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Date: May 4, 2022

To: Ken Michaud
Sunray Group
515 Consumers Road, Suite 701
Toronto, ON M2J 4Z2

Re: **Pedestrian Wind Assessment**
10 Aspen Springs Drive
Bowmanville, ON
SLR Project #241.30367.00000

Team: Nishat Nourin, M.Eng., P.Eng.
Microclimate Engineer

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Credit: Mataj Architects Inc.

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TABLE OF CONTENTS

1.0 INTRODUCTION

SLR Consulting (Canada) Ltd. (SLR) was retained by Sunray Group to conduct a pedestrian wind assessment for the proposed development at 10 Aspen Springs Drive in Bowmanville, Ontario. This report is in support of the Zoning Bylaw (ZBA) application for the development.

1.1 Existing Site

The proposed development is located at the northwest corner of the intersection of Bowmanville Avenue and Aspen Springs Drive. The site is currently unoccupied. **Figure 1** provides an aerial view of the immediate study area. A virtual site visit was conducted by SLR using Google Earth images dated June and August 2021; some of these images are included in **Figures 2a** through **2d**.

Immediately surrounding the site are empty treed lots to the west through northeast, albeit with a single storey commercial building to the north with low rise residential buildings to the east through south and southwest. Beyond the immediate surroundings are mainly low-rise residential and commercial buildings in all directions. Lake Ontario is located approximately 3.5 km to the south.

Typically, developments with Site Plan Control approval and/or those currently under construction within a 500 radius are included as existing surroundings. For this assessment, the SPC-approved development at 51-55 Clarington Boulevard was included.

Figure 1: Aerial view of existing site & surroundings
Credit: Google Earth Pro, dated 5/6/2018

Figure 2a: Looking north along Bowmanville Avenue (site to the left)

Figure 2b: Looking northeast along Aspen Springs Drive

Figure 2c: Looking northwest at the site from Bowmanville Avenue

Figure 2d: Looking southwest along Aspen Springs Drive (site to the right)

1.2 Proposed Development

The proposed development includes two buildings. Building 1 includes two 25-storey tall towers (Towers A and B) atop a four-storey podium on the north half of the site, with the long axis of the building parallel to Bowmanville Avenue. On the south edge there is a nine storey tall building (Building 2), with the long axis parallel to Aspen Springs Drive. Figure 3 shows the rendering of the proposed development.

1.3 Areas of Interest

Areas of interest for pedestrian wind conditions include those areas which pedestrians are expected to use on a frequent basis. Typically, these include sidewalks, main entrances, transit stops, plazas and parks. There are two transit stops along Bowmanville Avenue, within the project vicinity.

The main entrance to Towers A and B is located on the west façade of its building, and the main entrance to Building 2 is located on the north side of its building. Other secondary entrances and exits are located along all sides of the proposed developments. There is an outdoor amenity area between Tower B and Building 2. In addition, outdoor amenity terrace associated with the proposed development are located on the 5th floor podium roof of Building 1, and above the 10th floor roof of Building 2.

On-site areas of interest are shown in Figure 4.

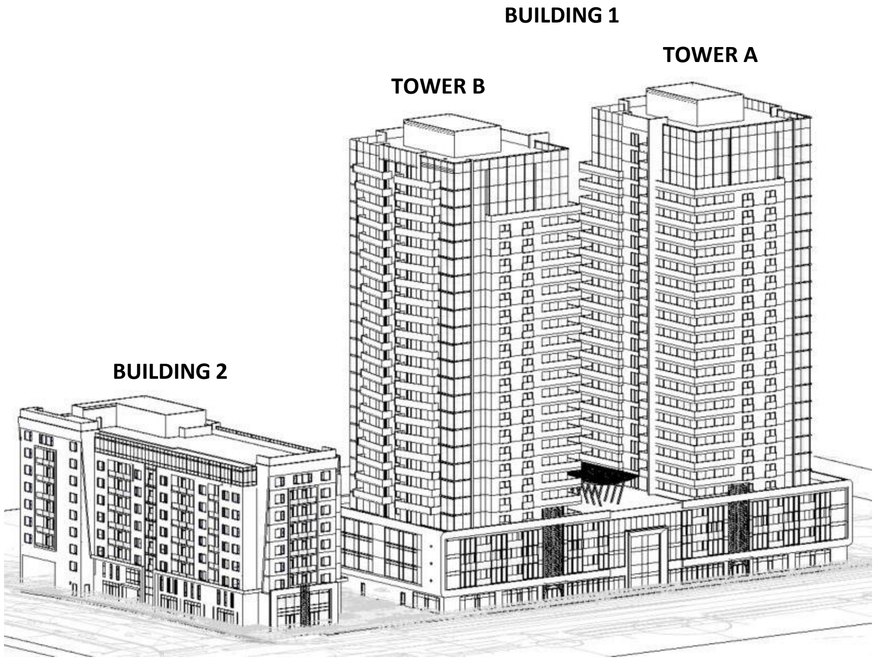


Figure 3: Rendering of proposed development

Credit: Mataj Architects Inc.

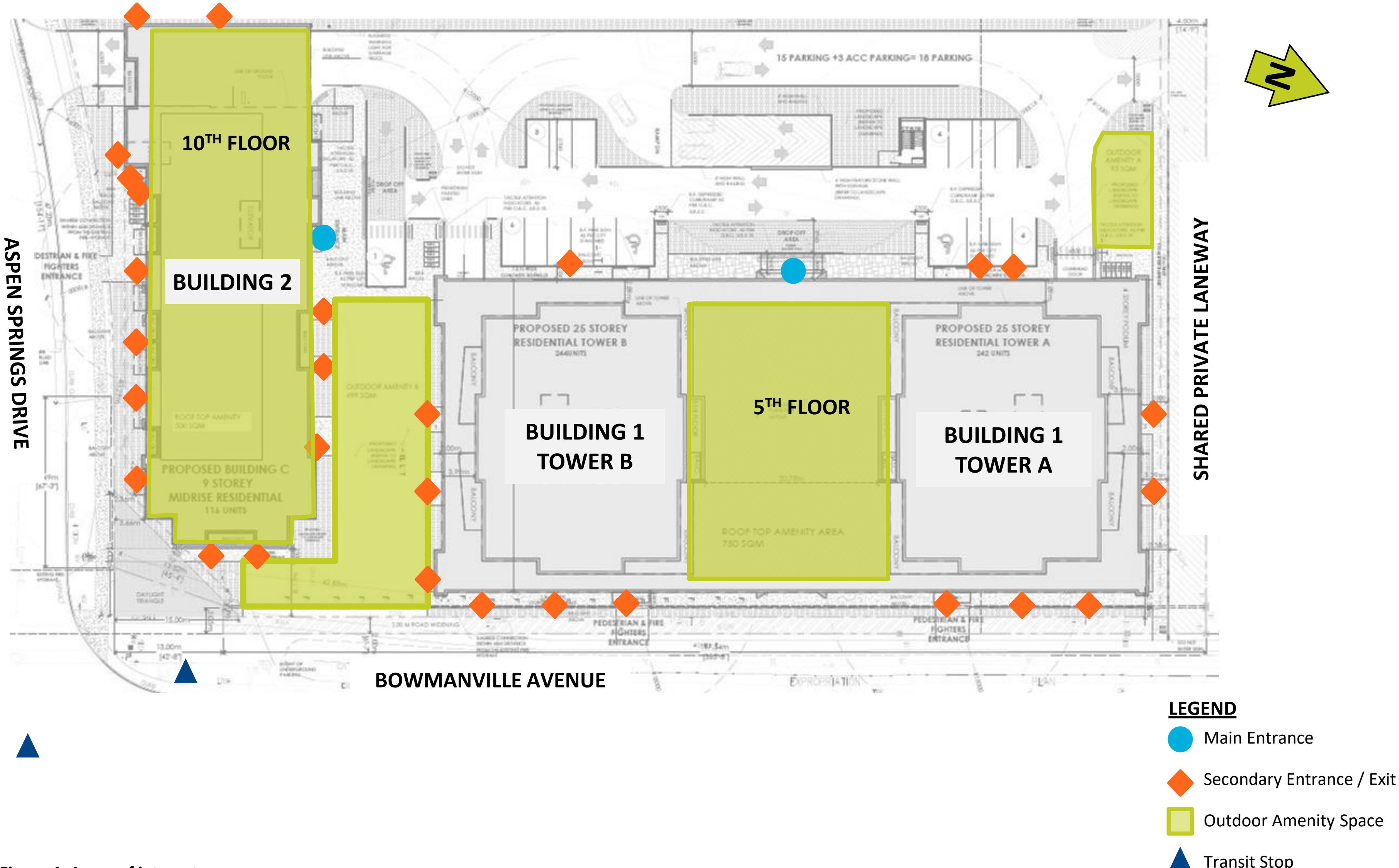


Figure 4: Areas of interest

2.0 APPROACH

A screening-level assessment was conducted using computational fluid dynamics (CFD). As with any simulation, there are some limitations with this modeling technique, specifically in the ability to simulate the turbulence, or gustiness, of the wind. Nonetheless, CFD analysis remains a useful tool to identify potential wind issues, especially when assessing mean wind speeds. This CFD-based mean wind speed assessment employs a comparable analysis methodology to that used in wind tunnel testing. The results of CFD modeling are also an excellent means of readily identifying relative changes in wind conditions associated with different site configurations or with alternative built forms.

