FINAL REPORT

RB CENTRAL

DUBLIN, IRELAND

PEDESTRIAN WIND COMFORT STUDY

RWDI #1802586-C

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SUBMITTED TO

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1 INTRODUCTION

RWDI was retained by TOTP Architects to conduct a Pedestrian Wind Comfort Study for the proposed RB Central development (referred to as the Proposed Development in this report) in Dublin, Ireland. This was accomplished through wind tunnel testing of a 1:300 scale model of the Proposed Development in the context of the existing and cumulative surrounding buildings and terrain.

The Proposed Development is a mixed-use scheme, ranging from 5 to 14 no. storeys in height. Outdoor amenity areas are situated within the central area and along the western thoroughfare at ground level. Public and private terraces are located on the rooftops in addition to balconies throughout.

The photographs in Figure 1 show the test model in RWDIs boundary-layer wind tunnel. The test model was constructed using the design information and drawings listed in Appendix A with the wind tunnel tests completed for five configurations of surrounding buildings and landscaping, namely the Proposed Development with existing surrounding buildings. This report summarises the methodology of wind tunnel studies for pedestrian wind conditions, describes the RWDI pedestrian wind criteria, presents the test results and wind control measures, where necessary.

The placement of wind measurement locations was based on RWDIs experience and understanding of the pedestrian usage for this Site.

Five configurations were tested and assessed:

- Configuration 1: The existing site with existing surrounding buildings;
- Configuration 2: The Proposed Development with existing surrounding buildings without landscaping;
- Configuration 3: The Proposed Development with cumulative surrounding buildings without landscaping;
- Configuration 4: The Proposed Development with existing surrounding buildings and proposed landscaping with mitigation measures; and
- Configuration 5: The Proposed Development with cumulative surrounding buildings and proposed landscaping with mitigation measures.

2 PRINCIPAL RESULTS

- Meteorological data for Dublin Airport shows the prevailing wind direction throughout the year is from the west-southwest with a secondary peak for south easterly winds. In addition, the background wind environment is generally windy (compared to other large cities such as London, for example) which can lead to uncomfortable conditions even in the baseline (existing) case.
- The configurations that have been tested in the wind tunnel are as follows:
  - Configuration 1: The existing site with existing surrounding buildings;
  - Configuration 2: The Proposed Development with existing surrounding buildings without landscaping;
  - Configuration 3: The Proposed Development with cumulative surrounding buildings without landscaping;
  - Configuration 4: The Proposed Development with existing surrounding buildings and proposed landscaping with mitigation measures; and
  - Configuration 5: The Proposed Development with cumulative surrounding buildings and proposed landscaping with mitigation measures.
- The model was initially tested devoid of landscaping in order to generate a worst-case scenario for Configurations 1 to 3. The assessment of Configurations 4 and 5 included the proposed landscaping and mitigation measures.

Baseline (Configuration 1, Figures 4 – 6)

- The baseline wind conditions at ground level for the winter season range from being suitable for sitting use to uncomfortable for all uses, and from sitting use to walking use during the summer season.
- The windiest, uncomfortable conditions were to the south west (at probe locations 39, 41 to 44 and 48) due to corner accelerations from the building directly west of the site. Uncomfortable conditions were also measured on-site at probe location 11 (to the north west).
- Probe location 44 (located at the south west corner of the Site), had strong gusts exceeding the safety criterion of 90km/h for more than 0.1% of the time annually during Configuration 1.

Proposed Development with Existing Surrounding Buildings (Configuration 2, Figures 7 – 11)

- The inclusion of the Proposed Development (without landscaping) generally provides beneficial shelter to the Site, providing a calmer environment to many locations. However, some areas did become windier, including the road directly south of the Proposed Development which experiences an increase in wind speeds.
- Thoroughfare locations were generally suitable or calmer for the intended use. Furthermore, several thoroughfare locations, particularly to the south-west, were calmer with the Proposed Development in situ.
- However, thoroughfares within landscaped areas (where pedestrians are expected to linger) at probe locations 43, 45, 48, 50 and 54 had walking use wind conditions which is one category windier than desired. In addition, 27, 28 and 42 had uncomfortable wind conditions, where the off-site thoroughfares to the south are windier with the Proposed Development in situ, which is two categories windier than desired. Mitigation measures are required at these locations.

- Probe location 44 also had wind conditions which were uncomfortable for all uses, however this is an existing windy condition (occurring in the baseline) which is not caused by the Proposed Development. In fact, these wind conditions are slightly calmer (in exceedance of the comfort threshold) than the baseline scenario. Therefore, mitigation measures are not required.
- Probe location 20 also had uncomfortable wind conditions, however as it is located on a road where pedestrians are unlikely to be, these wind conditions are acceptable as the location is safe (there were no measured strong gust exceeding the 90km/h threshold) for cyclists.
- Off-site entrances and the majority of on-site entrances are suitable for the intended use.
- On-Site entrance locations 17, 18, 35, 101, 106 and 117 are suitable for strolling use, which is one category windier than required for the intended use and required mitigation.
- Ground floor play spaces are suitable for the intended use, however seating locations within the central area and to the west of the Site is windier than required for the intended use during the summer season and requires mitigation.
- Many of the roof level private terraces (particularly to the south and west) are suitable for the intended use. However, the south facing eastern terraces, at probe locations 142 to 174, are windier than required by up to two categories in the summer season (suitable for standing and strolling use) and would require mitigation measures.
- Public roof level amenity spaces are windier than required for the intended use and require mitigation measures.
- The majority of balcony locations had wind conditions suitable for sitting use during the summer season. Balcony locations 137 to 139, 150, 161, 174, 175 and 180 had wind conditions suitable for standing use during the summer season. Standing use wind conditions are tolerable at private balcony locations though mitigation measures are recommended to further enhance the balcony spaces.
- Balconies on the north-western elevation had windier conditions, ranging from suitable for strolling use (probes 168 and 173) to walking use (probe locations 165, 167 and 169) during the summer season. These balconies require mitigation measures.
- Probe location 44 (located at the south-west corner of the Site) and 160 (a roof level location to the south-west), had strong gusts exceeding the safety criterion of 90km/h for more than 0.1% of the time annually during Configuration 2. Mitigation measures are required at these locations.

Proposed Development with Cumulative Surrounding Buildings (Configuration 3, Figures 12 – 16)

- The addition of cumulative surrounding buildings (without landscaping in situ) generally had little effect on the wind conditions at the Site, with most locations having the same wind conditions or calmer. The majority of locations requiring mitigation in the presence of existing surrounding buildings will also require mitigation in the future scenario, with the exception of thoroughfare location 42 and entrance locations 106 and 117.
- Furthermore, the addition of the cumulative building to the east results in calmer wind conditions off-Site to the south of the Proposed Development.
- Strong winds exceeding the safety threshold still occur at probe location 44.

Proposed Development with Existing Surrounding Buildings and Mitigation Measures (Configuration 4 – Figures 17 to 20)

- Configuration 4 tested the Proposed Development with the proposed landscaping and mitigation measures in context of the existing surrounding buildings which were developed through wind tunnel testing.
- Mitigation measures comprise:
    - Planters/shrubs of 1.2m height along the western thoroughfare (locations indicated in the proposed landscaping scheme);
    - 1.2m planters/shrubs either side of the entrances at probe locations 17 and 18;
    - 1.2m planter/shrub to the west of the entrance at probe location 117;
    - 1.2m shrubs or planters around the columns near probe location 101;
    - Four additional deciduous trees of at least 4m planted height to the south of the central seating area;
    - 50% porous 1.2m tall screening to the south and west of seating (the width of the seating area) at the central seating area near probe 115;
    - 2m balustrades at private terraces at probe locations 142 to 145;
    - 50% porous 1.2m tall screening to the south of seating (the width of the seating area) at rooftop terraces;
    - Seating to the south of the lower southern terrace (probe location 160) needs to be directly behind the 1.2m solid balustrade;
    - All seating at the western thoroughfare is to have 1.2m planting around the seat (on three sides);
    - Winter gardens at one column of southern balconies (represented by probe location 161);
    - 1.5m solid balustrades at the balconies represented by probe locations 137, 138, 139 and 173 to 175;
    - 1.5m solid balustrade and 2m solid screens at the southern side of balconies represented by 150, 162, 167, 168, 173 and 180;
    - 1.5m solid balustrade and a 3m solid screens at the southern side of balconies represented by 166; and
    - 1.5m balustrade with 2m side screens and a 1m wide 3m tall front screen at the western balconies represented by 165 and 169.
- The following mitigation measures have been included after mitigation testing and assessed qualitatively:
    - Probe 137 – 2m side screens at the west facing balconies of the central block (as demonstrated at probe location 180) are expected to result in sitting use wind conditions.
    - Probes 165 and 169 – these balconies will be made into winter gardens and therefore will results in sitting wind conditions as they will be protected from the oncoming wind in all directions.
- **With the final landscaping scheme and mitigation measures (including alterations made after testing) in place, the wind conditions at all locations at the Proposed Development and surrounding area would be considered suitable or calmer than required for the intended use.**
- It should be noted that the following locations had uncomfortable wind conditions:
    - Probe 20 – This is a marginal exceedance of the uncomfortable threshold wind condition in the road. Pedestrians are not expected to be at this location (particularly with the crossing

to the west), and wind conditions are safe. Furthermore, these wind conditions are temporary until the cumulative scenario develops.

- Probe 44 – This is an existing windy condition which is calmer with the Proposed Development in situ, therefore no mitigation is required.

Proposed Development with Cumulative Surrounding Buildings and Mitigation Measures (Configuration 5, Figures 21 – 24)

- The addition of cumulative developments does not change the suitability of wind effects at the Site and surrounding area when compared to the Proposed Development in the context of existing surrounding buildings with landscaping and mitigation measures in place.
- The only notable change in wind conditions is at probe location 20, which is calmer in the presence of cumulative surrounding buildings and suitable for walking use (where previously it was marginally uncomfortable for all uses).

3 METHODOLOGY

As shown in Figure 1, the 1:300 scale wind tunnel model included the Proposed Development and all relevant existing surrounding buildings as well as significant topographical features within a 360m radius of the centre of the study Site. The mean speed profile and turbulence of the natural wind approaching the modelled area was simulated in RWDIs boundary layer wind tunnel. The model was instrumented with up to 189 wind speed sensors to measure mean and gust wind speeds at a full-scale height of approximately 1.5m. These measurements were recorded for 36 wind directions (in 10-degree increments).

Wind statistics recorded at Dublin Airport between 1993 and 2013 were analysed between November and April and for May through October referred to hereafter as the winter season and summer season respectively. Figure 2 graphically depicts the distribution of wind frequency and directionality for the two seasons.

The meteorological data indicate that the prevailing wind direction throughout the year is from the west-southwest with a secondary peak for south-easterly winds. Based upon the background wind climate, Dublin is a relatively windy city (by comparison with London, for example) prior to any further wind-building interactions that might occur (i.e. in the baseline scenario). As a result of the generally windy climate it is considered that local residents will be acclimatised to stronger winds and are therefore more likely to tolerate typically adverse conditions.

Wind statistics from Dublin Airport were combined with the wind tunnel data in order to predict the frequency of occurrence of full-scale wind speeds. The full-scale wind predictions were then compared with the RWDI criteria for pedestrian comfort and safety.

4 EXPLANATION OF CRITERIA

The RWDI pedestrian wind criteria (as shown in Table 1 below) are used in the current study. These criteria have been developed by RWDI through research and consulting practice since 1974 (References 1 through 6). They have also been widely accepted by municipal authorities as well as by the building design and city planning community throughout the world.

Table 1: RWDI Pedestrian Wind Criteria

Comfort Category	GEM Speed (km/h)	Description
Sitting	≤ 10	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper without having it blown away
Standing	≤ 14	Gentle breezes acceptable for main building entrances and bus stops
Strolling	≤ 17	Moderate winds that would be 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 of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended

Notes: (1) Gust Equivalent Mean (GEM) speed = max (mean speed, gust speed/1.85); and (2) GEM speeds listed above are based on a seasonal exceedance of 20% of the time between 6:00 and 23:00.

A few additional comments are provided below to further explain the wind criteria and their applications.

- Generally, for a mixed-use Development, the target conditions are:
    - Sitting conditions at outdoor seating and amenity areas;
    - Standing/entrance conditions at main entrances, drop-off areas or taxi ranks, and bus stops;
    - Strolling or walking conditions on pedestrian thoroughfares, although walking conditions should be restricted to minor pedestrian routes where people are not expected to linger.
    - Uncomfortable classifications are usually avoided because of their association with occasional strong winds.
- Both mean and gust speeds can affect pedestrians comfort and their combined effect is typically quantified by a Gust Equivalent Mean (GEM) speed, with a gust factor of 1.85 (References 1, 5, 7 and 8).
- A 20% exceedance is used in these criteria to determine the comfort category, which suggests that wind speeds would be comfortable for the corresponding activity at least 80% of the time or four out of five days.

- Only gust winds need to be considered in the wind safety criterion. These are usually rare events, but deserve special attention in city planning and building design due to their potential safety impact on pedestrians.

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. Comparisons of wind speeds for different building configurations are the most objective way in assessing local pedestrian wind conditions.

5 APPLICABILITY OF RESULTS

The results presented in this report pertain to the model of the proposed RB Central development constructed using the architectural design drawings listed in Appendix A. Should there be any design changes that deviate from this list of drawings, the results presented may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

6 REFERENCES

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7. Lawson, T.V. (1973). "Wind Environment of Buildings: A Logical Approach to the Establishment of Criteria", Report No. TVL 7321, Department of Aeronautical Engineering, University of Bristol, Bristol, England.
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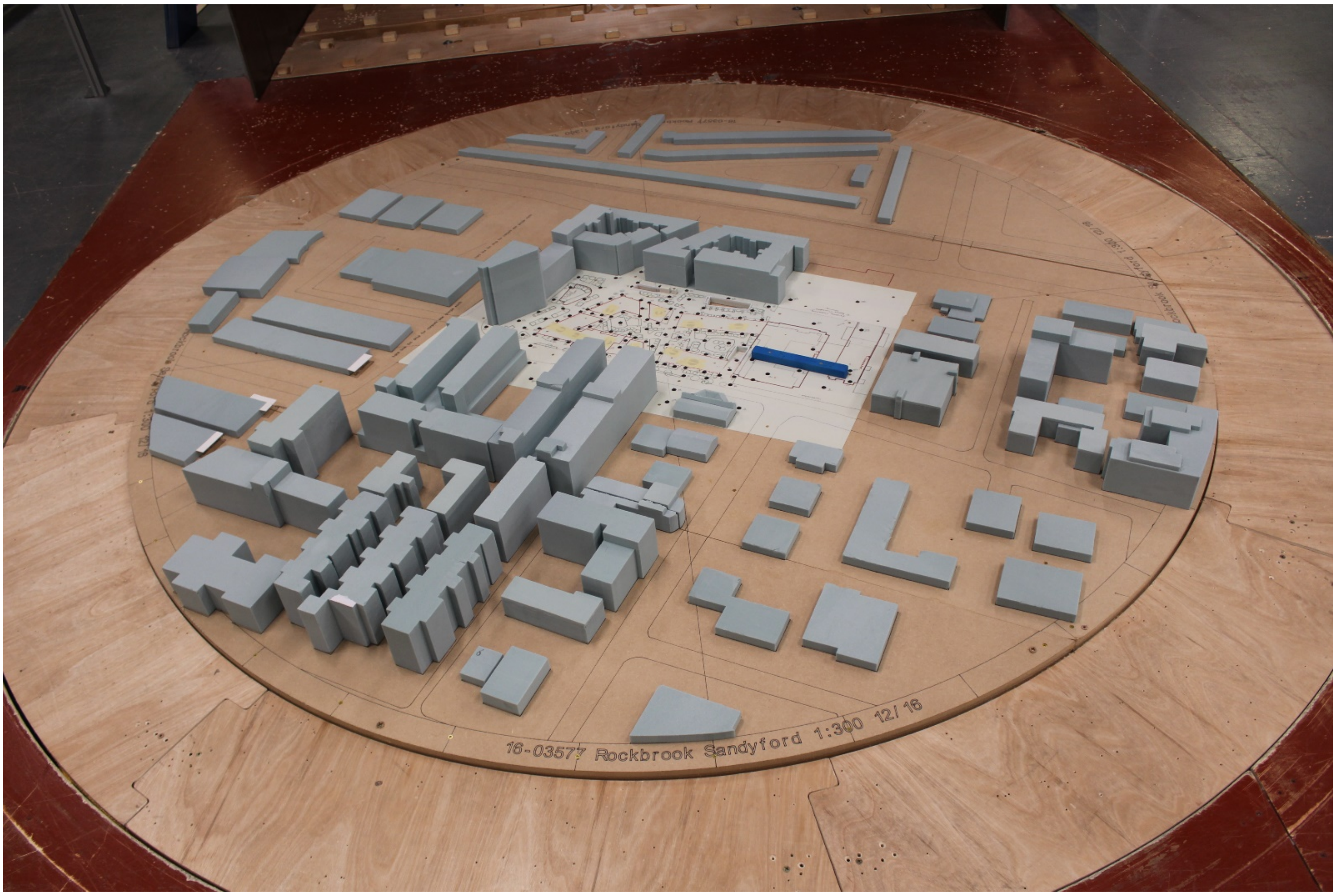
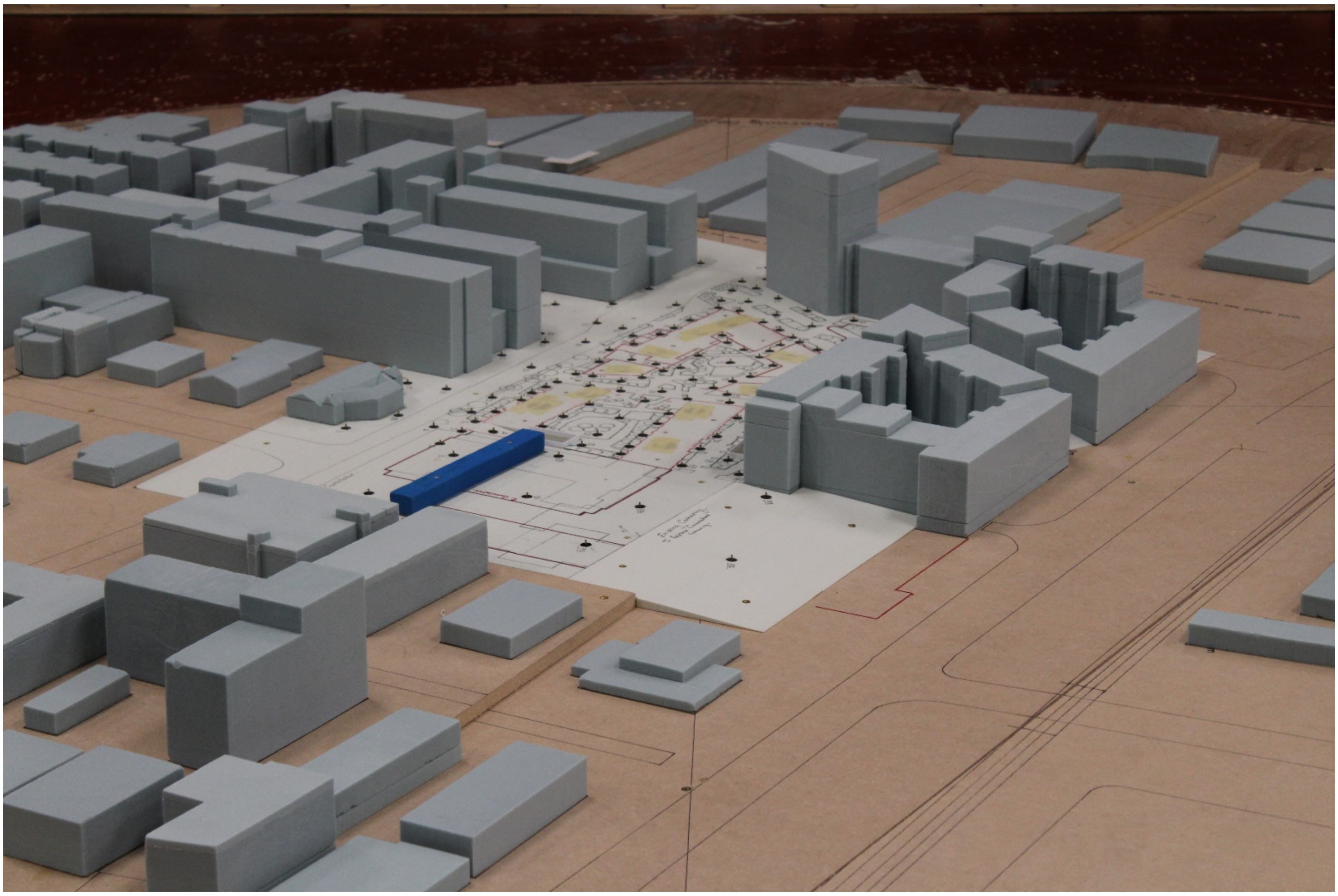
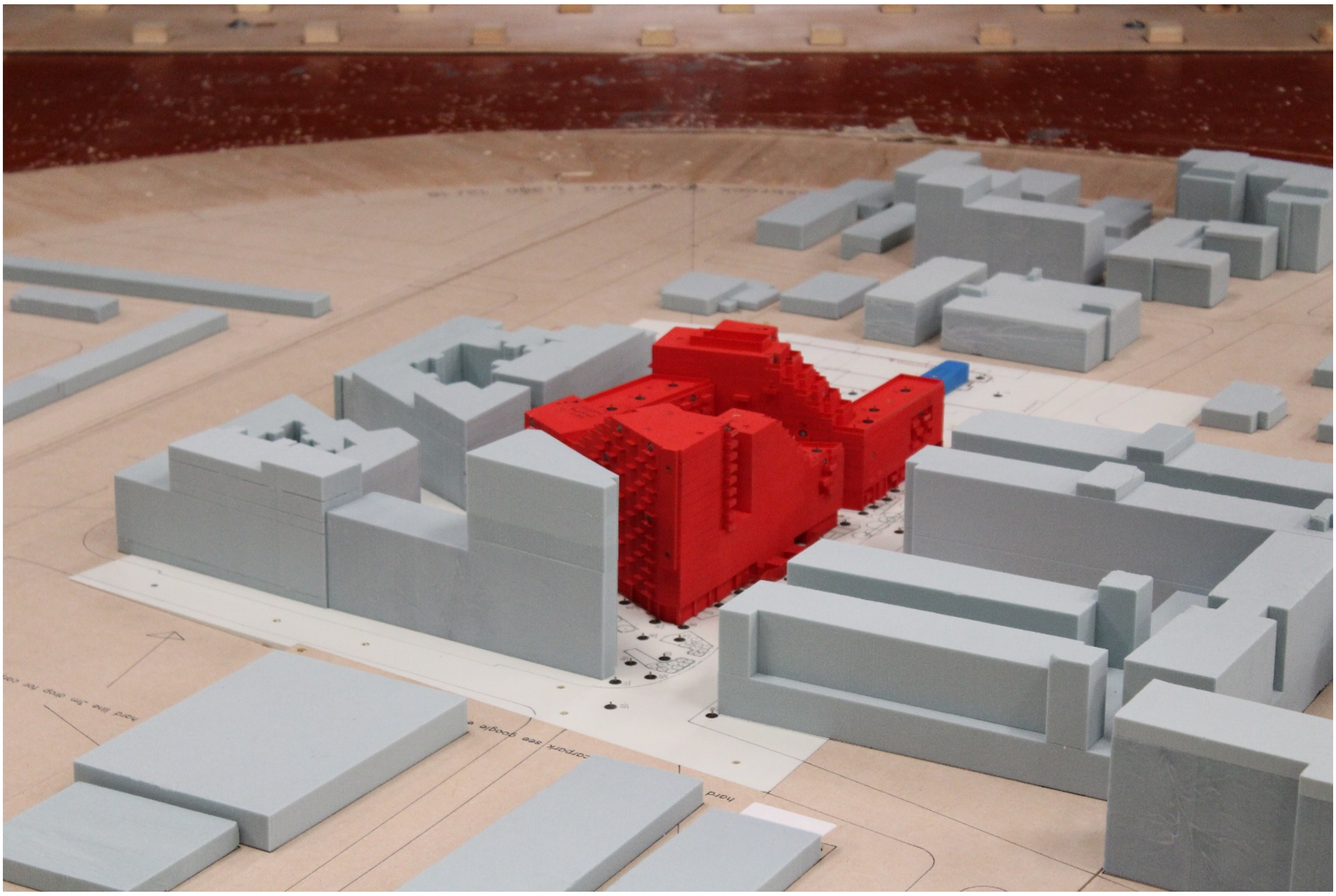
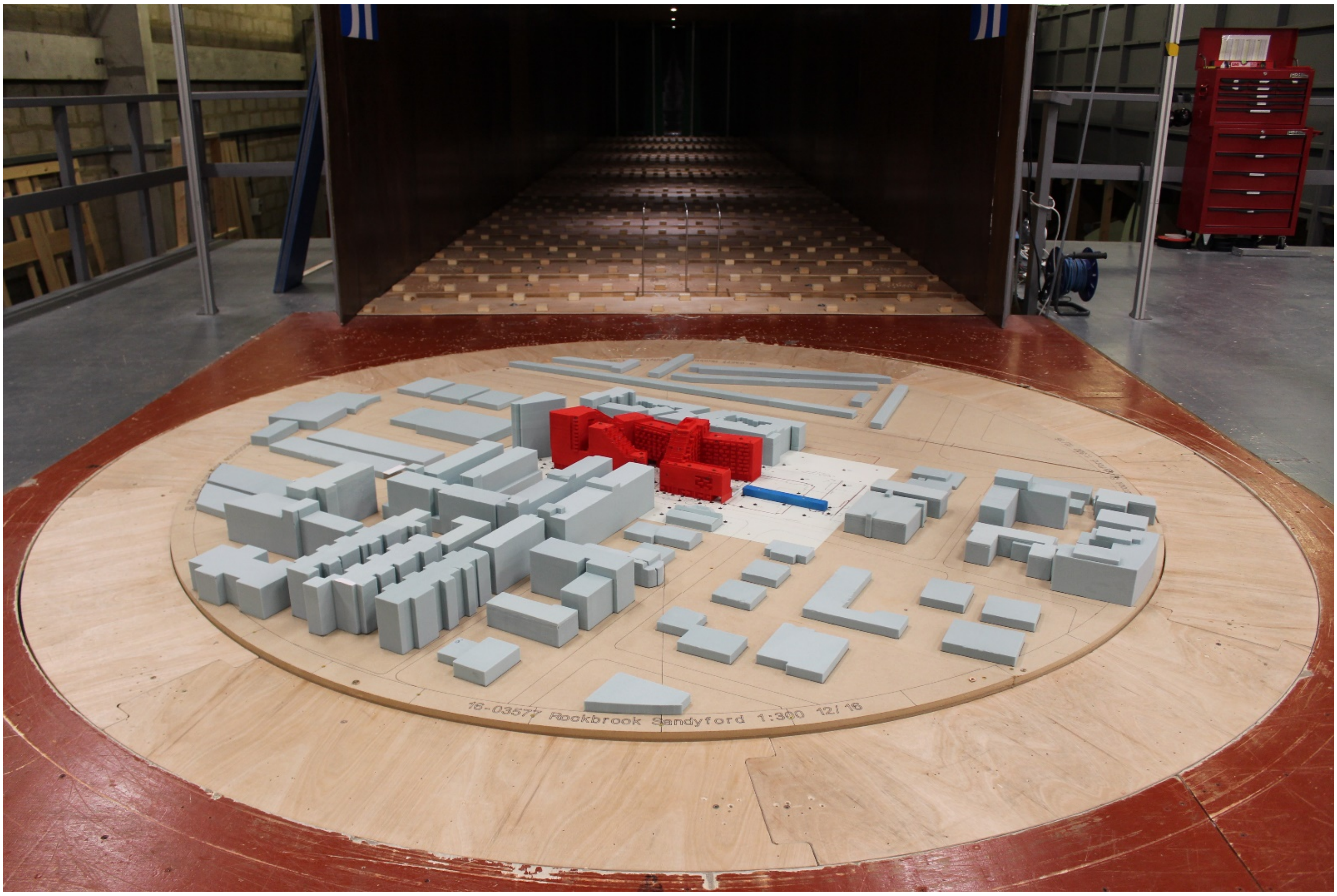
FIGURES



