REPORT

1 FAIRVIEW ROAD EAST

MISSISSAUGA, ON

PEDESTRIAN WIND STUDY
RWDI # 2001112
December 18, 2019

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed 1 Fairview Road East development in Mississauga, ON (Image 1). Based on our wind-tunnel testing for the proposed development under the Existing, Proposed and Future configurations (Images 2A through 2C), and the local wind records (Image 3), the potential wind comfort and safety conditions are predicted as shown on site plans in Figures 1A through 3C, while the associated wind speeds are listed in Table 1. These results can be summarized as follows:

- Existing wind conditions are comfortable for the intended pedestrian usage on and around the project site throughout the year.
- With the addition of the proposed building, higher wind speeds are anticipated at the project site throughout the year, with uncomfortable conditions anticipated at several locations during the winter season. Higher-than-desired wind speeds are anticipated at most locations on the Level 7 terrace throughout the year.
- Wind comfort conditions at the main entrance of the proposed building are anticipated to be suitable for the intended usage throughout the year. The addition of the project is not expected to have a significant impact on wind comfort conditions in areas away from the project site throughout the year.
- The addition of future buildings is not expected to have a significant impact on wind conditions on and around the project site and on the Level 7 Amenity terrace.
- Wind speeds that meet the safety criterion are anticipated at all tested locations in the Existing configuration. In the Proposed configuration, wind speeds that exceed the safety criterion are anticipated at two grade-level locations at the southeast corner of the building and also at multiple locations on the Level 7 terrace. With the addition of future buildings, the safety criterion is met at one of the two grade-level locations where safety exceedances are anticipated in the Proposed configuration while wind safety conditions at the Level 7 terrace remain unchanged.
- With the implementation of appropriate wind control measures, reduced wind activities and calmer conditions can be achieved at all desired areas. Additional wind tunnel testing is required at a later design stage to quantify the effectiveness of any wind control solutions.

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1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed 1 Fairview Road East building in Mississauga, ON. This report presents the project objectives, background and approach, and discusses of the results from RWDI's assessment and provides conceptual wind control measures, where necessary.

1.1 Project Description

The project (site shown in Image 1) is located on the north side of the intersection between Hurontario Street and Fairview Road East. It consists of a mid-rise 36-storey/118 m tall building with an amenity area at Level 7.

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, the amenity area and public sidewalks.

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 1:400 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 480 m 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 79 wind speed sensors to measure mean and gust speeds at a full-scale height of approximately 1.5 m above local grade in pedestrian areas throughout the study site. Wind speeds were measured for 36 directions in a 10-degree increment. 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.

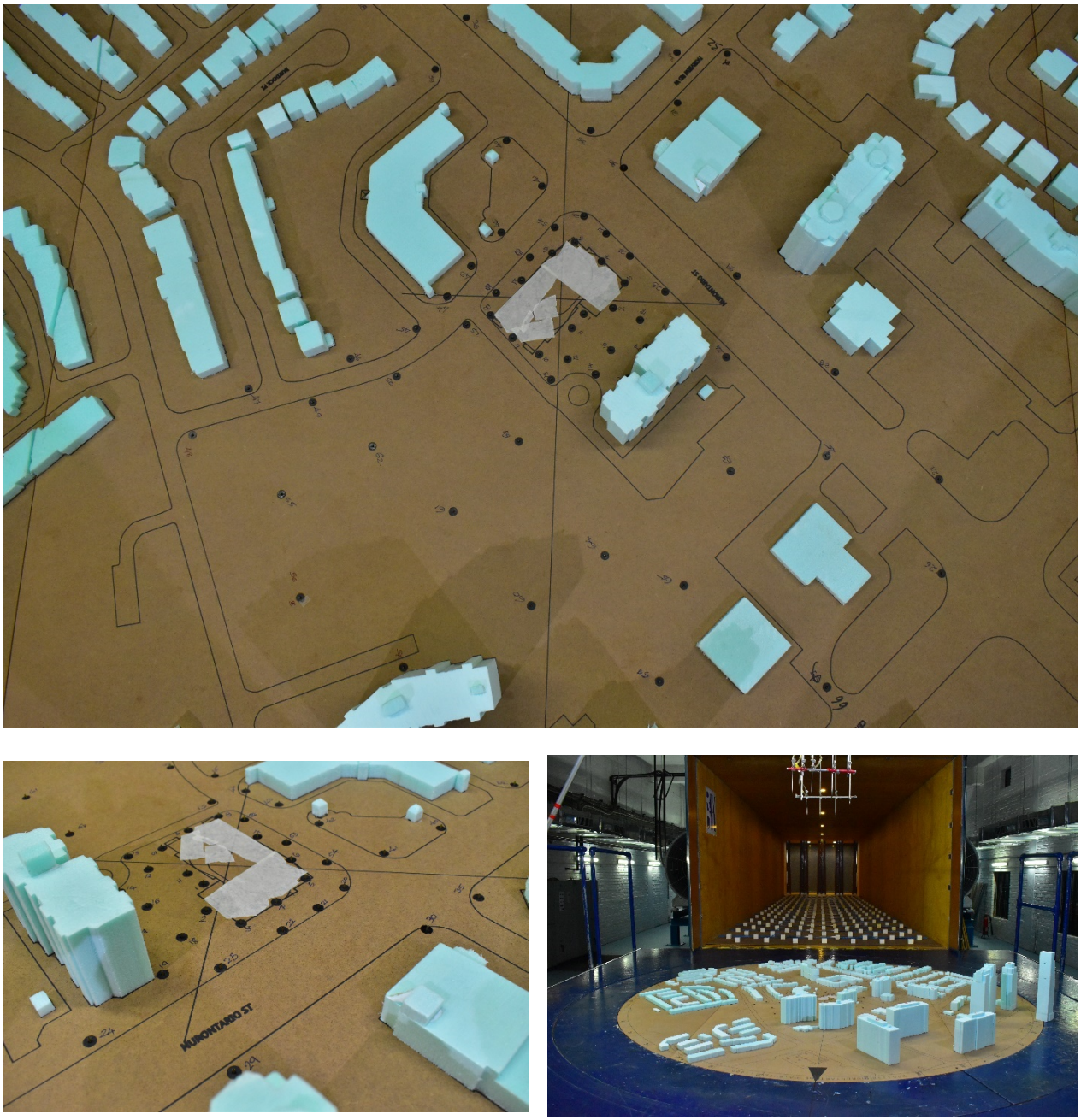
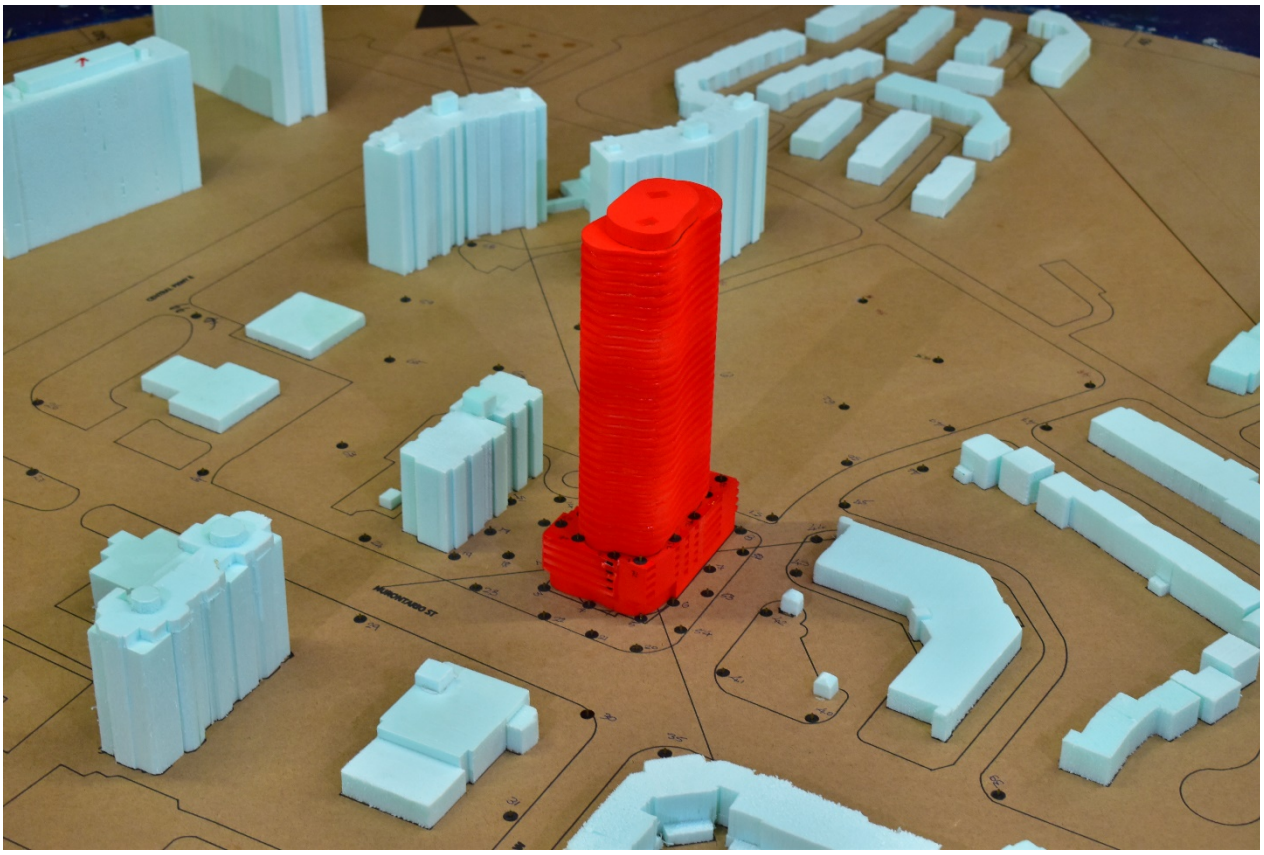
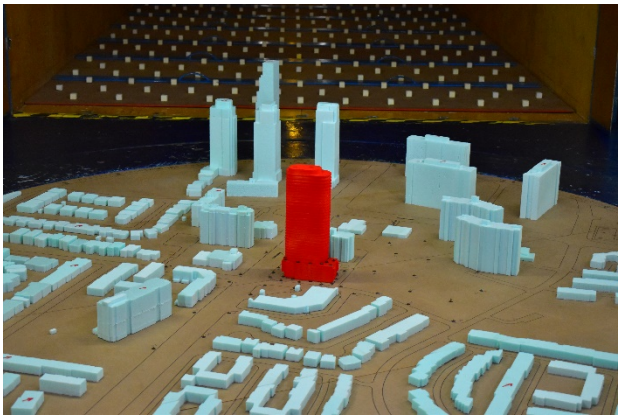


