing Lechmere Station	6,400	6,400	9,290	9,290	NA	NA
Extension	Green Line	Relocated Lechmere Station	NA	NA	NA	NA	8,820	8,820
	Green Line	Washington Street Station (formerly referred to as Brickbottom Station)	NA	NA	NA	NA	2,830	2,830
	Green Line	Gilman Square Station	NA	NA	NA	NA	3,930	3,930
	Green Line	Lowell Street Station	NA	NA	NA	NA	1,140	1,140
	Green Line	Ball Square Station	NA	NA	NA	NA	1,850	1,850
	Green Line	College Avenue Station	NA	NA	NA	NA	2,140	2,140
	Green Line	Union Square Station	NA	NA	NA	NA	3,570	3,570

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MEMORANDUM

TO: **Consulting Team** **February 24, 2011**

FROM: **Bruce Kaplan, CTPS**

RE: **Summary of User Benefits for Green Line Extension – Proposed Alternative**

As part of the New Starts process, CTPS was charged with computing the user benefits generated by future Green Line Extension scenarios. These were calculated by supplying the FTA-supplied SUMMIT software with data produced from scenarios run using the CTPS regional model. This memorandum details the user benefits generated by SUMMIT when the Proposed Alternative (D Line branch with a College Avenue terminus and E Line branch with a Union Square terminus) is compared to the Baseline Scenario. Specifically, the markets/districts in which substantial user benefits occur by both transit and automobile modes are explored. Additionally, this memorandum explains why the traditional discounting of user benefits accrued by the NT-CW market segment is not merited.

TRANSIT USER BENEFITS

Not surprisingly, user benefits resulting from new or improved transit trips primarily occur along the alignment of the Green Line. These benefits are clustered around the new extended alignment as well as along the heavily traveled Central Subway segment.

Productions

The largest amounts of transit user benefits are produced by districts lying along the current and proposed Green Line alignment. Over 1000 hours of transit user benefits emante from the Spring Hill district. More than 700 hours of transit user benefits are produced by the East Cambridge district. Over 600 hours of transit user benefits come from the "Rest of Boston" district, largely due to its immense geographic size in conjunction with it containing three rapid transit lines (Orange, Red, and Silver) that ultimately interface with the Green Line. In terms of other substantial transit user benefit production, more than 500 hours originate in two populous and busy activity areas along the current Green Line alignment - Boston University/Fenway/Longwood Medical Area/North Jamaica Plain district and the Boston Proper district.

Attractions

The largest transit user benefits are attracted to Boston and Cambridge districts lying along the Green Line alignment. This is not surprising given the improved transit access (one-seat rides) to activity centers located in East Cambridge, downtown Boston, and Back Bay for residents of Somerville and Medford as well as improved service frequency along the Green Line between Lechmere and Government Center. More than 2000 hours of transit user benefits are accrued by the attractions in the Boston Proper district while more than 800 hours are accumulated by the East Cambridge District as well as the Boston University/Fenway/Longwood Medical Area/North Jamaica Plain district. Somerville's Spring Hill district, which lies along the proposed Green Line alignment, attracts nearly 600 hours of user benefits while more than 400 hours of user benefits are attracted to the East Boston/Silver Line Market, which contains containing rapid transit lines (Blue and Silver) that interface with the Green Line.

District-to-District Pairings

In terms of district-to-district pairings, the greatest flows of transit user benefits occur from three study area Green Line districts (Spring Hill, East Cambridge, and Davis Square) to the primary Boston district located along the Green Line Central Subway alignment (Boston Proper). The greatest losses of transit user benefits occur within Somerville district pairings: Winter Hill to and from Spring Hill; Davis Square to Winter Hill. These losses can be attributed to longer average walk distances to/from the new Green Line stations compared to/from the stops of the enhanced Route 80 bus service.

AUTOMOBILE USER BENEFITS

Automobile user benefits counter-intuitively result from transit service enhancements. CTPS, when calibrating its mode-choice model to regional household survey data, identified that Single Occupant Vehicle (SOV) Non-home Based (NHB) purpose trips are related to the SOV mode share of Home-Based Work (HBW) trips. People generally cannot make a NHB auto trip unless they previously drove from their home to their NHB origin. Therefore, transit service enhancements, which cause a reduction in the HBW SOV mode share, also increase the likelihood of using non-SOV modes, namely High Occupancy Vehicle (HOV), transit, and the non-motorized (walk) mode, for NHB trips. Although this inituitively leads to an increase in the utilities (and mode shares) for transit trips, it counterintuitively also leads to an increase in non-motorized (walk) trips and HOV trips (both of which are non-transit) that results in auto (non-transit) user benefits.

The "automobile" user benefits bear this out for the Green Line Extension project. The largest increase in non-transit user benefits occur internally in the largest attraction districts located along the Green Line alignment. Presumably, these result from new NHB trips following new transit HBW or Home-Based Other (HBO) trips. The greatest increase in auto user benefits occurs internally in the Boston Proper district. The other large gains in auto user benefits occur internally in the Boston University/Fenway/ Longwood Medical Area/North Jamaica Plain district and in the East Cambridge District.

TOTAL USER BENEFITS

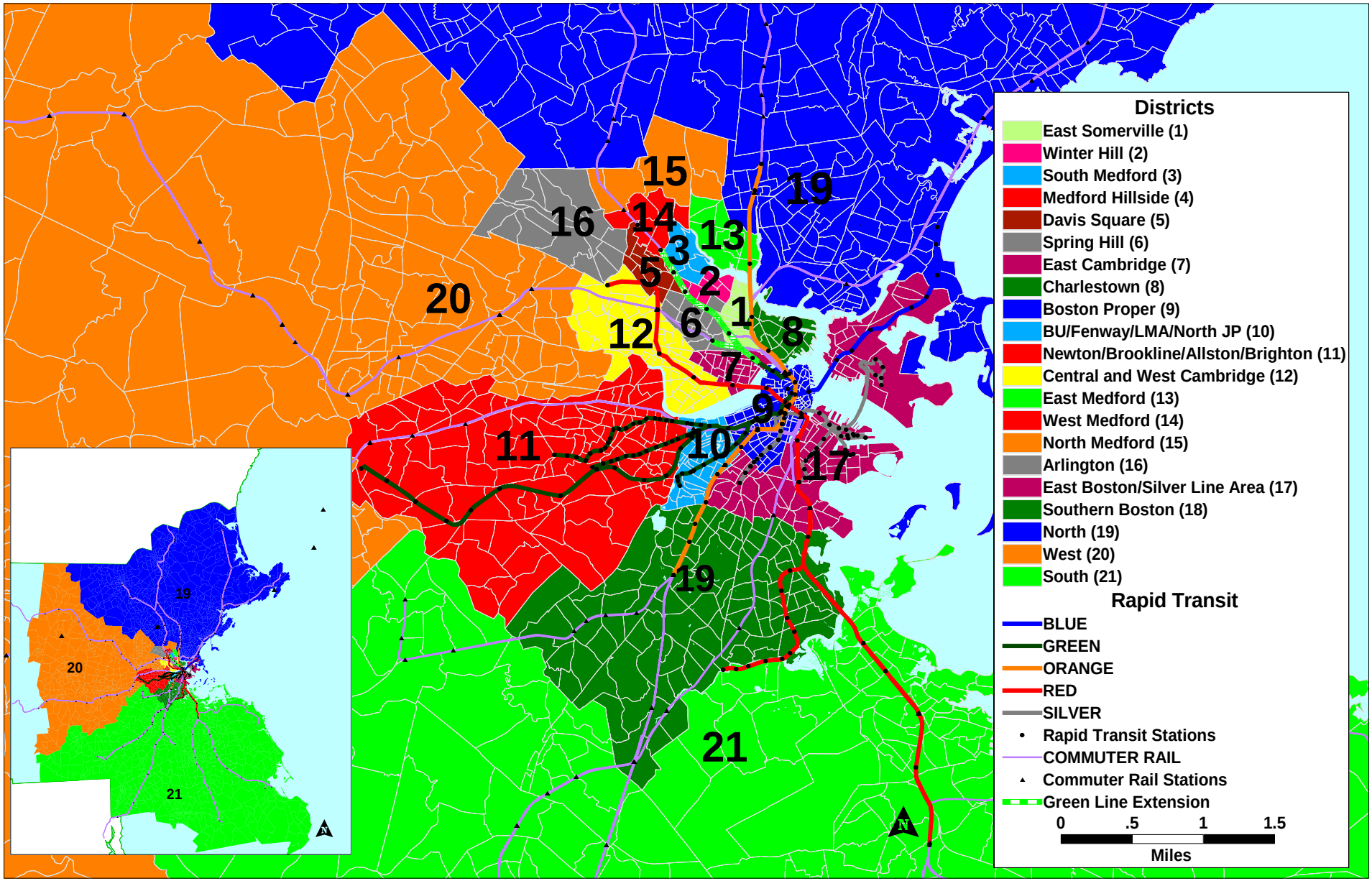
The overall pattern of user benefits chiefly mimcs the transit user benefits patterns. The destination district with the most user benefits is located along the Green Line Central Subway (Boston Proper), with other substantial destinations located along the current Green Line alignment (East Cambridge, Boston University/Fenway/Longwood Medical Area/North Jamaica Plain, Newton/Brookline) as well as along the Green Line extension (Spring Hill, East Somerville), and districts accessible by a single transfer from the Green Line (East Boston/Silver Line Market, Rest of Boston). The production district with the most user benefits is Spring Hill, located along the proposed Green Line Extenstion. Other districts with large amounts of production benefits also emanate from districts along the existing Green Line (East Cambridge, Boston Proper, Boston University/Fenway/Longwood Medical Area/North Jamaica Plain, and Newton / Brookline) and from a district with rapid transit service a transfer away from the Green Line (Rest of Boston).

