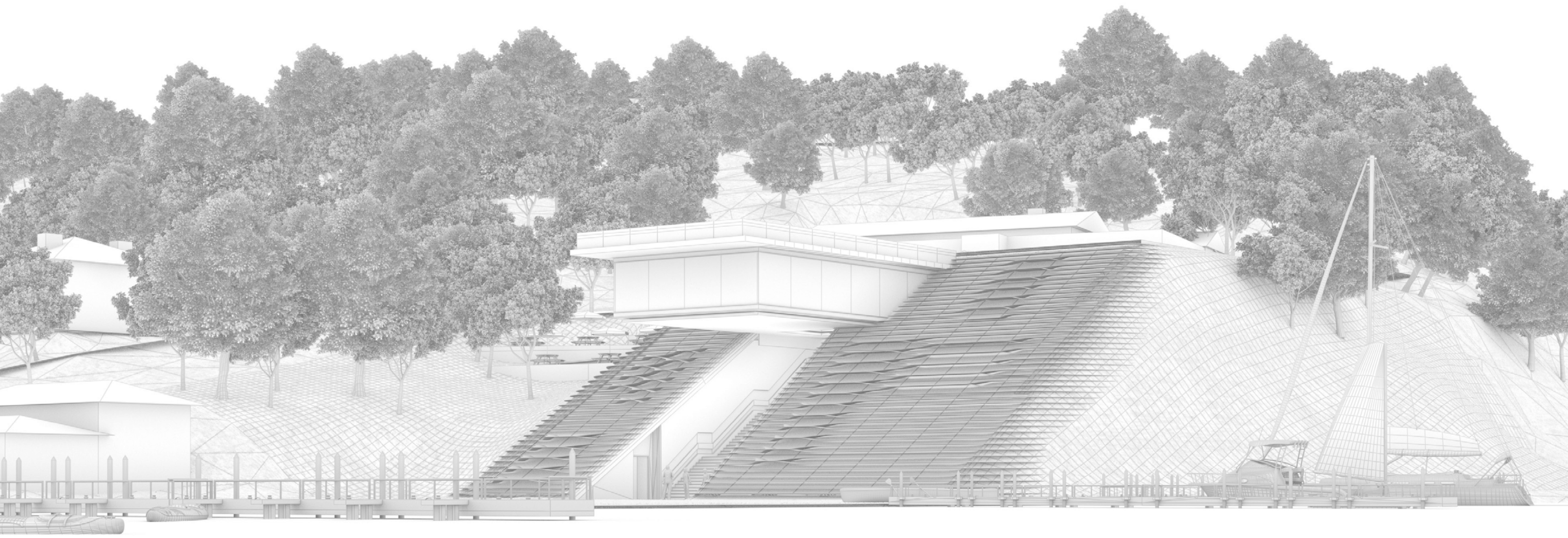
Tiburon Treasure

Contents:

project narrative



Tiburon Treasure is a project with a sustainable approach not only in terms of building performance but also improving the user experience through the creation of an iconic environment for learning about ecology, biology, restoration, and oceanography, all in the context of sustainable design. Inspired by its unique location, this project pays careful attention to preserving the site values without interrupting the future program of the RTC.

The key factors that were considered for siting the project are proper building orientation for the solar access, maintaining the remarkable views to and from the wharf, providing universal access to the building and making the building geometry as a natural extension of the site to minimize its impact.

According to the climate analysis, most hours of the year fall within the human comfort zone, with the exception of the early morning and late afternoon conditions which are expected to be quite cold. According to the psychometric chart, the most effective passive strategy to improve the building performance would be to maximize internal heat gain. In order to reduce the exposed surfaces for preserving energy and increasing the program efficiency, the two programs are combined into a single building. The whole structure is then embedded into the ground to benefit from earth sheltering and provide a vast glazed facade that faces the views to the southeast. To achieve the ZNE building, an integrated photo-voltaic shading system is employed to generate the needed electricity while controlling the natural daylight, enhancing natural ventilation, framing the outside view and providing sufficient shade throughout the year.

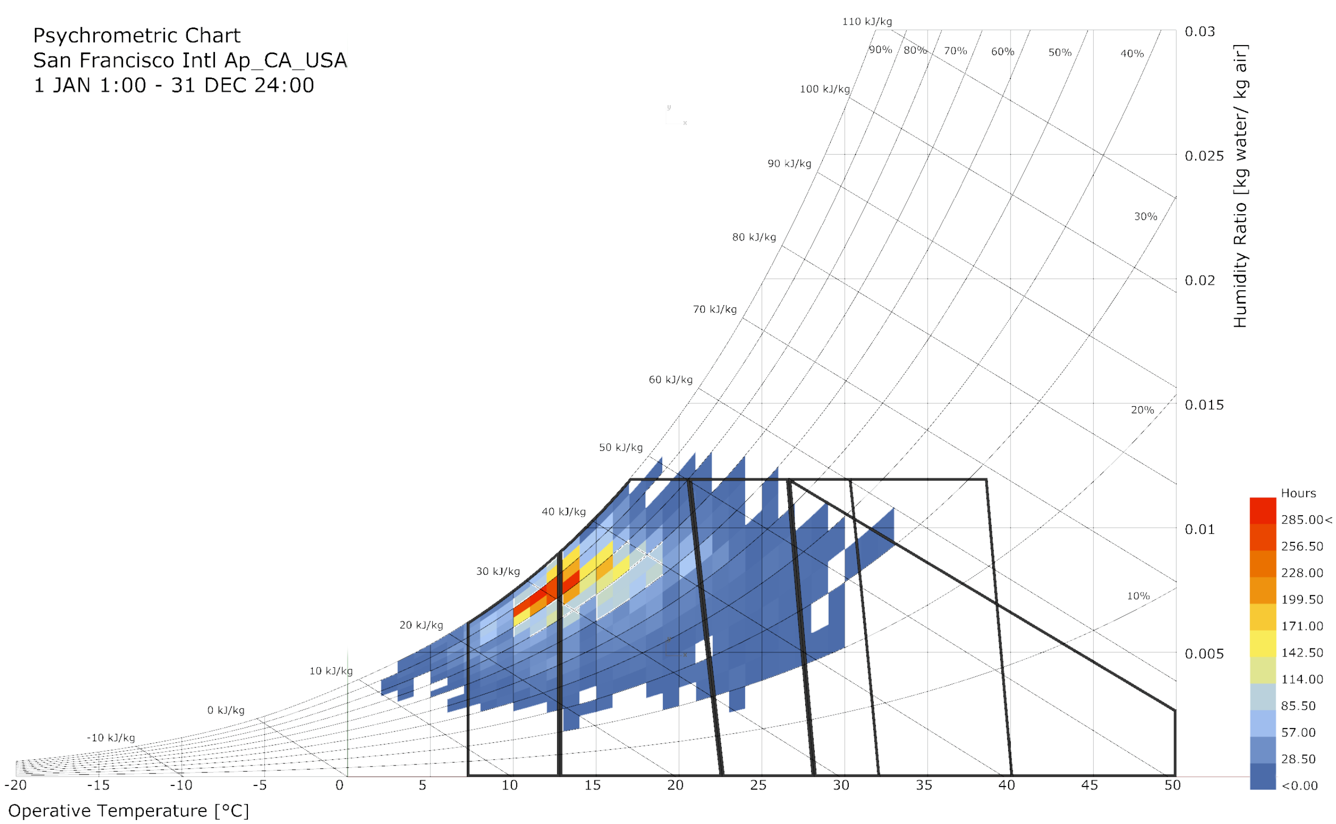
The PV panels are intentionally visible to the students inside as well as the observation deck to help demonstrate the sustainable strategies of the project.

climate analysis

Psychometric Chart

The psychometric chart for the site indicates a climate that is cold and very humid for most of the year. The main challenge, therefore, is how to heat the space.

