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Date: February 18, 2022

To: Mr. Mark Sim
Pinemount Developments Ltd.
1 Whitehorse Road, Units 16-18
Toronto, ON M3J 3G8

Re: **Pedestrian Wind Assessment**
129 Collier Street
Barrie, Ontario
SLR Project #241.30258.00000

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Credit: RAW Design

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1.0 INTRODUCTION

SLR Consulting (SLR) was retained by Pinemount Developments Ltd. to conduct a pedestrian wind assessment for the 129 Collier Street development in Barrie, Ontario. This report is in support of the Site Plan Control (SPC) application for the development.

1.1 Existing Development

The proposed development is located at 129 Collier Street, on the south side of the street, between Collier Street and Dunlop Street. 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 August 8, 2019; some of these images are included in Figures 2a through 2d.

Immediately surrounding the site are low-rise commercial and residential developments in all directions, except to the southeast where Sam Cancilla Park is located, and to the south, where the Lakhouse development is under construction currently. Beyond the immediate surroundings, there are a few mid to high-rise developments to the southwest and northwest of the project site. Lake Simcoe is located approximately 65m 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 the current assessment, the following future developments were included: 185-205 Dunlop Street East (Lakhouse) and 217 Dunlop Street East.

Figure 1: Aerial view of existing site & surroundings
Credit: Google Earth Pro, dated 7/24/2019

Figure 2a: Collier Street looking east (Site to the right)

Figure 2b: Collier Street looking west (Site to the left)

Figure 2c: Dunlop Street East looking east (Site to the left)

Figure 2d: Dunlop Street East looking west (Site to the right)

1.2 Proposed Development

The proposed development consists of two phases: Phase 1 on the north half of the site, and Phase 2 on the south half. The North Tower is ten-storeys tall (approximately 33m in height), while the South Tower is 12-storeys tall and approximately 50m in height. These two towers are connected with a three-storey podium with underground level parking. Due to the sloped nature of the site (downwards from north to south), Phase 2 will also have retail space at grade. The east elevation of the proposed development are shown in Figure 3.

Figure 3: East elevation of proposed development

Credit: RAW Design

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 is a transit stop along Collier Street to the northwest of the proposed development. The main residential entrances to the North Tower are located on the north and south sides of the building, while the retail and secondary entrances are located on the north facade along Collier Street. The main entrance of the South Tower, as well as the secondary entrances are located on the north side of the building. The entrances on Level 1 are shown in Figure 4a.

Amenity spaces associated with the new development are located on the north side of the North Tower and to the west of South Tower of Level 1. Above-grade level amenity areas are at Level 4 of North Tower and at Level 3 of south tower, as shown in Figure 4b. The entrances and exits on the south side of the South Tower are also shown on Figure 4b.

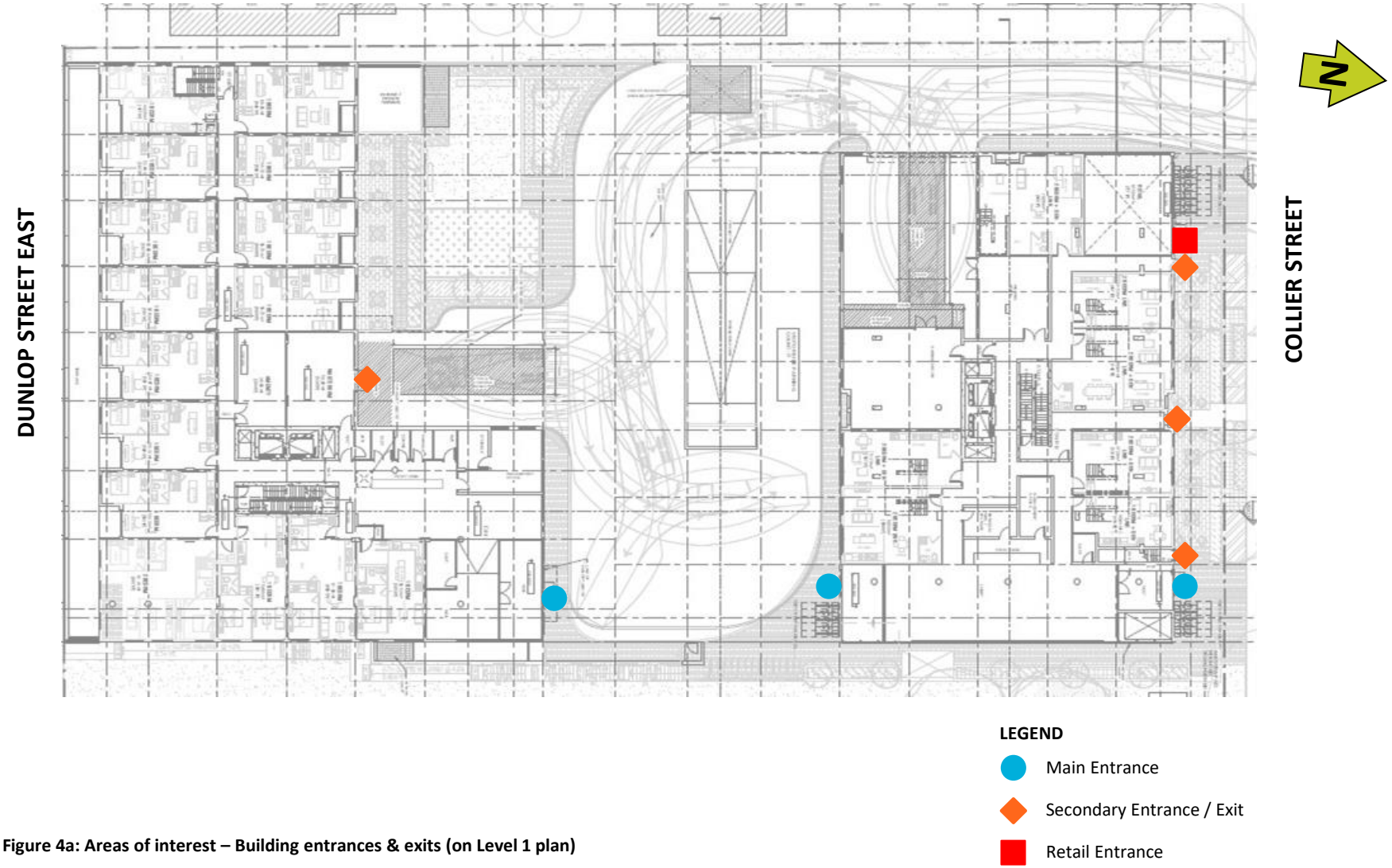

Figure 4a: Areas of interest – Building entrances & exits (on Level 1 plan)

