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April 14, 2020

Mr. Michael Kulesza
Vice Chairman, Zoning Board of Appeals
Norfolk Town Hall
One Liberty Lane
Norfolk, MA 02056

Subject: Residences at Norfolk Station,
Request for Additional Traffic Information

Dear Mr. Kulesza

As a result of the public hearing on April 1, 2020, Green International Affiliates, Inc. (Green), on behalf of the applicant for the Residences at Norfolk Station, has compiled some additional information that was requested at the hearing by the town counsel. This includes:

- Additional information on sight distance requirements taking into account the downgrade on Main Street approaching the site drive from the east,
- Provide sight line triangle plans that can be incorporated into the overall site plans to indicate areas at the site drive to keep clear of any obstructions to sight distances, and
- Provide a sense of the operating conditions (Level of Service) that would be expected at the site drive once the project is built and occupied.

In general, our previous analyses described in letter reports[1] [2] [3] to the Board have shown that adequate sight distances will exist and that with the proposed project generating an estimated lower amount of traffic than the current uses would, the traffic operations in the project area would be similar to current conditions. The following paragraphs and attachments provide the additional

Sight Distances

Visibility in relation to the site drives is an important consideration for any development. Although the proposed project will utilize one of the existing drive connections to Main Street, a field review was initially completed to confirm the conditions. The minimum criteria for establishing adequate stopping and intersection sight distances are defined by the American Association of State Highway and Transportation Officials (AASHTO).[4] Stopping sight distance (SSD) represents the distance required for a driver traveling at a specified speed to come to a complete stop and therefore relates specifically to safety. Intersection sight distance (ISD) relates to an exiting driver's view of approaching traffic and represents the distance an approaching vehicle travels during a specified time gap. As indicated by AASHTO, if the available ISD meets or exceeds the minimum SSD criteria, then there is adequate safe sight distance available for motorists to avoid collisions. Minimum required sight distances are calculated based on operating speeds of approaching

[1] Green International Affiliates, Letter to Mr. Michael Kulesza, Norfolk Zoning Board of Appeals, dated November 8, 2019
[2] Green International Affiliates, Letter to Mr. Christopher Wider, Norfolk Zoning Board of Appeals, dated December 23, 2019
[3] Green International Affiliates, Letter to Mr. Michael Kulesza, Norfolk Zoning Board of Appeals, dated March 25, 2020
[4] American Association of State Highway Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Streets (Green Book), Washington, D.C., 2018.

drivers and can also take in to account the grade of the roadway. Some agencies and State transportation departments do not adjust for grades as there are factors such as a driver then having a higher effective eye height that mitigates the grade effect.

For 30 mph speeds, the minimum stopping and intersection sight distance criterion would be 200 feet. Using the following equation that accounts for reaction time and braking distance the stopping sight distance can be calculated:

$$SSD=1.47Vt + V^2/[30((a/32.2) +/- G/100)]$$

Where: V=speed; t=reaction time; a=deceleration rate and G=grade

Tables are already set up in AASHTO as well as reprinted in the MassDOT Design Guide that have already computed the values and taken into account potential grade effects on the distances. The stopping sight table from these sources is illustrated below:

Exhibit 3-8
Motor Vehicle Stopping Sight Distances

	Stopping Sight Distance (ft) by Percent Grade (%)						
		Downgrade			Upgrade		
Design Speed	0	3	6	9	3	6	9
20	115	116	120	126	109	107	104
25	155	158	165	173	147	143	140
30	200	205	215	227	200	184	179
35	250	257	271	287	237	229	222
40	305	315	333	354	289	278	269
45	360	378	400	427	344	331	320
50	425	446	474	507	405	388	375
55	495	520	553	593	469	450	433
60	570	598	638	686	538	515	495
65	645	682	728	785	612	584	561
70	730	771	825	891	690	658	631
75	820	866	927	1003	772	736	704

Source: A Policy on Geometric Design of Streets and Highways, AASHTO, Washington DC, 2004. Chapter 3 Elements of Design

It has been noted by the peer review consultant that the downgrade at the MBTA overpass is between 5 and 6 percent before it flattens out towards the site drive. While not necessarily critical in relation to safe operation at the proposed site drive, the required sight distances to and from the east could be increased slightly due to this downgrade. As can be seen in the table, using 6 percent and 30 mph, the required minimum distance would be 215 feet. If one was to use 35 mph, the required minimum distance would be 271 feet with the same 6% downgrade.

