Common Ground: A Coast Guard Station in Boston Harbor

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Abstract
This thesis begins with the premise that the natural landscape is not a benign entity, but an active operator in the act of spatial perception and space-making. Founded on this premise, the thesis seeks to develop techniques and propositions for constructing space and infrastructure in the hostile, ever-changing environment of an island shoreline.

To investigate the transformative and evolutionary processes of the alongshore environment, relies not only on a fundamental understanding of the natural processes which shape it, but a reconsidering of the mode through which we conceive our natural surroundings. Accepting the shoreline as a place of change, we then open ourselves to an exploration of the physical, natural environment beyond the picturesque.

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House along the shore in Nantucket, MA.
Introduction

The landscape is not benign. Somehow, we always manage to forget that. Distracted by modern amenities and technologically-centered lifestyles we retreat from the city in order to find piece and quiet in the idyllic landscape of the ocean or the mountains. For many, Nature is a peaceful antithesis to the chaotic and denatured city. The collective, modern perception of nature and the natural landscape as a place of contemplation and beauty is deeply embedded in Western culture. Celebrated in the works of the Transcendentalists and painters of the Hudson River School, the untamed American landscape became the subject of great attention in the 18th and 19th centuries. The wilderness became a place not only of bountiful resources, but of mythology and beauty.

The Island

The island is at once both a mythic and an actual space onto which we project the depths of our imaginations. Thomas Mann’s Utopia imagines an idealized island nation immune to corruption, a present-day Eden. In other instances, the island is a metonym for the untamed, savage forces of nature; a place of imprisonment. In any case, it is a place onto which we project out deepest hopes and fears. Untamed by the forces of the human hand, the shoreline is a dynamic wilderness which constantly reforms and reconstitutes itself, despite efforts to contain it. It continues to change as the sea persists ever inland and onward. As we build closer and closer to the sea, the more vulnerable and ill-equipped our structures become. Eventually the structures are consumed by the epic forces of the sea. The disaster is not that the shoreline moves, but the fact that it is not expected to. The disaster is the perception of the land. The perception is based on traditional models of island formation,
To recognize that the landscape is active gives new imperative to the act of intervening. To intervene in such a site is to understand the forces that shape it. But to build in this dynamic unstable environment means to actually intervene and alter these processes, for better or for worse. The intervention must remain viable and flexible in the kinetic environment. As the use and form of the island changes over time, the structure must be able to adapt to new demands.

Accepting the island as an environment of change, we come closer to appreciating it beyond the surface. Though no longer viewed as a treacherous landscape as it were historically, the shoreline is still a place which demands respect. The idea of the beach as a place for recreation is a fairly new sociological construct. That is not to say, however, that the two views are mutually exclusive. The ocean and the landscape have many personalities; Trascendentalism and the painters of the Hudson River school viewed the landscape and the natural world through a new and innovative lens. Somewhere between these two themes lies the inspiration for and the investigation for this project.
Aerial view of Boston Harbor (BRA)
Massachusetts Bay is a projection of the Atlantic Ocean, which stretches between Gloucester in the north and Marshfield in the south. It encompasses an area of about 50 square miles with roughly 30 islands that dot the inner and outer harbors.

Boston Harbor Islands have played an integral part of the history and development of Boston. A continuously working harbor since the mid 17th century, and the islands have undergone significant physical transformation over the last 300 years. Both human actions and natural forces have caused this change. The dramatic expansion of the Shawmut Peninsula by filling tidal land over the centuries to create what is now the city of Boston. Natural forces significantly erode many of the islands; several have disappeared completely within the past 200 years. Causeways and land bridges now connect many of them to the mainland; others have succumbed to infill in efforts to expand the city.

The use of the islands, from a rendering concern to hospitals, almshouses, reformatories, made them an integral part of the system, but their use slowly declined after World War I. During the last few years, there has been an effort to make the islands accessible to the public through the auspices of the National Park Service.

