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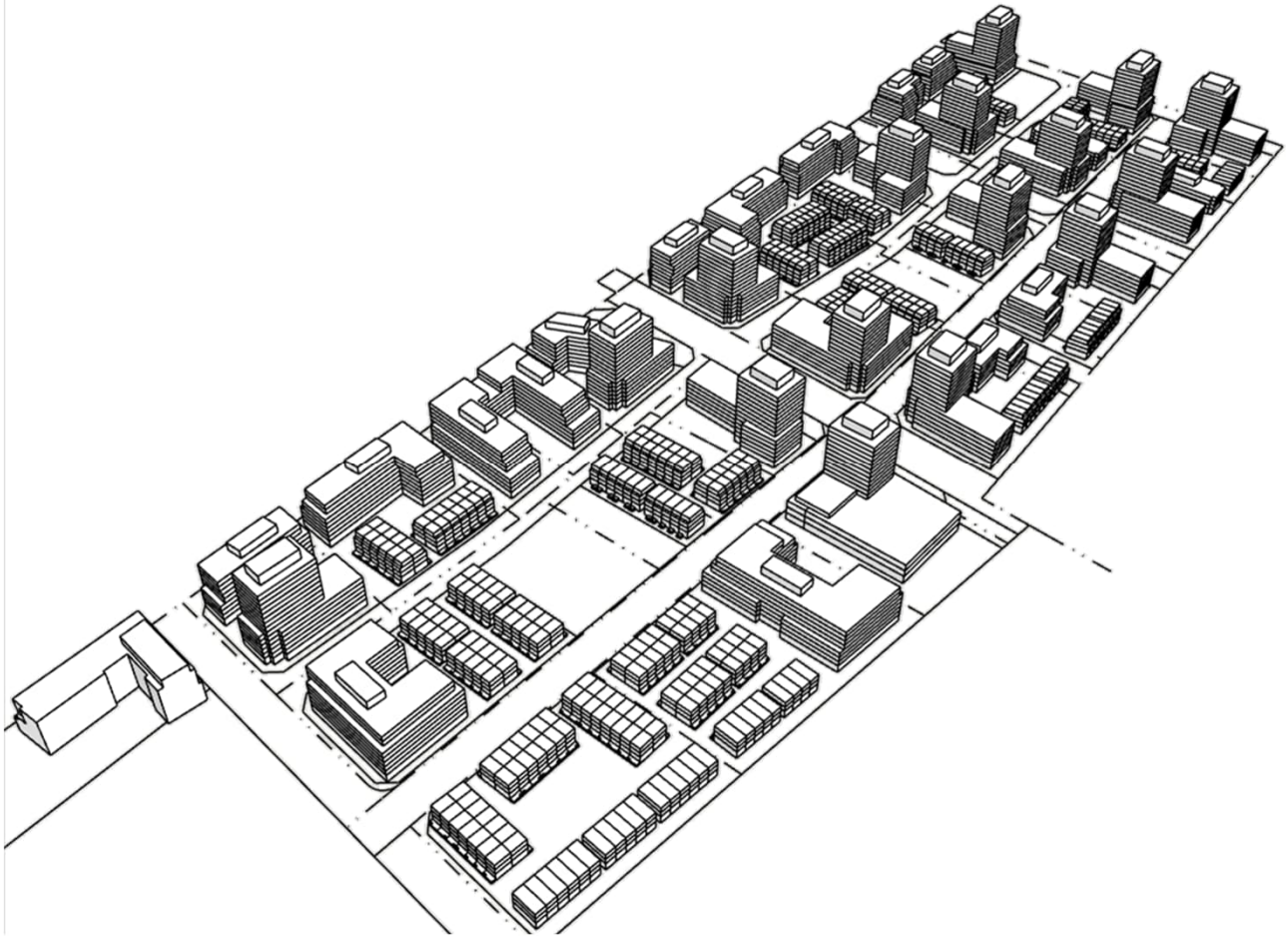
**Date:** September 26, 2023

