

SITE LINES
Building in Earth and Sky

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Master of Architecture

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I would like to thank my teachers and classmates whose knowledge, curiosity, sensitivity and judgment inspire me to ask better questions.

I would like to thank my friends and family whose patience and support have sustained me in this project and throughout my life.

This book is dedicated to my parents.

ABSTRACT

At Jones Point in Alexandria, Virginia, it is easy to perceive the movements of the tides, the stars, and the sun, or to point to the markers and structures that dot the peninsula. However, the rules that govern the heavenly bodies and the intended purposes of the earthly constructions are not as readily discerned. Situated here, a marina and sailing school on the banks of the Potomac River finds order in the astronomical rhythm and man-made history of Jones Point, and they structure the significance of the site through building.

This project first aspired to reimagine the ceiling and the floor as primary architectural elements. The floor and the ceiling became an analogy: The floor is the Earth, the ceiling is the sky. This building orders its site by unifying the diverse elements at Jones Point and allows one to find orientation in the terrestrial as well as the celestial.

It is by building that we put ourselves in relation to the world. We imbue materials and our constructions with significance. In Architecture, it is the construction of our ideals, desires, and wonder -- rendered in material -- that shelters us from the biting cold or the beating sun. We draw our stories in the sky and we build them on the earth.

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Jones Point: An Encounter



Jones Point: An Encounter

Jones Point, a small peninsula at the southern tip of Alexandria, Virginia, reaches into the Potomac River -- about 8 miles south of Washington, D.C. The rectangular grid of Alexandria, oriented to the Potomac River, ends at the northern edge of Jones Point Park. The monumental piers that support the twelve-lane span of Interstate 95's Woodrow Wilson Bridge march east-west, splitting Jones Point Park into two. The north side currently sports a children's playground, sports fields and a heavily wooded northern border. Basketball courts as well as restrooms sit under the bridge; however, hundreds of parking spaces partition most of the huge swath of paved asphalt. To the south of the bridge, a walking trail encircles an open field and a thicket. The walking trail leads to a small, white lighthouse with a white picket fence around it. Only the cupola perched on the roof that distinguishes the building as a lighthouse. The house is locked, and the interior is dark and barren. The house has

Images
From left to right:
1a. Field with Jones Point Lighthouse beyond
1b. Skylight above Federal Cornerstone
1c. Historic boundary marker placed in 20th century
1d. Gravel path through thicket

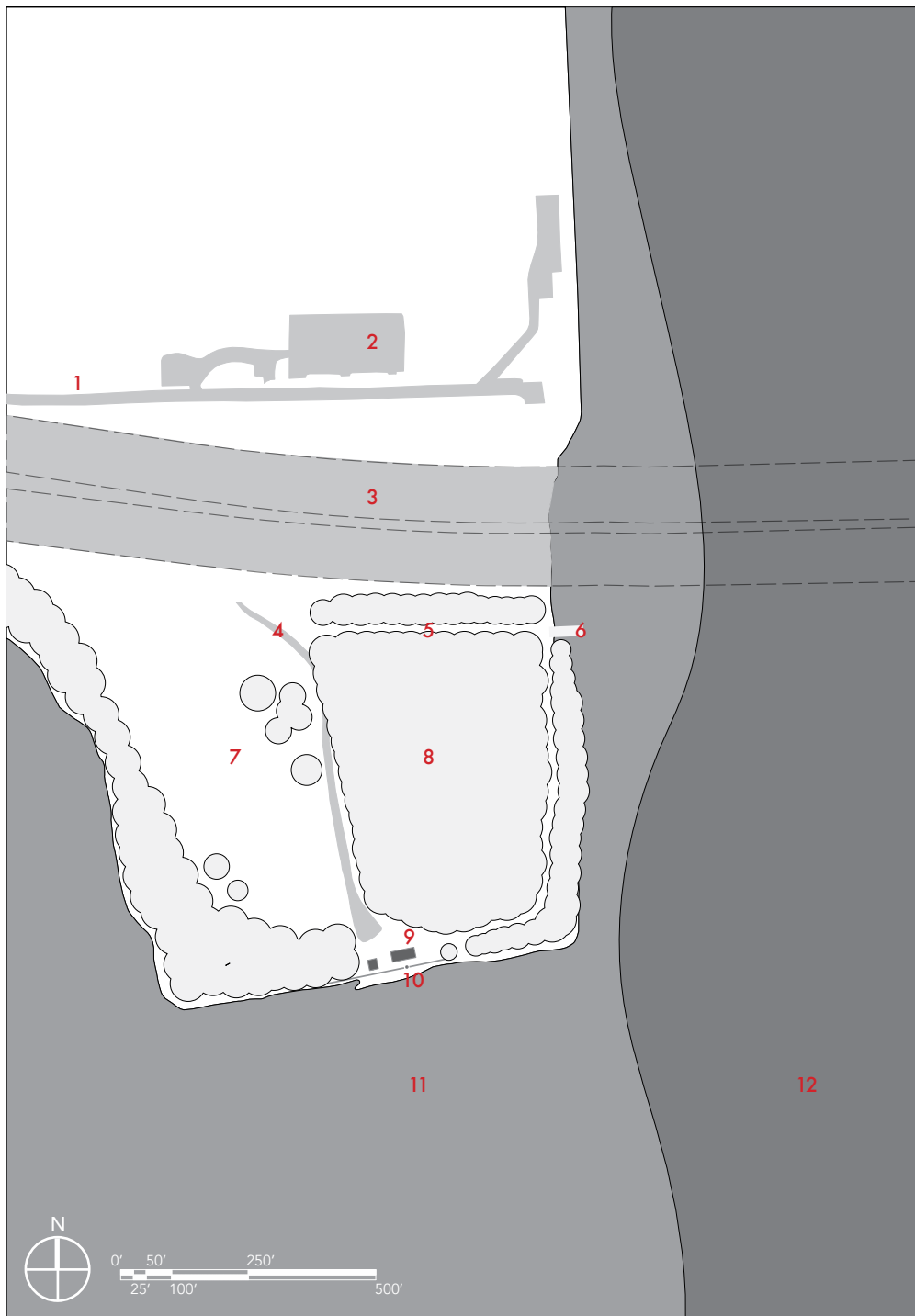
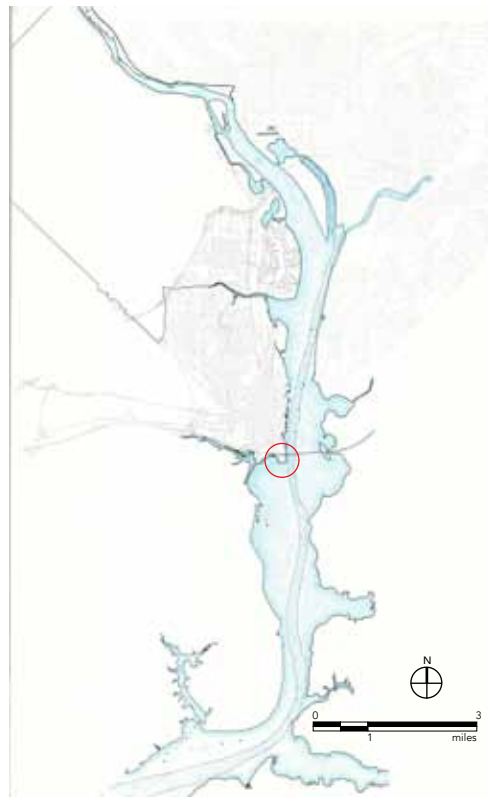


two doors: one from the small porch on its western side and the other on its southern side with steps that extend toward the river only a few yards beyond. At the bottom of the stairs, a strange glass lantern peers down onto a roughly-hewn stone. The stone sits in the cavity of a low sea wall behind a metal grate. The walking trail continues between a thicket of trees and the stoney shoreline. Boats navigate the river beyond, but it seems unlikely they would attempt to land along the shoreline here. As the trail loops back toward the bridge, it comes to a short concrete pier where a few men fish. A path extends from the fishing pier through the thicket; however, it does not seem to lead anywhere. The structures, marks, and even the ground at Jones Point are nearly forgotten remnants. The meandering trail -- the tamed reflection of the shoreline -- is the sole thread that perceptively stitches Jones Point together. It offers no story or narrative, only a series of simultaneously fragments.

Images
From left to right:
2a. Concrete pier with Woodrow Wilson Bridge above
2b. Jones Point Lighthouse



Images
From left to right:
3a. Below the monumental spans of the Woodrow Wilson Bridge
3b. Potomac River Panorama looking south from Jones Point

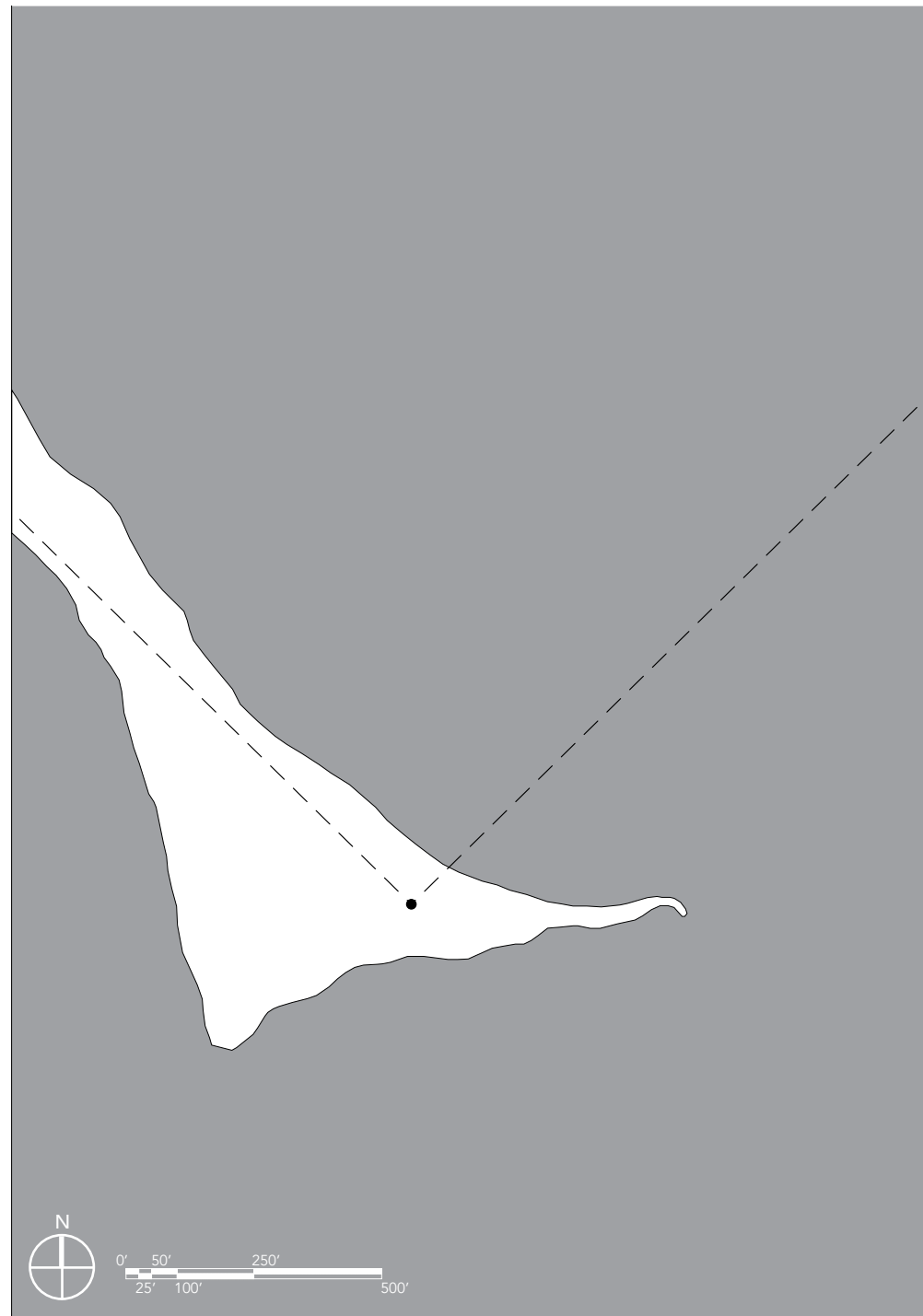


Locating Jones Point

- 1 Entrance Drive
- 2 Playground
- 3 Woodrow Wilson Bridge (Above)
- 4 Gravel Driveway to Jones Point Light
- 5 Gravel Path
- 6 Concrete Pier
- 7 Field
- 8 Thicket
- 9 Jones Point Lighthouse
- 10 Federal Cornerstone
- 11 Potomac River
- 12 Navigable Channel of Potomac River

Images
 Top, 4a: Aerial View of Jones Point and Lighthouse with Woodrow Wilson Memorial Bridge Looking North, Library of Congress.
 Left, 4b: Map of Potomac River and the Navigable Channel
 4c. Current Map of Jones Point

Histories + Discoveries



Establishing the Capital: The First Federal Monument

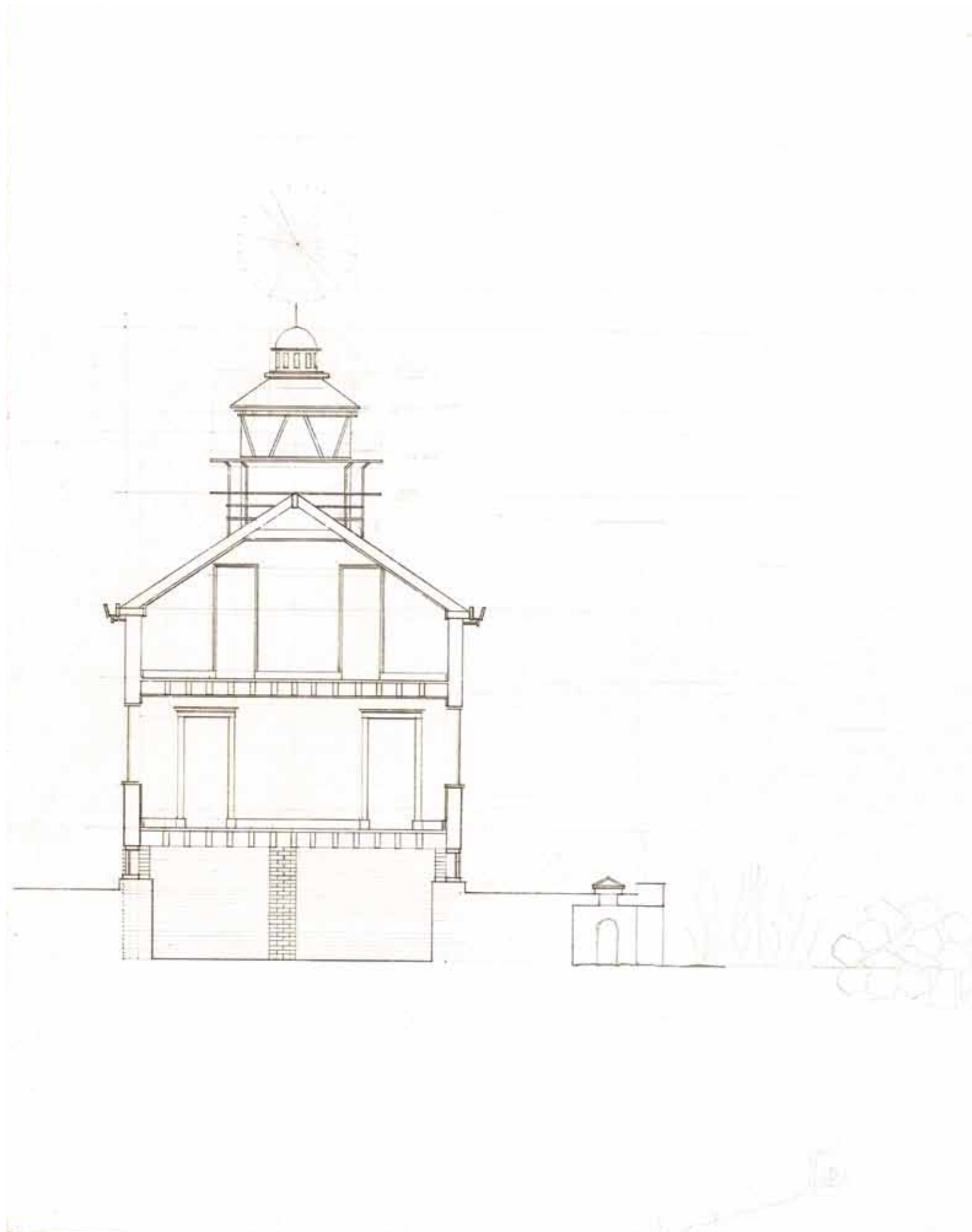
In the Residence Act of 1790, which was amended in 1791, Congress declared that a new and permanent federal capital for the United States would be established along the Potomac River. Under the direction of President George Washington and Secretary of State Thomas Jefferson, Major Andrew Ellicott conducted a survey for a new federal city. Benjamin Banneker made the astronomical observations and calculations in order to locate the first boundary stone of the District of Columbia. This boundary stone, located at Jones Point, marks the southern corner of the original District of Columbia -- the origin of the federal city.



In 1846, the part of the District of Columbia west of the Potomac River was retroceded to Virginia. As a result, the cornerstone no longer delineates the boundary of the District. Many of the boundary stones still remain in their original location; however, the Virginia boundary with the District as well as Maryland is now the low-water mark of the Potomac River.