Since most of the hours during the year have plotted in a small area, it was deemed easier to use passive strategies rather than attempt a very diverse or energy intensive design solution.

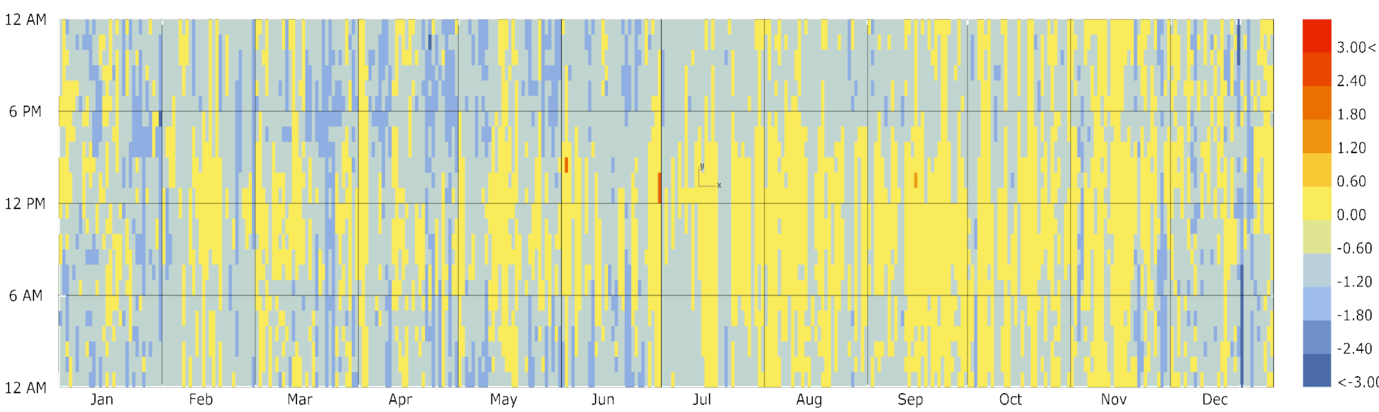

Psychrometric Chart
San Francisco Intl Ap_CA_USA
1 JAN 1:00 - 31 DEC 24:00
Operative Temperature [°C]
Humidity Ratio [kg water/ kg air]
Hours
285.00<
256.50
228.00
199.50
171.00
142.50
114.00
85.50
57.00
28.50
<0.00

climate analysis

Outdoor Thermal Comfort

The use of a building model analysis (Ladybug) as well as an outdoor comfort calculator helped to determine the extreme climate parameters within the comfort zone. According to this analysis, the climate can be considered within comfortable conditions for 36.3% of the time. Although the analysis also indicates no extreme heat stress during the year, the moderate to extreme cold condition remains the key challenge for this environment. Because of the high humidity, the thermal condition is predicted to fluctuate very little and the cold condition spread throughout the year, specifically early in the mornings and late in the afternoons.

-3 = Extreme Cold | -2 = Cold | -1 = Cool | 0 = Comfort | 1 = Warm | 2 = Hot | 3 = Extreme Heat

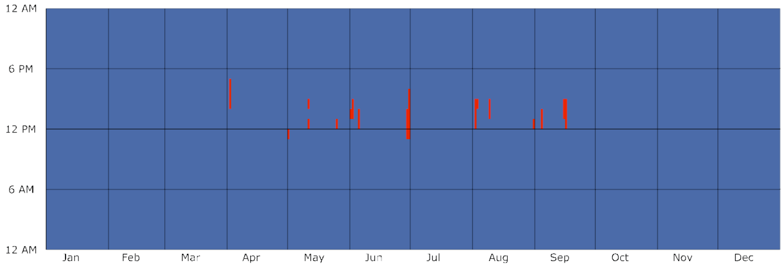


Outdoor Comfort (-3 = Extreme Cold | -2 = Cold | -1 = Cool | 0 = Comfort | 1 = Warm | 2 = Hot | 3 = Extreme Heat) - Hourly
San Francisco Intl Ap_CA_USA
1 JAN 1:00 - 31 DEC 24:00

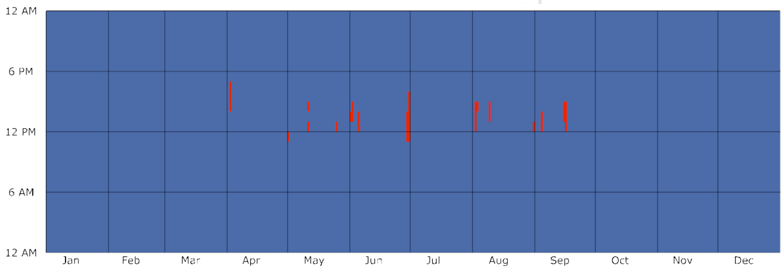
climate analysis

Passive Sterategies

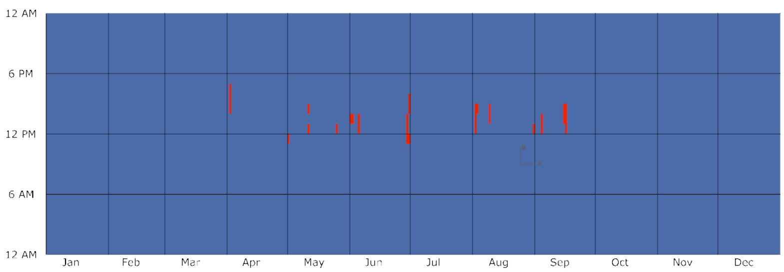
The same building model analysis software is helpful for evaluating possible passive strategies in order to reduce building energy consumption. The following charts calculate the general comfort throughout the year for a person dressed in a three-piece suit. The red areas illustrate hours when this person occupies the comfort zone. By comparison, these charts make it clear that the most efficient passive strategy throughout the year will be internal heat gain and passive solar heating.



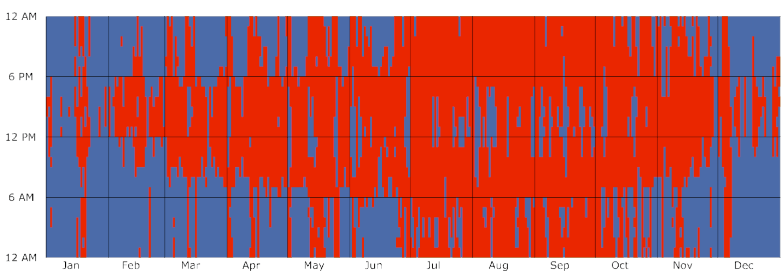
1. Comfortable Hours in Evaporative Cooling Polygon (Boolean Value) - Hourly
San Francisco Intl Ap CA USA
1 JAN 1:00 - 31 DEC 24:00