Sight distances measured in relation to the proposed site drive located on the western edge of the site frontage were approximately 350 to 360 feet to and from the east. This available distance significantly exceeds required minimums for both 30 and 35 mph and takes into account the most severe possible grade that again, flattens out as one approaches the site drive. Based on this analysis, the site drive location is properly situated with respect to safe sight distances. The available sightlines are more than adequate to ensure safe traffic operations.

There were no questions raised in regard to sight distances to and from the west that exceed 500 feet.

A sight line triangle plan has been prepared and is included in this transmittal. It can also become part of the overall site plan set to define the areas that should be kept clear of any obstructions.

Level of Service – Proposed Site Drive

Although it has been concluded and agreed by all that the proposed project will generate fewer site drive vehicle trips than the existing uses would, it was requested at the last hearing that a level of service analysis be completed for the site drive to provide an indication of the ability for site traffic to enter and exit the site during peak hours. The site traffic was estimated based on ITE trip models and presented in our last letter report to the Board.

To estimate future build volume conditions in the vicinity of the site drive, the 2017 automatic traffic recorder count available for Main Street west of the project site was utilized as a foundation. Applying a one percent annual growth rate to the identified AM and PM peak hour flows for ten years as well as adding estimated traffic past the site related to both Boyde's Crossing and the 18 Union Street developments resulted in an estimated 2027 peak hour traffic condition. The 2017 ATR data is attached.

A level of service analysis was completed and the results showed that site traffic would be able to enter and exit the site with short to moderate average vehicle delays. Table 1 summarizes the results from the analysis and the computation reports are attached. As can be seen, motorists exiting the site during the peak hours are expected to experience a LOS C while those turning left into the site are expected to operate at LOS A. These are more than acceptable operating conditions and show that the impact the project has on Main Street flows in this area will be minimal.

Table 1
Summary of Level of Service Analysis

Time Period	Average Delay	Volume to Capacity Ratio	Level of Service	95th Percentile Queue
AM Peak Hour				
Main Street EB Left	8.0	0.00	A	0.0
Site Drive Exit	22.2	0.10	C	0.3
PM Peak Hour				
Main Street EB Left	9.2	0.01	A	0.0
Site Drive Exit	20.8	0.06	C	0.2

Based on this supplemental information as well as the information contained in our previous documents have shown that the currently proposed project is expected to have less of a traffic impact that the current uses would have, that safe access and egress can be accommodated at the proposed site drive and that given the project's location, it should likely result in pedestrian related trips within the center of town as well as to and from the commuter rail station that will serve to further reduce the vehicle traffic effect of the project.

We hope this supplemental information addressed the final questions of the Board pertaining to traffic.

Very truly yours,
GREEN INTERNATIONAL AFFILIATES, INC.

