REPORT

50 KING STREET AND 399 RIDOUT STREET NORTH

LONDON, ON

PEDESTRIAN WIND COMFORT ASSESSMENT

PROJECT #2201565
May 16, 2023

SUBMITTED TO

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1. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained to conduct a pedestrian wind assessment for the proposed project at 50 King Street and 399 Ridout Street North in London, Ontario. The objective of this assessment is to provide an evaluation of the potential wind impact of the proposed development in support of the Site Plan Control Application. This report discusses the results from a wind assessment completed in 2022 using the massing design that was received on September 16, 2022, and provides an experience-based opinion on the relevance of the results to the current proposed massing design.

The project site is located on the northwest corner of the intersection of King Street and Ridout Street North. The-site is surrounded by Ivey Park and Thames river to the immediate west, buildings ranging up to the order of 25 storeys to the immediate south, east and northeast, the old courthouse and Museum London grounds and Harris Park to the north and low-rise suburban neighborhoods farther away in all directions (Image 1).

The proposed project is a mixed-use development that will include two high-rise towers with a shared podium and building heights of 50 storeys (Tower 1) and 40 storeys (Tower 2). Tower 1 will be at the Ridout Street North/King Street intersection and Tower 2 will front the King Street corridor. Key areas of interest for this assessment include the public sidewalks, neighbouring properties (including the existing parks), main entrances to the towers, proposed outdoor amenity spaces including a central main plaza, lookout feature area, landscaped forecourts, and courtyards (Image 3).

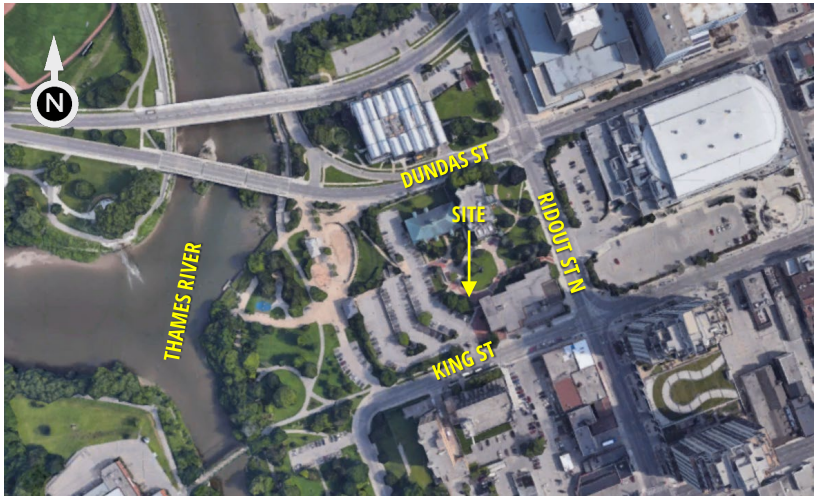


Image 1: Aerial view of the existing site and surroundings
Source: Google Maps

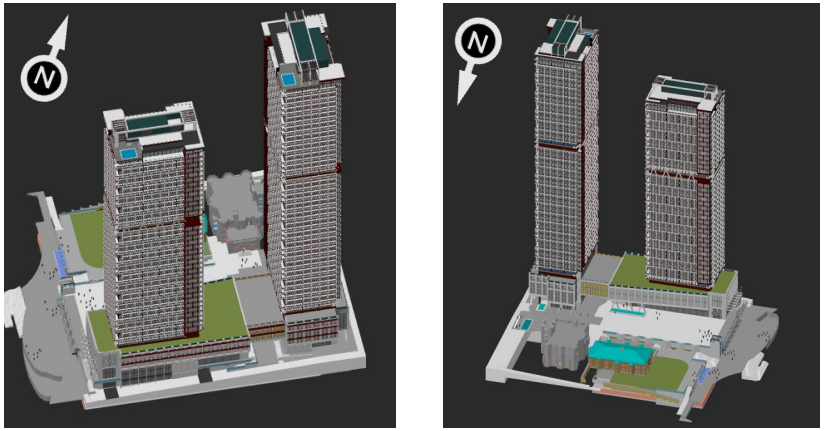


Image 2: Conceptual Massing/Rendering of the Proposed Project

1. INTRODUCTION

Image 3: Floor Plans identifying Key Outdoor Areas of Interest

RWDI Project #2201565
May 16, 2023

2. METHODOLOGY

2.1 Objective

The objective of this assessment is to provide an evaluation of the potential wind conditions and impact of the proposed development on wind conditions in pedestrian areas on and around it based on Computational Fluid Dynamics (CFD) modelling. The assessment is based on the following:

- A review of the regional long-term meteorological data from London International Airport;
- The use of *Orbital Stack*, an in-house CFD tool;
- CFD assessment completed based on the schematic design package and 3D e-model of the proposed project received on September 16 and 20, 2022, respectively;
- Review of updated architectural package received on May 11, 2023;
- RWDI's engineering judgment, experience, and expert knowledge of wind flows around buildings[1-3]; and,
- The RWDI wind comfort and safety criteria.

Note that other microclimate issues such as those relating to cladding and structural wind loads, door operability, air quality, snow impact, noise, vibration, etc. are not part of the scope of this assessment

2.2 CFD for Wind Simulation

CFD is a numerical technique for simulating wind flow in complex environments. For modelling winds around buildings, CFD techniques are used to generate a virtual wind tunnel where flows around the site, surroundings and the study building are simulated at full scale. The computational domain that covers the site and surroundings are divided into millions of small cells where calculations are performed, which allows for the "mapping" of wind conditions across the entire study domain. CFD excels as a tool for wind modelling and presentation for providing early design advice, comparing different design and site scenarios, resolving complex flow physics, and helping diagnose problematic wind conditions.

Gust conditions are infrequent but deserve special attention due to their potential impact on pedestrian safety. The computational modelling method used in the current assessment does not quantify the transient behaviour of the wind, including wind gusts. The effect of gust, i.e., wind safety, is predicted qualitatively in this assessment using analytical methods and wind-tunnel-based empirical models[1]. The assessment has been conducted by experienced microclimate specialists in order to provide an accurate prediction of wind conditions.

In order to quantify the transient behaviour of wind and refine any conceptual mitigation measures, more detailed assessment would be required using either boundary-layer wind tunnel or transient computational modelling.

2. METHODOLOGY

2.3 Simulation Model

CFD simulations were completed for two scenarios:
Existing: Existing site and surroundings.
Proposed: Proposed development with the existing surroundings.

The CFD modelling for the Proposed configuration used the 3-D e-model received on September 16, 2022. The computer model of the proposed building is shown in Image 4, and the Existing and Proposed configurations in the surrounding context are shown in Images 5a and 5b, respectively The 3D models were simplified to include only the necessary building and terrain details that would affect the local wind flows in the area and around the site. Landscaping and other smaller architectural and accessory features were not included in the computer model in order to provide more conservative wind conditions (as is the norm for this level of assessment).

The wind approaching the modelled area were simulated for 16 directions (starting at 0°, at 22.5° increments around the compass), accounting for the effects of the atmospheric boundary layer and terrain impacts. Wind data were obtained in the form of ratios of wind speeds at approximately 1.5m above concerned levels, to the mean wind speed at a reference height. The data was then combined with meteorological records obtained from London International Airport to determine the wind speeds and frequencies in the simulated areas.

