# POTTERY AND MUSEUM IN ABUJA, NIGERIA EDP Episode 1 19/20DL Erika Rees

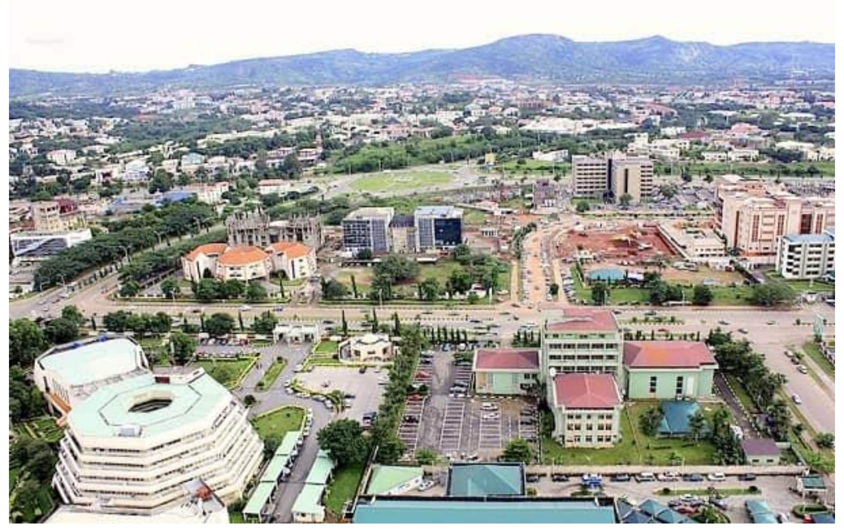


Approximate extent of annual oscillation of the of the **Inter-tropical discontinuity**(ITD), which marks the interface between the moist monsoon air and the dry Harmattan air. Areas within this region have both monsoonal and dry 'Harmattan' seasons.

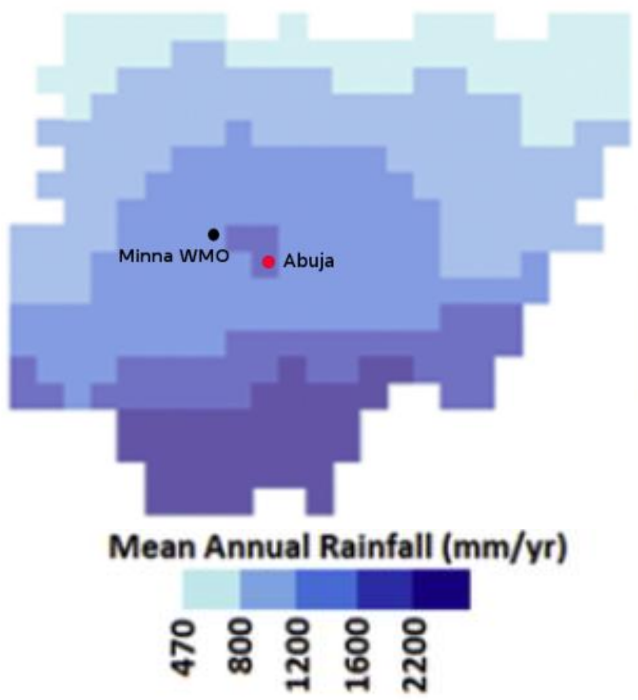
Abuja's climate is classified under the KÖppen-Geiger climate classification as **Aw**– Tropical Savannah with dry winters.


Dry Dusty 'Harmattan' Winds originating from The Sahara desert.

Warm moist monsoon winds push the ITD north from the coast from March/ April until July/ August.



Abuja: Low density low rise city except city centre.



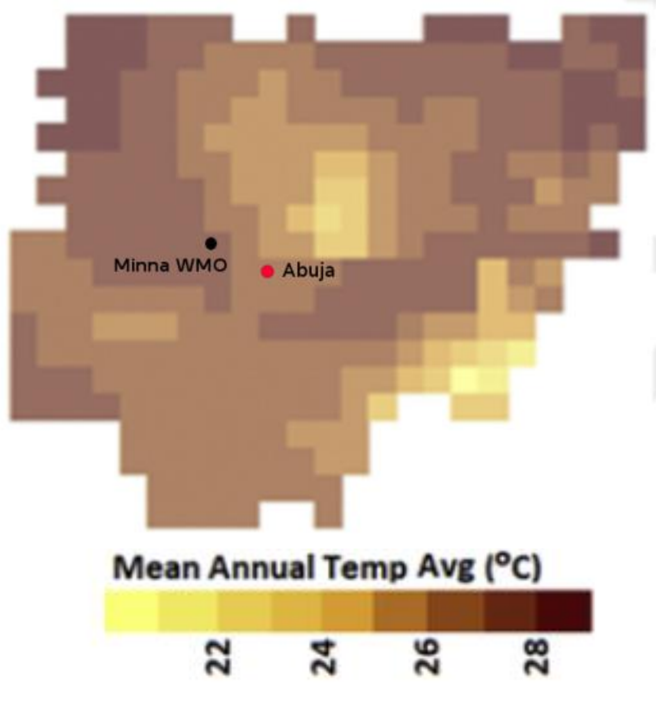




Image left. (Shiru, M. 2019)

**Weather Station Adjustments**

Located higher up on the windward slopes of the Jos plateau slopes, Abuja is subject to greater rainfall and lower temperatures than Minna.

Climate data adjustments made to:

Dry Bulb Temperatures:

Environmental lapse applied at 6.5°K/1000m.

Wind: See following sheet.

## WEATHER STATION

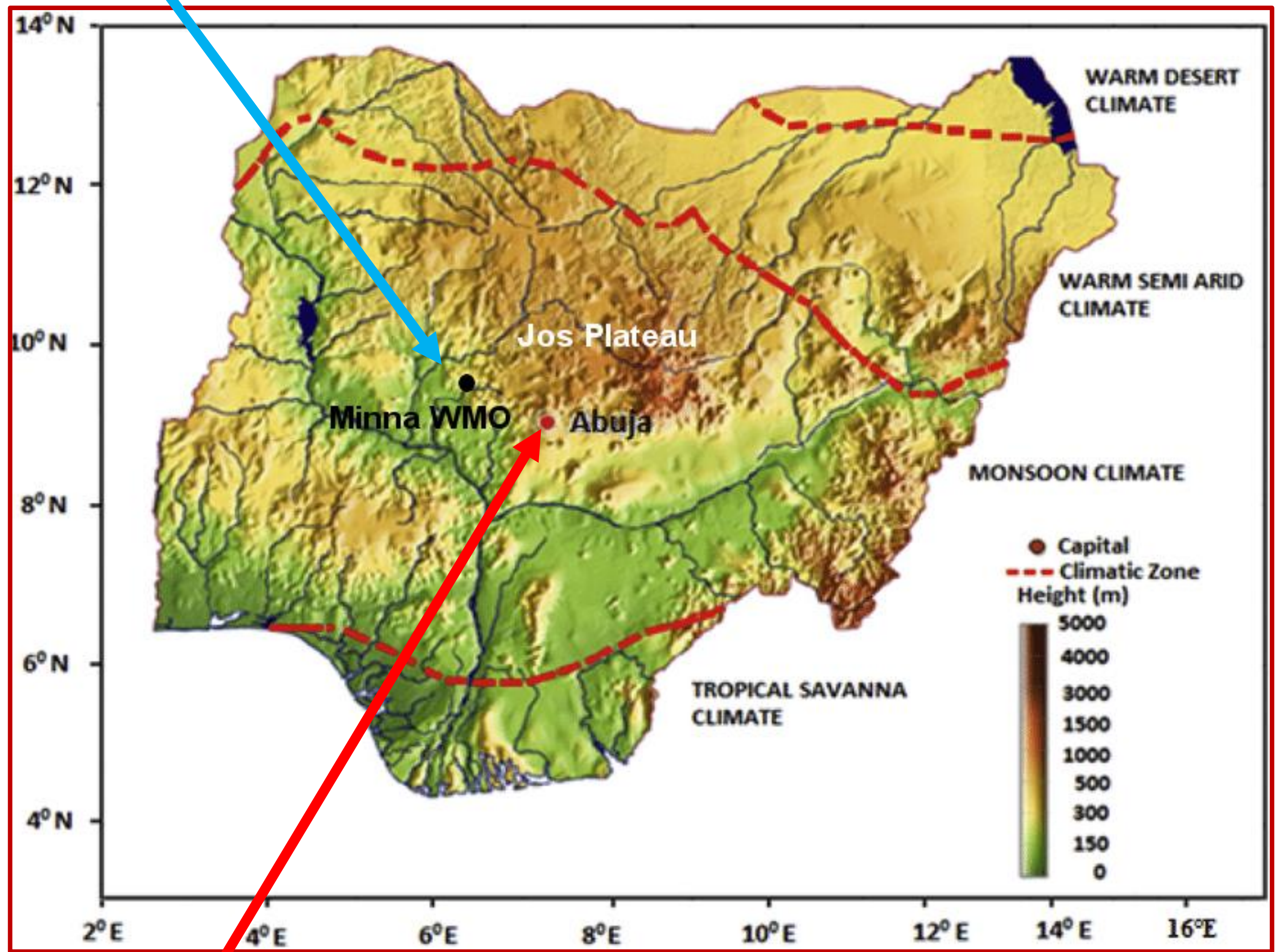
**Minna WMO Weather Station / Abuja comparison**

Minna: Low density low rise suburb.