NON-TRANSIT TO CAN-WALK (NT-CW) MARKET SEGMENT ISSUE

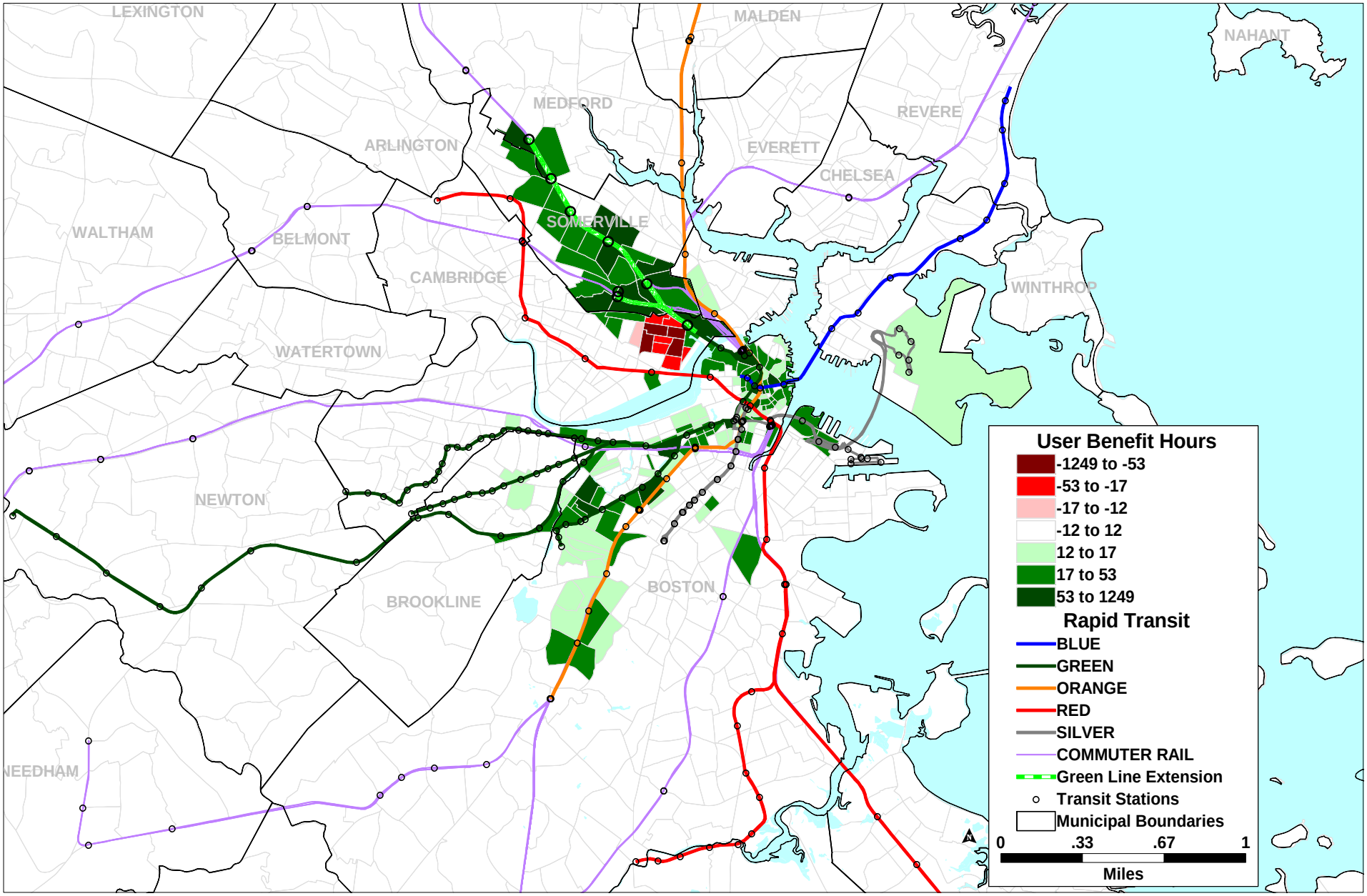
In past New Starts work, FTA identified that CTPS's model produced user benefits associated with the non-transit to can-walk (NT-CW) market segment that were too high. This was due to a phenomenon in which resulted from a substantial number of people switching their optimal path from an all-walk path in the Baseline alternative to a path including transit (Silver Line) in the Build alternative despite having the same access to transit stations in both alternatives. Consequently, CTPS developed an FTA-approved methodology to discount these user benefits.

However, this does not appear to be an issue with regards to the Green Line Extension project. Only 132 hours of user benefits can be attributed to the NT-CW market. This is only 1.8% of the total user benefits and only 2% of the overall transit user benefits. Hence these insubstantial amounts need not be discounted.

