



# Natural Lighting Analysis & Remodeling

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# ABOUT THE BUILDING

- **Location:** Backford, A41, north of Chester.
- **Date of Opening:** October 14, 2021.
- **Facilities:** Main Hall, activity room, stage, kitchen, and bar.
- **Purpose:** Hosts a wide range of social, educational, sporting, cultural, and group activities and events.
- **Accessibility:** located with a large on-site parking area surrounded by trees.



# CURRENT PROGRAMS & FUTURE PLANS

## Current Programs:

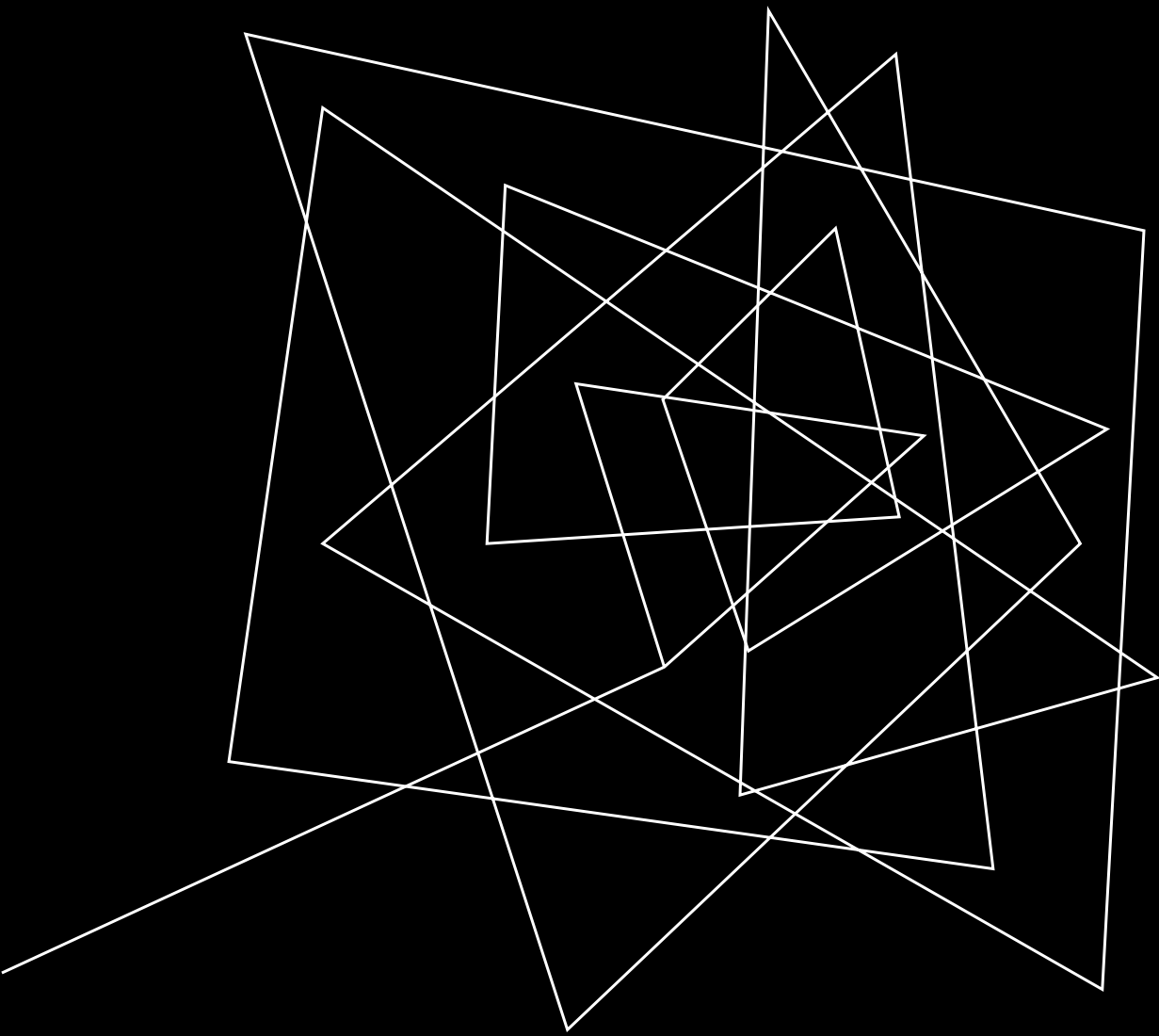
- Local CO OP
- Community Green Space
- Rentable Spaces (Main Hall, Activity Room, Bar, Kitchen)



## Future Plans:

- Outdoor MUGA Center
- Expanding Green Space
- CO OP Proceeds For Upkeep & Other Plans





CLIMATE OF CHESTER

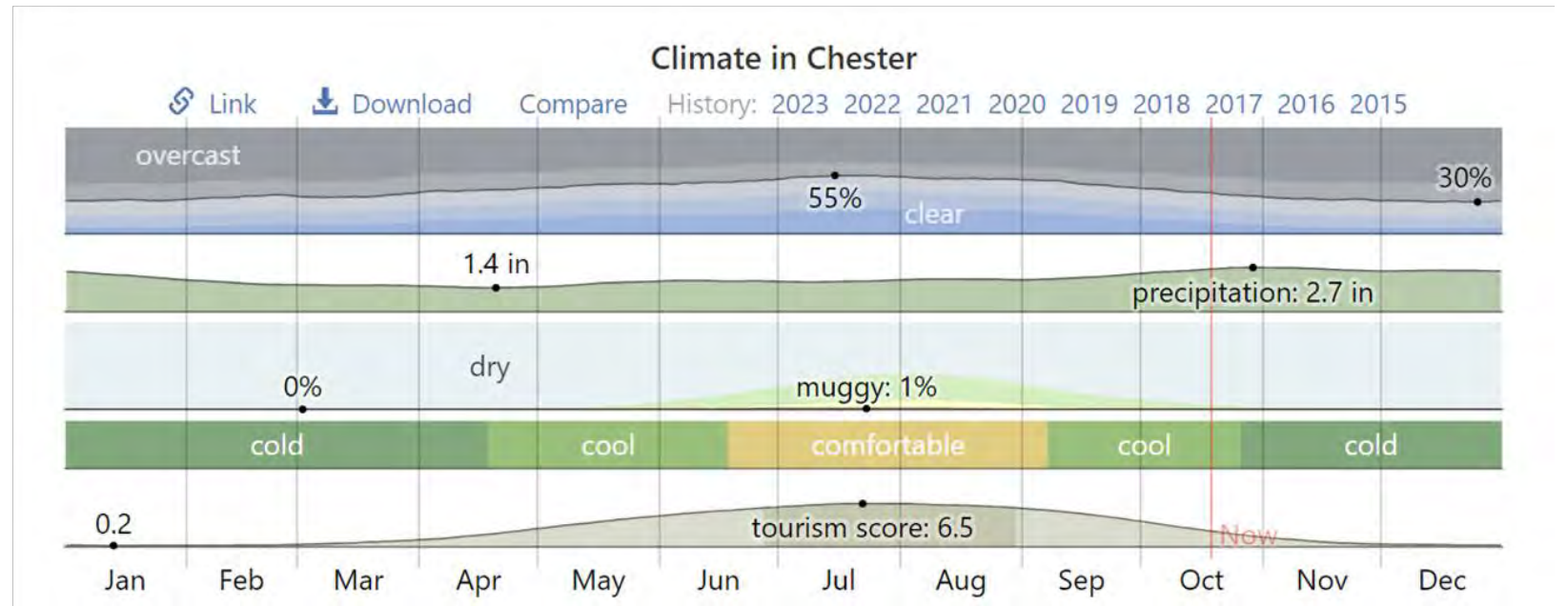
## Summers

- Comfortable
- Partly cloudy

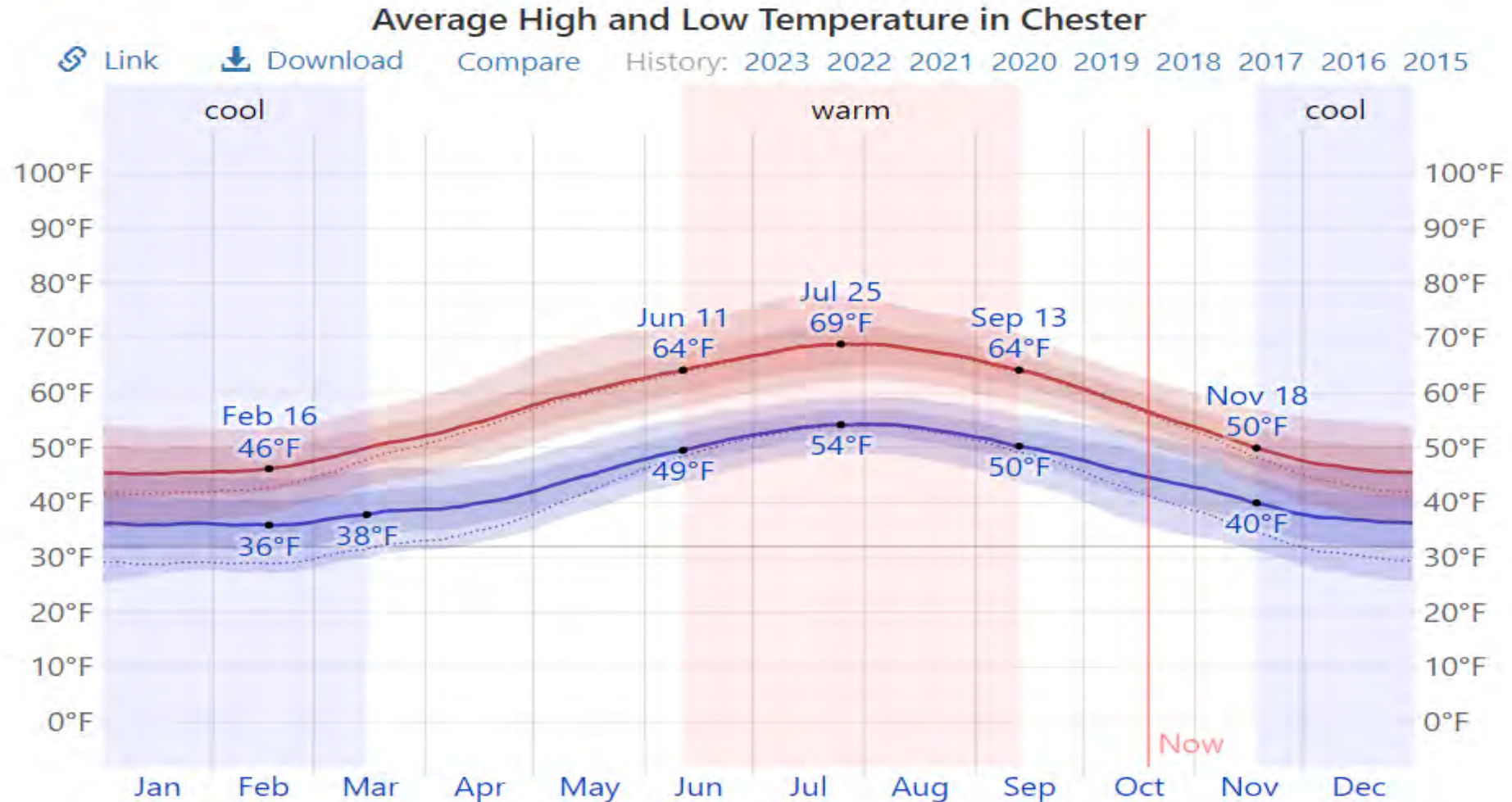
## Winters

- Long
- Very cold
- Windy
- Mostly cloudy

Over the course of the year, the temperature typically varies from 36°F to 69°F and is rarely below 26°F or above 78°F.

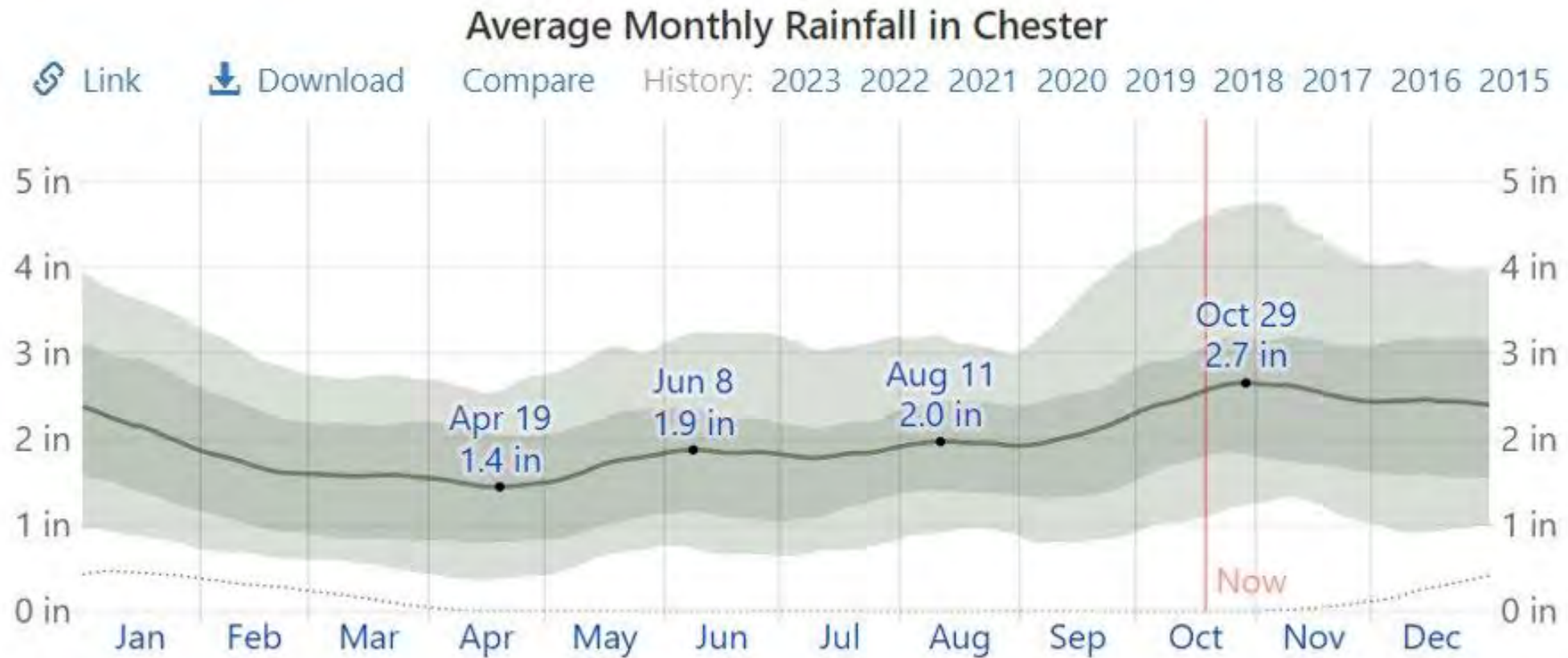


The warm season lasts for 3.0 months, from June 11 to September 13, with an average daily high temperature above 64°F. The hottest month of the year in Chester is July, with an average high of 68°F and low of 54°F. The cool season lasts for 3.9 months, from November 18 to March 15, with an average daily high temperature below 50°F. The coldest month of the year in Chester is January, with an average low of 36°F and high of 45°F.



Rain falls throughout the year in Chester. The month with the most rain in Chester is *November*, with an average rainfall of *2.6 inches*.

The month with the least rain in Chester is *April*, with an average rainfall of *1.4 inches*.

