Gradient Microclimate Engineering Inc.

August 9, 2012

Mr. Kevin A. Harper
Development Manager – High Rise
Minto Communities Inc.
200-180 Kent Street
Ottawa, Ontario
K1P 0B6

Dear Mr. Harper:

Re: 485 Richmond Road, Ottawa
Qualitative Pedestrian Wind Assessment
GmE File Ref.: 12-082-DTPLW

1. INTRODUCTION

Gradient Microclimate Engineering Inc. (*GmE*) was retained by Minto Communities Inc. to undertake a qualitative pedestrian level wind assessment for a planned residential development located at 485 Richmond Road in Ottawa, Ontario. This report provides a qualitative assessment of pedestrian wind comfort for the noted site based on architectural drawings provided by Wallman Architects in August 2012, a review of existing surrounding context, statistical knowledge of the Ottawa wind climate, and experience with similar past projects in Ottawa. A qualitative wind assessment, as distinct from the more elaborate wind tunnel or computational study, is suitable to identify potential pedestrian comfort issues at an early design stage, and develop mitigation strategies as may be necessary.

2. TERMS OF REFERENCE

The focus of this qualitative wind assessment is a planned residential development located at 485 Richmond Road in Ottawa, Ontario. The site is situated on a parcel of land surrounded by Richmond Road to the south, Fraser Avenue to the west, the Ottawa River Parkway to the north, and Berkley Avenue to the east.

The curved plan-form tower of twenty (20) storey sits atop a rectangular five (5) storey podium used for parking, to create a twenty-five (25) storey residential building that features wrap-around balconies, a private outdoor amenity area, as well as an outdoor common area along its north façade at grade. Cladding over the podium levels consists of a mix of curtain wall systems, porous vertical fins and solid vertical louvers. Vehicle parking and bicycle storage will be accommodated within a multi-level parking garage with egress/ingress provided via ramp access at the building's southwest corner. The building is aligned approximately northwest-southeast, with the long axis of its rectangular floor plate perpendicular to Richmond Road. At 6th level the tower sets back over the podium to create a large terrace area on the south side. Vehicle access is restricted to the building's south façade from Richmond Road.

Regarding wind exposure, the study building is surrounded in close proximity by lower commercial and residential buildings to the west and south, the single storey Rodgers building to the immediate east, and a cluster of mid-height residential towers to the east, located west of Berkley Avenue. At greater distances, referred to as the far field, the site is surrounded by the Ottawa River to the north and low rise residential properties for most other directions. As such, the existing massing creates generally suburban wind exposures for the northeast clockwise through to southwest quadrants, and open exposures for the remaining cardinal directions.

With respect to pedestrian winds, key areas under investigation include the main entrances, exit doors on the east façade, the noted outdoor common area, as well as the podium roof amenity terrace. A site plan is provided in Figure 1, while Figures 2 and 3 respectively provide the ground floor plan and 6th floor terrace plan.

