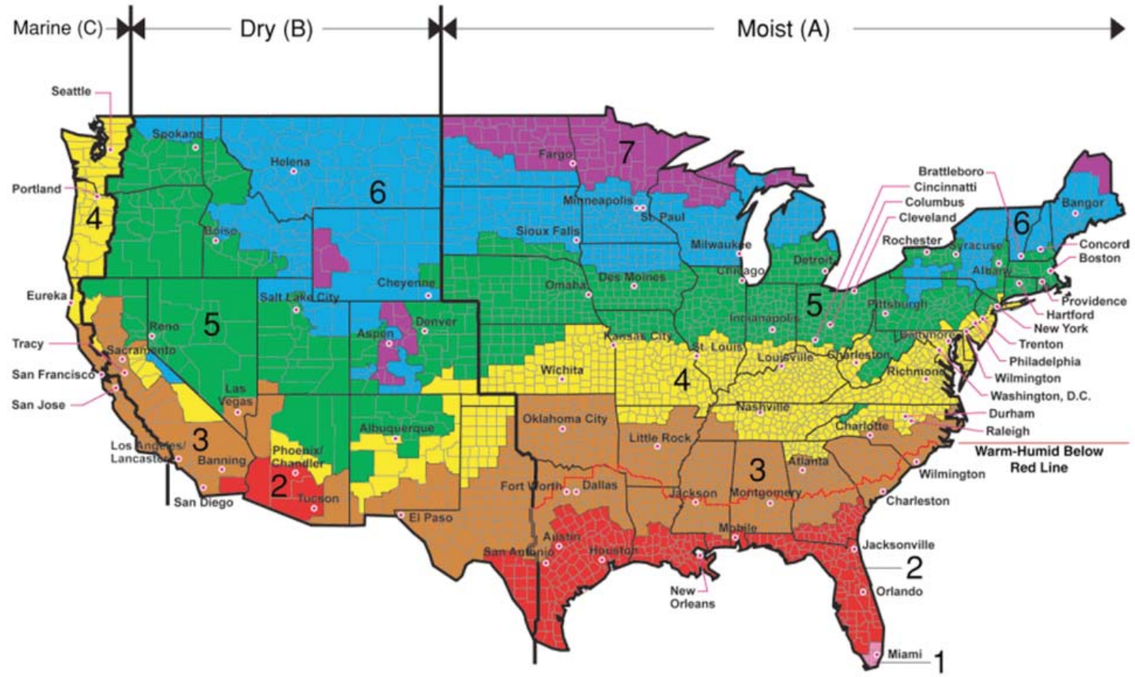
MIAMI

Janki A Vyas | Ksenia Knyazkina

CLIMATE ANALYSIS

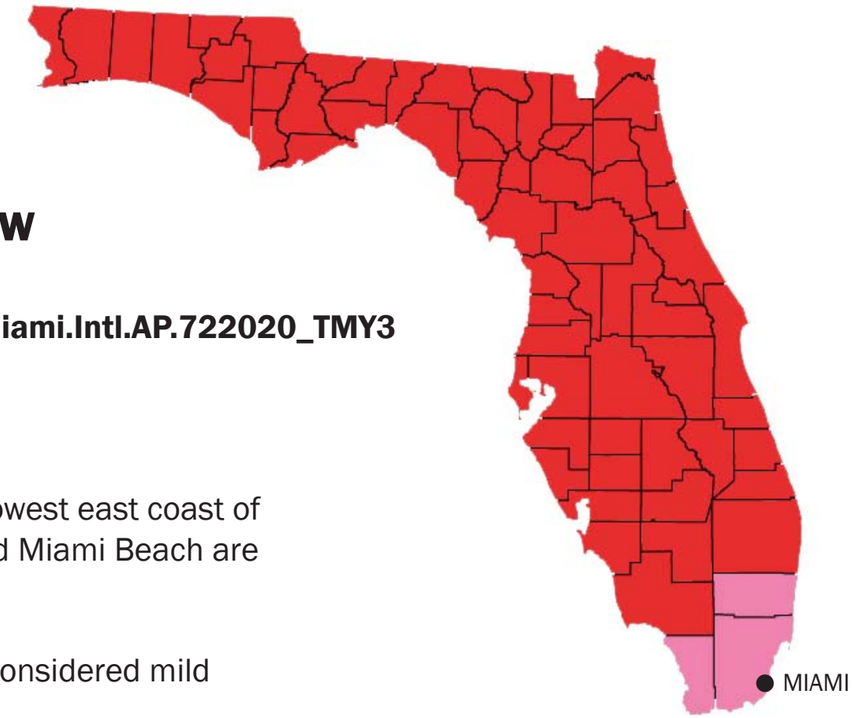


http://www.iaqsource.com/article.php/ashrae-climate-zone-map/?id=194

City: **Miami**
State: **Florida**
Country: **United State**

25.76°N -80.21°W

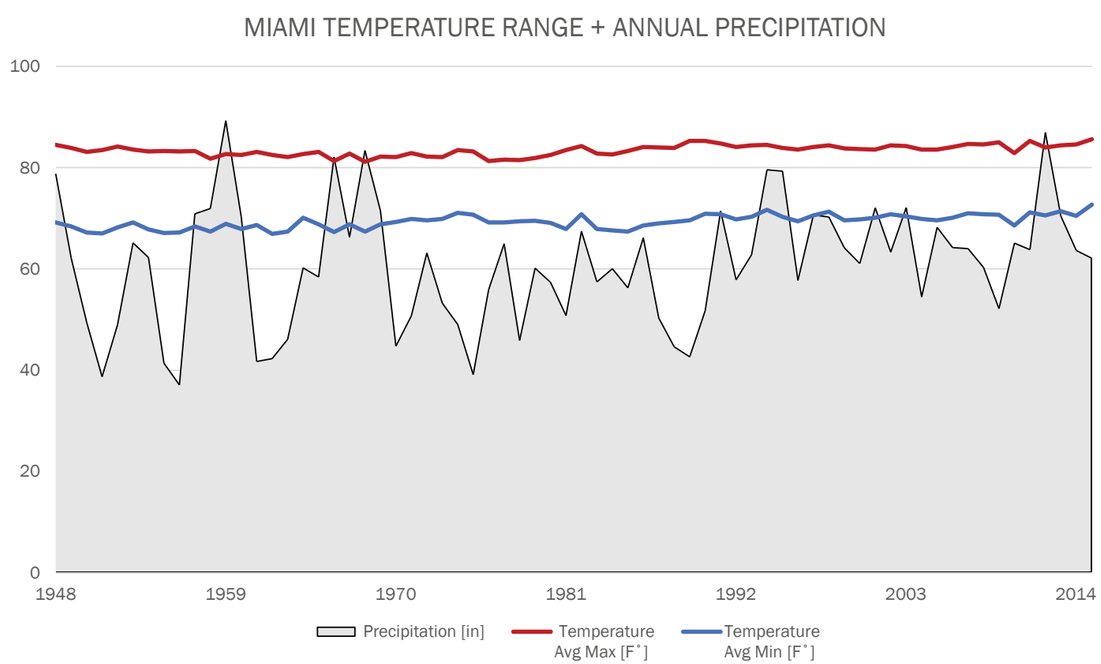
Weather File: **USA_FL_Miami.Intl.AP.722020_TMY3**



https://energycode.pnl.gov/EnergyCodeReqs/?state=Florida

Miami is located at the lowest east coast of Florida. Biscayne Bay and Miami Beach are both to the east.

The climate of Miami is considered mild subtropical marine.



Summers are long and hot with plentiful rainfall, averaging about 60 inches a year. Temperatures range from average lows of 75-76°F to highs of 88-90°F.

Winters are mild and dry. Conditions outdoors in the winter, spring and fall are pleasant. Temperatures range from average lows of 60-61°F to highs of 76-77°F.

Overall, Miami is a hot and humid climate with very humid nights and cooling ocean breezes. Buildings generally need cooling for most of the year.

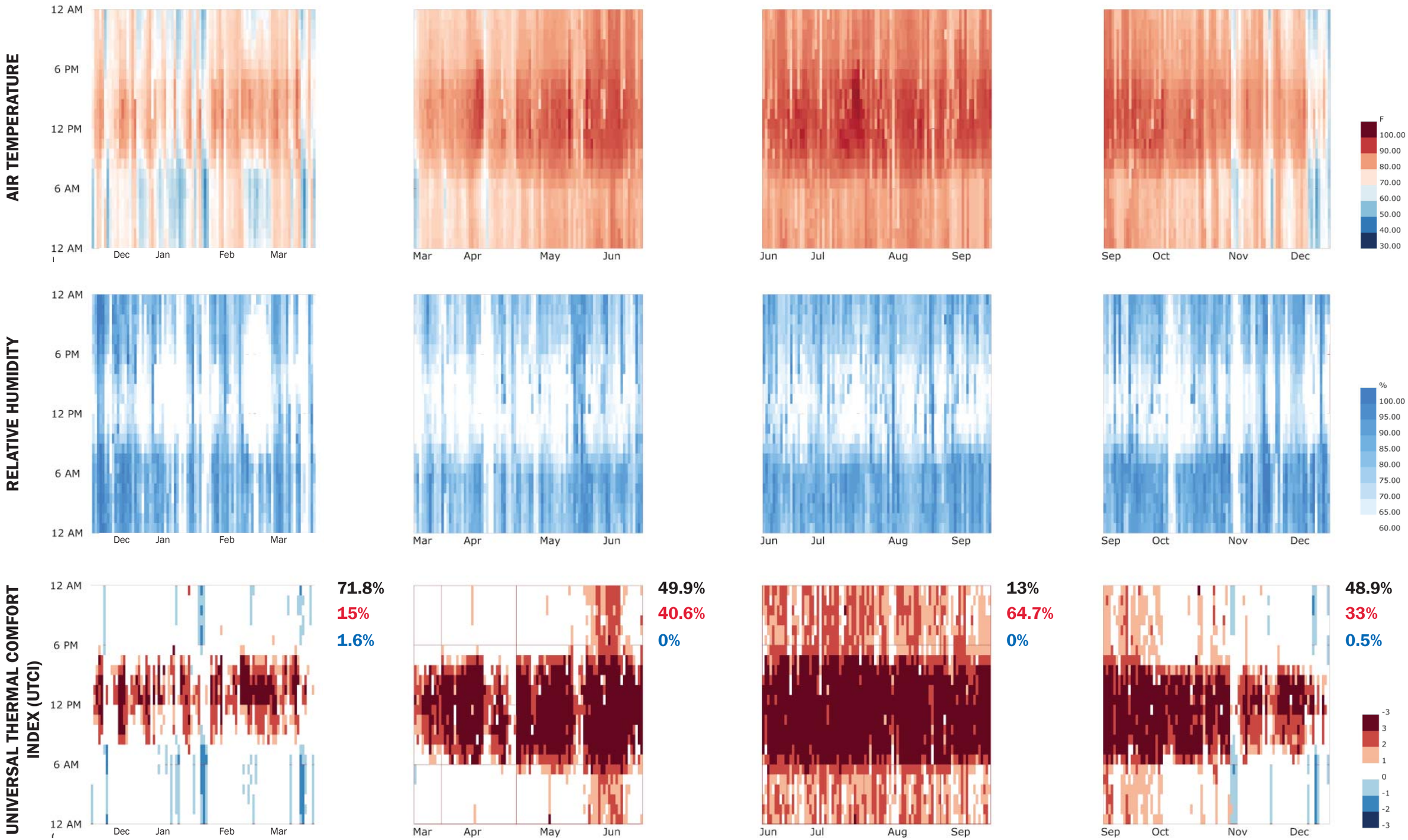
CLIMATE ANALYSIS

WINTER
December 21 - March 20

SPRING
March 21 - June 20

SUMMER
June 21 - September 20

FALL
September 21 - December 20



CLIMATE ANALYSIS

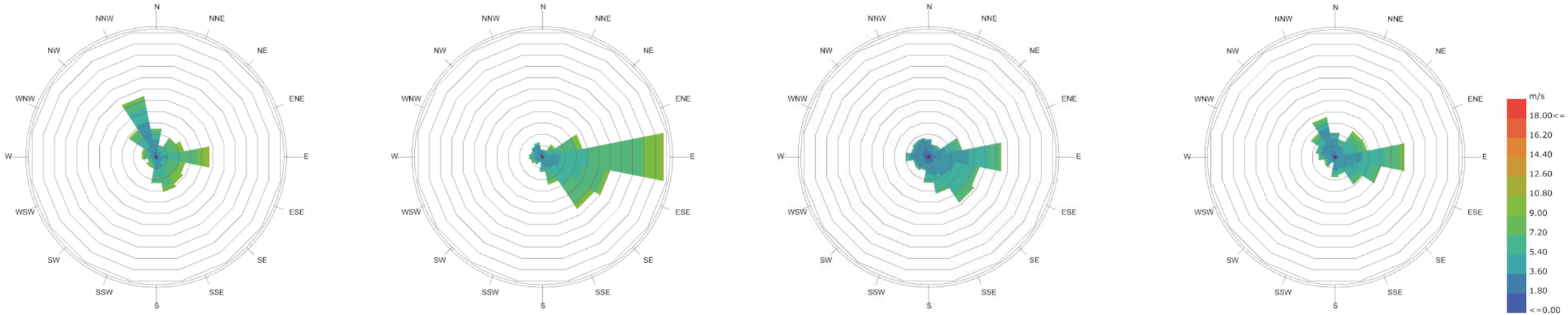
WINTER
December 21 - March 20

SPRING
March 21 - June 20

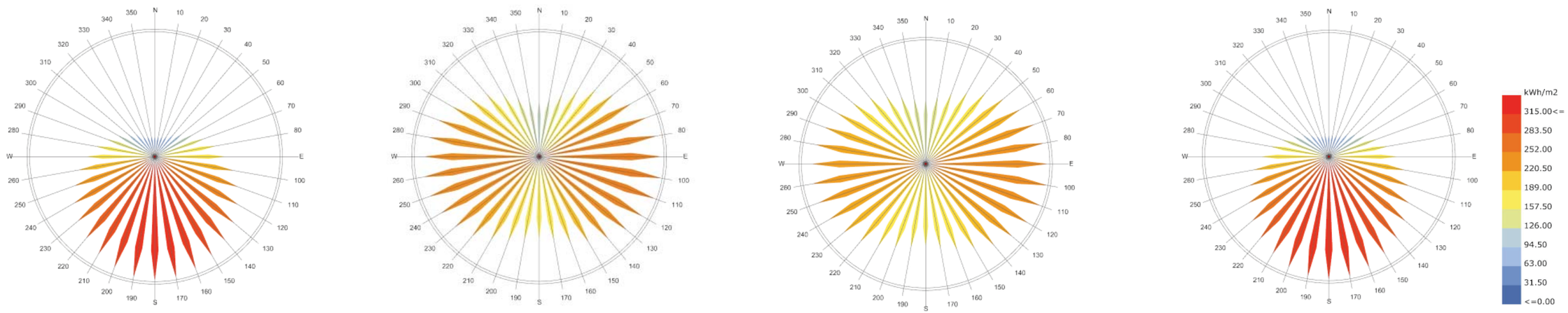
SUMMER
June 21 - September 20

FALL
September 21 - December 20

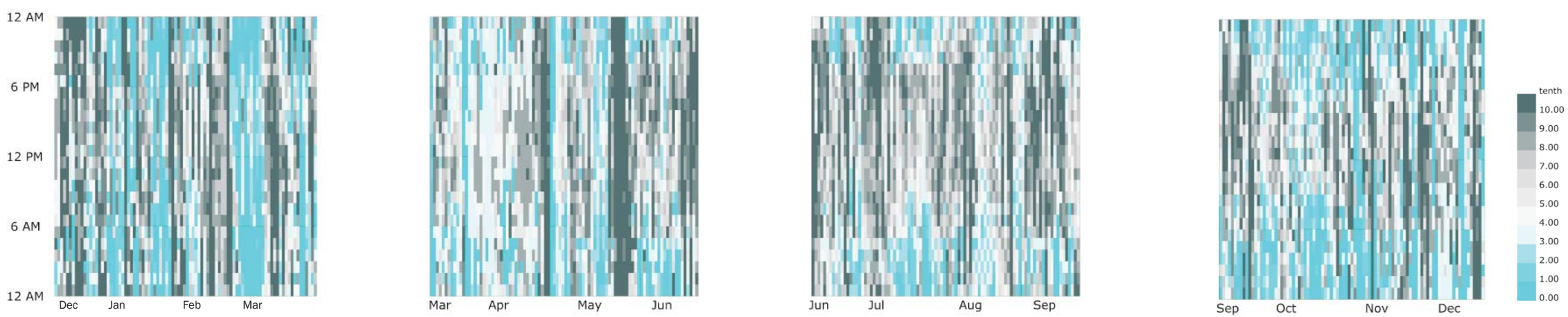
WIND SPEED + DIRECTION

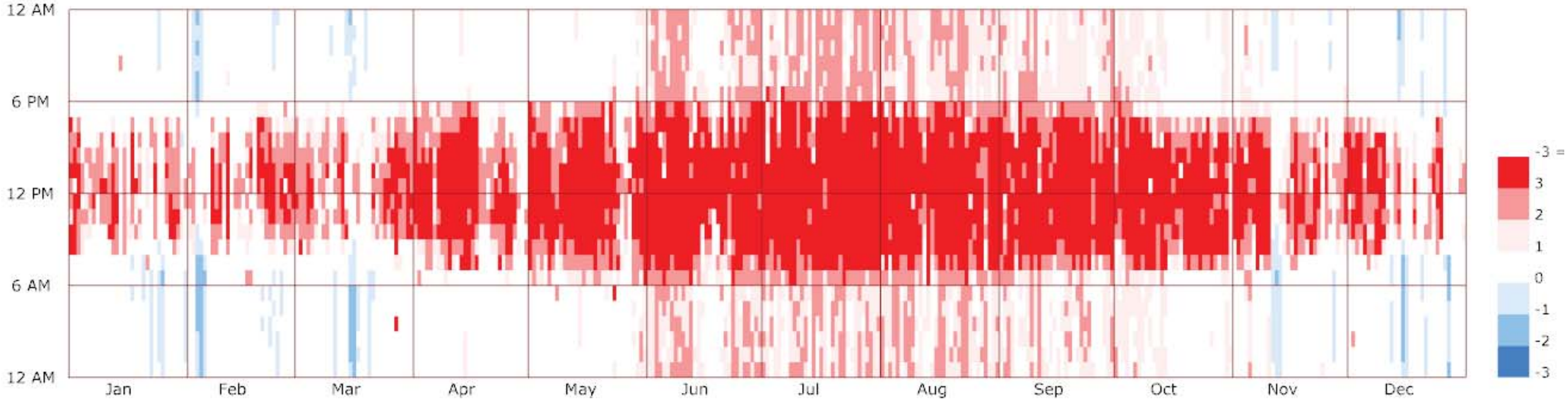


TOTAL RADIATION

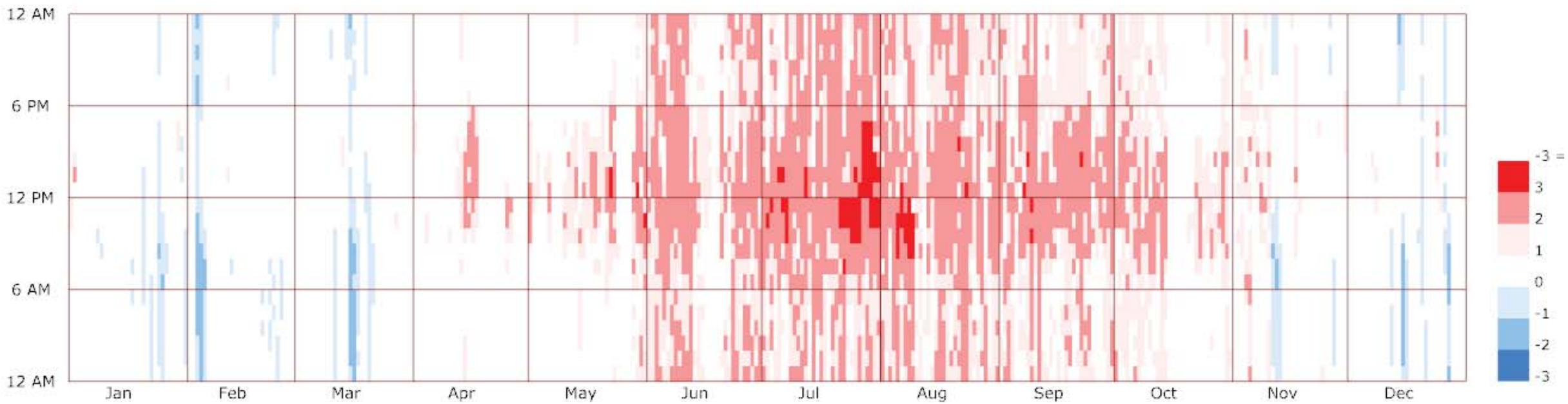


SKY COVER



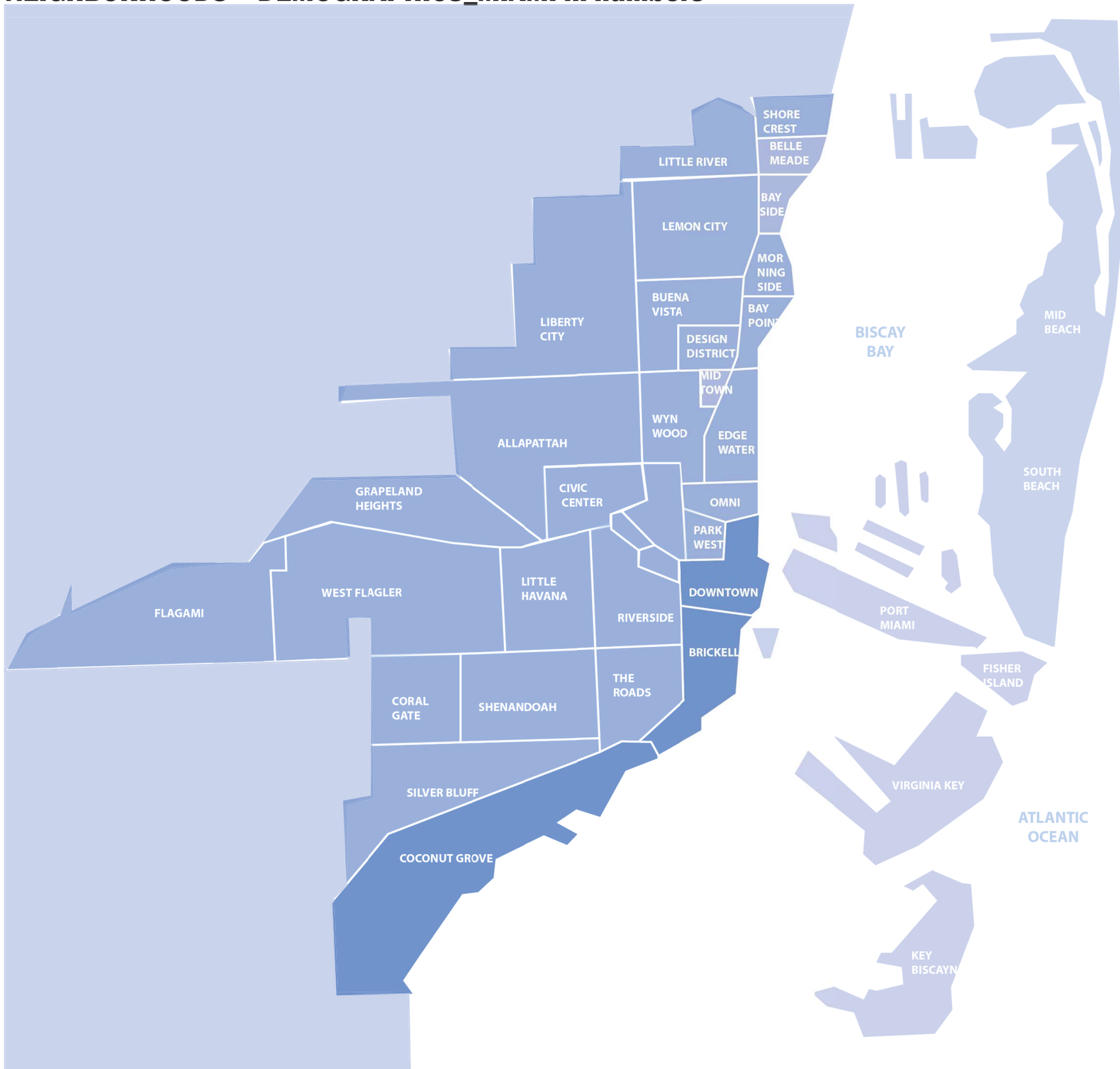


OUTDOOR COMFORT _NO SHADES_45% COMFORT



OUTDOOR COMFORT _WITH SHADES_61% COMFORT

NEIGHBORHOODS + DEMOGRAPHICS_MIAMI in numbers



8 most walkable city in USA

6 ft average elevation

399,457 population

11, 135 people per square mile

PUBLIC TRANSPORTATION INFRASTRUCTURE_Metrorail Underline + MPath

69% MIAMI WORKERS **DRIVE ALONE** TO WORK

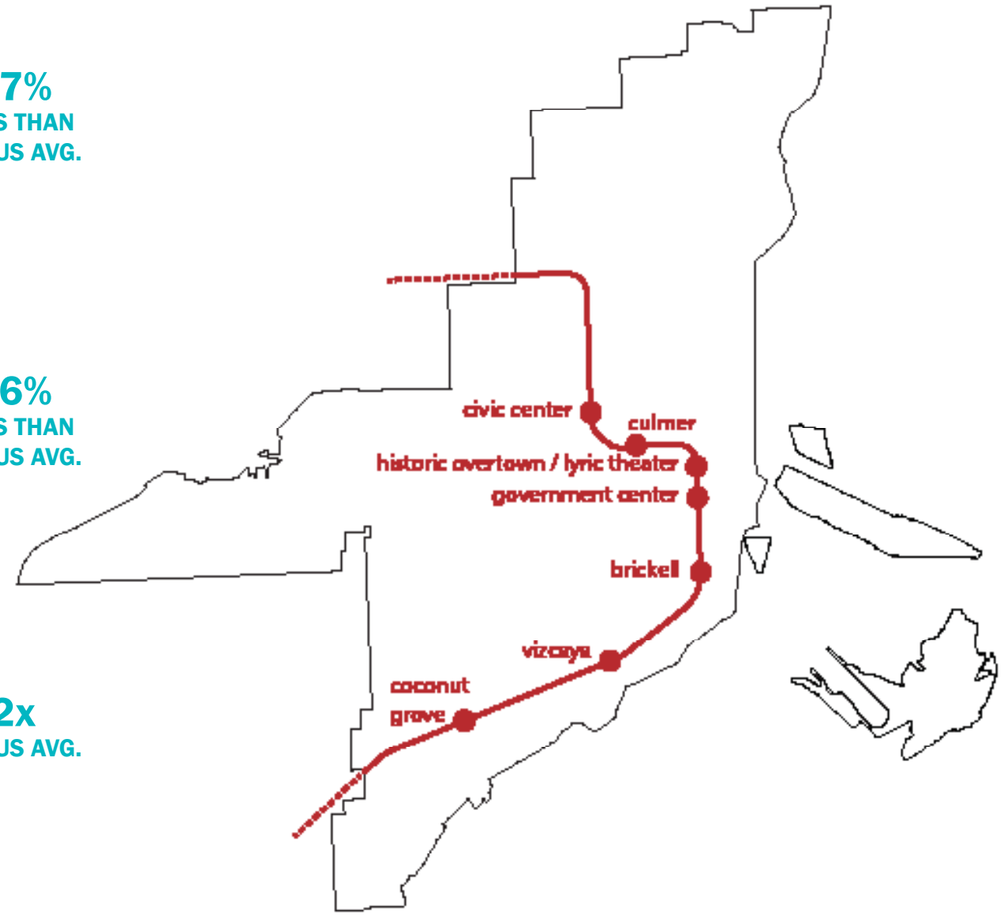
~7% LESS THAN THE US AVG.

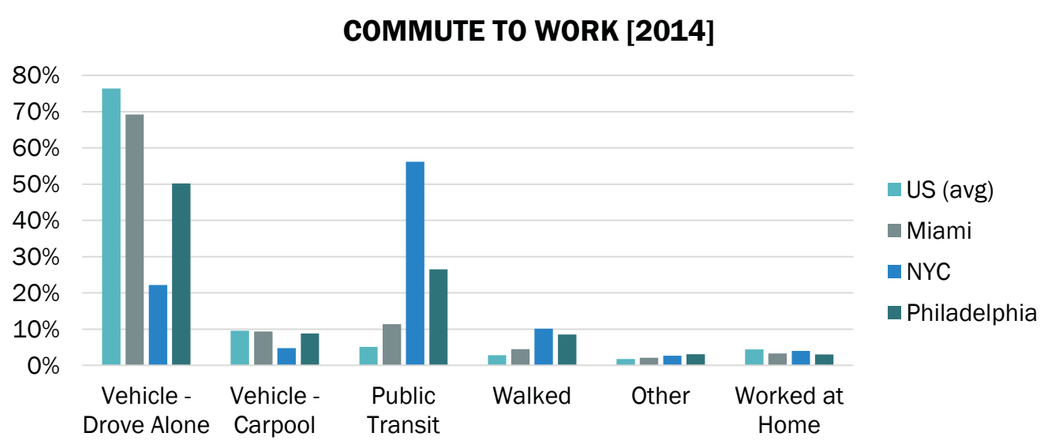
11% TAKE **PUBLIC TRANSPORTATION** TO WORK

~6% LESS THAN THE US AVG.

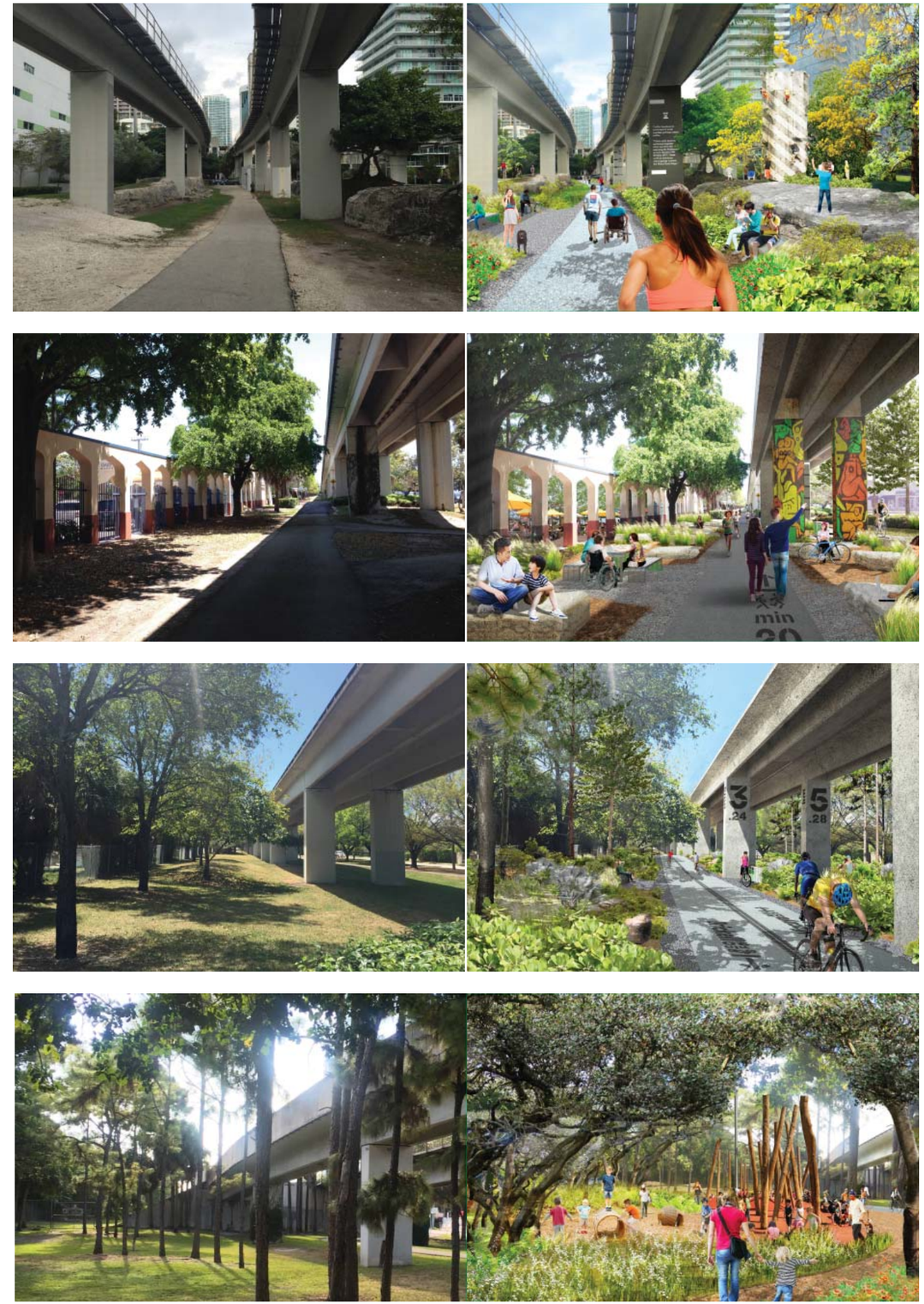
2.8% **WALK** TO WORK

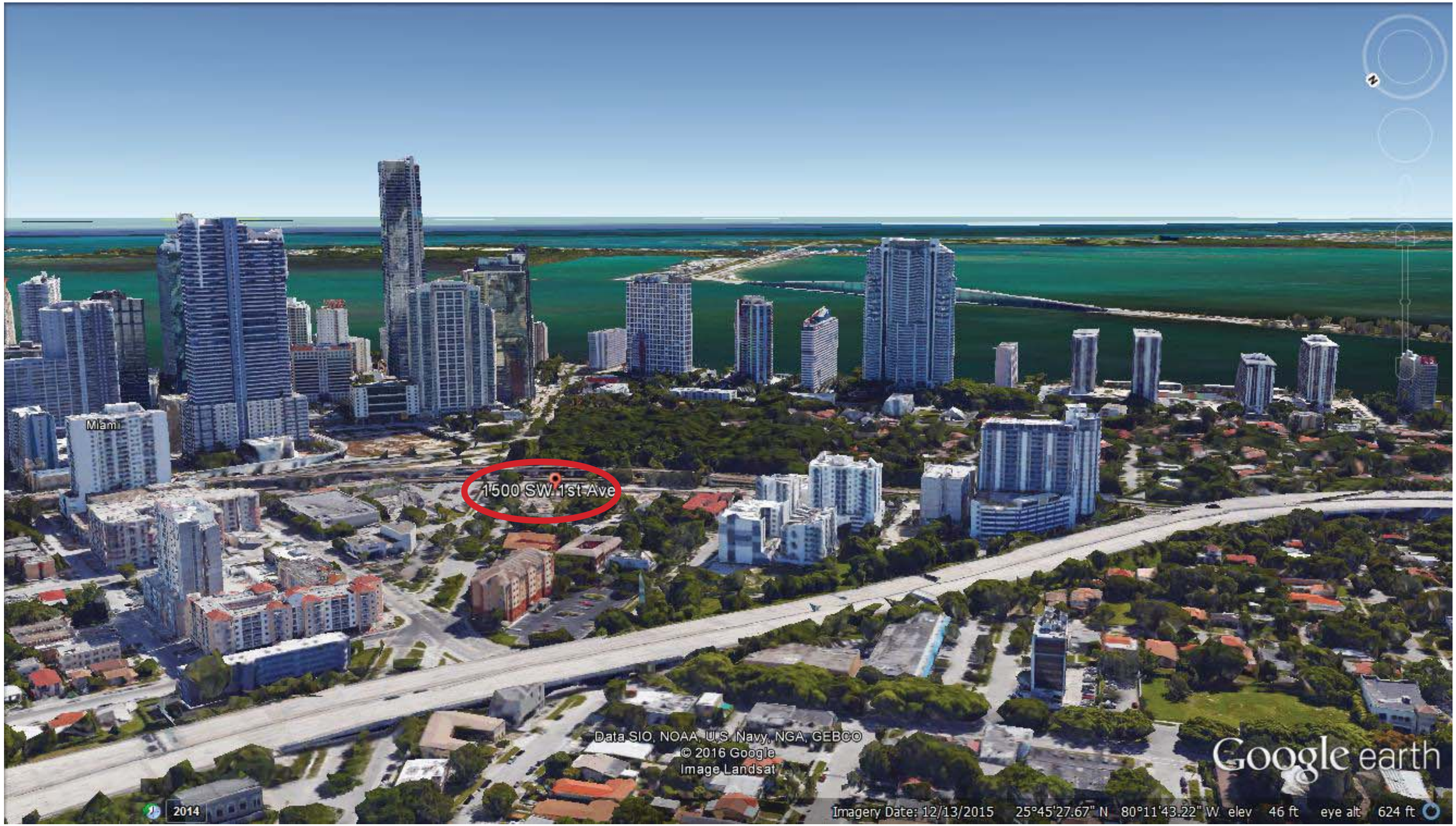
2x THE US AVG.