2.1 Methodology

Wind comfort conditions for areas of interest were predicted on and around the development site to identify potentially problematic windy areas. A 3D model of the proposed development, as well as floor plans and elevations, were provided by Mataj Architects Inc. on February 28, March 2 and 3, 2022. A view of the 3D model used in the computer wind comfort analysis is shown in **Figure 5**. This model included surrounding buildings within 500 m from the study site centre. The simulations were performed using CFD software by Meteodyn Inc.

The entire 3D space throughout the modeled area is filled with a three-dimensional grid. The CFD virtual wind tunnel calculates wind speed at each one of the 3D grid points. The upstream “roughness” for each test direction is adjusted to reflect the various upwind conditions and wind characteristics encountered around the actual site. Wind flows for a total of 16 compass directions were simulated. Although wind speeds are calculated throughout the entire modeled area, wind comfort conditions were only plotted for a smaller area immediately surrounding the proposed development. SLR assessed two configurations for comparison purposes. The descriptions are as follows:

- **Existing Configuration:** Existing site with existing and approved surroundings.
- **Proposed Configuration:** Proposed development with existing and approved surroundings.

A view of two configurations are shown in **Figures 5a** and **5b**.

Wind flows were predicted for both the existing site, as well as with the proposed development for comparison purposes. The CFD-predicted wind speeds for all test directions and grid points were then combined with historical wind climate data for the region to predict the occurrence of wind speeds in the pedestrian realm, and to compare against wind criteria for comfort and safety; these results are shown in the various wind flow images. The analysis of wind conditions is undertaken for four seasons: Winter (January to March), Spring (April to June), Summer (July to September), and Autumn (October to December). However, only the seasonal extremes of summer and winter are discussed within the report. The results of the analysis for spring and autumn can be found in **Appendix A**.

Results are presented through discussion of the wind conditions along major streets and the areas of interest. The comfort criteria are based on predictions of localized wind forces combined with frequency of occurrence. Climate issues that influence a person’s overall “thermal” comfort, (e.g., temperature, humidity, wind chill, exposure to sun or shade, etc.) are not considered in the comfort rating.

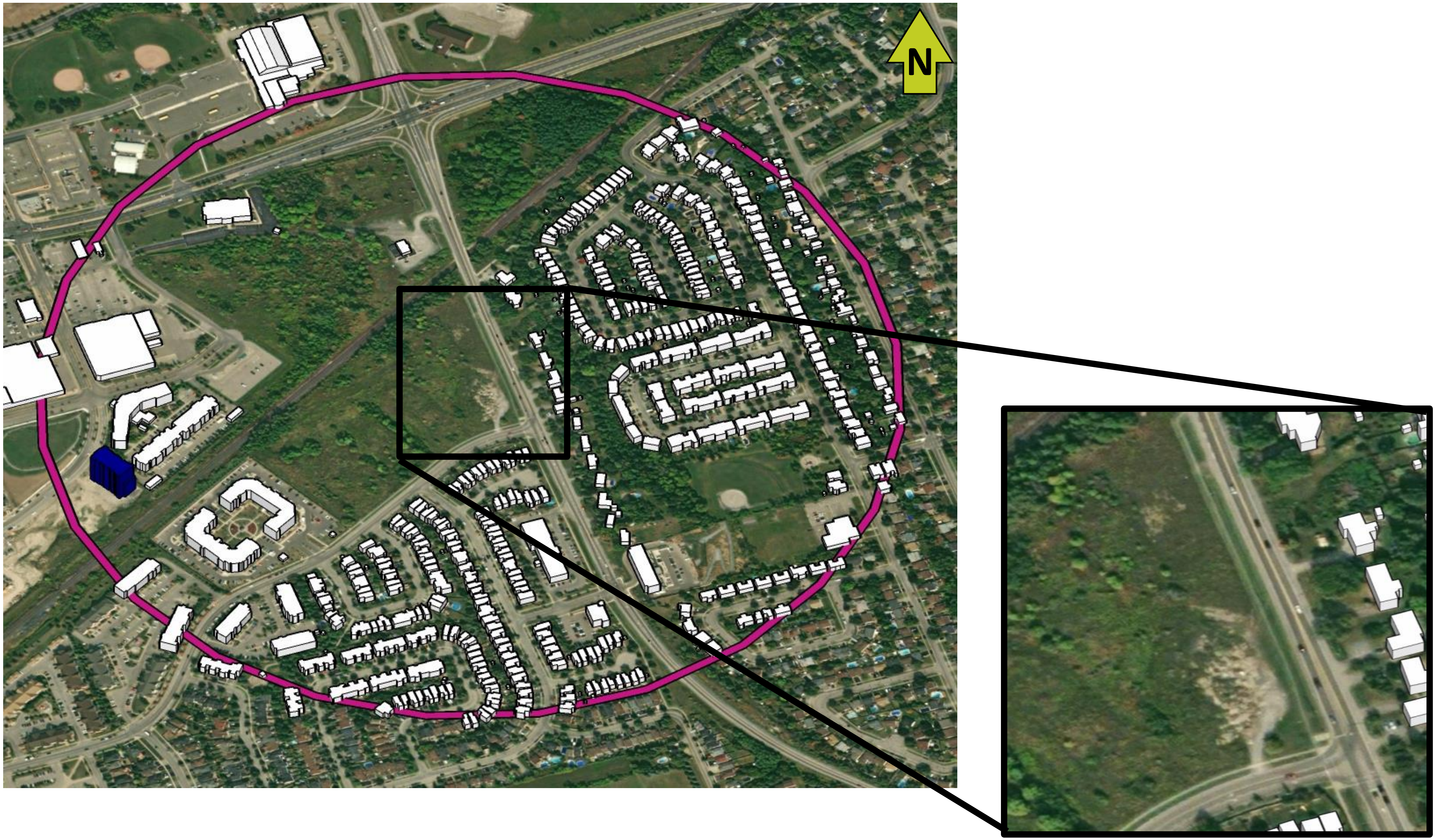


Figure 5a: Massing Model – Existing Configuration

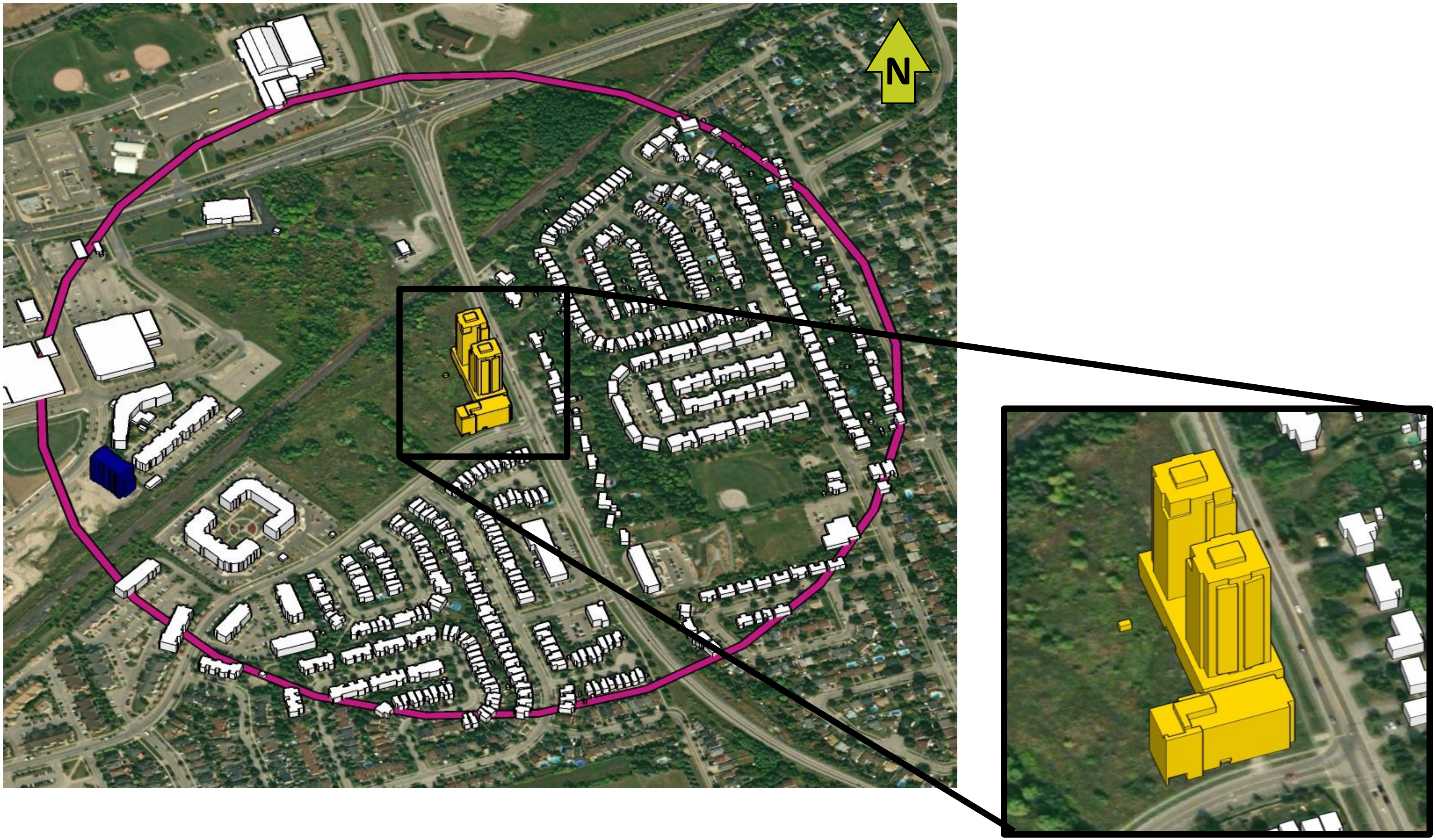


Figure 5b: Massing Model – Proposed Configuration

2.2 Wind Climate

Wind data recorded at Oshawa Airport in Oshawa for the period of 2010 to 2020 were obtained and analysed to create a wind climate model for the region. Annual and seasonal wind distribution diagrams ("wind roses") are shown in **Figure 6**. These diagrams illustrate the percentage of time wind blows from the 16 main compass directions. Of main interest are the longest peaks that identify the most frequently occurring wind directions. The annual wind rose indicates that wind approaching from the northwest quadrant as well as easterly directions are most prevalent. The seasonal wind roses readily show how the prevalent winds shift throughout the year.

