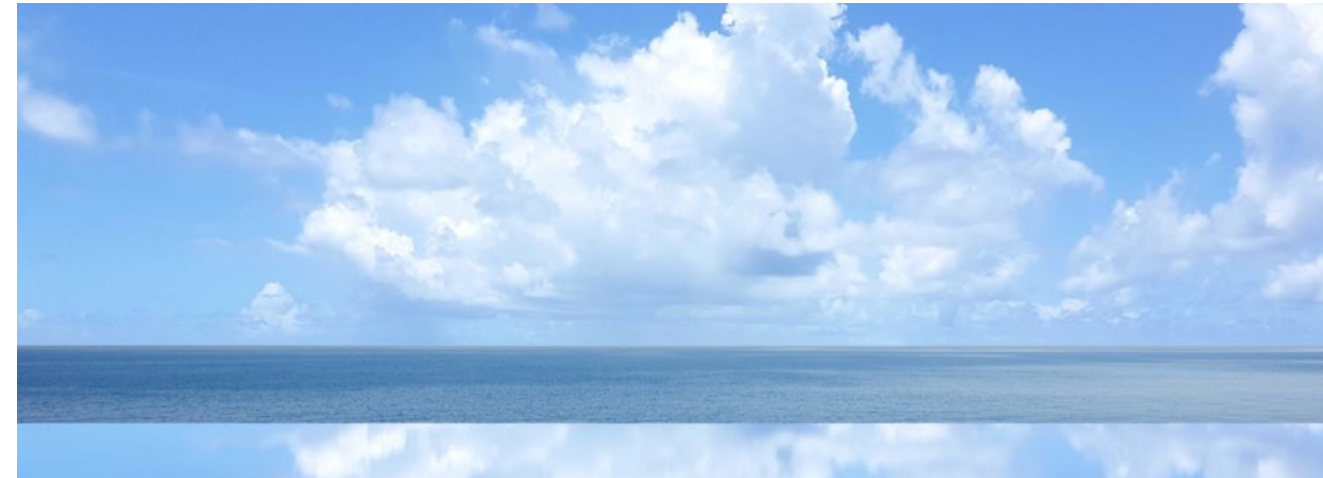


# minawetu



A design/build offering  
currently under construction

## Prospectus

Biophilic—Botanical

The desire to create innovative,  
sustainable, and ecologically  
sensitive design

“Passion can create drama  
out of inert stone.”

— Le Corbusier

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East view





Aerial view





Roof view





Stair view





Main view





Kitchen view





Living room view





North view





# minawetu

## Island home

The name Minawetu is derived from the Wampanoag names for Island (Munahee) and home (Weetyoo).



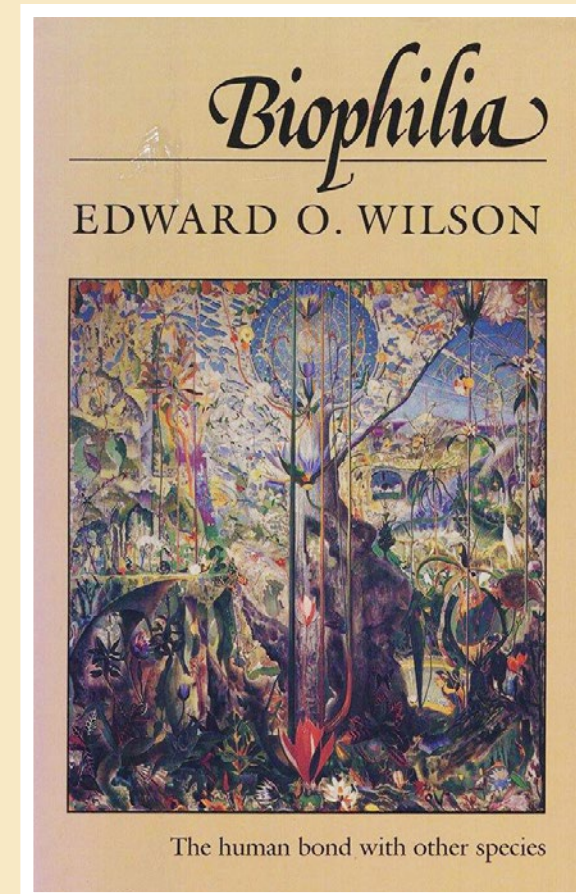
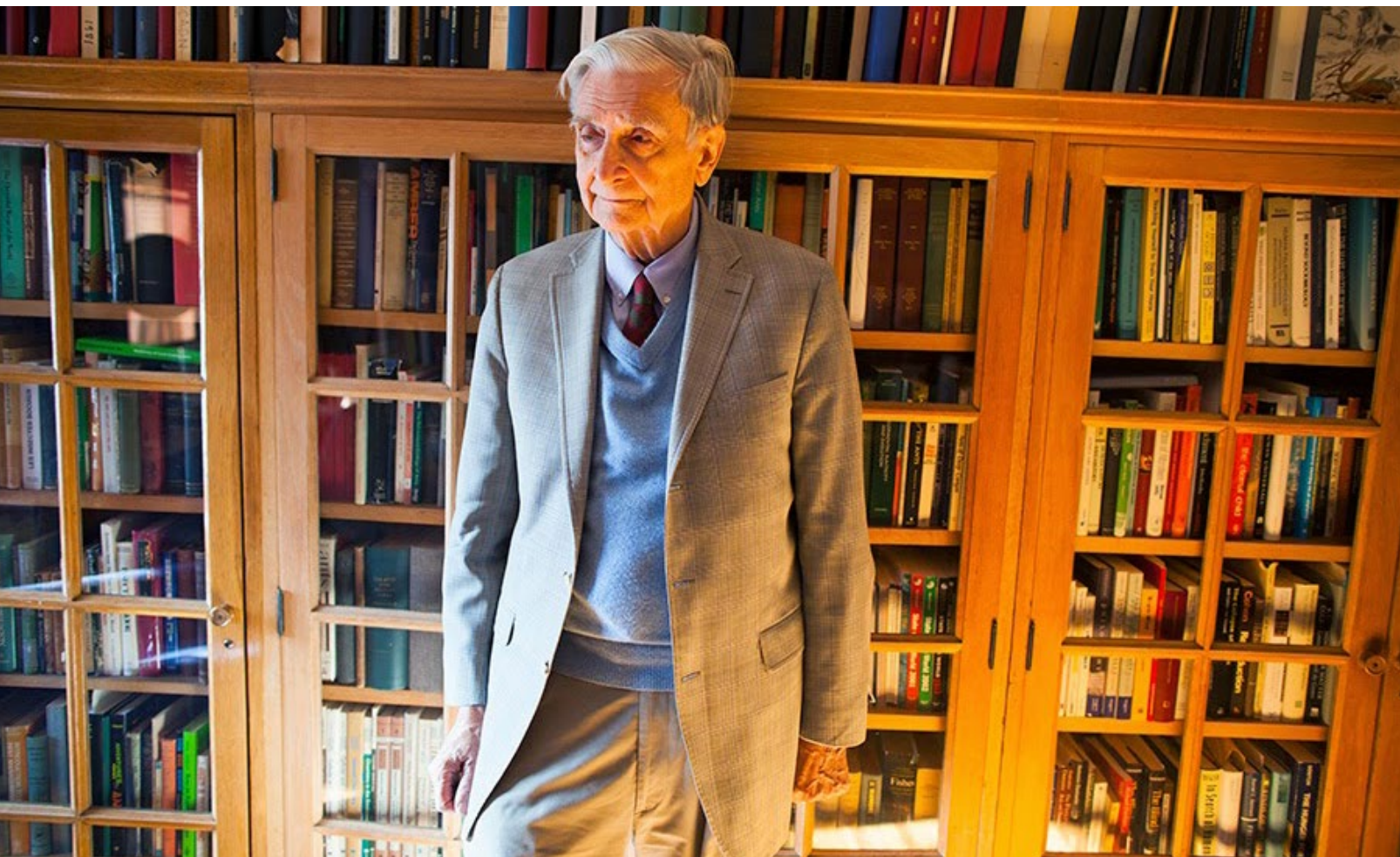


# Biophilia

Minawetu is designed to respect the works of American biologist, theorist, naturalist and author Edward O. Wilson from Harvard University. Wilson popularized the term *Biophilia* in the 1980's when he observed how increasing rates of urbanization were leading to a disconnection with the natural world. *Bio-* means "life or living things", *-philia* means "love". *Biophilia* refers to "love of life or living systems."

"The concept of Biophilia," Wilson wrote, "implies that humans hold a biological need for connection with nature on physical, mental, and social levels, and this connection affects our personal wellbeing, productivity, and societal relationships."

Photo: Edward O. Wilson, who popularized the term *Biophilia*.



The cover of Wilson's book *Biophilia*, published in 1984.

**"The concept of Biophilia," Wilson wrote, "implies that humans hold a biological need for connection with nature on physical, mental, and social levels, and this connection affects our personal well-being, productivity, and societal relationships."**



# Biophilic design

## Connecting with nature to improve health and well-being

Biophilic Design uses Wilson's Biophilia principles to create a human centered approach that when applied improves our homes with numerous benefits to our health and well-being. Businesses at the vanguard of workplace design such as Apple, Google, Amazon, and Facebook are investing heavily in Biophilic Design elements. These principles are shown to improve worker concentration, engagement and cognitive ability, but also to attract and retain staff in the "war for talent." This practice is now weaving its way into single family dwelling architecture.

## Homes can become more calming and restorative

Biophilic design aims to incorporate a bit of nature into our home.

Biophilic design emphasizes human adaptations to the natural world that over evolutionary time have proven instrumental in advancing people's health, fitness, and wellbeing.

Biophilic design depends on repeated and sustained engagement with nature.

Biophilic design requires reinforcing and integrating design interventions that connect with the overall setting or space.

Biophilic design fosters emotional attachments to settings and places.

Effective Biophilic design fosters connections between people and their environment, enhancing feelings of relationship, and a sense of membership in a meaningful community.

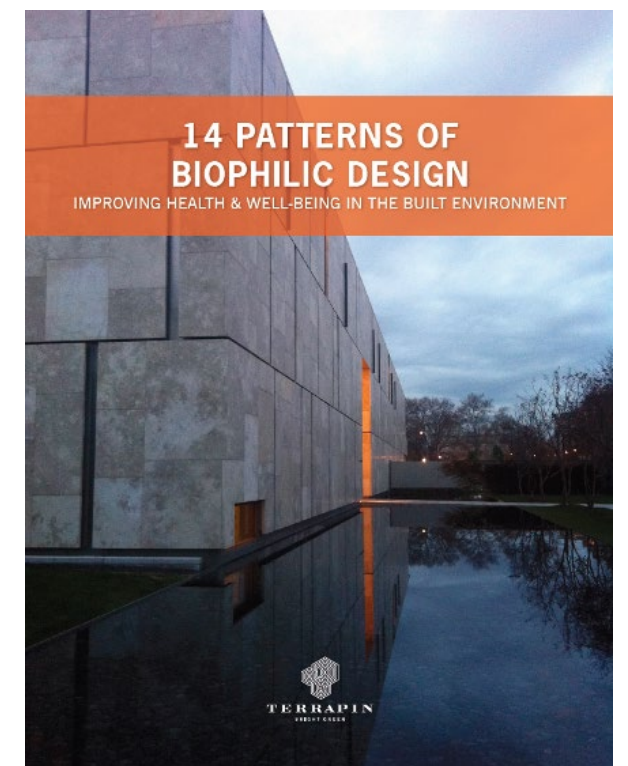
The fundamental goal of Biophilic design is to create a good habitat for people as biological organisms inhabiting modern structures and landscapes.

Biophilic design's emphasis is on engaging with and repeated contact with nature.

Biophilic design recognizes how much our physical and mental wellbeing continues to rely on the quality of our connections to the world beyond ourselves.

Biophilic design targets psychological well-being on the grounds that everyone has an innate affinity for both beauty and nature.

At Minawetu, Tate Builders' Design-Build fully embraces Terrapin's 14 Patterns of Biophilic Design. This is a 64 page peer-reviewed study which is now our working model for all new and future works. At Minawetu, we endeavored to employ each of the 14 patterns and all of their associated elements.





# Split-face Chelmsford granite

Chelmsford Grey, originally quarried in Chelmsford, MA, is a light grey stone with fine to medium homogeneous grain that's highlighted with small black flecks.





Our goal was for this home to radiate substance, stability and orderliness. Minawetu has a distinct character and weight that can be attributed, in part, to its building material: Chelmsford Grey granite. Chelmsford Grey, originally quarried in Chelmsford, MA, is a light grey stone with fine to medium homogeneous grain that’s highlighted with small black flecks. It’s been characterized as having a quiet and enduring beauty and has long been used in major building and civic projects across the country, including the Peabody Essex Museum (PEM) in Salem, MA.



The chief of facilities and planning for the new expansion of the Peabody Essex Museum helped to connect us with the original fabricators of the Chelmsford Grey Granite exterior cladding.



sourcing • consulting • installation  
**J. A. J. Co., Inc.**  
**M A S O N S**



A rugged, uneven, concave-convex finish that reveals reflections from the crystal is produced by the splitting action of a guillotine. Detail character ranges from low to high for fine grain through coarse grain stones, respectively. The stones are split to the specified wall thickness, but with random tolerance in Salem, MA.



A granite quarry in Chelmsford, MA.



Tate Builders commissioned Structural Stone, one of the largest stone fabricators in North America, to supply and fabricate. Structural Stone, LLC is equipped with state of the art heavy duty fabrication equipment including several multi-wire saws and diamond wire saws which provide them with the capability to cut and inventory a large volume of slabs. Done in an environmentally conscious manner, Structural Stone employs the use of a water filtration device to recycle water consumed during the slab cutting procedure.



Tate Builders commissioned J.A.J. Masons to assist with installation. Founded in 1988, J.A.J. Co., Inc. is a family business that has proven itself repeatedly as one of the best specialty contractors in the industry. With unmatched industry knowledge, the J. A. J. Co., Inc. team is a leader in stone consulting, sourcing, and installation. Specialties include natural stone and tile installation, masonry, restoration, and waterproofing.