3. METHODOLOGY

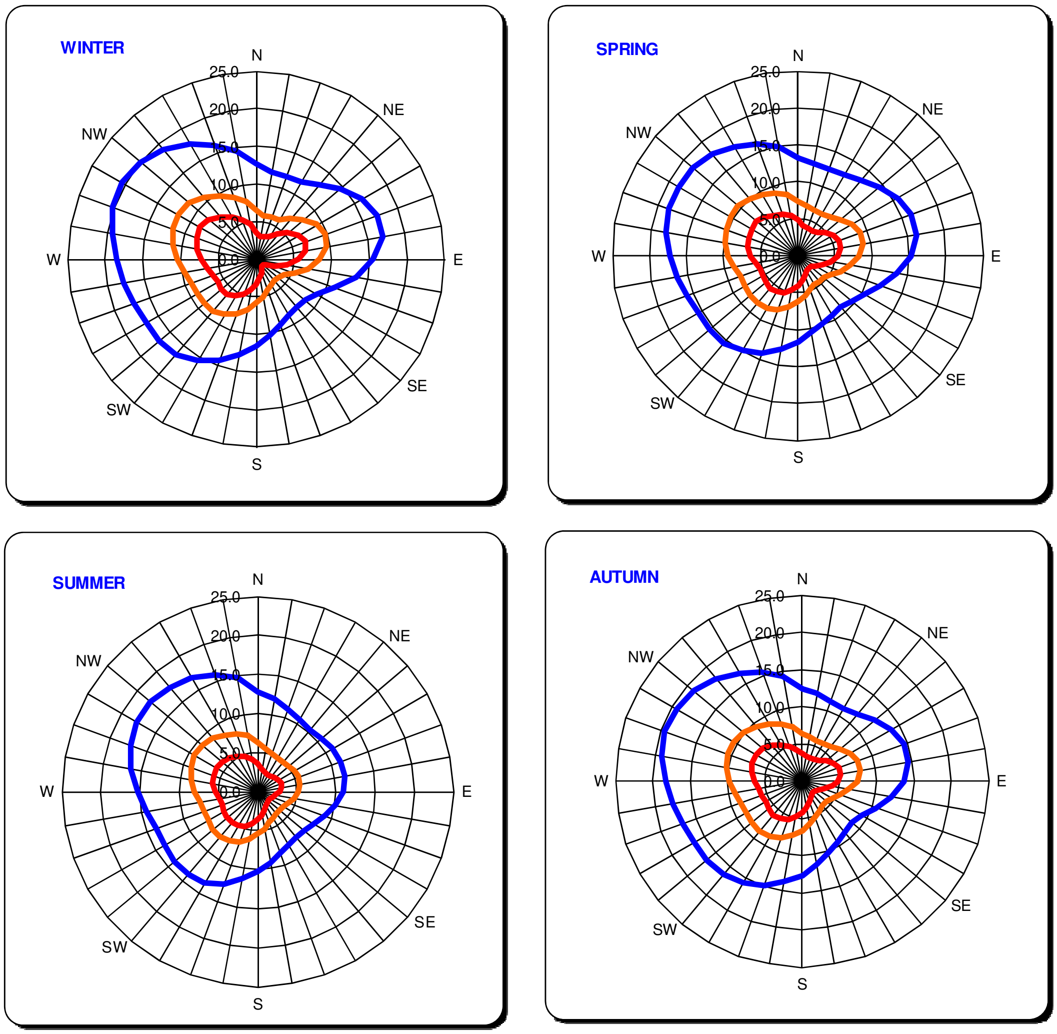
The following section describes the analysis process, including a background discussion of pedestrian comfort. The essential aspects of a wind analysis include: (i) consideration of the statistical properties of the local wind climate, (ii) consideration of the massing of the site (i.e., the shape and orientation of the buildings), and (iii) estimation of anticipated pedestrian comfort conditions based on in-house experience.

3.1 Meteorological Data Analysis

A statistical model of the Ottawa wind climate, indicating the directional character of local winds on a seasonal basis, is presented on the following page. The plots illustrate three contours representing three probability levels superimposed on a polar grid of wind speed at gradient height in metres/second (m/s). The three contours represent the mean hourly wind speed occurring once per month (innermost contour), once per year and once every ten years (outermost contour). The preferred wind directions can be identified as the angular position where the given contour has the largest radial distance from the centre. For Ottawa, the most common winds occur for westerly wind directions, followed by those from the east; the directional preferences and corresponding wind speeds vary seasonally. By convention in microclimate studies, wind direction refers to the wind origin (e.g., a north wind blows from north to south).

SEASONAL DISTRIBUTION OF WINDS FOR VARIOUS PROBABILITIES

MACDONALD-CARTIER INTERNATIONAL AIRPORT, OTTAWA



Notes:

1. Radial distances indicate wind speed in metres/second at a height of 10 m above grade.
2. A point along the innermost contour represents the wind speed exceeded on average 0.1% of the time within a 10° sector centered on that direction.
3. The middle and outermost contours represent probability levels of 0.01% and 0.001%, respectively.