Abuja: Low density medium rise city.

Distance from Abuja: 115 km NorthWest.

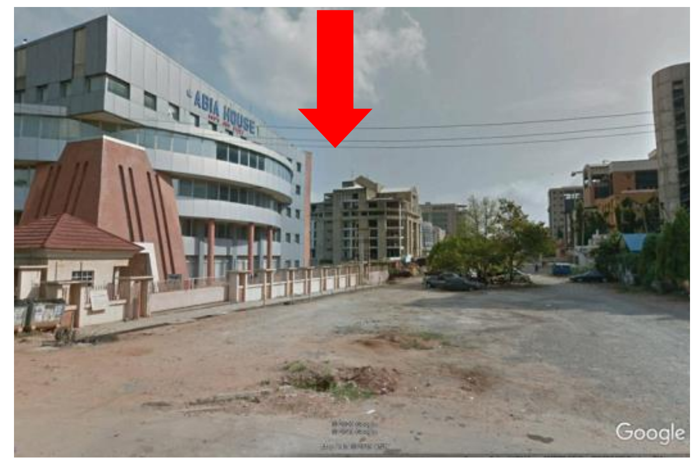
Altitude Difference from Abuja : - 216m.




## SITE


The site is a vacant lot at the edge of the city centre. It has a brook and open space to the north, a dual carriageway to the west and a carparking boulevard to the south.

View A

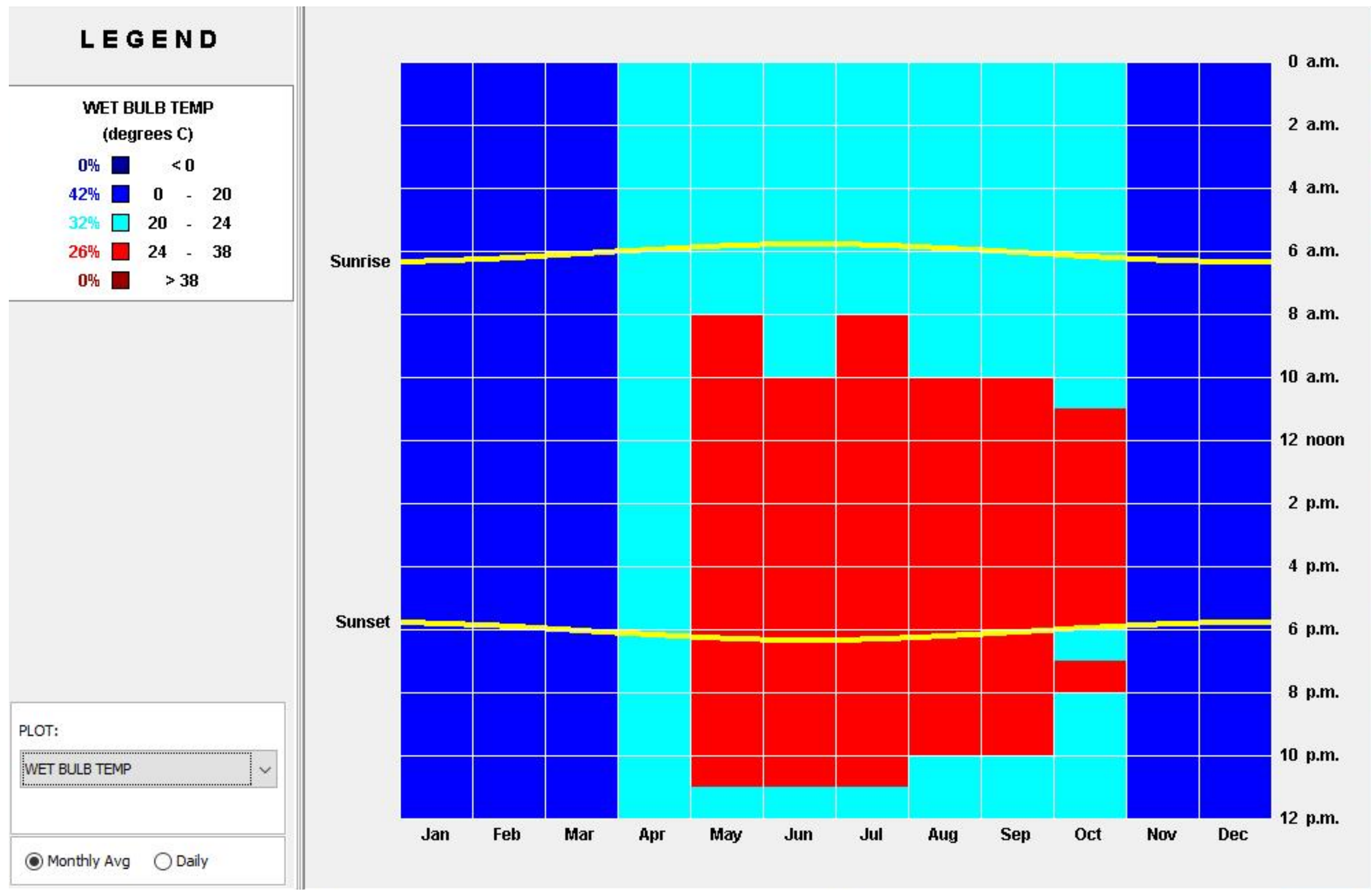


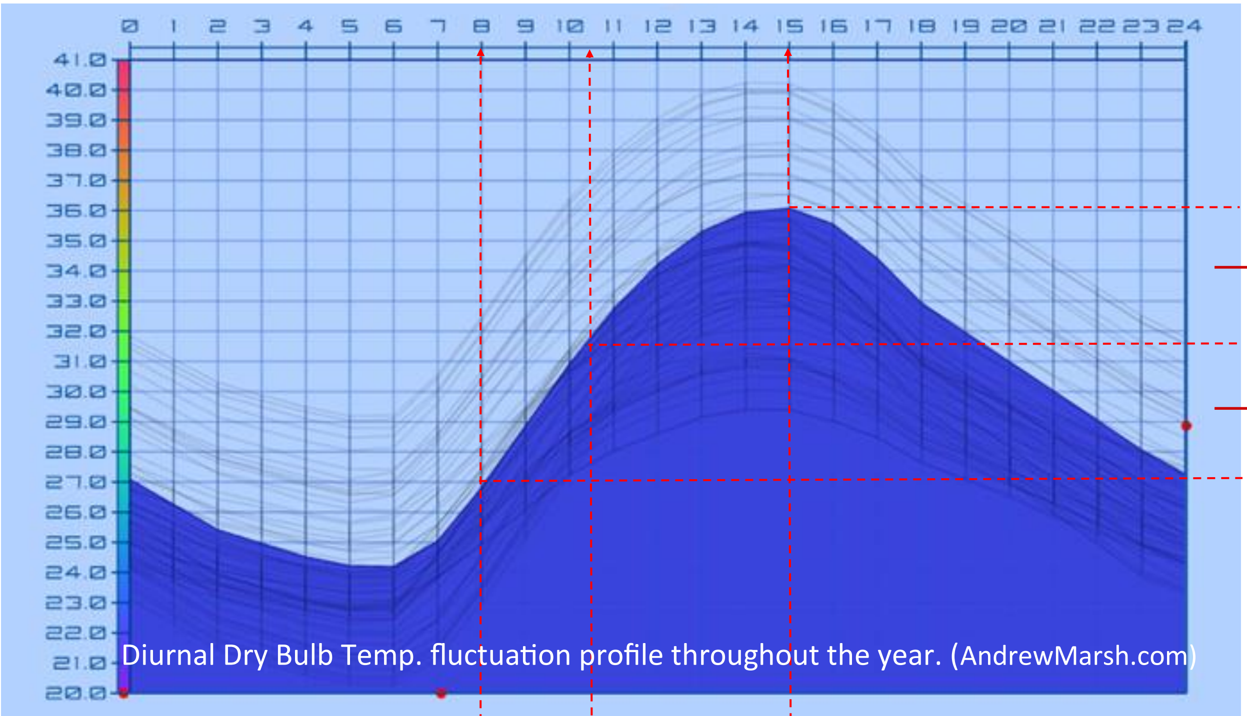
View B

**Wet Bulb temperatures**

These clearly indicate the two distinct seasons in Abuja. The distinction is also clear in the Bioclimatic charts.