The directions from which stronger winds (e.g., > 30 km/h) approach are also of interest as they have the highest potential of creating problematic wind conditions, depending upon site exposure and the building configurations. The wind roses in **Figure 6** also identify the directional frequency of these stronger winds, as indicated in the figure's legend colour key. On an annual basis, strong winds occur from the northwesterly, westerly and easterly sectors. All wind speeds and directions were included in the wind climate model.

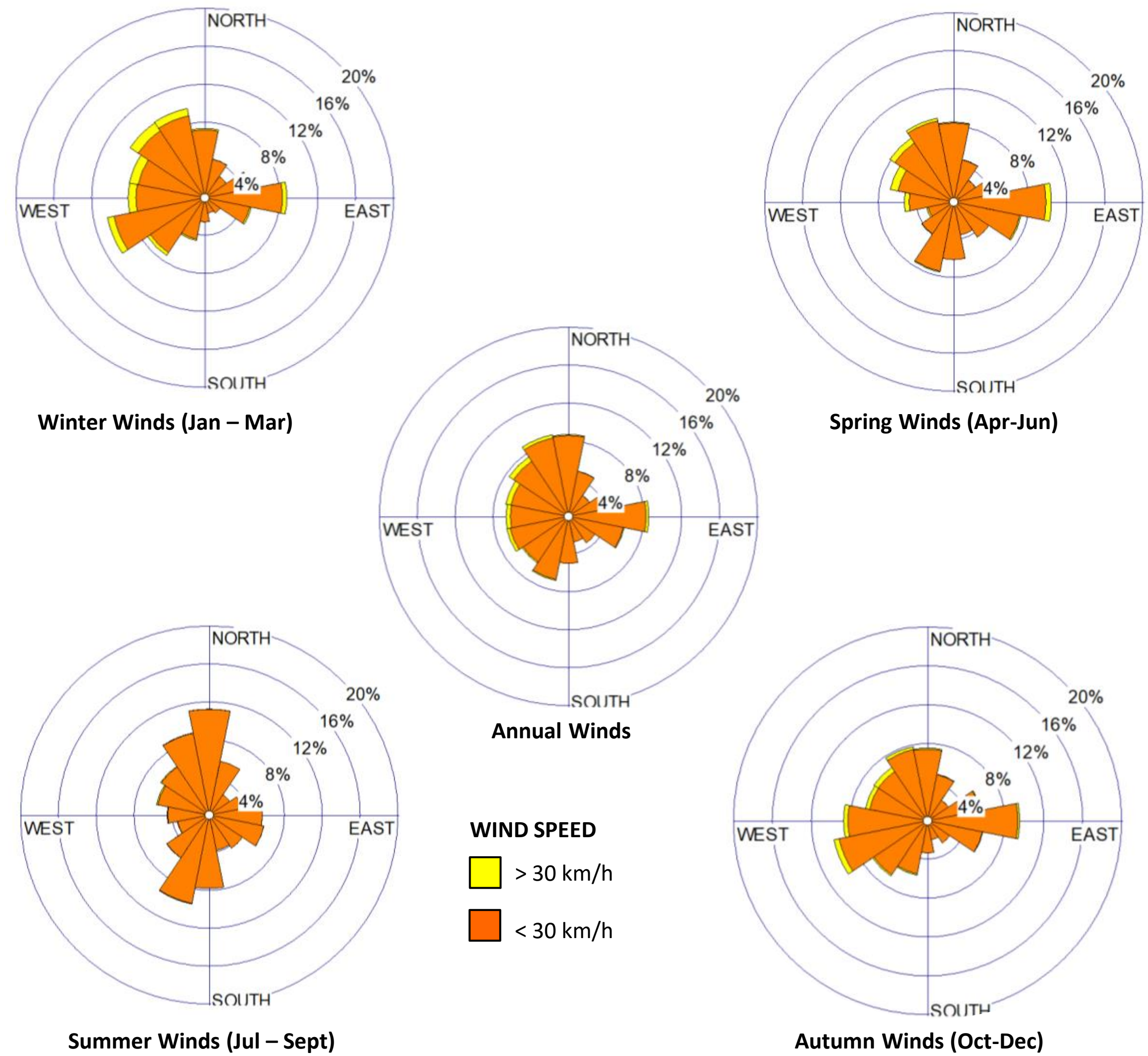


Figure 6: Wind Roses for Oshawa Airport (2010-2020)

3.0 PEDESTRIAN WIND CRITERIA

Wind comfort conditions are discussed in terms of being acceptable for certain pedestrian activities and are based on predicted wind force and the expected frequency of occurrence. Wind chill, clothing, humidity and exposure to direct sun, for example, all affect a person's thermal comfort; however, these influences are not considered in the wind comfort criteria.

The comfort criteria, which are based on certain predicted hourly mean wind speeds being exceeded 5% of the time, are summarized in **Table 1**. Generally, this is equivalent to a wind event of several hours duration occurring about once per week.

The criterion for wind safety in the table is based on hourly mean wind speeds that are exceeded once per year (approximately 0.01% of the time). When more than one event is predicted annually, wind mitigation measures are then advised. The wind safety criterion is shown in **Table 2**.

The criteria for wind comfort and safety used in this assessment are similar to those developed at the Boundary Layer Wind Tunnel Lab of Western University, together with building officials in London, England. They are broadly based on the Beaufort Scale and on previous criteria that were originally developed by Davenport. Similar criteria are used by the Alan G. Davenport Wind Engineering Group Boundary-Layer Wind Tunnel Laboratory for pedestrian wind study projects located around the globe. For a list of references, describing the criteria and history of its development see **Section 7.0**.

Table 1: Wind Comfort Criteria

Activity	Comfort Ranges for Mean Wind Speed Exceeded 5% of the Time		Description of Wind Comfort
Sitting	0 to 14 km/h	0 to 4 m/s	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper comfortably.
Standing	0 to 22 km/h	0 to 6 m/s	Gentle breezes suitable for main building entrances and transit stops.
Leisurely Walking	0 to 29 km/h	0 to 8 m/s	Moderate breezes suitable for walking along pedestrian thorough fares.
Fast Walking	0 to 36 km/h	0 to 10 m/s	Strong breezes that can be tolerated if one's objective is to walk, run or cycle without lingering.
Uncomfortable	> 36 km/h	> 10 m/s	Strong winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended.

Table 2: Wind Safety Criterion

Activity	Safety Criterion Mean Wind Speed Exceeded Once Per Year (0.01%)		Description of Wind Effects
Any	72 km/h	20 m/s	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.

4.0 RESULTS

Figures 7a through **10b** present graphical images of the wind comfort conditions for the summer and winter months around the proposed development. These represent the seasonal extremes of best and worst case. **Appendix A** presents the wind comfort conditions for spring and autumn. The "comfort zones" shown are based on an integration of wind speed and frequency for all 16 wind directions tested with the seasonal wind climate model. The presence of mature trees can lead to wind comfort levels that are marginally more comfortable than shown, during seasons when foliage is present. **Appendix B** presents the wind safety conditions on an annual basis.

There are generally accepted wind comfort levels that are desired for various pedestrian uses. However, in some climates these may be difficult to achieve in the winter due to the overall climate. For sidewalks, walkways and pathways, wind comfort suitable for leisurely walking are desirable year-round but may not be feasible in the winter. The presence of benches on a sidewalk, which are an optional use, does not change the overall wind comfort requirement for sidewalk. Wind conditions of fast walking are satisfactory for loading areas, laneways, and a limited portion of a sidewalk, considering exposure is brief for pedestrians. For main entrances, transit stops, and public amenity spaces such as parks and playgrounds, wind conditions conducive to standing are preferred throughout the year. For on-site amenity areas, wind conditions suitable for sitting or standing are desirable during the summer, with stronger wind flows, conducive to leisurely walking, tolerated in the winter. The most stringent category of sitting is desirable during the summer for dedicated seating areas, such as patios, where calmer wind is expected for the comfort of patrons.

4.1 Building Entrances & Walkways

Existing wind condition on-site are expected to be comfortable for sitting year-round (**Figures 7a and 8a**).