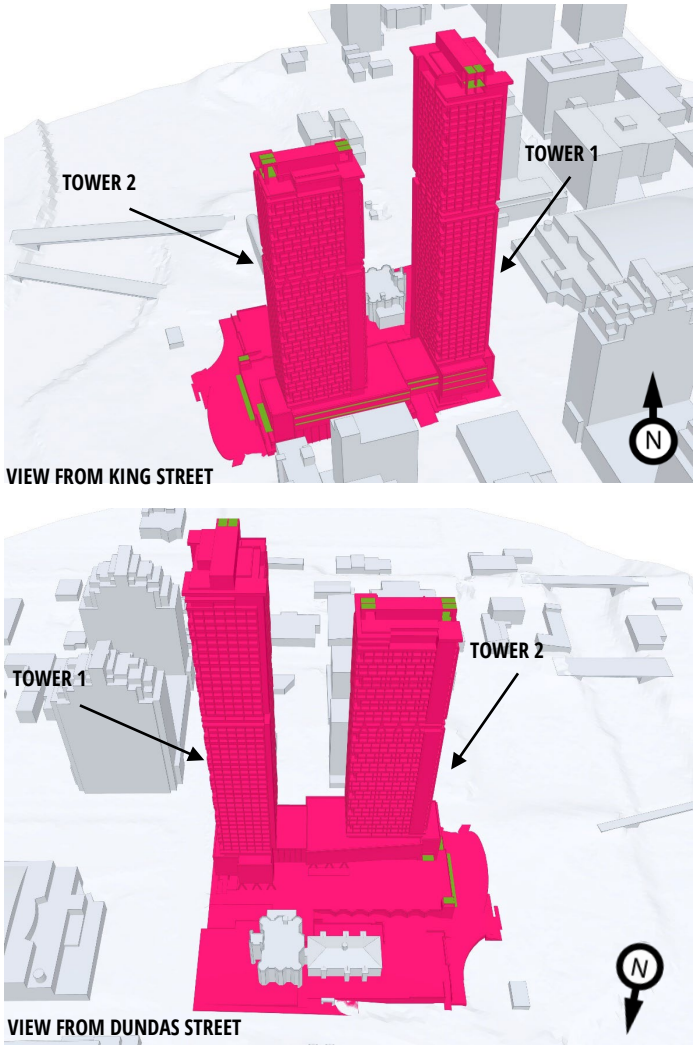


Image 4: Computer model of the proposed project

2. METHODOLOGY

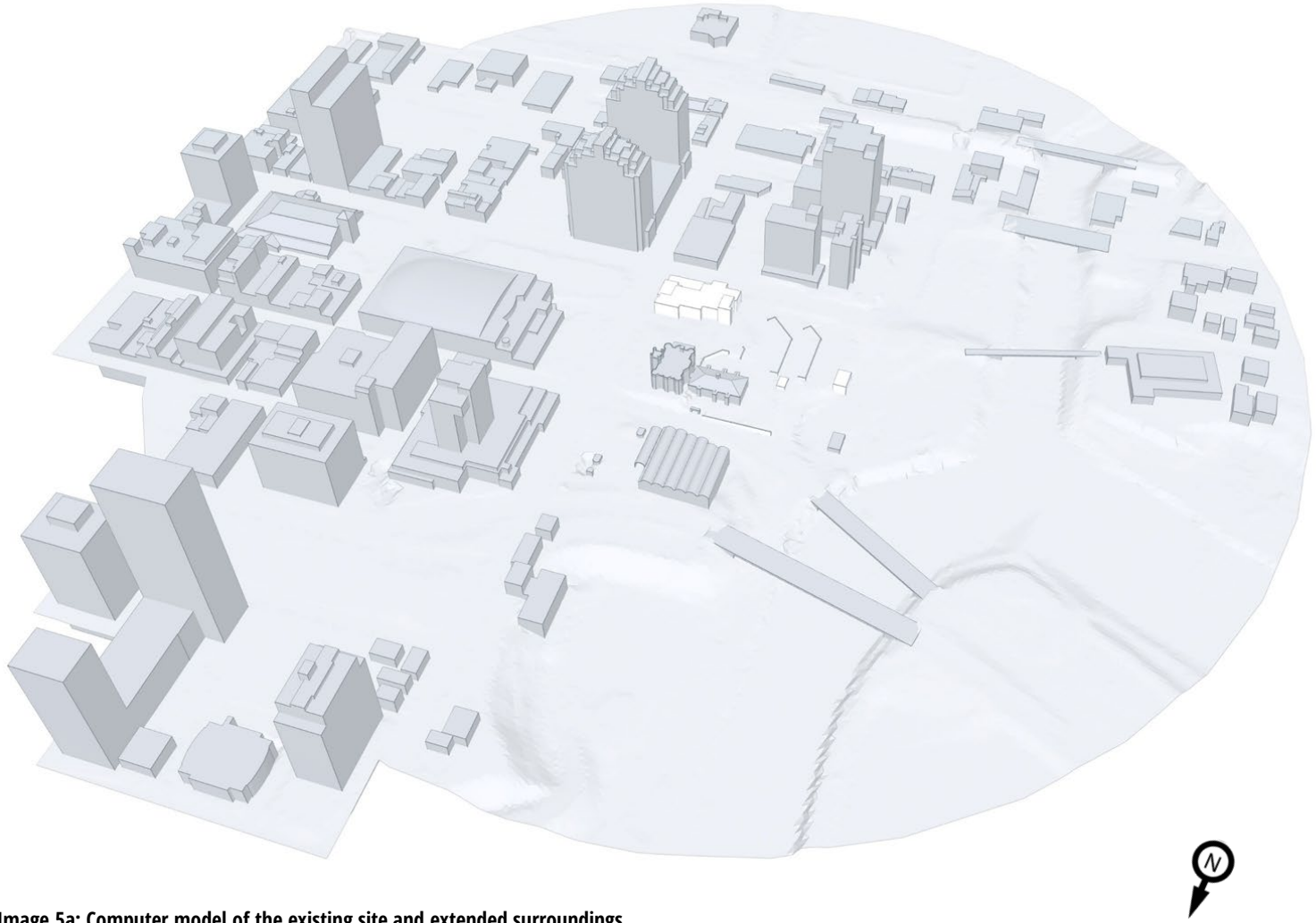


Image 5a: Computer model of the existing site and extended surroundings

2. METHODOLOGY

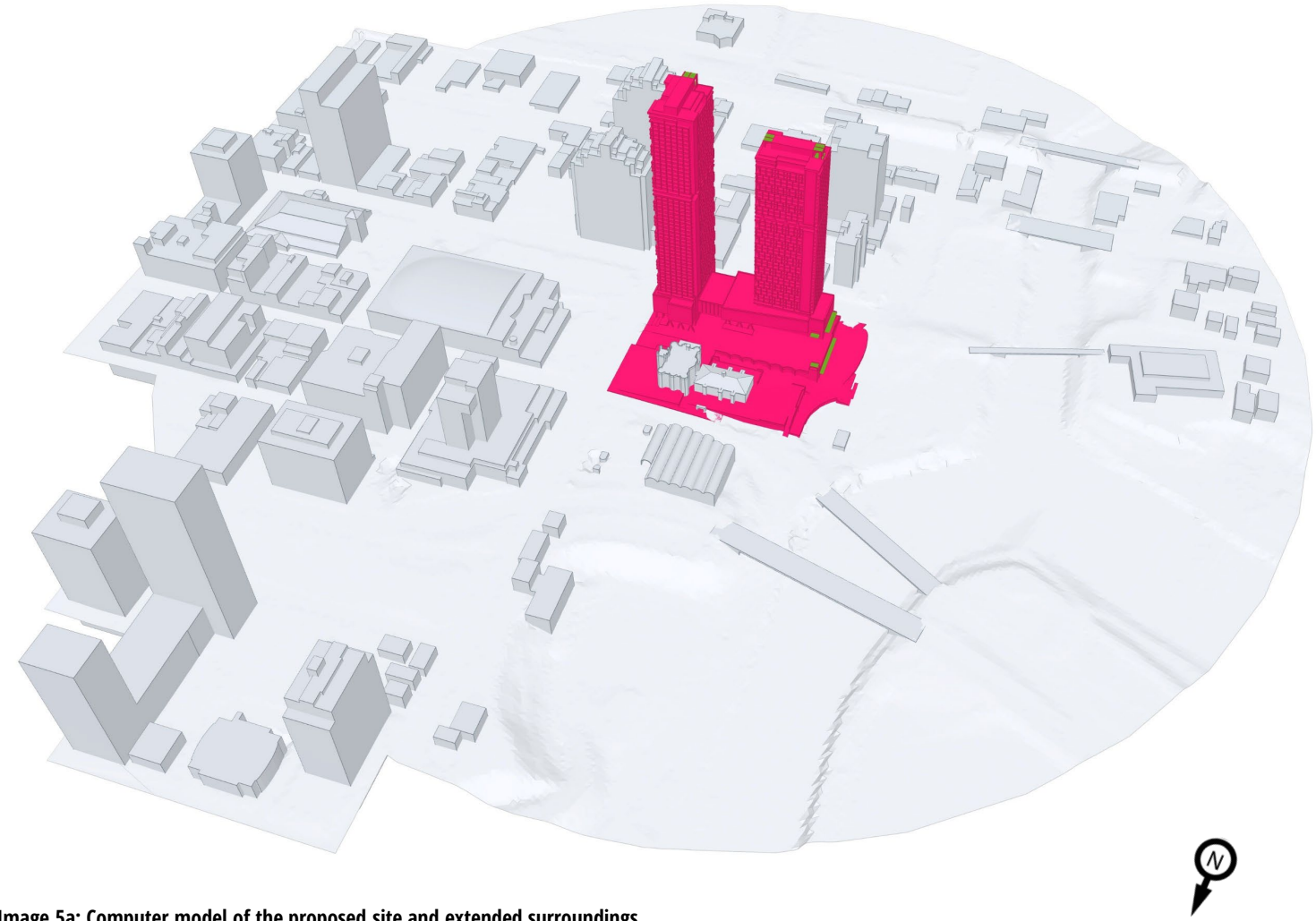


Image 5a: Computer model of the proposed site and extended surroundings

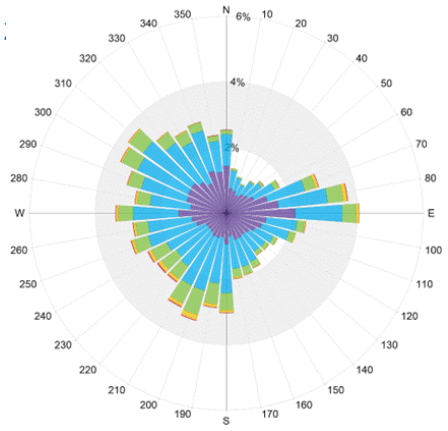
2. METHODOLOGY

Long-term wind data recorded at London International Airport between 1989 and 2019, inclusive, were analyzed for the summer (May to October) and winter (November to April)) months. Image 6 graphically depicts the directional distributions of wind frequencies and speeds for these periods.