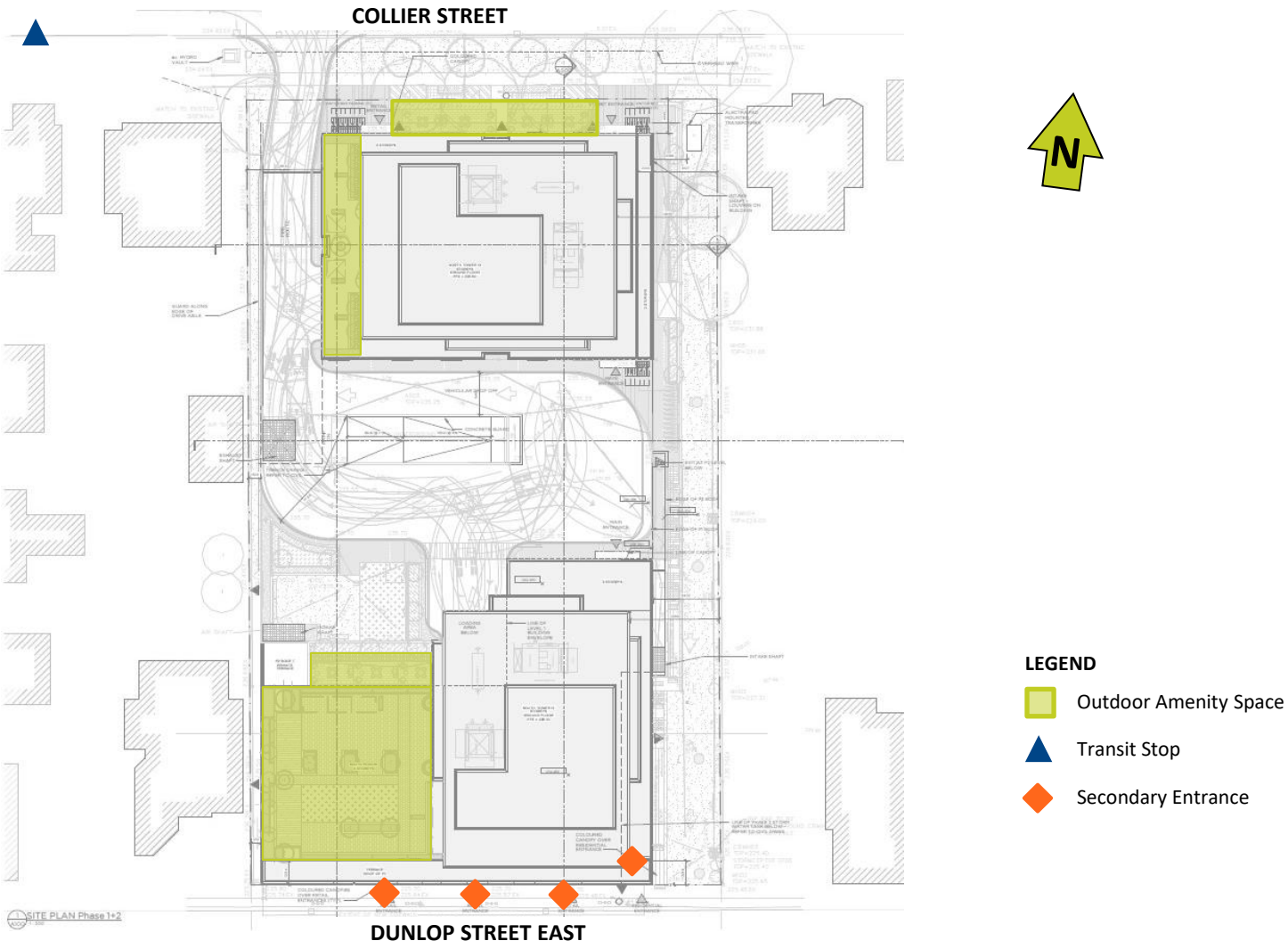

Figure 4b: Areas of Interest – Outdoor Amenity areas, Transit Stop and Secondary Entrances (Ground Floor – P3 Plan)

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 Raw Design on July 9, 2021. 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.

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.

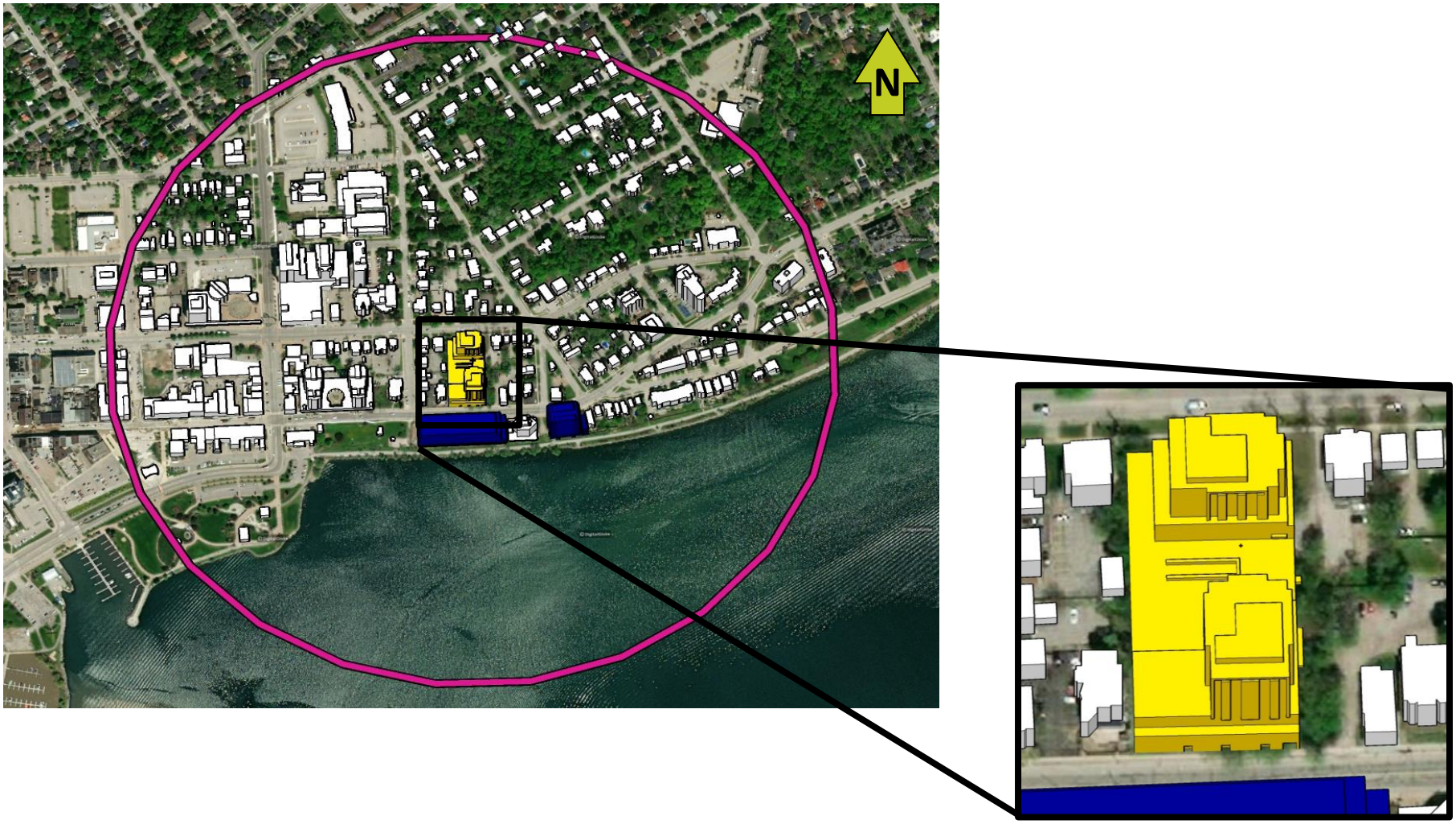

Figure 5: Massing Model

2.2 Wind Climate

Wind data recorded at the Lake Simcoe Regional Airport, to the northeast of Barrie, for the period of 2004 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 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 west-northwest, west and northwest directions. All wind speeds and directions were included in the wind climate model.

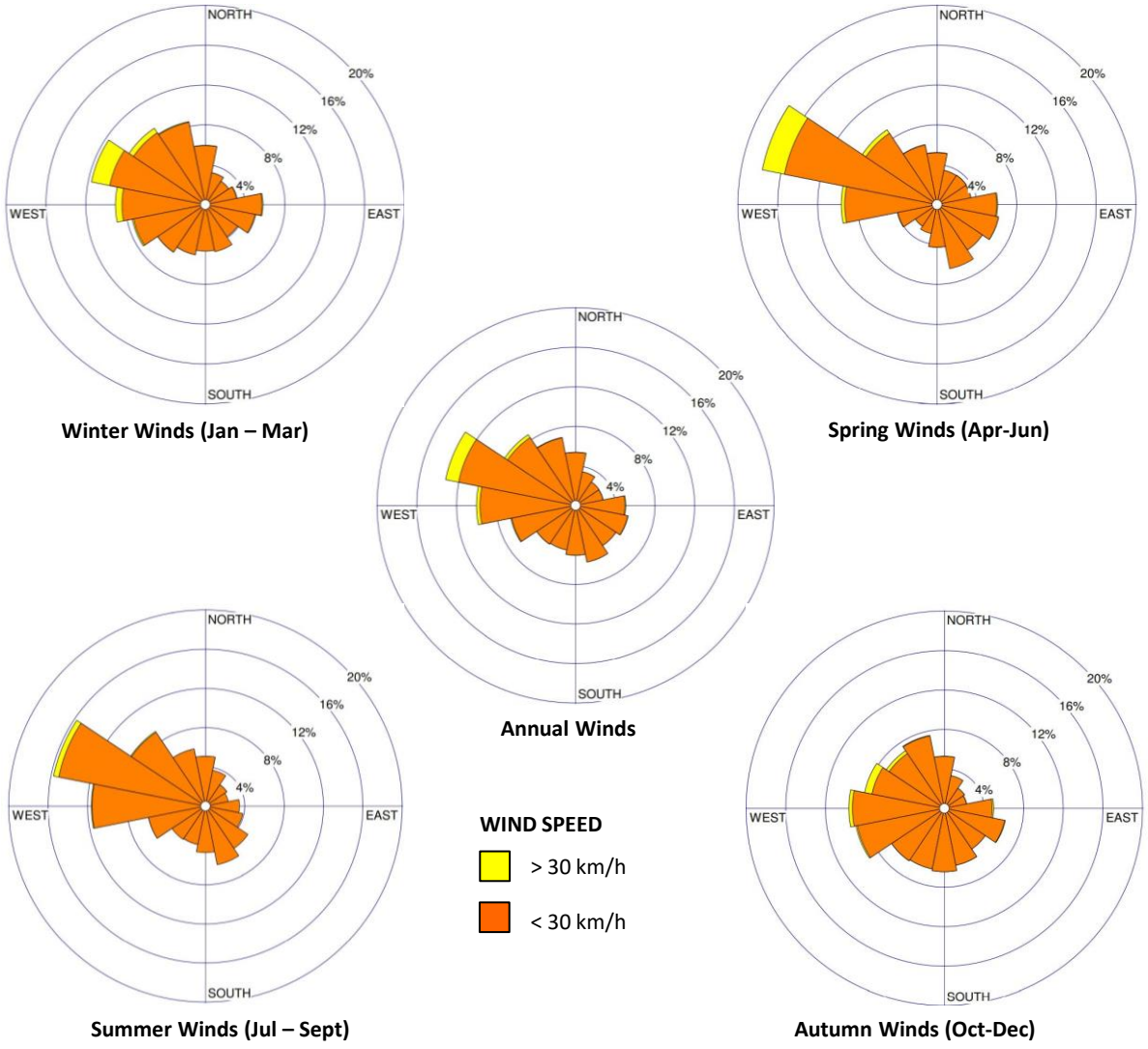

Figure 6: Wind Roses for Lake Simcoe Regional Airport (2004-2020)

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 criteria utilized for this analysis is provided by the City of Barrie, in the *Wind Study – Terms of Reference* (October 2018). The comfort criteria, which is based on certain predicted hourly gust-equivalent mean (GEM) wind speeds being exceeded 20% of the time, are summarized in Table 1. By allowing for a 20% exceedance, it assumes wind speeds will be comfortable for the corresponding activity at least four out of five days. The comfort criteria consider only daytime hours, between 6:00am and 11:00pm. GEM is defined as the maximum mean wind speed or the gust wind speed divided by 1.85.