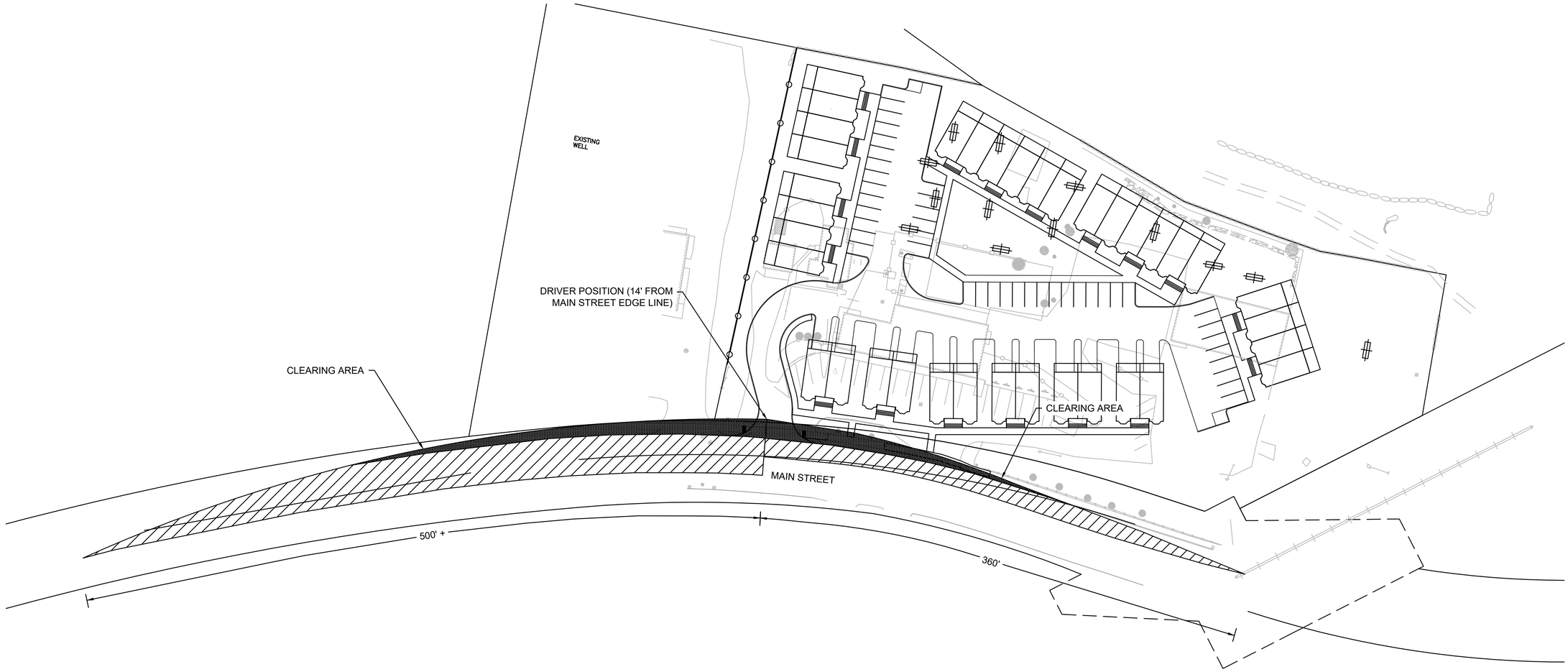
William J Scully

William J. Scully, P.E.
Vice President
Municipal Transportation &
Infrastructure Services

WJS/-

Attachments

Cc M. O'Shaughnessy



0 40 100 160

SCALE: 1" = 40'

PROJECT:
194 MAIN STREET DEVELOPMENT

DESIGN SUBMISSION:
SIGHT DISTANCE TRIANGLES

DRAWING TITLE:
INTERSECTION SIGHT DISTANCE

PREPARED FOR:

ZENITH CONSULTING ENGINEER, LLC.
3 MAIN STREET
LAKEVILLE, MA 02347

PREPARED BY:

GREEN INTERNATIONAL AFFILIATES, INC.
TRANSPORTATION | STRUCTURAL | WATER RESOURCES | CIVIL/SITE
239 LITTLETON ROAD, SUITE 3 WESTFORD, MA 01886
978.923.0400 | www.greenintl.com

SCALE: AS NOTED	DESIGNED BY: AV	
DATE: 4/13/2020	DRAWN BY: AV	SHEET NO.
PROJECT NO. 19101	CHECKED BY: WS	2 OF 2

I:\19101\Engineering\Projects\2019\19101DWG\SIGHT DISTANCE FIGURES.dwg Printed: 4/13/2020 1:18 PM

Accurate Counts

978-664-2565

Location : Main Street
Location : West of #194 Main Street
City/State: Norfolk, MA