# Chelmsford Gray Granite Properties Testing

**Water Absorption:** 0.31 By weight %

**Compressive Strength:** 159.3 MPa

**Density:** 2696 kg/m<sup>3</sup>

**Flexural Strength:** 9.8 MPa

## Description

English Metric Test Method—American Society for Testing and Materials (ASTM)

Absorption by weight 0.31% 0.31% ASTM C97-47

Absorption massique

Density (Specific Gravity) 168.3 lbs/ft<sup>3</sup> 2,696 kg/m<sup>3</sup> ASTM C97-47

Plids volumique (Densité apparente)

Compression strength 23,100 psi 159.3 MPa ASTM C170-50/90

Résistance à la compression

Modulus of rupture 2,860 psi 19.7 MPa ASTM C99-52

Module de rupture

Abrasion resistance, hardness 86 HA No Value Established  
ASTM C241-51

Résistance à l'abrasion

Flexural strength 1,420 psi 9.8 MPa ASTM C880-89



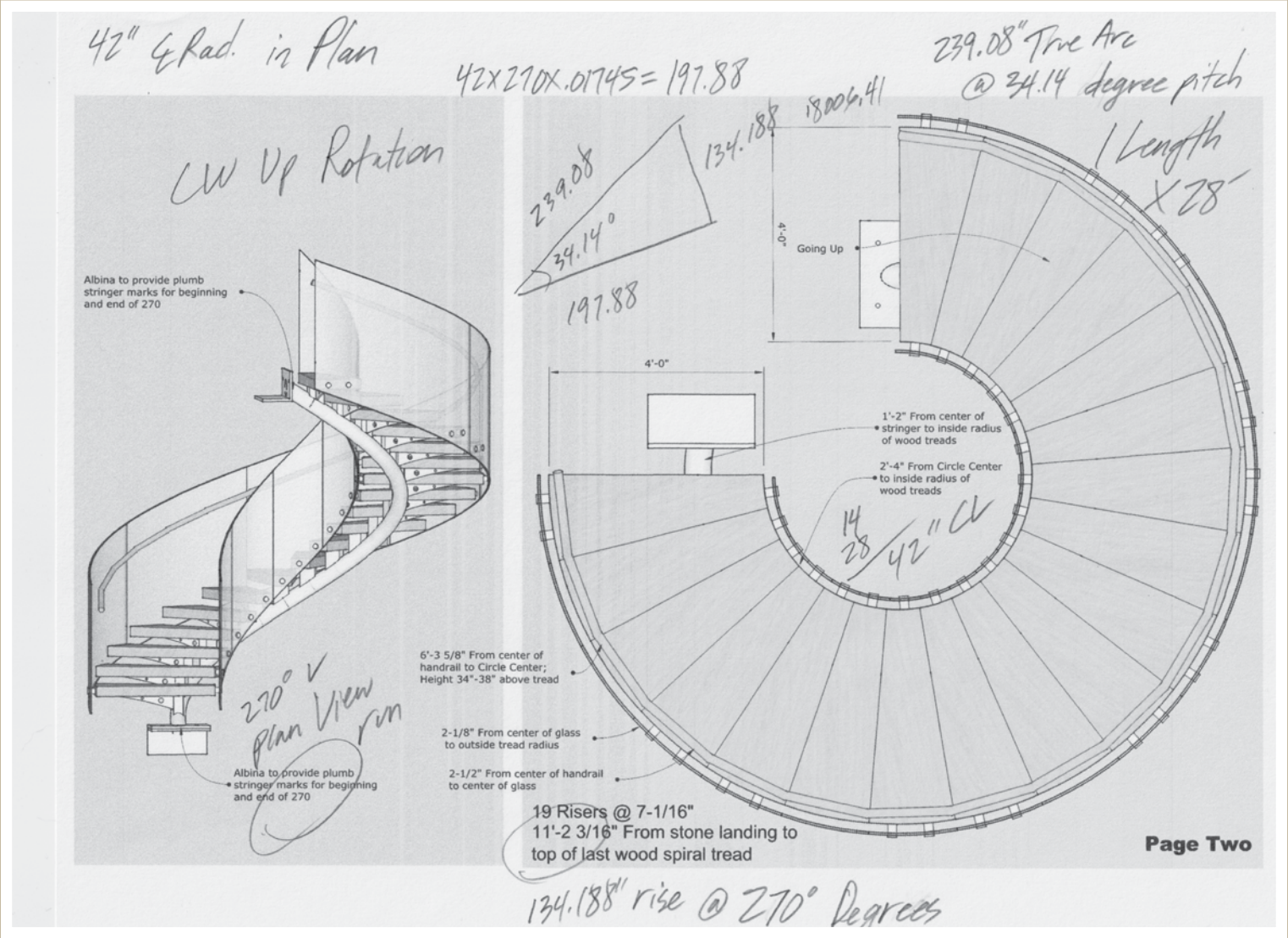
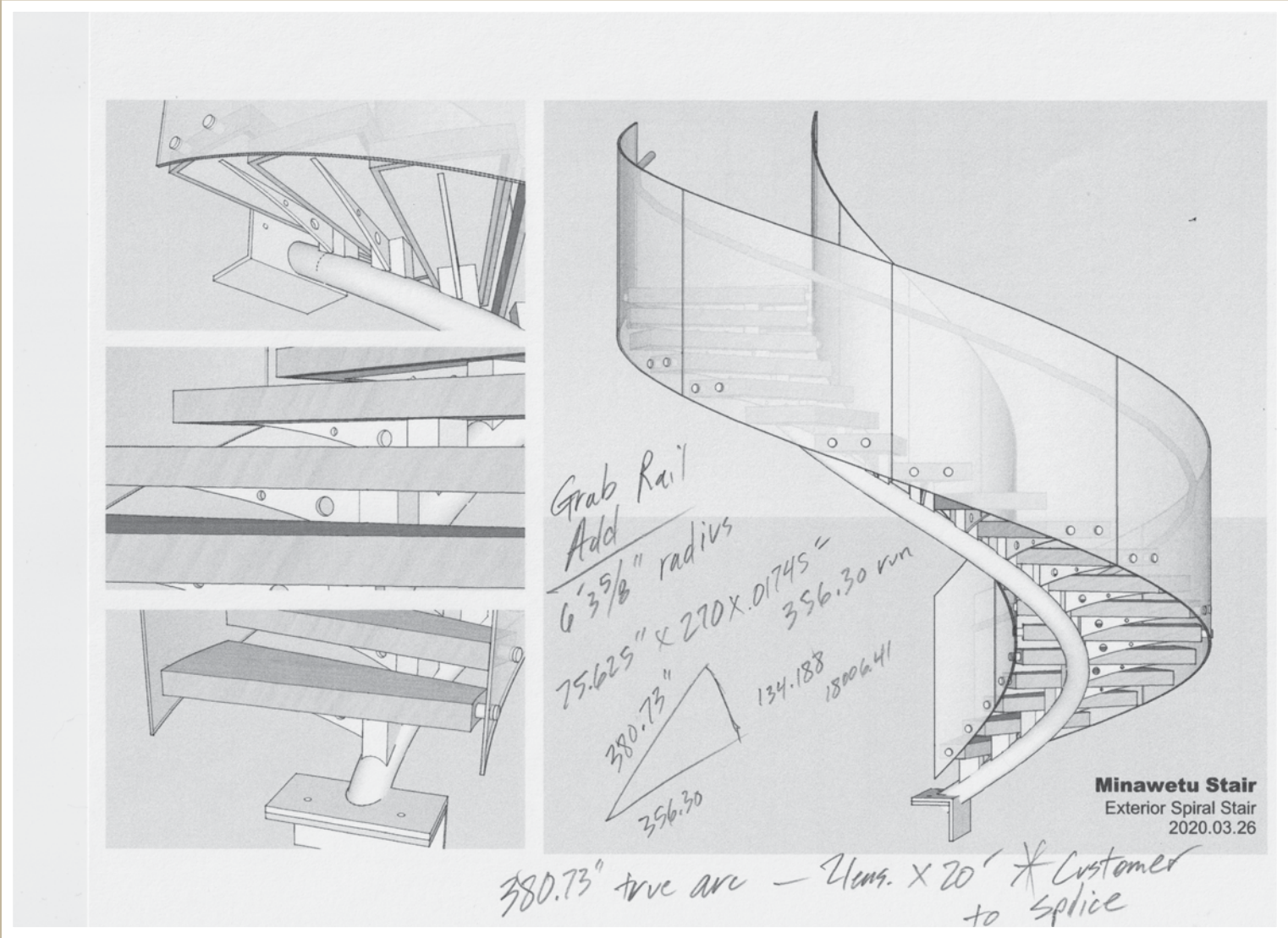
# Circular staircase

The circular staircase to Minawetu's rooftop living space was fabricated with singular mono-stringer and off-set treads with African mahogany. We then commissioned Prestige Mirror and Glass to fabricate the custom curved Starfire glass guardrails with stainless steel handrail. The planting bed at the mono-stringer's base will have complementing vines which will train and twirl their way up and around this element, leading you to the rooftop gardens.





Process

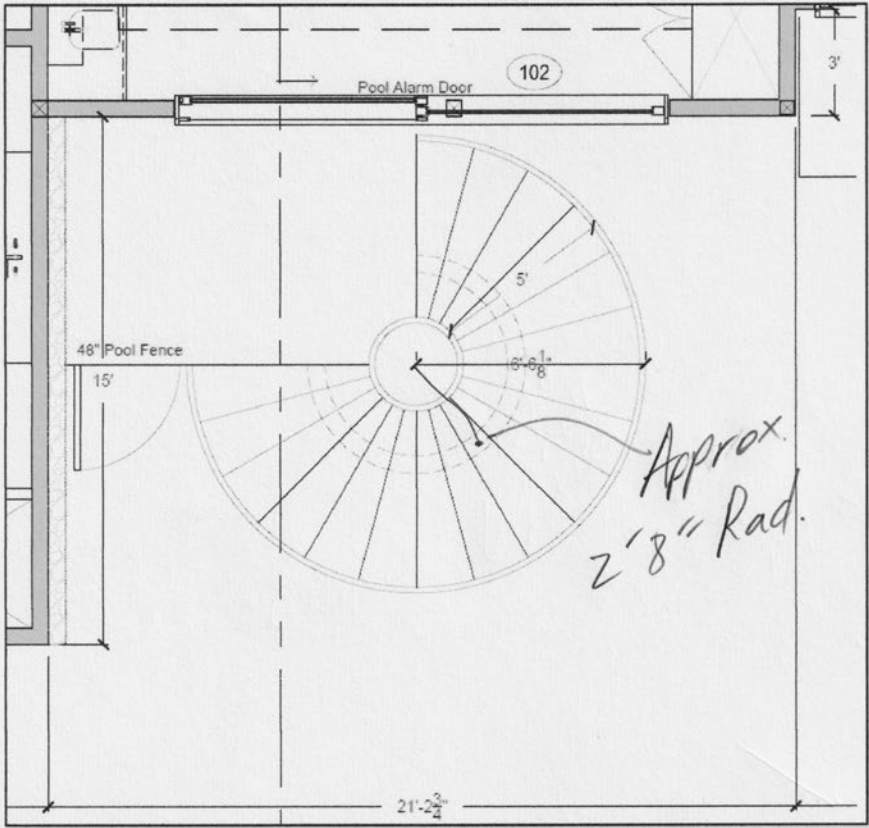




Process

Offset Version Calcs

The plan view below indicates a singular stringer off-center with asymmetrical steel treads.

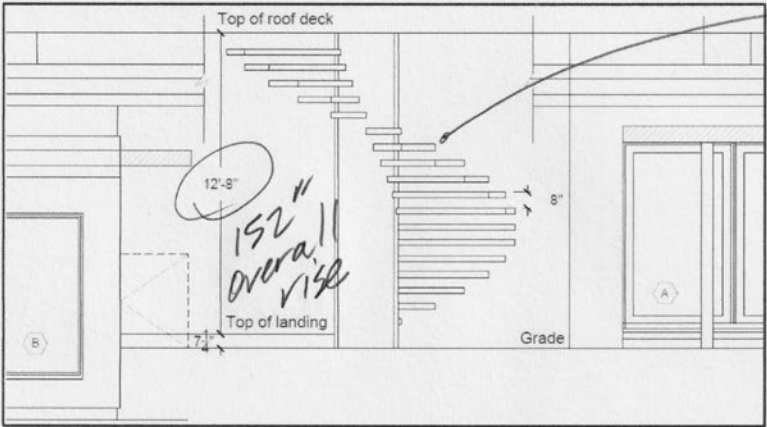


\* True Arc  
214.09"  
45.23° pitch

32" Rad. in Plan     $32 \times 270 \times .01745 = 150.77'$   
270° in Plan    run in plan  
152" rise  
 $\frac{214.09}{150.77} = 45.23^\circ$

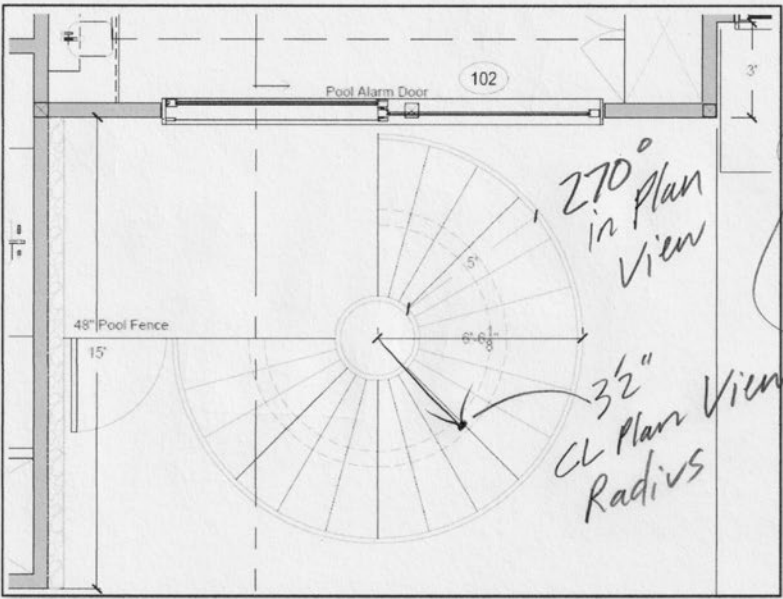
Centered Version Calcs

We are looking for an exterior grade steel mono-stringer stair. Please price in two ways, with singular stringer on centerline of tread, but also with singular stringer off-center with asymmetrical steel treads.



CW UP  
Rotation

The plan view below indicates a singular stringer on centerline of cantilevered steel treads.



