REPORT

40-70 PLAINS ROAD EAST

BURLINGTON, ON

PEDESTRIAN WIND STUDY
RWDI # 2103038
April 13, 2021

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed 40-70 Plains Road East in Burlington, ON. Based on our wind-tunnel testing for the existing site, proposed development in the existing surrounding context and the proposed development in the future surrounding context (Existing, Proposed and Future configurations, respectively), the local wind records, and the Burlington wind criteria for pedestrian comfort and safety. The potential wind comfort conditions are predicted as shown on site plans in Figures 1A through 2C, while the associated wind speeds are listed in Table 1. These results can be summarized as follows:

- Wind conditions that meet the safety criterion are predicted at all locations for all configurations assessed.
- Wind conditions at the existing site and surroundings are calm in the summer, with seasonally higher wind speeds, typical for Burlington, in the winter.
- When the proposed building is introduced, wind conditions at all locations assessed are predicted to remain suitable for their intended pedestrian use, apart from the bus stops which are windier than desired for waiting areas during the winter months. Wind conditions at the bus stops would be expected with any similar building at this site, and can be mitigated with strategic landscaping or hardscaping. Above grade, the Level 10 terrace is predicted to be comfortable for passive activities during the summer, which is appropriate.
- When future buildings are introduced (on the north side of Plains Road and the east side of Birchwood Avenue), wind conditions throughout the site and surroundings remain comfortable for the intended pedestrian use, including on the Level 10 terrace, and the conditions at the bus stops improve significantly. Conditions at the main entrance to the proposed 40-70 Plains Road are expected to be windier than desired for an entrance from time to time during the winter months. This could be mitigated through the use of hard or soft landscaping if required in the future.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1 INTRODUCTION 1

1.1 Project Description 1

1.2 Objectives 1

2 BACKGROUND AND APPROACH 2

2.1 Wind Tunnel Study Model 2

2.2 Meteorological Data 6

2.3 Burlington Pedestrian Wind Criteria 7

3 RESULTS AND DISCUSSION 8

3.1 Grade Level (Locations 1 through 82) 8

3.1.1 Existing Conditions (Figures 1A and 2A) 8

3.1.2 Proposed Conditions (Figures 1B and 2B) 8

3.1.3 Future Conditions (Figures 1C and 2C) 10

3.2 Above-Grade Levels (Locations 83 through 96) 10

4 APPLICABILITY OF RESULTS 11

5 REFERENCES 11

LIST OF FIGURES

Figure 1A: Pedestrian Wind Comfort Conditions – Existing – Summer
Figure 1B: Pedestrian Wind Comfort Conditions – Proposed – Summer
Figure 1C: Pedestrian Wind Comfort Conditions – Future – Summer

Figure 2A: Pedestrian Wind Comfort Conditions – Existing – Winter
Figure 2B: Pedestrian Wind Comfort Conditions – Proposed – Winter
Figure 2C: Pedestrian Wind Comfort Conditions – Future – Winter

LIST OF TABLES

Table 1: Pedestrian Wind Comfort and Safety Conditions

1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed 40-70 Plains Road East in Burlington, ON. This report presents RWDI's approach and findings from the wind tunnel assessment and provides conceptual wind control measures for the design team to consider.

1.1 Project Description

The project (site shown in Image 1) is located to the south of Plains Road East between xx and Birchwood AvenueThe proposed building is approximately 32.8m tall, consisting of a 10-storey tower with an outdoor amenity terrace on Level 10.

1.2 Objectives

The objective of the study was to assess the effect of the proposed development on local conditions in pedestrian areas on and around the study site and provide recommendations for minimizing adverse effects, if needed. This quantitative assessment was based on wind speed measurements on a scale model of the project and its surroundings in one of RWDI's boundary-layer wind tunnels. These measurements were combined with the local wind records and compared to appropriate criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including building entrances and drop off zone, public sidewalks, and bus stops.



Image 1: Aerial View of Site and Surroundings (Photo Courtesy of Google™ Earth)

2 BACKGROUND AND APPROACH

2.1 Wind Tunnel Study Model

To assess the wind environment around the proposed project, a 1:300 scale model of the project site and surroundings was constructed for the wind tunnel tests of the following configurations:

A - Existing: Existing site with existing surroundings (Image 2A),

B - Proposed: Proposed project with existing surroundings (Image 2B), and,

C - Future: Proposed project with existing and future surroundings (Image 2C).

The wind tunnel model included all relevant surrounding buildings and topography within an approximately 360m radius of the study site. The wind and turbulence profiles in the atmospheric boundary layer beyond the modelled area were also simulated in RWDI's wind tunnel. The wind tunnel model was instrumented with omni-directional wind speed sensors to measure mean and gust speeds at a full-scale height of approximately 1.5m above local grade in pedestrian areas throughout the study site. Wind speeds were measured for 36 directions in a 10-degree increments. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the mean wind speed at a reference height above the model. The placement of wind measurement locations was based on our experience and understanding of the pedestrian usage for this site, and reviewed by the Community Planning Department at the City of Burlington.



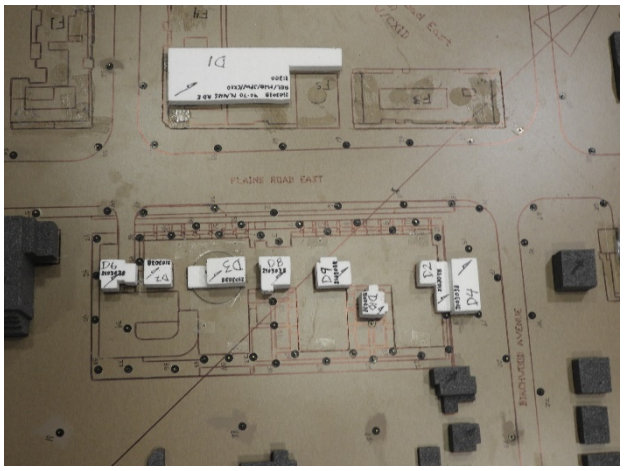
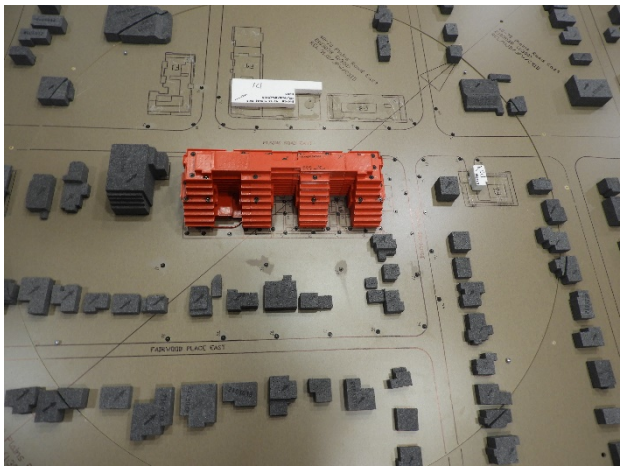




Image 2A: Wind Tunnel Study Model – Existing Configuration





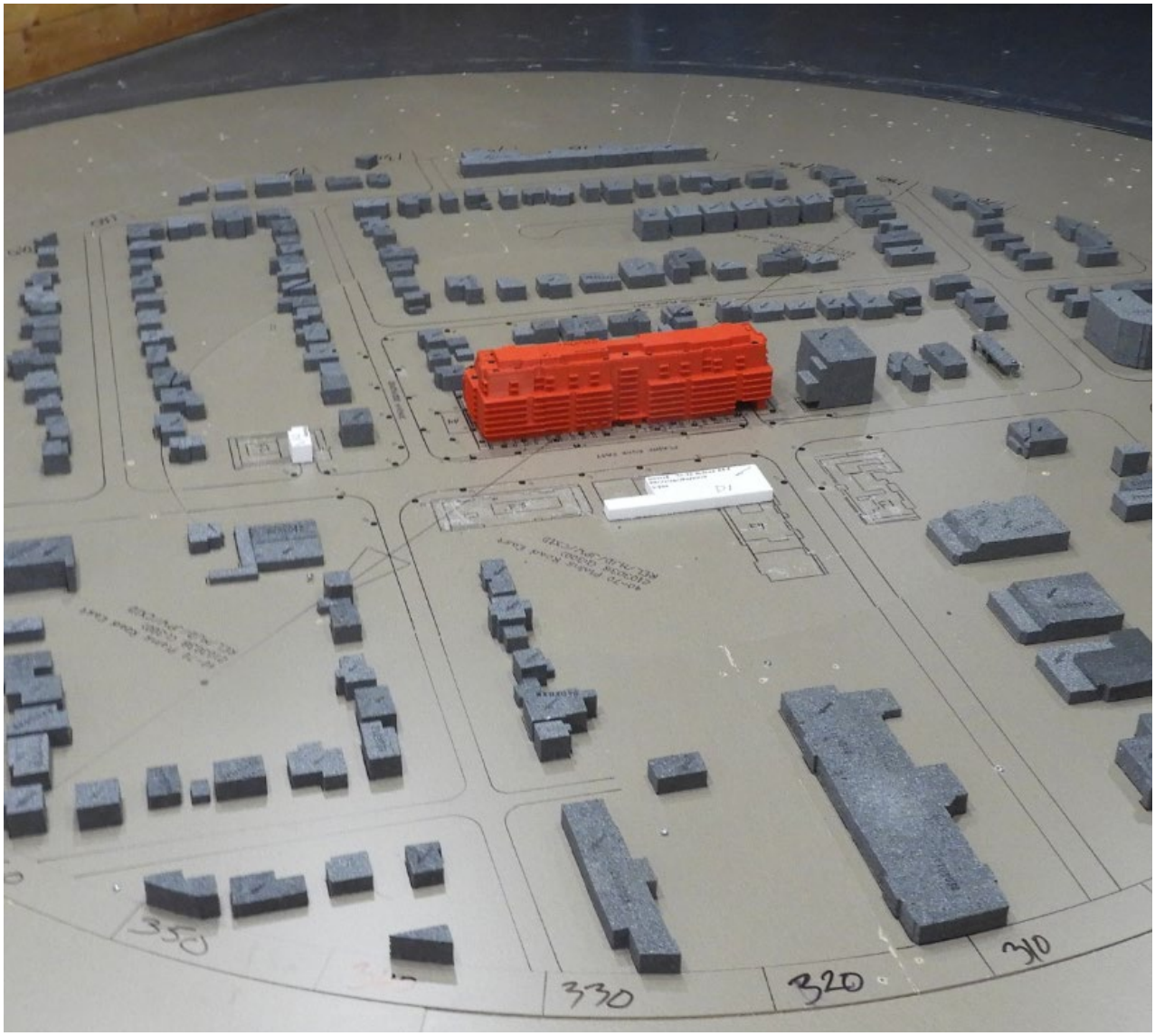
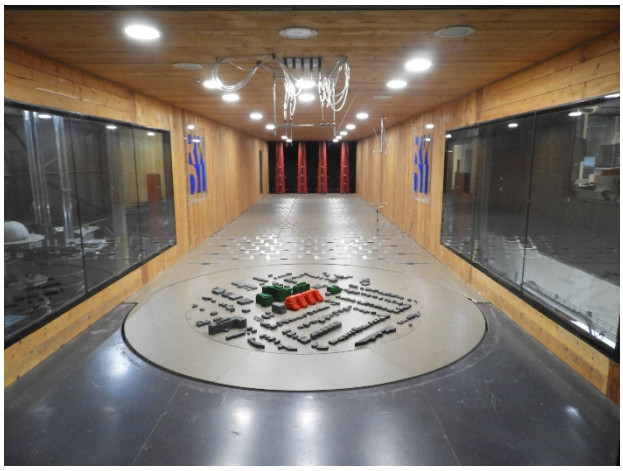
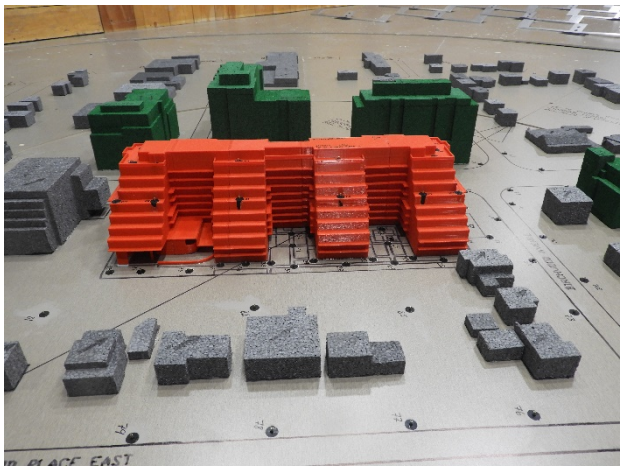


