

Outdoor Comfort Report: Weston Site

Phase 2 Proposal (Updated)

This report includes updates to the Phase 2 Outdoor Comfort Report for Weston, Toronto, ON which assesses and evaluates the Phase 2 Proposal for its projected outdoor comfort conditions. The report is based on City of Toronto Outdoor Thermal Comfort Guidelines and references city outdoor comfort targets for design and development. The updates addresses comments from the City, specifically adding in reference block plans, public realm plans, and additional focuses on outdoor comfort results for key outdoor spaces.

The report consists of three sections:

Section I: Wind Analysis and Pedestrian Level Comfort
wind analysis, pedestrian level wind comfort, solar impact

Section II: Pedestrian Level Comfort and UTCI Comparison: Phase 2 v. Existing Scenario
comfort percentage map, statistical comparisons, outdoor comfort evaluation focus on key outdoor public spaces

Section III: Detailed UTCI
UTCI maps, wind and direct radiation map

Phase 2 Outdoor Comfort Conditions – Weston Site (Section I)

Wind Analysis and Pedestrian Level Comfort

This section presents an overview of the Phase 2 Proposal outdoor comfort conditions at the Weston site, focusing on the two dominant factors: **wind** and **solar exposure**. These analyses form the basis for the detailed Universal Thermal Comfort Index (UTCI) maps (section III), which consolidates multiple comfort drivers into a single value for each 10 m grid of the site. A comparison with the existing condition is included in Section II.

Section I includes:

- **Wind:** Computational fluid dynamics (CFD) simulations were conducted for 16 wind directions to understand seasonal patterns and magnitudes affecting pedestrian comfort. A **pedestrian wind comfort study** was also completed, assessing the *mechanical comfort* of wind for pedestrians.
- **Solar:** A representative solar radiation study was completed to assess the shading effects of typical buildings in the area.
- **Combined comfort:** A preliminary comparison was made between expected UTCI results and varying combinations of wind, solar, air temperature, and humidity across the seasons.

While the detailed UTCI maps in Section III provide a high-resolution, site-specific view of comfort conditions, the reduction of all variables to a single number can obscure *the causes* of comfort or discomfort. This section therefore highlights the key driving forces—wind exposure and solar access—so they can be explicitly considered in design iteration.

Executive Summary

- Phase 2 proposed site wind comfort and safety assessed according to Toronto Wind Comfort and Safety Criteria. There are key regions where gusts result in unsafe conditions. These gusts are created from wind tunneling down street canyons, corner acceleration off buildings, and downdraft which are highlighted.
 - Strategies like architectural canopies, increased vegetation, building articulation and chamfering, and further wind barriers can reduce these gust scenarios and reduce unsafe conditions.
 - Development upwind can also reduce these unsafe zones.
 - Landscape elements that integrate well with traffic flow on Weston Rd and reduce acceleration of high west winds.
- Pedestrian wind comfort is within largely within comfortable ranges:
 - It is comfortable around the whole site in the summer and fall.
 - There are a few small regions of uncomfortable pedestrian wind comfort areas during the winter and spring, at the eastern end of Weston Rd and at the corner of Weston Rd and Lawrence Ave W.
 - Further strategies can be implemented to move between wind comfort categories according to the desired usage for that location.
 - In this climate, calm (low wind) conditions are largely favorable year-round to increasing thermal comfort, but has a counter impact of being air stagnant areas. There are a few low air circulation areas between denser buildings.
- Compared to the existing site, the Phase 2 Proposal increased wind in Block 20 due to an increase in high building towers and density.
 - This results in the gust conditions there, but also **removed most low air circulation zones that existed previously** and provides more wind shadows elsewhere in the building density.
 - The **new proposal increases comfort in spring, summer, and fall.**

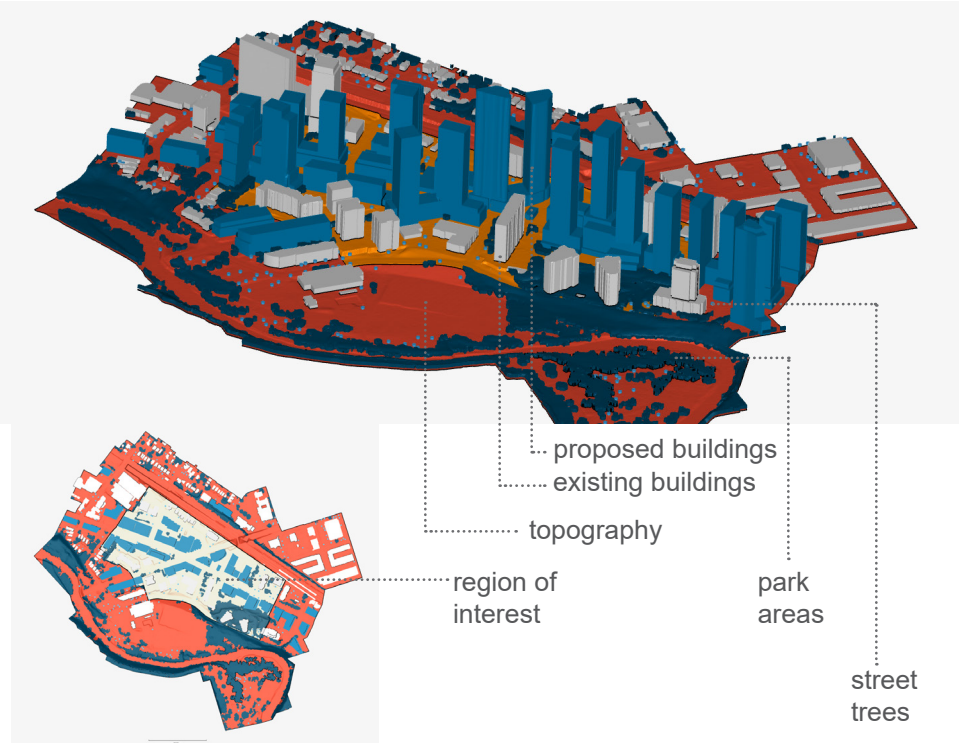
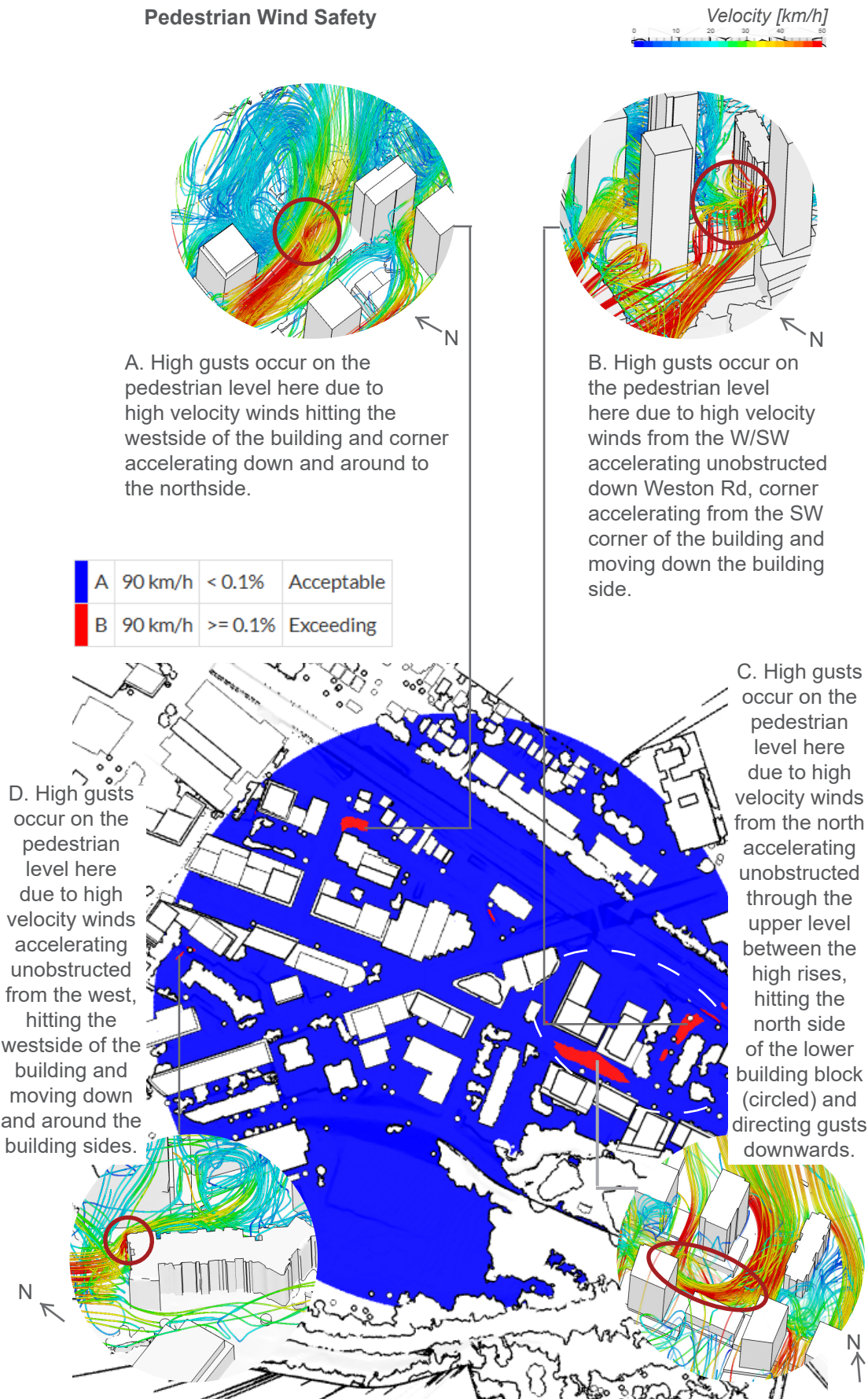


Figure 1: Model of Phase 2 Proposal Scenario (light yellow is simulated region of interest)

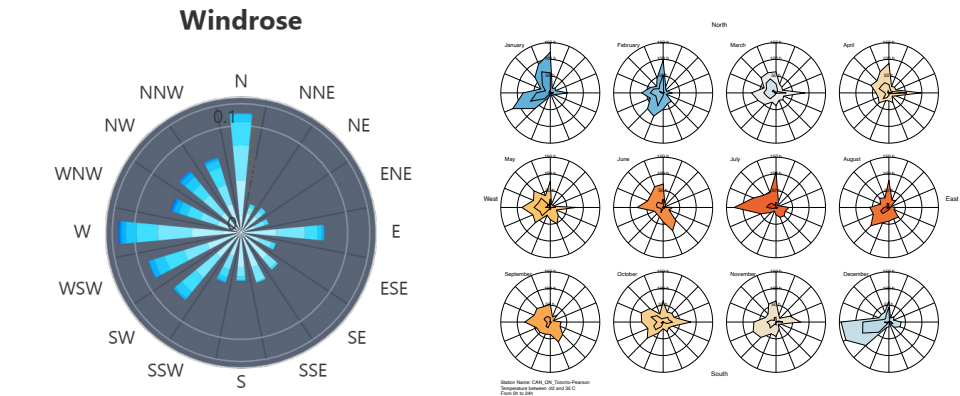


Figure 2a: Annual Wind Rose 00:00 - 00:00

Figure 2b: Monthly Wind Rose 00:00 -00:00

Safety Category	Gust Speed [km/h]	Minimum Occurrence [% of time]	Description	Area of Application
Exceeded	> 90	0.1	Excessive gust speeds that can adversely affect safety and a pedestrian's balance and footing. Wind mitigation is typically required.	Not acceptable in any areas of interest.

Figure 3: City of Toronto Pedestrian Wind Safety Criteria

Phase 2 Outdoor Comfort Conditions – Weston Site (Section I)

Wind Analysis and Pedestrian Level Comfort

The pedestrian wind comfort is assessed cumulating the 16 wind directions from historical weather file data for velocity, direction, and frequency. Following the Toronto Wind Comfort Criteria (see Figure 5), the pedestrian level comfort from wind is assessed at a 1.5 m height from the ground per season.

Winter

- There are large parts of the site in which people are comfortable standing (light blue).
- Some areas are suitable for sitting activities (dark blue), around buildings and vegetation.
- Throughout the site, especially on the main roads, and Station St, John St, winds are higher and comfortable only when walking.
- On Lawrence Ave W, near the intersection with Weston Rd, as well as on Weston Rd between Block 20 and Block 2, there are regions where winds are too high and uncomfortable.

Spring

- Similar comfort levels and locations as winter without the very high uncomfortable region on Lawrence Ave W, near the intersection with Weston Rd.

Summer and Fall

- Most of the site is comfortable for standing and sitting. Areas between Weston Rd and Lawrence Ave W have some higher winds comfortable when walking.

