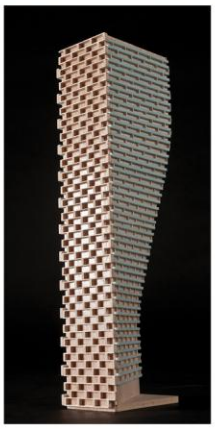
GRADIENTWIND
ENGINEERS & SCIENTISTS

PEDESTRIAN LEVEL WIND STUDY

2233-35 Hurontario Street
Mississauga, Ontario

REPORT: GW25-253-WTPLW







November 13, 2026

PREPARED FOR

2233 & 2235 Hurontario LTD.
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PREPARED BY

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EXECUTIVE SUMMARY

This report describes a wind tunnel pedestrian level wind study undertaken to assess wind conditions for a proposed mixed-use development located at 2233-2235 Hurontario Street in Mississauga, Ontario. Two configurations were studied: (i) *existing scenario*, including all approved, surrounding developments and without the proposed development, and (ii) *proposed scenario* with the proposed development in place. The study involves wind tunnel measurements of pedestrian wind speeds using a physical scale model, combined with meteorological data integration, to assess pedestrian comfort at key areas within and surrounding the study site. Grade-level areas investigated include sidewalks, walkways, laneways, parking areas, nearby transit stops, outdoor amenities, and building access points. Wind comfort is also evaluated over the Levels 7 and 8 outdoor amenity terraces. The results and recommendations derived from these considerations are summarized in the following paragraphs and detailed in the subsequent report.

Our work is based on industry standard wind tunnel testing and data analysis procedures, architectural drawings prepared by BDP. Quadrangle in March 2026 and updated in April 2026, surrounding street layouts, as well as existing and approved future building massing information obtained from the City of Mississauga, and recent site imagery.

A complete summary of the predicted wind conditions is provided in Section 5 of this report and is also illustrated in Figures 2A through 4B, as well as Tables A1-A2 and B1-B3 in the appendices. Based on wind tunnel test results, meteorological data analysis, and experience with similar developments in Mississauga, we conclude that the future wind conditions over most grade-level pedestrian wind-sensitive areas within and surrounding the study site will be acceptable for the intended uses on a seasonal basis. Exceptions include the grade-level outdoor amenity and the retail entrances facing Hurontario Street, for which mitigation is recommended as described in Section 5.2. With the mitigation detailed in Section 5.2, the Level 7 and 8 amenity terraces are generally expected to be safe and comfortable for sitting or more sedentary activities during the summer months.

Within the context of typical weather patterns, which exclude anomalous localized storm events such as tornadoes and downbursts, no areas over the study site, apart from the previously noted portions of the Level 7 and 8 terraces, which have been mitigated, were found to experience wind conditions that are considered unsafe.

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1. INTRODUCTION

This report describes a wind tunnel pedestrian level wind (PLW) study undertaken to assess wind conditions for a proposed mixed-use development located at 2233-2235 Hurontario Street in Mississauga, Ontario. Two configurations were studied: (i) *existing scenario*, including all approved, surrounding developments and without the proposed development, and (ii) *proposed scenario* with the proposed development in place. The study was performed in accordance with industry standard wind tunnel testing techniques, architectural drawings prepared by BDP. Quadrangle in March 2026 and updated in April 2026, surrounding street layouts and existing and approved future building massing information, as well as recent site imagery.

2. TERMS OF REFERENCE

The focus of this wind tunnel pedestrian wind study is the proposed mixed-use development located at 2233-35 Hurontario Street in Mississauga, Ontario. The study site is situated along the northeast side of Hurontario Street, approximately 120 metres southeast of the intersection of Hurontario Street and Queensway.

The study building comprises two 35-storey towers aligned southwest-northeast and labelled Towers 1 and 2, respectively, rising from a shared seven-storey podium of approximately rectangular planform oriented perpendicular to Hurontario Street. A laneway connecting to Hurontario Street along the south elevation (relative to Project North) provides access to the loading areas, surface parking, and the ramp to three levels of underground parking. The ground floor comprises a central residential lobby accessed both from the north and south elevations, indoor amenities along the north elevation, a retail space along the west elevation, a secondary lobby in the northeast corner, and building support services in the remaining spaces. An outdoor amenity is located northeast of the building, adjacent to the drive aisle and surface parking area. Levels 2-6 are reserved for residential use, with central lockers. At Level 7, the floorplate steps back to the base of Tower 1, accommodating an outdoor amenity on the podium rooftop and indoor amenities within, as well as residential spaces to the east of Tower 2. Tower 2 steps back to the tower's base at Level 8, accommodating additional outdoor and indoor amenity spaces. Above, both towers rise uniformly to their full height. Indoor amenity spaces are located along the south elevation at Level 35, and each tower is capped by a mechanical penthouse.

Regarding wind exposures, the near-field surroundings of the development (defined as an area falling within a 200-metre radius of the site) are characterized by a mix of mid-rise buildings and open green space in all directions, with the 22-storey Peter Gilgan Mississauga hospital under construction to the southwest, and two existing residential buildings (12 and 13 storeys) located within the site. The far-field surroundings (defined as the area beyond the near-field and within a two-kilometre radius) are characterized by low-rise suburban exposure in all directions, with clusters of mid-rise buildings to the northwest along Hurontario Street, and to the west along Dundas Street West.

Grade-level areas investigated include sidewalks, walkways, laneways, parking areas, nearby transit stops, outdoor amenities, and building access points. Wind comfort is also evaluated over the Levels 7 and 8 outdoor amenity terraces. Figures 1A and 1B illustrate the *existing* and *proposed* study sites and surrounding context, respectively, and Photographs 1 through 6 depict the wind tunnel model used to conduct the study.

3. OBJECTIVES

The principal objectives of this study are to (i) determine pedestrian level wind comfort and safety conditions at key areas within and surrounding the development site; (ii) identify areas where wind conditions may interfere with the intended uses of outdoor spaces; (iii) recommend suitable mitigation measures, where required; and (iv) evaluate the influence of the proposed development on the existing wind conditions.

4. METHODOLOGY

The approach followed to quantify pedestrian wind conditions over the site is based on wind tunnel measurements of wind speeds at selected locations on a reduced-scale physical model, meteorological analysis of the Mississauga area wind climate, and synthesis of wind tunnel data with industry-accepted guidelines[1]. The following sections describe the analysis procedures, including a discussion of the pedestrian comfort and safety guidelines.

[1] City of Mississauga Urban Design Terms of Reference, Wind Comfort and Safety Studies, June 2014

4.1 Wind Tunnel Context Modelling

A detailed PLW study is performed to determine the influence of local winds at the pedestrian level for a proposed development. The physical model of the proposed development and relevant surroundings, illustrated in Photographs 1 through 6 following the main text, was constructed at a scale of 1:400. The wind tunnel model includes all existing buildings and approved future developments within a full-scale diameter of approximately 840 metres. The general concept and approach to wind tunnel modelling is to provide building and topographic detail in the immediate vicinity of the study site on the surrounding model, and to rely on a length of wind tunnel upwind of the model to develop wind properties consistent with known turbulent intensity profiles that represent the surrounding terrain.

An industry standard practice is to omit trees, vegetation, and other existing and planned landscape elements from the wind tunnel model due to the difficulty of providing an accurate seasonal representation of vegetation. The omission of trees and other landscaping elements produces slightly more conservative wind speed values.

4.2 Wind Speed Measurements

The PLW study was performed by testing a total of 78 sensor locations on the scale model in Gradient Wind's wind tunnel, with 66 sensors located at grade and the remaining 12 sensors over the Levels 7 and 8 outdoor amenity terraces. Wind speed measurements were performed for each of the 78 sensors for 36 wind directions at 10° intervals. Figures 1A and 1B illustrate the *existing* and *proposed* study sites and surrounding context, respectively, while sensor locations used to investigate wind conditions are illustrated in Figures 2A through 4B.

Mean and peak wind speed values for each location and wind direction were calculated from real-time pressure measurements, recorded at a sample rate of 500 samples per second, and taken over a 60-second time period. This period at model-scale corresponds approximately to one hour in full-scale, which matches the time frame of full-scale meteorological observations. Measured mean and gust wind speeds at grade were referenced to the wind speed measured near the ceiling of the wind tunnel to generate mean and peak wind speed ratios. Ceiling height in the wind tunnel represents the depth of the boundary layer of wind flowing over the earth's surface, referred to as the gradient height. Within this boundary layer, mean wind speed increases up to the gradient height and remains constant thereafter. Appendices

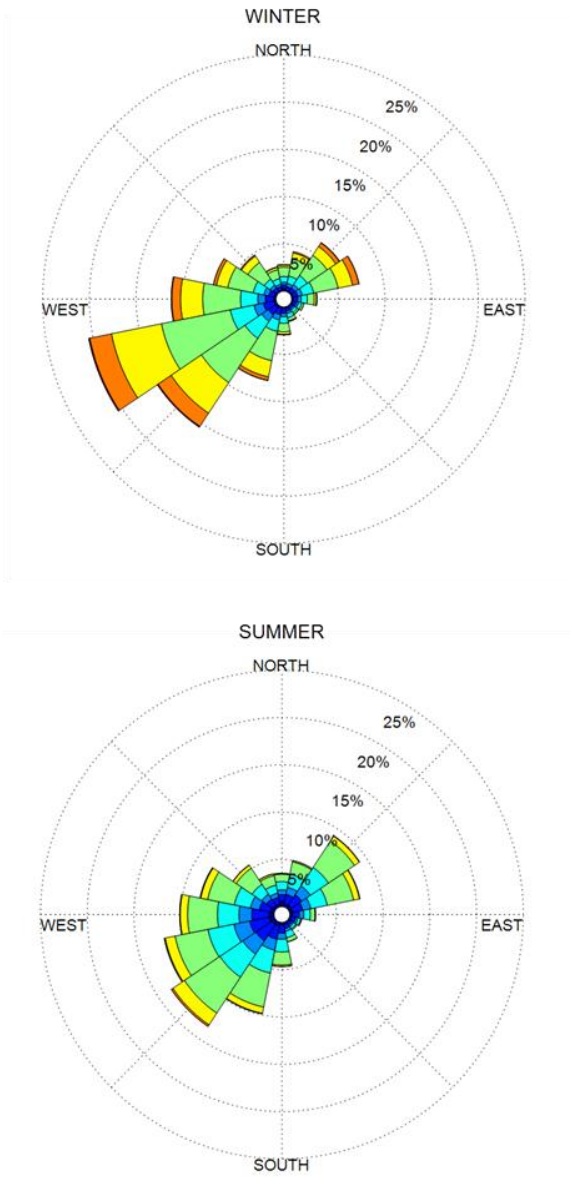
C and D provide greater detail of the theory behind wind speed measurements. Wind tunnel measurements for this project, conducted in Gradient Wind's wind tunnel facility, meet or exceed guidelines found in the National Building Code of Canada 2015 and of 'Wind Tunnel Studies of Buildings and Structures', ASCE Manual 7 Reports on Engineering Practice No 67.