Images
 Far Left, 5a: Map of Jones Point with historic shoreline and location of the First Boundary Stone Above, 5b. The First Boundary Stone (photograph by Rachael Nease, used with permission)
 Left, 5c. The Boundary Stone in Sea Wall

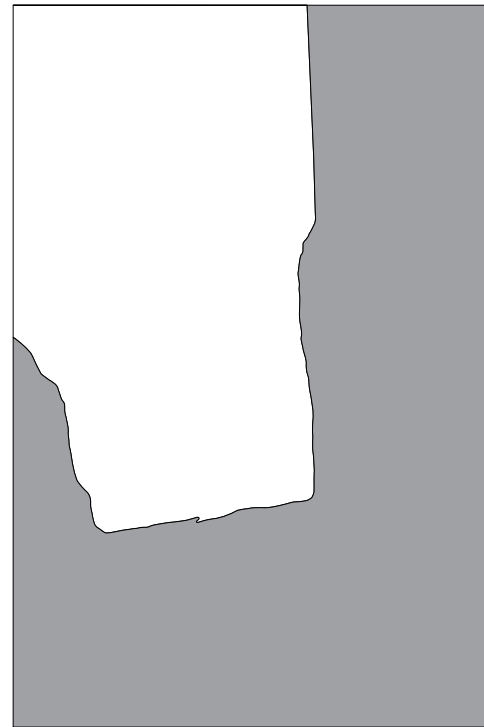
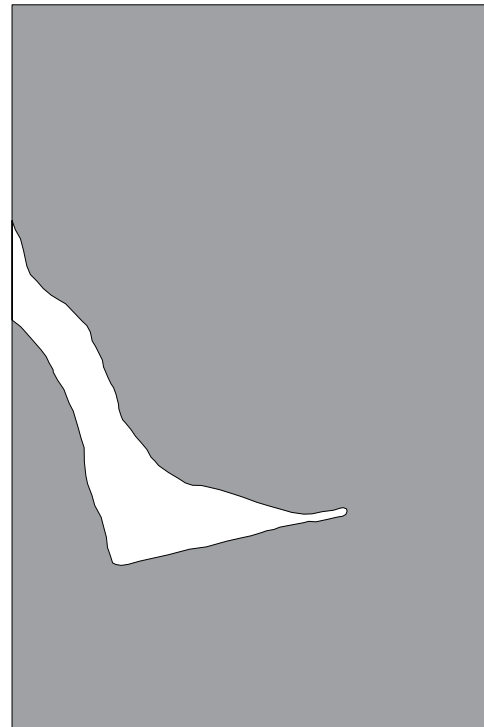
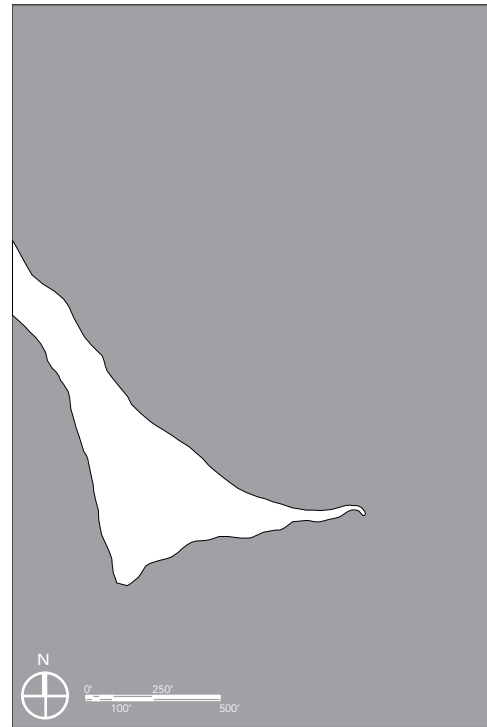


Navigating the River: Jones Point Lighthouse

In 1855, a lighthouse was built on the slender tip of Jones Point as a navigational aid to river traffic approaching and departing Alexandria, Virginia and Washington, DC. The lighthouse was constructed only a few feet from the federal cornerstone. The lantern, perched on the ridge of the building, is the only characteristic that distinguishes the otherwise typical wood house, where the lightkeeper and his family would live. The lantern housed a 5th order Fresnel lens that would cast a beam from Jones Point Light as far as nine miles away. In 1926, a new beacon replaced the the lighthouse as a navigational aid.



Images
 Far Left, 6a: Section through Jones Point Lighthouse and the historic Boundary Marker
 Above Left, 6b. Jones Point Light
 Above Right, 6c. 5th Order Fresnel Lens that operated at Jones Point Lighthouse, photograph by Ser Amantio di Nicolao
 Left, 6d. Jones Point Lighthouse before its restoration in the late 20th century, Library of Congress.



Remaking the Earth: The Shifting Shoreline

The shape of Jones Point has changed dramatically over the last two centuries. The currents and tides of the Potomac River continually sculpt the shoreline. In the mid-19th century, Jones Point was a delicate peninsula reaching into the Potomac River between the mouth of Little Hunting Creek to the southwest and Battery Cove to the north.

In the early 20th century, the U.S. Army Corp of Engineers dredged the navigable channel of the Potomac River. The spoil filled Battery Cove and significantly reshaped Jones Point.

The shoreline of Jones Point is a constant site of change. It reflects the daily rhythm of the tides, the persistent force of the river's current as well as the human dominion.

Images
 Left to Right:
 7a. 1851 Map of Jones Point shoreline
 7b. 1877 Map of Jones Point shoreline
 7c. 20th century Map of Jones Point Shoreline
 7d. Jones Point Shoreline - Today

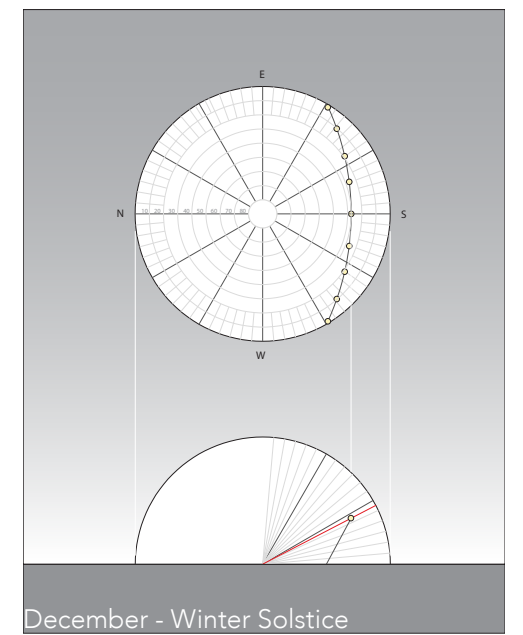
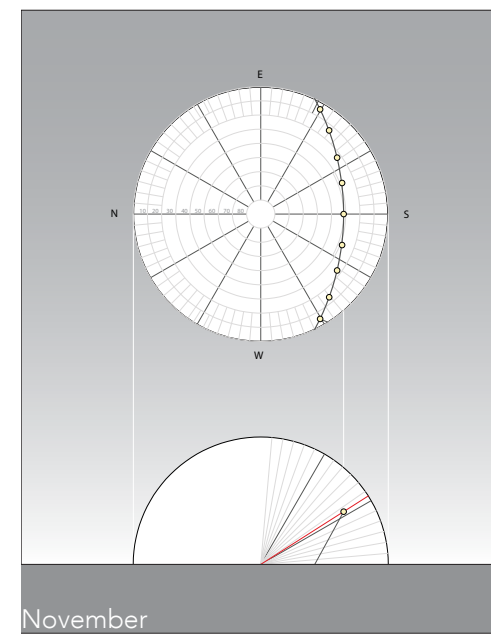
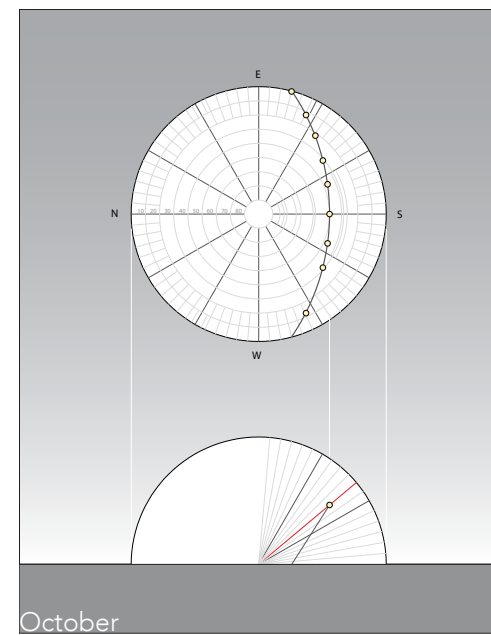
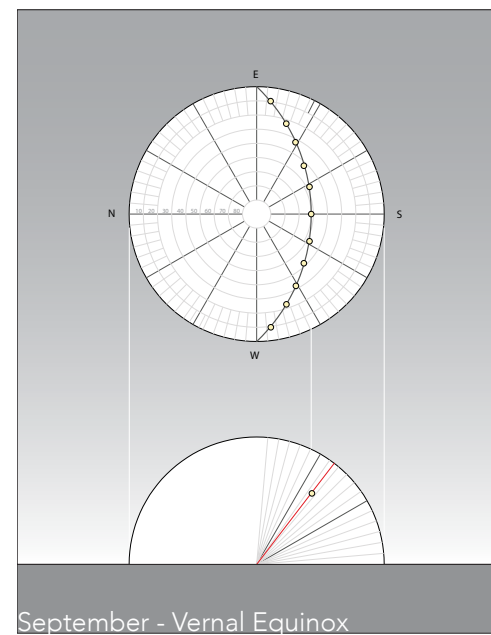
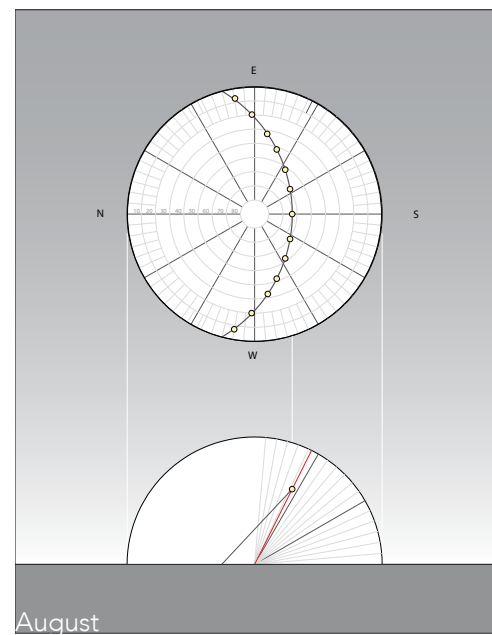
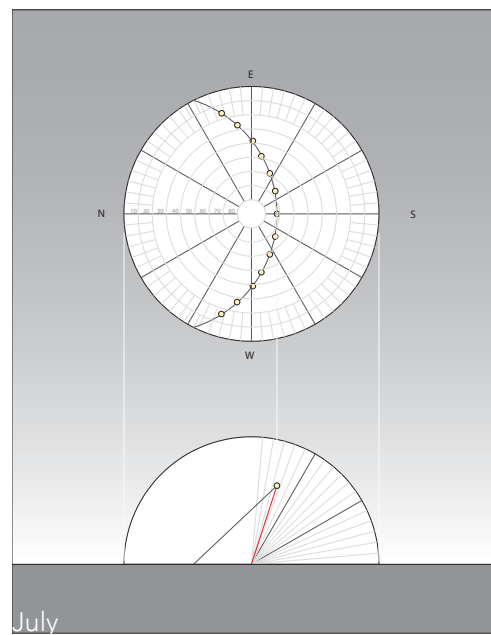
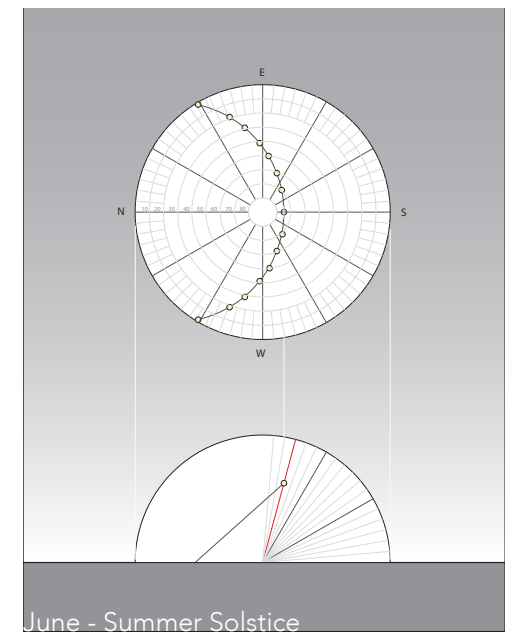
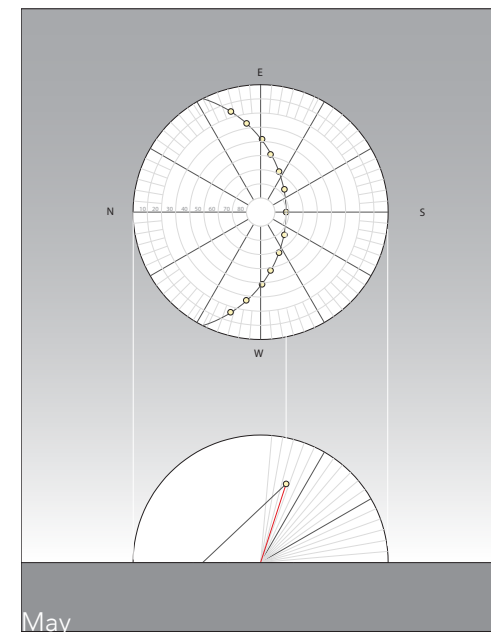
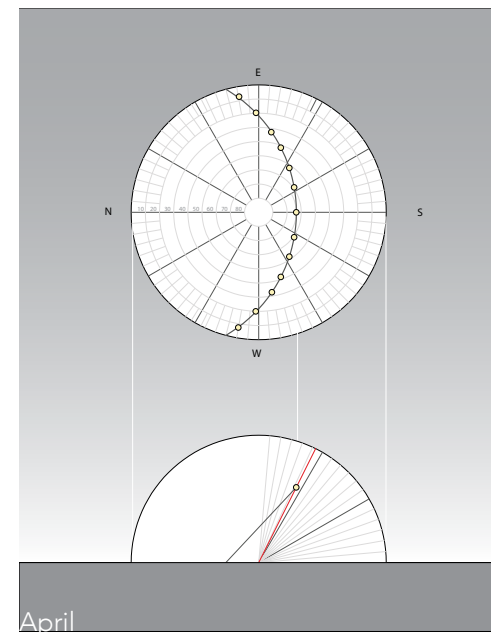
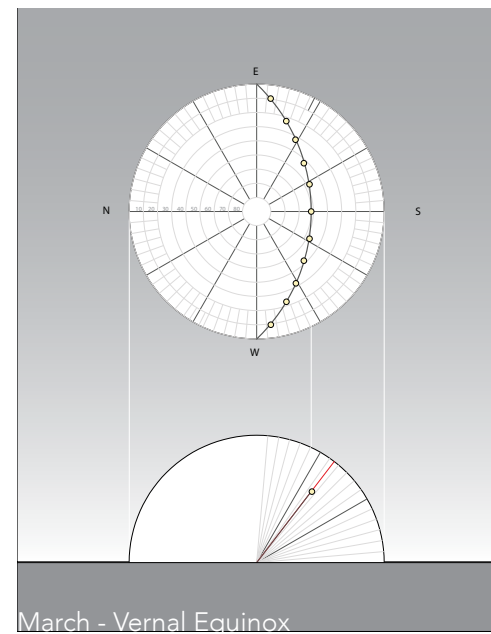
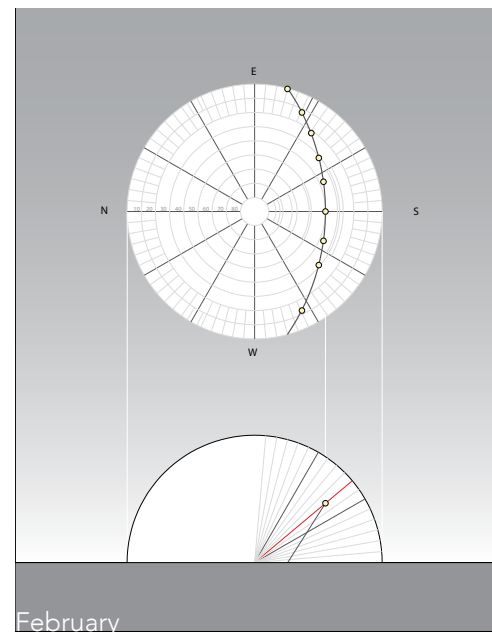
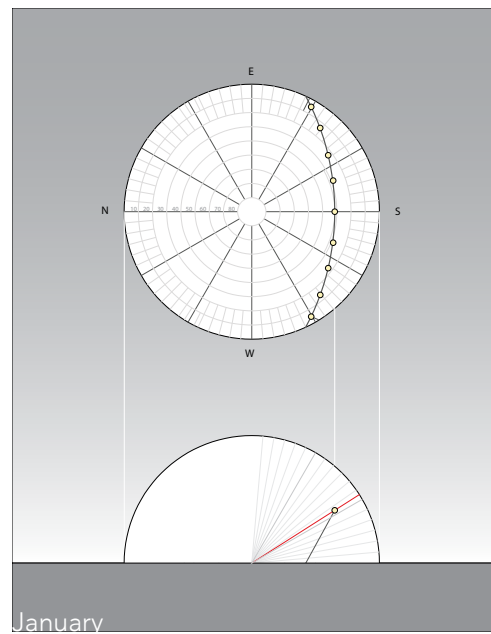


Working the Water: The Wartime Shipyard

The Virginia Ship Building Company established a shipyard on the landfill at Jones Point in 1917. Thousands of people worked at the shipyard which built steel-hulled merchant ships. The ships were constructed in four shipways and serviced by two craneways.



Images
 Left, 8a: Map of Virginia Shipbuilding Corporation shipyard at Jones Point (after Sanborn Fire Insurance Map from Alexandria, Independent Cities, VA, pg. 25.)
 Top Left, 8b: Va. ship launching of Clemence C. Morse (delivered), Library of Congress, Prints & Photographs Division, LC-DIG-npcc-00993 (digital file from original).
 1920 January 10
 Above Left, 8c: Va. ship launching of Clemence C. Morse, 1/10/20, Library of Congress.
 Above Right, 8d: Va. ship launching of E.A. Morse, Library of Congress.
 Left, 8e: Shipways, Virginia Shipbuilding Corp., Feb 14, '19, Library of Congress.