Image 2A: Wind Tunnel Study Model – Existing Configuration





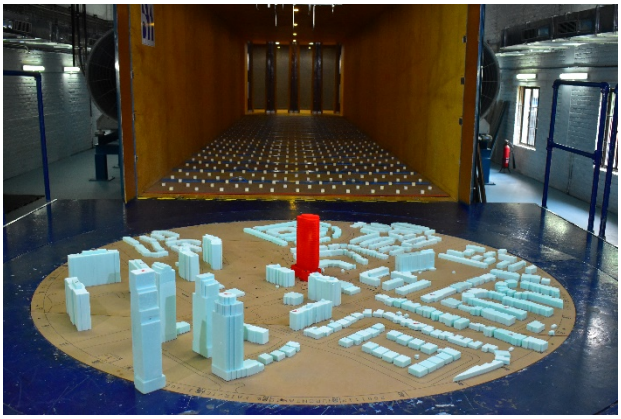
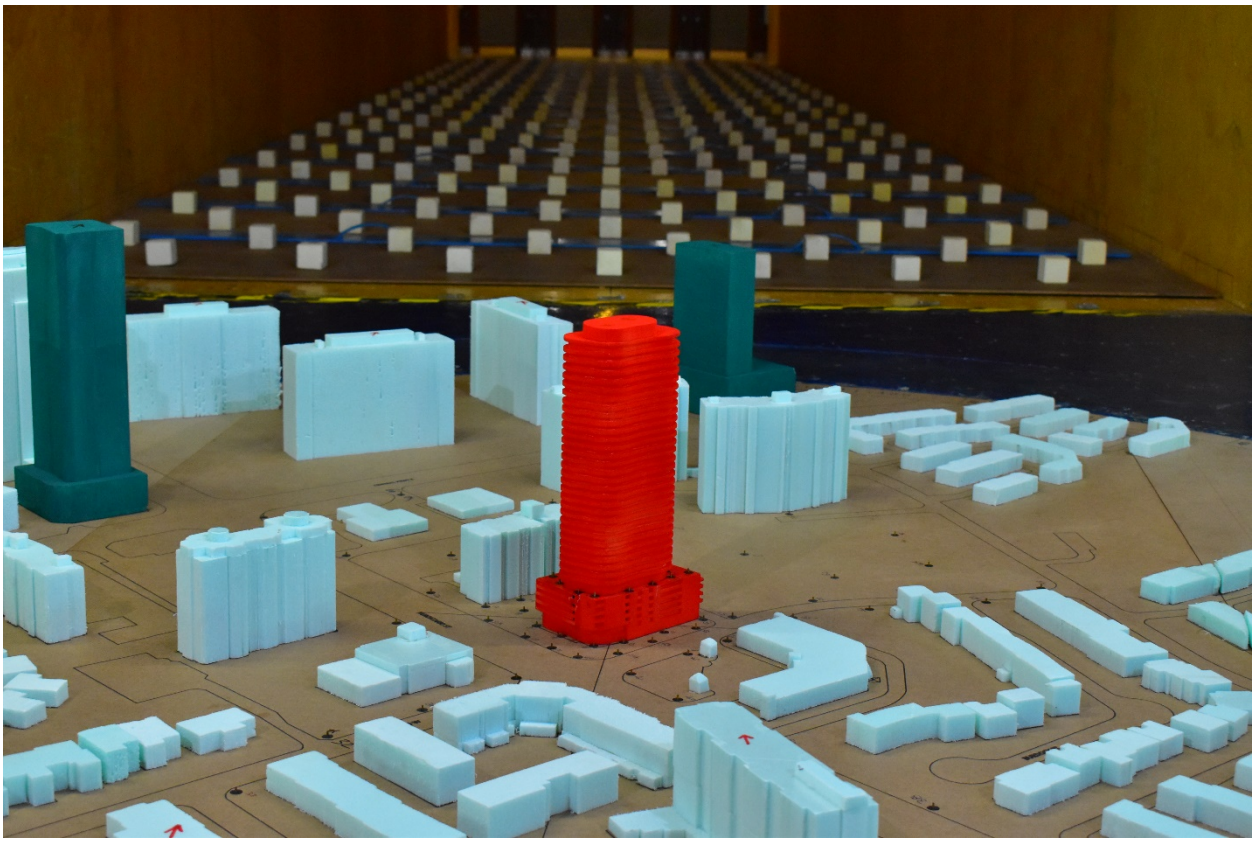


Image 2B: Wind Tunnel Study Model – Proposed Configuration



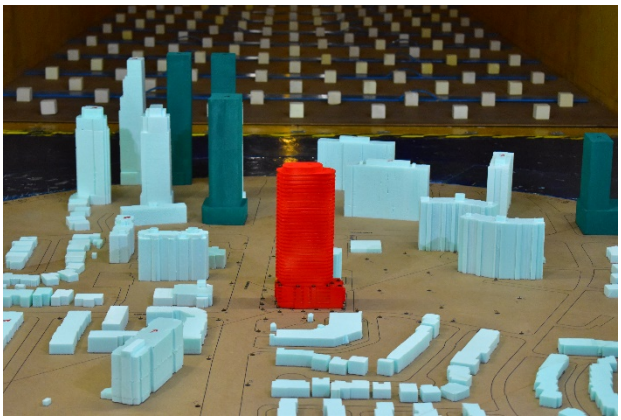
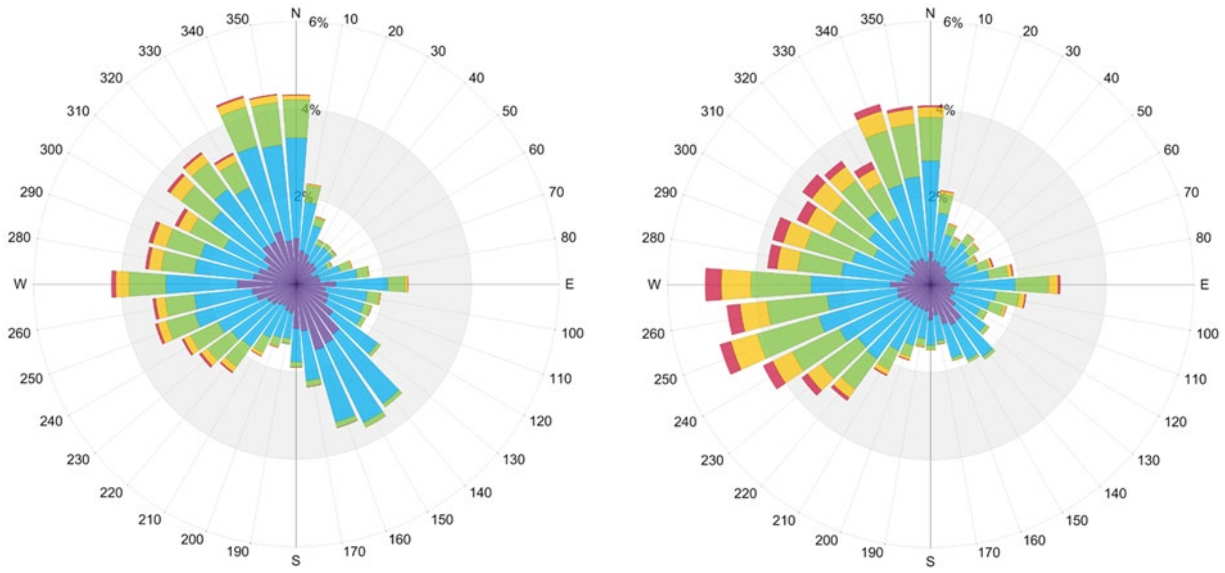


Image 2C: Wind Tunnel Study Model – Future Configuration

2.2 Meteorological Data

Wind statistics recorded at Toronto Pearson International Airport between 1988 and 2018, 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 southwest through north directions are predominant during both summer and winter. During the winter season, the prevailing winds from the east direction are also frequent, as indicated by the wind roses. The southeast winds are frequent in the summer, but typically of low wind speeds. Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10 m) occur for 4.6% and 11.2% 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.



Summer (May – October) **Winter (November – April)**

Wind Speed (km/h)	Probability (%) Summer	Winter
Calm	5.8	3.9
1-10	31.7	22.8
11-20	42.3	39.8
21-30	15.5	22.2
31-40	3.7	8.0
>40	0.9	3.2

Image 3: Directional Distribution of Winds Approaching Toronto Pearson International Airport from 1988 to 2018

2.3 Mississauga Pedestrian Wind Criteria

The Mississauga pedestrian wind criteria, developed in June 2014, are specified in the Urban Design Terms of Reference, "Pedestrian Wind Comfort and Safety Studies". The following defines the criterion in detail.

Comfort Category	GEM Speed (km/h)	Description
Sitting	≤ 10	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper without having it blown away
Standing	≤ 15	Gentle breezes suitable for main building entrances and bus stops
Walking	≤ 20	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
Uncomfortable	> 20	Strong winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended

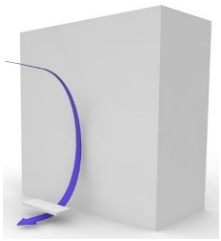
Notes:
(1) GEM speed = max (mean speed, gust speed/1.85);
(2) GEM speeds listed above are based on a seasonal exceedance of 20% of the time between 6:00 and 23:00.