4.3 Meteorological Data Analysis - Pearson International Airport

A statistical model for winds in Mississauga was developed from over 50 years of hourly meteorological wind data recorded at Pearson International Airport. Wind speed and direction data were analyzed for each month of the year in order to determine the statistically prominent wind directions and corresponding speeds, and to characterize similarities between monthly weather patterns. Following the City of Mississauga Urban Design Terms of Reference, the year is represented by a two-season model, and not according to the traditional calendar method.

The statistical model of the Mississauga area wind climate, which indicates the directional character of local winds on a seasonal basis, is illustrated on the following page. The plots illustrate the seasonal distribution of measured wind speeds and directions in km/h. Probabilities of occurrence of different wind speeds are represented as stacked polar bars in sixteen azimuth divisions. The radial direction represents the percentage of time for various wind speed ranges per wind direction during the measurement period. The preferred wind speeds and directions can be identified by the longer length of the bars. For Pearson International Airport, the most common winds concerning pedestrian comfort occur from the southwest clockwise to the north, as well as those from the east. The directional preference and relative magnitude of the wind speed varies somewhat from season to season, with the summer months displaying the calmest winds relative to the remaining seasonal periods.

SEASONAL DISTRIBUTION OF WINDS FOR VARIOUS PROBABILITIES
PEARSON INTERNATIONAL AIRPORT, TORONTO, ONTARIO



Notes:

1. Radial distances indicate percentage of time of wind events.
2. Wind speeds are mean hourly in km/h, measured at 10 m above the ground.

4.4 Pedestrian Comfort and Safety Guidelines

Pedestrian comfort and safety guidelines are based on the mechanical effects of wind without consideration of other meteorological conditions (i.e. temperature, relative humidity). The comfort guidelines assume that pedestrians are appropriately dressed for a specified outdoor activity during any given season. Four pedestrian comfort classes are based on 80% non-exceedance Guest Equivalent Mean (GEM) wind speed ranges, which include (i) Sitting; (ii) Standing; (iii) Walking; and (iv) Uncomfortable. More specifically, the comfort classes and associated GEM wind speed ranges are summarized as follows:

(i) **Sitting** – A wind speed below 10 km/h (i.e. 0 – 10 km/h) would be considered acceptable for sedentary activities, including sitting.

(ii) **Standing** – A wind speed below 15 km/h (i.e. 10 km/h – 15 km/h) is acceptable for activities such as standing or leisurely strolling.

(iii) **Walking** – A wind speed below 20 km/h (i.e. 15 km/h – 20 km/h) is acceptable for walking or more vigorous activities.

(iv) **Uncomfortable** – A wind speed over 20 km/h is classified as uncomfortable from a pedestrian comfort standpoint. Brisk walking and exercise, such as jogging, would be acceptable for moderate excesses of this criterion.

The pedestrian safety wind speed guideline is based on the approximate threshold that would cause a vulnerable member of the population to fall. A 0.1% exceedance gust wind speed of greater than 90 km/h is classified as dangerous.

Experience and research on people's perception of mechanical wind effects have shown that if the wind speed levels are exceeded for more than 20% of the time, the activity level would be judged to be uncomfortable by most people. For instance, if wind speeds of 10 km/h were exceeded for more than 20% of the time, most pedestrians would judge that location to be too windy for sitting or more sedentary activities. Similarly, if 20 km/h at a location were exceeded for more than 20% of the time, walking or less vigorous activities would be considered uncomfortable. As most of these criteria are based on subjective reactions of a population to wind forces, their application is partly based on experience and judgment.

Once the pedestrian wind speed predictions have been established at tested locations, the assessment of pedestrian comfort involves determining the suitability of the predicted wind conditions for their

associated spaces. This step involves comparing the predicted comfort class to the desired comfort class, which is dictated by the location type represented by the sensor (i.e. a sidewalk, building entrance, amenity space, or other). An overview of common pedestrian location types and their desired comfort classes are summarized below.

DESIRED PEDESTRIAN COMFORT CLASSES FOR VARIOUS LOCATION TYPES

Location Types	Desired Comfort Classes
Primary Building Entrance	Standing
Secondary Building Access Point	Walking
Public Sidewalks / Pedestrian Walkways	Walking
Outdoor Amenity Spaces	Sitting / Standing
Cafés / Patios / Benches / Gardens	Sitting / Standing
Plazas	Standing / Walking
Transit Stops	Standing
Public Parks	Sitting / Walking
Garage / Service Entrances	Walking
Vehicular Drop-Off Zones	Walking
Laneways / Loading Zones	Walking

5. RESULTS AND DISCUSSION

Tables A1 and A2 in Appendix A provide a summary of seasonal comfort predictions for each sensor location under the *existing* massing scenario. Similarly, Tables B1 through B3 in Appendix B provide the seasonal comfort predictions for under the *proposed* massing scenario. The tables indicate the 80% non-exceedance GEM wind speeds and corresponding comfort classifications as defined in Section 4.4. In other words, a wind speed threshold of 19.1 for the summer season indicates that 80% of the measured data falls at or below 19.1 km/h during the summer months and conditions are therefore suitable for walking, as the 80% threshold value falls within the exceedance range of 15-20 km/h for walking. The tables include the predicted threshold values for each sensor location during each season, accompanied by the corresponding predicted comfort class (i.e., sitting, standing, walking, etc.).

The most significant findings of the PLW study are summarized in Sections 5.1 and 5.2. To assist with understanding and interpretation, predicted conditions for the proposed development are also illustrated in colour-coded format in Figures 2A through 4B. Conditions suitable for sitting are represented by the colour blue, while standing is represented by green, and walking by yellow. Conditions considered uncomfortable for walking are represented by the colour orange. For locations where the wind safety criterion is exceeded, the sensor is highlighted in red.

5.1 Pedestrian Comfort Suitability – *Existing Scenario*

Based on the analysis of the measured data, consideration of local climate data, and the suitability descriptors provided in Tables A1 and A2 in Appendix A and illustrated in Figures 2A and 2B, this section summarizes the significant findings of the PLW study with respect to the *existing scenario*, as follows:

1. Most public sidewalks, walkways, laneways, landscaped spaces, and parking areas within and surrounding the proposed development currently experience wind conditions suitable for walking or better throughout the year. An exception is an isolated parking area to the north of the site (Sensor 19), which becomes uncomfortable for walking during the winter months.
2. The entrances to the existing buildings within (Sensors 37 & 48), and to the southeast (Sensor 26), of the site are currently suitable for standing or better year-round.
3. The existing tennis court to the southeast of the site (Sensors 28 & 29) experiences standing or better wind conditions throughout the year.
4. The nearby transit stops along Hurontario Street, south of the study site (Sensors 5 & 7), are currently suitable for standing year-round, with the stop across Hurontario Street (Sensor 5) exceeding the standing criterion during the winter months. It is noteworthy that these transit stops are equipped with pedestrian shelters.
5. Within the context of typical weather patterns, which exclude anomalous localized storm events such as tornadoes and downbursts, no areas over the study site were found to experience wind conditions that are considered unsafe.

5.2 Pedestrian Comfort Suitability – *Proposed Scenario*

Based on the analysis of the measured data, consideration of local climate data, and the suitability descriptors provided in Tables B1-B3 in Appendix B and illustrated in Figures 3A through 4B, this section summarizes the significant findings of the PLW study with respect to the *proposed scenario*, as follows:

1. Most public sidewalks, walkways, laneways, landscaped spaces, and parking areas within and surrounding the proposed development will experience wind conditions suitable for walking or better during each seasonal period, which is acceptable for the intended uses of spaces. Exceptions include isolated areas to the northwest of the building (Sensors 34 & 36), which become uncomfortable for walking during the winter months. It is noteworthy that the uncomfortable conditions are marginal (< 0.6 km/h; See Appendix B) and restricted to winter months, with the proposed and existing landscaping expected to further reduce wind speeds. Overall, the noted conditions are considered acceptable.

2. Most residential lobby and retail main entrances throughout the proposed development will be comfortable for standing or better throughout the year, which is acceptable for the intended use. Exceptions include the retail entrances facing Hurontario Street (Sensors 62 & 63), which exceed the standing criterion during the winter months. To achieve standing conditions throughout the year, it is recommended to either recess these entrances into the building façade, provide a canopy overhead, or flank the doorway with vertical wind barriers. Barriers may take the form of high-solidity wind screens, dense coniferous plantings, or a combination thereof, and should rise at least 2.0 metres at the time of installation.

   All secondary building access points (including stairwell exits, loading areas, vehicle entrances, etc.) throughout the proposed development will be comfortable for walking or better throughout the year, which is acceptable.

3. The entrances to the existing buildings within (Sensors 37 & 48), and to the southeast (Sensor 26), of the site will generally remain suitable for standing or better year-round, with the entrance to the north (Sensor 37) exceeding the standing criterion during the winter months. Given the marginality of the exceedance (~0.8km/h; see Appendix B) and the existing canopy, further mitigation is not expected to be necessary.

4. The proposed grade-level outdoor amenity (Sensor 50) will be suitable for standing during the summer months and walking during the winter months. If sitting conditions are desired in this amenity, it is recommended to provide targeted upwind barriers directly northeast and southwest of designated spaces. Barriers may take the form of high-solidity wind screens, dense coniferous plantings, or a combination thereof, and should rise at least 2.0 metres at the time of installation.
5. The existing tennis court to the southeast of the site (Sensors 28 & 29) will experience standing conditions during the summer months and walking or better conditions during the winter months, which is acceptable for the intended use.
6. The nearby transit stop along Hurontario Street, south of the site (Sensors 7), will remain suitable for standing year-round, while the stop across Hurontario Street (Sensor 5) will exceed the standing criterion year-round. Notably, this transit stop is equipped with a pedestrian shelter, so further mitigation is not needed.
7. The Levels 7 and 8 outdoor amenity terraces (Sensors 67-73 and 74-78, respectively) will generally experience a mix of standing and walking conditions during the summer months, with the areas at the northwest corner (Sensor 67) and east side (Sensors 69 & 71) of the Level 7 terrace (relative to Project North), experiencing conditions uncomfortable for walking. Additionally, the northwest corner and the east side of Tower 1 (Sensors 67 and 71, respectively), as well as the northeast corner of Tower 2 (Sensor 78), will exceed the annual safety criterion.

   To achieve safe and calm conditions comfortable for sitting or more sedentary activities throughout the warmer months, it is recommended to raise portions of the perimeter guard to at least 2.4 metres above the walking surface, install targeted wind barriers directly upwind of seating areas, and provide canopy or pergola structures overhead, to buffer prominent northwesterly winds that accelerate around the building corners and channel between the towers. Such barriers may comprise 1.8-metre-tall high-solidity wind screens, raised planters with dense coniferous plantings, or a combination thereof. The exact composition and configuration of such mitigation can be coordinated with the design team as the terrace landscape plans develop.