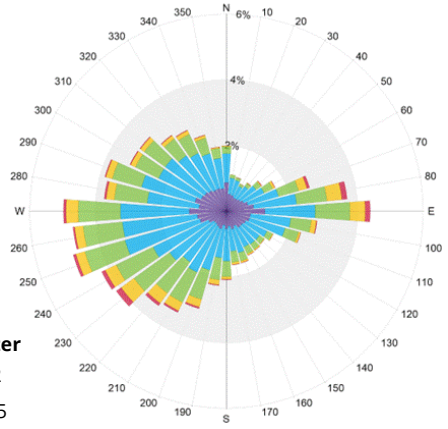
In the summer and winter months, winds from the easterly direction and from the west half of the compass are predominant. In the winter, winds from the east and southwest are significantly more frequent.

Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10m) are more frequent in the winter (red and yellow bands in Image 6). These winds potentially could be the source of uncomfortable or severe wind conditions, depending on the site exposure and development design.

Wind statistics were combined with the simulated data to predict the wind conditions at the project site and assessed against the wind criteria for pedestrian comfort.



Summer
(May through October)



Winter
(November through April)

Wind Speed (km/h)	Probability (%) Summer	Winter
Calm	9.2	4.2
1-10	37.0	24.5
11-20	40.0	41.8
21-30	11.7	22.3
31-40	1.8	5.8
>40	0.3	1.4

Image 6: Directional distribution of wind approaching London International Airport (1989 to 2019)

3. WIND CRITERIA

The RWDI pedestrian wind criteria are used in the current study; the criteria presented in the table below, addresses pedestrian safety and comfort. These criteria have been developed by RWDI through research and consulting practice since 1974. They have also been widely accepted by municipal authorities, building designers and the city planning community.

3.1 Pedestrian Comfort

Pedestrian comfort is associated with common wind speeds conducive to different levels of human activity. Wind conditions are considered suitable for sitting, standing, strolling or walking if the associated mean wind speeds (see table) are expected for at least four out of five days (80% of the time). The assessment considers winds occurring between 6 AM and midnight. Limited usage of outdoor spaces is anticipated in the excluded period. Speeds that exceed the criterion for Walking are categorized Uncomfortable. These criteria for wind forces represent average wind tolerance. They are sometimes subjective and regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. can also affect people's perception of the wind climate.

Comfort Category	GEM Speed (km/h)	Description (Based on seasonal compliance of 80%)
Sitting	≤ 10	Calm or light breezes desired for outdoor seating areas where one can read a paper without having it blown away
Standing	≤ 14	Gentle breezes suitable for main building entrances, bus stops, and other places where pedestrians may linger
Strolling	≤ 17	Moderate winds appropriate for window shopping and strolling along a downtown street, plaza or park
Walking	≤ 20	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
Uncomfortable	> 20	Strong winds considered a nuisance for all pedestrian activities. Wind mitigation is typically recommended

3.2 Pedestrian Safety

Pedestrian safety is associated with excessive Gust Speeds that can adversely affect a person's balance and footing. These are usually infrequent events but deserve special attention due to the potential impact on pedestrian safety.

Safety Criterion	Gust Speed (km/h)	Description (Based on annual exceedance of 9 hrs or 0.1% of time)
Exceeded	> 90	Excessive gusts that can adversely affect one's balance and footing. Wind mitigation is typically required.

4. RESULTS AND DISCUSSION

4.1 Presentation of Results

The results of the assessment are presented and discussed in detail in Sections 4.3 and 4.4. The graphical presentation is in the form of colour contours of wind speeds calculated based on the wind comfort criteria (Section 3.1), approximately 1.5 m above the concerned level. The assessment against the safety criterion (Section 3.2) was conducted qualitatively based on the predicted wind conditions and our extensive experience with wind tunnel assessments. A detailed discussion of the expected wind conditions with respect to the prescribed criteria and applicability of the results follows in Sections 4.3., 4.4., and 4.5. The discussion includes recommendations for wind control to reduce the potential for high wind speeds for the design team's consideration.

Target Conditions

For the current development, wind speeds comfortable for walking or strolling are appropriate for sidewalks and walkways where pedestrians are likely to be active and moving intentionally. Lower wind speeds comfortable for standing are required for entrances and areas where people are expected to be engaged in passive activities. Calm wind speeds suitable for sitting are desired in areas where prolonged periods of passive activities are anticipated, such as outdoor amenity areas, seating areas etc., especially during the summer when these areas are typically in use.

4.2 Wind Flow around the Project

Buildings that are taller than their surroundings tend to intercept and redirect wind around them. The mechanism in which winds are directed down the height of a building is called *Downwashing*. These flows subsequently move around exposed building corners, causing a localized increase in wind activity due to *Corner Acceleration*. When two buildings are situated side by side, wind tends to accelerate through the space between the buildings due to *channelling effect*. Podium extension around towers, stepped facades, low roofs and canopies diffuse downwash and reduce the potential wind impact on the ground level. These flow patterns are illustrated in Image 7.

The proposed towers at 40 and 50 storeys, will be taller than the buildings that exist in the surrounding area. The project is expected to redirect winds around it; however, potential wind impacts would be moderated by the low, large and stepped podium around towers. Also, with the alignment of the longer axis of the proposed west tower with the prevailing winds, the shorter building façade will face the prevailing winds hence moderating the impact from downwashing.

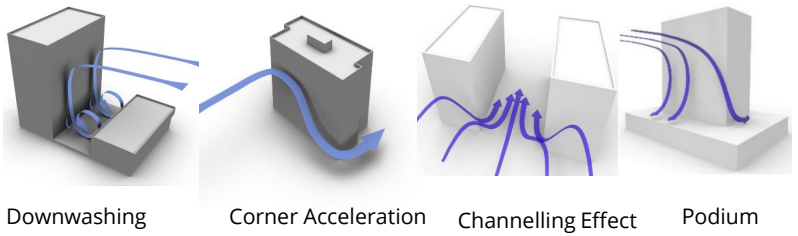


Image 7: General wind flow patterns

4.3 Existing Scenario

The existing building on the site is low-rise and therefore will not redirect winds to create any notable impact. Wind conditions at most areas in the existing scenario are considered comfortable for sitting or standing in the summer (blue regions in Image 8a) and for standing, strolling, or walking in the winter (light blue, green, and yellow regions in Image 8b). Closer to the building perimeters, conditions are considered comfortable for sitting or standing throughout the year.

Wind conditions at all areas near the project site are expected to meet the safety criterion.

4.4 Proposed Scenario: Safety

The proposed project is not expected to significantly alter wind conditions around the site, owing to its stepped podium massing at the base of the towers, and the orientation of the towers with the prevailing winds resulting into the building facades with shorter widths perpendicular to the prevailing winds hence moderating the impact of downwashing. The elevated areas at grade on the west side also acts in favour of reducing wind impact. Wind conditions at grade level around the proposed project are predicted to meet the safety criterion. The wind activity on the rooftop pool decks of the towers potentially exceeds the safety criterion due to the elevation and resulting exposure. to stronger winds.