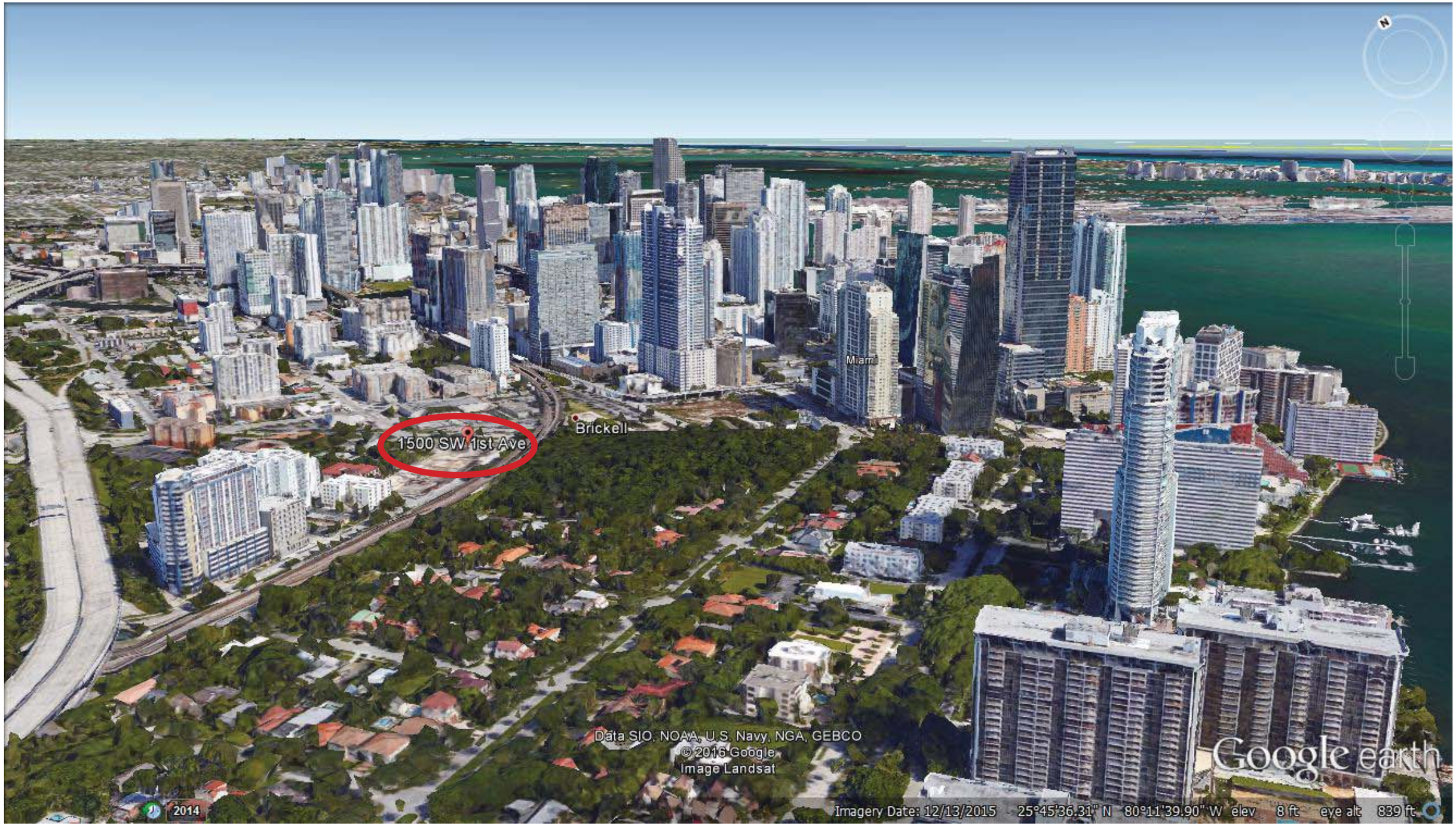


Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates




Miami
1500 SW 1st Ave
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2016 Google
Image Landsat
Google earth
2014
Imagery Date: 12/13/2015 25°45'27.67" N 80°11'43.22" W elev 46 ft eye alt 624 ft

1500 SW 1st Ave
Brickell
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2016 Google
Image Landsat
Google earth
2012
25°45'19.07" N 80°11'41.88" W elev 300 ft eye alt 1293 ft


1500 SW 1st Ave
Brickell
Miami
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2016 Google
Image Landsat
Google earth
2014
Imagery Date: 12/13/2015 25°45'36.31" N 80°11'39.90" W elev 8 ft eye alt 839 ft

BRICKELL

Settled: **1830**
Lowest Elevation: **0 - 5 ft**
Population: **26,472 (2010 U.S. Census)**
Density: **27,302/ sq mi**

Brickell is an urban neighborhood of Greater Downtown Miami, Florida, United States. Directly south of the historic CBD, Brickell is Miami and South Florida's major financial district.

With Brickell serving as the financial business district of our urban core, it's no surprise to find significant commercial (9.6%) and office (7.8%) space. It's an increasingly residential area too, with nearly 20% dedicated to condos and apartments, comprising the largest land-use class in the area: multi-family residential. 6% of undeveloped land is currently actively being eaten up by the future Brickell City Center.

Brickell was settled in the modern era in the mid-1800s by early pioneers, growing to become Miami's "Millionaire's Row" in the early 1900s after the construction of lavish mansions along Brickell Avenue by Mary Brickell. By the 1970s, office towers, hotels and apartments began replacing the historic mansions. Today, Brickell has grown to overtake the city's historic central business district to the north, as one of the largest financial districts in the United States. With a fast-growing residential population, Brickell is one of Miami's fastest-growing as well as its most dense neighborhood.

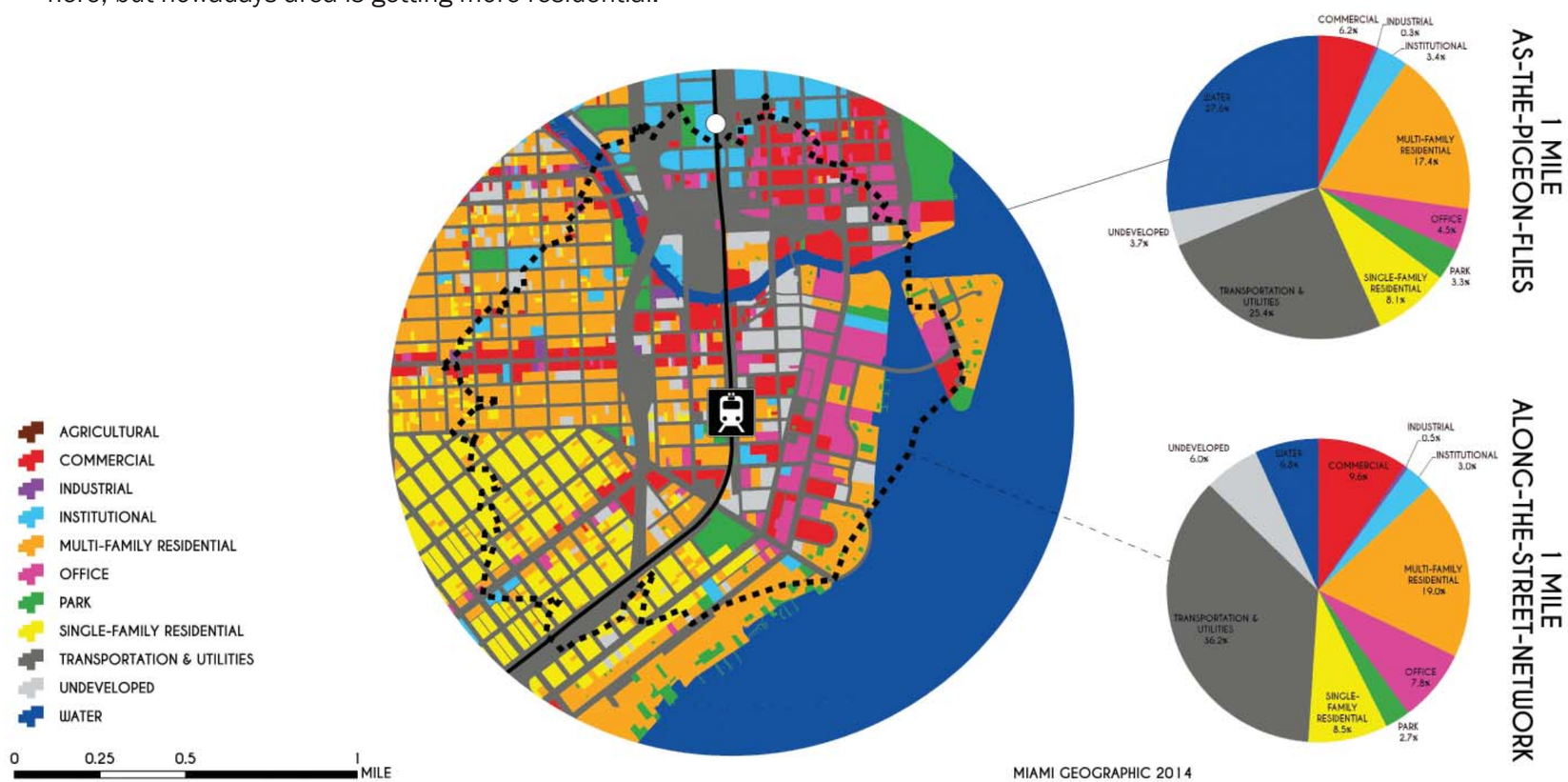
Brickell has a large concentration of wealthy Argentine, Colombian, Cuban, Nicaraguan and Venezuelan residents. Many work in the neighborhood's financial and trade sectors, or live in Brickell part-time.

Brickell is served by Metrobus throughout the area, the Miami Metrorail, and the Metromover.

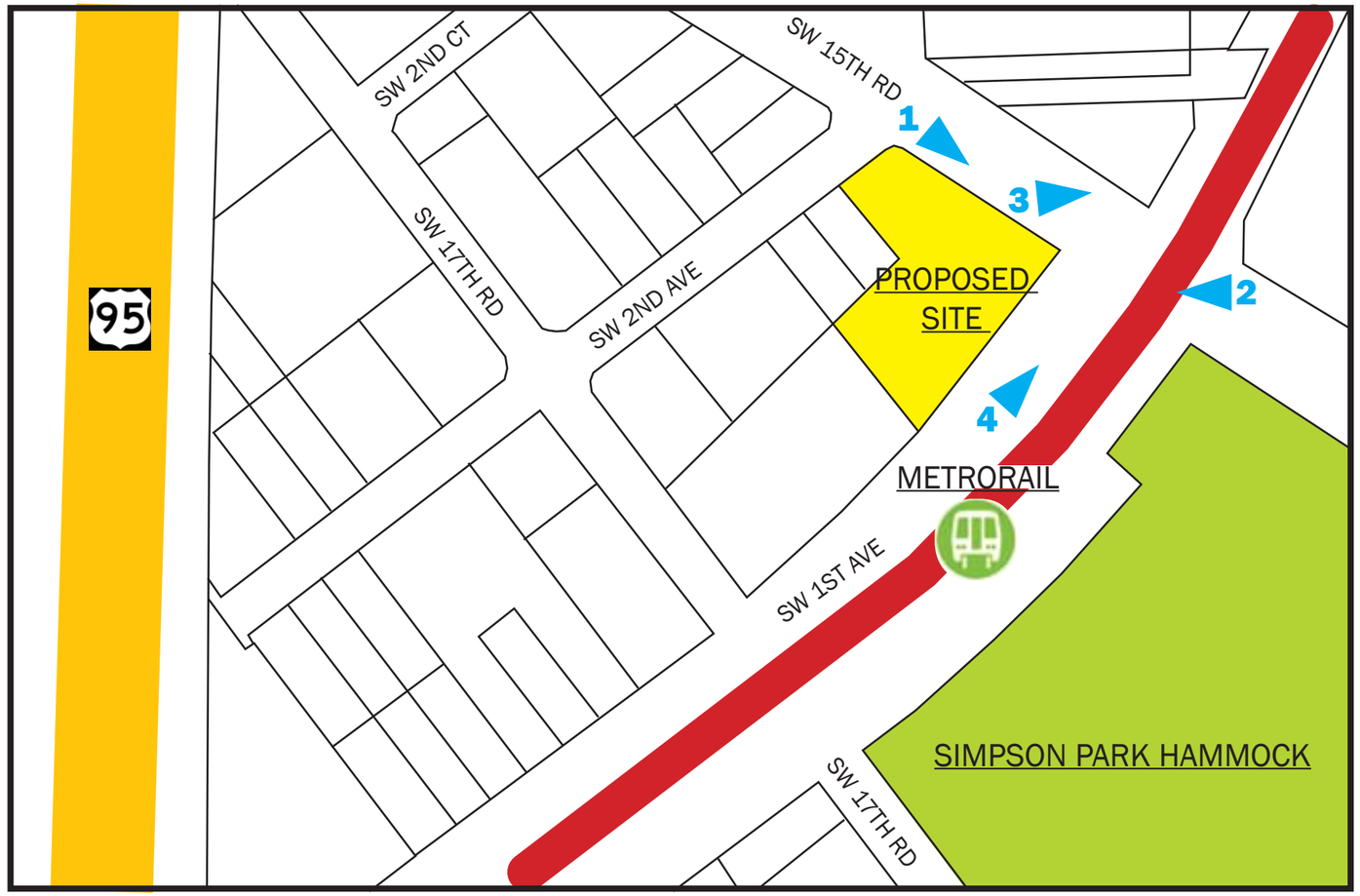
West Brickell - residential neighborhood with low and mid rise apartment houses. Condominium boom started here in 2012 - luxury apartments replaced prewar homes.

Southeast Brickell - single family homes from early 1900 on the south and high-rise residential towers along east side.

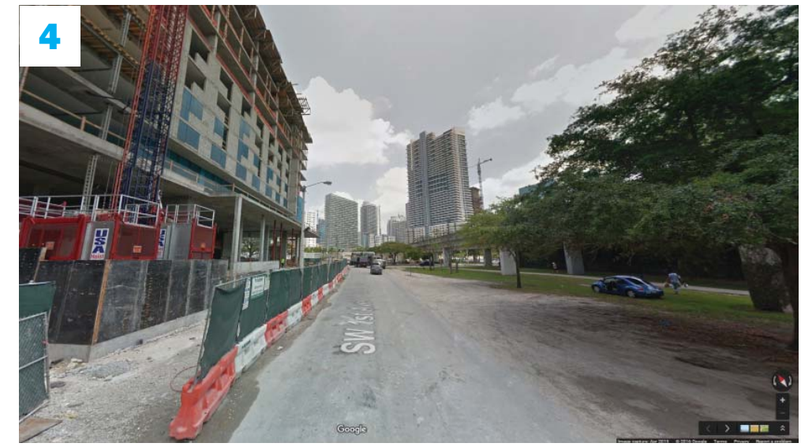
Financial District - historically banks headquarters and commercial offices were build here, but nowadays area is getting more residential.

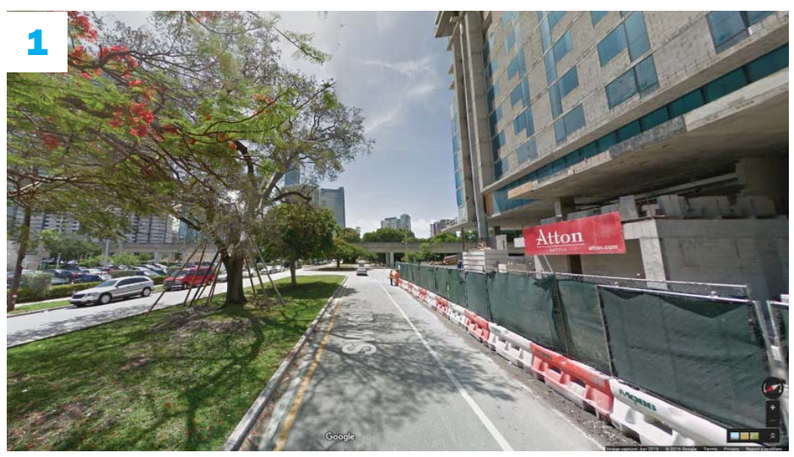


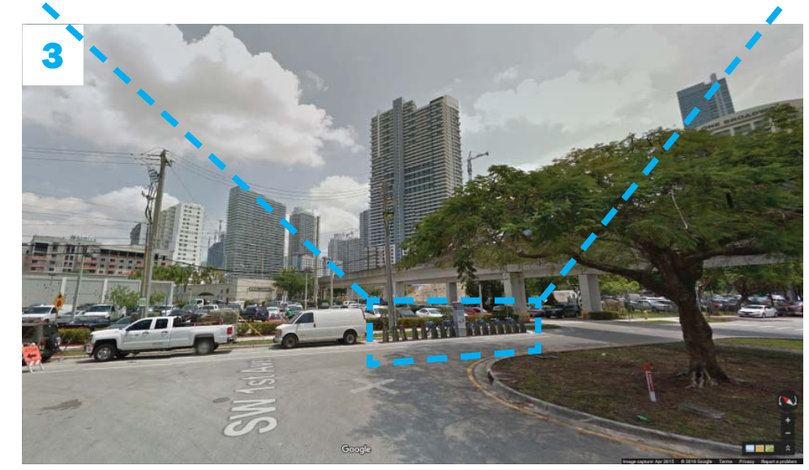
SITE CONTEXT_Northeast - Downtown



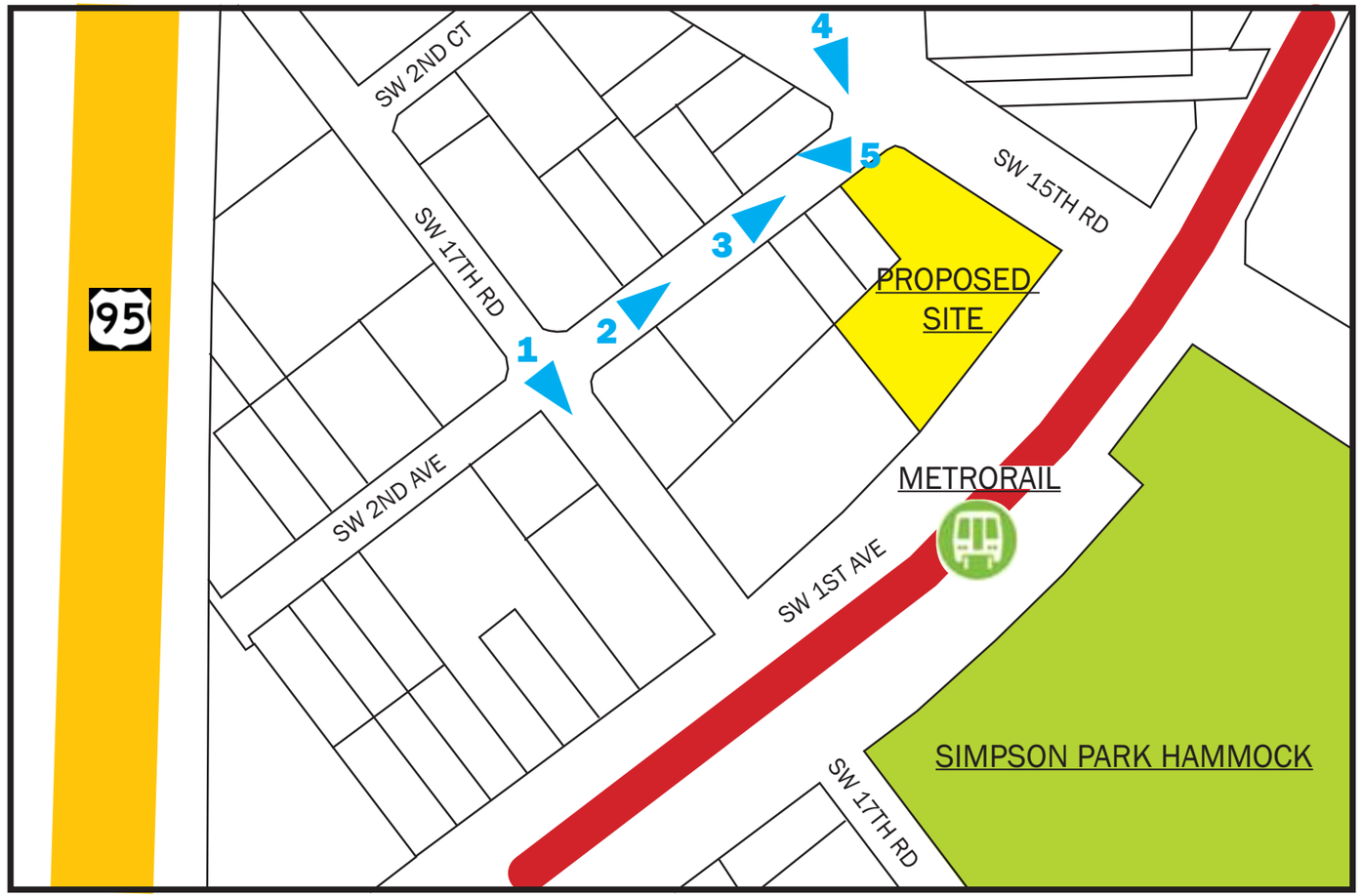
Address: **1500 SW 1st Ave., Miami, FL 33129**
Lot Size: **39,852 SF**
Zone: **T6-8 Urban Core Zone**





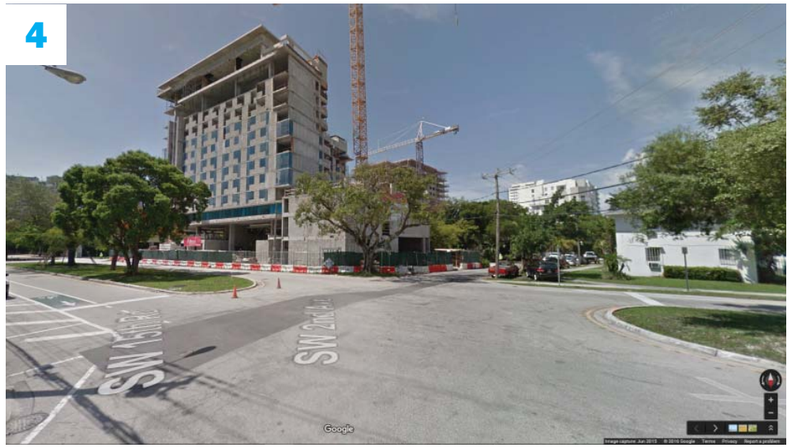


SITE CONTEXT_Southwest - Residential

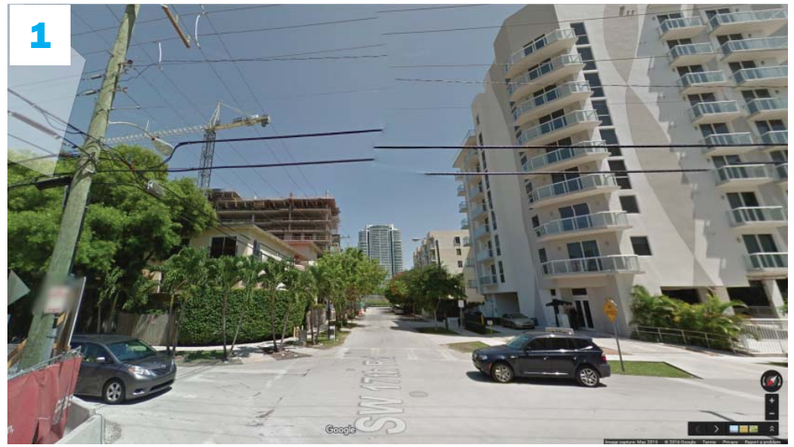


5

4



1



2

3

SIMPSON PARK HAMMOCK

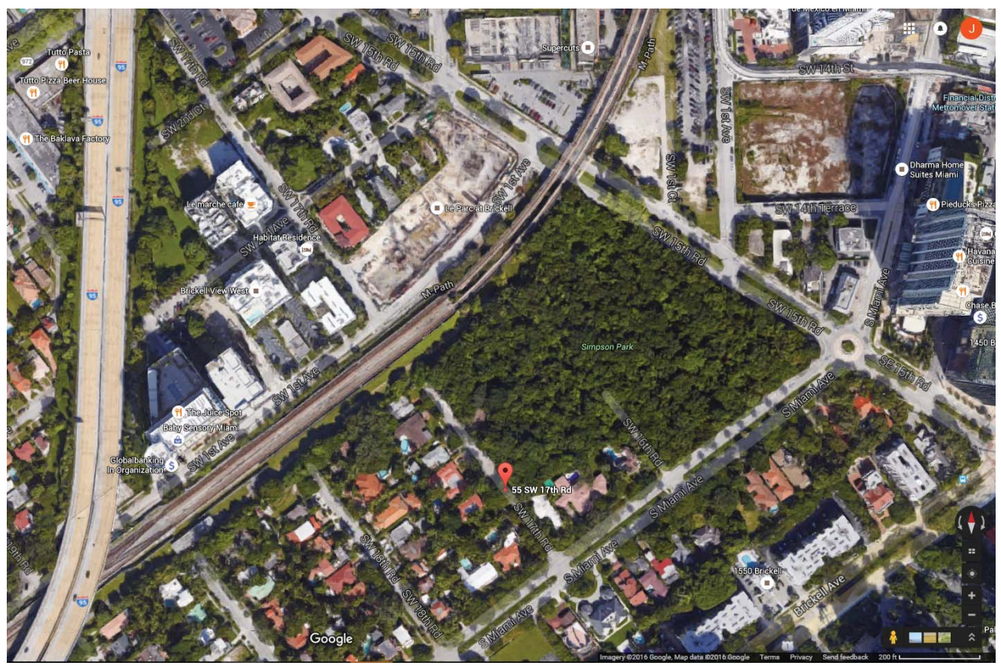
HISTORY

Simpson Park is a 7.8-acre oasis of tropical hardwood hammock biodiversity located in Miami's Brickell district. The city purchased approximately 8.5 acres of land from Mary Brickell in 1916 to preserve this small tract of native subtropical jungle. In the 1930's it was named after the author and naturalist Charles Torrey Simpson. The once vast and most diverse hammock in South Florida spanned from the Miami River down to Coconut Grove. The dense forest grows on a natural elevation of a few inches to a few feet. The canopy serves as shelter to many native fauna, as well as, fifteen endangered and nine threatened plant species.

MICROCLIMATE

The climate in the understory is shaded, humid and damp. Wind is greatly dampened, resulting in a still environment. Heat and humidity speeds up the decomposition of matter resulting in poor soil quality beyond the top layer.

55 SW 17 Road, Miami 33129



EMERGENT LAYER

Typically evergreens, which are able to withstand harsher temperatures and higher winds. Eagles, butterflies, and bats inhabit this layer.

CANOPY LAYER

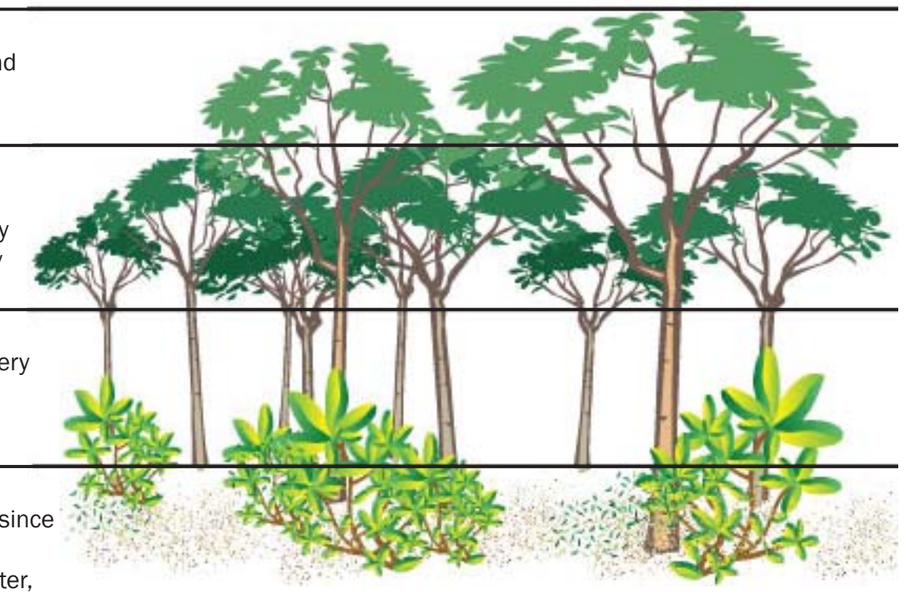
The densest areas of biodiversity are found in the forest canopy, a continuous cover formed by adjacent treetops. It traps moisture & humidity underneath & blocks ~95% of the sunlight.

UNDERSTORY LAYER

The leaves are much larger at this layer since very little light makes it down from the canopy.