Image 2B: Wind Tunnel Study Model – Proposed Configuration





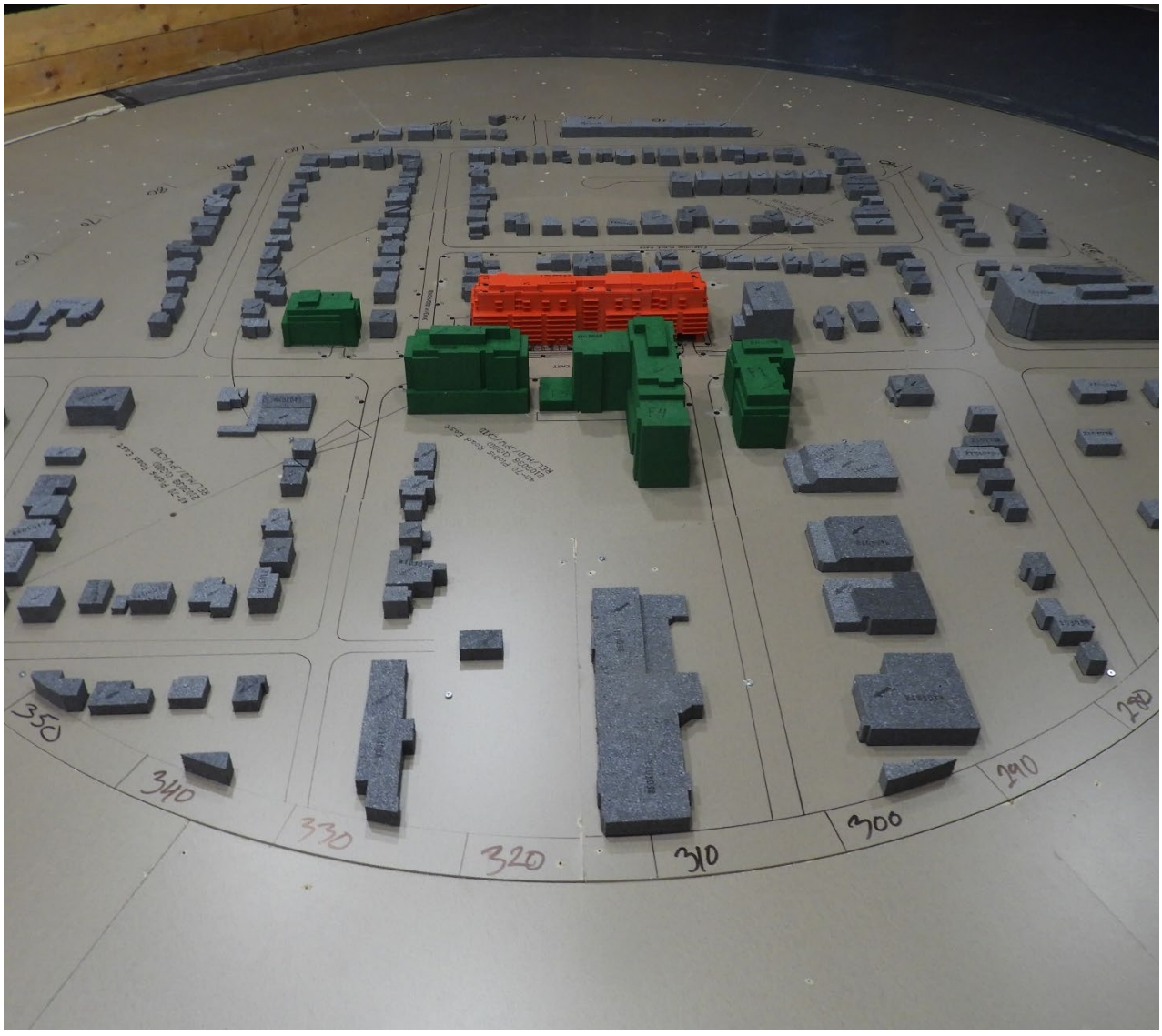
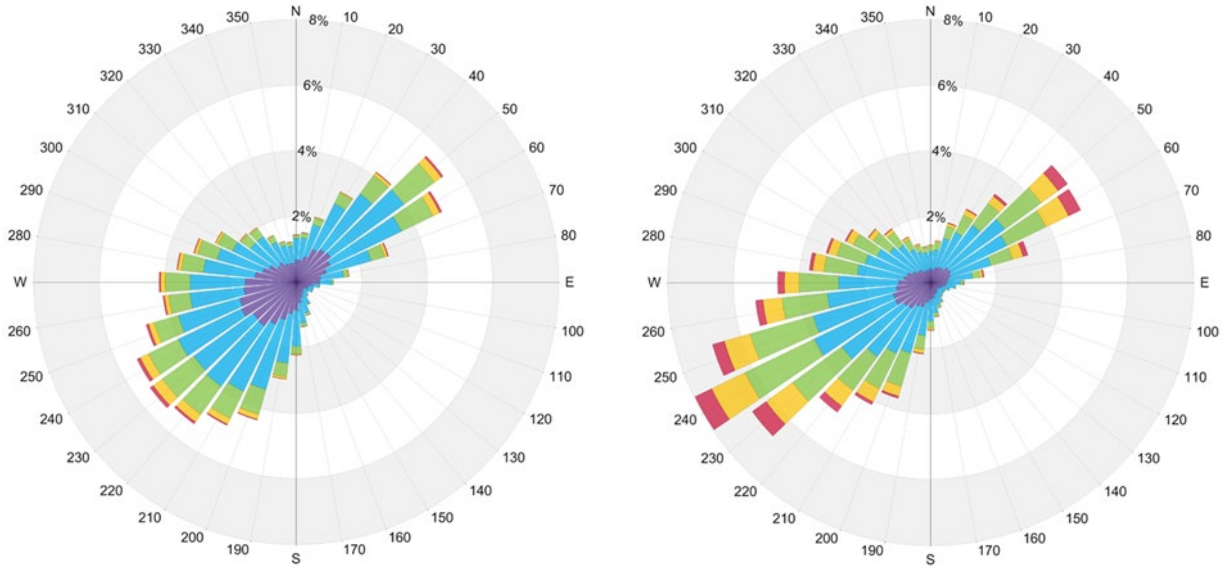


Image 2C: Wind Tunnel Study Model – Future Configuration

2.2 Meteorological Data

Wind statistics recorded at Hamilton International Airport between 1989 and 2019, inclusive, were analyzed for the summer (May through October) and winter (November through April) seasons. Image 3 graphically depicts the directional distributions of wind frequencies and speeds for these two seasons. Winds from the northeast and southwest directions are predominant in both summer and winter, as indicated by the wind roses. Strong winds of a mean speed greater than 30 km/h, measured at the airport (at an anemometer height of 10 m), occur for 3.8% and 12.9% of the time during the summer and winter seasons, respectively.

Wind statistics were combined with the wind tunnel data to predict the frequency of occurrence of full-scale wind speeds. The full-scale wind predictions were then compared with the wind criteria for pedestrian comfort and safety.



Wind Speed (km/h)	Probability (%) Summer	Winter
Calm	3.9	2.4
1-10	33.9	21.7
11-20	43.1	39.4
21-30	15.3	23.6
31-40	3.0	9.2
>40	0.8	3.7

Image 3: Directional Distribution of Winds Approaching Hamilton International Airport between 1989 and 2019

2.3 Burlington Pedestrian Wind Criteria

The Burlington pedestrian wind criteria, developed in March 2020, are specified in the Guidelines and Terms of Reference, "Pedestrian Level Wind Study". The following table presents the criterion in detail.

Comfort Category	GEM Speed (km/h)	Description
Sitting	≤ 10	Calm or light breezes • Appropriate for dedicated seating areas such as cafés, patios, and outdoor amenity areas
Standing	≤ 14	Gentle breezes • Appropriate for main building entrances, bus stops, and other places where pedestrians may linger
Leisurely Walking	≤ 17	Moderate winds • Appropriate for shopping and strolling along retail streets and parks
Fast Walking	≤ 20	Relative higher speed winds • Appropriate for areas where pedestrians are walking, running, or cycling without lingering
Uncomfortable	> 20	Strong winds • Inappropriate due to nuisance for all pedestrian activities • Wind mitigation measures required

Notes:

(1) GEM is defined as the maximum mean wind speed or gust speed divided by 1.85 (whichever is larger). Gust speed can be directly measured in a wind tunnel or represented by mean wind speed + 3*RMS (Root Mean Square) wind speed.