**Re:** **Pedestrian Wind Assessment**

**Rangeview Estates Development Master Plan**
Mississauga, Ontario

**SLR Project #241.V30662.00000**



*Credit: Bousfields Inc.*

**Prepared by**

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**For**

**Rangeview Landowners Group Inc.**


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## 1.0 INTRODUCTION

SLR Consulting (Canada) Ltd. (SLR) was retained by Rangeview Landowners Group Inc. to conduct a pedestrian wind assessment for the proposed Rangeview Estates development in Mississauga, Ontario. This report is in support of the combined Development Master Plan (DMP) and Official Plan Amendment (OPA) applications for the development.

### 1.1 Existing Development

The Rangeview Estates Development Master Plan includes the redevelopment of the blocks encompassed by Lakeshore Road East to the north, Hydro Road to the east, and East Avenue to the west. The site is currently occupied by low-rise commercial and light industrial buildings. Figure 1 provides an aerial view of the immediate study area. A virtual site visit was conducted by SLR using Google Earth images dated May and September 2021. Several images of the site and surroundings are included in Figures 2a through 2d.

Immediately surrounding the site are low-rise commercial buildings to the northwest and north along Lakeshore Road, Sunflower Garden Park and the waterfront trail to the northeast and east, Lakeview Park, Douglas Kennedy Park and the Lakeview Water Treatment Plant buildings to the south and Waterworks Park to the west. Beyond the immediate surroundings are low-rise residences to the southwest through west to north, the Lakeview Wastewater Treatment Plant to the east and Lake Ontario the south. There is outdoor amenity and park space, as well as the Waterfront Trail.

Typically, developments with Site Plan Control approval and/or those currently under construction within a 500 m radius are included as existing surroundings. For this assessment, only the future building at the southwest corner of the proposed development was included in our assessment.