DRY: Nov—March WET: April—October



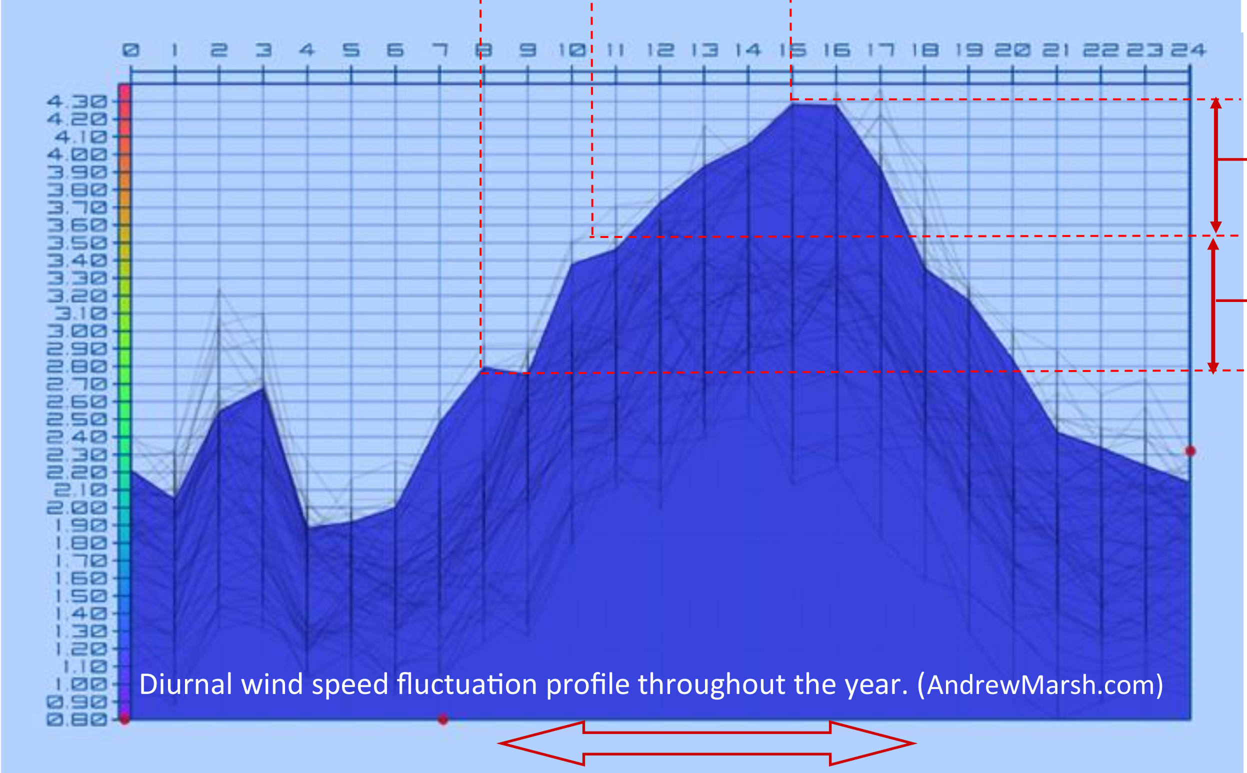

Highest DBT at 15:00.

EQ

Mid DBT at 10:30.

EQ

Lowest DBT at 08:00




Highest wind speed at 15:00.

EQ

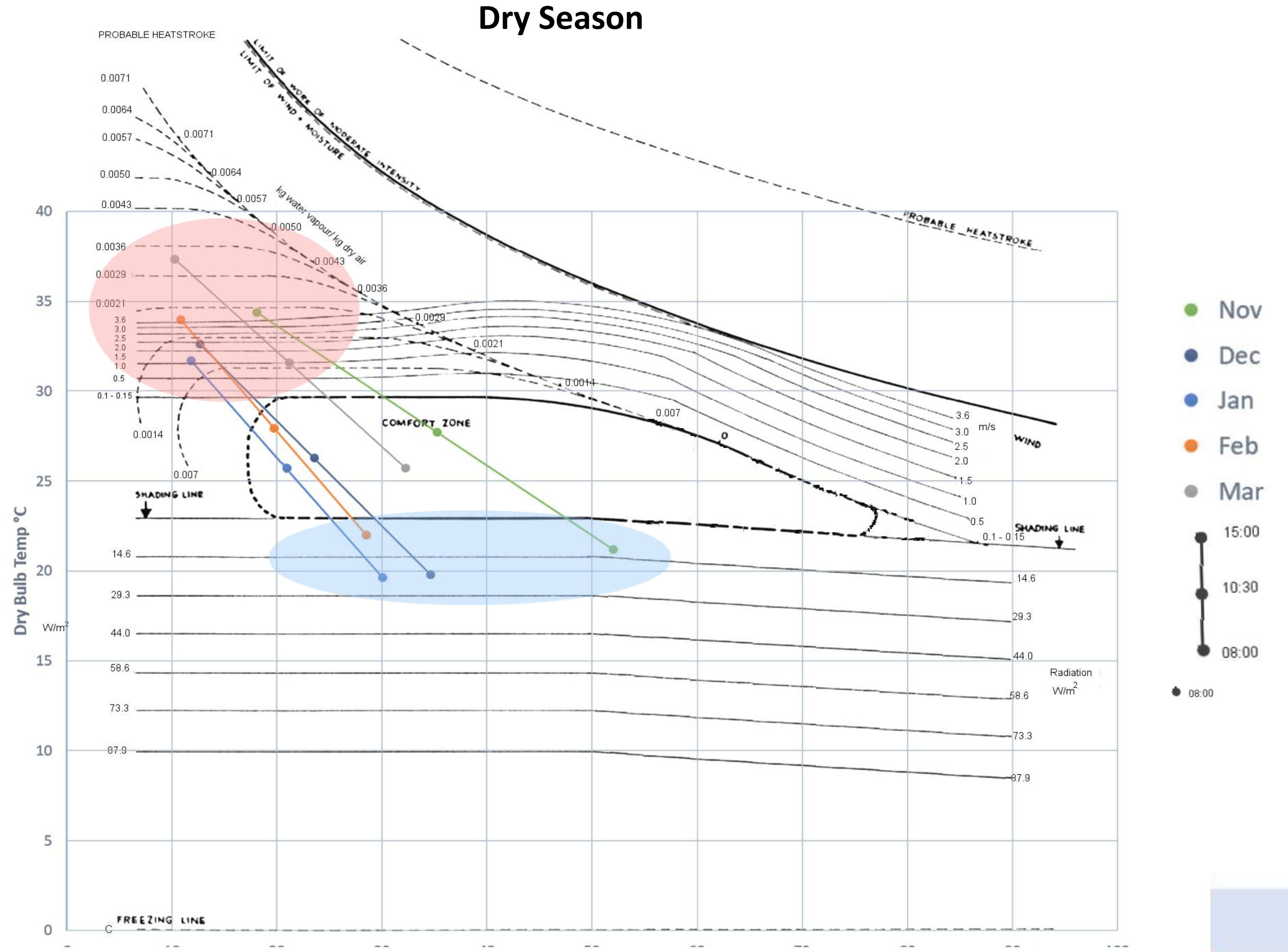
Mid wind speed at 10:30.