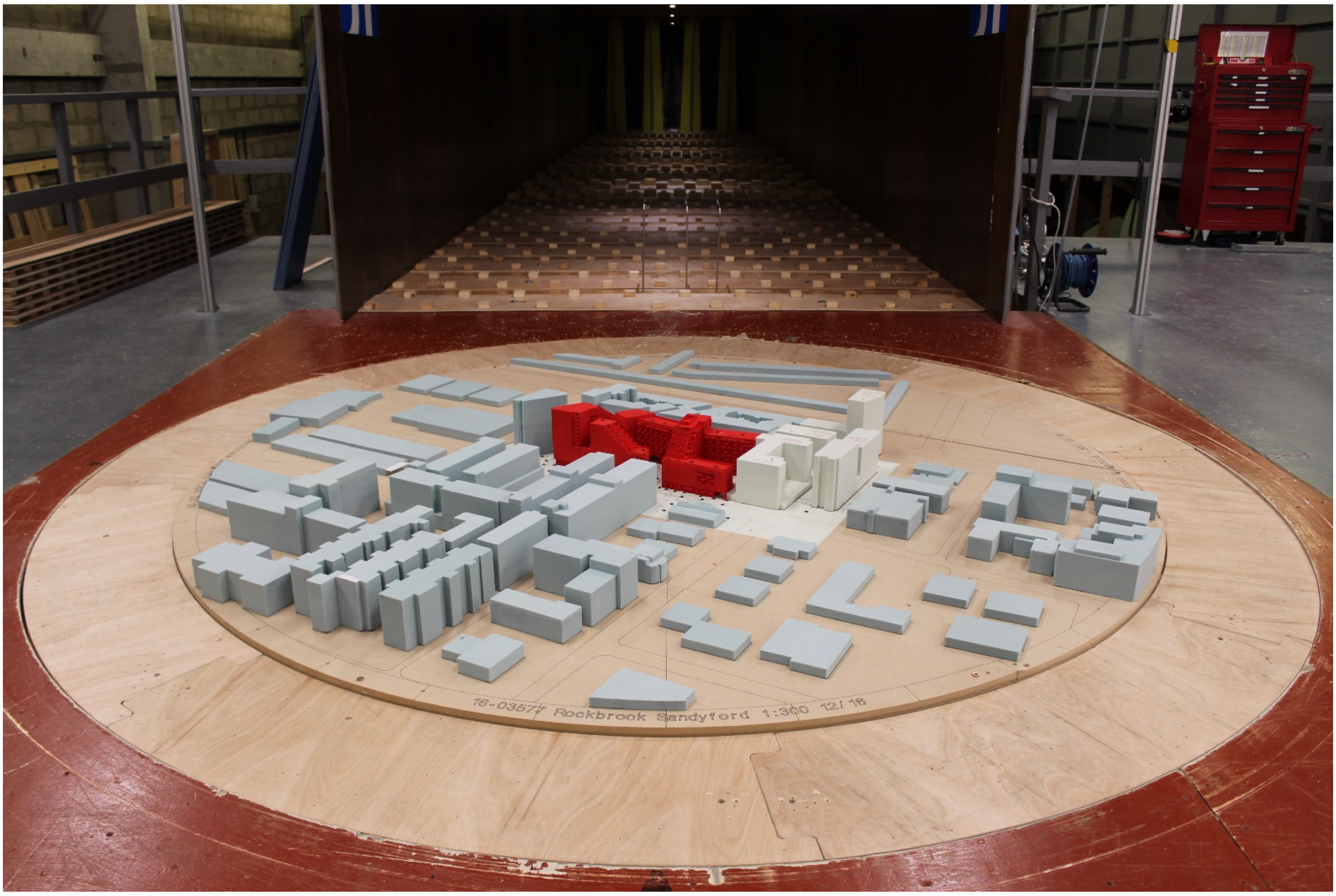


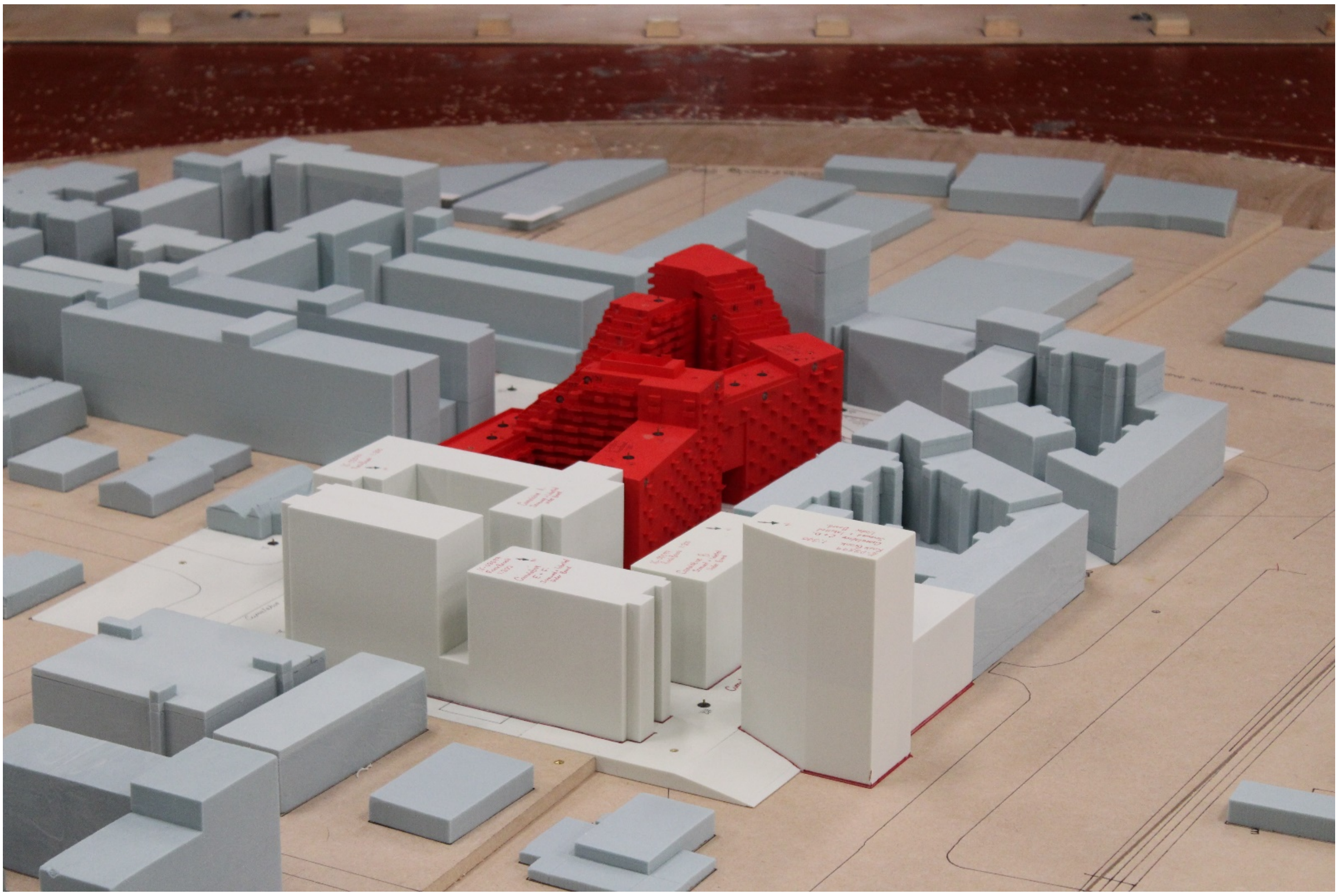
Wind Tunnel Study Model **Configuration 1: Existing Site with existing surrounding buildings**	Figure 1a
RB Central, Dublin, Ireland — Project #1802586	Date: December 10, 2018





Wind Tunnel Study Model **Configuration 2: Proposed Development with existing surrounding buildings**	Figure 1b	
RB Central, Dublin, Ireland — Project #1802586	Date: December 10, 2018	





Wind Tunnel Study Model

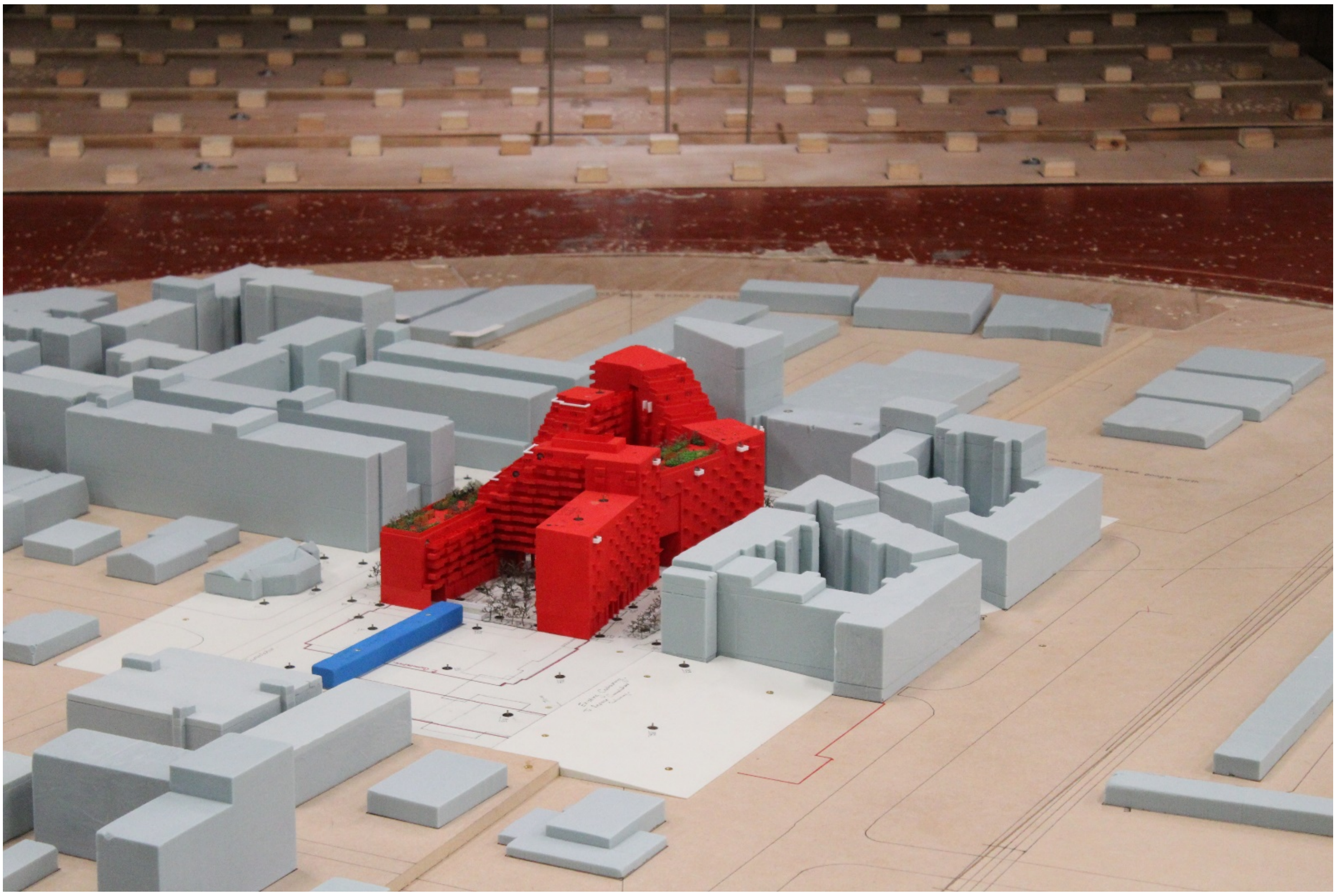
Configuration 3: Proposed Development with cumulative surrounding buildings

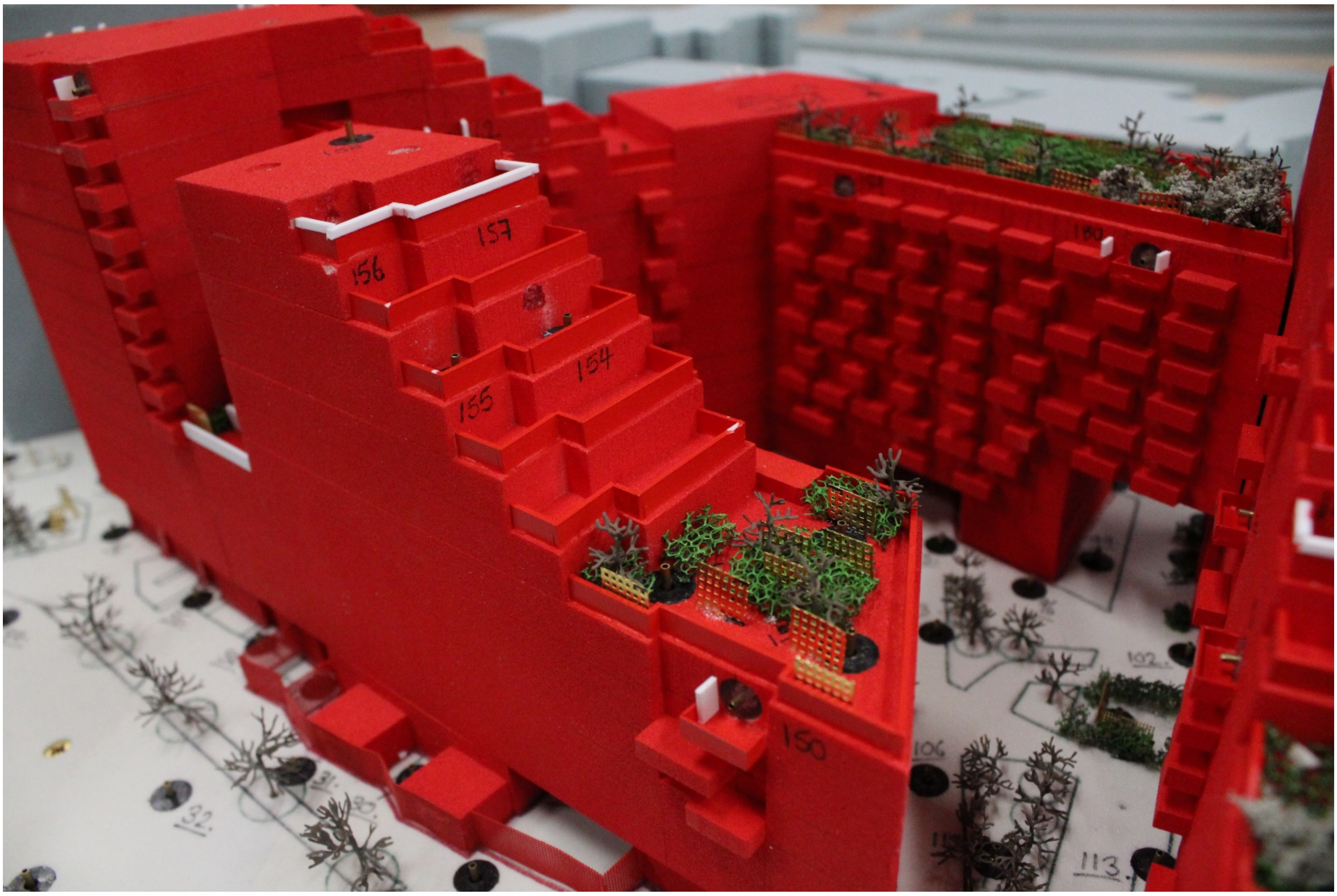
RB Central, Dublin, Ireland

Project #1802586

Figure 1c

Date: December 10, 2018





Wind Tunnel Study Model

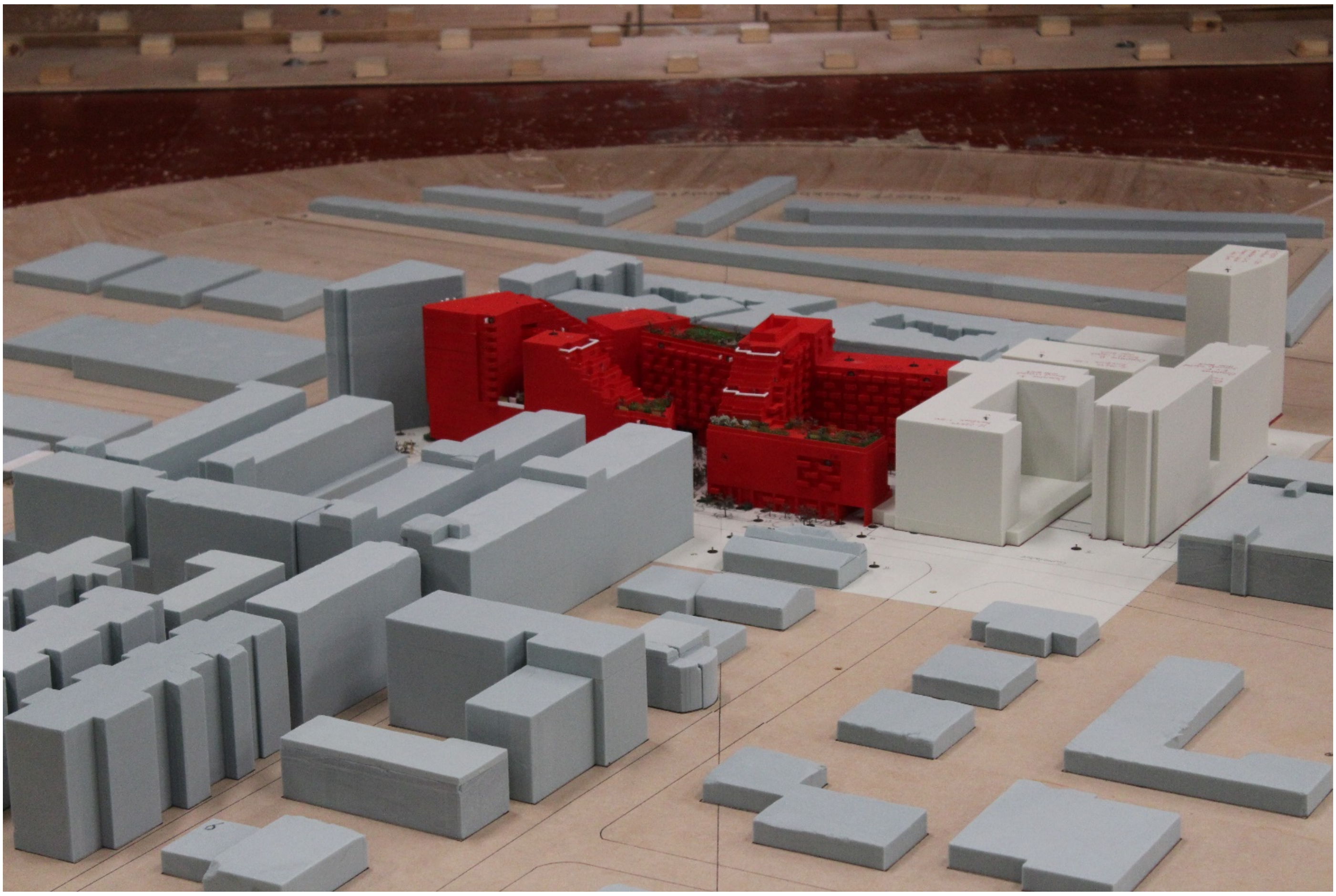
Configuration 4: Proposed Development with existing surrounding buildings and mitigation measures