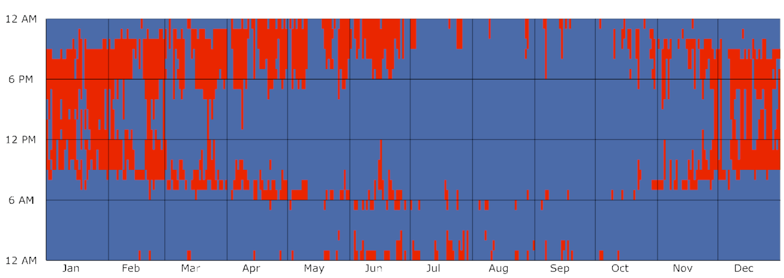
2. Comfortable Hours in Thermal Mass + Night Vent Polygon (Boolean Value) - Hourly
San Francisco Intl Ap CA USA
1 JAN 1:00 - 31 DEC 24:00



3. Comfortable Hours in Occupant Use of Fans Polygon (Boolean Value) - Hourly
San Francisco Intl Ap_CA_USA
1 JAN 1:00 - 31 DEC 24:00



4. Comfortable Hours in Internal Heat Gain Polygon (Boolean Value) - Hourly
San Francisco Intl Ap_CA_USA
1 JAN 1:00 - 31 DEC 24:00



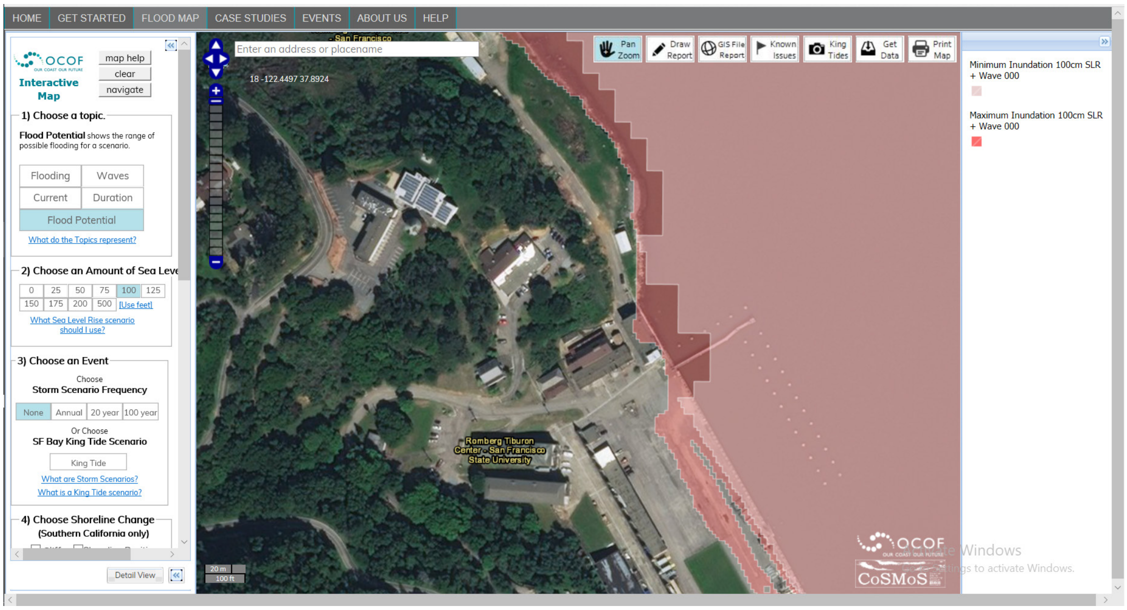
5. Comfortable Hours in Passive Solar Heating Polygon (Boolean Value) - Hourly
San Francisco Intl Ap CA USA
1 JAN 1:00 - 31 DEC 24:00

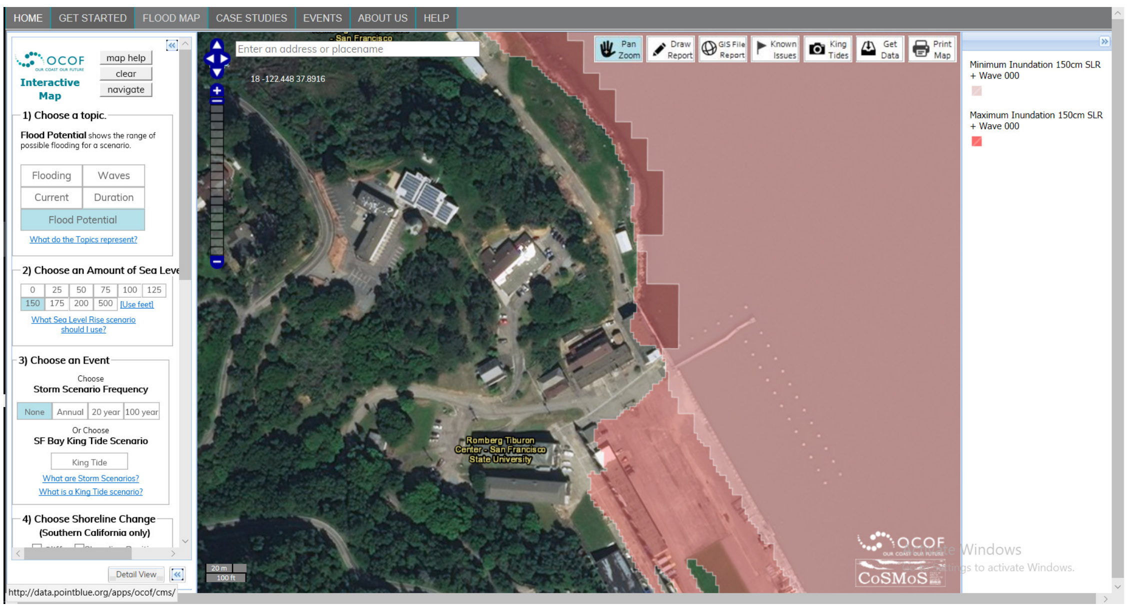
1. Evaporative Cooling
2. Thermal Mass+Night Ventilation
3. Occupant Use of Fans
4. Capture Internal Heat Gain
5. Passive Solar Heating

climate analysis

Flood Potential

Since the project is located on Bayside, the risk of flood is considered during the design process. The flood maps show that most flat part of the site will be eventually at risk of flood. The higher levels on hills will be in a safe zone even in a 500-year period.