In the Proposed Configuration, wind conditions on the site are predicted to be comfortable for sitting or standing in the summer (**Figure 7b**). During the winter months, wind conditions conducive to leisurely walking are expected in some areas (**Figure 8b**). Wind conditions at the main entrances and all other secondary entrances and exits are expected to be comfortable for sitting or standing throughout the year, which is considered comfortable for the intended use (**Figures 9a** and **9b**).

4.2 Amenity Spaces

Wind conditions at the amenity space at grade between Tower B and Building 2 are expected to be comfortable for sitting or standing in the summer (**Figure 9a**). During the winter, wind conditions in this area are predicted to be comfortable for leisurely walking or better. Based on the landscape plan (received on March 4, 2022) a 2.5 m tall wind screen has been added on the west side of the amenity space, which will be beneficial to disrupting the strong wind flows from the west. With this feature and the proposed landscaping in place, wind conditions are expected to be suitable for the intended use throughout the year within the amenity space.

In the off-leash dog area near the northwest corner of Building 1, wind conditions are predicted to be comfortable for sitting or standing throughout the year, which is considered suitable for the intended use (**Figures 9a and 9b**).

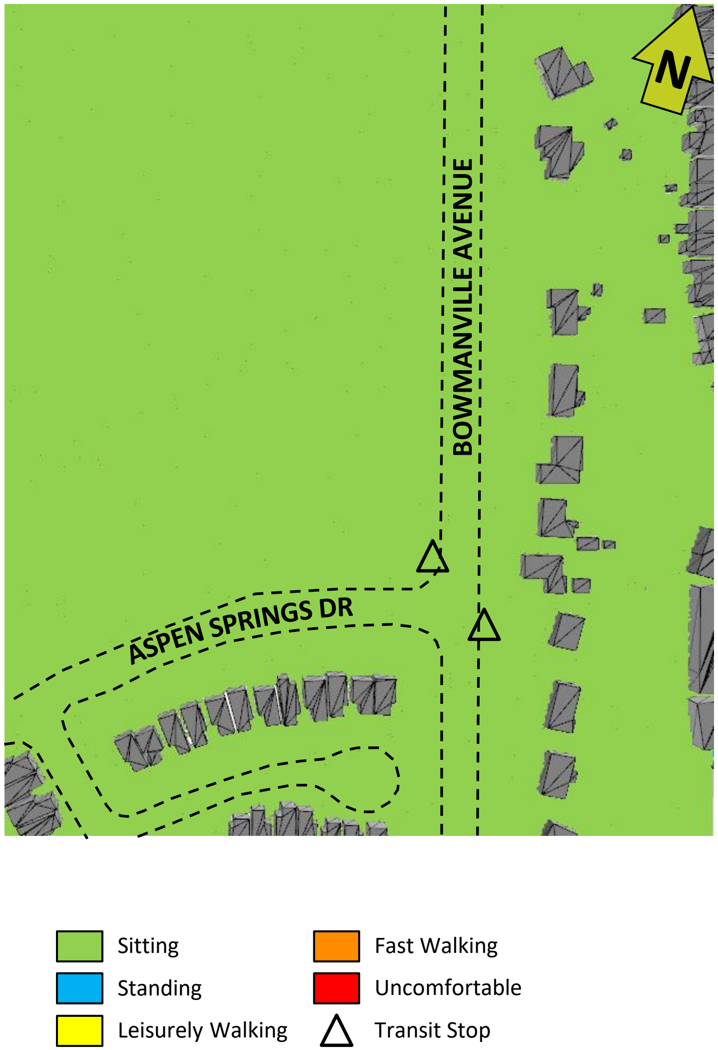


Figure 7a: Existing Configuration – Pedestrian Wind Comfort Summer – On-site & Surrounding Areas

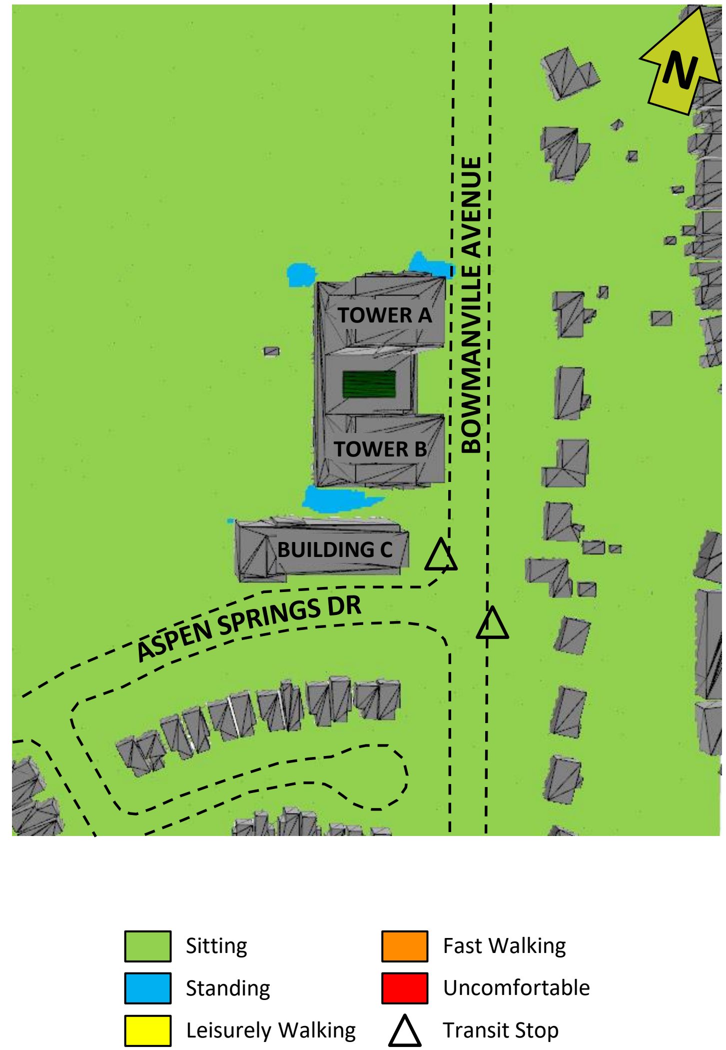
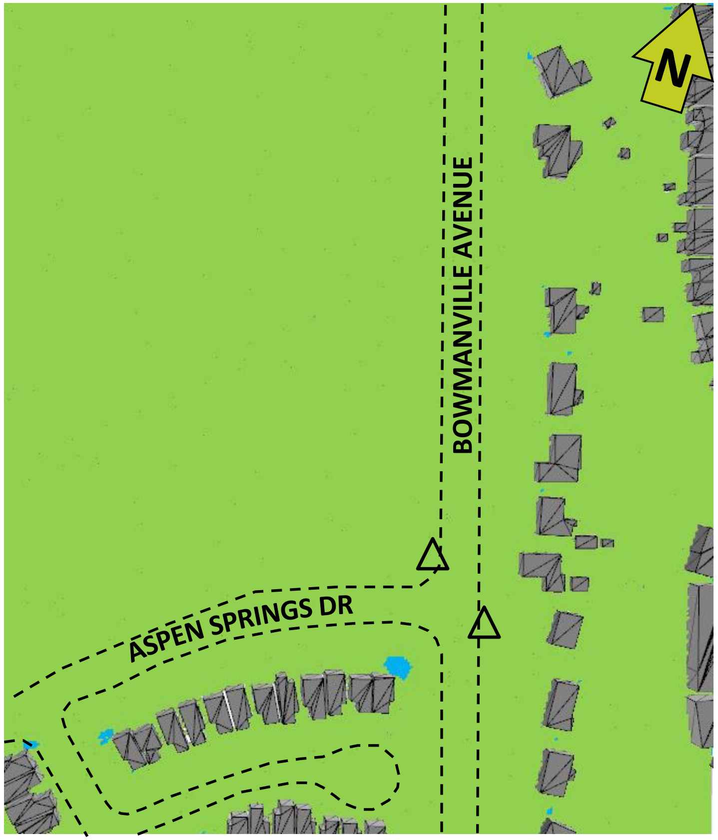
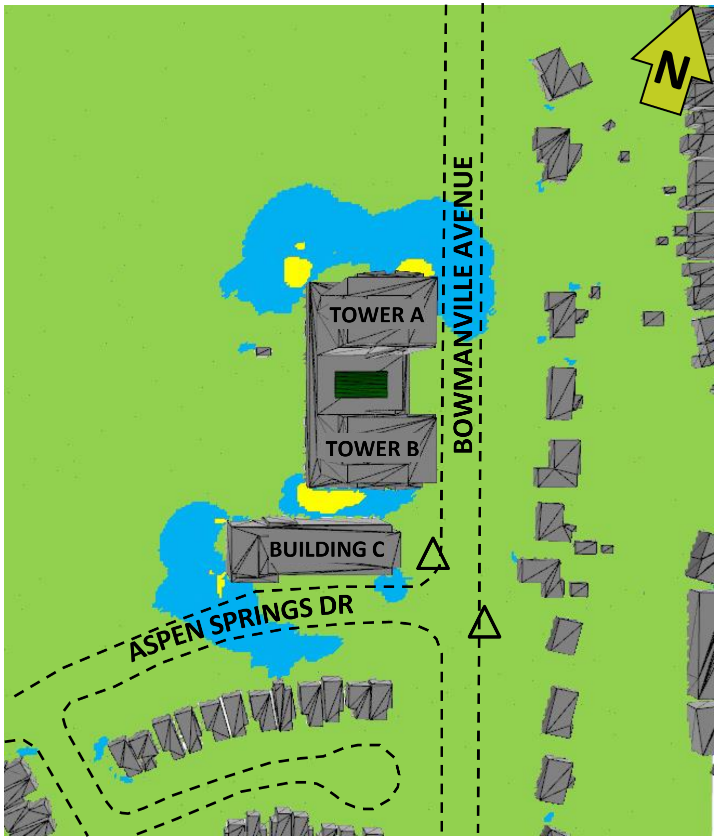