(2) GEM speeds listed above are based on a seasonal exceedance of 20% of the time between 06:00 and 23:00. The criterion has been met if the wind speeds occur at least four out of five days.

Safety Criterion	Gust Speed (km/h)	Description
Exceeded	> 90	• Excessive gust speeds • Adverse effect on pedestrian's balance and footing • Wind mitigation is required

Notes:

(1) Based on an annual exceedance of 9 hours or 0.1% of the time for 24 hours a day.

(2) Gust speed can be directly measured in a wind tunnel or represented by mean wind speed + 3*RMS wind speed.

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown on site plans in Figures 1A through 2C and the associated wind speeds are presented in Table 1, located in the "Tables" section of this report. The following is a detailed discussion of the suitability of the predicted wind conditions for the anticipated pedestrian use of each area of interest.

Wind conditions that meet the safety criterion are predicted at all locations for all configurations assessed.

3.1 Grade Level (Locations 1 through 82)

Wind conditions comfortable for walking or strolling are appropriate for sidewalks and walkways as pedestrians will be active and less likely to remain in one area for prolonged periods of time. Lower wind speeds conducive to standing are preferred at main entrances or bus stops where pedestrians are apt to linger. Wind speeds comfortable for sitting are preferred for areas intended for passive activities, such as outdoor patios.

3.1.1 Existing Conditions (Figures 1A and 2A)

Wind speeds throughout the existing site are calm during the summer (sitting or standing at all locations, Figure 1A). In the winter, wind speeds are seasonably higher in Burlington. Winds suitable for walking activities are present along the north side of Plains Road (Figure 2A).

3.1.2 Proposed Conditions (Figures 1B and 2B)

When the proposed building is introduced, wind conditions at all locations assessed are predicted to remain suitable for their intended pedestrian use during the summer, including the main entrance (Location 1, Figure 1B) and the bus stops (near Locations 12 and 65, Figure 1B).

During the winter months, conditions at all locations remain appropriate for the site usage with the exception of the bus stops near Locations 12 and 65 (Figure 2B). This is a result of the exposure to the prevailing winds approaching along Plains Road East (both the north-easterly and the southwesterly winds, with respect to true north). The increase in wind speeds at the Plains Road and Beachwood Avenue intersection is caused by the prevailing winds passing around the corner of the development, causing them to accelerate. This wind flow phenomenon would occur for any similar building introduced on this site, and can be mitigated with strategic landscaping or hardscaping (see illustration in Image 4). Recommended placement for either solid screens or winter landscaping are presented in Image 5, with examples provided in Image 6. Solid screens on either side of the bus stop area would shelter patrons from the approaching winds along Plains Road East. Alternatively, the use of winter landscaping (meaning landscaping which retains foliage through the winter season) upwind along Plains Road East would act to impede the oncoming winds and improve pedestrian comfort. Further, RWDI notes that future developments are expected to ameliorate the wind conditions at both bus stops. See Section 3.1.3 for a discussion of the future conditions.

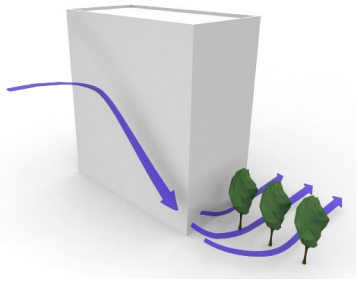


Image 4: Diffusing Winds around Building Corners

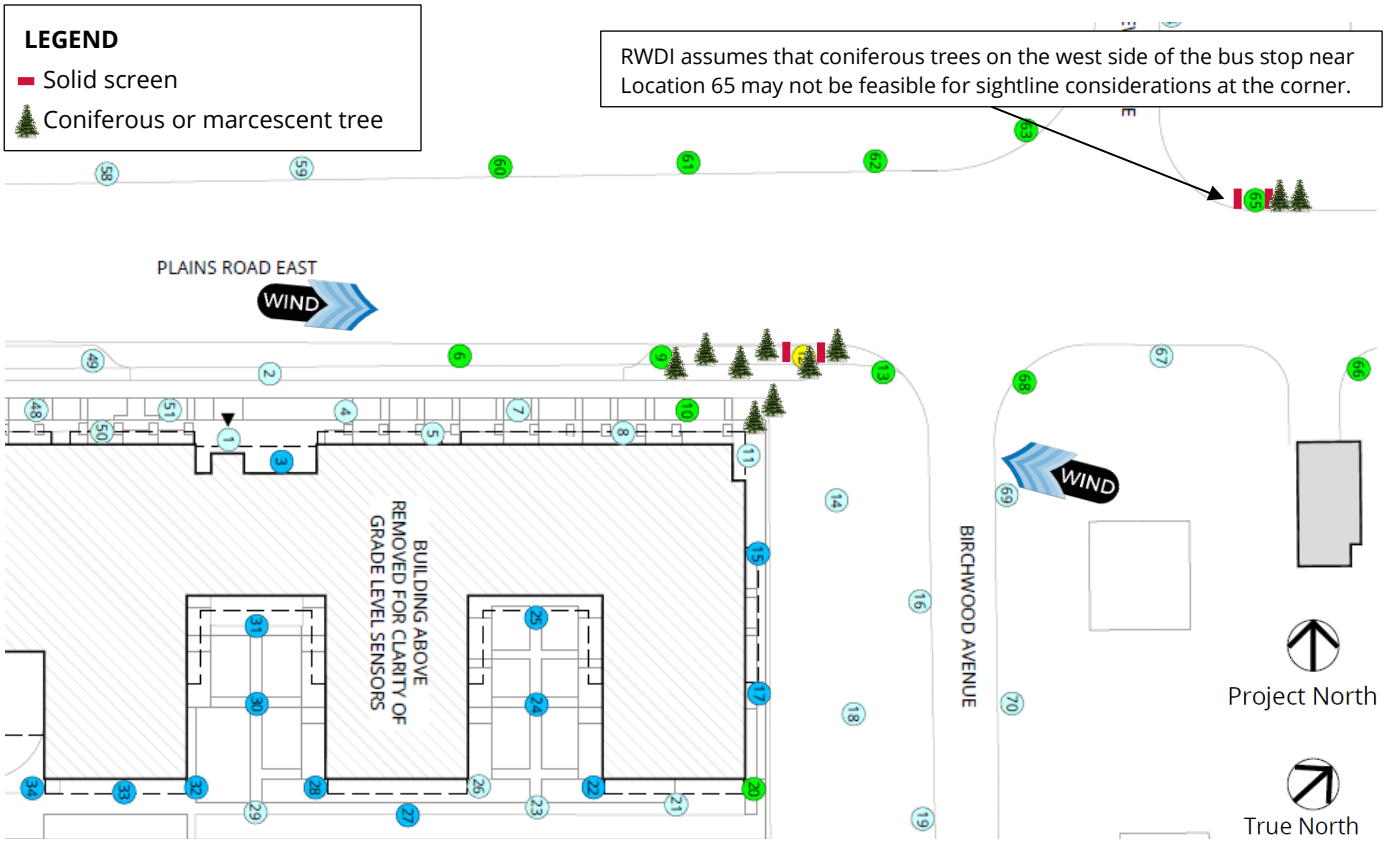


Image 5: Recommended Placement of Either Wind Screens or Winter Landscaping for Improved Conditions at Bus Stops Along Plains Road East

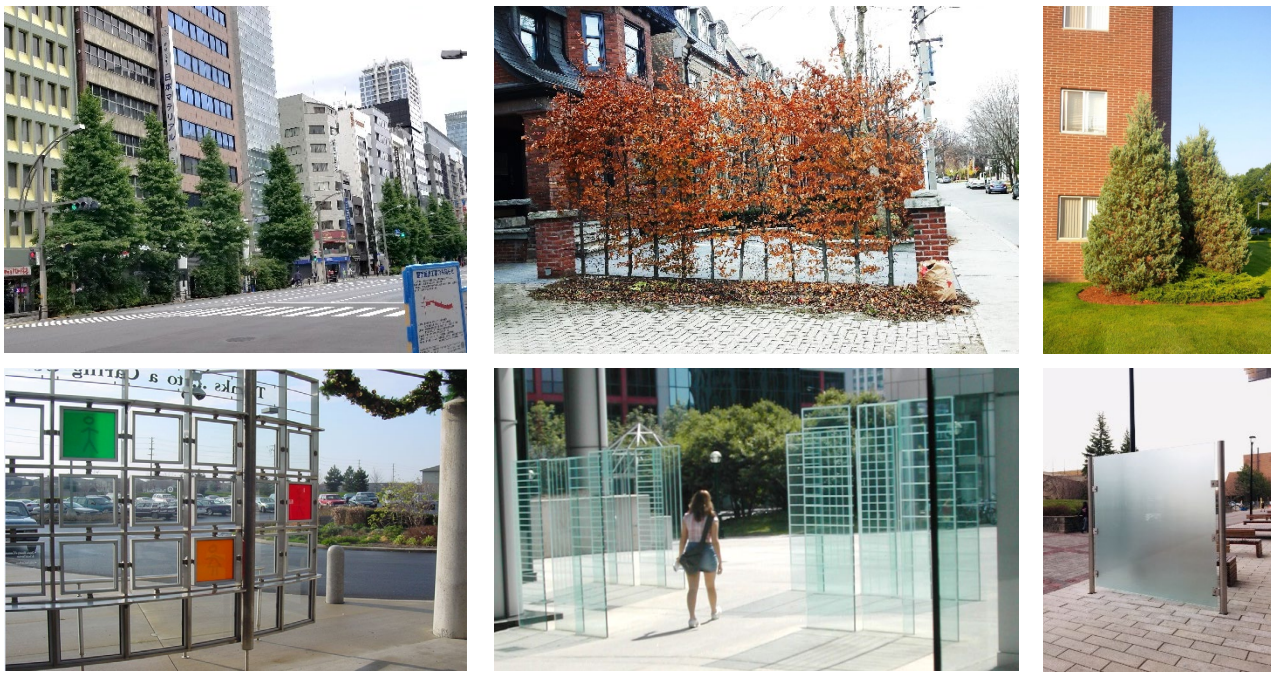


Image 6: Examples of Appropriate Mitigation Measures – Winter Landscaping (top) and Screens (bottom)

3.1.3 Future Conditions (Figures 1C and 2C)

When the future buildings along Plains Road East and Birchwood Avenue are introduced, wind conditions around the project are expected to remain appropriate (Figures 1C and 2C), and significantly calmer conditions are anticipated at the bus stops near Locations 12 and 65 (Figures 1C and 2C compared with Figures 1B and 2B). Wind control measures as shown in Images 5 and 6 would still be recommended for the bus stop near Location 12 to bring about wind speeds comfortable for standing during the winter months (Location 12, Figure 2C).