Safety Criterion	Gust Speed (km/h)	Description
Exceeded	> 90	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.

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

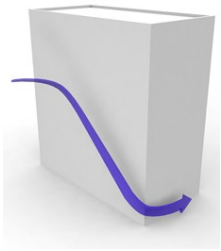
2.4 Generalized Wind Flows

In our discussion of wind conditions, reference is made to the following generalized wind flows (Image 4):



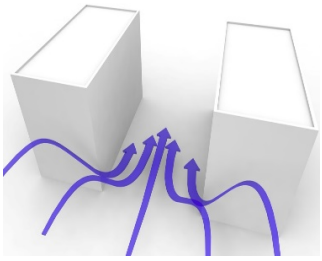
DOWNWASHING

Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. This is often the main cause for wind accelerations around large buildings at the pedestrian level.



CORNER ACCELERATION

When winds approach at an oblique angle to a tall façade and are deflected down, a localized increase in the wind activity or corner acceleration can be expected around the exposed building corners at pedestrian level.



CHANNELLING EFFECT

When two buildings are situated side by side, wind flow tends to accelerate through the space between the buildings due to channelling effect caused by the narrow gap.

Image 4: Generalized Wind Flows

If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity. Design details such as; setting back a tall tower from the edges of a podium, deep canopies close to ground level, wind screens, tall trees with dense landscaping, etc. (Image 5) can help reduce wind speeds. The choice and effectiveness of these measures would depend on the exposure and orientation of the site with respect to the prevailing wind directions and the size and massing of the proposed buildings.

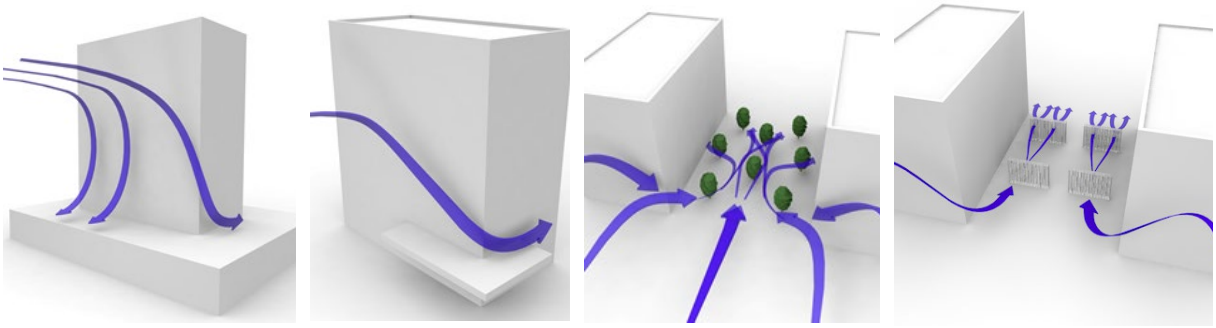


Image 5: Common Wind Control Measures: (left to right) Podium/tower setback, canopy, landscaping and wind screens

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown on site plans in Figures 1A through 3C located in the "Figures" section of this report. These conditions and the associated wind speeds are also represented 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.

3.1 Grade Level (Locations 1 through 67)

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 sitting or standing are preferred at main entrances where pedestrians are apt to linger.

3.1.1 Existing Configuration

In general, the wind speeds on and around the existing site are generally rated comfortable for standing in the summer and for standing or walking in the winter (Figures 1A and 2A), which is suitable for the intended usage.

Wind speeds that meet the safety criterion are prevalent at all locations in the Existing configuration (Figure 3A).

3.1.2 Proposed Configuration

Apart from the existing mid-rise building to the west and two high-rise buildings to its distant northwest, the proposed project is mostly surrounded by flat areas such as parking lots and parks to its north and west directions, which are also the dominant wind directions throughout the year. Therefore, we expect that the proposed massing will cause a significant redirection of wind around it and towards the ground level. This is due to prevailing winds accelerating around the corners and downwashing off the facades of the proposed building as well as channeling between the proposed building and the nearby mid-rise building, as shown in Image 4. The proposed building includes a large podium at Level 7, with the tower set back significantly from the edges of the podium. This is a positive feature that contributes towards reducing the impact of downwashing of prevailing winds at the grade level.

With the addition of the proposed building, wind speeds remain suitable for the intended usage at the grade-level during summer, with conditions suitable for walking anticipated at most onsite locations and at a few off-site locations on the sidewalks along Hurontario St and Fairview Rd E across the building (Figure 1B). During winter, uncomfortable conditions are anticipated at a number of locations to the northwest and southeast of the proposed building (Figure 2B). It is our understanding that landscaping is planned along parts of the building perimeter and this was not included in the wind tunnel test. Mitigation measures to improve wind conditions should be added and tested during detailed design stage.

At grade-level, wind speeds that meet the safety criterion are anticipated at all except two locations at the southeast corner of the building (Locations 5 and 54 in Figure 3B).

The main entrance of the proposed building is situated near Location 1 in Figures 1B, 1C, 2B, 2C, 3B and 3C. Wind speeds at the main entrance are anticipated to remain suitable for the intended usage throughout the year (Figures 1B and 2B).

3.1.3 Future Configuration

The addition of the future buildings is not expected to make a significant impact on wind comfort conditions on and around the site throughout the year (Figures 1C and 2C).

With the addition of future buildings, the wind safety criterion is met at one of the two grade-level locations at the southeast corner of the building (Location 54 in Figure 3C) where safety exceedances are anticipated in the Proposed configuration (Figure 3B). The wind safety criterion is exceeded at only one grade-level location (Location 5) in the Future configuration.

3.2 7 Amenity (Locations 68 through 79)

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 acceptable.

3.2.1 Proposed Configuration

Higher-than-desired wind speeds, including uncomfortable and unsafe wind speeds, are anticipated at most locations on the Level 7 Amenity terrace throughout the year (Figures 1B, 2B and 3B). These elevated wind speeds are caused by the prevailing winds downwashing off the façade as well as accelerating around the massing (Image 4) and flowing down towards the Level 7 terrace. Mitigation measures to improve wind conditions should be added and tested during detailed design stage.

Wind speeds that exceed the safety criterion are anticipated at several locations on the Level 7 Amenity terrace (Figure 3B). With the addition of the recommended parapet and the trellises, reduced wind speeds can be anticipated at the terrace. Additional wind tunnel testing is required to quantify the effectiveness of the recommended wind control solutions.

3.2.2 Future Configuration

The addition of the future buildings is not expected to make a significant impact on both wind comfort and wind safety conditions at the Level 7 terrace throughout the year (Figures 1C, 2C and 3C).

4 APPLICABILITY OF RESULTS

The wind conditions presented in this report pertain to the model of the 1 Fairview Road East building 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)
2019-12-12_1FairviewRd	PDF	13/12/2019
Massing	Sketchup	12/11/2019

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.
3. Williams, C.J., Soligo M.J. and Cote, J. (1992). "A Discussion of the Components for a Comprehensive Pedestrian Level Comfort Criteria," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.41-44, pp.2389-2390.
4. Soligo, M.J., Irwin, P.A., and Williams, C.J. (1993). "Pedestrian Comfort Including Wind and Thermal Effects," *Third Asia-Pacific Symposium on Wind Engineering*, Hong Kong.
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6. Williams, C.J., Wu, H., Waechter, W.F. and Baker, H.A. (1999). "Experiences with Remedial Solutions to Control Pedestrian Wind Problems," *Tenth International Conference on Wind Engineering*, Copenhagen, Denmark.
7. Lawson, T.V. (1973). "Wind Environment of Buildings: A Logical Approach to the Establishment of Criteria", *Report No. TVL 7321*, Department of Aeronautic Engineering, University of Bristol, Bristol, England.
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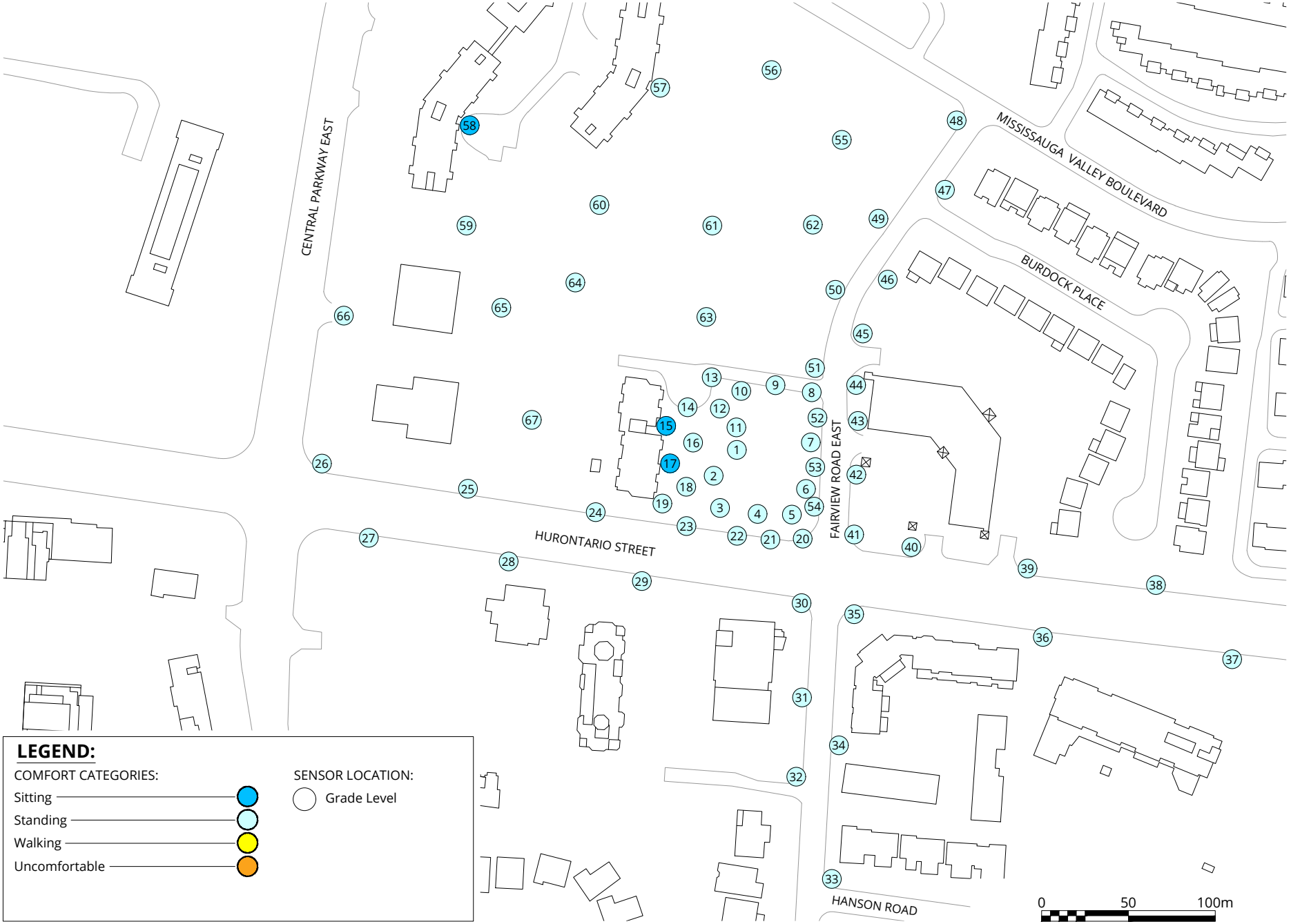
9. Wu, H. and Kriksic, F. (2012). "Designing for Pedestrian Comfort in Response to Local Climate", *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.104-106, pp.397-407.
10. Wu, H., Williams, C.J., Baker, H.A. and Waechter, W.F. (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", *ASCE Structure Congress 2004,* Nashville, Tennessee.