Figure 7b: Proposed Configuration – Pedestrian Wind Comfort Summer – On-site & Surrounding Areas



Sitting | Fast Walking
Standing | Uncomfortable
Leisurely Walking | Transit Stop

Figure 8a: **Existing Configuration – Pedestrian Wind Comfort Winter – On-site & Surrounding Areas**



Sitting | Fast Walking
Standing | Uncomfortable
Leisurely Walking | Transit Stop

Figure 8b: **Proposed Configuration – Pedestrian Wind Comfort Winter – On-site & Surrounding Areas**

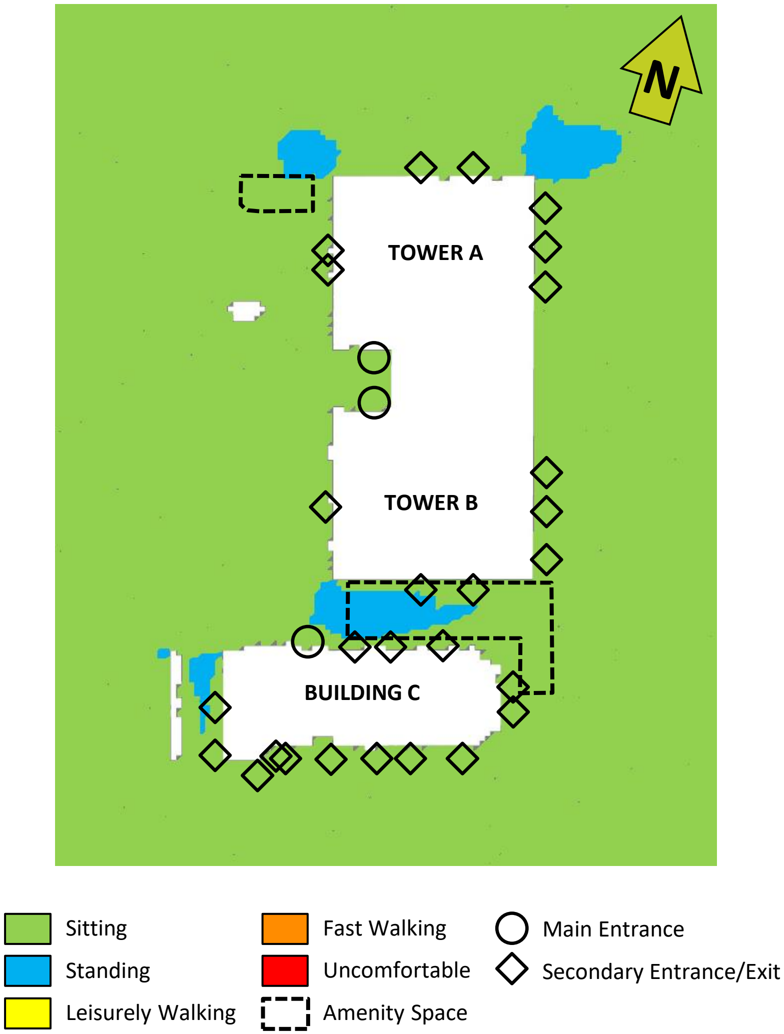


Figure 9a: Proposed Configuration – Pedestrian Wind Comfort Summer – Building Entrances & Walkways

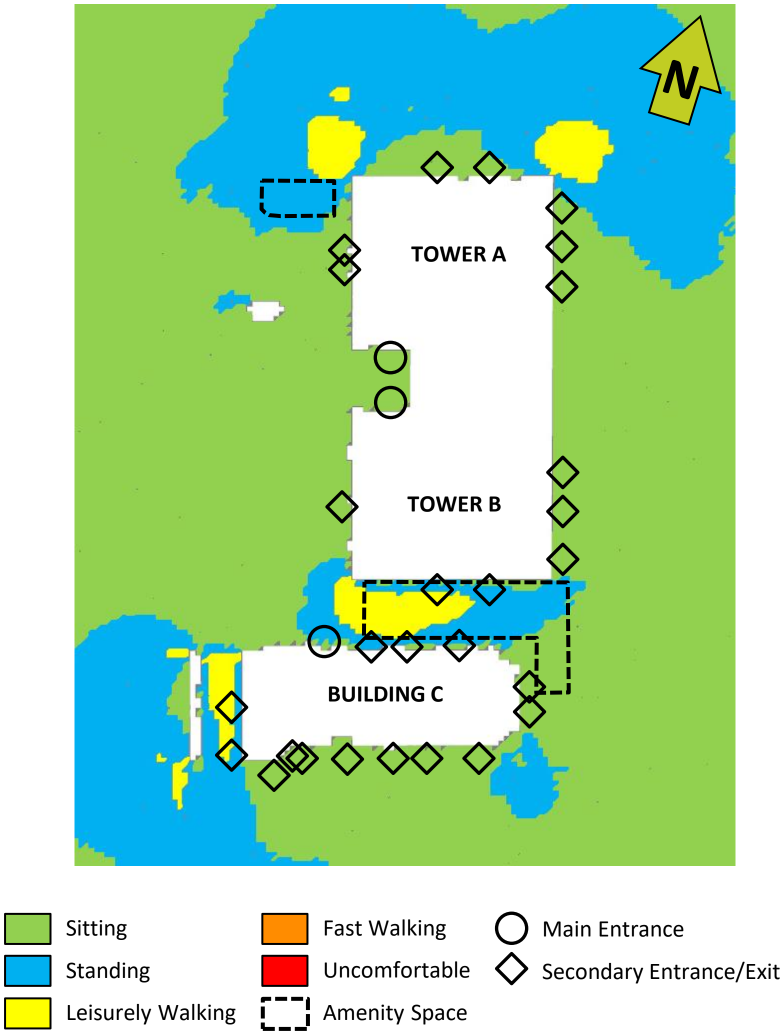


Figure 9b: Proposed Configuration – Pedestrian Wind Comfort Winter – Building Entrances & Walkways

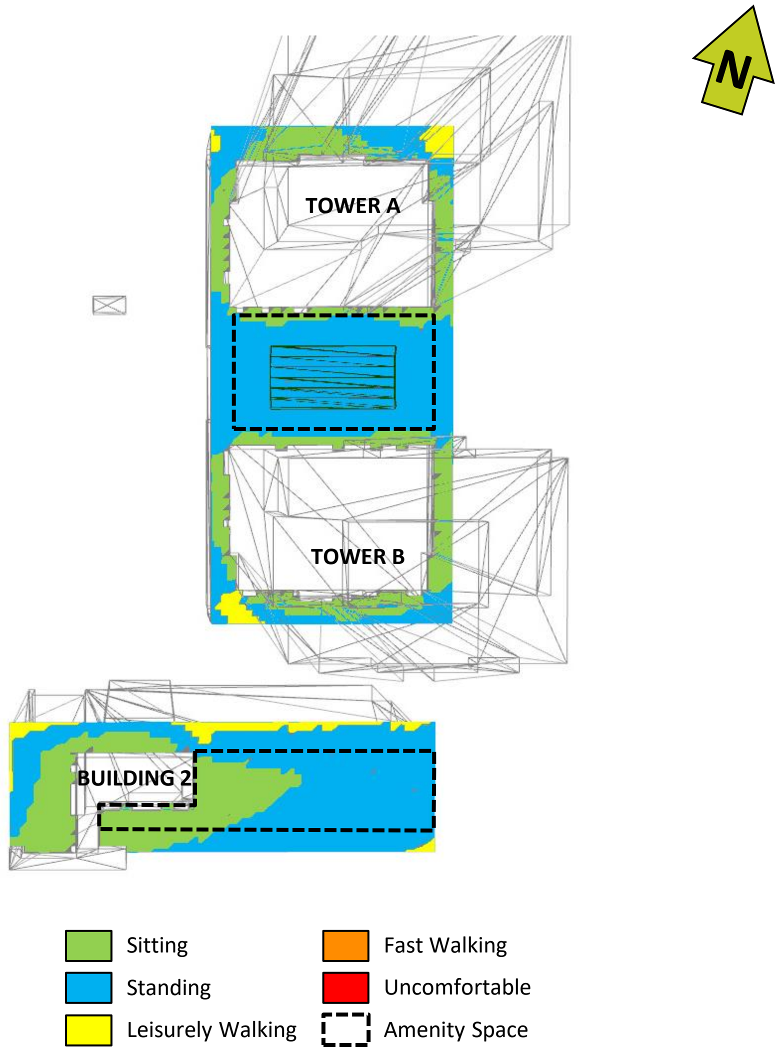


Figure 10a: Proposed Configuration – Pedestrian Wind Comfort Summer – Amenity Terraces