**Figure 1: Aerial view of existing site & surroundings**
*Credit: Google Earth Pro, dated 6/27/2019*

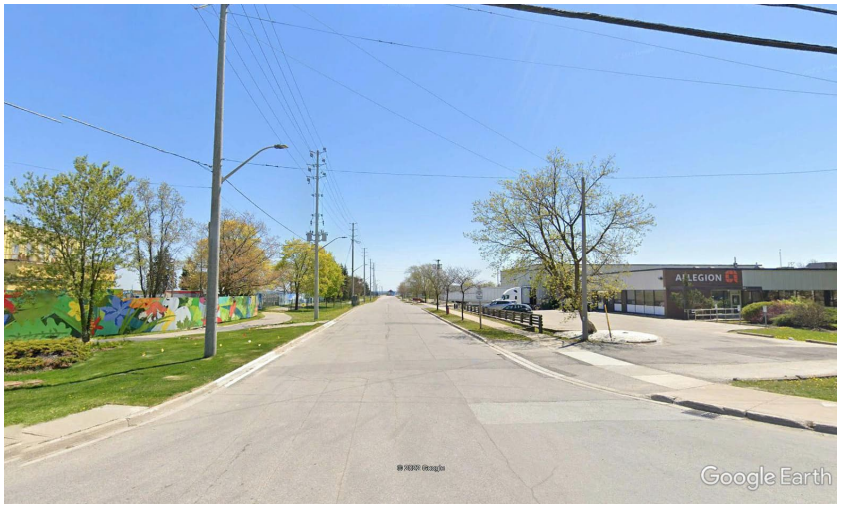



**Figure 2a: Hydro Road, looking south**

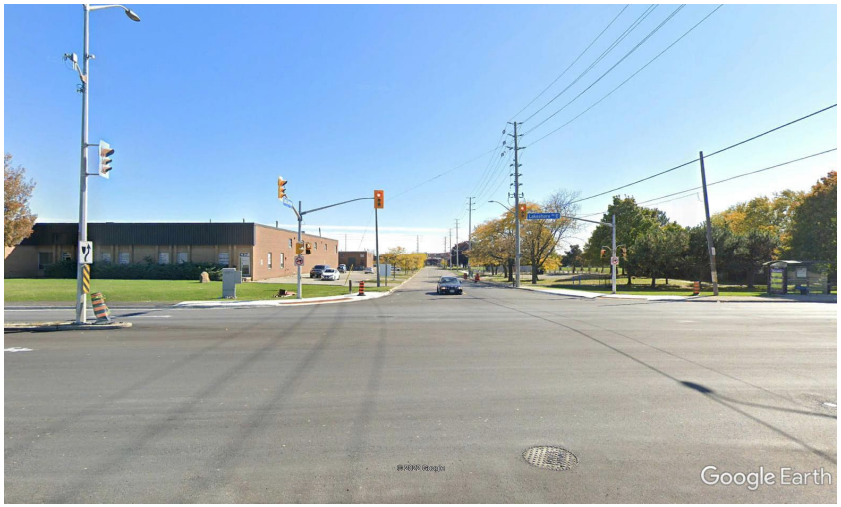



**Figure 2b: East Avenue, looking south**


**Figure 2c: Lakeshore Road East, looking northeast**

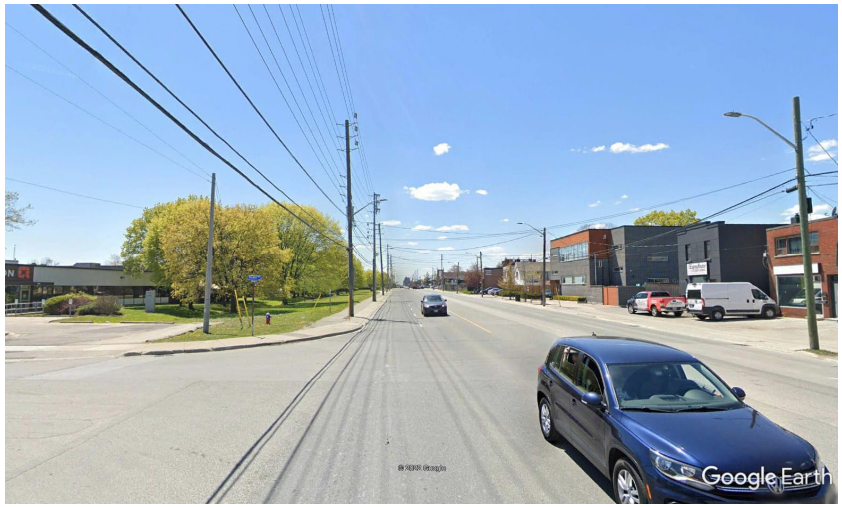



**Figure 2d: Lakeshore Road East, looking southwest**

## 1.2 Proposed Development

The proposed development includes 44 low-rise buildings, 11 mid-rise buildings, and 16 high-rise buildings across approximately 28 hectares. The development also includes several parks and an urban school. A 3D model of the proposed development is shown in Figure 3. Our understanding is no building on the site would exceed 15 storeys in height.

As the development is in the DMP and OPA phases, building details such as entrances, exits and outdoor amenity spaces have not been confirmed. SLR has provided recommendations regarding entrance and amenity locations in Section 4.3 based on the results of the analysis.

## 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 several transit stops along Lakeshore Road East in the vicinity of the proposed development, as well as proposed park spaces at Rangeview Park, Lakefront Greenway, Central Square, Ogden Park, and Hydro Common. On-site areas of interest are shown in Figure 4.