Since the study was conducted, the Level 7 and Level 8 terrace perimeter guards have been raised to 2.4 metres above the walking surface, with localized wind barriers and a pergola/trellis structure provided at the Level 7 terrace, as delineated in the updated architectural plans. These measures are generally expected to fulfill the wind recommendation for the terraces noted above.

8. Within the context of typical weather patterns, which exclude anomalous localized storm events such as tornadoes and downbursts, no areas over the study site, apart from the previously noted portions of the Level 7 and 8 terraces, which have been mitigated, were found to experience wind conditions that are considered unsafe.

6. CONCLUSIONS AND RECOMMENDATIONS

This report summarizes the methodology, results, and recommendations related to a pedestrian level wind study for a proposed mixed-use development located at 2233-2235 Hurontario Street in Mississauga, Ontario. The study was performed in accordance with industry standard wind tunnel testing and data analysis procedures.

A complete summary of the predicted wind conditions is provided in Section 5 of this report and is also illustrated in Figures 2A through 4B, as well as Tables A1-A2 and B1-B3 in the appendices. Based on wind tunnel test results, meteorological data analysis, and experience with similar developments in Mississauga, we conclude that the future wind conditions over most grade-level pedestrian wind-sensitive areas within and surrounding the study site will be acceptable for the intended uses on a seasonal basis. Exceptions include the grade-level outdoor amenity and the retail entrances facing Hurontario Street, for which mitigation is recommended as described in Section 5.2. With the mitigation detailed in Section 5.2, the Level 7 and 8 amenity terraces are generally expected to be safe and comfortable for sitting or more sedentary activities during the summer months.

Within the context of typical weather patterns, which exclude anomalous localized storm events such as tornadoes and downbursts, no areas over the study site, apart from the previously noted portions of the Level 7 and 8 terraces, which have been mitigated, were found to experience wind conditions that are considered unsafe.

This concludes our pedestrian level wind study and report. Please advise the undersigned of any questions or comments.

Sincerely,

Gradient Wind Engineering Inc.