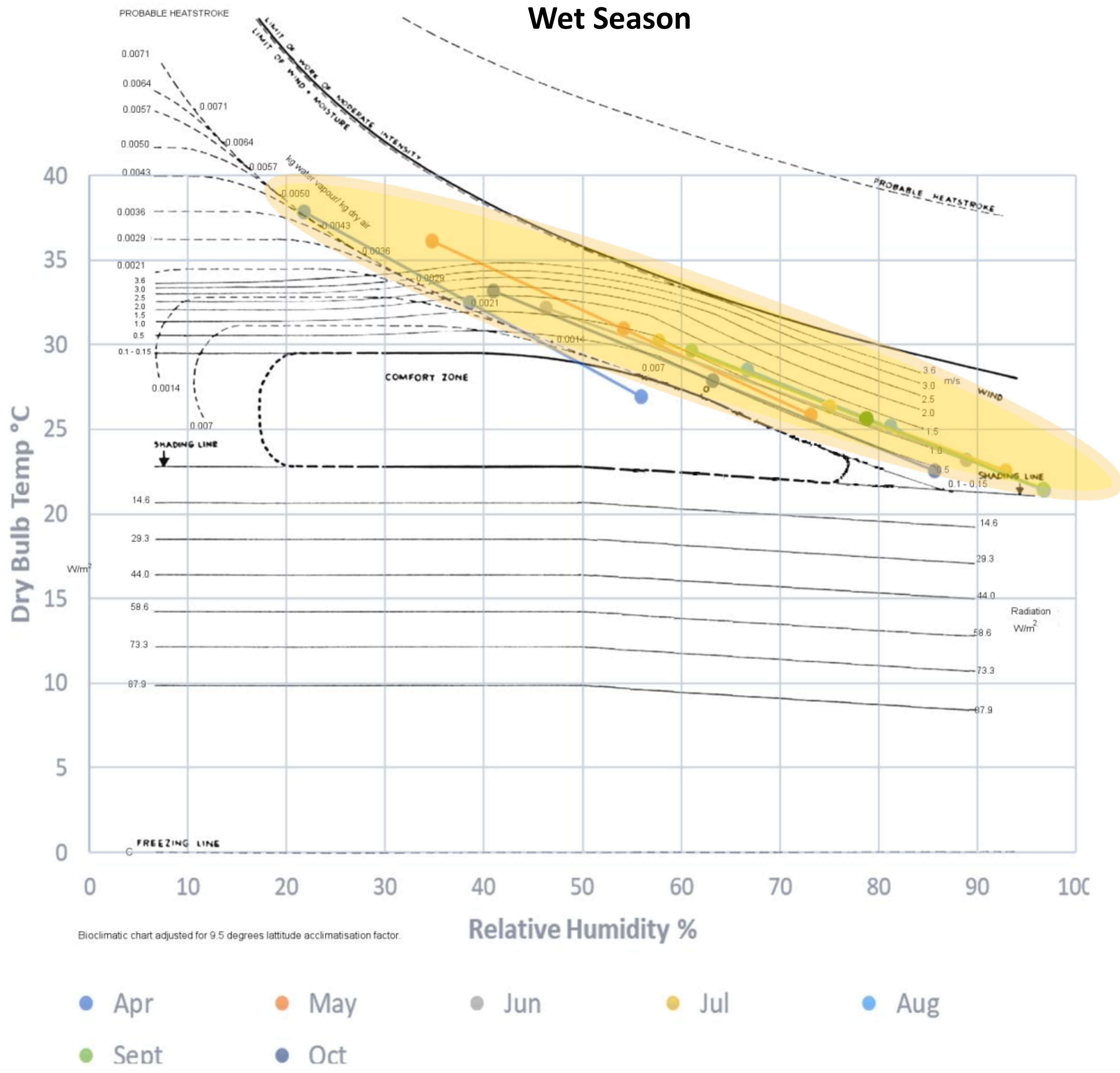
EQ

Lowest windspeed at 08:00

Diurnal Dry Bulb Temperature (DBT) and Wind Speed profiles are consistent throughout the year.