$38'' \text{ Rad} \times 270^\circ = 179.03''$   
run in Plan

$\frac{234.82}{179} = 40.33^\circ$   
152"

True Arc  
235" min  
40.33°  
Pitch

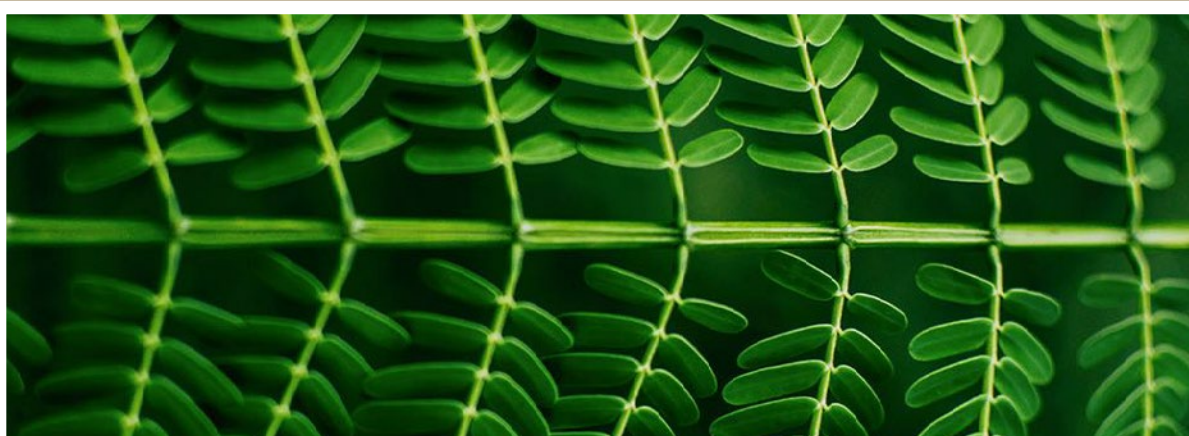
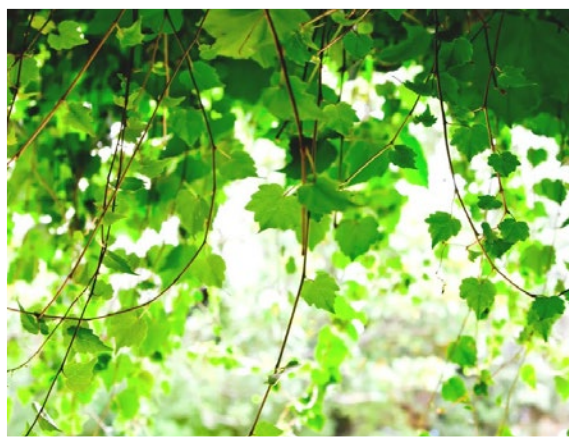
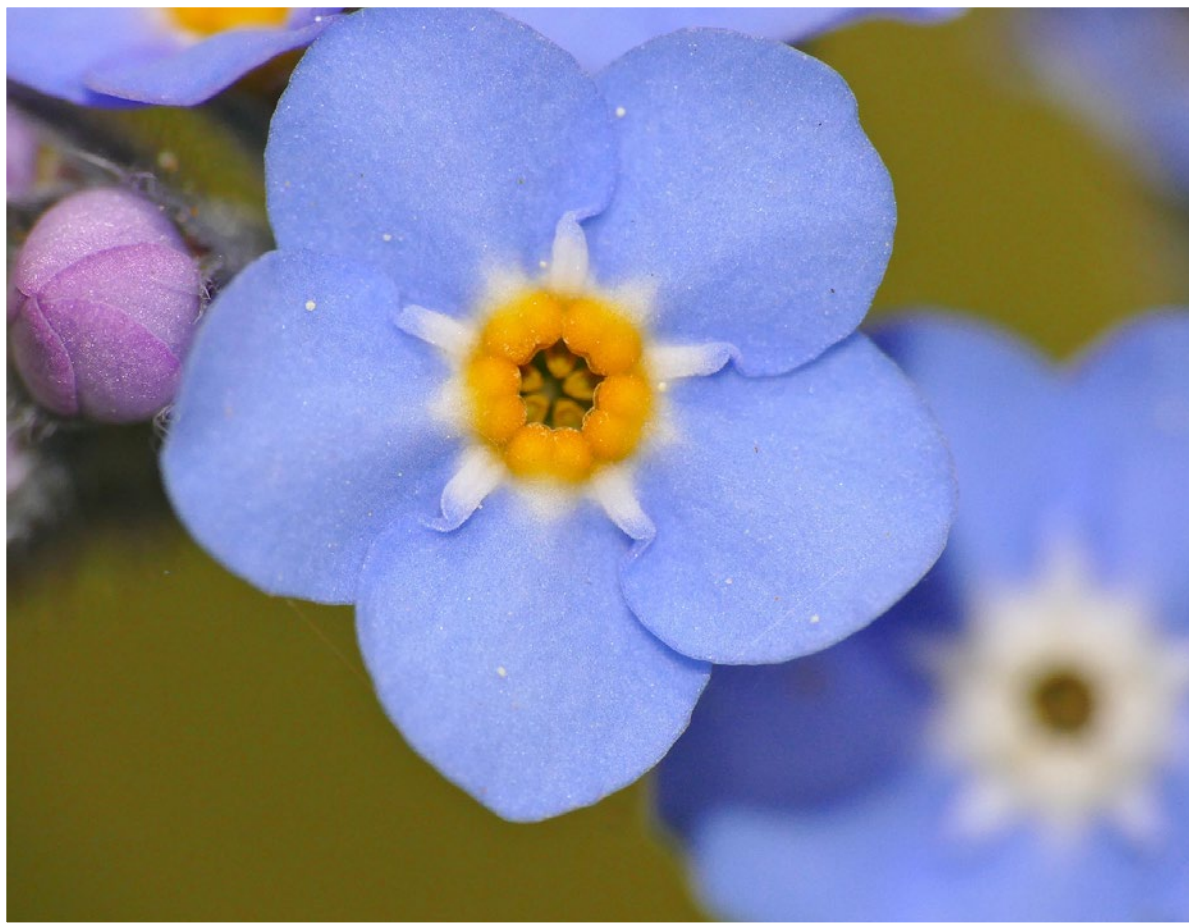


# Softscape

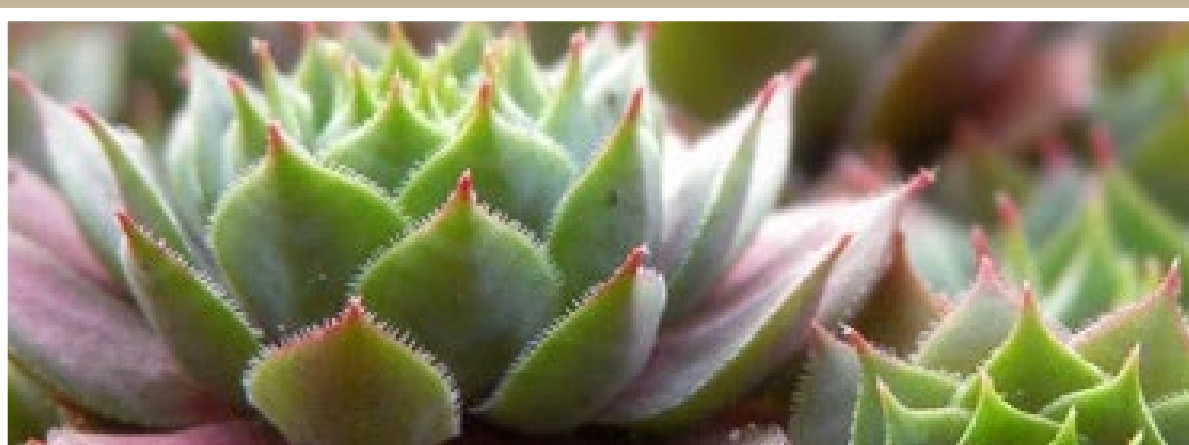
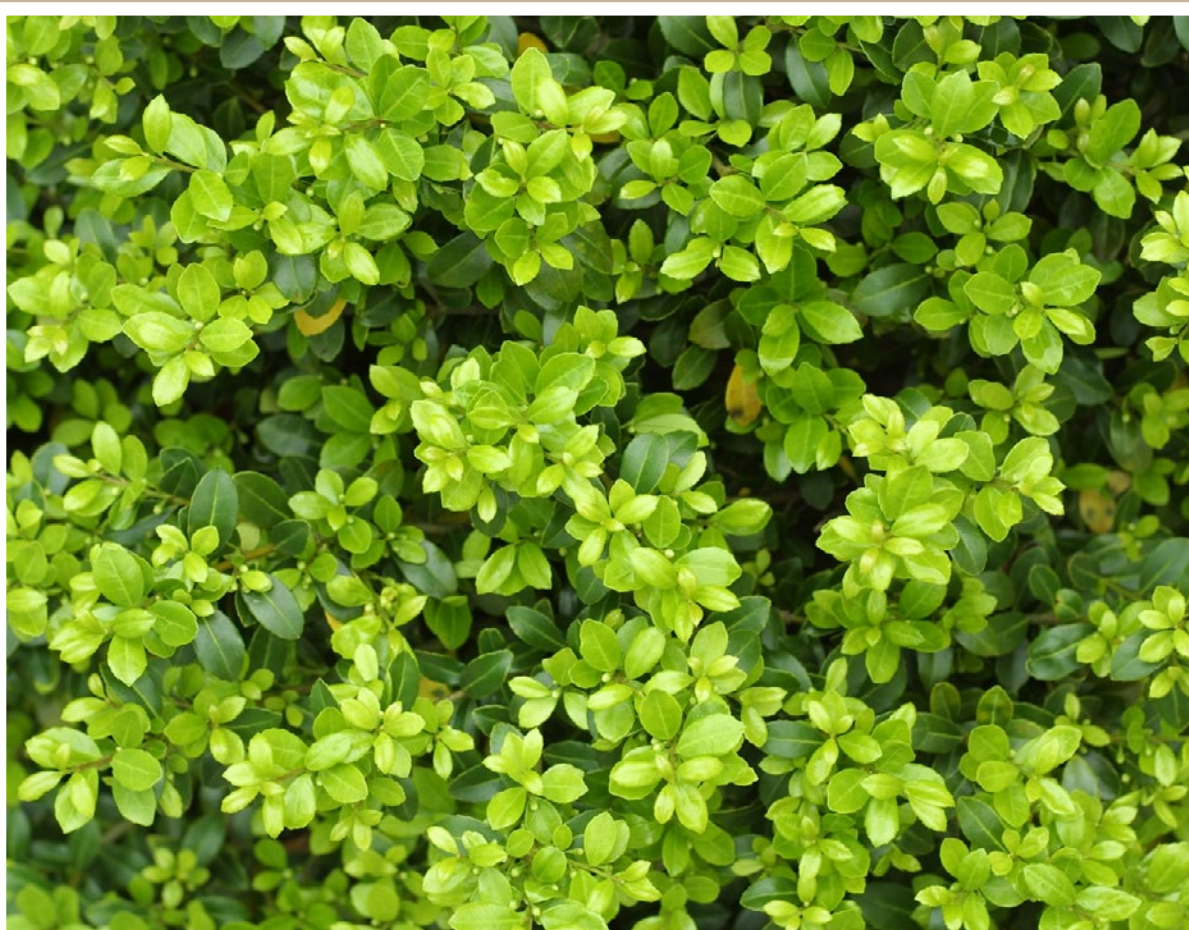
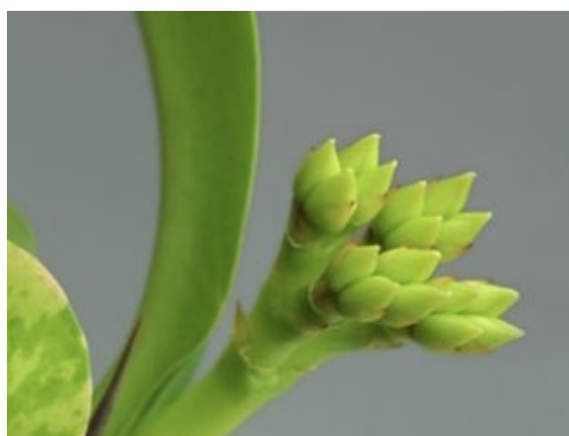
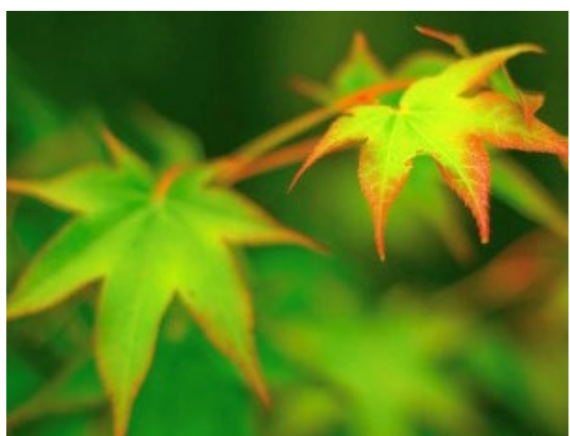
Minawetu's architecture is essentially a Botanical Garden platform.













# Minawetu trees



Tupelo (*Nyssa sylvatica*)



Eastern Red Cedar (*Juniperus virginiana*)



Red Maple (*Acer rubrum*)



Kousa Dogwood (*Cornus kousa*)



# Shrubs & perennials



Inkberry (*Ilex glabra*)



Bayberry (*Myrica pensylvanica*)



Summersweet (*Clethra alnifolia*)



Annabelle Hydrangea (*Hyd. arborescens* 'Annabelle')



Cunningham Rhododendron (*R.* 'Cunningham white')



Arrowwood Viburnum (*Viburnum dentatum*)



Russian Sage (*Perovskia atriplicifolia*)



Lady's Mantle (*Alchemilla mollis*)



White Salvia (*Salvia* 'Snow Hill')



Sweet Woodruff (*Galium odoratum*)



White Cranesbill (*Geranium san.* 'Album')



Purple Aster (*Symphyotrichum puniceum*)



# Minawetu vines



Boston Ivy (*Parthenocissus tricuspidata*)



Virginia Creeper (*Parthenocissus quinquefolia*)



Climbing Hydrangea (*Hydrangea petiolaris*)



Fox Grape (*Vitis labrusca*)



Clematis (*Clematis x jackmanii*)



Morning Glory Vine (*Ipomoea purpurea*)



Trumpet Vine (*Campsis radicans*)



American Wisteria (*Wisteria frutescens*)



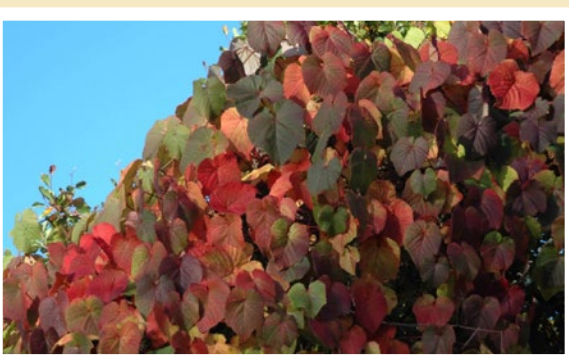
Climbing Yellow Rose (*Rose banksiae lutea*)



Climbing Apricot Rose (*Rosa crepuscule*)



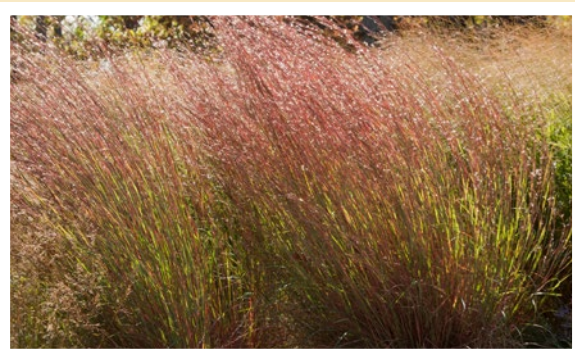
Pierre de Ronsard Rose (*Rosa 'Eden'*)



Crimson Glory Vine (*Vitis coignetiae*)



# Grasses & ferns



Little Bluestem (*Schizachyrium scoparium*)



Karl Foerster Grass (*Calamagrostis x acutiflora* 'Karl Foerster')



Switchgrass (*Panicum virgatum*)



Little Bluestem 'Prairie Blues' (*Schizachyrium scoparium* 'Prairie Blues')



Dwarf Fountain Grass (*Pennisetum* 'Hamelin')



Dwarf Fountain Grass (*Pennisetum* 'Piglet')



Cinnamon Fern (*Osmunda cinnamomea*)



Hayscented Fern (*Dennstaedtia punctilobula*)



Ostrich Fern (*Matteuccia struthiopteris*)



# Rooftop living space

One of the most unique features of Minawetu will be the extraordinary Rooftop Living Space. With the unparalleled views from this amazing waterfront site our design was conceived of from the rooftop down. Features of this amazing space include, but are not limited to:

- Reflecting pool
- Rooftop Ipe deck
- Green roof with Sedum and a variety of native grasses in irrigated planting beds
- Star fire Glass Guardrails
- Access to rooftop living space via circular stair
- Future Solar PV panels





# Minawetu's botanical rooftop gardens

Minawetu's rooftop gardens contain Sedum and a variety of native grasses in irrigated planting beds.