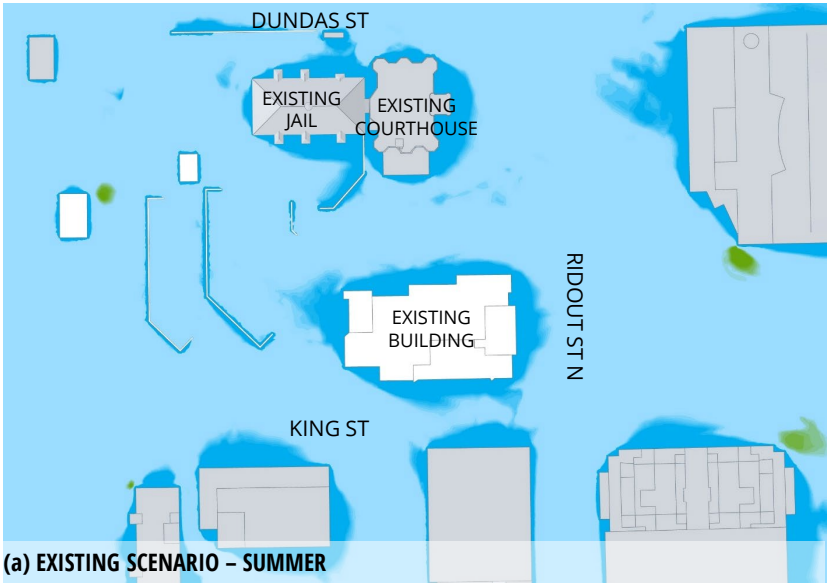
4.5 Proposed Scenario: Comfort

4.5.1 Sidewalks and Neighbouring Properties

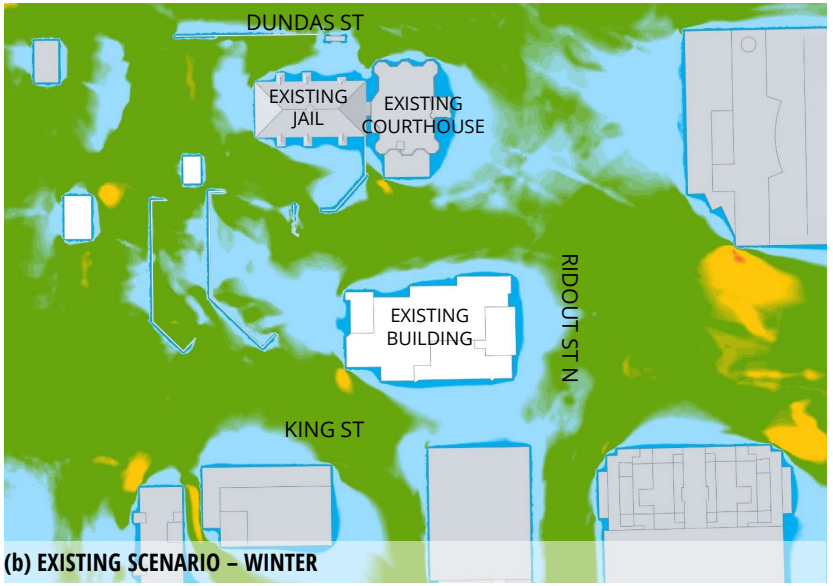
The introduction of relatively tall buildings in an open and mid-rise context will result in an increase in wind speeds around it. As discussed previously, the impact of the project will be moderated to a large extent by the wind-responsive design features. The resulting conditions in the parks and public grounds to the north and west of the site are not expected to be impacted negatively and wind speeds will continue to be similar to existing conditions. Wind speeds on most sidewalks and off-site areas are expected to be comfortable for standing or strolling in the summer, and for strolling or walking in the winter (Images 9a and 9b). These conditions are appropriate for sidewalk use.

During the winter months, potentially uncomfortable wind speeds are expected in localized areas at the northwest corner and in the undercut along the west facade of Tower 1 (see red regions in Image 9b). These elevated wind speeds are mainly due to winds accelerating under the building overhangs/undercuts. These conditions will be infrequent and seasonal; however, if lower speeds are desired, wind screens or tall planters with dense foliage are recommended to diffuse wind accelerating through these areas (see Image 10).

4. RESULTS AND DISCUSSION



(a) EXISTING SCENARIO – SUMMER



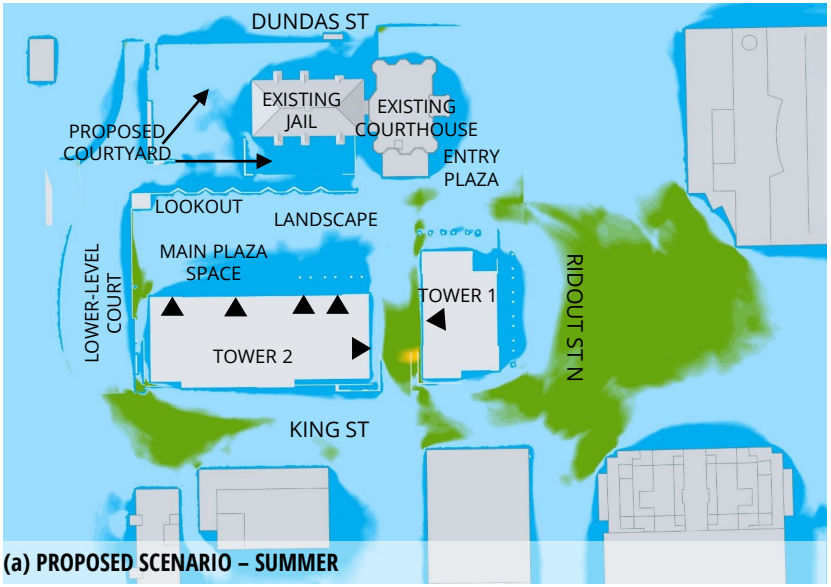
(b) EXISTING SCENARIO – WINTER

COMFORT: SITTING | STANDING | STROLLING | WALKING | UNCOMFORTABLE

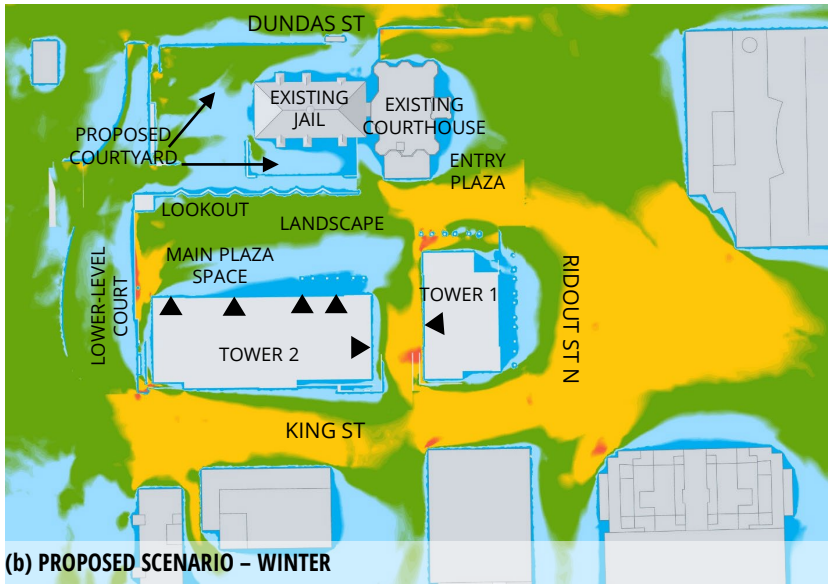
SAFETY: The criterion will be met at all grade level areas.

Image 8: Predicted wind conditions – GROUND LEVEL

4. RESULTS AND DISCUSSION



(a) PROPOSED SCENARIO – SUMMER



(b) PROPOSED SCENARIO – WINTER

COMFORT: SITTING | STANDING | STROLLING | WALKING | UNCOMFORTABLE

▶ Entrances

SAFETY: The criterion will be met at all grade level areas.

Image 9: Predicted wind conditions – GROUND LEVEL

4.5.2 Main Entrances

Wind conditions at the northern retail entrances and Tower 1 residential entrance in the drop-off underpass are predicted to be comfortable for sitting or standing in the summer and winter seasons (Image 9). These conditions are appropriate for the intended pedestrian use.

The residential lobby entrance for Tower 1 is located on the east side in the drop-off underpass. Wind speeds at this entrance are predicted to be higher than desired for a main entrance, comfortable for strolling in the summer and for walking in the winter season. This is due to the prevailing winds channeling through the underpass and the west-facing entrance being exposed to the impacts of the predominant westerly winds. Lower wind speeds can be achieved at this entrance by recessing the entrance into the building façade or by installing wind screens/planters that are at least 2 m tall on both sides of the entrance perpendicular to the façade as shown in Image 11.

4.5.3 Grade Level Amenity Areas

The areas of the main plaza close to the north façade of Tower 2, and the proposed courtyard on the south side of the existing jail building are expected to be comfortable for sitting in the summer season, which is appropriate for passive pedestrian usage. During the summer season, wind conditions comfortable for standing are predicted at the other outdoor amenities such as the entry plaza, lookout area, lower-level court and the proposed courtyard on the west side of the existing jail.

While conditions comfortable for standing are appropriate for general passive activities, wind speeds may be slightly higher than desired if prolonged seated use is desired in these areas (Image 10a).