Green Line Extension Study: SUMMIT Districts 11/10/10

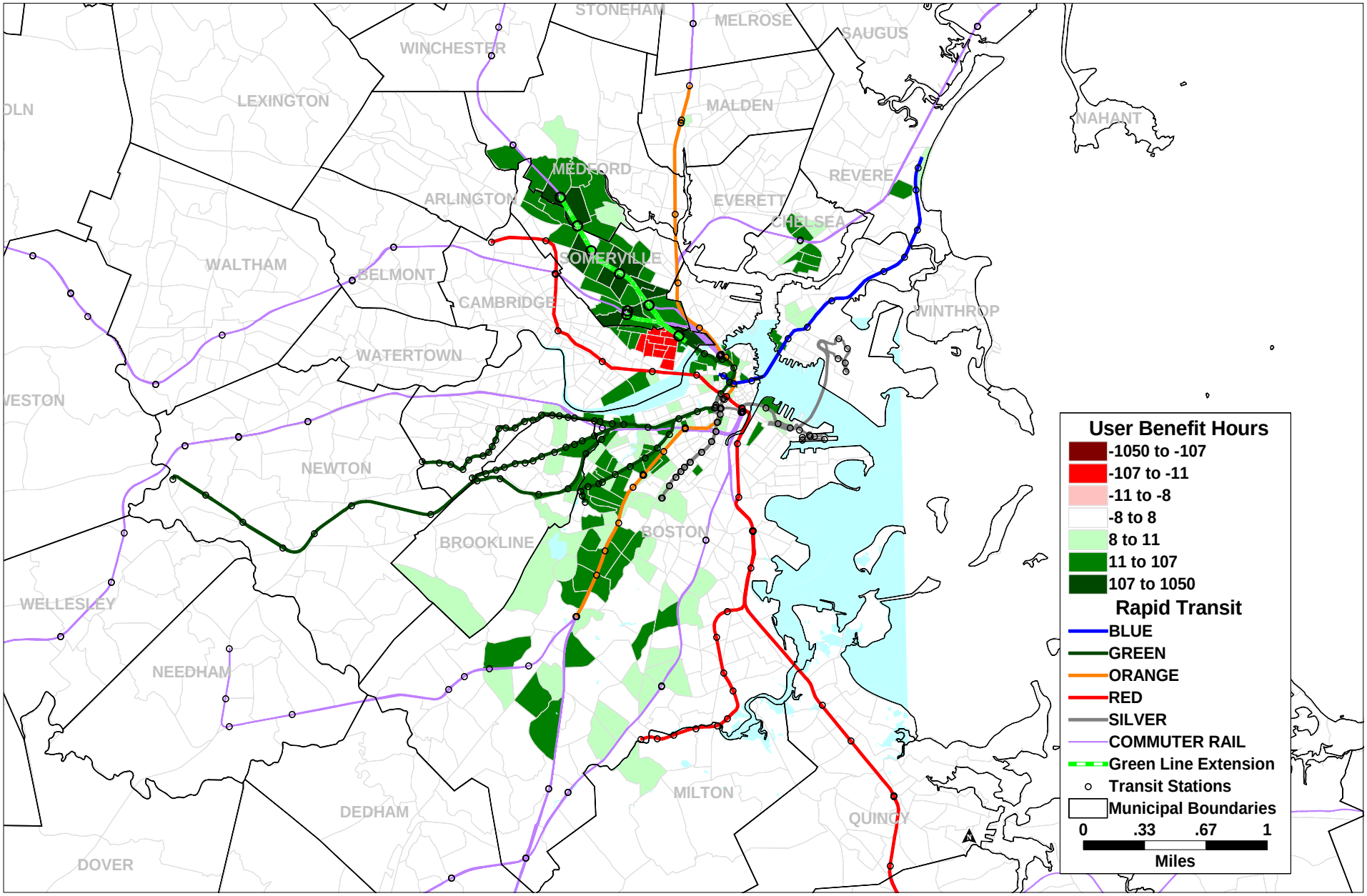


Daily Attraction User Benefits - Proposed Alternative



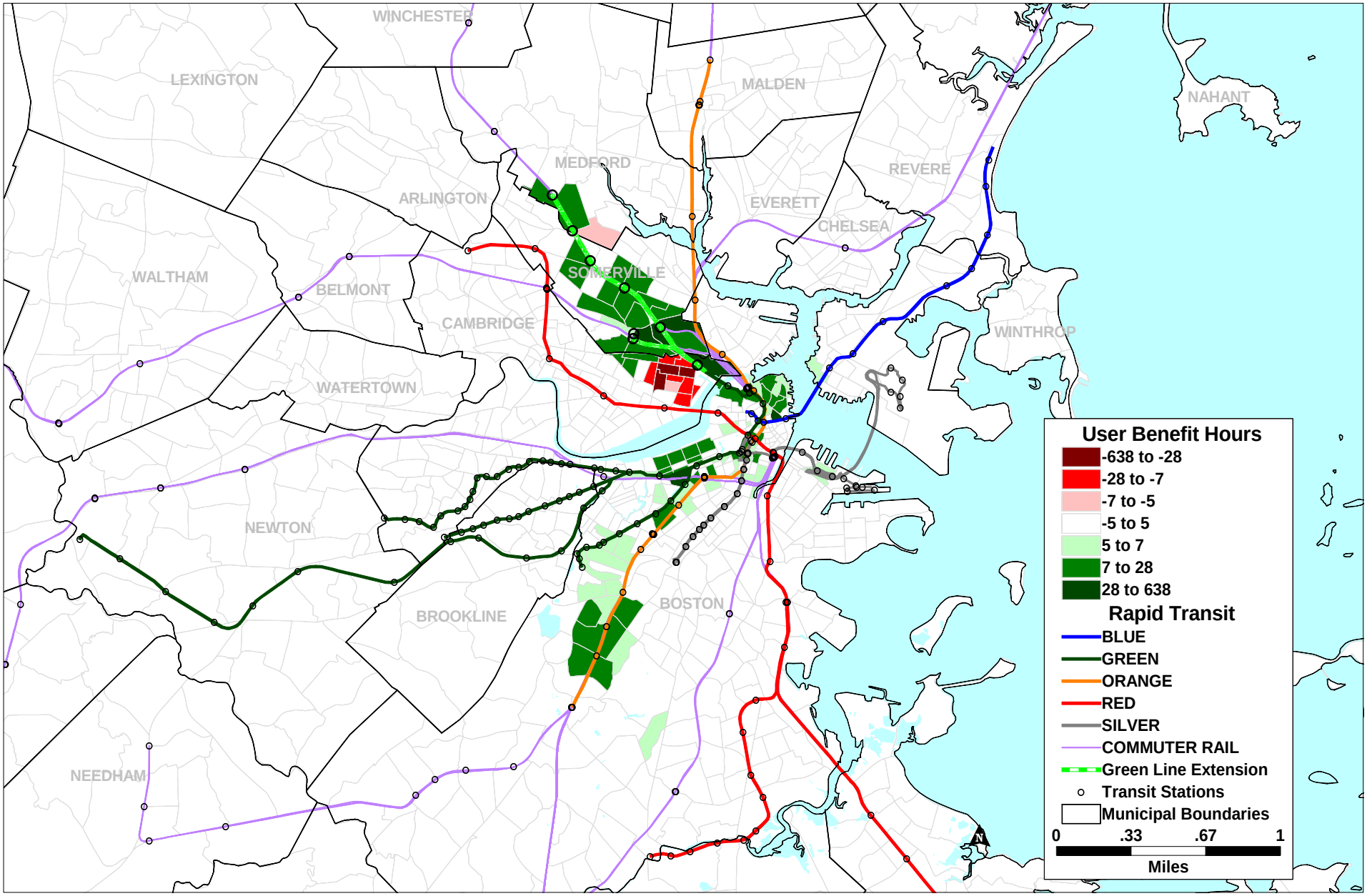
March 14, 2011

Daily Production User Benefits - Proposed Alternative