At the project site, conditions at the main entrance to the proposed 40-70 Plains Road are expected to be windier than desired for an entrance from time to time during the winter months (Location 1, Figure 2C). Because the future condition may be subject to change, RWDI recommends monitoring the entrance as the surrounding developments change to assess whether mitigation is warranted. If desired, vertical screens or dense winter plantings on either side of the entrance would be expected to provide sufficient wind control (similar to examples shown in Image 6).

3.2 Above-Grade Levels (Locations 83 through 96)

It is generally desirable for wind conditions on terraces intended for passive activities to be comfortable for sitting more than 80% of the time in the summer. During the winter, the area would not be used frequently and increased wind activity would be considered appropriate.

Wind speeds on the Level 10 terrace are expected to remain comfortable for passive activities during the summer for both the proposed and future sites, which is appropriate (Figures 1B and 1C). No mitigation measures are required.

3.3 Update to Underground Access

Subsequent to the wind tunnel modeling and testing, there was a modification to the orientation of the underground access (see plan view below). Upon review, and based on our expertise, this change is considered very minor from a wind perspective, and is not expected to alter the results presented herein.

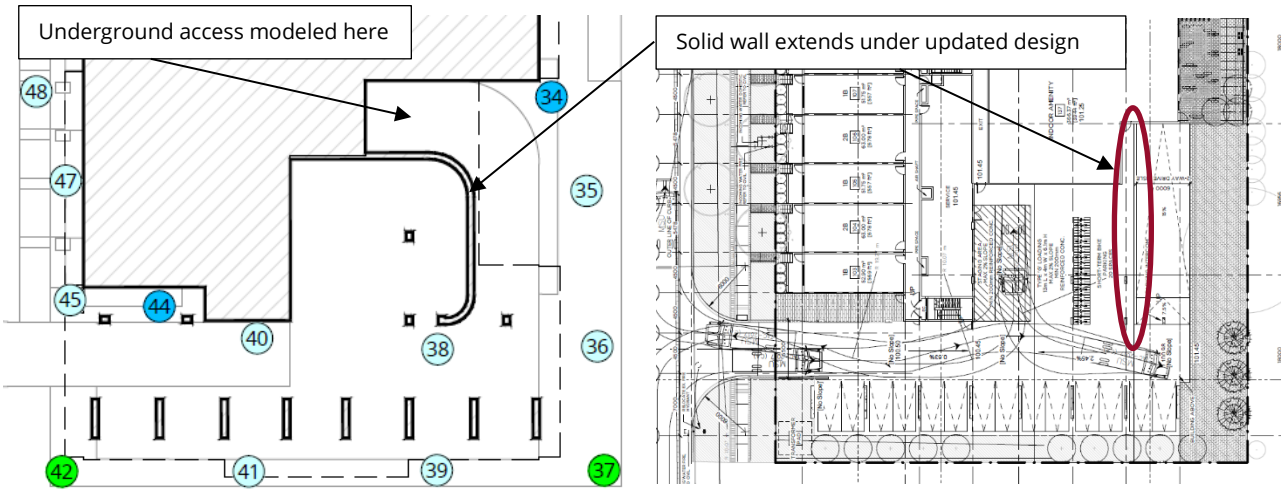


Image 7: Underground Access As-Modeled (Left), and Current (Right)

4 APPLICABILITY OF RESULTS

The wind conditions presented in this report pertain to the model of the 40-70 Plains Road East constructed using the drawings and information listed below. Should there be any design changes that deviate from this list of drawings, the wind condition predictions presented may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

File Name	File Type	Date Received (dd/mm/yyyy)
18035 Plains Road_Central_File_2020_detached	RVT	04/03/2021
18035 Plains Road_Rezoning Architectural Drawings_20201110	PDF	02/03/2021

5 REFERENCES

1. ASCE Task Committee on Outdoor Human Comfort (2004). *Outdoor Human Comfort and Its Assessment*, 68 pages, American Society of Civil Engineers, Reston, Virginia, USA.
2. Williams, C.J., Hunter, M.A. and Waechter, W.F. (1990). "Criteria for Assessing the Pedestrian Wind Environment," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.36, pp.811-815.
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9. Wu, H. and Kriksic, F. (2012). "Designing for Pedestrian Comfort in Response to Local Climate", *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.104-106, pp.397-407.
10. Wu, H., Williams, C.J., Baker, H.A. and Waechter, W.F. (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", *ASCE Structure Congress 2004,* Nashville, Tennessee.

FIGURES

CLEARVIEW AVENUE

BIRCHWOOD AVENUE

PLAINS ROAD EAST

COOKE BOULEVARD

FAIRWOOD PLACE EAST

EXISTING BUILDINGS

EXISTING BUILDING

EXISTING BUILDINGS

LEGEND:

COMFORT CATEGORIES:

- Sitting
- Standing
- Leisurely Walking
- Fast Walking
- Uncomfortable

SENSOR LOCATION:

- Grade Level

0 10 30m

Pedestrian Wind Comfort Conditions

Existing Configuration

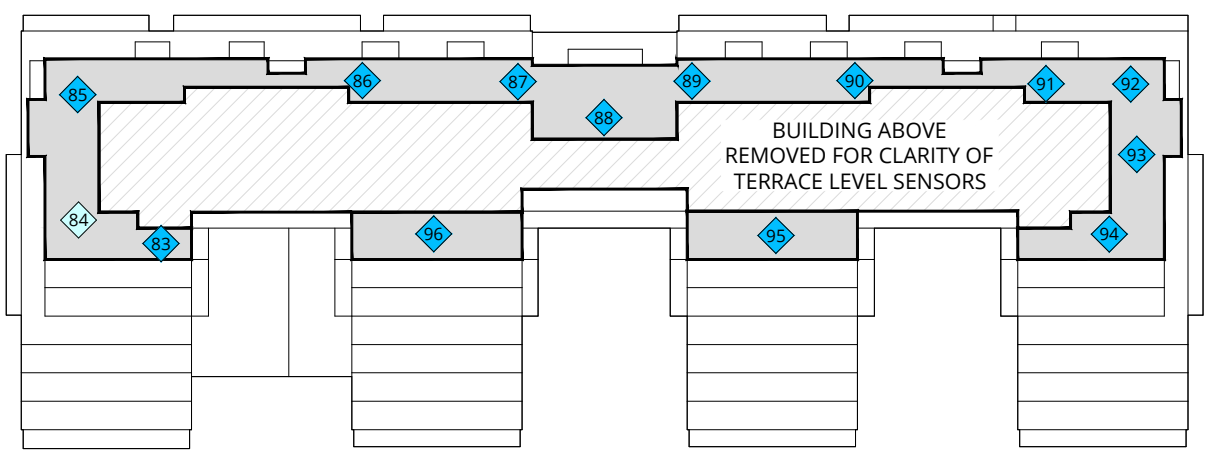
Summer (May to October, 6:00 to 23:00)

40-70 Plains Road East - Burlington, ON

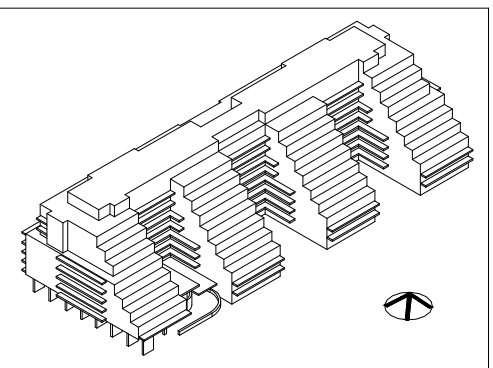
Project North True North

Project #2103038

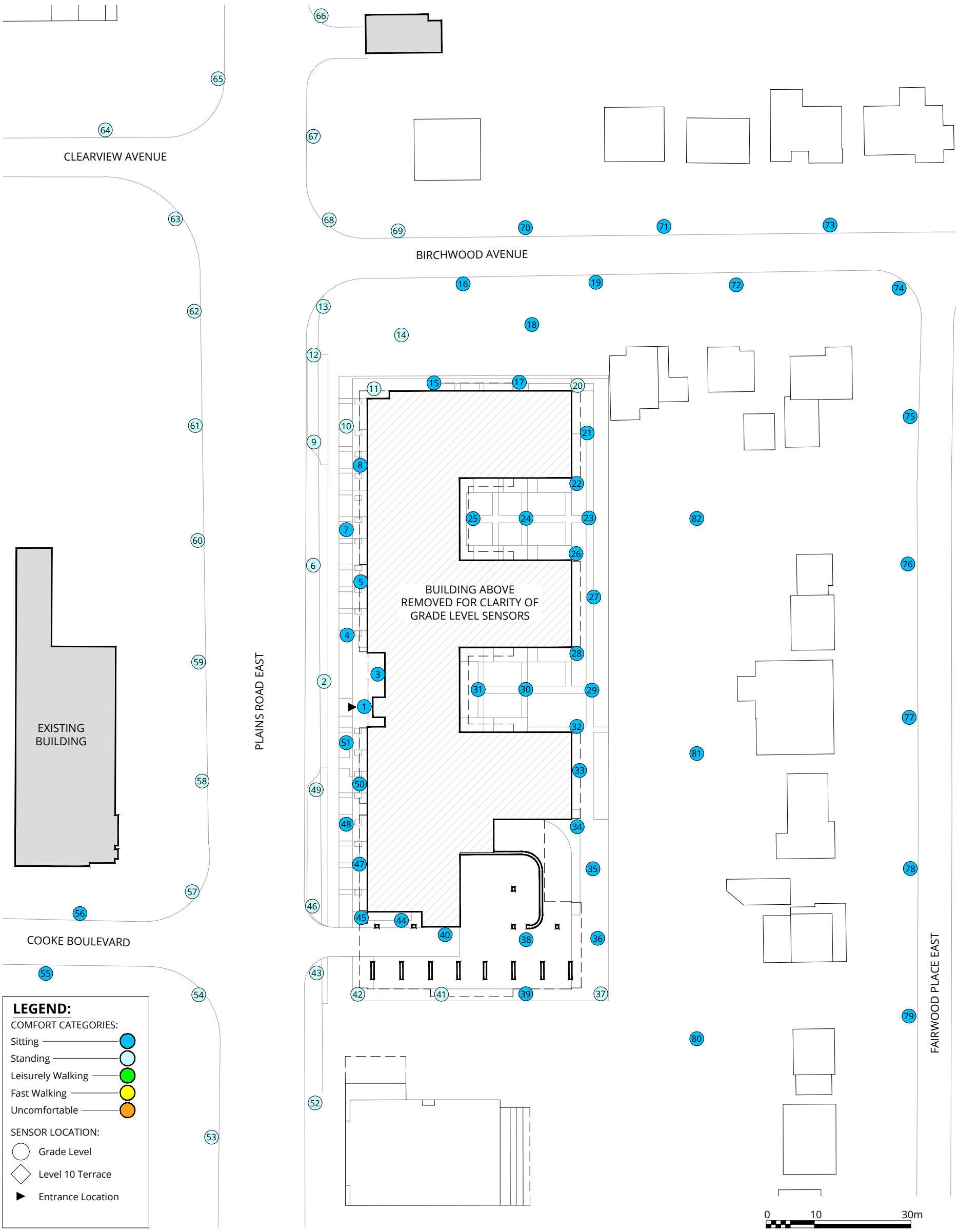
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Date Revised:	Mar. 18, 2021		