**Figure 3: 3D Model of proposed development**


**Figure 4: Areas of interest – Overall master plan**
*Credit: Bousfields Inc.*

## 2.0 APPROACH

A qualitative assessment was conducted using computational fluid dynamics (CFD). As with any approach, there are some limitations with this analysis technique, specifically in the ability to simulate the turbulence of the wind. Nonetheless, a qualitative CFD analysis is a useful tool to identify potential wind issues, as it employs a comparable analysis methodology to that used in quantitative wind tunnel testing.

### 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 Delta Urban on July 3, 2023, and an updated site plan was provided on August 25, 2023. 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 only assessed the Proposed Configuration. This configuration included the proposed Rangeview Estates development, along with the future building to the southwest, along Lake Shore Road East. The massing of the proposed development is shown in Figure 5.

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 two seasons: Winter (November to April) and Summer (May to October).

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.

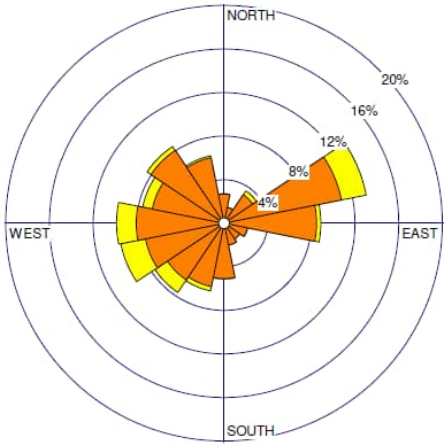

**Figure 5: Massing Model – Proposed Configuration**

## 2.2 Wind Climate

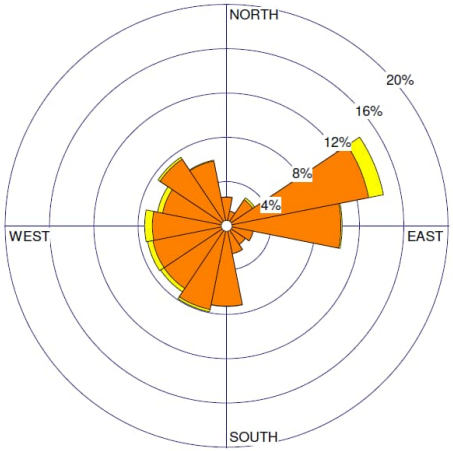
Wind data recorded at Billy Bishop Toronto City Airport for the period of 1991 to 2020 were obtained and analysed to create a wind climate model for the region. Annual and seasonal wind distribution diagrams ("wind roses") are shown in Figure 6. These diagrams illustrate the percentage of time wind blows 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 westerly and east-northeasterly 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 westerly and east-northeasterly directions. All wind speeds and directions were included in the wind climate model.

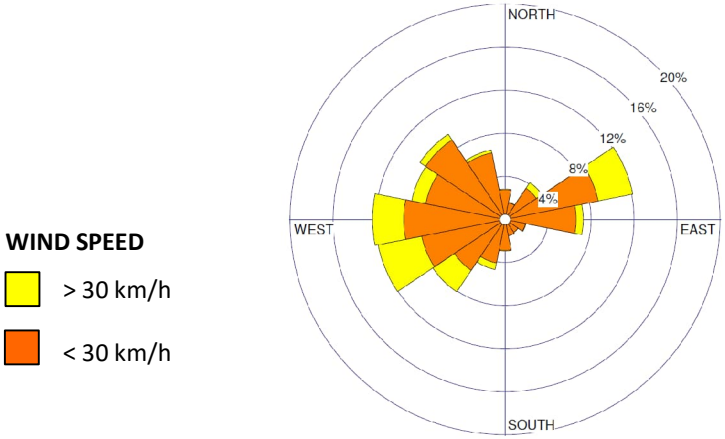
The seasonal wind roses show daytime hours only from 6:00am to 11:00pm, while the annual wind rose shows all hours.