The Harbor has four distinct chains of islands: the Inner Harbor Islands (the area closest to the city); Quincy Bay Islands; Hingham Bay Islands; and the Outer Harbor Islands (often referred to as the Brewsters). Each group of islands has its own unique morphology and history of use.
Geomorphology

Boston Harbor is part of the Boston Basin, a topographic lowland underlain by sedimentary layers deposited at the end of the Precambrian time. Where bedrock is exposed it is a slate-like formation called Cambridge Argillite which was deposited on the muddy floor of an ocean dating back some 570 million years.

In the past 100,000 years, two separate periods of Pleistocene glaciation formed the hills that cap most islands of Boston Harbor and created the local drainage system, consisting of the Charles, Mystic, and Neponset watersheds. The cores of many harbor islands are drumlins-glacier-formed, asymmetrical, elongate masses of till formed into smooth-sloped hills on the Boston Basin lowlands. In profile, they look like upside-down teaspoons. As the climate warmed and the glacier receded from the Boston area some 15,000 years ago, the melting of glacial ice raised the level of the ocean, eventually creating this section of the basin and isolating the islands.

Drumlins occur as scattered single hills, or in so-called “swarms.” The Boston Harbor Islands are part of the only drumlin swarm in the United States that intersects a coastline. This cluster of about 30 of more than 200 drumlins in the Boston Basin are not all elongate in shape as most other drumlins are (molded in the direction of glacial flow) due to erosion. Geologists believe the islands illustrate two separate periods of glacial action. Many of the islands have more than one drumlin.
Aerial view of Boston Harbor (BRA)
Drumlins, Tombolos and Island Formation

Most of the Harbor Islands contain at least one drumlin. Drumlins are formed of till. They are elongated features that can reach a kilometer or more in length, 500m or so in width and over 50m in height. The Stoss end is the steeper of the two ends and used to face into the ice flow.

The Lee slope is the more gentle slope and becomes lower as you move away from the source of the ice. This means that the highest point will always be at the Stoss end of the drumlin, and the lowest point will be the end of the Lee slope. It is common to find several drumlins grouped together. The collection of drumlins is called a swarm.

There is still some debate about how drumlins are formed, but the most widely accepted idea is that they were formed when the ice became overloaded with sediment. When the competence of the glacier was reduced, material was deposited, in the same way that a river overloaded with sediment deposits the excess material. The glacier may have experienced a reduction in its competence for several reasons, including melting of the ice and changes in velocity.

Drumlin formations are not limited to the harbor, but are distributed extensively across the metro-Boston area. It is the primary topographical unit of the region.
The geomorphological evolution of Nantasket Beach, MA. (Williams, London 1960). Diagrams illustrate the formation of the Nantasket peninsula through the formation of tombolos and spits created from eroding drumlins.
Climate and Site Forces

Pravailing Winds

Island Grain/ Erosive Wind

Glacial Flow
Ferry Routes

Islands Connected to the Mainland

Currents
Boston Harbor. Rainsford Island shown in white.
Rainsford Island, situated between Long and Peddocks Islands, is a small island of 11 acres at mean low tide. In 1737, the area’s quarantine hospital was moved from nearby Spectacle Island to the island’s west end; ironically, the eastern end of the island became a popular summer resort with an inn. However, different and seemingly incompatible, the two facilities co-existed for near 150 years. In 1996, Rainsford became part of the Boston Harbor Islands National Park.

**Site Description**

Rainsford Island, situated between Long and Peddocks Islands, is a small island of 11 acres at mean low tide. In 1737, the area’s quarantine hospital was moved from nearby Spectacle Island to the island’s west end; ironically, the eastern end of the island became a popular summer resort with an inn. However, different and seemingly incompatible, the two facilities co-existed for near 150 years. In 1996, Rainsford became part of the Boston Harbor Islands National Park.