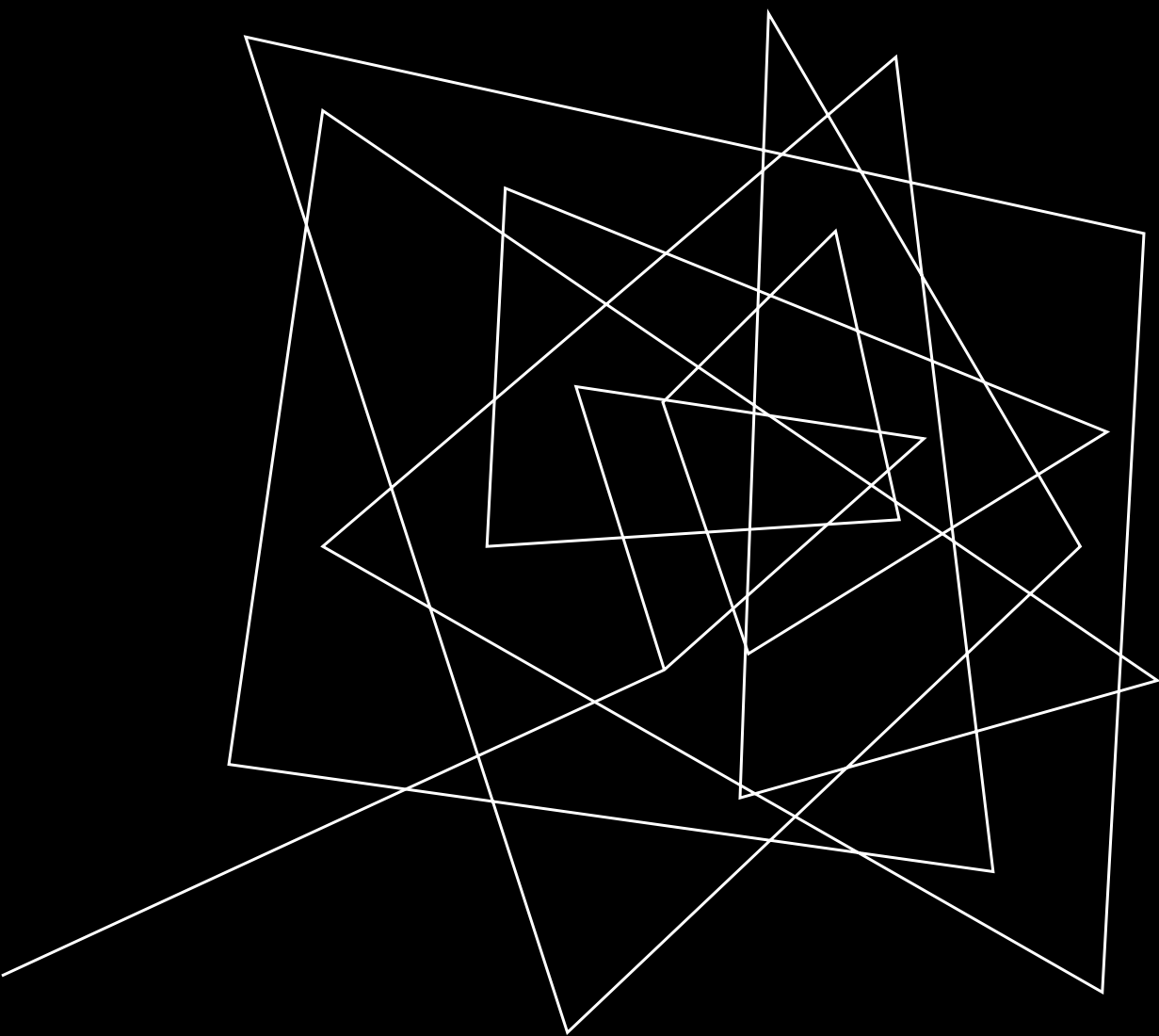


The length of the day in Chester varies extremely over the course of the year. In 2023, the shortest day is *December 22*, with *7 hours, 32 minutes* of daylight; the longest day is *June 21*, with *16 hours, 58 minutes* of daylight.

The *earliest sunrise* is at *4:43 AM* on *June 18*, and the *latest sunrise* is *3 hours, 42 minutes* later at *8:26 AM* on *December 30*. The *earliest sunset* is at *3:53 PM* on *December 13*, and the *latest sunset* is *5 hours, 49 minutes* later at *9:42 PM* on *June 24*.

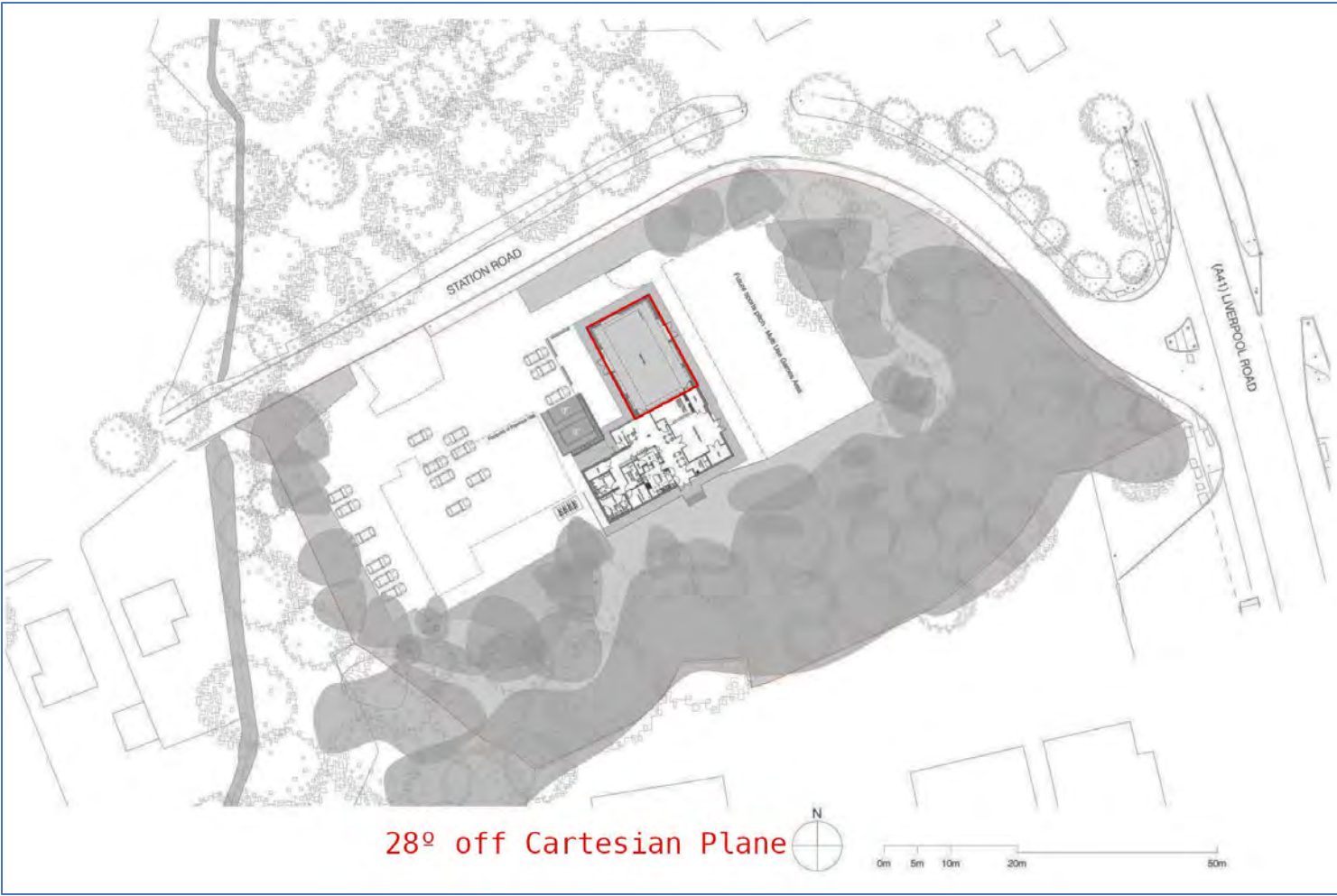






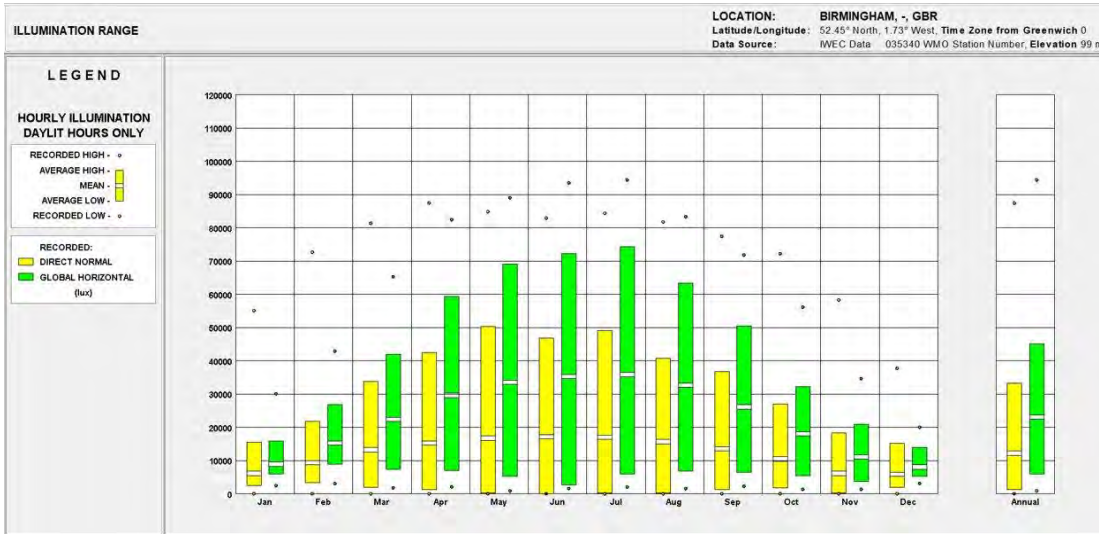
CONTEXT & ORIENTATION

# Orientation on Site, Context



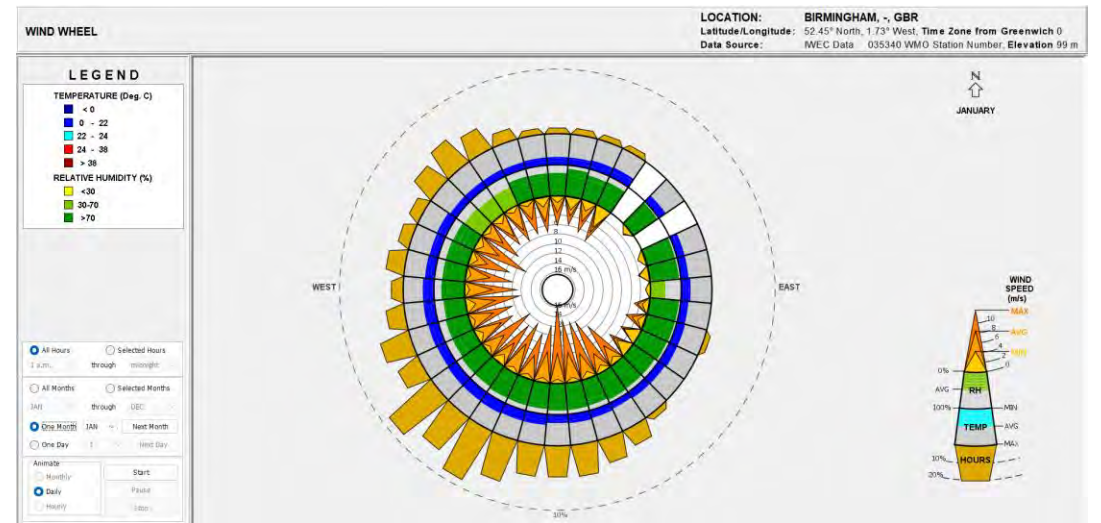
- East / West(-ish) apertures? Not great without shading devices
  - Although, the foliage on site likely blocks intense direct light in summer (it appears to be deciduous)
  - Opportunities for southern apertures (roof) used for passive heating

# Illumination

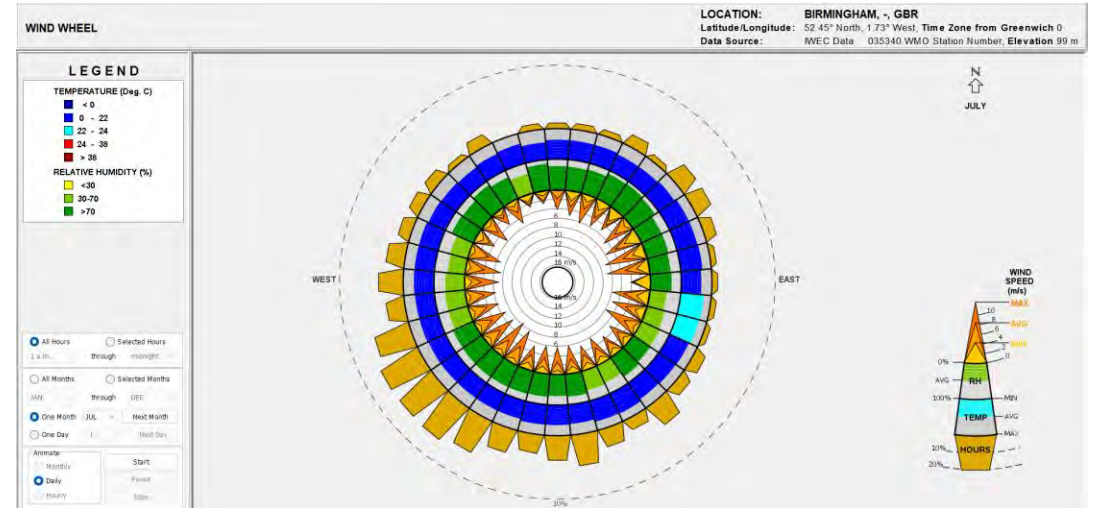


# Wind Wheels

Winter



Summer

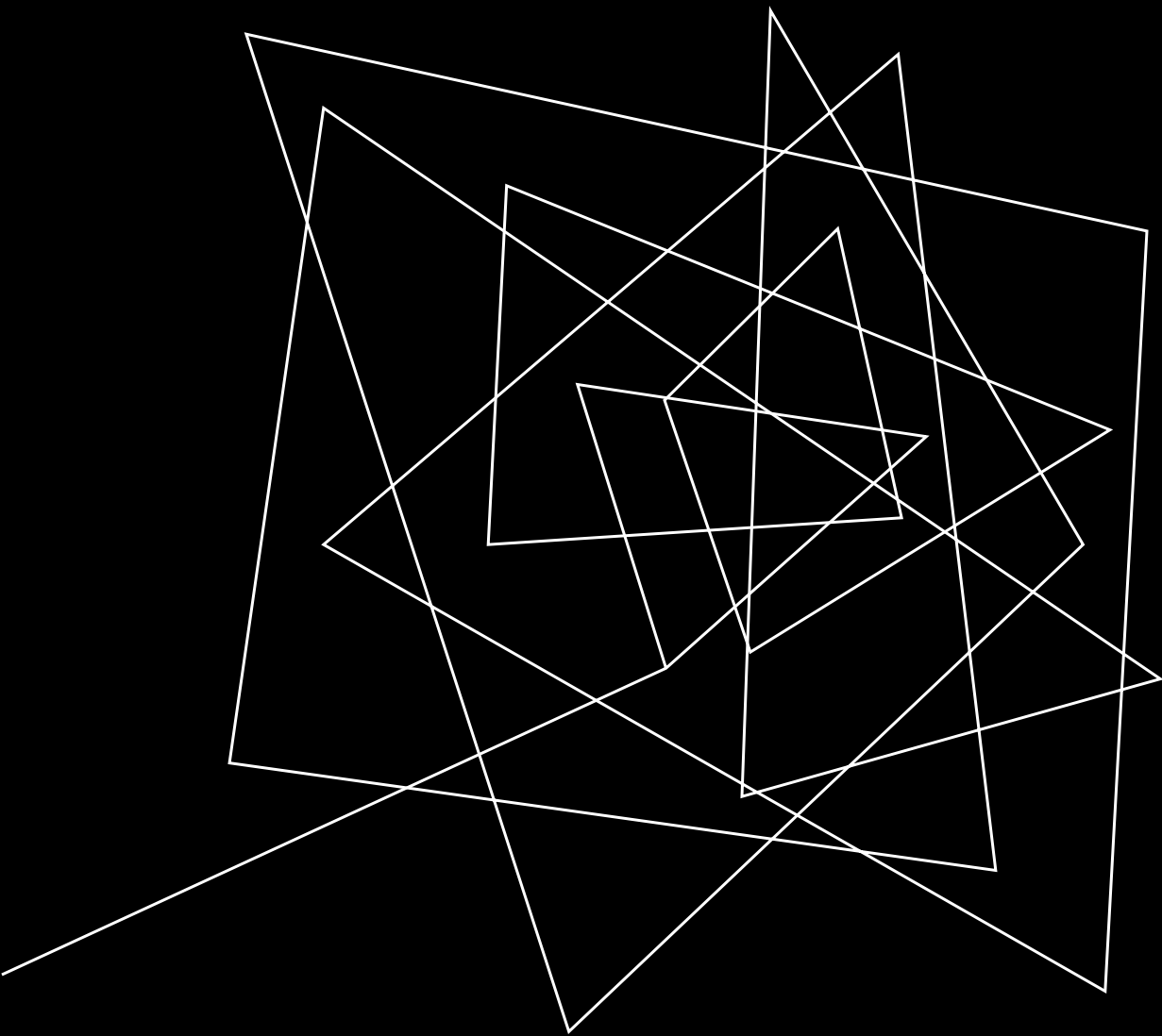


## Worth Noting:

- The worst winter winds are generally blocked by the extension of the building which we are not modeling
- Cooling summer winds also seem somewhat blocked, but perhaps are a bit more westwardly originating- which may allow cross ventilation due to the pressure differential
- Illumination is higher in the summer