A	10 km/h	< 20%	Sitting
B	15 km/h	< 20%	Standing
C	20 km/h	< 20%	Walking
D	20 km/h	>= 20%	Uncomfortable

Pedestrian Wind Comfort

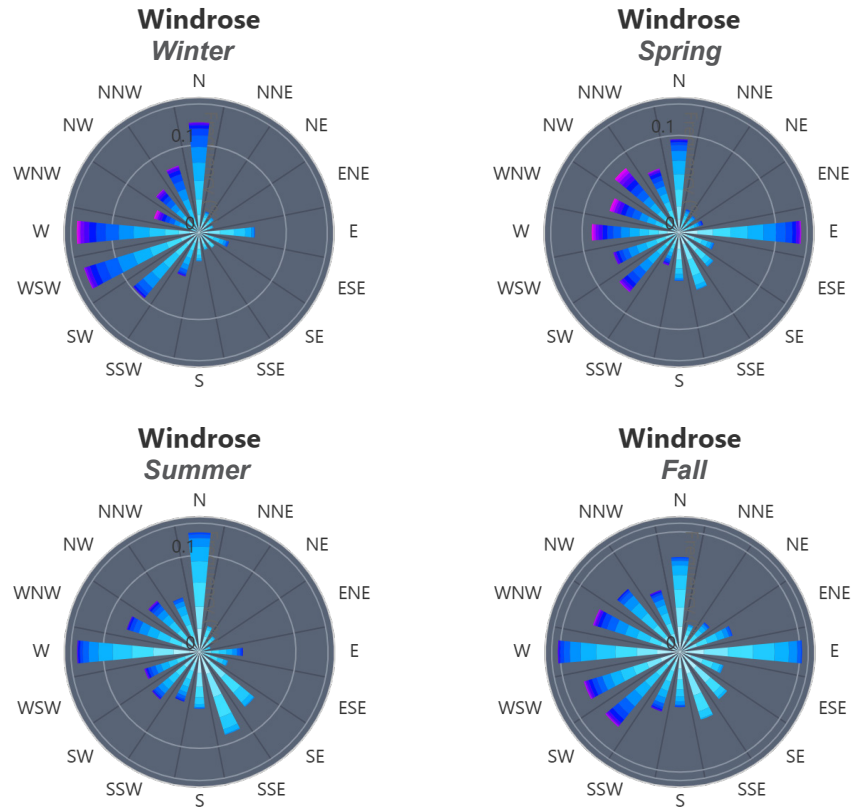
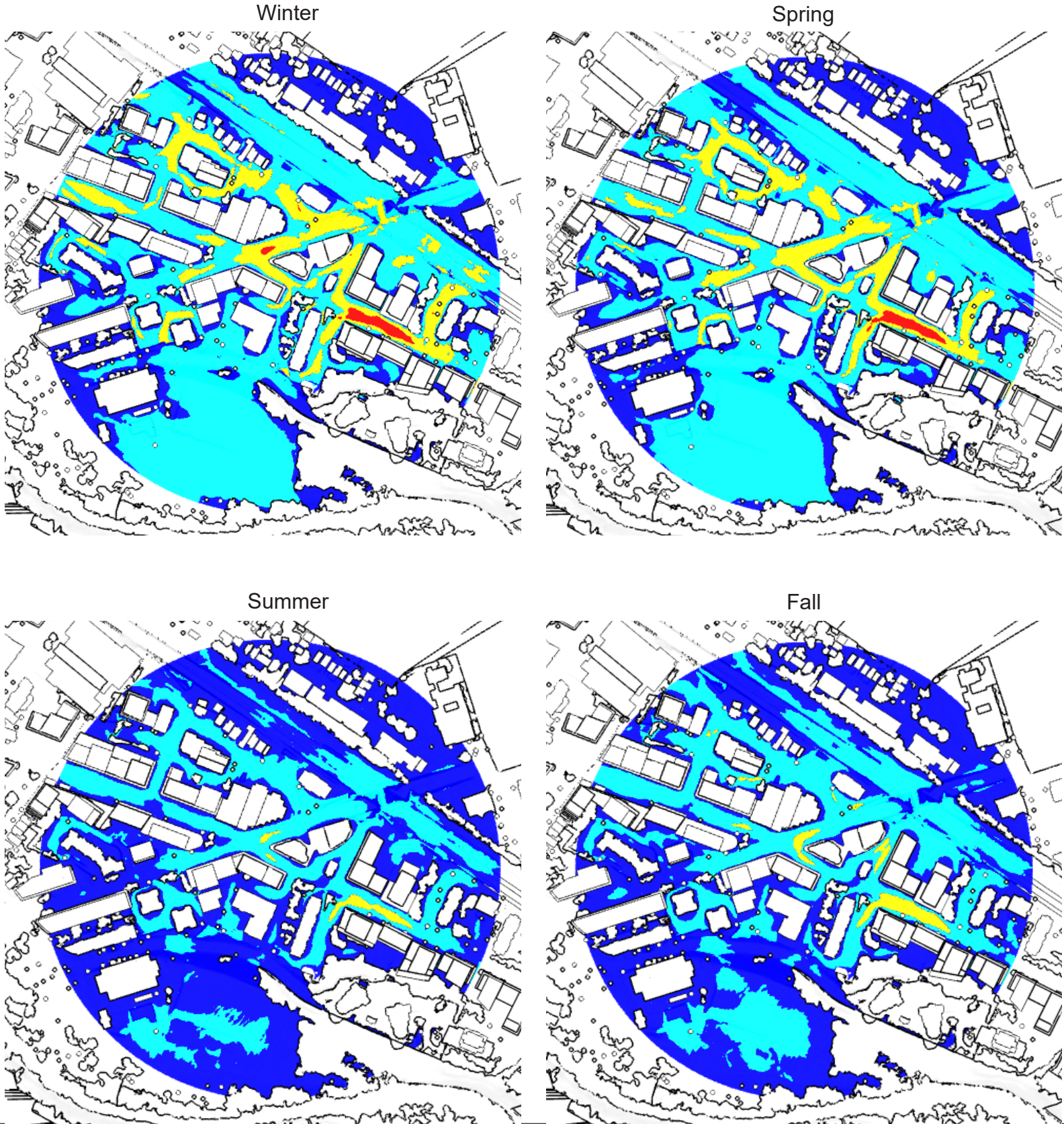


Figure 4: Seasonal Wind Rose
06:00 - 23:00

Comfort Category	GEM Speed [km/h]	Minimum Occurrence [% of time]	Description	Area of Application
Sitting	≤10	80	Light breezes desired for outdoor seating areas where one can read a paper without having it blown away.	Park benches, restaurant and cafe seating, balconies, amenity terraces, children's areas, etc. intended for relaxed, and usually seated activities.
Standing	≤15	80	Gentle breezes suitable for passive pedestrian activities where a breeze may be tolerated.	Areas where seated activities are not expected but would be used for passive activities such as bus stops, dog areas, and main entrances.
Walking	≤20	80	Relatively high speeds that can be tolerated during intentional walking, running, and other active movements.	Sidewalks, parking lots, laneways and areas where pedestrian activity is primarily for walking.
Uncomfortable	> 20	20	Strong winds, considered a nuisance for most activities.	Not acceptable in areas with pedestrian access.

Figure 5: City of Toronto Pedestrian Wind Comfort Criteria

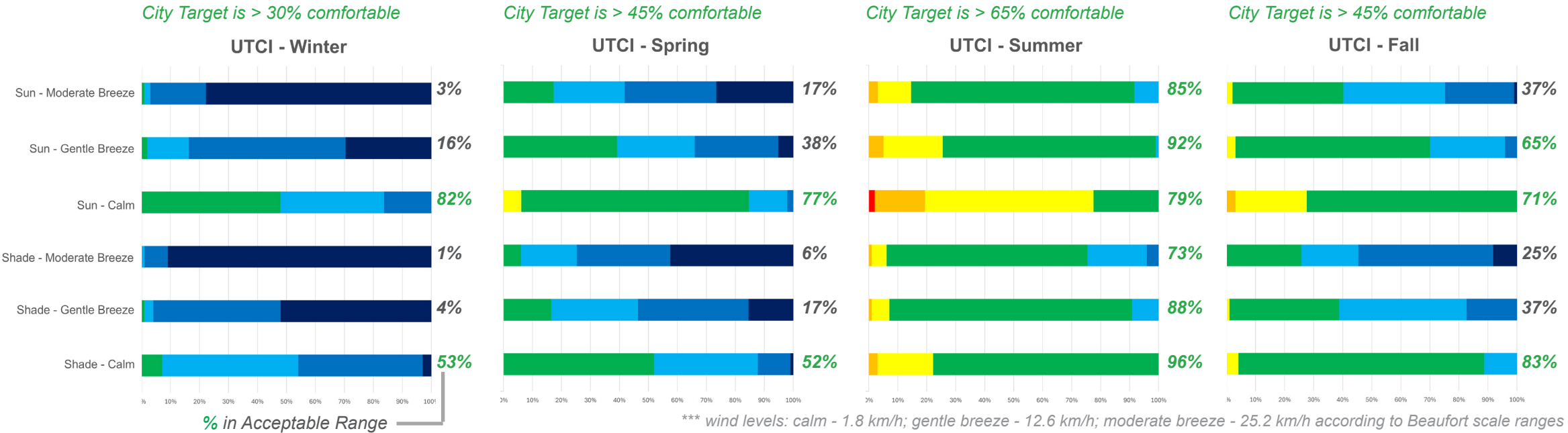
Thermal Comfort: UTCI

High levels of comfort outdoors can be achieved leveraging solar access or shade/shadows and wind conditions. By varying levels of sun and wind on site, different comfort levels can be achieved and for differing activities. Wind is a big driver of comfort in this climate.

Year Period	Time Period	Acceptable UTCI Range
Winter: Nov-Feb	08:00-17:00	0° ≤ UTCI ≤ 26°
Spring: Mar-May	08:00-20:00	9° ≤ UTCI ≤ 26°
Summer: Jun-Aug	06:00-21:00	9° ≤ UTCI ≤ 32°
Fall: Sep-Oct	08:00-20:00	9° ≤ UTCI ≤ 26°

Figure 6: City of Toronto Thermal Comfort Criteria

- Very Strong Heat Stress (38°+)
- Strong Heat Stress (32-38°)
- Moderate Heat Stress (26°-32°)
- No Thermal Stress (9°-26°)
- Slight Cold Stress (0°-9°)
- Moderate Cold Stress (-13°-9°)
- Strong Cold Stress (<-13°)



Solar Impact: Radiation

Buildings impact the amount of sun on site. In this radiation study of the site, building height, orientation, and density affect the amount of sun or shadow/shade received at the pedestrian level affecting thermal comfort.

- tall buildings negatively impact comfort* by shading most of the site shadowing

*However because wind is a bigger driver of comfort, these tall buildings also block wind, improving comfort

Winter

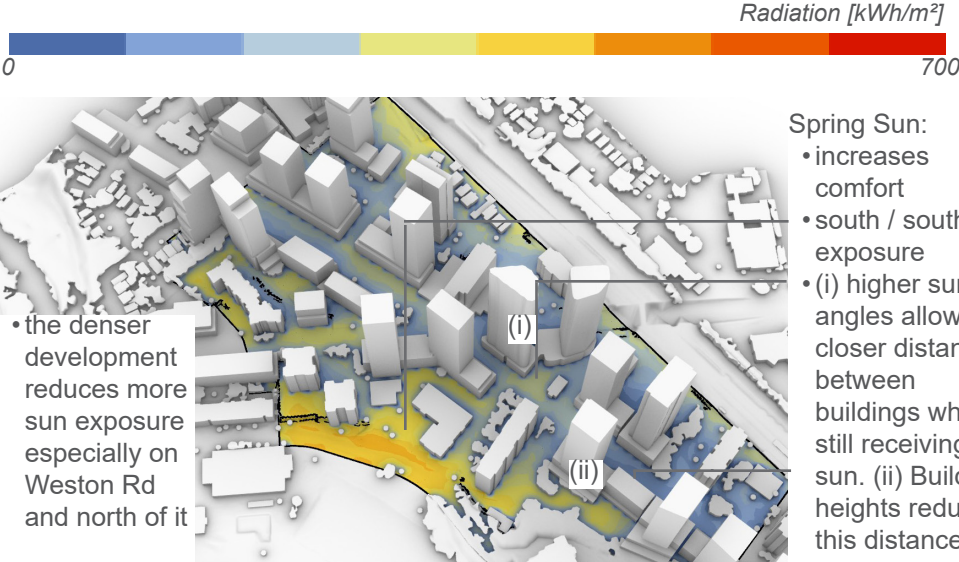
- Summer Shade:
- increases comfort when there is no wind (calm conditions)
 - higher buildings reduce solar radiation and offer greater shaded areas
 - narrow street canyons also create pedestrian level shadow and buildings with podiums

Summer

- Winter Sun:
- increases comfort
 - expose southern areas (sunnier orientation)
 - there is little areas of high winter sun areas due to the denser development

- Summer Sun:
- increases comfort when there are winds
 - decreases comfort when in a wind shadow
 - high sun angles allow sun to reach between buildings

Tree shading impacts on all seasons. See section 2.5 for more details on the tree model.