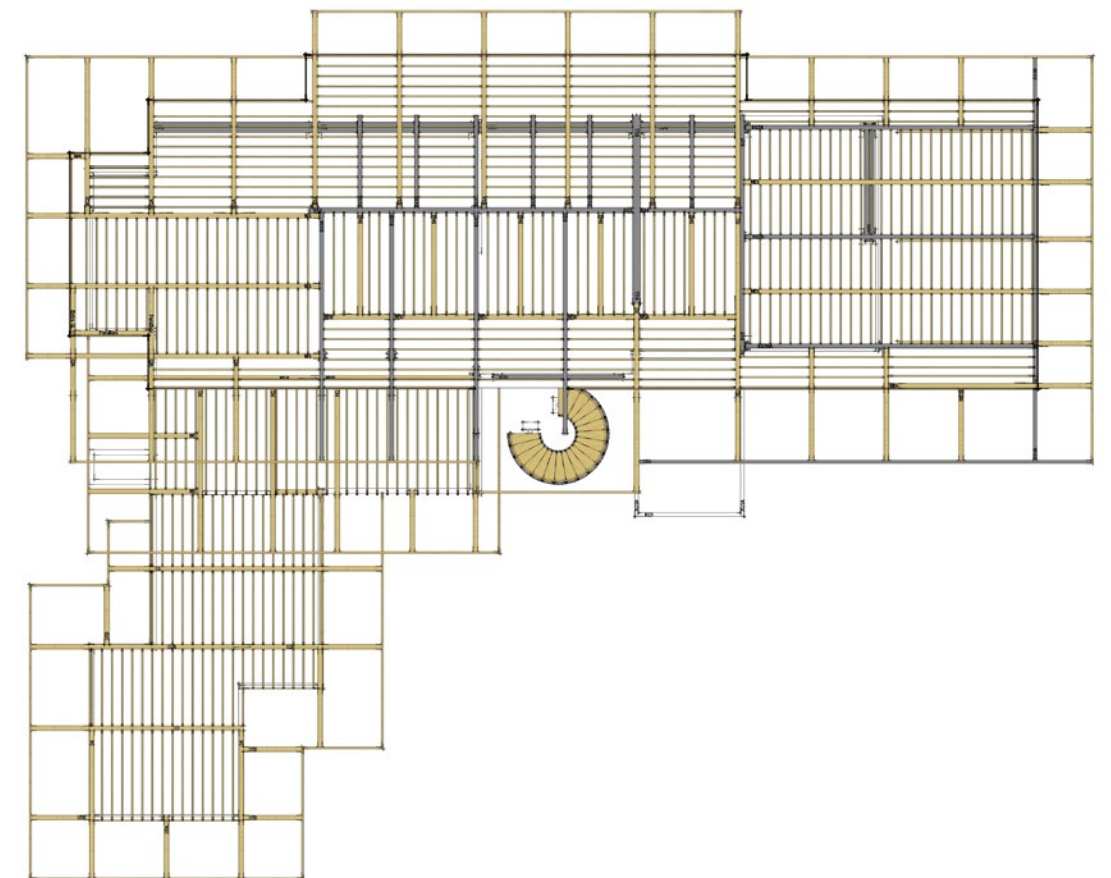
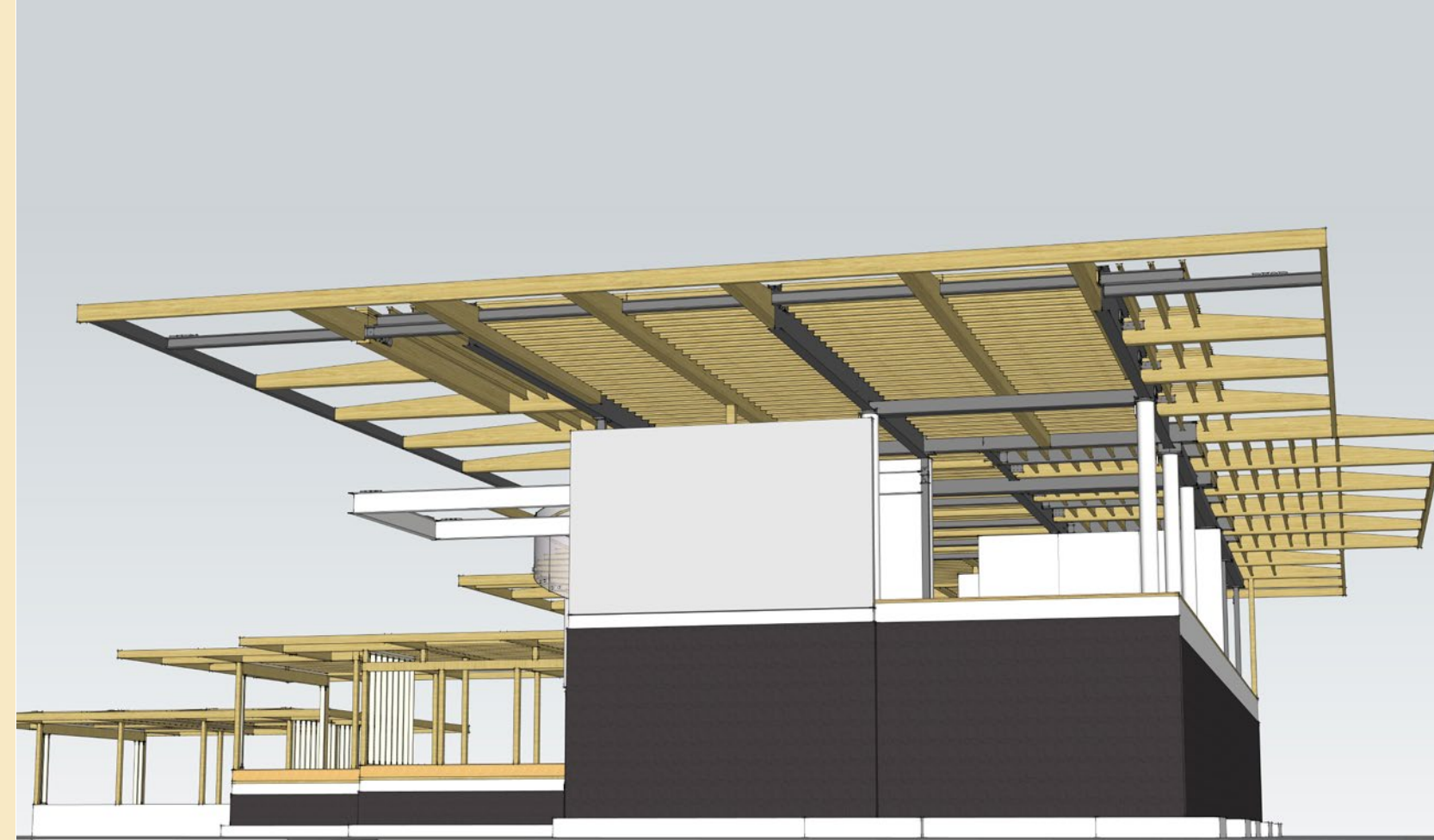
# Engineering

Vineyard Land Surveying (VLS) provided structural engineering for Minawetu and helped to develop practical and innovative engineering solutions for this complex structure. The VLS structural engineering responds to the 265,000 lb rooftop pool weight.

The extraordinary 28 ft cantilevered overhang, along with roof top pool, require large format Steel I-Beams which are specified by VLS.

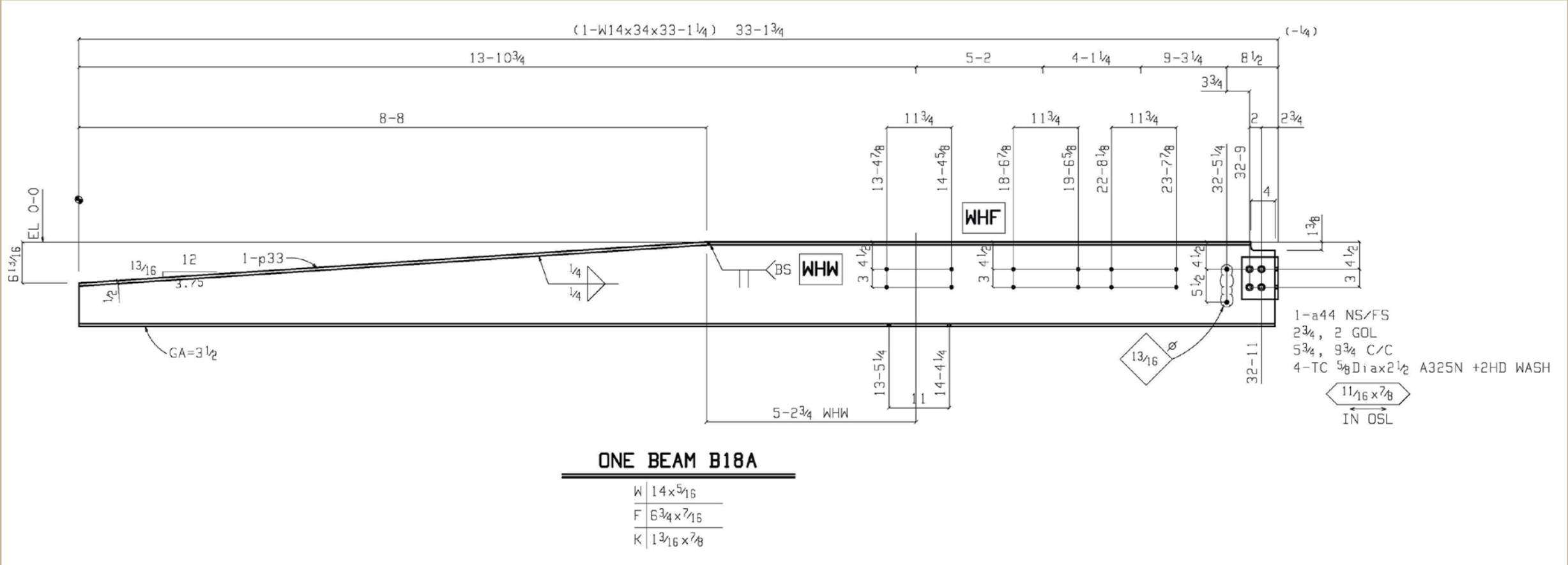
The engineers studied both the dynamic loading and design deflection of the wooden roof beams so as to allow for anticipated dynamic flexibility during advanced wind events.

These sailcloth overhangs, once populated with organic matter, will react in a manner not dissimilar to nature all the while with an aesthetic intended to please the eye.