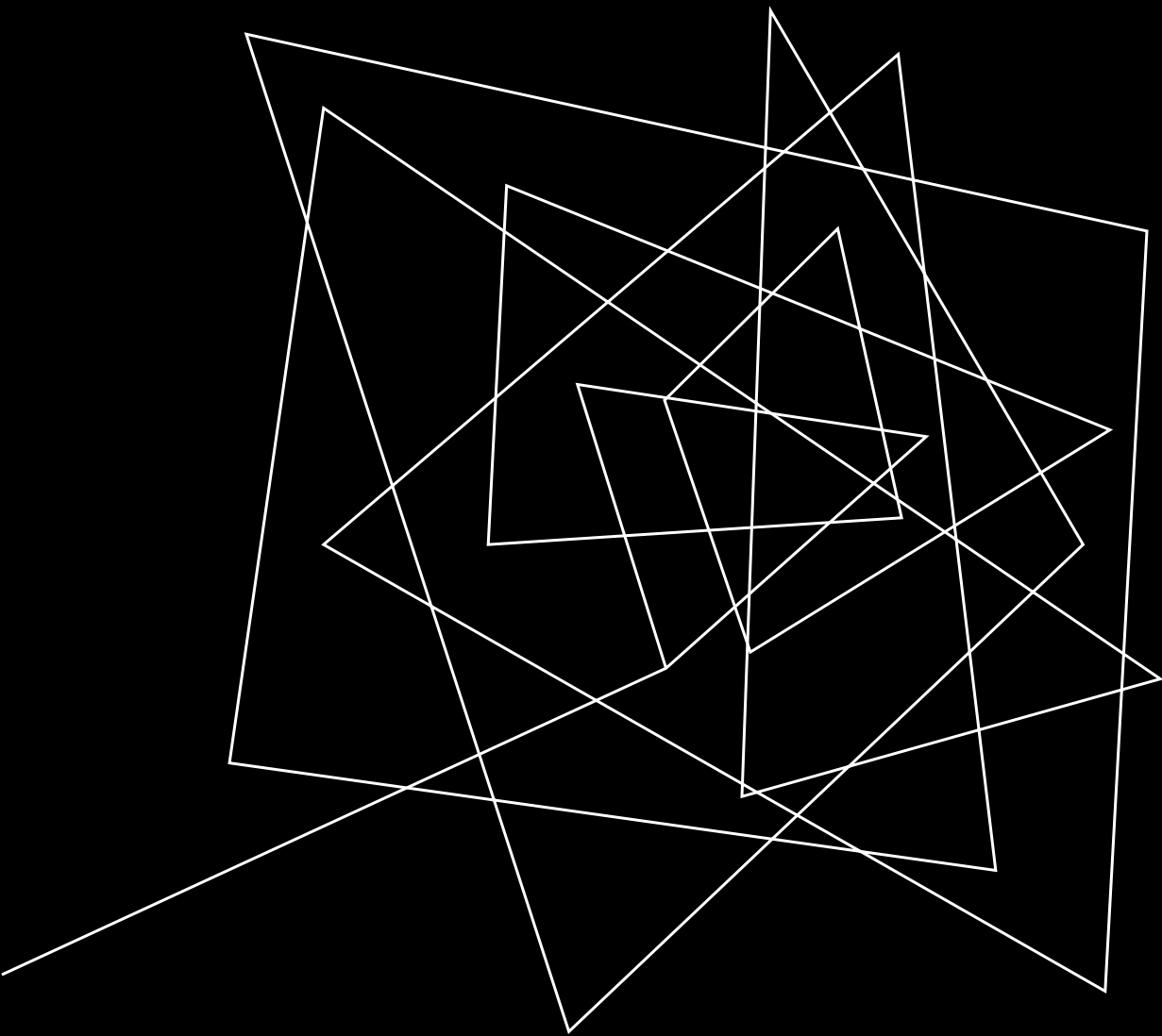
constant reminder:



DIGITAL MODEL OF THE  
CURRENT BUILDING



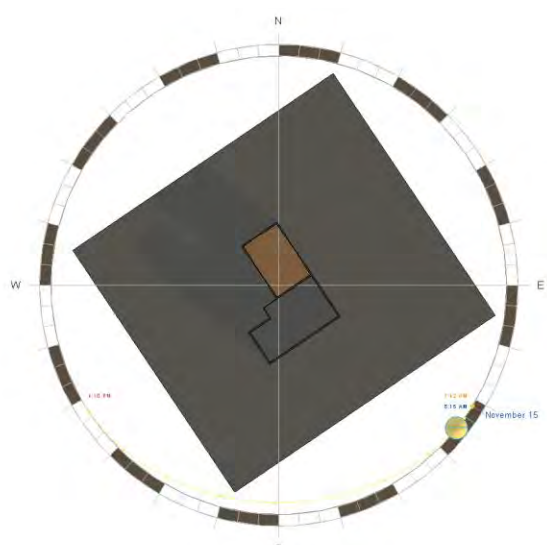




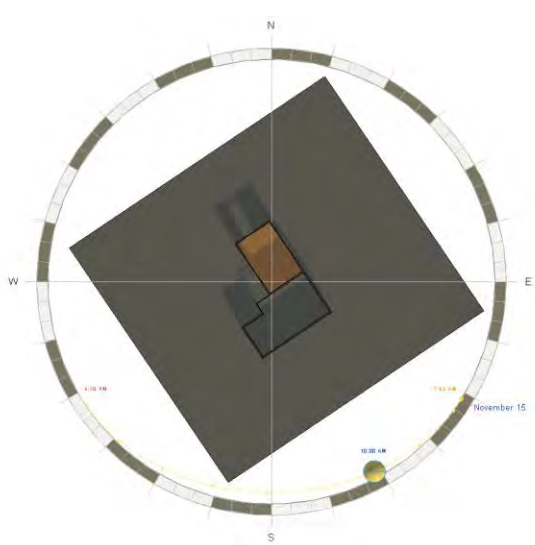
# SOLAR STUDY OF THE CURRENT BUILDING

# November 15

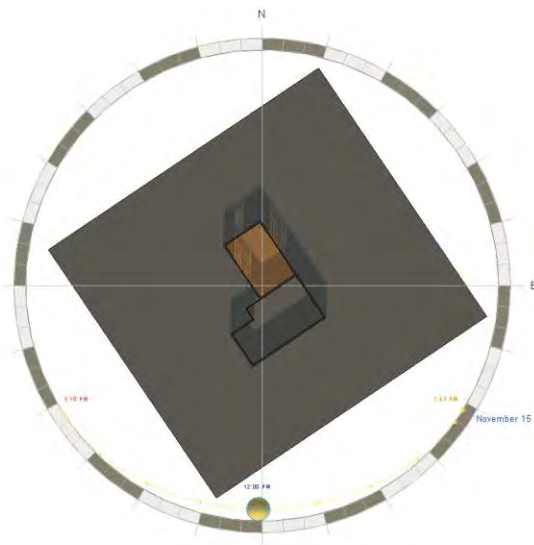
Sunrise: 7:42 AM  
Sunset: 4:10 PM



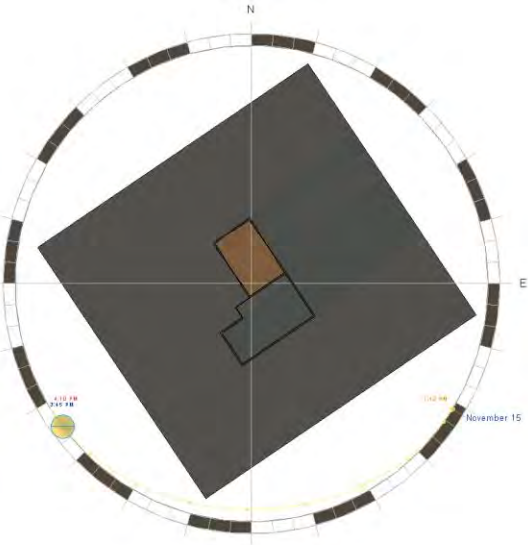
8:15 AM



10:00 AM



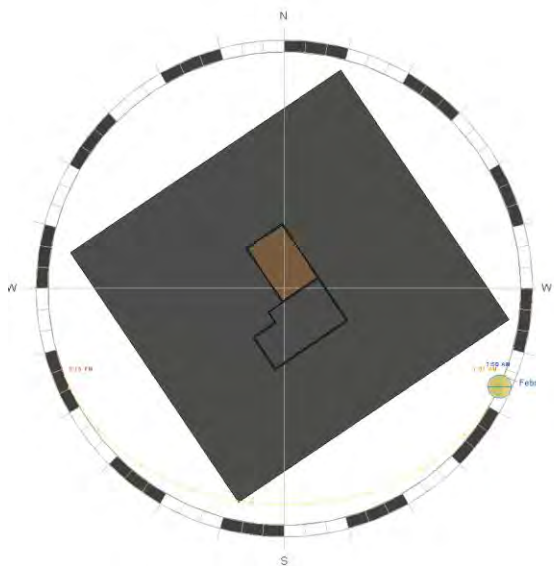
12:00 PM



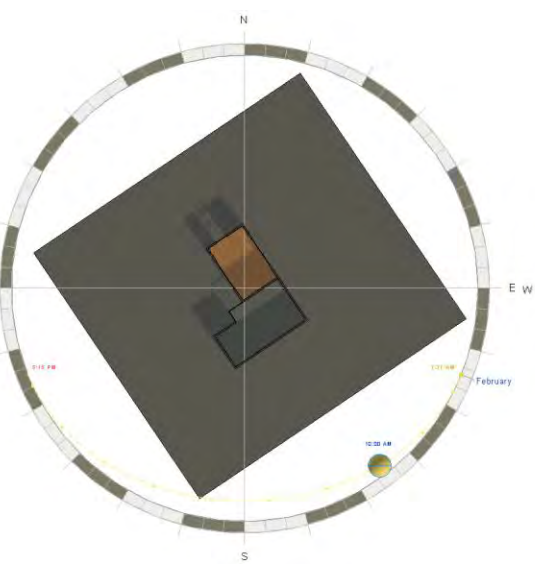
3:45 PM

# February 15

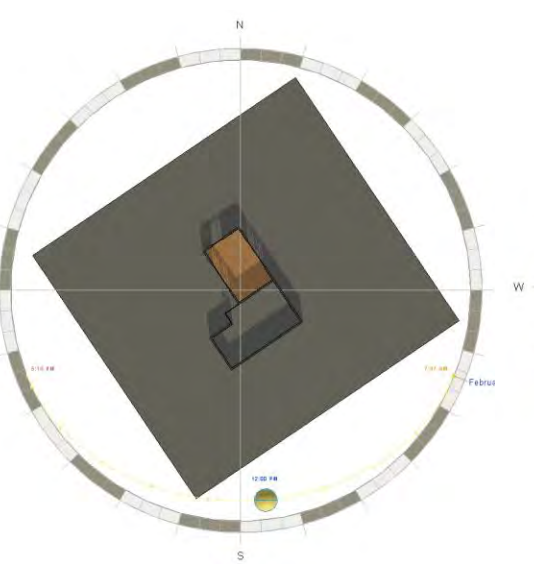
Sunrise: 7:36 AM  
Sunset: 5:15 PM



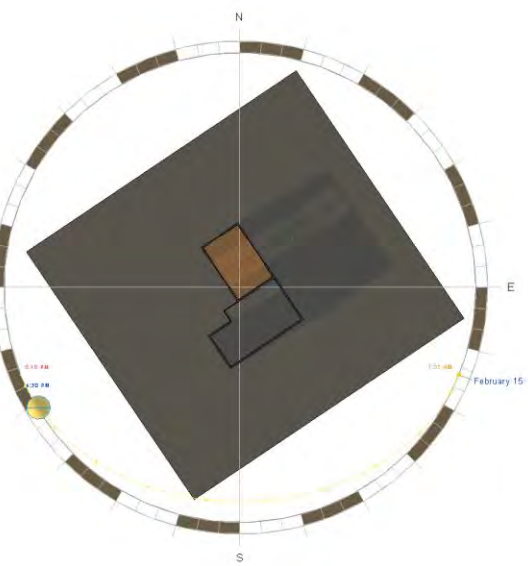
7:50 AM



10:00 AM



12:00 PM

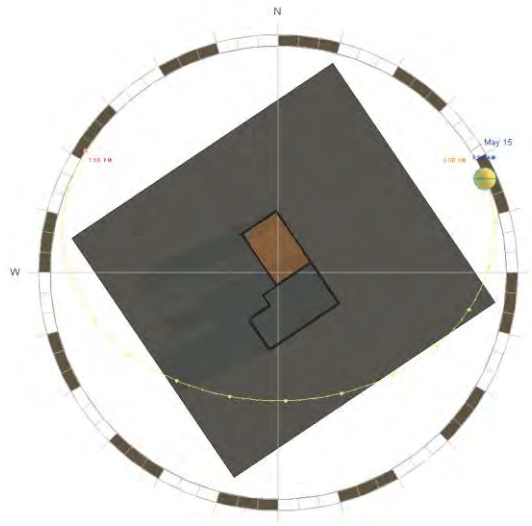


4:30 PM

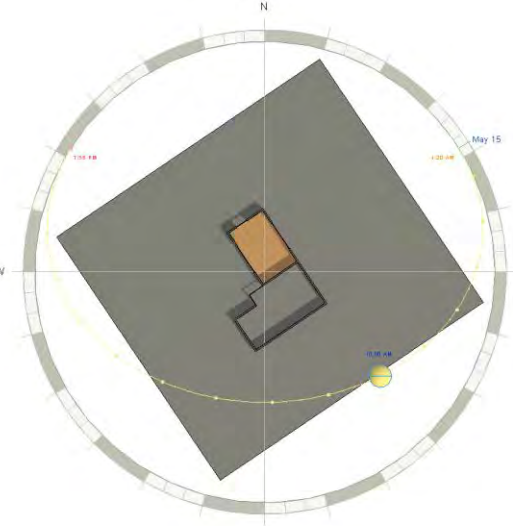


# May 15

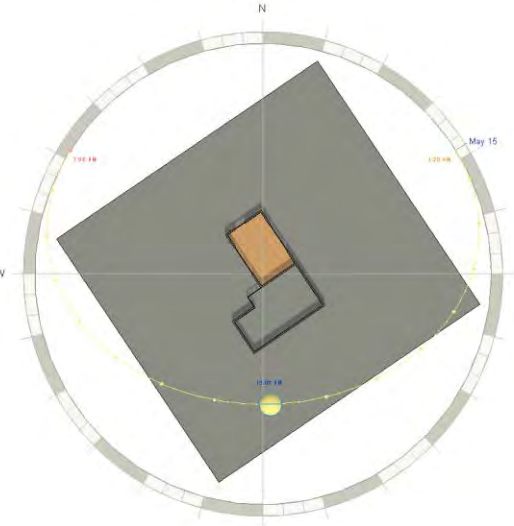
Sunrise: 4:20 AM  
Sunset: 7:56 PM



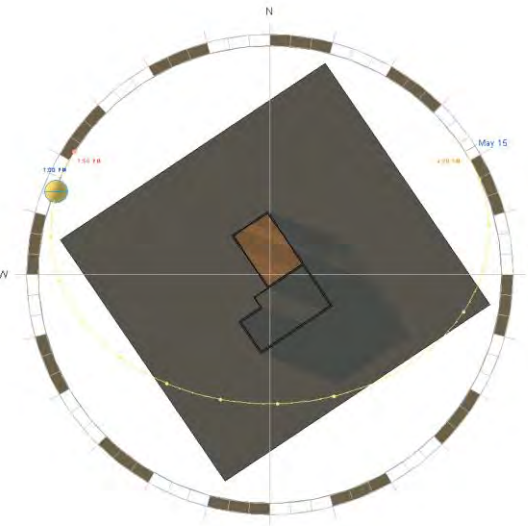
5:00 AM



10:00 AM



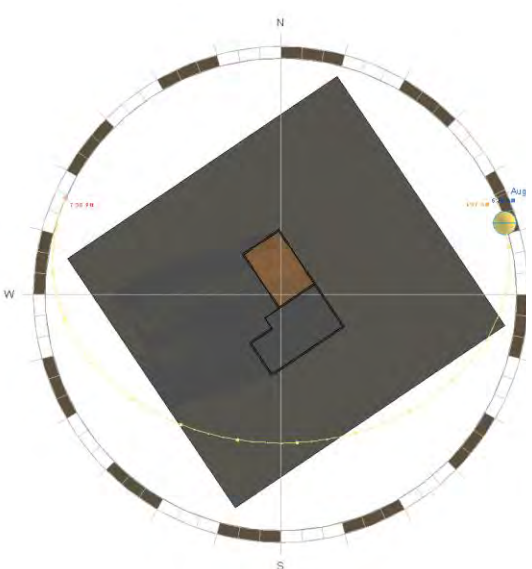
12:00 PM



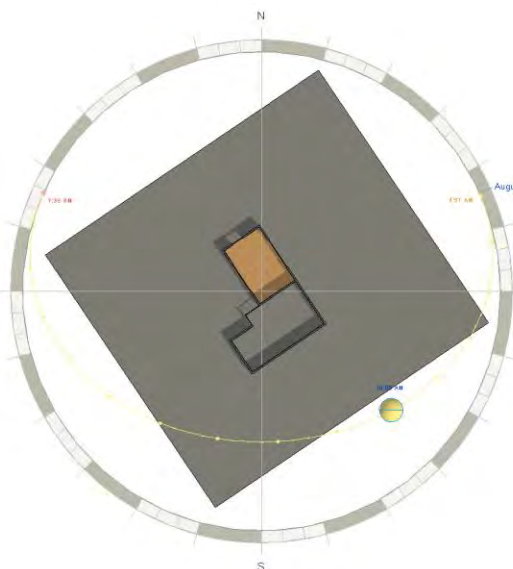
7:00 PM

# August 15

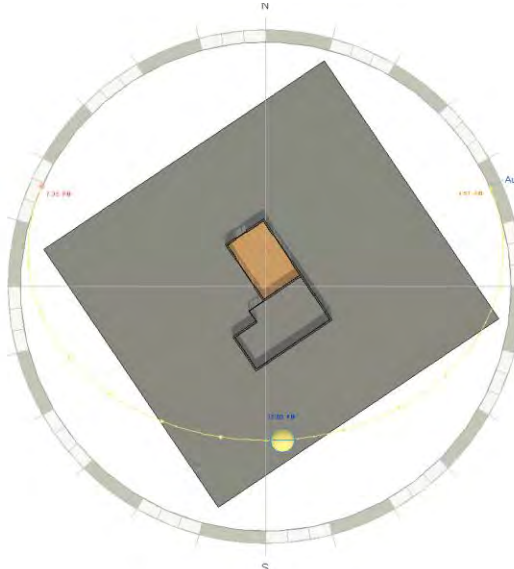
Sunrise: 4:58 AM  
Sunset: 7:35 PM



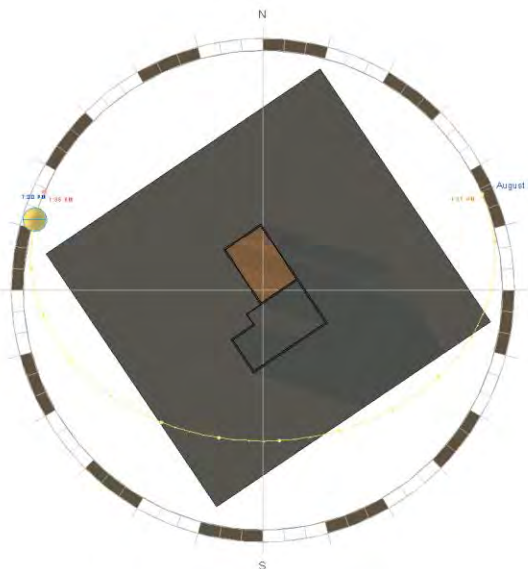
5:30 AM



10:00 AM