Spring

- Fall Shade:
- increases comfort when there is no wind
 - low sun angles create shadows and shading throughout the site with the built density

Fall

- Fall Sun:
- increases comfort when there are winds
 - sunnier when far from buildings and exposed to south sun

Air Circulation Impact: Low Winds

The following map shows locations on site where there are generally low winds (< 5 km/h) for more than 80% of the time. Lower winds often are beneficial and comfortable areas on site as it increases thermal comfort. However, air stagnation reduces air circulation. At least a minimal light air (> 1.8 km/h) is recommended for good air circulation. Air circulation and comfort need to be prioritized accordingly, but areas of low wind are limited in this proposal.



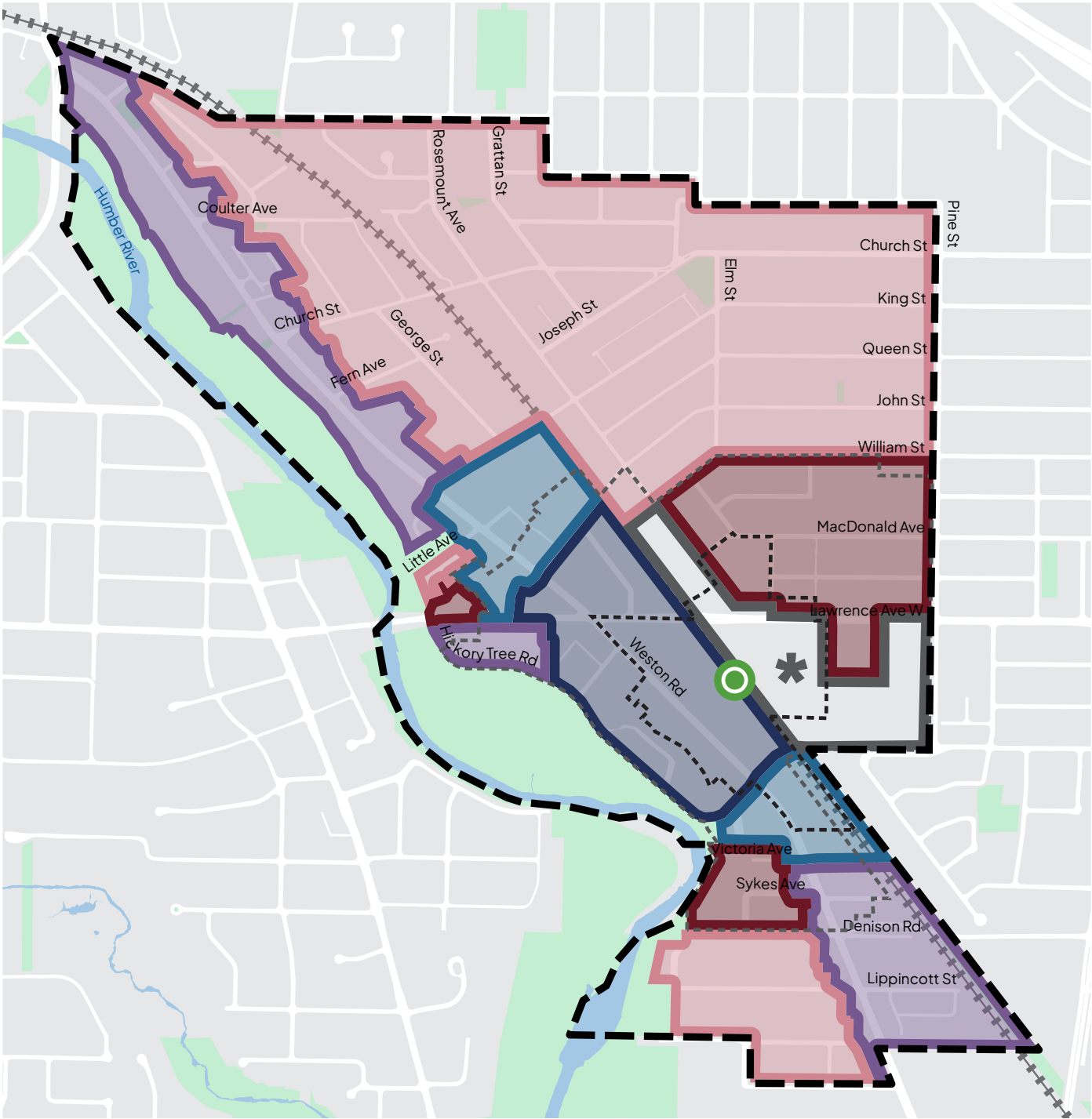
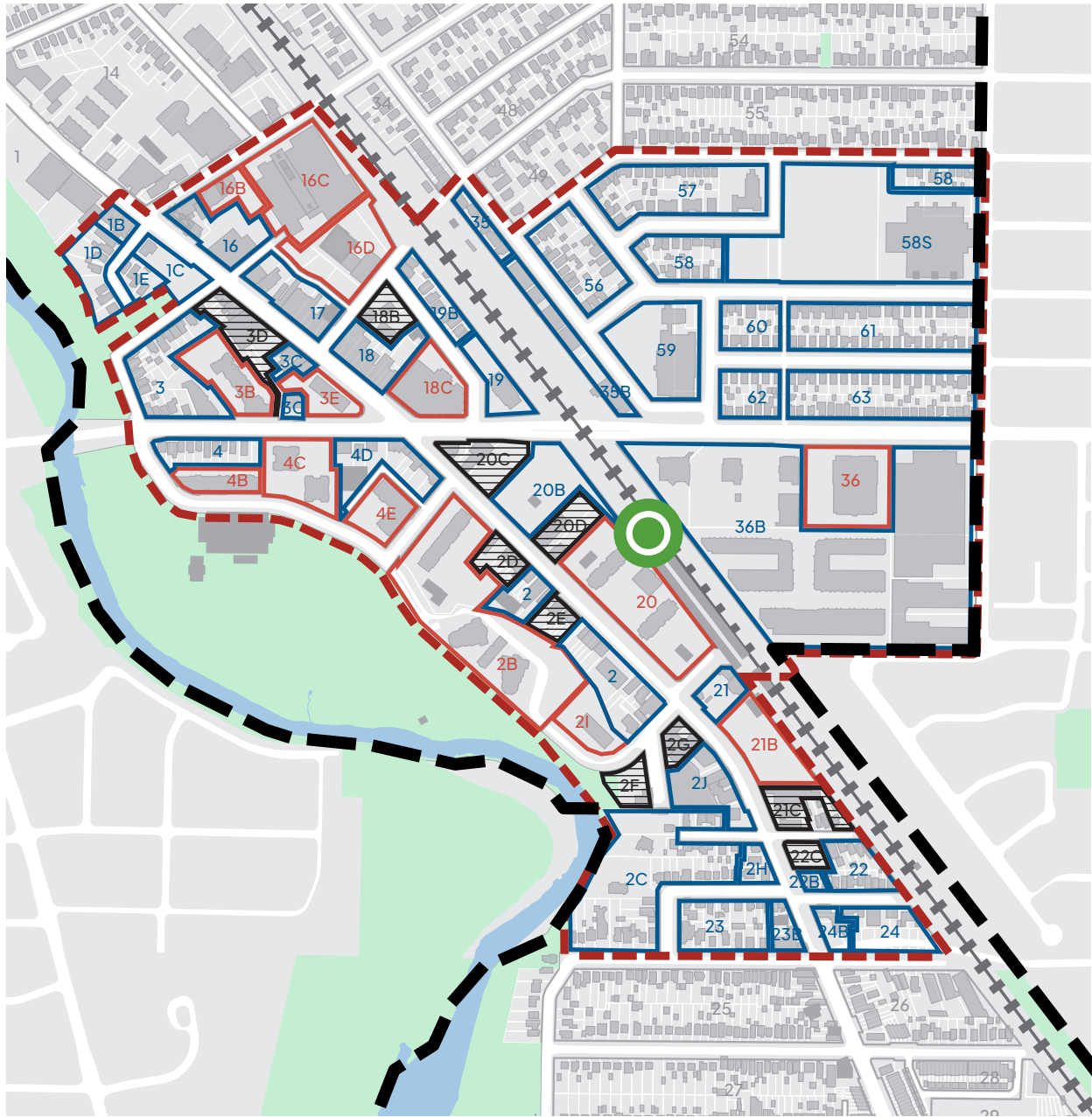
Phase 2 Outdoor Comfort Conditions – Weston Site (Section I)

Wind Analysis and Pedestrian Level Comfort

Block Key and Heights

The following is a block key and height reference for the Weston development plan. The report references these plot divisions, development categories, and height restrictions in its analysis and recommendations.

Block key and height references provided by DTAH.



Phase 2 Outdoor Comfort Comparison – Weston Site (Section II)

Urban Comfort Mapping - Universal Thermal Comfort Indices (UTCI)

This comparative summary presents an overview of Phase 2 Proposed design’s thermal comfort conditions at the Weston site compared to the existing scenario, mapping the thermal comfort using the Universal Thermal Comfort Index (UTCI), which consolidates multiple comfort drivers into a single value for each 10 m grid of the site.

As per City of Toronto’s Microclimate Guidelines, the new design should reduce pedestrian thermal comfort by no more than 5%, combining the seasonal comfort hours into an annual thermal comfort percentage.

To assess the Phase 2 Proposed design in comparison to the existing scenario, the absolute comfort percentage change between the designs are calculated and mapped. Due to the increase in building density in the Phase 2 proposal, only the relevant sensors points from the existing scenario that correspond to pedestrian occupiable space (not under buildings) are included in the comparison.

The Phase 2 Proposal includes:

- additional buildings
- modifications to some existing buildings
- no changes to the street tree plan from the existing scenario (except when a building is planned where an existing tree stood)
- no changes to the surrounding landscape or topography of the existing site.

Key Findings

- On average, across all the sensor points 10m apart, there is an annual increase in comfort by 11%.
- The Phase 2 proposal increases comfort in spring, summer, and fall, however decreases comfort in the winter.
 - Winter: 9% less sensors that meet comfort target; Phase 2 proposal sees less comfort everywhere except the north part of the site by the train tracks. There especially is less comfort points in the main part of the built area around the Weston Rd x Lawrence Ave W junction.
 - Spring: 11% more sensors that meet comfort target; Phase 2 proposal sees greater comfort north of Weston Rd.
 - Summer: 9% more sensors that meet comfort target; Phase 2 proposal maximizes summer comfort.
 - Fall: 31% more sensors that meet comfort target; Phase 2 proposal makes the biggest comfort contribution in the fall season. The built area around the Weston Rd x Lawrence Ave W junction increases in comfort points.
 - Annual: **70% of the site meets the target of a less than 5% reduction in comfort compared to the existing scenario.** Fig. 7 shows where the Phase 2 proposal improves or reduces comfort and how significantly.