FIGURES



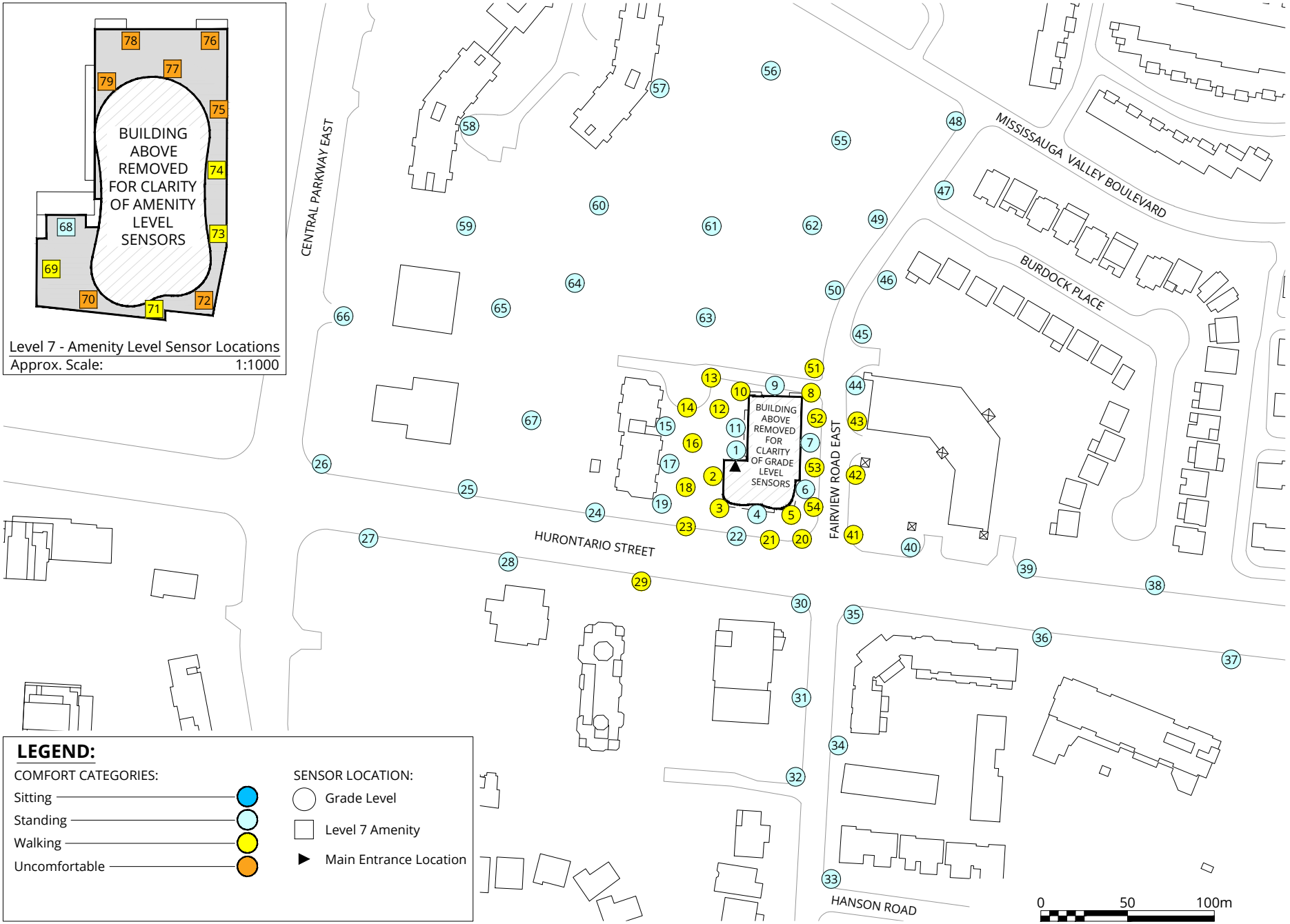
Pedestrian Wind Comfort Conditions
Existing Configuration
Summer (May to October, 6:00 to 23:00)

1 Fairview Road East - Mississauga, ON

True North

Project #2001112

Drawn by: DF	Figure: 1A
Approx. Scale:	1:2500
Date Revised:	Dec. 17, 2019



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

1 Fairview Road East - Mississauga, ON

True North

Project #2001112

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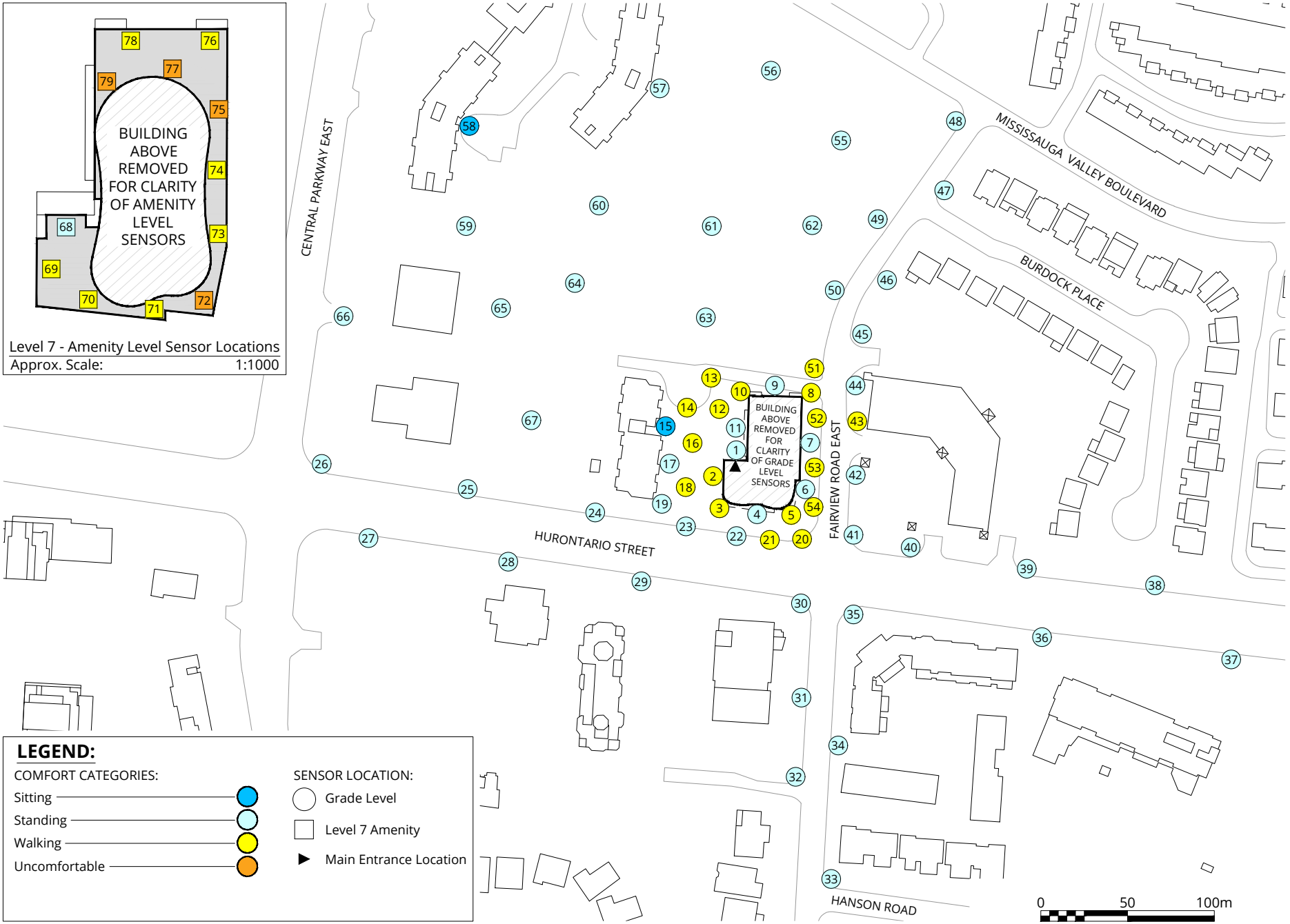