Elevated Sensor Locations - Level 10 Terrace
Approx. Scale: 1:800



Isometric View of Building



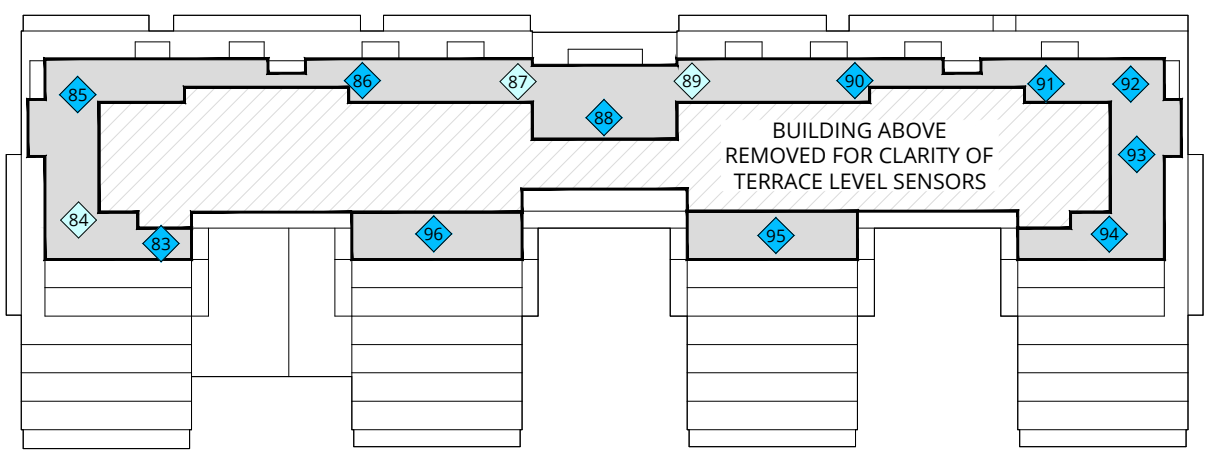
Pedestrian Wind Comfort Conditions
Proposed Configuration
Summer (May to October, 6:00 to 23:00)

40-70 Plains Road East - Burlington, ON

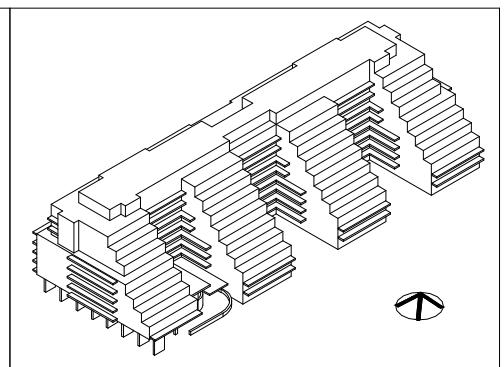
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Project #2103038

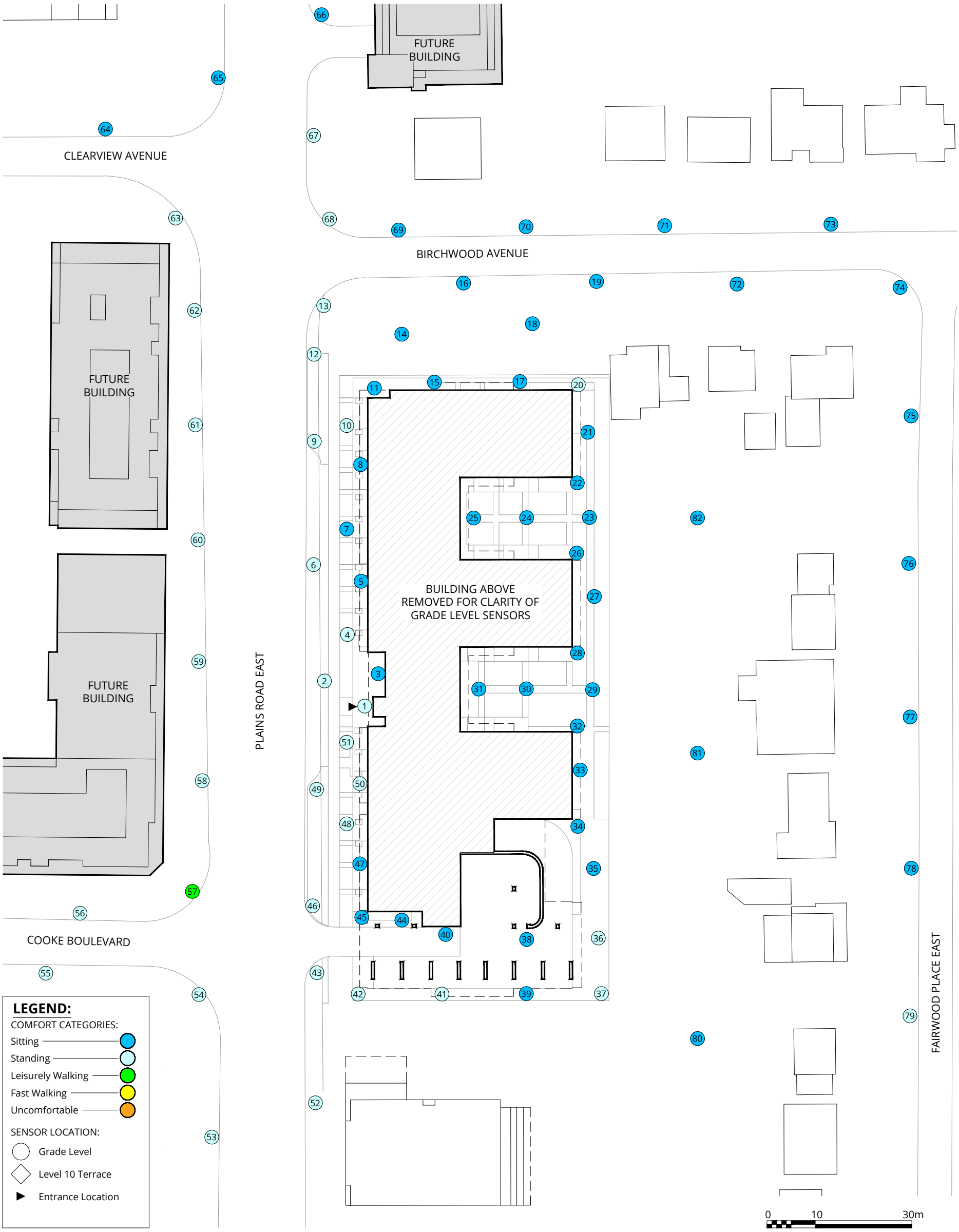
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Elevated Sensor Locations - Level 10 Terrace
Approx. Scale: 1:800



Isometric View of Building



Pedestrian Wind Comfort Conditions
Future Configuration
Summer (May to October, 6:00 to 23:00)

40-70 Plains Road East - Burlington, ON

Project North True North

Project #2103038

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Date Revised:	Mar. 18, 2021

CLEARVIEW AVENUE

BIRCHWOOD AVENUE

PLAINS ROAD EAST

COOKE BOULEVARD

FAIRWOOD PLACE EAST

EXISTING BUILDINGS

EXISTING BUILDING

EXISTING BUILDINGS

LEGEND:

COMFORT CATEGORIES:

- Sitting
- Standing
- Leisurely Walking
- Fast Walking
- Uncomfortable

SENSOR LOCATION:

- Grade Level

0 10 30m

Pedestrian Wind Comfort Conditions

Existing Configuration

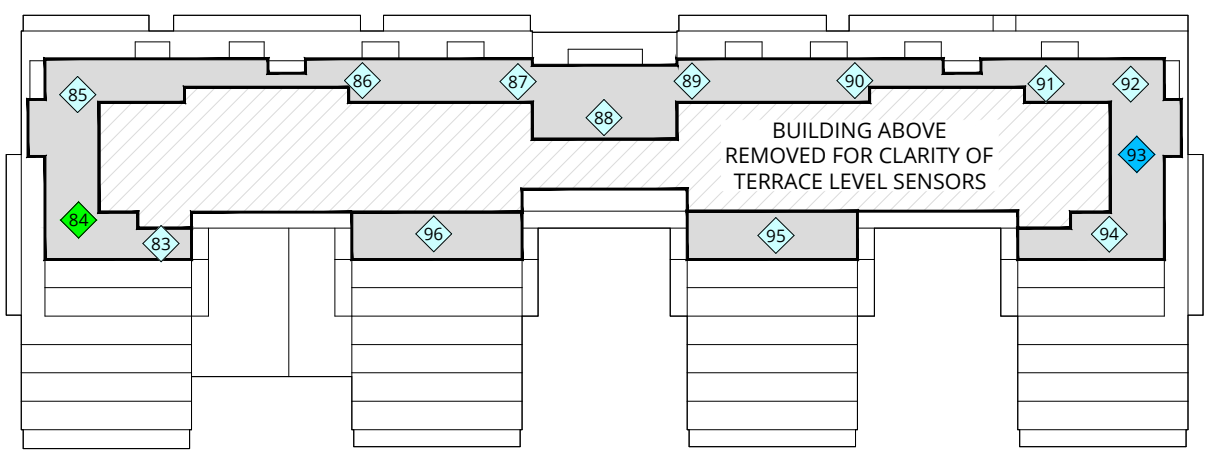
Winter (November to April, 6:00 to 23:00)