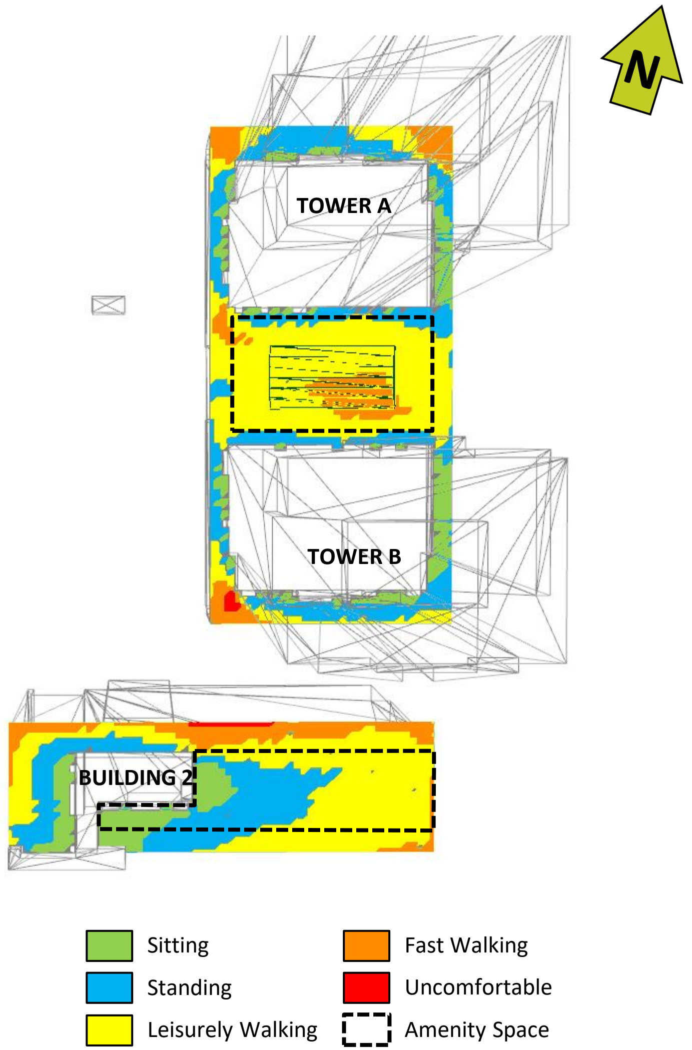


Figure 10b: Proposed Configuration – Pedestrian Wind Comfort Winter – Amenity Terraces

On the amenity terrace of the podium roof of Building 1, wind conditions are predicted to be comfortable for sitting or standing in the summer (**Figure 10a**). In the winter months, wind conditions conducive to fast walking or better are expected (**Figure 10b**). On the rooftop amenity terrace of Building 2, wind conditions are generally expected to be comfortable for sitting or standing in the summer (**Figure 10a**). During the winter, wind conditions on this terrace are predicted to be comfortable for leisurely walking or better (**Figure 10b**). It should be noted that the active rooftop amenity on Building 2 is setback from the building edge to minimize wind issues.

The strong wind flows on the terrace of Building 1 are due to the overall exposure of the building to the westerly winds. These winds flows are intercepted by the towers and directed downwards to the podium, where the flows are then channeled between the towers. These wind flows create local accelerations at the tower corners, as well as between the towers. The latest landscaping plans show a 2.5 glass wall along the west side of the terrace, which will protect the terrace from the westerly winds. In addition, trellis structures have been added around the southeast and southwest corners of Tower A, as well as the northwest corner of Tower B. These features will be beneficial as they will disrupt the downwashing wind flows. With these features and the proposed landscaping in place, wind conditions on the terrace are predicted to be suitable for the intended use year-round.

The strong wind flows on Building 2 rooftop amenity terrace are due to the overall exposure of the roof to the predominant winds. We recommend the design team include a 2.5 m tall glass wall along the perimeter of the terrace, to provide a calmer wind climate. Proposed landscaping on the terrace is a positive design feature, as it will further enhance the wind comfort conditions.

4.3 Surrounding Sidewalks

Existing wind conditions along the sidewalks of Aspen Springs Drive and Bowmanville Avenue, including the transit stops, are expected to be suitable for sitting or standing year-round (**Figures 7a and 8a**).

With the proposed development in place, wind conditions are predicted to remain suitable for sitting or standing throughout the year on the surrounding sidewalks and at the transit stops (**Figures 7b and 8b**). These wind conditions are satisfactory for the anticipated use.

4.4 Wind Safety

In the Existing Configuration the wind safety criterion is expected to be met in all areas on an annual basis (**Appendix B**).

In the Proposed Configuration, the wind safety criterion was met in all areas on an annual basis at grade level. On the podium roof terrace of Building 1, the wind safety criterion is predicted to exceed near the southwest corner of Tower A. The previously described wind control measures are expected to eliminate the safety concern.

The wind safety criterion is also predicted to be met on the rooftop terrace of Building 2 on an annual basis (**Appendix B**).

5.0 CONCLUSIONS & RECOMMENDATIONS

The pedestrian wind conditions predicted for the proposed development at 10 Aspen Springs Drive in Bowmanville have been assessed through computational fluid dynamics modeling techniques. Based on the results of our assessment, the following conclusions have been reached:

- The wind safety criterion is met at all grade level areas on and surrounding the development in both the Existing and Proposed Configurations. In the Proposed Configuration, wind conditions at the southwest corner of the podium roof terrace of Building 1 are predicted to exceed the safety criterion. Mitigation measures are recommended.
- Wind conditions at the main entrances, as well as all other entrances and exits, are expected to be suitable for the intended use year-round.
- Wind conditions at the outdoor amenity space at grade level are predicted to be suitable for the intended use year-round with the inclusion of the landscaping features.
- At the outdoor amenity terraces, wind conditions are expected to be suitable for the intended use throughout the year with the inclusion of the landscaping features. Additional wind control measures are recommended for Building 2 rooftop terrace.
- On the sidewalks surrounding the proposed development, wind conditions are predicted to remain similar between the two configurations and are generally expected to be suitable for the intended use.

6.0 ASSESSMENT APPLICABILITY

This assessment is based on computer modeling techniques and provides a qualitative overview of the pedestrian wind comfort conditions on and surrounding the proposed development site. Any subsequent alterations to the design may influence these findings, possibly requiring further review by SLR. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Sincerely,

SLR Consulting (Canada) Ltd.

Nishat Nourin, M.Eng., P.Eng.
Microclimate Engineer

Tahrana Lovlin, MAES, P.Eng.
Specialist – Microclimate

7.0 REFERENCES

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Appendix A

Pedestrian Wind Comfort Analysis

Spring (April – June) and Autumn (October – December)

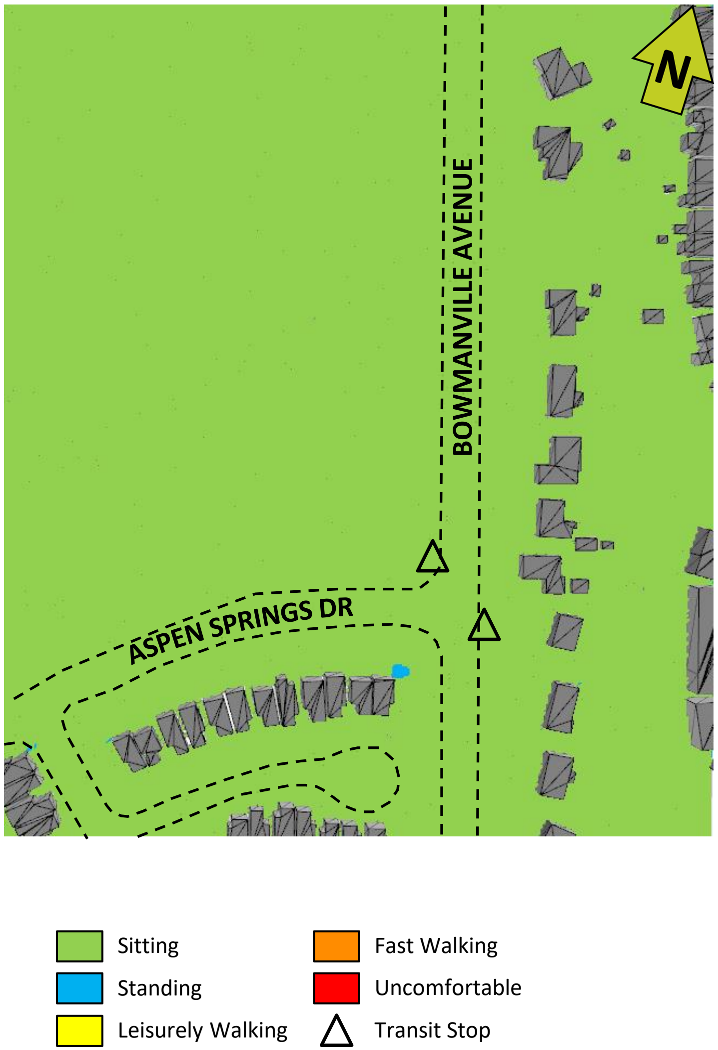


Figure A1a: Existing Configuration – Pedestrian Wind Comfort Spring – On-site & Surrounding Areas