3.2 Pedestrian Wind Comfort Criteria

Pedestrian comfort criteria are based on mechanical wind effects without consideration of other meteorological conditions (e.g., temperature, relative humidity). The criteria provide an assessment of comfort, assuming that pedestrians are appropriately dressed for a specified outdoor activity during any given season. Five pedestrian comfort classes and corresponding gust wind speed ranges are used to assess pedestrian comfort, which include: (i) Sitting; (ii) Standing; (iii) Walking; (iv) Uncomfortable; and (v) Dangerous. More specifically, the comfort classes, associated wind speed ranges and limiting criteria are summarized as follows:

i) **Sitting** – Wind speeds below 14 km/h (i.e. 0 - 14 km/h), occurring more than 70% of the time, are acceptable for sedentary activities, including sitting.
ii) **Standing** – Wind speeds below 22 km/h (i.e. 0 - 22 km/h), occurring more than 80% of the time, are acceptable for activities such as standing, strolling or more vigorous activities.
iii) **Walking** – Wind speeds below 30 km/h (i.e. 0 - 30 km/h), occurring more than 80% of the time, are acceptable for walking or more vigorous activities.
iv) **Uncomfortable** – Uncomfortable conditions are characterized by predicted values that fall below the 80% criterion target for walking. Brisk walking and exercise, such as jogging, would be acceptable for moderate excesses of this criterion.
v) **Dangerous** – Wind speeds greater than 90 km/h, occurring more than 0.01% of the time, are classified as dangerous. From calculations of stability, it can be shown that gust wind speeds of 90 km/h would be the approximate threshold that would cause an average elderly person in good health to fall.

The wind speeds associated with the above categories are gust wind speeds. Corresponding mean wind speeds are approximately calculated as gust wind speed divided by 1.5. Gust speeds are used in the criteria because people tend to be more sensitive to wind gusts than to steady winds for lower wind speed ranges. These criteria are applied according to the intended use of the outdoor area. For example, an entrance to a building without a vestibule should be suitable for standing, but need not be suitable for sitting.

3.3 Massing vs. Climate – Geometric Effects

Physical features of a site that influence the local wind microclimate include; the density of surrounding buildings, the massing of the study site, and the geometry of the study building(s). Massing density typically increases over time, which can provide greater shielding to wind and calmer wind conditions at grade.

For the study site, pedestrian comfort will primarily be influenced by winds originating from the northwest counterclockwise through to southwest, as well as from the east. Although the remaining wind directions have a lower statistical frequency of occurrence, strong wind flows associated with multiple low probability wind directions can cumulatively influence pedestrian comfort.

Based on the orientation of the development relative to prominent wind directions, the form of the study building, and in-house knowledge of common wind impacts, moderate wind conditions at grade level are generally expected to be acceptable for anticipated pedestrian uses. Specific wind conditions for the study site are discussed in the following section.

4. ANTICIPATED PEDESTRIAN COMFORT

Based on the massing of the study site, surrounding building massing and the orientation to the local wind climate, the following statements summarize our experience of how these conditions affect pedestrian comfort in key areas around the site.

4.1 Main Residential Entrances, Ramp Access to Vehicle and Bicycle Parking, Vehicular Drop-Off Area (Figure 2, Tag A), West Elevation (Figure 2, Tag B)

The building's main entrances, ramp access to vehicle and bicycle parking, as well as the vehicular drop-off area, are exposed to west, southwest and east winds. Despite alignment with statistically prominent winds, building occupants are afforded adequate grade-level protection due to the surrounding massing (size and geometry) in the immediate vicinity of the noted areas of interest, considerable setback of the tower at the 6th level, and upwind exposures. Therefore, wind conditions along the building's south façade at grade are anticipated to be suitable for sitting during the summer, standing during the shoulder months of spring and autumn, and suitable for walking during the winter months.