40-70 Plains Road East - Burlington, ON

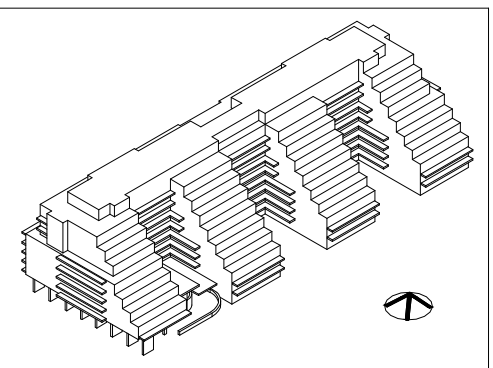
Project North True North

Project #2103038

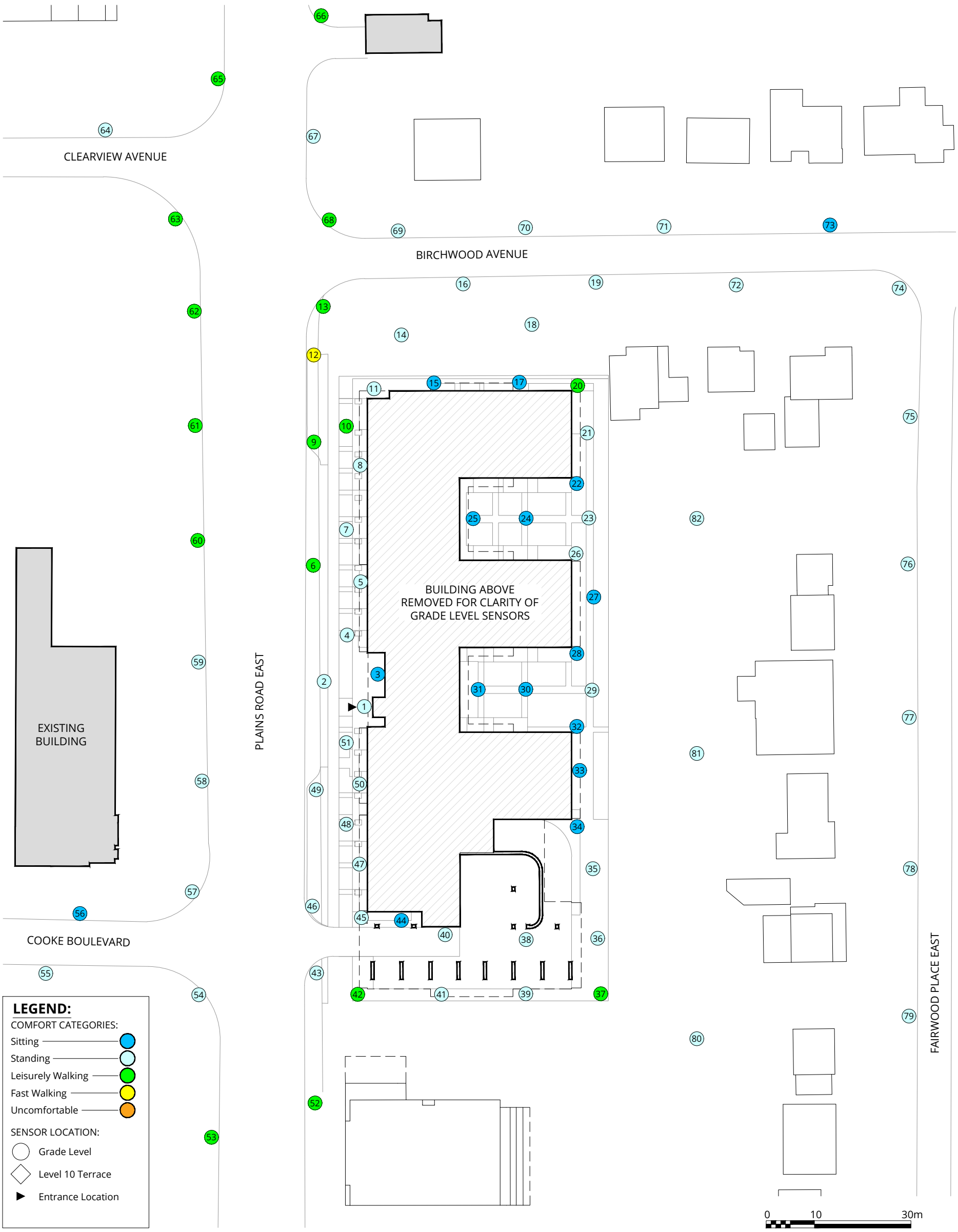
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Elevated Sensor Locations - Level 10 Terrace
Approx. Scale: 1:800



Isometric View of Building



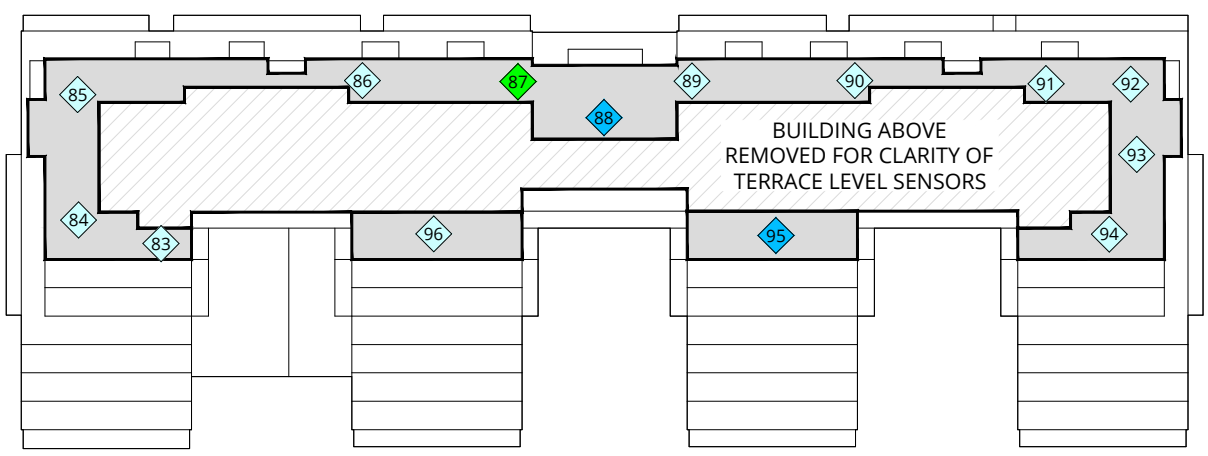
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Proposed Configuration
Winter (November to April, 6:00 to 23:00)

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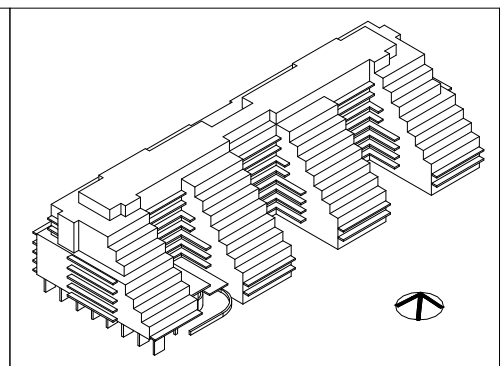
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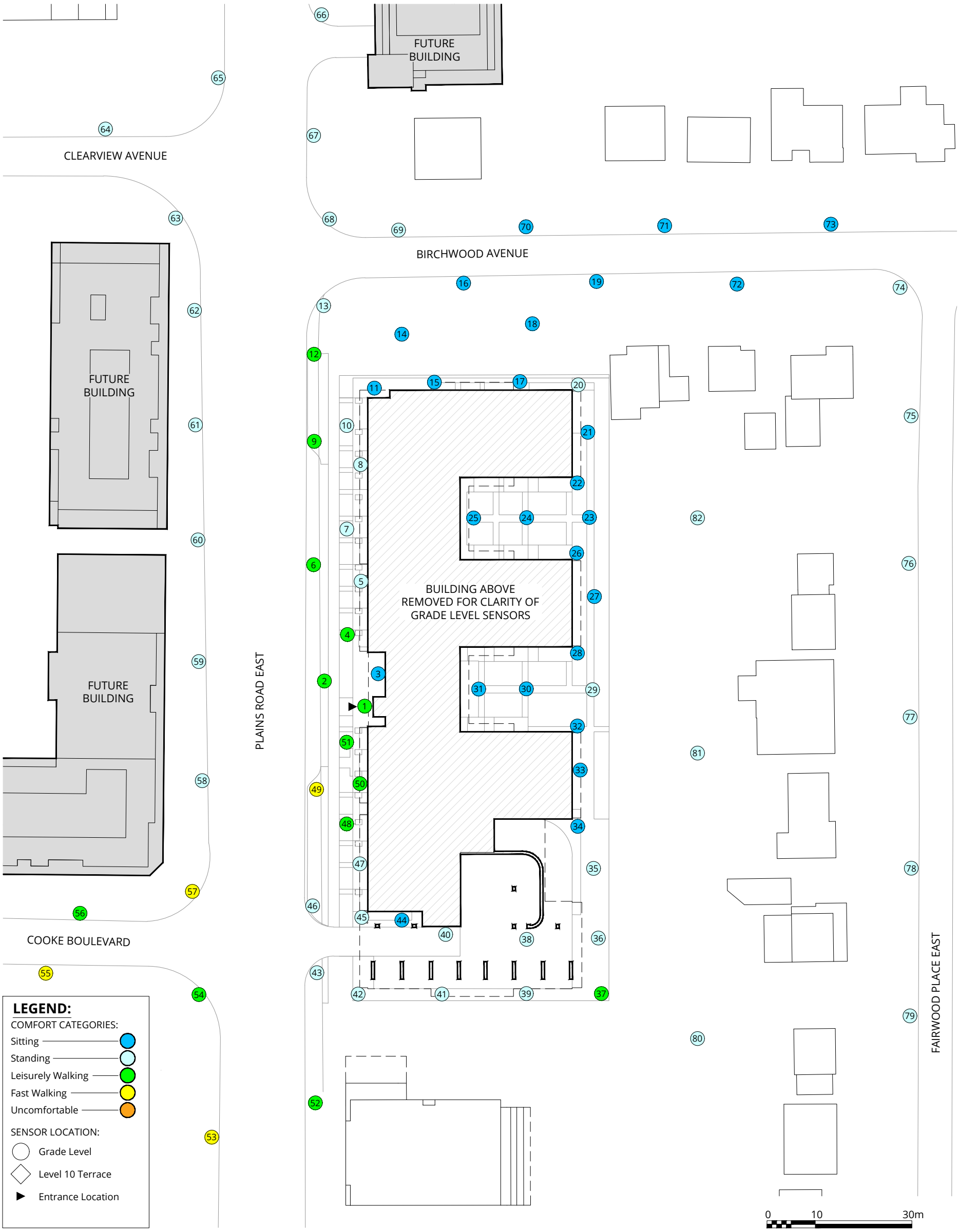
Drawn by: GRE	Figure: 2B
Approx. Scale:	1:800
Date Revised:	Mar. 18, 2021