FOREST FLOOR

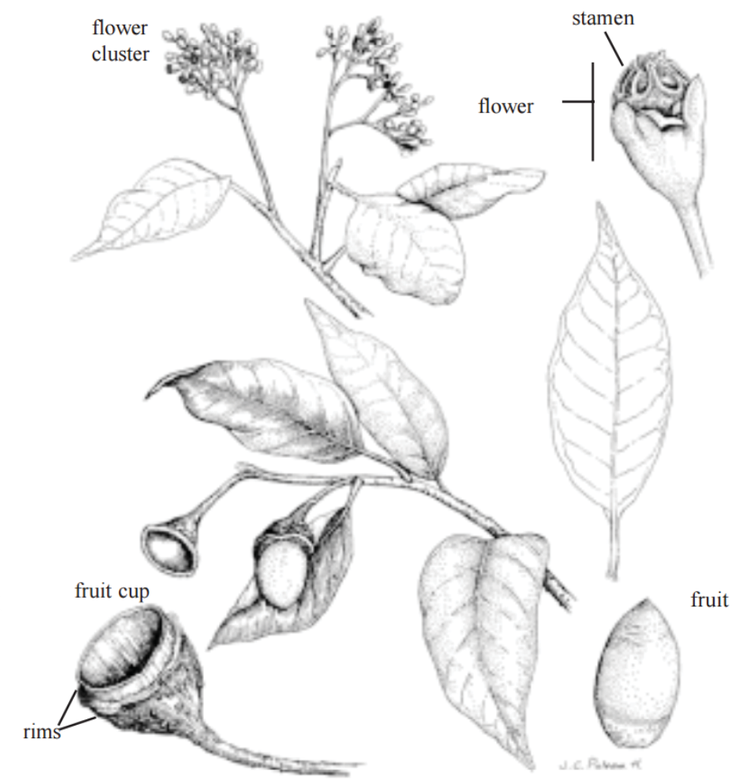
The forest floor is relatively clear of vegetation, since very little sunlight penetrates to ground level. It contains mostly decaying plant and animal matter, which disappear quickly due to the lack of sunlight.



http://blog.growingwithscience.com/wp-content/uploads/2011/11/rainforest-diagram.jpg

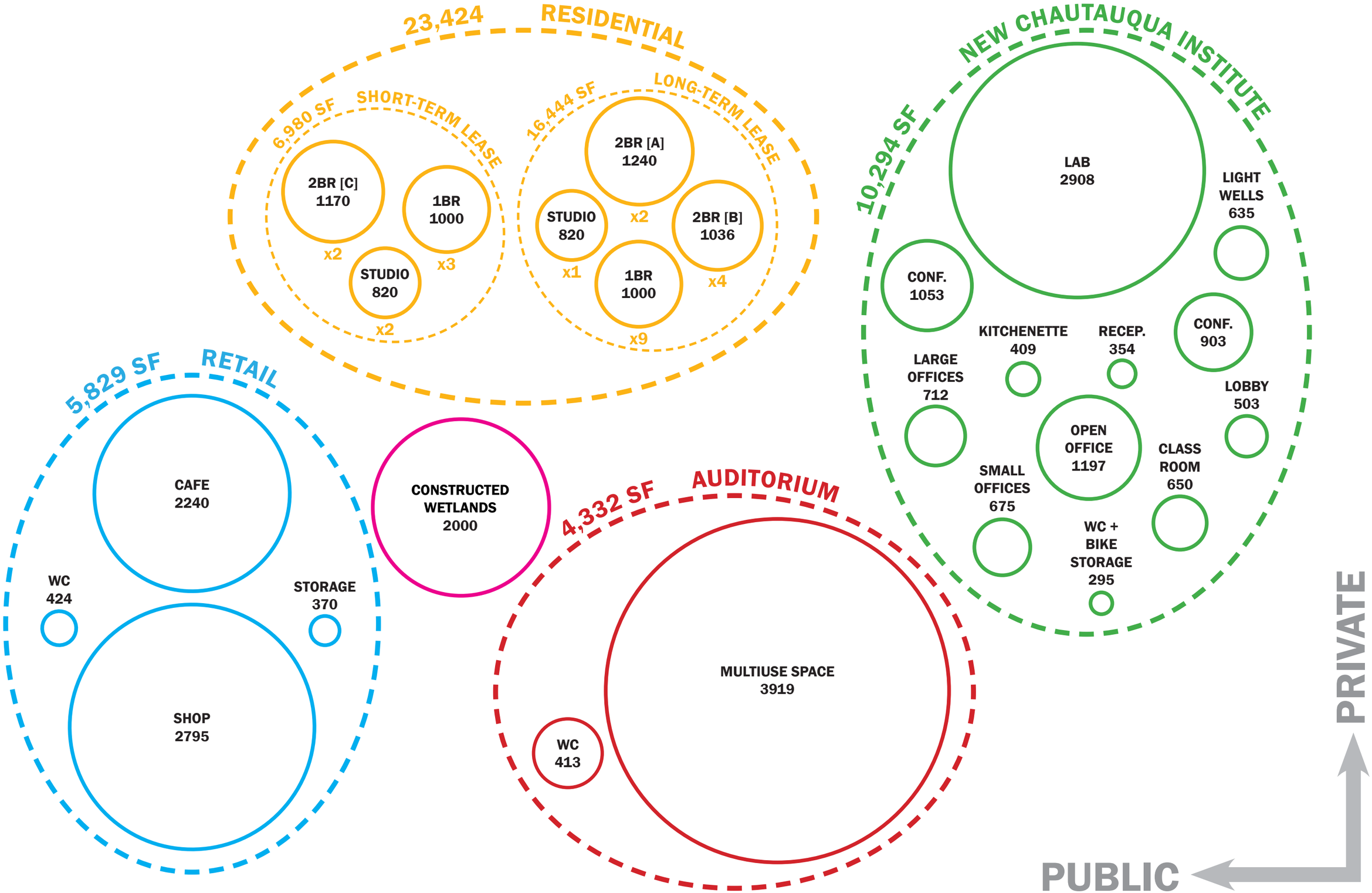
ENDANGERED AND THREATENED SPECIES

The most notable of the endangered plant species is the *Licaria triandra*. Before Hurricane Katrina, Simpson Park housed the only reproductive adult of *Licaria triandra* in the United States. Like many tropical canopy species, this species maintains a population of thousands of seedlings and juveniles waiting in the understory of the hammock canopy. Hurricane Katrina felled the only adult Licaria triandra, allowing the waiting juveniles and seedlings to quickly respond with new, flushed leaves and growth.



http://www.fnai.org/FieldGuide/pdf/Licaria_triandra.pdf

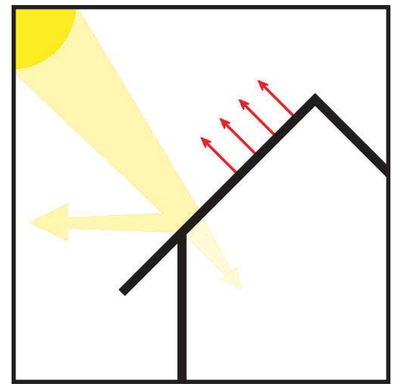
PROGRAM AREA TAKEOFFS



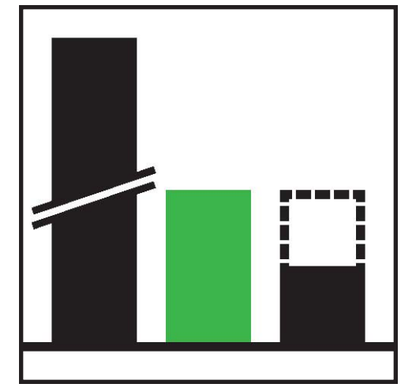
URBAN + ENVIRONMENTAL FORCES

CONNECTION TO PARK

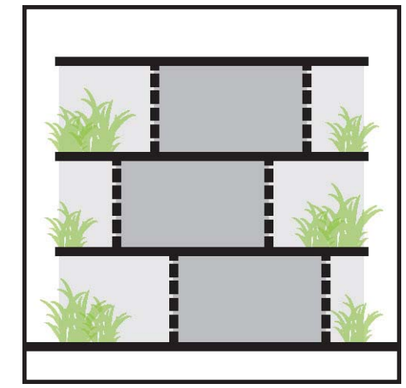
RESTORING HABITAT



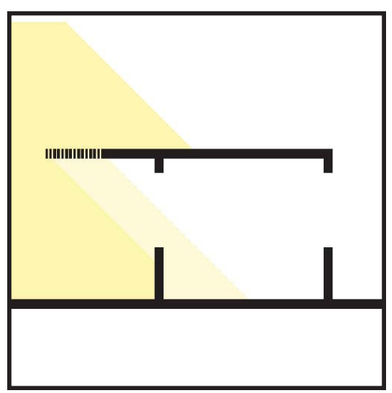
MITIGATE HEAT ISLAND EFFECT



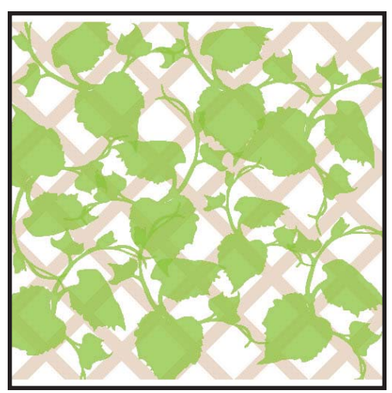
MEDIUM DENSITY SCALE



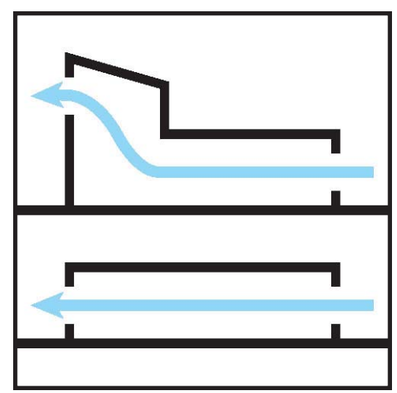
BLURRING THE LINE BTWN INSIDE + OUT



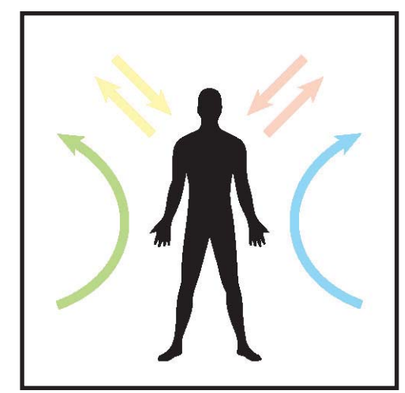
ARCHITECTURAL SHADING



VEGETATIVE SHADING

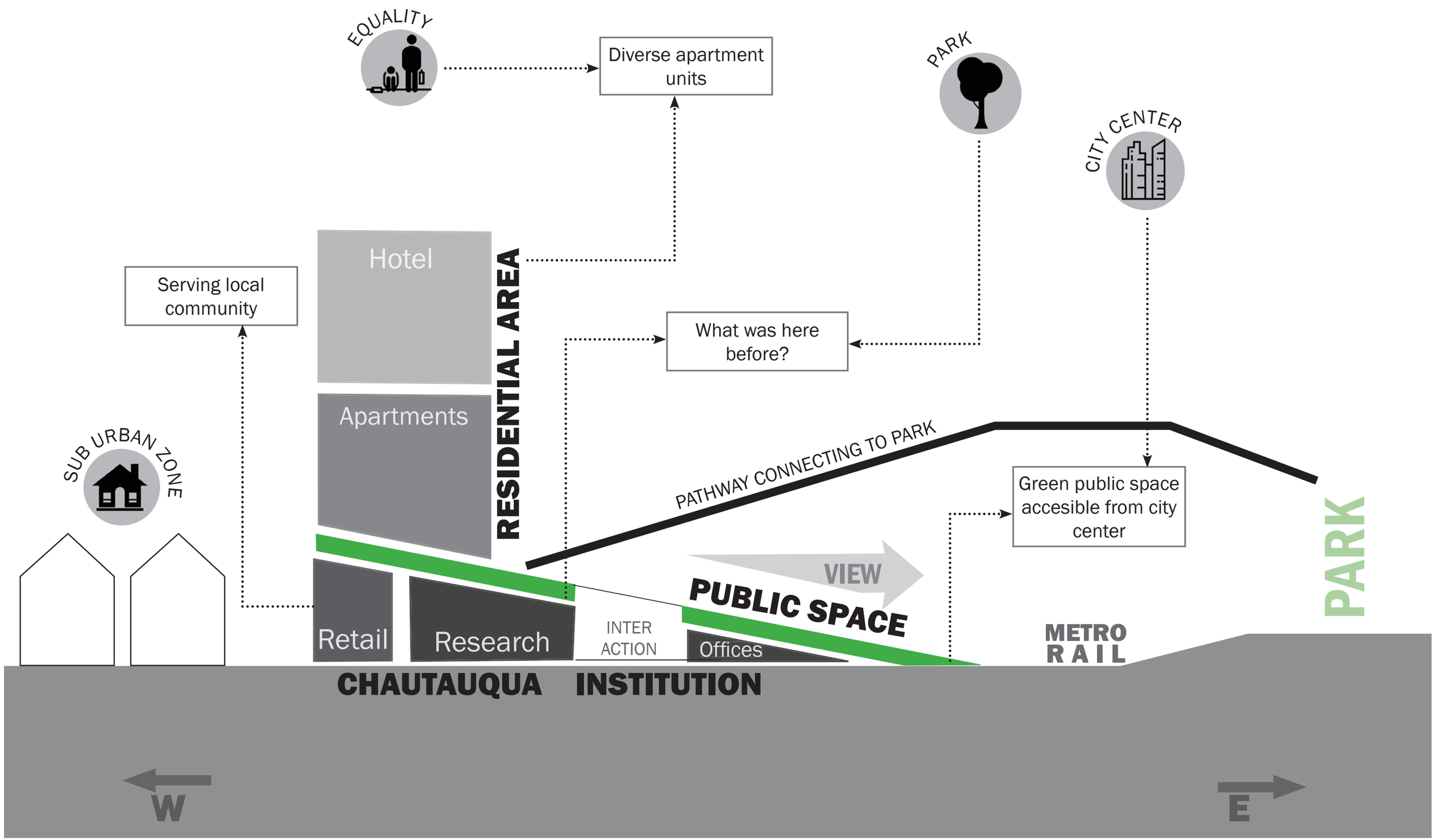


VENTILATION



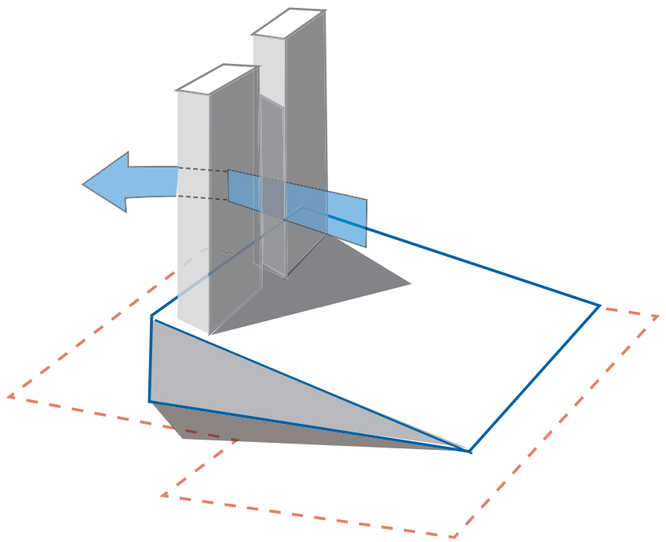
MAXIMIZE THERMAL COMFORT

PROGRAM SYNTHESIS

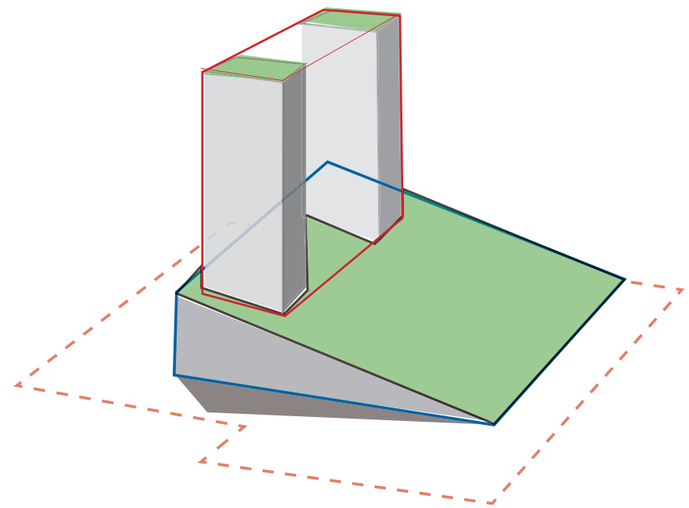


EARLY CONCEPTUAL MASSING STUDIES

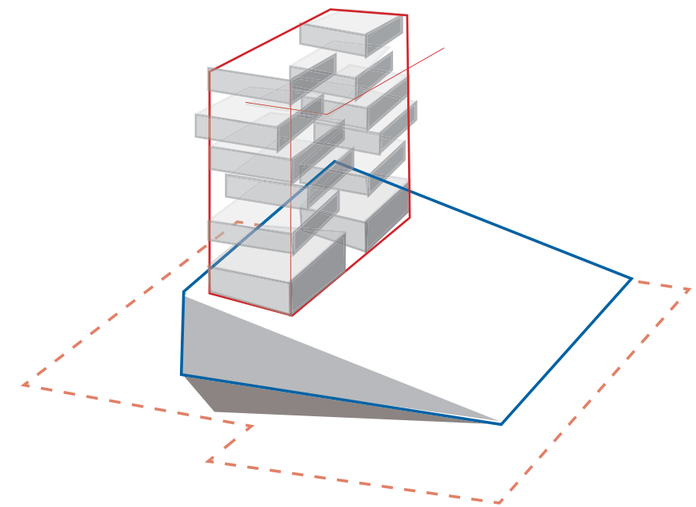
LIVING / PRIVATE SPACE
CONCEPTUAL STUDY DIAGRAMS



Thin massing to maximize natural ventilation potential and allow for shading from structures

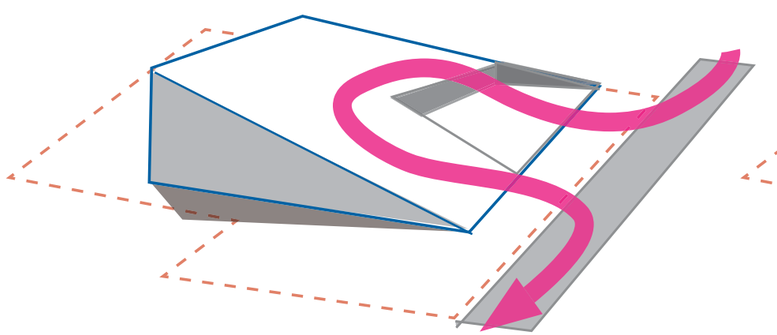


Water harvesting by sloping surfaces and green roofs

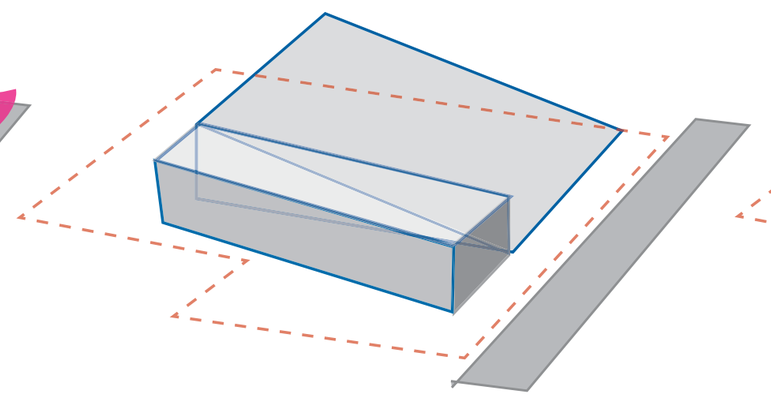


Staggering to allow for terrace spaces

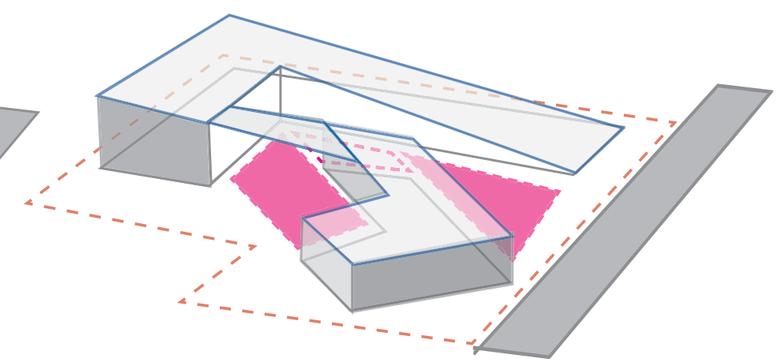
WORK / PUBLIC SPACE
CONCEPTUAL STUDY DIAGRAMS



Inviting site corner with public plaza, place for respite, contemplation.

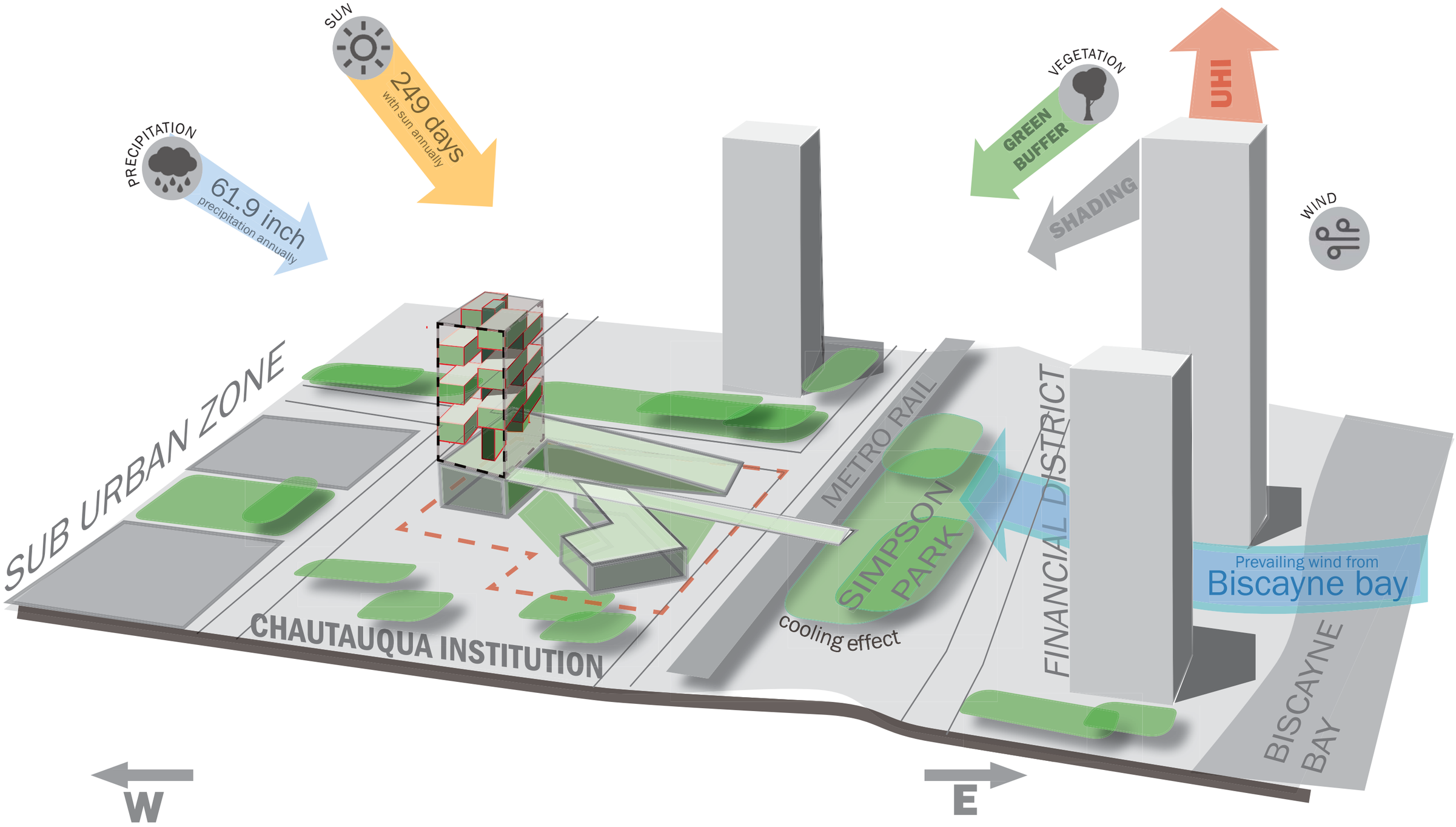


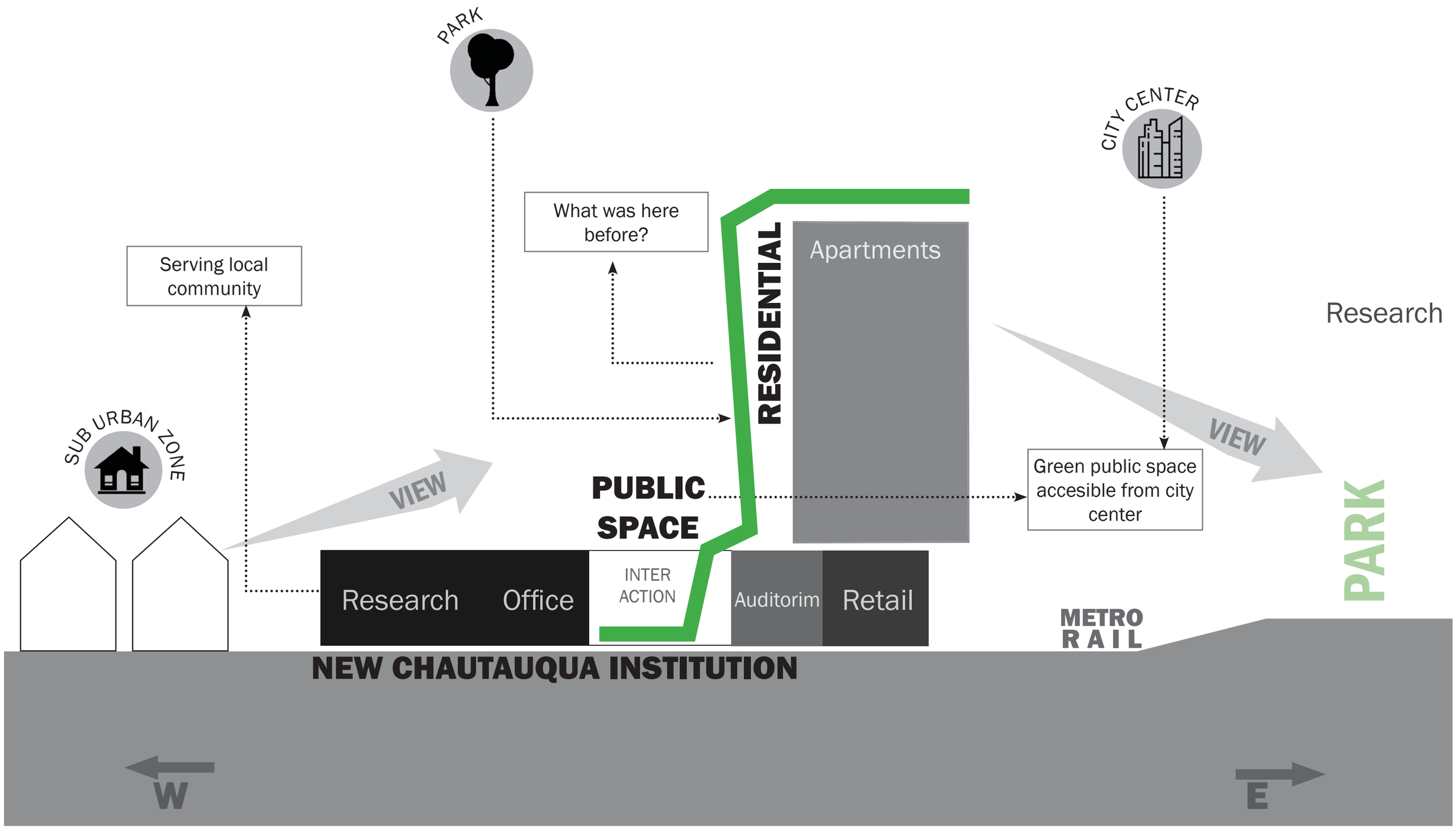
Green house to the south for study of natural flora and fauna.



Private courtyard tucked away to the inside for office and residential use.

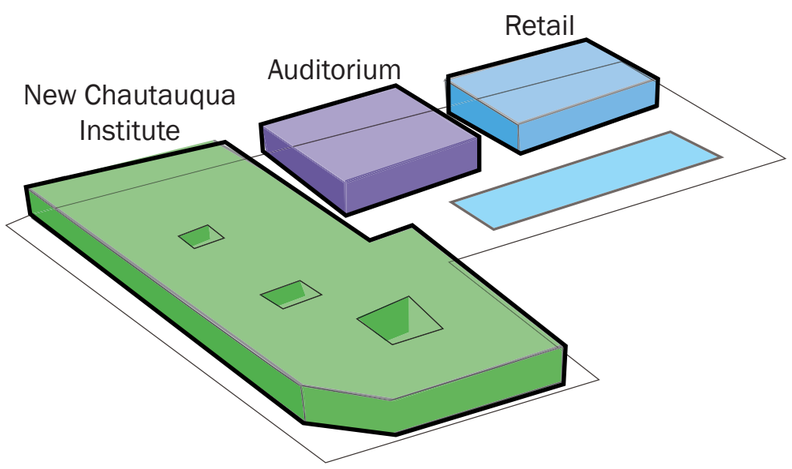
EARLY CONCEPTUAL MASSING STUDIES



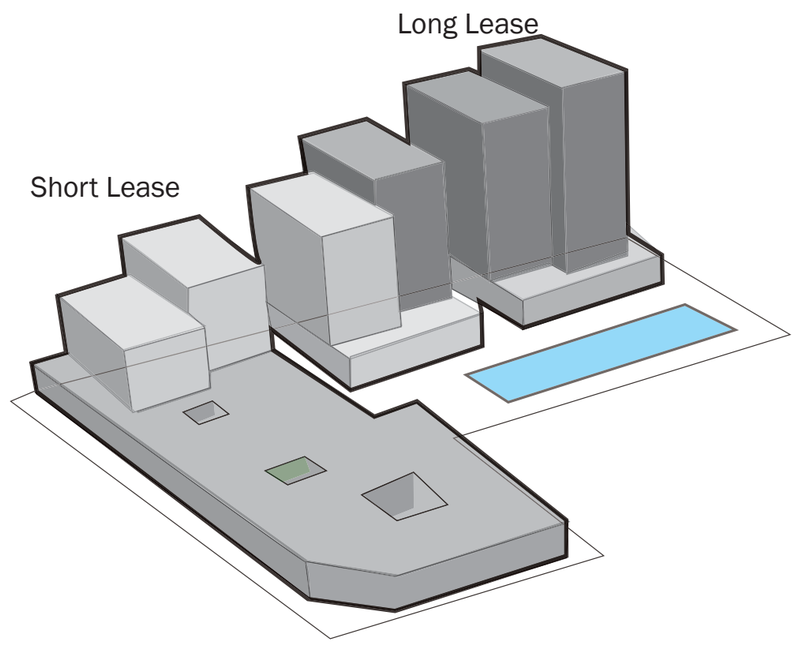

PARK
CITY CENTER
What was here before?
Serving local community
RESIDENTIAL
Apartments
SUB URBAN ZONE
VIEW
VIEW
PUBLIC SPACE
Green public space accesible from city center
Research
Office
INTER ACTION
Auditorim
Retail
PARK
METRO RAIL
NEW CHAUTAUQUA INSTITUTION
W
E