**Topographic Features**

The island is composed of two prominent headlands, the island appears as two islands tenuously connected by a tombolo. The eastern headland is comprised of a 60’ tall drumlin, axially oriented a southeast-northwest axis in the direction of the ancient glacial retreat from which it formed. Composed of bedrock and slate, the western end of the island is relatively flat and rocky. The island is central and relatively secluded, though it is at the same time near the entrance to the main channels of the harbor. In addition to the two headlands, the island has three, clearly defined coves: two small coves facing Quincy and Hingham Bay to the south; and a larger cove facing Long Island to the north. The two smaller coves, due to their orientation, are situated in calmer water and generally protected from the harsh northeast winds. The northern cove, in contrast faces the full erosive force of the wind and waves.
Coves

Drumlins and high points

Tombolo
Spatial and Phenomenological Features

The varied topography of the island creates a variety of spaces and perceptual experiences. To walk across the island from one end, one engages in both the strong horizontality of the tombolo and the vertical ascent of the drumlin.

The Cove

There are three coves on the island: the largest facing the city and the rough waters to the north; and two smaller coves facing Quincy to the south. The intimate, interiorized quality of the cove produces a sense of protection from the elements and a focused view.

The Drumlin

In contrast to the interiorized experience of the coves, the drumlin creates a sense of vastness and vulnerability. From its peak, one has a panoramic view of the ocean to the east and the Boston skyline to the Northwest.

The Tombolo

Situated along the longitudinal axis of the island, the tombolo is a datum between the North and South shorelines. It is also an ephemeral line between the sea and the land.
At mean high tide, the tombolo that connects the two headlands is almost entirely submerged. At low tide, it connects one side of the island. The placement of a sea wall on the east side of the island in efforts to slow erosion has ironically accelerated the rate of erosion on the north side of the tombolo. If the current rate of erosion continues, the tombolo will be completely eroded in a matter of years. Displaced sediment from the tombolo will predictably move to westward, in the direction of the littoral drift. As part of the design criteria, the natural processes of erosion and accretion—along with the determinant location of the sediment—must be considered.

In addition, the investigation of the spatial, visual and psychological qualities that the views and landforms create must be taken into consideration. Views looking towards the city, for example, create a sense of displacement and a point of reference.
Tidal zones/ Degrees of saturation

Material composition

Erosion/ Accretion
Erosion and accretion on Rainsford Island from 1898-1990. The diagram indicates severe erosion on the north side. On the west ends of both headlands, the land is accreting.
Design Process
Site studies/ Scheme s
As an exercise, 20 site models were built in one afternoon. From this exercise, the primary themes and scenarios were developed. The exercise allowed for an open exploration of site planning strategies. The proximity of the coast guard station relative to park facilities were studied, tested and examined. In a few schemes, the tombolo remained as an ephemeral connector between the two parts of the island; in these, the two programs remained autonomous on one of the ends of the island. In other schemes, the area of the shoreline was considered as a potential site. A third approach towards the site—which consolidated both programs onto one side and left the other side as wilderness—was also considered.

After the first exercise, a handful of additional site studies were constructed the next day in order to synthesize the successful parts of each subsequent scheme. As a result, a scheme which allowed for movement between the coast guard and the park through a bridge formed by an interlacing of these two programmatic elements while still allowing some degree of autonomy had evolved.
Sketch
Study model of the chosen scheme. Two lines following the two dominant coves and overlapping over the tombolo. The southern cove—which is comprised of public park facilities, extends out over the lagoon in the form of cabins which serve as breakwaters and groins. Over time, the sediment will drift southward and caught by their perpendicular walls.
Concept diagram illustrating the placement of foundation walls parallel to the direction of the heavy wind and ocean current.
Study model of bridge-pieces. Foundation walls remain parallel to the direction of the heaviest water and wind to allow these elements to pass through with minimum resistance. As the water flows beneath the structure, the sediment is eventually collected by the cabins downstream to form a spit. In time, the spit will become a tombolo, linking the island to a developing island nearby.
From these independent studies, the tectonic and phenomological themes were chosen. Rather than a arbitrary patchwork of differing spaces, uses and experiences, the project is regulated through a system of walls, views and paths which both lay the conceptual, experiential framework of the project as well as a passive strategy for building in the harsh environment of the New England shoreline.