Trees, combined with underplanting will aid in reducing wind speeds in these areas. Vertical screens or tall planters may be placed to the west, north and south of designated seating areas to create a localized low-wind zone. In addition, overhead trellises in the amenity areas closer to the facades of the proposed towers will also help in sheltering the areas from vertical wind accelerations. Examples are shown in Image 12.

During the winter, most of the outdoor amenity areas are predicted to be windy for passive use (Image 10b), which is acceptable as the areas will likely not be occupied frequently in the cold months.

4. RESULTS AND DISCUSSION


Image 10: Wind control measures for building corners


Image 11: Wind control measures for residential entrance

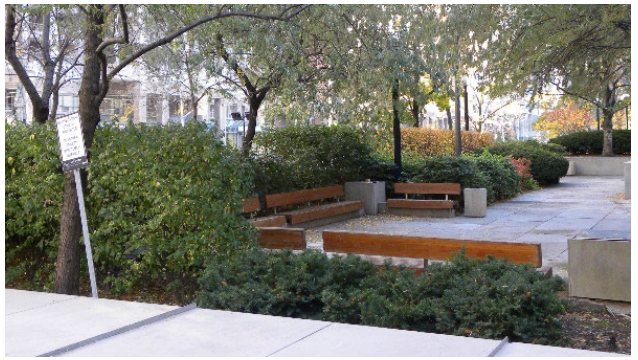




Image 12: Wind control measures for outdoor amenities

4.5.4 Level 4 Podium terrace and Level 5 terraces on Tower 1

Wind speeds at most areas on the Level 4 podium terrace situated between Towers 1 and 2 are expected to be comfortable for strolling during the summer season (see Image 13a). The wind speeds on the Level 5 terraces along the northern, eastern, and southern facades of Tower 1 are expected to be comfortable for sitting or standing during the summer, while higher wind speeds are predicted along the outer edges. Seasonally stronger wind speeds during the winter months are expected to result in elevated wind speeds in these areas (see Image 13b), however since these outdoor areas may not be used frequently during the colder winter months the predicted conditions may be deemed acceptable.

Lower wind speeds can be achieved by introducing tall railings around the terrace perimeters and screens/partitions/planters around any designated seating areas. These features should be at least 2 m tall and at most 30% porous to offer adequate wind protection. At the shared Level 4 podium, in order to provide overhead protection from downwashing winds canopies or trellises may be introduced near the tower base (see Image 15 for examples).

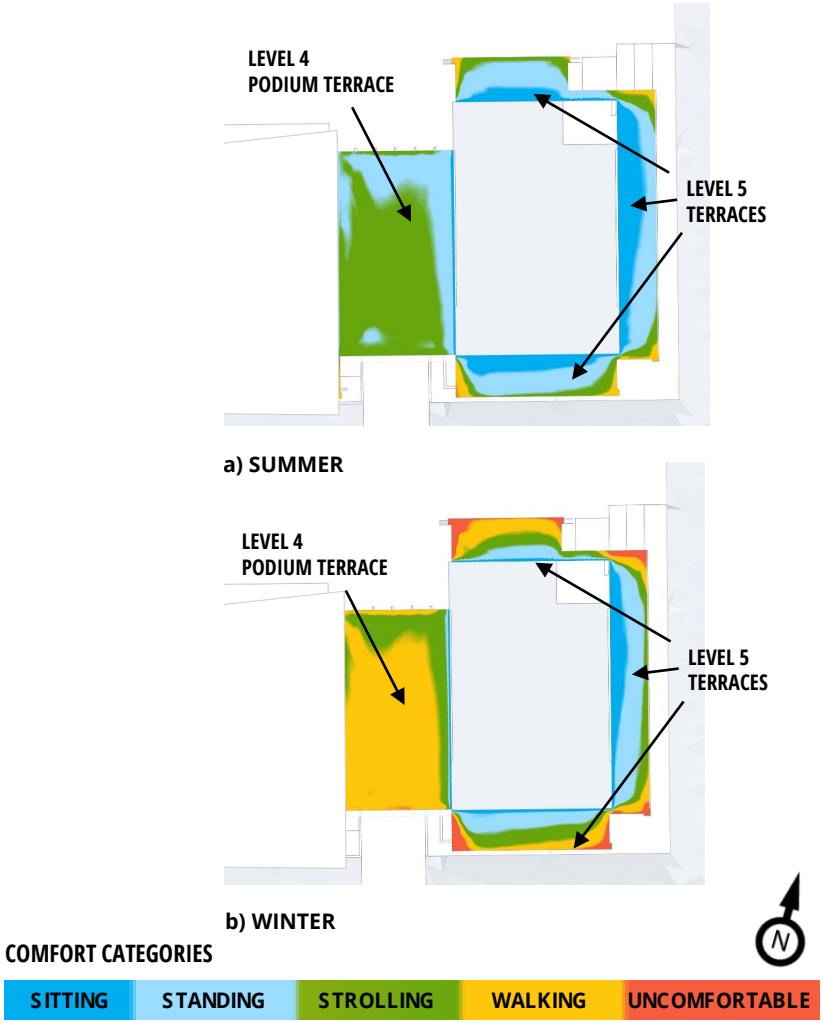


Image 13: Predicted wind conditions – LEVEL 4 & 7 TERRACES

4.5.5 Rooftop and Pool terraces

Wind speeds on the Level 41 & 51 rooftop terraces are anticipated to be comfortable for standing in the summer with strolling or walking conditions predicted in the outer periphery of these terraces.

The Level 42 & 52 pool deck terraces on the Towers 1 and 2 are anticipated to be too windy for the intended use, with uncomfortable conditions potentially exceeding the annual safety criterion in the areas indicated in Image 14b. Lower speeds comfortable for sitting or standing are expected under the proposed trellis cover and close to the interior walls where wind movement would be limited.

It should be noted that during the winter wind speeds will be higher than in the summer months and these conditions may be acceptable as these above grade outdoor amenity areas will likely not be occupied frequently in the colder months (Image 14b).

Wind mitigation strategies should be aimed at reducing the exposure of the terrace to the predominant winds. Mitigation approaches similar to those recommended for the lower terraces in Section 4.5.4 are applicable to the roof terraces as well. See examples in Image 15.