HOME
GET STARTED
FLOOD MAP
CASE STUDIES
EVENTS
ABOUT US
HELP
OCOF
Interactive Map
map help
clear
navigate
1) Choose a topic.
Flood Potential shows the range of possible flooding for a scenario.
Flooding
Waves
Current
Duration
Flood Potential
What do the Topics represent?
2) Choose an Amount of Sea Leve
0 25 50 75 100 125
150 175 200 500 [Use feet]
What Sea Level Rise scenario should I use?
3) Choose an Event
Choose
Storm Scenario Frequency
None
Annual
20 year
100 year
Or Choose
SF Bay King Tide Scenario
King Tide
What are Storm Scenarios?
What is a King Tide scenario?
4) Choose Shoreline Change
(Southern California only)
Detail View
Enter an address or placename
18 -122.4497 37.8924
Pan Zoom
Draw Report
GIS File Report
Known Issues
King Tides
Get Data
Print Map
Romberg Tiburon Center - San Francisco State University
20 m
100 ft
CoSMoS
Minimum Inundation 100cm SLR + Wave 000
Maximum Inundation 100cm SLR + Wave 000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0 25 50 75 100 125
150 175 200 500 [Use feet]
What Sea Level Rise scenario should I use?
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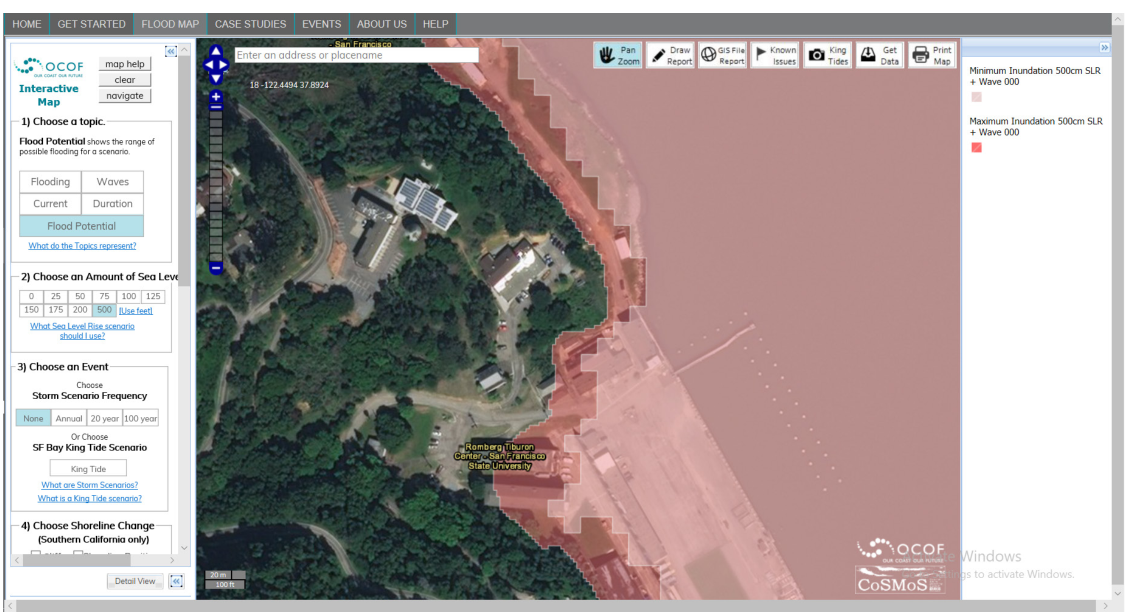
None
Annual
20 year
100 year
Or Choose
SF Bay King Tide Scenario
King Tide
What are Storm Scenarios?
What is a King Tide scenario?
4) Choose Shoreline Change
(Southern California only)
Detail View
http://data.pointblue.org/apps/ocof/cms/
Enter an address or placename
18 -122.448 37.8916
Pan Zoom
Draw Report
GIS File Report
Known Issues
King Tides
Get Data
Print Map
Romberg Tiburon Center - San Francisco State University
20 m
100 ft
CoSMoS
Minimum Inundation 150cm SLR + Wave 000
Maximum Inundation 150cm SLR + Wave 000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Flooding
Waves
Current
Duration
Flood Potential
What do the Topics represent?
2) Choose an Amount of Sea Leve
0 25 50 75 100 125
150 175 200 500 [Use feet]
What Sea Level Rise scenario should I use?
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100 year
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King Tide
What are Storm Scenarios?
What is a King Tide scenario?
4) Choose Shoreline Change
(Southern California only)
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18 -122.4494 37.8924
Pan Zoom
Draw Report
GIS File Report
Known Issues
King Tides
Get Data
Print Map
Romberg Tiburon Center - San Francisco State University
20 m
100 ft
CoSMoS
Minimum Inundation 500cm SLR + Wave 000
Maximum Inundation 500cm SLR + Wave 000

design ideas

Site Concept

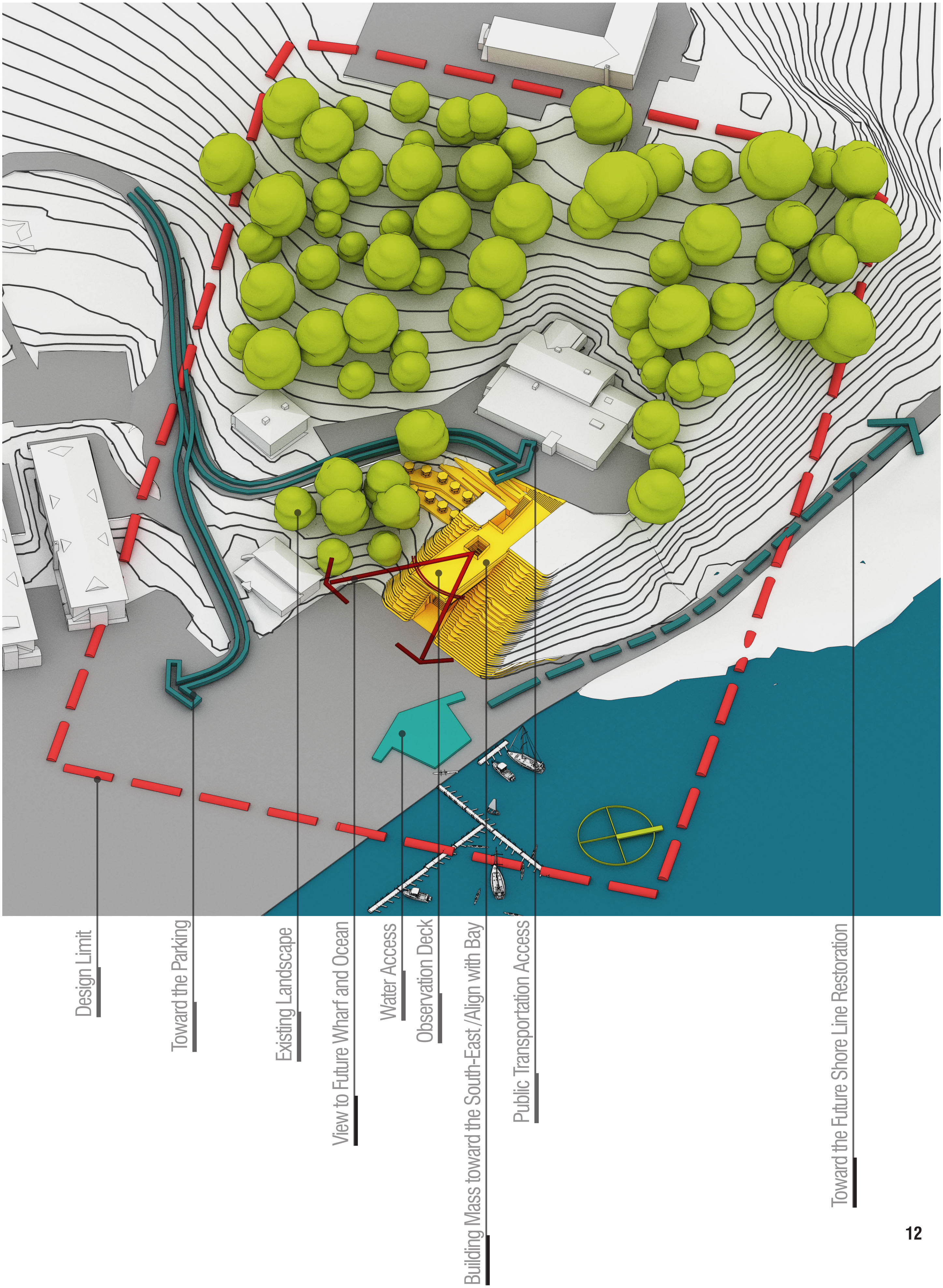
The first consideration to locating the building mass is by exploring the potential of a site with multiple levels that provide diverse views and access to the project.