Study Period 08:00– 18:00




**Cold**
Sun needed

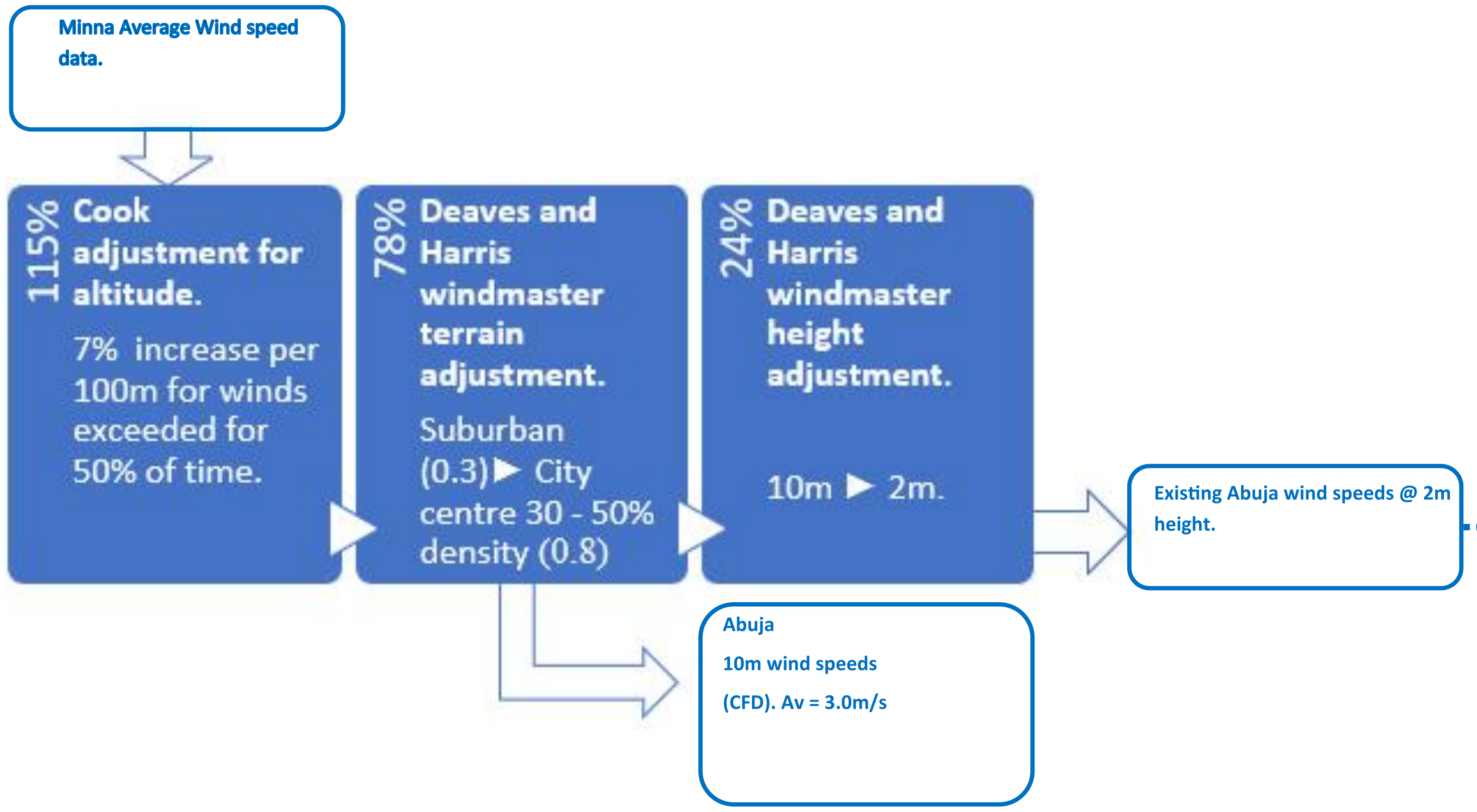
**Hot Humid**
Wind needed

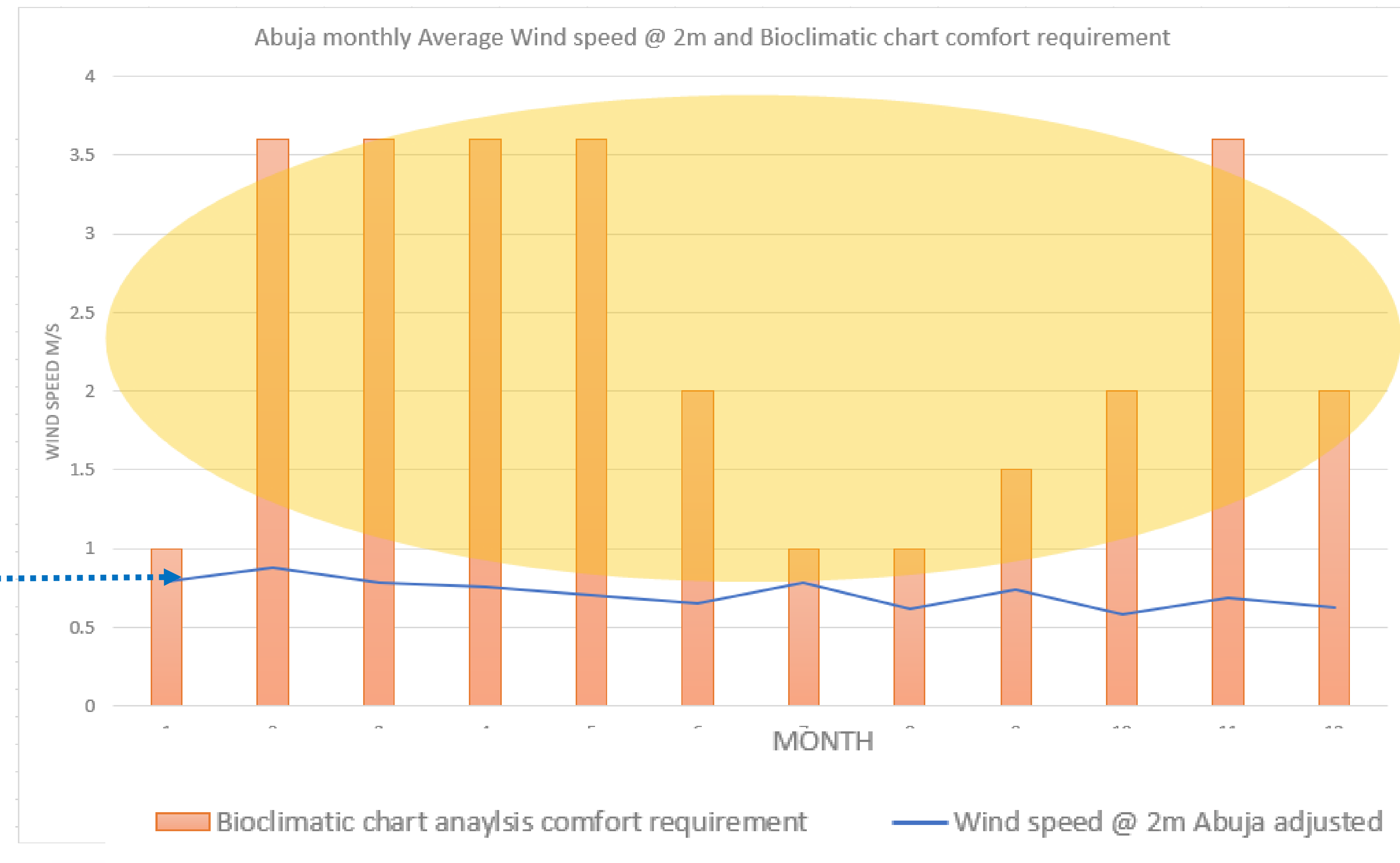
**Hot Dry**
Moisture and
Wind needed

Olgyay Outdoor Comfort Bioclimatic chart adjusted for 9° latitude from temperate climate graph by raising comfort zone by 2.4°C. (Olgyay, 1963)

# ABUJA POTTERY & MUSEUM

## Climate and Comfort Analysis




**Bioclimatic chart comfort mismatch**

| | | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 08:00 | | m/s | 0 | 0 | 0 | 0 | 1.0 | 1.0 | 1.0 | 1.5 | 1.5 | 0.5 | 0 | 0 |
| | | Kg /kg | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | W/m² | 29.3 | 14.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.6 | 29.3 |
| 10:30 | | m/s | 0 | 0 | 1.0 | 1.5 | 1.0 | 1.0 | 1.5 | 1.5 | 1.5 | 0.5 | 0 | 0 |
| | | Kg /kg | 0 | 0 | 0.0014 | 0.0021 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | W/m² | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:00 | | m/s | 1.0 | 3.6 | 3.6 | 3.6 | 3.6 | 2.0 | 1.0 | 1.0 | 1.5 | 2.0 | 3.6 | 2.0 |
| | | Kg /kg | 0.0014 | 0.0021 | 0.0029 | 0.0043 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0023.61 | 0.0014 |
| | | W/m² | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Average horizontal global radiation at 08:00 for months of Nov, Dec, Jan, Feb is **95.89** W/m², rising rapidly to an average of **288** W/m² by 09:00. This is significantly higher than levels required, and likely to push conditions out of comfort levels.

As such, an option to mitigate any wind will be allowed for instead.

| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Predominant Wind direction and humidity | | | | | | | | | | | | | |
| Average wind Speed @ 15:00@ 2m height. | m/s | 0.79 | 0.88 | 0.78 | 0.76 | 0.71 | 0.65 | 0.0.78 | 0.62 | 0.74 | 0.58 | 0.68 | 0.63 |
| Average GH Radiation @ 08:00 | W/m² | 69.4 | 73.0 | 109.2 | 156.1 | 172.0 | 169.5 | 146.2 | 125.0 | 148.4 | 154.4 | 145.7 | 94.9 |

3 predominant wind directions identified from wind rose analysis.

**SW (225°):** Jun—October ( Wet season)

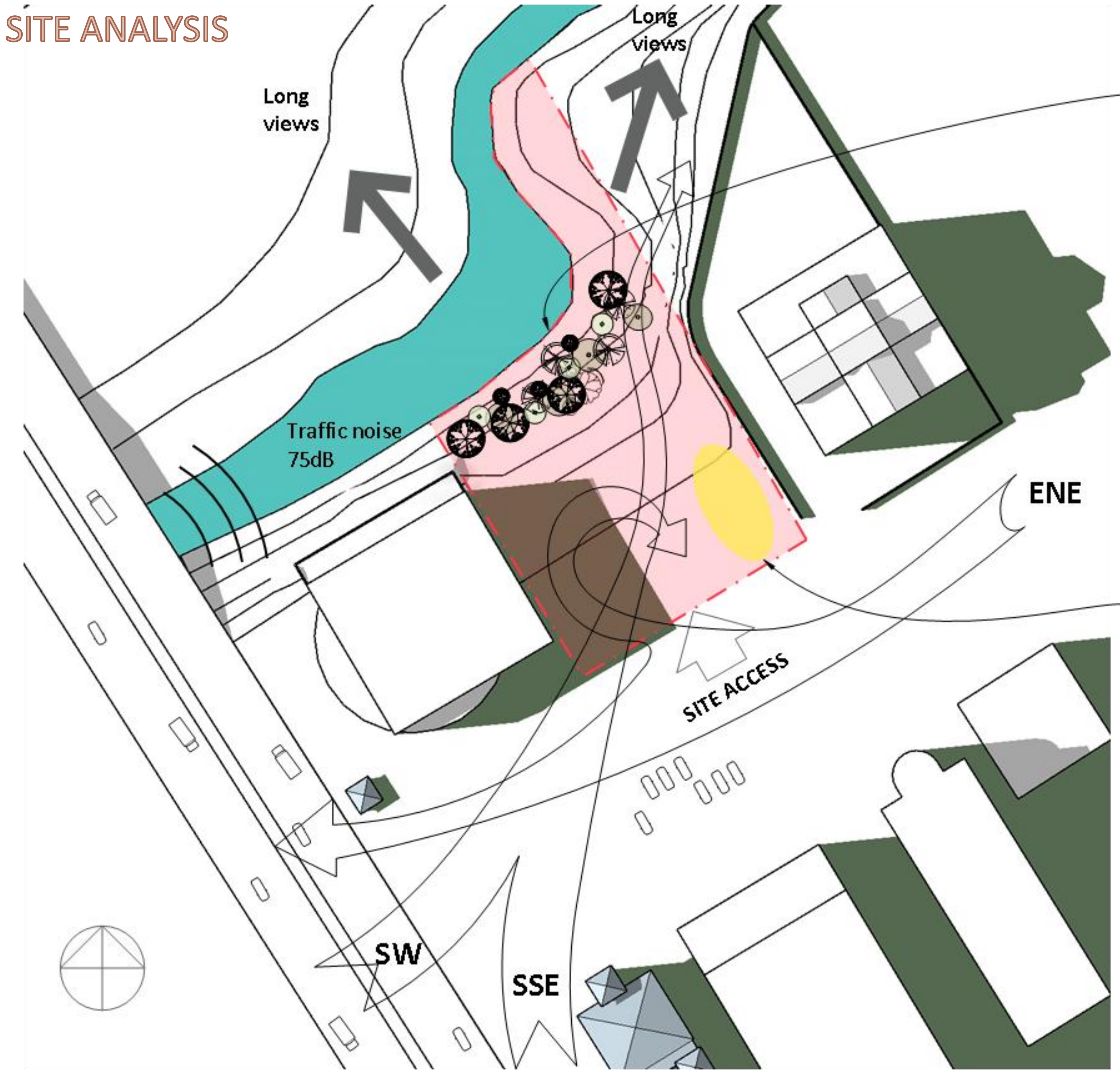
**SSE (165°):** Dec—Feb (Dry) and April (Dry)

Wind speeds currently insufficient to achieve comfort.

| Comfort | Comfort unachievable | Cold Sun needed | Hot Humid Wind needed | Hot Dry Moisture and Wind needed | Moderate RH | Low RH | High RH |
|---|---|---|---|---|---|---|---|

# ABUJA POTTERY & MUSEUM

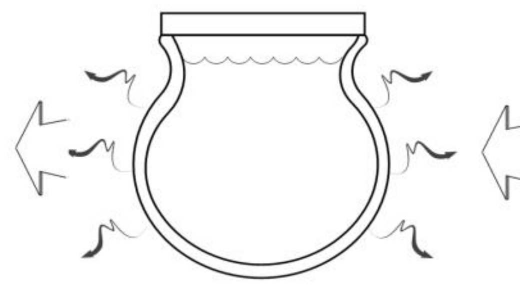
## SITE ANALYSIS




Riverbank over-grown with trees and shrubs blocking wind passage.