The criterion for wind safety in the table is based on hourly gust wind speeds that are exceeded nine hours per year (approximately 0.1% 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.

Table 1: Wind Comfort Criteria

Activity	Comfort Ranges for GEM Wind Speed Exceeded 20% of the Time		Description of Wind Comfort
Sitting	0 to 10 km/h	0 to 2.8 m/s	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper without having it blown away.
Standing	0 to 15 km/h	0 to 4.2 m/s	Gentle breezes suitable for main building entrances and bus stops.
Walking	0 to 20 km/h	0 to 5.6 m/s	Moderate breezes that can be tolerated if one's objective is to walk, run or cycle without lingering.
Uncomfortable	> 20 km/h	> 5.6 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 Gust Wind Speed Exceeded Once Per Year (0.1%)		Description of Wind Effects
Any	90 km/h	25 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. 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 assessment does not account for the presence of mature trees, thus wind comfort conditions for months when foliage is present could be better than those predicted.

Appendix A includes graphical images of the annual wind safety for the Existing and Proposed Configurations. Appendix B includes vertical slices of the wind flows around the building.

There are generally accepted wind comfort levels that are desired for various pedestrian uses. For example, for public sidewalks, wind comfort suitable for walking would be desirable year-round. For main entrances and transit stops, wind conditions conducive to standing would be preferred throughout the year but can be difficult to achieve in regions where winter winds are inherently harsh. For amenity spaces, wind conditions suitable for sitting and/or standing are generally desirable during the summer months. The most stringent category of sitting is considered appropriate for cafes and dedicated seating areas, while for parks sitting and/or standing would be appropriate in the summer.

4.1 Building Entrances & Walkways

Existing wind conditions on the walkways on-site are comfortable for sitting throughout the year (Figures 7a and 8a).

With the proposed development in place wind conditions on site are predicted to be comfortable for sitting or standing throughout the year. These wind conditions are considered suitable for the intended usage.(Figures 7b and 8b).

Wind conditions at the main residential entrances, as well as the retail and secondary entrances and exits, are predicted to be comfortable for sitting throughout the year, which is considered suitable for the anticipated use (Figures 7b and 8b through 10b).