Strung together by a geotextile path that extends from the slately west headland, the cabins extend and construct a new connection between Rainsford Island and a developing island a quarter-mile to the south. As the cabins and the paths move further into the water, the natural processes that continually shape the island are made more visible through the revealing of the architectural infrastructure. As one moves along the path, they are made more vulnerable to the wind and surf by the inherent properties of the seascape, no longer shielded from the island topography or the interiorized space.
The approach to the bridge piece began as a mergance and consolidation of the private coast guard station and the public park facility. The spaces are conceived in varying degrees of publicity and privacy: the most public components of each (restrooms, restaurant, lecture halls, gallery, and swimming pool) are placed in the most dense and common space of over the tombolo. As the two overlap, a new positive interaction between the two constituencies is created.
Final Design Scheme
The final scheme is composed of two lines which stitch together both physically and programmatically over the space of the tombolo. The tectonic and spatial vocabulary of each is differentiated and articulated as one moves towards the terminal points of the system. The system lining the northern cove is inherently different than the system facing the south. By this logic, the system—mostly reserved for the coast guard and the MWR program—is constructed based on a system of concrete caisson-like walls which run parallel to the flow of the wind and the water. Punctures in this line allow these elements to pass through with little to no resistance while framing the landscape and spaces beyond. This system not only allows for passive cooling and flexibility in the inevitable event of significant erosion, but a framework for the way in which one navigates through the space.

The degree of privacy and exposure to the elements increases as one moves away from the center towards the ends of each system. Though immediately adjacent to the public space of the bridgepiece, the territory of the smaller public cabins on the east end of the island are effectively distanced visually and programmatically through the manipulation of paths and the ground plane. The path leading to the cabins splits from the main path to follow the contour of the south cove. As the path diverges, the visitor shifts from the shared space of the park to the private space of the cove. The view focuses on the distant drumlins of Peddocks island to the south, and the cabins shielded from the public path by the tall marsh grasses.
Site Plan

1. Coast Guard Station
2. Coast Guard Dock
3. MWR Suites
4. Common Spaces
5. Park Cabins
6. Information Center
7. Public Dock
8. Park Trail
9. Observation Points
Aerial view of Coast Guard station and park cabins looking eastward
The two program pieces follow the contours of the two major coves on the island. Following the topography, the main path splits into two: one leading to the summit; and one which follows a continual elevation along the shoreline. In effect, two paths offer different experiences: differing views, speeds, duration, sensation and focus are exploited. Though both systems conform to a line-based organization, they follow the convexities and concavities of the island form. In doing so, the structure occasionally wraps back onto itself to create a more focused, interiorized space.

The structural intervention is not limited to the dry land surface. By approaching the island strategy as a continuous field that continues beyond the water’s edge, the project becomes more engaged with the landscape. The use of geotextiles to collect the sediment along the southern cabins can also be used to sculpt the sea floor topography for other recreational activities. As the erosion of the tombolo progresses, a new surf spot for park-goers can develop from the placement of an artificial reef.
First Floor Plan
Scale: 1"=300'

1 CG Control Room
2 CG Conference Room
3 CG Offices/ Administration
4 Helipad
5 Cutter Repair Shed
6 Restrooms
7 MWR Suites
8 Activity Rooms w/ Outdoor rooms
9 Recreation room
10 Changing Rooms
11 Restaurant/ Cafe
12 Swimming Pool
13 Storytelling Room/ Auditorium
14 Auxillery Office
15 Public changing rooms/
Second Floor Plan

Scale: 1"=300'

1 CG Mess Hall
2 CG Kitchen
3 CG Deck
4 CG Lounge

5 Restrooms
6 Berthing Rooms
7 Multi-purpose Room
8 Library
9 Storytelling Room
Sections through site. On opposite page, sections have been taken transversally through tombolo; the north and south coves; and the communal spaces of the bridge. In the distance, the cabins extend from the mainland out into open water.