Full sun exposure year round from 08:00 to 16:00

SITE ANALYSIS: AS EXISTING

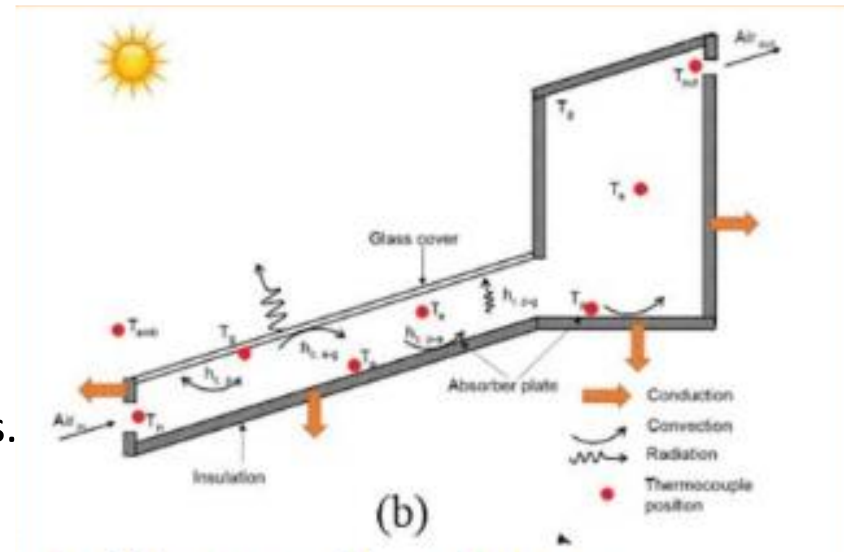


**3.** Non glazed porous ceramic pots with lids filled with water located within the wind channel will simultaneously cool and humidify, whilst not exposing open water to increase malaria risk. These can be emptied and removed when

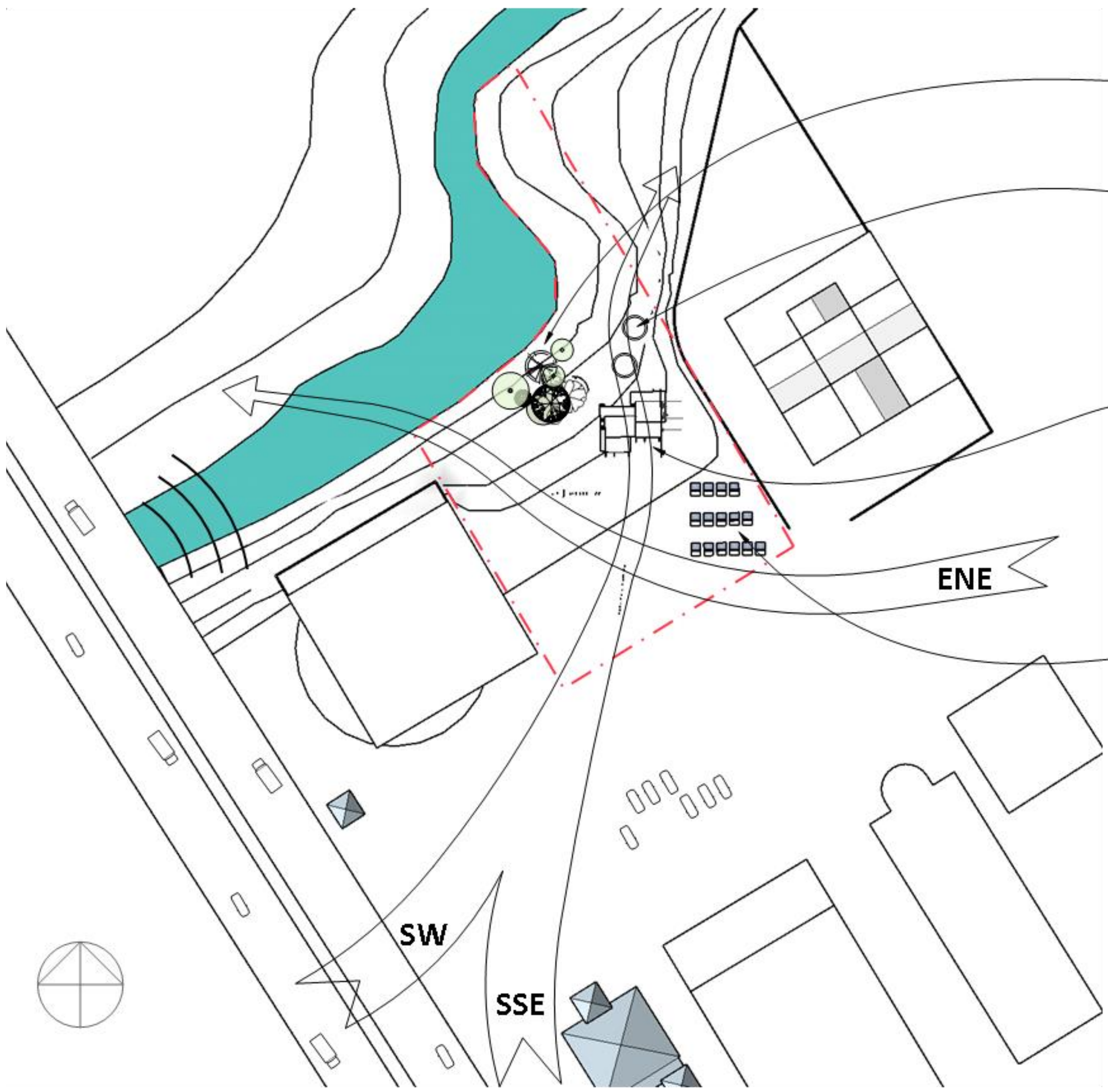
**4.** Provide shade horizontally and vertically for outdoor workshops. Vertical shade can also function to moderate

**5.** Provide traditional open pit kilns down wind of activities.

**6.** Provide facility to allow uniform drying of pottery.




**Indirect solar dryer.**




Trees cut back to open wind channel. Grove of trees retained to shield and lessen perception of road noise.

Traditional open pit kiln located down-wind.

Outdoor workshops located at brow of slope and in wind channel to benefit from acceleration of wind.

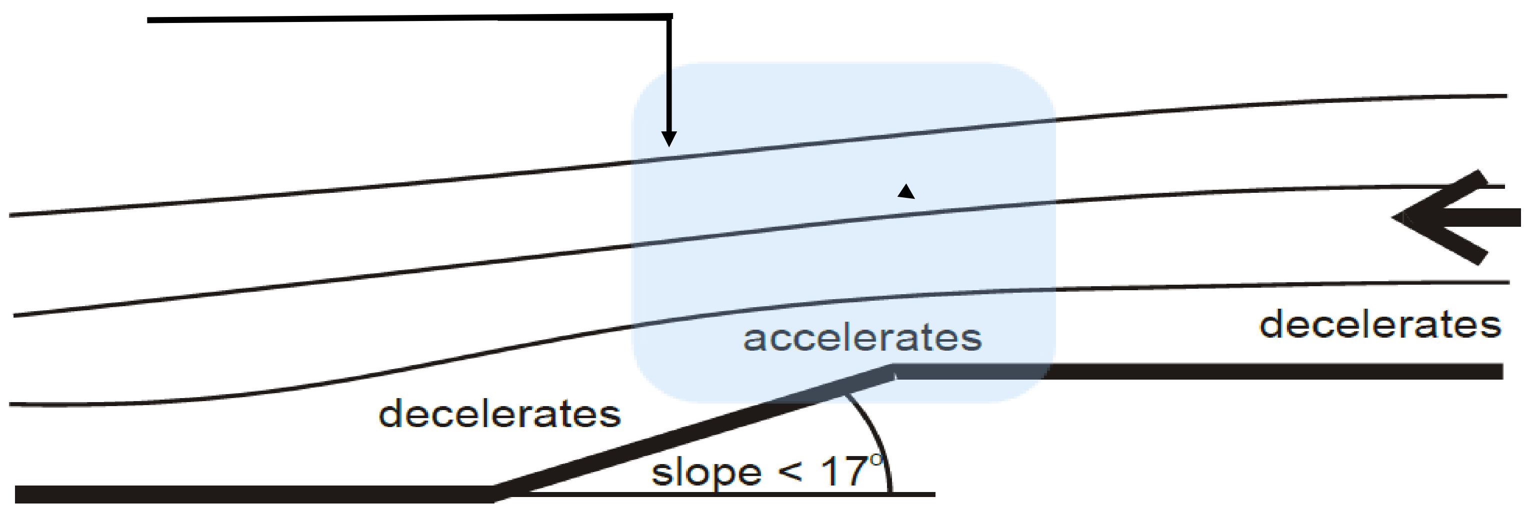
Indirect solar dryers located in area of maximum sun exposure.