Research

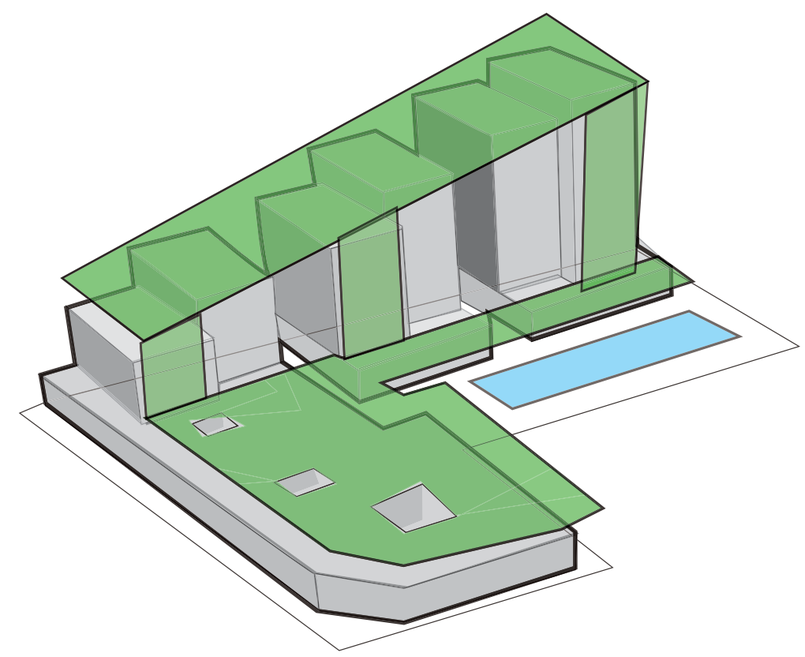
MASSING APPROACH



GROUND FLOOR

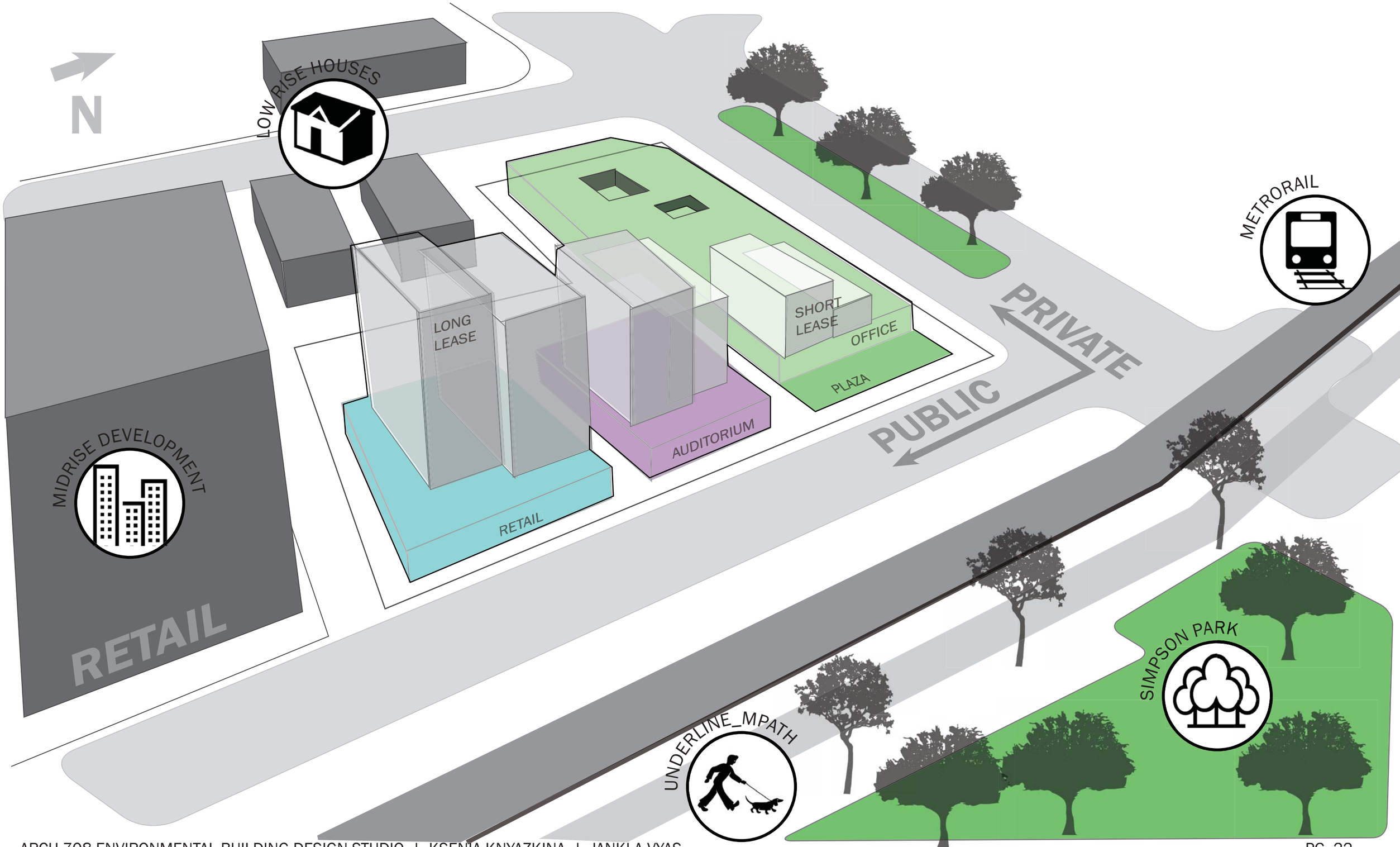


RESIDENTIAL UNITS

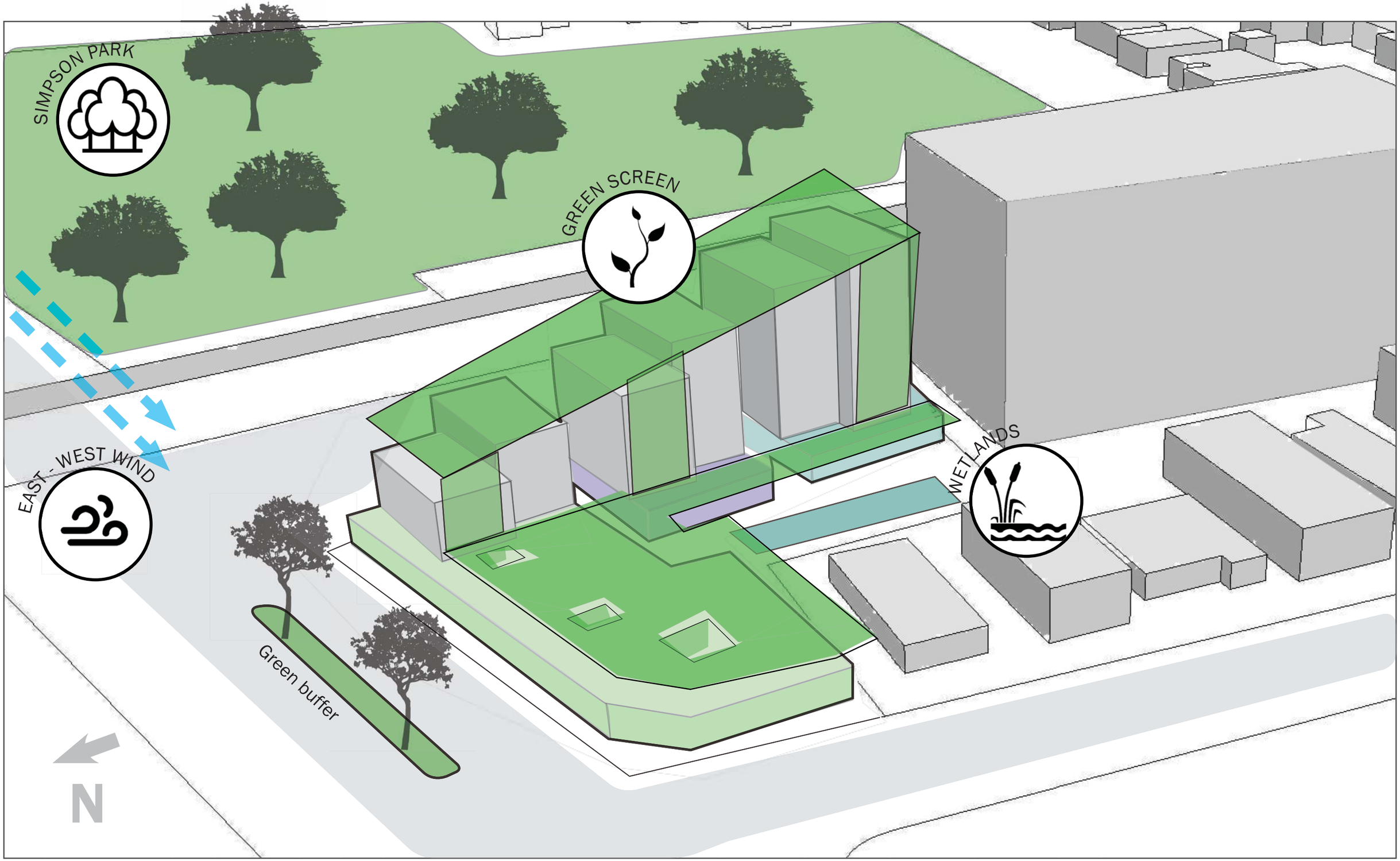


SCREEN

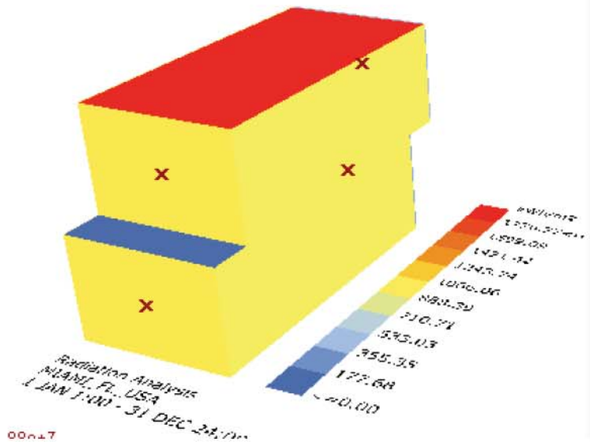
URBAN FORCES



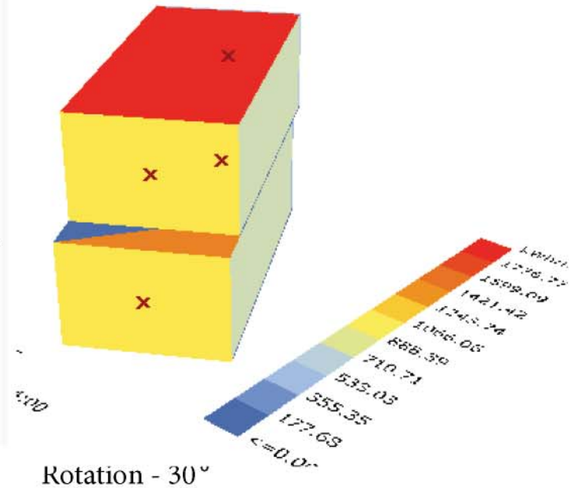
ENVIRONMENTAL FORCES



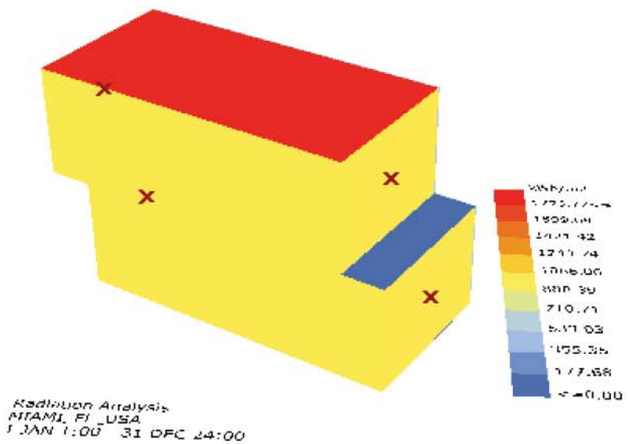
RESIDENTIAL UNIT DAYLIGHT & RADIATION STUDY



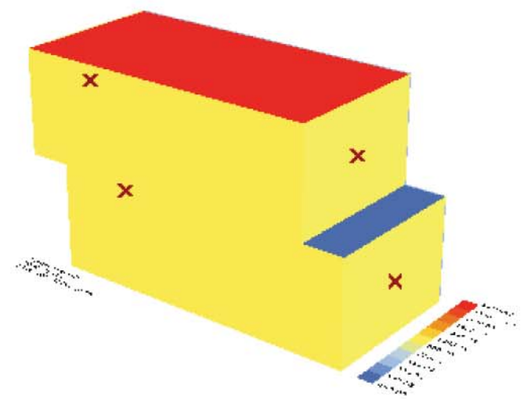
Rotation - 0°
Solar gains 16.39 MW/ft2



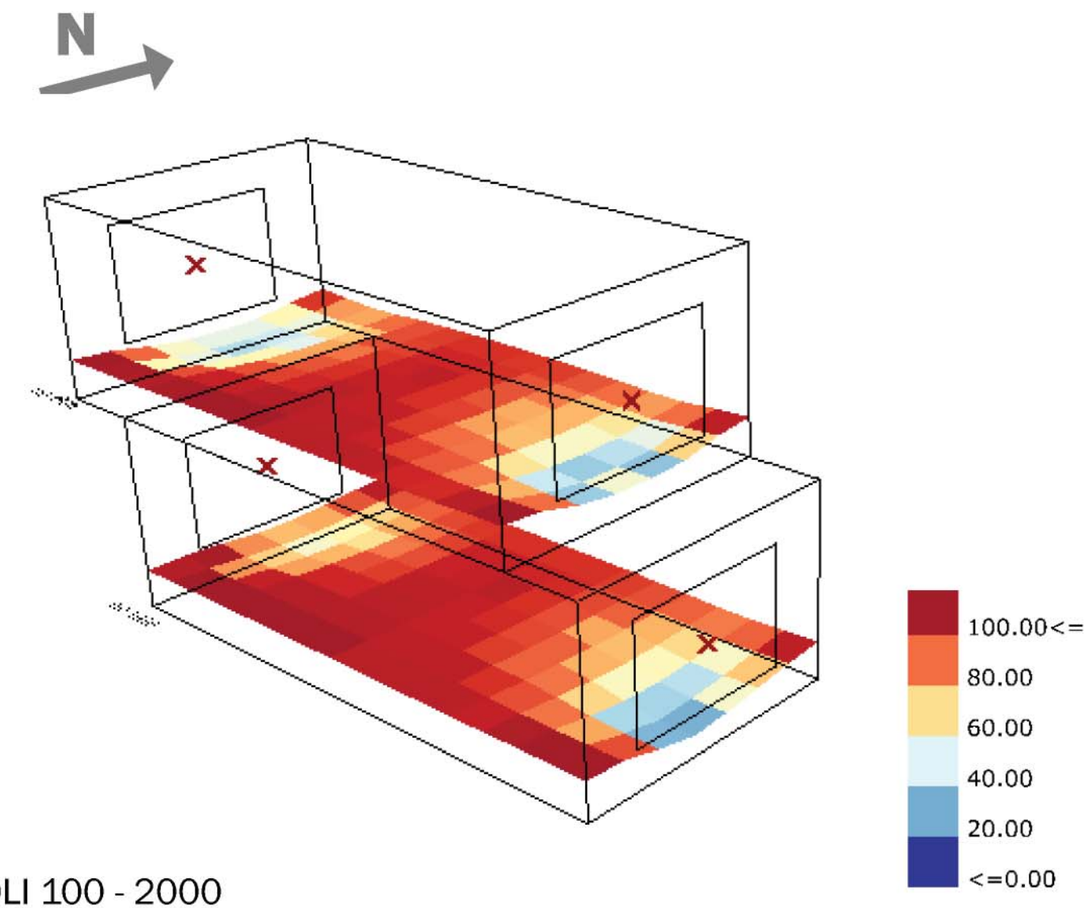
Rotation - 30°
Solar gains 16. MW/ft2



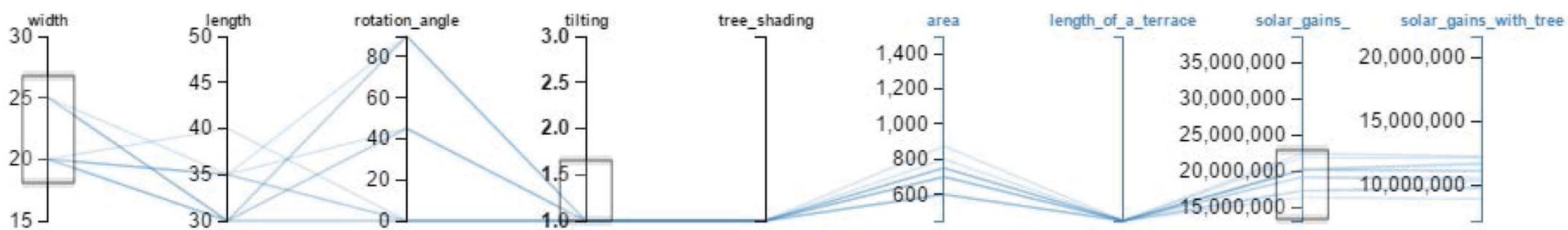
Rotation - 60°
Solar gains 14.17 MW/ft2



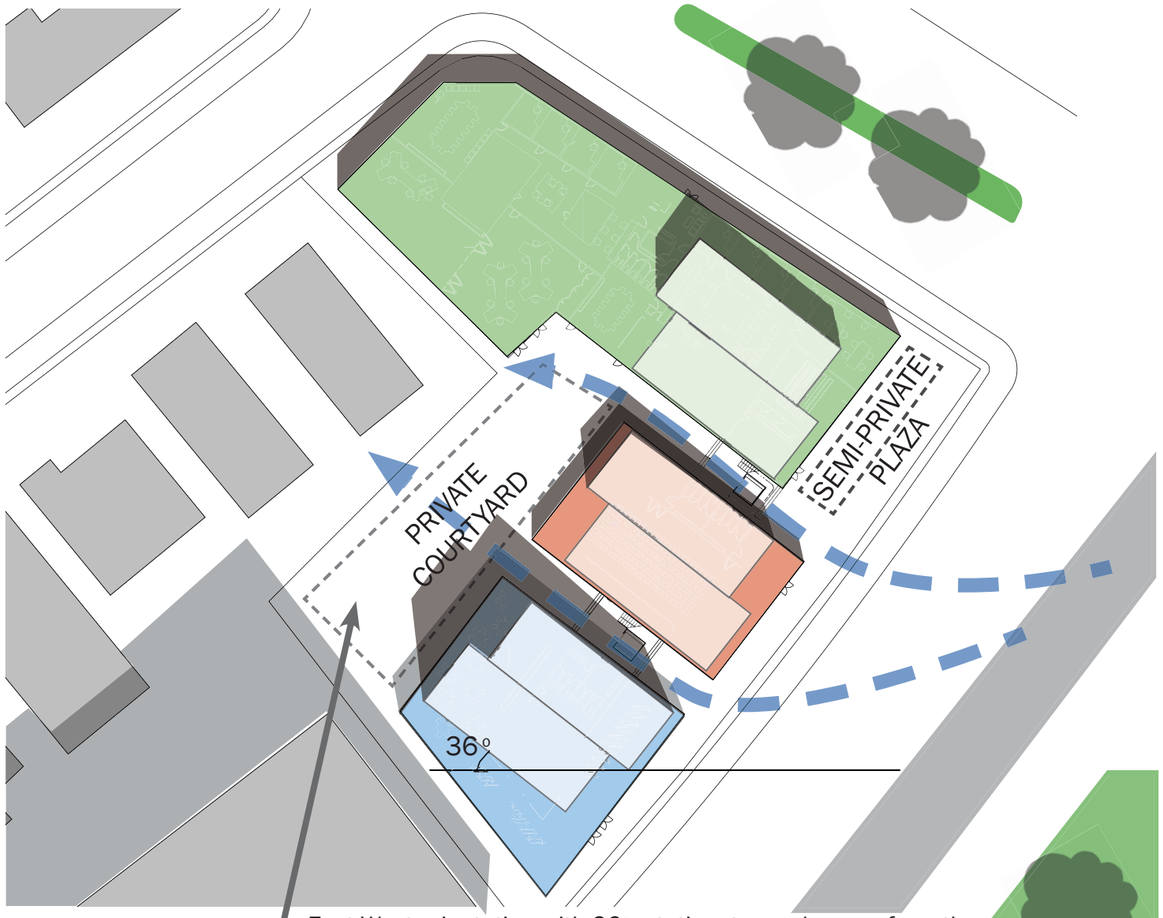
Rotation - 90°
Solar gains 13.39 MW/ft2



UDLI 100 - 2000

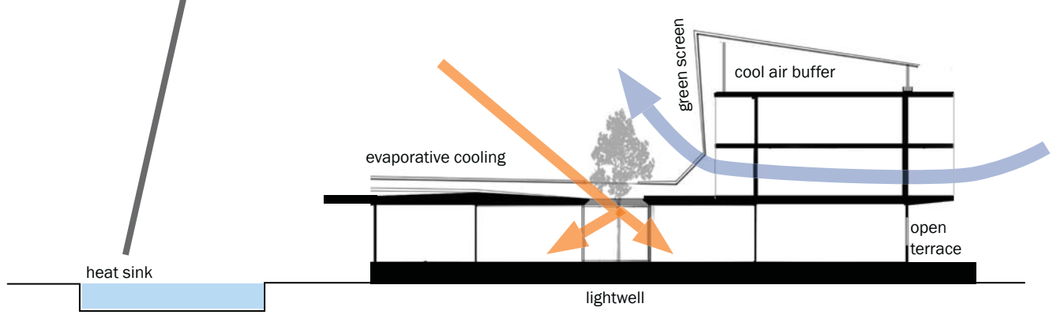


ORIENTATION

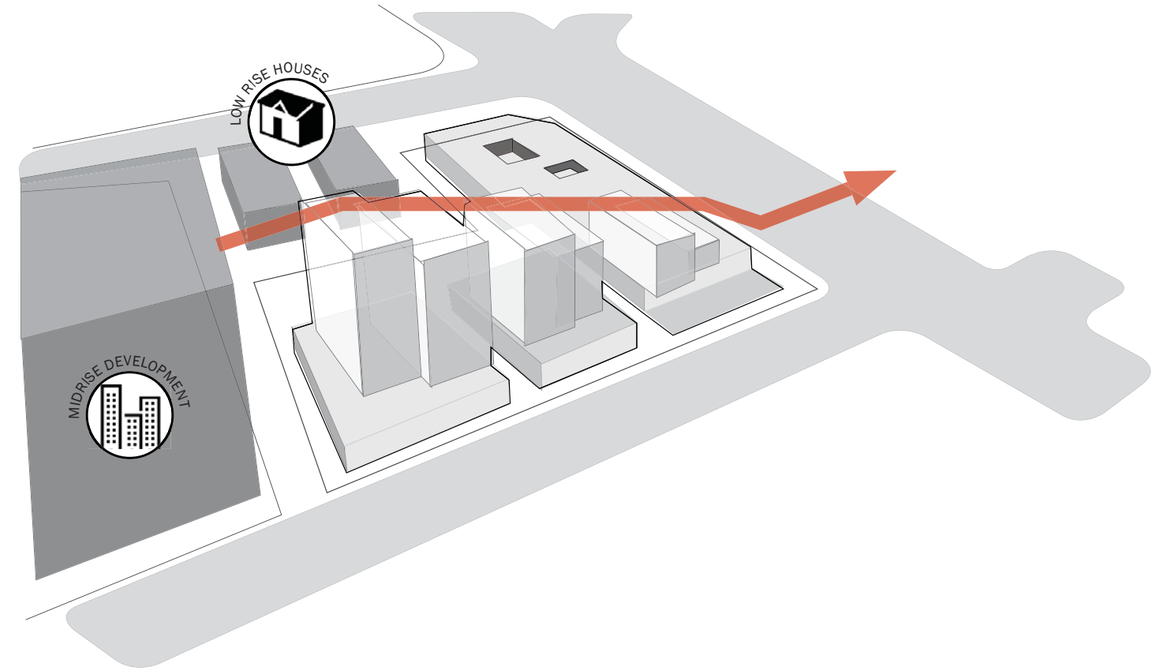


East-West orientation with 36° rotation, to use breeze from the ocean and shade parts of the west facade from evening sun.

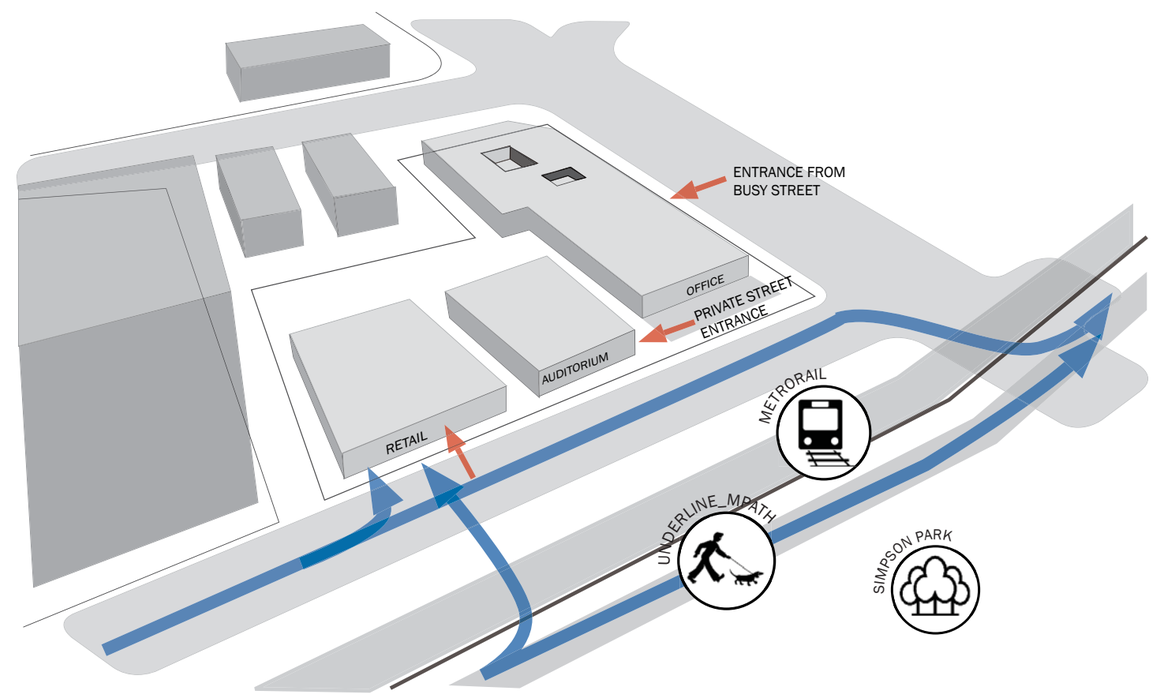
WETLANDS AS A HEAT SINK



MIDRISE - LOWRISE HEIGHT MITIGATION

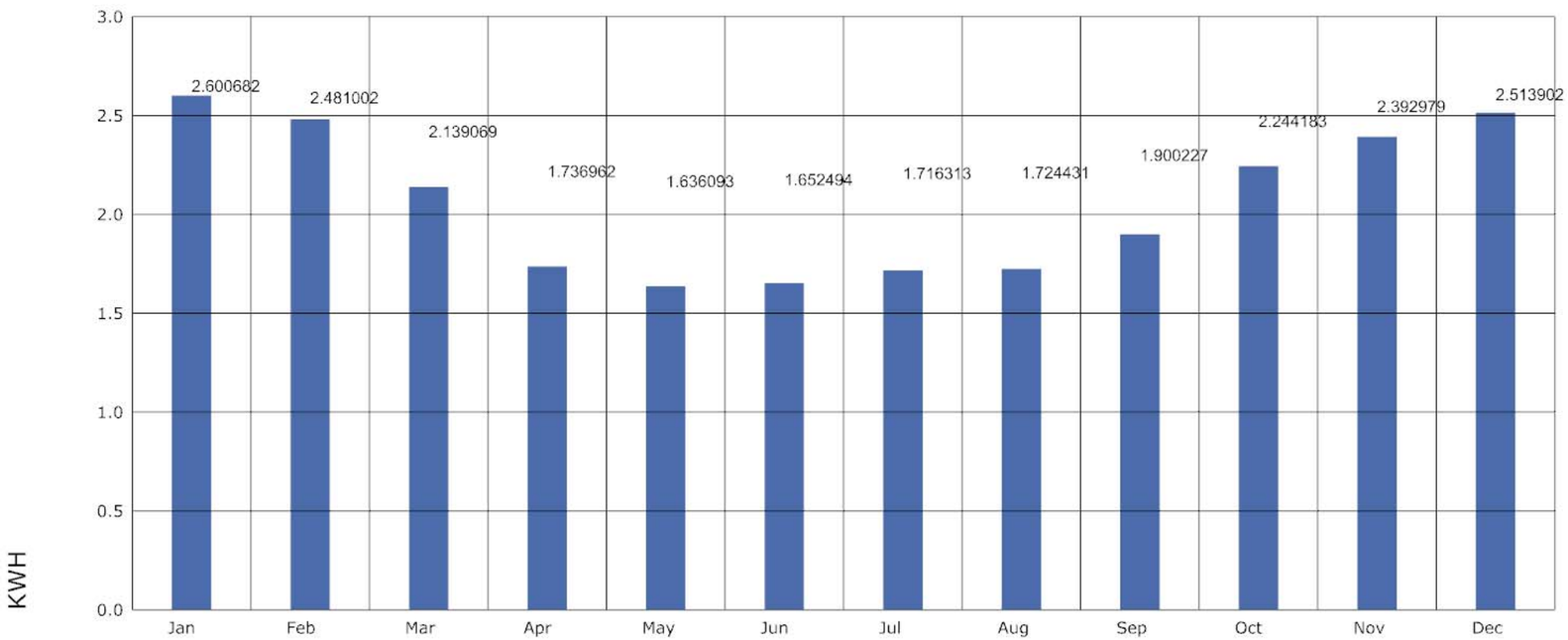


ENTRANCE HIERARCHY



ENERGY SIMULATIONS_SIMPLE THERMODYNAMIC STUDY

AVERAGE SOLAR GAIN



NATURAL VENTILATION CONFIGURATION

20°C MIN OUTDOOR AIR TEMPERATURE

28°C MAX OUTDOOR AIR TEMPERATURE

TEST CASE CONSTRUCTION

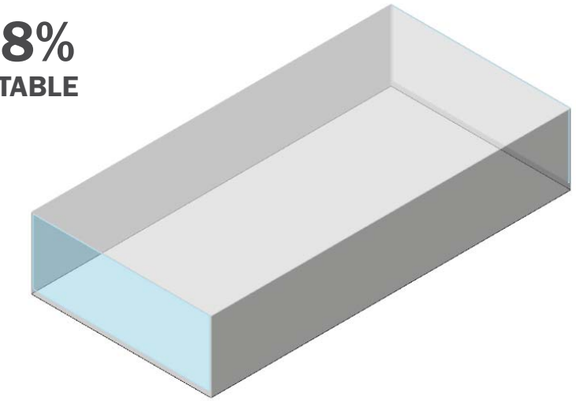
WALLS 1” STUCCO | 8” CONCRETE | +/- 1” INSULATION | 1/2” GYPBOARD

ROOF 8” CONCRETE | EXTENSIVE GREEN ROOF *

FLOOR 8” CONCRETE

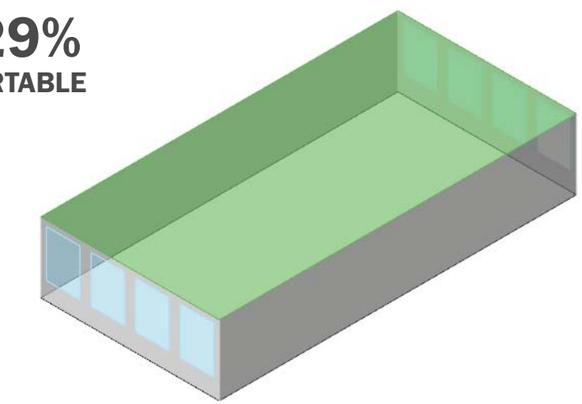
NO GREEN ROOF_90% GLAZED_70% OPEN

21.98%
COMFORTABLE



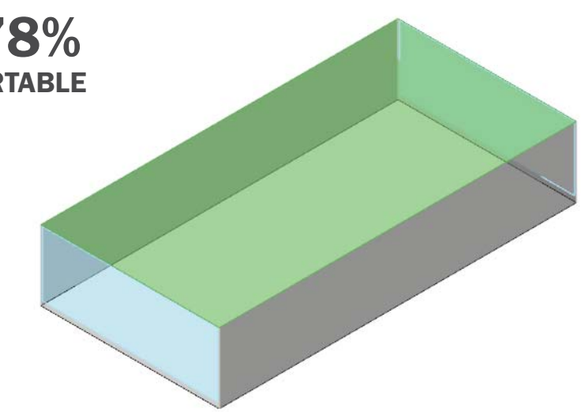
GREEN ROOF_50% GLAZED_50% OPEN

16.29%
COMFORTABLE

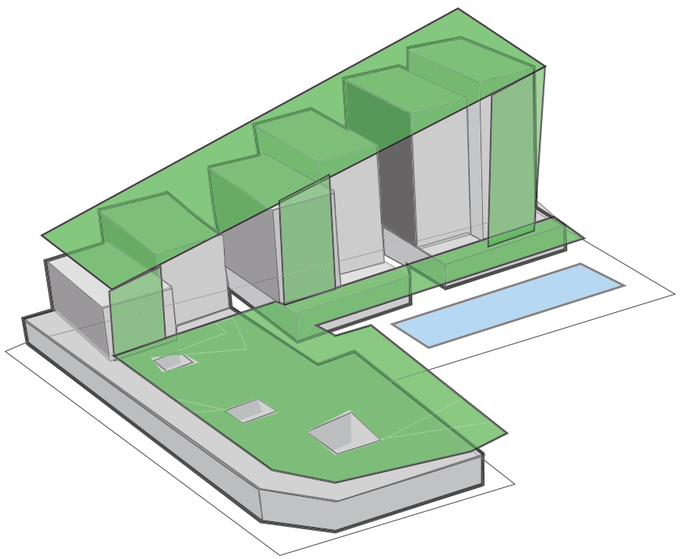


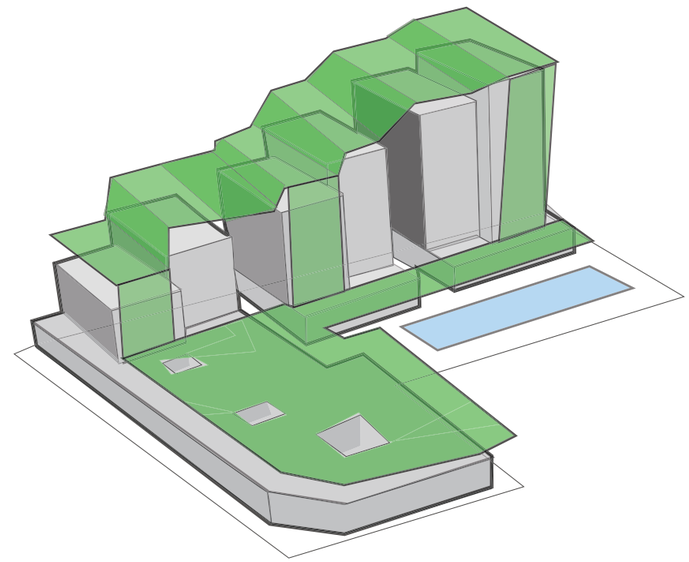
GREEN ROOF_90% GLAZED_70% OPEN

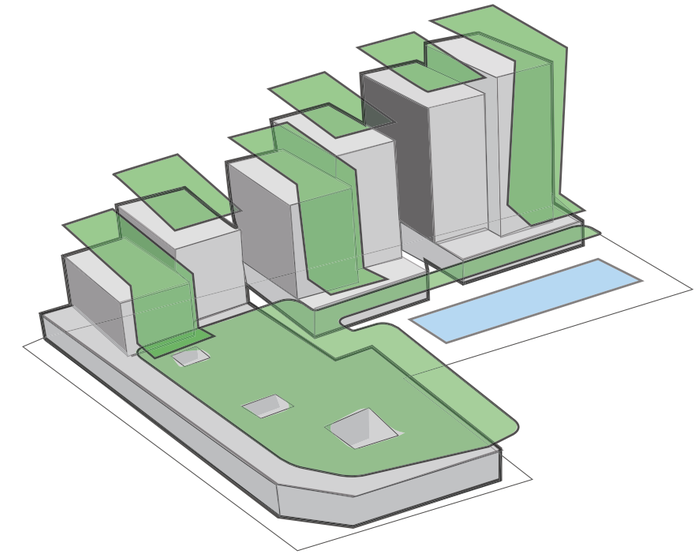
16.78%
COMFORTABLE



TRELLIS + VEGETATION STUDY







PASSION VINE

-

5-10 FT

YUCCA

3-6 FT

3-12 FT

WILD COFFEE

4-10 FT

4-10 FT

LEATHER FERN

3-5 FT

4-8 FT

MORNING GLORY

0.5 FT

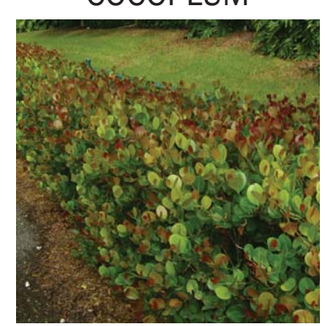
10-75 FT

SCRUB PALMETTO

4-6 FT

4-6 FT

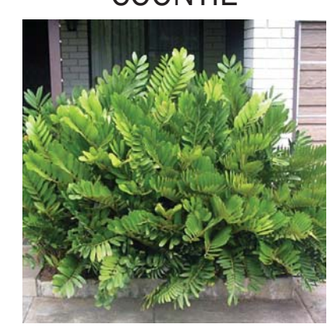
COCOPLUM



10-20 FT

3-30 FT

COONTIE



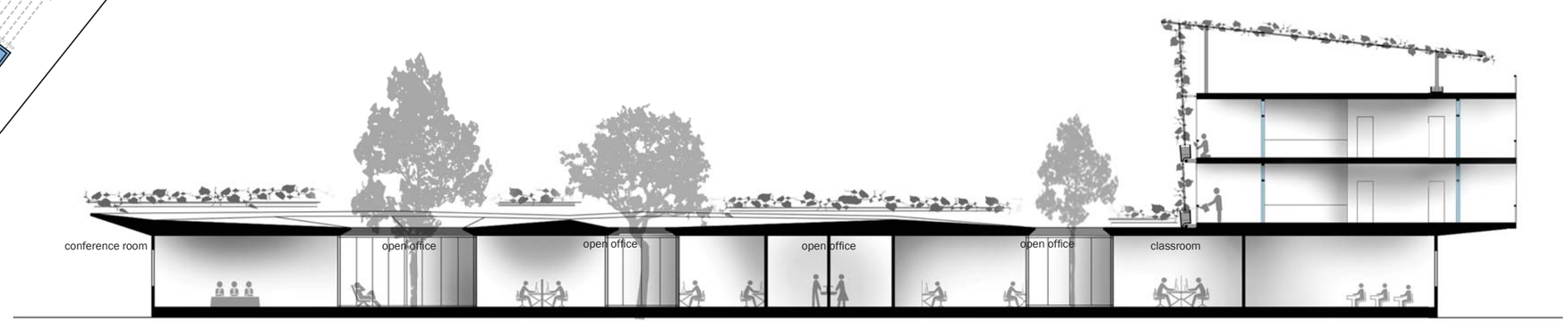
3-5 FT

1-5 FT

GROUND FLOOR

GROUND FLOOR PLAN

SITE PLAN



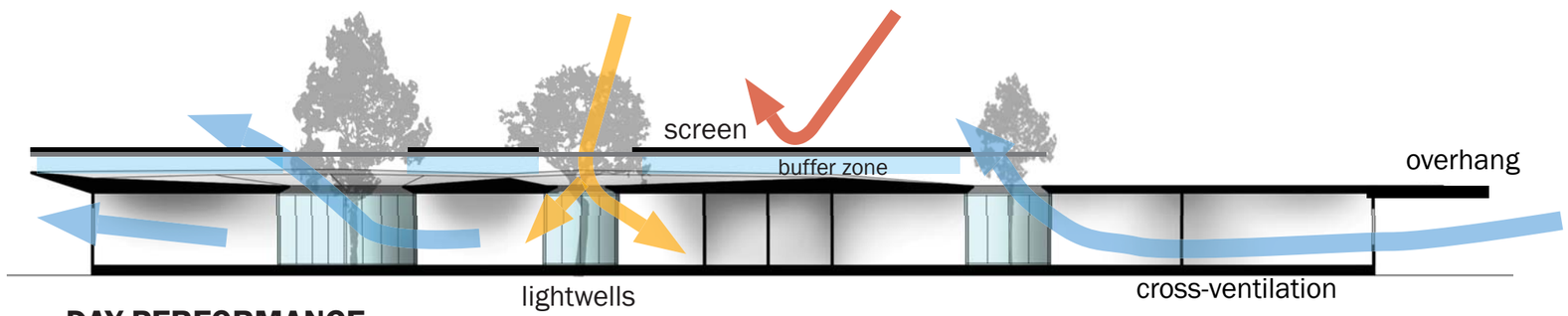
SECTION A-A

OFFICE REQUIREMENTS + KEY DESIGN FACTORS

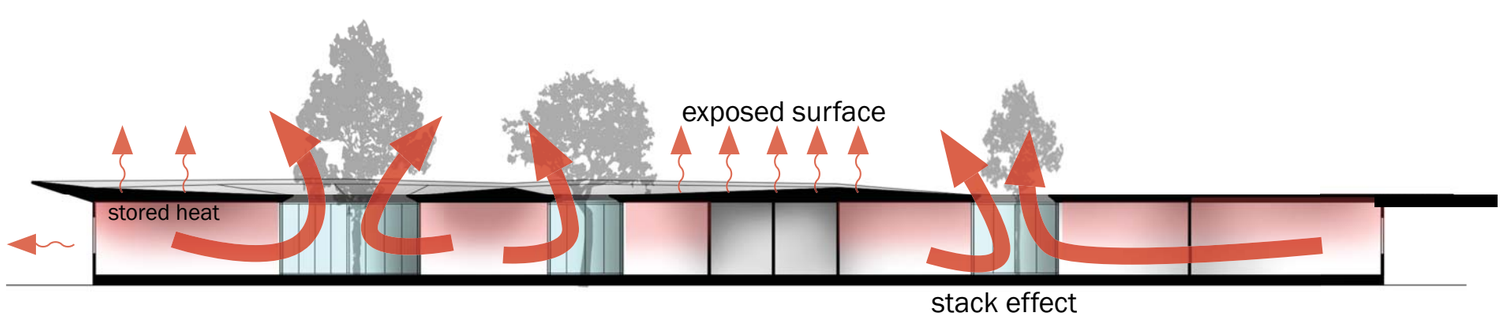
DAYLIGHTING
Evenly spread sunlight
300 lux min