Elevated Sensor Locations - Level 10 Terrace
Approx. Scale: 1:800



Isometric View of Building



Pedestrian Wind Comfort Conditions
Future Configuration
Winter (November to April, 6:00 to 23:00)

40-70 Plains Road East - Burlington, ON

Project North True North

Project #2103038

Drawn by: GRE	Figure: 2C
Approx. Scale:	1:800
Date Revised:	Mar. 18, 2021

TABLES

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
1	Existing	9	Sitting	12	Standing	49	Pass
	Proposed	8	Sitting	11	Standing	50	Pass
	Future	11	Standing	15	Strolling	68	Pass
2	Existing	10	Sitting	13	Standing	53	Pass
	Proposed	11	Standing	14	Standing	58	Pass
	Future	13	Standing	17	Strolling	64	Pass
3	Existing	9	Sitting	12	Standing	48	Pass
	Proposed	4	Sitting	5	Sitting	24	Pass
	Future	4	Sitting	6	Sitting	25	Pass
4	Existing	10	Sitting	14	Standing	52	Pass
	Proposed	10	Sitting	14	Standing	60	Pass
	Future	12	Standing	16	Strolling	69	Pass
5	Existing	10	Sitting	13	Standing	52	Pass
	Proposed	9	Sitting	11	Standing	44	Pass
	Future	9	Sitting	11	Standing	47	Pass
6	Existing	10	Sitting	14	Standing	54	Pass
	Proposed	12	Standing	15	Strolling	62	Pass
	Future	13	Standing	16	Strolling	63	Pass
7	Existing	10	Sitting	13	Standing	52	Pass
	Proposed	10	Sitting	13	Standing	53	Pass
	Future	10	Sitting	13	Standing	55	Pass
8	Existing	10	Sitting	13	Standing	50	Pass
	Proposed	9	Sitting	12	Standing	49	Pass
	Future	9	Sitting	12	Standing	51	Pass
9	Existing	11	Standing	14	Standing	53	Pass
	Proposed	14	Standing	17	Strolling	75	Pass
	Future	13	Standing	17	Strolling	68	Pass
10	Existing	10	Sitting	13	Standing	52	Pass
	Proposed	12	Standing	15	Strolling	64	Pass
	Future	11	Standing	14	Standing	61	Pass
11	Existing	9	Sitting	12	Standing	50	Pass
	Proposed	11	Standing	13	Standing	80	Pass
	Future	7	Sitting	8	Sitting	66	Pass
12	Existing	11	Standing	14	Standing	54	Pass
	Proposed	14	Standing	18	Walking	76	Pass
	Future	12	Standing	15	Strolling	61	Pass

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Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
13	Existing	10	Sitting	14	Standing	52	Pass
	Proposed	13	Standing	17	Strolling	66	Pass
	Future	11	Standing	14	Standing	58	Pass
14	Existing	10	Sitting	13	Standing	56	Pass
	Proposed	11	Standing	14	Standing	64	Pass
	Future	8	Sitting	10	Sitting	52	Pass
15	Existing	-	-	-	-	-	
	Proposed	6	Sitting	7	Sitting	47	Pass
	Future	6	Sitting	7	Sitting	43	Pass
16	Existing	9	Sitting	11	Standing	49	Pass
	Proposed	10	Sitting	13	Standing	59	Pass
	Future	8	Sitting	10	Sitting	49	Pass
17	Existing	7	Sitting	10	Sitting	47	Pass
	Proposed	7	Sitting	9	Sitting	52	Pass
	Future	6	Sitting	7	Sitting	49	Pass
18	Existing	8	Sitting	11	Standing	46	Pass
	Proposed	10	Sitting	12	Standing	63	Pass
	Future	7	Sitting	9	Sitting	46	Pass
19	Existing	9	Sitting	11	Standing	44	Pass
	Proposed	9	Sitting	11	Standing	52	Pass
	Future	8	Sitting	10	Sitting	44	Pass
20	Existing	10	Sitting	13	Standing	53	Pass
	Proposed	12	Standing	16	Strolling	66	Pass
	Future	11	Standing	13	Standing	58	Pass
21	Existing	9	Sitting	12	Standing	46	Pass
	Proposed	9	Sitting	11	Standing	50	Pass
	Future	8	Sitting	10	Sitting	50	Pass
22	Existing	9	Sitting	11	Standing	46	Pass
	Proposed	8	Sitting	9	Sitting	46	Pass
	Future	7	Sitting	8	Sitting	42	Pass
23	Existing	8	Sitting	11	Standing	45	Pass
	Proposed	9	Sitting	12	Standing	50	Pass
	Future	8	Sitting	10	Sitting	44	Pass
24	Existing	8	Sitting	11	Standing	46	Pass
	Proposed	6	Sitting	8	Sitting	38	Pass
	Future	6	Sitting	7	Sitting	36	Pass

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Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
25	Existing	-	-	-	-	-	
	Proposed	7	Sitting	9	Sitting	38	Pass
	Future	6	Sitting	8	Sitting	33	Pass
26	Existing	9	Sitting	11	Standing	46	Pass
	Proposed	8	Sitting	11	Standing	44	Pass
	Future	7	Sitting	9	Sitting	39	Pass
27	Existing	9	Sitting	12	Standing	48	Pass
	Proposed	8	Sitting	10	Sitting	43	Pass
	Future	7	Sitting	9	Sitting	40	Pass
28	Existing	9	Sitting	12	Standing	48	Pass
	Proposed	7	Sitting	9	Sitting	41	Pass
	Future	6	Sitting	8	Sitting	38	Pass
29	Existing	9	Sitting	12	Standing	50	Pass
	Proposed	9	Sitting	12	Standing	50	Pass
	Future	8	Sitting	11	Standing	46	Pass
30	Existing	9	Sitting	11	Standing	47	Pass
	Proposed	6	Sitting	8	Sitting	37	Pass
	Future	6	Sitting	7	Sitting	37	Pass
31	Existing	9	Sitting	11	Standing	47	Pass
	Proposed	6	Sitting	8	Sitting	37	Pass
	Future	6	Sitting	7	Sitting	31	Pass
32	Existing	9	Sitting	12	Standing	49	Pass
	Proposed	8	Sitting	10	Sitting	43	Pass
	Future	7	Sitting	9	Sitting	40	Pass
33	Existing	9	Sitting	12	Standing	49	Pass
	Proposed	7	Sitting	9	Sitting	41	Pass
	Future	7	Sitting	8	Sitting	39	Pass
34	Existing	9	Sitting	11	Standing	48	Pass
	Proposed	7	Sitting	9	Sitting	41	Pass
	Future	7	Sitting	9	Sitting	41	Pass
35	Existing	9	Sitting	11	Standing	48	Pass
	Proposed	9	Sitting	11	Standing	49	Pass
	Future	8	Sitting	11	Standing	48	Pass
36	Existing	9	Sitting	11	Standing	48	Pass
	Proposed	10	Sitting	12	Standing	52	Pass
	Future	11	Standing	14	Standing	56	Pass

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Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
37	Existing	10	Sitting	12	Standing	48	Pass
	Proposed	11	Standing	16	Strolling	69	Pass
	Future	11	Standing	15	Strolling	67	Pass
38	Existing	8	Sitting	11	Standing	44	Pass
	Proposed	9	Sitting	12	Standing	54	Pass
	Future	10	Sitting	13	Standing	62	Pass
39	Existing	9	Sitting	12	Standing	47	Pass
	Proposed	9	Sitting	12	Standing	60	Pass
	Future	9	Sitting	12	Standing	56	Pass
40	Existing	-	-	-	-	-	
	Proposed	10	Sitting	12	Standing	58	Pass
	Future	10	Sitting	14	Standing	63	Pass
41	Existing	10	Sitting	13	Standing	58	Pass
	Proposed	11	Standing	14	Standing	60	Pass
	Future	11	Standing	14	Standing	61	Pass
42	Existing	12	Standing	16	Strolling	68	Pass
	Proposed	12	Standing	15	Strolling	56	Pass
	Future	11	Standing	14	Standing	56	Pass
43	Existing	11	Standing	15	Strolling	59	Pass
	Proposed	12	Standing	14	Standing	58	Pass
	Future	11	Standing	14	Standing	58	Pass
44	Existing	8	Sitting	11	Standing	42	Pass
	Proposed	7	Sitting	9	Sitting	46	Pass
	Future	7	Sitting	10	Sitting	46	Pass
45	Existing	9	Sitting	12	Standing	52	Pass
	Proposed	10	Sitting	13	Standing	61	Pass
	Future	10	Sitting	13	Standing	60	Pass
46	Existing	11	Standing	14	Standing	55	Pass
	Proposed	11	Standing	13	Standing	58	Pass
	Future	11	Standing	14	Standing	59	Pass
47	Existing	9	Sitting	12	Standing	51	Pass
	Proposed	9	Sitting	12	Standing	48	Pass
	Future	9	Sitting	12	Standing	56	Pass
48	Existing	10	Sitting	13	Standing	51	Pass
	Proposed	9	Sitting	12	Standing	52	Pass
	Future	11	Standing	15	Strolling	61	Pass