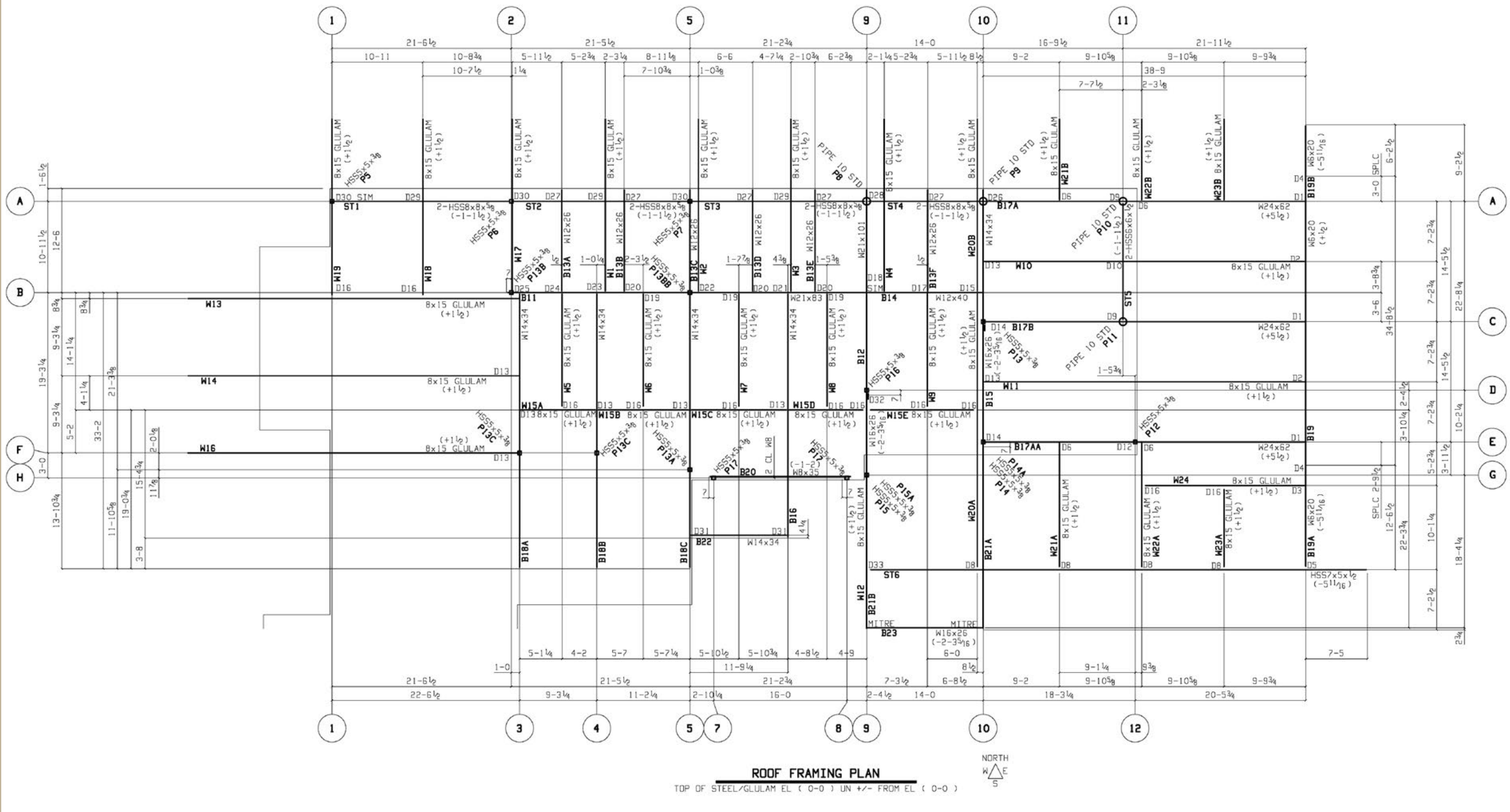


Roof beam



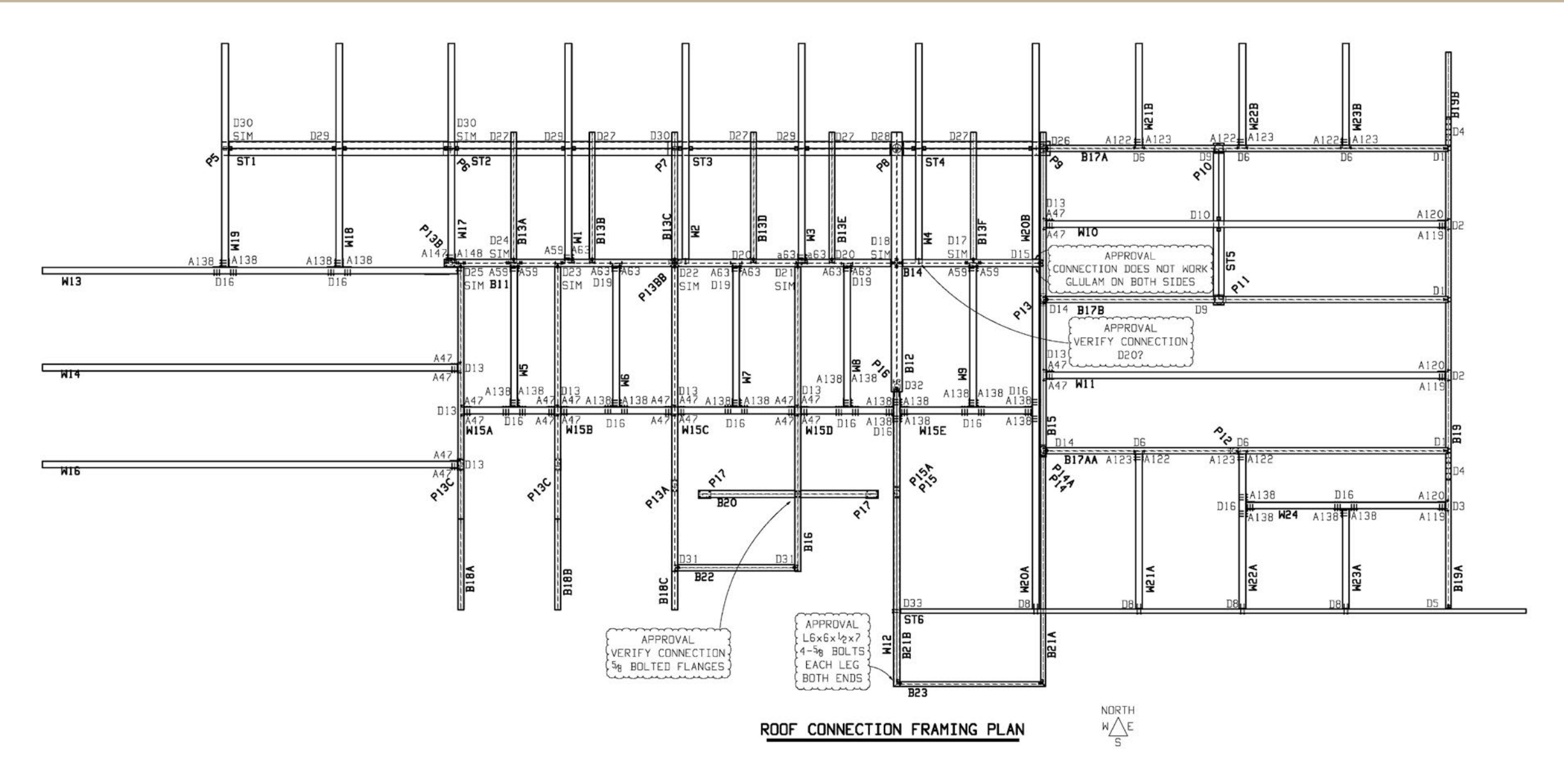


# Roof framing





# Roof connection framing

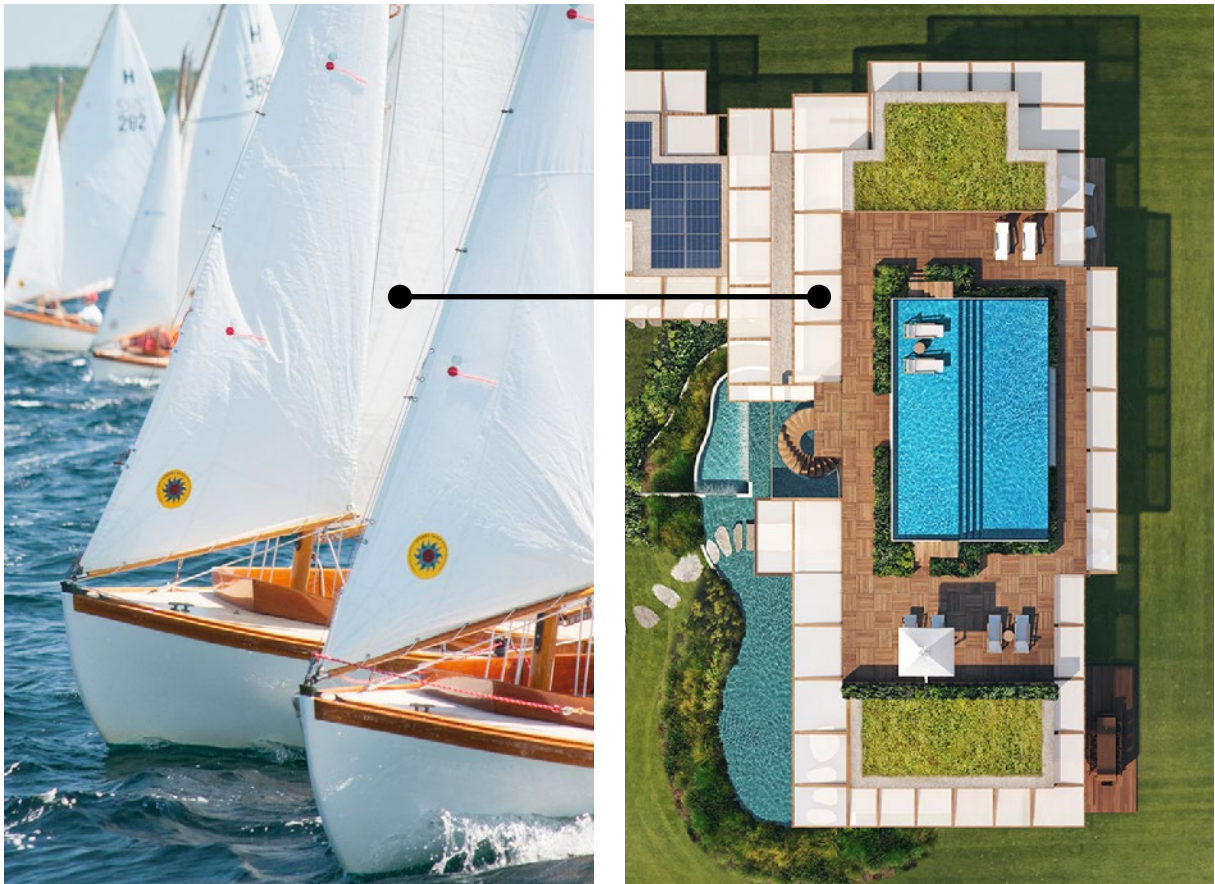
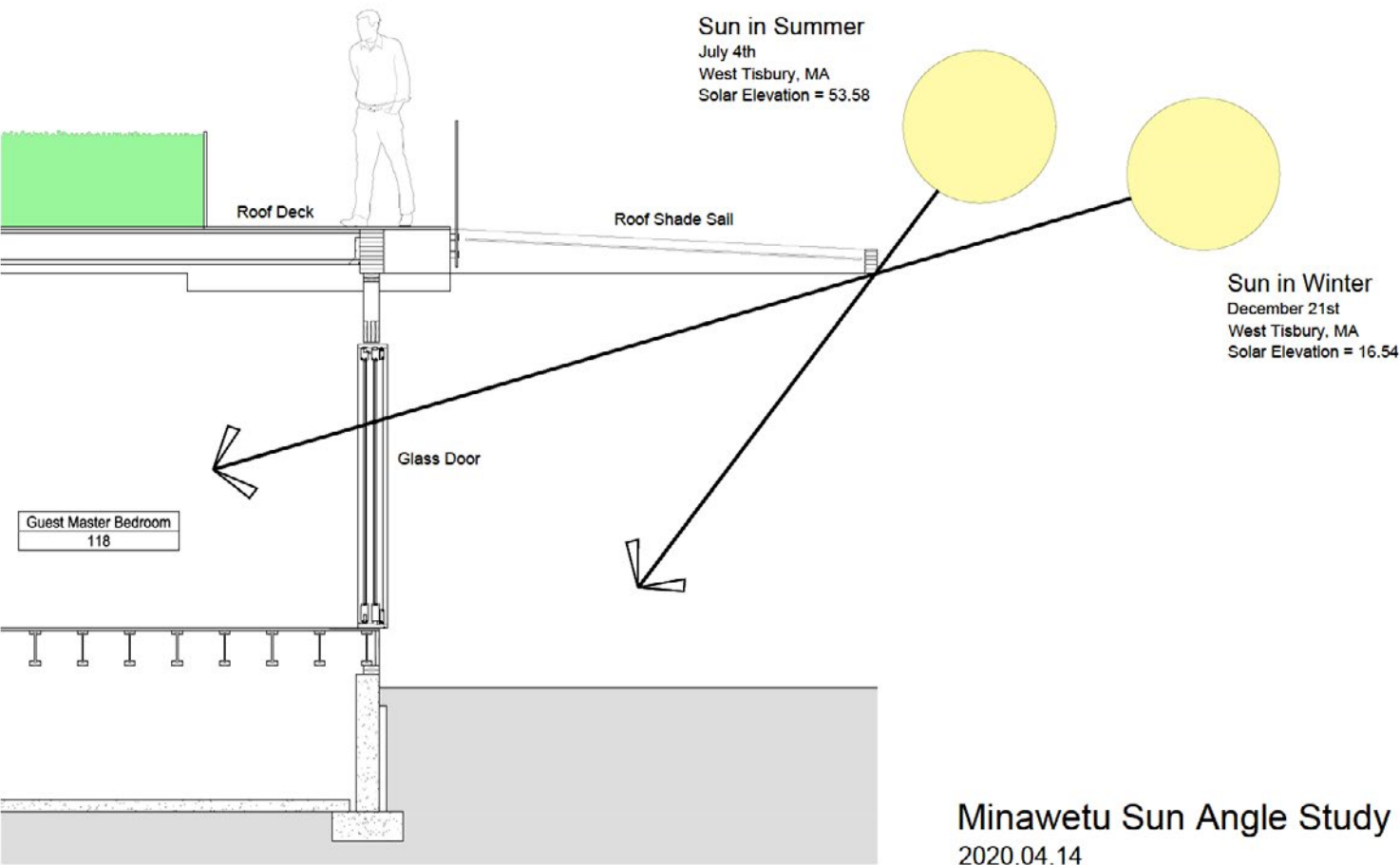




# Energy model

At Minawetu, summer shading is purposed for less cooling requirement. Winter sun achieves passive solar gain. We achieve this by incorporating Sperry Sails' handcrafted sailcloth canopies around every linear foot of roof overhangs around all of the Minawetu structures.

Summer shading is purposed for less cooling requirement. Winter sun achieves passive solar gain.



We achieve Minawetu's energy model by incorporating Sperry Sails' handcrafted sailcloth canopies around every linear foot of roof overhangs around all of the Minawetu structures.

Provisions for further on-site electrical generation are accommodated for at Minawetu. Options for Solar PV to generate electricity on-site would further improve our HERS score.

Minawetu's indoor air quality will be optimized with an HRV/ERV to satisfy the Code and which will help mitigate any moisture, and assist with a variety of other air quality options.

With HVAC we will be exploring once the Energy Model is done. Solar PV could sync with our HVAC system, such as Carrier Infinity or Trane, using heat pumps with set point for high efficiency.



# Minawetu's energy certificate

## Home Energy Rating Certificate Projected Report

Rating Date:  
Registry ID: Unregistered  
Ekotrope ID: pdWZRZbL

**HERS® Index Score:**  
**55**  
Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit [www.hersindex.com](http://www.hersindex.com)

**Annual Savings**  
**\$7,022**  
\*Relative to an average U.S. home

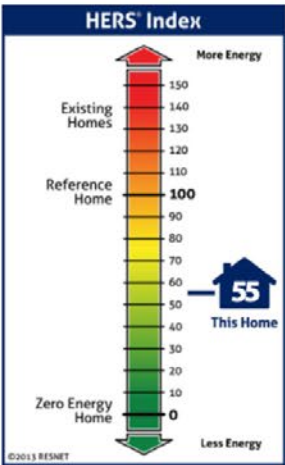
**Home:**  
60 Bartimus Luce  
Tisbury, MA 02575  
**Builder:**  
Tate Builders

### Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	35.8	\$2,215
Cooling	2.5	\$154
Hot Water	4.0	\$249
Lights/Appliances	32.8	\$2,029
Service Charges		\$0
Generation (e.g. Solar)	0.0	\$0
<b>Total:</b>	<b>75.1</b>	<b>\$4,647</b>

### This home meets or exceeds the criteria of the following:

2015 International Energy Conservation Code



### Home Feature Summary:

Home Type:	Single family detached
Model:	N/A
Community:	N/A
Conditioned Floor Area:	5,584 ft²
Number of Bedrooms:	5
Primary Heating System:	Air Source Heat Pump • Electric • 3.08 COP
Primary Cooling System:	Air Source Heat Pump • Electric • 16 SEER
Primary Water Heating:	Water Heater • Electric • 2.73 Energy Factor
House Tightness:	2.4 ACH50
Ventilation:	40.0, 81.6 CFM • 27.0, 8.0 Watts
Duct Leakage to Outside:	120 CFM25 (3.35 / 100 s.f.)
Above Grade Walls:	R-26
Ceiling:	Attic, R-57
Window Type:	U-Value: 0.28, SHGC: 0.67
Foundation Walls:	N/A

### Rating Completed by:

**Energy Rater:**Chris Mazzola  
RESNET ID:8873503

**Rating Company:**Home Energy Raters LLC  
180 State Rd, Suite 2U Sagamore Beach MA 02562  
508-833-3100

**Rating Provider:**Energy Raters of Massachusetts  
2 Woodlawn Street Amesbury, MA 01913  
978-270-3911



Chris Mazzola, Certified Energy Rater  
Date: 10/2/19 at 10:53 AM

Ekotrope RATER - Version:3.1.1.2266

The Energy Rating Disclosure for this home is available from the Approved Rating Provider.  
This report does not constitute any warranty or guarantee.



# Sperry sails

Sperry Sails' mission is to create high quality, handcrafted products that exceed their customer's expectations. They cultivate a welcoming workspace where people can bring their creative sailcloth requirements for viable solutions. In our case at Minawetu it's for the detail of sailcloth roof overhangs 360 degrees all the way around the entire structure.

Minawetu's vented handcrafted sailcloth soffits further contemplates landscaping softscape by introducing a wide variety of climbing vines with intent on aesthetic and energy savings. These vines will be trained to climb up the exterior walls and out onto the roof structure around the sailcloth panels.



SPERRY SAILS



**“With Minawetu’s unique handcrafted sailcloth shade canopy soffits, our energy model can adjust for shading and in air conditioning intensive areas to further realize considerable energy efficiencies.”**

**—Herb Rice, Home Energy Raters LLC**



# Water feature

Our main entry approach side water feature is modeled after techniques used by the celebrated Reed Hilderbrand Landscape Architect's approach at Clark Art Institute. The Minawetu roof-top pool is more than a lens to frame views of the landscape from below though, it's the starting point for our design predicated on Vineyard Sound.

The Minawetu water feature is the starting point for our design predicated on Vineyard Sound.



Our main entry approach side water feature is modeled after techniques used by the celebrated Reed Hilderbrand Landscape Architect's approach at Clark Art Institute.



## Under-gravel suction/filtration

The under-gravel filtration is a series of pipes on the bottom with 3/8-inch diameter holes drilled in them. The pipes were buried in a 1-inch round gravel with about two inches above the pipe.



The spacing between the pieces of gravel is fairly large, and the holes in the piping are large compared to the waste to be broken down. All the holes in the suction pipes are six inches apart, providing the waste a flow route. Once the under-gravel grid of PVC piping is installed it will be ready for gravel.