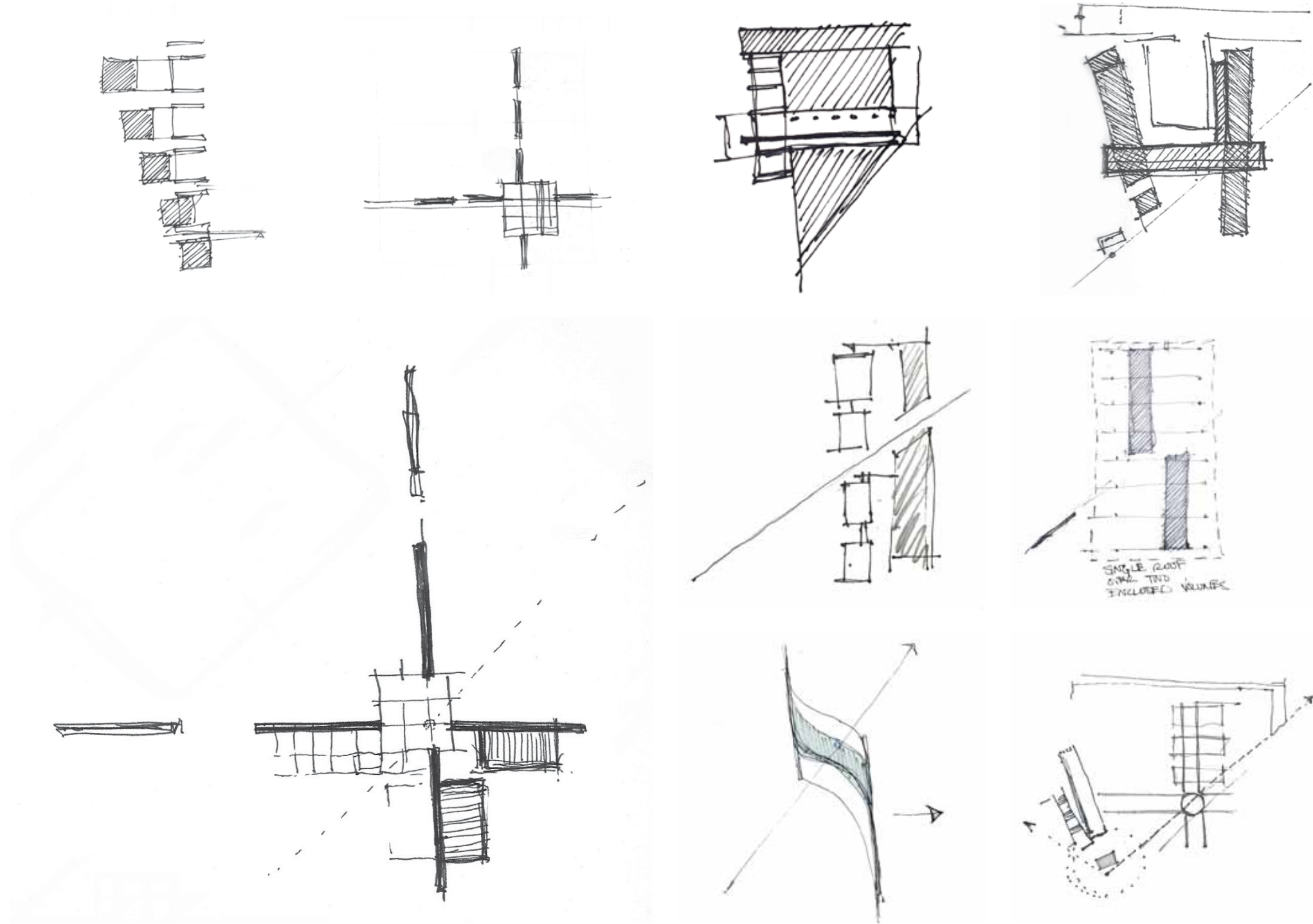


Studying the Sun: Seeing the Sun

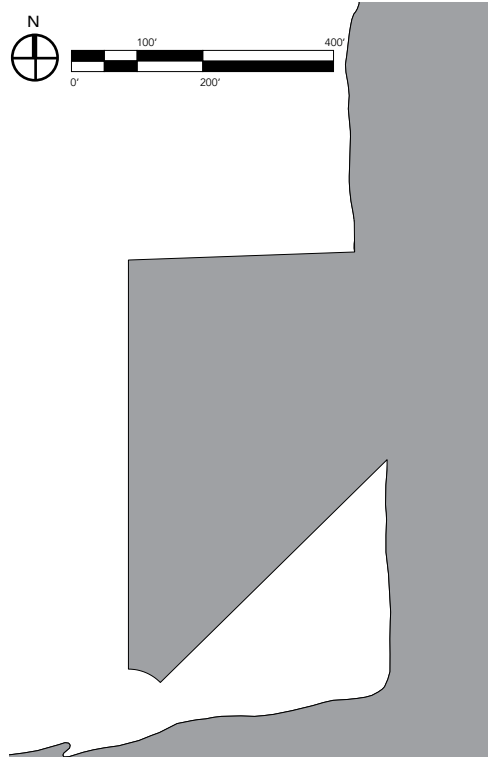
A series of solar studies shows how the sun tracks across the sky as viewed from Jones Point in Alexandria, Virginia on the equinoxes and solstices in 2014 as well as at approximately one month intervals between these astronomic events.

Images
9a. Solar Studies at Jones Point

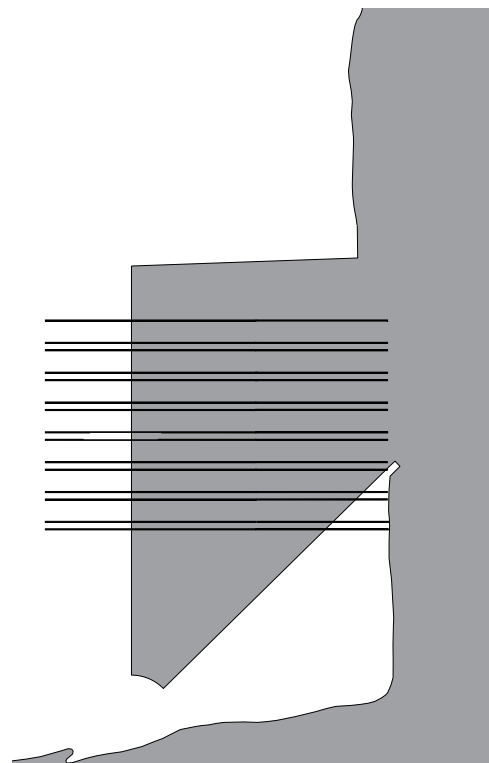
Building the Site/
Siting the Building



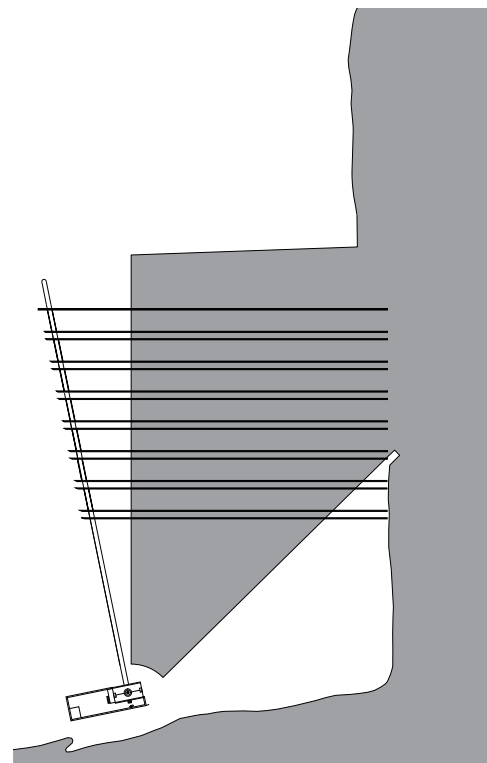
10a Site Plan Development Sketches



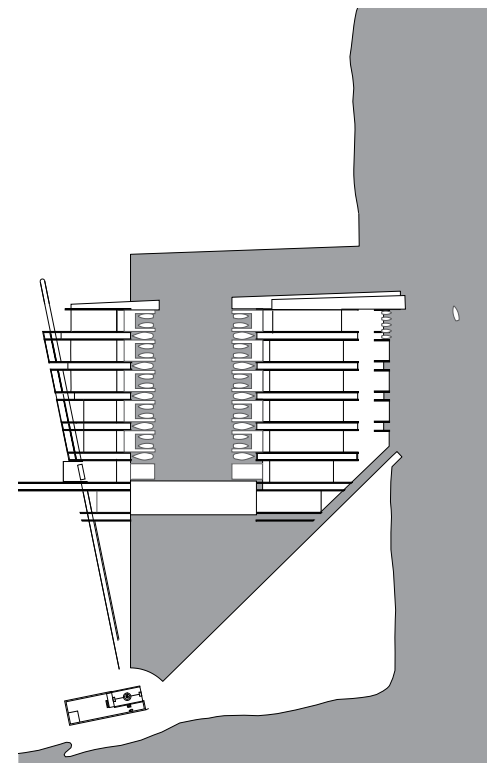
The historic boundary of the District of Columbia, the abstract geometric line of survey, becomes a physical boundary for the site. The southeastern boundary line becomes the boundary between water and land.



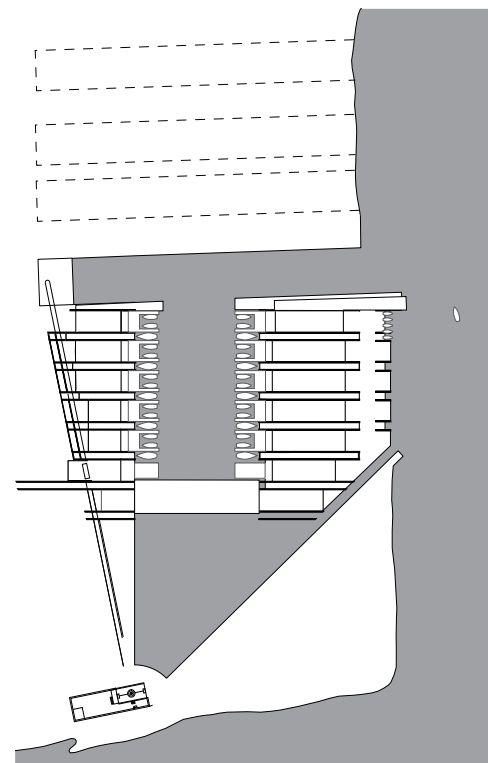
The building is organized along an east-west alignment with concrete walls that divide the building into alternating bays of 10 feet and 30 feet. The orientation of the walls are a nod to the cardinal directions of the boundary survey. At the same time, they also reflect the orientation of the Alexandria city grid to the Potomac River as well as allowing the structure of the building to track the sun and other celestial objects.



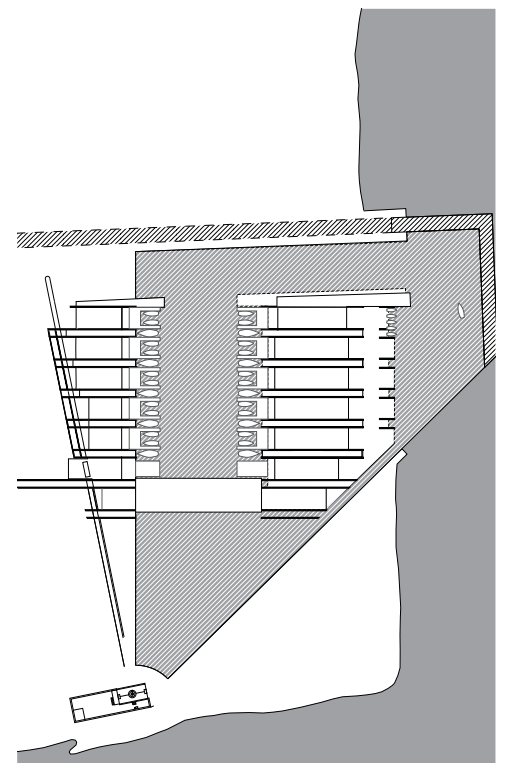
Jones Point Lighthouse acts as an orienting element on the site, drawing on its historical use as an active lighthouse for the Potomac River. The driveway approach to the marina parallels the alignment of the lighthouse. A walkway along the axis with Jones Point Light pierces the walls of the marina, creating a colonnade from the boat launch to the marina's entrance.



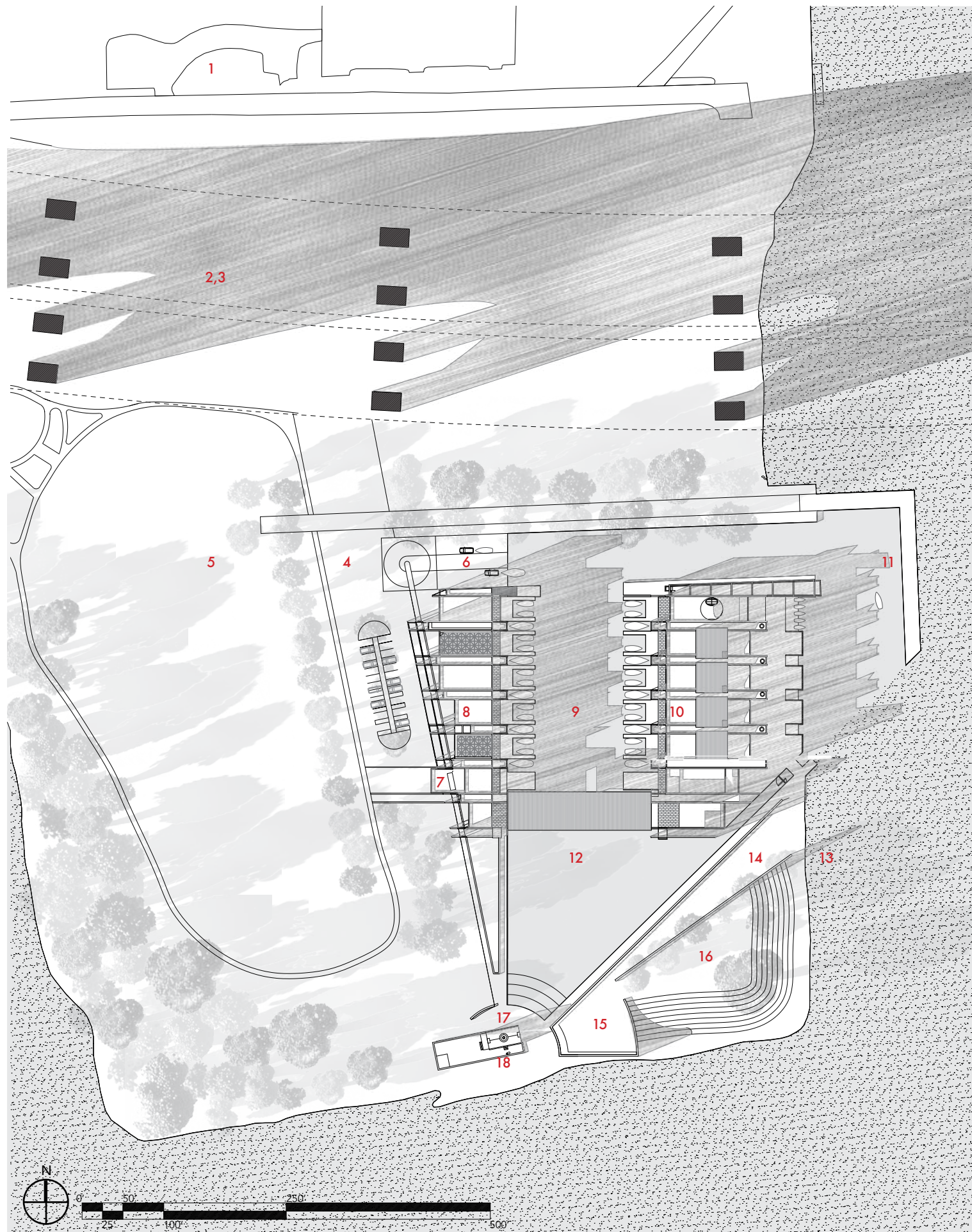
The harbor is organized as an aqueous courtyard -- a room for sailboats. The marina surrounds the harbor on three sides while the harbor opens onto the waterway of the boat launch to the north.



The project invokes Jones Point's history as a World War I shipyard by excavating one of the four shipways. The marina uses the excavated shipway as a large boat launch, capable of launching multiple boats simultaneously.

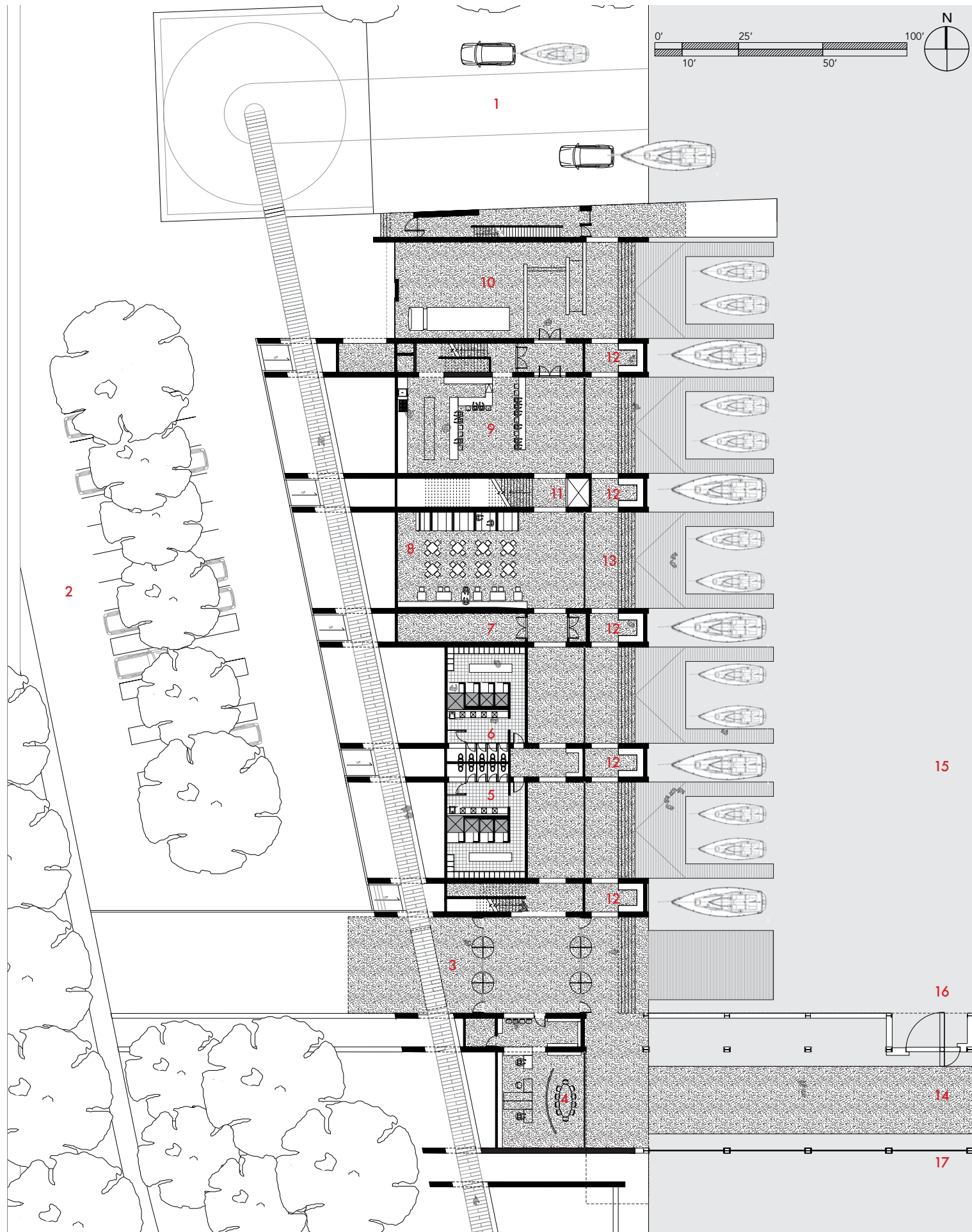


The concrete pier of the shipyard's cranes, which is still visible, is extended further into the river as a breakwater for the marina. The breakwater delineates the current boundaries of Virginia, Maryland, and the District of Columbia while simultaneously separating the domesticated water of the marina from current of the Potomac River. The domesticated water offers refuge for the marina as well as marking the historic boundary of the District of Columbia in the water itself.