Pedestrian Wind Comfort Conditions

Future Configuration

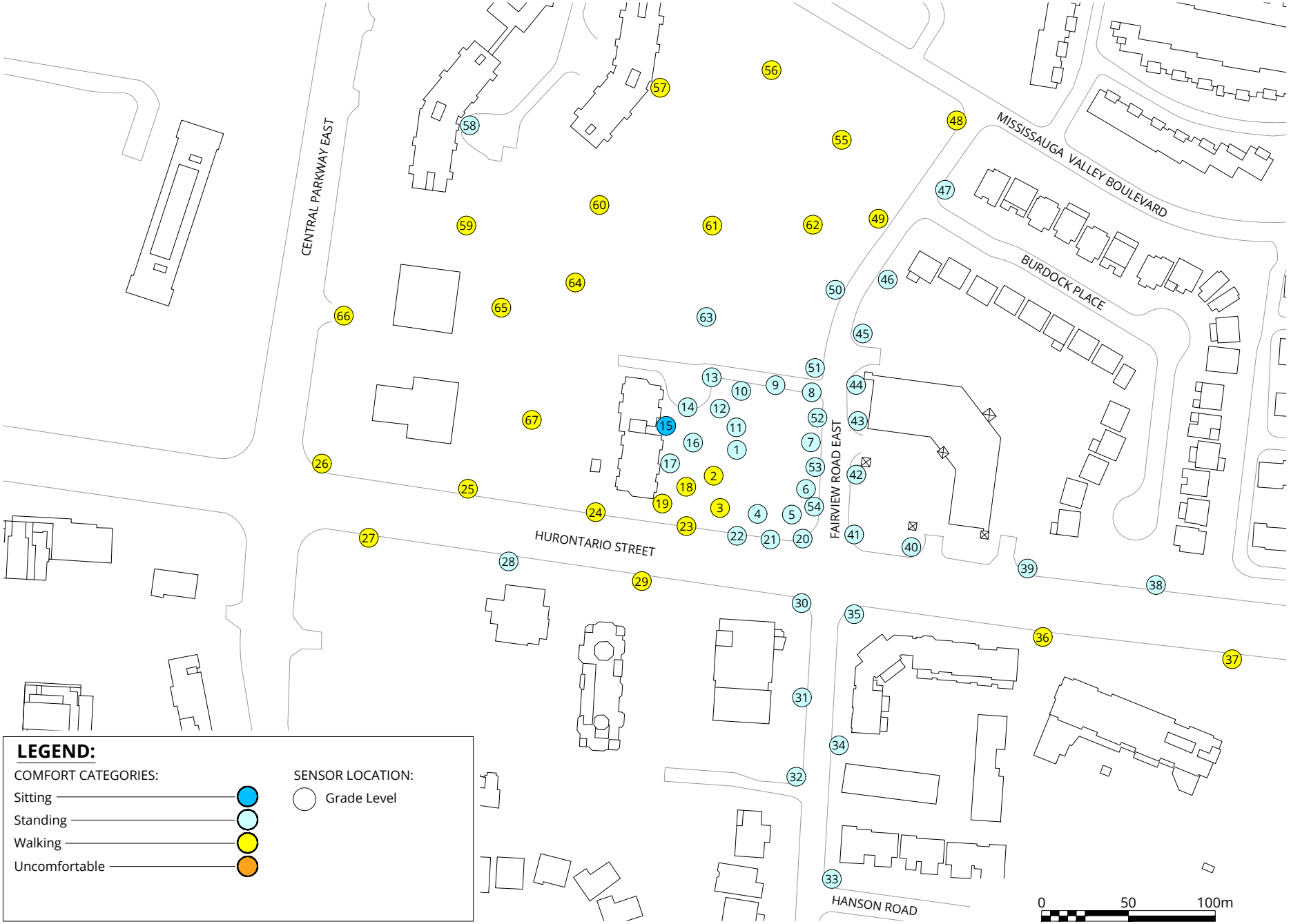
Summer (May to October, 6:00 to 23:00)

1 Fairview Road East - Mississauga, ON

Project #2001112

True North

Drawn by:	DF	Figure:	1C
Approx. Scale:	1:2500		
Date Revised:	Dec. 17, 2019		



LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level

Pedestrian Wind Comfort Conditions

Existing Configuration

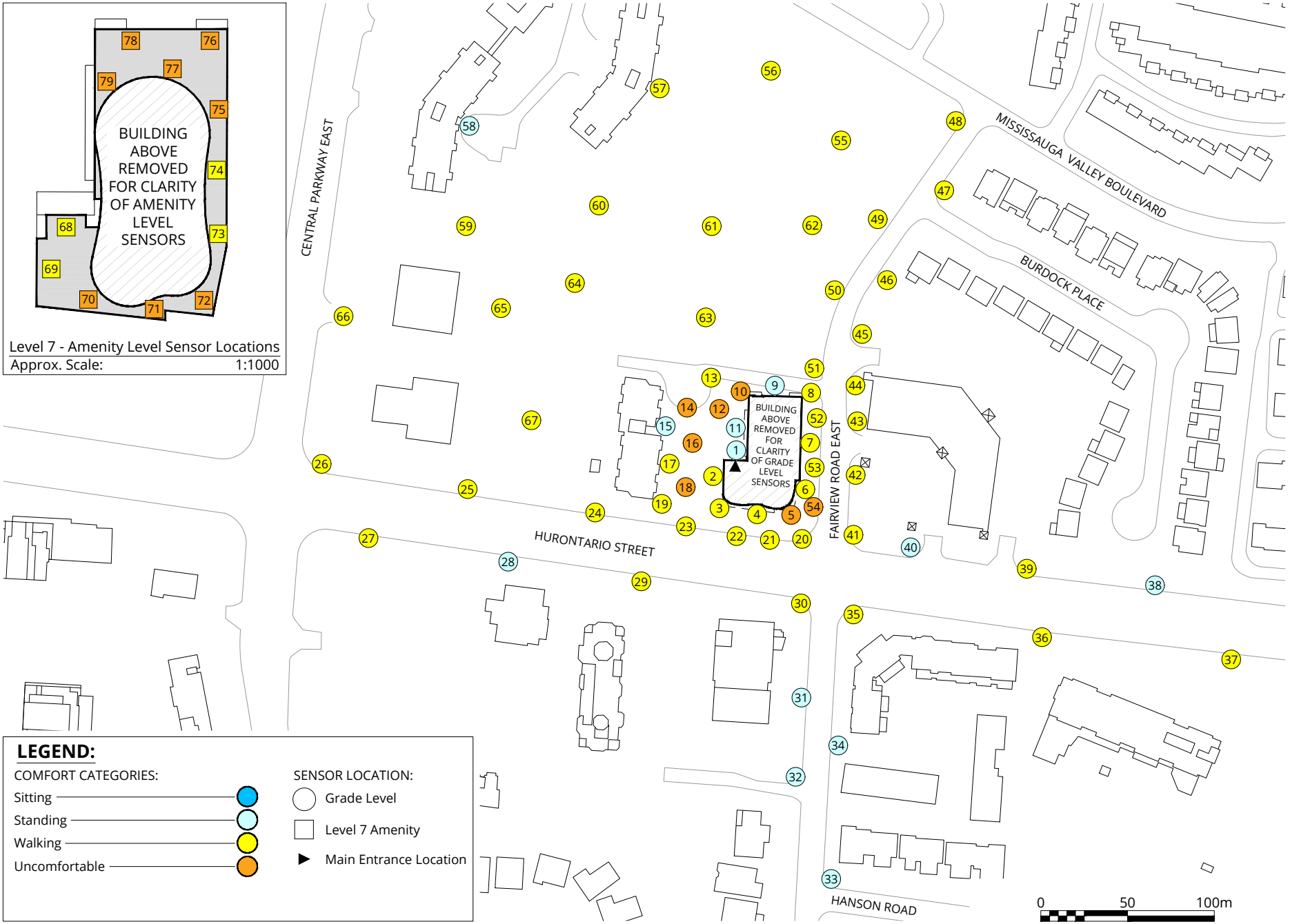
Winter (November to April, 6:00 to 23:00)