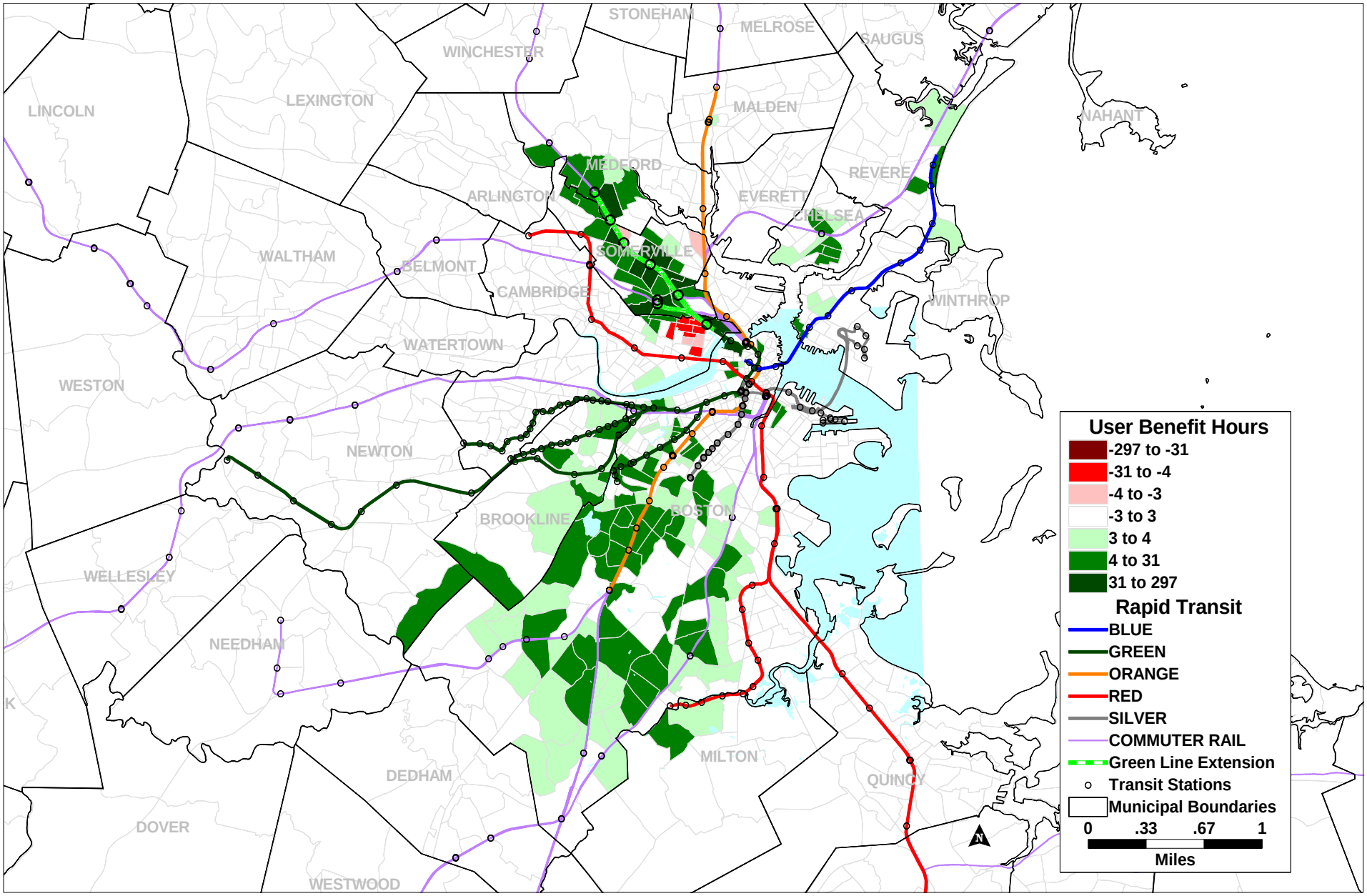
March 14, 2011

Daily HBO Attraction User Benefits - Proposed Alternative



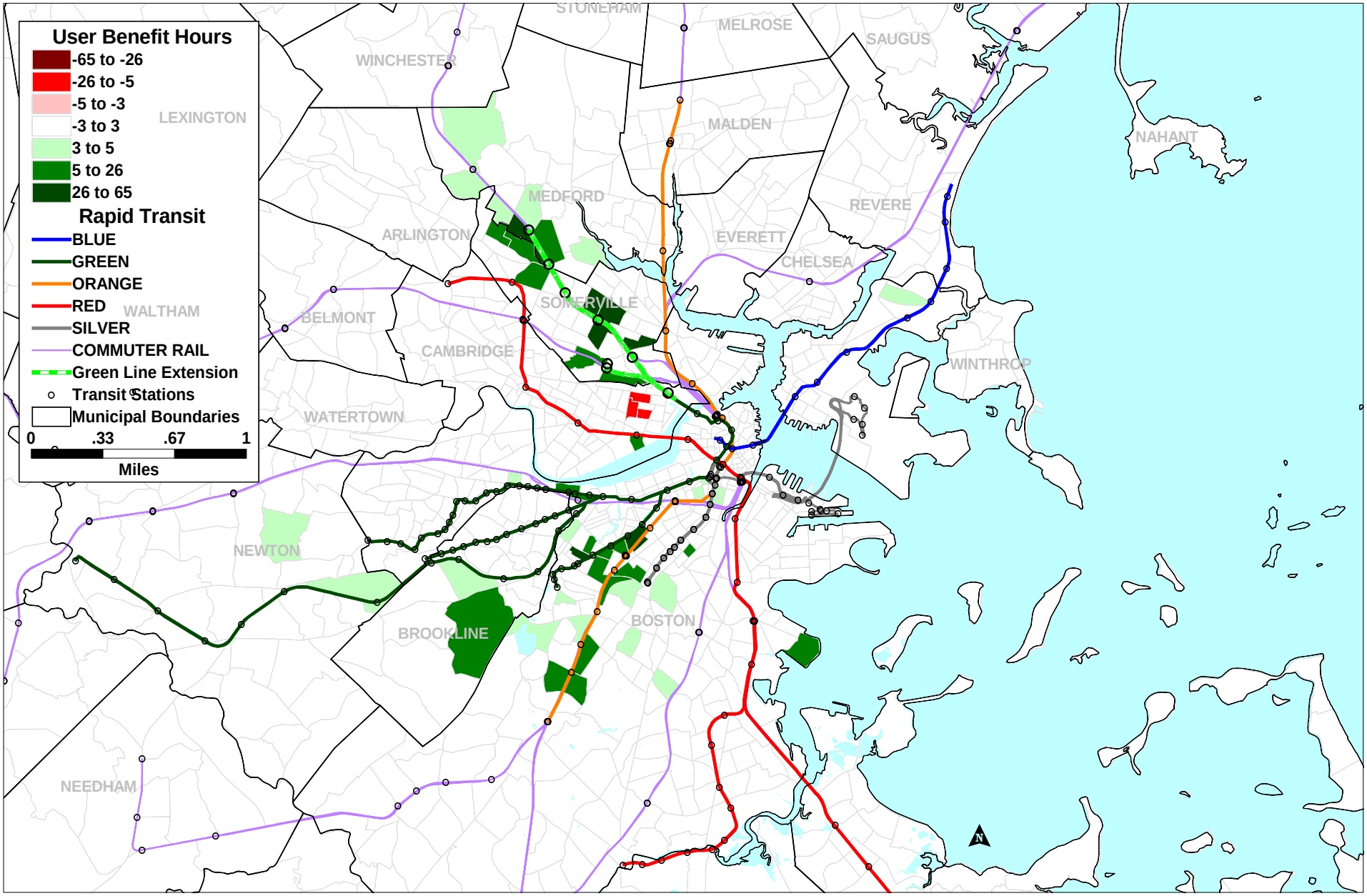
March 14, 2011

Daily HBO Production User Benefits - Proposed Alternative



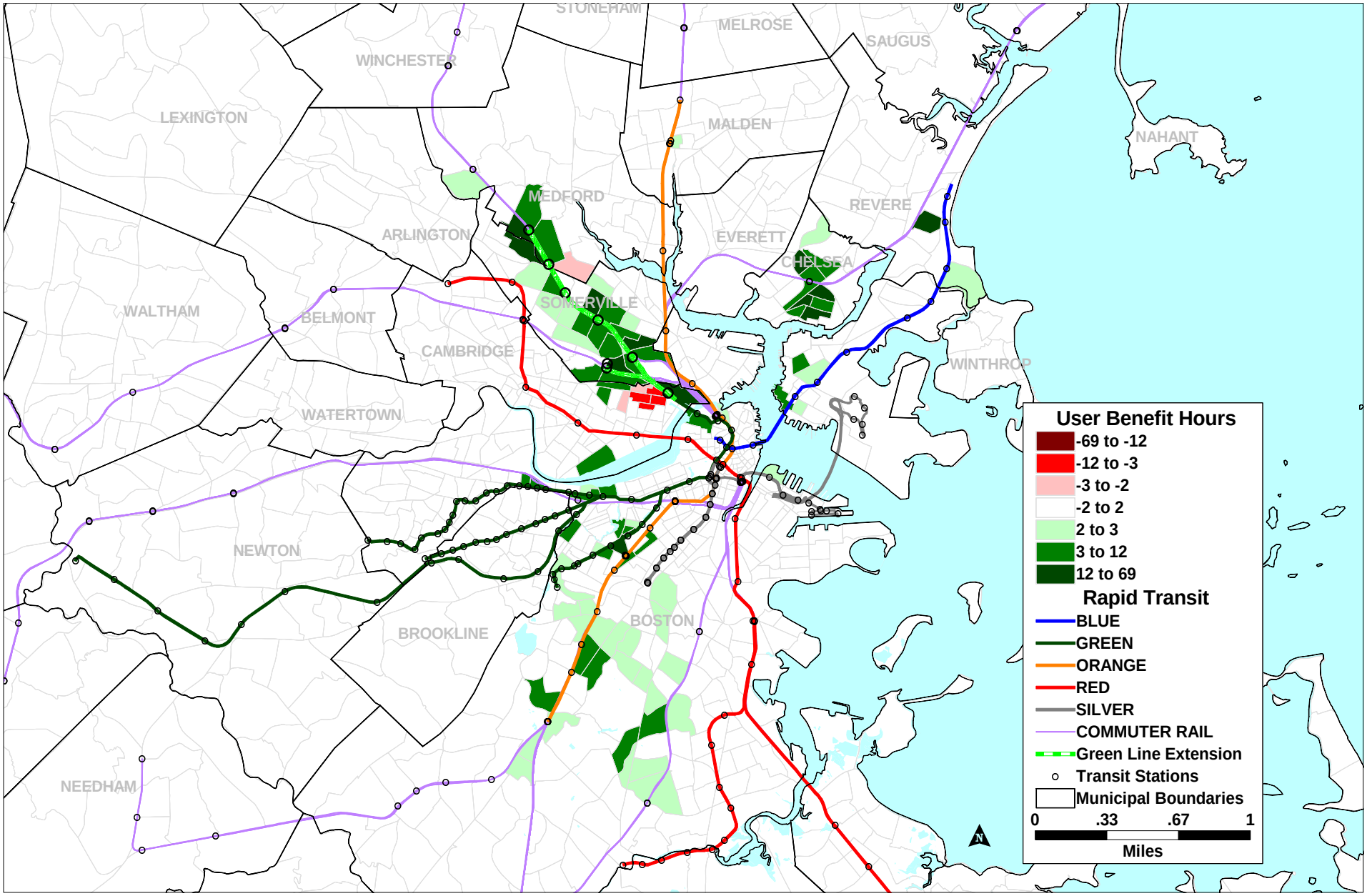