7626VOL

Start	5/15/2017		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
Time	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB
12:00 AM	*	*	*	*	25	9	26	5	*	*	*	*	*	*	26	7
01:00	*	*	*	*	5	5	10	2	*	*	*	*	*	*	8	4
02:00	*	*	*	*	9	6	6	0	*	*	*	*	*	*	8	3
03:00	*	*	*	*	0	6	1	8	*	*	*	*	*	*	0	7
04:00	*	*	*	*	5	28	8	26	*	*	*	*	*	*	6	27
05:00	*	*	*	*	41	163	40	158	*	*	*	*	*	*	40	160
06:00	*	*	*	*	137	483	124	438	*	*	*	*	*	*	130	460
07:00	*	*	*	*	288	**800**	273	**774**	*	*	*	*	*	*	280	**787**
08:00	*	*	*	*	**292**	595	**302**	650	*	*	*	*	*	*	**297**	622
09:00	*	*	*	*	259	410	264	445	*	*	*	*	*	*	262	428
10:00	*	*	*	*	209	283	237	275	*	*	*	*	*	*	223	279
11:00	*	*	*	*	251	303	264	270	*	*	*	*	*	*	258	286
12:00 PM	*	*	*	*	269	306	293	289	*	*	*	*	*	*	281	298
01:00	*	*	*	*	312	274	313	317	*	*	*	*	*	*	312	296
02:00	*	*	*	*	349	311	338	339	*	*	*	*	*	*	344	325
03:00	*	*	*	*	507	**399**	508	**427**	*	*	*	*	*	*	508	**413**
04:00	*	*	*	*	541	362	515	351	*	*	*	*	*	*	528	356
05:00	*	*	*	*	**637**	398	**594**	342	*	*	*	*	*	*	**616**	370
06:00	*	*	*	*	571	345	555	375	*	*	*	*	*	*	563	360
07:00	*	*	*	*	324	203	359	210	*	*	*	*	*	*	342	206
08:00	*	*	*	*	234	144	282	130	*	*	*	*	*	*	258	137
09:00	*	*	*	*	148	70	168	98	*	*	*	*	*	*	158	84
10:00	*	*	*	*	90	43	126	58	*	*	*	*	*	*	108	50
11:00	*	*	*	*	50	21	82	32	*	*	*	*	*	*	66	26
Lane	0	0	0	0	5553	5967	5688	6019	0	0	0	0	0	0	5622	5991
Day	0		0		11520		11707		0		0		0		11613	
AM Peak	-	-	-	-	08:00	07:00	08:00	07:00	-	-	-	-	-	-	08:00	07:00
Vol.	-	-	-	-	292	800	302	774	-	-	-	-	-	-	297	787
PM Peak	-	-	-	-	17:00	15:00	17:00	15:00	-	-	-	-	-	-	17:00	15:00
Vol.	-	-	-	-	637	399	594	427	-	-	-	-	-	-	616	413

Comb. Total	0	0	11520	11707	0	0	0	11613

ADT ADT 11,614 AADT 11,614

HCS7 Two-Way Stop-Control Report

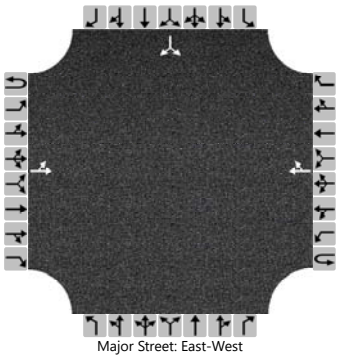
General Information

Analyst	wjs
Agency/Co.	
Date Performed	4/13/2020
Analysis Year	2020
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	194 Main 2027 Build

Site Information

Intersection	Main Street at Site Drive
Jurisdiction	Norfolk
East/West Street	Main Street
North/South Street	Site Drive
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		2	872				321	4						15		7
Percent Heavy Vehicles (%)		0												0		0
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized																
Median Type | Storage																

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.10												6.40		6.20
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.20												3.50		3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		2													24	
Capacity, c (veh/h)		1217													233	
v/c Ratio		0.00													0.10	
95% Queue Length, Q_{95} (veh)		0.0													0.3	
Control Delay (s/veh)		8.0													22.2	
Level of Service (LOS)		A													C	
Approach Delay (s/veh)		0.0												22.2		
Approach LOS														C		

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HCS7 Two-Way Stop-Control Report

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Analyst	wjs
Agency/Co.	
Date Performed	4/13/2020
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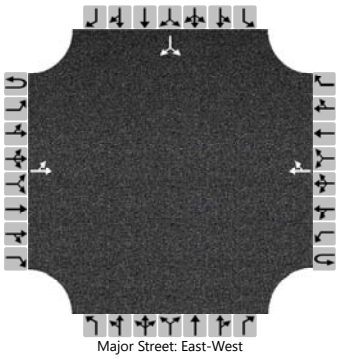
Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		9	424				690	13						8		5
Percent Heavy Vehicles (%)		0												0		0
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized																
Median Type | Storage			Undivided													

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.10												6.40		6.20
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.20												3.50		3.30

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		10													14	
Capacity, c (veh/h)		858													242	
v/c Ratio		0.01													0.06	
95% Queue Length, Q_{95} (veh)		0.0													0.2	
Control Delay (s/veh)		9.2													20.8	
Level of Service (LOS)		A													C	
Approach Delay (s/veh)		0.3												20.8		
Approach LOS														C		

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