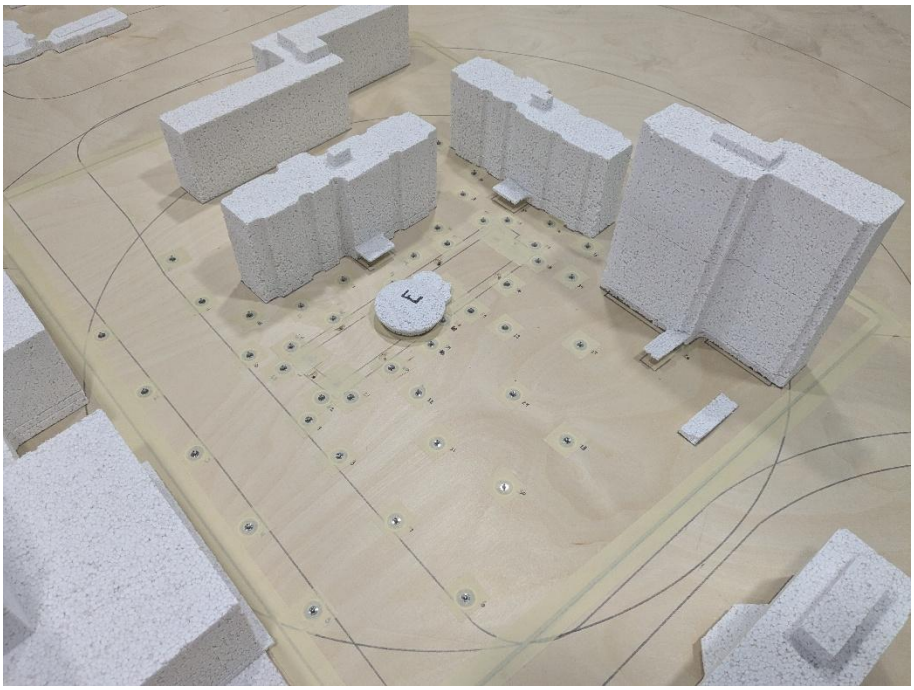


Cristiano Kondo, MESc., P.Eng.,
Wind Engineer

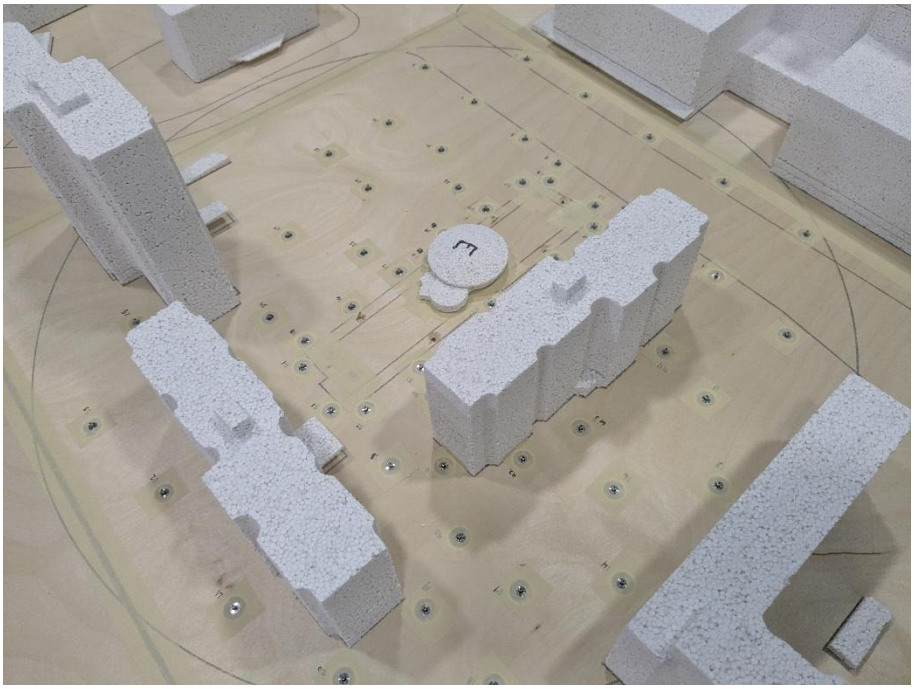


Nick Petersen, P.Eng.,
Wind Engineer

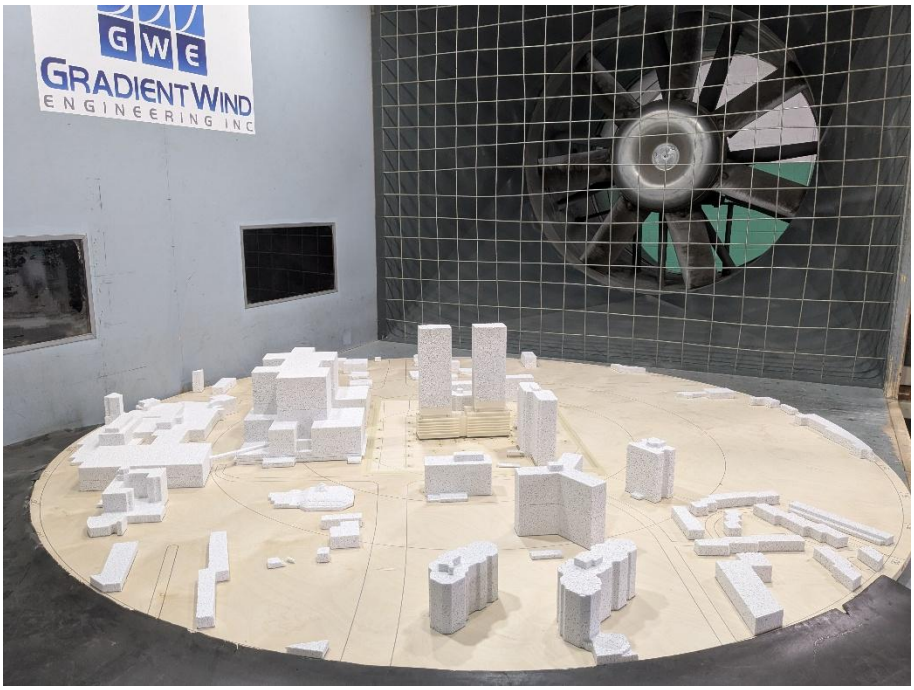
GW25-253-WTPLW



PHOTOGRAPH 1: CLOSE-UP VIEW OF EXISTING CONTEXT MODEL LOOKING NORTH



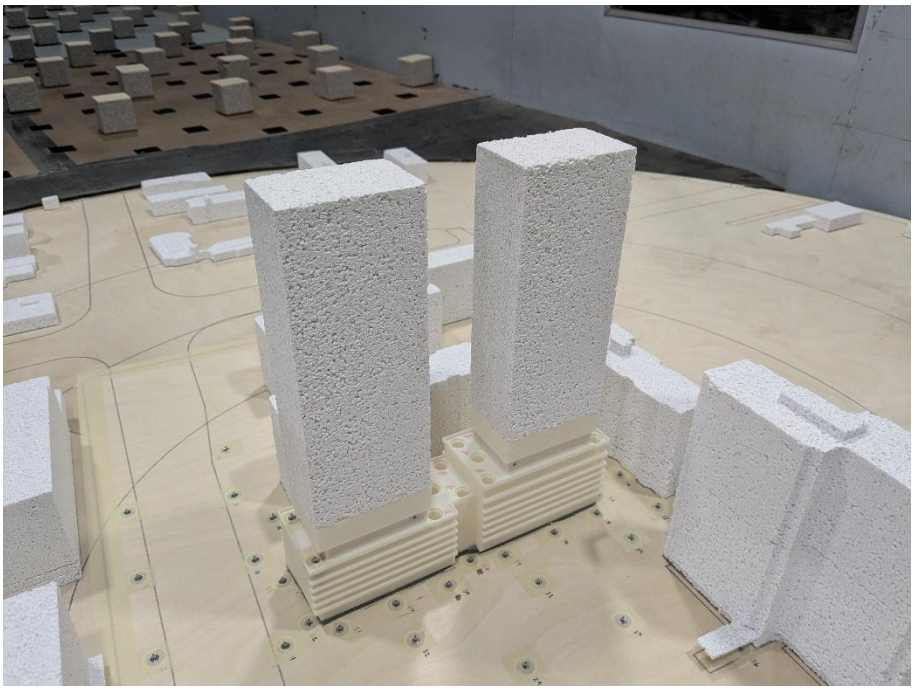
PHOTOGRAPH 2: CLOSE-UP VIEW OF EXISTING CONTEXT MODEL LOOKING SOUTH



PHOTOGRAPH 3: PROPOSED STUDY MODEL INSIDE THE GWE WIND TUNNEL LOOKING DOWNWIND



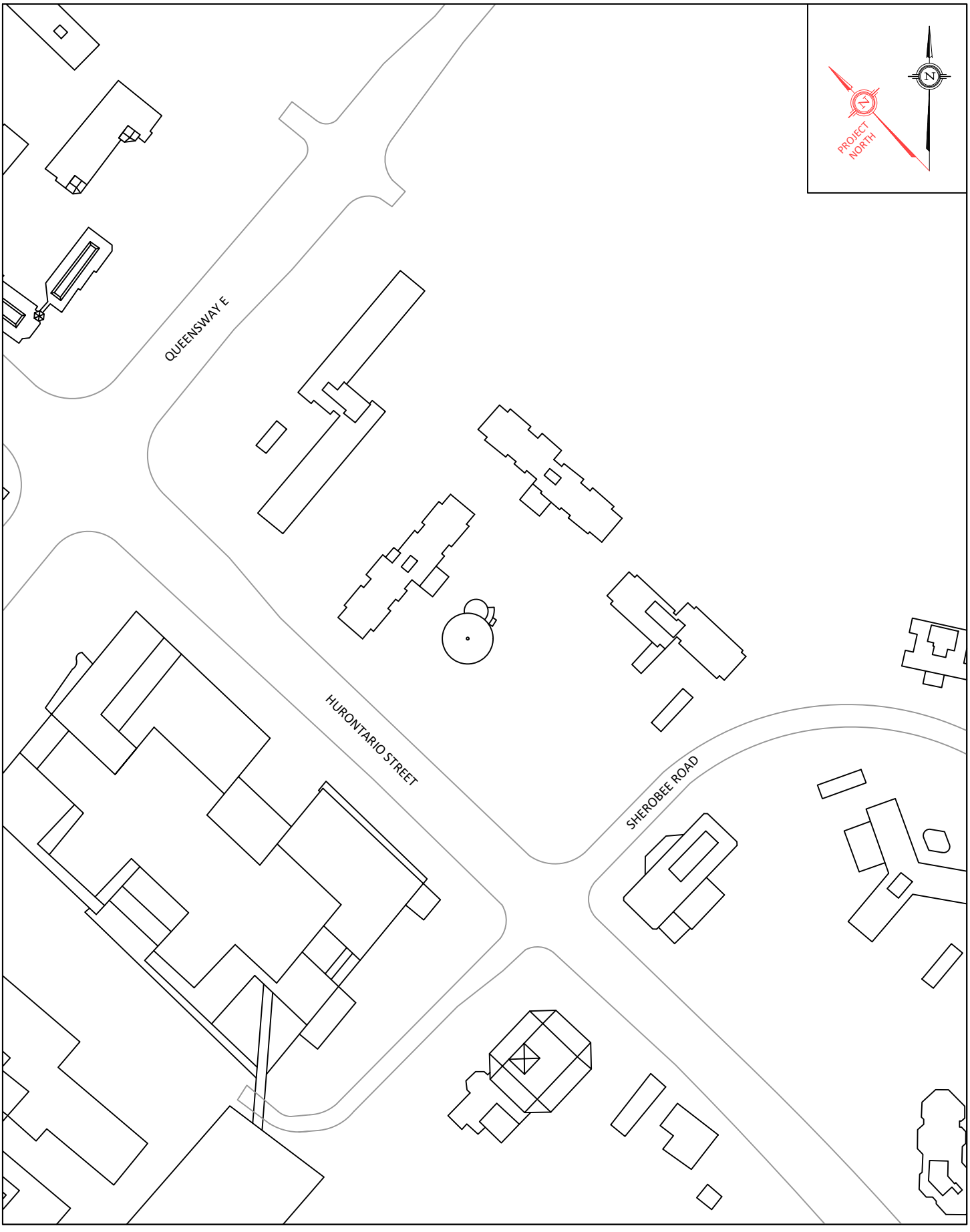
PHOTOGRAPH 4: PROPOSED STUDY MODEL INSIDE THE GWE WIND TUNNEL LOOKING UPWIND



PHOTOGRAPH 5: CLOSE-UP VIEW OF PROPOSED STUDY MODEL LOOKING NORTH



PHOTOGRAPH 6: CLOSE-UP VIEW OF PROPOSED STUDY MODEL LOOKING SOUTH



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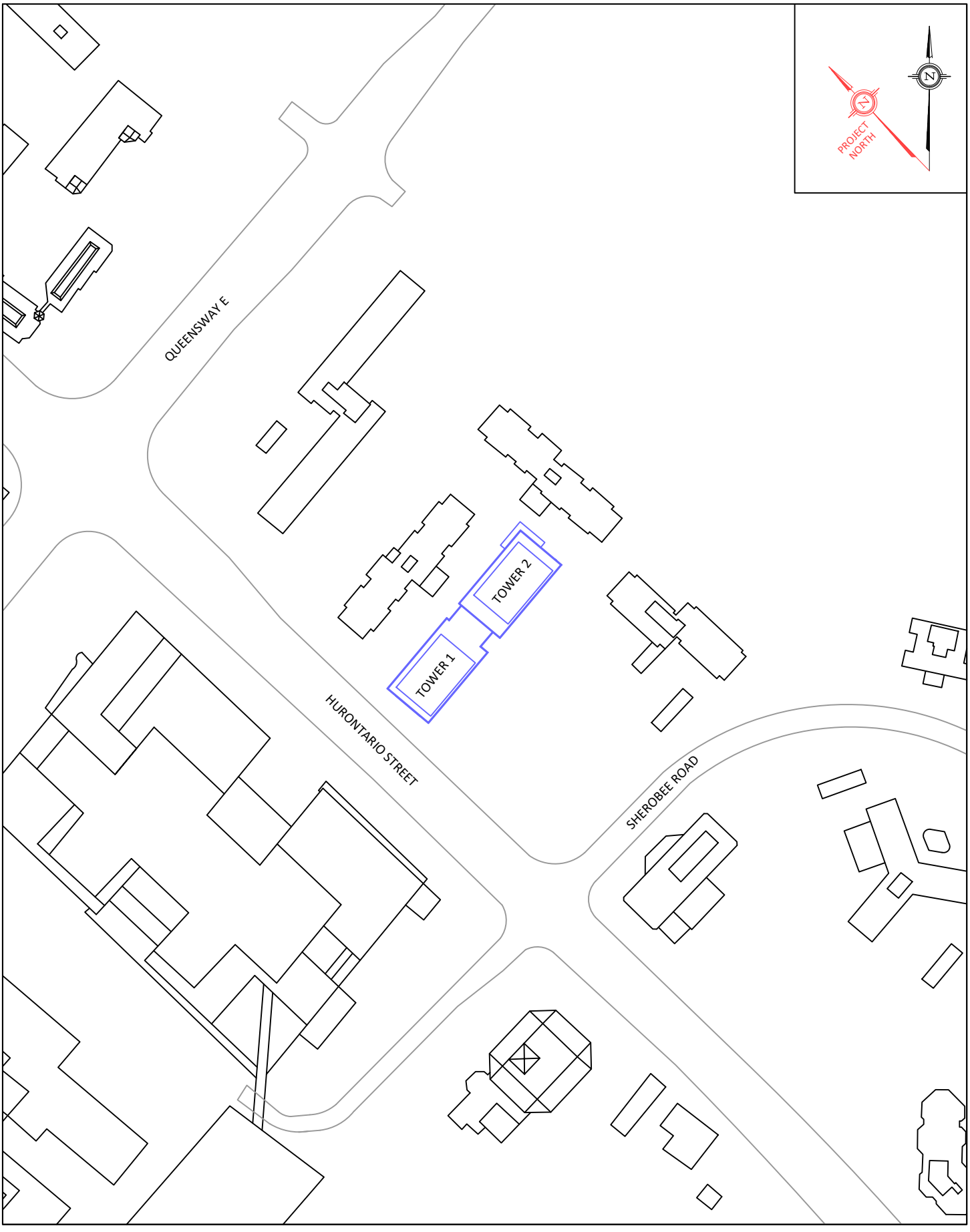
PROJECT	2233 HURONTARIO STREET, MISSISSAUGA PEDESTRIAN LEVEL WIND STUDY		DESCRIPTION
SCALE	1:2500 (APPROX.)	DRAWING NO.	GW25-253-PLW-1A
DATE	APRIL 1, 2026	DRAWN BY	C.E.

FIGURE 1A:
EXISTING SITE PLAN
AND SURROUNDING CONTEXT



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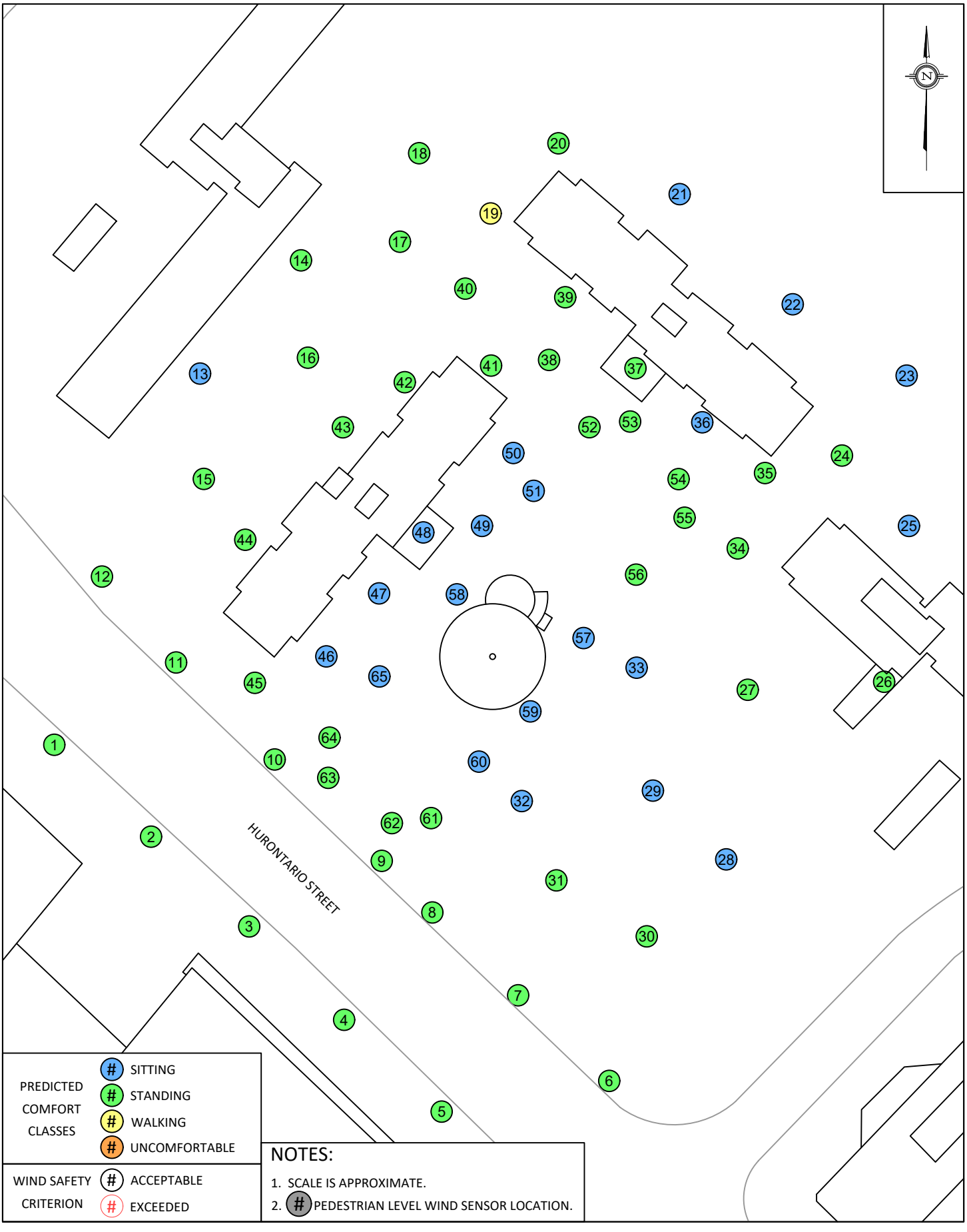
PROJECT	2233 HURONTARIO STREET, MISSISSAUGA PEDESTRIAN LEVEL WIND STUDY
SCALE	1:2500 (APPROX.)
DRAWING NO.	GW25-253-PLW-1B
DATE	APRIL 1, 2026
DRAWN BY	C.E.