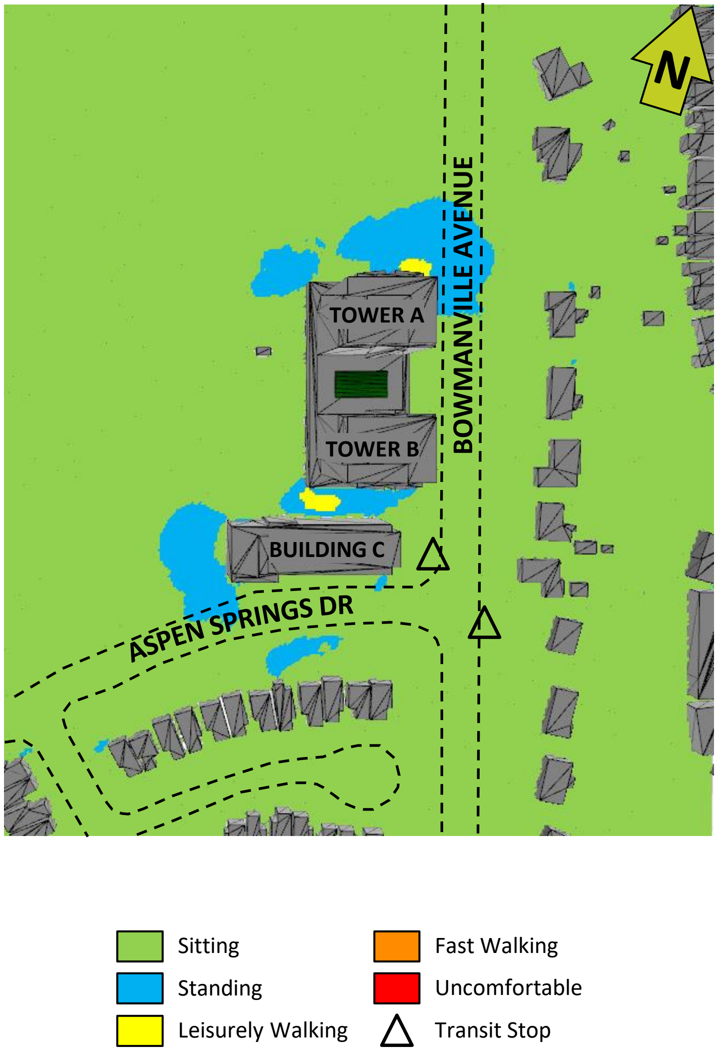
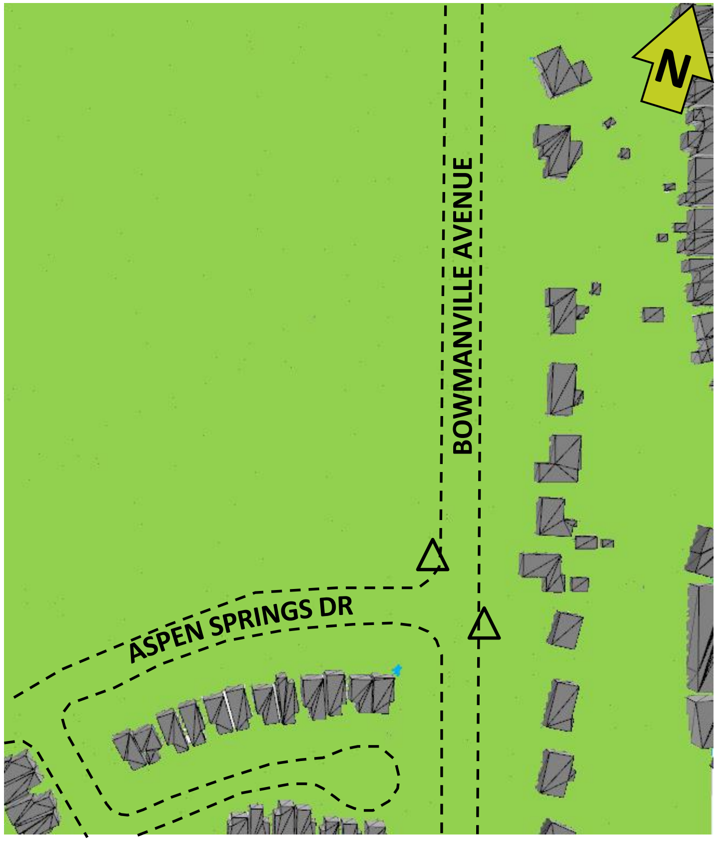
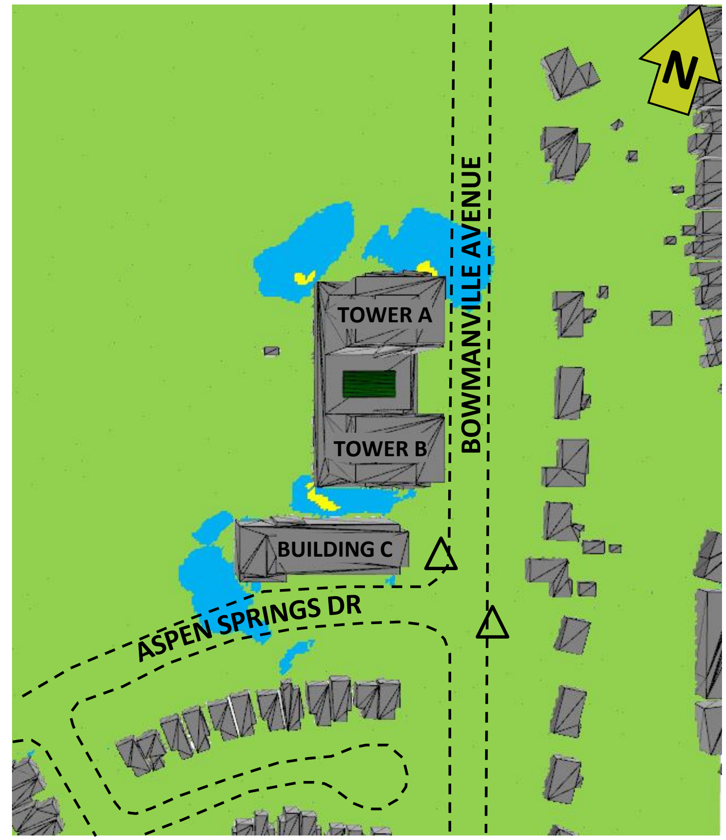


Figure A1b: Proposed Configuration – Pedestrian Wind Comfort Spring – On-site & Surrounding Areas



Sitting | Standing | Leisurely Walking | Fast Walking | Uncomfortable | Transit Stop

Figure A2a: Existing Configuration – Pedestrian Wind Comfort Autumn – On-site & Surrounding Areas



Sitting | Standing | Leisurely Walking | Fast Walking | Uncomfortable | Transit Stop

Figure A2b: Proposed Configuration – Pedestrian Wind Comfort Autumn – On-site & Surrounding Areas

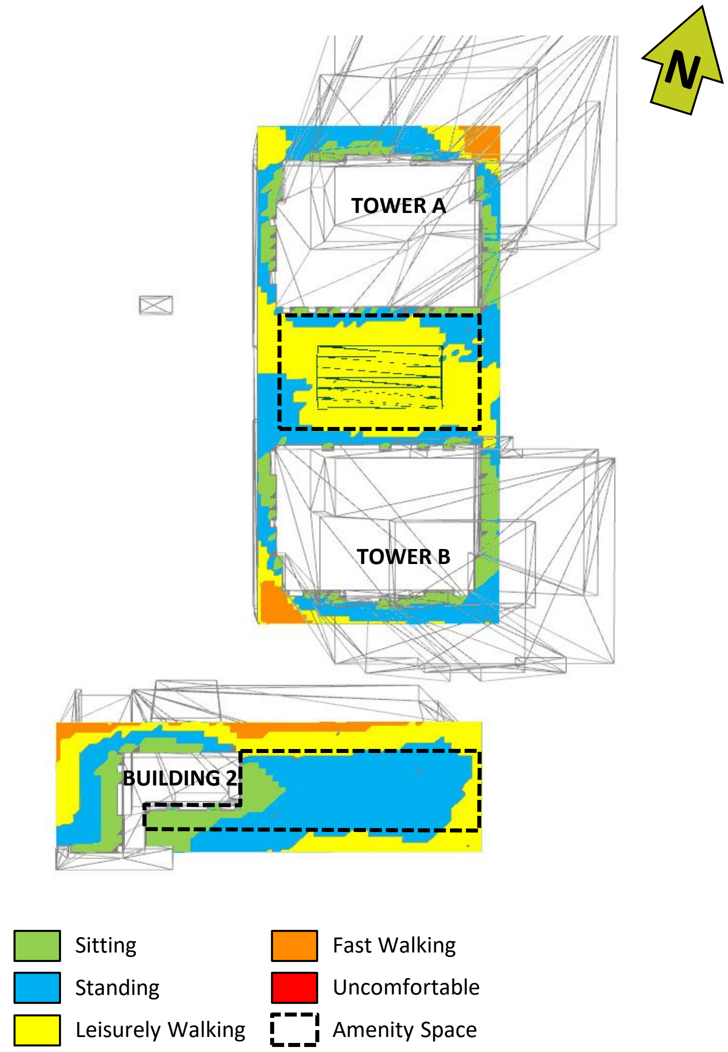


Figure A3a: Proposed Configuration – Pedestrian Wind Comfort Spring – Amenity Terraces