Year Period	Existing: % of the Site (sensors) that Meets Thermal Comfort Target	Phase 2 Proposal: % of the Site (sensors) that Meets Thermal Comfort Target
Winter	43%	34%
Spring	17%	28%
Summer	90%	99%
Fall	45%	76%

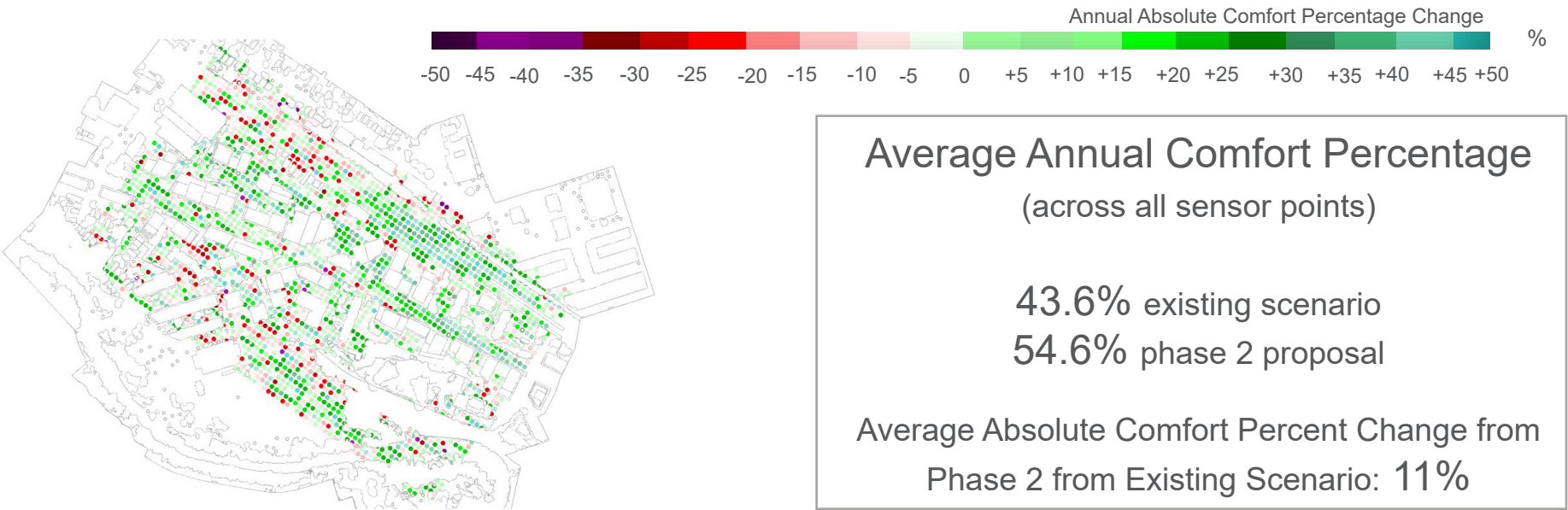


Figure 7: Annual Absolute Comfort Percentage Change between Phase 2 Proposal and the Existing Scenario

Comfort Percentage Map: Comparing Phase 2 Proposal v. Existing Scenario



- = Phase 2 proposal results in < 5% annual comfort reduction or better
- = Phase 2 does *not* meet annual comfort reduction target compared to existing

Year Period	Time Period	Acceptable UTCI Range
Winter: Nov-Feb	08:00-17:00	0° ≤ UTCI ≤ 26°
Spring: Mar-May	08:00-20:00	9° ≤ UTCI ≤ 26°
Summer: Jun-Aug	06:00-21:00	9° ≤ UTCI ≤ 32°
Fall: Sep-Oct	08:00-20:00	9° ≤ UTCI ≤ 26°

Year Period	Comfort % Target
Winter	30%
Spring	45%
Summer	60%
Fall	45%
Annual	< 5% reduction in annual comfortable hours (the combined time periods and temperature ranges for seasonal comfort)

Figure 8: City of Toronto Thermal Comfort Criteria

Phase 2 Outdoor Comfort Comparison – Weston Site (Section II)

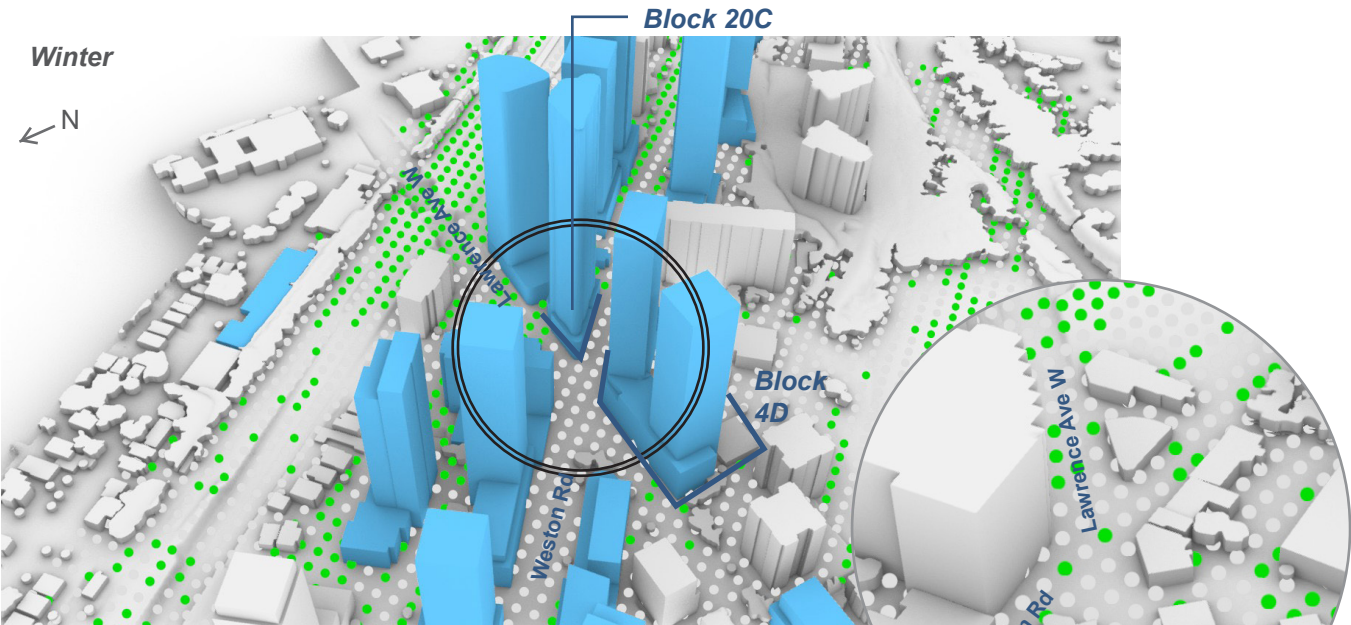
Urban Comfort Mapping - Universal Thermal Comfort Indices (UTCI)

This is a comparison of the outdoor comfort condition of the Phase 2 proposal with the existing scenario for the **key public space**: intersection of Weston Rd and Lawrence Ave W. Comfort criteria and target follows that of the City of Toronto’s as shown in Figure 11. With the additional build-up from the Phase 2 design, there are some improvements in the comfort of this area in the Phase 2 design.

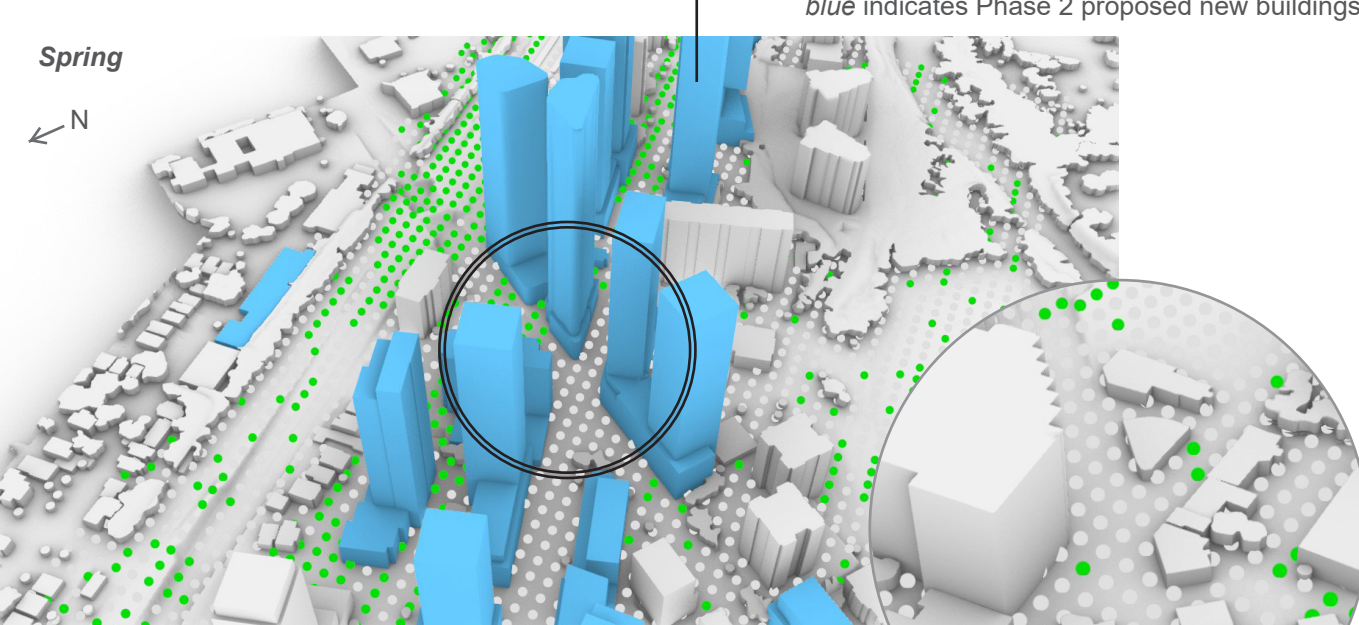
- = meets comfort percentage target
- = does *not* meet comfort percentage target

Phase 3 will further explore and evaluate opportunities to improve comfort, especially for the spring and fall.

Phase 3 will also focus on additional key public spaces.

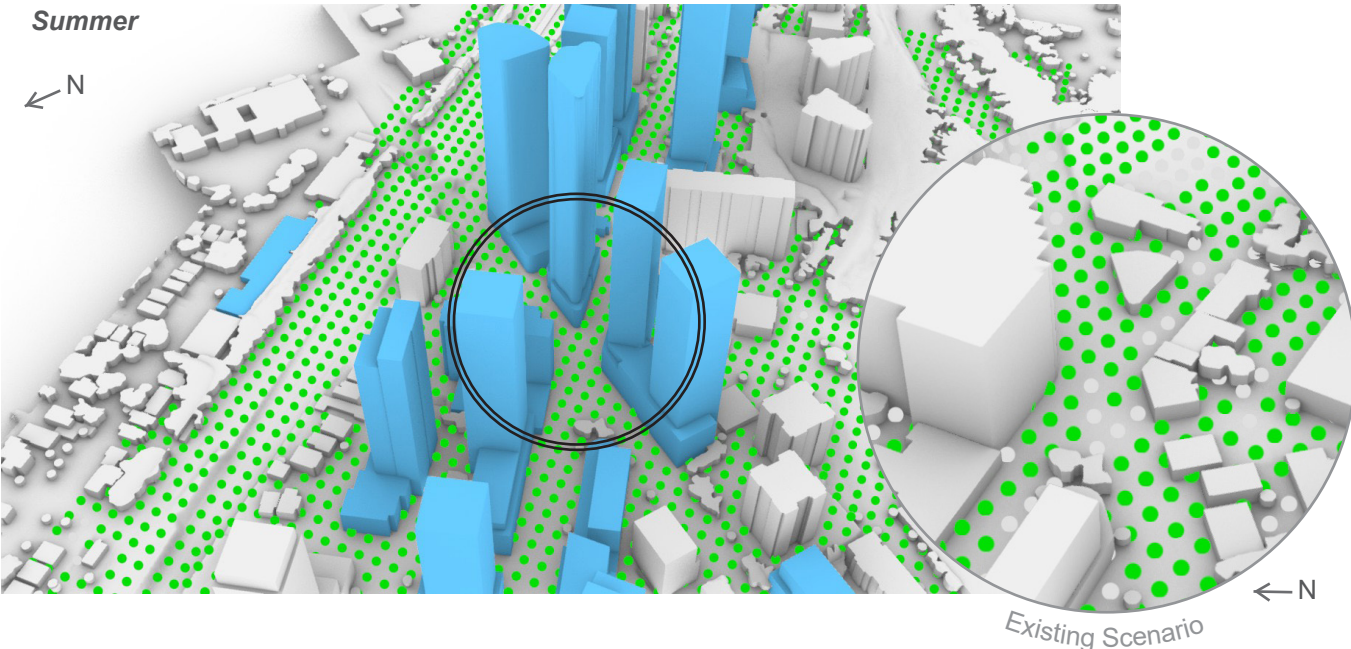


- Winter comfort has decreased with the Phase 2 proposal at the main intersection and the northside of Weston Rd, but not significantly. This is due to greater shade from the towers in the new proposal and high winds hitting the corner tower on Block 20C. High frequent wind gusts from the SW and N/NW winds contribute to the wind and cold discomfort at the pedestrian of this intersection, but with the additional buildings, there is added wind funneling and downdraft around the tower causing the additional discomfort of phase 2.
- The east side of Lawrence Ave W is improved significantly with the new proposal. This is due to lower winds there despite being more shaded.
- Emphasis here to use the building massing of Block 4D, which may be developed up to 50 storeys, just south of this tower is an opportunity to reduce winds to improve comfort. Furthermore, street plantings and sky bridges across Weston Rd and reduce the wind acceleration on this road.