Above, a section cut along the longitudinal axis reveals the topographical variation between the east and west side of the island. The section below shows the coast guard station in relation to the slate outcropping and the shallow shoreline.
Model, Plan View:
1/32" = 1'-0"
Building Components

- Roof plane
- Steel frame
- Room partitions
- Ground plane
- Concrete channel walls
Model of bridge component looking facing south. Concrete Walls extend full-height from the water into the interior. Partitions and walls function as brise-soleil during the warm season.
Detail of breezeway and channel walls on north elevation of bridge. The northeast winds and heavy surf of the harbor pass through with little impact.
Arriving on the east end of the island, the visitor moves across the flat topography of the marshland towards the bridge.

As one walks along the bridge, views of the city and elements of the landscape are framed by the concrete foundation walls.
The path splits into two: one leads to the recreational area while another which ascends vertically to the level of the west observation point.

As the visitor moves vertically, the vantage point relative to the horizon and the landscape changes from a framed to a panoramic view.
View of Coast Guard station, approaching from the southern path.
Axonometric view of 1/32" = 1'-0" site model.
Axonometric view of $\frac{1}{32}" = 1'-0"$ site model.
Appendix
Shoreline Building Strategies

Seawalls, groins, jetties and other shoreline stabilization structures have had tremendous impacts on our nation’s beaches. Shoreline structures are built to alter the effects of ocean waves, currents and sand movement.
Jetties

Jetties are large, man-made piles of boulders or concrete that are built on either side of a coastal inlet. Whereas groins are built to change the effects of beach erosion, jetties are built so that a channel to the ocean will stay open for navigation purposes. They are also built to prevent rivermouths and streams from meandering naturally.

Jetties completely interrupt or redirect the longshore current. Just as a groin accumulates sand on the updrift side, so do jetties. The major difference is that jetties are usually longer than groins and therefore create larger updrift beaches at the expense of the smaller downdrift beaches.

On East Coast barrier islands like the Harbor Islands, ocean tidal inlets migrate naturally with the longshore current. A jetty system will permanently disrupt the equilibrium of the beach. This may seriously affect the tidal circulation and the health of the wetlands between the barrier islands and the mainland.

Inlets with short jetties must be dredged on a regular basis. A “sand by-passing” system may be built to pump sand around the jetties. The sand pumping may come from within the inlet or from the updrift beach. These methods are expensive and must be maintained indefinitely.
**Groins**

A groin is a shoreline structure that is perpendicular to the beach. It is usually made of large boulders, but it can be made of concrete, steel or wood. It is designed to interrupt and trap the longshore flow of sand. Sand builds up on one side of the groin (updrift accretion) at the expense of the other side (downdrift erosion).

If the current direction is constant all year long, a groin takes sand that would normally be deposited on the downdrift end of the beach. The amount of sand on the beach stays the same. A groin merely transfers erosion from one place to another further down the beach.

**Breakwaters**

A breakwater is a large pile of rocks of a constructed geotextile surface built parallel to the shore. Often referred to as artificial reefs, breakwaters are designed to block the waves and heavy surf.

A breakwater can be offshore, underwater or connected to the land. As with groins and jetties, when the longshore current is interrupted, a breakwater will dramatically change the profile of the beach. Over time, sand will accumulate towards a breakwater. Downdrift sand will erode.
Seawalls

Seawalls are structures built of concrete, wood, steel or boulders that run parallel to the beach at the land/water interface. Though they are designed to protect structures by stopping the natural movement of sand by the waves, the construction of a seawall merely displaces sediment that it is built upon. They also prevent the natural landward migration of an eroding beach.

Seawalls can cause increased erosion in adjacent areas of the beach that do not have seawalls. When it is necessary to build a seawall, it should have a perforated, sloped face to lessen the energy of the incoming waves instead of reflecting it.