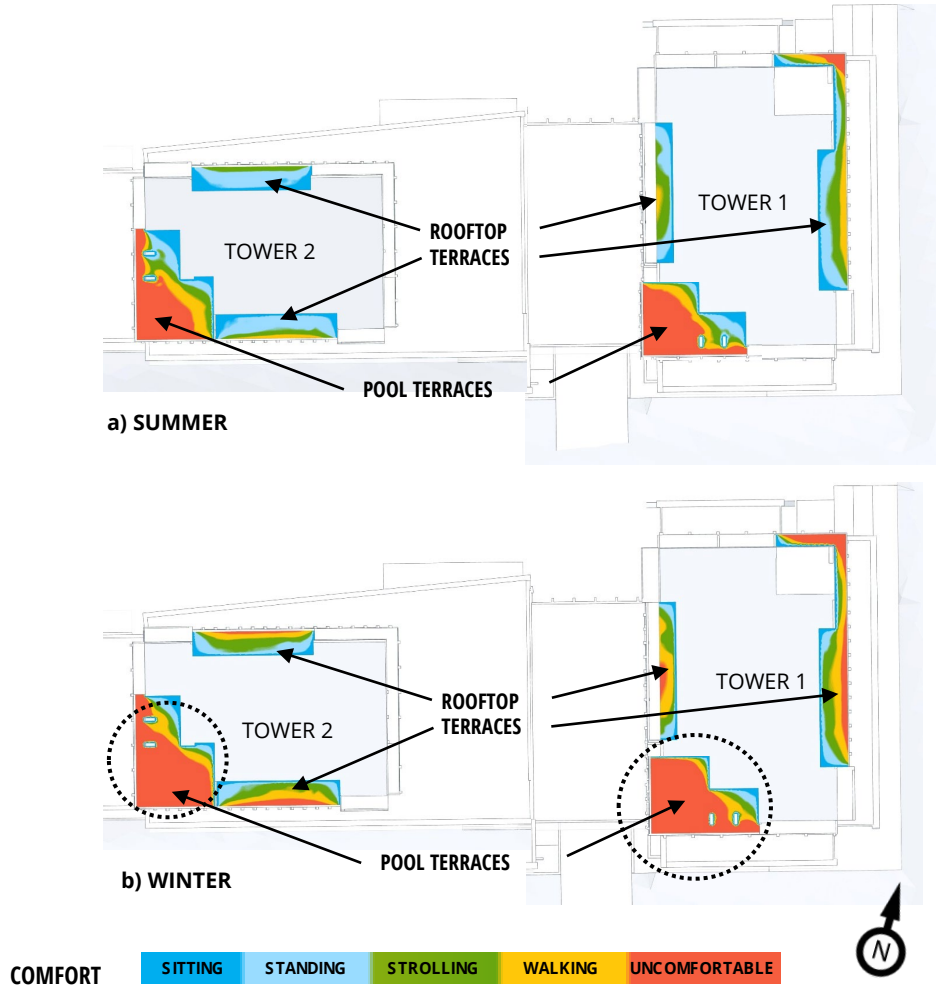


Image 14 Predicted wind conditions – ROOFTOP AND POOL TERRACES

4. RESULTS AND DISCUSSION

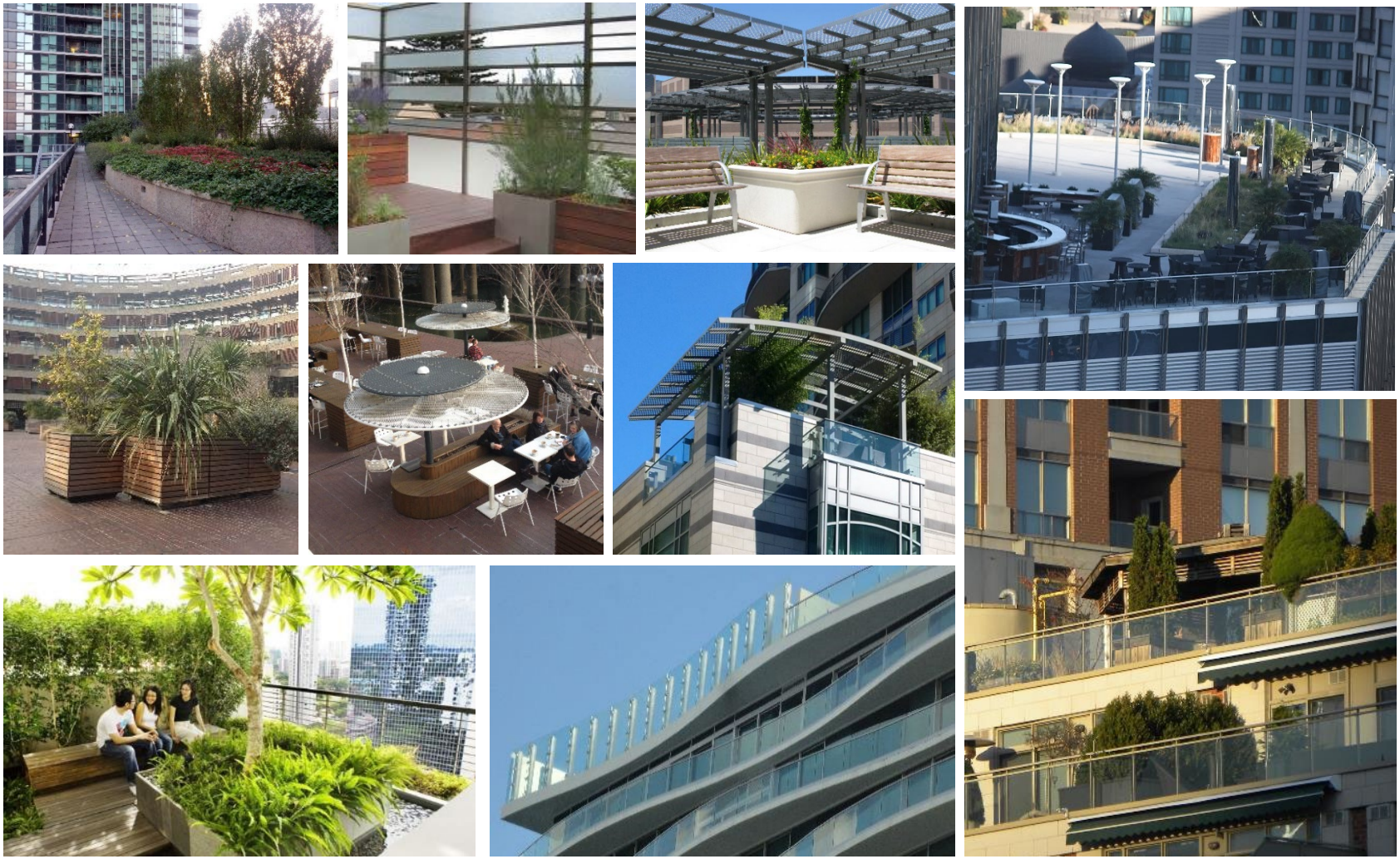


Image 15: Design strategies for wind control on terraces

4.6 Design Updates

RWDI received updated architectural plans for the project on May 11, 2023. Based on the new drawings, the overall massing and heights of the proposed towers are comparable, from a wind impact perspective, to the design used for the 2022 wind assessment. The grade level floor plan used for the 2022 wind assessment is shown in Image 16a, and the current proposed plan is shown in Image 16b. The design changes proposed are expected to have a localized impact on pedestrian wind conditions. The relevant design updates are to the footprints of Towers 1 and 2, with the elimination of the reentrant northeast corner of Tower 1. Also, the orientation of the rooftop terraces of Towers 1 and 2 has changed. The differences to the footprints are identified in red in Image 16b and the upper floor plans are shown in mages 17 and 18 for comparison. This section provides an experience-based discussion of the impact of the design changes on the results presented in Sections 4.4 and 4.5.

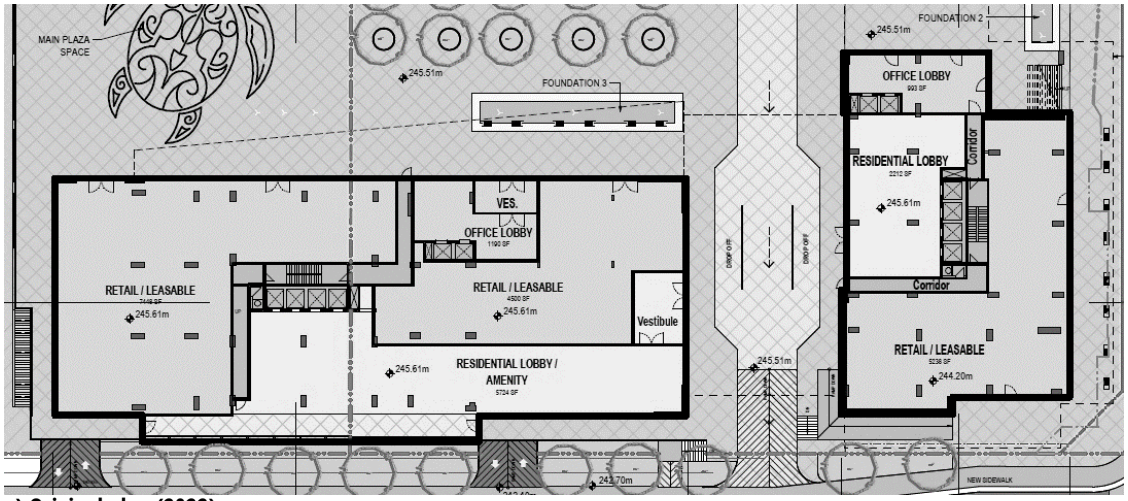
The changes to the proposed towers are not expected to significantly alter wind conditions around the building at grade level, on-site and off-site, and on the terraces on Levels 4 and 5 relative to the results presented in this report (Sections 4.4 and 4.5). Hence, any wind control measures recommended in the previous sections of the report for these areas are still applicable to the proposed project.

However, it should be noted that the rooftop pool deck and terraces on Towers 1 and 2 have significantly changed in terms of their placement. Wind speeds that are higher than desired for passive usage are predicted in these areas in the wind assessment. Similar elevated wind speeds may be anticipated on the new proposed rooftop pool decks and terraces on Towers 1 and 2. Hence, any wind control measures recommended for the rooftop terraces in this report continue to be applicable.