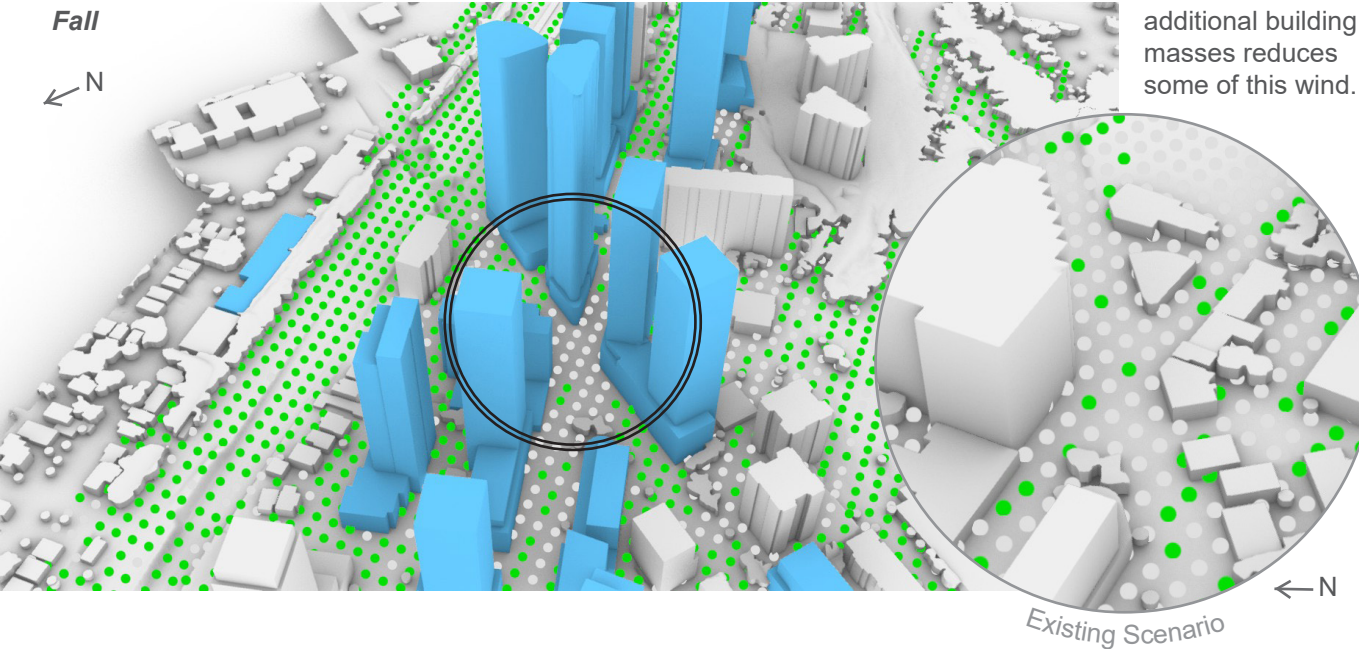


- Spring comfort has decreased with the Phase 2 proposal at the main intersection, but increased on the east side of Lawrence Ave W. This is because although solar has decreased with the increased massing, the wind is reduced on this eastside like in the winter case.
- Improved comfort is also recommended to follow the strategies like in the winter case.

- Fall comfort is similar at the intersection between the designs. But improved down Weston Rd and Lawrence Ave W because there is less wind, despite lower sun exposure. This is due to fall winds prevailing from the W and the additional building masses reduces some of this wind.



- Summer comfort was high in the existing case and even higher in the Phase 2 proposal. This is due to greater shading from the building massing.



Phase 2 Outdoor Comfort Conditions – Weston Site (Section III)

Urban Comfort Mapping - Universal Thermal Comfort Indices (UTCI)

This summary presents an overview of the Phase 2 Proposal thermal comfort conditions at the Weston site, mapping the thermal comfort using the Universal Thermal Comfort Index (UTCI), which consolidates multiple comfort drivers into a single value for each 10 m grid of the site.

These maps provide pedestrian-level (1.5 m from ground for an average standing height of a person) comfort resolutions for specific site locations using future 2050 weather and integrate all four parameters (air temperature, wind speed, relative humidity, and mean radiant temperature) into a single comfort index.

Factors considered in UTCI evaluation:

- Air Temperature:** The dry bulb air temperature for the site using weather station data morphed for future 2050 conditions under City of Toronto specified SSP5-8.5 scenario.
- Relative Humidity:** The relative humidity for the site using weather station data morphed for future 2050 conditions under City of Toronto specified SSP5-8.5 scenario.
- Wind:** Computational fluid dynamics (CFD) simulations were conducted for 16 wind directions to understand seasonal patterns and magnitudes affecting pedestrian comfort. Wind data using historical wind as per City of Toronto wind modeling guidelines.
- Mean Radiant Temperature:**
 - Solar Radiation:* The solar radiation specific to the site is included through the impact of direct and diffuse radiation on the person and the reflectance of the surrounding context.
 - The radiation onto the person from the surrounding ground is also included.
 - Tree Shading:* The shading and reflectivity effect of the existing trees is included and impacts all seasons.
- Person Parameters:** The UTCI model compares actual outdoor conditions to a reference environment where a standard person is walking (2.3 METs, or metabolic rate) with a standardized level of clothing insulation appropriate for each season.

Key Findings

- The summer period is comfortable over the entire site.
- Fall also has large areas of the site that meet the comfort % target. Key areas that do not meet the comfort % target are demarcated with gray dots in the seasonal thermal comfort maps. The areas where comfort could be improved include areas at the intersection of Weston Rd and Lawrence Ave W, and further areas on Weston Rd.
- Winter and spring has less comfortable areas over the site that meet the comfort % target.
 - The areas north of Weston Rd are more comfortable.
 - Like the existing scenario, spring conditions are still colder than the comfort target.
- Spring shows potential to improve comfort throughout the site because the distribution of UTCI values show many areas only moderately short of the comfort targets. This suggests that passive measures have high potential for improving conditions past the target threshold. Spring mainly sees moderate levels of shading throughout the site with higher than desired winds. Through focusing on designs and local measures that can reduce spring dominant winds (east, west incoming winds), pedestrian comfort conditions can improve.
- Winter comfort is also decreased from increased winter winds and shading. Design that mitigates winter winds (W, SW) will improve comfort.

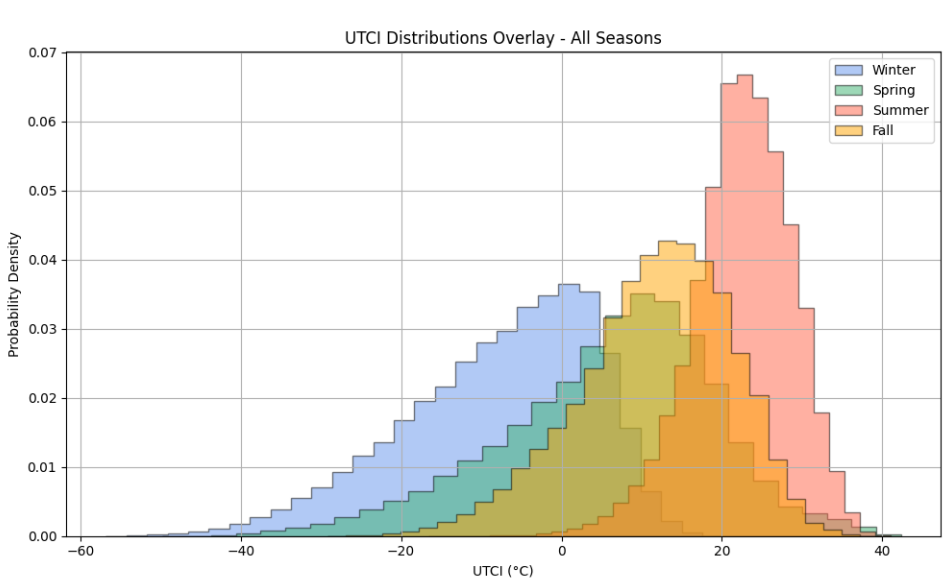
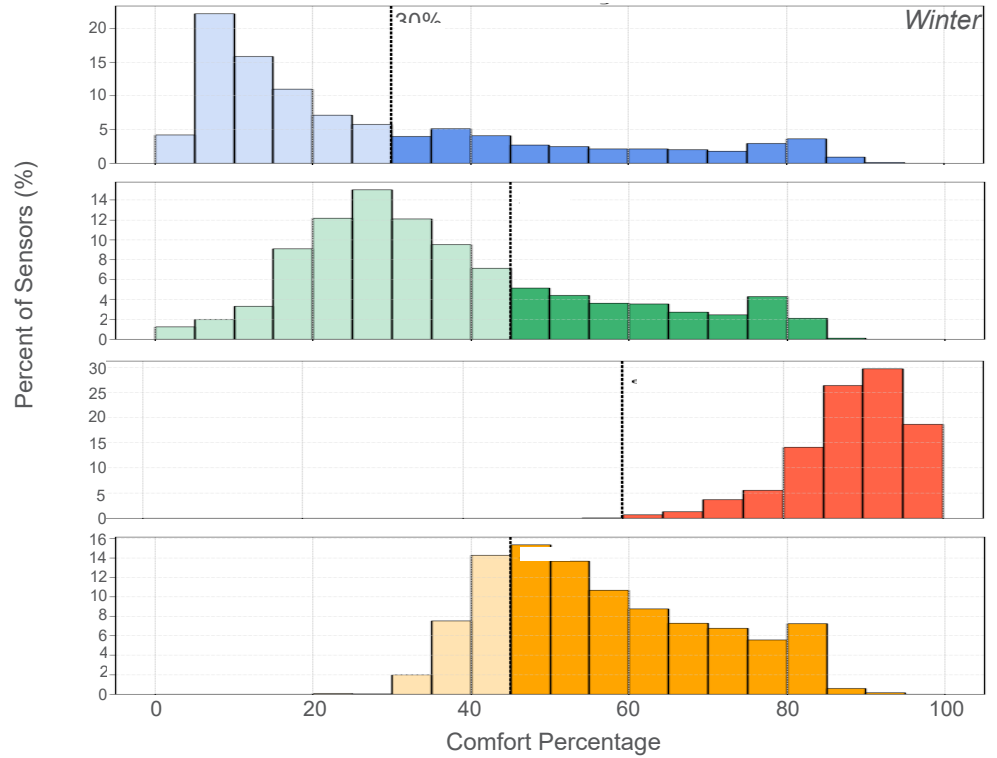


Figure 9: Distribution of Seasonal UTCI [top left]
Figure 10: Distribution of Seasonal Comfort Percentages [top right]



Comfort Percentage Maps



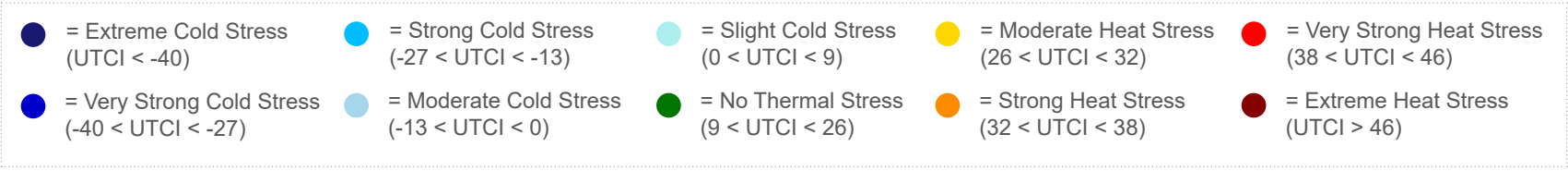
Figure 11: City of Toronto Thermal Comfort Criteria

Phase 2 Outdoor Comfort Conditions – Weston Site (Section III)

Urban Comfort Mapping - Universal Thermal Comfort Indices (UTCI)

To assess the comfort on site per season, a typical day and hour was used to provide a point-in-time of the UTCI.