GLARE
Prevent overlit spaces
and glare

THERMAL COMFORT
Maintain temperature
in a range 20 - 28 C



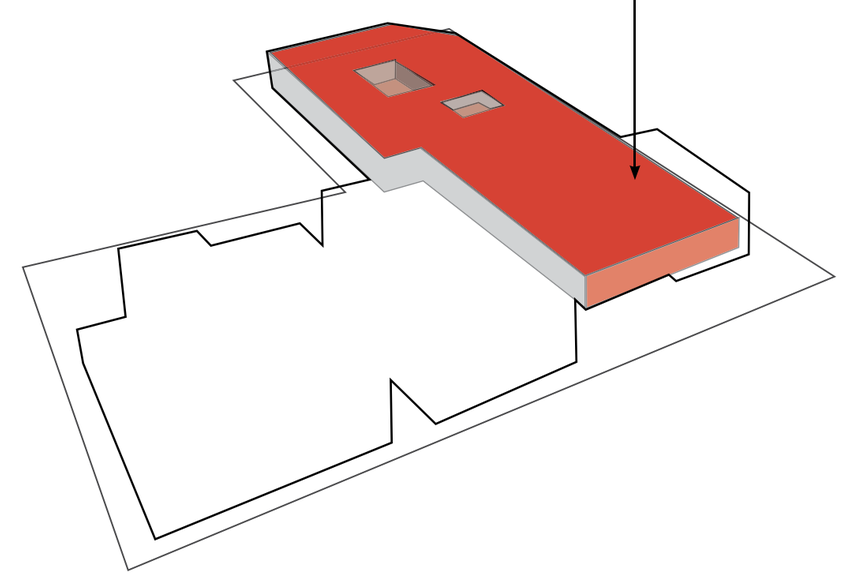
DAY PERFORMANCE



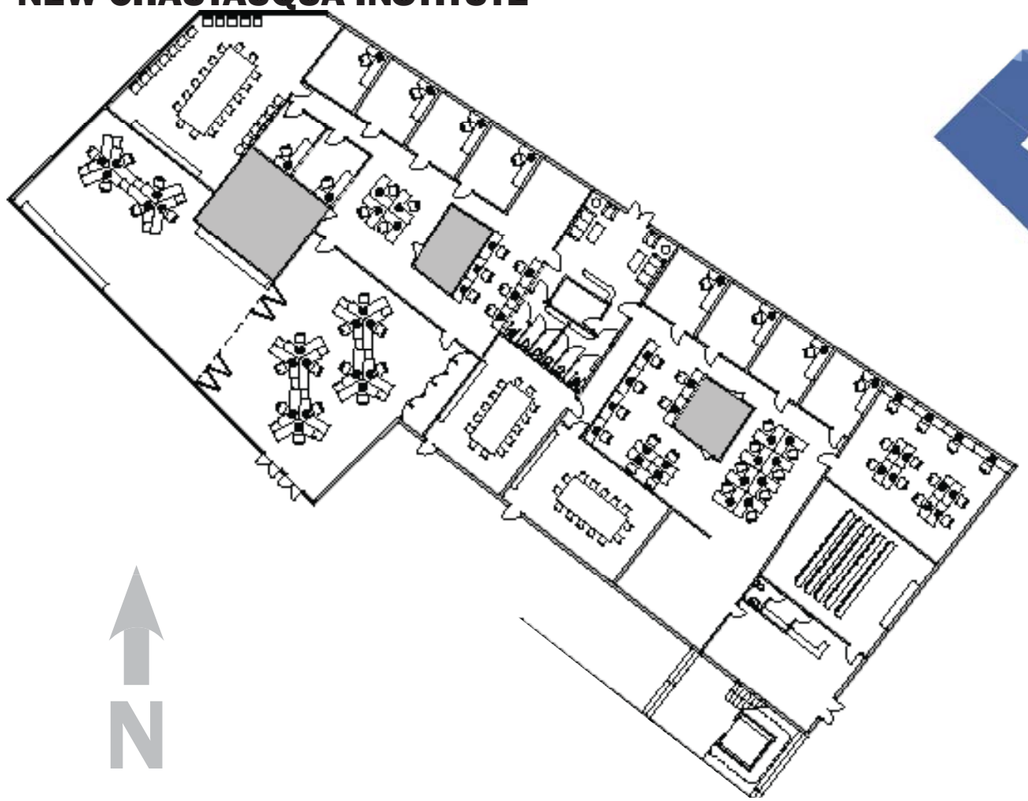
NIGHT PERFORMANCE

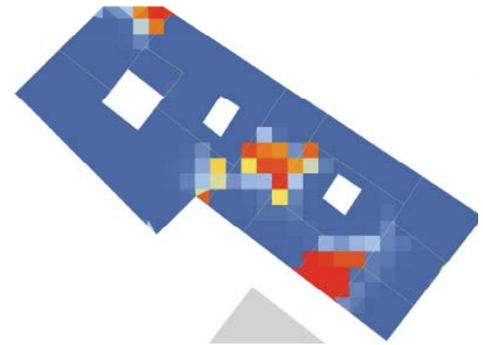
PROBLEMATIC ZONES

Roof Exposed to direct solar radiation.
East & West Exposed to the sun

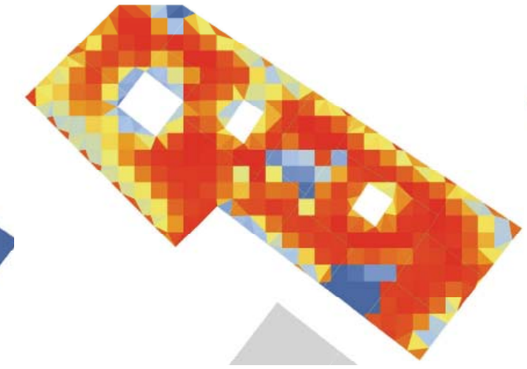


NEW CHAUTAUQUA INSTITUTE

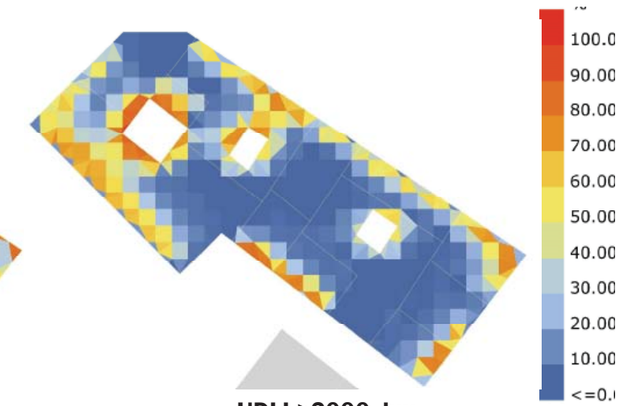




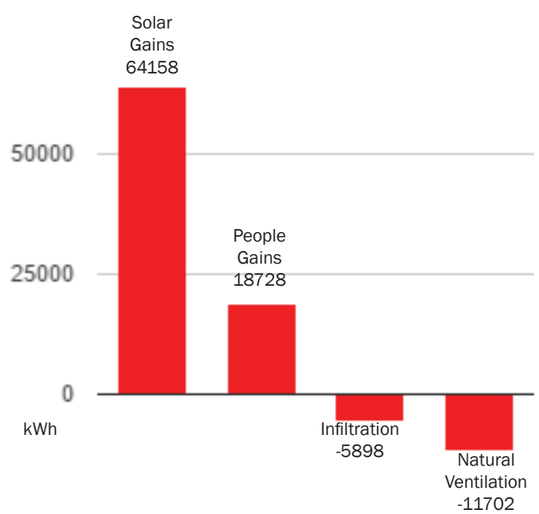
UDLI <100 lux

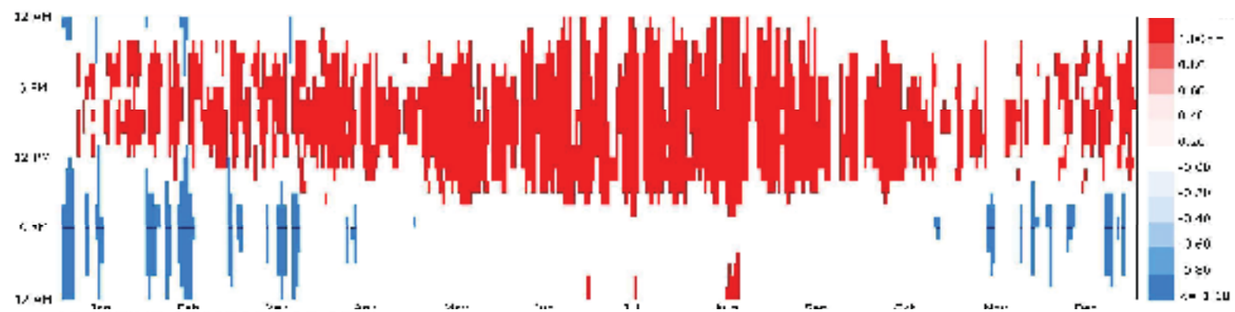


UDLI 100<2000 lux

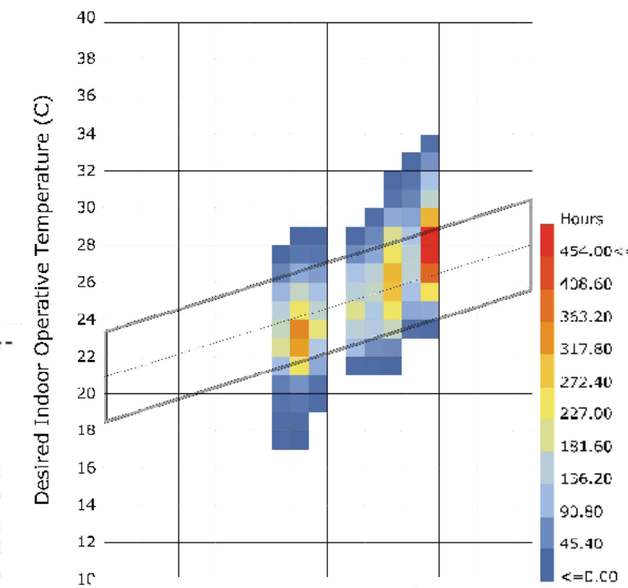


UDLI >2000 lux

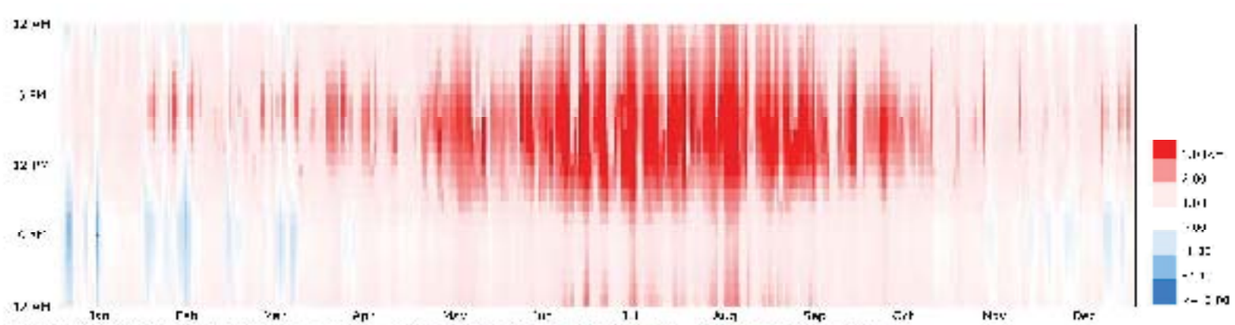




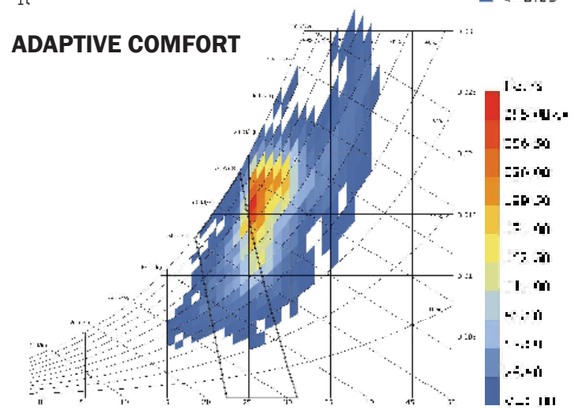
ADAPTIVE COMFORT 65,67 % 1 - hot , 0 - comfortable , -1 - cold



ADAPTIVE COMFORT

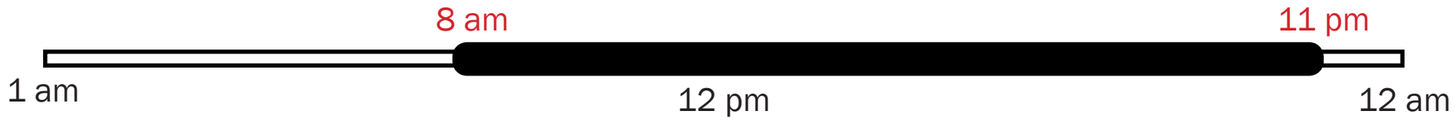


PMV 12.80% 3 - hot , 2 - warm, 1 - slightly warm, 0 - neutral , -1 - slightly cool, -2 - cool, -3 - cold



PSYCHROMETRIC CHART

AUDITORIUM REQUIREMENTS + KEY DESIGN FACTORS



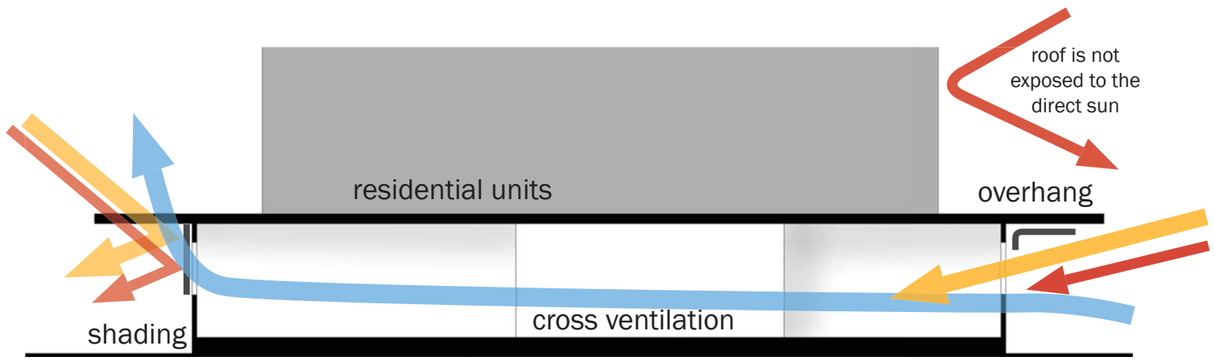
REQUIRED COMFORTABLE HOURS

DAYLIGHTING
Evenly spread sunlight
300 lux min

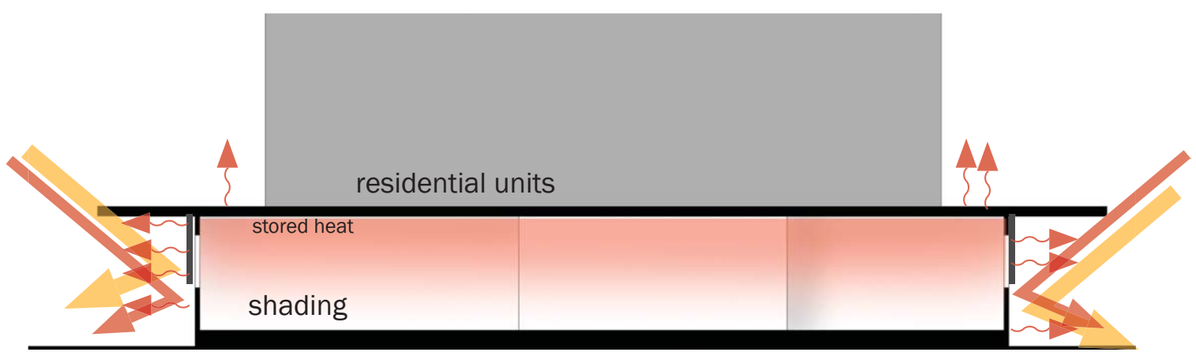
GLARE
Prevent overlit spaces
and glare

THERMAL COMFORT
Maintain temperature
in a range 20 - 28 C

FLEXIBILITY
Space designed to be
functional for multiple
uses

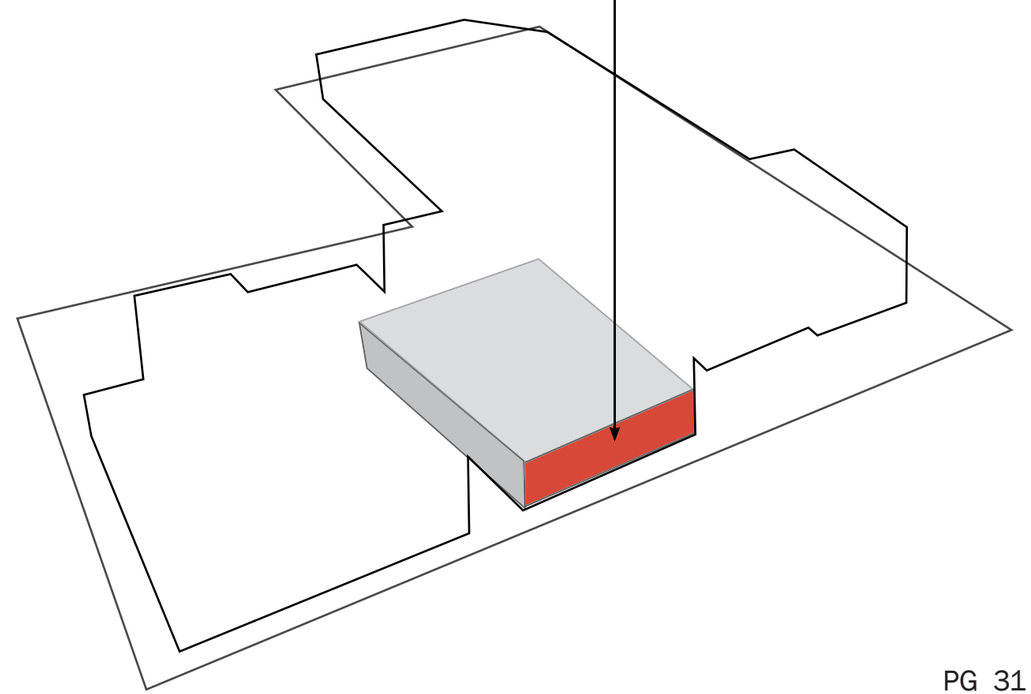


DAY / OCCUPIED PERFORMANCE

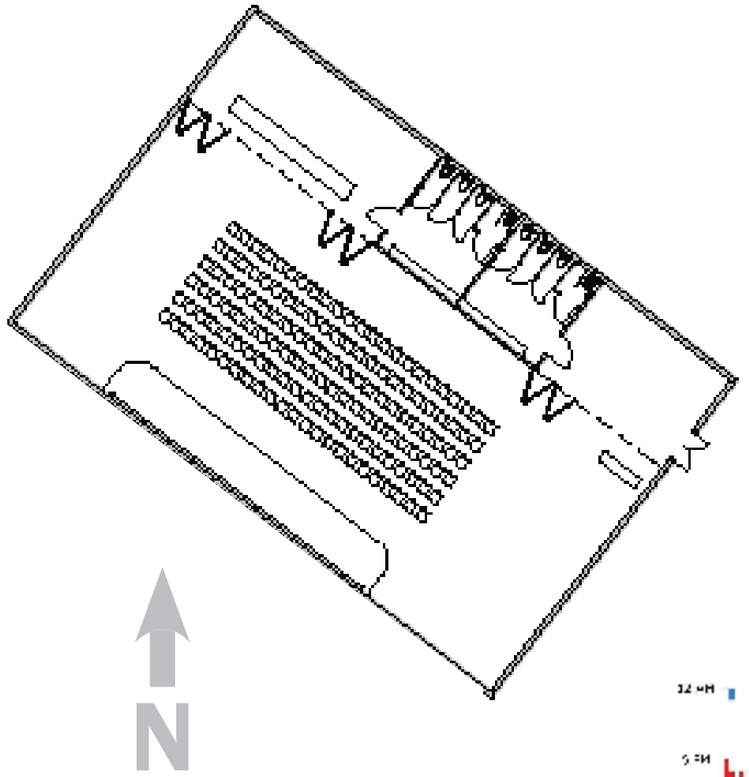


NIGHT / UNOCCUPIED PERFORMANCE

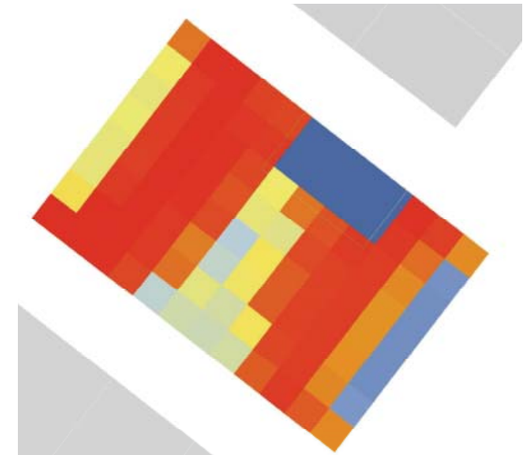
PROBLEMATIC ZONES
Roof Protected by Residential above. **East & West** Exposed to the sun



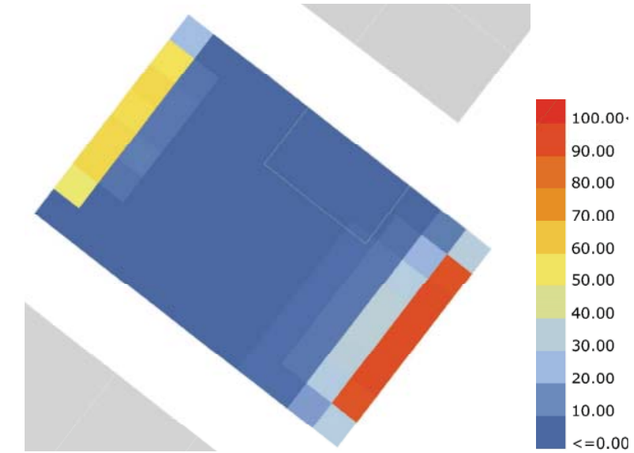
AUDITORIUM



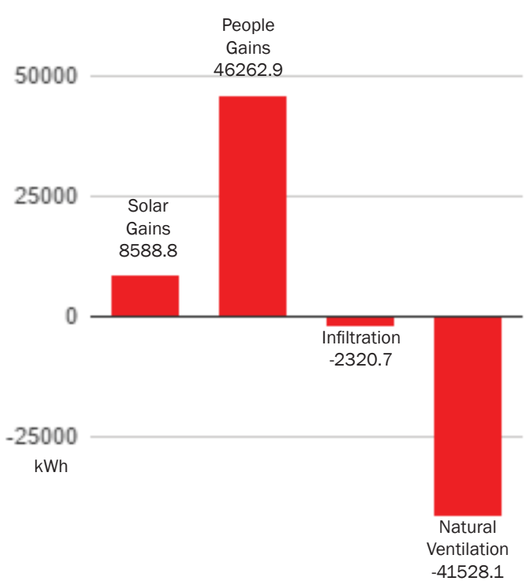
UDLI <100 lux

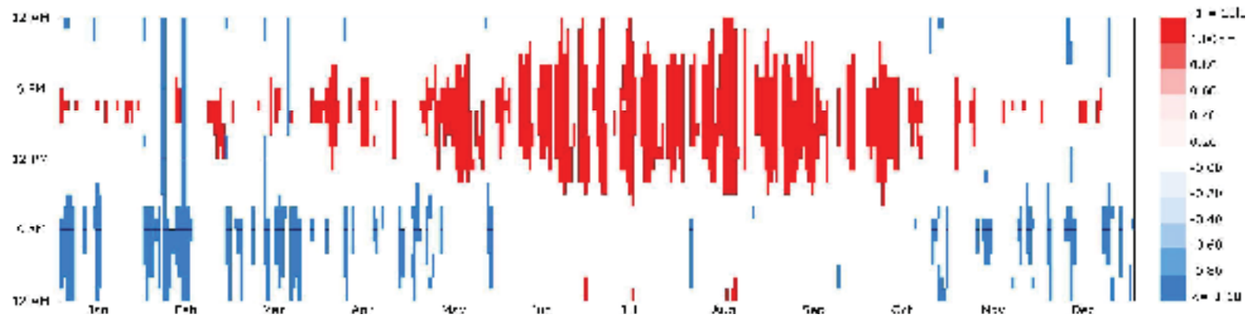


UDLI 100-2000 lux

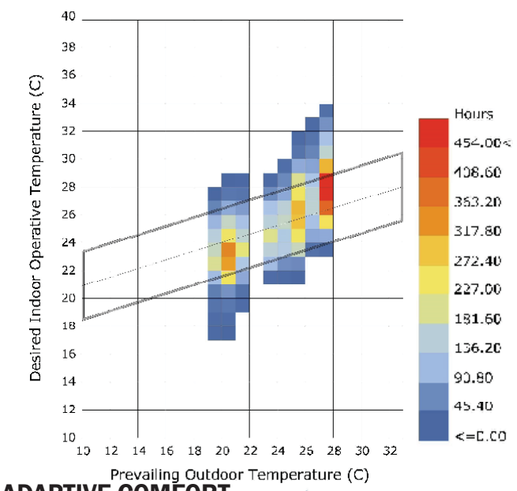


UDLI >2000 lux

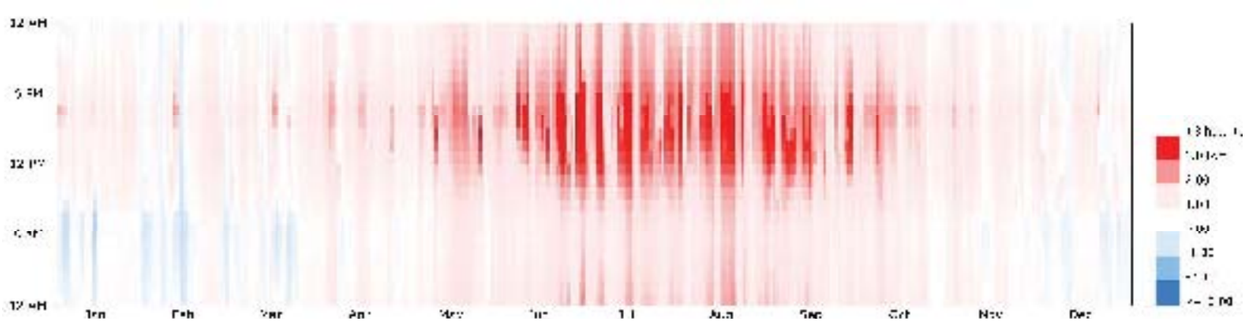




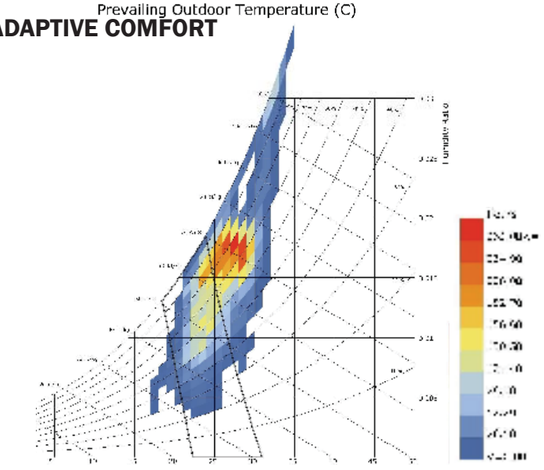
ADAPTIVE COMFORT 79.82% 1 - hot , 0 - comfortable , -1 - cold



ADAPTIVE COMFORT



PMV 29.34% 3 - hot , 2 - warm, 1 - slightly warm, 0 - neutral , -1 - slightly cool, -2 - cool, -3 - cold



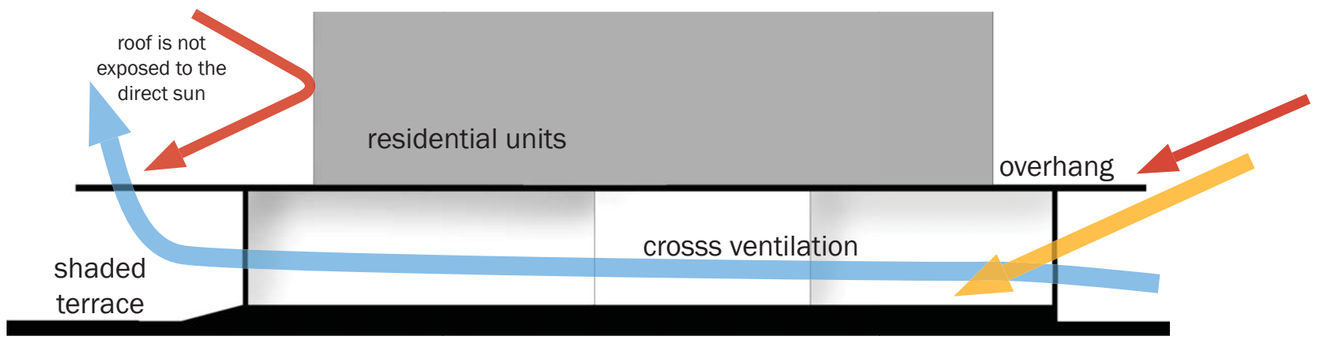
PSYCHROMETRIC CHART

RETAIL REQUIREMENTS + KEY DESIGN FACTORS

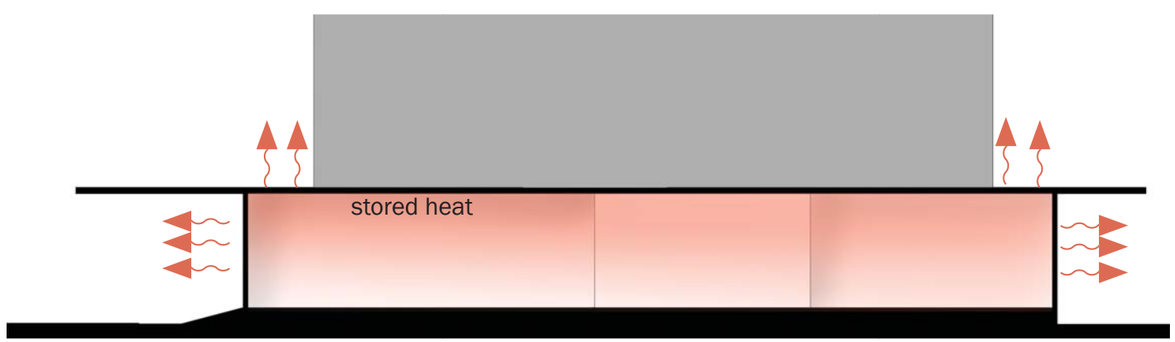
DAYLIGHTING
Evenly spread sunlight
300 lux min