Site Plan

- 1 Playground [Existing]
- 2 Woodrow Wilson Bridge [Existing and Above]
- 3 Car and Trailer Parking [Existing and Below]
- 4 Marina Driveway + Parking
- 5 Field [Existing]
- 6 Boat Launch
- 7 Marina Entrance
- 8 Public Marina
- 9 Harbor
- 10 Sailing School
- 11 Breakwater
- 12 Tidal Basin
- 13 Potomac River
- 14 Ramp
- 15 Overlook
- 16 Berm
- 17 Jones Point Lighthouse [Existing]
- 18 South Cornerstone [Existing]



1st Floor West

The western side of the marina is given to activities that are generally open to the public - a restaurant, bar and bathrooms as well as activities that support the operation of the marina, such as offices, service dock, and a boat launch.

- 1 Boat Launch
- 2 Parking Lot
- 3 Main Entrance
- 4 Marina Offices
- 5 Women's Room
- 6 Men's Room
- 7 Utility Room
- 8 Restaurant Dining Room
- 9 Restaurant Kitchen + Bar
- 10 Service Dock
- 11 Elevator
- 12 Boat Slip Lockers
- 13 Colonnade
- 14 Bridge to Sailing School
- 15 Harbor
- 16 Tidal Door
- 17 Tidal Basin





2nd Floor West

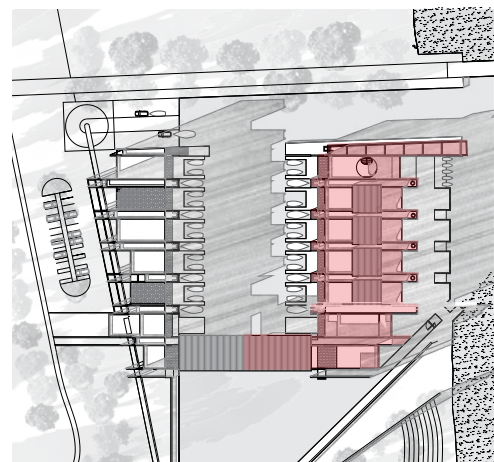
- 1 Harbormaster's Office
- 2 Roof
- 3 Restaurant Terrace
- 4 Elevator
- 5 Open to Dining Room Below
- 6 Yacht Club Room
- 7 Yacht Club Terrace
- 8 Balcony
- 9 Bridge to Sailing School
- 10 Window to Jones Point Lighthouse

The second floor is a place of leisure. The yacht club uses two bays while people dining in the restaurant eat on the terrace. Others walk along the balcony overlooking the harbor and occasionally sit on the benches as the masts gently bob. At the southern end, a large aperture looks directly south to Jones Point Light, which continues to be a terrestrial reference point inside the marina.

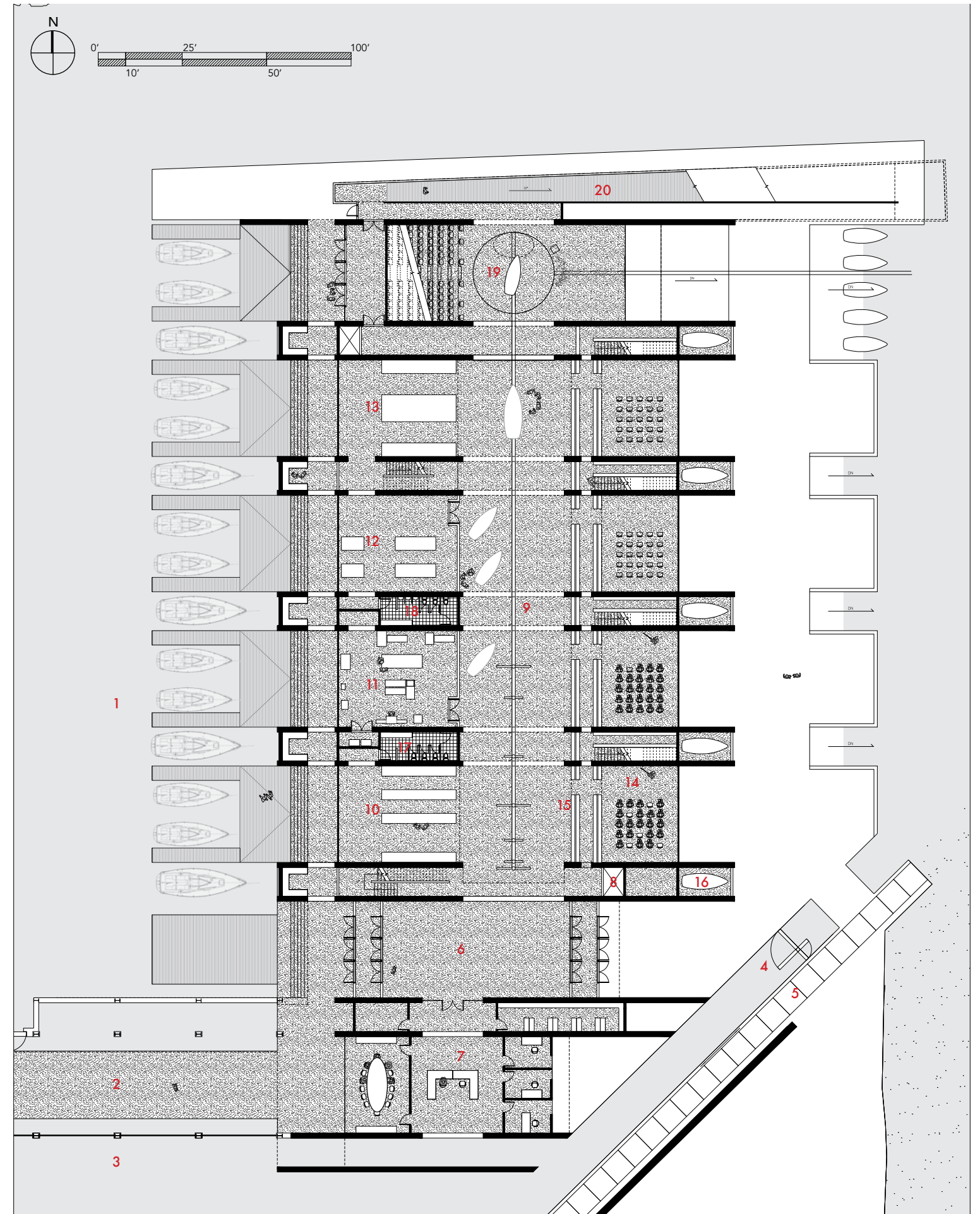


1st Floor East

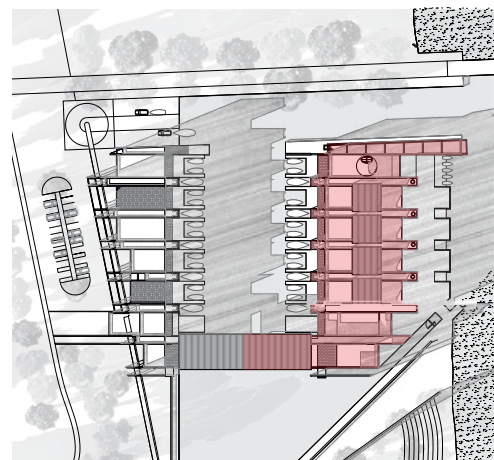
The east side of the marina is used as a school for sailing and boat building. Different stages of dinghy design and construction are located in the bays on the left side while the Great Hall may be used for dry-rigging and display of the boats. Two walls of bookcases run the length of the hall and act as a screen to classrooms that overlook the river. An auditorium anchors the north end of building. It serves as a place for school and/or public lectures and events as well as a ceremonial space for launching recently completed sailboats.



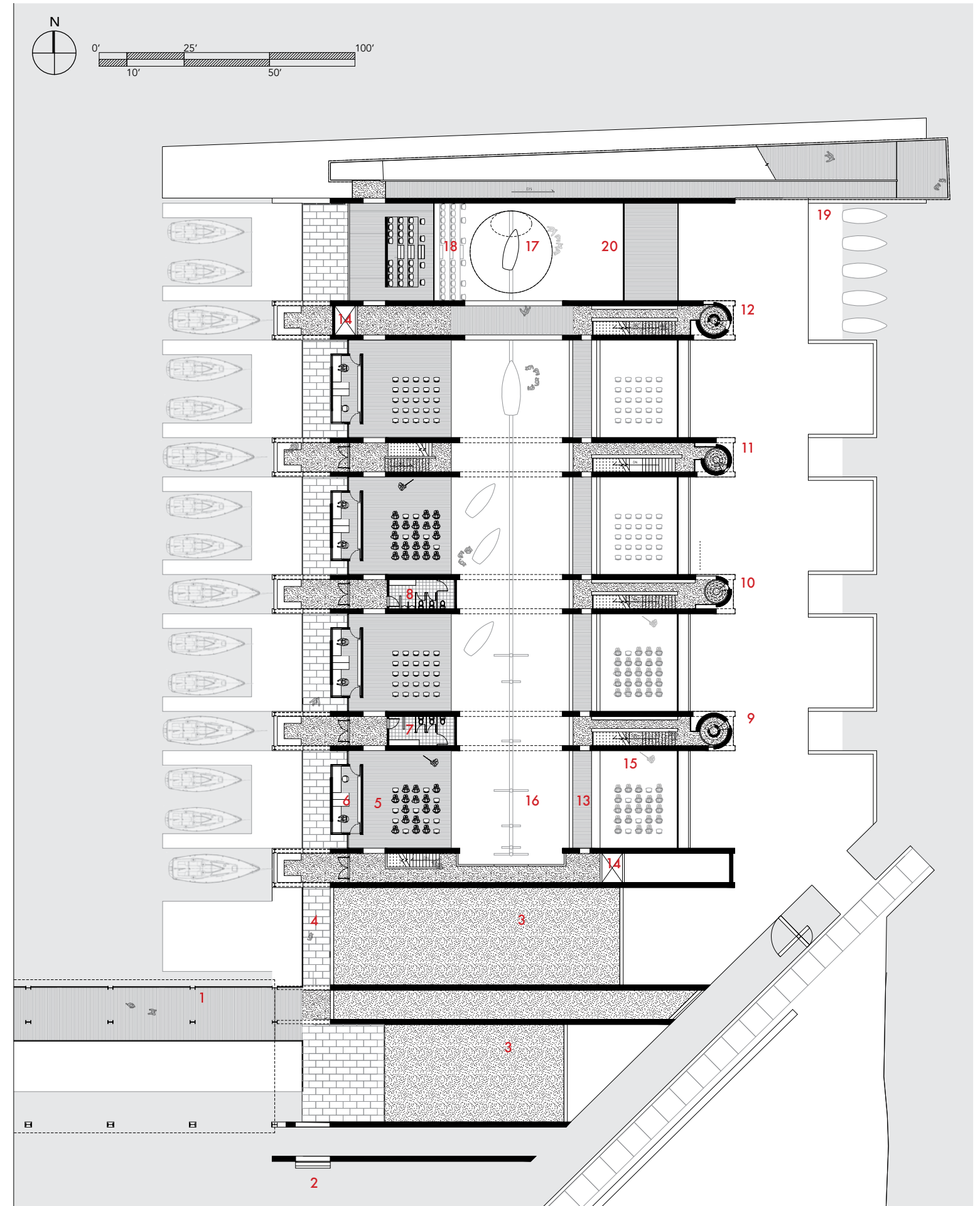
- 1 Harbor
- 2 Bridge to Public Marina
- 3 Tidal Basin
- 4 Tidal Door
- 5 Boundary Walk
- 6 School Entrance
- 7 School Offices
- 8 Elevator
- 9 Great Hall
- 10 Boat Design Studio
- 11 Boat Building Workshop
- 12 Boat Finishing Shop
- 13 Sail Shop
- 14 Classroom
- 15 Library
- 16 Dinghy Storage
- 17 Womens Room
- 18 Mens Room
- 19 Auditorium
- 20 Ramp



2nd Floor East



- 1 Bridge to Public Marina
- 2 Equatorial Sundial
- 3 Roof
- 4 Balcony
- 5 Classroom
- 6 Faculty Office
- 7 Women's Room
- 8 Men's Room
- 9 Vega: Summer Solstice Observatory
- 10 Arcturus: Vernal Equinox Observatory
- 11 Fomalhaut: Autumnal Equinox Observatory
- 12 Rigel: Winter Solstice Observatory
- 13 Library
- 14 Elevator
- 15 Open to Classroom Below
- 16 Open to Great Hall Below
- 17 Polaris Observatory (Above)
- 18 Auditorium Balcony
- 19 Ramp
- 20 Open to Auditorium Below

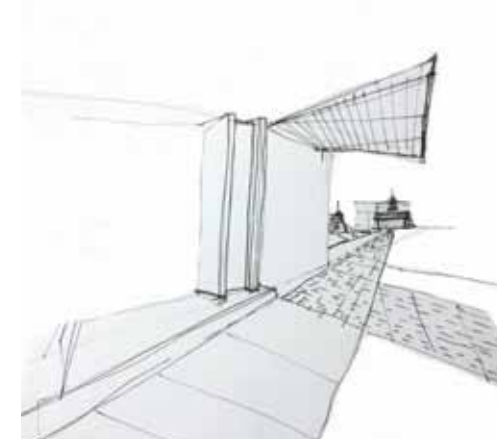
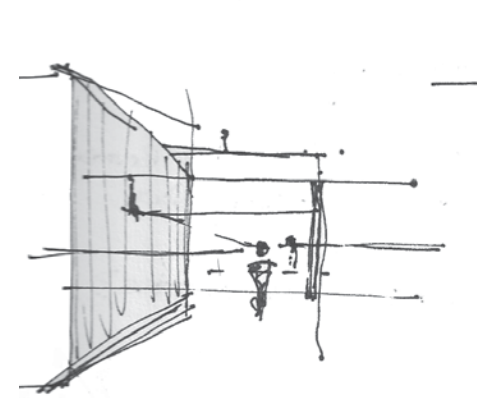
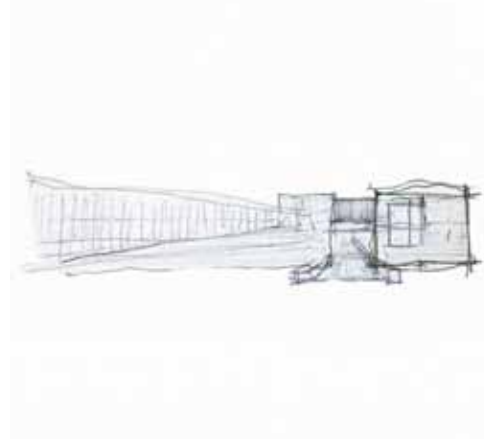
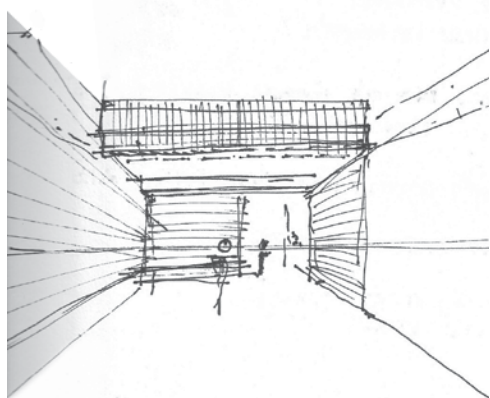
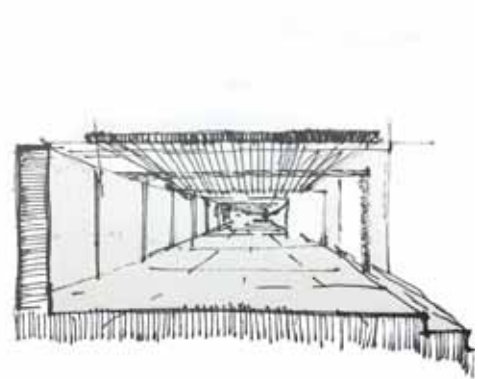




The Entry

Different iterations of the entry aimed to find a correspondance between the floor and the ceiling. Early designs attempted to assert the floor and ceiling as independent and clearly expressed architectural elements. Other versions looked to find a proportioning system in music, math and the human body as these proportions were thought to join the earthly and Heavenly realms throughout history.

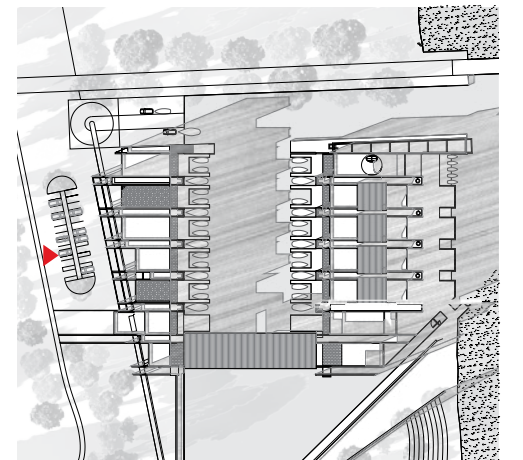
In the final design, a series of piers extend over a walkway from the walls of the marina like a colonnade. The piers introduce visitors to the order of the building before reaching the door, and frame the lighthouse beyond.