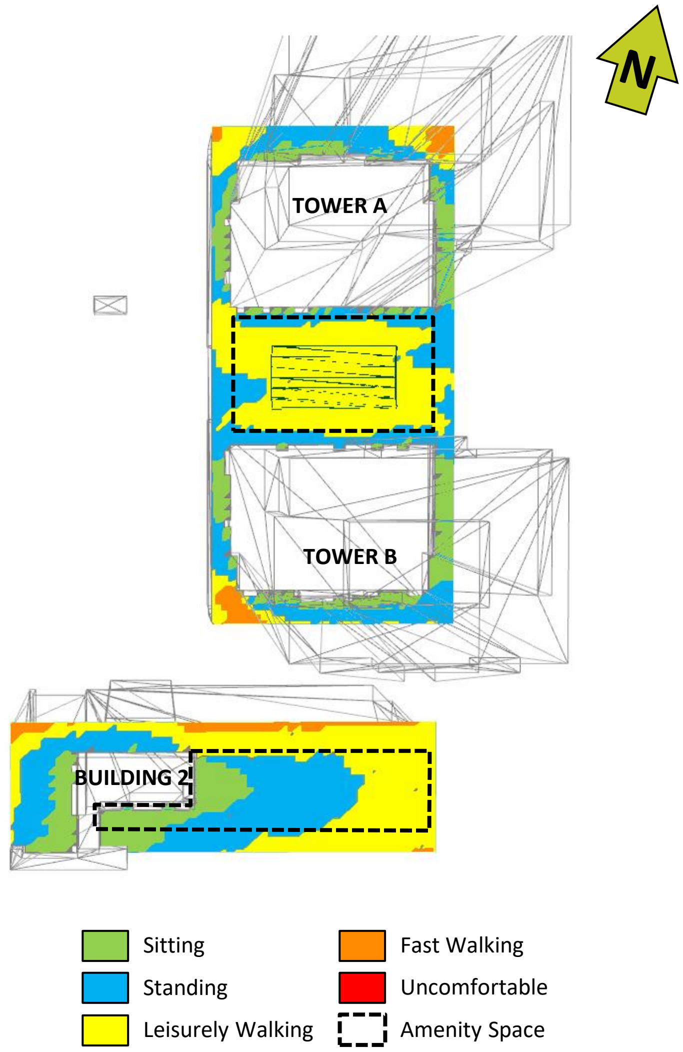


Figure A3b: Proposed Configuration – Pedestrian Wind Comfort Autumn – Amenity Terraces

Appendix B

Pedestrian Wind Safety Analysis

Annual

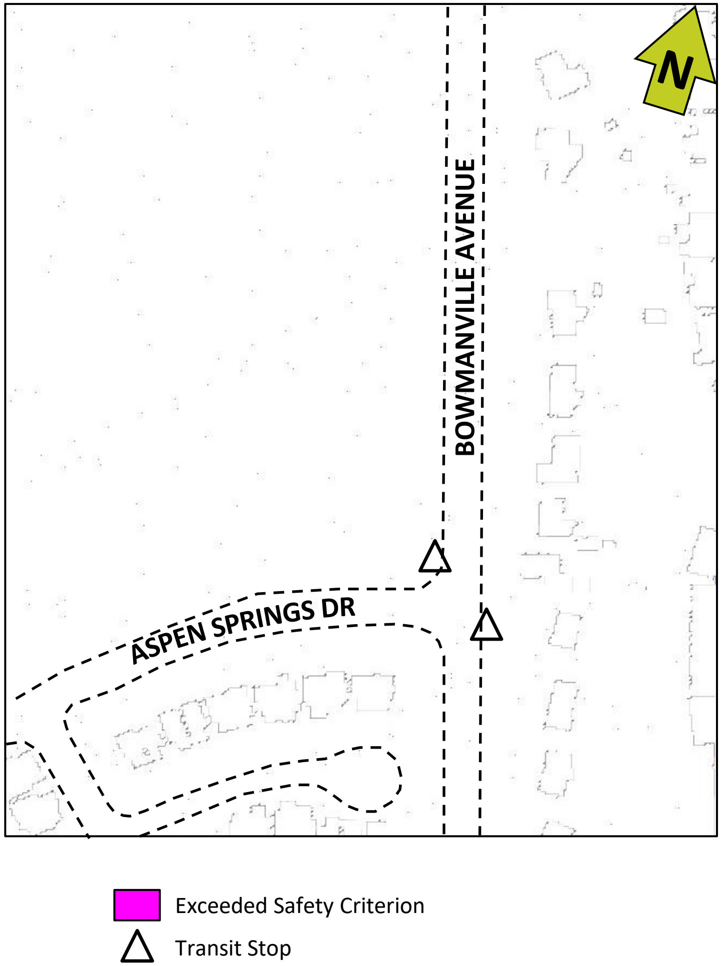


Figure B1a: Existing Configuration – Wind Safety Annual – On-site & Surrounding Areas

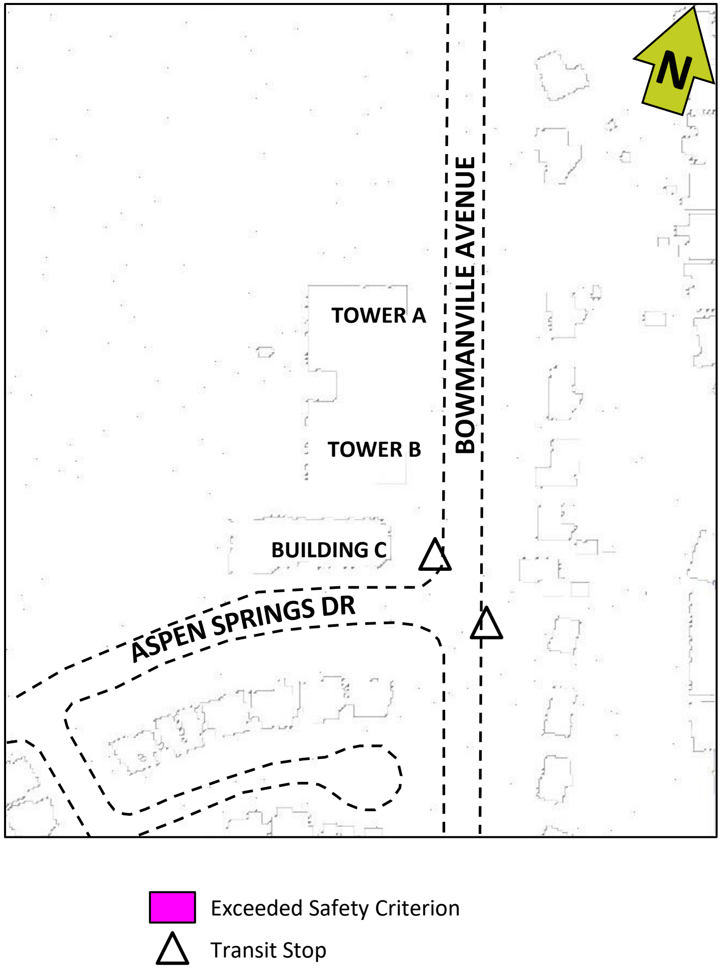


Figure B1b: Proposed Configuration – Wind Safety Annual – On-site & Surrounding Areas

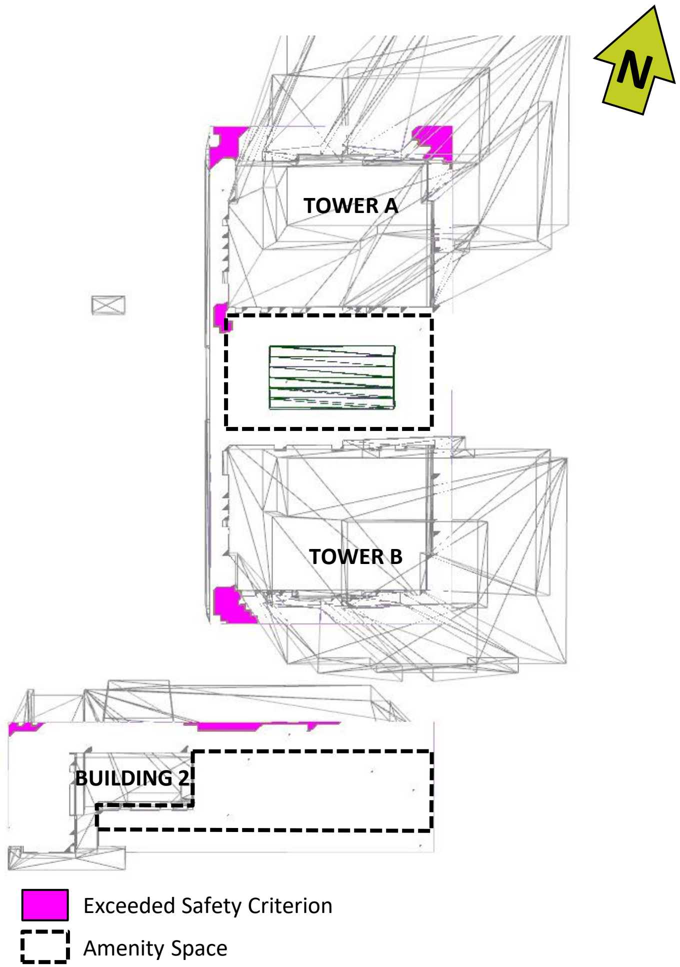


Figure B2a: Proposed Configuration – Wind Safety Annual – Amenity Terraces