DESCRIPTION

FIGURE 1B:
PROPOSED SITE PLAN
AND SURROUNDING CONTEXT



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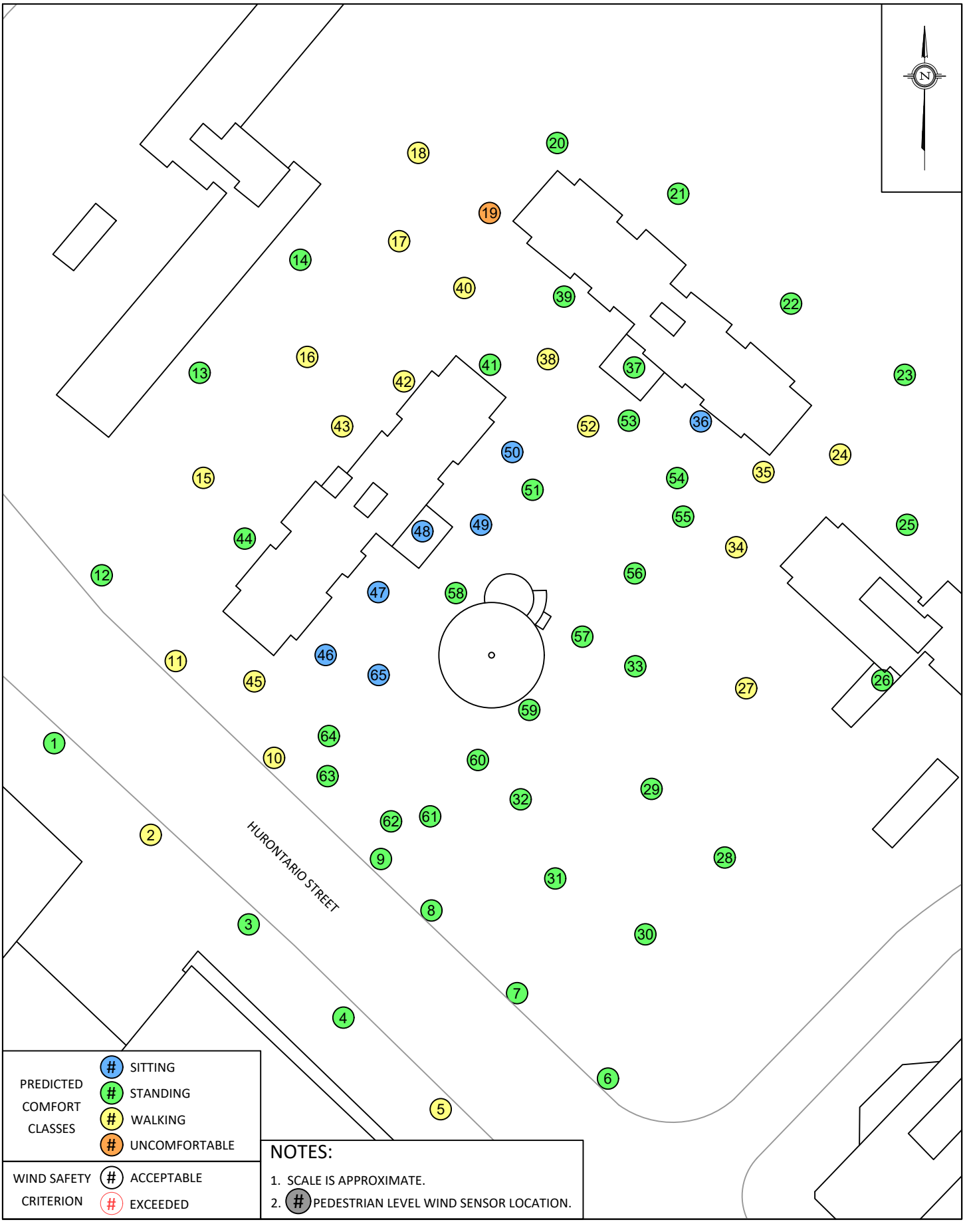
PROJECT	2233 HURONTARIO STREET, MISSISSAUGA PEDESTRIAN LEVEL WIND STUDY
SCALE	1:1200 (APPROX.)
DRAWING NO.	GW25-253-PLW-2A
DATE	APRIL 1, 2026
DRAWN BY	C.E.

DESCRIPTION

FIGURE 2A: SUMMER
EXISTING GROUND FLOOR PLAN
PEDESTRIAN COMFORT PREDICTIONS



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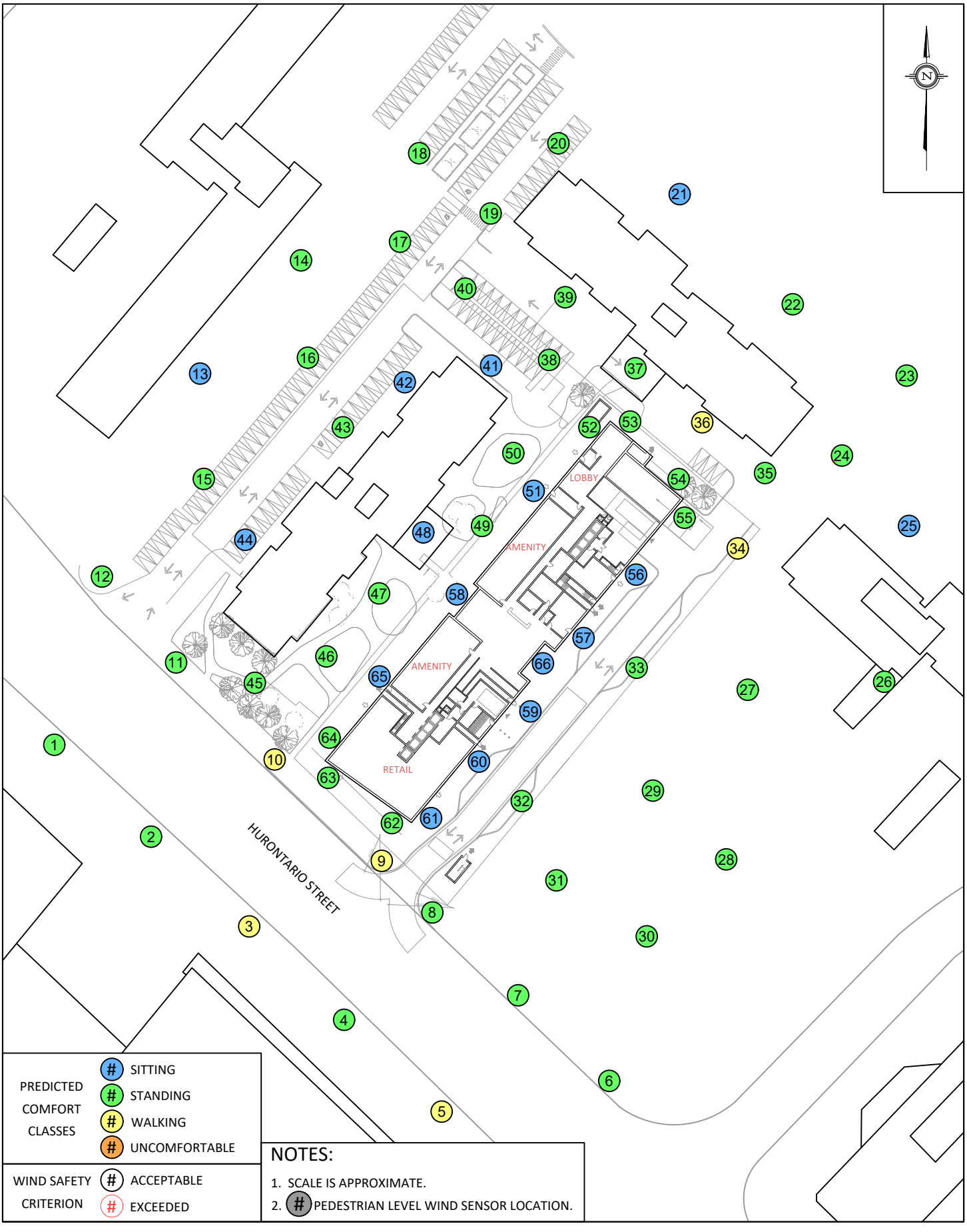
PROJECT	2233 HURONTARIO STREET, MISSISSAUGA PEDESTRIAN LEVEL WIND STUDY
SCALE	1:1200 (APPROX.)
DRAWING NO.	GW25-253-PLW-2B
DATE	APRIL 1, 2026
DRAWN BY	C.E.