17a Development Drawings for Entry

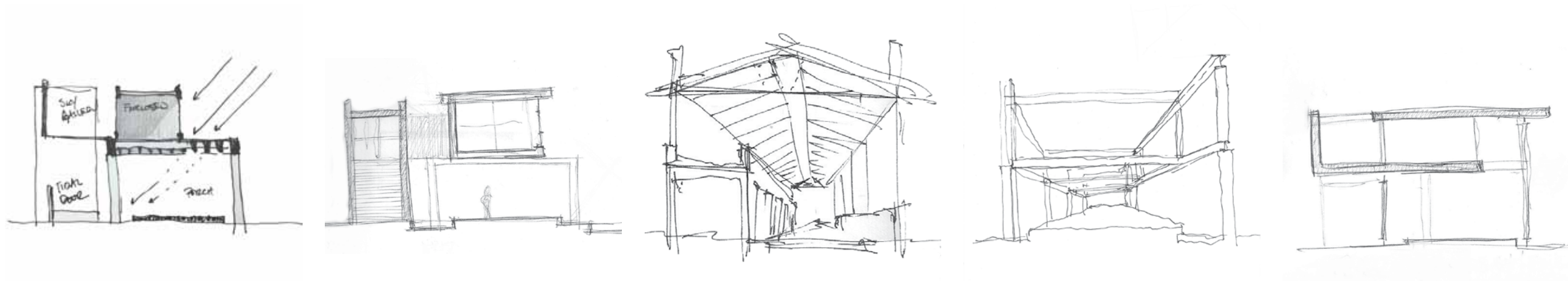
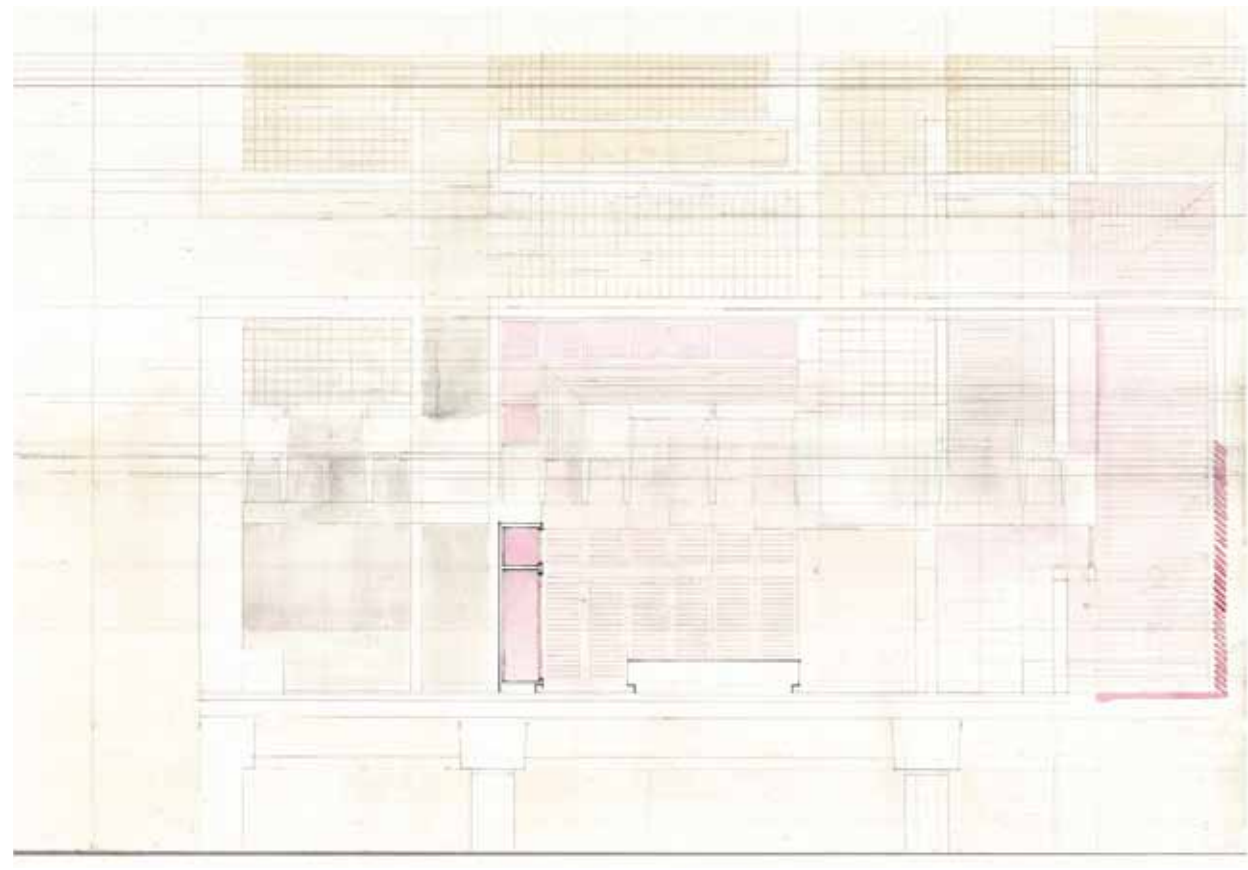
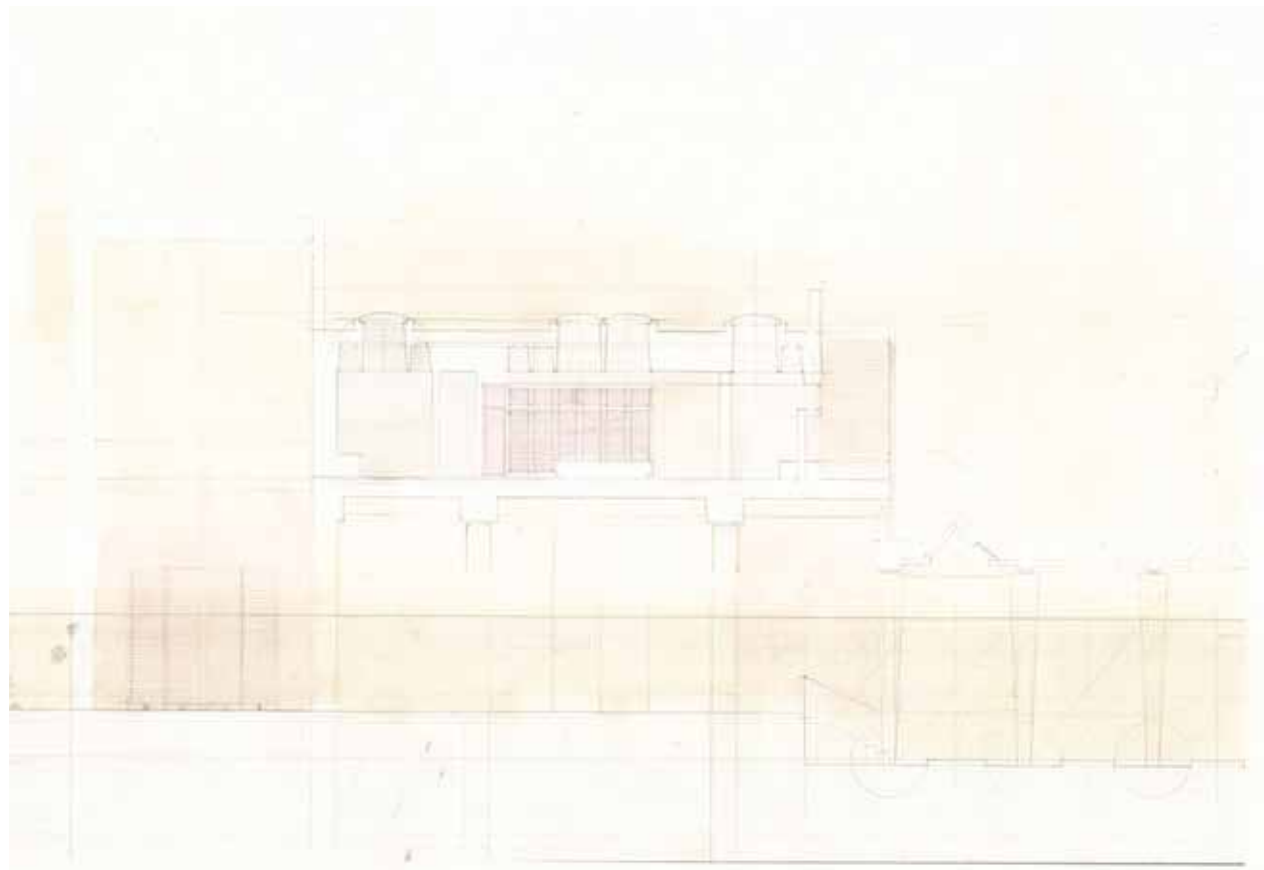


18a Entrance (West) Elevation

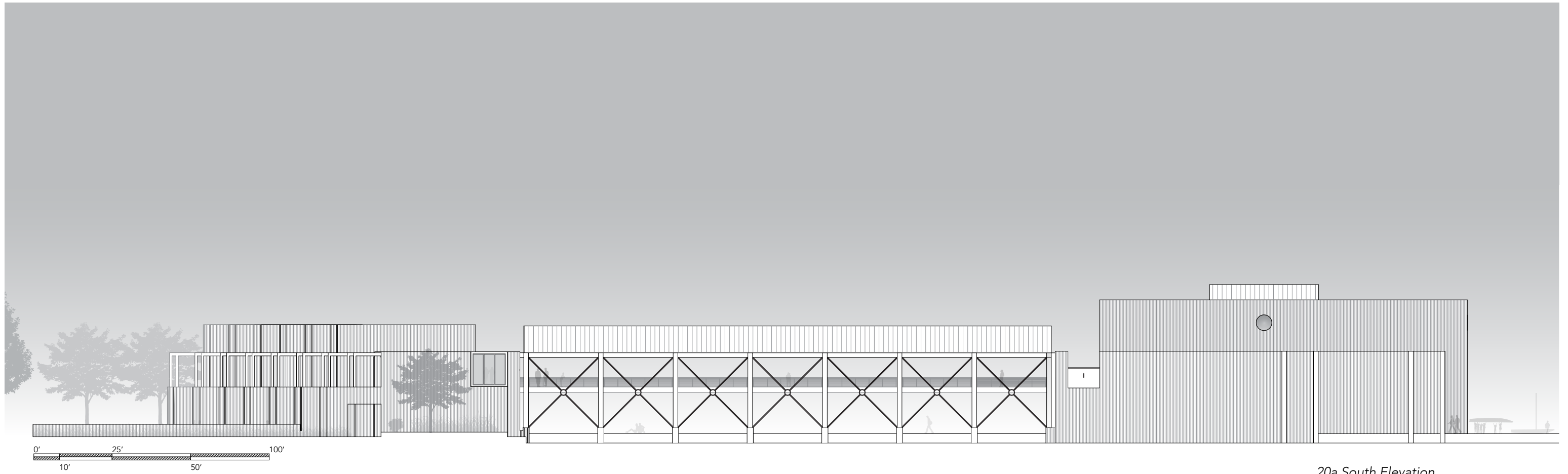


The Bridge

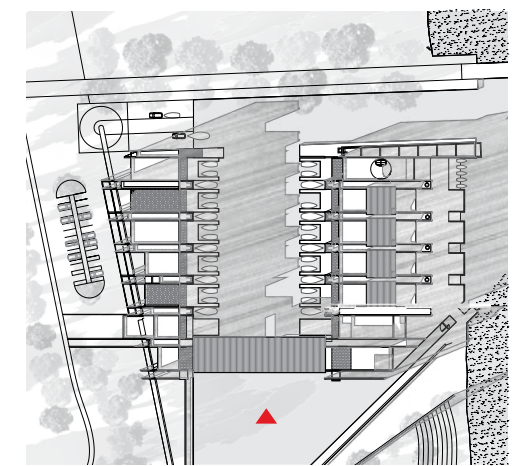
The bridge forms the south side of the courtyard as it carries the structural order between the marina and sailing school. Even though it shares the order of the rest of the marina, it finds a different expression in the delicate steel frame as it crosses the water. The open frame allows air to circulate through the courtyard while sheltering students as they cross the bridge to class.