Two Spillways are incorporated for both function and beauty. The falling water is designed to re-oxygenate the water. It is also used to speak to Terrapin's 5th of the 14 patterns—"the presence of water" for both visual and audible experiences.

**“The objective of the Presence of Water pattern is to capitalize on the multi-sensory attributes of water to enhance the experience of a place in a manner that is soothing, prompts contemplation, enhances mood, and provides restoration from cognitive fatigue.”**



# Parry windows and doors

Known for manufacturing highly engineered custom windows and doors, Parry Windows & Doors, founded by Will Parry in 1976 was established in Chilmark, Massachusetts on the island of Martha's Vineyard in 1986. All design and handcrafted fabrication is here on the island of Martha's Vineyard.

Inspired by the footsteps of his father Will, son Cameron Parry joins in the family business as the manager for Parry Windows & Doors. Parry provides detailed CAD shops for Minawetu.

Parry Windows & Doors meet strict environmental standards and are airtight with low heat transfer. They utilize Forestry Stewardship Council certified woods and reclaimed woods.

For waterfront clientele concerned about hurricane protection they have partnered with Storm Solutions provider of hurricane curtains for added assurance. TBI makes provisions for future hurricane shutters.

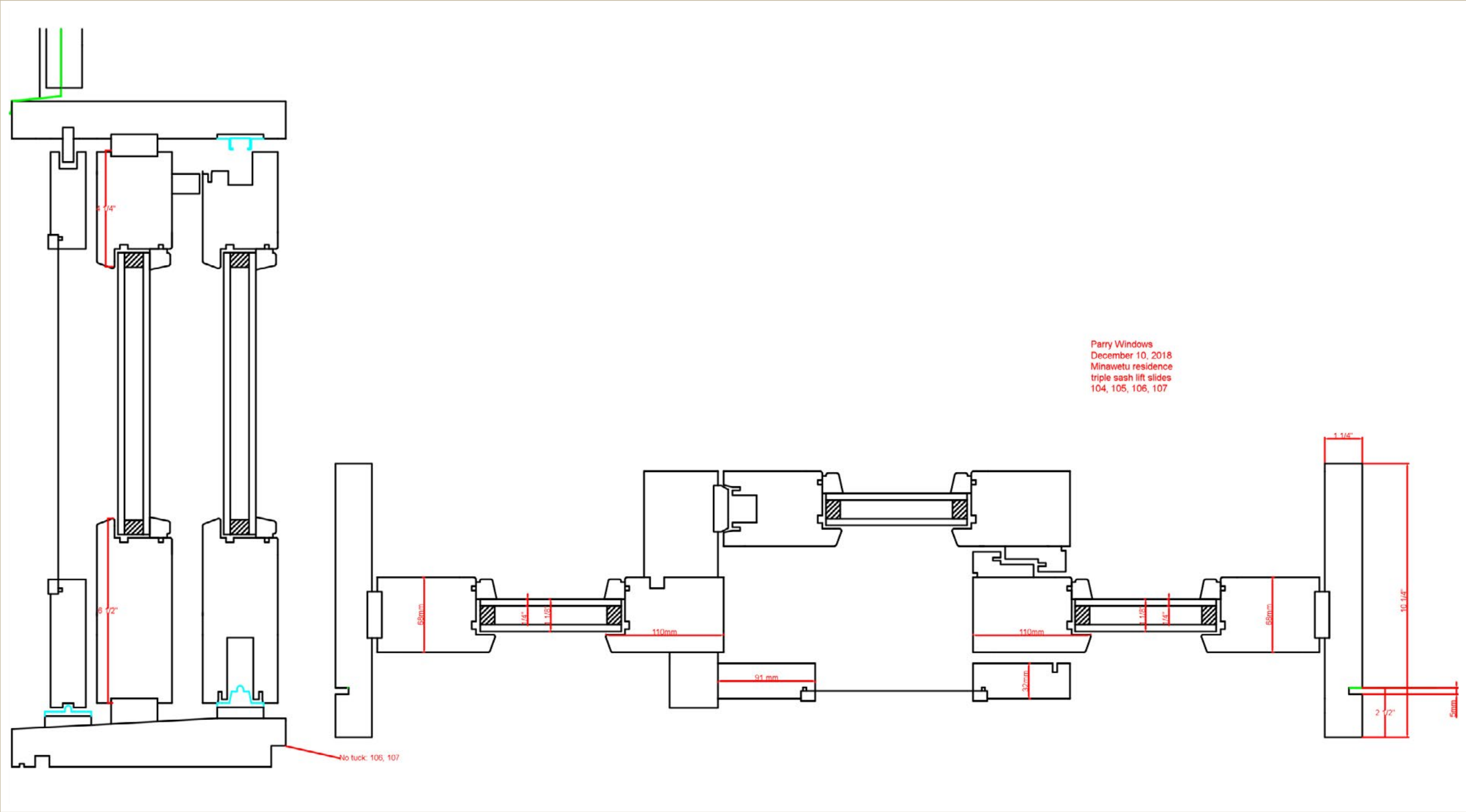
Parry Windows millwork is the finest and joinery the best, using only mortise & tenon and slot & tenon construction.

PARRY WINDOWS & DOORS LLC





Rendering





# Red Grandis

Minawetu's extraordinary  
sustainable hardwood

Red Grandis is a hardwood from plantation-grown Eucalyptus tree (Eucalyptus Grandis). It has a uniform but moderately coarse-textured grain, which is usually straight or slightly interlocked. Red Grandis is a top quality solid wood product ideally suited for high-end applications in furniture, cabinets, moldings, doors and windows, etc. Red Grandis offers an ecological alternative to many tropical hardwoods. Versatile and strong, this beautiful hardwood is 100% pure FSC®-certified.



*Sustainable forests*

## RED GRANDIS





# Exterior cladding: White scratched coral

Minawetu's organic coral, made from nature millions of years ago, was sourced from a dry-land quarry in the Dominican Republic, in the Caribbean region.





# White Glass Terrazzo Flooring

Since ancient times when Italian quarry workers took home small, fractured pieces of marble, blended them with sand and goat's milk, and spread the mixture over their terraces, Terrazzo has been a recycled material. Terrazzo has long been valued for its life cycle characteristics: SUSTAINABLE, a new standard where design development and a thriving environment go together: low maintenance, durability, and indoor air quality - with recycled content being an additional attractive feature.

For Minawetu we commissioned DePaoli Mosaics who has extensive experience working towards LEED and MA-CHPS standards. Today's epoxy Terrazzo can contribute to the US Green Building Council's credits, under the LEED Rating System, Version 2.0. Based on the standards set forth by the LEED Rating System.



## Materials & Resources

Epoxy Terrazzo flooring utilizes natural materials and conserves resources due to the long life cycle of the product (1-2 points). Terrazzo systems are poured and set on-site, thereby eliminating transportation costs associated with off-site production. This helps to reduce fuel consumption and eliminate harmful emissions (1 point). Marble chips are often by-products of quarried stone, which may have otherwise been disposed of as waste. Glass and synthetic aggregates utilize both post-industrial and post-consumer glass and plastics (1 point). Epoxy resins can be shipped directly to the job-site in recycled drums. Once empty, the drums can be used to store residue from the grinding operation. Chemical precipitators can be added to this residue to separate the water from the solid material. This reduces the amount of grinding residue which must be transported to the landfill and allows the Terrazzo contractor to recycle the water and complete additional grinding (1 point).

## Indoor Air Quality

Seamless floors like epoxy Terrazzo help maintain IAQ as they are easy to clean, non-porous and do not harbor dust or microbes. In addition, epoxy terrazzo will seal the concrete and prevent radon and other gases from migrating into the building (1-2 points). The resins used in epoxy Terrazzo contain no Volatile Organic Compounds (1 point).

## Resource Reuse

Epoxy Terrazzo flooring is exceedingly durable and will last for the life of the structure in which it is installed. While other flooring systems will require repairs or even replacement, Terrazzo required extremely low maintenance cost. This ease of maintenance reduces the floor's embodied energy, as well as reducing the need to consume valuable resources in the future (1-2 points).



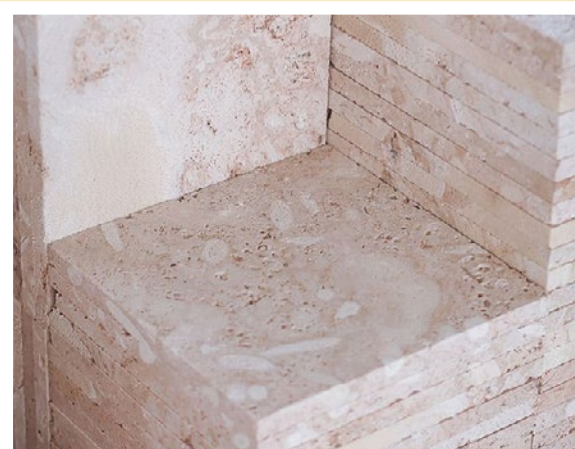
# White coral bath tile

Minawetu's Coral stone is a natural product found in Dominican dryland quarries.

The stone is distinguished by fossilized inlays and marks of sea organisms such as corals, calcareous algae that excrete carbonate, and other fossilized organisms and calcium carbonate.

It is rustic-looking, calcareous stone of a metamorphic origin, containing pores in different sizes and depths. It also contains small quantities of minerals such as hematite, siderite, quartz, and other minerals which can slightly modify the color and degree of coherence of the stone.

The pure white color of Dominican Coral stone comes from the limestone formed in shallow warm seas tens of thousands of years ago one this tropical island was beneath the sea.



Nature gives a unique character to each stone, thanks to the existence of these beautiful fossils.

One of Dominican Coral's most notable characteristics is that of maintaining a cool temperature even when being exposed to high summer temperatures.

Dominican Coral stone can be exposed to extreme cold, heat or rain. Testing has subjected this stone to cycles of extreme temperatures of -40 degrees Fahrenheit without noticing any changes in the structure of the stone.



# Italian interior doors

Glas Italia, established in 1972 in Brianza supported by century-long experience of the family glass factory and driven by an inexhaustible passion for glass. Research and design combined with the most advanced technology, in collaboration with internationally renowned designers, realizing the ideas of their creative talent come true. Sophistication, originality, intrinsic and formal quality are the salient features of all Glas Italia doors.

Inaugurated in 2011 with a project by Piero Lissoni, the Glas Italia Headquarters in Macherio occupy an area of 11.000 square meters. Glas Italia doors are designed to optimize the diffusion of natural light in the working environment.