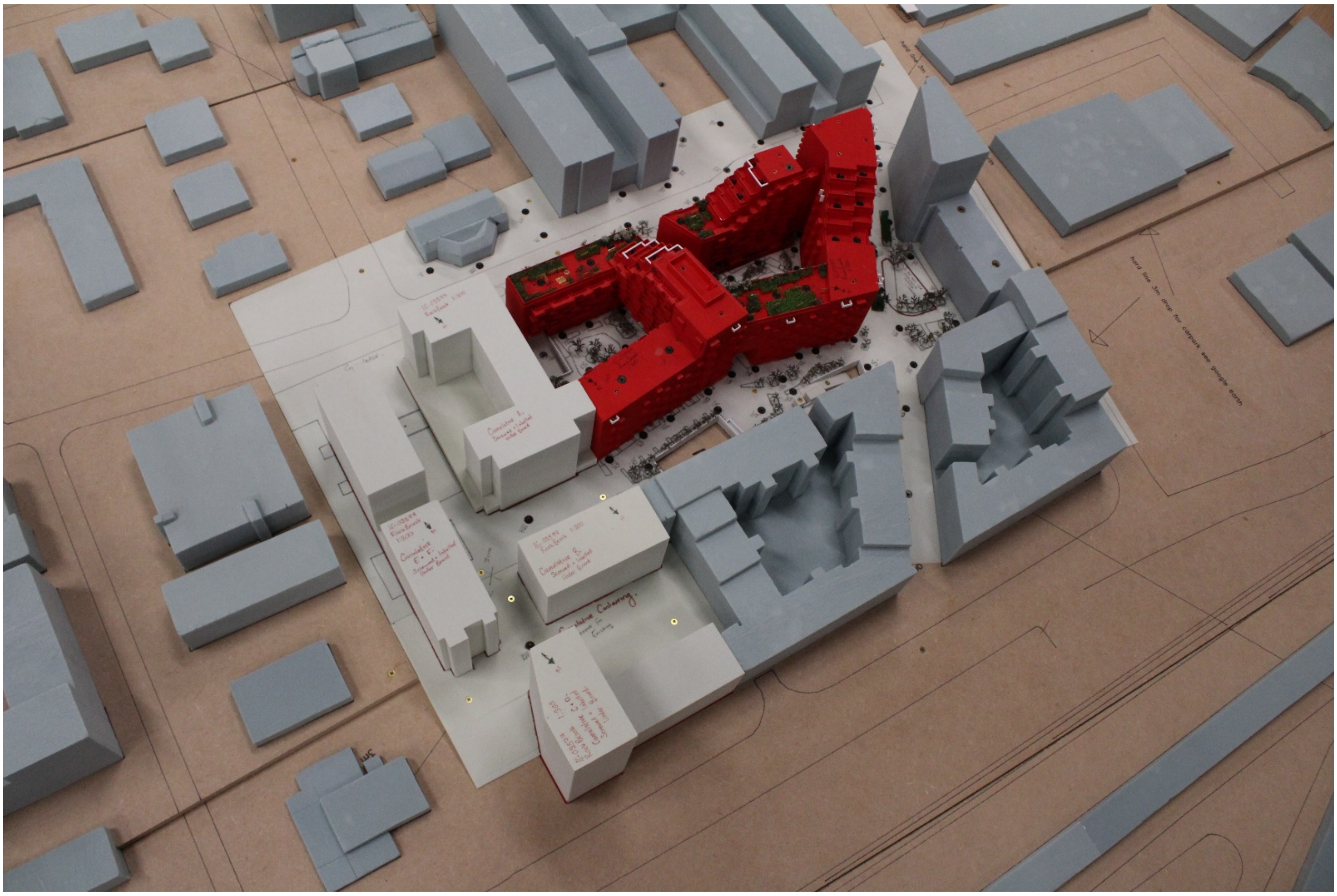
RB Central, Dublin, Ireland

Project #1802586

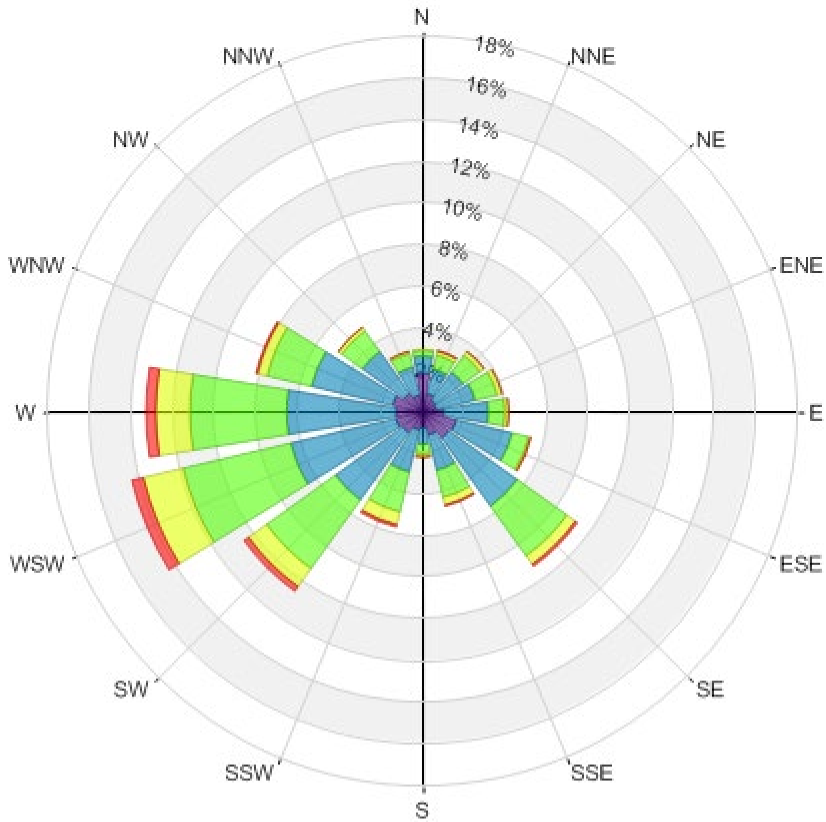
Figure 1d

Date: December 10, 2018

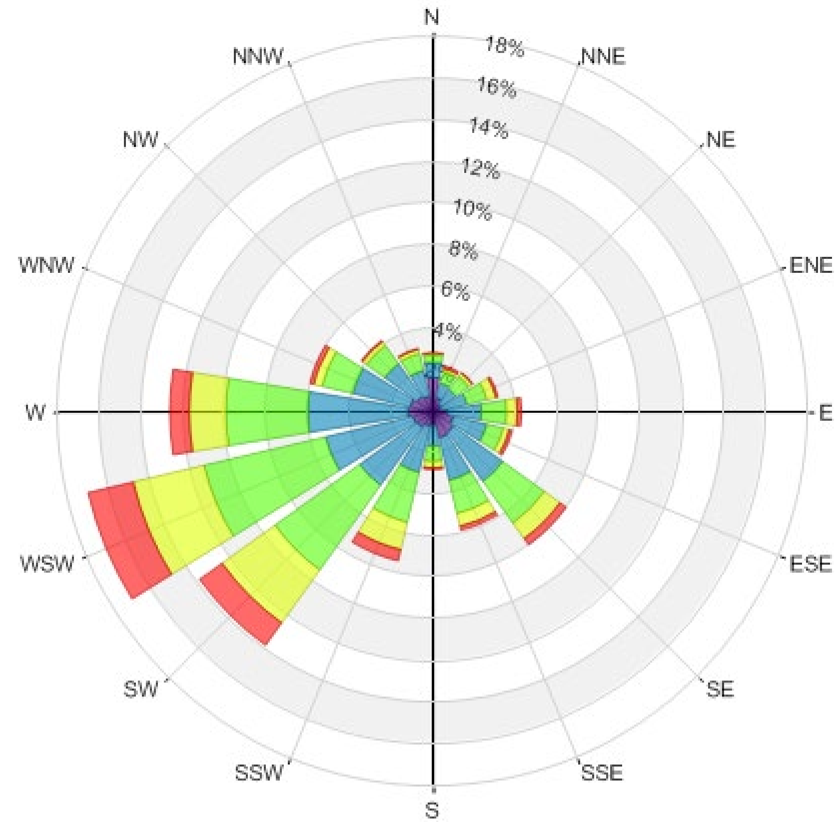




Wind Tunnel Study Model **Configuration 5: Proposed Development with cumulative and mitigation measures**	Figure 1e
RB Central, Dublin, Ireland — Project #1802586	Date: December 10, 2018



Summer
(May - October)



Winter
(November - April)

Wind Speed (km/h)	Probability (%) Summer	Probability (%) Winter
Calm	0.9	0.6
1-10	18.4	14.6
11-20	41.3	33.8
21-30	29.5	30.3
31-40	8.0	14.1
>40	1.8	6.6

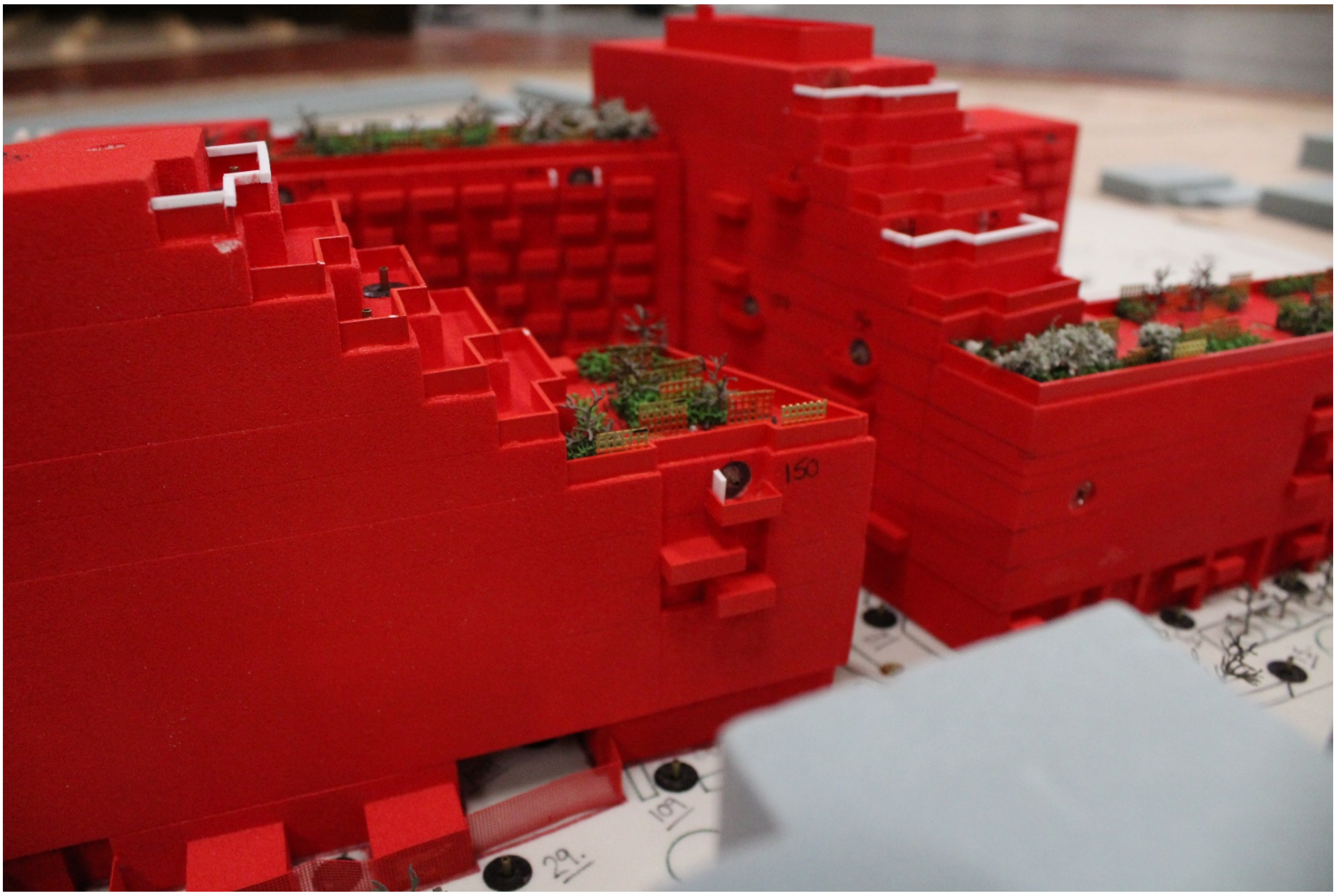
Directional Distribution (%) of Winds (Blowing From)
Dublin Airport (1993 - 2013)

RB Central – Dublin, Ireland

Project #1802586

Figure No. 2

Date: December 10, 2018



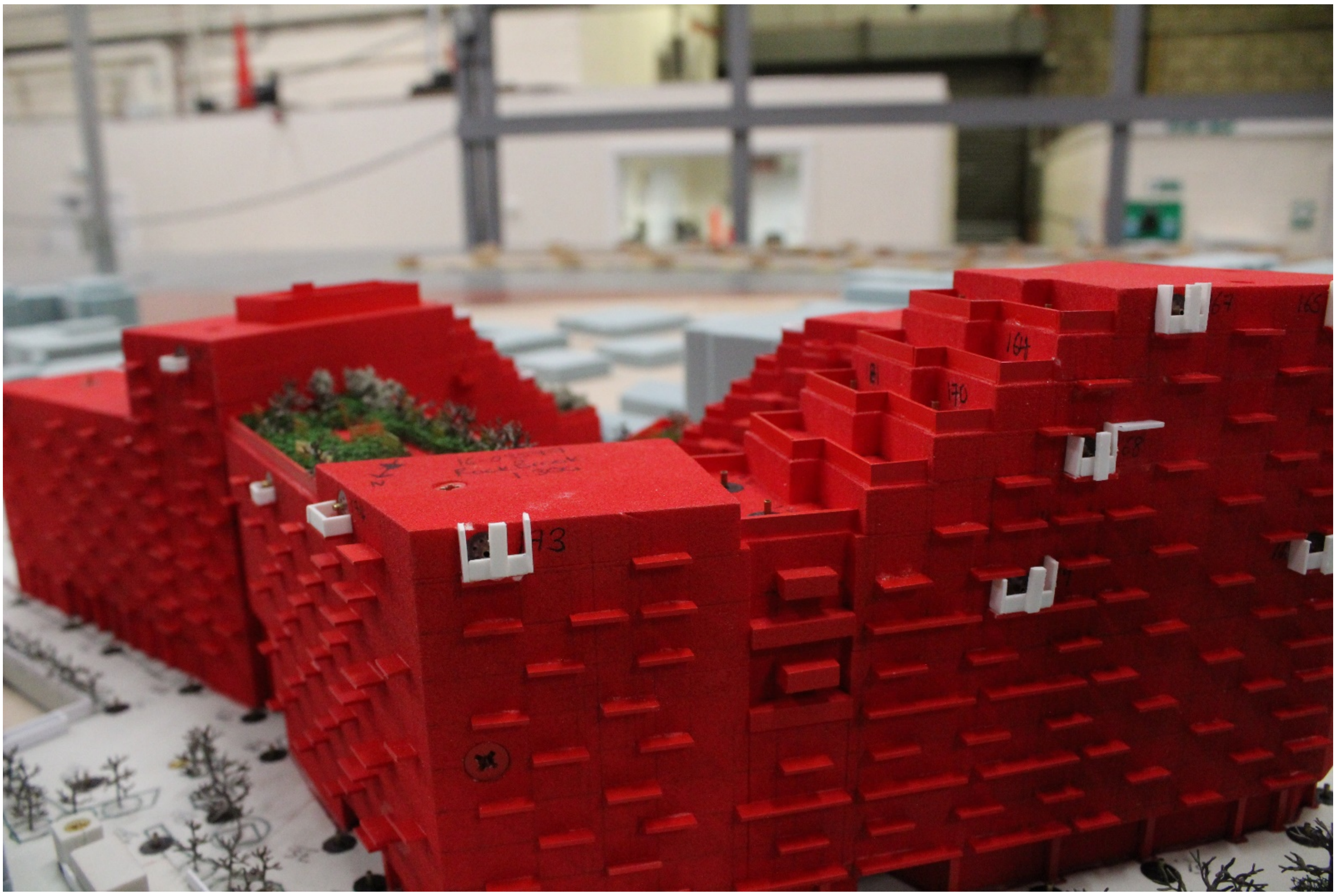
Mitigation Measures
Public and private roof terraces

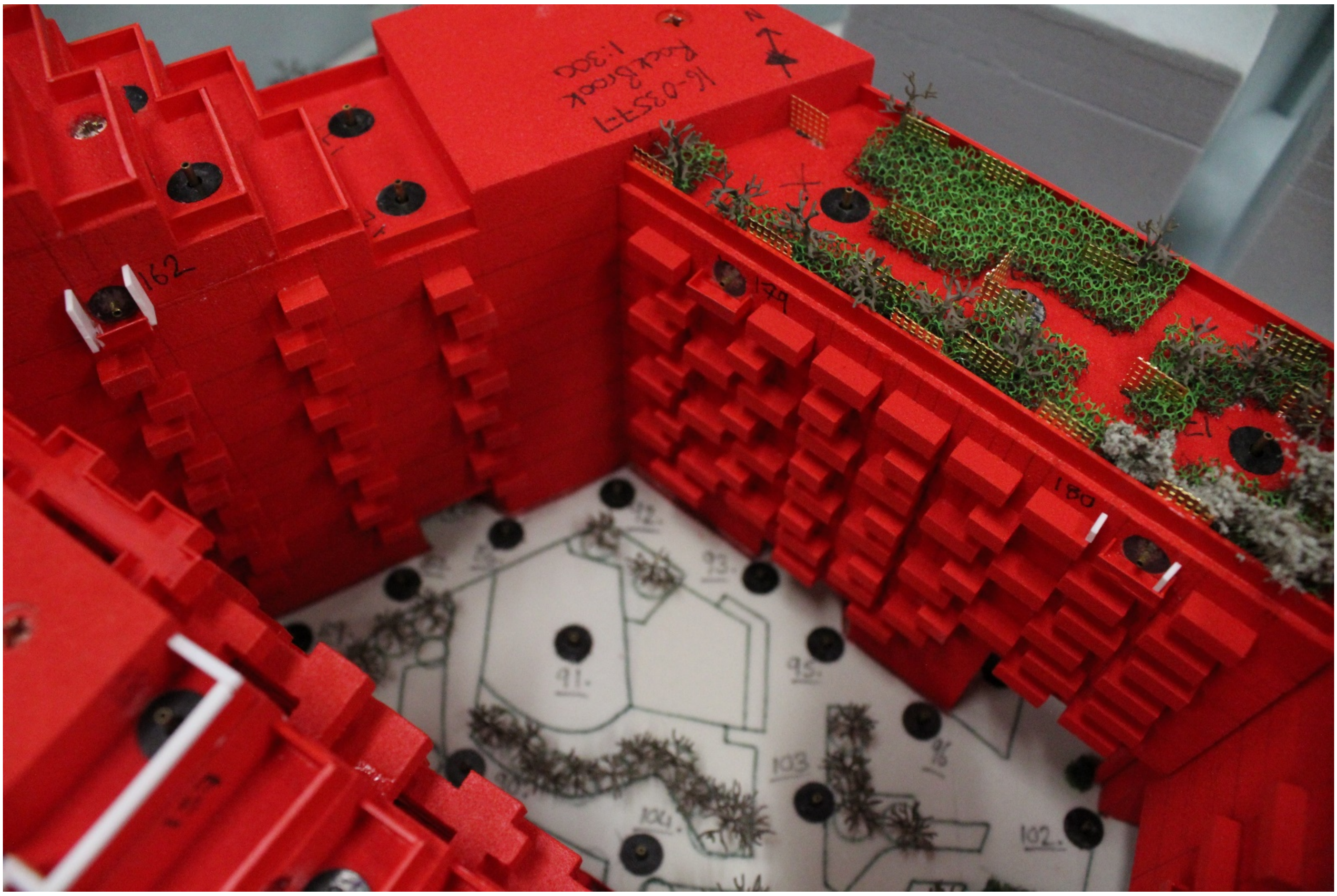
RB Central, Dublin, Ireland

Project #1802586

Figure 3a

Date: December 10, 2018





Mitigation Measures
Balconies

RB Central, Dublin, Ireland

Project #1802586

Figure 3b

Date: December 10, 2018

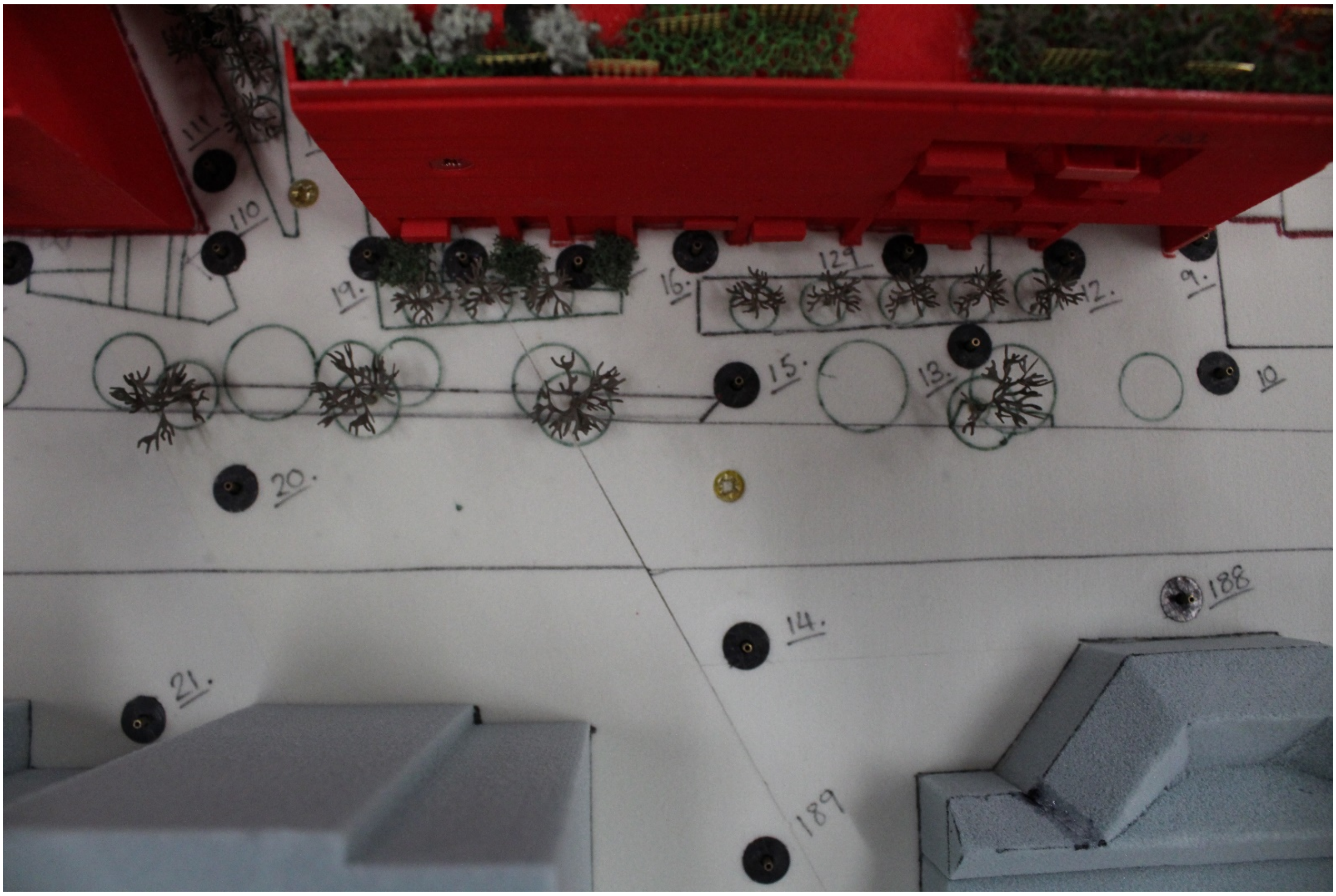
Mitigation Measures
Ground level seating areas