GLARE
Prevent overlit spaces
and glare

THERMAL COMFORT
Maintain temperature
in a range 20 - 28 C



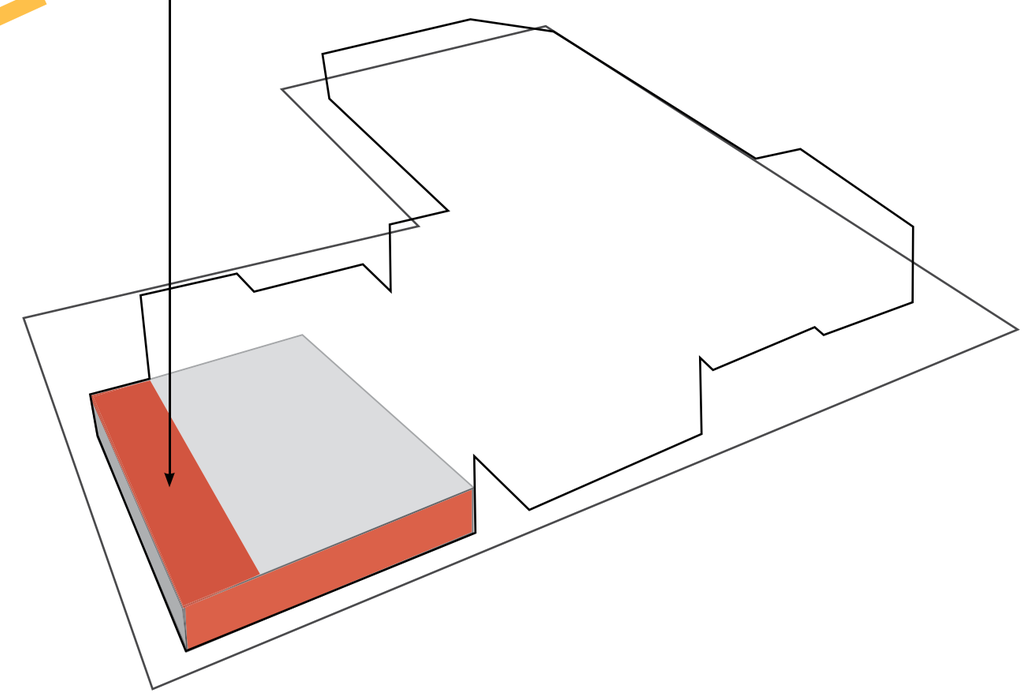
DAY PERFORMANCE



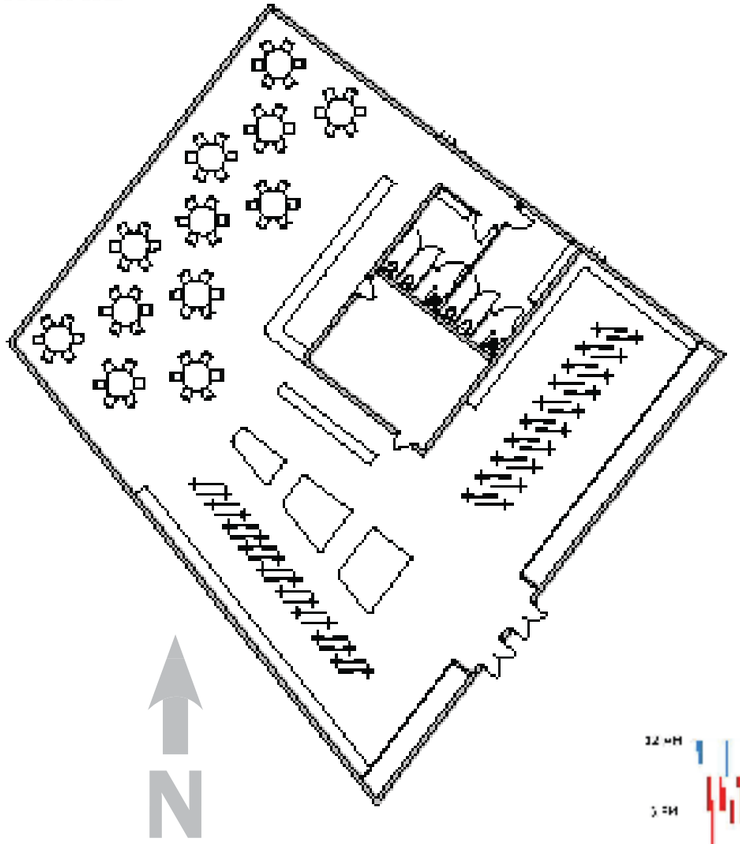
NIGHT PERFORMANCE

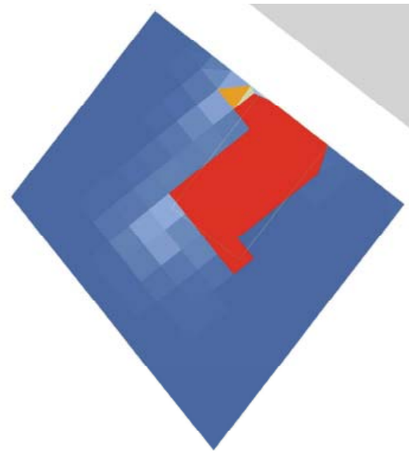
PROBLEMATIC ZONES

Roof Exposed to direct solar radiation.
East & West Exposed to the sun

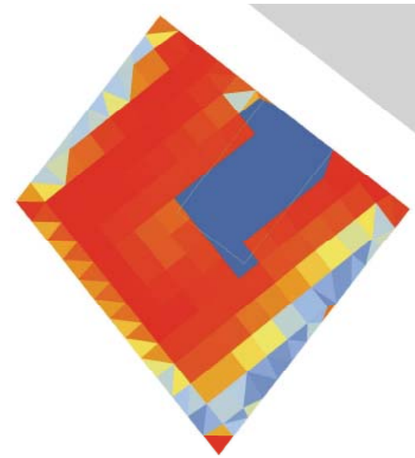


RETAIL

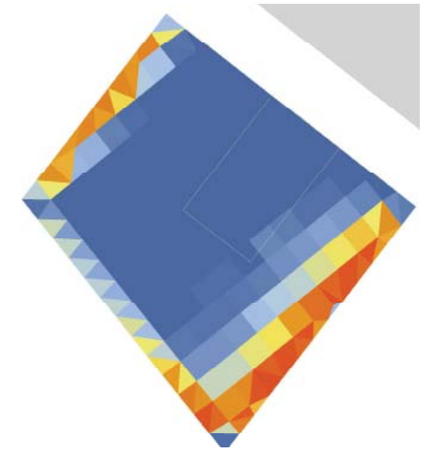




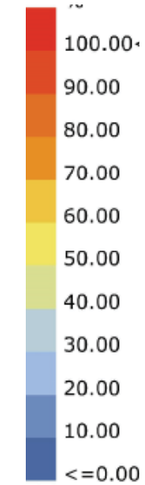
UDLI <100 lux

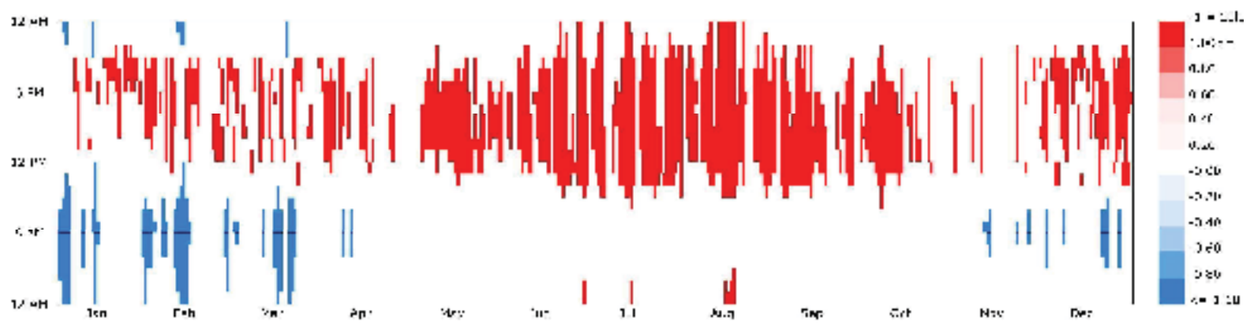


UDLI 100-2000 lux

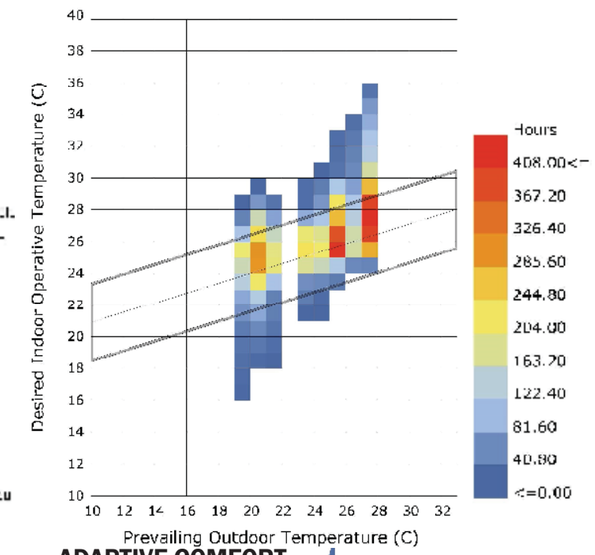


UDLI >2000 lux

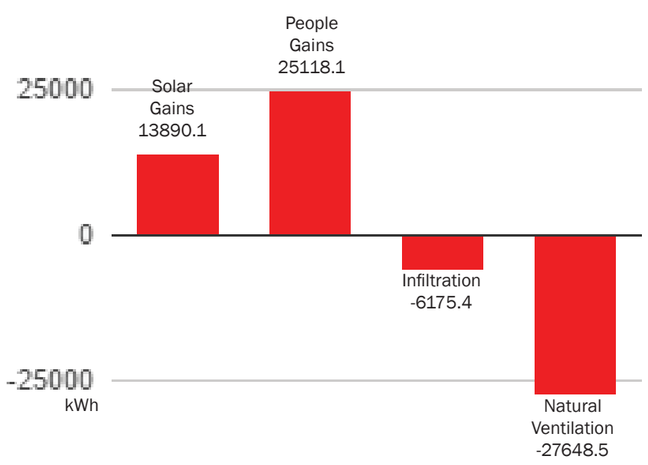


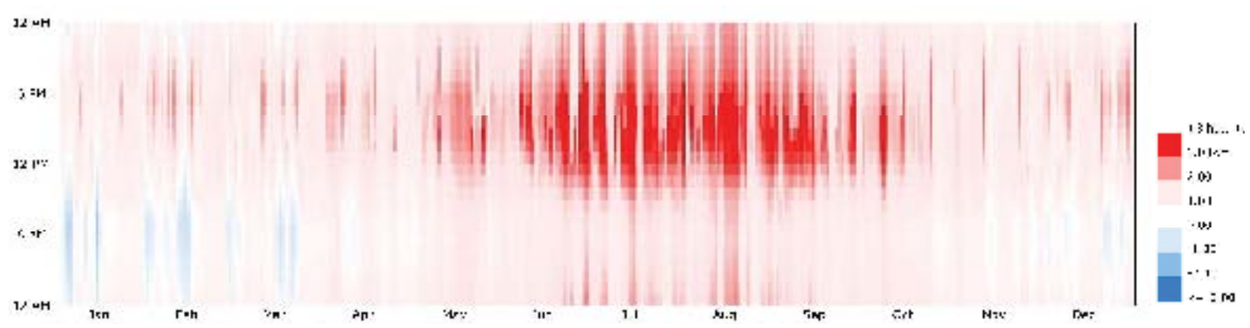


ADAPTIVE COMFORT 76.40% 1 - hot , 0 - comfortable , -1 - cold

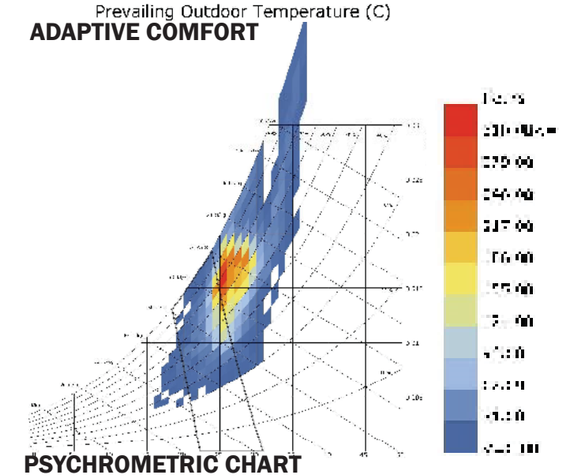


ADAPTIVE COMFORT



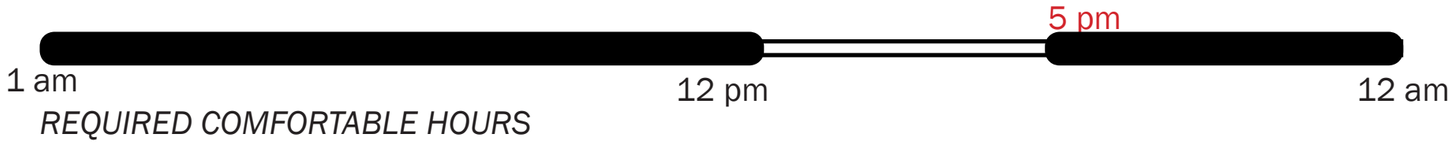


PMV 12.93% 3 - hot , 2 - warm, 1 - slightly warm, 0 - neutral , -1 - slightly cool, -2 - cool, -3 - cold



PSYCHROMETRIC CHART

RESIDENTIAL UNIT REQUIREMENTS + KEY DESIGN FACTORS



REQUIRED COMFORTABLE HOURS

DAYLIGHTING
Evenly spread sunlight
300 lux min

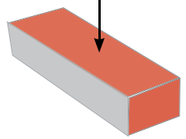
GLARE
Prevent overlit spaces
and glare

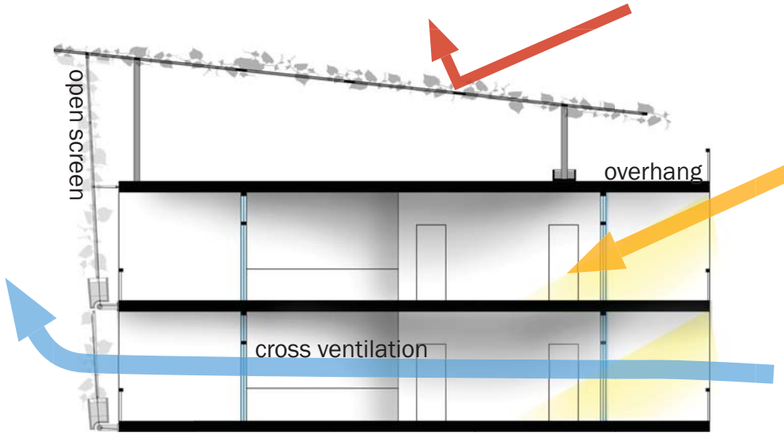
THERMAL COMFORT
Maintain temperature
in a range 20 - 28 C

CONTROL HUMIDITY
Spaces with high humidity
level [kitchen/bathrooms] are
located leeward