March 14, 2011

Daily HBS Attraction User Benefits - Proposed Alternative



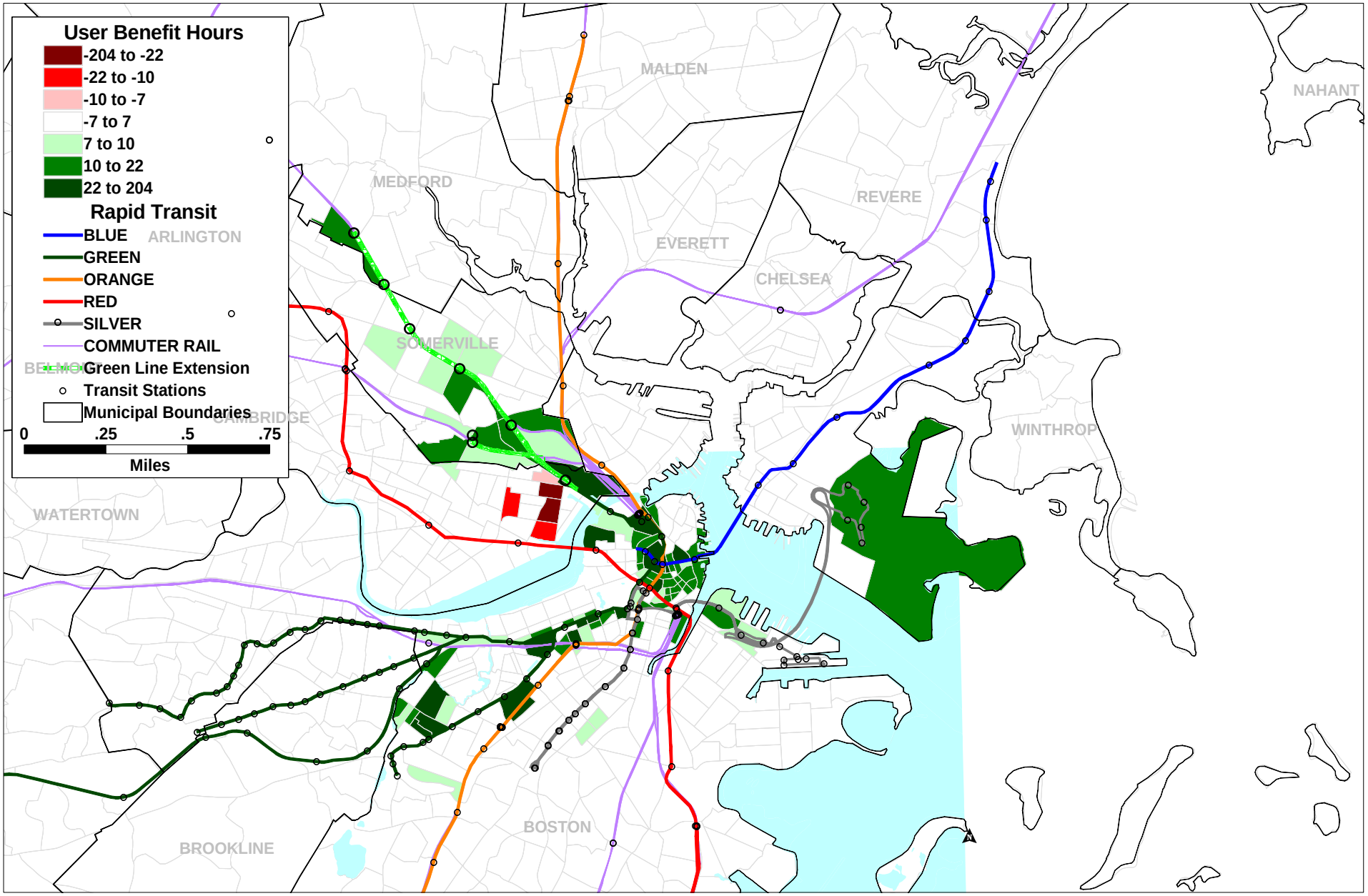
March 14, 2011

Daily HBS Production User Benefits - Proposed Alternative



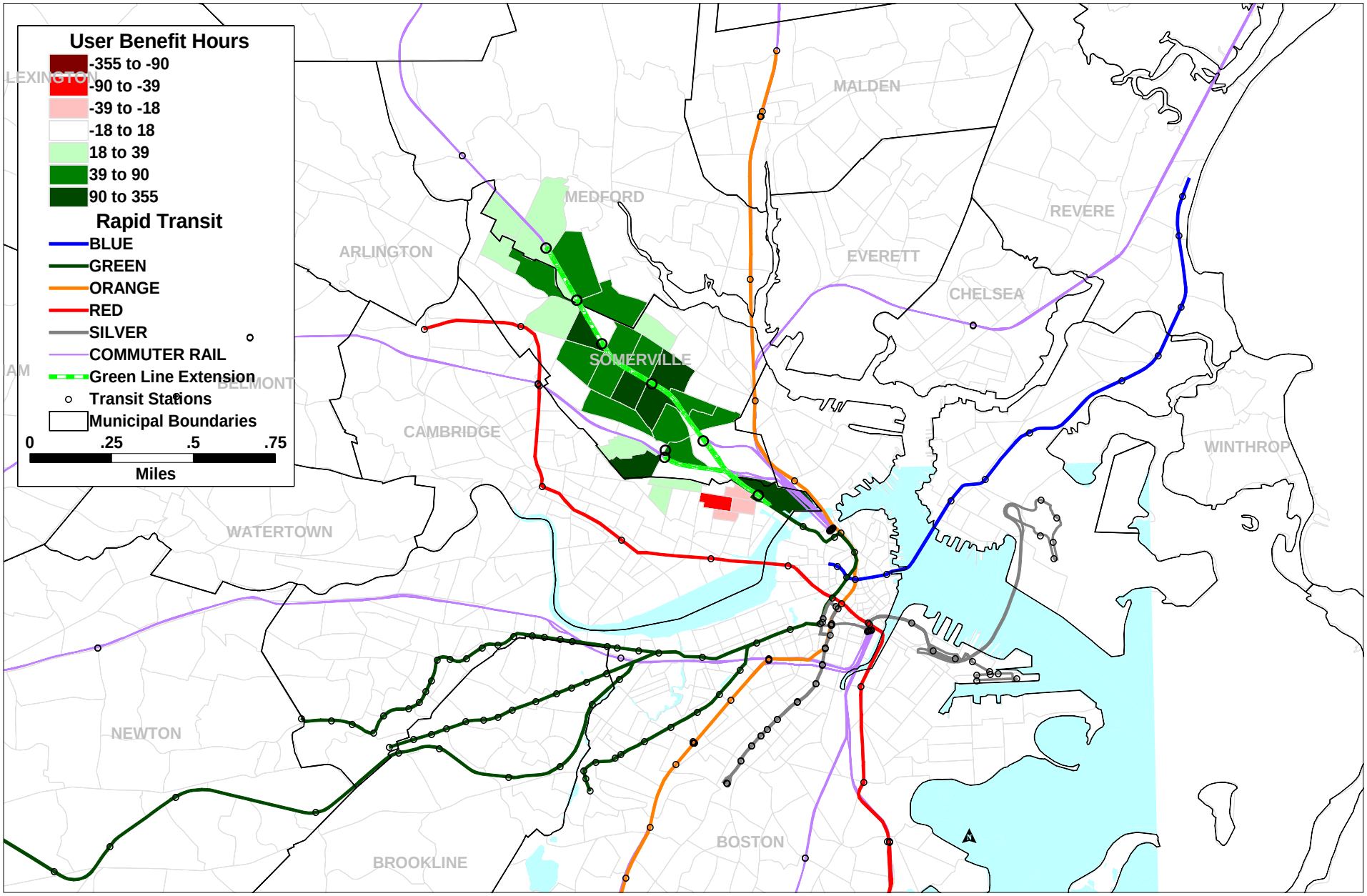
March 14, 2011