Thermal Comfort Map for Typical Day in Each Season - UTCI



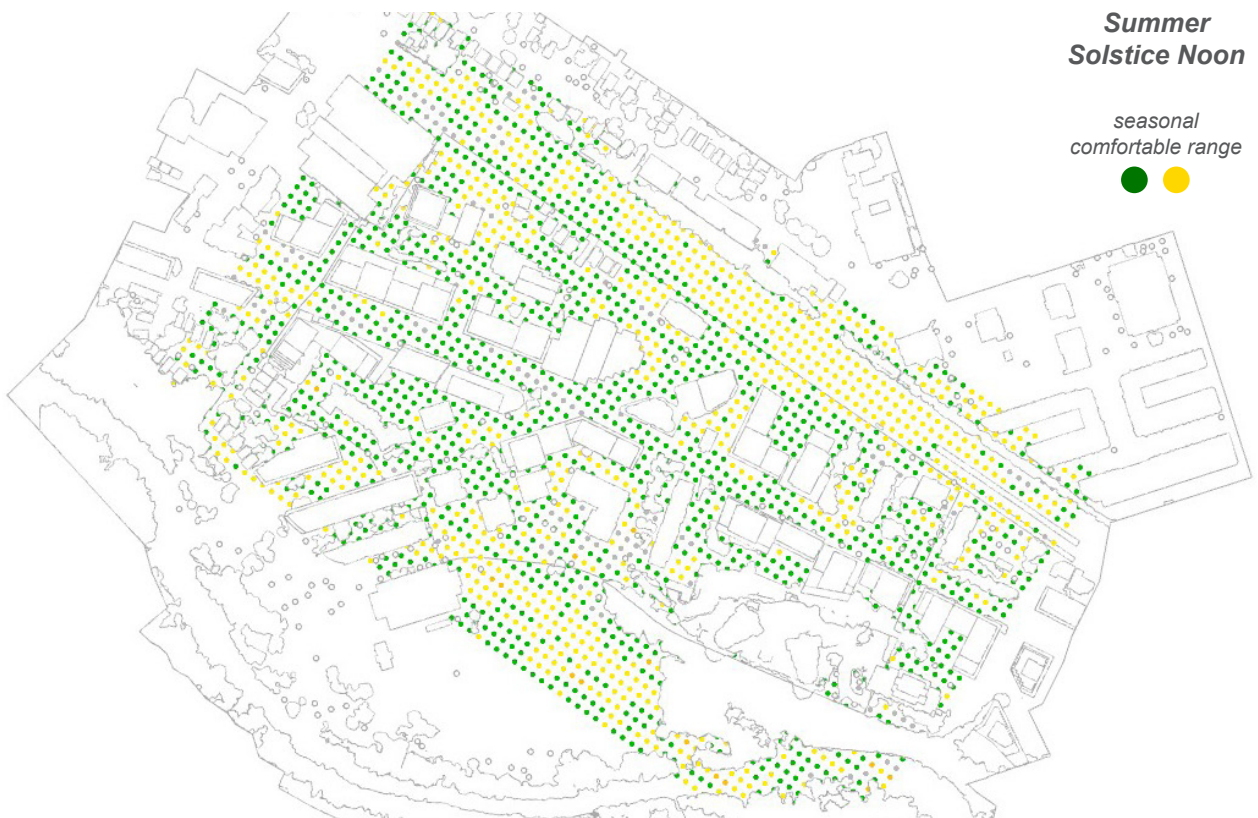
Winter (Solstice Noon Case)

- A smaller portion of the site is within the comfort target. These comfortable locations are all in slight cold stress UTCI, which is acceptable in winter. There are no points that are in the upper range of the comfort range in which the UTCI results in no thermal stress.
- The comfortable regions on site could be expanded as there are some “moderate cold stress” areas adjacent to the ones in acceptable slight cold stress. There is potential for passive techniques to improve these areas to the comfortable range. (See circled examples.)



Spring (Equinox Noon Case)

- Spring is still the worst performing season. Weston's climate is cold in the early spring months and mostly unable to reach the target comfort range for spring. There are large areas of the site in slight cold stress; the site provides winter comfort conditions.
- There are some targeted areas that could be focused on to improve comfort where use is most desired/applicable. See circled examples for some suitable locations. Interdispersed comfort pockets through the site leveraging local measures are recommended.



Summer (Solstice Noon)

- Summer is comfortable.
- There are some areas that have slight heat stress (yellow) and could be still comfortable with higher winds. The areas that have no thermal stress (green) could still be comfortable with less shade or less winds, if it these changes would improve the other seasons.

Fall (Equinox Noon)

- Large parts of the site are comfortable. Circled areas (pink) show key locations that could be improved.
- SW parts of the site have areas that have moderate heat stress and could be mitigated through design strategies (see red circles.)

Phase 2 Outdoor Comfort Conditions – Weston Site (Section III)

Urban Comfort Mapping - Universal Thermal Comfort Indices (UTCI)

The following maps show the solar radiation seasonally. This is the largest contributing factor to thermal comfort through sun access/radiation. It shows the 50th percentile (median) radiation during the season to assess a representative case.

Winter

- There are low sun conditions.
- The highest sun exposure is on the south of the site, resulting in greater comfort there given other climatic factors (such as wind) is controlled.

Spring

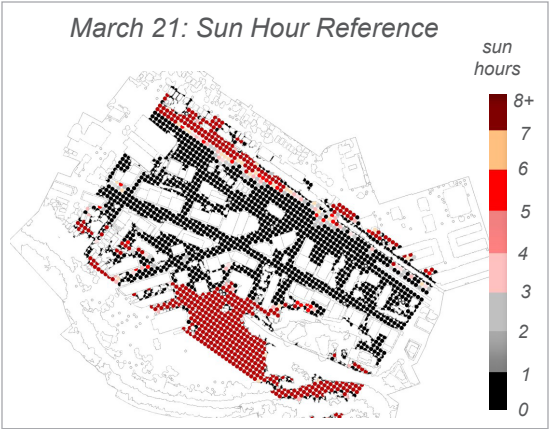
- Most of the high sun exposure areas are in the outer surroundings (Raymore Park, Weston Lions Park) and on the train tracks. The rest of the site has low-moderate sun conditions.
- Improving solar access in the spring increases thermal comfort levels.

Summer

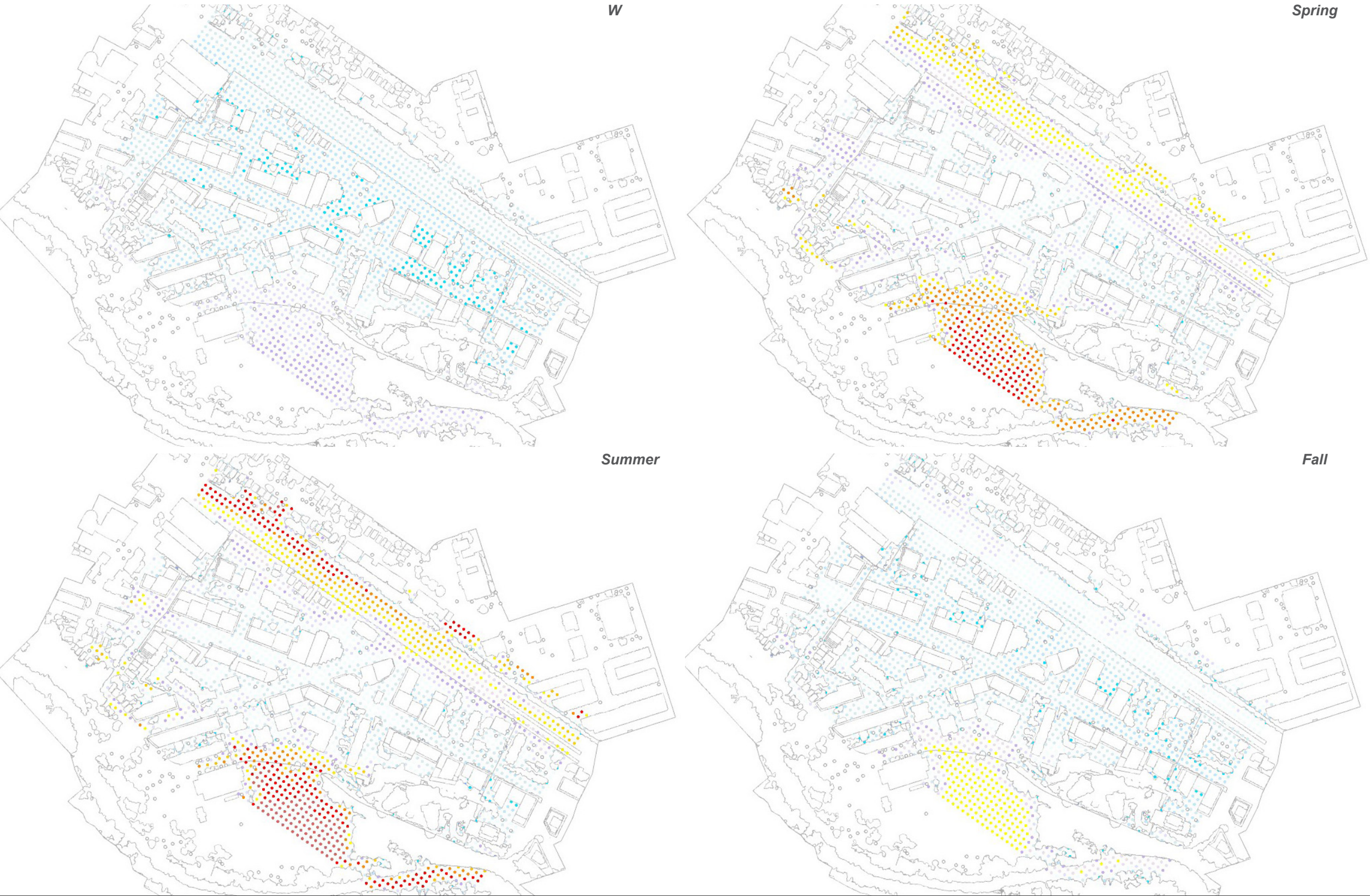
- Moderate solar exposure throughout the outer surroundings of the site, by the train tracks. High solar only by Weston Lions Park.
- There are well shadowed areas in between the buildings and along the treelines.

Fall

- Low-moderate solar exposure throughout the site. Higher sun only by Weston Lions Park.
- Good shading between the buildings from building shadows reducing heat stress and offering more comfortable conditions.



50th Percentile Direct Solar Radiation Per Season



Phase 2 Outdoor Comfort Conditions – Weston Site (Section III)

Urban Comfort Mapping - Universal Thermal Comfort Indices (UTCI)

The pedestrian wind comfort is assessed cumulating the 16 wind directions from historical weather file data for velocity, direction, and frequency. The 50th percentile (median) wind speeds are shown in the following maps per season to assess typical conditions.

Winter

- There are high wind conditions throughout the site (dark blue). The highest winds are mainly along Weston Rd and south of Weston Rd.
- There are also pockets of wind protected areas which offer more comfortable winter conditions.
- Building massing, landscaping, and other local measures are opportunities to mitigate high winds that prevail from the W in the winter.

Spring

- Spring has cold temperatures and high wind speeds.
- There are high wind conditions through the site. Wind conditions are similar to the winter with the addition of cold east winds too. Using design strategies to reduce winds will be able to improve spring outdoor comfort.

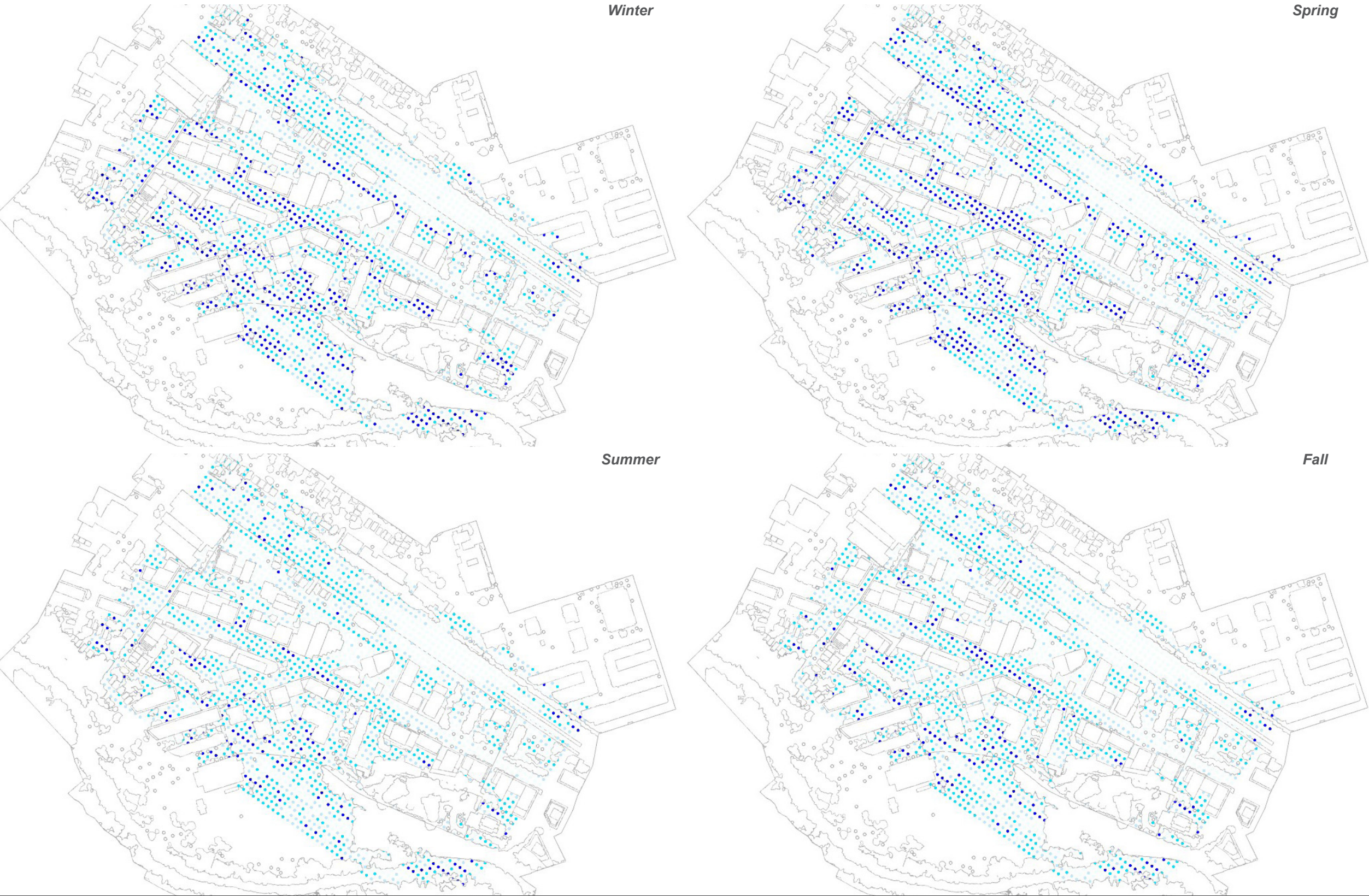
Summer

- There is a mix of wind conditions throughout the site, with mostly moderate beneficial breezes.