Bridges

Bridges are constructed to allow passage over open water or a depression. Spanning over the open water, a bridge connects two sites which were once disconnected. Though the deck of the bridge spans well-overhead, their foundations often play a significant role in the fluvial dynamics of the waterway.
Geotextiles and Artificial Reefs

Geotextiles are essentially matrices which catch sediment in a dense network of open cells. Often used to rehabilitate dunes and marine environments like reefs, Unlike seawalls and groins, geotextile systems are flexible, reversible and more beneficial to the delicate ecosystem of the alongshore environment.
Boston Harbor Islands National Park

In 1996, the harbor became a national park under the auspices of the National Park Service. Easily accessible from the city via ferry service, the islands are accessible via ferry most of the year. There fare several ferry terminal locations on the mainland, including downtown Boston, Hingham (South Shore), and Lynn (North Shore). George’s Island serves as the Park’s central point of arrival and departure; from there, water shuttles take visitors to other islands. Private boats may anchor off-shore.

In general, the average time spent on each island ranges between one hour (on shorter loops) to 6 hours. The visitor has the option to choose to spend the entire day or weekend on one island, or make a series of several shorter trips or visits.

Park activities range from hiking, bird-watching and swimming; to kayaking, wind-surfing and sight-seeing.

Depending on the island location and orientation, the degree of exposure to the elements may vary. In effect, the perception of nature as a picturesque landscape, as seen on Thompson Island varies greatly with the harsh landscape of the outer harbor.
United States Coast Guard

The personnel of the United States Coast Guard range from Full-time personnel (active-duty) to members in the Reserves. Within this, a rank within an official hierarchy ranging from high-officer to patrolman is used to identify status. Depending on one’s rank, involvement and details surrounding their active duty, stay on a base varies from hours to months.

There are three primary constituencies of the Coast Guard:

*Reserves:* Part-time. Two weeks spent on active duty. Reservists spend one weekend a month; or two consecutive weeks on duty for at least four years. Stay in dormitory suites or berthing rooms.

*Active Duty:* A minimum of forty hours a week on active duty. Stay varies on the base and its facilities. Officers are at minimum provided separate sleeping quarters. Full-time personnel in urban areas most often live off campus and commute for the day.

*Auxillery:* Though not part of the military force, members of the auxillery participate in routine search and patrol missions. As public citizens, the auxillery coordinates and supervises educational expeditions and workshops involving the waterway and the general public. Minimal facilities, if any, are needed for the auxillery.
United States Coast Guard

The United States Coast Guard has a complex history: beginning as a humanitarian effort in Boston Harbor, it has evolved into a multimission military service whose purpose is to protect the nation’s ports and waterways, along the coast, on international waters and maritime regions.

The Coast Guard is one of the oldest organizations of the federal government. Though it is at times part of the armed forces, it straddles several uses and identities. In times of peace it operates as part of the Department of Homeland Security. In times of war, the Coast Guard operates under the Navy Department.

Coast Guard Stations have traditionally been sited in locations which allow maximum access and surveillance. Often located along entryways into major ports and harbors, access to the stations are often restricted to military personnel.

As the coast modernizes and assumes more diverse range of responsibilities, the need to rely on visual and physical surveillance is becoming less necessary. Through GPS and radar, the coast guard can patrol the harbor without leaving the control room.

With these new technologies, however, the coast guard grows more distant from its inception. The need to re-familiarize the guard with its physical environment and the people it serves becomes more critical.
MWR Program

Morale, Wellness, and Recreation. The program was created as a division of the Coast Guard to provide members of the Armed Forces with recreational/leisure programs and services. Vital for mental and physical well-being, the activities and services range from the libraries to swimming pools.

Though the MWR program provides services for active duty members, it also serves the broader military community. Active, operational stations are provided private lodging and communal facilities as vacation suites. The suites are rented to other members one of the five forces.

In effect, the coast guard facility must be designed to serve not only as the force’s utilitarian and pragmatic requirements but should also address the recreational needs of its users and faculty.
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