The building's west elevation, while being exposed to west and northwest winds, the existing building at 495 Richmond Road (former Region of Ottawa Carleton) serves to shield the west elevation against most westerly wind events. As a result, the corresponding wind conditions along this elevation, identified with the symbol B in Figure 2, are anticipated to be suitable for sitting during the summer and autumn, and standing during the spring and winter months.

These conditions over areas tagged A and B in Figure 2 are considered to be acceptable for the anticipated pedestrian uses.

4.2 Exit Doors on East Façade (Figure 2, Tag C)

The building's east façade is primarily exposed to prominent east winds. A primary concern is the height difference between the study building's podium and the massing to the immediate east; a gap measuring approximately 5.5 m separates the two properties. East winds will tend to collide with the study building's east façade and spill downward due to the difference in localized pressure. This will result in accelerated flow and more frequent strong winds at grade. However, this effect is moderated by the cluster of taller buildings west of Berkley Avenue and north of Richmond Road.

The net impact of these described wind flows is to create moderately windy grade-level conditions suitable for standing during the summer and autumn months, and suitable for walking during the winter and spring months. These conditions are considered acceptable for the intended functions of the spaces.

4.3 Outdoor Common Area along North Façade (Figure 2, Tag D)

The outdoor area along the building's north façade is exposed to statistically prominent winds, flowing over the open fetches of the Ottawa River and unobstructed lands south of the Ottawa River Parkway. As a result, the local pedestrian environment is expected to be moderately windy, resulting in conditions suitable for standing during the summer and autumn months, and suitable for walking during the spring and winter months. These wind conditions are considered to be acceptable for the intended uses of the space. On the other hand if this area will be used in the future for sitting, lounging or other outdoor leisure activities, mitigation in the form of architectural barriers or coniferous screening will be required along the western and northern perimeter of the area.

4.4 Pedestrian Comfort within the Podium Rooftop (Figure 3)

Exposure to prominent winds coupled with downwash effects from the 20-storey residential tower will likely result in windier conditions over much of the amenity area of podium roof. Moderately strong wind conditions are anticipated some regularity which are not conducive to prolonged sitting or lounging particularly over the central amenity space around the fire pit. Depending on the specific use intended, it is advisable to introduce wind protection in the form of transparent vertical windscreens along the entire perimeter of the podium at a height no less than 1.8 m. Additionally, in order to deflect the noted downward accelerating flows, an overhead canopy spanning the west, south and east façades of the tower may be necessary. The canopy should be continuous, at a height of 3 m above the walking surface of the podium rooftop, and extending outward no less than 2.5 m. With the noted mitigation measures in place, conditions suitable for sitting or lounging during the summer, standing during the spring and autumn, and walking during winter months are anticipated. It is emphasized that these mitigation steps are optional and depend on the intended frequency of use of the outdoor area. However, if mitigation measures are contemplated, detailed testing would be advisable to confirm the necessity and extent of the measures. The current landscaping is not robust enough to provide significant wind mitigation benefits.

Within the context of typical weather patterns (excluding severe local storm events, such as thunderstorms, tornadoes and downbursts), no dangerous or consistently strong wind conditions are expected anywhere over the subject site on a seasonal, nor on an annual, basis. During severe events, strong winds are influenced by specific local meteorological conditions and building geometries that cannot be predicted with the current understanding of these events. Research into the subject areas with respect to their impacts on buildings and pedestrians is currently in its infancy.

5. SUMMARY AND RECOMMENDATIONS

Based on the qualitative analysis of site plans, building forms and the local climate, the following statements summarize our interpretation of future wind conditions for the subject site massing. In general terms, wind conditions are considered to be acceptable for the intended uses according to the following statements and limitations:

1) The main residential entrances, ramp access to vehicle and bicycle parking, as well as the vehicular drop-off area are located along the building's south elevation. Wind conditions along the building's south façade at grade are anticipated to be suitable for sitting during the summer, standing during the shoulder months of spring and autumn, and suitable for walking during the winter months.