The geometry of the building is embedded into the sloping ground and acts as a natural extension of the surrounding topography, providing the maximum access without blocking views. This type of footprint is especially beneficial in terms of the building energy performance.

To preserve the existing vegetation, the construction is intentionally sited in the zone without trees.

The building connects two levels of the site without additional pavement. At the upper level, the existing parking is conceived as a temporary arrival point and drop-off area for public transportation. The lower level is located at the intersection for visitors who arrive by cars or by water as well as for those traveling toward the north shoreline.

The clear focal point of the building is an observation deck: a huge cantilever extending over the main volume of the building containing a stair that defines the entrances and connection between the upper and lower levels. This dominant gesture presents the building to its surroundings and establishes visual connection with the ocean beyond.

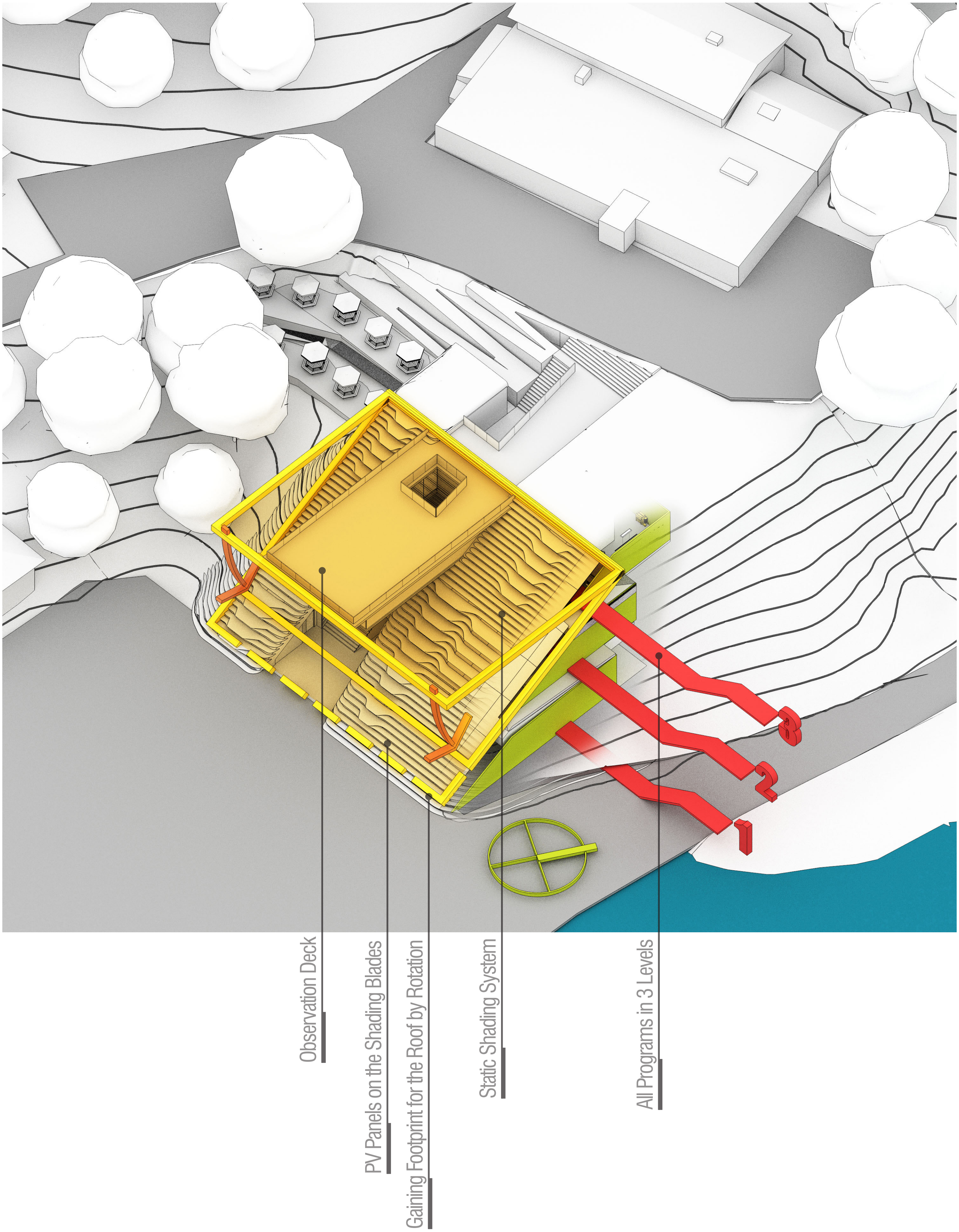

Design Limit
Toward the Parking
Existing Landscape
View to Future Wharf and Ocean
Water Access
Observation Deck
Building Mass toward the South-East /Align with Bay
Public Transportation Access
Toward the Future Shore Line Restoration

design ideas

Building Concept

The first big idea of this project is to embed the building into the ground in order to preserve energy while providing a large facade toward the south to increase solar heat gain. This facade needs protection during summer and also solar penetration during winter. The shading system provides these needs and also provides a surface for PV panel installation. Because the roof tiers are stepped with the slope of the terrain, this increases the roof footprint by 10% which is crucial for solar energy collection, but also provides a great view to the outside. Additionally, an advantage of a greater sloping roof area that this project envisions is that of rain water collection.

The second big idea of this design is combining the requested program into the one building in order to achieve greater efficiency. The program has been divided into three levels. Spaces like an interactive exhibition, administrative offices, multipurpose room and storage are located on the upper levels. The main wet spaces such as wet lab classrooms, restrooms and kayak storage are located on the lower level, reducing the energy consumption that would otherwise be required to pump water to the upper levels.


Observation Deck
PV Panels on the Shading Blades
Gaining Footprint for the Roof by Rotation
Static Shading System
All Programs in 3 Levels