SITE ANALYSIS: AS PROPOSED

## PROPOSAL

1. Reduce trees to improve wind flow across the site and channel winds to increase wind flow.

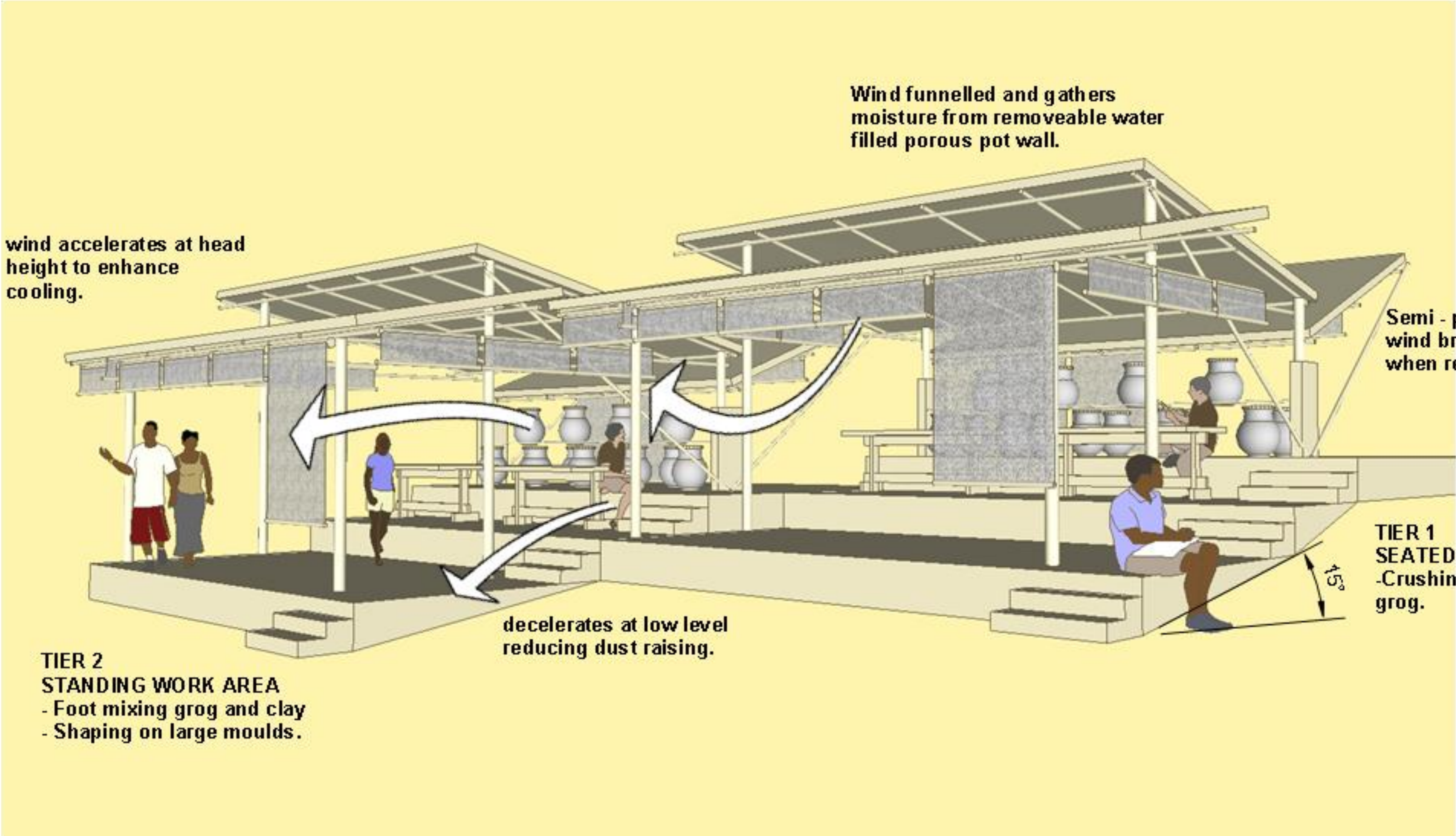
**2.** Locate workshops at brow of hill in wind channel to benefit from wind acceleration.

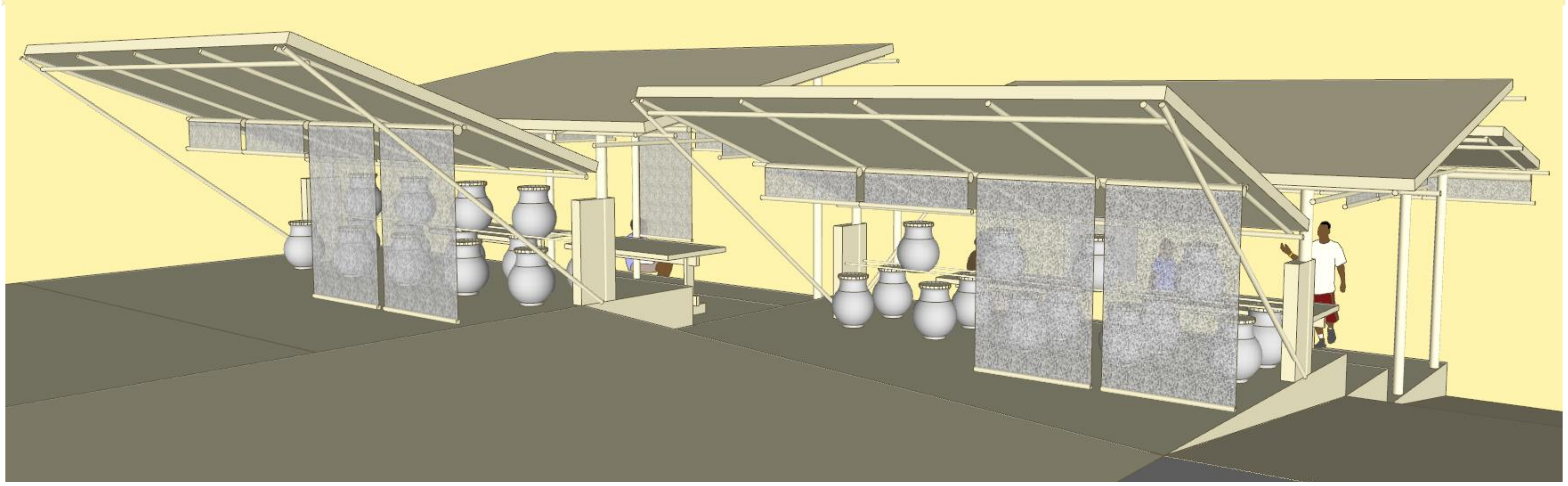



**Flow down shallow escarpment**

## PROPOSAL AND ASSESSMENT

### WORKSHOP



**Added humidity and temperature drop attributable to pottery vessels is dependent on :-**

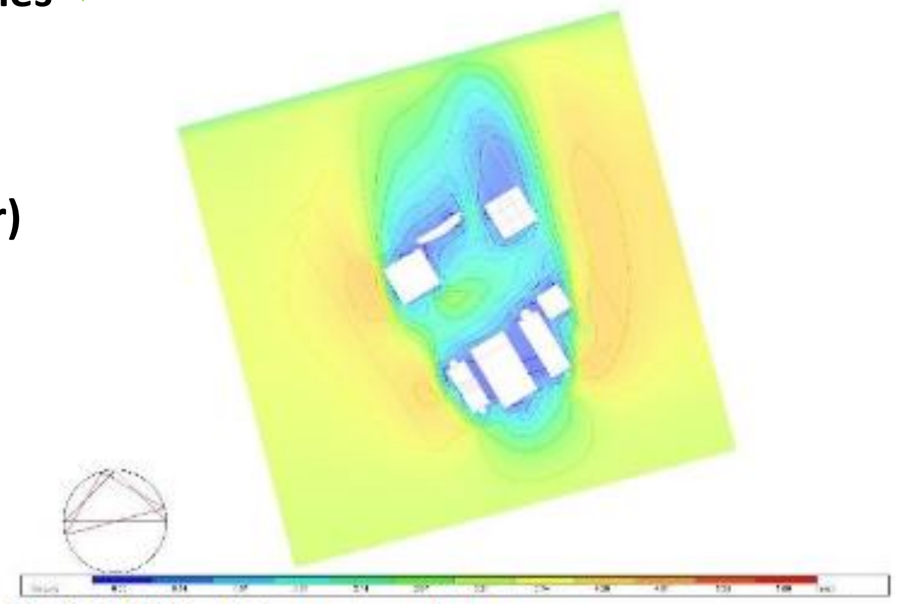
- **Pots configuration and shape. Pottery porosity Wind speed Water content and pressure Relative humidity.**