2) Wind conditions along the building's west façade at grade are anticipated to be suitable for sitting during the summer and autumn months, and standing during the remaining colder months.

3) For the building's east façade, east winds will tend to result in accelerated flow and more frequent strong winds at grade. More specifically, conditions suitable for standing during the summer and autumn months and suitable for walking during the winter and spring months are anticipated. These conditions are considered acceptable for the intended functions of the spaces.

4) The local pedestrian environment within the outdoor common area along the north façade of the building is expected to be moderately windy, resulting in conditions suitable for standing during the summer and autumn months, and suitable for walking during the spring and winter months. These wind conditions are considered to be acceptable for the intended uses of the space. However, mitigation would be warranted if the area is intended for sedentary and prolonged pedestrian activities such as outdoor eating.

5) Localized wind conditions are generally unsuited for prolonged sitting or lounging over the podium amenity area. Therefore, depending on the intended use and specific location of outdoor amenity areas, it may be necessary to introduce wind protection in the form of transparent vertical windscreens along the entire perimeter of the podium at a height no

less than 1.8 m. Additionally, an overhead canopy spanning the west, south and east façades of the tower will provide relief from strong winds. The canopy should be i) continuous, ii) at a height of 3 m above the walking surface of the podium rooftop, and iii) extending outward no less than 2.5 m. With the noted mitigation measures in place, conditions suitable for sitting or lounging during the summer, spring and autumn, and walking during winter months are anticipated. As indicated in the main text these mitigation measures are optional and dependent on the intended frequency of use of the outdoor area. Furthermore, any mitigation measures can be retrofitted after building occupancy, as experience indicates, or if the intended use changes. If mitigation measures are contemplated, they should be confirmed with detailed testing in the wind tunnel, or by means of computer modelling.

Based on the results of this qualitative wind study, the majority of the pedestrian areas are expected to perform satisfactory for the anticipated activities with local and isolated mitigation required in some areas.

The foregoing analysis and statements are based on experience and knowledge of wind flow patterns in urban and suburban settings. While the statements and conclusions relating to pedestrian safety are expected to be reliable for the site as a whole, the evaluation of comfort is more difficult to assess due to the limitations of visualizing local wind flows as well as the variable physiological response of pedestrians to similar environmental conditions. As a result, this assessment is intended to assure adequate pedestrian safety relating to wind, while providing general guidance relating to pedestrian comfort around the subject site.