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Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
49	Existing	10	Sitting	14	Standing	54	Pass
	Proposed	11	Standing	14	Standing	56	Pass
	Future	14	Standing	19	Walking	68	Pass
50	Existing	8	Sitting	11	Standing	47	Pass
	Proposed	9	Sitting	12	Standing	53	Pass
	Future	12	Standing	16	Strolling	66	Pass
51	Existing	9	Sitting	12	Standing	51	Pass
	Proposed	10	Sitting	13	Standing	55	Pass
	Future	13	Standing	17	Strolling	66	Pass
52	Existing	14	Standing	18	Walking	70	Pass
	Proposed	11	Standing	15	Strolling	59	Pass
	Future	12	Standing	16	Strolling	59	Pass
53	Existing	13	Standing	16	Strolling	60	Pass
	Proposed	12	Standing	15	Strolling	60	Pass
	Future	14	Standing	18	Walking	73	Pass
54	Existing	12	Standing	16	Strolling	56	Pass
	Proposed	12	Standing	14	Standing	58	Pass
	Future	12	Standing	15	Strolling	62	Pass
55	Existing	10	Sitting	13	Standing	47	Pass
	Proposed	9	Sitting	12	Standing	46	Pass
	Future	14	Standing	18	Walking	78	Pass
56	Existing	9	Sitting	11	Standing	44	Pass
	Proposed	8	Sitting	10	Sitting	39	Pass
	Future	12	Standing	16	Strolling	63	Pass
57	Existing	12	Standing	16	Strolling	56	Pass
	Proposed	11	Standing	14	Standing	56	Pass
	Future	15	Strolling	19	Walking	78	Pass
58	Existing	11	Standing	14	Standing	54	Pass
	Proposed	11	Standing	14	Standing	56	Pass
	Future	11	Standing	13	Standing	59	Pass
59	Existing	11	Standing	15	Strolling	54	Pass
	Proposed	11	Standing	14	Standing	58	Pass
	Future	12	Standing	14	Standing	63	Pass
60	Existing	11	Standing	14	Standing	54	Pass
	Proposed	12	Standing	15	Strolling	68	Pass
	Future	11	Standing	14	Standing	59	Pass

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Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
61	Existing	11	Standing	15	Strolling	56	Pass
	Proposed	13	Standing	16	Strolling	65	Pass
	Future	11	Standing	13	Standing	56	Pass
62	Existing	11	Standing	15	Strolling	54	Pass
	Proposed	12	Standing	15	Strolling	57	Pass
	Future	11	Standing	13	Standing	70	Pass
63	Existing	11	Standing	15	Strolling	55	Pass
	Proposed	12	Standing	15	Strolling	56	Pass
	Future	12	Standing	14	Standing	65	Pass
64	Existing	11	Standing	14	Standing	51	Pass
	Proposed	11	Standing	14	Standing	51	Pass
	Future	10	Sitting	13	Standing	59	Pass
65	Existing	12	Standing	15	Strolling	56	Pass
	Proposed	12	Standing	15	Strolling	57	Pass
	Future	10	Sitting	13	Standing	52	Pass
66	Existing	11	Standing	15	Strolling	56	Pass
	Proposed	11	Standing	15	Strolling	55	Pass
	Future	10	Sitting	13	Standing	51	Pass
67	Existing	10	Sitting	14	Standing	53	Pass
	Proposed	11	Standing	14	Standing	53	Pass
	Future	11	Standing	13	Standing	54	Pass
68	Existing	11	Standing	14	Standing	53	Pass
	Proposed	11	Standing	15	Strolling	55	Pass
	Future	11	Standing	13	Standing	58	Pass
69	Existing	10	Sitting	12	Standing	47	Pass
	Proposed	11	Standing	14	Standing	59	Pass
	Future	9	Sitting	12	Standing	56	Pass
70	Existing	9	Sitting	12	Standing	46	Pass
	Proposed	9	Sitting	12	Standing	53	Pass
	Future	8	Sitting	10	Sitting	49	Pass
71	Existing	8	Sitting	10	Sitting	40	Pass
	Proposed	8	Sitting	11	Standing	46	Pass
	Future	7	Sitting	9	Sitting	38	Pass
72	Existing	7	Sitting	9	Sitting	40	Pass
	Proposed	8	Sitting	11	Standing	47	Pass
	Future	7	Sitting	9	Sitting	42	Pass

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Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
73	Existing	7	Sitting	10	Sitting	39	Pass
	Proposed	8	Sitting	10	Sitting	43	Pass
	Future	7	Sitting	9	Sitting	36	Pass
74	Existing	9	Sitting	11	Standing	45	Pass
	Proposed	9	Sitting	12	Standing	49	Pass
	Future	9	Sitting	11	Standing	43	Pass
75	Existing	9	Sitting	12	Standing	52	Pass
	Proposed	10	Sitting	13	Standing	54	Pass
	Future	9	Sitting	12	Standing	52	Pass
76	Existing	9	Sitting	12	Standing	50	Pass
	Proposed	10	Sitting	13	Standing	51	Pass
	Future	10	Sitting	13	Standing	51	Pass
77	Existing	10	Sitting	13	Standing	52	Pass
	Proposed	10	Sitting	13	Standing	52	Pass
	Future	10	Sitting	13	Standing	54	Pass
78	Existing	10	Sitting	13	Standing	55	Pass
	Proposed	10	Sitting	13	Standing	54	Pass
	Future	10	Sitting	13	Standing	56	Pass
79	Existing	11	Standing	14	Standing	56	Pass
	Proposed	10	Sitting	14	Standing	54	Pass
	Future	11	Standing	14	Standing	55	Pass
80	Existing	10	Sitting	13	Standing	54	Pass
	Proposed	10	Sitting	13	Standing	55	Pass
	Future	10	Sitting	13	Standing	55	Pass
81	Existing	9	Sitting	11	Standing	47	Pass
	Proposed	10	Sitting	12	Standing	50	Pass
	Future	9	Sitting	12	Standing	49	Pass
82	Existing	9	Sitting	11	Standing	47	Pass
	Proposed	9	Sitting	12	Standing	52	Pass
	Future	8	Sitting	11	Standing	45	Pass
83	Existing	-	-	-	-	-	
	Proposed	10	Sitting	13	Standing	57	Pass
	Future	9	Sitting	11	Standing	49	Pass
84	Existing	-	-	-	-	-	
	Proposed	12	Standing	16	Strolling	68	Pass
	Future	11	Standing	14	Standing	60	Pass

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Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
85	Existing	-	-	-	-	-	
	Proposed	10	Sitting	12	Standing	51	Pass
	Future	10	Sitting	12	Standing	50	Pass
86	Existing	-	-	-	-	-	
	Proposed	10	Sitting	14	Standing	55	Pass
	Future	9	Sitting	12	Standing	46	Pass
87	Existing	-	-	-	-	-	
	Proposed	10	Sitting	13	Standing	57	Pass
	Future	11	Standing	15	Strolling	57	Pass
88	Existing	-	-	-	-	-	
	Proposed	8	Sitting	11	Standing	46	Pass
	Future	8	Sitting	10	Sitting	42	Pass
89	Existing	-	-	-	-	-	
	Proposed	10	Sitting	13	Standing	55	Pass
	Future	11	Standing	14	Standing	57	Pass
90	Existing	-	-	-	-	-	
	Proposed	10	Sitting	13	Standing	54	Pass
	Future	9	Sitting	12	Standing	48	Pass
91	Existing	-	-	-	-	-	
	Proposed	9	Sitting	12	Standing	54	Pass
	Future	9	Sitting	11	Standing	53	Pass
92	Existing	-	-	-	-	-	
	Proposed	9	Sitting	12	Standing	58	Pass
	Future	10	Sitting	12	Standing	57	Pass
93	Existing	-	-	-	-	-	
	Proposed	9	Sitting	10	Sitting	65	Pass
	Future	9	Sitting	11	Standing	63	Pass
94	Existing	-	-	-	-	-	
	Proposed	9	Sitting	11	Standing	53	Pass
	Future	9	Sitting	11	Standing	48	Pass
95	Existing	-	-	-	-	-	
	Proposed	9	Sitting	11	Standing	50	Pass
	Future	8	Sitting	10	Sitting	49	Pass
96	Existing	-	-	-	-	-	
	Proposed	9	Sitting	11	Standing	55	Pass
	Future	9	Sitting	11	Standing	53	Pass

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Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
97	Existing	-	-	-	-	-	
	Proposed	8	Sitting	11	Standing	54	Pass
	Future	8	Sitting	11	Standing	51	Pass
98	Existing	-	-	-	-	-	
	Proposed	16	Strolling	21	Uncomfortable	84	Pass
	Future	15	Strolling	20	Walking	85	Pass
99	Existing	-	-	-	-	-	
	Proposed	9	Sitting	10	Sitting	57	Pass
	Future	9	Sitting	10	Sitting	57	Pass
100	Existing	-	-	-	-	-	
	Proposed	9	Sitting	11	Standing	59	Pass
	Future	9	Sitting	11	Standing	58	Pass
101	Existing	-	-	-	-	-	
	Proposed	9	Sitting	11	Standing	59	Pass
	Future	8	Sitting	10	Sitting	57	Pass
102	Existing	-	-	-	-	-	
	Proposed	8	Sitting	10	Sitting	52	Pass
	Future	8	Sitting	9	Sitting	49	Pass
103	Existing	-	-	-	-	-	
	Proposed	14	Standing	16	Strolling	87	Pass
	Future	13	Standing	15	Strolling	83	Pass
104	Existing	-	-	-	-	-	
	Proposed	7	Sitting	8	Sitting	49	Pass
	Future	7	Sitting	8	Sitting	51	Pass

Season	Months	Hours
Summer	May - October	6:00 - 23:00 for comfort
Winter	November - April	6:00 - 23:00 for comfort
Annual	January - December	0:00 - 23:00 for safety

Configurations	
Existing	Existing site and surroundings
Proposed	40-70 Plains Road with existing surroundings
Future	40-70 Plains Road with future surroundings

Comfort Speed (km/h) (20% Seasonal Exceedance)	
≤ 10	Sitting
11 - 14	Standing
15 - 17	Strolling
18 - 20	Walking
> 20	Uncomfortable

Safety Speed (km/h) (0.1% Annual Exceedance)	
≤ 90	Pass
> 90	Exceeded