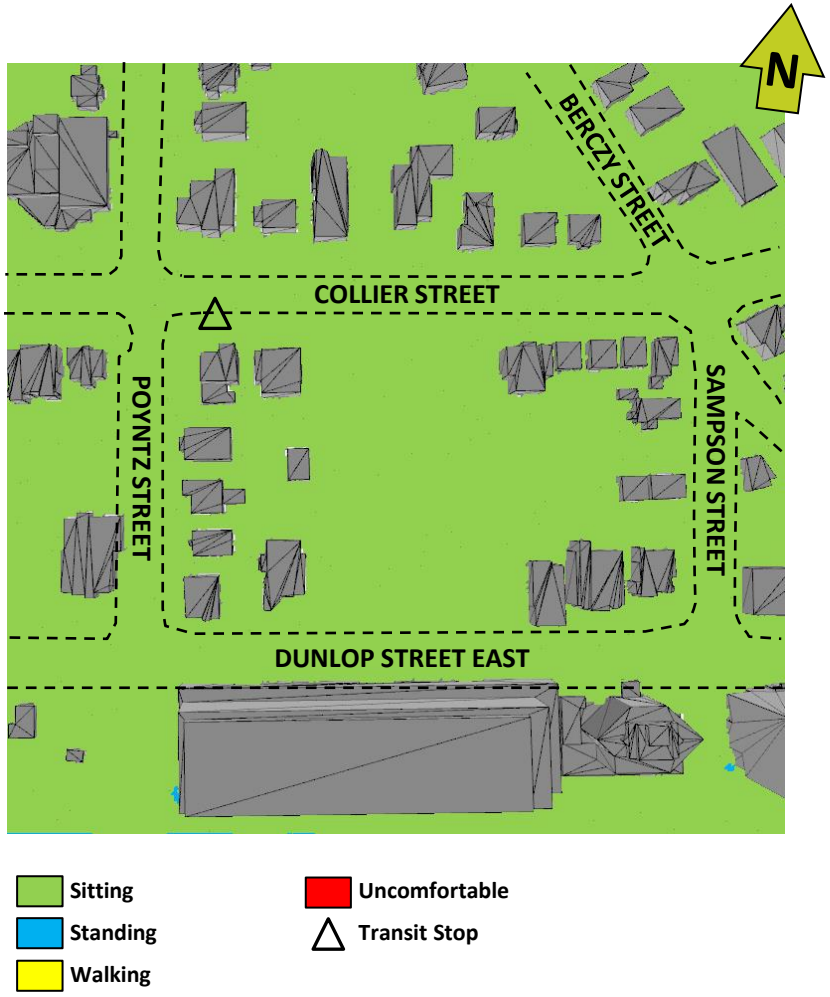

Figure 7a: Existing Configuration – Wind Comfort – Summer

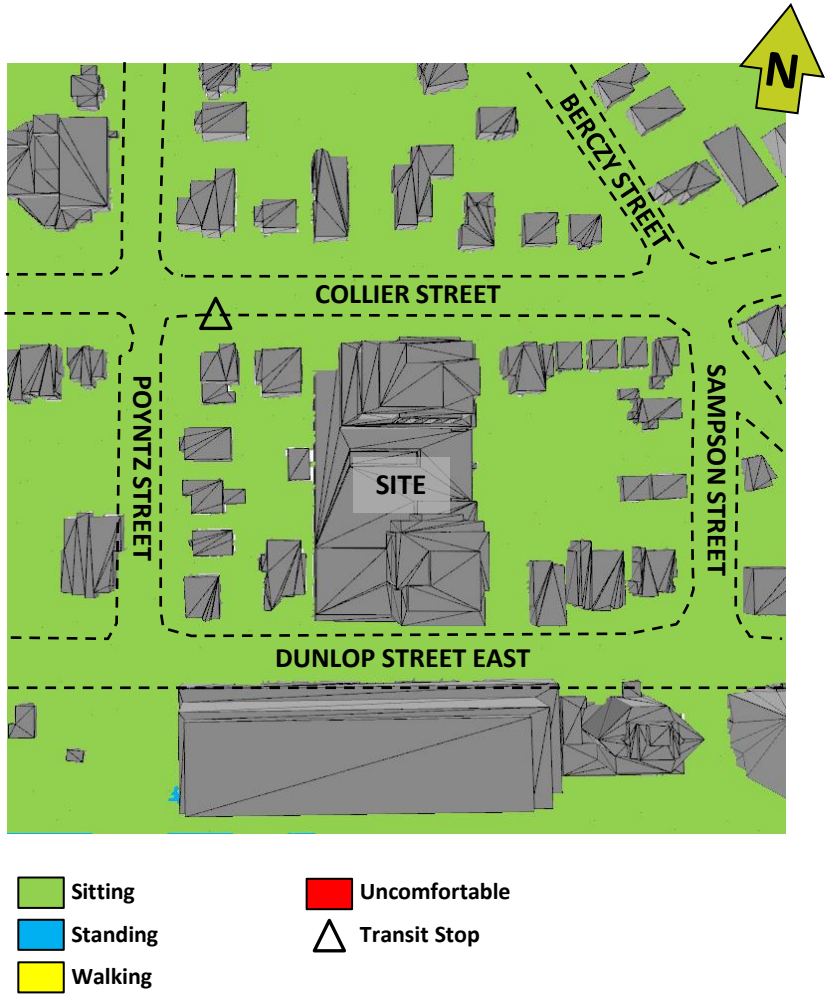

Figure 7b: Proposed Configuration – Wind Comfort – Summer

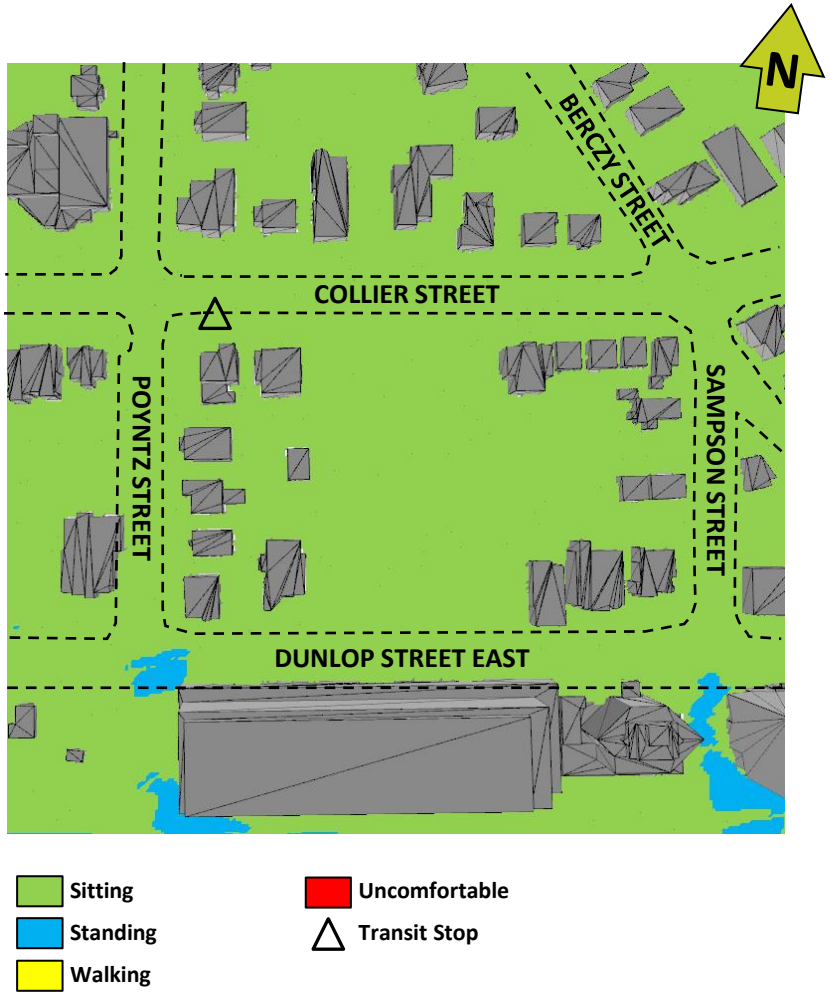

Figure 8a: Existing Configuration – Wind Comfort – Summer

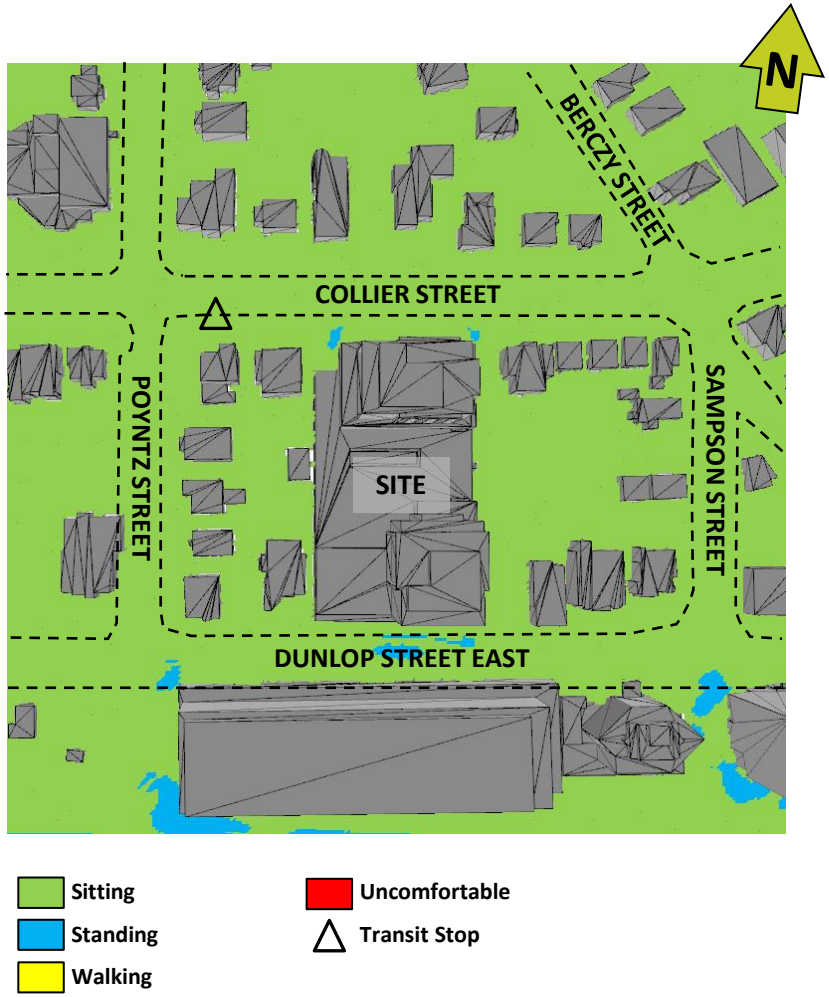

Figure 8b: Proposed Configuration – Wind Comfort – Summer

4.2 Amenity Terraces

There is an outdoor seating area to the north of North Tower and another outdoor amenity area to the west of South Tower at Level 1. Wind conditions on these outdoor amenity areas are expected to be comfortable for sitting throughout the year, which is considered suitable for the intended use (Figures 10a and 10b).

Wind conditions at the terraces of Level 3 of the South Tower and Level 4 of the North Tower are predicted to be comfortable for sitting or standing year-round. These wind conditions are considered suitable for the anticipated use (Figures 10 and 10b).

4.3 Surrounding Sidewalks

In the Existing Configuration, wind conditions along the sidewalks of Collier Street, Dunlop Street East, Poyntz Street, Sampson Street and Berczy Street are comfortable for standing year-round. Wind conditions at the transit stop along Collier Street are also comfortable for sitting throughout the year (Figures 7a and 8a).

With the proposed development in place, wind conditions are predicted to remain similar to the existing conditions along the surroundings sidewalks and at the transit stop (Figures 7b and 8b).

These wind conditions are considered appropriate for the intended usage.

4.4 Wind Safety

The wind safety criterion is expected to be met at all areas at grade and above assessed for both the Existing and Proposed Configurations (Appendix B).