**GLAS**  
ITALIA

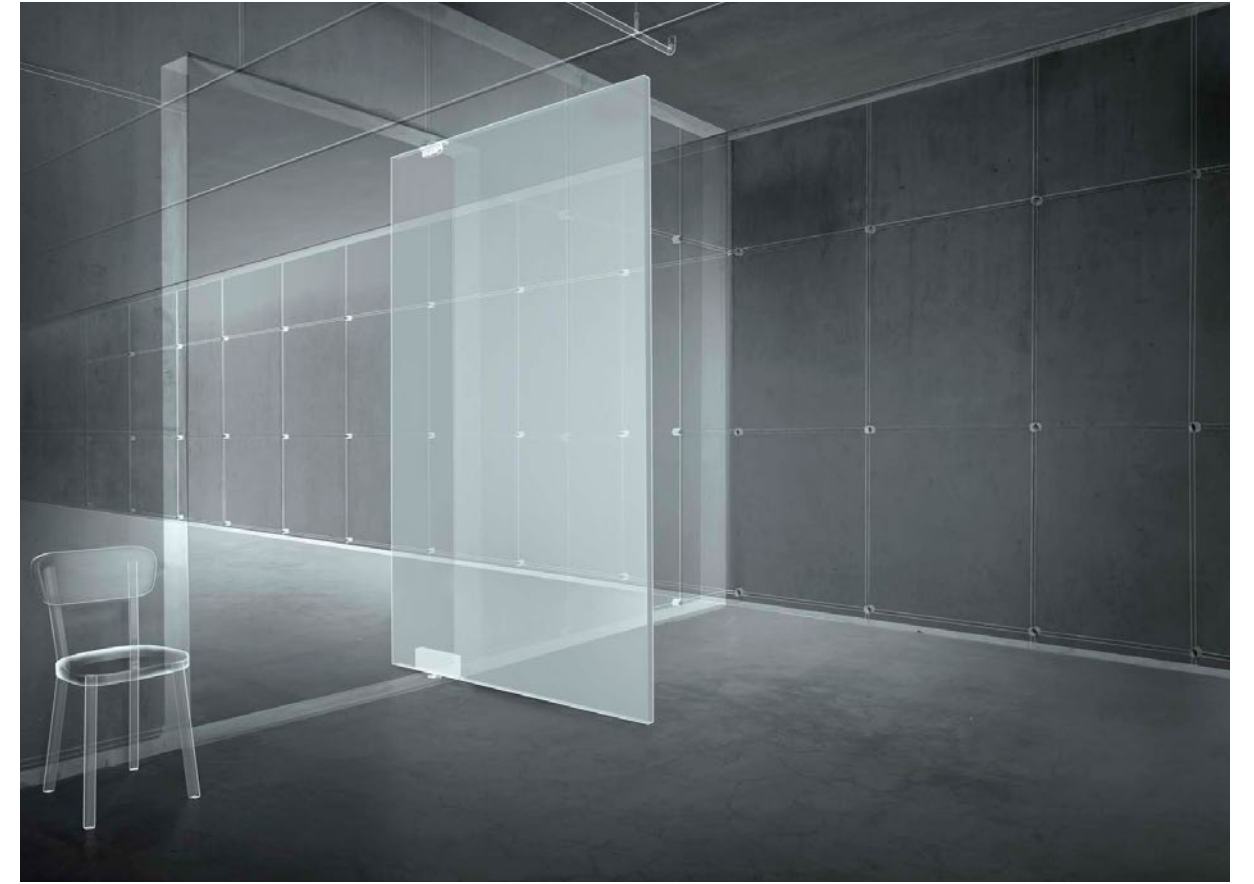




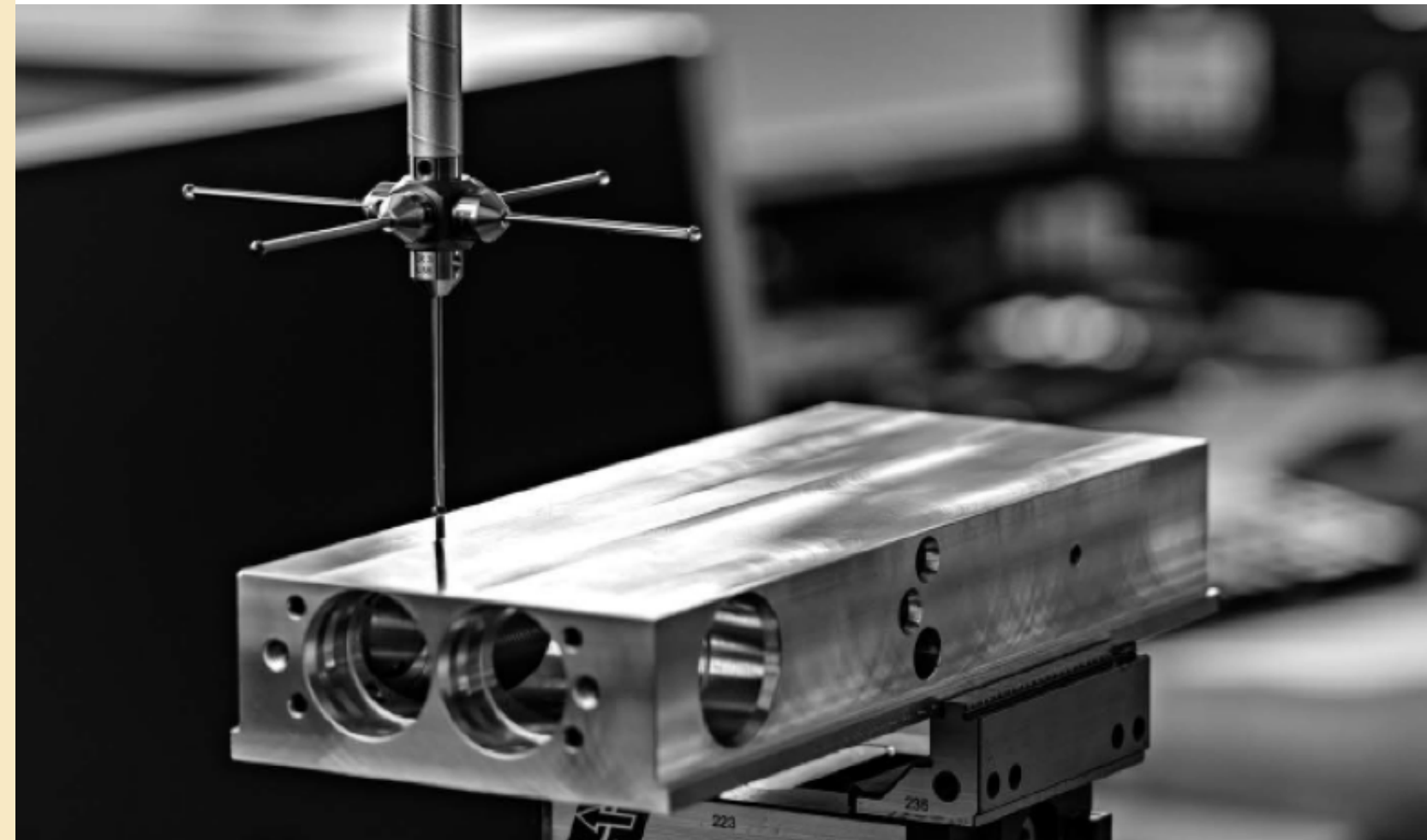
# Custom glass door pivot hinges

We swing these doors with state of the art innovative FritsJurgens pivot hinges which exude timeless beauty and which also excel in terms of functionality including old open and self closing functions.

FritsJurgens, has been presented with the following awards: German Design Award (2015), Architizer A+Award (2016), Iconic Award Best of Best (2016) and the Archiproducts Design Award (2016).



FritsJurgens®





# Stone kitchen tops

We searched far and wide for Minawetu's kitchen tops and were delighted when we finally found the pure white Calacatta Lincoln pieces imported from Italy from Connecticut Stone.





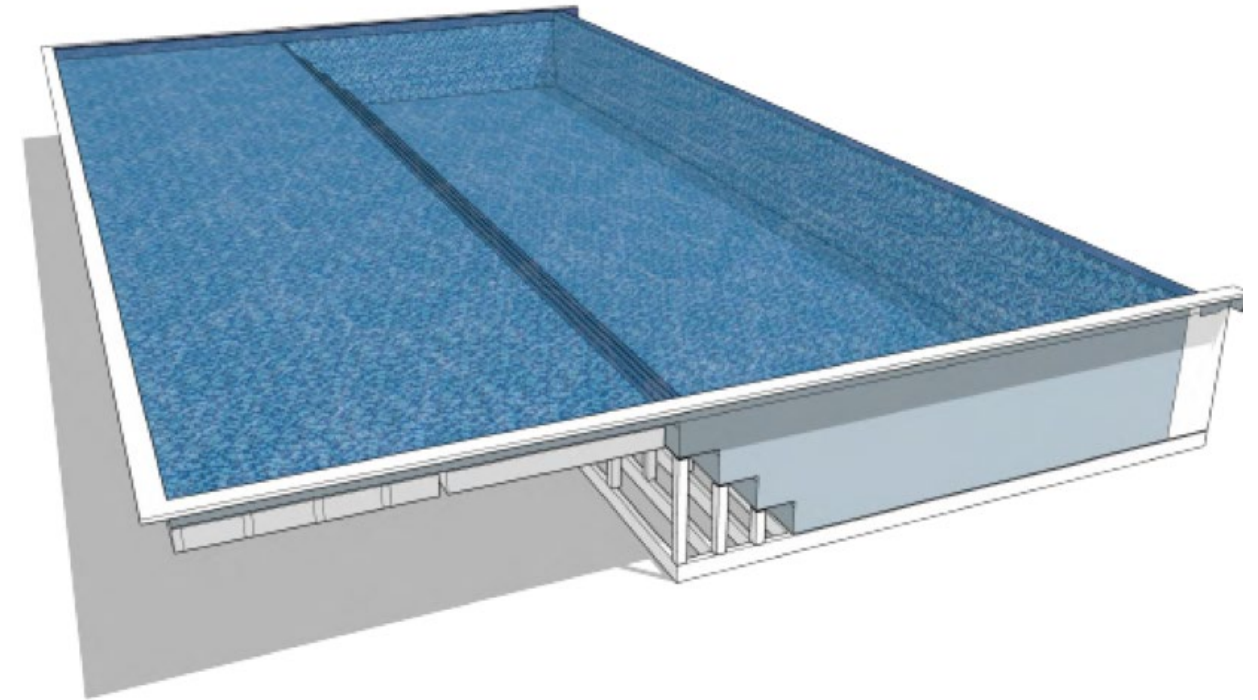
# Minawetu rooftop pool

Weighing at least three times less than concrete vessels of similar size and maintaining watertight reliability, we decided that a stainless steel pool was the perfect solution for Minawetu's rooftop applications. The Bradford custom pool will have impressive strength-to-weight ratios as their stainless steel pool offers first-class structural durability, longevity, and corrosion resistance.

The pool will require less long-term maintenance and extensive repairs than other competitive construction materials, due to the highest quality 316L and 304 stainless steel used in fabrication. Properly maintained, the pool will not delaminate, crack, peel, discolor, leak, or require renewing finishes over the lifespan of the vessel. Employing the use of leading edge CAD engineering and CNC laser cutting, Bradford will deliver the Minawetu pool as an unmatched level of precision as will be required for this unique rooftop application.

Stainless steel construction ensures longevity, faster installation, and sustainability. Using stainless steel provides your project one of the many factors that are considered for LEED certification.

The pool is finished with an Italian Vidrepur glass mosaic tile.



The pool is finished with an Italian Vidrepur glass mosaic tile.

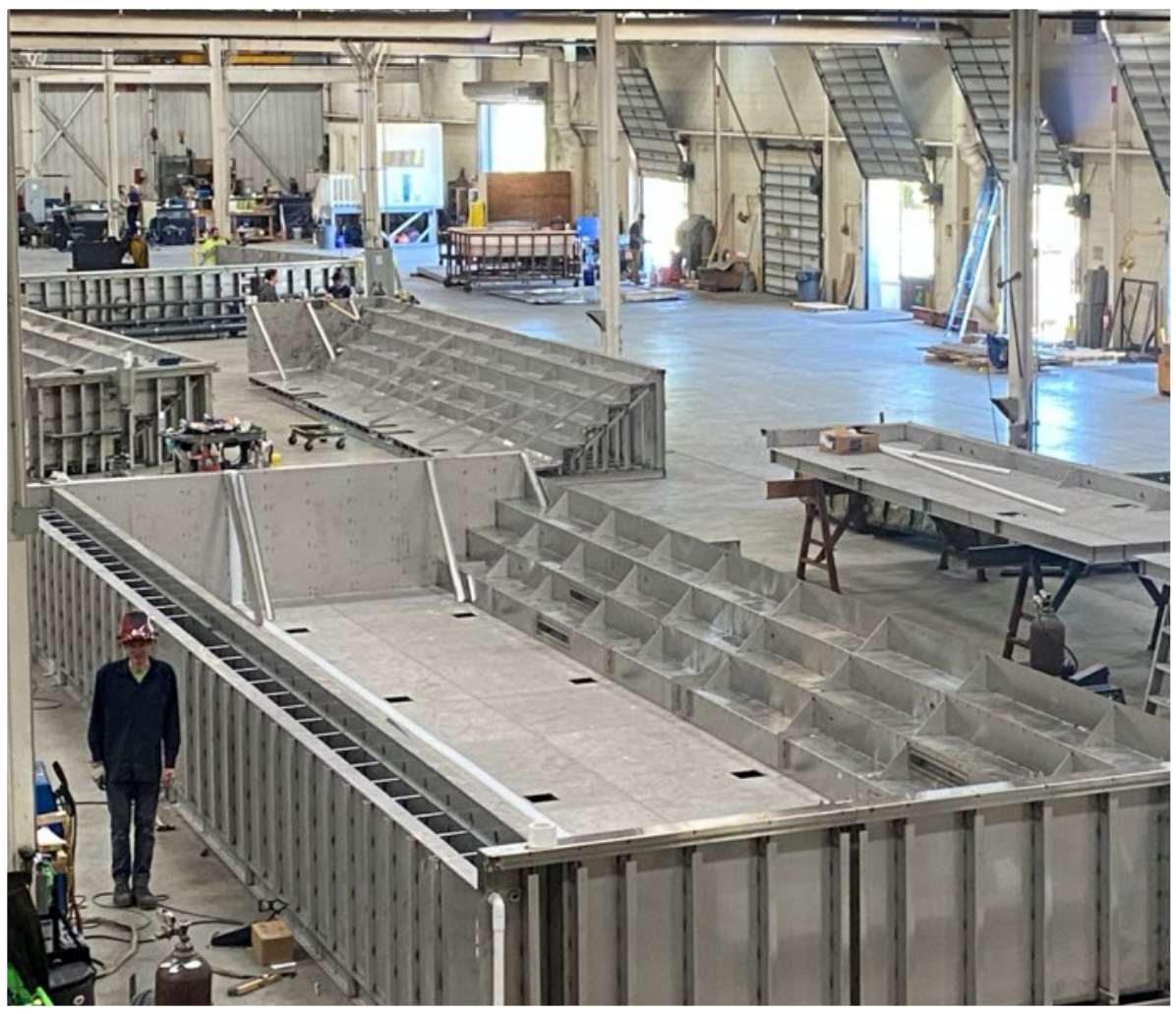
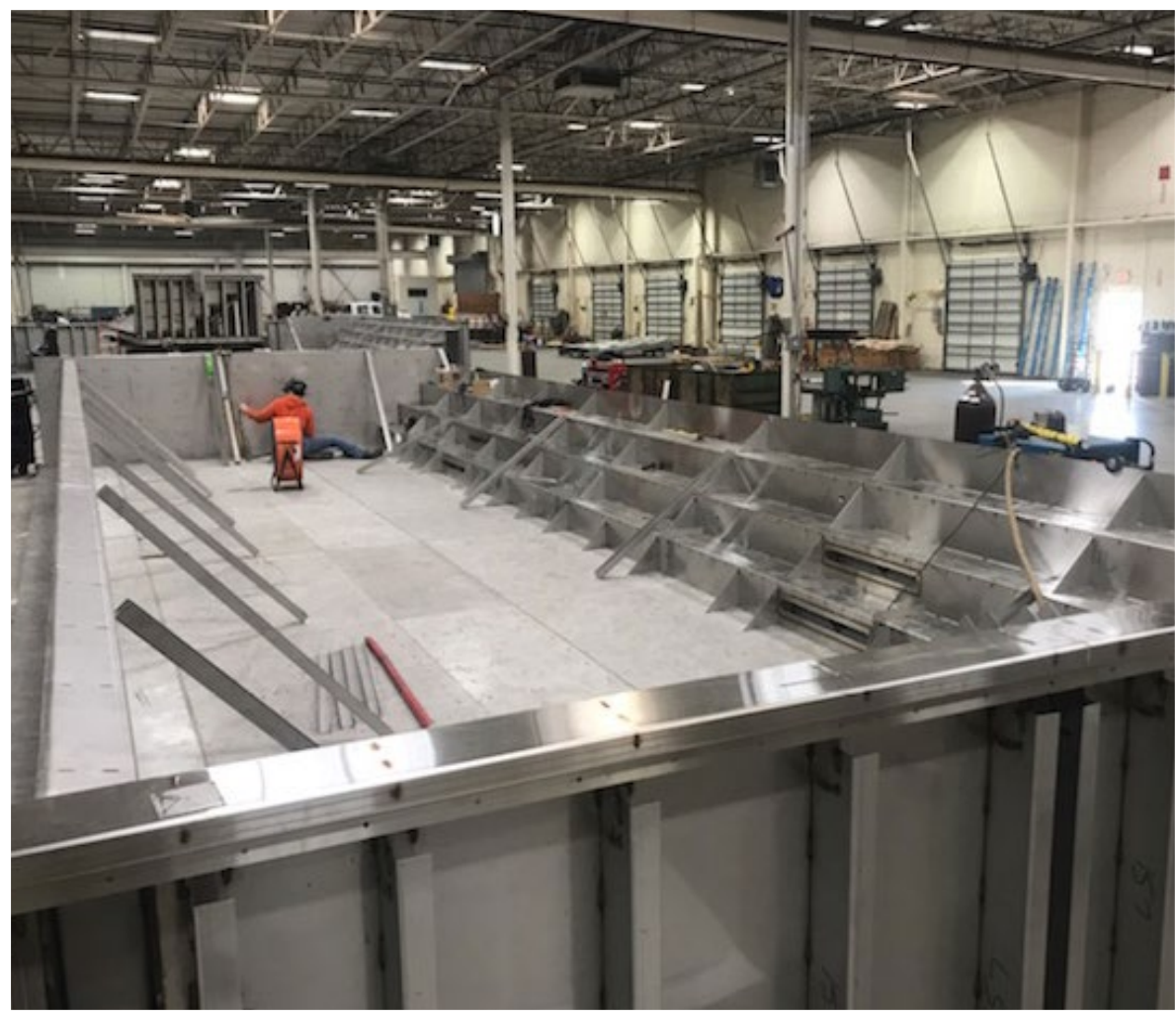
## Key features

- Watertight Welded Integrity
- Reduced Weight Loads
- Precision Engineering



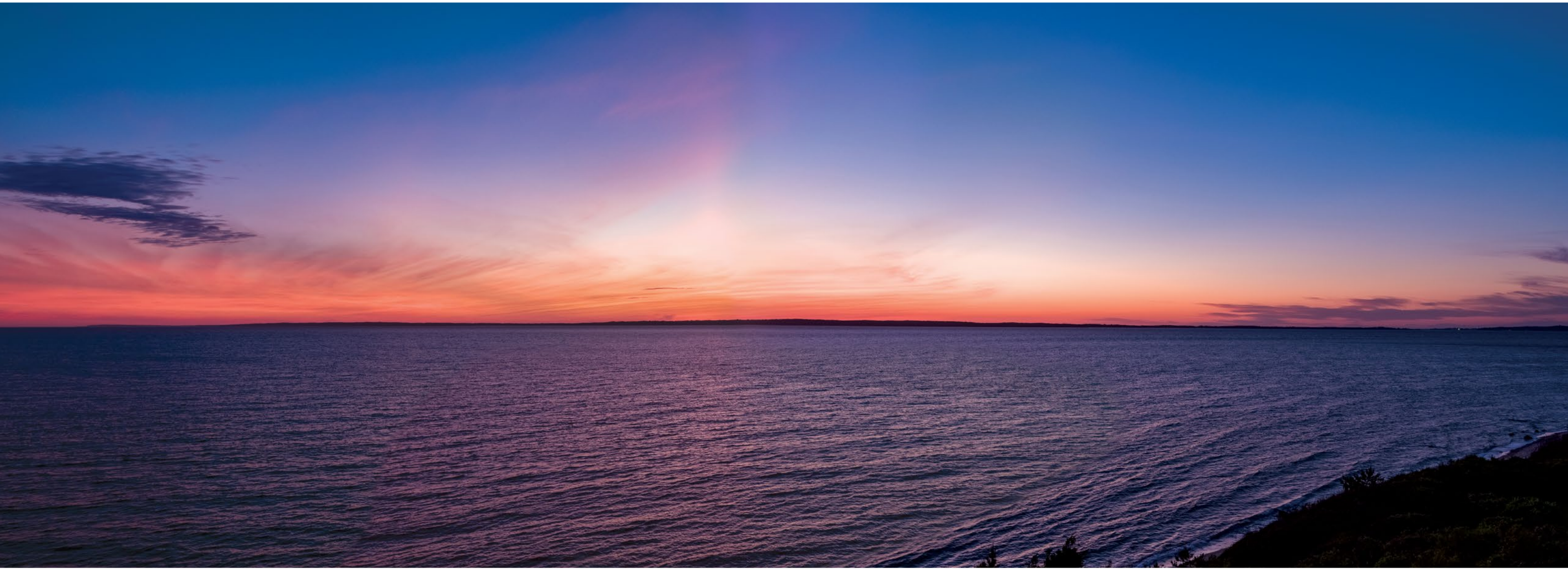


Process





View from rooftop pool





# Light

We reach for sustainability by weaving natural materials into as many details and elements as possible. For light fixtures we embrace Rattan, bamboo, wicker and other natural warm feel-good elements.