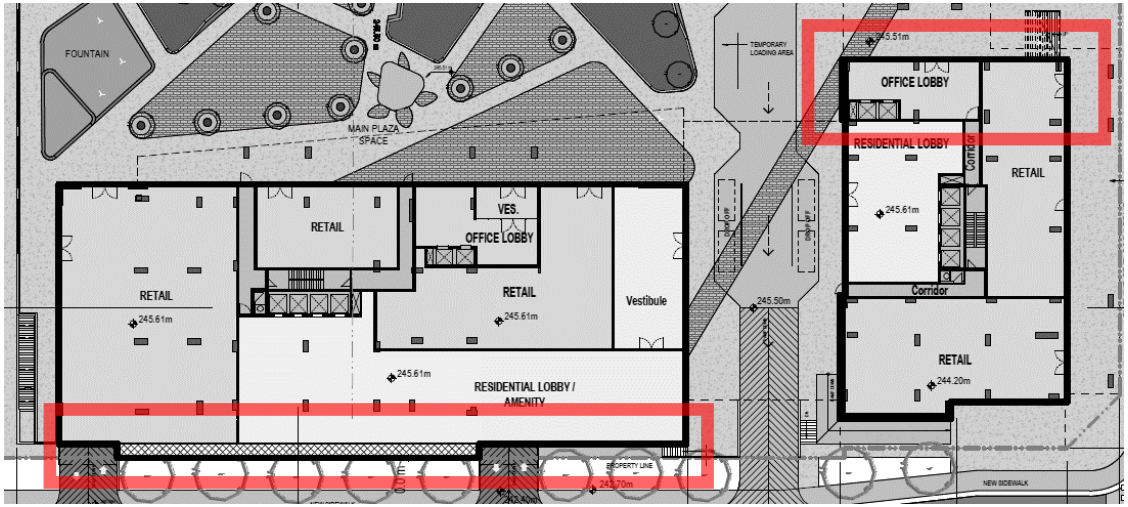
The updated drawings also included the landscape plan on site. Landscaping helps in diffusing the intensity of winds. However, the wind control efficacy of landscaping depends on its orientation relative to the prevailing winds, height, and density of foliage. The comments in this section are based on the baseline results that excluded landscape modelling, and an understanding of the proposed landscaping plan. With the introduction of the proposed trees and tall hedges on site (see Image 19), wind speeds will generally reduce moderately. The densely populated trees at the proposed courtyard on the west side of the existing jail will lower wind speeds locally around them for the space to be comfortable for passive usage. The proposed landscaping layout in the entry plaza and areas near the lookout space is not expected to significantly reduce wind speeds. Hence the wind control suggestions provided in Section 4.5.3 for the entry plaza, lookout area, and proposed lower courtyard are still applicable.

These recommendation on the design updates and landscaping plan are based on the results from the 2022 wind assessment that used the latest massing design at the time, and an understanding of the updated architectural plans. However, any potential changes in wind conditions, the effectiveness of landscape features, and any wind control suggestions should be quantified through wind tunnel testing.

4. RESULTS AND DISCUSSION



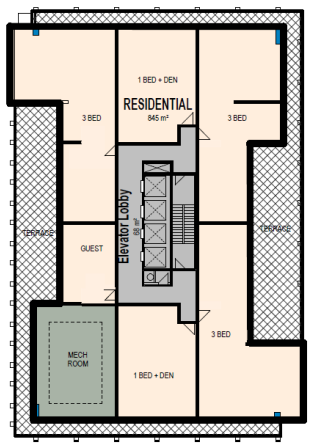
a) Original plan (2022)



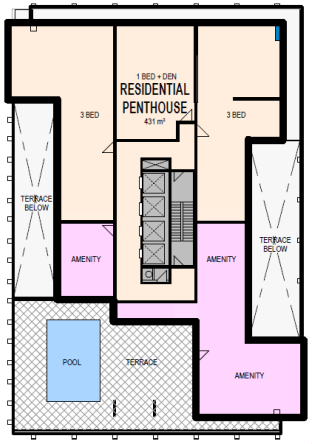
b) Updated plan (2023)

Image 16: Grade level floor plan

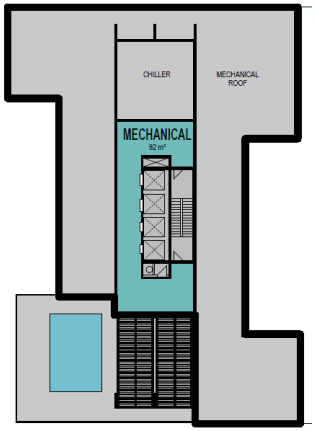
4. RESULTS AND DISCUSSION



LEVEL 51

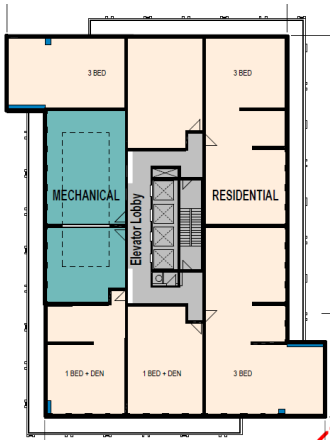


LEVEL 52

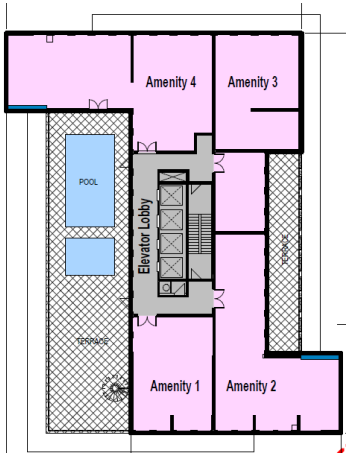


LEVEL 53

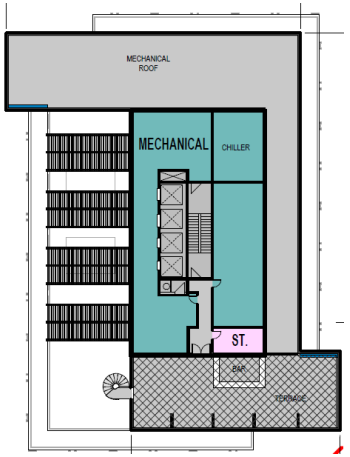
a) Original plan (2022)



LEVEL 51



LEVEL 52

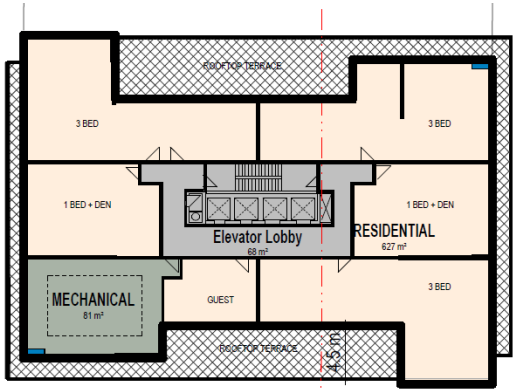


LEVEL 53

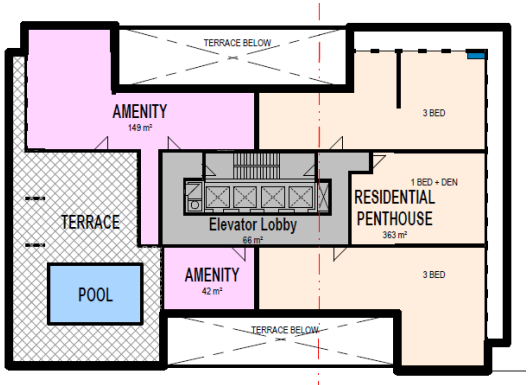
b) Updated plan (2023)

Image 17: Roof top terraces on Tower 1: Original plan 2022 (top) ; Updated plan 2023 (bottom)

4. RESULTS AND DISCUSSION



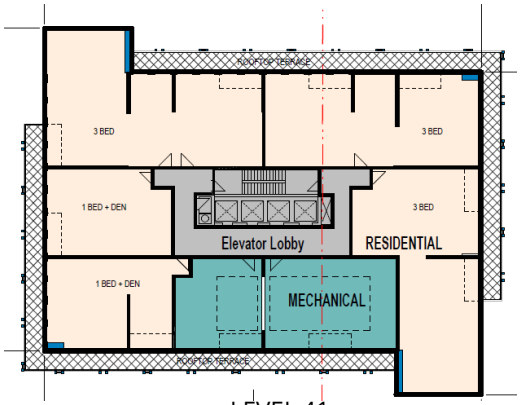
LEVEL 41



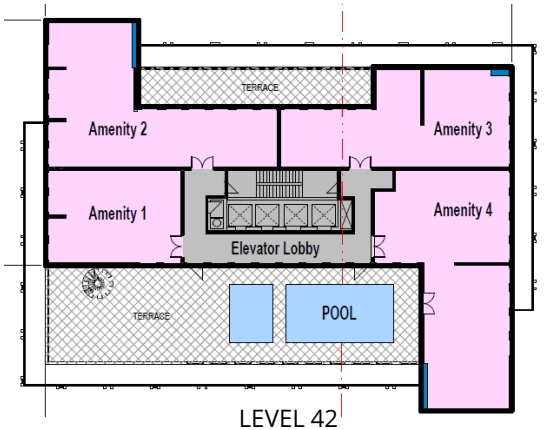
LEVEL 42

LEVEL 43

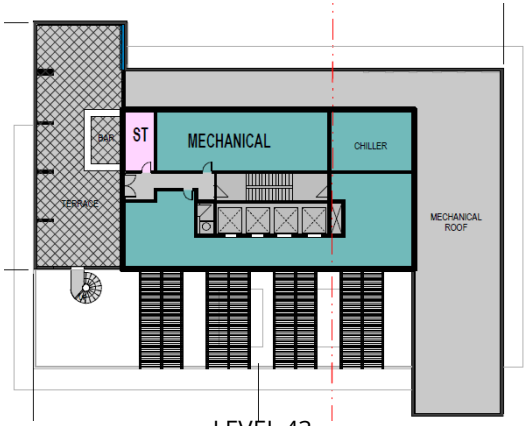
a) Original plan (2022)