design ideas

Component Relation

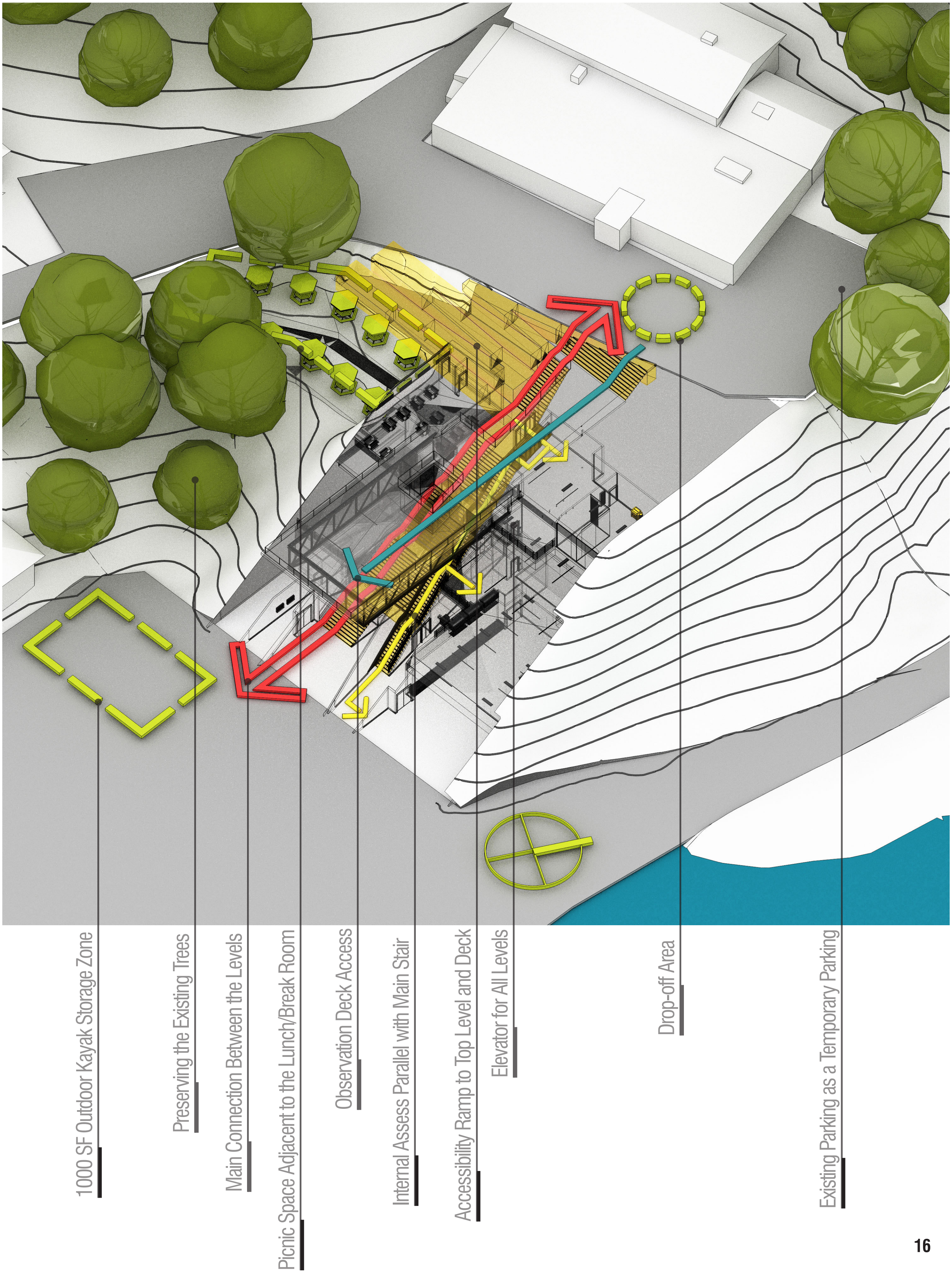
The first challenge by locating the building on a slope is the access to the building. The main stair that connects

two levels of the site extends into and through the building to provide internal circulation as well. Public areas such as the observation deck, picnic area and stair itself can serve the visitor independent of the building operations.

While the outside ramp provides accessibility to the observation deck, picnic area and visitor center entrance on the top floor, an internal elevator provides accessibility to all levels as well.

The two building programs combine into a single building not only to share the public space but also to enhance the building energy performance by reducing the exposed surfaces and infrastructure. As a result, the two entrances were conceived such that the upper entrance primarily serves the Visitor Center while the lower entrance serves the Science-On-the-Bay program. Although all spaces are interconnected, the Science building program has an internal separation that can isolate this program as needed.

Finally, the picnic area is thoughtfully located adjacent to the lunch/break room and the existing trees.

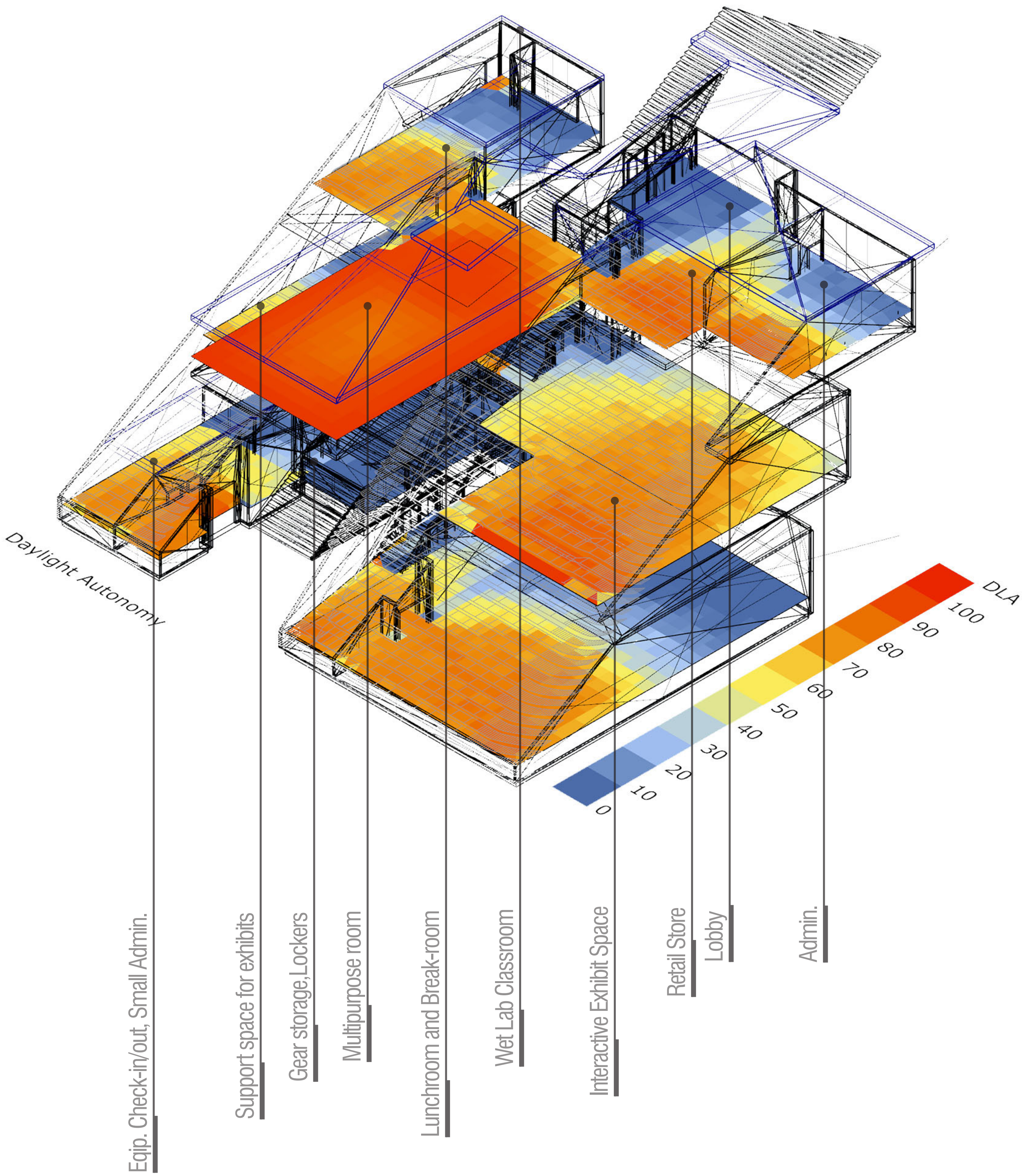

1000 SF Outdoor Kayak Storage Zone
Preserving the Existing Trees
Main Connection Between the Levels
Picnic Space Adjacent to the Lunch/Break Room
Observation Deck Access
Internal Assess Parallel with Main Stair
Accessibility Ramp to Top Level and Deck
Elevator for All Levels
Drop-off Area
Existing Parking as a Temporary Parking

building performance

Daylight Simulation

This daylight simulation is done by Honeybee plugin to demonstrate the percentage of the time during the active occupancy hours that the test points (in this case 3' above the floor) receive between 100 to 2000 lux.