1 Fairview Road East - Mississauga, ON

True North

Project #2001112

Drawn by:	DF	Figure:	2A
Approx. Scale:	1:2500		
Date Revised:	Dec. 17, 2019		



Pedestrian Wind Comfort Conditions

Proposed Configuration

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

1 Fairview Road East - Mississauga, ON

Project #2001112

True North

Drawn by:	DF	Figure:	2B
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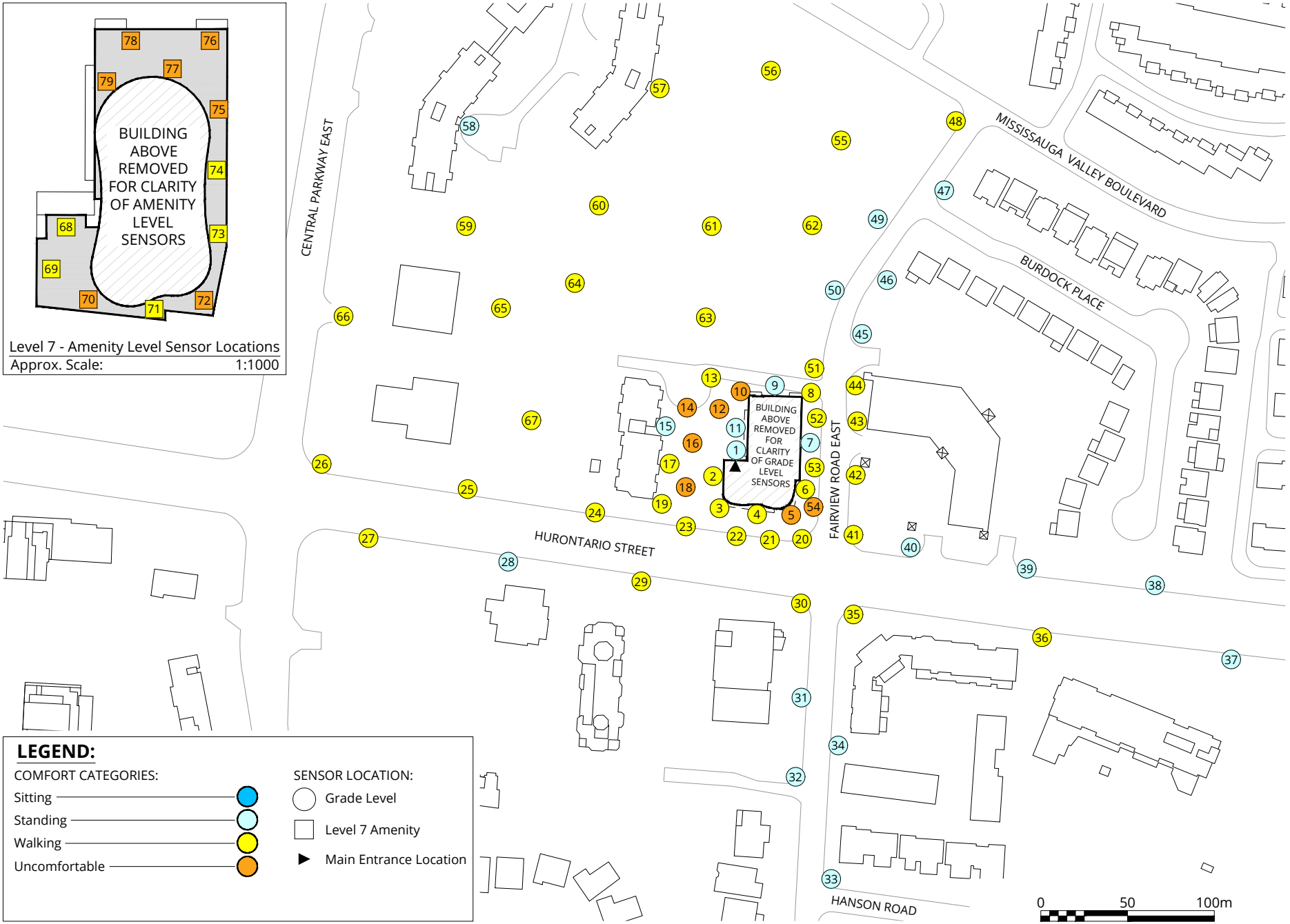
Date Revised:	Dec. 17, 2019		



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

1 Fairview Road East - Mississauga, ON

True North

Project #2001112

Drawn by: DF	Figure: 2C	
Approx. Scale: 1:2500		
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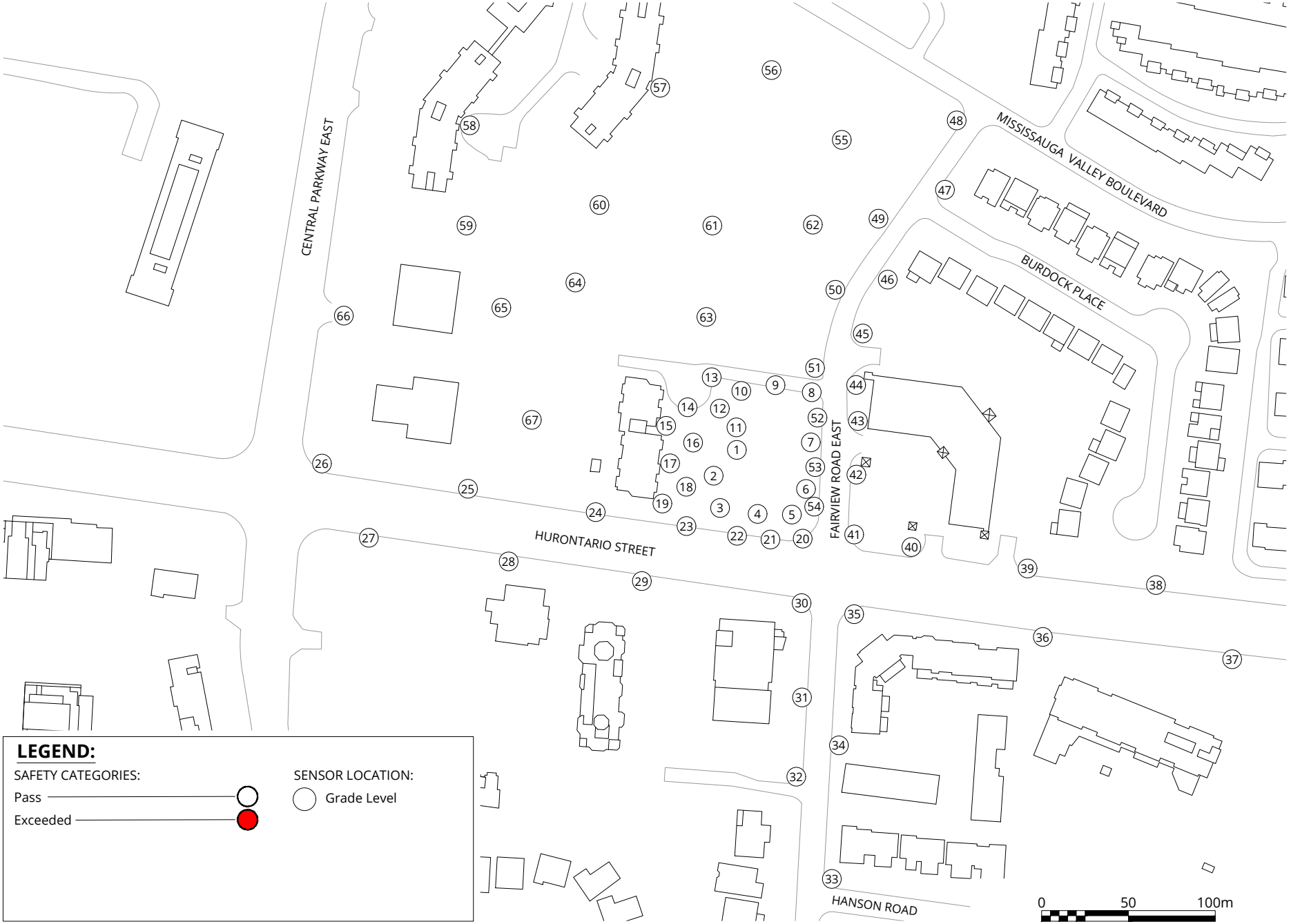


LEGEND:

SAFETY CATEGORIES:

Pass

Exceeded

SENSOR LOCATION:

Grade Level

Pedestrian Wind Safety Conditions

Existing Configuration

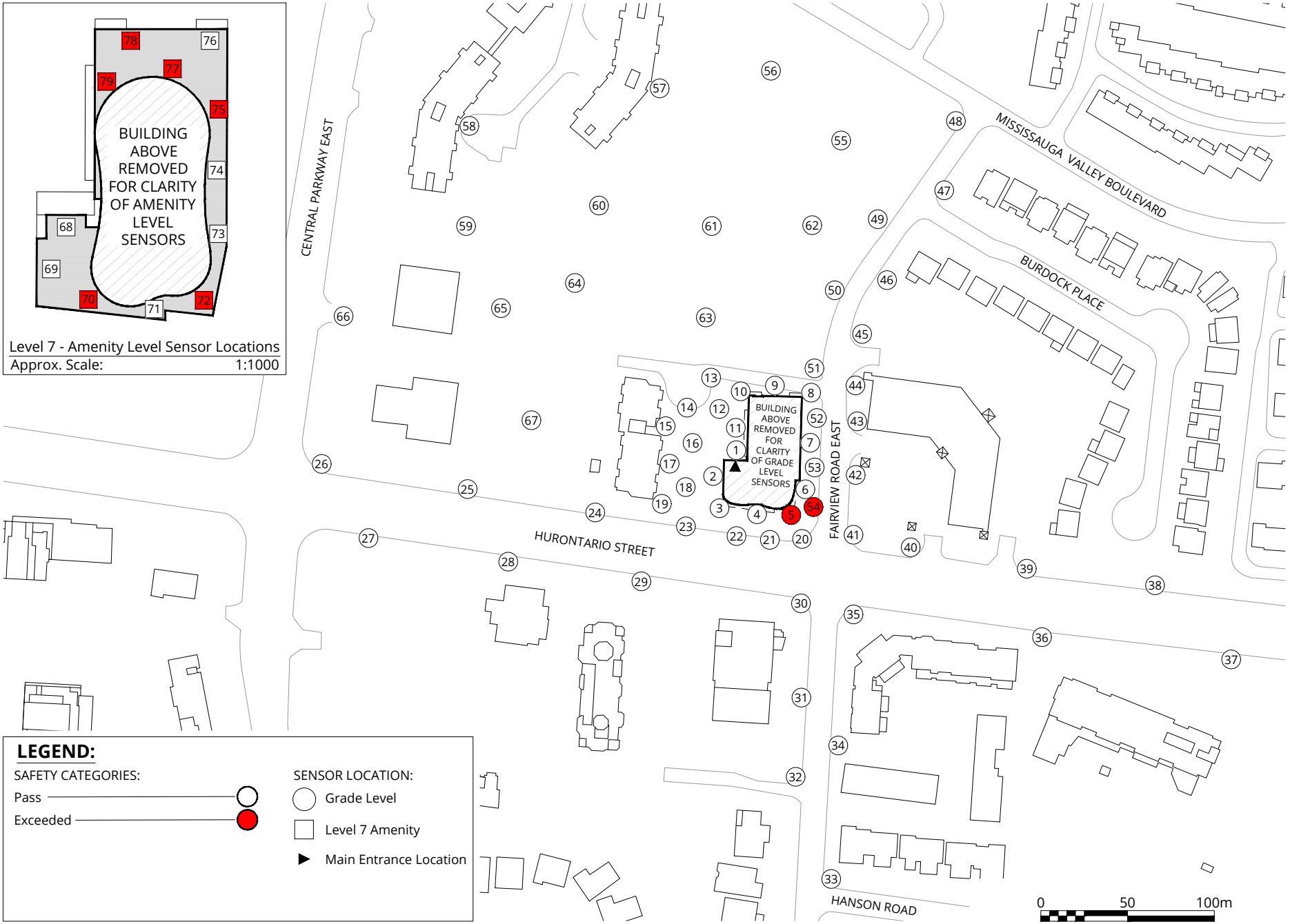
Annual (January to December, 0:00 to 23:00)