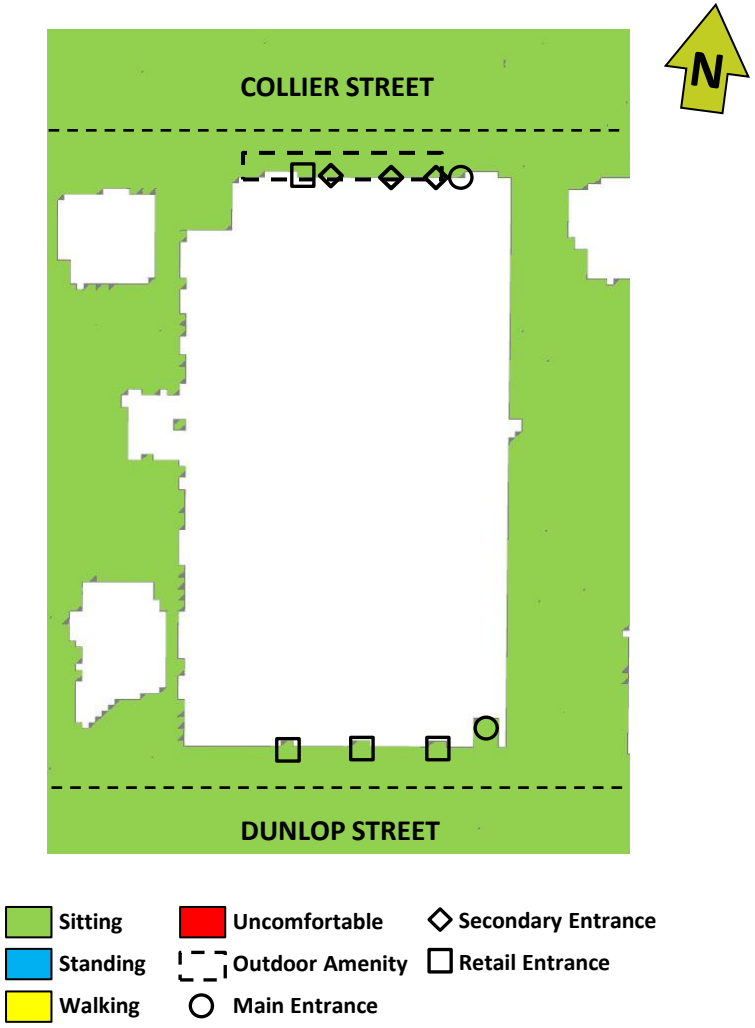

Figure 9a: Proposed Configuration – Wind Comfort – At Grade – Summer

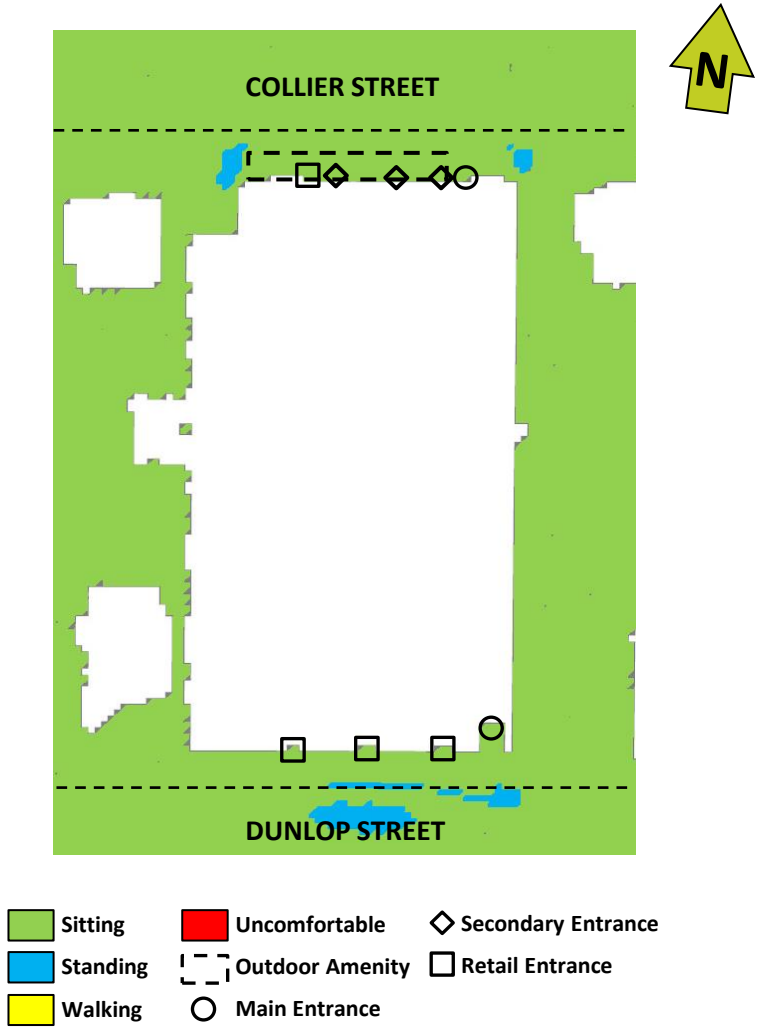

Figure 9b: Proposed Configuration – Wind Comfort – At Grade – Winter

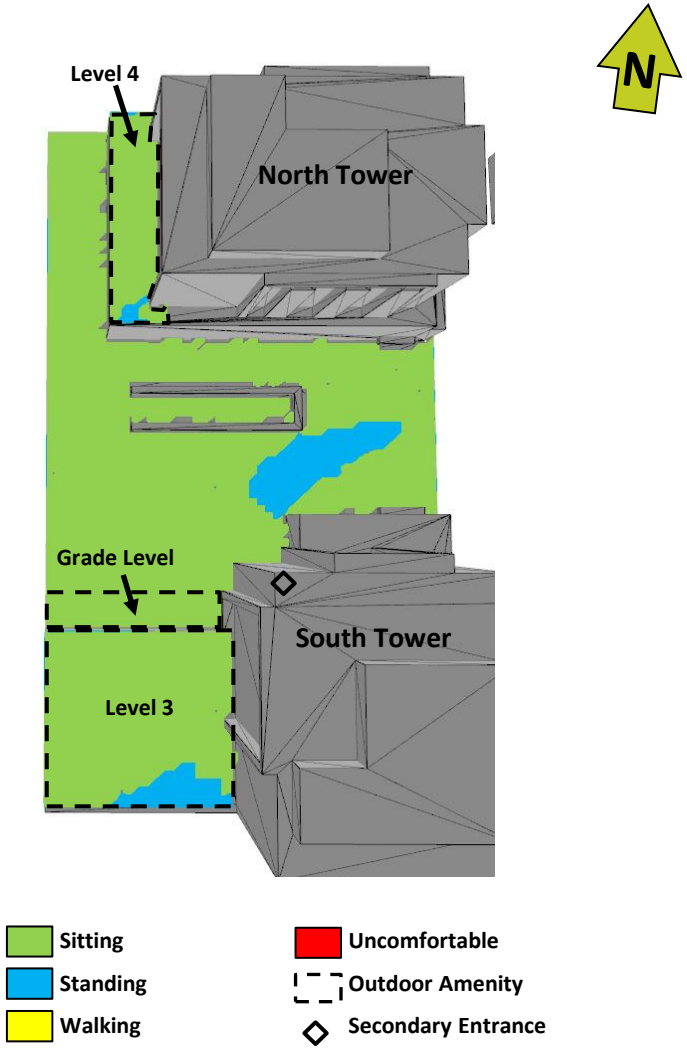

Figure 10a: Proposed Configuration – Wind Comfort – Outdoor Amenity – Summer

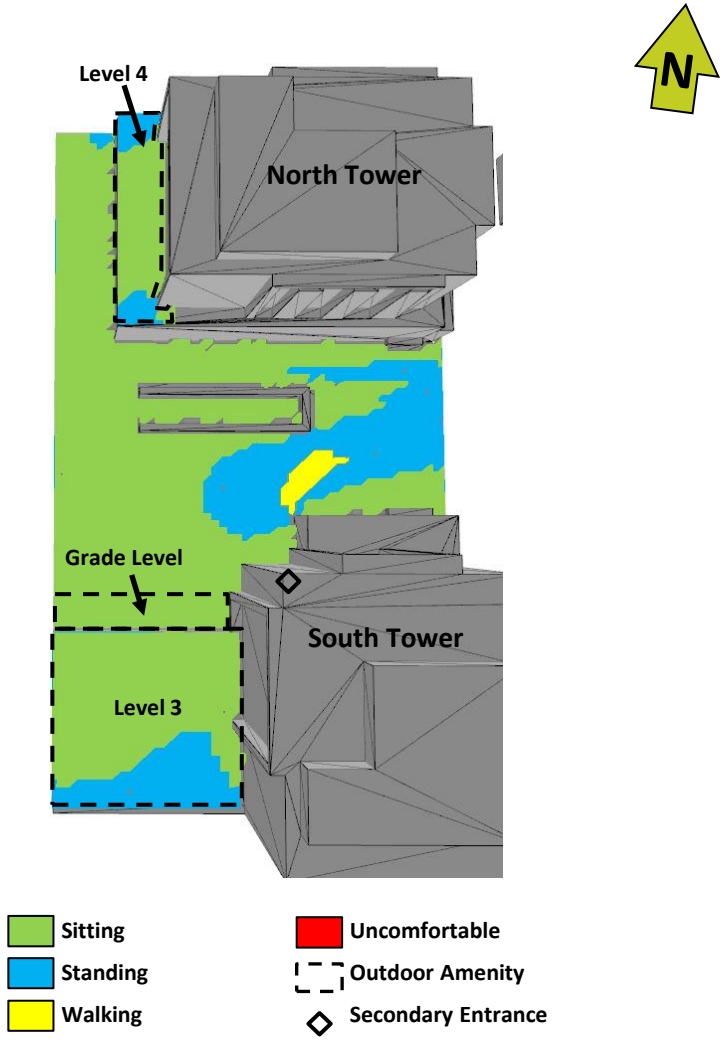

Figure 10b: Proposed Configuration – Wind Comfort – Outdoor Amenity – Winter

5.0 UPDATED ARCHITECTURAL DRAWINGS REVIEW

Updated architectural drawings were provided on February 16, 2022. The updated site plan is shown in Figure 11. Based on the review of the latest information, the following is a discussion on differences in the buildings and their impact on wind conditions:

- The height of the North Tower increased from 33 m to 39 m, adding two additional storeys for total 12 storeys. As this increase in height is minimal, the resultant wind conditions around the North Tower are expected to remain similar to those previously discussed.
- The massing of the North Tower has been altered along the north and east sides, as there is now a stepped facade on Levels 2, 3 and 11. These step backs are a positive design feature as the resulting horizontal elements provide an obstruction to the downwashing wind flows.
- The Level 4 outdoor amenity terrace on the North Tower has been removed. There are now outdoor terraces on Levels 2, 3 and 11. Wind conditions on the Level 2 and 3 terraces are predicted to be suitable for the intended use throughout the year.
- On Levels 1 and 2 of the South Tower, the footprint has been altered to match the floors above. Thus, the loading area was filled in and the two-storey podium at the northeast corner has been removed. With these changes, there is the potential for slightly stronger wind flows to occur at the northwest corner of the building, as it is no longer recessed. We expect wind conditions in this area of the South Tower to be suitable for standing in the summer and leisurely walking in the winter. Wind conditions are the main entrance to the South Tower are expected to remain comfortable for the intended use throughout the year.