As it was predictable, the daylight level is very high for most spaces close to the south facade. On the Second floor, all of the main exhibition space receive a very good amount of the daylight. The only problematic space that in %10 or below receives less than 100 lux is north part of the wet lab which will require artificial lighting.


Daylight Autonomy
DLA
0
10
20
30
40
50
60
70
80
90
100
Eqip. Check-in/out, Small Admin.
Support space for exhibits
Gear storage,Lockers
Multipurpose room
Lunchroom and Break-room
Wet Lab Classroom
Interactive Exhibit Space
Retail Store
Lobby
Admin.

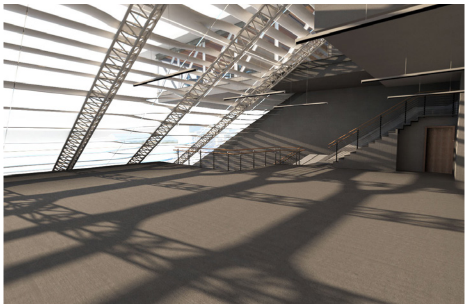
building performance

Shading Studies

The shading system is rows of fixed blades that design according to the latitude of the site. In order to determine the depth and distances of the blades in this system, the median degree for 3 coldest months considered as 33^0 and for 3 warmest months the median degree considered 65^0 . According to these angles, the depth of the blades is 2’1” and the distance between them is 1’.

The final rendering results show that the system is successful in protecting inside of the building during summer and enabling solar access during the winter.

December 21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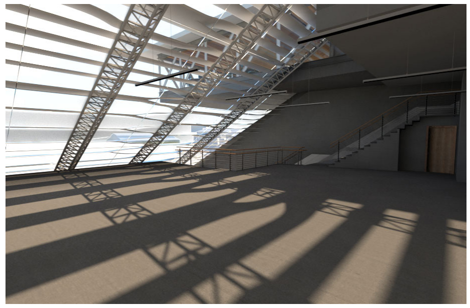
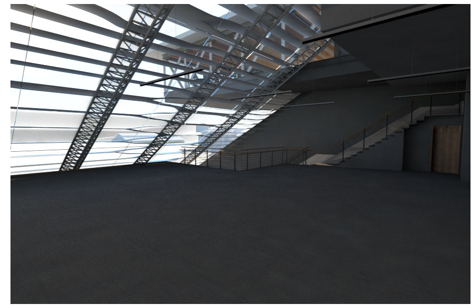
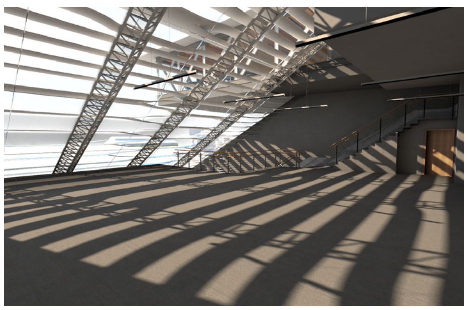
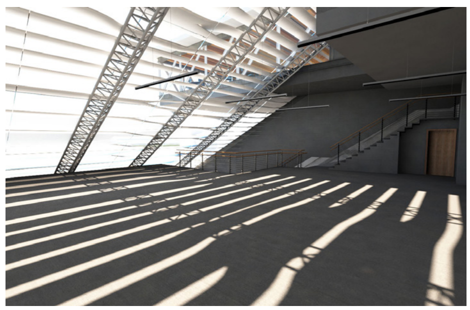
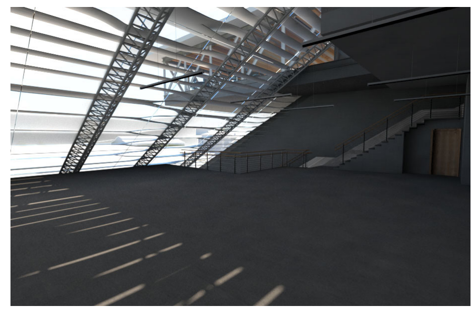

12 noon


15 p.m

March 21/September 21


9 a.m


12 noon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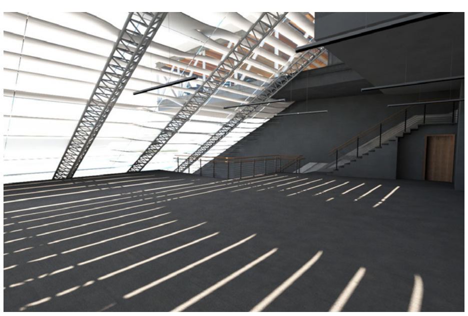
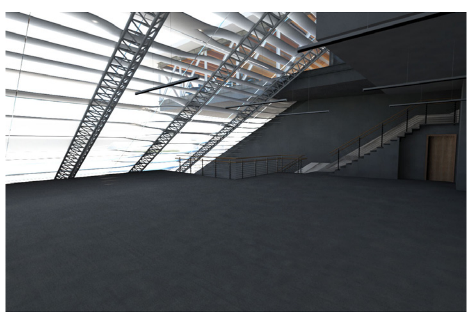
June 21


9 a.m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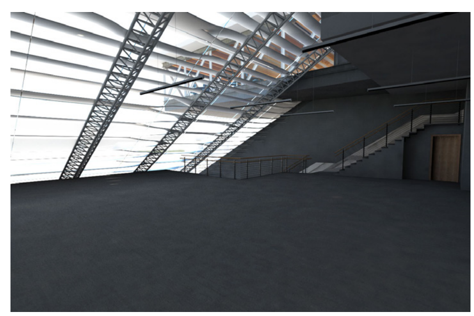

15 p.m

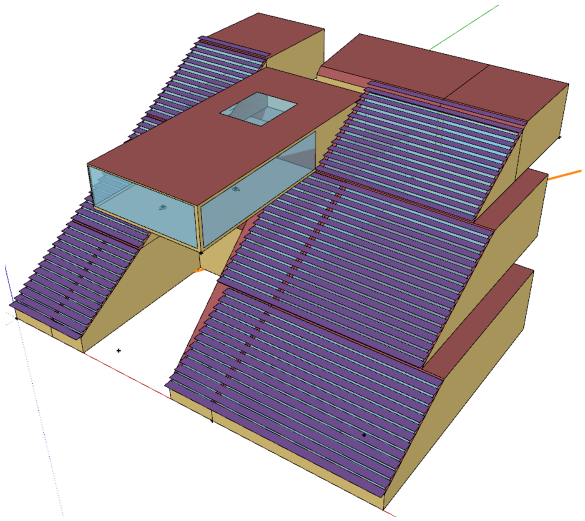
building performance

Building Performance

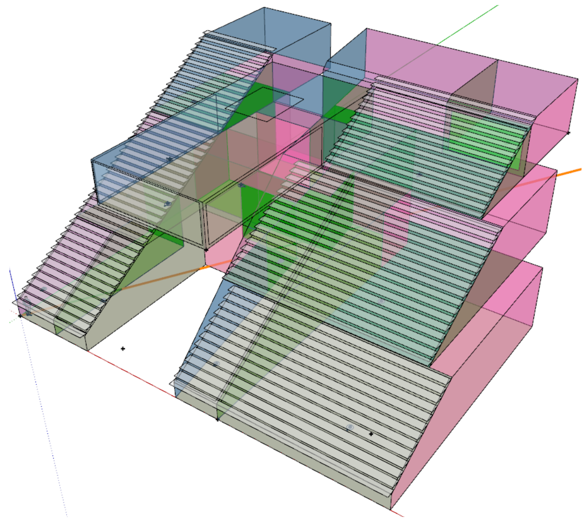
OpenStudio is used as energy simulation tools. Since the threes sides of the building are inside the ground, these surfaces defined as adiabatic surfaces which are very helpful to preserving the energy inside the geometry.