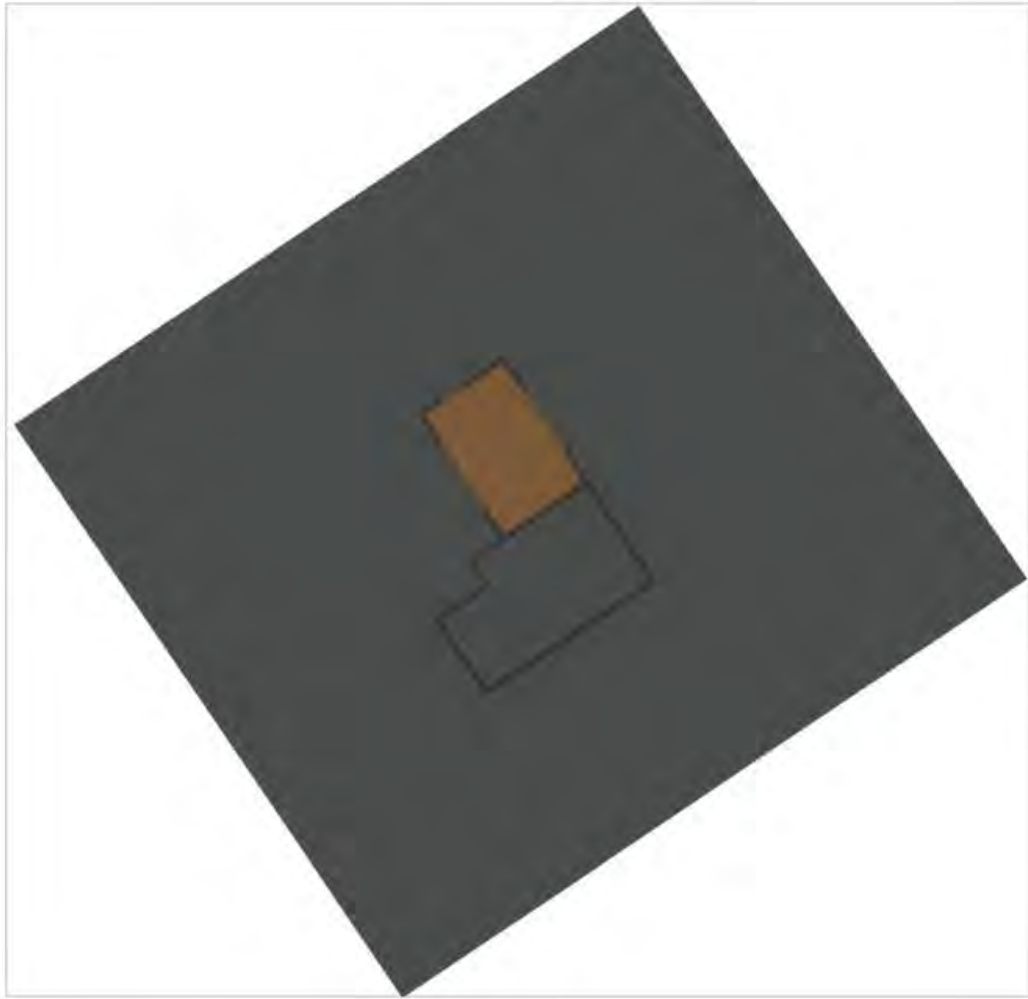


12:00 PM

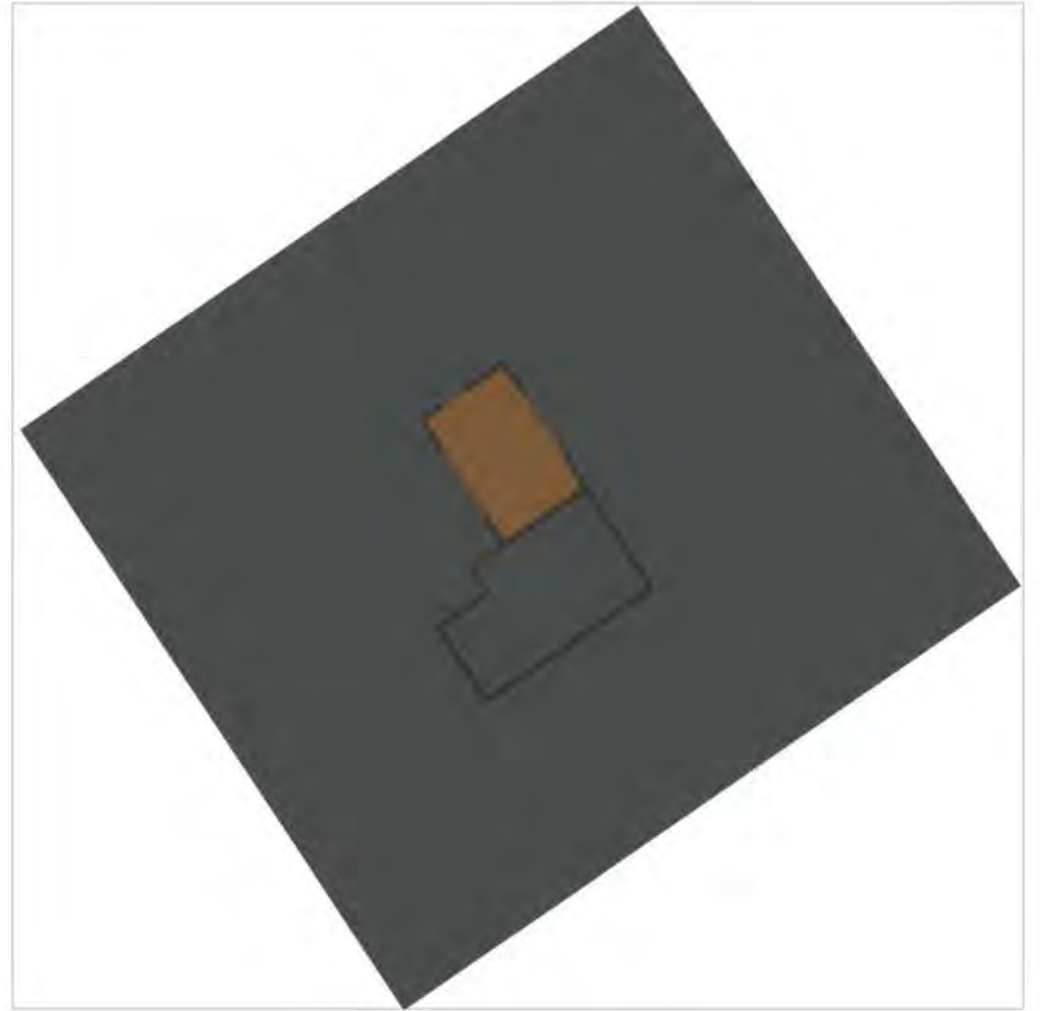


7:00 PM

# SOLAR ANIMATIONS

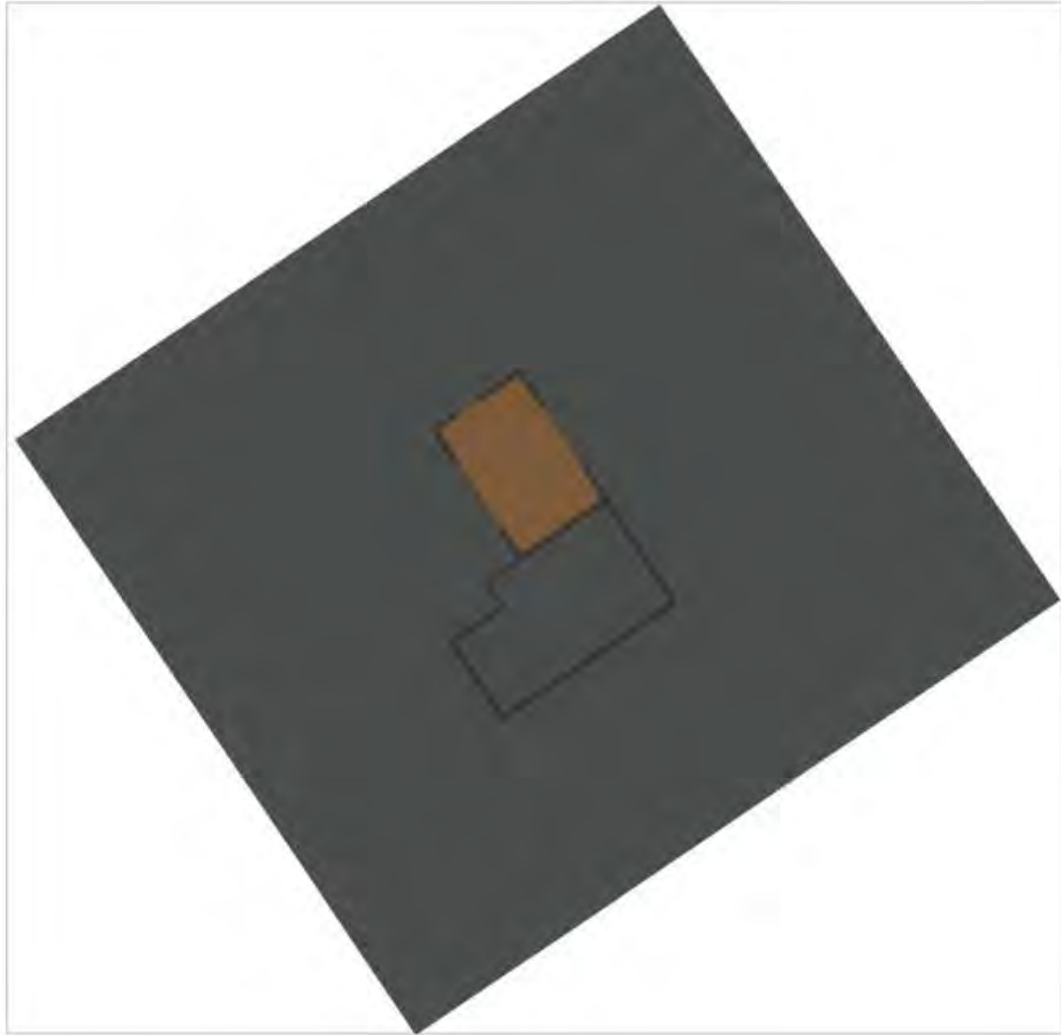


November 15, 2023

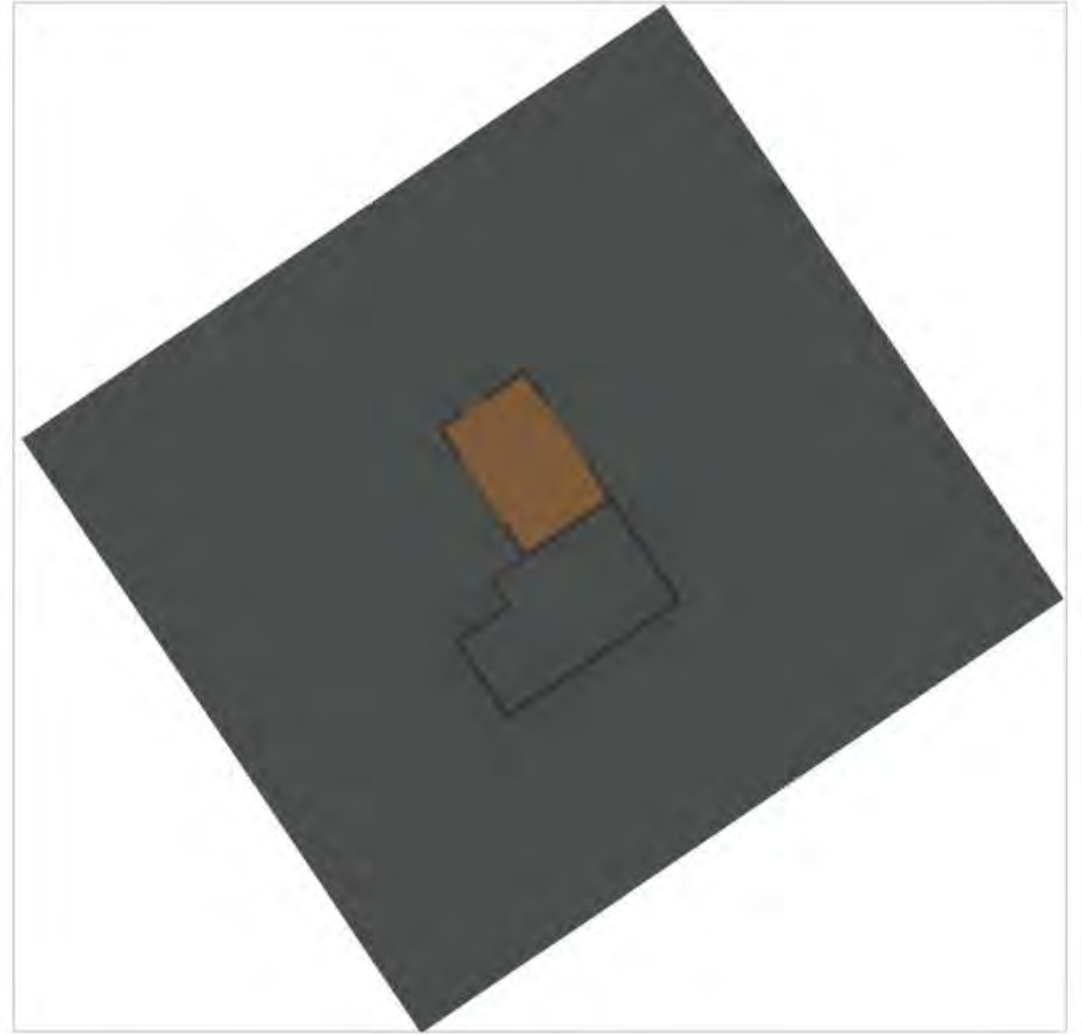


February 15, 2023

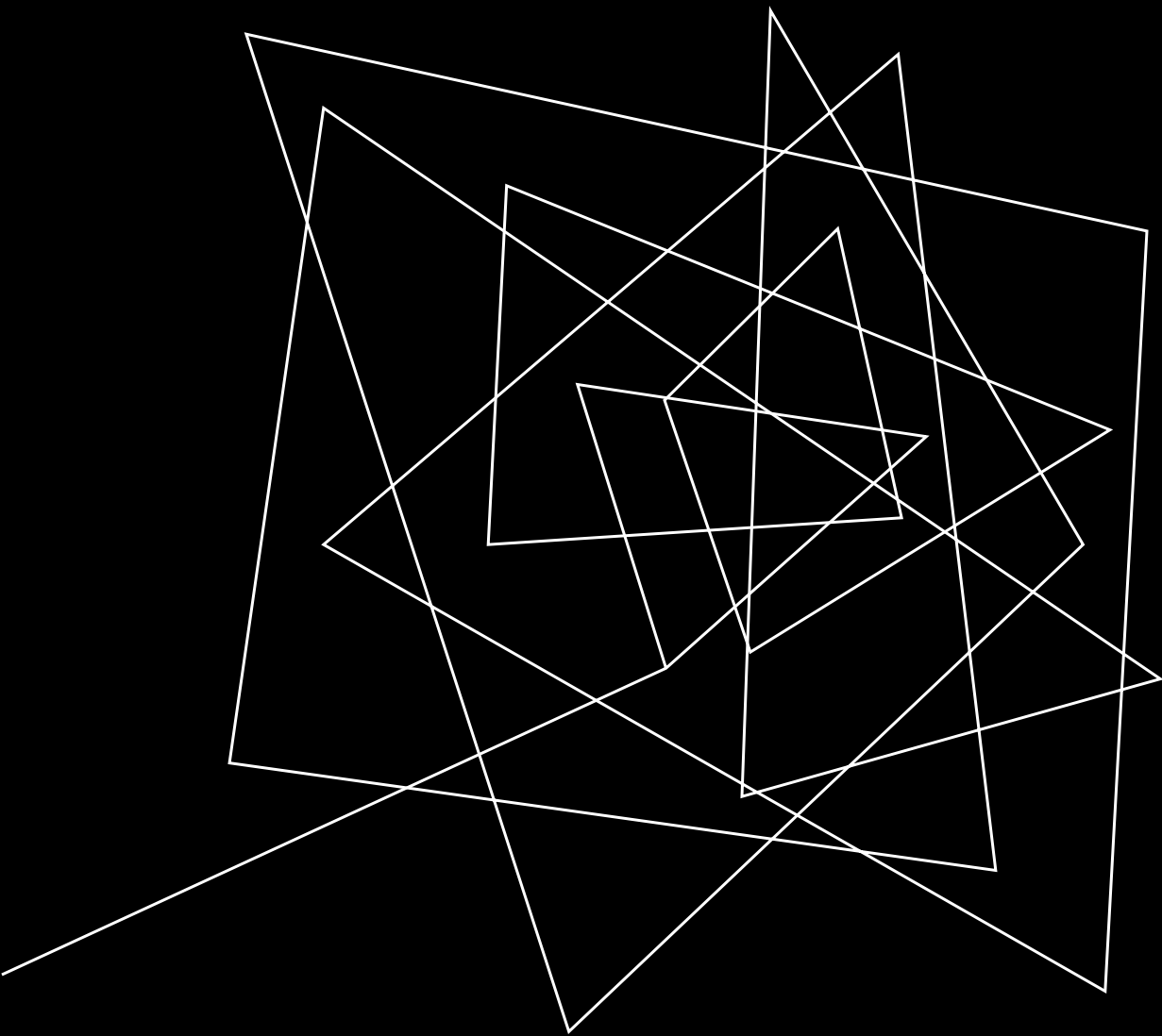
# SOLAR ANIMATIONS



May 15, 2023



August 15, 2023



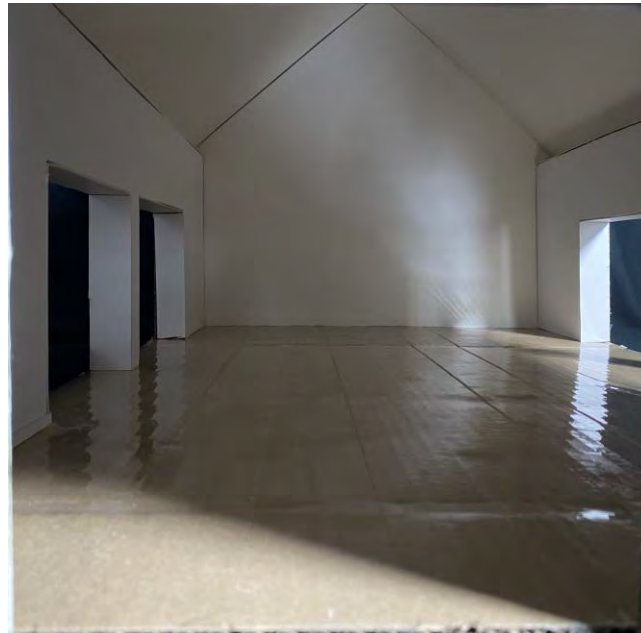
LIGHTING ANALYSIS  
OF THE CURRENT  
BUILDING



Summer late day



Winter late day

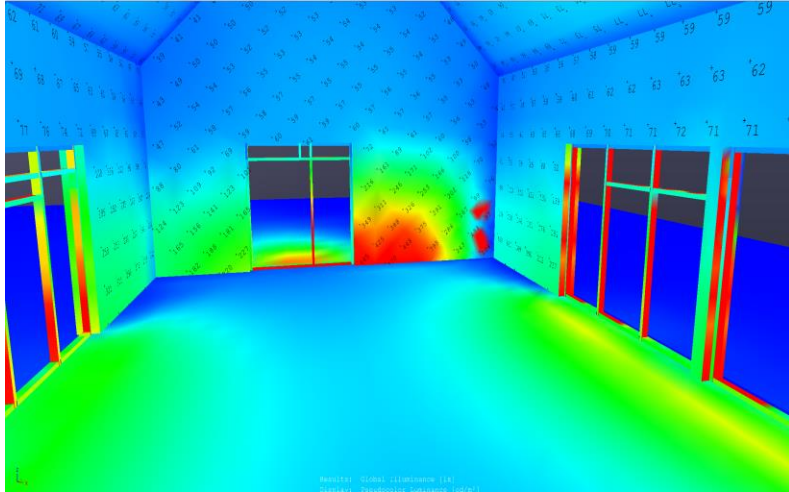


Night time photograph

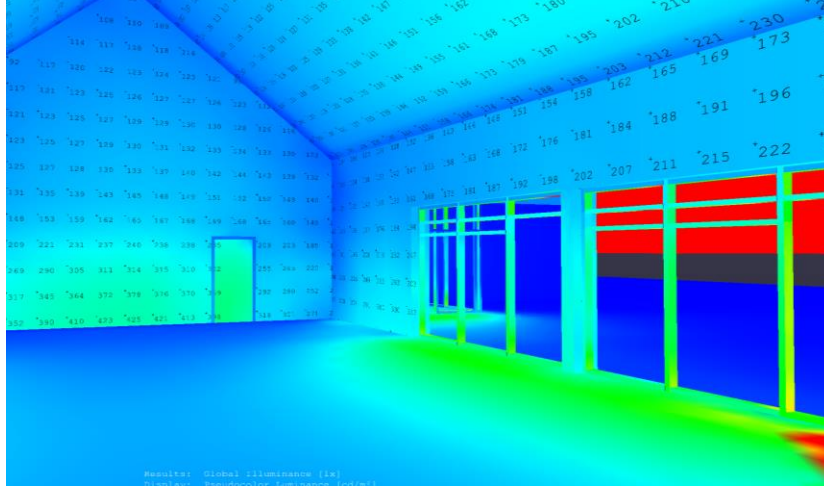


\*simulating unclouded direct sunlight entering the space

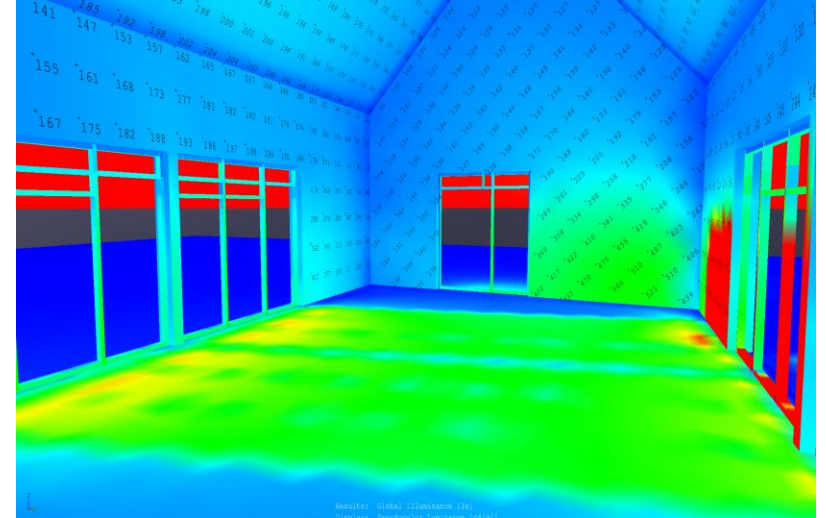
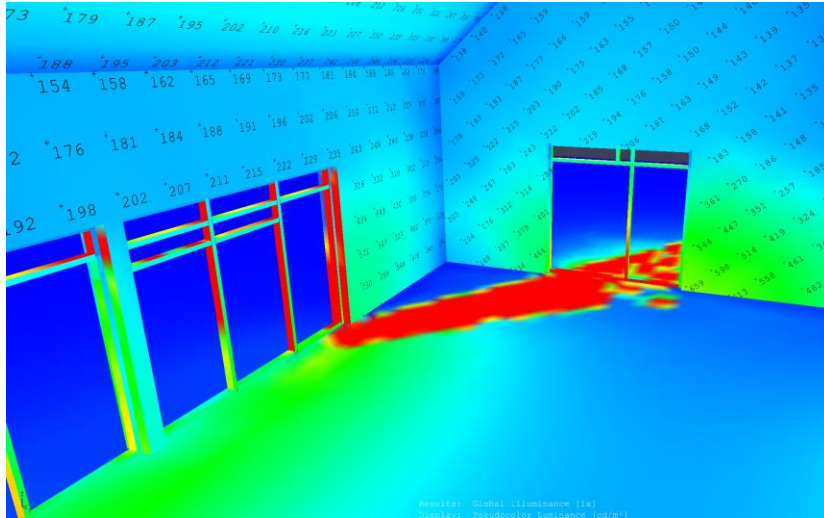
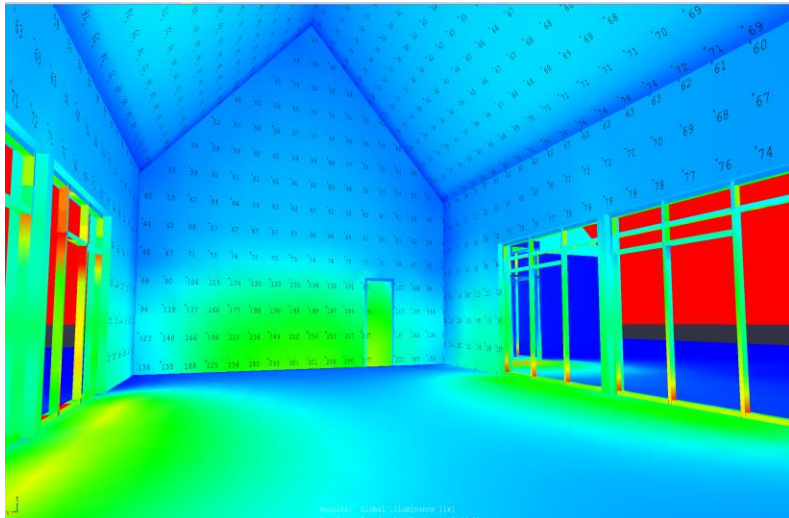
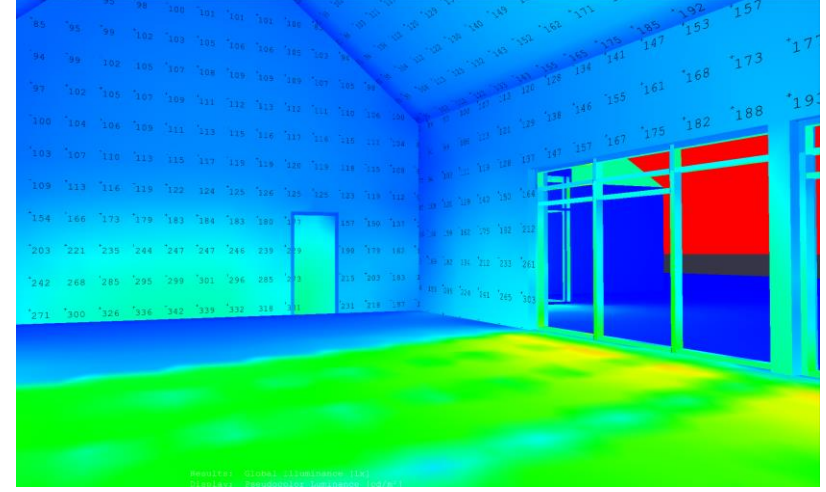
July 15 9:00 AM



July 15 12:00 PM



July 15 3:00 PM



As Expected:

- Lowest solar illuminance along the back wall and the corners

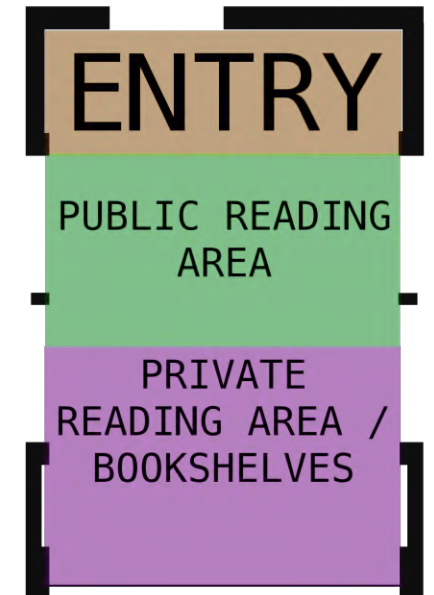
What Does This Mean for a Programmatic Shift to a Library?:

- We need to increase natural lighting in these spots.