1 Fairview Road East - Mississauga, ON

True North

Project #2001112

Drawn by:	DF	Figure:	3A
Approx. Scale:	1:2500		
Date Revised:	Dec. 17, 2019		



Pedestrian Wind Safety Conditions
Proposed Configuration
Annual (January to December, 0:00 to 23:00)

1 Fairview Road East - Mississauga, ON

True North

Project #2001112

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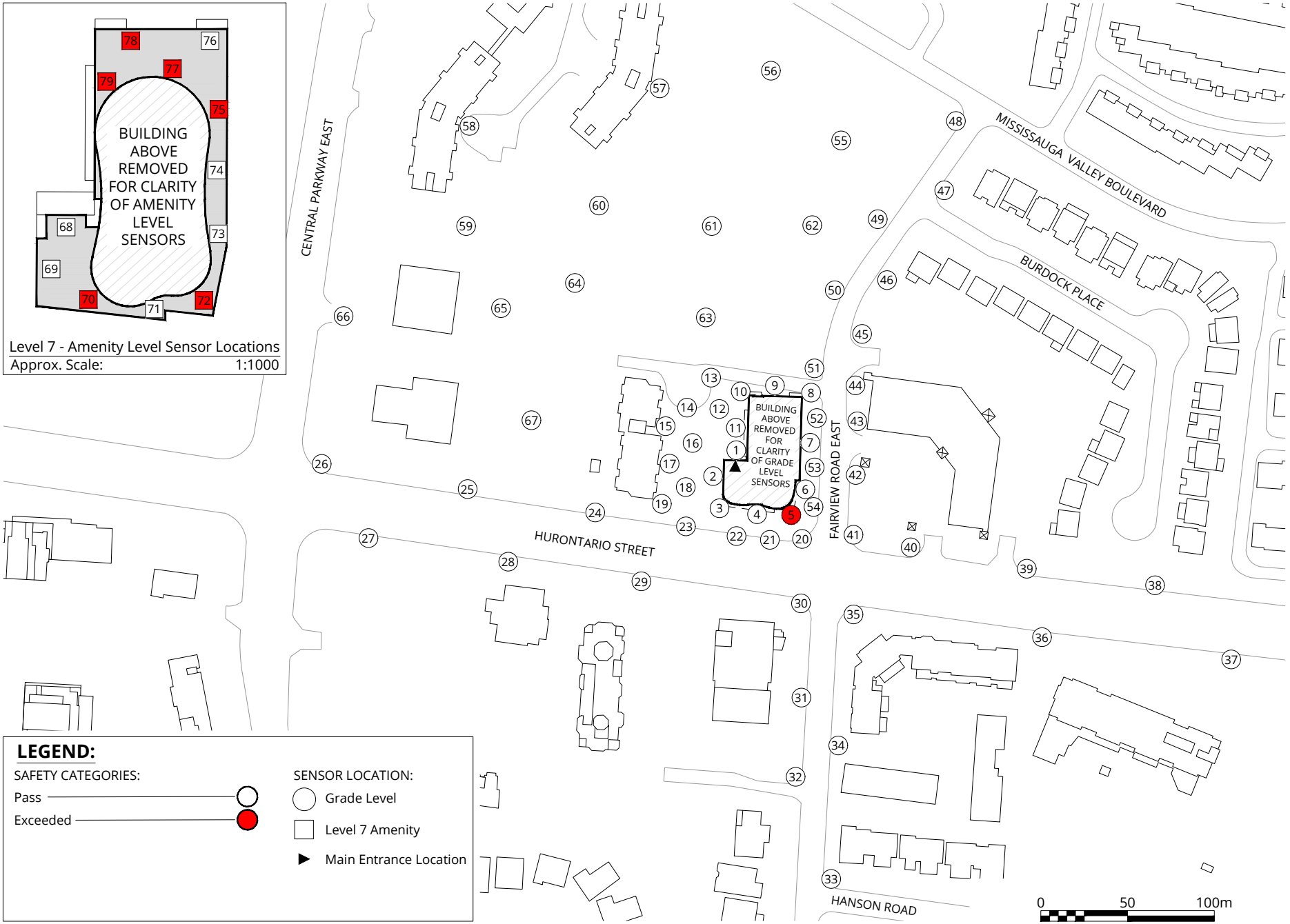
Date Revised: Dec. 17, 2019		



Pedestrian Wind Safety Conditions
Future Configuration
Annual (January to December, 0:00 to 23:00)

1 Fairview Road East - Mississauga, ON

True North

Project #2001112

Drawn by: DF	Figure: 3C	
Approx. Scale: 1:2500		
Date Revised: Dec. 17, 2019		

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	12	Standing	15	Standing	58	Pass
	Proposed	11	Standing	13	Standing	55	Pass
	Future	11	Standing	13	Standing	53	Pass
2	Existing	13	Standing	16	Walking	69	Pass
	Proposed	16	Walking	19	Walking	78	Pass
	Future	16	Walking	19	Walking	77	Pass
3	Existing	13	Standing	16	Walking	66	Pass
	Proposed	17	Walking	20	Walking	81	Pass
	Future	17	Walking	19	Walking	83	Pass
4	Existing	12	Standing	15	Standing	60	Pass
	Proposed	14	Standing	17	Walking	69	Pass
	Future	14	Standing	17	Walking	68	Pass
5	Existing	12	Standing	14	Standing	57	Pass
	Proposed	20	Walking	25	Uncomfortable	109	Exceeded
	Future	19	Walking	24	Uncomfortable	107	Exceeded
6	Existing	12	Standing	14	Standing	56	Pass
	Proposed	13	Standing	16	Walking	70	Pass
	Future	13	Standing	16	Walking	70	Pass
7	Existing	12	Standing	14	Standing	57	Pass
	Proposed	13	Standing	16	Walking	68	Pass
	Future	13	Standing	15	Standing	65	Pass
8	Existing	12	Standing	15	Standing	57	Pass
	Proposed	18	Walking	20	Walking	77	Pass
	Future	17	Walking	19	Walking	79	Pass
9	Existing	12	Standing	15	Standing	57	Pass
	Proposed	12	Standing	14	Standing	53	Pass
	Future	11	Standing	13	Standing	50	Pass
10	Existing	12	Standing	14	Standing	57	Pass
	Proposed	18	Walking	22	Uncomfortable	83	Pass
	Future	17	Walking	21	Uncomfortable	82	Pass
11	Existing	12	Standing	14	Standing	57	Pass
	Proposed	12	Standing	13	Standing	52	Pass
	Future	12	Standing	13	Standing	52	Pass
12	Existing	12	Standing	15	Standing	58	Pass
	Proposed	18	Walking	21	Uncomfortable	79	Pass
	Future	17	Walking	21	Uncomfortable	78	Pass
13	Existing	13	Standing	15	Standing	61	Pass
	Proposed	17	Walking	20	Walking	81	Pass
	Future	17	Walking	20	Walking	80	Pass

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
14	Existing	13	Standing	15	Standing	59	Pass
	Proposed	18	Walking	21	Uncomfortable	83	Pass
	Future	18	Walking	21	Uncomfortable	83	Pass
15	Existing	8	Sitting	9	Sitting	38	Pass
	Proposed	11	Standing	12	Standing	47	Pass
	Future	10	Sitting	12	Standing	47	Pass
16	Existing	12	Standing	14	Standing	57	Pass
	Proposed	18	Walking	22	Uncomfortable	81	Pass
	Future	18	Walking	21	Uncomfortable	82	Pass
17	Existing	10	Sitting	12	Standing	55	Pass
	Proposed	14	Standing	16	Walking	66	Pass
	Future	14	Standing	16	Walking	65	Pass
18	Existing	13	Standing	16	Walking	70	Pass
	Proposed	18	Walking	22	Uncomfortable	81	Pass
	Future	18	Walking	21	Uncomfortable	81	Pass
19	Existing	14	Standing	16	Walking	70	Pass
	Proposed	15	Standing	17	Walking	70	Pass
	Future	14	Standing	17	Walking	71	Pass
20	Existing	12	Standing	14	Standing	54	Pass
	Proposed	17	Walking	20	Walking	77	Pass
	Future	16	Walking	20	Walking	76	Pass
21	Existing	12	Standing	14	Standing	55	Pass
	Proposed	17	Walking	19	Walking	83	Pass
	Future	16	Walking	19	Walking	83	Pass
22	Existing	12	Standing	14	Standing	55	Pass
	Proposed	15	Standing	17	Walking	65	Pass
	Future	15	Standing	17	Walking	65	Pass
23	Existing	13	Standing	16	Walking	67	Pass
	Proposed	16	Walking	18	Walking	72	Pass
	Future	15	Standing	18	Walking	73	Pass
24	Existing	14	Standing	16	Walking	66	Pass
	Proposed	14	Standing	16	Walking	65	Pass
	Future	14	Standing	17	Walking	68	Pass
25	Existing	13	Standing	16	Walking	63	Pass
	Proposed	13	Standing	16	Walking	64	Pass
	Future	14	Standing	16	Walking	66	Pass
26	Existing	14	Standing	17	Walking	72	Pass
	Proposed	14	Standing	17	Walking	72	Pass
	Future	15	Standing	17	Walking	70	Pass