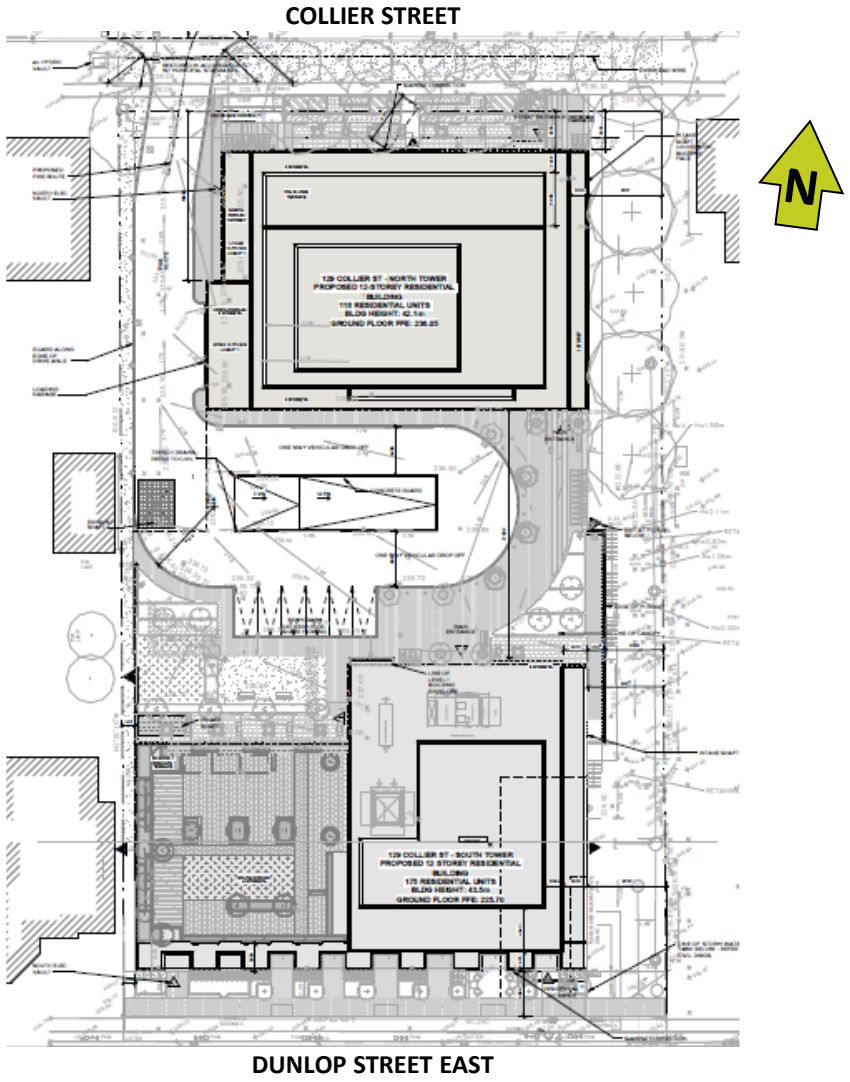

Figure 11: Updated site plan

6.0 CONCLUSIONS & RECOMMENDATIONS

The pedestrian wind conditions predicted for the proposed development at 129 Collier Street in Barrie, Ontario 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 expected to be met at all areas at grade and above for both the Existing and Proposed Configurations.
- Wind conditions at the main entrances, as well as the retail and secondary entrances are predicted to be comfortable for the intended use throughout the year.
- At the outdoor amenity areas of grade level and at the terraces on Level 3 and Level 4, wind conditions are suitable for sitting or standing throughout the year.
- On the sidewalks surrounding the proposed development, wind conditions remain similar between the two configurations, and are suitable for the intended usage.
- Updated architectural information provided highlights some minor adjustments in the overall massing of the development. Wind conditions in most areas of the site are expected to remain the same as those presented in the Section 4.0. Overall, wind conditions are expected to be suitable for the intended use year-round with the updated massing.