**Annual Winds**




**Summer Winds (May - Oct)**







**Autumn Winds (Nov - Apr)**

**Figure 6: Wind Roses for Billy Bishop Toronto City Airport (1991-2020)**

## 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 Mississauga, in the document *Urban Design Terms of Reference – Pedestrian Wind Comfort and Safety Studies* (June 2014). 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 7 and 8 present graphical images of the wind comfort conditions for the summer and winter months around the proposed development. These typically represent the seasonal extremes of best and worst case. 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 A presents the wind safety conditions on an annual basis.

There are generally accepted wind comfort levels that are desired for various pedestrian uses. However, it 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 walking are desirable year-round but may not be feasible in the winter. 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 Wind Safety

The wind safety criterion is predicted to be met in the Proposed Configurations in all areas at grade (Appendix A).

### 4.2 Overall Pedestrian Comfort

With the proposed Rangeview Estates development in place, wind conditions on the site are generally expected to be comfortable for sitting or standing throughout the year (Figures 7 and 8). This includes in the various outdoor park spaces and along sidewalks and walkways throughout the site. Similar wind conditions are predicted to occur at the various transit stops along Lakeshore Road.

Overall, these wind conditions are considered suitable for the intended use.

### 4.3 General Guidance

As the project is currently in the DMP phase, building details such as entrances, exits and above grade amenity spaces have not yet been determined.

As the design progresses, we suggest the design team and/or the individual site owners, consider the following guidance with regards to entrances and amenity spaces:

- Locate building entrances a minimum of 5 m away from building corners, to avoid localized wind accelerations.
- Locate amenity terraces to the north and west of taller building elements, to allow the taller elements to provide shelter from the prevailing southerly and northeasterly winds.

As the application moves forward, more detailed block-specific analyses should be undertaken, per the City's planning requirements, to confirm wind comfort conditions and the necessity of additional wind mitigation features.


**Figure 7: Proposed Configuration – Pedestrian Wind Comfort – Summer Season – On Site**


**Figure 8: Proposed Configuration – Pedestrian Wind Comfort – Winter Season – On Site**

## 5.0 CONCLUSIONS & RECOMMENDATIONS

The pedestrian wind conditions predicted for the proposed Rangeview Estates Development Master Plan in Mississauga have been assessed through qualitative CFD techniques. Based on the results of our assessment, the following conclusions have been reached:

- The wind safety criterion is predicted to be met at all areas of the master plan in the Proposed Configuration.
- Wind conditions throughout the proposed master plan, including walkways and park spaces, are expected to be suitable for the intended use year-round.
- On the sidewalks and transit stops surrounding the proposed master plan, wind conditions are expected to be suitable for the intended use.
- As the application moves forward, more detailed block-specific analyses should be undertaken to confirm wind comfort conditions.

## 6.0 LIMITATIONS OF LIABILITY

This report has been prepared and the work referred to in this report has been undertaken by SLR Consulting (Canada) Ltd. (SLR) for Delta Urban, hereafter referred to as the "Client". It is intended for the sole and exclusive use of the Client. The report has been prepared in accordance with the Scope of Work and agreement between SLR and the Client. Other than by the Client and by the City of Mississauga in their role as land use planning approval authorities, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted unless payment for the work has been made in full and express written permission has been obtained from SLR.

This report has been prepared in a manner generally accepted by professional consulting principles and practices for the same locality and under similar conditions. No other representations or warranties, expressed or implied, are made.

Opinions and recommendations contained in this report are based on conditions that existed at the time the services were performed and are intended only for the client, purposes, locations, time frames and project parameters as outlined in the Scope or Work and agreement between SLR and the Client. The data reported, findings, observations and conclusions expressed are limited by the Scope of Work. SLR is not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. SLR does not warranty the accuracy of information provided by third party sources.