Fall

- Wind conditions are similar to summer.
- Maintaining gentle and moderate breezes throughout the site reduces heat stress and increases fall comfort even further.
- Winds are already moderate or strong on the southern part of the site where conditions are warmer. Wind design is less impactful than additional shading measures to increase fall comfort here.
- Mitigating some strong winds to moderate or gentle breezes in the high density part of the site will increase comfort in late fall.

50th Percentile Wind Velocity Per Season



Phase 2 Outdoor Comfort Conditions – Weston Site

Urban Comfort Mapping - Universal Thermal Comfort Indices (UTCI)

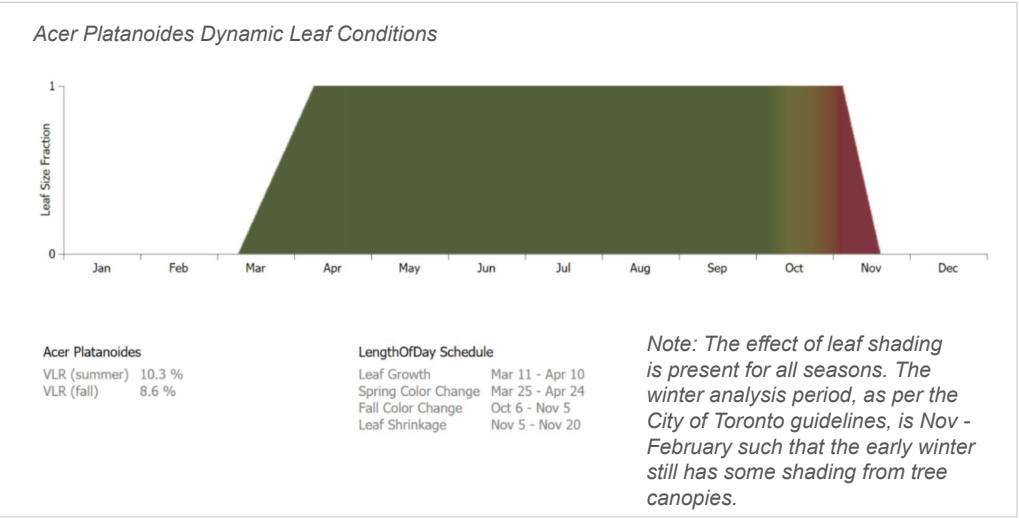
Simulation Details

- 16 wind direction computational fluid dynamic (CFD) simulation
- Incompressible LBM (lattice Boltzmann method) with 3 fluid passes
- Turbulence Model: k-omega SST DDES
- Software: SimScale (OpenFOAM® solver)
- Mesh y+ value: < 2000 in area of interest (stable)
- Modeled radius: 300 m region of interest with additional 50m+ of surrounding context region
- Wind Source: CAN_ON_Toronto-Pearson.Intl.AP.716240_TMYx
 - 65 year wind data: 1950-2023
- Includes terrain, existing buildings, existing landscape
- Pedestrian Wind Comfort assessed at 1.5 meters
- Wind safety criteria based on City of Toronto criteria (see Figure 3)
 - Evaluated for whole year, 00:00 - 00:00
- Wind comfort criteria based on City of Toronto criteria (see Figure 5)
 - Evaluated from 06:00 - 23:00
 - Evalued Seasonally:
 - Winter: December - February
 - Spring: March - May
 - Summer: June - August
 - Fall: September - November

Universal Thermal Comfort Index (UTCI)

The Universal Thermal Comfort Index (UTCI) accounts for air temperature, wind velocity, relative humidity, and the mean radiant temperature (effects from solar radiation) to assess human comfort given site and climate conditions independent of a person’s specific demographics.

- Assessment of high-level thermal comfort based on City of Toronto criteria (see Figure 6) with UTCI comfort metric for Section I
 - Wind level simulated using Beaufort scale ranges
 - Calm: 1.8 km/h
 - Gentle Breeze:12.6 km/h
 - Moderate Breeze: 25.2 km/h
 - Sun simulated: +20K mean radiant temperature
 - Shade simulated: +0K mean radiant temperature
- Assessment of detailed thermal comfort for Section II based on 2050 future SSP5-8.5 morphed weather file from the City of Toronto using Pearson International Airport weather station and a CWEC 2020 weather file.
 - Evapotranspiration and thermal mass effects are not included in UTCI model
 - Concrete ground assumed and included in the mean radiant temperature calculation.
 - Solar radiation conditions simulated on hourly basis
 - Tree species modeled with maple trees (*Acer Platanoides*) to simulate seasonal dynamic leaf conditions.
 - Leaf growth period: March 11 - April 10
 - Leaf shrinkage period: November 5-20
 - Leaves bare between November 20 - March 11



Appendix: Phase 2 Thermal Comfort Conditions – Weston Site

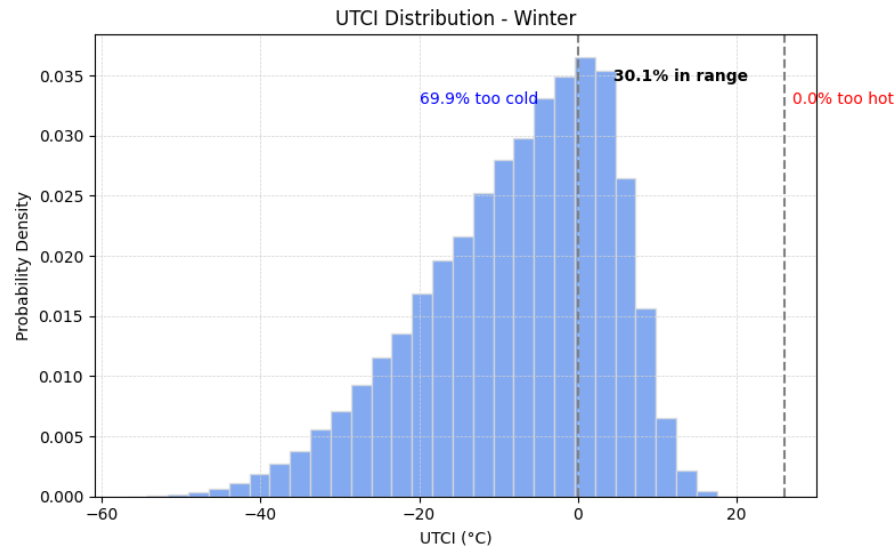
Comfort Percentage Map

Winter

Year Period	Time Period	Acceptable UTCI Range	Comfort % Target
Winter: Nov-Feb	08:00-17:00	$0^{\circ} \leq \text{UTCI} \leq 26^{\circ}$	30%

- = meets comfort percentage target
- = does *not* meet comfort percentage target

34% (871 out of 2,578) sensors are at or above comfortable percentage target.



Appendix: Phase 2 Thermal Comfort Conditions – Weston Site

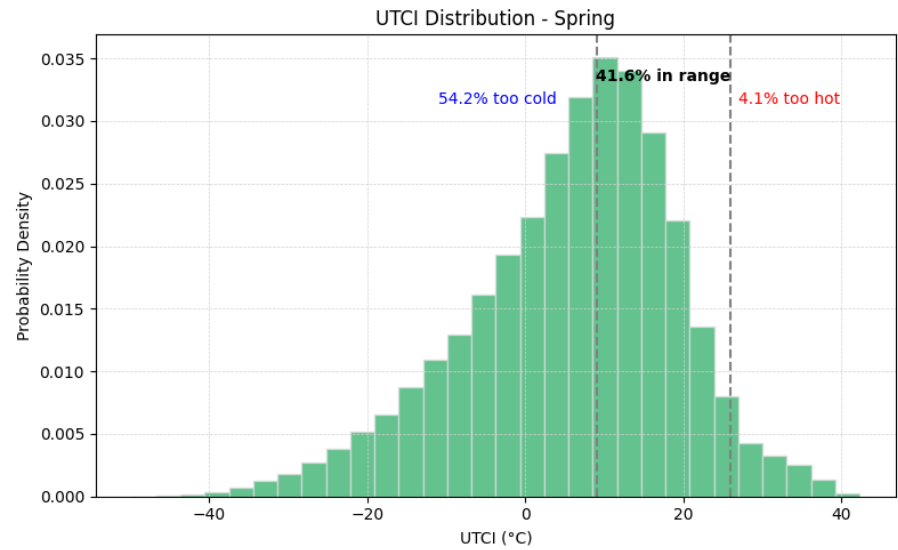
Comfort Percentage Map

Spring

Year Period	Time Period	Acceptable UTCI Range	Comfort % Target
Spring: Mar-May	08:00-20:00	$9^{\circ} \leq \text{UTCI} \leq 26^{\circ}$	45%

- = meets comfort percentage target
- = does *not* meet comfort percentage target

28% (732 out of 2,578) sensors are at or above comfortable percentage target



Appendix: Phase 2 Thermal Comfort Conditions – Weston Site

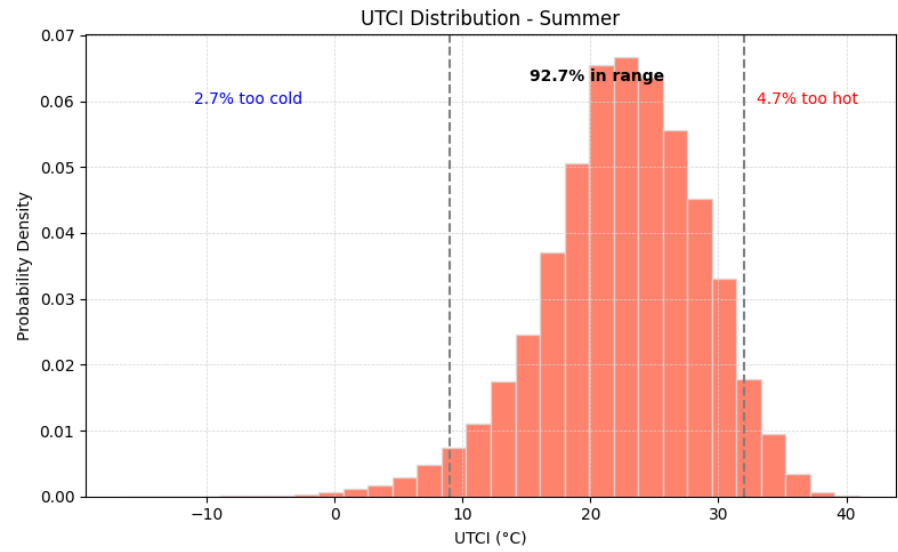
Comfort Percentage Map

Summer

Year Period	Time Period	Acceptable UTCI Range	Comfort % Target
Summer: Jun-Aug	06:00-21:00	$9^{\circ} \leq \text{UTCI} \leq 32^{\circ}$	60%

- = meets comfort percentage target
- = does *not* meet comfort percentage target