Also, the HVAC system design very efficiently to use ground source pipe in term of reducing the size of the system and also energy consumption. T

To calculate the amount of electricity that is generated by PV, the NREL PVWatt calculator used with premium module types and 0^0 for array tilt.



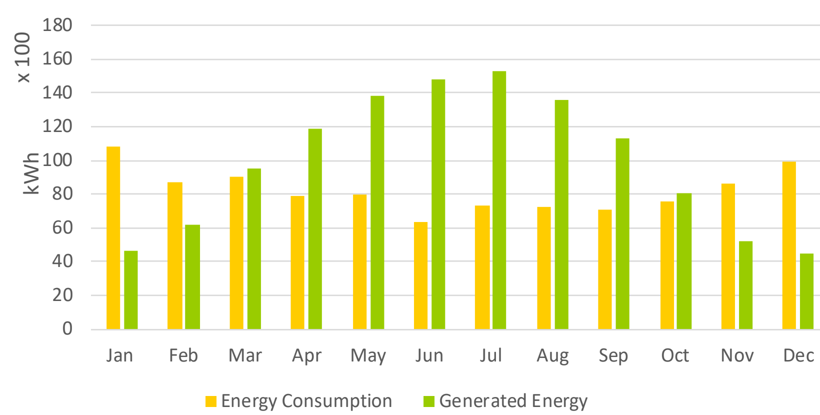
OpenStudio Model



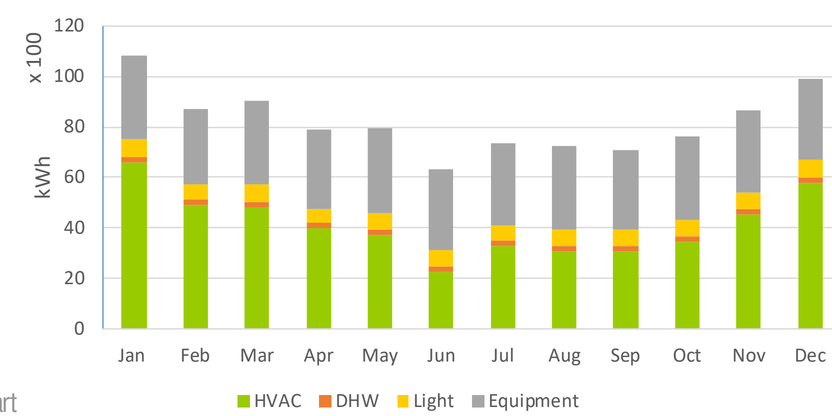
Surfaces Boundary (Adiabatic Surfaces Exterior Walls)

	Energy Use (kBtu/sf/year)
HVAC	10.12
Lighting	1.57
Equipment	7.93
DHW	0.53
Total	**20.15**
Exibition Consumption	2
Gross EUI	**22.15**
PV Production	24.26
Net EUI	**2.11**

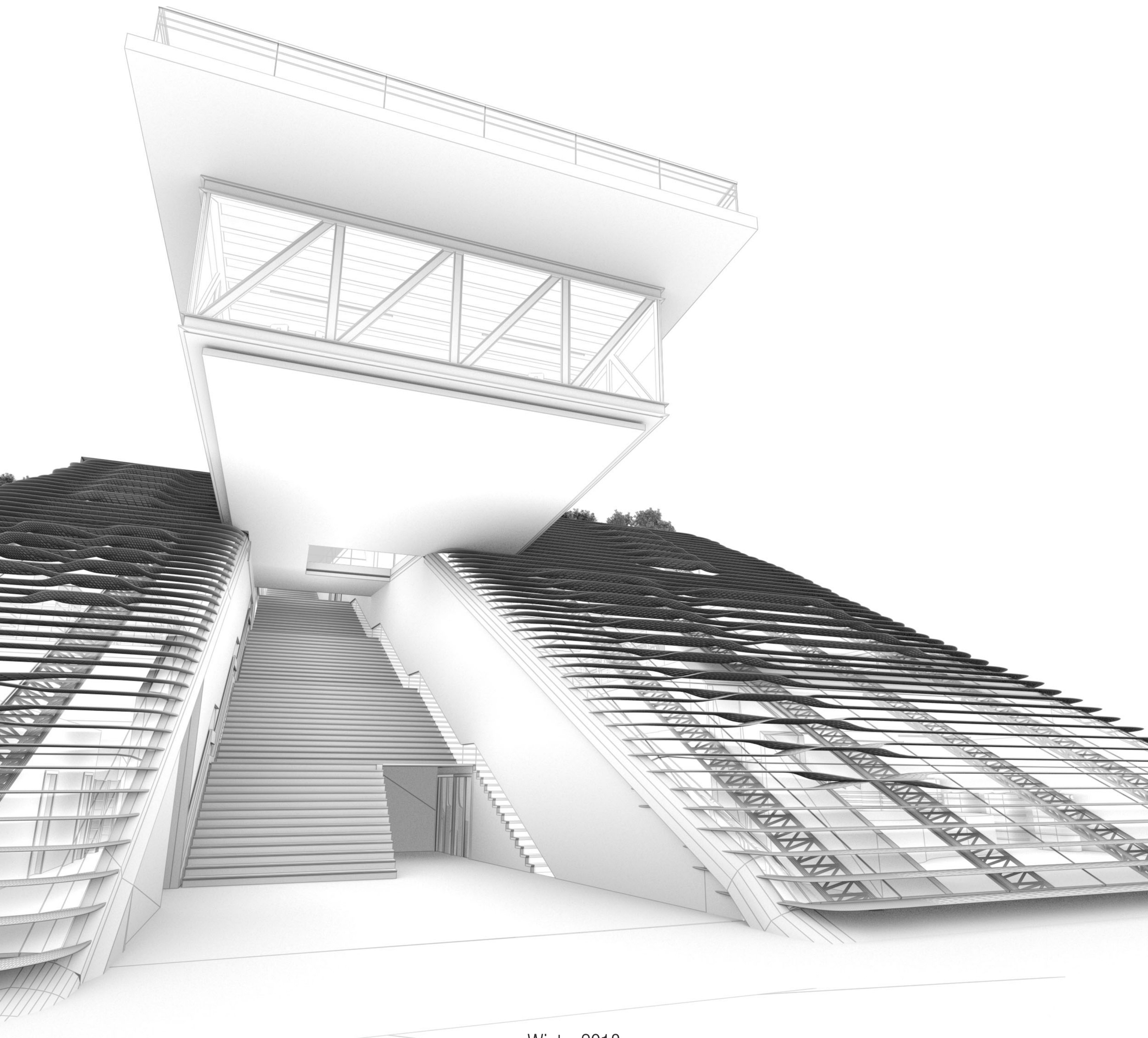
EUI Break Down



Monthly Energy Use and Produce Chart



Monthly End Use Energy Consumption Chart



Winter 2018