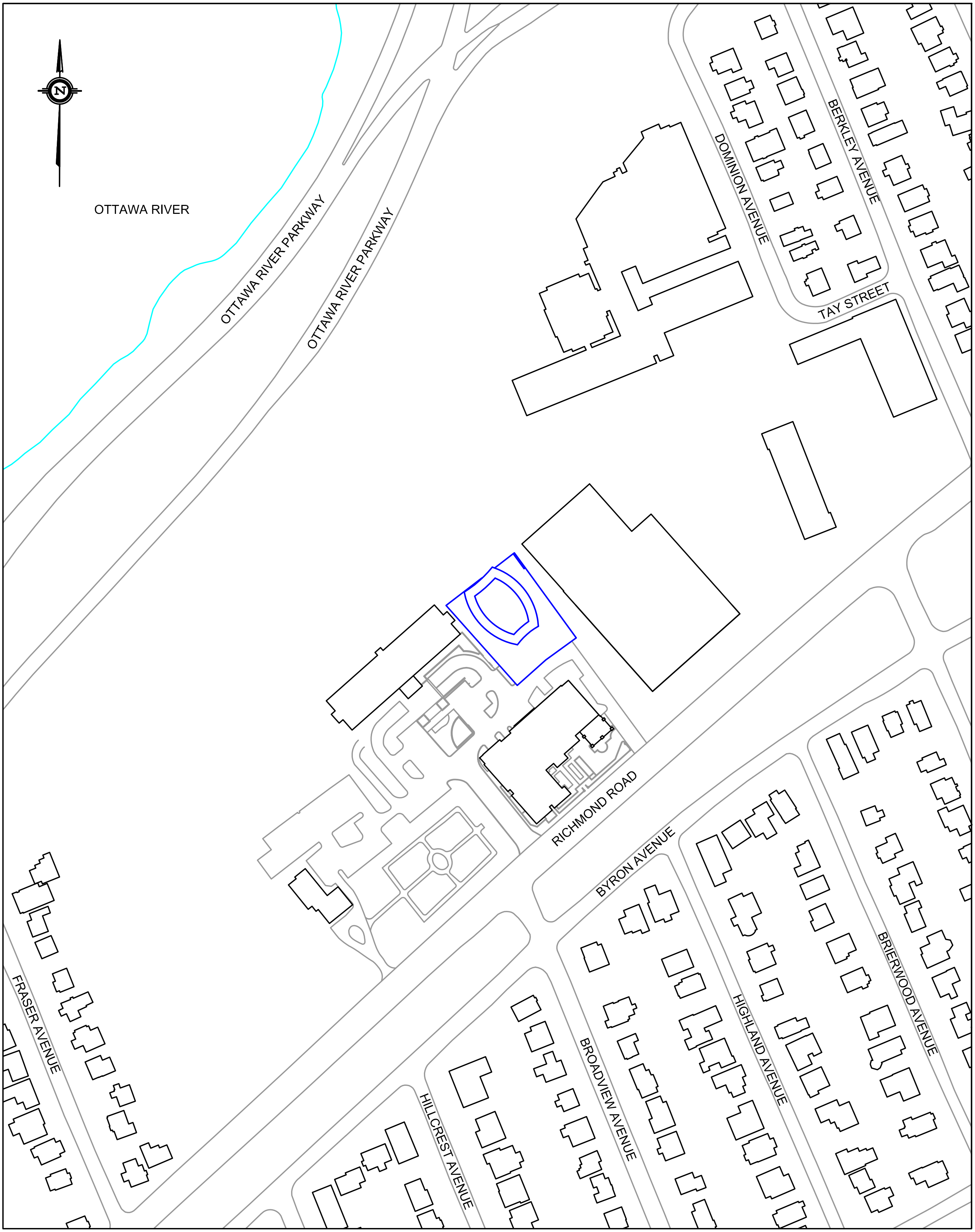
This concludes our pedestrian level wind assessment and report. Please advise the undersigned of any questions or comments.

Sincerely,

Gradient Microclimate Engineering Inc.