Daily HBW Attraction User Benefits - Proposed Alternative



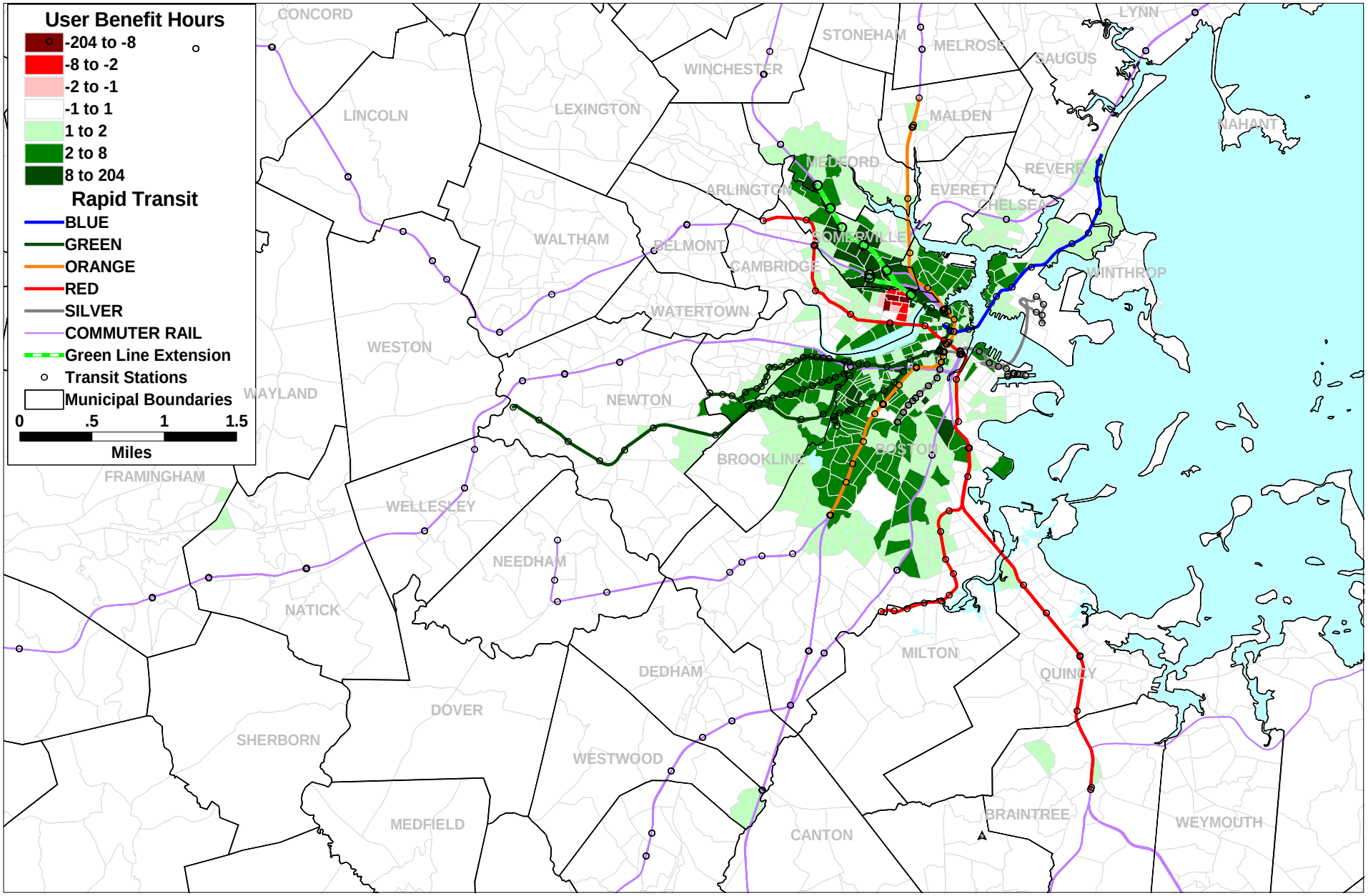
March 14, 2011

Daily HBW Production User Benefits - Proposed Alternative



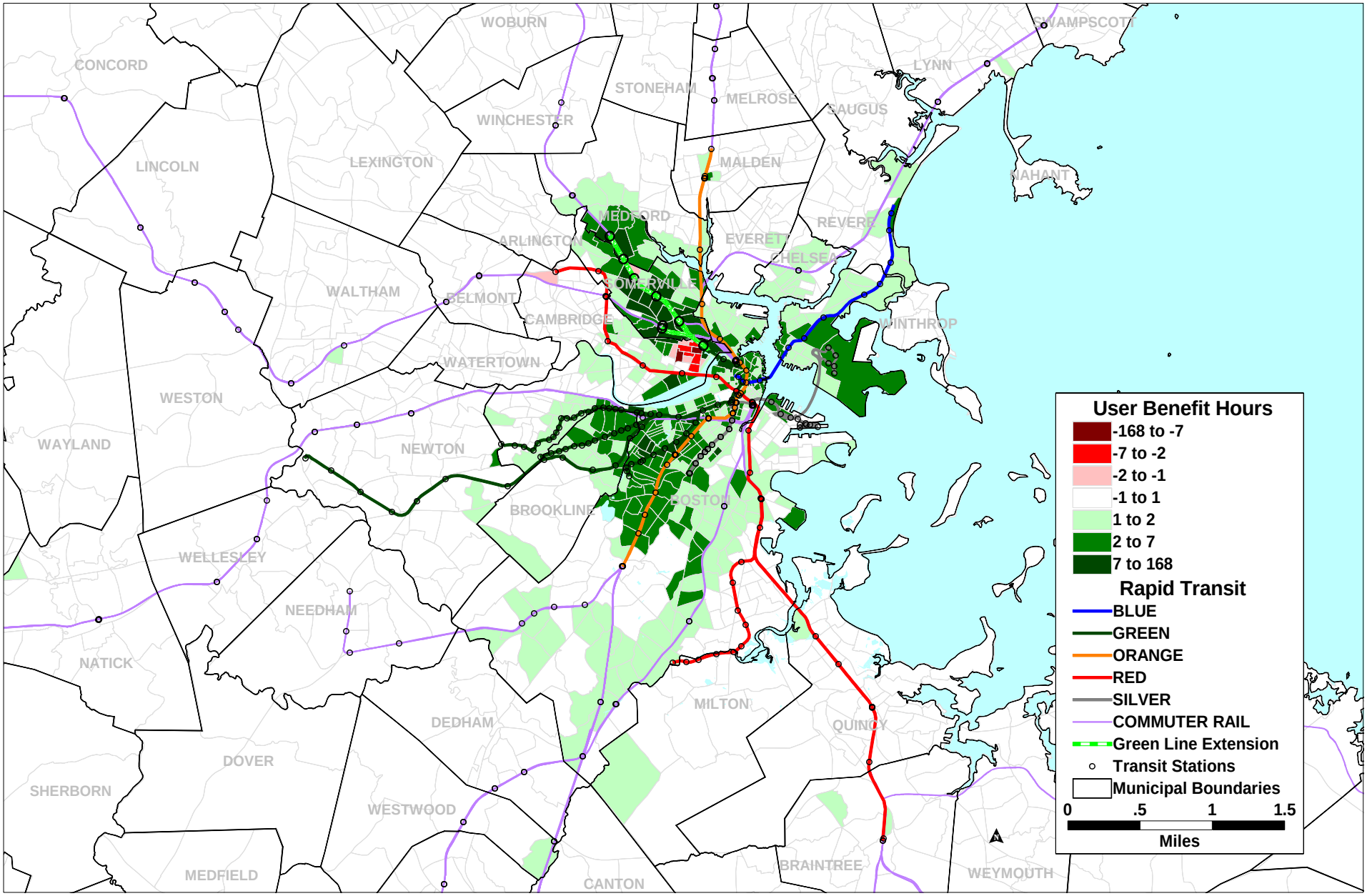
March 14, 2011