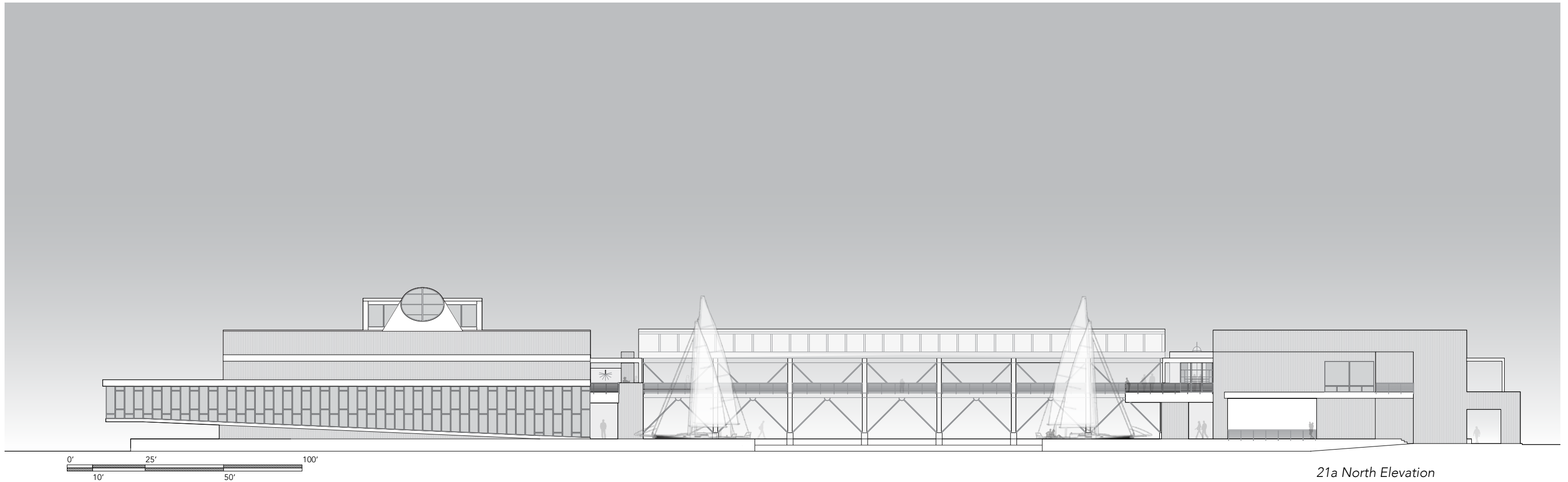


19a Bridge Development Drawings

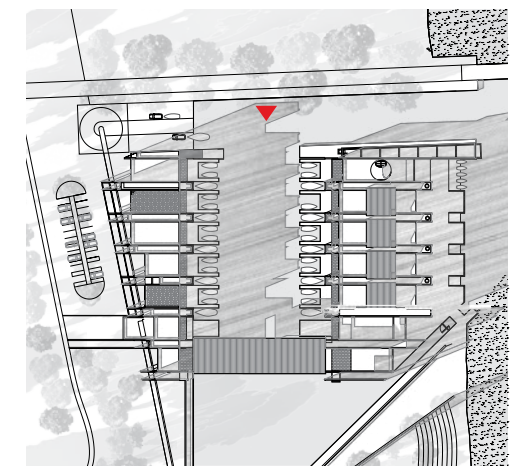


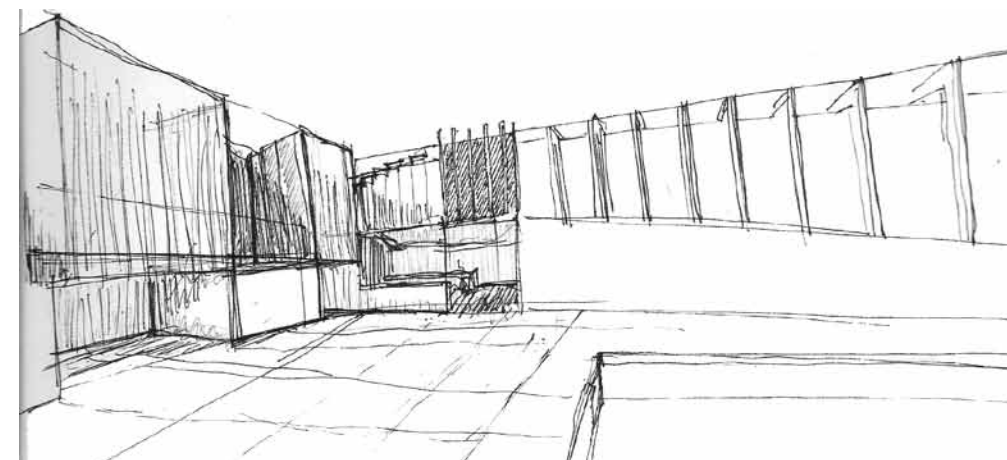
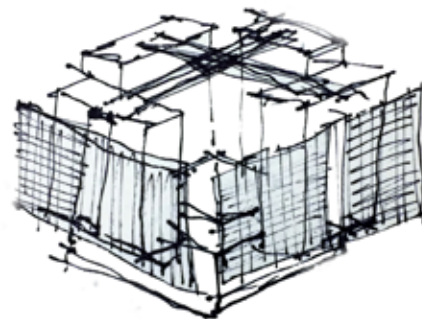
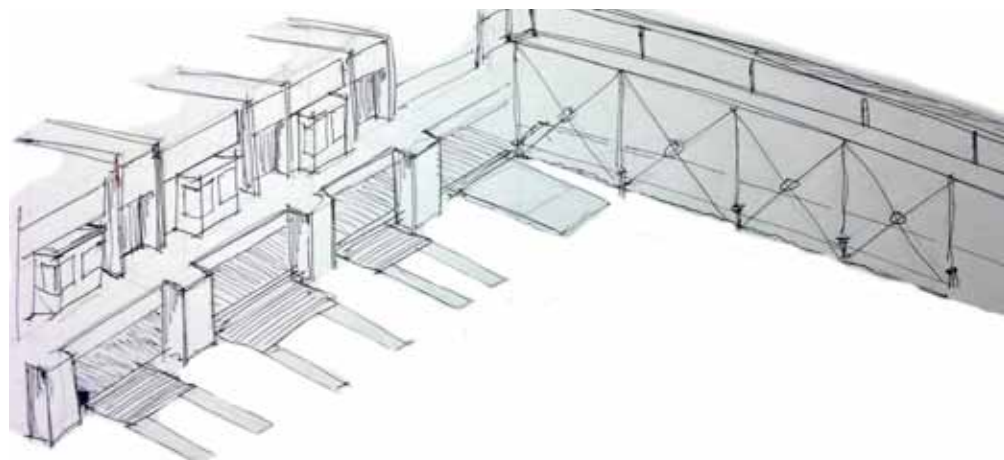
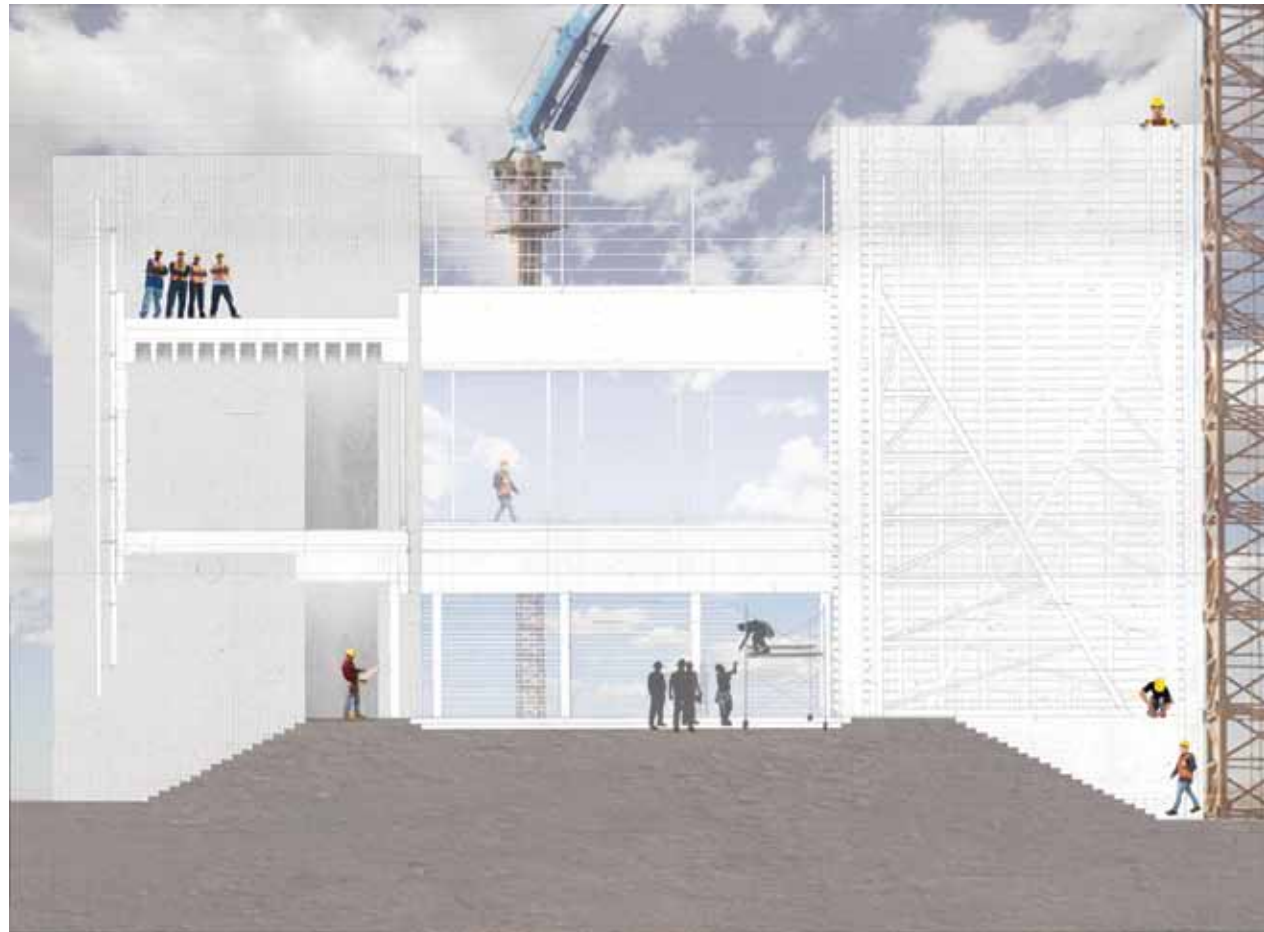
20a South Elevation





21a North Elevation

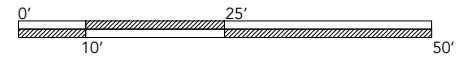




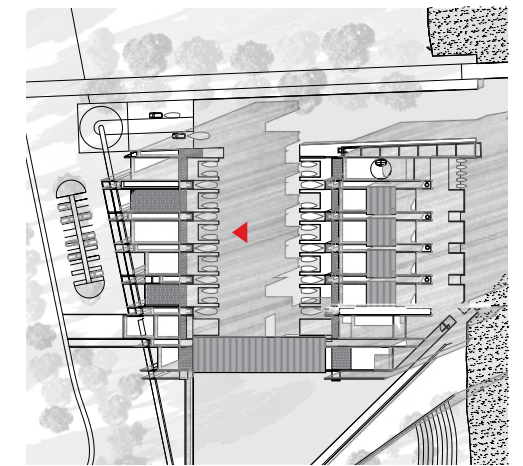
The Courtyard

The harbor represents a place of shelter and safehaven for boats, just as the courtyard as an architectural archetype offers a place of rest and repose. The courtyard gathers the functions and pleasures of the marina around the harbor. By denying a view to of the horizon, the courtyard also serves to focus one's view on the sky above or its reflection in the calm water below.

22a Courtyard Development Drawings

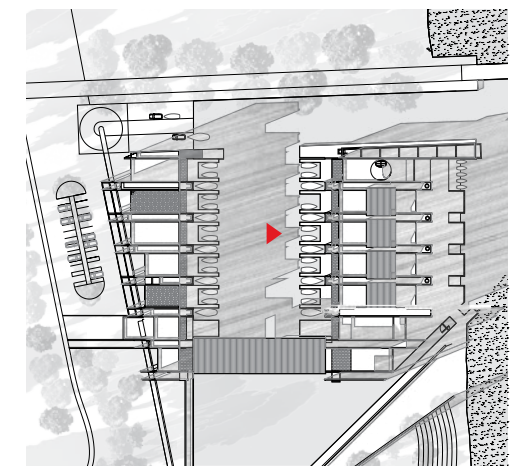


23a East-Facing Courtyard Elevation

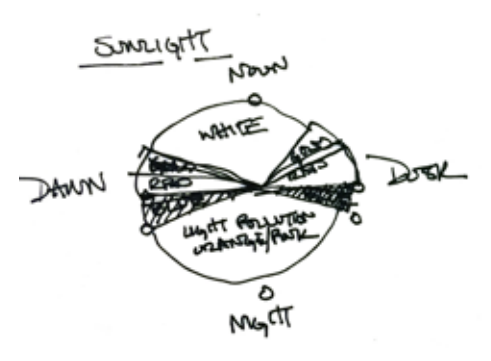
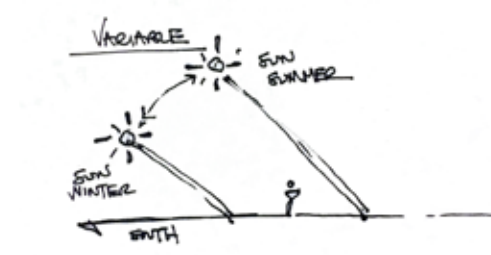
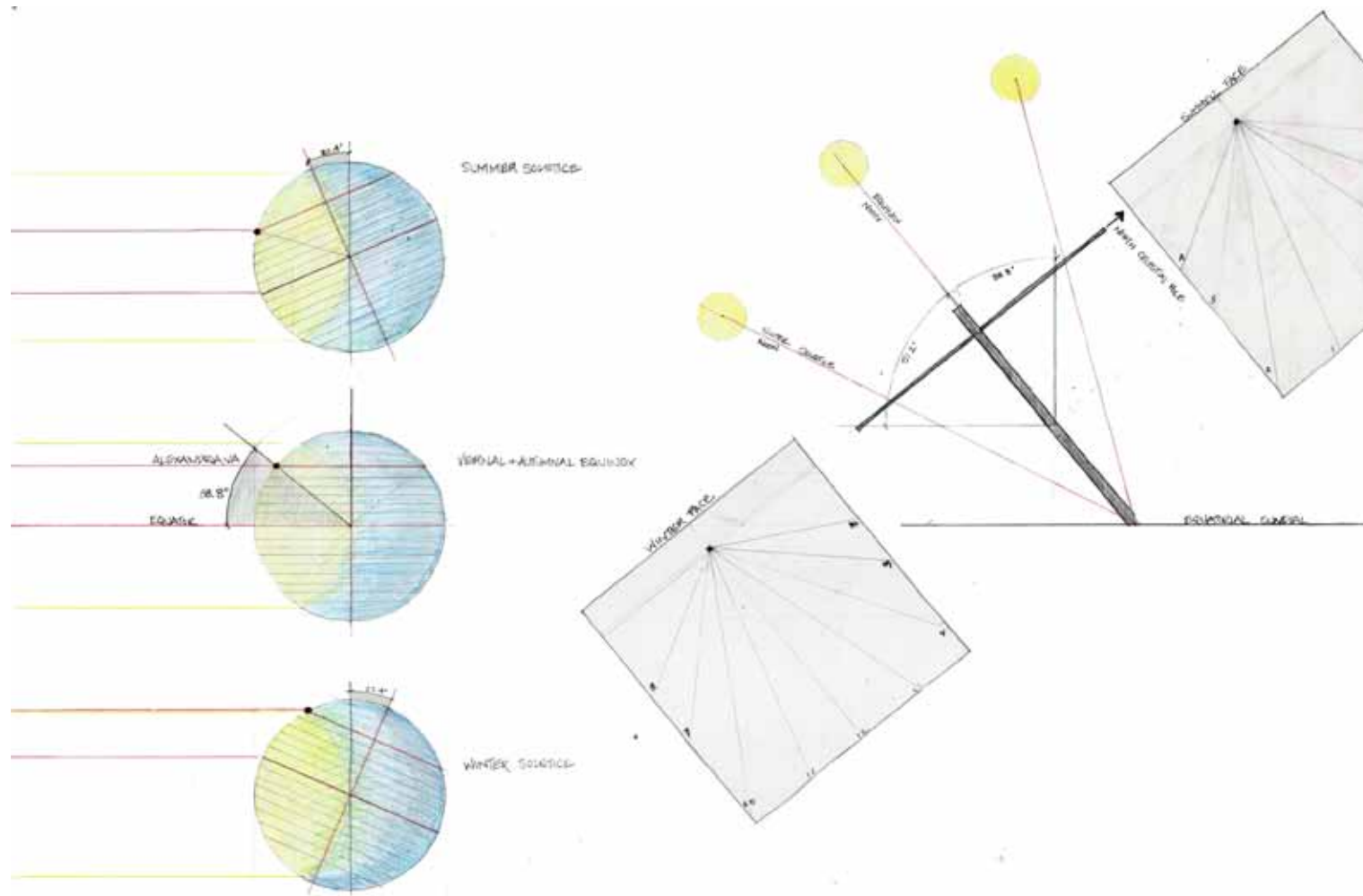




24a West-Facing Courtyard Elevation



Looking Up



Equitorial Sundial

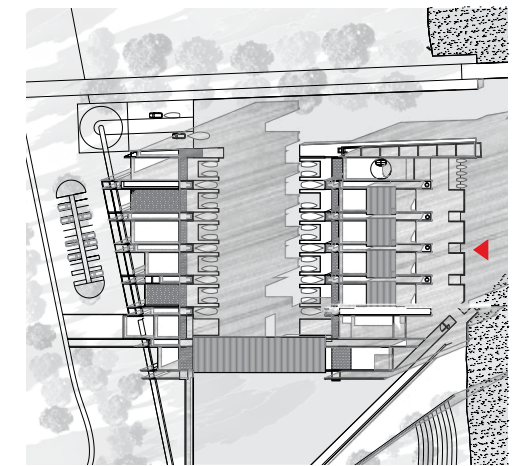
An equitorial sundial measures the hours of the day as well as the passage of seasons. When the sun is lower in the sky during the fall and winter, the gnomon casts a shadow on the underside of the panel. During the spring and summer the sun is higher in the sky and casts the gnomon's shadow on the upper side. As the sundial is angled to correspond with the sun's angle on the equinoxes, only the edge of the sundial would receive direct sunlight on those two days each year, leaving both faces in shade.

Images:
 Far Left, 25a Diagram for Equatorial Sundial
 Left, 25b Sundial Sketches

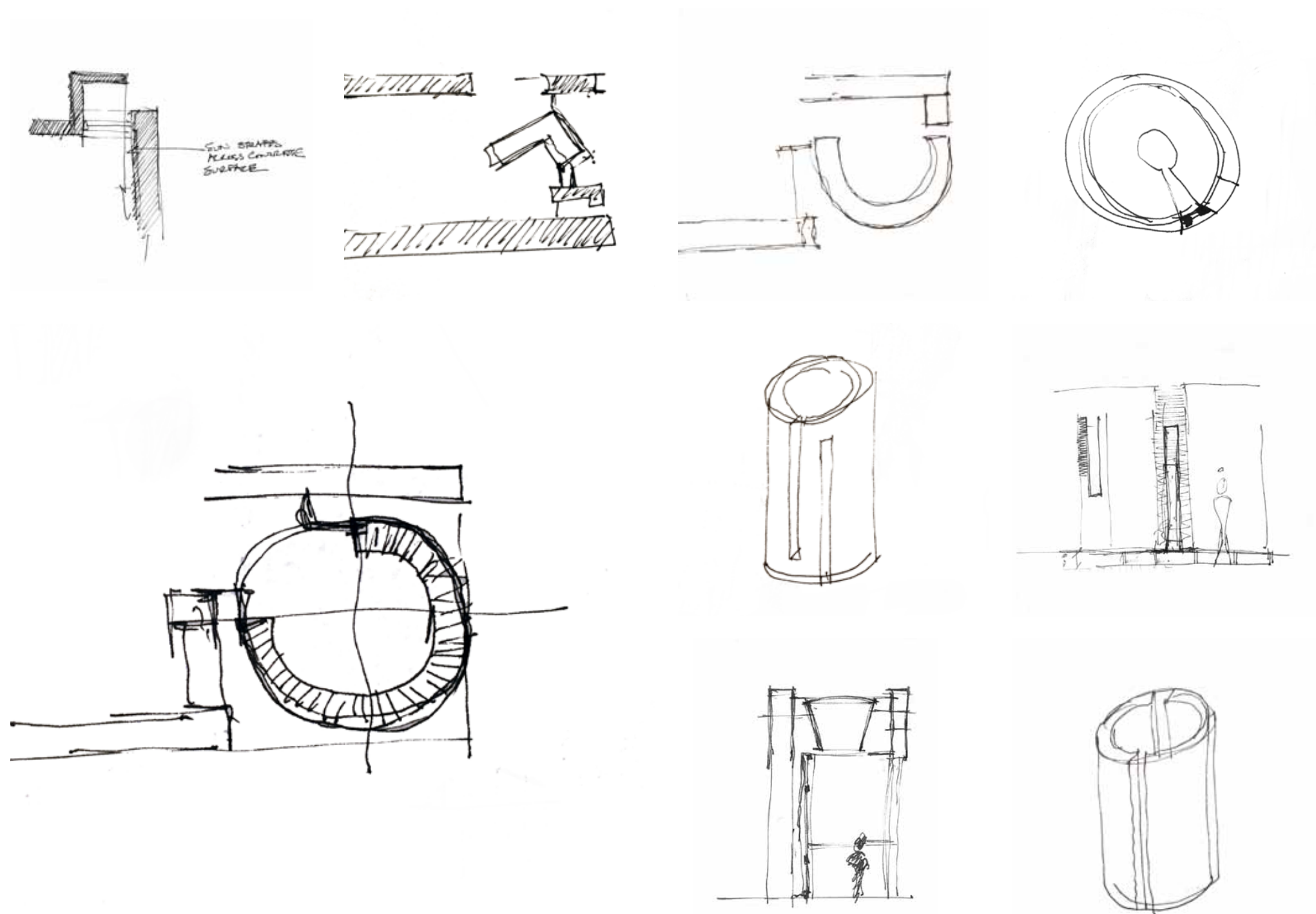


The second floor balcony, which overlooks the harbor on the marina's west side, ends in a large window framing a view of Jones Point Lighthouse -- a terrestrial marker. In contrast, an equatorial sundial -- a celestial measure -- rests at the southern end of the sailing school balcony. The large sundial, which obstructs the view to the south, redirects one's gaze to the sky above the harbor courtyard.