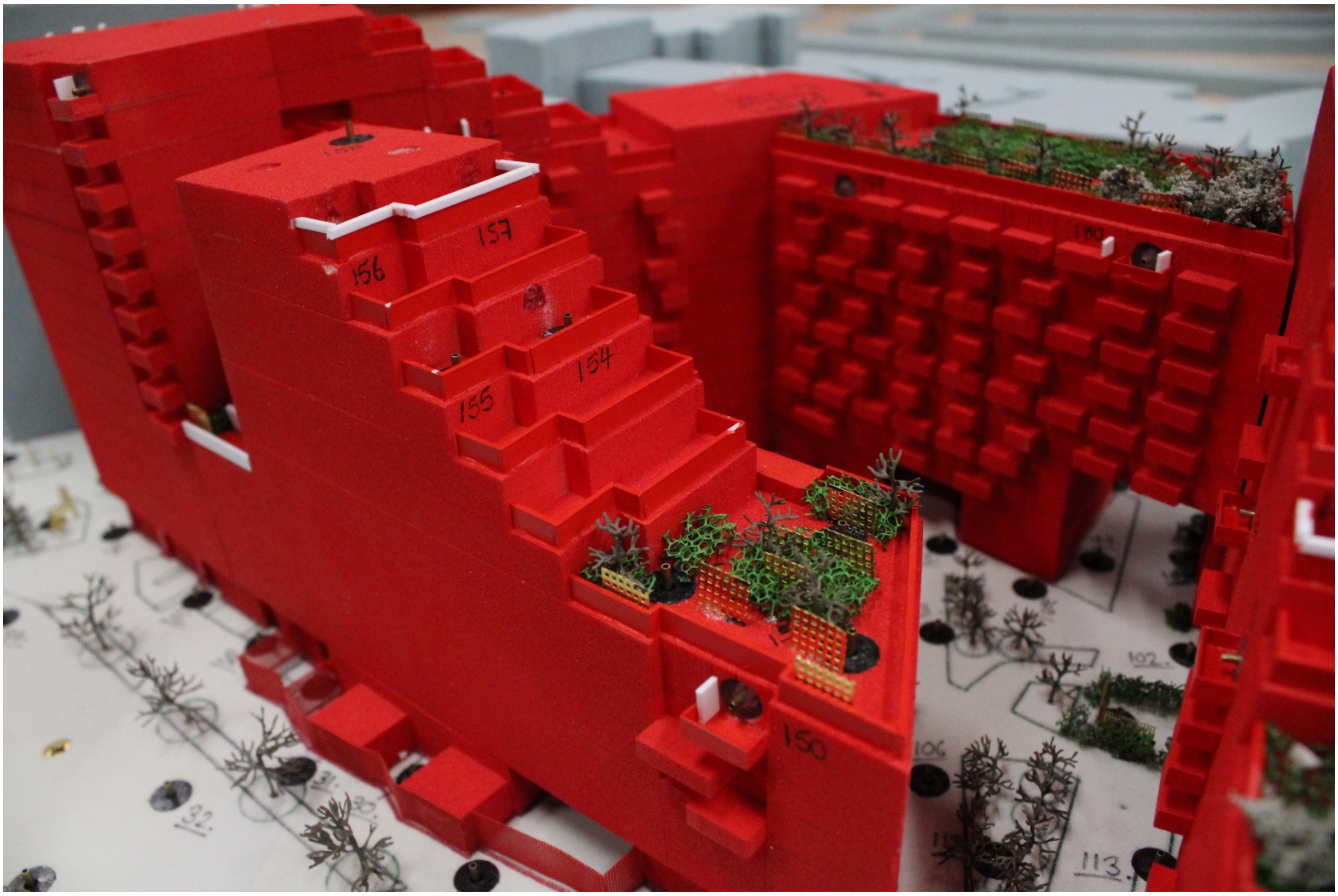
RB Central, Dublin, Ireland

Project #1802586

Figure 3c

Date: December 10, 2018





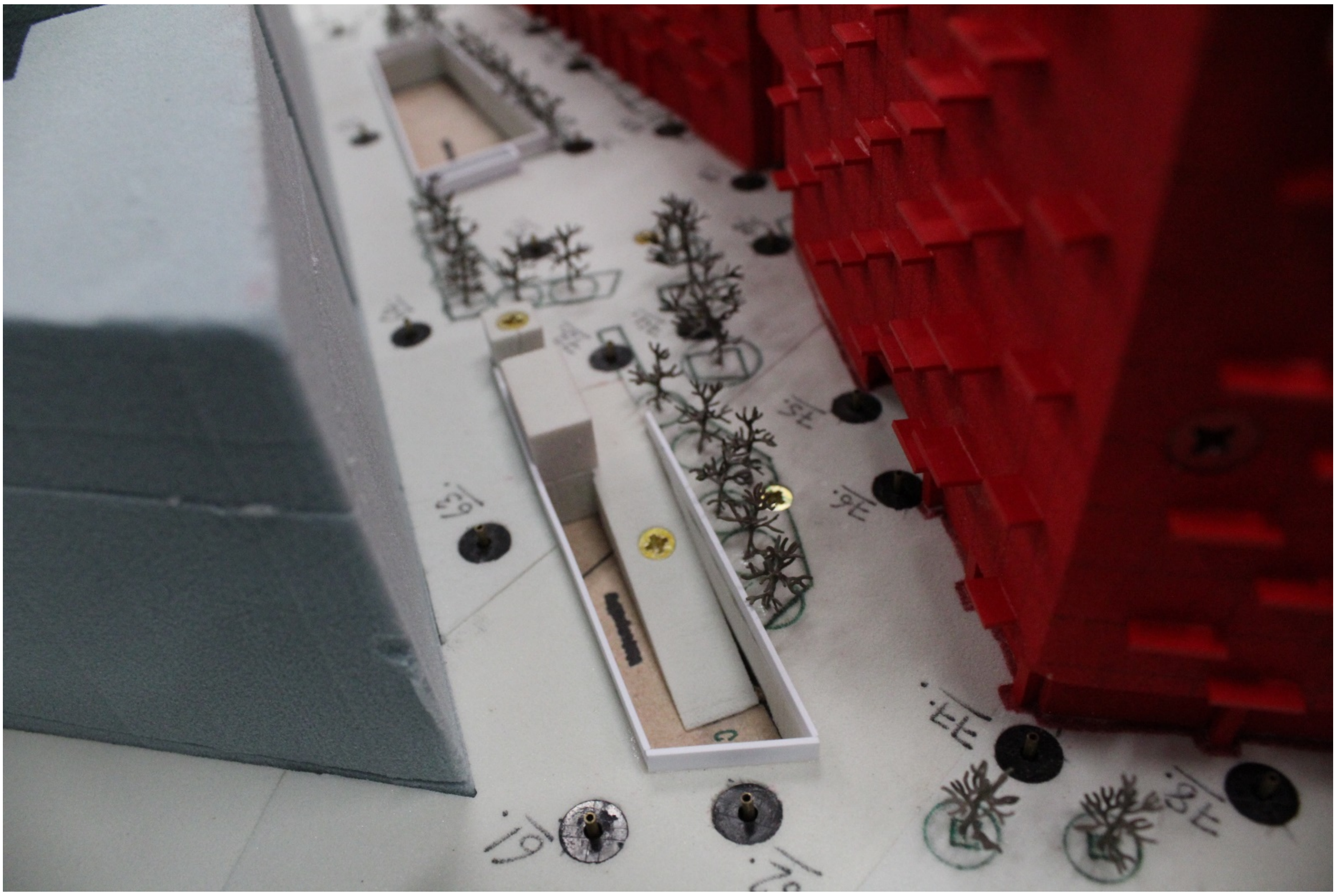
Mitigation Measures
Taller shrubs and additional trees at ground level

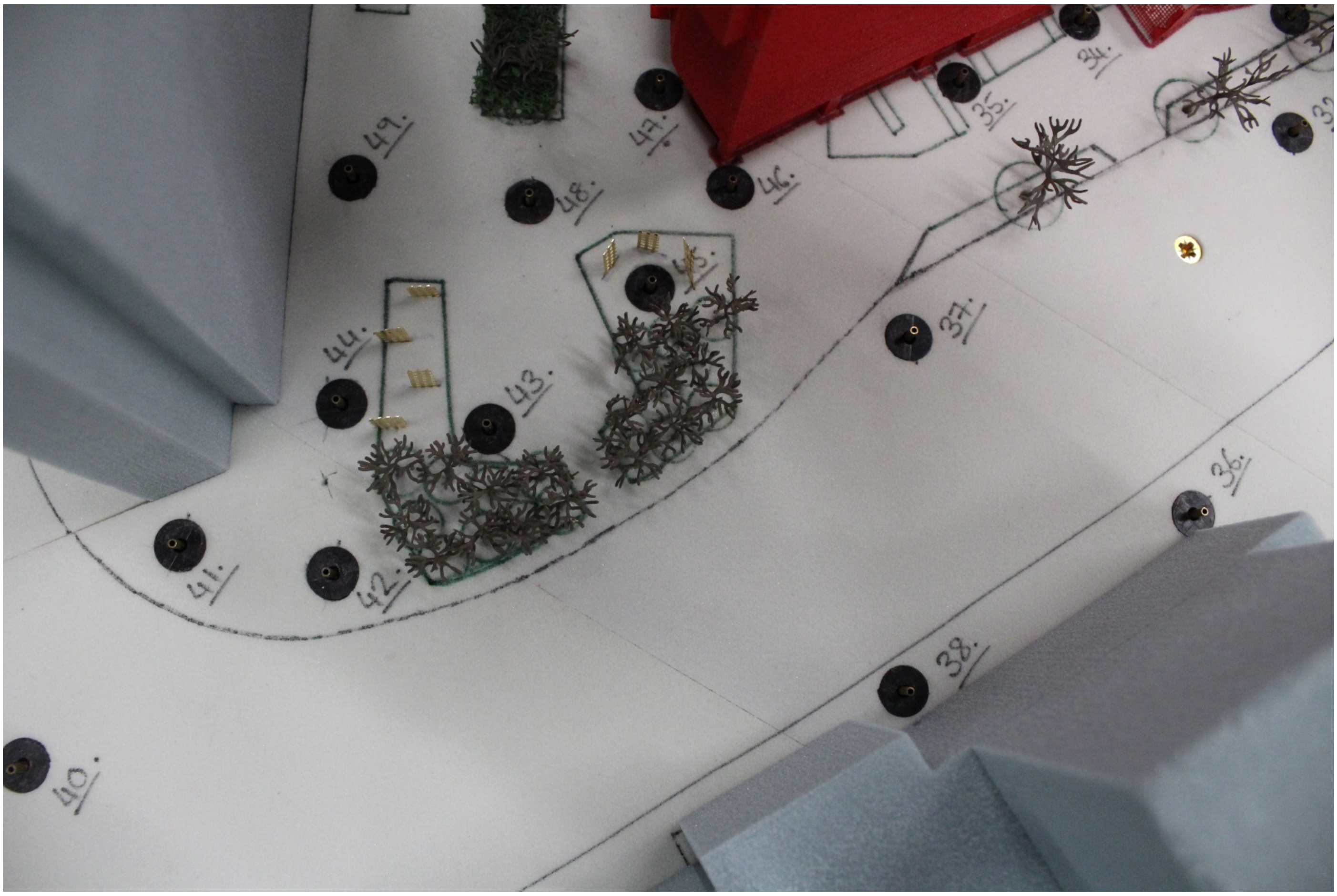
Figure 3d

RB Central, Dublin, Ireland

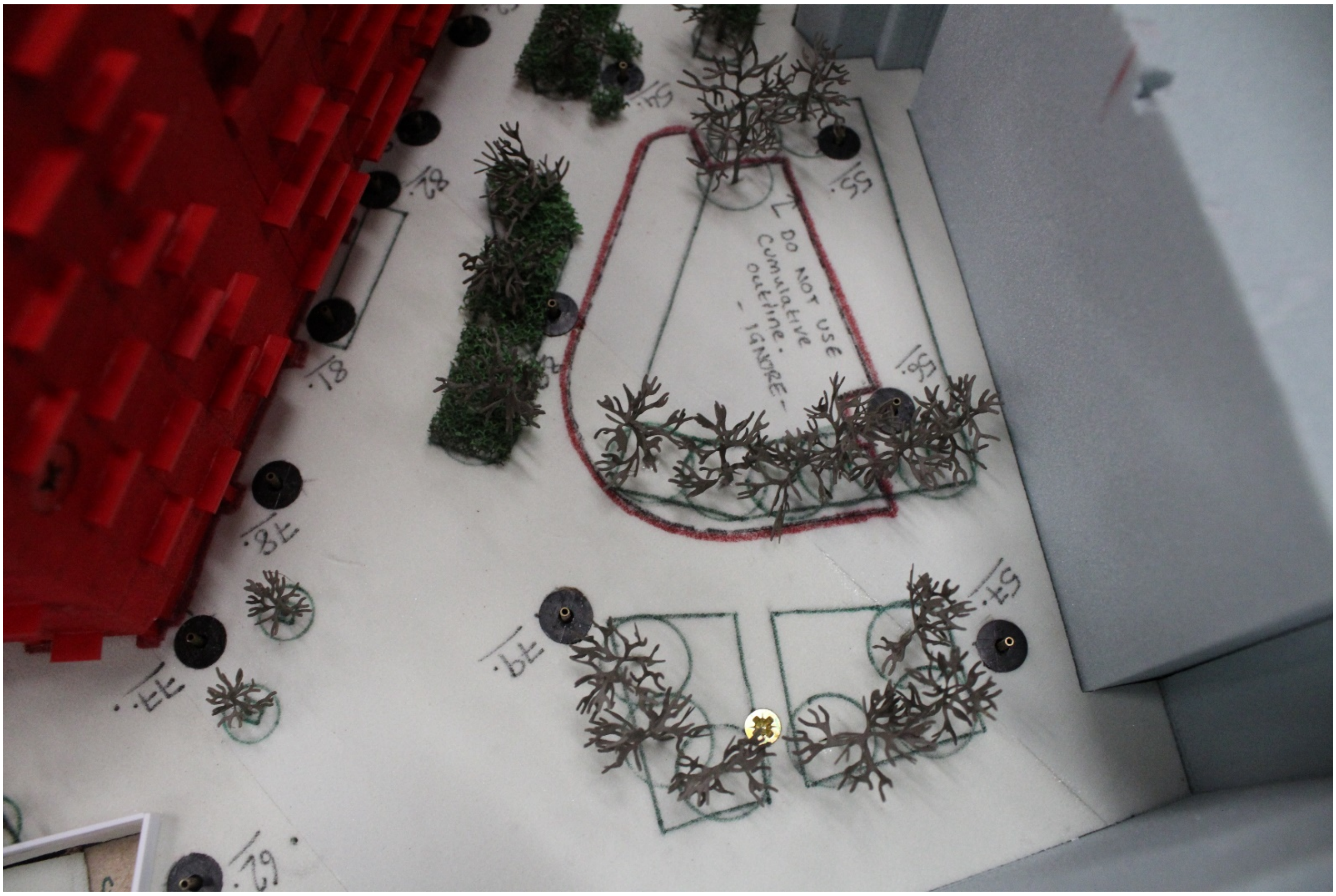
Project #1802586

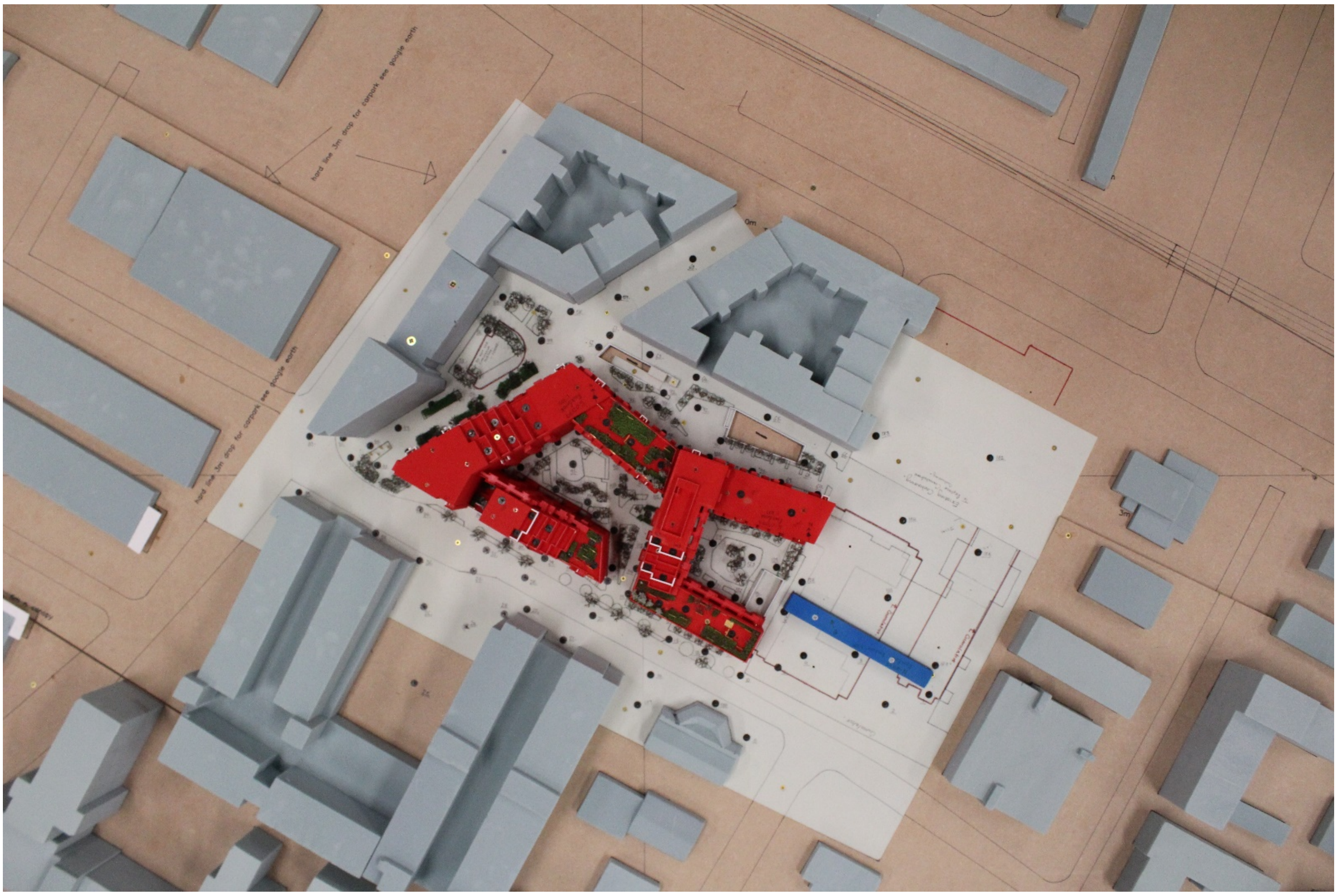
Date: December 10, 2018





Mitigation Measures **Ground level proposed landscaping**	Figure 3e	RWDI
RB Central, Dublin, Ireland — Project #1802586	Date: December 10, 2018	