# Optional: Biophilic Lighting

Minawetu offers optional biophilic lighting. There is more to light than meets the eye. While light enables us to see our world in vivid color and stunning detail, we have learned that light also regulates many biological responses in people that are not associated with our sense of sight, including an 'internal clock' in our bodies that makes us alert during the day and sleepy at night. The daily changes in our physical, mental and behavioral states that respond to light-and-dark cycle is commonly known as our circadian rhythm.



Just as a sunflower faces and tracks the sun to maximize the amount of sunshine it receives, historically people have always planned their lives around the availability of daylight. In the absence of man-made light sources, people rose with the dawn and went to sleep in the dark: when the sun went down and the campfire was reduced to ashes, the moon and stars provided our only light. Light around us signaled to our bodies when it was time to be active, and when it was time to rest. It was black and white. Light kept our daily lives in harmony with local time.

Our activities are no longer limited by the setting of the sun: today we can arrive home in the dark, turn on the lights and tend to additional tasks, such as making dinner, playing with the kids, and enjoying hobbies. Man-made lighting boosted productivity by allowing us to continue to work late into the night, but simultaneously created a society that is no longer in sync with the local time.

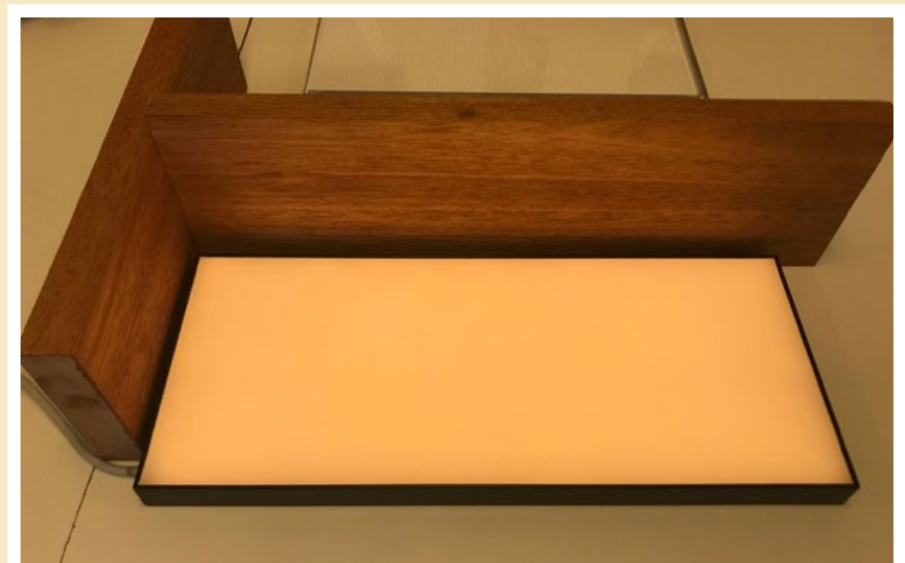
Think of the circadian system like a wind-up watch: it needs to be wound and set to the correct time every day, and if you do that it will continue ticking along like clockwork. Industrialized society spends most of its time indoors, within an engineered environment that can provide for our every need—but the electric lighting we are working and living under during the daytime does not match the dynamic quality and amount of light the sun provides. Although the lights may be on indoors, we are in circadian darkness. Instead of the clear black and white signal our circadian systems used to receive, our internal clocks are operating in a world without contrast. Our days blur into nights. For most people living in modern society, we are forgetting to wind up our biological watch.



What does daylight have that most forms of electric lighting do not? It's dynamic—ranging from really, really bright to complete darkness. It's variable—from incredibly clear blue skies to lovely fuchsia sunsets. And timing is everything. Daylight provides bright, blue-rich light in the early morning to deliver an alerting signal as we wake up—but exposure to that same light at night can keep you up at night, and throw off your game the next day. In the early evening, daylight provides a warm, low-level light to cue our bodies for a period of rest. Why wouldn't we want to replicate this natural light cycle with our interior lighting, to give ourselves the best chance of feeling good from day to day.

How can we mimic natural daylight patterns in our own homes? Here's where tunable white technology comes in. Tunable white LED fixtures make it possible to imitate the color and brightness shifts of natural daylight like never before. Daylight undergoes many changes throughout the day, but here's a rough overview:

- Lighting in the morning and early afternoon should be bright and include blue wavelengths of light (in other words, you want your light sources to be a higher color temperature).
- By the late afternoon and evening, lighting should be less bright and more amber in color (so you'll want the light source to be a lower color temperature).



Tunable white LED fixtures allow you to adjust the color temperature of your lighting, tuning it to a bluer, whiter light or a warmer, more amber light depending on the time of day to achieve biomimicry.



# Four reasons biophilic lighting is better lighting

## 1. Regulates Circadian Rhythm

The circadian rhythm does more than tell the body when to wake up and when to go to sleep. It also regulates the release of hormones that helps the body stay energetic and alert during the daytime (serotonin) and have a healthy, restful sleep at night (melatonin). Unlike natural, biophilic lighting, artificial lighting disrupts the circadian rhythm, leading to problems with attention during the day and restlessness at night.

## 2. Reduces Stress, Depression, & Illness

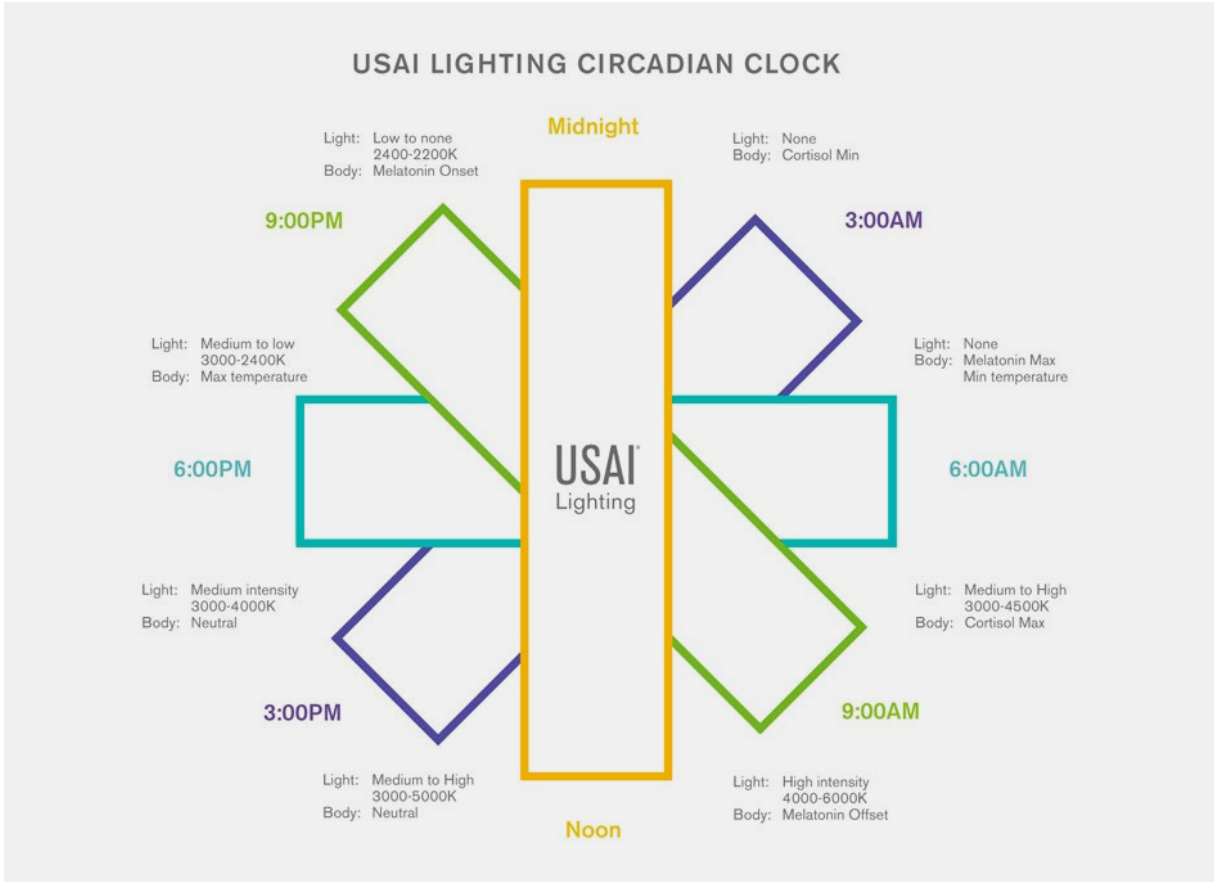
Our engineered environment influences stress levels and overall health. Proper lighting design in particular has been shown to relate directly to how a person feels by reducing stress, tiredness, and the feelings of being overwhelmed.

## 3. Sharpens Focus

Creating an environment that is comfortable and healthy eliminates distractions. Artificial lights flicker intermittently that can cause headaches and repetitive eye strain. Natural lighting provides greater contentment and pleasure, which helps sharpen concentration and aids focus on tasks that need to be completed.

## 4. Facilitates Biophilic Design Elements

Sunlight in the foundation of life, and as such it supports those elements of design that provide direct contact to the natural environment. Contact with plants, animals, views of nature, and exposure to weather patterns all facilitate natural design and are closely linked to the existence of natural light in a space.

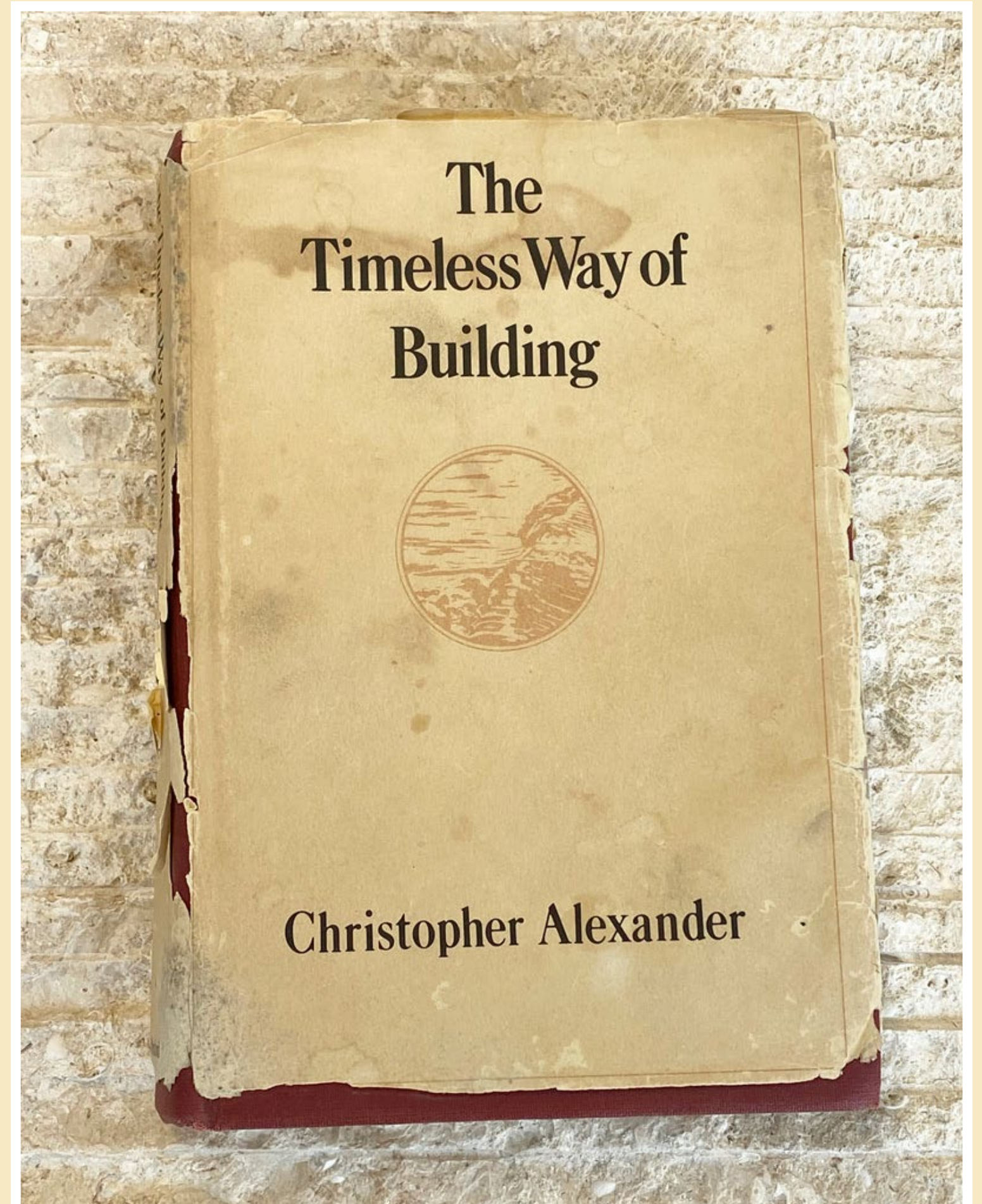


Circadian clock from USAI Lighting.



“There is a central quality which is the root criterion of life and spirit in a man, a town, a building, or a wilderness. This quality is objective and precise, but it cannot be named.”

— Christopher Alexander,  
*The Timeless Way of Building*







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