Daily NHO Attraction User Benefits - Proposed Alternative



March 14, 2011

Daily NHO Production User Benefits - Proposed Alternative



March 14, 2011

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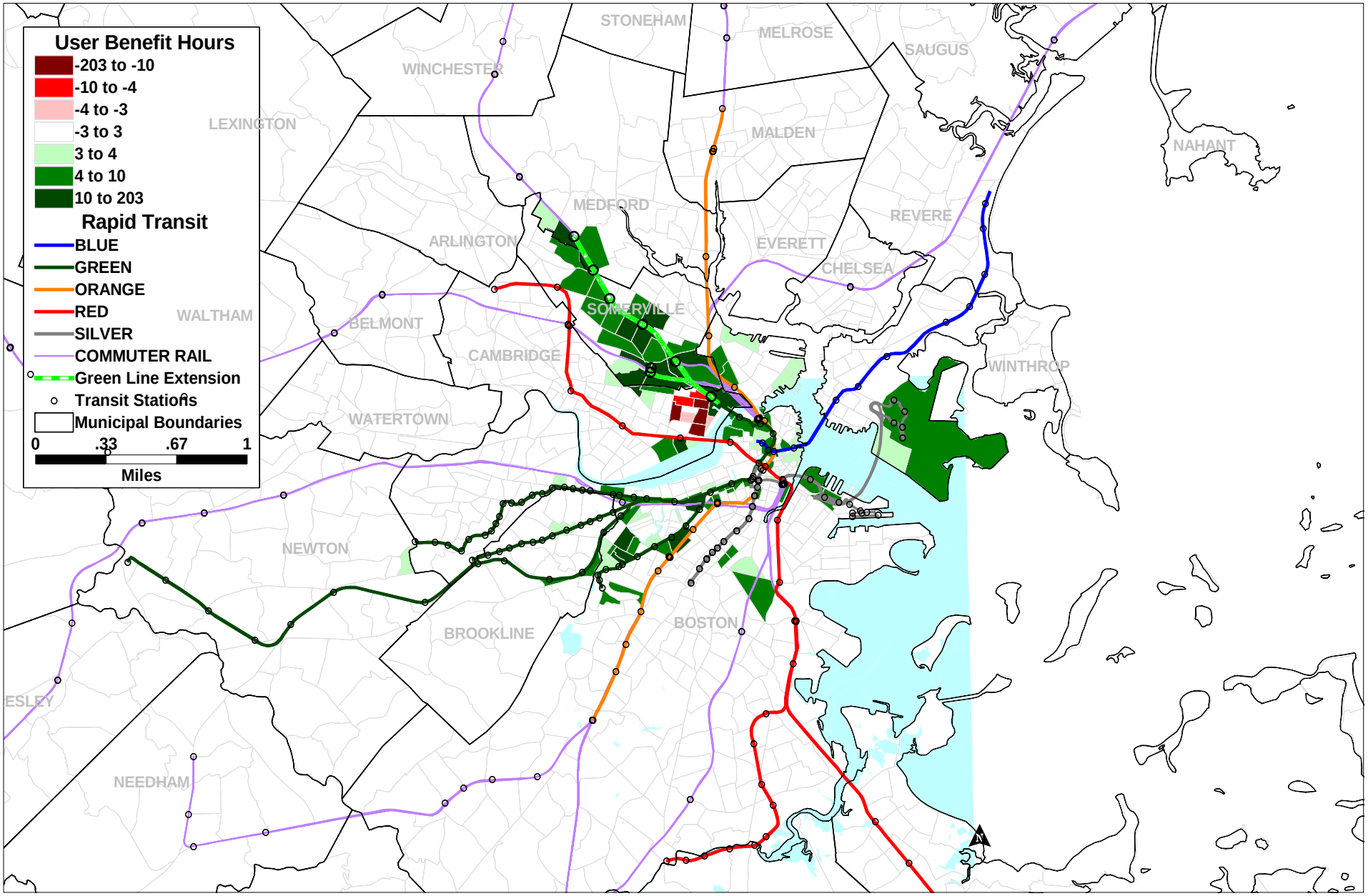
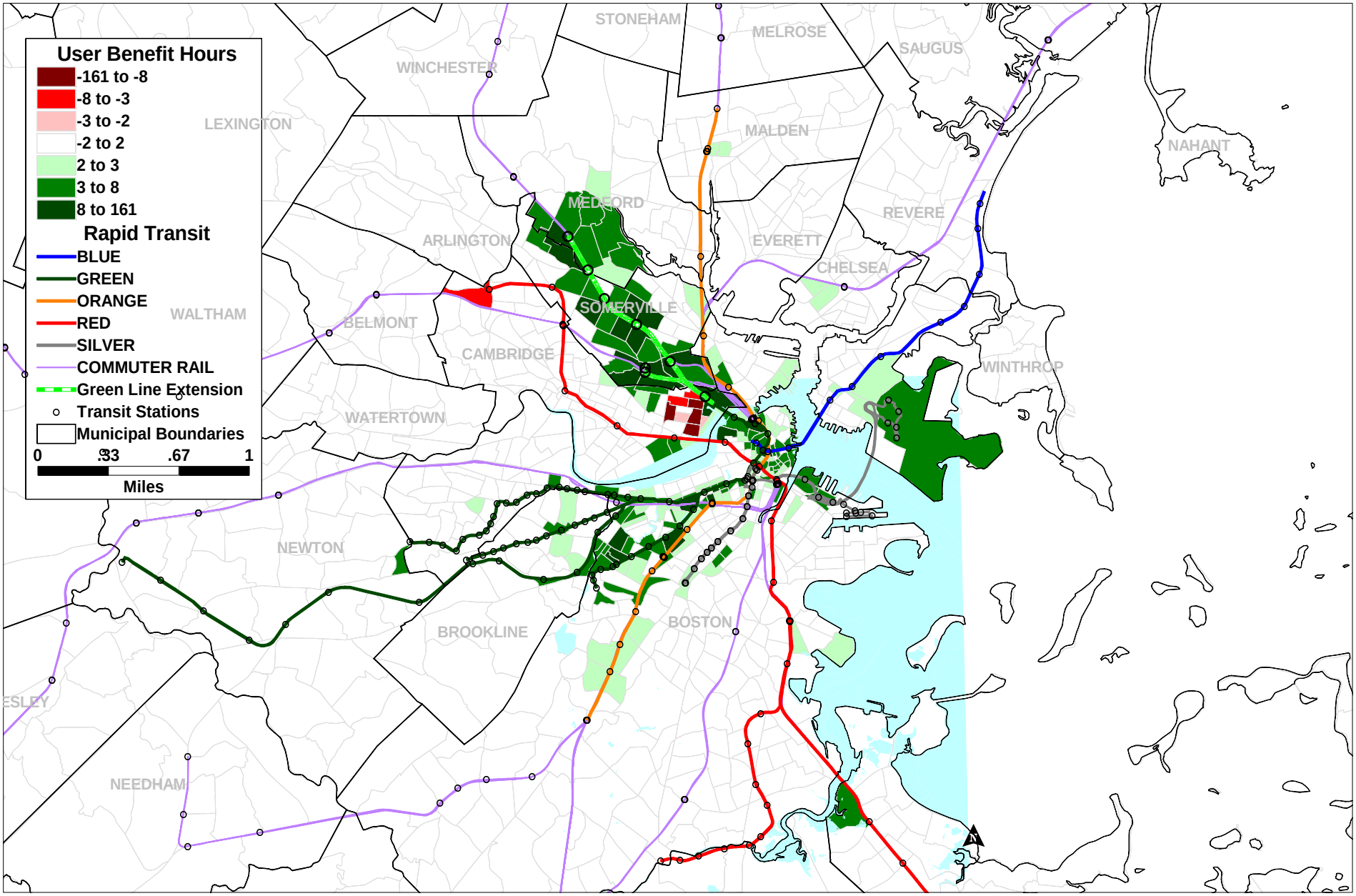