Justin Ferraro, EIT
Project Manager
GmE 12-082-DTPLW

Vincent Ferraro, M.Eng., P.Eng.
Principal



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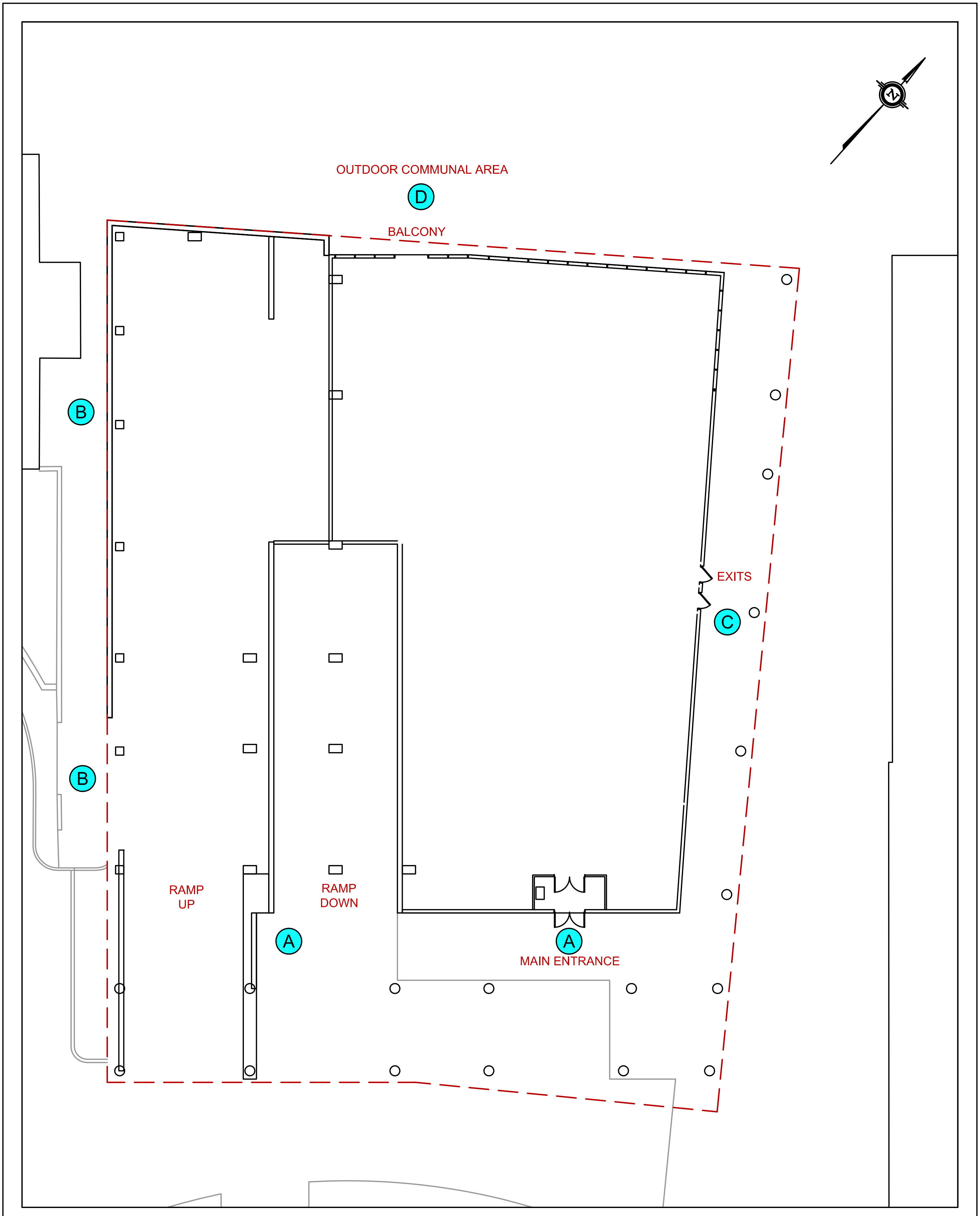
PROJECT	485 RICHMOND ROAD - QUALITATIVE WIND ASSESSMENT
SCALE	1:2500 (APPROX.)
DRAWING NO.	GME12-082-DTPLW-1
DATE	AUGUST 9, 2012
DRAWN BY	A.S. / J.F.
DESCRIPTION	FIGURE 1: SITE PLAN AND SURROUNDING CONTEXT