**A study by Ibrahim (2003) has indicated that temperature drops of 6-8 °K and humidity adjustments of 30% are achievable.**

**Wind CFD studies with reduced wind break.**

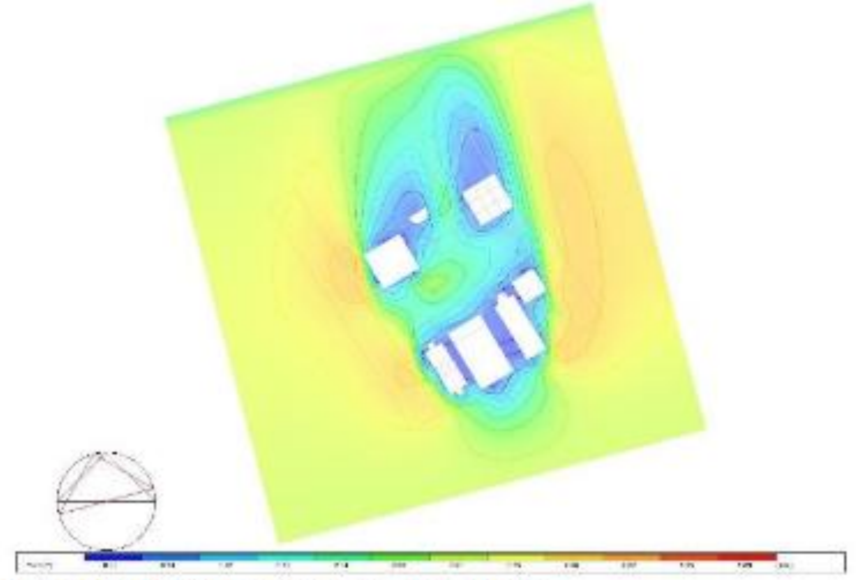
**( Designbuilder)**

AS EXISTING



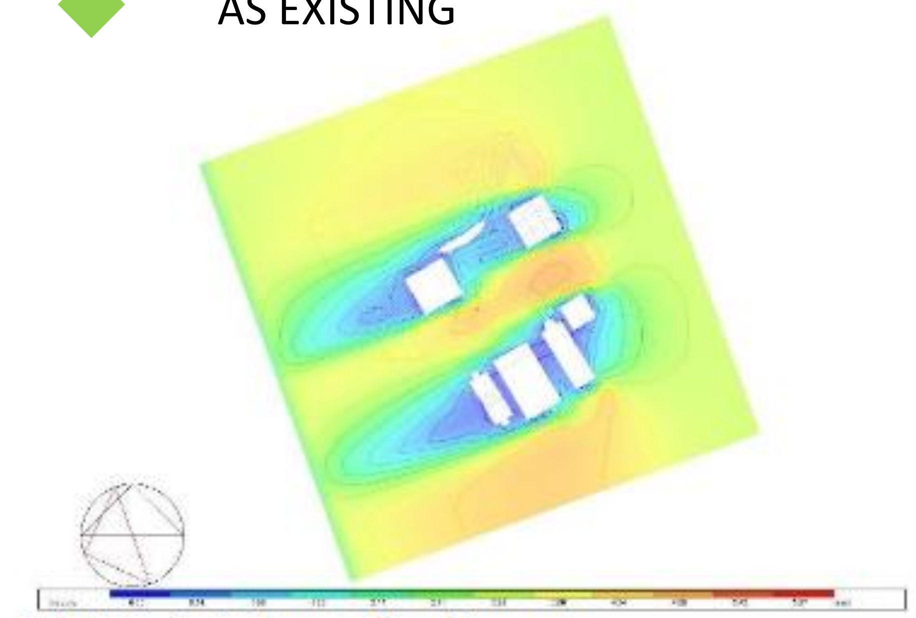
SSE 165° Wind; December - February

PROPOSED



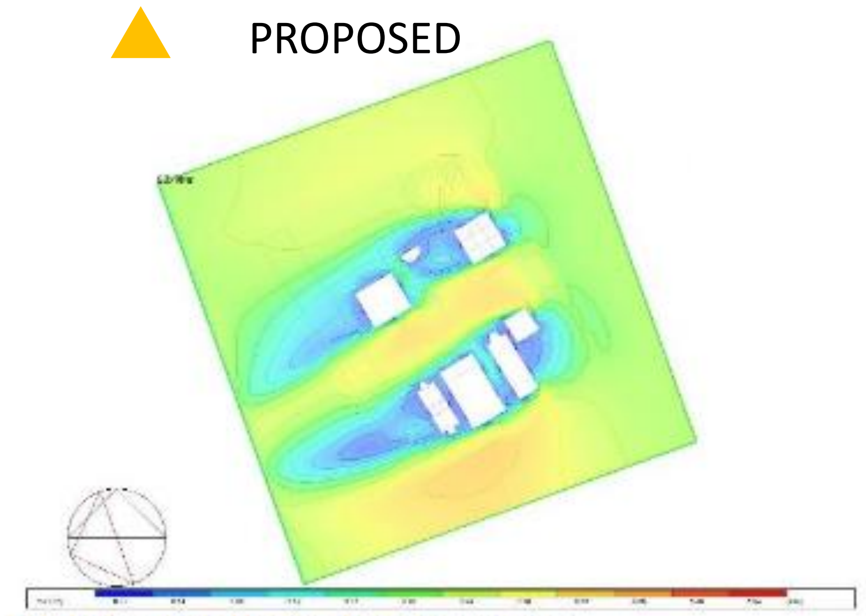
SSE 165° Wind; December - February

AS EXISTING



ENE 70° wind; March, May, November

PROPOSED



ENE 70° wind; March, May, November

**FINAL ADJUSTED BIOCLIMATIC CHART**

| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 08:00 | m/s | 0 | 0 | 0 | 0 | 1.0 | 1.0 | 1.0 | 1.5 | 1.5 | 0.5 | 0 | 0 |
| | Kg /kg | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | W/m² | 29.3 | 14.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.6 | 29.3 |
| 10:30 | m/s | 0 | 0 | 1.0 | 1.5 | 1.0 | 1.0 | 1.5 | 1.5 | 1.5 | 0.5 | 0 | 0 |
| | Kg /kg | 0 | 0 | 0.0014 | 0.0021 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | W/m² | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15:00 | m/s | 1.0 | 3.6 | 3.6 | 3.6 | 3.6 | 2.0 | 1.0 | 1.0 | 1.5 | 2.0 | 3.6 | 2.0 |
| | Kg /kg | 0.0014 | 0.0021 | 0.0029 | 0.0043 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0021 | 0.0014 |
| | W/m² | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Predominant Wind direction and humidity | | | | | | | | | | | | |
| New Wind Speed (m/s) @ 1.5m height at workshop by CFD analysis. (Wind speed @ 10m = 3 m/s.) | 2.68 | 2.68 | 1.62 | 2.68 | 1.62 | 1.52 | 1.52 | 1.52 | 1.52 | 1.52 | 1.62 | 2.68 |
| Extg Wind Speed (m/s) @ 1.5m height at workshop by CFD analysis. (Wind speed @ 10m = 3 m/s.) | 1.61 | 1.61 | 0.54 | 1.61 | 0.54 | 1.52 | 1.52 | 1.52 | 1.52 | 1.52 | 0.54 | 1.61 |

Note:

Assumed sufficient moisture added. Wind speeds as determined by CFD analysis at workshop location.

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