99% (2,576 out of 2,578) sensors are at or above comfortable percentage target



Appendix: Phase 2 Thermal Comfort Conditions – Weston Site

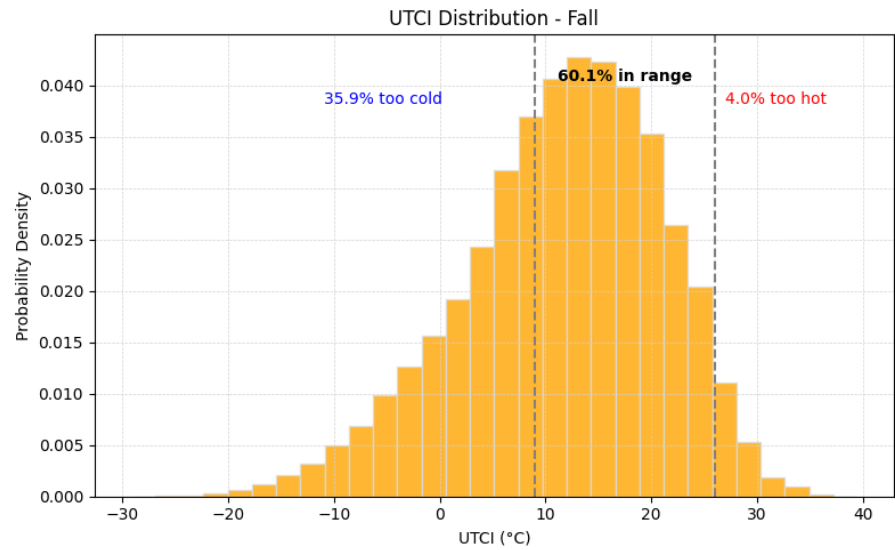
Comfort Percentage Map

Fall

Year Period	Time Period	Acceptable UTCI Range	Comfort % Target
Fall: Sep-Oct	08:00-20:00	$9^{\circ} \leq \text{UTCI} \leq 26^{\circ}$	45%

- = meets comfort percentage target
- = does *not* meet comfort percentage target

76% (1,962 out of 2,578) sensors are at or above comfortable percentage target



Appendix: Phase 2 Thermal Comfort Conditions – Weston Site

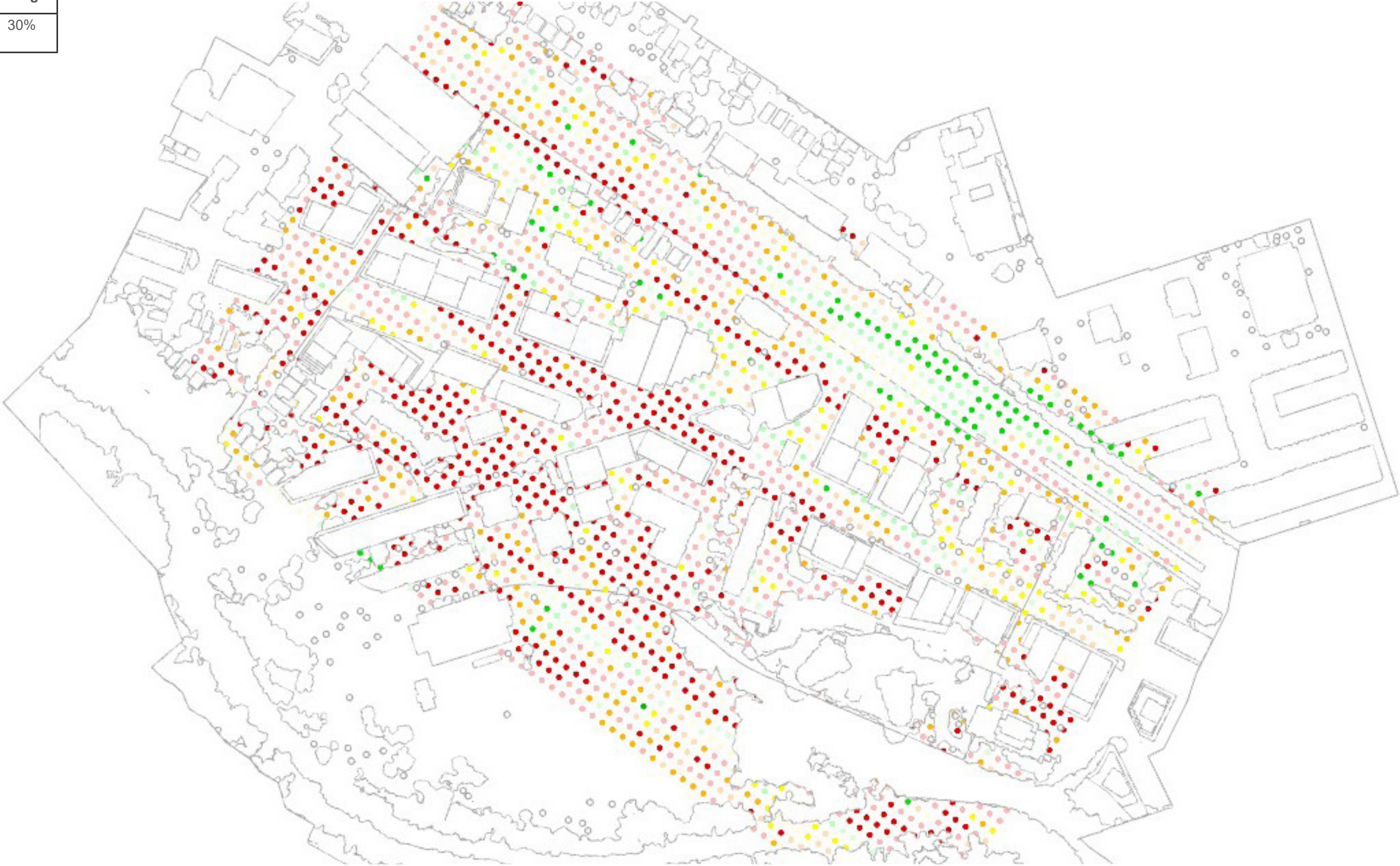
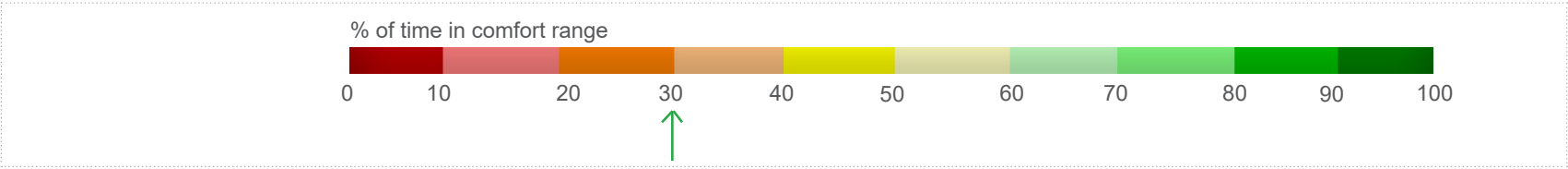
Comfort Percentage Map (10% Intervals)

Year Period	Time Period	Acceptable UTCI Range	Comfort % Target
Winter: Nov-Feb	08:00-17:00	$0^{\circ} \leq \text{UTCI} \leq 26^{\circ}$	30%

- Locations 10% below the comfort target (orange) are areas with high comfort improvement with design interventions, especially with passive means. These are recommended to be focus areas during development of the site.

Thermal Comfort Map

Winter



Appendix: Phase 2 Thermal Comfort Conditions – Weston Site

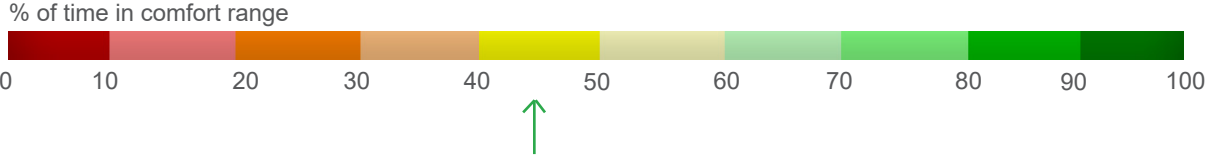
Comfort Percentage Map (10% Intervals)

Year Period	Time Period	Acceptable UTCI Range	Comfort % Target
Spring: Mar-May	08:00-20:00	9° ≤ UTCI ≤ 26°	45%

- Locations 10% below the comfort target (yellow, light orange) are areas with high comfort improvement with design interventions, especially with passive means. These are recommended to be focus areas during development of the site.

Thermal Comfort Map

Spring



Appendix: Phase 2 Thermal Comfort Conditions – Weston Site

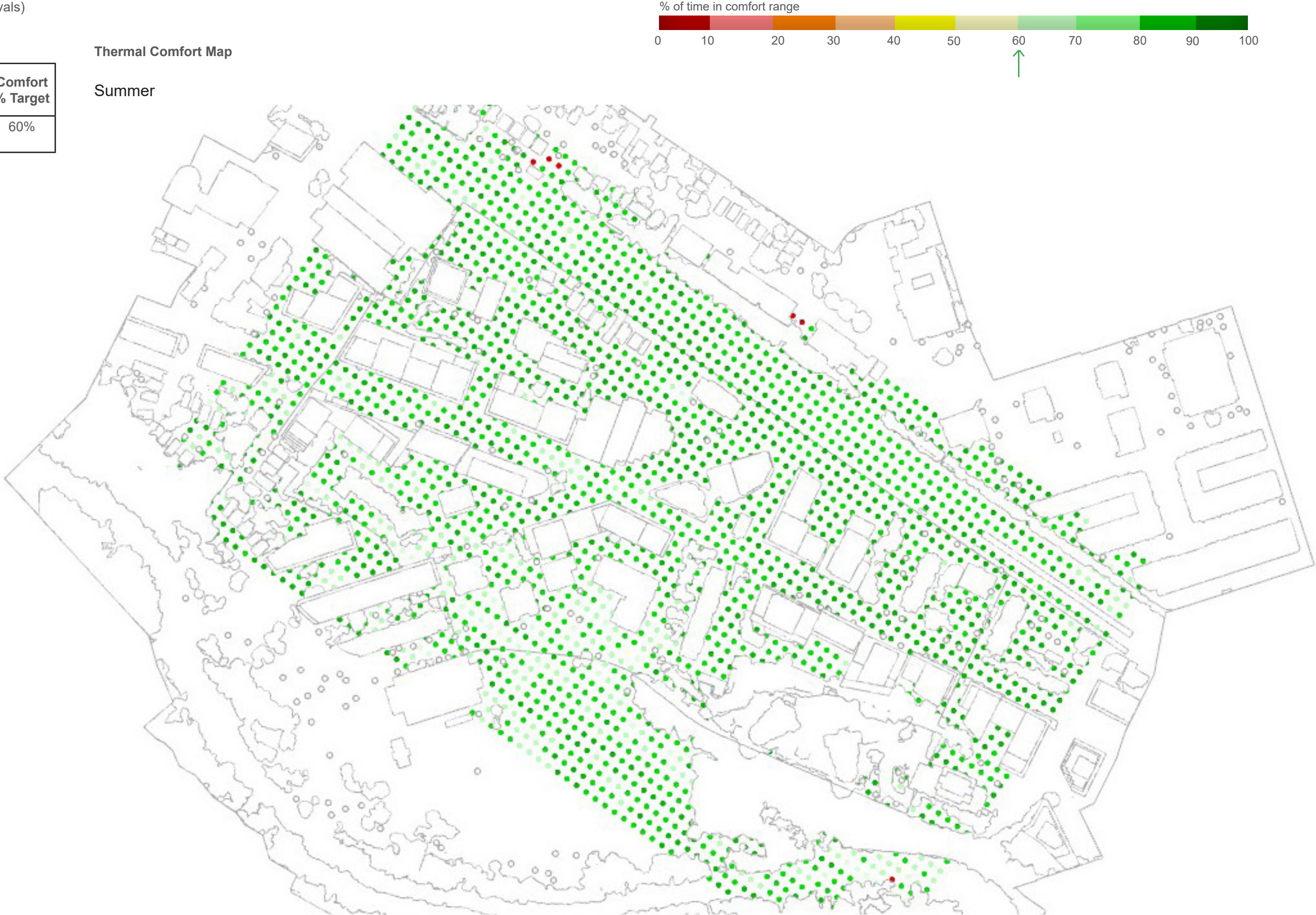
Comfort Percentage Map (10% Intervals)

Year Period	Time Period	Acceptable UTCI Range	Comfort % Target
Summer: Jun-Aug	06:00-21:00	$9^{\circ} \leq \text{UTCI} \leq 32^{\circ}$	60%

- Locations 10-20% below the comfort target (pale yellow, yellow) are areas with high comfort improvement with design interventions, especially with passive means. These are recommended to be focus areas during further development of the site, however conditions already are comfortable throughout the site with this proposal and no summer improvement is needed.

Thermal Comfort Map

Summer



Appendix: Phase 2 Thermal Comfort Conditions – Weston Site

Comfort Percentage Map (10% Intervals)

Year Period	Time Period	Acceptable UTCI Range	Comfort % Target
Fall: Sep-Oct	08:00-20:00	$9^{\circ} \leq \text{UTCI} \leq 26^{\circ}$	45%

- Locations 10% below the comfort target (yellow, light orange) are areas with high comfort improvement with design interventions, especially with passive means. These are recommended to be focus areas during development of the site.

Thermal Comfort Map

Fall