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
27	Existing	14	Standing	17	Walking	68	Pass
	Proposed	14	Standing	17	Walking	69	Pass
	Future	14	Standing	17	Walking	69	Pass
28	Existing	13	Standing	15	Standing	59	Pass
	Proposed	12	Standing	15	Standing	59	Pass
	Future	12	Standing	14	Standing	58	Pass
29	Existing	15	Standing	17	Walking	67	Pass
	Proposed	16	Walking	18	Walking	69	Pass
	Future	15	Standing	18	Walking	70	Pass
30	Existing	11	Standing	13	Standing	53	Pass
	Proposed	13	Standing	16	Walking	66	Pass
	Future	13	Standing	16	Walking	65	Pass
31	Existing	12	Standing	15	Standing	57	Pass
	Proposed	12	Standing	14	Standing	56	Pass
	Future	12	Standing	14	Standing	57	Pass
32	Existing	12	Standing	14	Standing	54	Pass
	Proposed	11	Standing	14	Standing	53	Pass
	Future	11	Standing	14	Standing	55	Pass
33	Existing	12	Standing	14	Standing	58	Pass
	Proposed	12	Standing	14	Standing	59	Pass
	Future	12	Standing	14	Standing	57	Pass
34	Existing	12	Standing	14	Standing	56	Pass
	Proposed	12	Standing	14	Standing	58	Pass
	Future	12	Standing	15	Standing	62	Pass
35	Existing	13	Standing	15	Standing	61	Pass
	Proposed	13	Standing	16	Walking	61	Pass
	Future	13	Standing	16	Walking	63	Pass
36	Existing	15	Standing	18	Walking	74	Pass
	Proposed	14	Standing	18	Walking	74	Pass
	Future	14	Standing	18	Walking	75	Pass
37	Existing	14	Standing	16	Walking	64	Pass
	Proposed	14	Standing	16	Walking	65	Pass
	Future	13	Standing	15	Standing	64	Pass
38	Existing	13	Standing	15	Standing	56	Pass
	Proposed	13	Standing	14	Standing	57	Pass
	Future	12	Standing	14	Standing	57	Pass
39	Existing	13	Standing	15	Standing	61	Pass
	Proposed	13	Standing	16	Walking	64	Pass
	Future	13	Standing	15	Standing	64	Pass

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
40	Existing	12	Standing	13	Standing	53	Pass
	Proposed	12	Standing	15	Standing	61	Pass
	Future	12	Standing	14	Standing	60	Pass
41	Existing	12	Standing	14	Standing	55	Pass
	Proposed	16	Walking	19	Walking	78	Pass
	Future	15	Standing	18	Walking	75	Pass
42	Existing	12	Standing	14	Standing	54	Pass
	Proposed	16	Walking	19	Walking	74	Pass
	Future	15	Standing	18	Walking	75	Pass
43	Existing	11	Standing	14	Standing	54	Pass
	Proposed	16	Walking	19	Walking	75	Pass
	Future	16	Walking	19	Walking	73	Pass
44	Existing	11	Standing	14	Standing	55	Pass
	Proposed	14	Standing	17	Walking	66	Pass
	Future	14	Standing	16	Walking	62	Pass
45	Existing	13	Standing	15	Standing	59	Pass
	Proposed	13	Standing	16	Walking	71	Pass
	Future	13	Standing	15	Standing	64	Pass
46	Existing	12	Standing	15	Standing	58	Pass
	Proposed	13	Standing	16	Walking	63	Pass
	Future	13	Standing	15	Standing	61	Pass
47	Existing	13	Standing	15	Standing	60	Pass
	Proposed	13	Standing	16	Walking	62	Pass
	Future	12	Standing	15	Standing	58	Pass
48	Existing	14	Standing	17	Walking	65	Pass
	Proposed	14	Standing	17	Walking	66	Pass
	Future	13	Standing	16	Walking	62	Pass
49	Existing	13	Standing	16	Walking	63	Pass
	Proposed	13	Standing	16	Walking	64	Pass
	Future	13	Standing	15	Standing	61	Pass
50	Existing	13	Standing	15	Standing	61	Pass
	Proposed	14	Standing	16	Walking	66	Pass
	Future	13	Standing	15	Standing	62	Pass
51	Existing	13	Standing	15	Standing	59	Pass
	Proposed	17	Walking	19	Walking	75	Pass
	Future	16	Walking	18	Walking	72	Pass
52	Existing	13	Standing	15	Standing	59	Pass
	Proposed	17	Walking	20	Walking	83	Pass
	Future	17	Walking	20	Walking	83	Pass

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
53	Existing	12	Standing	14	Standing	58	Pass
	Proposed	16	Walking	20	Walking	80	Pass
	Future	16	Walking	20	Walking	81	Pass
54	Existing	12	Standing	15	Standing	58	Pass
	Proposed	19	Walking	24	Uncomfortable	91	Exceeded
	Future	18	Walking	23	Uncomfortable	88	Pass
55	Existing	14	Standing	17	Walking	65	Pass
	Proposed	14	Standing	17	Walking	66	Pass
	Future	14	Standing	16	Walking	63	Pass
56	Existing	15	Standing	18	Walking	71	Pass
	Proposed	15	Standing	18	Walking	70	Pass
	Future	13	Standing	16	Walking	64	Pass
57	Existing	14	Standing	17	Walking	77	Pass
	Proposed	14	Standing	18	Walking	79	Pass
	Future	13	Standing	16	Walking	77	Pass
58	Existing	10	Sitting	12	Standing	48	Pass
	Proposed	11	Standing	12	Standing	48	Pass
	Future	10	Sitting	11	Standing	44	Pass
59	Existing	15	Standing	17	Walking	67	Pass
	Proposed	15	Standing	17	Walking	69	Pass
	Future	13	Standing	16	Walking	66	Pass
60	Existing	15	Standing	17	Walking	66	Pass
	Proposed	15	Standing	17	Walking	67	Pass
	Future	14	Standing	16	Walking	62	Pass
61	Existing	13	Standing	16	Walking	62	Pass
	Proposed	14	Standing	16	Walking	63	Pass
	Future	13	Standing	16	Walking	60	Pass
62	Existing	13	Standing	16	Walking	63	Pass
	Proposed	14	Standing	16	Walking	64	Pass
	Future	13	Standing	16	Walking	63	Pass
63	Existing	13	Standing	15	Standing	61	Pass
	Proposed	14	Standing	17	Walking	67	Pass
	Future	14	Standing	16	Walking	65	Pass
64	Existing	14	Standing	17	Walking	67	Pass
	Proposed	15	Standing	17	Walking	68	Pass
	Future	13	Standing	16	Walking	63	Pass
65	Existing	14	Standing	16	Walking	63	Pass
	Proposed	14	Standing	17	Walking	64	Pass
	Future	14	Standing	16	Walking	63	Pass

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
66	Existing	15	Standing	18	Walking	73	Pass
	Proposed	15	Standing	18	Walking	74	Pass
	Future	15	Standing	18	Walking	76	Pass
67	Existing	13	Standing	16	Walking	62	Pass
	Proposed	13	Standing	16	Walking	64	Pass
	Future	14	Standing	16	Walking	65	Pass
68	Existing		-		-		-
	Proposed	15	Standing	18	Walking	89	Pass
	Future	14	Standing	17	Walking	88	Pass
69	Existing		-		-		-
	Proposed	17	Walking	20	Walking	85	Pass
	Future	17	Walking	20	Walking	84	Pass
70	Existing		-		-		-
	Proposed	21	Uncomfortable	24	Uncomfortable	99	Exceeded
	Future	20	Walking	24	Uncomfortable	101	Exceeded
71	Existing		-		-		-
	Proposed	18	Walking	21	Uncomfortable	85	Pass
	Future	17	Walking	20	Walking	82	Pass
72	Existing		-		-		-
	Proposed	22	Uncomfortable	26	Uncomfortable	104	Exceeded
	Future	21	Uncomfortable	25	Uncomfortable	103	Exceeded
73	Existing		-		-		-
	Proposed	16	Walking	19	Walking	79	Pass
	Future	16	Walking	19	Walking	79	Pass
74	Existing		-		-		-
	Proposed	16	Walking	19	Walking	73	Pass
	Future	16	Walking	18	Walking	73	Pass
75	Existing		-		-		-
	Proposed	23	Uncomfortable	24	Uncomfortable	95	Exceeded
	Future	22	Uncomfortable	24	Uncomfortable	96	Exceeded
76	Existing		-		-		-
	Proposed	21	Uncomfortable	24	Uncomfortable	90	Pass
	Future	20	Walking	23	Uncomfortable	89	Pass
77	Existing		-		-		-
	Proposed	25	Uncomfortable	28	Uncomfortable	110	Exceeded
	Future	23	Uncomfortable	27	Uncomfortable	110	Exceeded
78	Existing		-		-		-
	Proposed	21	Uncomfortable	25	Uncomfortable	95	Exceeded
	Future	20	Walking	24	Uncomfortable	93	Exceeded

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
79	Existing		-		-		-
	Proposed	23	Uncomfortable	29	Uncomfortable	119	Exceeded
	Future	22	Uncomfortable	28	Uncomfortable	115	Exceeded

Seasons		Hours
Summer	May - October	6:00 - 23:00 for comfort
Winter	November - April	0:00 - 23:00 for safety

Configurations	
Existing	Without the proposed development
Proposed	With the proposed development
Future	With the future surroundings

Comfort Speed (km/h) (20% Seasonal Exceedance)	
≤ 10	Sitting
11 - 15	Standing
16 - 20	Walking
> 20	Uncomfortable

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