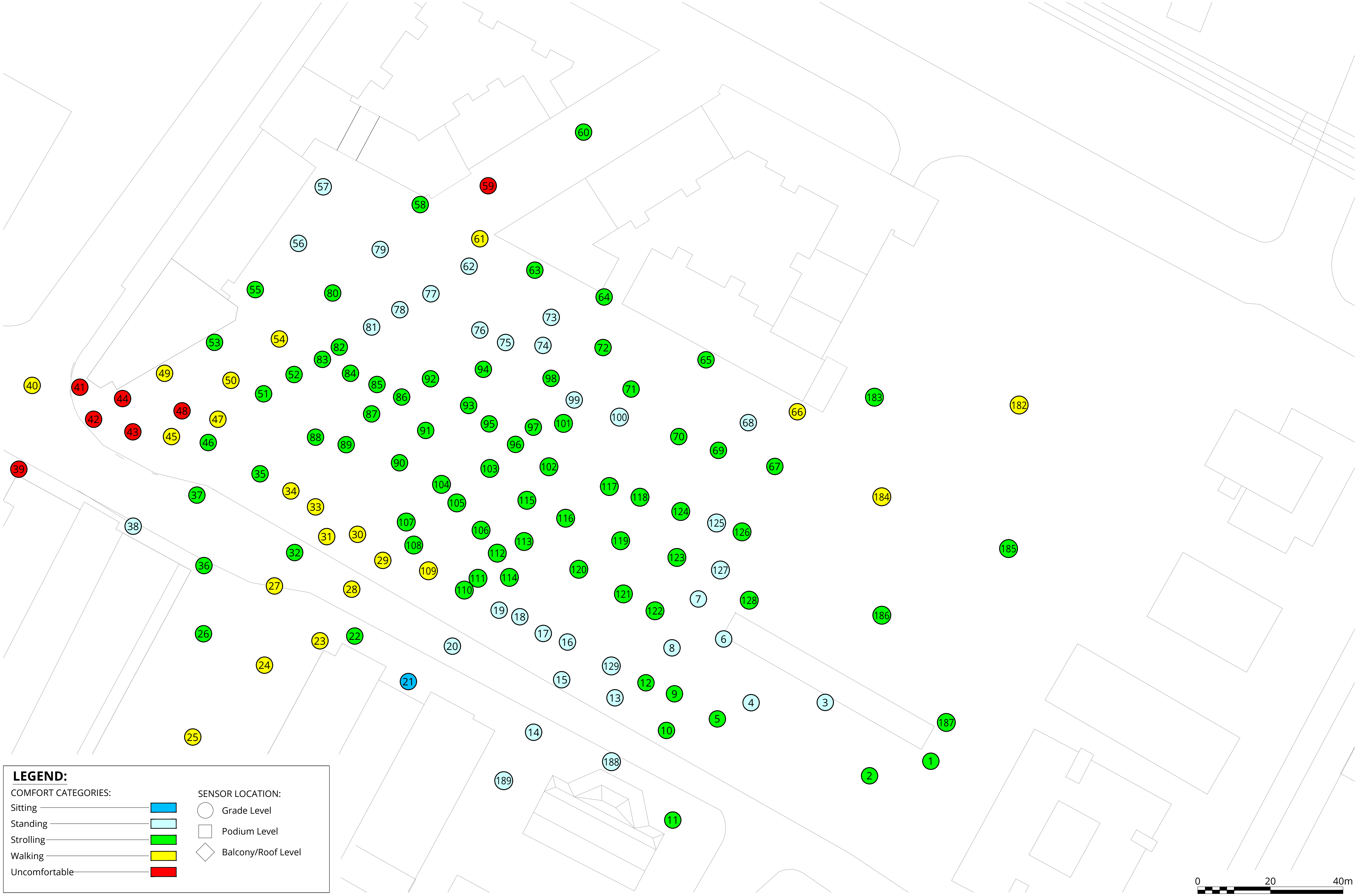
Mitigation Measures
Proposed landscaping and mitigation measures

RB Central, Dublin, Ireland

Project #1802586

Figure 3f

Date: December 10, 2018



LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Podium Level
- Balcony/Roof Level

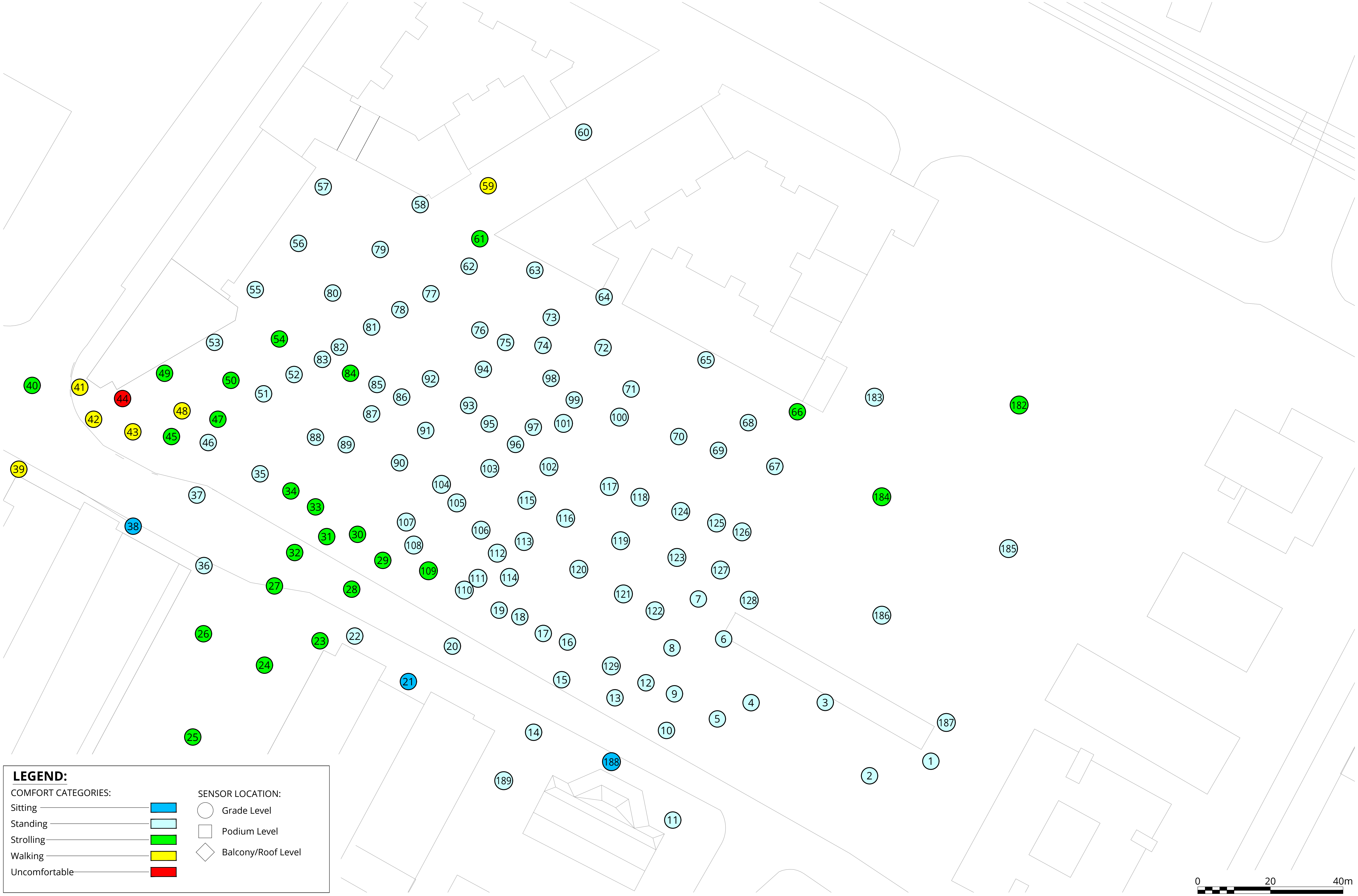
Pedestrian Wind Comfort Conditions - Ground Floor
Configuration 1: Existing Site with Existing Surrounding Buildings
Winter Season

Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

Drawn by: JLF	Figure: 4
Approx. Scale @A3:	1:1000
Date Revised:	Nov. 16, 2018



Pedestrian Wind Comfort Conditions - Ground Floor
Configuration 1: Existing Site with Existing Surrounding Buildings
Summer Season

Rockbrook Sandyford - Dublin, Ireland

Project #1802586

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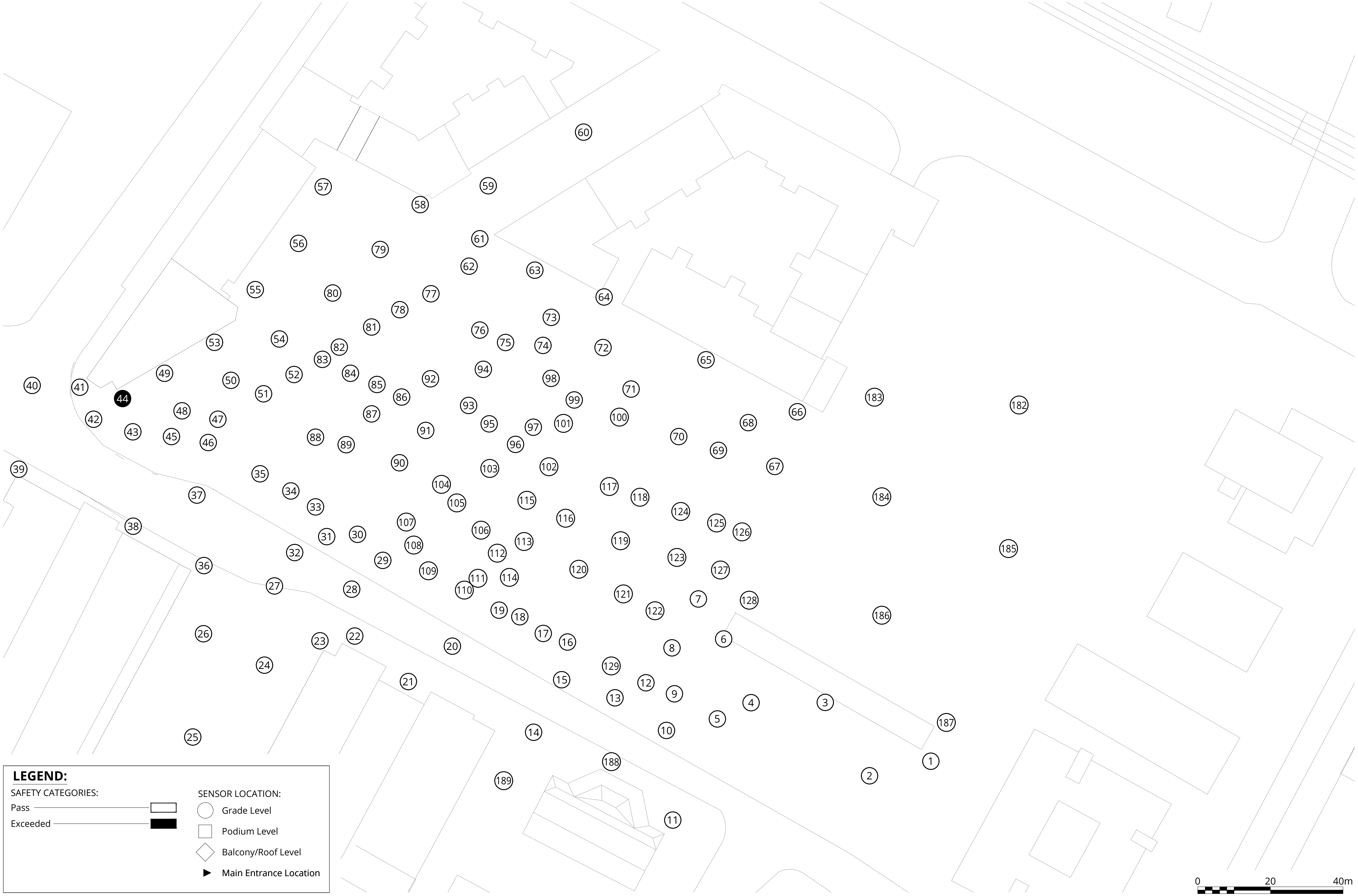

Pedestrian Wind Safety Conditions - Ground Floor

Configuration 1: Existing Site with Existing Surrounding Buildings

Annual

Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

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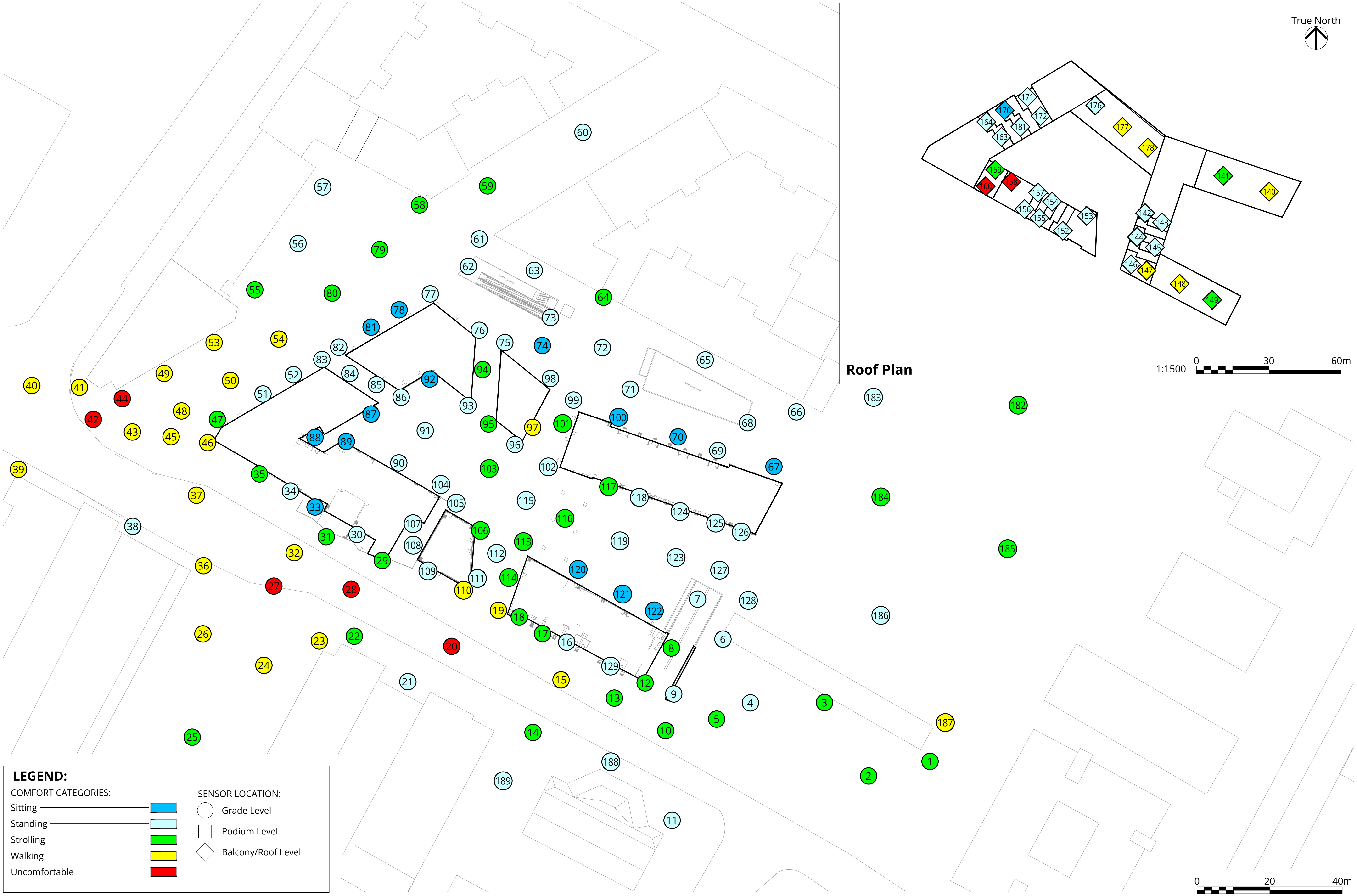

Pedestrian Wind Comfort Conditions - Ground Floor
Configuration 2: Proposed Development with Existing Surrounding Buildings
Winter Season

Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

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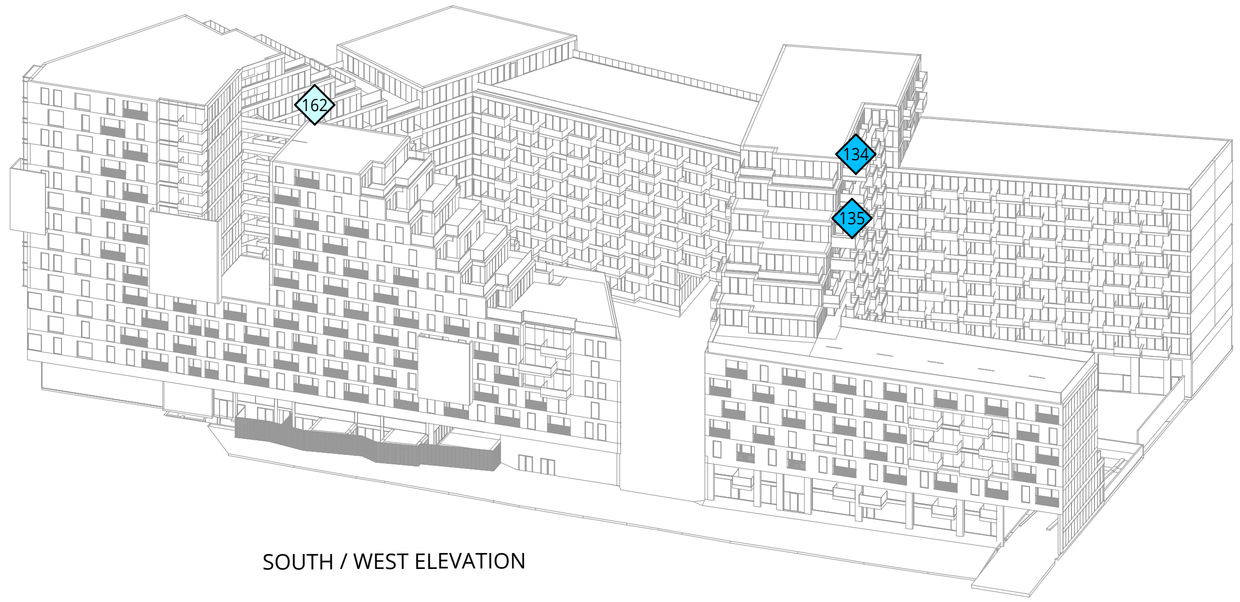
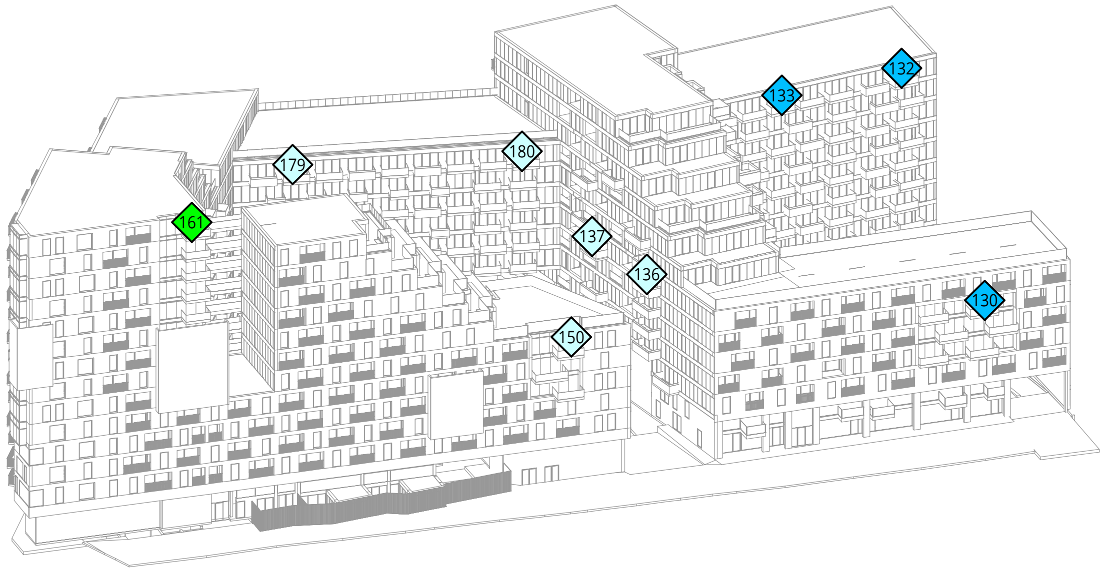
Date Revised:	Nov. 16, 2018		

NORTH / WEST ELEVATION



SOUTH / WEST ELEVATION



SOUTH / WEST ELEVATION

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Podium Level
- Balcony/Roof Level

0 20 40m

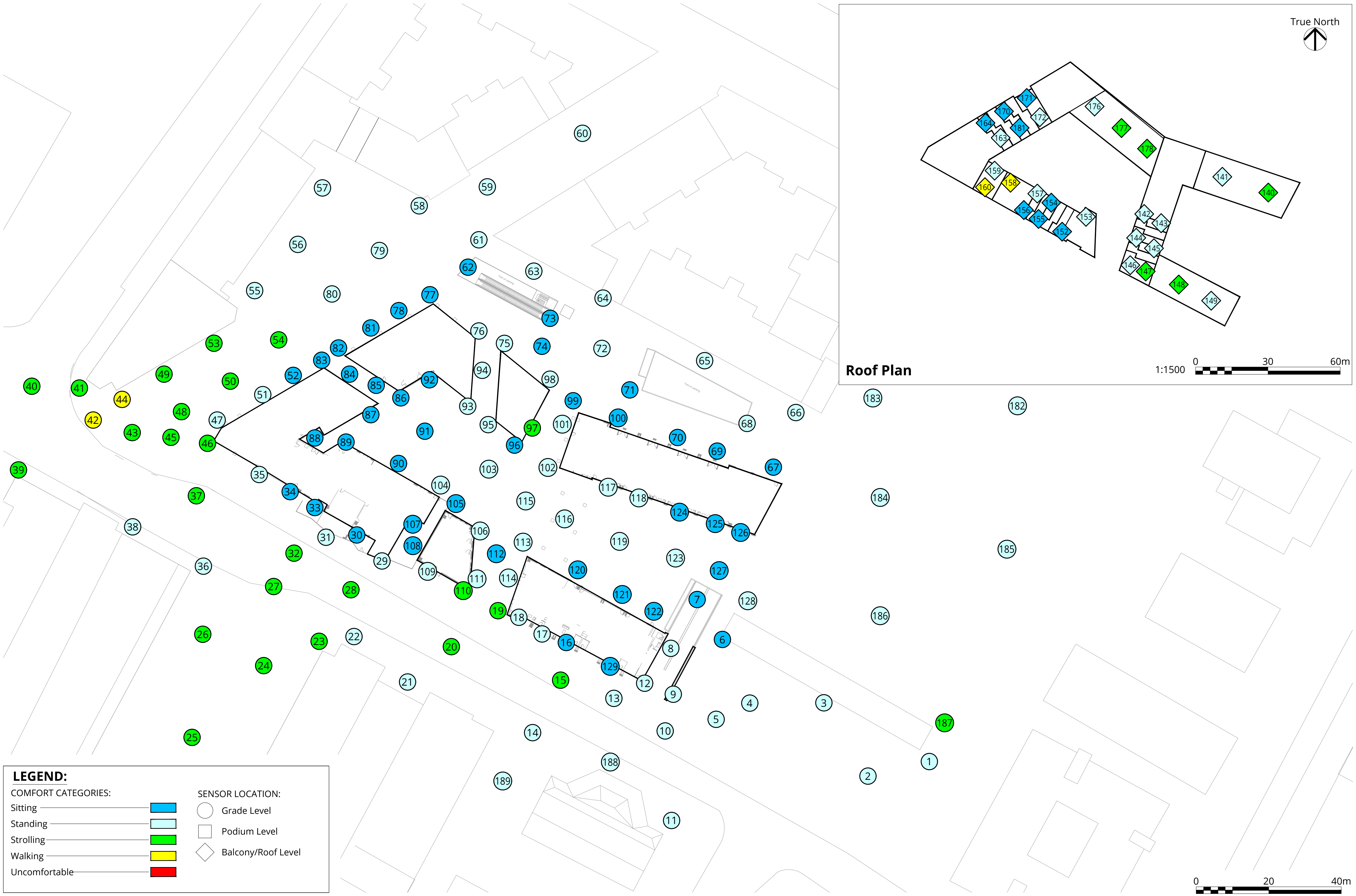
Pedestrian Wind Comfort Conditions - Isometric Views
Configuration 2: Proposed Development with Existing Surrounding Buildings
Winter Season

Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

Drawn by:	JLF	Figure:	8
Approx. Scale @A3:	1:1000		
Date Revised:	Nov. 16, 2018		



LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Podium Level
- Balcony/Roof Level

Pedestrian Wind Comfort Conditions - Ground Floor

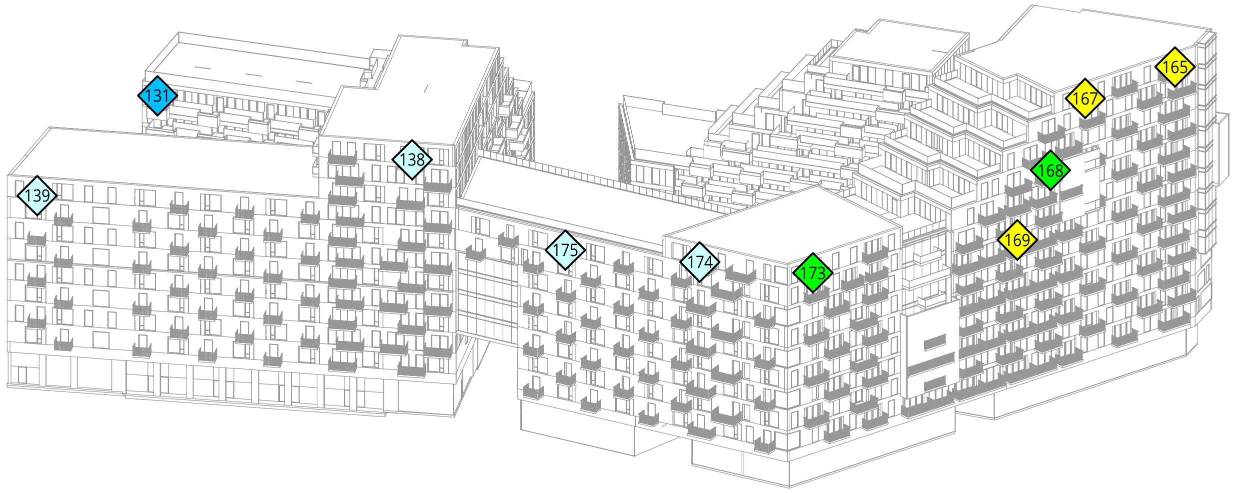
Configuration 2: Proposed Development with Existing Surrounding Buildings
Summer Season

Rockbrook Sandyford - Dublin, Ireland

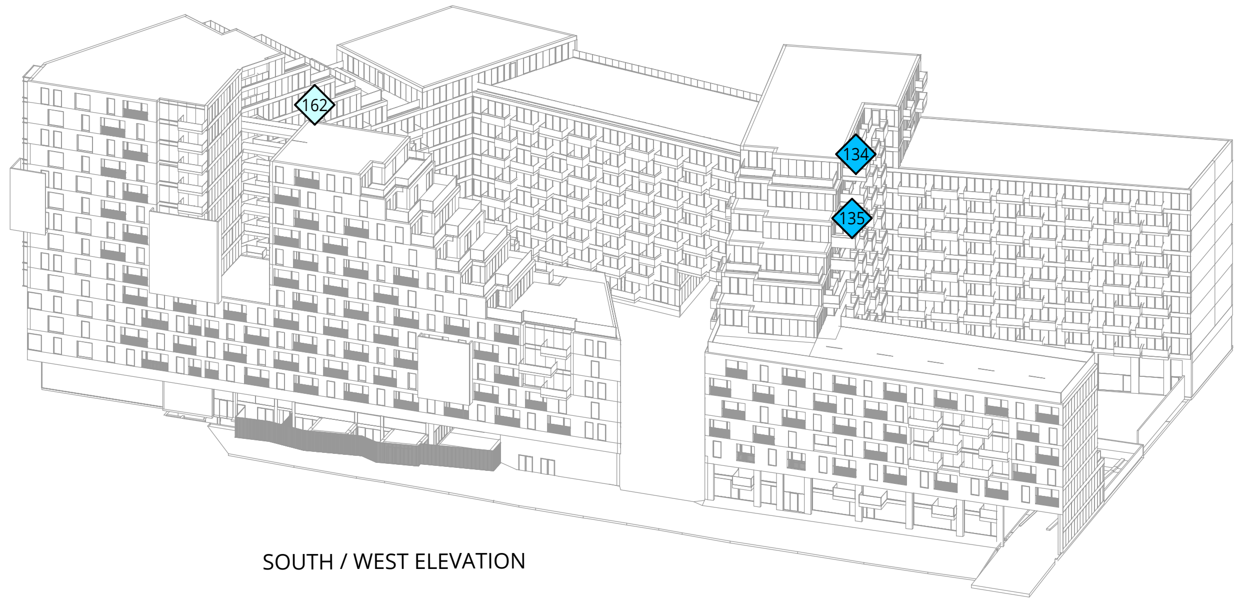
True North

Project #1802586

Drawn by:	JLF	Figure:	9
Approx. Scale @A3:	1:1000		
Date Revised:	Nov. 16, 2018		



NORTH / WEST ELEVATION



SOUTH / WEST ELEVATION

SOUTH / WEST ELEVATION

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Podium Level
- Balcony/Roof Level

0 20 40m

Pedestrian Wind Comfort Conditions - Isometric Views
Configuration 2: Proposed Development with Existing Surrounding Buildings
Summer Season

Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

Drawn by: JLF	Figure: 10
Approx. Scale @A3:	1:1000
Date Revised:	Nov. 16, 2018

LEGEND:

SAFETY CATEGORIES:

- Pass
- Exceeded

SENSOR LOCATION:

- Grade Level
- Podium Level
- Balcony/Roof Level
- Main Entrance Location

Pedestrian Wind Safety Conditions - Ground Floor

Configuration 2: Proposed Development with Existing Surrounding Buildings
Annual

Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

Drawn by: JLF	Figure: 11
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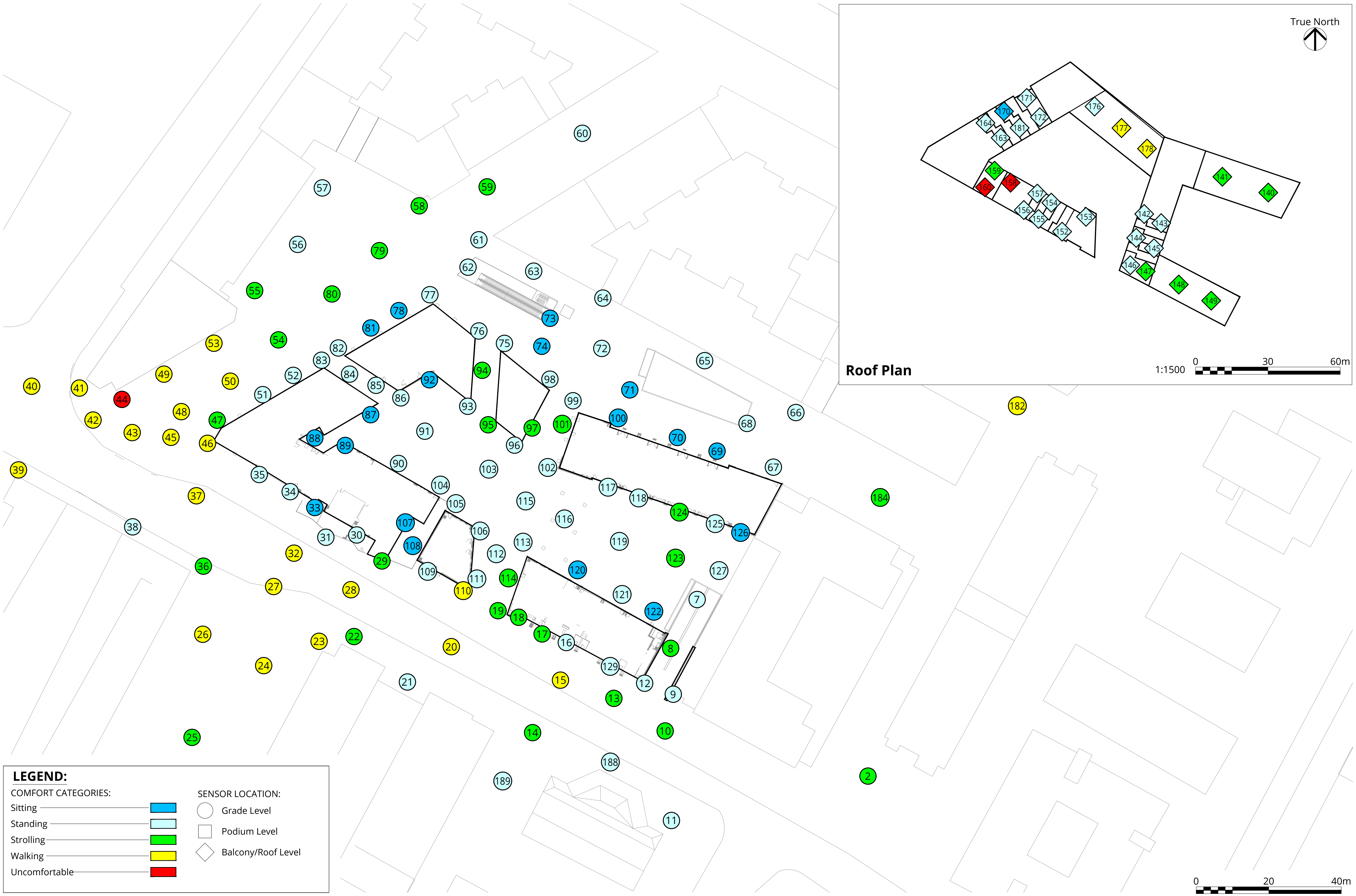
Date Revised:	Nov. 16, 2018



LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Podium Level
- Balcony/Roof Level

Pedestrian Wind Comfort Conditions - Ground Floor

Configuration 3: Proposed Development with Cumulative Surrounding Buildings
Winter Season

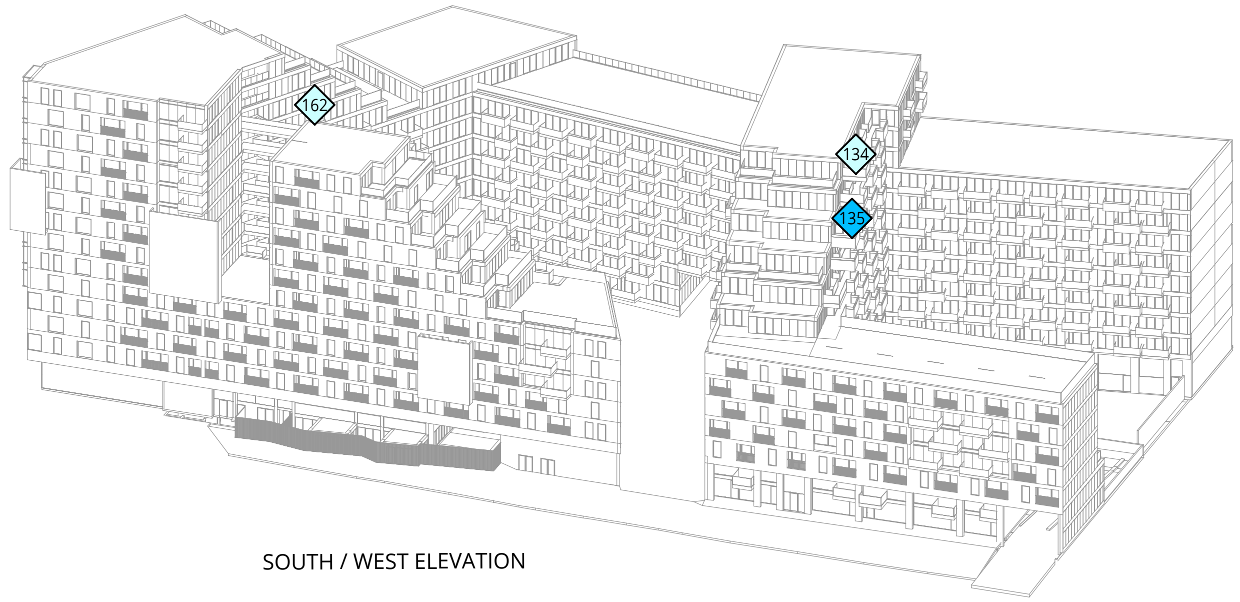
Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

Drawn by: JLF	Figure: 12
Approx. Scale @A3:	1:1000
Date Revised:	Nov. 16, 2018

NORTH / WEST ELEVATION



SOUTH / WEST ELEVATION

SOUTH / WEST ELEVATION

LEGEND:

COMFORT CATEGORIES:

- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:

- Grade Level
- Podium Level
- Balcony/Roof Level

0 20 40m

Pedestrian Wind Comfort Conditions - Isometric Views
Configuration 3: Proposed Development with Cumulative Surrounding Buildings
Winter Season

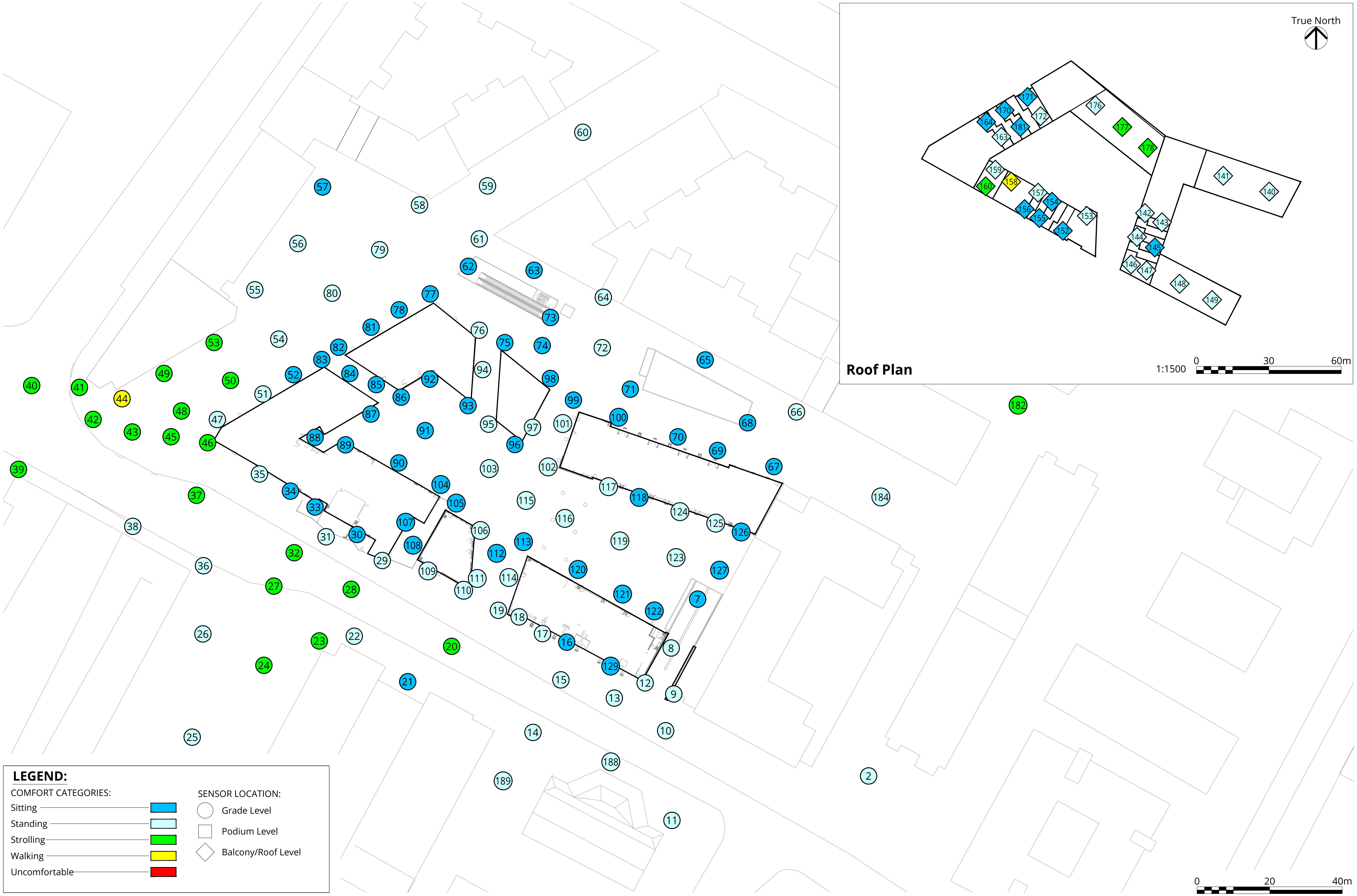
Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

Drawn by: JLF	Figure: 13
Approx. Scale @A3:	1:1000
Date Revised:	Nov. 16, 2018

RWDI



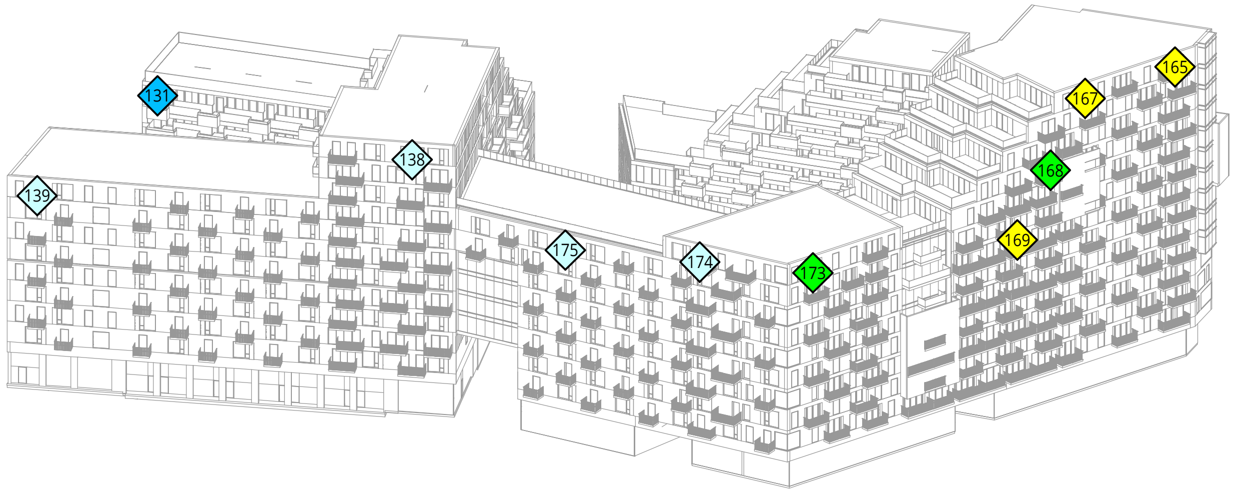
Pedestrian Wind Comfort Conditions - Ground Floor
Configuration 3: Proposed Development with Cumulative Surrounding Buildings
Summer Season

Rockbrook Sandyford - Dublin, Ireland

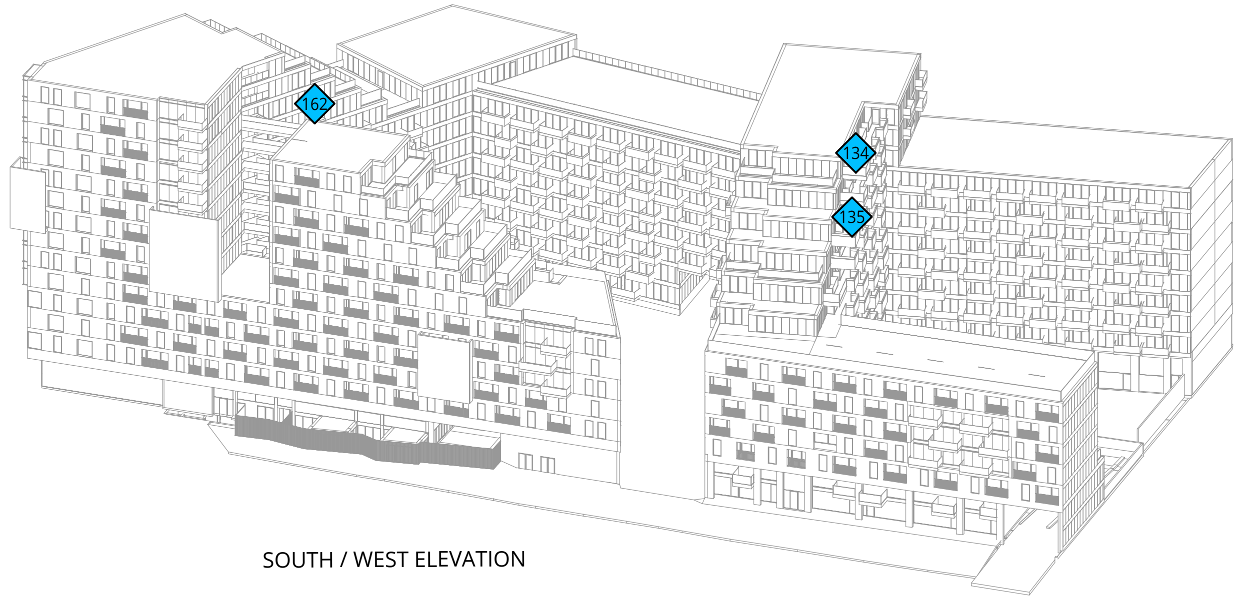
True North

Project #1802586

Drawn by:	JLF	Figure:	14
Approx. Scale @A3:	1:1000		
Date Revised:	Nov. 16, 2018		



NORTH / WEST ELEVATION



SOUTH / WEST ELEVATION

SOUTH / WEST ELEVATION

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Podium Level
- Balcony/Roof Level

0 20 40m

Pedestrian Wind Comfort Conditions - Isometric Views
Configuration 3: Proposed Development with Cumulative Surrounding Buildings
Summer Season

Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

Drawn by: JLF	Figure: 15
Approx. Scale @A3:	1:1000
Date Revised:	Nov. 16, 2018

LEGEND:

SAFETY CATEGORIES:

- Pass
- Exceeded

SENSOR LOCATION:

- Grade Level
- Podium Level
- Balcony/Roof Level
- Main Entrance Location

Pedestrian Wind Safety Conditions - Ground Floor

Configuration 3: Proposed Development with Cumulative Surrounding Buildings
Annual

Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

Drawn by:	JLF	Figure:	16
Approx. Scale @A3:	1:1000		
Date Revised:	Nov. 16, 2018		

RWDI

Pedestrian Wind Comfort Conditions - Ground Floor
Configuration 4: Proposed Development with Existing Surrounding Buildings and Mitigation Measures
Winter Season

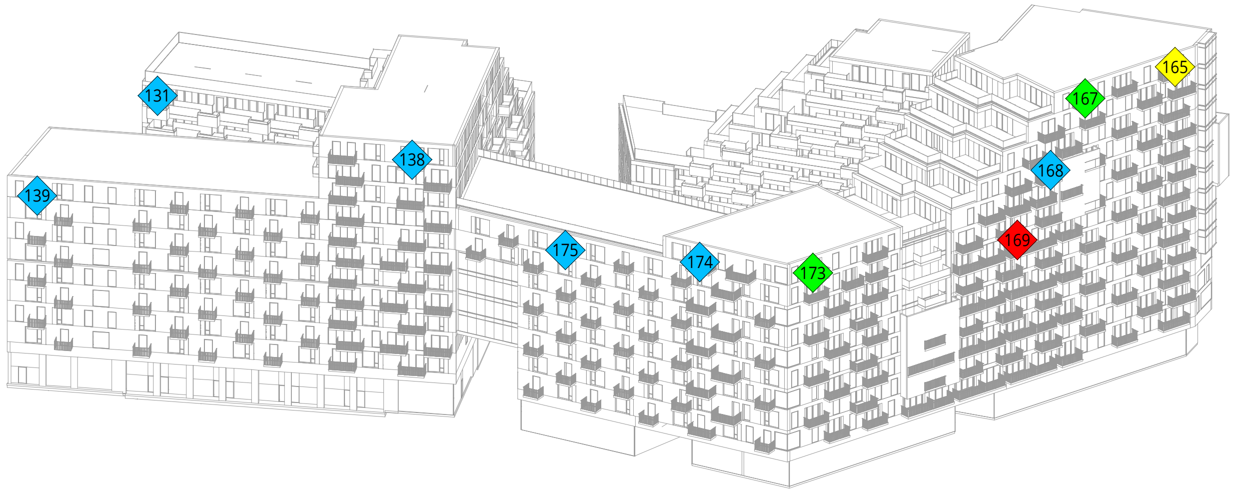
Rockbrook Sandyford - Dublin, Ireland

True North

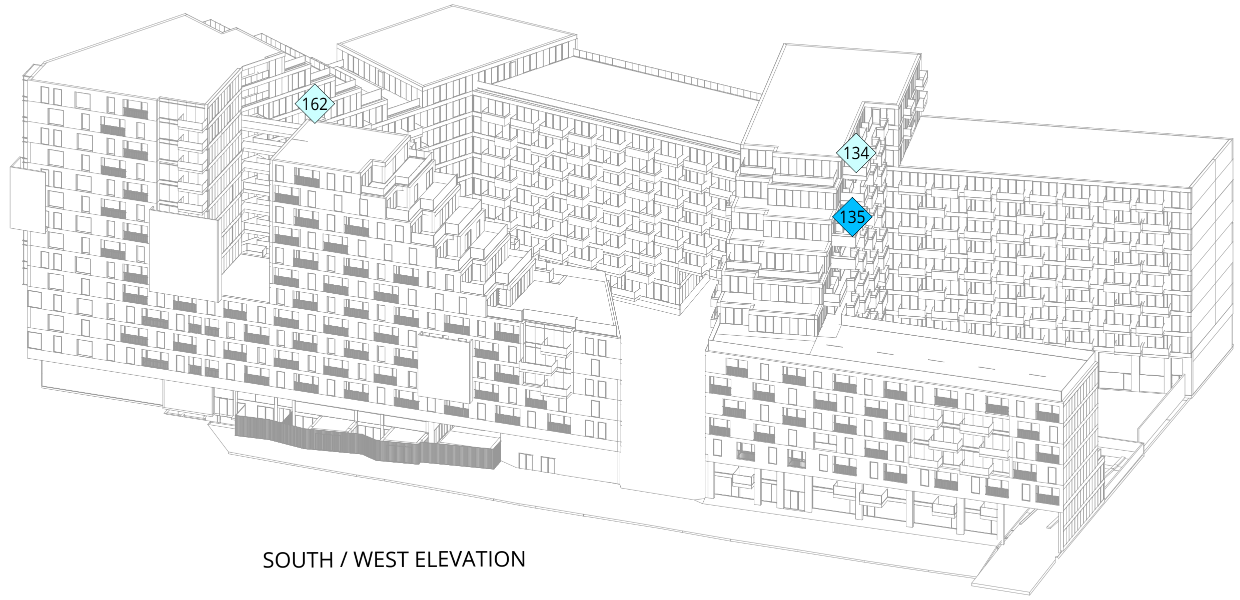
Project #1802586

Drawn by: JLF	Figure: 17
Approx. Scale @A3:	1:1000
Date Revised:	Nov. 30, 2018

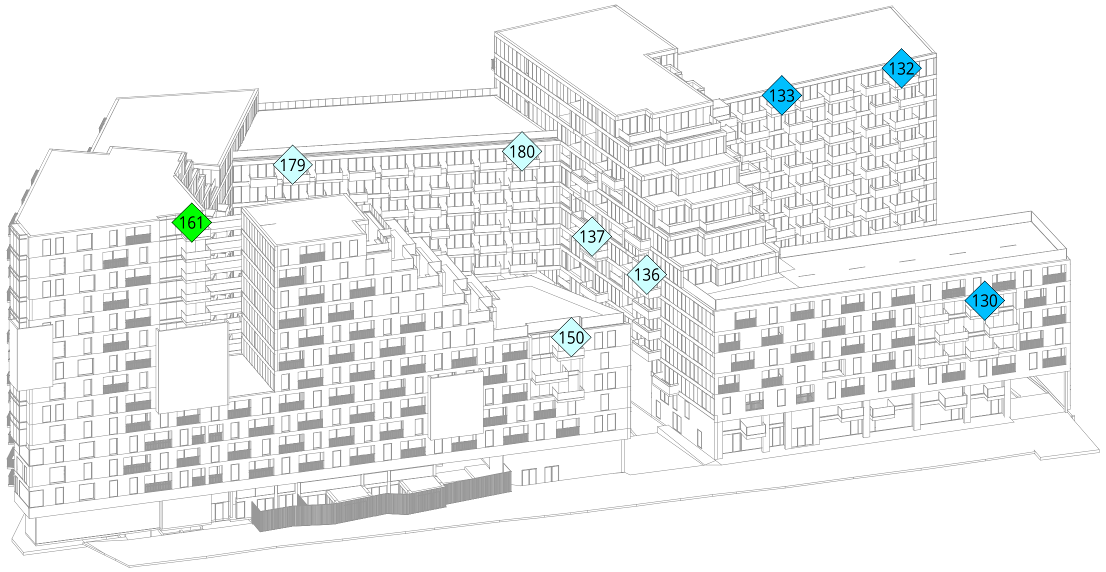
RWDI



NORTH / WEST ELEVATION



SOUTH / WEST ELEVATION



SOUTH / WEST ELEVATION

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Podium Level
- Balcony/Roof Level

0 20 40m

Pedestrian Wind Comfort Conditions - Isometric Views

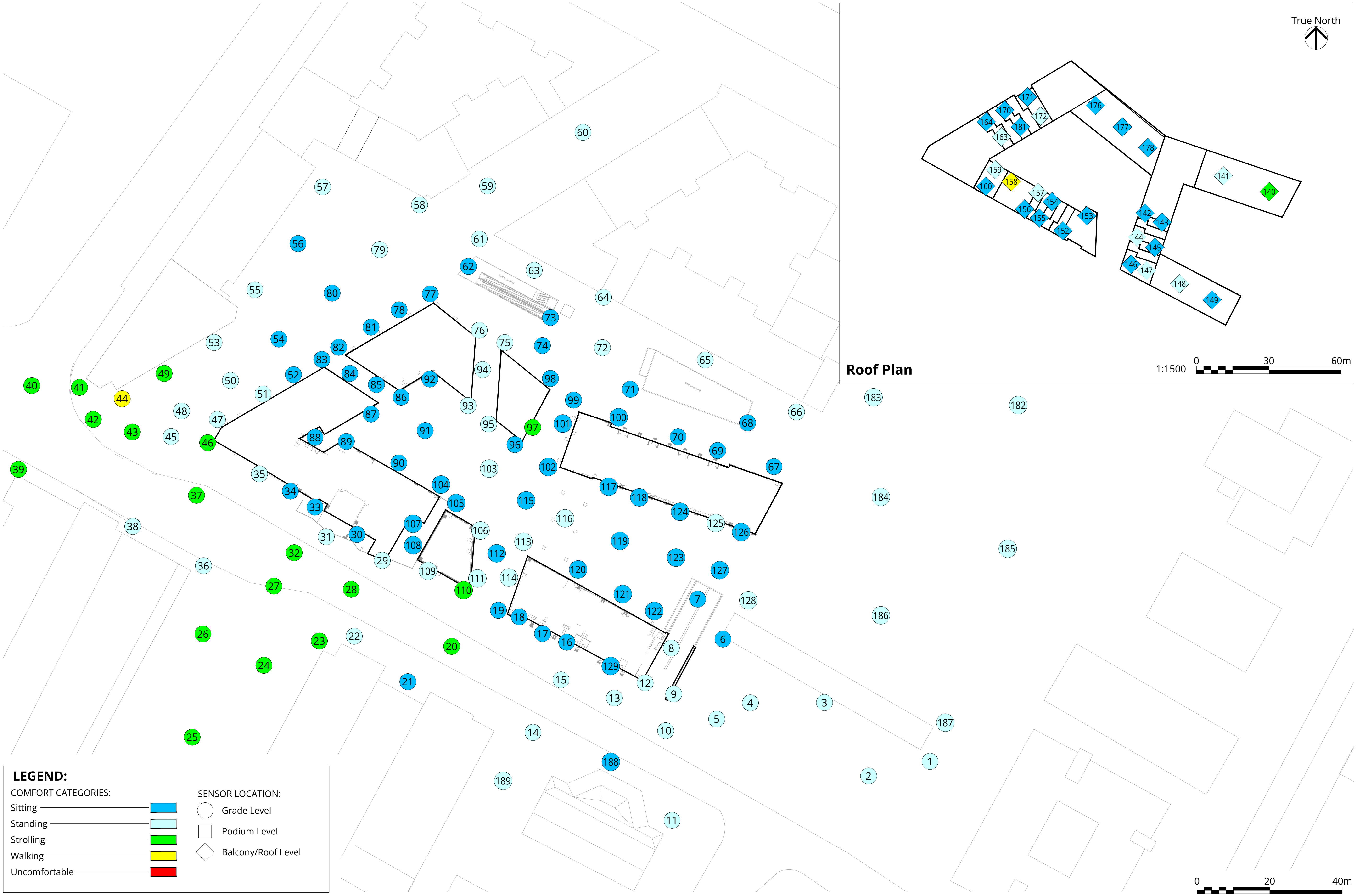
Configuration 4: Proposed Development with Existing Surrounding Buildings and Mitigation Measures
Winter Season

Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

Drawn by: JLF	Figure: 18
Approx. Scale @A3:	1:1000
Date Revised:	Nov. 30, 2018



Pedestrian Wind Comfort Conditions - Ground Floor

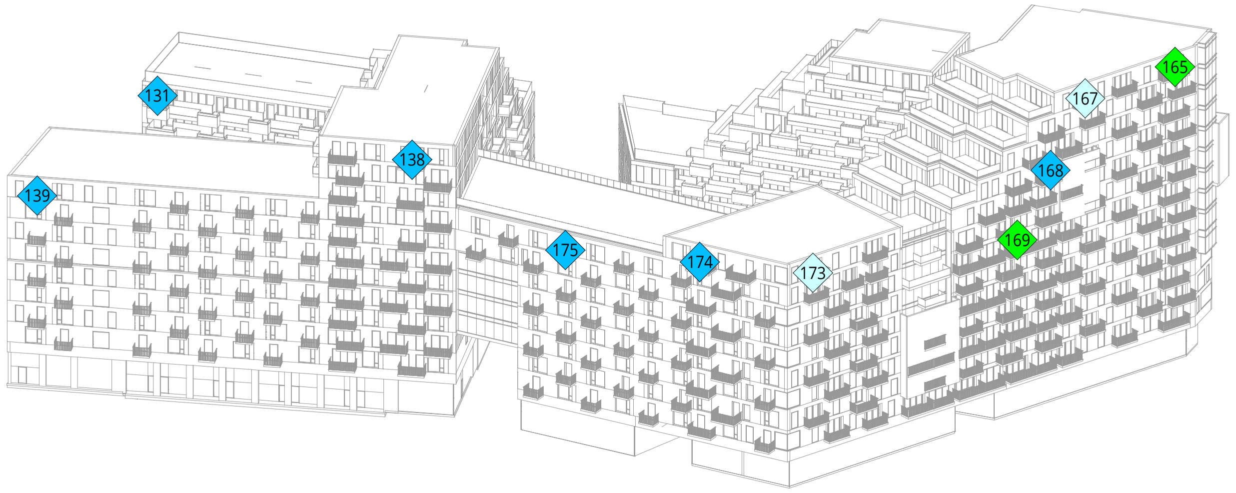
Configuration 4: Proposed Development with Existing Surrounding Buildings and Mitigation Measures
Summer Season

Rockbrook Sandyford - Dublin, Ireland

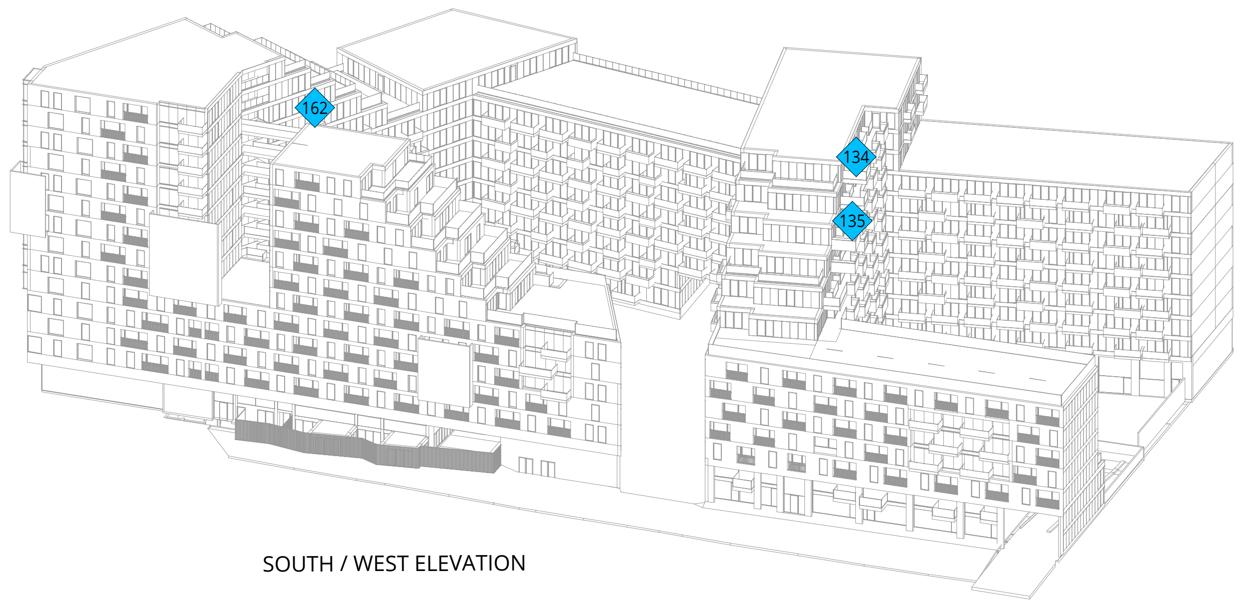
True North

Project #1802586

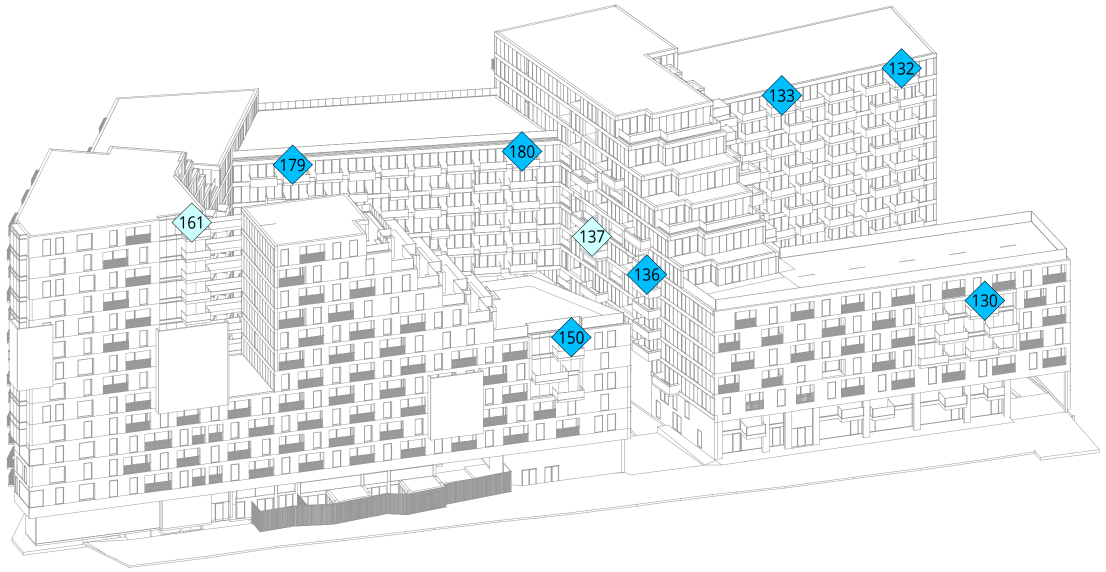
Drawn by:	JLF	Figure:	19
Approx. Scale @A3:		1:1000	
Date Revised:		Nov. 30, 2018	



NORTH / WEST ELEVATION



SOUTH / WEST ELEVATION



SOUTH / WEST ELEVATION

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Podium Level
- Balcony/Roof Level

0 20 40m

Pedestrian Wind Comfort Conditions - Isometric Views

Configuration 4: Proposed Development with Existing Surrounding Buildings and Mitigation Measures
Summer Season

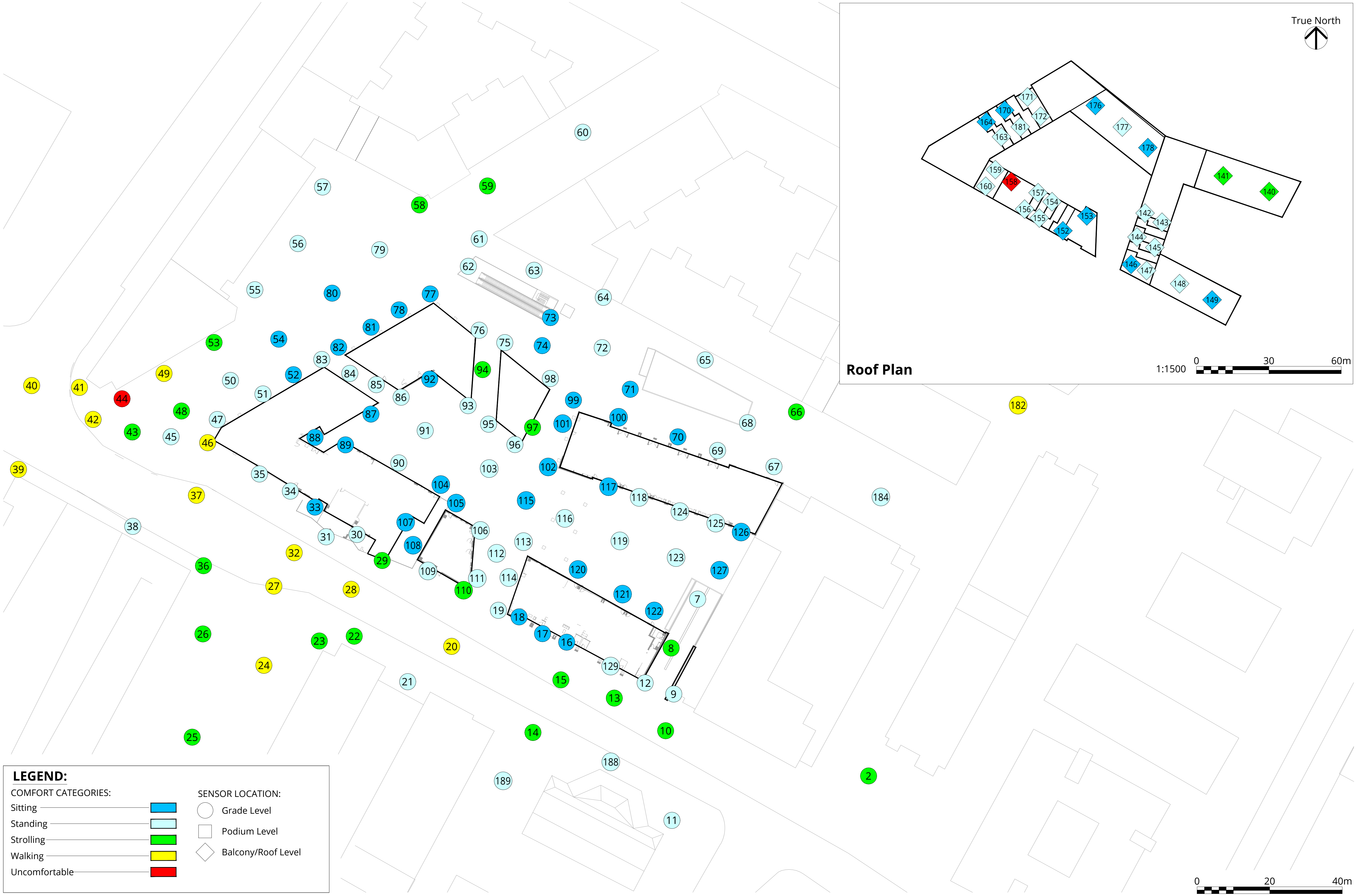
Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