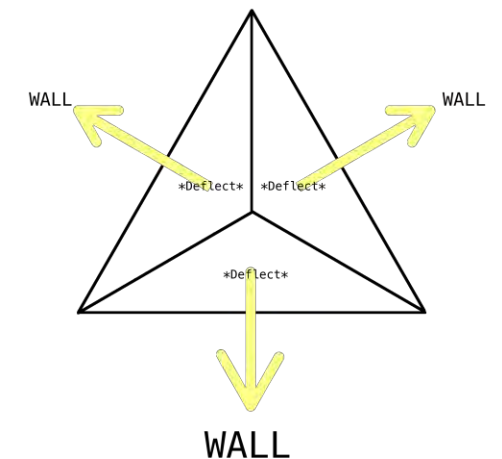
But how much?

- More-so in the more public-oriented space that we have defined for the reception area and a more "public reading space"
- A more private reading space and the bookshelves are better lit with deflected or diffused light which can illuminate the back wall with less intensity.
- We've considered a triangle shaped device, which can cast light onto the back wall as well as the side walls to a lesser extent.

Similar to the idea behind this, though with a skylight where the light shelves are angled facets of a tetrahedron



Plan view of device:



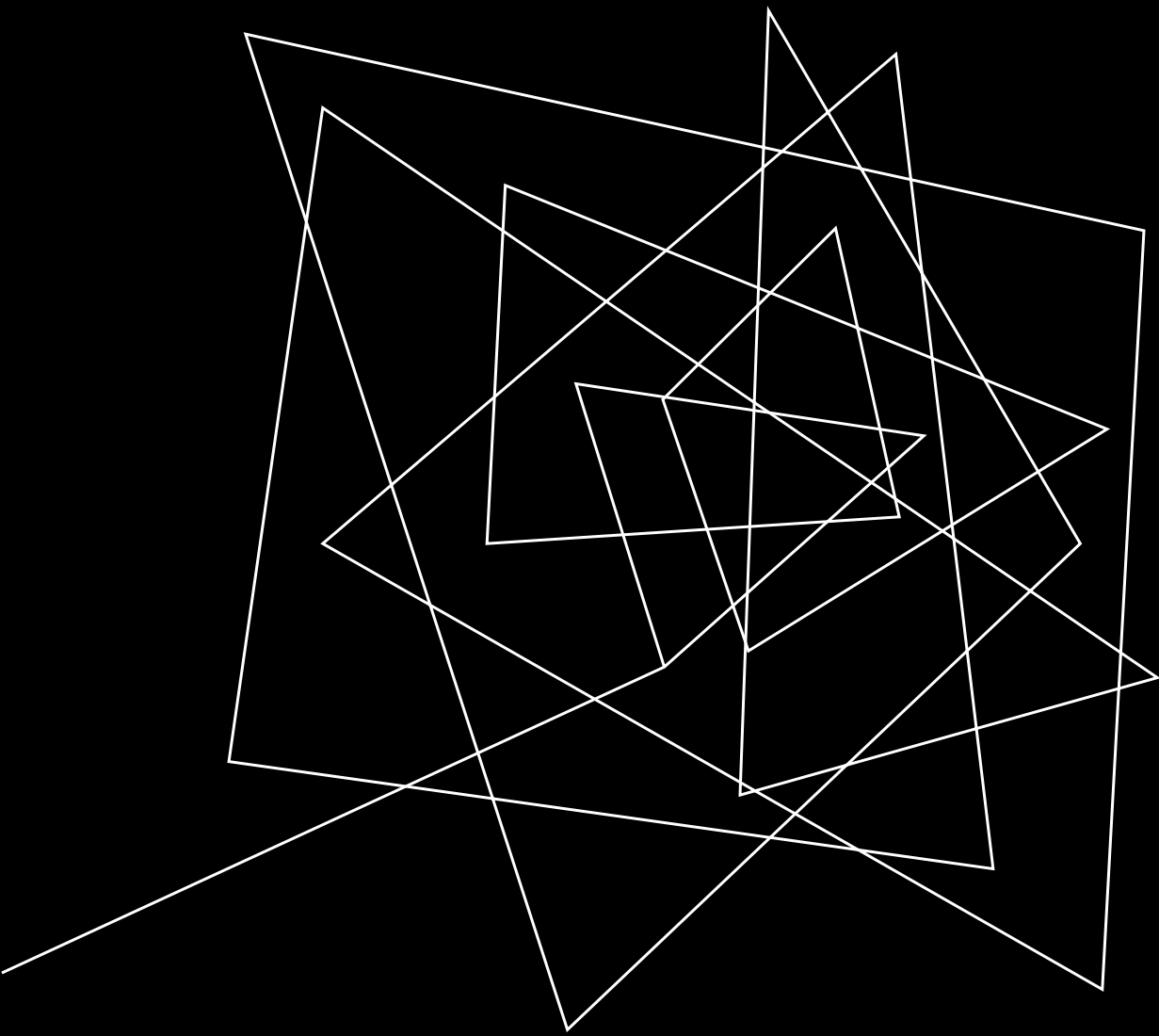


- An example of translucent polymer sheets being used to diffuse light throughout an interior (Barrisol® Translucides®), though it is electric light. (University of Wollongong, NSW, AU)
- The 'Equniox BEL 02' option has a 50% light transmission rate and 50% reflection rate. It is nacreous (lustrous, pearly) when not exposed to light, and diffuses when lit.



**Our Plan for  
expressing this  
material in our  
physical model**





# DIGITAL MODEL OF THE FUTURE BUILDING

# LIBRARY



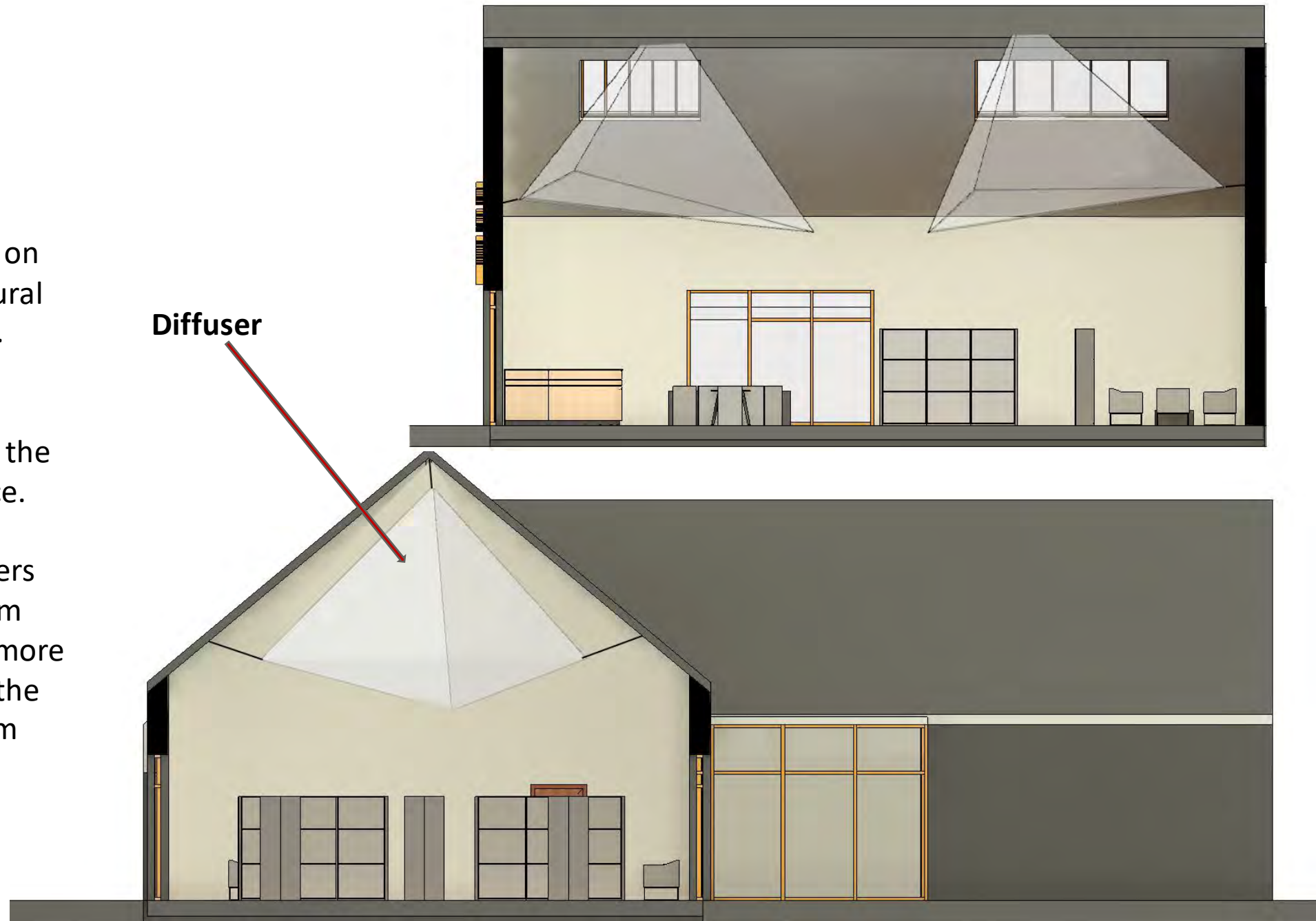
## Legend

- Bookshelves
- Check Out
- Computers
- Entrance
- Lounge space
- Room
- Study Area



## The adjustments:

- Installed 4 new skylights on the roof to enhance natural lighting within the room.
- Removed two aperture schemes on each side of the room to keep the balance.
- Implemented two diffusers to diffuse direct light from the skylights, creating a more pleasant atmosphere in the room- directing light from the skylights to the large planes of roof and walls.

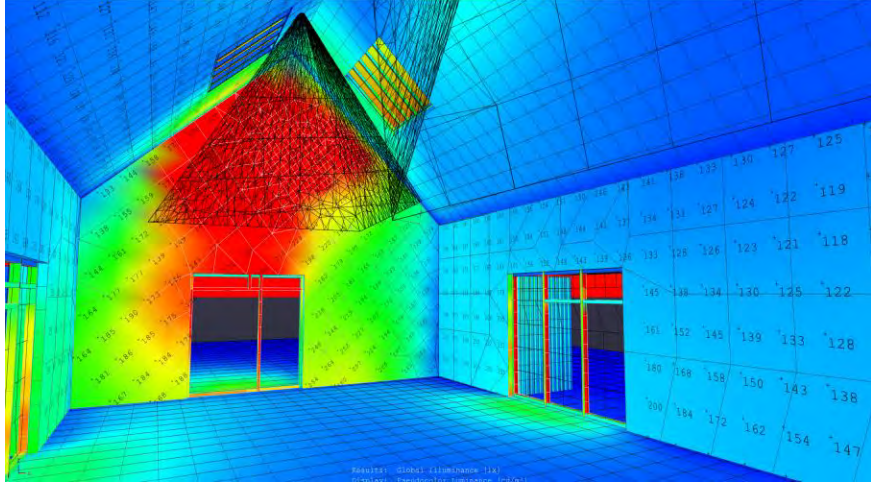


# PERSPECTIVE

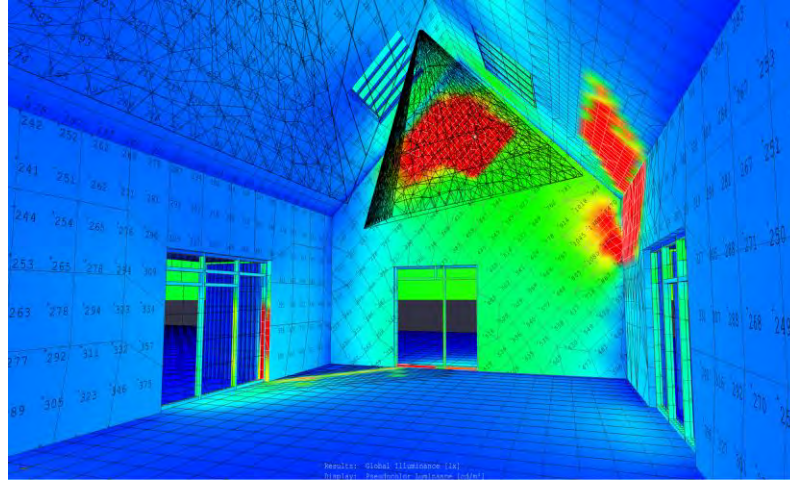


- The diffusers disperse the glare and create a softer lighting
- Enhance light temperature
- sufficient and comfortable daylighting

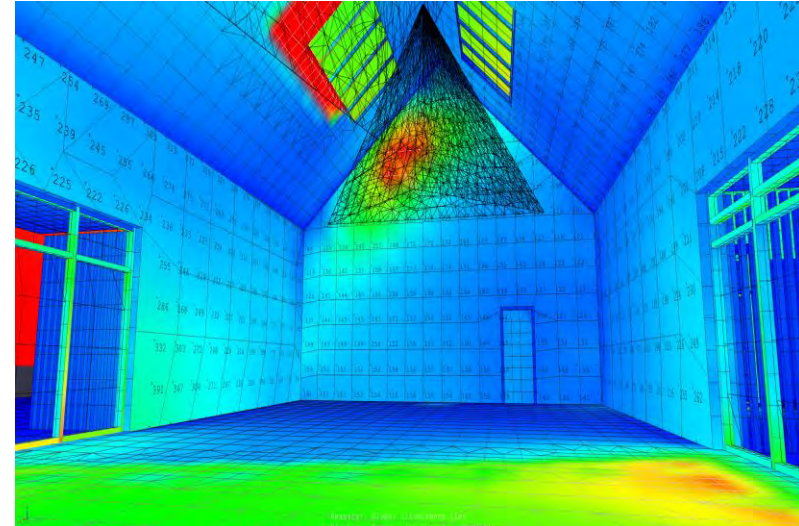
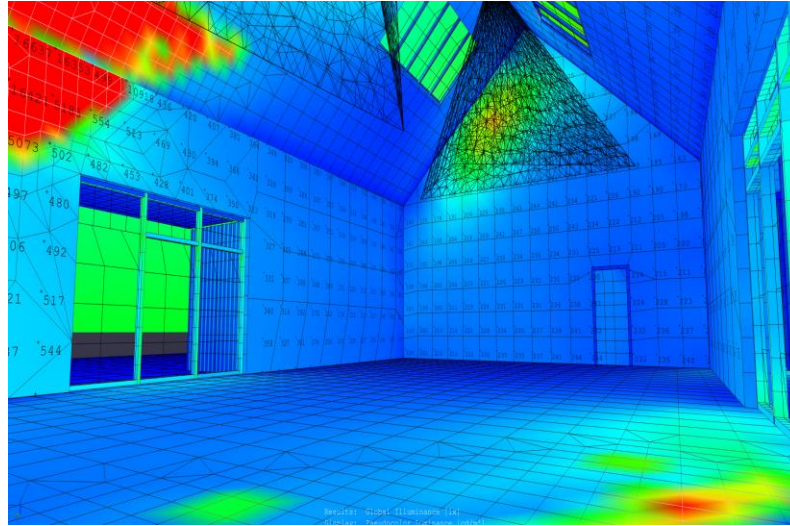
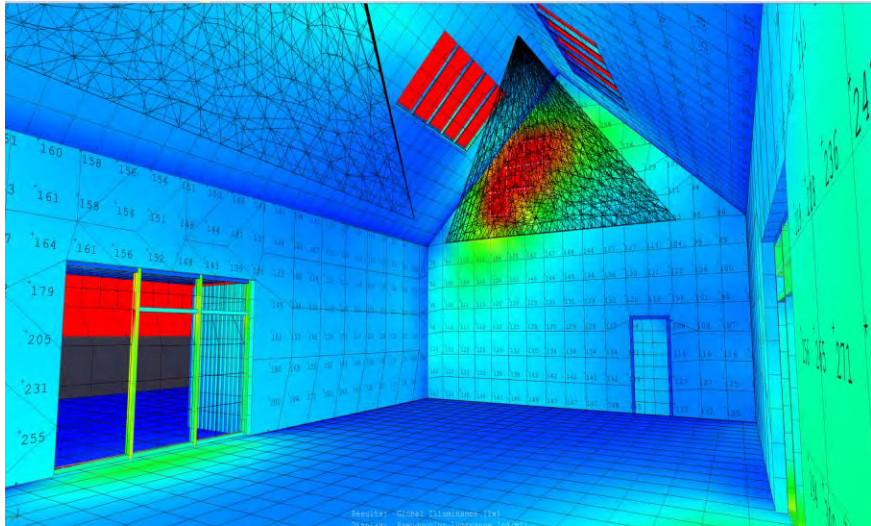
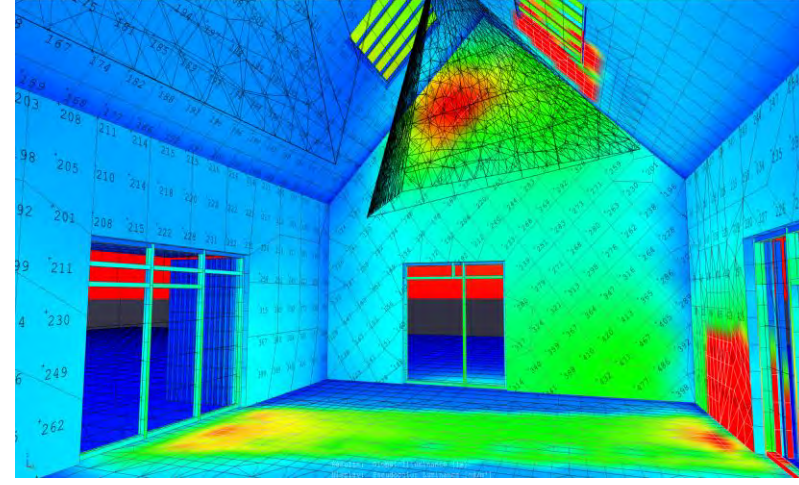
July 15 9:00 AM