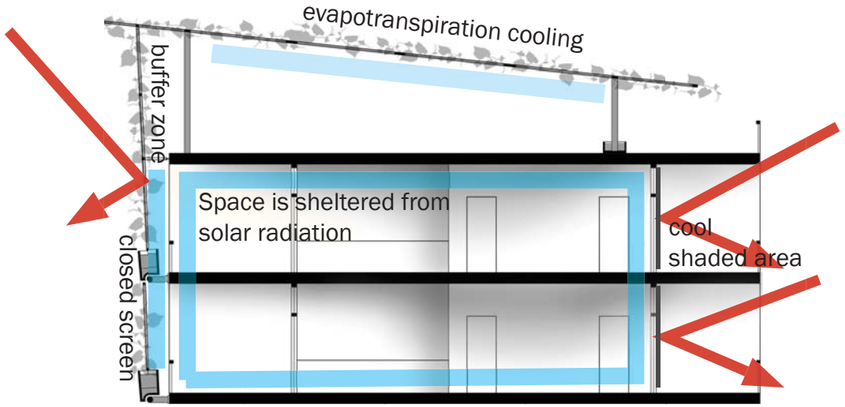
PROBLEMATIC ZONES

Roof Exposed to direct solar radiation.
East & West Exposed to the sun

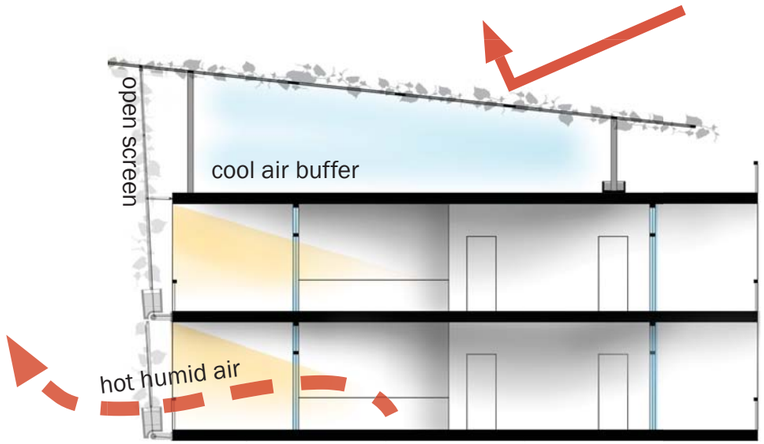




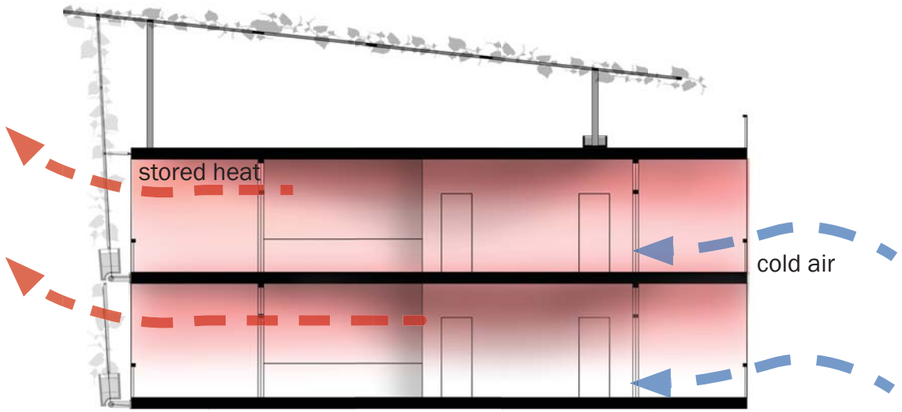
MORNING PERFORMANCE



UNOCCUPIED PERFORMANCE



AFTERNOON PERFORMANCE



NIGHT PERFORMANCE

RESIDENTIAL

2ND LEVEL

3RD LEVEL

4TH LEVEL

RESIDENTIAL

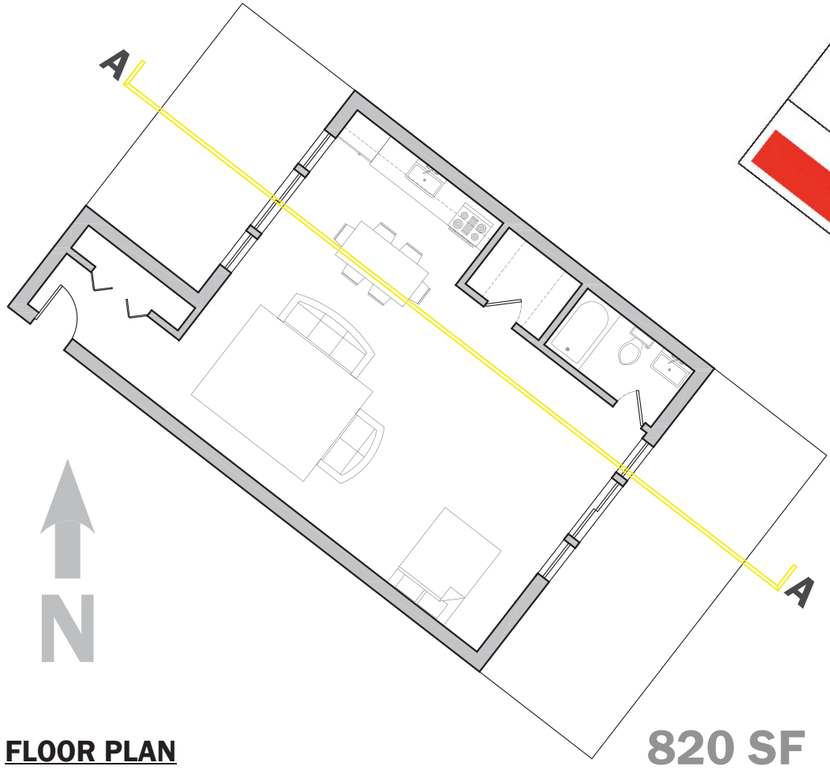
4TH LEVEL

5TH LEVEL

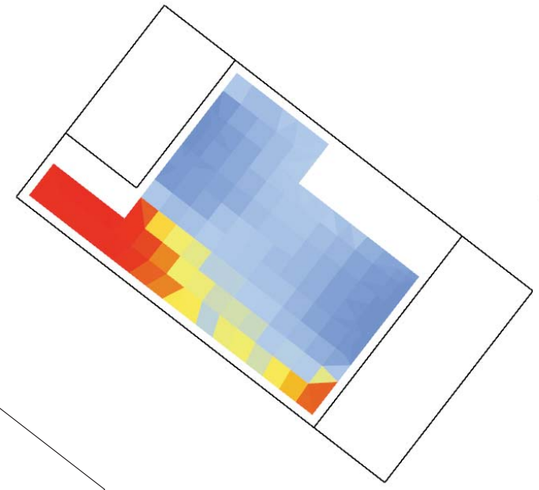
6TH LEVEL

7TH LEVEL

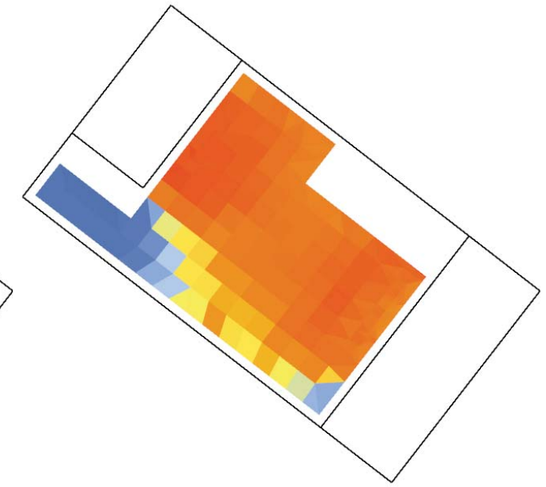
STUDIO



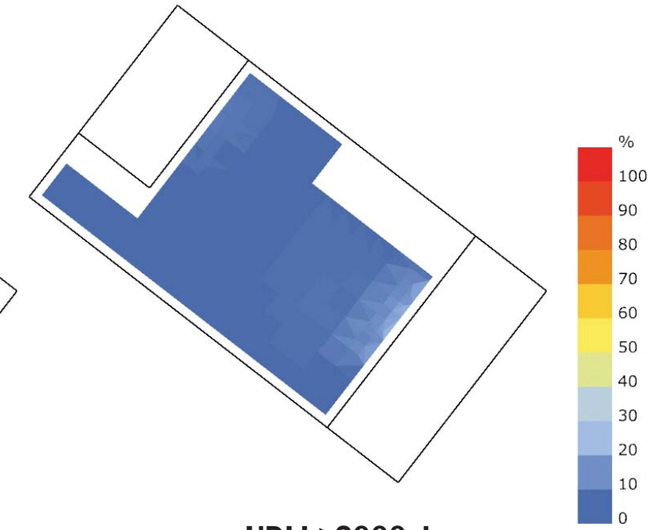
FLOOR PLAN



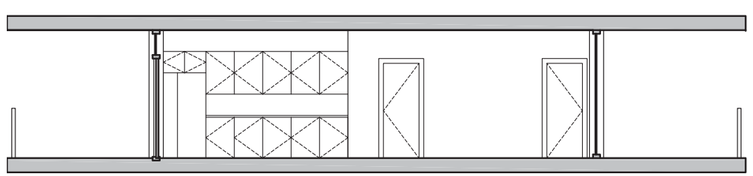
UDLI <100 lux



UDLI 100-2000 lux

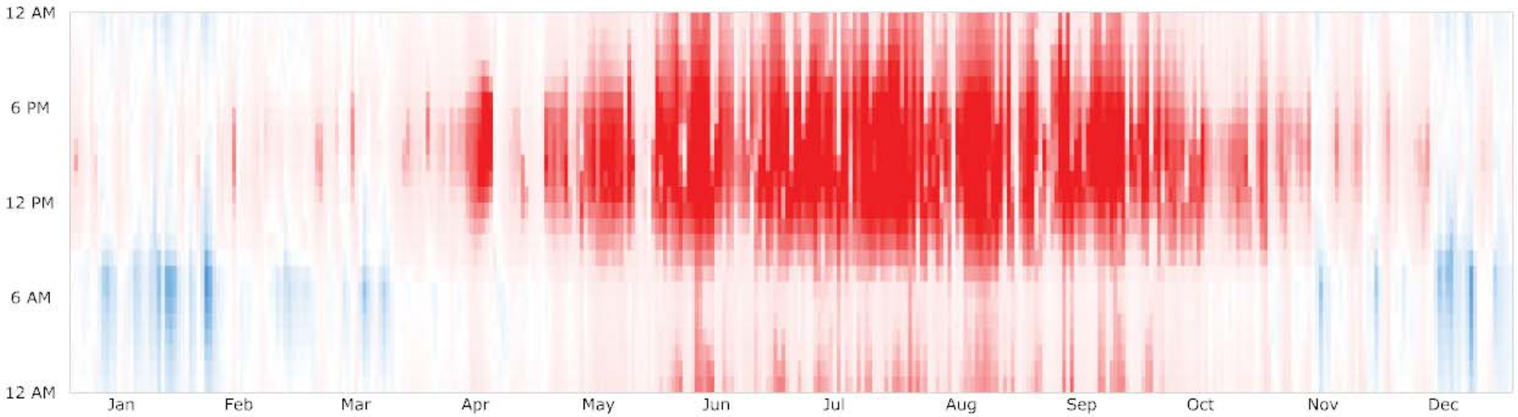


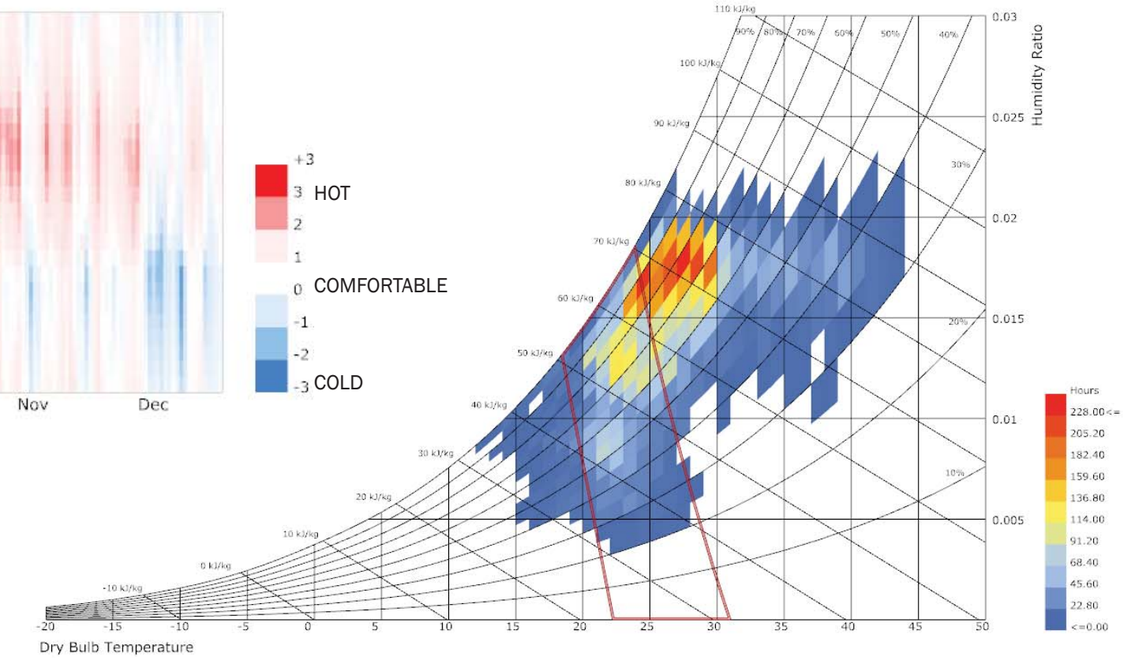
UDLI >2000 lux



SECTION A-A

STUDIO

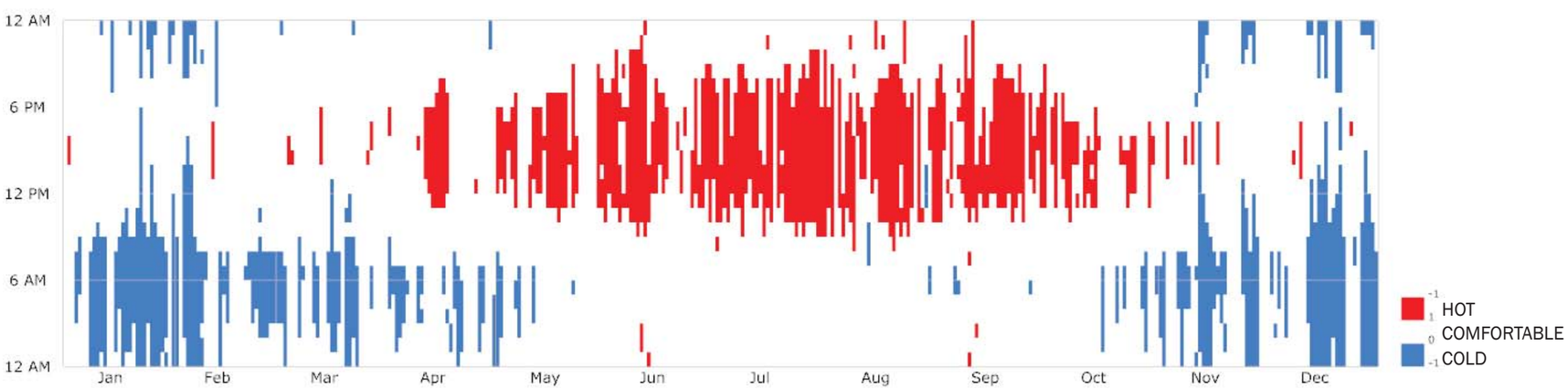


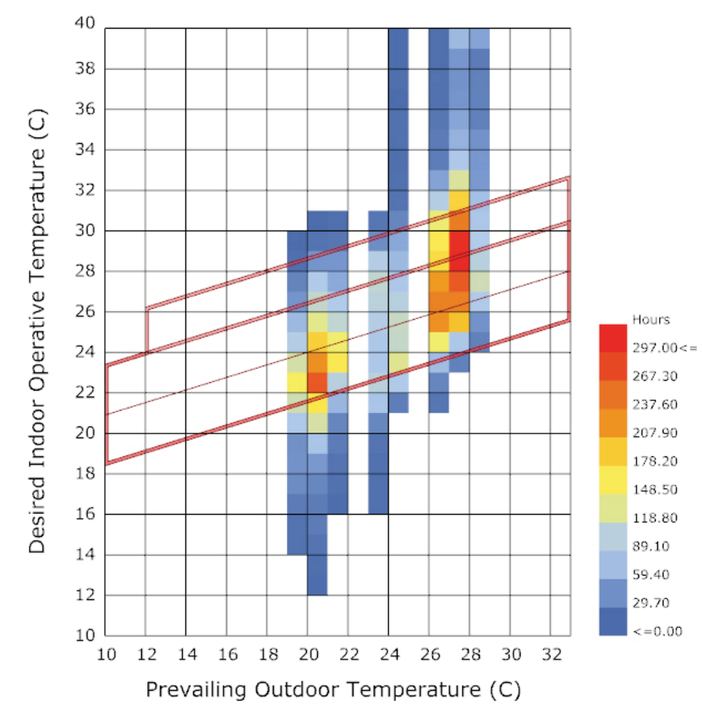


PREDICTED MEAN VOTE

23% COMFORT

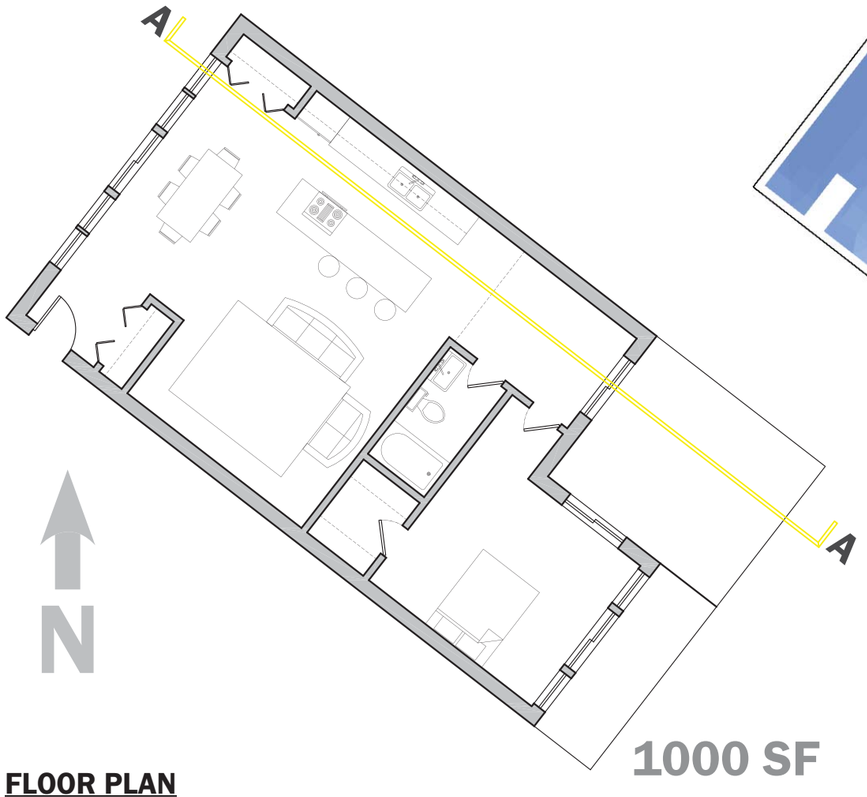
74% COMFORT



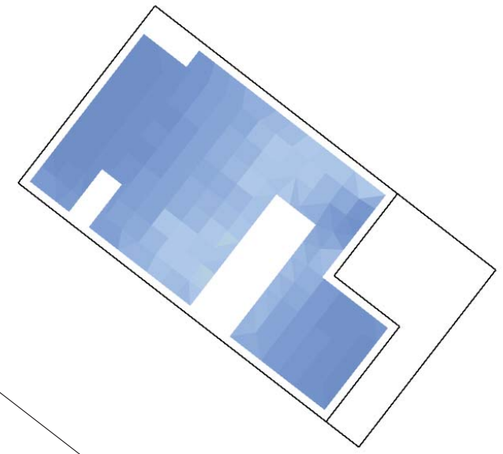


ADAPTIVE COMFORT

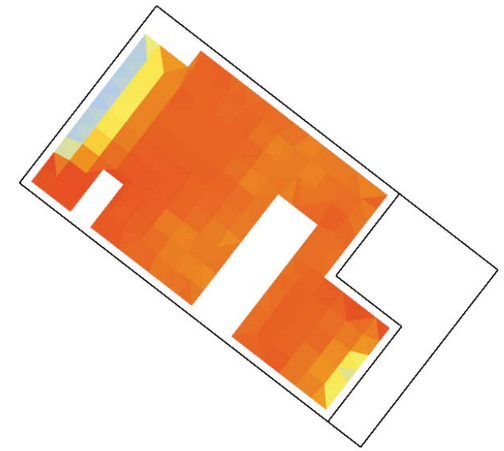
1 BEDROOM UNIT



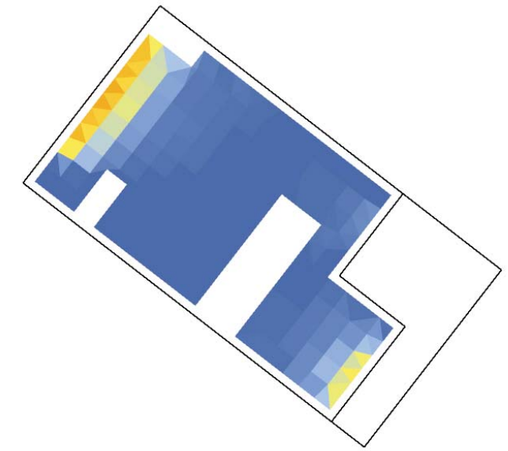
FLOOR PLAN



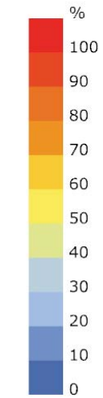
UDLI <100 lux

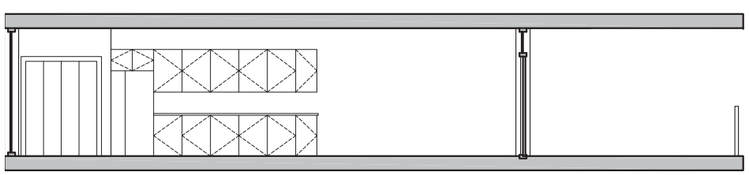


UDLI 100-2000 lux



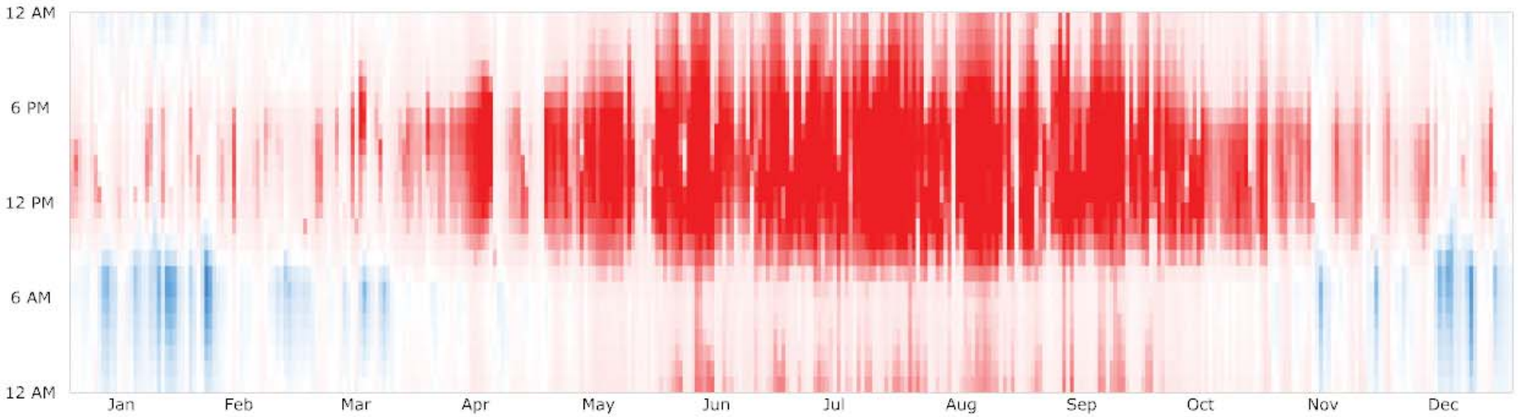
UDLI >2000 lux

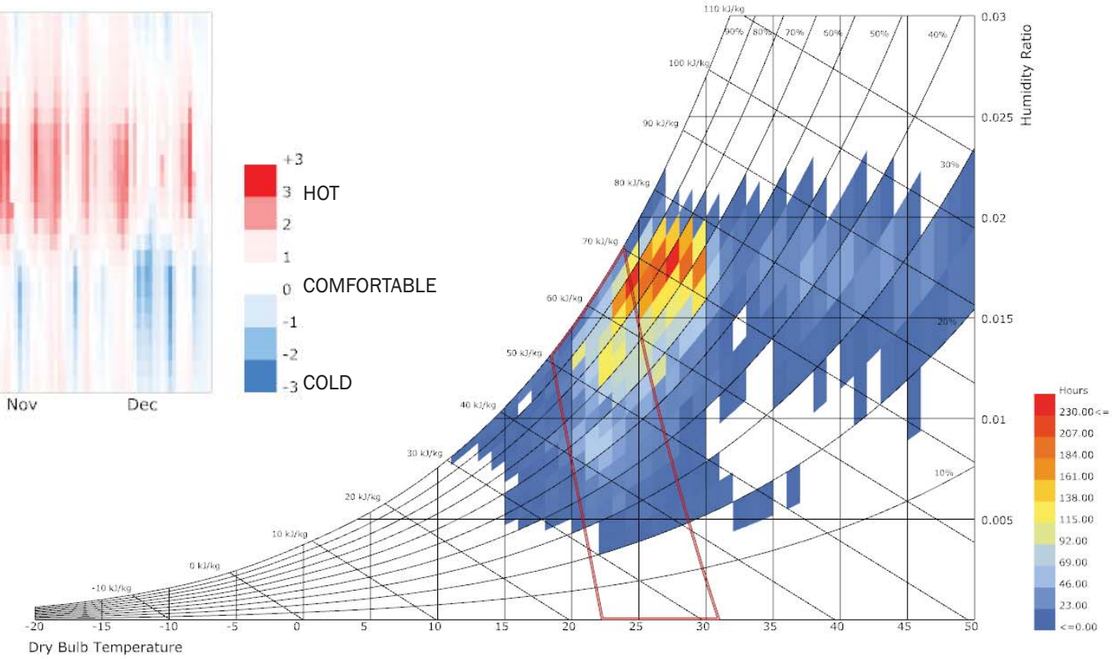




SECTION A-A

1 BEDROOM UNIT

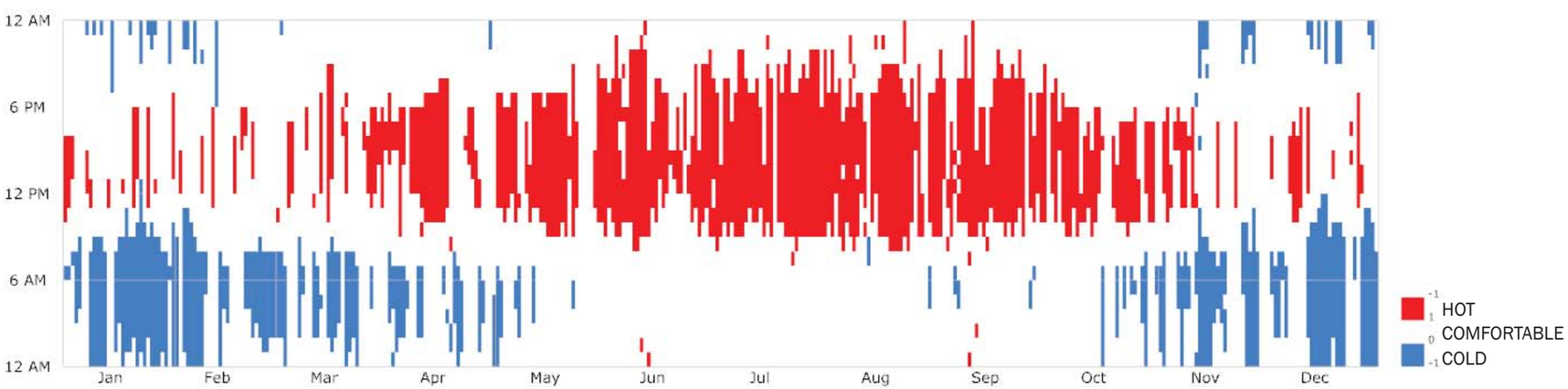


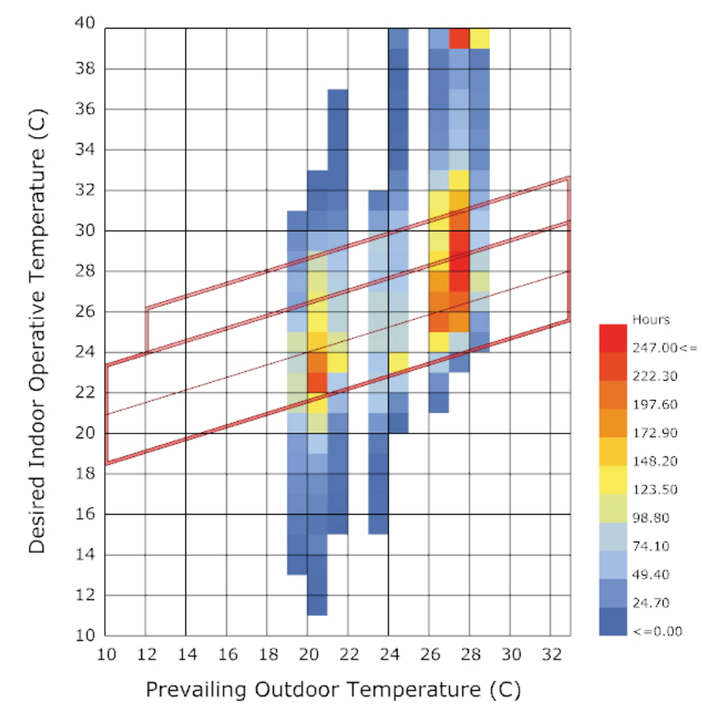


PREDICTED MEAN VOTE

21% COMFORT

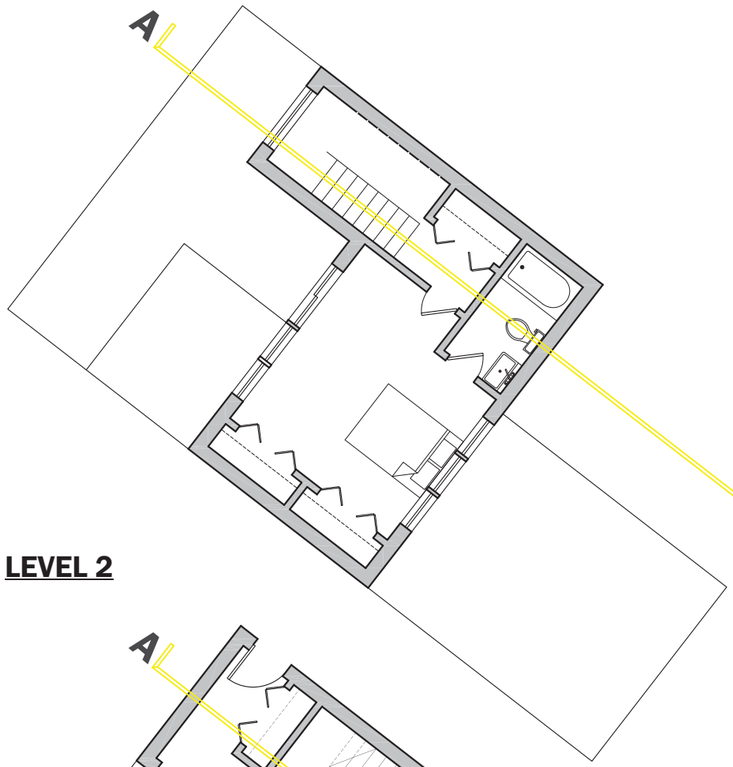
68% COMFORT



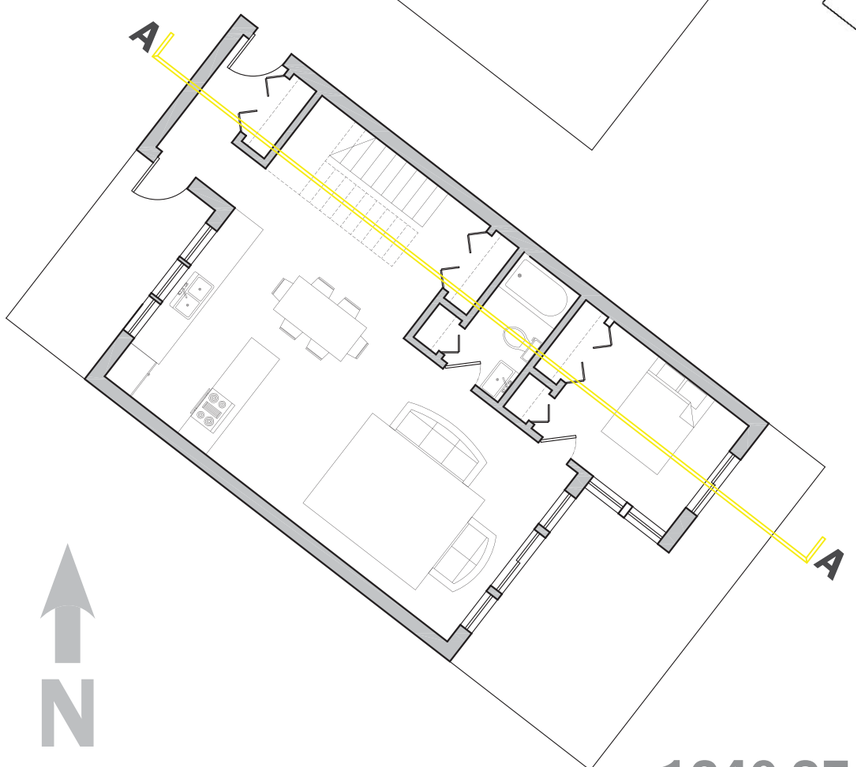


ADAPTIVE COMFORT

2 BEDROOM UNIT_TYPE A

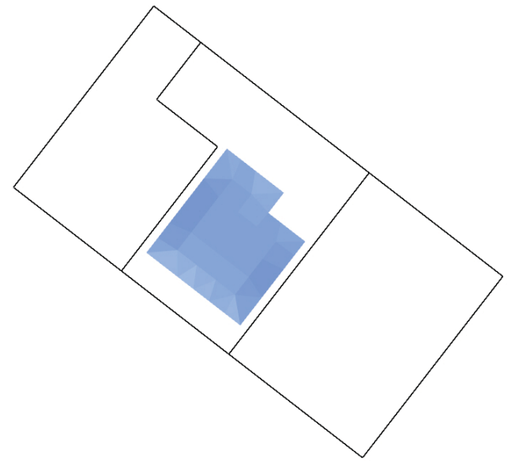


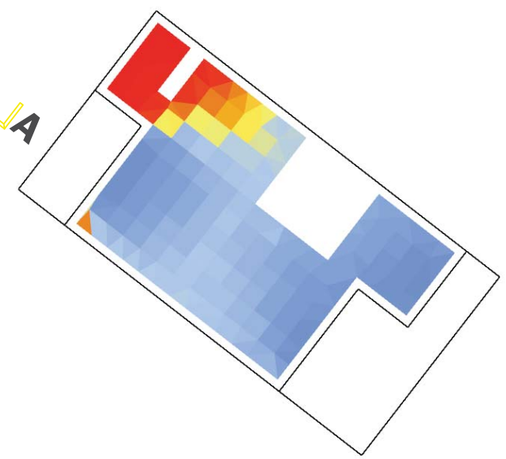
LEVEL 2



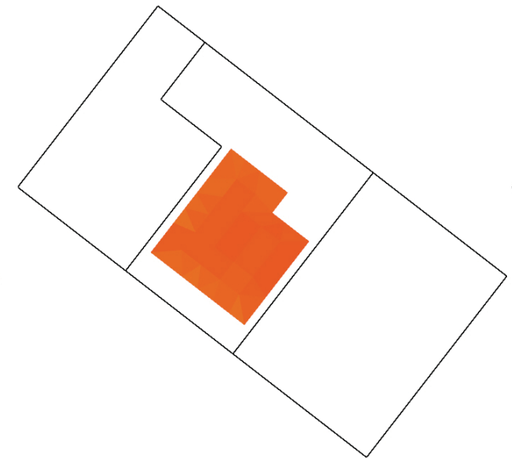
LEVEL 1

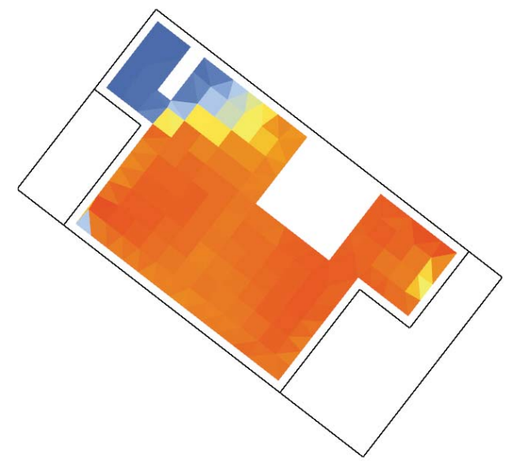
1240 SF



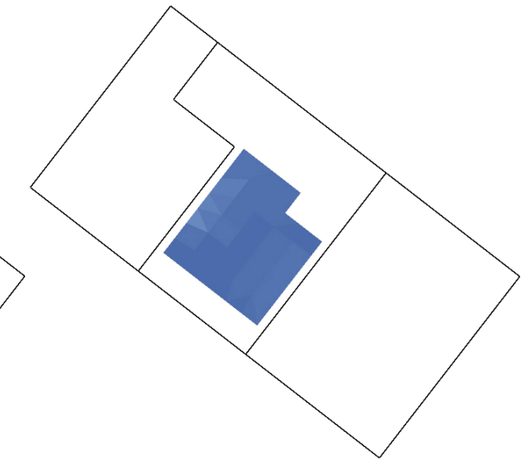


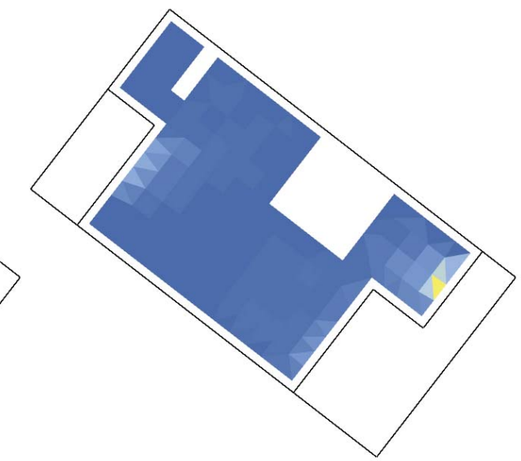
UDLI <100 lux



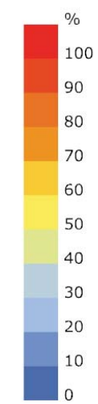


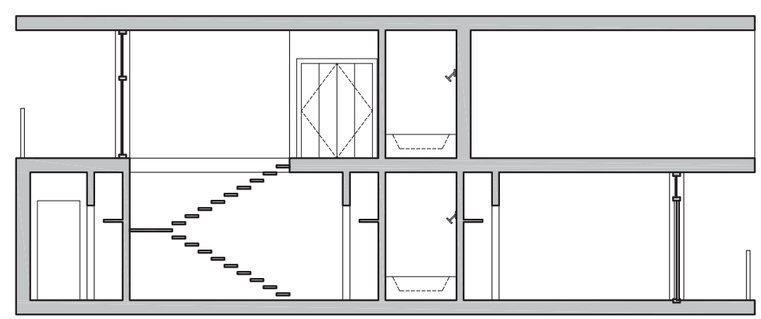
UDLI 100-2000 lux





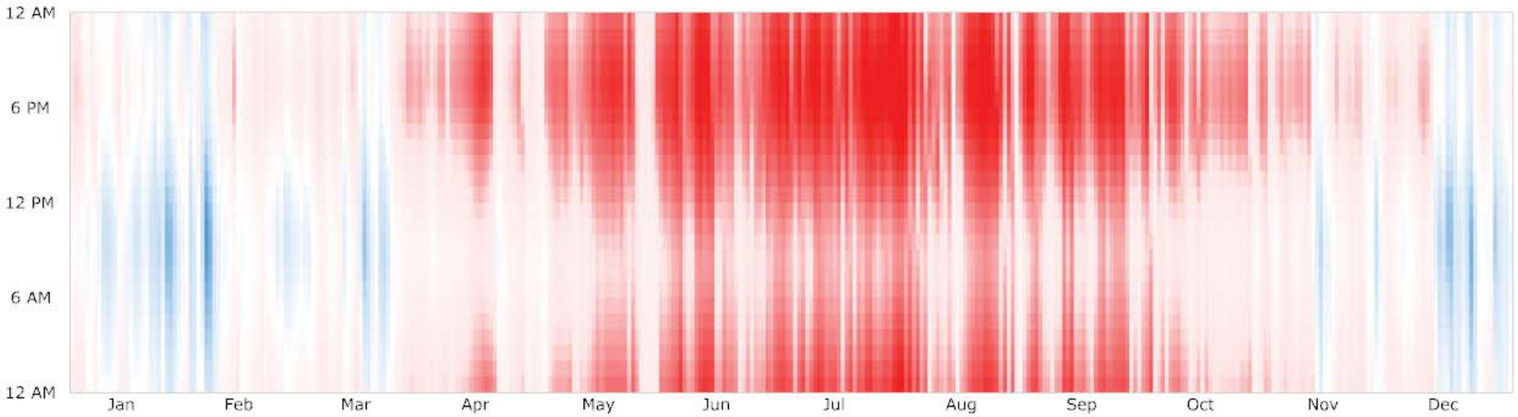
UDLI >2000 lux