March 14, 2011

Daily NHW Production User Benefits - Proposed Alternative



March 14, 2011

DRAFT MEMORANDUM

To: Green Line Extension Project Files **July 18, 2008**

From: Scott Peterson

Re: Calculation of Annualization Factor

Background

The Annualization Factor is the means for deriving a yearly estimate of ridership, costs, and travel time benefits from an average weekday number. The technical analysis that CTPS performed for the Silver Line Phase III EIR, Green Line Extension EIR, and the Urban Ring RDEIR used the same Annualization factor and was derived from two different methods resulting in the same answer, a factor of 293.

Data Sources

The Annualization factor is based on data from the 2006 MBTA Blue Book and examining MBTA schedules for weekday, weekend, and holiday schedules. The Blue Book provides historical and current information on boardings for all modes on an average weekday, weekend, as well as annual usage. The light and heavy rails considered in both methods consist of the Green Line, Red Line, Orange Line, and Blue Line services. These constitute the major transit services in the Boston core and reflect the modes being examined for the studies that the Annualization factor will be used for. The year 2005 was chosen because it was the most current year that contains the complete set of information needed to complete the analysis described below.

Method 1: MBTA Blue Book

The MBTA Blue Book lists the use of the light and heavy rails lines on an average weekday and annually and is shown in Table 1. An analysis of the relationship of the weekday light and heavy rails ridership to annual ridership is shown in Table 2. This analysis demonstrates that the various light and heavy rails, including the Green Line, show a consistent relationship between the weekday and annual ridership, translating into a factor of 292.97, rounded up to 293.

Method 2: Service Schedules

An examination of the light and heavy rails weekday service operation relative to annual operations was undertaken with the following assumptions:

- 265 weekdays in a typical year
- 50 Sundays in a typical year.
- 50 Saturdays in a typical year.
- 15 holiday per year
- MBTA operates regular weekday schedule on 250 days,
- Saturday schedule on 57 days (including 7 holidays)
- Sunday schedule on 58 days (including 8 holidays)
- Saturday ridership = 0.5* weekday ridership
- Sunday ridership = 0.25* weekday ridership

Based on these assumptions, CTPS was able to estimate how many days a year the MBTA draw an average weekday ridership.

250+(0.5*57)+(0.25*58)=293 weekday ridership.

Thus using two very different methods, CTPS was able to derive a consistent factor of 293 to expand an average weekday ridership to an annual ridership.

TABLE 1: 2006 Blue Book of Ridership by Weekday and Annually

Ridership By Mode and Line

Mode	Ridership (Unlinked Trips)	FY 1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006 YTD (Jul-Oct 2005)
Urban 4-Mode	Typical Weekday	1,041,883	1,038,850	1,081,750	1,059,200	1,027,350	1,014,950	991,400	1,030,800
	Annual Total	305,362,807	306,629,800	317,390,100	310,091,933	301,293,462	299,959,000	290,480,900	
Bus	Typical Weekday	353,550	361,700	371,750	382,600	371,750	369,300	375,050	367,200
	Annual Total	103,727,500	106,790,800	109,094,600	112,197,900	109,022,262	109,147,800	109,885,900	
Trackless Trolley	Typical Weekday	14,358	14,200	14,800	13,800	12,750	13,300	12,500	12,200
	Annual Total	3,944,207	3,991,100	4,138,300	3,846,600	3,560,400	3,729,900	3,482,700	
Green Line Light Rail	Typical Weekday	249,433	222,700	230,250	232,000	217,750	212,550	192,700	208,600
	Annual Total	73,141,700	65,758,200	67,567,700	67,927,100	63,859,500	62,831,500	56,455,100	
Green Line Surface Portion	*Typical Weekday*	137,200	74,900	82,050	87,900	89,100	95,350	78,000	77,900
	Annual Total	24,329,200	22,122,900	24,073,600	25,743,900	26,132,800	28,178,100	22,855,700	
Green Line Subway Portion	*Typical Weekday*	166,400	147,800	148,200	144,100	128,650	117,200	114,650	130,700
	Annual Total	48,812,500	43,635,300	43,494,100	42,183,200	37,726,700	34,653,400	33,599,400	
Heavy Rail	Typical Weekday	424,542	440,600	465,350	430,800	425,700	420,450	411,800	443,400
	Annual Total	124,549,400	130,089,700	136,589,500	126,120,333	124,851,300	124,249,800	120,657,200	
Red Line Portion	*Typical Weekday*	226,374	226,550	241,600	214,100	214,100	210,500	202,250	220,300
	Annual Total	66,414,700	66,876,200	70,910,900	62,691,100	62,786,000	62,217,000	59,265,900	
Orange Line Portion	*Typical Weekday*	134,060	157,200	165,600	160,800	155,750	154,350	152,800	165,500
	Annual Total	39,317,800	46,414,100	48,606,000	47,075,800	45,668,700	45,613,000	44,773,100	
Blue Line Portion	*Typical Weekday*	64,108	56,900	58,200	55,900	55,900	55,600	56,750	57,600
	Annual Total	18,816,900	16,799,400	17,072,700	16,353,500	16,396,600	16,419,700	16,618,200	

file: BB Ch1/Mode04 Ridership Urban 4-Mode Chart.xls 12-05-05 FY05 Revised 12-05

TABLE 2: Annualization Factor

			Factor
Blue	56,750	16,618,200	292.83
Orange	152,800	44,773,100	293.02
Green	192,700	56,455,100	292.97
Red	202,300	59,265,900	292.96
Subway/Trolley	604,550	177,112,300	292.97

Source 2006 MBTA Blue Book of Service Statistics.