Drawn by: JLF	Figure: 20
Approx. Scale @A3:	1:1000
Date Revised:	Nov. 30, 2018

RWDI



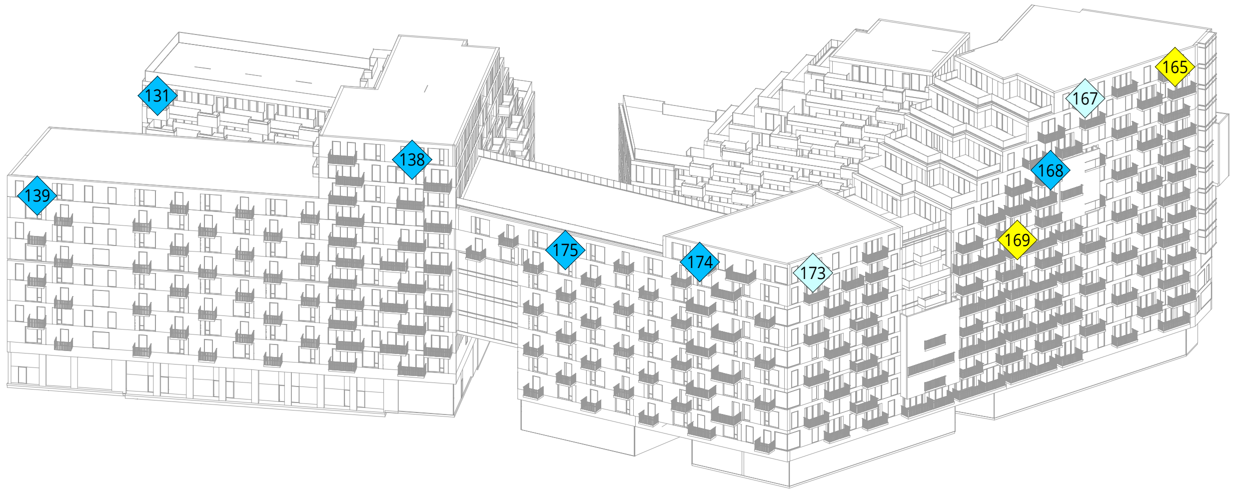
Pedestrian Wind Comfort Conditions - Ground Floor
Configuration 5: Proposed Development with Cumulative Surrounding Buildings and Mitigation Measures
Winter Season

Rockbrook Sandyford - Dublin, Ireland

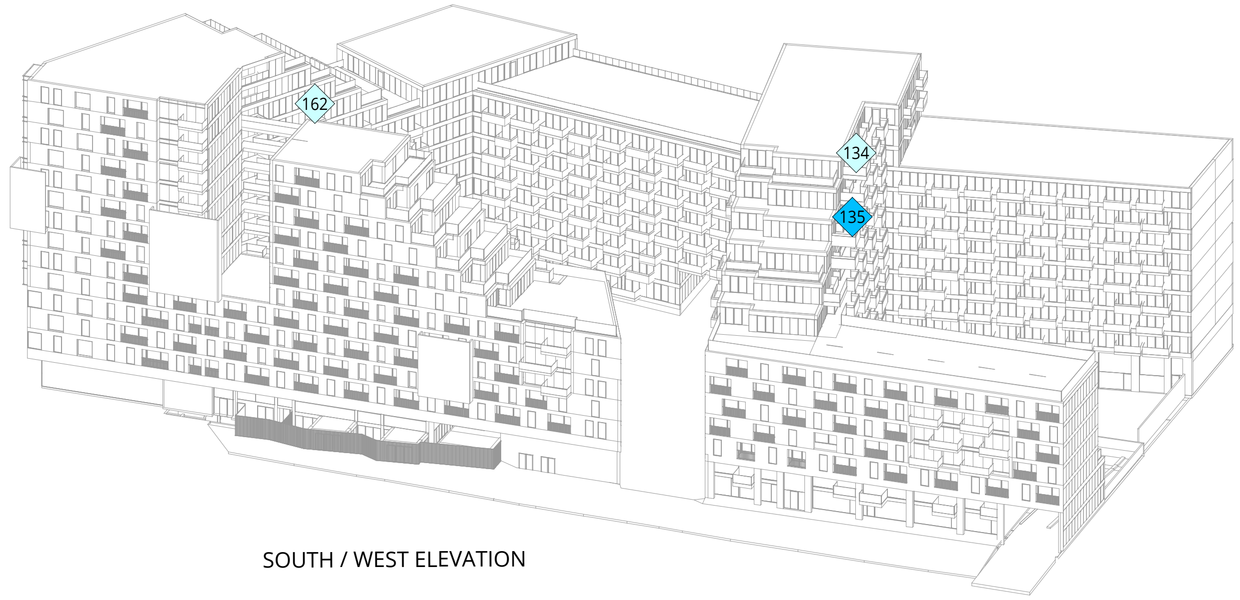
True North

Project #1802586

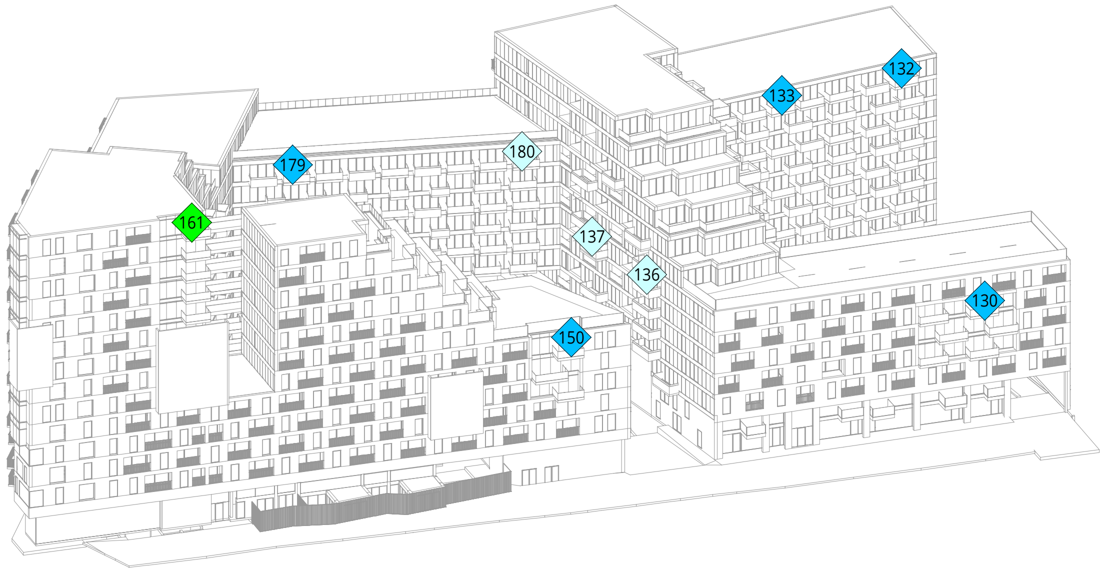
Drawn by:	JLF	Figure:	21
Approx. Scale @A3:	1:1000		
Date Revised:	Nov. 30, 2018		



NORTH / WEST ELEVATION



SOUTH / WEST ELEVATION



SOUTH / WEST ELEVATION

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Podium Level
- Balcony/Roof Level

0 20 40m

Pedestrian Wind Comfort Conditions - Isometric Views

Configuration 5: Proposed Development with Cumulative Surrounding Buildings and Mitigation Measures

Winter Season

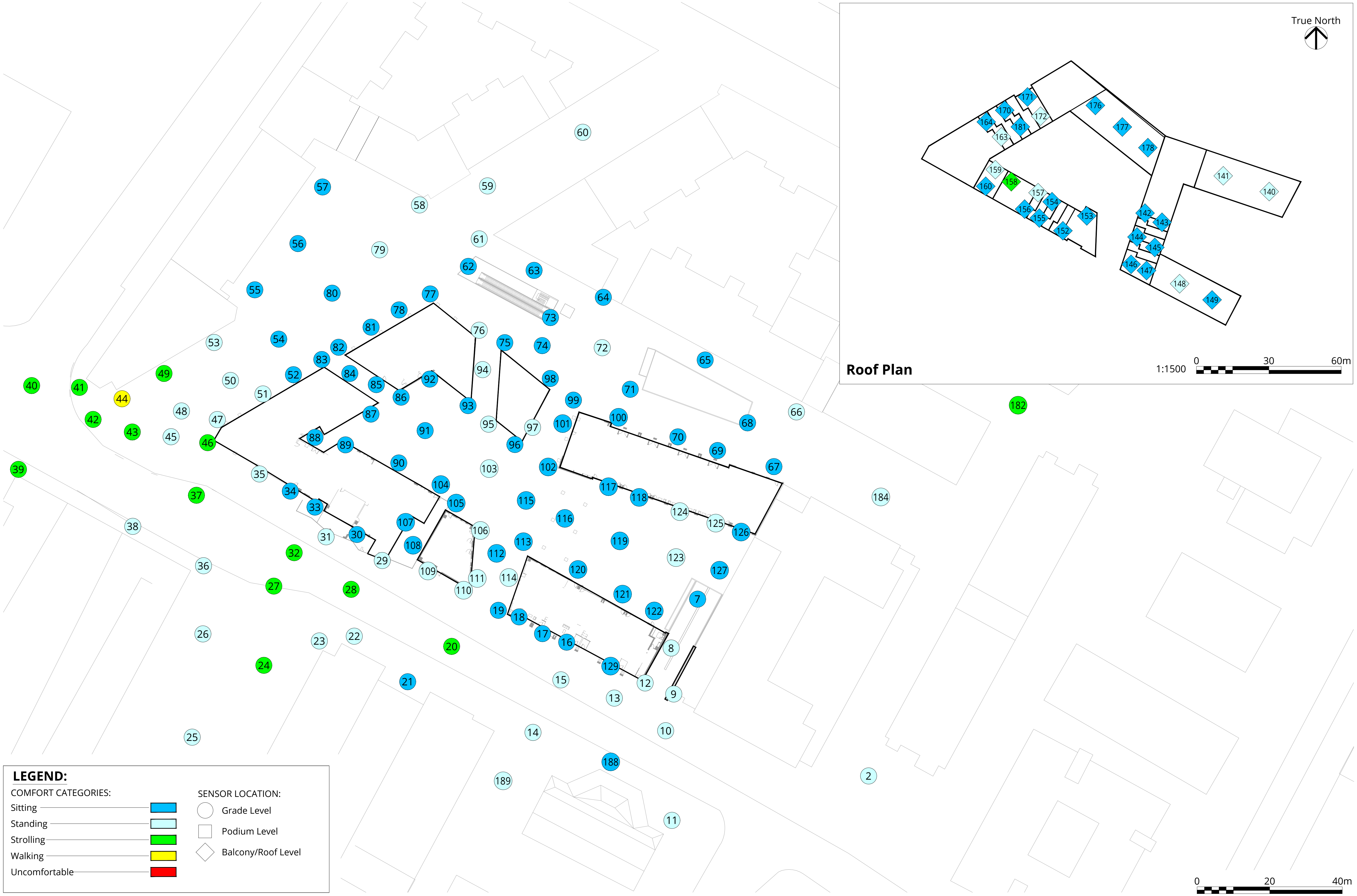
Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

Drawn by: JLF	Figure: 22
Approx. Scale @A3:	1:1000
Date Revised:	Nov. 30, 2018

RWDI



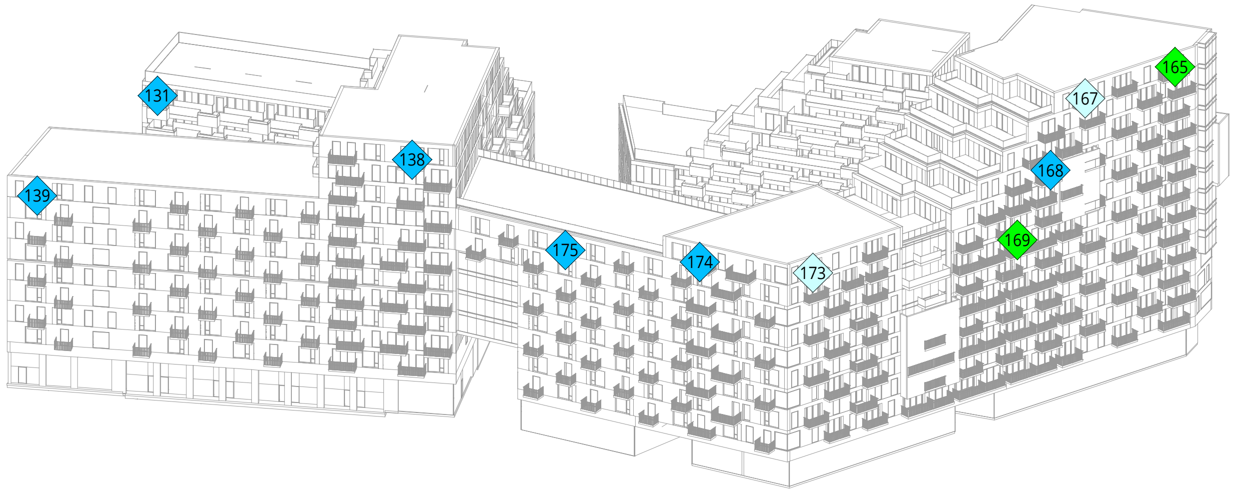
Pedestrian Wind Comfort Conditions - Ground Floor
Configuration 5: Proposed Development with Cumulative Surrounding Buildings and Mitigation Measures
Summer Season

Rockbrook Sandyford - Dublin, Ireland

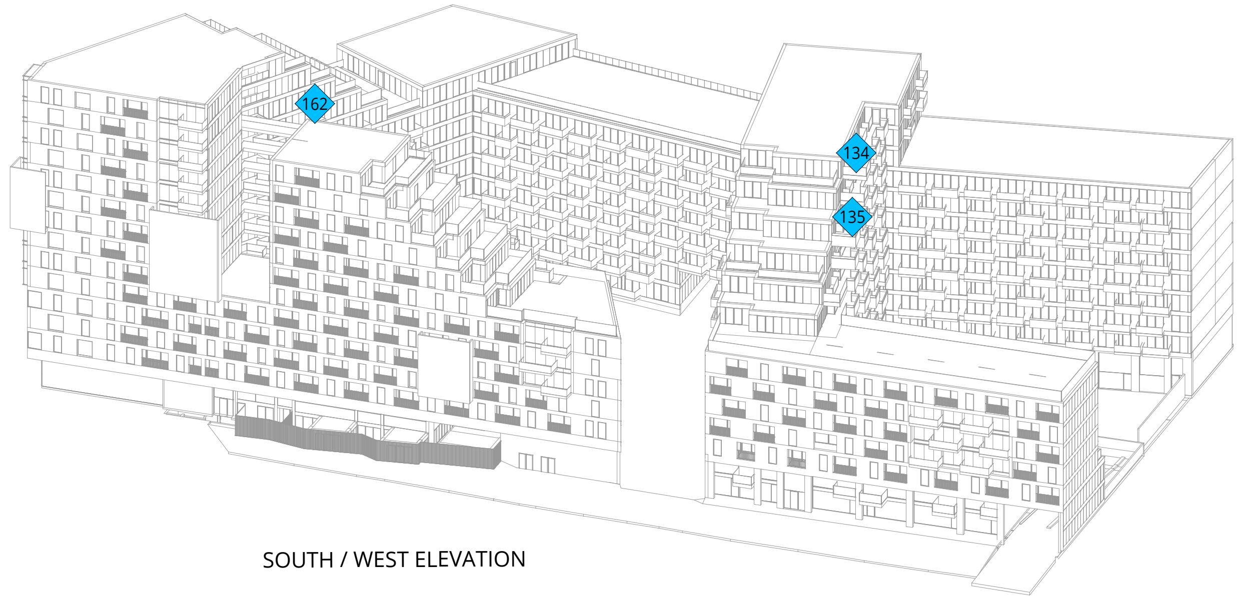
True North

Project #1802586

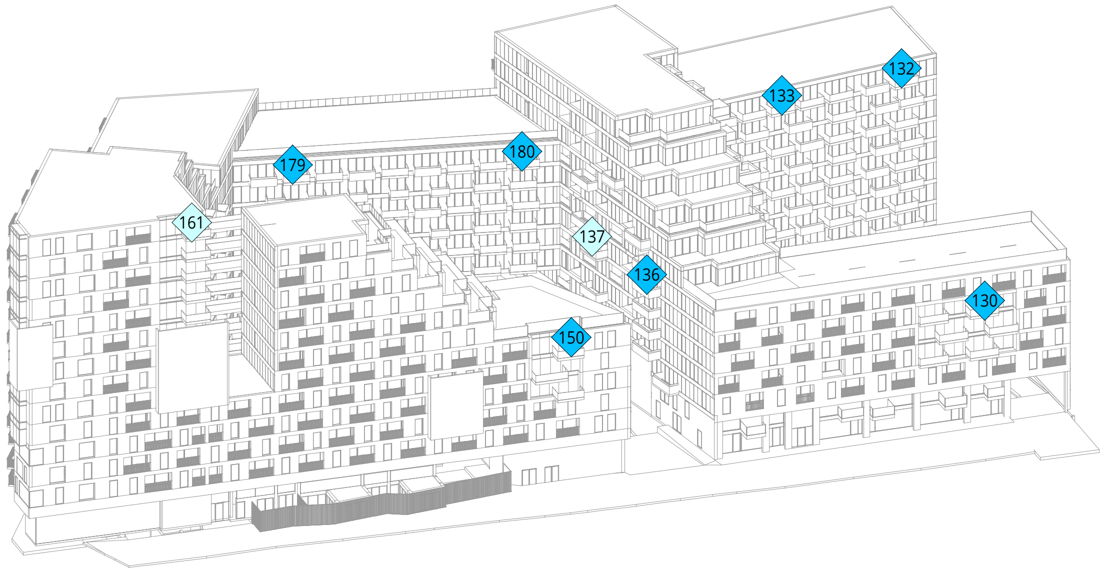
Drawn by: JLF	Figure: 23
Approx. Scale @A3:	1:1000
Date Revised:	Nov. 30, 2018



NORTH / WEST ELEVATION



SOUTH / WEST ELEVATION



SOUTH / WEST ELEVATION

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Strolling
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Podium Level
- Balcony/Roof Level

0 20 40m

Pedestrian Wind Comfort Conditions - Isometric Views
Configuration 5: Proposed Development with Cumulative Surrounding Buildings with Mitigation Measures
Summer Season

Rockbrook Sandyford - Dublin, Ireland

True North

Project #1802586

Drawn by: JLF	Figure: 24
Approx. Scale @A3:	1:1000
Date Revised:	Nov. 30, 2018

RWDI

APPENDICES

APPENDIX A: DRAWING LIST FOR MODEL CONSTRUCTION

The drawings and information listed below were used to construct the scale model of the proposed RB Central development. Should there be any design changes that deviate from this list of drawings, the results may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

File Name	File Type	Date Received (dd/mm/yyyy)
RB-TOT-ZZ-M3-AR-ZZ-0001	.dxfx	23/10/2018
17-42_Rockbrook_Plan room_12th Floor	.dwg	23/10/2018
1729_SK_P_01 V22tree size	.pdf	01/11/2018
1729_SK_P_01_RevF_Masterplan	.pdf	01/11/2018
1729_SK_P_02.1_RevD_RoofTerraces_1	.pdf	01/11/2018
1729_SK_P_02.2_RevD_RoofTerraces_2	.pdf	01/11/2018
1729_SK_S_01.1_RevA_Sections_1	.pdf	01/11/2018
1729_SK_S_01.2_RevA_Sections_2	.pdf	01/11/2018

APPENDIX B: PROPOSED LANDSCAPING

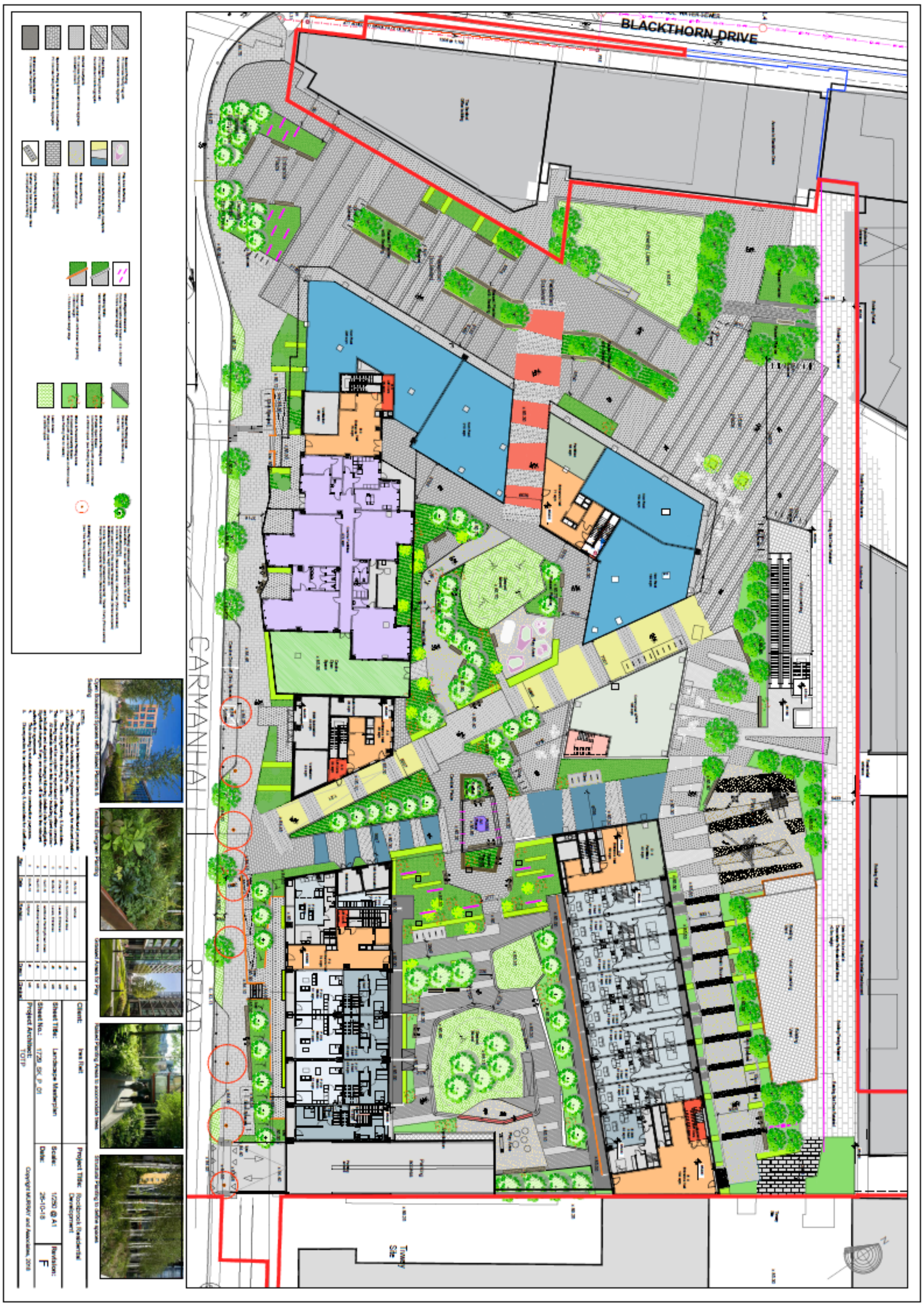


Figure 25: Proposed landscaping received November 1st, 2018 "1729_SK_P_01_RevF_Masterplan"

APPENDIX C: FURTHER MITIGATION MEASURES

Figure 26: Balcony changes after wind tunnel testing