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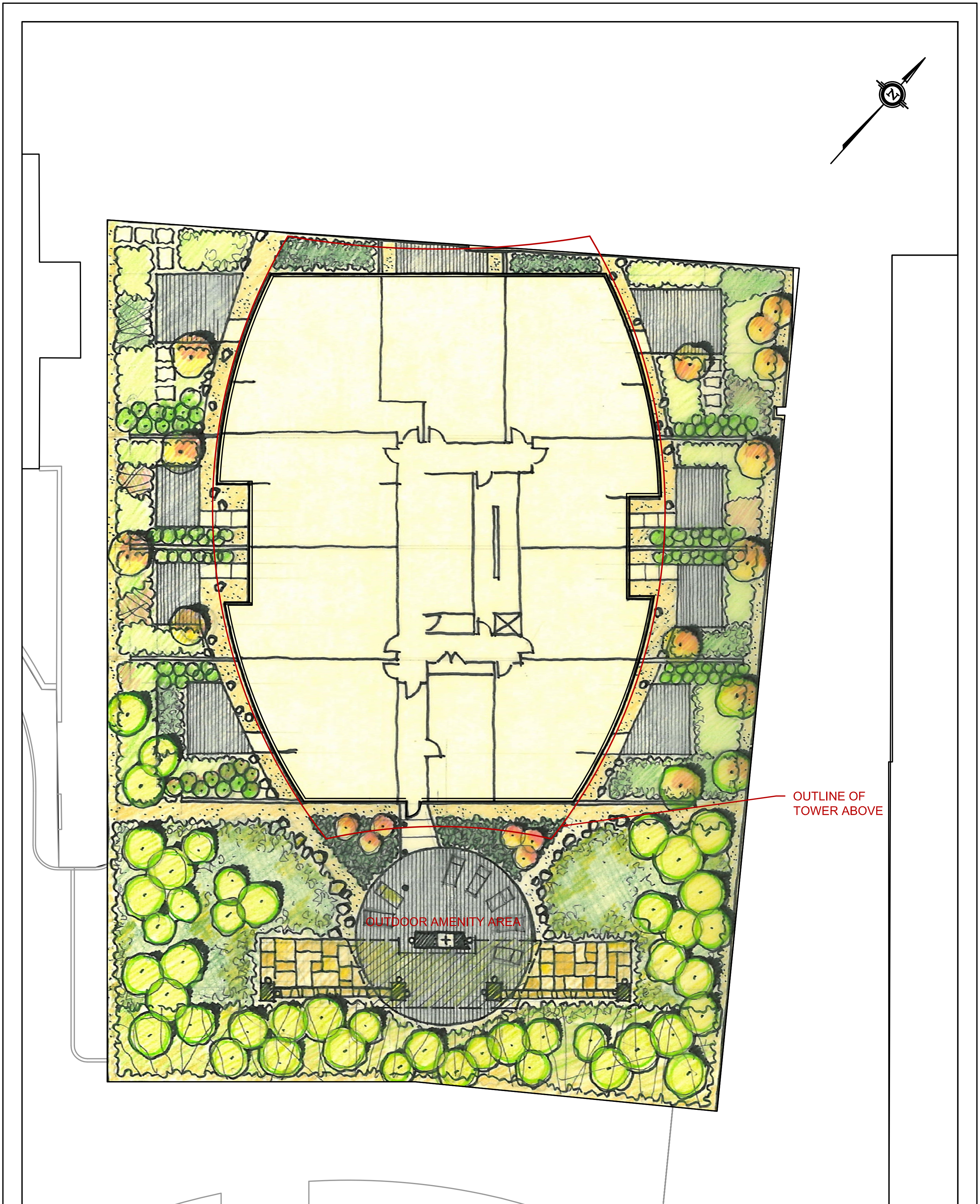
PROJECT	485 RICHMOND ROAD - QUALITATIVE WIND ASSESSMENT
SCALE	1:300 (APPROX.)
DRAWING NO.	GME12-082-DTPLW-2
DATE	AUGUST 9, 2012
DRAWN BY	A.S. / J.F.
DESCRIPTION	FIGURE 2: GROUND FLOOR PLAN WITH REFERENCE MARKERS



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PROJECT: 485 RICHMOND ROAD - QUALITATIVE WIND ASSESSMENT		DESCRIPTION: FIGURE 3: OUTDOOR AMENITY PLAN ON PODIUM ROOFTOP
SCALE: 1:300 (APPROX.)	DRAWING NO.: GME12-082-DTPLW-3	
DATE: AUGUST 9, 2012	DRAWN BY: A.S. / J.F.	