DESCRIPTION

FIGURE 2B: WINTER
EXISTING GROUND FLOOR PLAN
PEDESTRIAN COMFORT PREDICTIONS



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SCALE	1:1200 (APPROX.)
DRAWING NO.	GW25-253-PLW-3A
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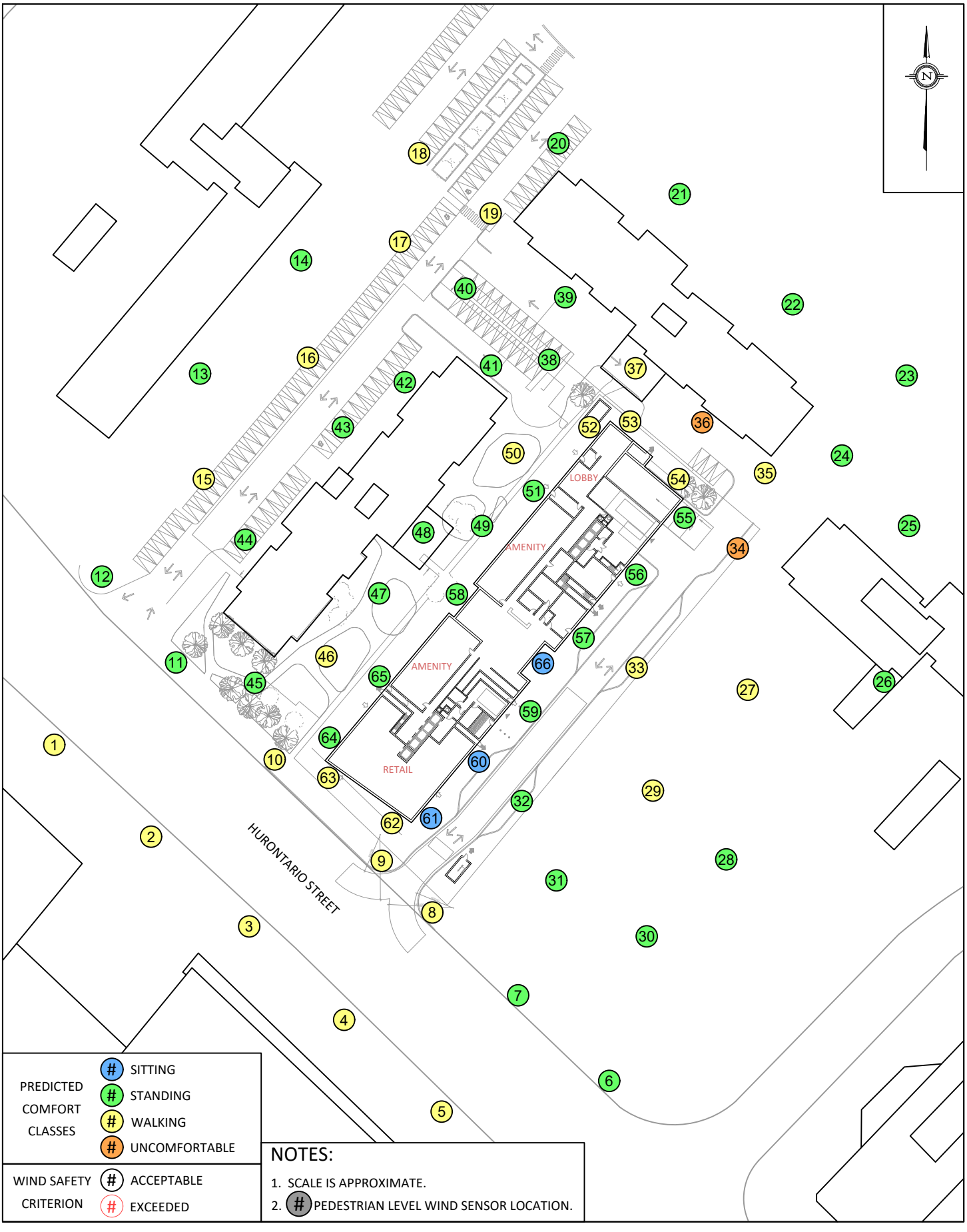
DRAWN BY	C.E.

DESCRIPTION

FIGURE 3A: SUMMER
PROPOSED GROUND FLOOR PLAN
PEDESTRIAN COMFORT PREDICTIONS



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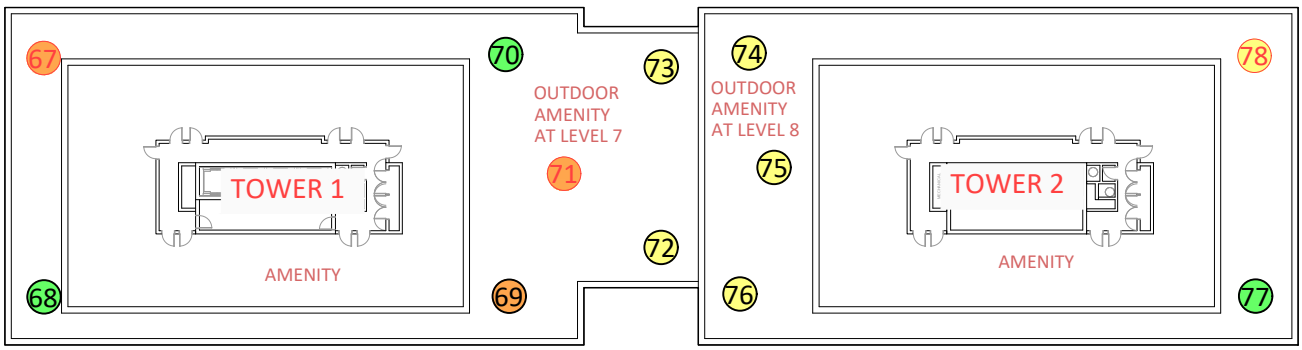
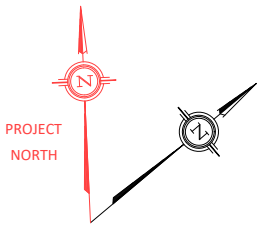
PROJECT	2233 HURONTARIO STREET, MISSISSAUGA PEDESTRIAN LEVEL WIND STUDY
SCALE	1:1200 (APPROX.)
DRAWING NO.	GW25-253-PLW-3B
DATE	APRIL 1, 2026
DRAWN BY	C.E.

DESCRIPTION

FIGURE 3B: WINTER
PROPOSED GROUND FLOOR PLAN
PEDESTRIAN COMFORT PREDICTIONS





PREDICTED COMFORT CLASSES	#	SITTING
	#	STANDING
	#	WALKING
	#	UNCOMFORTABLE
WIND SAFETY CRITERION	#	ACCEPTABLE
	#	EXCEEDED

NOTES:

1. SCALE IS APPROXIMATE.
2. # PEDESTRIAN LEVEL WIND SENSOR LOCATION.

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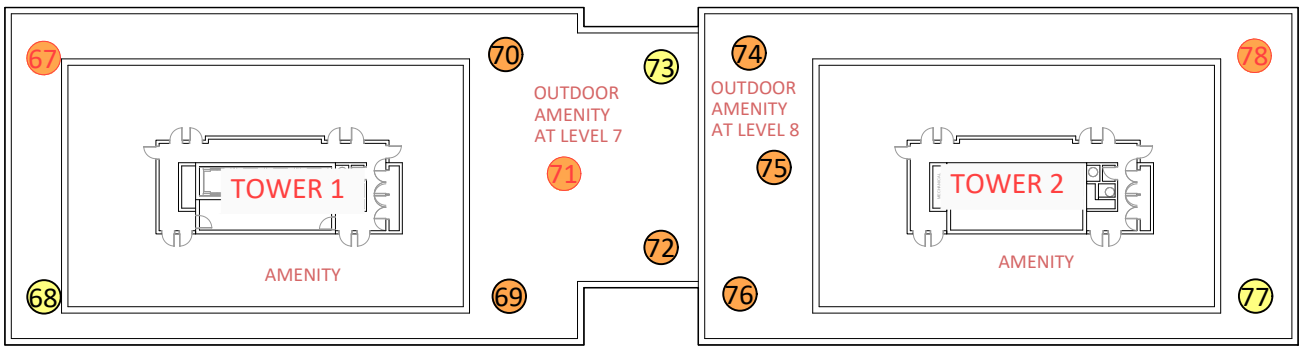
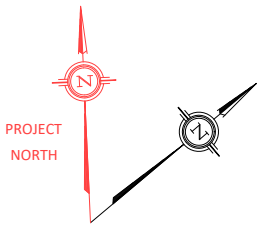
SCALE	1:600 (APPROX.)	DRAWING NO.	GW25-253-PLW-4A
DATE	APRIL 1, 2026	DRAWN BY	C.E.

FIGURE 4A: SUMMER
OUTDOOR AMENITY PLAN
PEDESTRIAN COMFORT PREDICTIONS





PREDICTED COMFORT CLASSES	#	SITTING
	#	STANDING
	#	WALKING
	#	UNCOMFORTABLE
WIND SAFETY CRITERION	#	ACCEPTABLE
	#	EXCEEDED

NOTES:

1. SCALE IS APPROXIMATE.
2. # PEDESTRIAN LEVEL WIND SENSOR LOCATION.

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SCALE	1:600 (APPROX.)
DRAWING NO.	GW25-253-PLW-4B
DATE	APRIL 1, 2026
DRAWN BY	C.E.

DESCRIPTION

FIGURE 4B: WINTER
OUTDOOR AMENITY PLAN
PEDESTRIAN COMFORT PREDICTIONS



APPENDIX A

PEDESTRIAN COMFORT SUITABILITY, TABLES A1-A2 (EXISTING SCENARIO)

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Guidelines	
Pedestrian Comfort	**20% exceedance wind speed** 0-10 km/h = Sitting, 10-15 km/h = Standing, 15-20 km/h = Walking, >20 km/h = Uncomfortable
Pedestrian Safety	**0.1% exceedance wind speed** 0-90 km/h = Safe

TABLE A1: SUMMARY OF PEDESTRIAN COMFORT (EXISTING SCENARIO)

Sensor	Pedestrian Comfort				Pedestrian Safety	
	Summer		Winter		Annual	
	Wind Speed	Comfort Class	Wind Speed	Comfort Class	Wind Speed	Safety Class
1	11.8	Standing	14.9	Standing	59.7	Safe
2	13.2	Standing	16.5	Walking	65.0	Safe
3	11.9	Standing	14.4	Standing	58.8	Safe
4	10.7	Standing	13.1	Standing	55.0	Safe
5	14.5	Standing	16.1	Walking	54.2	Safe
6	12.2	Standing	14.1	Standing	53.6	Safe
7	12.4	Standing	14.5	Standing	52.8	Safe
8	11.0	Standing	13.4	Standing	55.3	Safe
9	10.4	Standing	12.8	Standing	56.2	Safe
10	12.1	Standing	15.1	Walking	59.4	Safe
11	13.5	Standing	16.5	Walking	57.4	Safe
12	11.2	Standing	14.6	Standing	57.2	Safe
13	9.9	Sitting	11.8	Standing	44.3	Safe
14	10.7	Standing	13.1	Standing	50.9	Safe
15	12.8	Standing	16.7	Walking	61.0	Safe
16	13.6	Standing	18.2	Walking	69.3	Safe
17	13.3	Standing	17.7	Walking	69.0	Safe
18	13.8	Standing	18.0	Walking	66.0	Safe
19	16.5	Walking	20.8	Uncomfortable	72.4	Safe
20	10.4	Standing	13.4	Standing	53.9	Safe
21	9.2	Sitting	11.6	Standing	46.5	Safe
22	9.2	Sitting	11.6	Standing	52.3	Safe
23	9.6	Sitting	11.8	Standing	52.6	Safe
24	13.7	Standing	16.8	Walking	65.1	Safe
25	9.5	Sitting	12.4	Standing	56.6	Safe
26	11.8	Standing	14.2	Standing	57.1	Safe
27	13.0	Standing	15.8	Walking	64.5	Safe
28	10.0	Sitting	12.7	Standing	51.3	Safe
29	10.0	Sitting	12.2	Standing	50.3	Safe
30	10.7	Standing	12.9	Standing	54.2	Safe
31	10.8	Standing	12.9	Standing	52.6	Safe
32	9.8	Sitting	11.9	Standing	50.4	Safe
33	10.0	Sitting	12.4	Standing	50.5	Safe
34	13.7	Standing	16.1	Walking	57.6	Safe
35	12.8	Standing	15.7	Walking	53.4	Safe