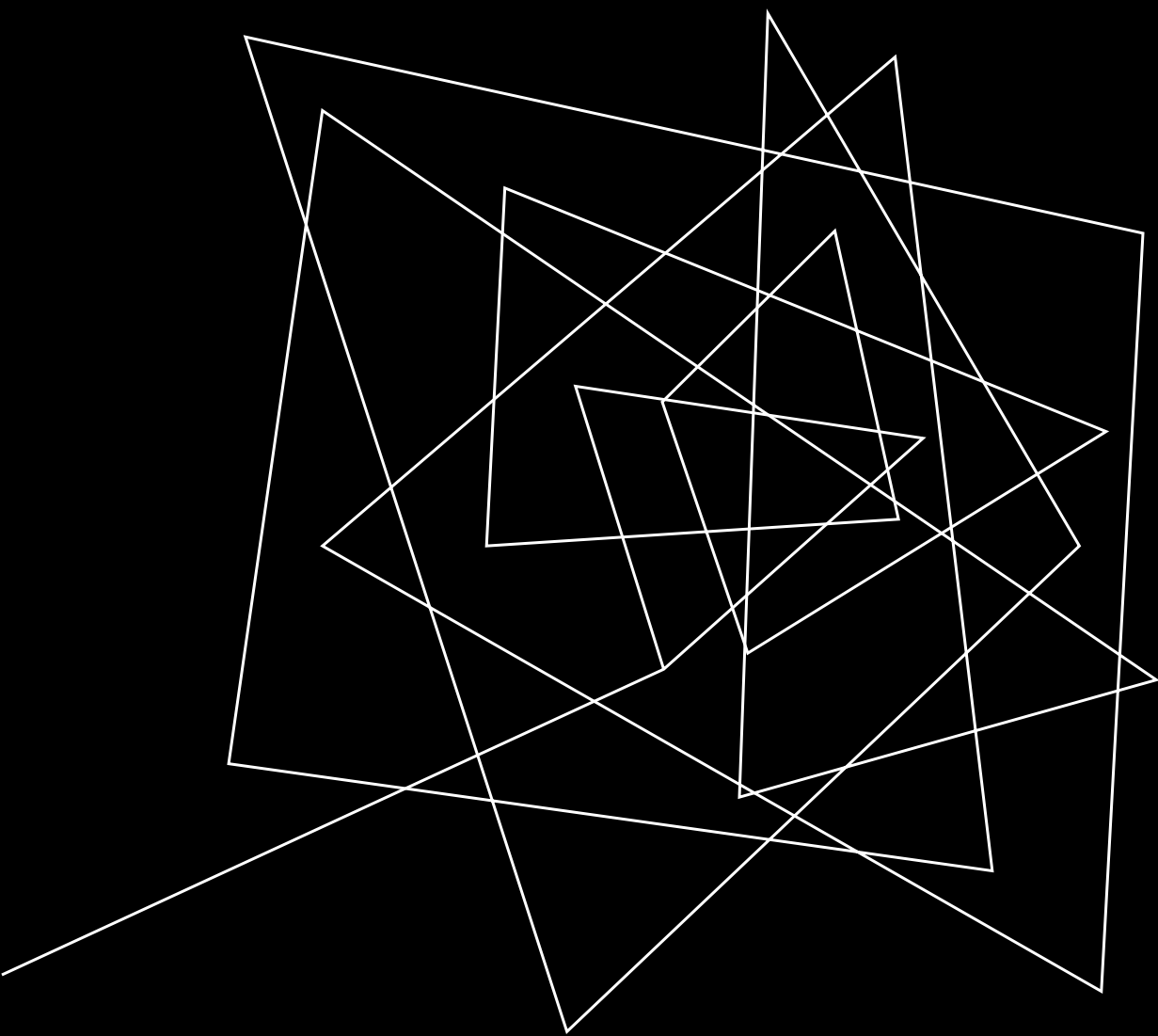


July 15 12:00 PM

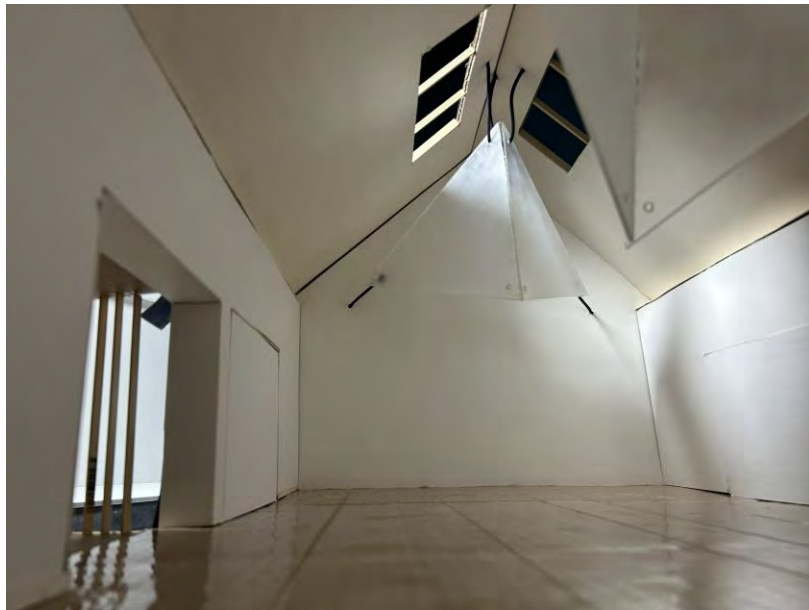
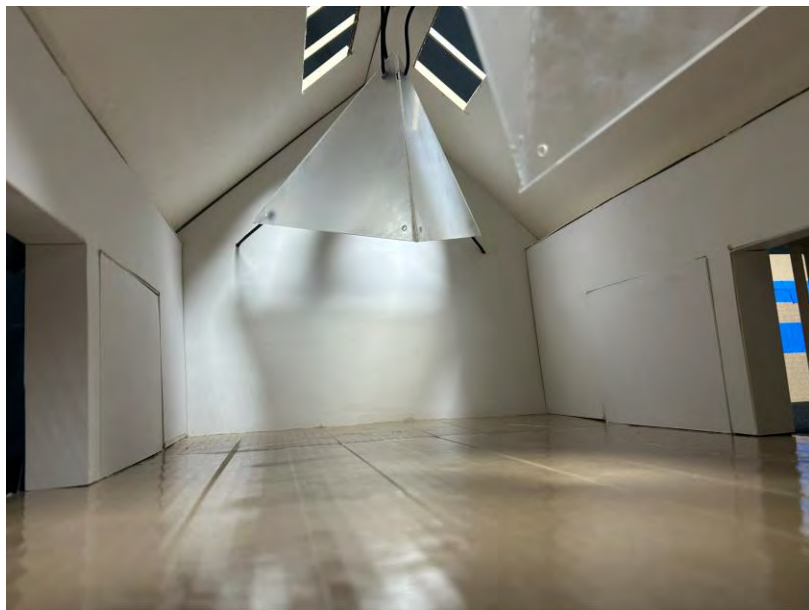
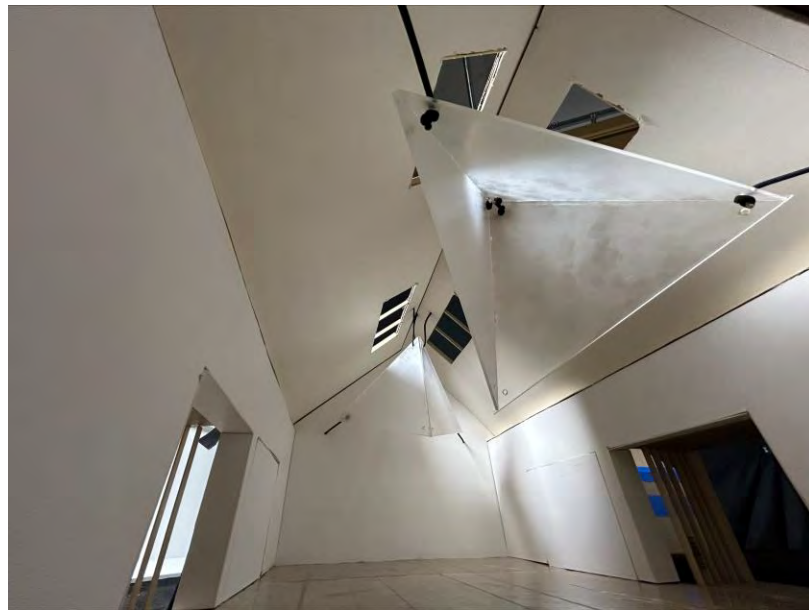
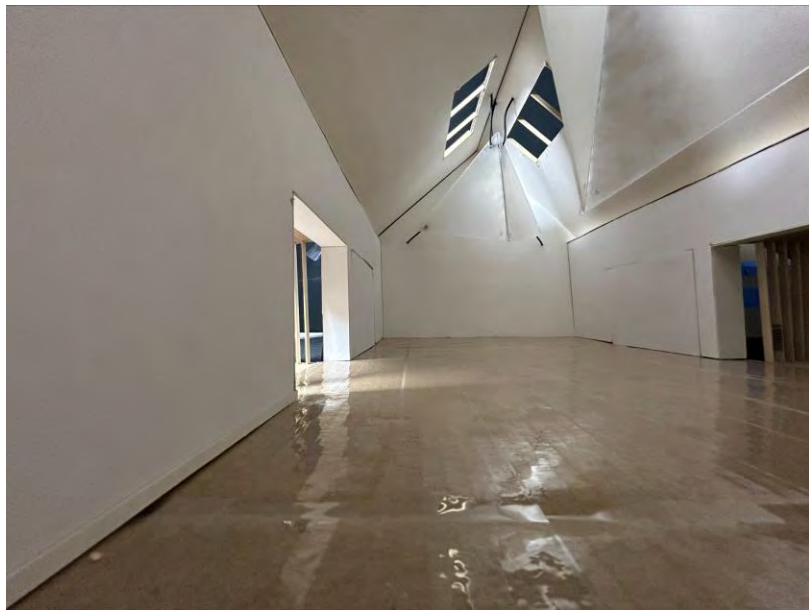


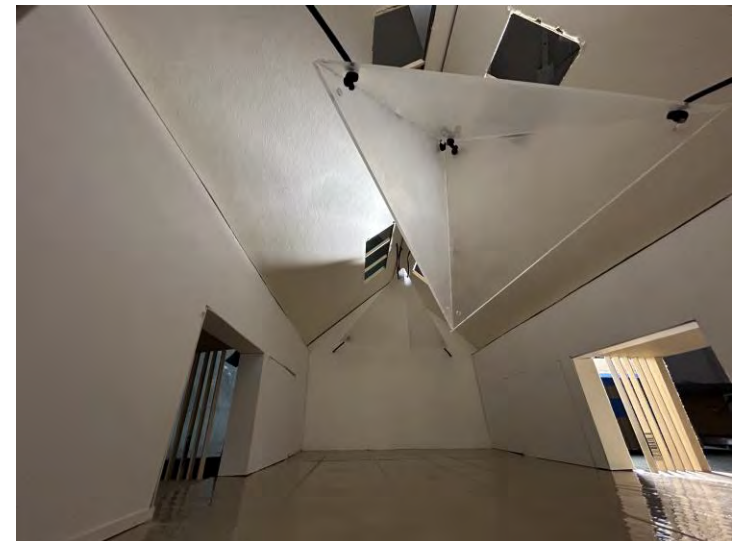
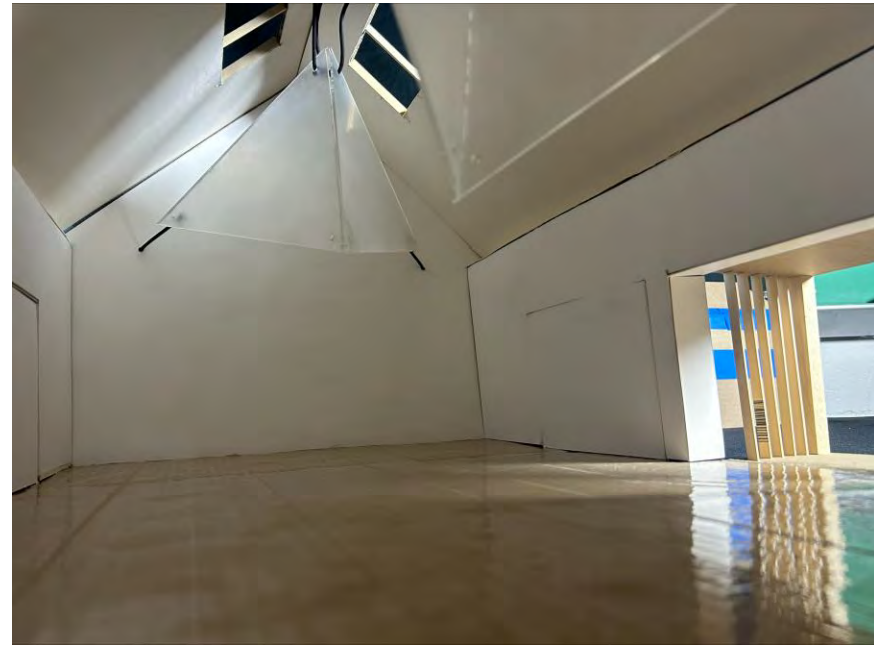
July 15 3:00 PM