## 7.0 REFERENCES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# Appendix A

Pedestrian Wind Safety Analysis

Annual

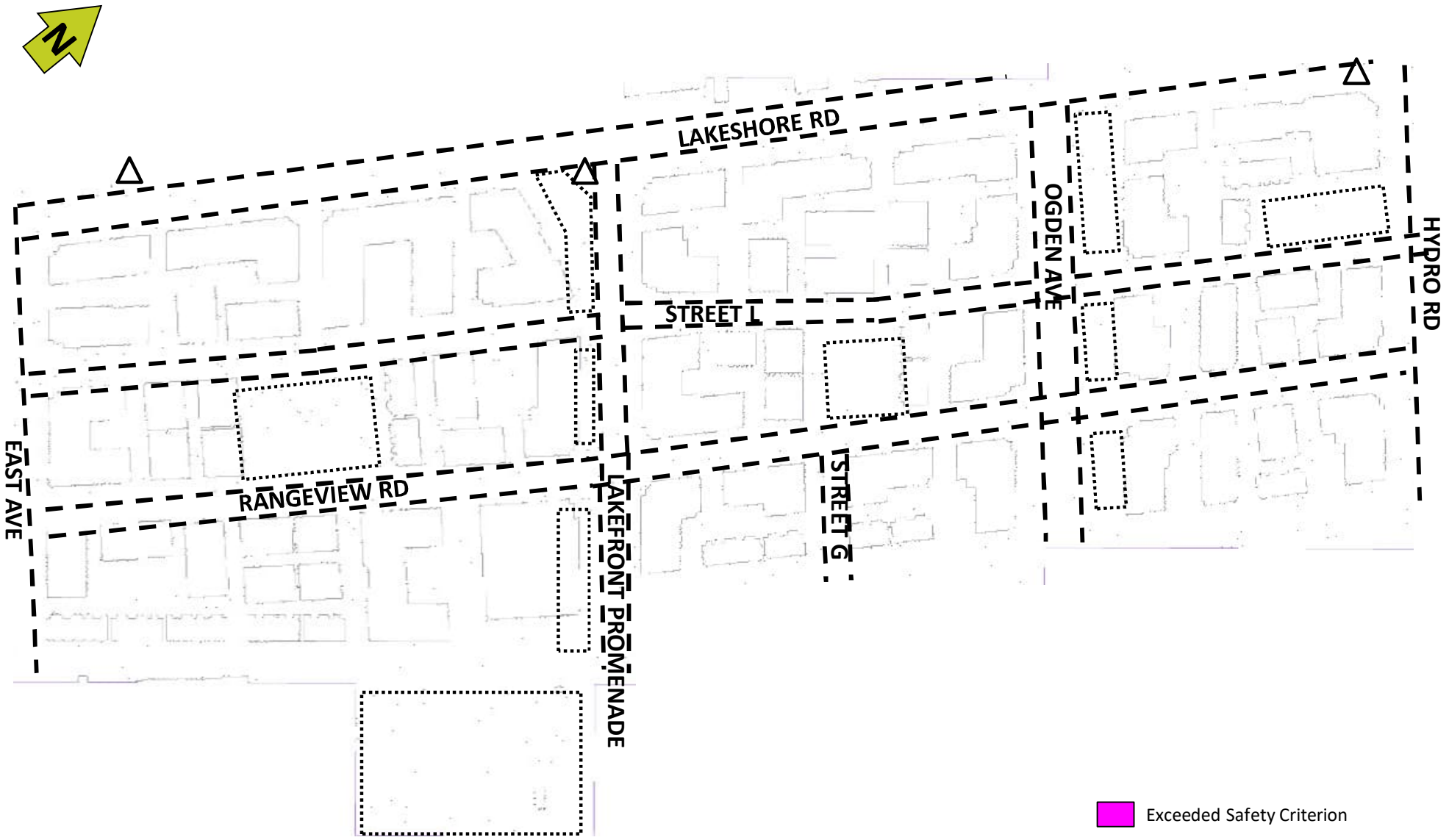


**Figure A1: Proposed Configuration – Pedestrian Safety Annual – On Site**