7.0 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

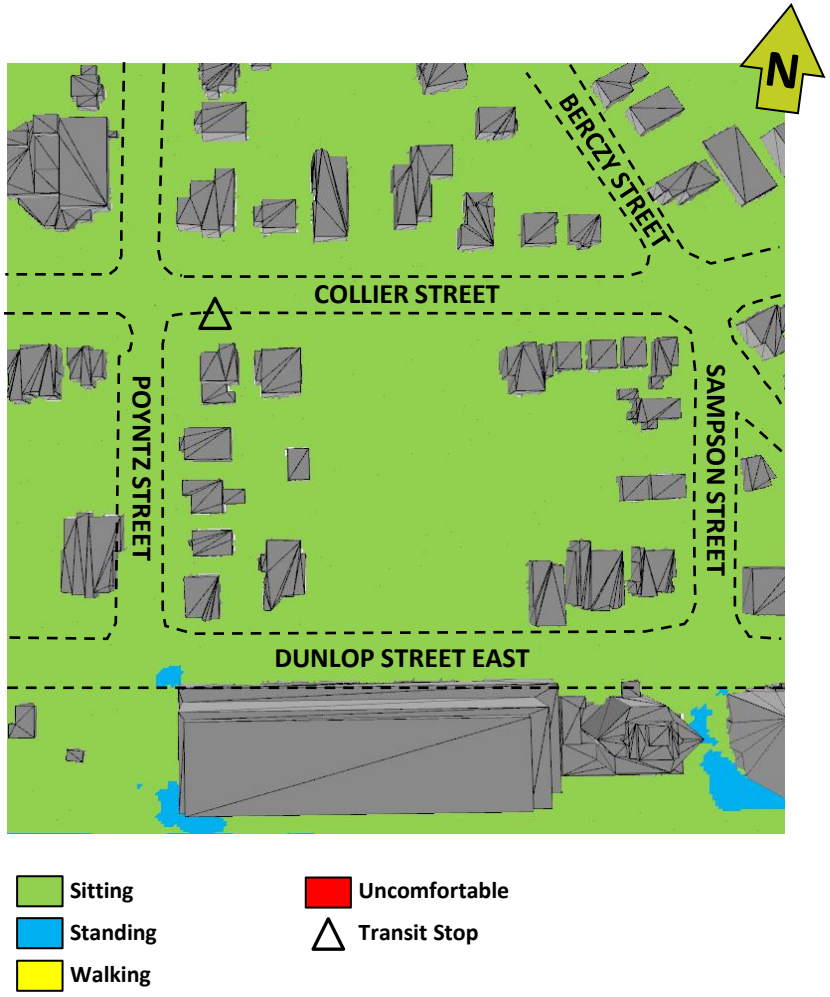

Figure A1a: Existing Configuration – Wind Comfort – Spring

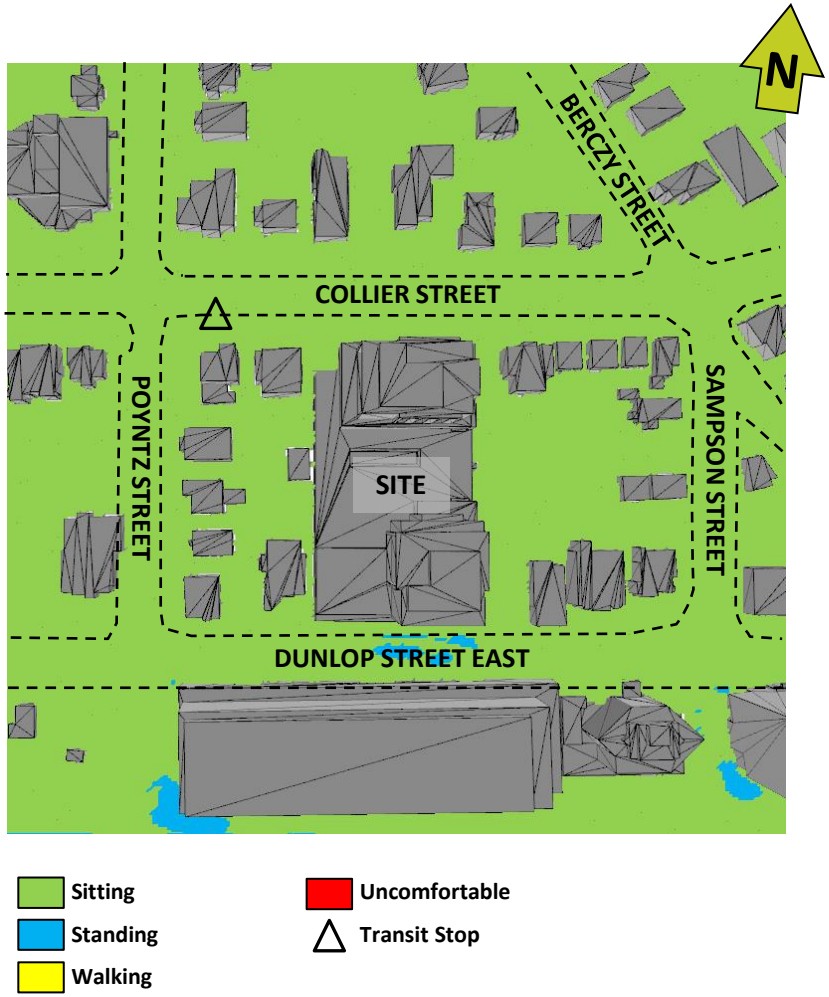

Figure A1b: Proposed Configuration – Wind Comfort – Spring

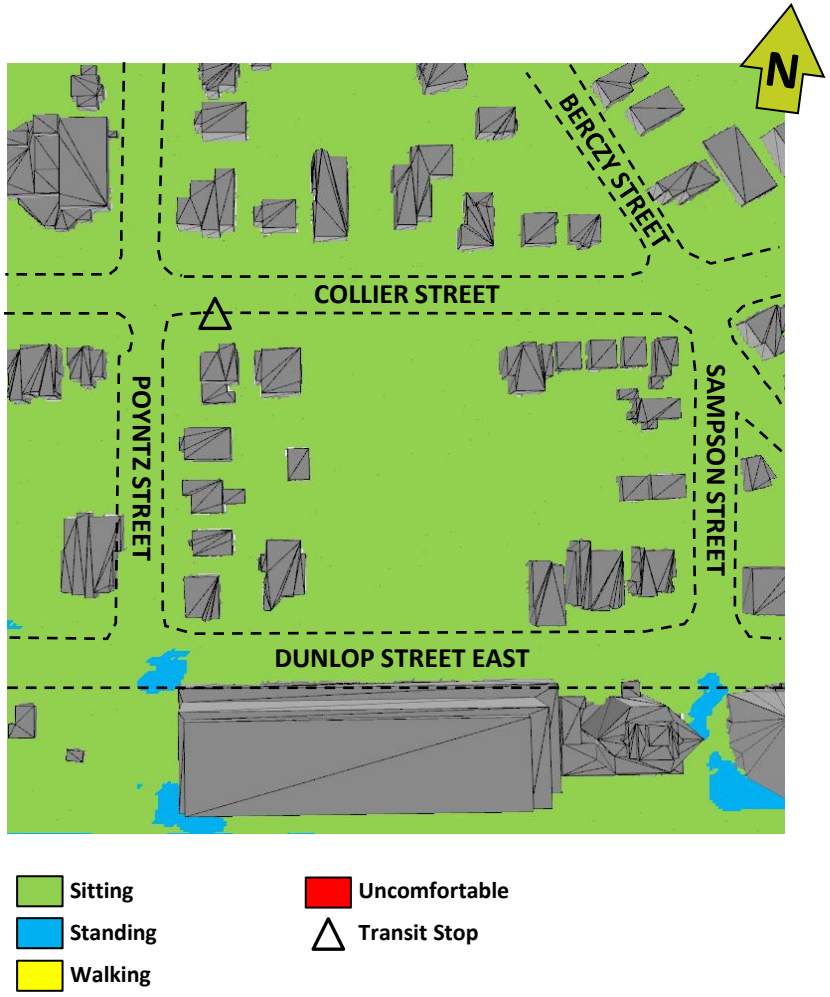

Figure A2a: Existing Configuration – Wind Comfort – Autumn

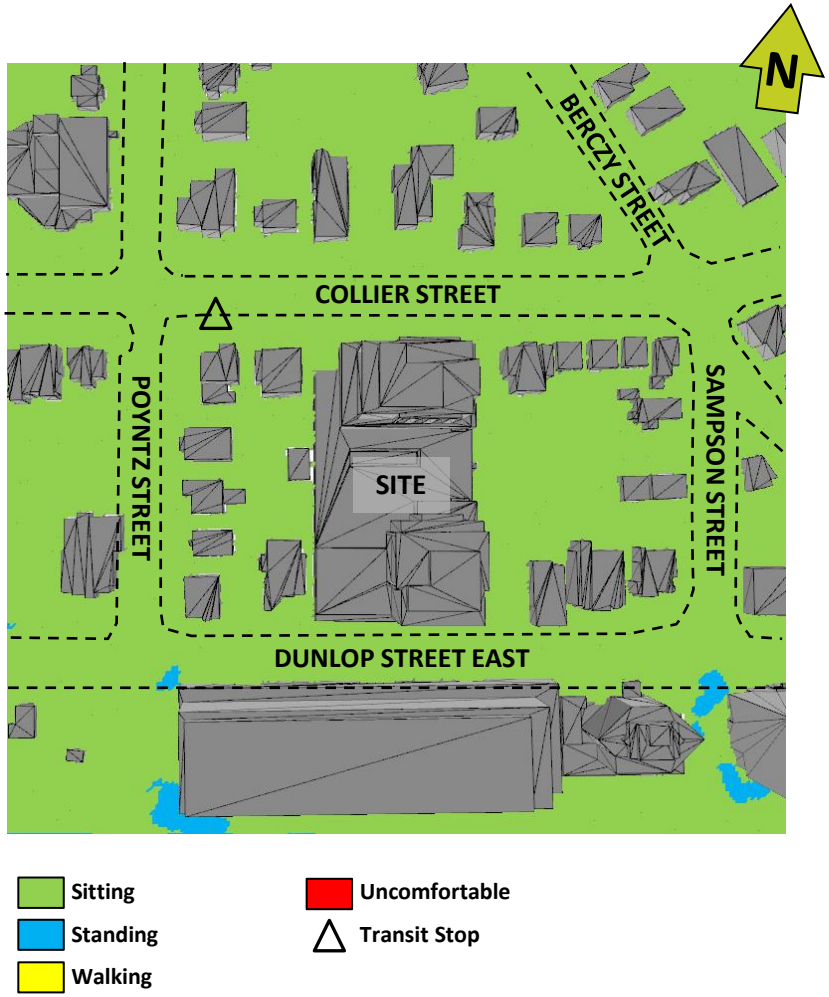

Figure A2b: Proposed Configuration – Wind Comfort – Autumn

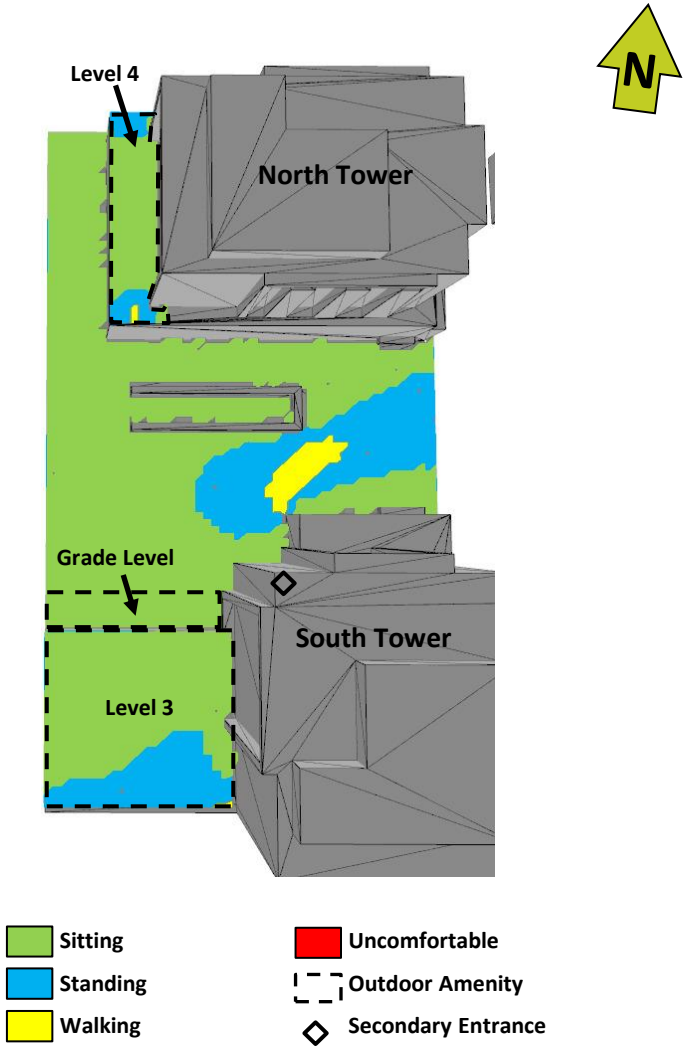