Guidelines	
Pedestrian Comfort	**20% exceedance wind speed** 0-10 km/h = Sitting, 10-15 km/h = Standing, 15-20 km/h = Walking, >20 km/h = Uncomfortable
Pedestrian Safety	**0.1% exceedance wind speed** 0-90 km/h = Safe

TABLE A2: SUMMARY OF PEDESTRIAN COMFORT (EXISTING SCENARIO)

Sensor	Pedestrian Comfort				Pedestrian Safety	
	Summer		Winter		Annual	
	Wind Speed	Comfort Class	Wind Speed	Comfort Class	Wind Speed	Safety Class
36	8.2	Sitting	10.0	Sitting	37.9	Safe
37	10.7	Standing	12.9	Standing	62.5	Safe
38	13.0	Standing	15.5	Walking	58.7	Safe
39	11.3	Standing	13.4	Standing	52.7	Safe
40	13.6	Standing	16.4	Walking	64.0	Safe
41	10.1	Standing	12.2	Standing	57.2	Safe
42	11.2	Standing	15.2	Walking	65.6	Safe
43	12.6	Standing	16.9	Walking	65.7	Safe
44	10.4	Standing	13.2	Standing	55.0	Safe
45	12.9	Standing	15.2	Walking	55.9	Safe
46	8.4	Sitting	9.6	Sitting	41.1	Safe
47	7.2	Sitting	8.6	Sitting	34.9	Safe
48	7.8	Sitting	9.0	Sitting	33.5	Safe
49	8.3	Sitting	10.0	Sitting	37.3	Safe
50	8.5	Sitting	10.0	Sitting	37.7	Safe
51	8.8	Sitting	10.9	Standing	45.2	Safe
52	12.4	Standing	15.7	Walking	59.7	Safe
53	11.7	Standing	14.7	Standing	56.8	Safe
54	11.5	Standing	14.5	Standing	54.1	Safe
55	11.8	Standing	14.5	Standing	54.7	Safe
56	11.3	Standing	14.5	Standing	57.2	Safe
57	8.9	Sitting	11.1	Standing	45.7	Safe
58	8.3	Sitting	10.1	Standing	44.9	Safe
59	8.2	Sitting	10.3	Standing	46.1	Safe
60	9.1	Sitting	11.1	Standing	48.4	Safe
61	10.4	Standing	12.7	Standing	52.5	Safe
62	10.4	Standing	12.6	Standing	52.5	Safe
63	10.4	Standing	13.2	Standing	56.3	Safe
64	10.5	Standing	13.0	Standing	51.7	Safe
65	7.8	Sitting	9.9	Sitting	44.3	Safe



APPENDIX B

PEDESTRIAN COMFORT SUITABILITY, TABLES B1-B3 (PROPOSED SCENARIO)

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Guidelines	
Pedestrian Comfort	**20% exceedance wind speed** 0-10 km/h = Sitting, 10-15 km/h = Standing, 15-20 km/h = Walking, >20 km/h = Uncomfortable
Pedestrian Safety	**0.1% exceedance wind speed** 0-90 km/h = Safe

TABLE B1: SUMMARY OF PEDESTRIAN COMFORT (PROPOSED SCENARIO)

Sensor	Pedestrian Comfort				Pedestrian Safety	
	Summer		Winter		Annual	
	Wind Speed	Comfort Class	Wind Speed	Comfort Class	Wind Speed	Safety Class
1	12.5	Standing	15.0	Walking	55.6	Safe
2	14.9	Standing	18.5	Walking	62.4	Safe
3	15.3	Walking	18.3	Walking	61.8	Safe
4	14.7	Standing	18.4	Walking	65.1	Safe
5	15.5	Walking	18.3	Walking	63.7	Safe
6	10.1	Standing	13.0	Standing	57.1	Safe
7	11.3	Standing	14.7	Standing	62.1	Safe
8	13.8	Standing	17.7	Walking	70.4	Safe
9	16.4	Walking	19.6	Walking	70.7	Safe
10	15.9	Walking	19.6	Walking	70.9	Safe
11	11.7	Standing	14.0	Standing	50.5	Safe
12	11.3	Standing	13.7	Standing	50.5	Safe
13	9.9	Sitting	11.6	Standing	44.0	Safe
14	11.0	Standing	13.2	Standing	49.8	Safe
15	12.3	Standing	15.7	Walking	56.8	Safe
16	13.3	Standing	17.2	Walking	65.9	Safe
17	13.4	Standing	17.6	Walking	68.0	Safe
18	13.8	Standing	18.2	Walking	71.2	Safe
19	14.2	Standing	19.0	Walking	76.0	Safe
20	10.8	Standing	14.1	Standing	62.5	Safe
21	10.0	Sitting	12.9	Standing	55.1	Safe
22	11.2	Standing	14.5	Standing	63.2	Safe
23	11.4	Standing	14.4	Standing	63.2	Safe
24	12.0	Standing	13.8	Standing	56.6	Safe
25	8.9	Sitting	11.4	Standing	46.4	Safe
26	11.5	Standing	13.9	Standing	53.7	Safe
27	12.1	Standing	15.3	Walking	67.5	Safe
28	10.1	Standing	13.3	Standing	63.3	Safe
29	11.6	Standing	15.1	Walking	67.4	Safe
30	10.5	Standing	13.9	Standing	62.3	Safe
31	10.5	Standing	13.9	Standing	65.0	Safe
32	10.7	Standing	13.3	Standing	58.5	Safe
33	12.6	Standing	15.7	Walking	71.6	Safe
34	17.0	Walking	20.2	Uncomfortable	67.1	Safe
35	13.7	Standing	17.0	Walking	60.2	Safe

Guidelines	
Pedestrian Comfort	**20% exceedance wind speed** 0-10 km/h = Sitting, 10-15 km/h = Standing, 15-20 km/h = Walking, >20 km/h = Uncomfortable
Pedestrian Safety	**0.1% exceedance wind speed** 0-90 km/h = Safe

TABLE B2: SUMMARY OF PEDESTRIAN COMFORT (PROPOSED SCENARIO)

Sensor	Pedestrian Comfort				Pedestrian Safety	
	Summer		Winter		Annual	
	Wind Speed	Comfort Class	Wind Speed	Comfort Class	Wind Speed	Safety Class
36	16.6	Walking	20.5	Uncomfortable	71.1	Safe
37	14.2	Standing	15.8	Walking	58.5	Safe
38	11.2	Standing	13.6	Standing	51.8	Safe
39	10.6	Standing	12.2	Standing	44.1	Safe
40	11.2	Standing	14.1	Standing	55.4	Safe
41	9.8	Sitting	11.7	Standing	45.9	Safe
42	9.5	Sitting	12.4	Standing	50.7	Safe
43	10.5	Standing	14.0	Standing	56.1	Safe
44	9.3	Sitting	11.7	Standing	45.9	Safe
45	10.5	Standing	12.9	Standing	49.0	Safe
46	13.8	Standing	17.3	Walking	62.9	Safe
47	12.1	Standing	14.9	Standing	54.3	Safe
48	9.8	Sitting	12.8	Standing	48.4	Safe
49	10.7	Standing	13.6	Standing	54.8	Safe
50	11.9	Standing	15.5	Walking	59.8	Safe
51	9.0	Sitting	11.3	Standing	52.3	Safe
52	10.7	Standing	15.2	Walking	68.2	Safe
53	13.2	Standing	17.0	Walking	65.9	Safe
54	12.1	Standing	15.8	Walking	59.3	Safe
55	12.3	Standing	13.5	Standing	51.8	Safe
56	9.1	Sitting	11.4	Standing	48.2	Safe
57	9.5	Sitting	11.8	Standing	50.4	Safe
58	9.4	Sitting	12.2	Standing	49.9	Safe
59	8.5	Sitting	10.6	Standing	48.6	Safe
60	7.8	Sitting	9.9	Sitting	41.4	Safe
61	7.7	Sitting	9.2	Sitting	36.6	Safe
62	13.0	Standing	15.8	Walking	61.4	Safe
63	11.9	Standing	16.0	Walking	74.2	Safe
64	10.1	Standing	13.0	Standing	57.1	Safe
65	9.0	Sitting	11.4	Standing	50.3	Safe
66	7.1	Sitting	8.9	Sitting	36.8	Safe
67	23.4	Uncomfortable	29.7	Uncomfortable	99.8	Dangerous
68	14.8	Standing	16.8	Walking	78.9	Safe
69	22.3	Uncomfortable	25.9	Uncomfortable	80.7	Safe
70	14.5	Standing	20.2	Uncomfortable	87.6	Safe

Guidelines	
Pedestrian Comfort	**20% exceedance wind speed** 0-10 km/h = Sitting, 10-15 km/h = Standing, 15-20 km/h = Walking, >20 km/h = Uncomfortable
Pedestrian Safety	**0.1% exceedance wind speed** 0-90 km/h = Safe

TABLE B3: SUMMARY OF PEDESTRIAN COMFORT (PROPOSED SCENARIO)

Sensor	Pedestrian Comfort				Pedestrian Safety	
	Summer		Winter		Annual	
	Wind Speed	Comfort Class	Wind Speed	Comfort Class	Wind Speed	Safety Class
71	22.0	Uncomfortable	27.7	Uncomfortable	98.9	Dangerous
72	17.2	Walking	22.7	Uncomfortable	74.0	Safe
73	16.1	Walking	19.8	Walking	79.4	Safe
74	18.6	Walking	21.8	Uncomfortable	79.0	Safe
75	17.3	Walking	21.2	Uncomfortable	85.6	Safe
76	16.5	Walking	21.6	Uncomfortable	79.3	Safe
77	13.2	Standing	15.4	Walking	70.9	Safe
78	17.8	Walking	26.2	Uncomfortable	98.3	Dangerous



APPENDIX C

WIND TUNNEL SIMULATION OF THE NATURAL WIND

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WIND TUNNEL SIMULATION OF THE NATURAL WIND

Wind flowing over the surface of the earth develops a boundary layer due to the drag produced by surface features such as vegetation and man-made structures. Within this boundary layer, the mean wind speed varies from zero at the surface to the gradient wind speed at the top of the layer. The height of the top of the boundary layer is referred to as the gradient height, above which the velocity remains more-or-less constant for a given synoptic weather system. The mean wind speed is taken to be the average value over one hour. Superimposed on the mean wind speed are fluctuating (or turbulent) components in the longitudinal (i.e. along wind), vertical and lateral directions. Although turbulence varies according to the roughness of the surface, the turbulence level generally increases from nearly zero (smooth flow) at gradient height to maximum values near the ground. While for a calm ocean the maximum could be 20%, the maximum for a very rough surface such as the center of a city could be 100%, or equal to the local mean wind speed. The height of the boundary layer varies in time and over different terrain roughness within the range of 400 metres (m) to 600 m.