LEVEL 41



LEVEL 42



LEVEL 43

b) Updated plan (2023)

Image 18: Roof top terraces on Tower 2 : Original plan 2022 (top) ; Updated plan 2023 (bottom)

4. RESULTS AND DISCUSSION

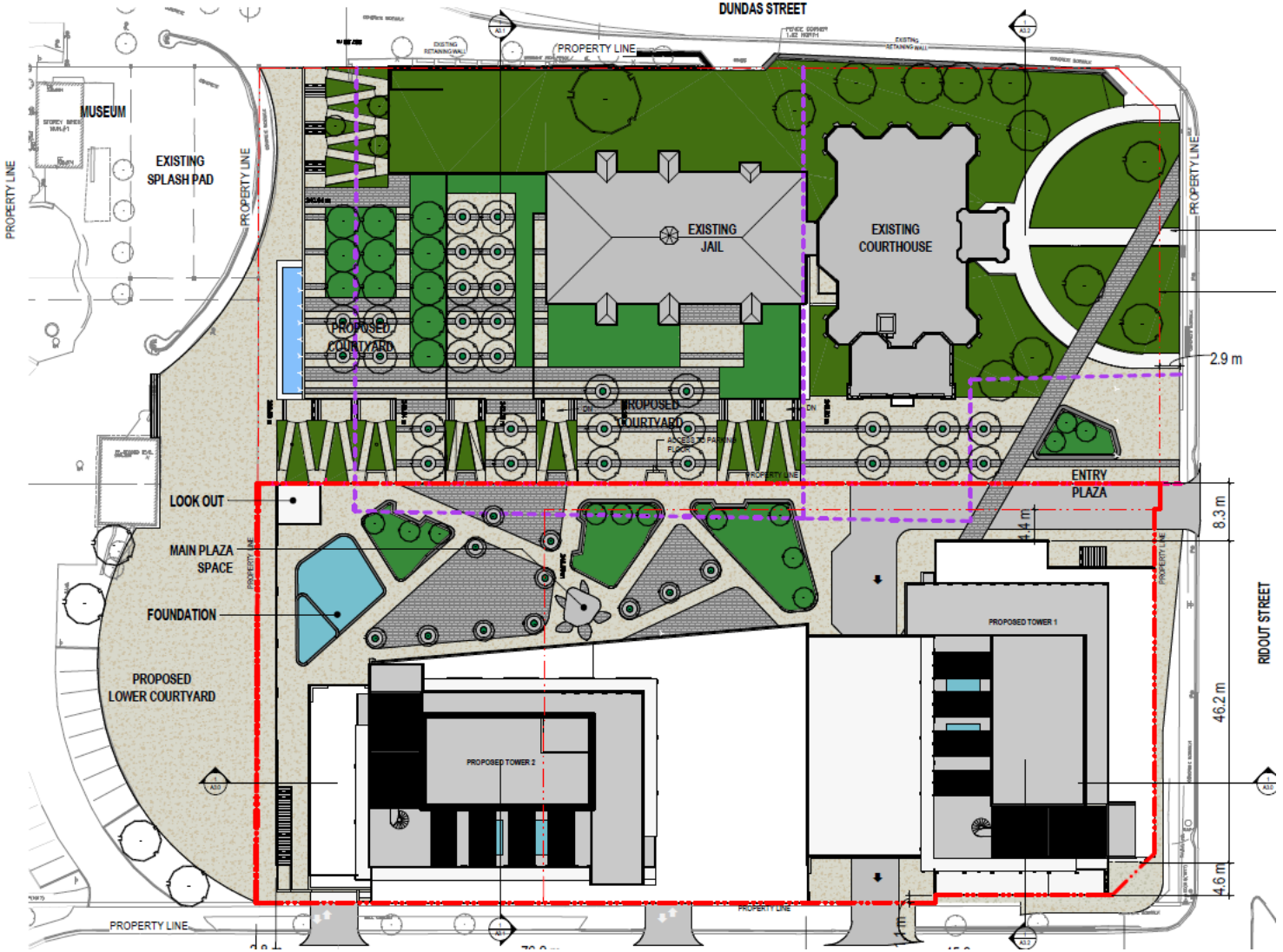


Image 19: Site plan identifying proposed tree locations (2023)

5. SUMMARY

RWDI was retained to provide an assessment of the potential pedestrian level wind impact of the proposed project at 50 King Street and 399 Ridout Street North in London, Ontario. Our assessment was based on computational modelling, simulation and analysis of wind conditions for the proposed development design, in conjunction with the local wind climate data and the RWDI wind criteria for pedestrian comfort and safety.

The computational modelling and analysis was completed in October 2022 using the massing design that was current at the time. RWDI reviewed updated architectural drawings and landscape plan of the proposed project received on May 11, 2023. No significant changes in wind conditions are anticipated at grade level and or the terraces. Our findings are summarized as follows:

- The proposed buildings are taller than the surroundings, and therefore will redirect winds to ground level. However, several positive features in the massing design such as podium setbacks and orientation of towers with prevailing winds will help moderate wind impacts to a large extent.
- Wind conditions at ground level, including the entrances of Tower 2 and sidewalks are expected to be appropriate for the intended usage. The project is not expected to have a notable influence on wind conditions on the nearby parks and public grounds.
- The residential entrance of Tower 1 is expected with elevated wind speeds that are higher than desired for an entrance area. Also, the outdoor amenities at grade level are shown to be expected with wind speeds that are slightly higher than desired for passive usage.
- Potentially uncomfortable wind speeds are expected around the northwest corner of Tower 1 and in a localized area under the building undercut along the western façade of Tower 1.
- Wind speeds at most areas on the Level 4 podium terrace, Level 5 terraces on Tower 1, and the pool deck terraces on Towers 1 & 2 are expected to be higher than desired for passive usage during the summer season. Uncomfortable conditions and safety exceedances are predicted on the pool deck terraces situated on Towers 1 and 2.
- Wind conditions on the rooftop pool decks and terraces on the proposed towers are expected to be higher than desired for passive usage over the year.
- Wind control strategies have been suggested in the report for any areas associated with higher than desired wind speeds.

RWDI can help guide the placement of wind control features, including landscaping, to achieve appropriate levels of wind comfort based on the programming of the various outdoor spaces.

6. DESIGN ASSUMPTIONS

The findings/recommendations in this report are based on the building geometry and architectural drawings communicated to RWDI in September 2022 and May 2023, listed below. Should the details of the proposed design and/or geometry of the building change significantly, results may vary.

File Name	File Type	Date Received (mm/dd/yyyy)
19-045 - 50 King SD_v4	PDF	09/16/2022
2022.07	DWG	09/20/2022
19-045 - 50 King SD_v6_2023.04.12(1)	PDF	05/11/2023

Changes to the Design or Environment

It should be noted that wind comfort is subjective and can be sensitive to changes in building design and operation that are possible during the life of a building. These could be, for example: outdoor programming, operation of doors, elevators, and shafts pressurizing the tower, changes in furniture layout, etc.. In the event of changes to the design, construction, or operation of the building in the future, RWDI could provide an assessment of their impact on the discussions included in this report. It is the responsibility of Others to contact RWDI to initiate this process.

7. STATEMENT OF LIMITATIONS

This report was prepared by Rowan Williams Davies & Irwin Inc. for YORK Developments ("Client"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein and authorized scope. The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.

7. REFERENCES

1. H. Wu, C.J. Williams, H.A. Baker and W.F. Waechter (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", *ASCE Structure Congress 2004,* Nashville, Tennessee.

2. H. Wu and F. Kriksic (2012). "Designing for Pedestrian Comfort in Response to Local Climate", *Journal of Wind Engineering and Industrial Aerodynamics*, vol.104-106, pp.397-407.

3. C.J. Williams, H. Wu, W.F. Waechter and H.A. Baker (1999), "Experience with Remedial Solutions to Control Pedestrian Wind Problems", *10th International Conference on Wind Engineering*, Copenhagen, Denmark.