Figure A3a: Proposed Configuration – Wind Comfort – Outdoor Amenity – Spring

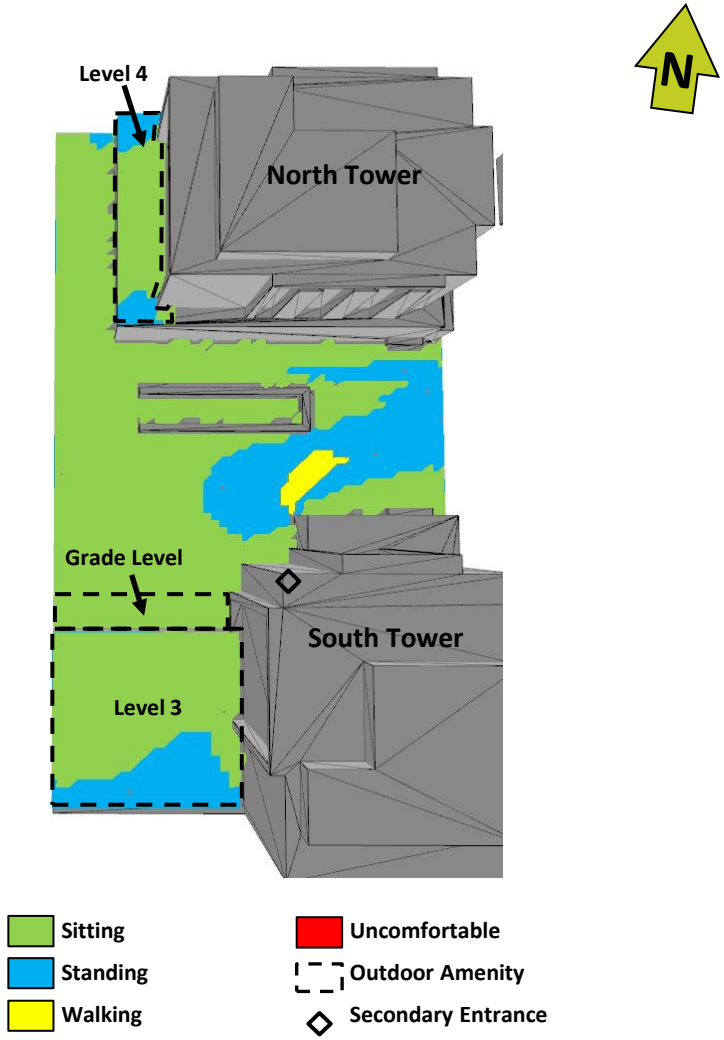

Figure A3b: Proposed Configuration – Wind Comfort – Outdoor Amenity – Autumn

Appendix B

Pedestrian Wind Safety Analysis

Annual

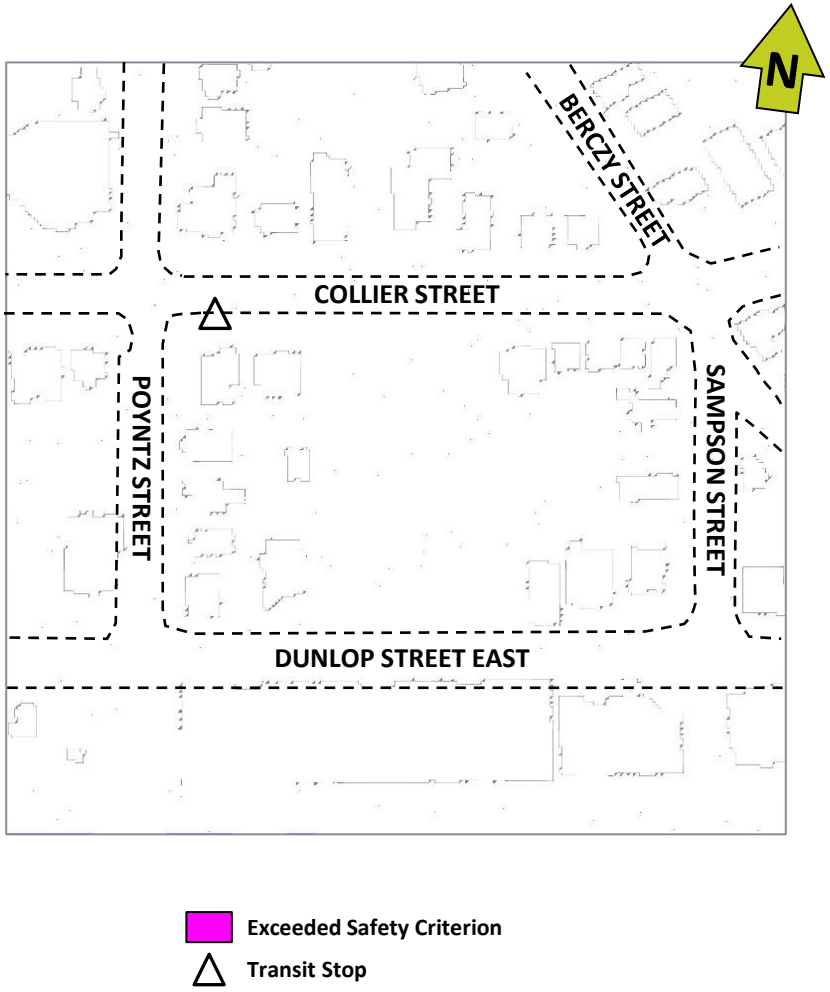

Figure B1a: Existing Configuration – Safety – Annual

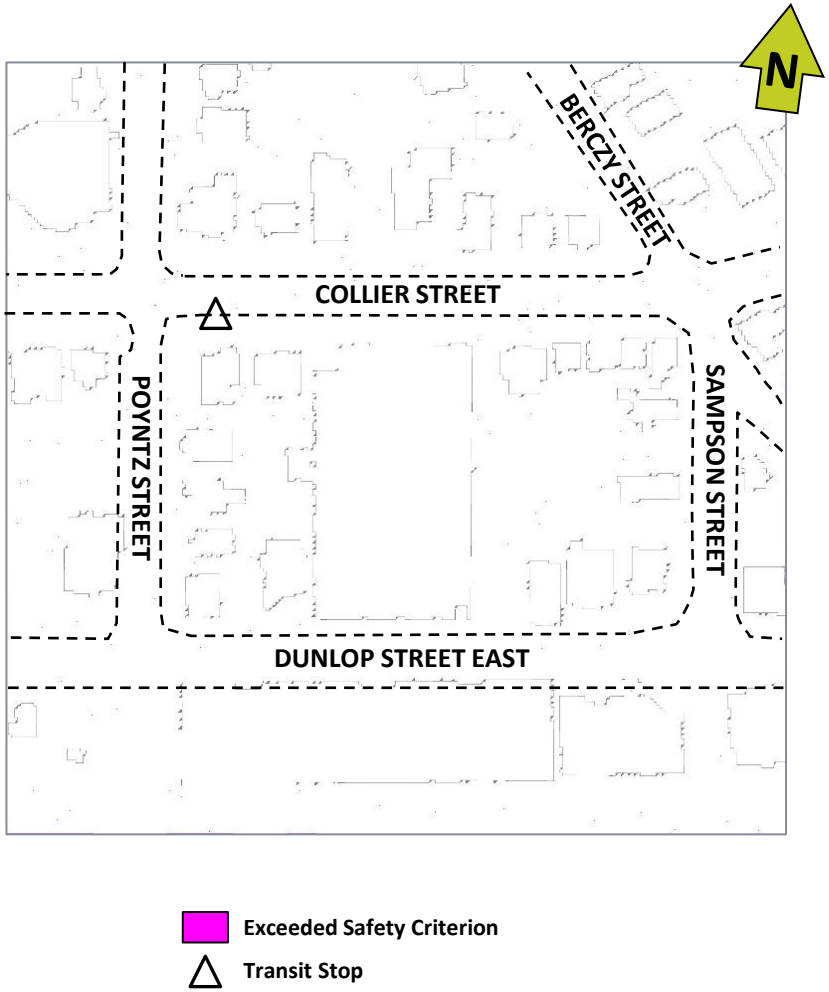

Figure B1b: Proposed Configuration – Safety – Annual

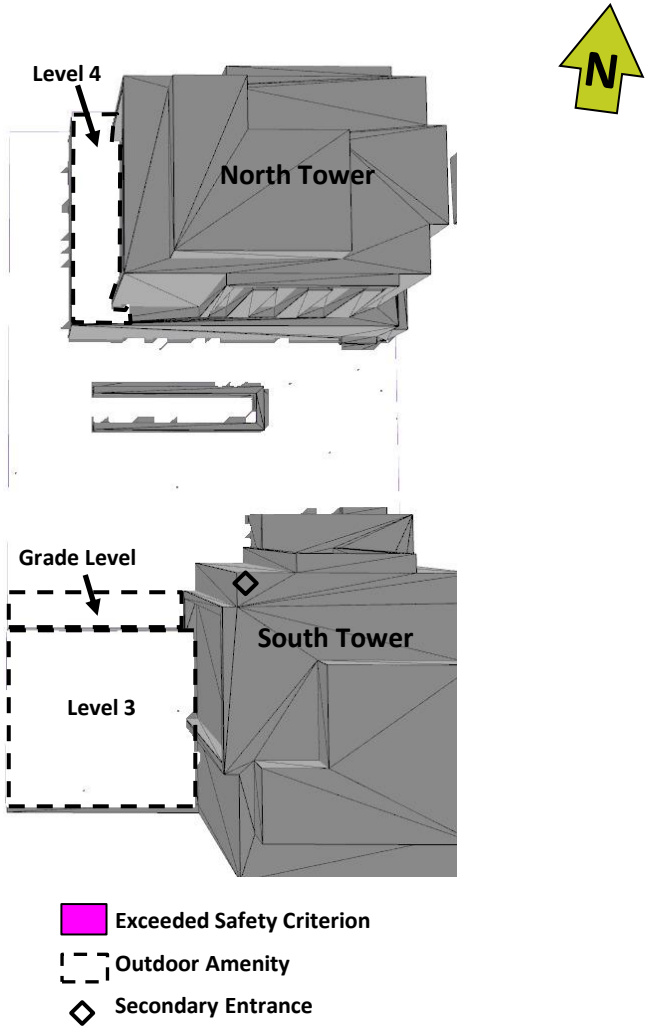

Figure A3a: Proposed Configuration – Safety – Outdoor Amenity – Annual