Simulating real wind behaviour in a wind tunnel requires simulating the variation of mean wind speed with height, simulating the turbulence intensity, and matching the typical length scales of turbulence. It is the ratio between wind tunnel turbulence length scales and turbulence scales in the atmosphere that determines the geometric scales that models can assume in a wind tunnel. Hence, when a 1:200 scale model is quoted, this implies that the turbulence scales in the wind tunnel and the atmosphere have the same ratios. Some flexibility in this requirement has been shown to produce reasonable wind tunnel predictions compared to full scale. In model scale the mean and turbulence characteristics of the wind are obtained with the use of spires at one end of the tunnel and roughness elements along the floor of the tunnel. The fan is located at the model end and wind is pulled over the spires, roughness elements and model. It has been found that, to a good approximation, the mean wind profile can be represented by a power law relation, shown below, giving height above ground versus wind speed.

$$U = U_g \left(\frac{Z}{Z_g} \right)^{\alpha}$$

Where; U = mean wind speed, U_g = gradient wind speed, Z = height above ground, Z_g = depth of the boundary layer (gradient height) and α is the power law exponent.

Figure B1 on the following page plots three velocity profiles for open country, and suburban and urban exposures.

The exponent α varies according to the type of upwind terrain; α ranges from 0.14 for open country to 0.33 for an urban exposure. Figure C2 illustrates the theoretical variation of turbulence for open country, suburban and urban exposures.

The integral length scale of turbulence can be thought of as an average size of gust in the atmosphere. Although it varies with height and ground roughness, it has been found to generally be in the range of 100 m to 200 m in the upper half of the boundary layer. Thus, for a 1:300 scale, the model value should be between 1/3 and 2/3 of a metre. Integral length scales are derived from power spectra, which describe the energy content of wind as a function of frequency. There are several ways of determining integral length scales of turbulence. One way is by comparison of a measured power spectrum in model scale to a non-dimensional theoretical spectrum such as the Davenport spectrum of longitudinal turbulence. Using the Davenport spectrum, which agrees well with full-scale spectra, one can estimate the integral scale by plotting the theoretical spectrum with varying L until it matches as closely as possible the measured spectrum:

$$f \times S(f) = \frac{\frac{4(Lf)^2}{U_{10}{}^2}}{\left[1 + \frac{4(Lf)^2}{U_{10}{}^2}\right]^{\frac{4}{3}}}$$

Where, f is frequency, S(f) is the spectrum value at frequency f, U10 is the wind speed 10 m above ground level, and L is the characteristic length of turbulence.

Once the wind simulation is correct, the model, constructed to a suitable scale, is installed at the center of the working section of the wind tunnel. Different wind directions are represented by rotating the model to align with the wind tunnel center-line axis.

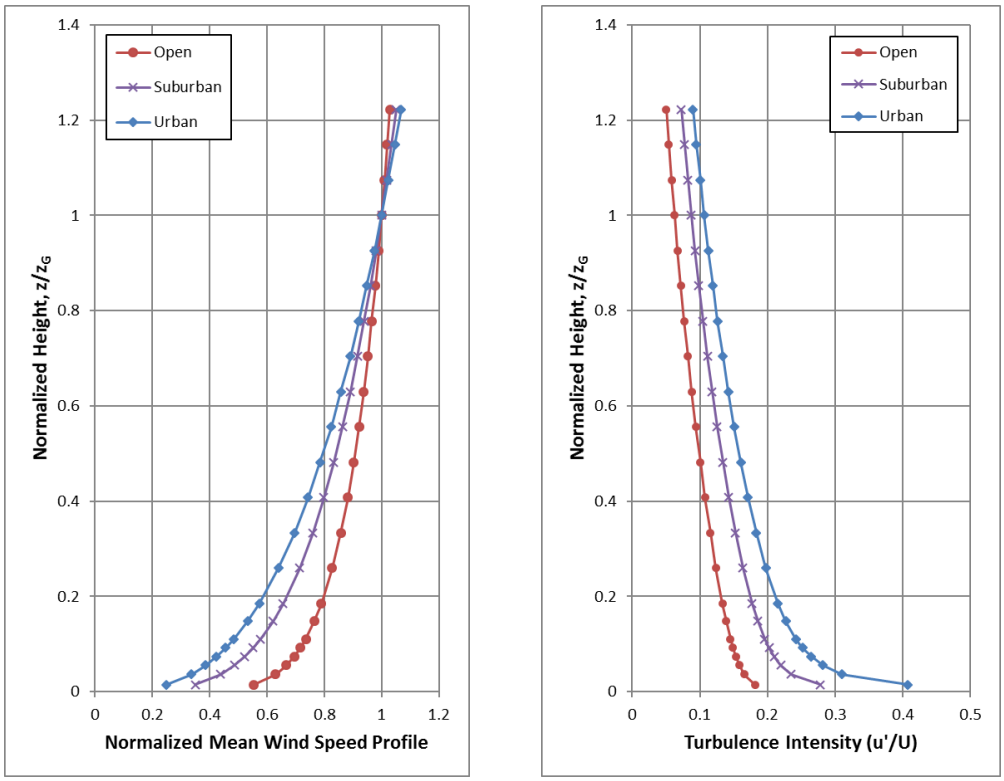

FIGURE C1 (LEFT): MEAN WIND SPEED PROFILES;
FIGURE C2 (RIGHT): TURBULENCE INTENSITY PROFILES

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APPENDIX D

PEDESTRIAN LEVEL WIND MEASUREMENT METHODOLOGY

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PEDESTRIAN LEVEL WIND MEASUREMENT METHODOLOGY

Pedestrian level wind studies are performed in a wind tunnel on a physical model of the study buildings at a suitable scale. Instantaneous wind speed measurements are recorded at a model height corresponding to 1.5 m full scale using either a hot wire anemometer or a pressure-based transducer. Measurements are performed at any number of locations on the model and usually for 36 wind directions. For each wind direction, the roughness of the upwind terrain is matched in the wind tunnel to generate the correct mean and turbulent wind profiles approaching the model.

The hot wire anemometer is an instrument consisting of a thin metallic wire conducting an electric current. It is an omni-directional device equally sensitive to wind approaching from any direction in the horizontal plane. By compensating for the cooling effect of wind flowing over the wire, the associated electronics produce an analog voltage signal that can be calibrated against velocity of the air stream. For all measurements, the wire is oriented vertically so as to be sensitive to wind approaching from all directions in a horizontal plane.

The pressure sensor is a small cylindrical device that measures instantaneous pressure differences over a small area. The sensor is connected via tubing to a transducer that translates the pressure to a voltage signal that is recorded by computer. With appropriately designed tubing, the sensor is sensitive to a suitable range of fluctuating velocities.

For a given wind direction and location on the model, a time history of the wind speed is recorded for a period of time equal to one hour in full-scale. The analog signal produced by the hot wire or pressure sensor is digitized at a rate of 400 samples per second. A sample recording for several seconds is illustrated in Figure D1. This data is analyzed to extract the mean, root-mean-square (rms) and the peak of the signal. The peak value, or gust wind speed, is formed by averaging a number of peaks obtained from sub-intervals of the sampling period. The mean and gust speeds are then normalized by the wind tunnel gradient wind speed, which is the speed at the top of the model boundary layer, to obtain mean and gust ratios. At each location, the measurements are repeated for 36 wind directions to produce normalized polar plots, which will be provided upon request.

In order to determine the duration of various wind speeds at full scale for a given measurement location the gust ratios are combined with a statistical (mathematical) model of the wind climate for the project site. This mathematical model is based on hourly wind data obtained from one or more meteorological stations (usually airports) close to the project location. The probability model used to represent the data is the Weibull distribution expressed as:

$$P\left(>U_g\right) = A_\theta \bullet \exp\left[\left(-\frac{U_g}{C_\theta}\right)^{K\theta}\right]$$

Where,

P (> U_g) is the probability, fraction of time, that the gradient wind speed ***U_g*** is exceeded; ***θ*** is the wind direction measured clockwise from true north, ***A***, ***C***, ***K*** are the Weibull coefficients, (Units: A - dimensionless, C - wind speed units [km/h] for instance, K - dimensionless). ***A_θ*** is the fraction of time wind blows from a 10° sector centered on ***θ***.

Analysis of the hourly wind data recorded for a length of time, on the order of 10 to 30 years, yields the ***A_θ***, ***C_θ*** and ***K_θ*** values. The probability of exceeding a chosen wind speed level, say 20 km/h, at sensor *N* is given by the following expression:

$$P_N(>20) = \Sigma_\theta P\left[\frac{(>20)}{\left(\frac{U_N}{U_g}\right)}\right]$$

P_N (> 20) = Σ_θ P { > 20/(U_N/Ug) }

Where, ***U_N/U_g*** is the gust velocity ratios, where the summation is taken over all 36 wind directions at 10° intervals.

If there are significant seasonal variations in the weather data, as determined by inspection of the C_θ and K_θ values, then the analysis is performed separately for two or more times corresponding to the groupings of seasonal wind data. Wind speed levels of interest for predicting pedestrian comfort are based on the comfort guidelines chosen to represent various pedestrian activity levels as discussed in the main text.

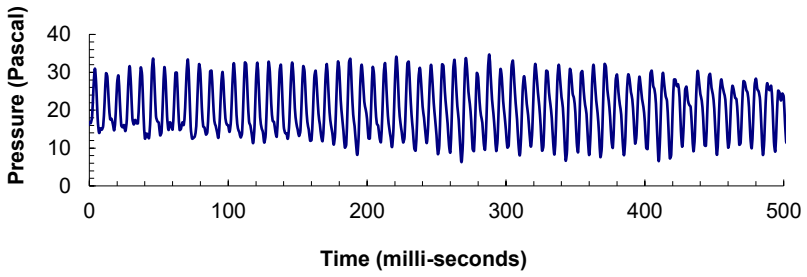

FIGURE D1: TIME VERSUS VELOCITY TRACE FOR A TYPICAL WIND SENSOR

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