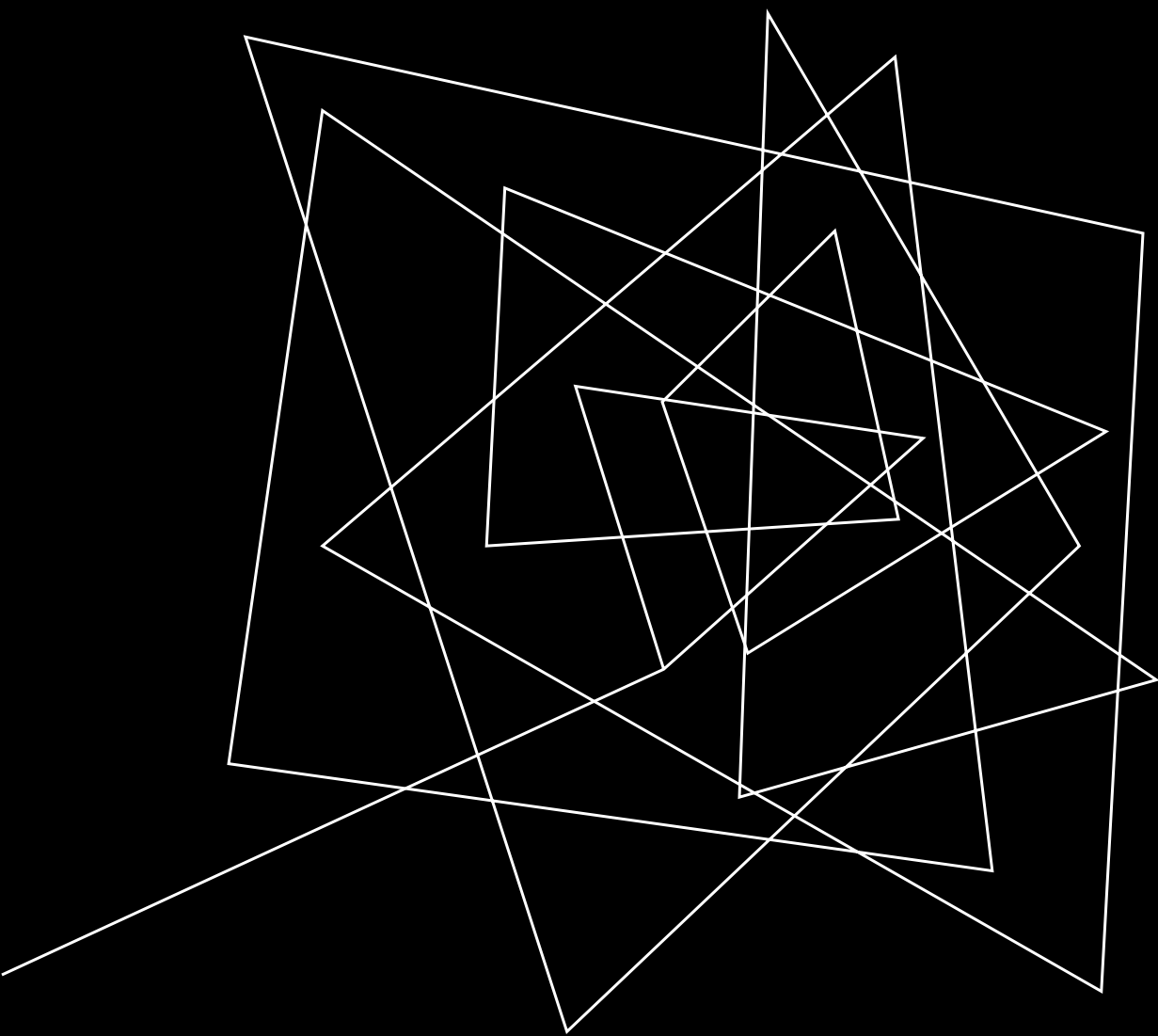


PHYSICAL MODEL OF THE  
FUTURE BUILDING



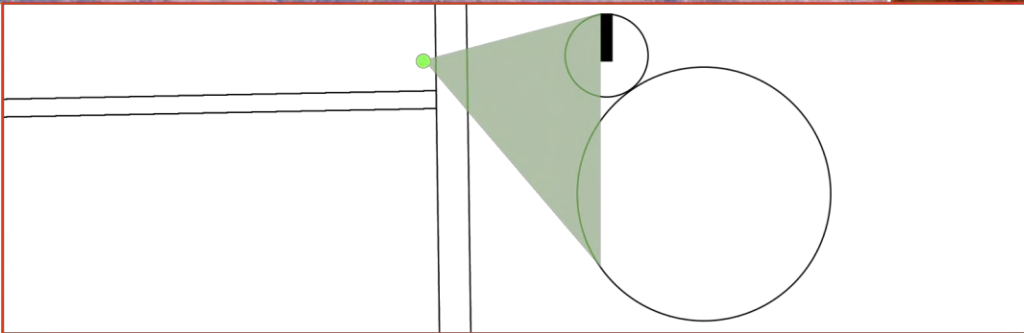
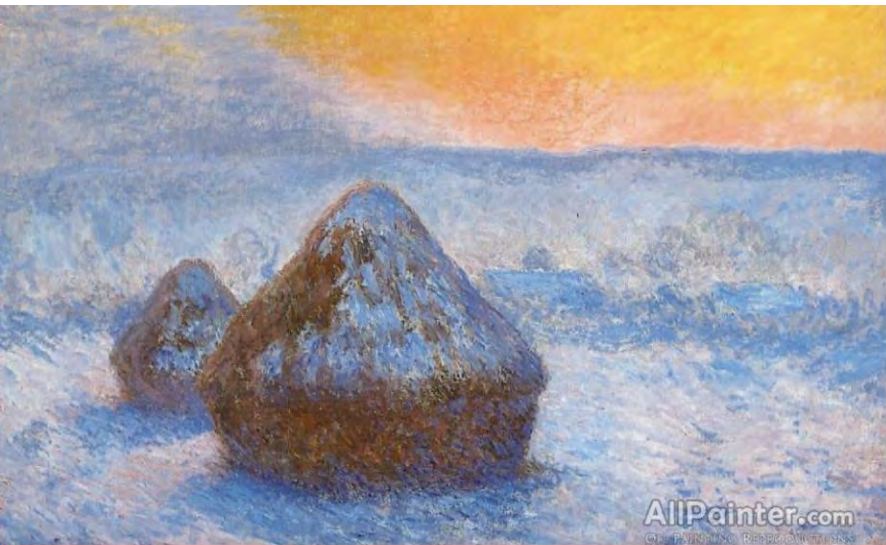






KNOWING WHERE TO  
STAND: MONET  
HAYSTACKS COMPILATION

# QUALITIES OF LIGHT ON CONES



1015 ± 315

Morning / early Afternoon

Equinox  
occurs



09-05 1048 09-07 1058 09-12 1052 09-13 1329 09-14 1048 09-22 0745 10-03 1035 10-05 1108 10-17 1059 10-19 1108



10-24 1101 10-26 1058 10-31 1108 11-02 1111 11-07 0911 11-14 0910 11-16 0913

1645 ± 250

late Afternoon / Evening

DST

Equinox  
occurs



09-01 1706 09-06 1800 09-08 1752 09-11 1703 09-13 1652 09-15 1554 09-18 1621 09-25 1723 09-27 1804 10-04 1620

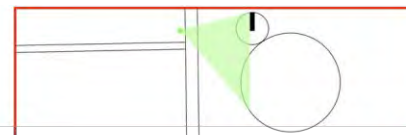


10-06 1618 10-09 1528 10-13 1750 10-18 1605 10-20 1749 10-23 1521 10-27 1745 10-30 1604 11-01 1741 11-07 1513

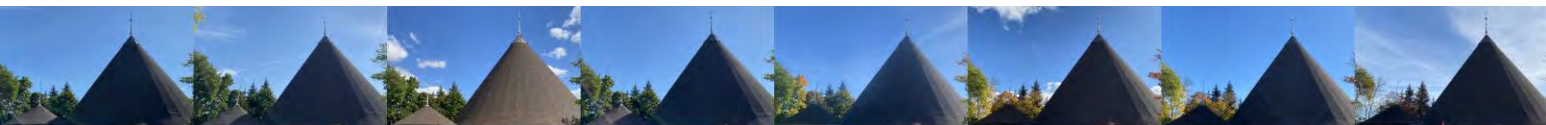


11-15 1408

DST



Date Format : MM-DD HHMM

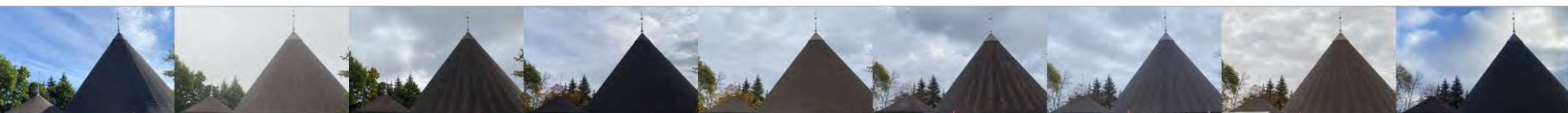


"UNCLOUDED"

09-05 1048 09-12 1052 09-13 1329 09-14 1048 10-05 1108 10-17 1059 10-19 1108 10-31 1108



09-01 1706 09-06 1800 09-08 1752 09-13 1652 09-15 1554 09-18 1621 10-04 1620 10-06 1618 10-13 1750 10-18 1605 10-20 1749 10-23 1521 10-30 1604



"CLOUDED"

09-07 1058 09-22 0745 10-03 1035 10-24 1101 10-26 1058 11-02 1111 11-07 0911 11-14 0910 11-16 0913



09-11 1703 09-25 1723 09-27 1804 10-09 1528 10-27 1745 11-01 1741 11-07 1513 11-15 1408

# Highlights



09-22 0745 LIGHT DIFFUSED  
BY THE UNIFORM CLOUDS-  
UNIFORM EXPRESSION



10-09 1709  
BRIGHT, LOW, UNIDIRECTIONAL  
SUNLIGHT- REVEALS FACETS OF THE  
"CONE"

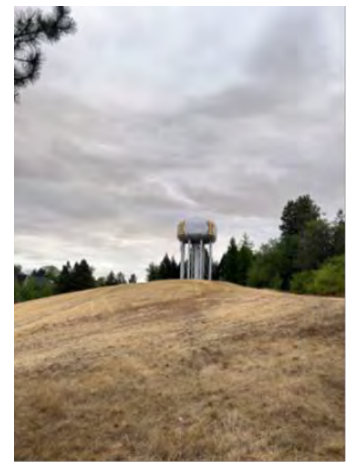


11014 0910  
LIGHT DIFFUSED BY THE CLOUDS,  
THOUGH IT ILLUMINATES THE  
"CONE" LESS UNIFORMLY BECAUSE  
OF THEIR FORMATION

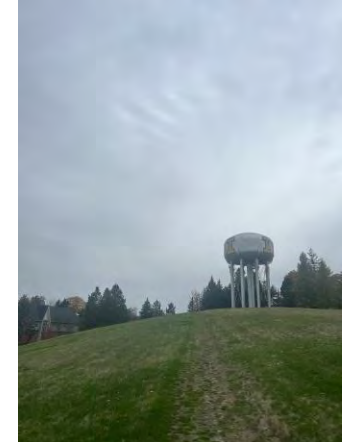
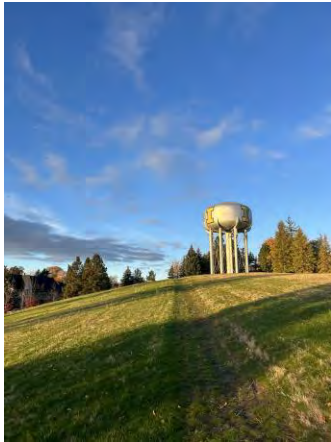
Chronological Timelapse (60 seconds)- Mornings & Evenings



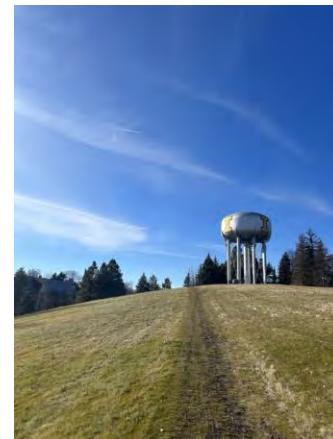
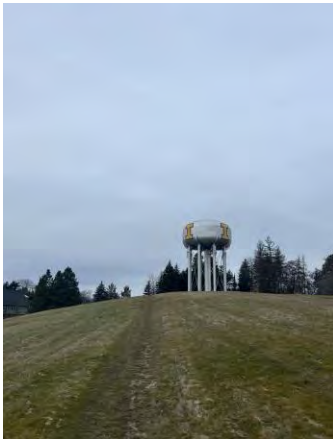
**Late Summer**  
Aug 31 – Sept 16



**Early Fall**  
Sept 17 – Oct 15



**Late Fall**  
Oct 16 – Dec 14



20XX

**Morning**  
7 am – 11 am

**Mid Day**  
11 am – 3 pm

**Evening**  
3 pm – 7 pm



1



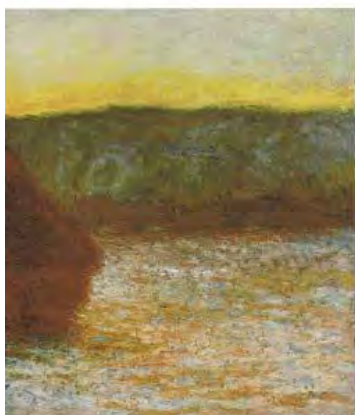
2



3



4



5



6

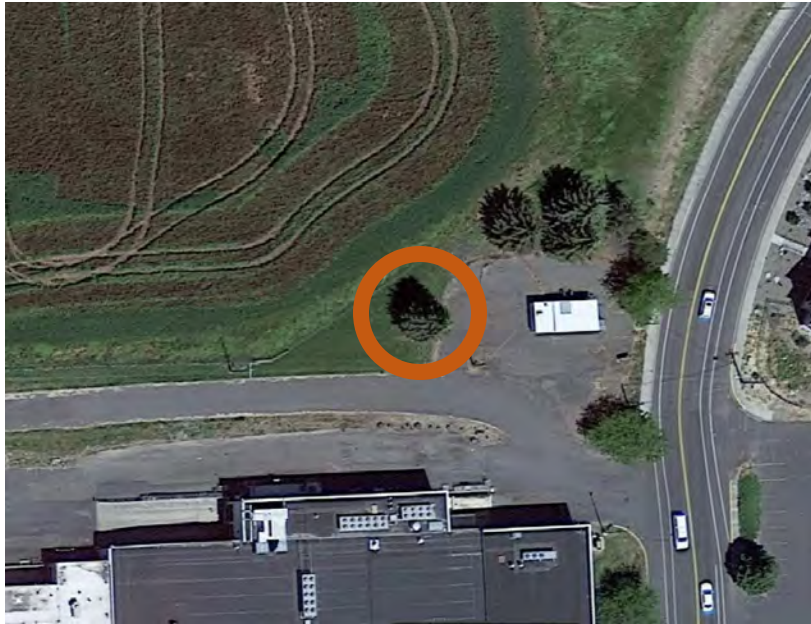
# THE QUALITY OF LIGHT

## STACKED WHEAT

- Fatemeh Sakhi



# LOCATION



**SEPTEMBER**



September 11, 2023

6:26 AM

- Sunset
- Warm Light
- Partly Cloudy



September 11, 2023

12:20 PM

- Warm Light
- Clear Sky
- Shadows



September 11, 2023

5:38 PM

- Cool light
- Cloudy Sky



September 11, 2023

6:47 PM

- Warm Light
- Cloudy Sky



September 11, 2023

7:16 PM

- Sunset
- Cloudy Sky

OCTOBER





October 17, 2023

7:00 AM

- Sunrise
- Warm light
- Clear Sky



October 16, 2023

2:30 PM

- Cool Light
- Partly Cloudy Sky



October 17, 2023

4:40 PM

- Diffused Light
- Mostly Cloudy Sky



October 17, 2023

5:40 PM

- Diffused Light
- Mostly Cloudy
- foggy



October 17, 2023

18:00 PM

- Sunset
- Cloudy Sky

**NOVEMBER**



November 28, 2023

7:00 AM

- Sunrise
- Clear Sky



November 29, 2023

12:00 PM

- Diffused light
- Snowy
- Foggy





November 29, 2023

2:00 PM

- Diffused light
- Snowy
- Cloudy Sky
- Foggy



November 29, 2023

4:00 PM

- Sunset
- Foggy



November 29, 2023

5:00 PM

- Dark
- Cloudy Sky
- Foggy

**MATRIX**

Sept 11



6:26 AM



12:20 PM



5:38 PM



6:47 PM



7:16 PM

Oct 16



7:00 AM



2:30 PM



4:40 PM



5:40 PM



6:00 PM

Nov 28, 29



7:00 AM



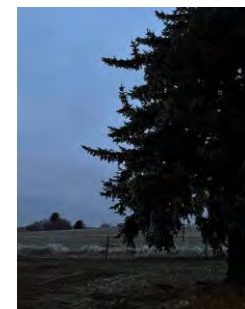
12:00 PM



2:00 PM



4:00 PM



5:00 PM