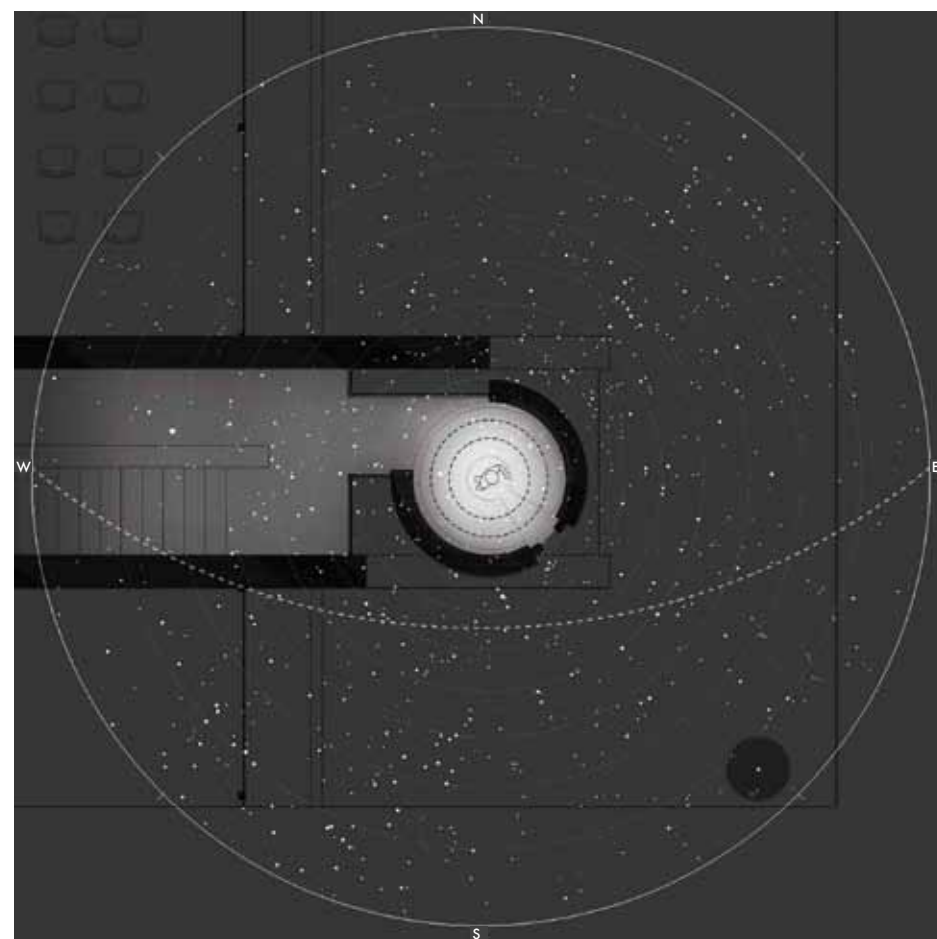
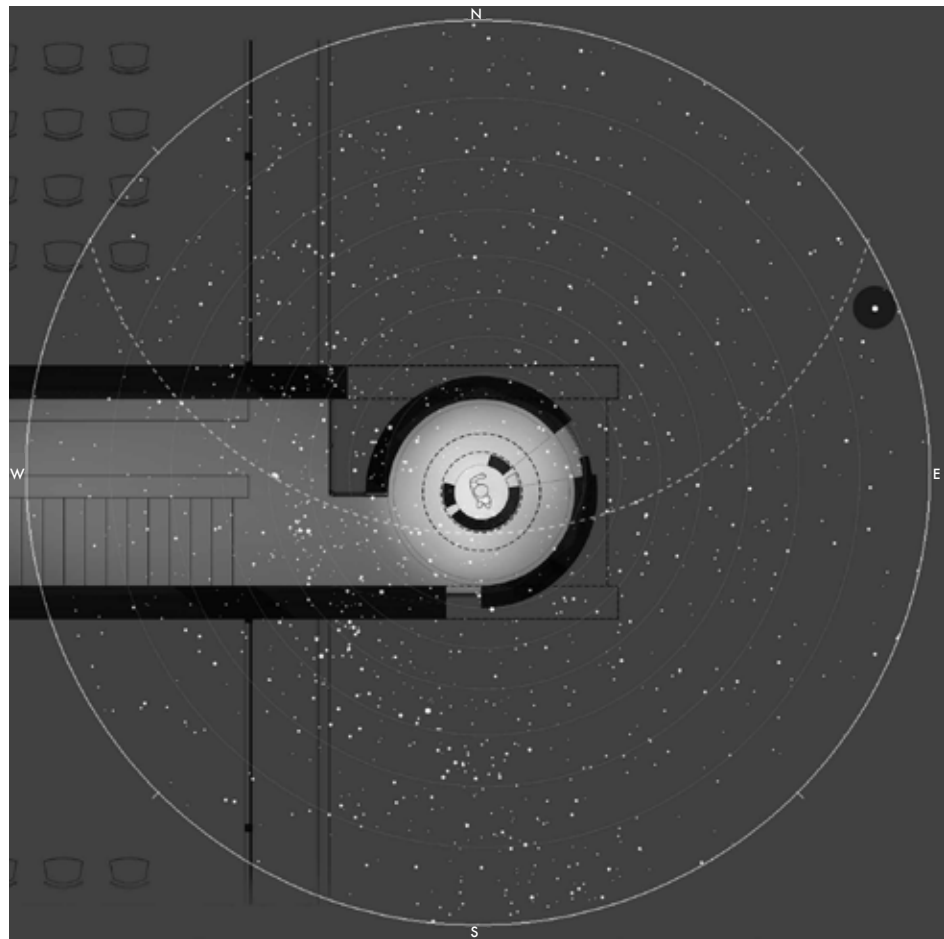
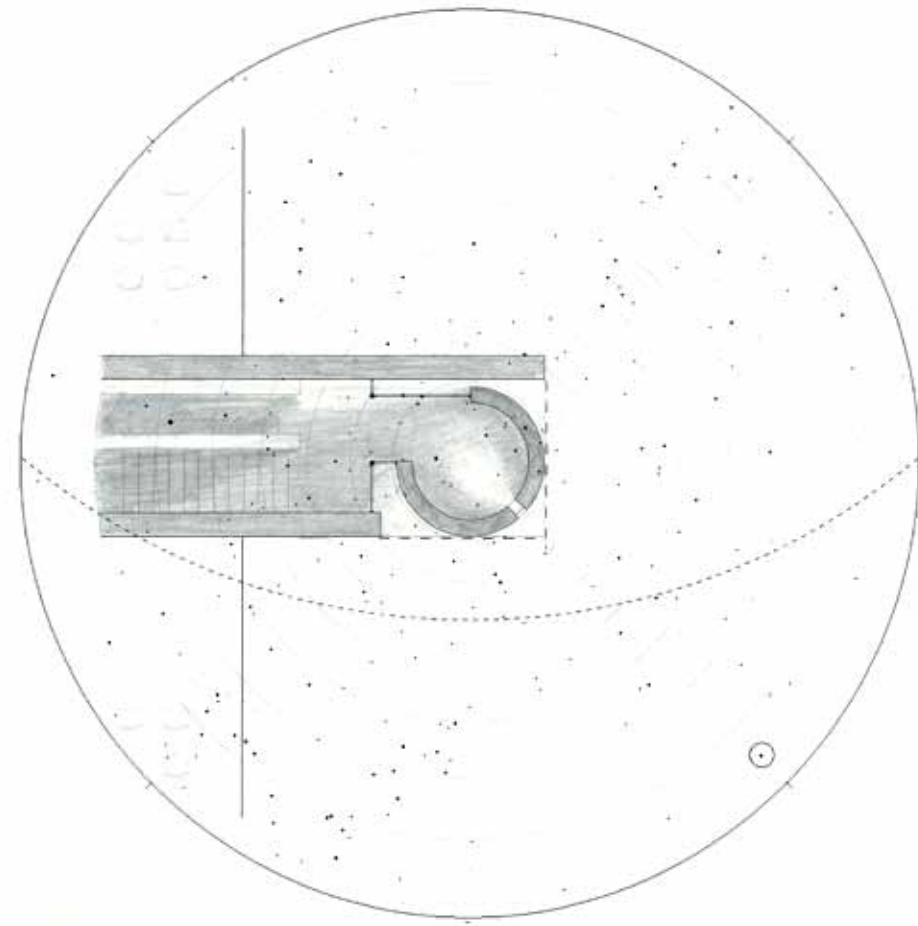
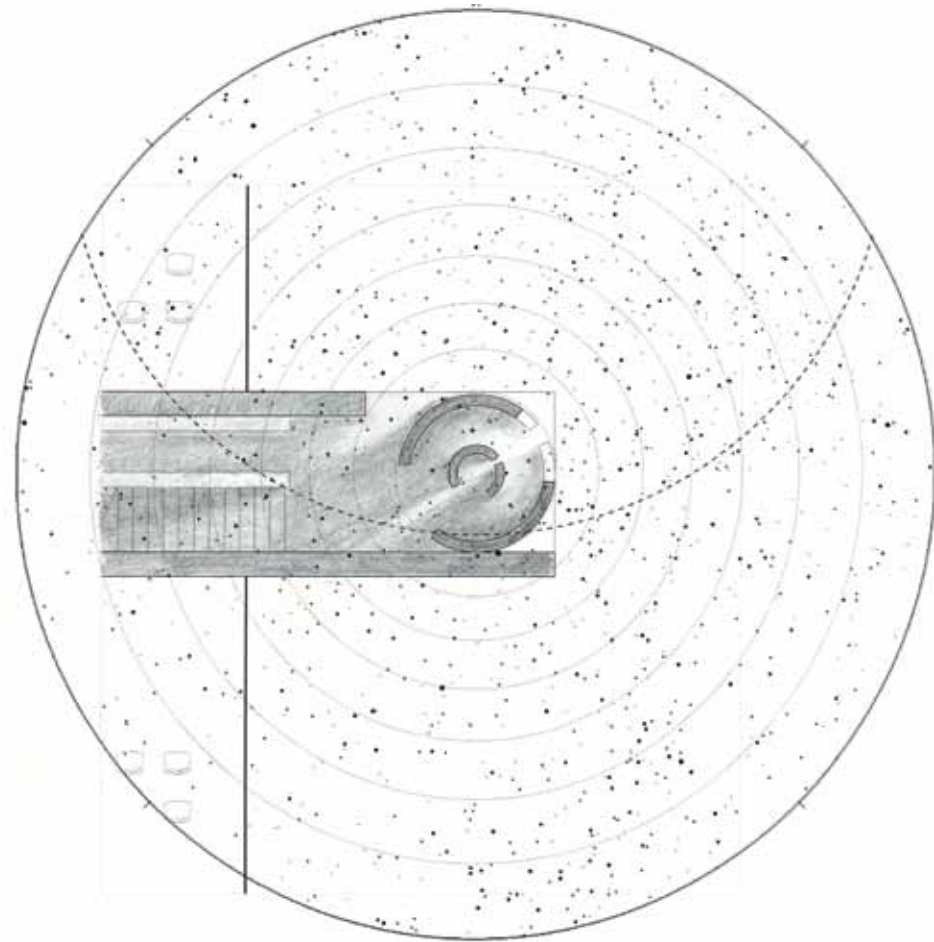
26a River (East) Elevation with Equatorial Sundial at Far Left



Navigating by the Stars



27 Observatory Development Drawings



The Observatories

Perched on the second level along the river, four concrete cylinders act as observatories. The observatories have openings that frame an astronomical event. In each of the observatories, the alignment of one slot and the sun reveals an equinox or a solstice. Another opening in each of the observatories focuses upon a single navigational star the following evening. As such, these observatories become a series of timepieces over the course of the year as well as navigational aids. These cylindrical observatories orient the building to the stars.

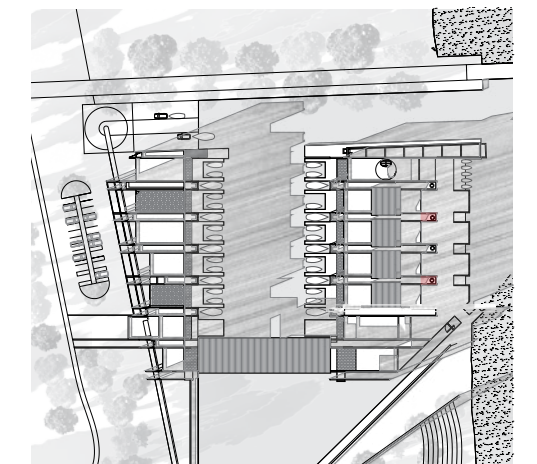
Images

Top Left, 28a: Plan of Vega: Summer Solstice Observatory at Sunrise

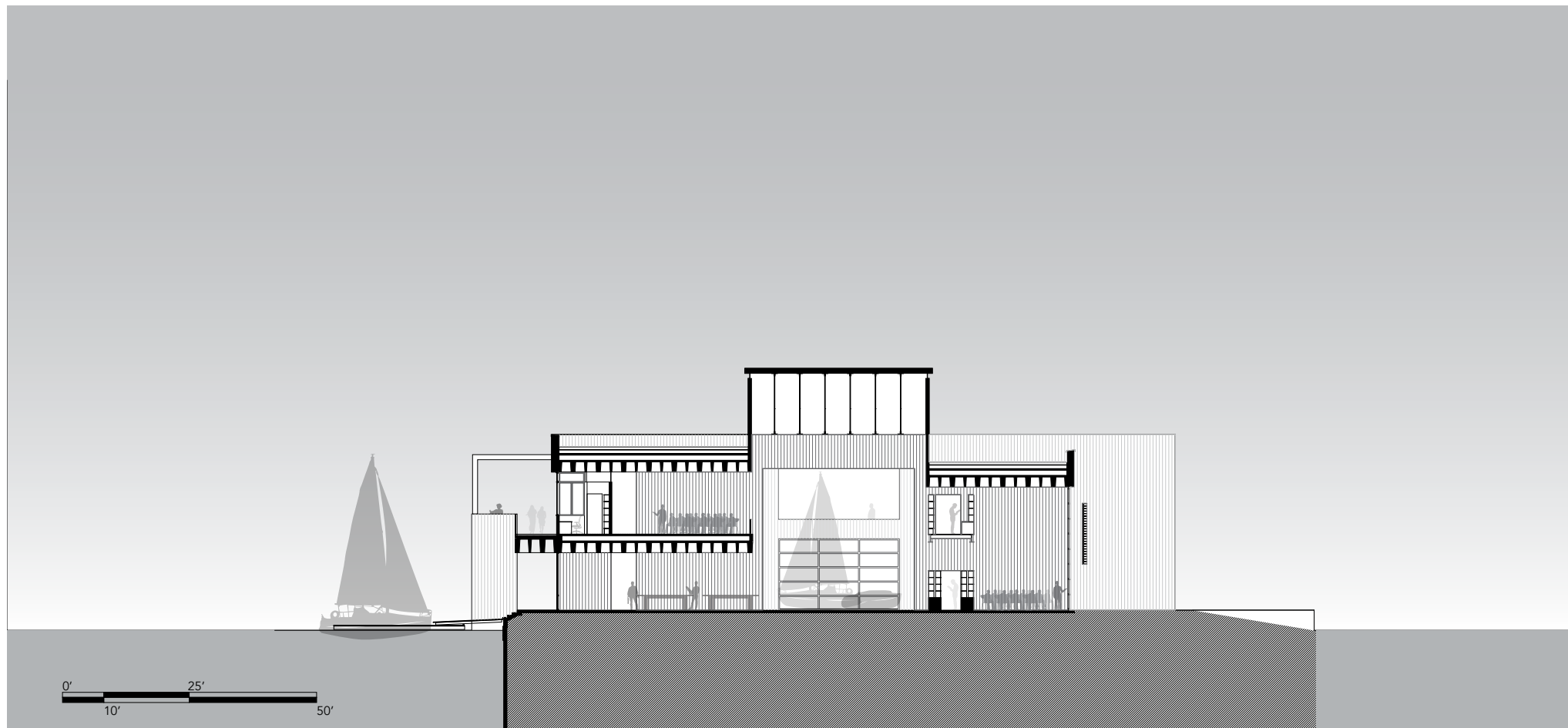
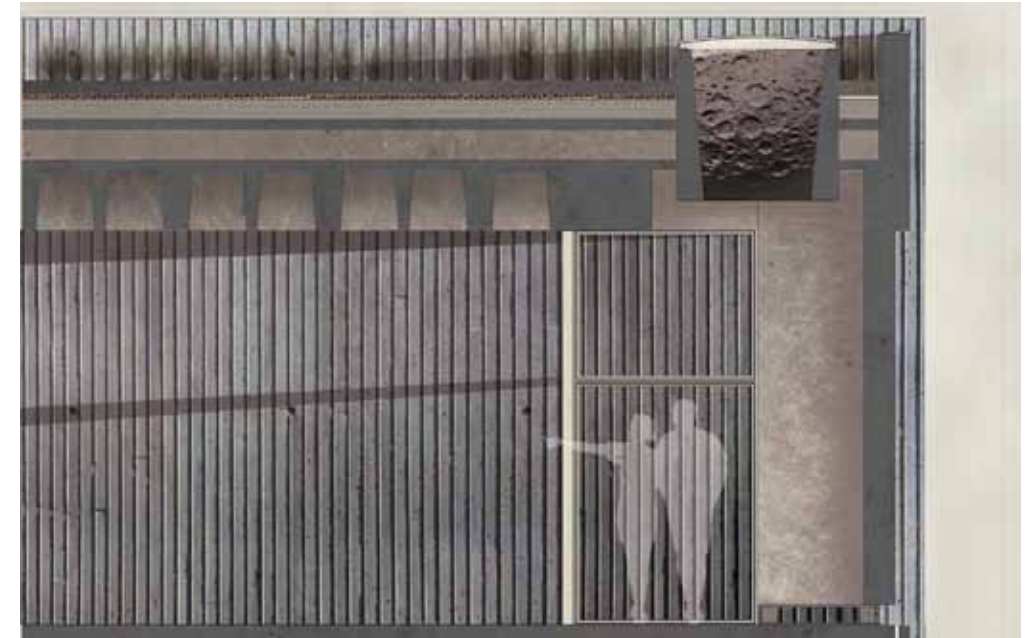
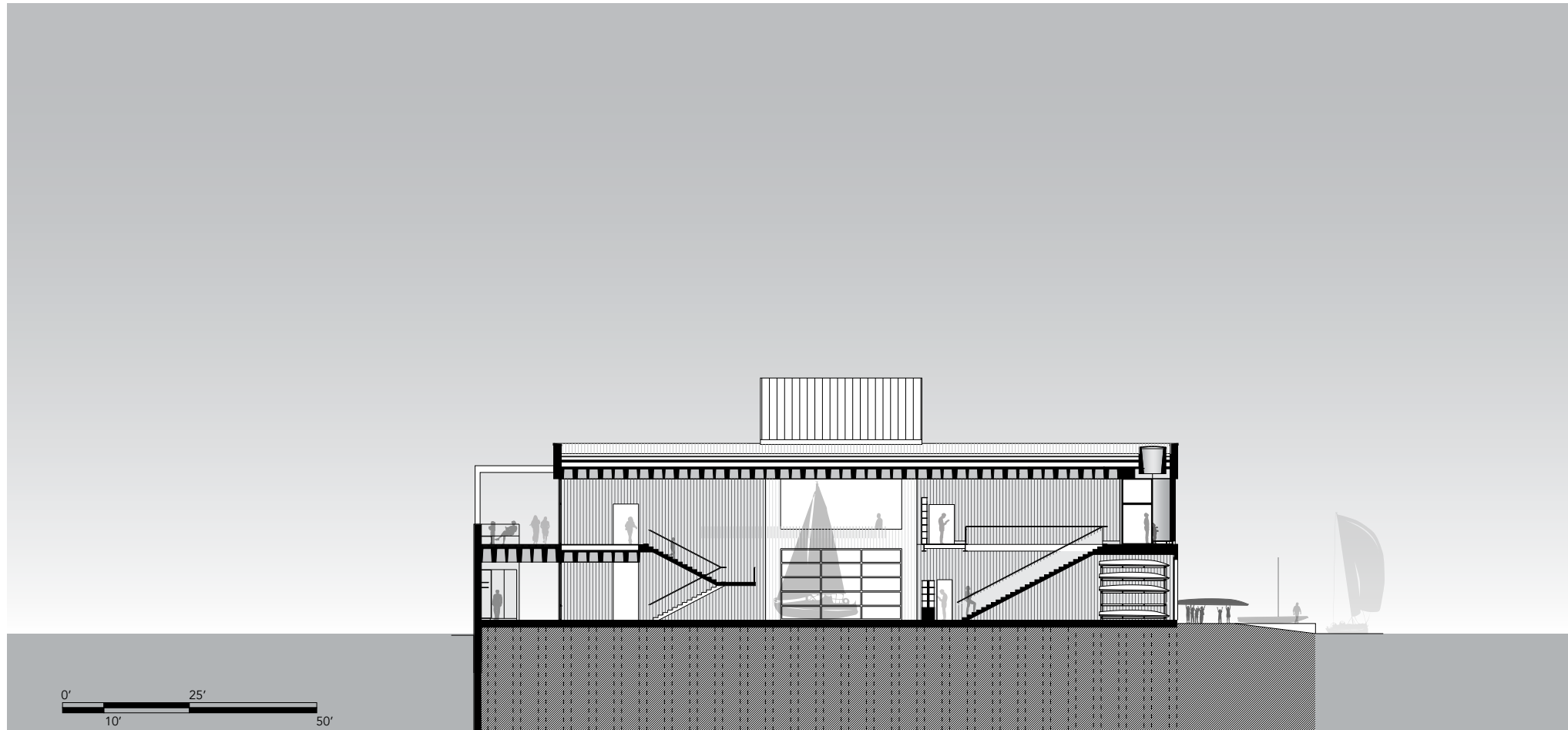
Left, 28b: Plan of Vega: Summer Solstice Observatory at Dusk