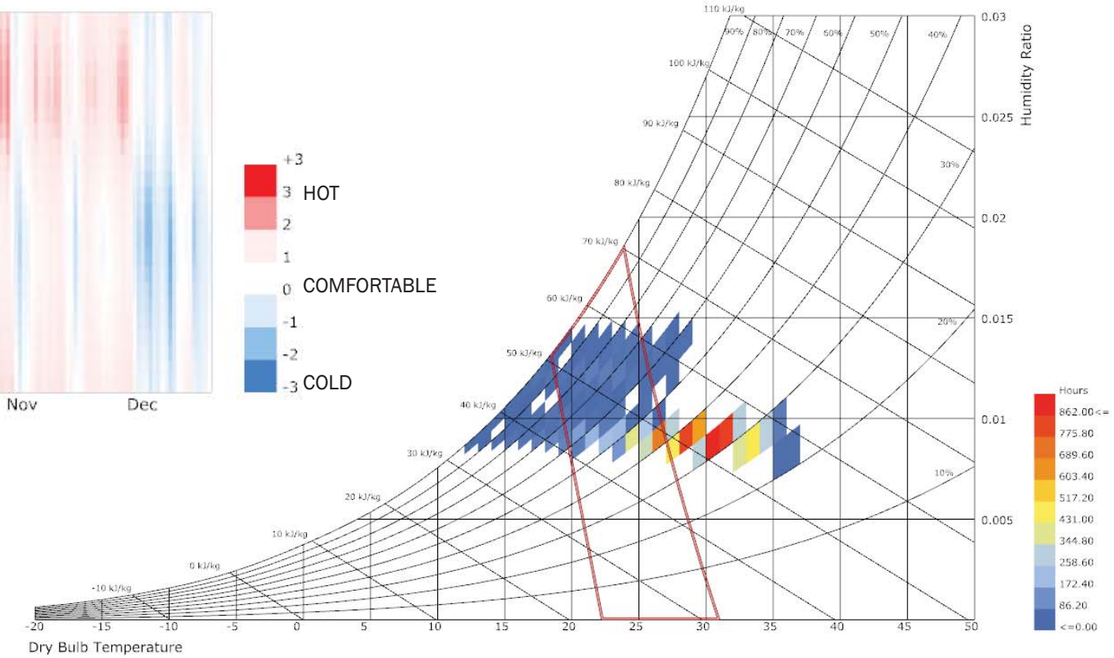




SECTION A

2 BEDROOM UNIT TYPE A LEVEL 1

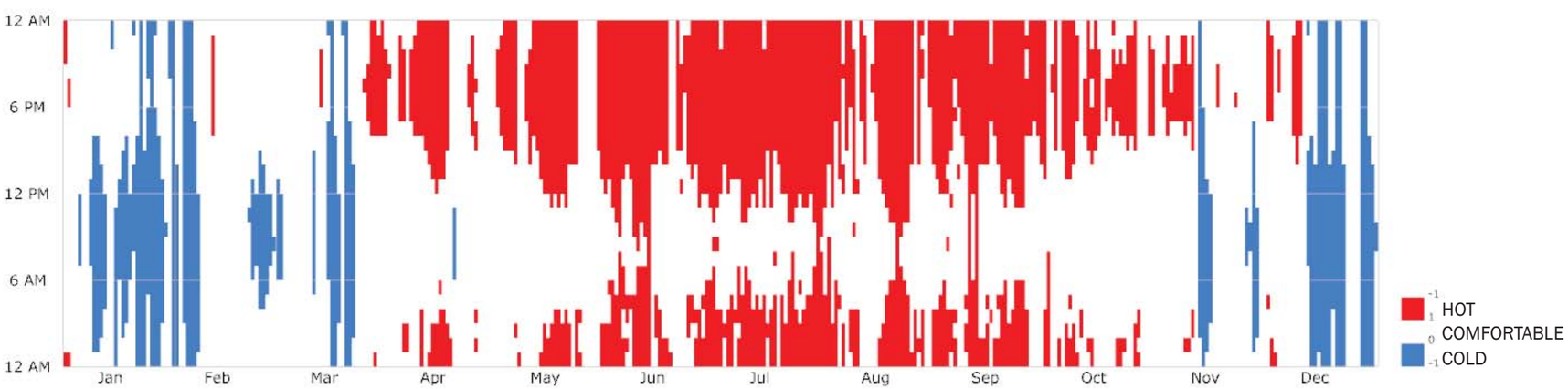


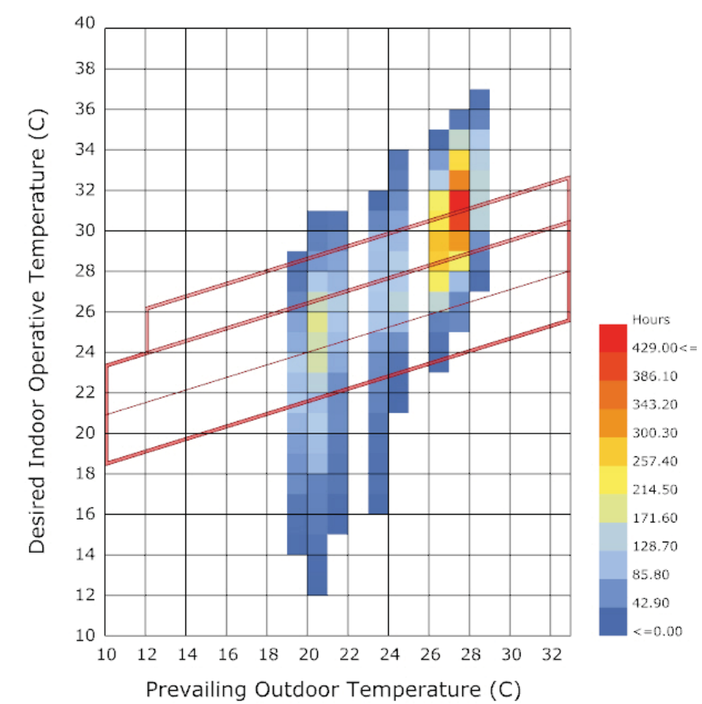


PREDICTED MEAN VOTE

15% COMFORT

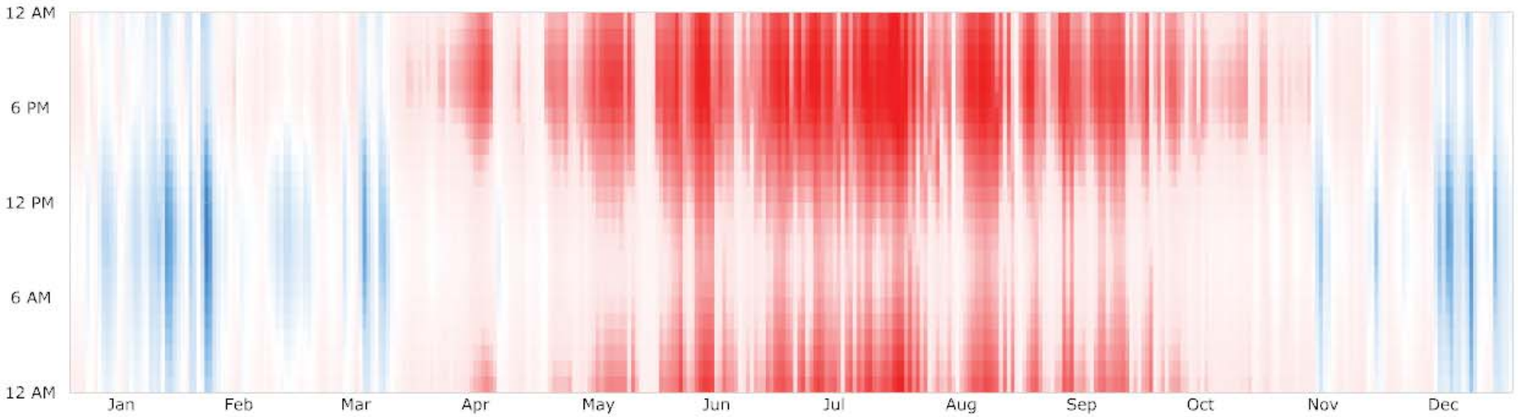
60% COMFORT

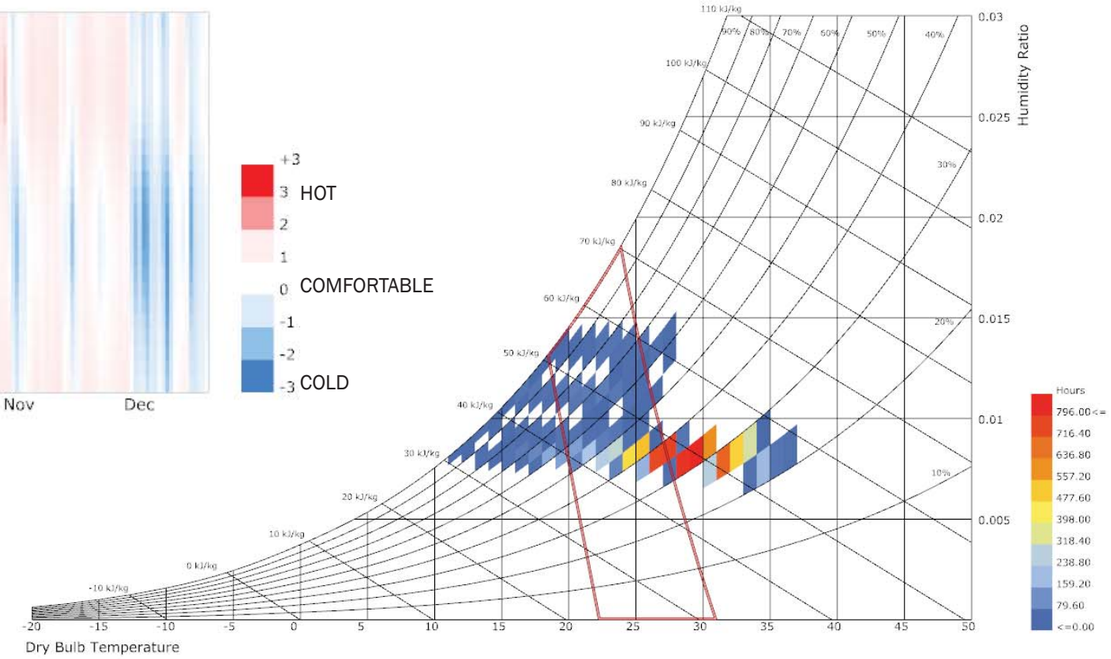




ADAPTIVE COMFORT

2 BEDROOM UNIT TYPE A LEVEL 2

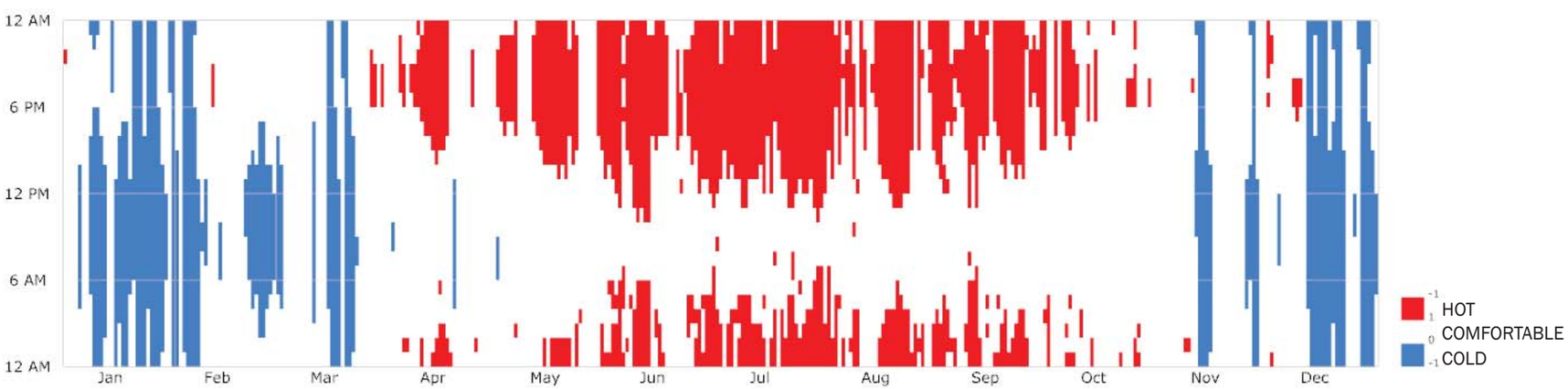


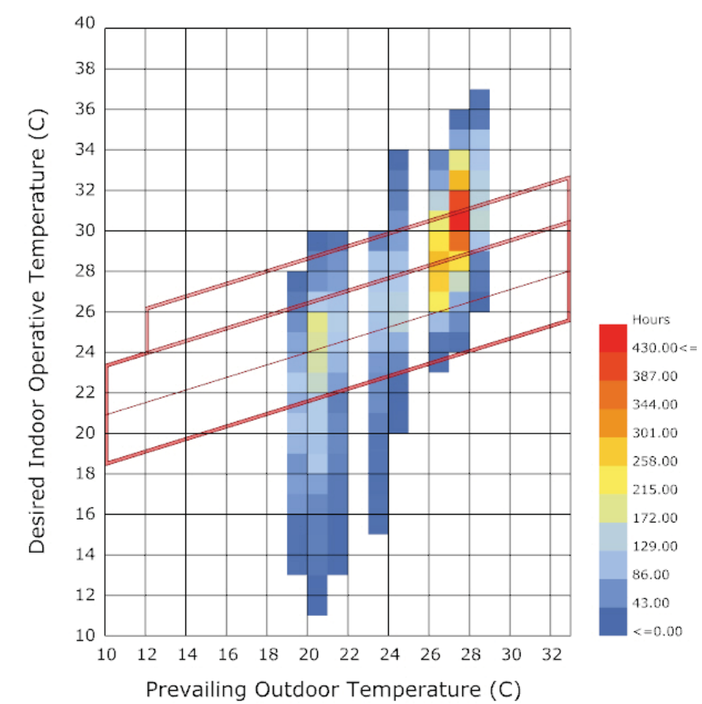


PREDICTED MEAN VOTE

17% COMFORT

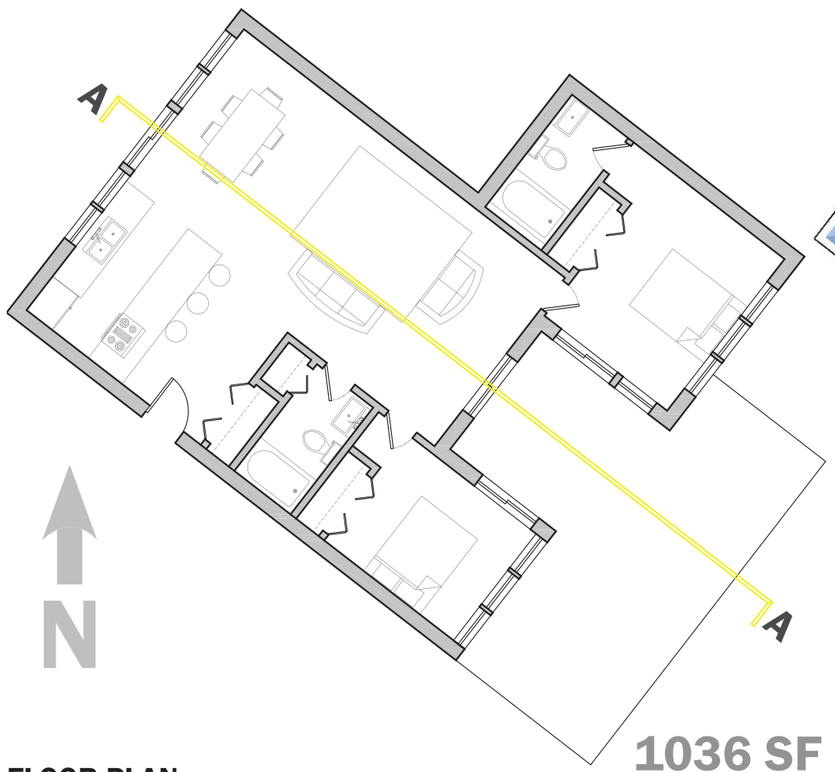
65% COMFORT





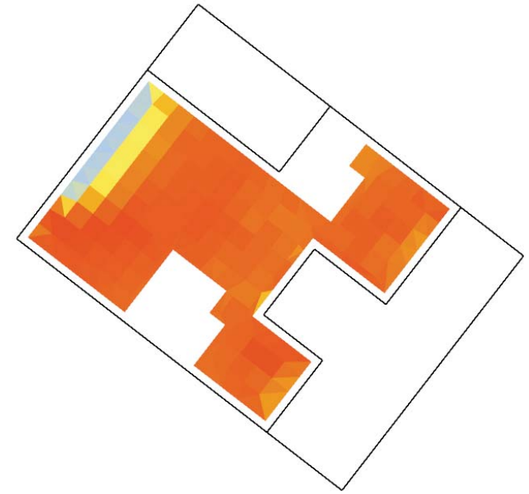
ADAPTIVE COMFORT

2 BEDROOM UNIT_TYPE B

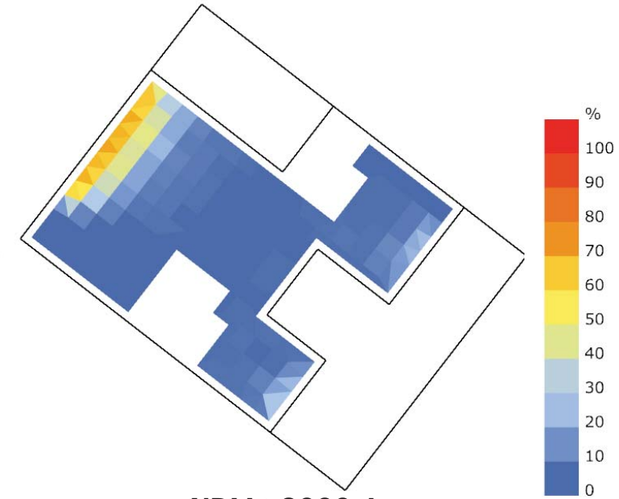


FLOOR PLAN

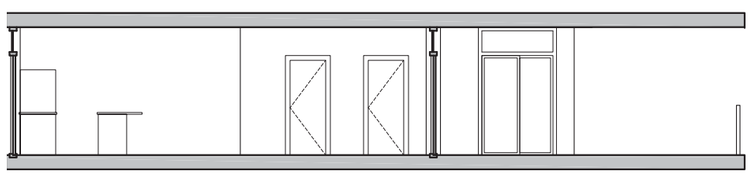
UDLI <100 lux



UDLI 100-2000 lux

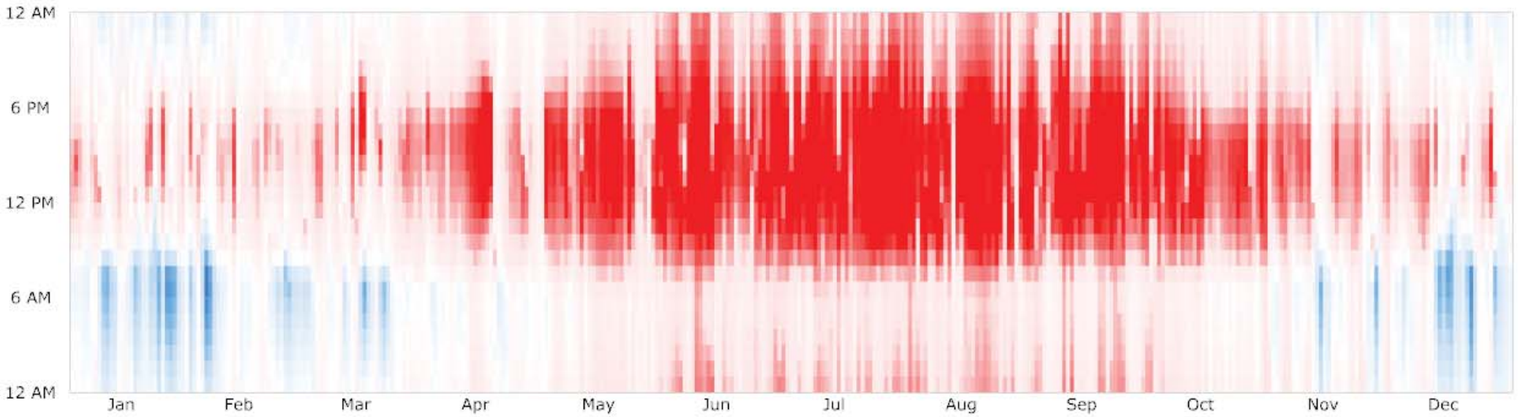


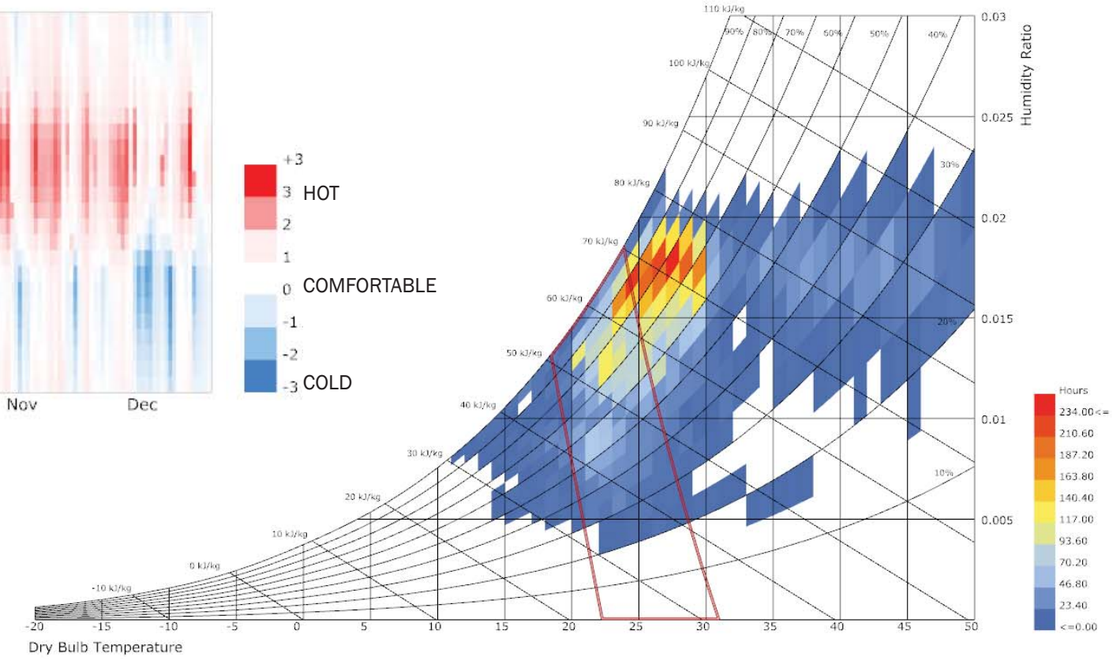
UDLI >2000 lux



SECTION A

2 BEDROOM UNIT TYPE B

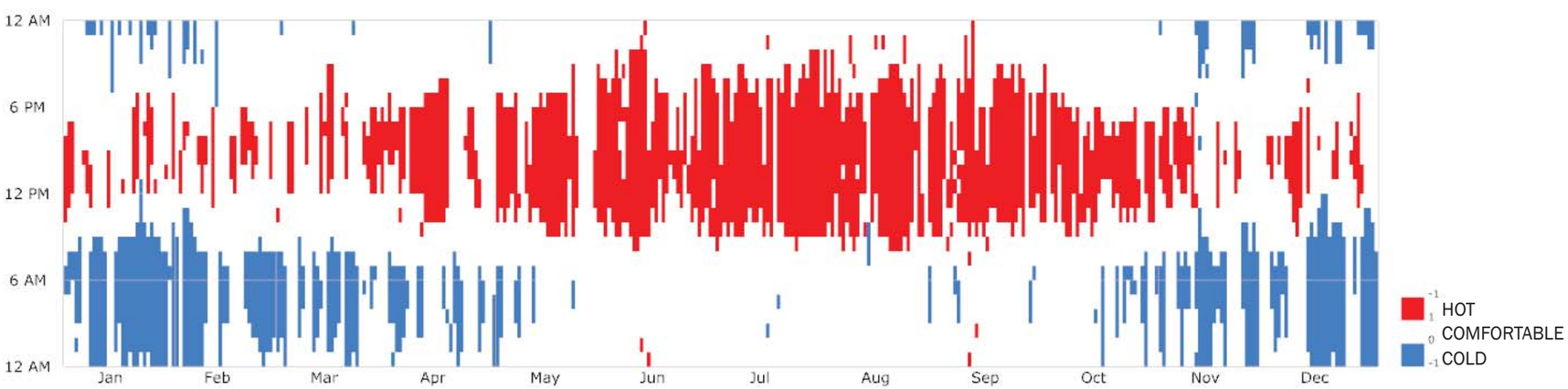


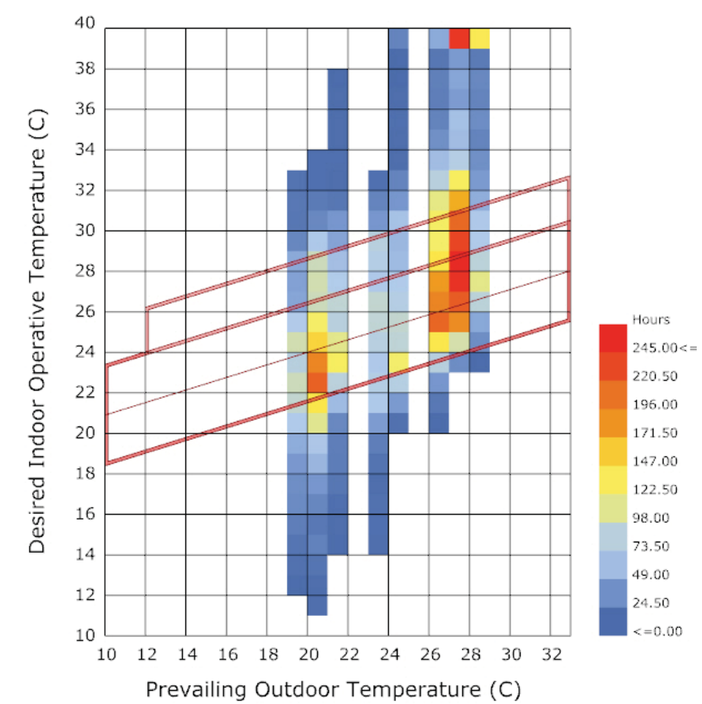


PREDICTED MEAN VOTE

21% COMFORT

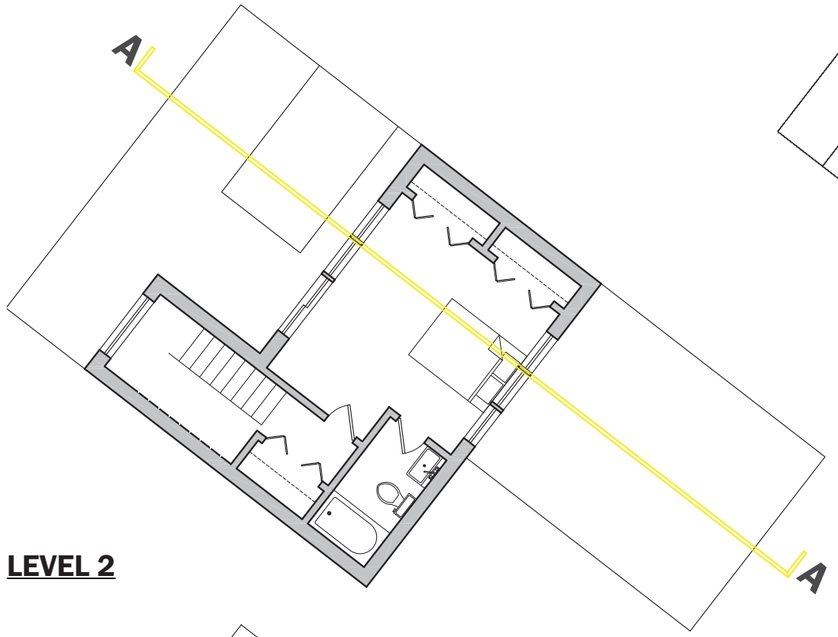
67% COMFORT



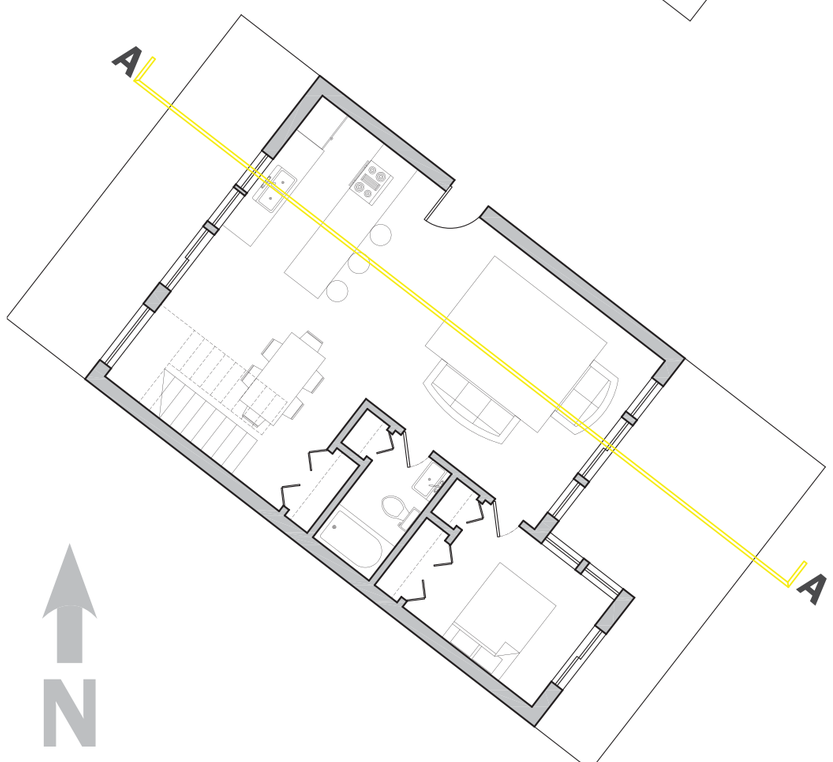


ADAPTIVE COMFORT

2 BEDROOM UNIT_TYPE A

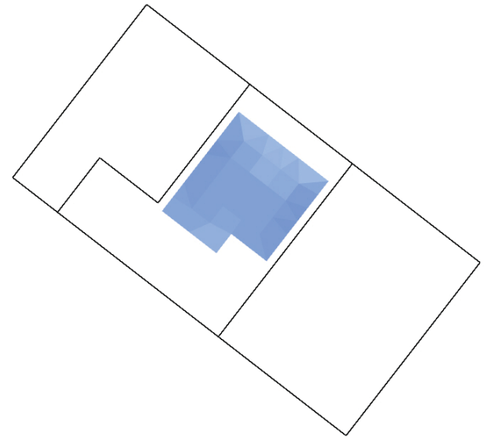


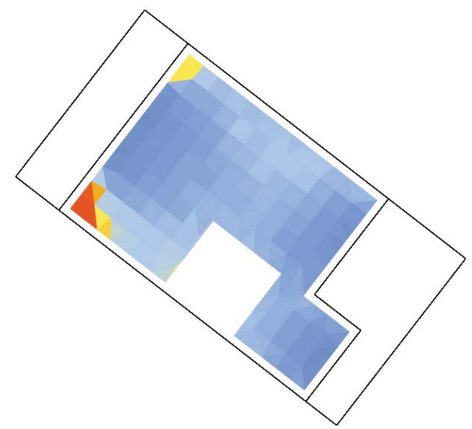
LEVEL 2



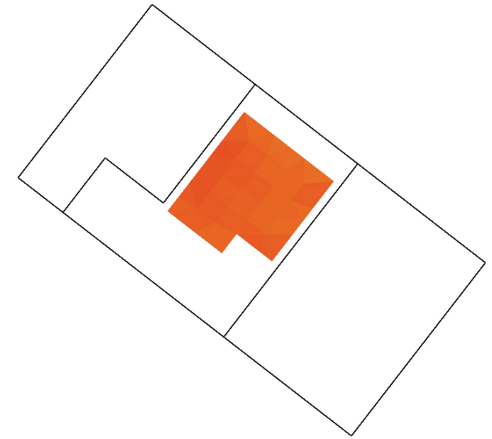
LEVEL 1

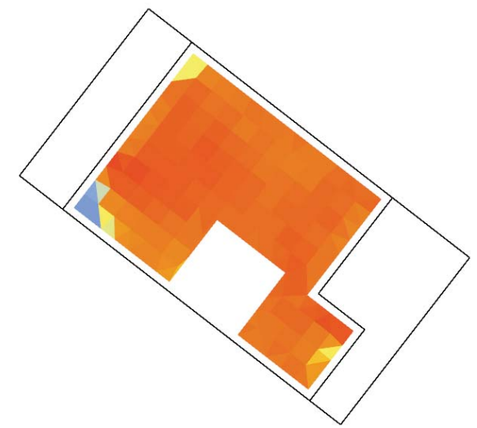
1170 SF



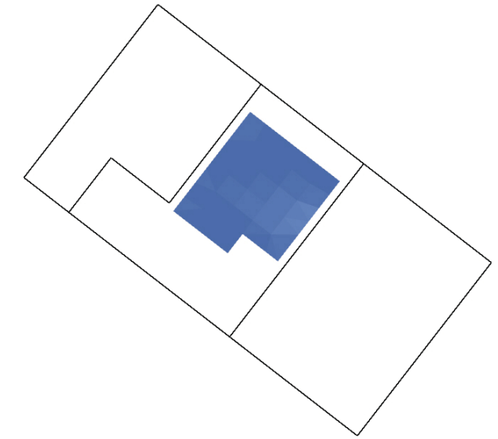


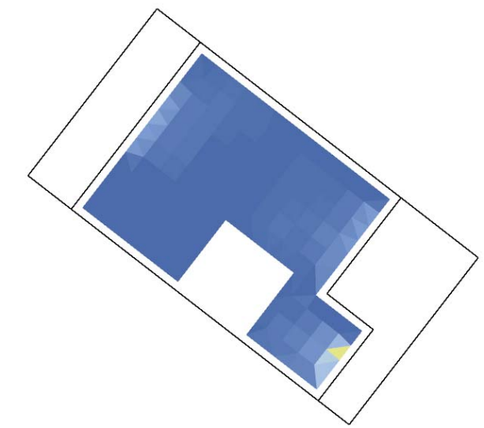
UDLI <100 lux



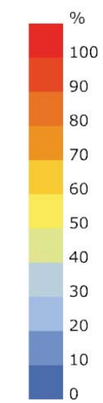


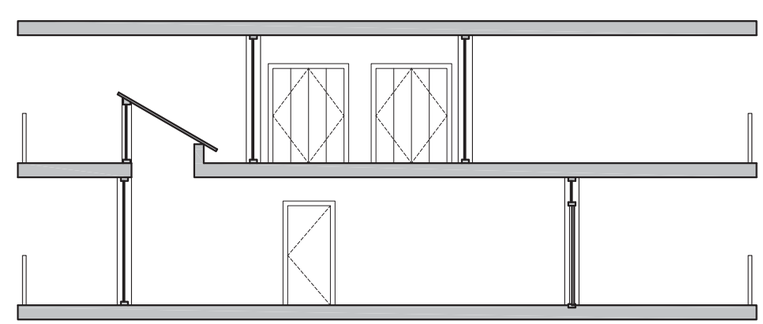
UDLI 100-2000 lux





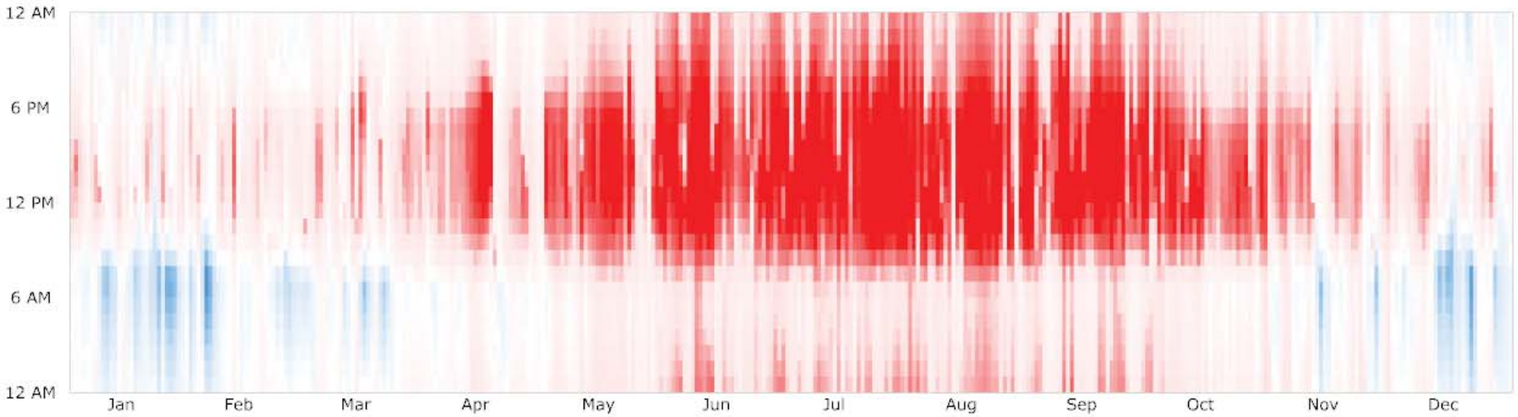
UDLI >2000 lux

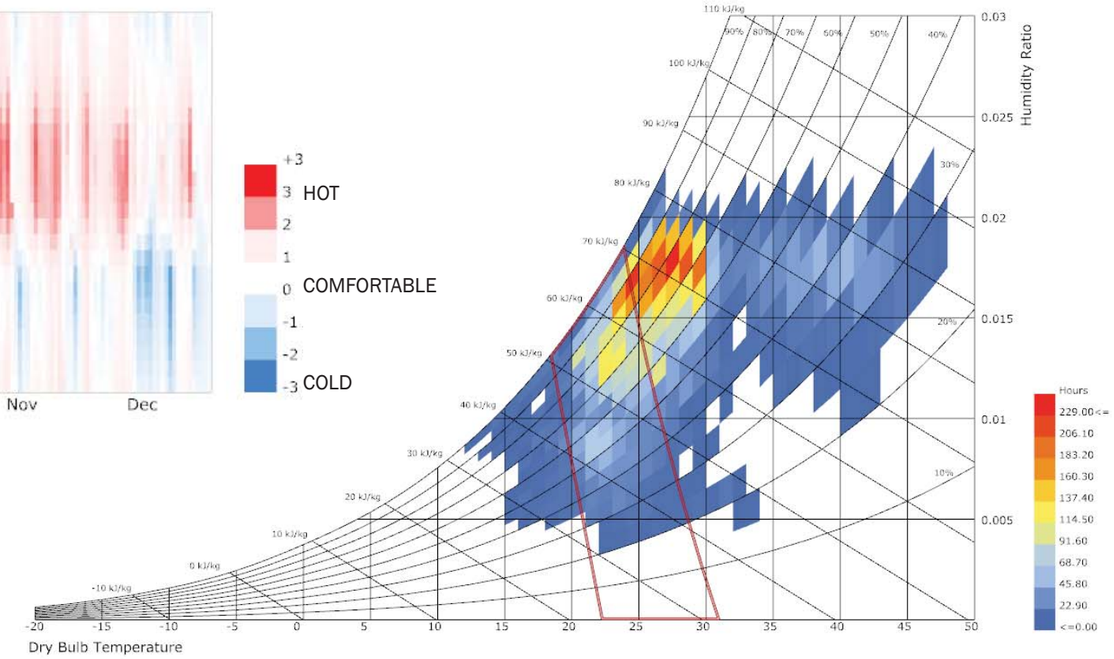




SECTION A

2 BEDROOM UNIT TYPE A LEVEL 1

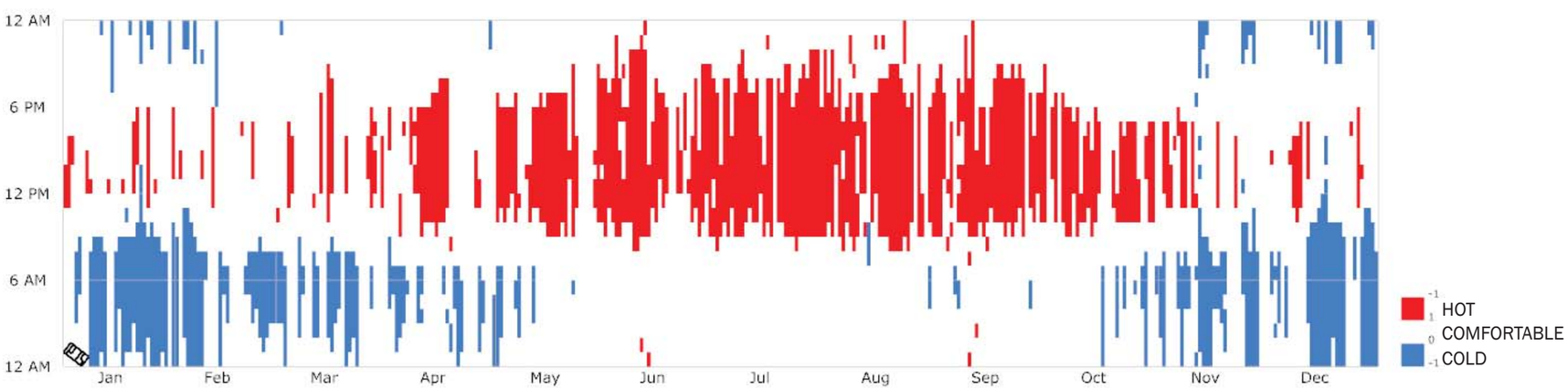


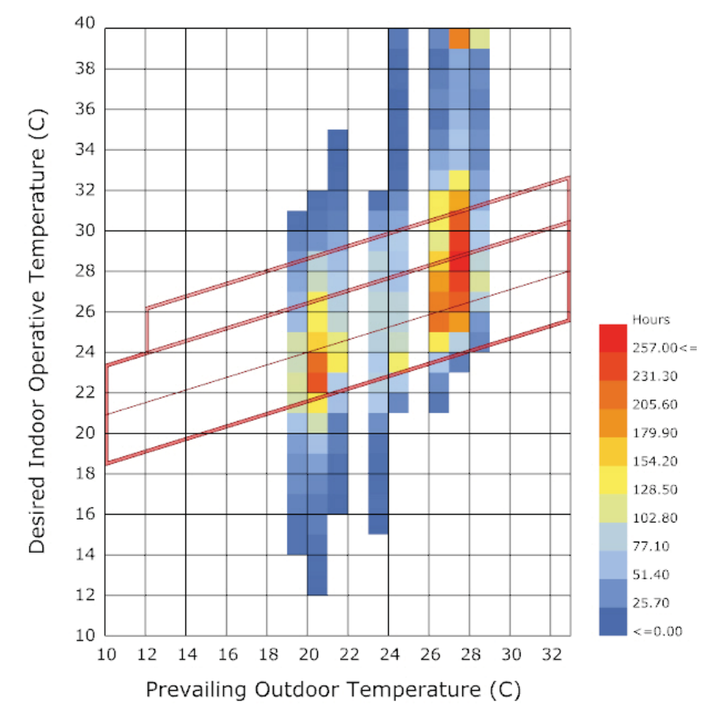


PREDICTED MEAN VOTE

21% COMFORT

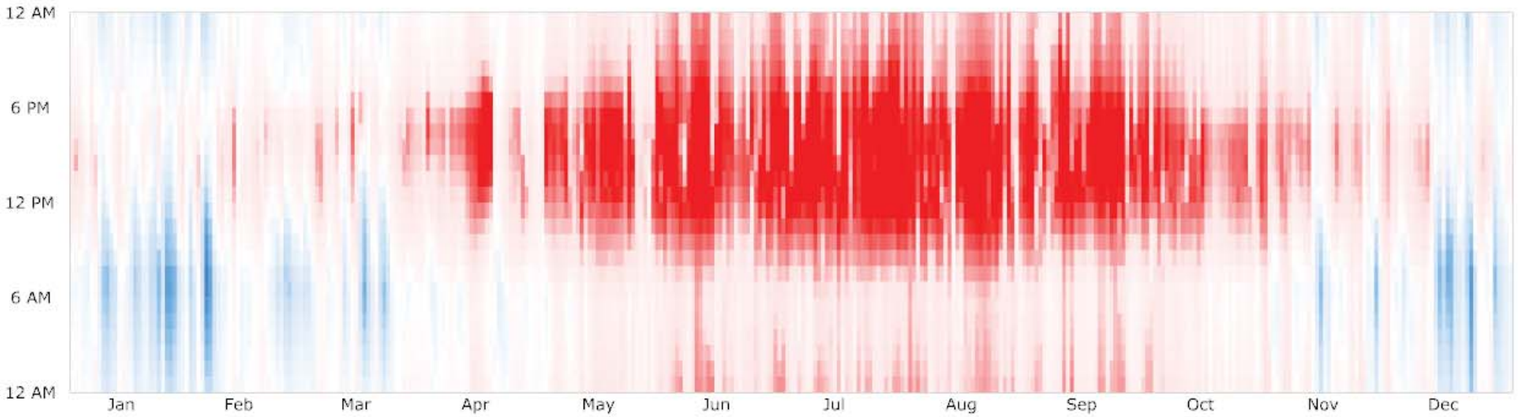
70% COMFORT

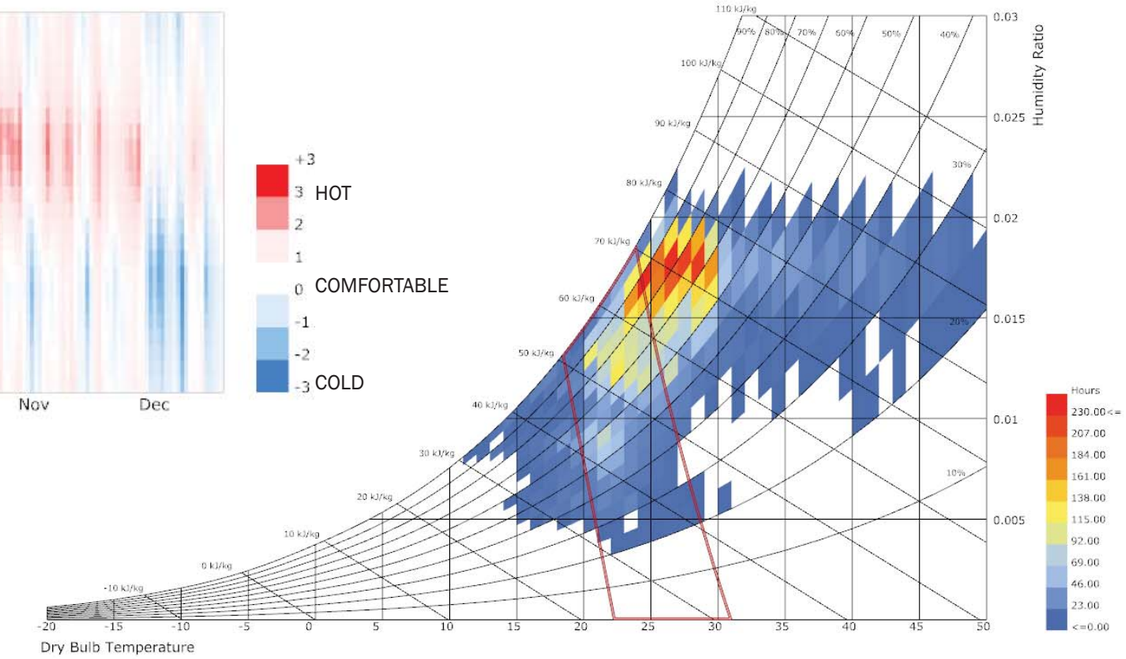




ADAPTIVE COMFORT

2 BEDROOM UNIT TYPE A LEVEL 2

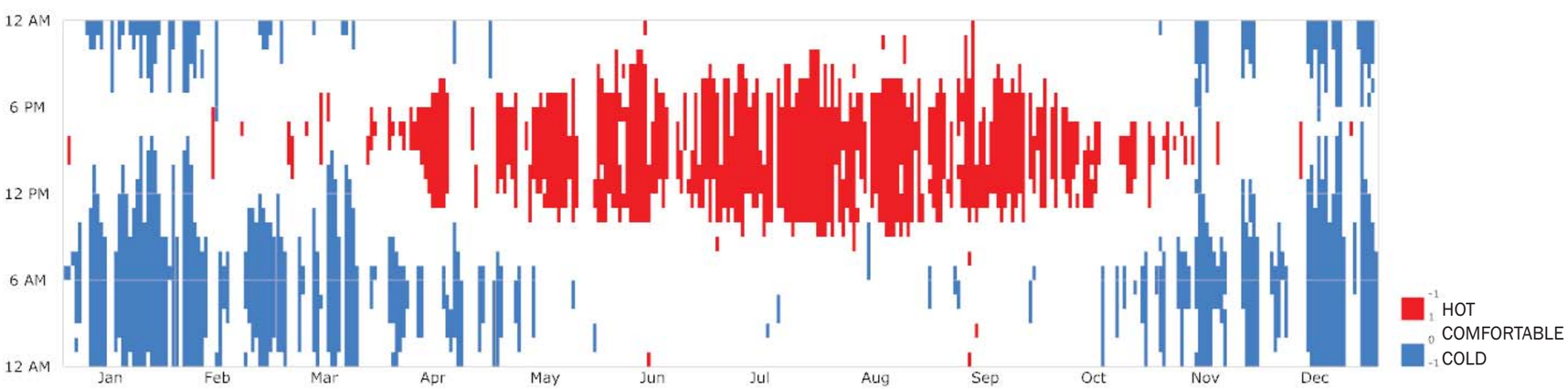


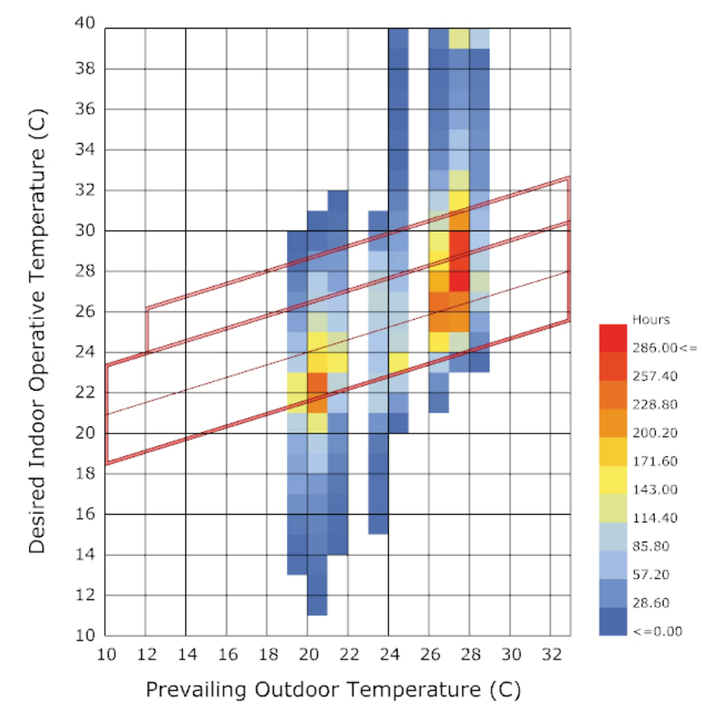


PREDICTED MEAN VOTE

23% COMFORT

70% COMFORT





ADAPTIVE COMFORT