Top Right, 28c: Plan of Fomalhaut: Autumnal Equinox Observatory at Sunrise

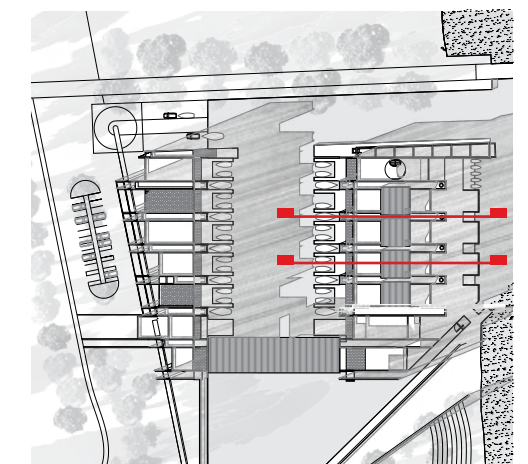
Right, 28d: Plan of Fomalhaut: Autumnal Equinox Observatory at Dusk

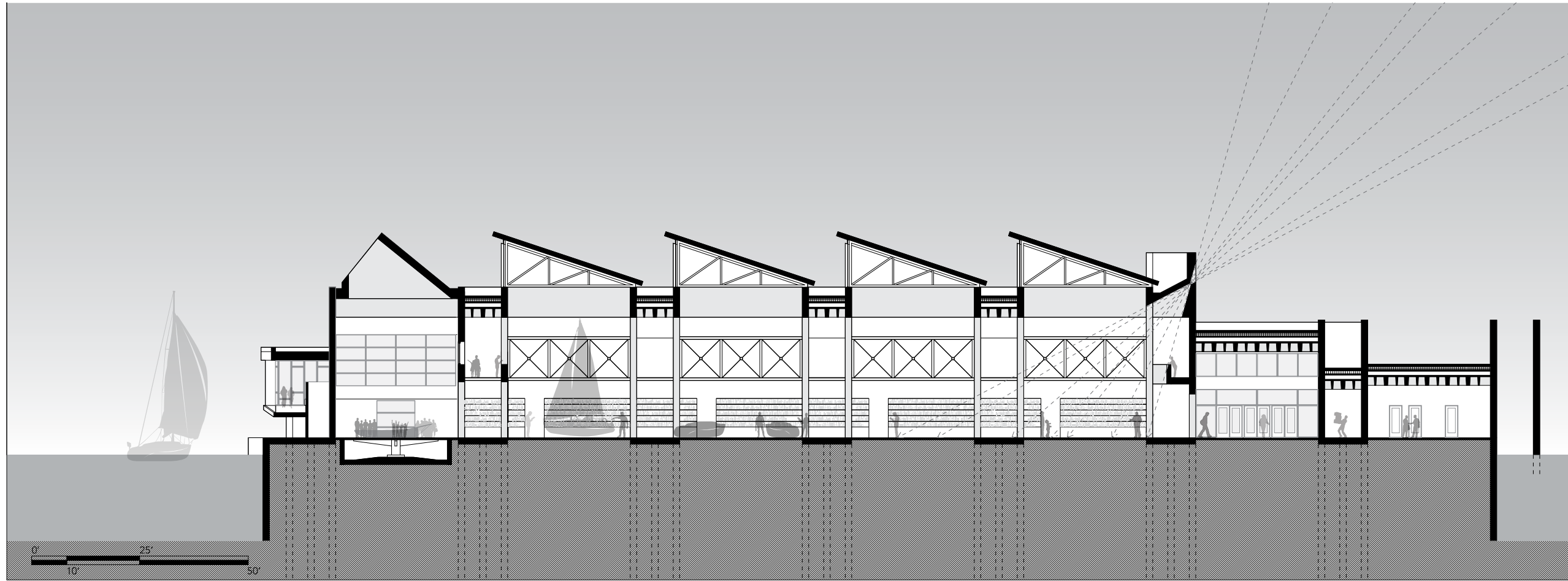






Images
 Top Left, 30a: Transverse Section through Double-Walled Bay of Sailing School
 Left, 30b: Transverse Section through Bay of Sailing School
 Above, 30c: Section and Interior Elevation of Fomalhaut: Autumnal Equinox at Sunrise



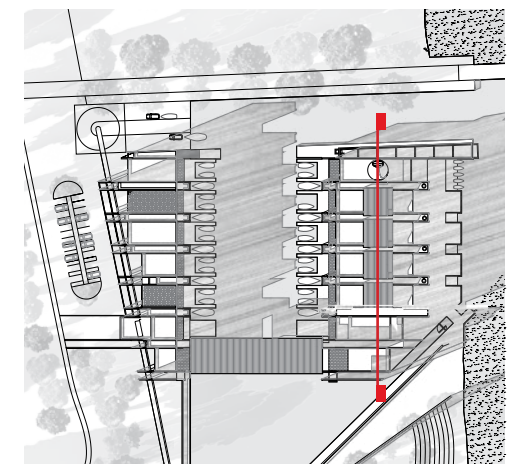


This section cuts through the Great Hall of the sailing school. A small aperture on the south wall (right) allows a focused light into the hall at solar noon everyday. The sunbeam fall on a meridian line in the floor of the hall, tracking the passage of days throughout the year.

The north bay of the school is an auditorium. A large skylight in the ceiling of the auditorium looks to Polaris.

In the great hall of the sailing school, the building accommodates the celestial motions. The ceiling opens up precisely to the sky to engage with the floor. As sailors understand the currents and tides of water beneath the hull and the movements of the stars above the mast, students and visitors to the school find an analogy between the floor and the ceiling and develop greater sensitivity to what is below and what is above.

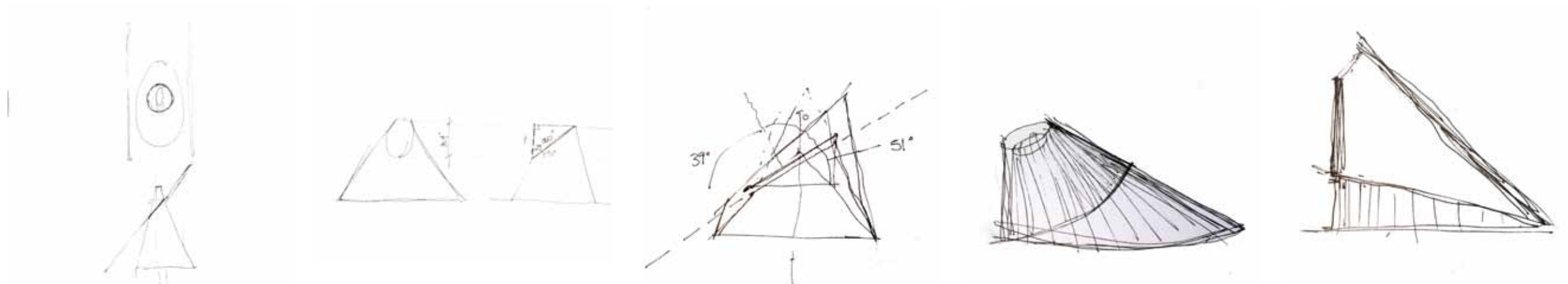
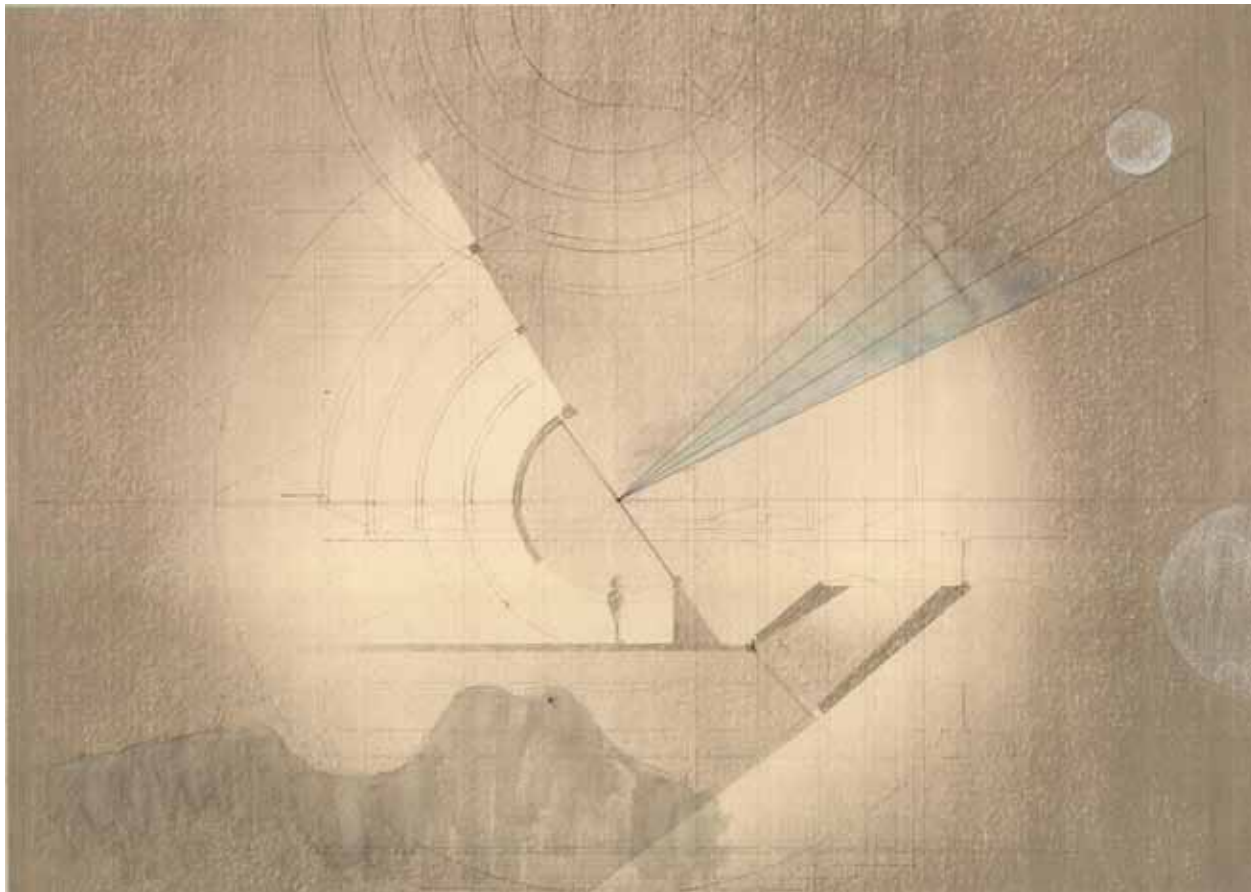
31a Longitudinal Section of Sailing School



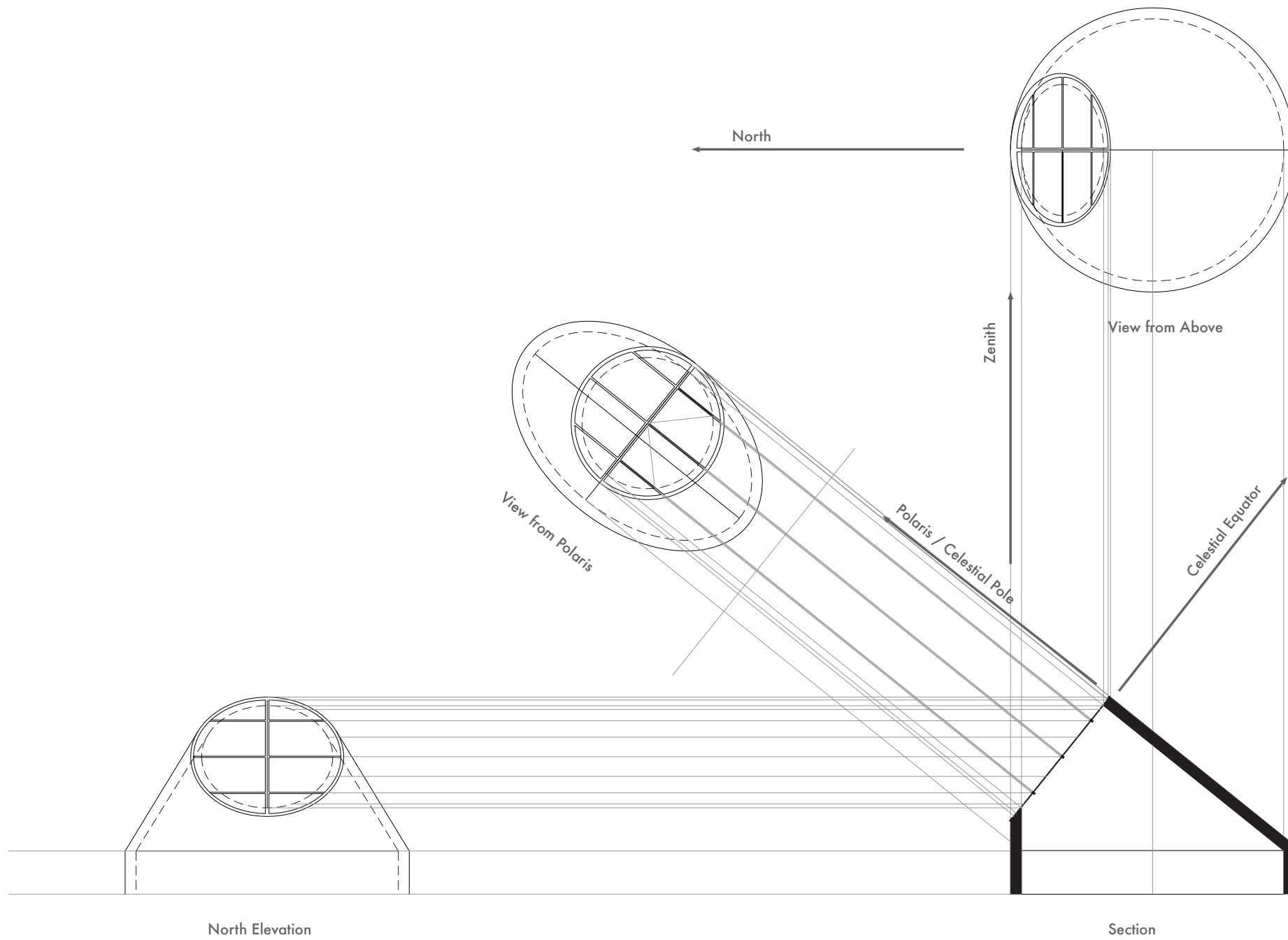
Polaris Skylight

In the auditorium of the sailing school, a large conical skylight tilts toward Polaris, the celestial pole star. In the northern hemisphere, Polaris appears to remain nearly fixed in the sky each night and throughout the year as the rest of the heavens circle around it.

As Polaris is the pivoting point in the sky, a large turntable ceremoniously rotates in the floor below to turn the boats -- constructed in the Great Hall -- toward the river before they are launched.



32a Skylight Development Drawings



Constructing the Skylight

The skylight draws its geometry from a series of astronomical measurements taken at Jones Point. Using descriptive geometry, these measurements describe a cone with two truncated cuts that open a circle in the ceiling of the auditorium as well as a circle to Polaris' sightline.

Images
33a: Diagram of Polaris Skylight



Appendix

IMAGE REFERENCES

All images, drawings, photographs, and text by author unless otherwise noted. Any borrowed image and referenced images comply with the Fair Use Policy of Virginia Tech. All images are used solely for educational purposes only.

- 4a *Aerial View of Jones Point and Lighthouse with Woodrow Wilson Memorial Bridge Looking North*, Library of Congress, Prints & Photographs Division, HAER VA, 30-____, 8--48.
- 5b *The First Boundary Stone*, photograph by Rachael Nease, used with permission.
- 6c *5th Order Fresnel Lens that operated at Jones Point Light*, photograph by Ser Amantio di Nicolao / CC-BY-SA-3.0.
- 6d *Jones Point Lighthouse before its restoration in the late 20th century*, Library of Congress,
- 8b *Va. ship launching of Clemence C. Morse (delivered)*, Library of Congress, Prints & Photographs Division, LC-DIG-npcc-00993 (digital file from original).
- 8c *Va. ship launching of Clemence C. Morse, 1/10/20*, Library of Congress, Prints and Photographs Division, LC-DIG-npcc-00992 (digital file from original).
- 8d *Va. ship launching of E.A. Morse*, Library of Congress, Prints & Photographs Division, LC-DIG-npcc-01000 (digital file from original).
- 8e *Shipways, Virginia Shipbuilding Corp., Feb 14, '19*, Library of Congress, Prints & Photographs Division, LC-DIG-npcc-30744 (digital file from original).

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