

ABSTRACT

Title of Thesis:

ILLUMINATING PUBLIC SPACES
THROUGH ARTFUL LIGHTING DESIGN:
A RESPONSE TO THE PROPOSED
ELEVATED SEAWALL ON STATEN
ISLAND

Debra Shteinberg, Master of Landscape
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Thesis Directed By:

Professor Jack Sullivan, Department of Plant
Science and Landscape Architecture

This thesis explores the ways in which lighting can be used to create a memorable nocturnal experience that engages users and strengthens connections to their landscapes. Far more than functional, lighting is an art form that can be used to transform the very way we understand and experience our public spaces. Through the lens of lighting design, a redesign of the FDR Beach and Boardwalk is proposed in response to the building of the East Shore Seawall, a large-scale infrastructure project that will threaten the community's ability to engage with this vital open space. Lighting is used to create spaces that allow for entertainment, education, and reflection, which will activate the site, providing legibility, enhance the nighttime experience, and create a sense of identity.

ILLUMINATING PUBLIC SPACES THROUGH ARTFUL LIGHTING DESIGN:
A RESPONSE TO THE PROPOSED ELEVATED SEAWALL ON STATEN ISLAND

by

Debra Shteinberg

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Advisory Committee:

Professor Jack Sullivan, Chair
Dr. Deni Ruggeri
Professor Ronit Eisenbach
Debra Gilmore IALD, MIES

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Chapter 1 : Introduction

“Lighting affects everything it falls upon. How you see what you see, how you feel about it, and how you hear what you are hearing” (Rosenthal & Werternbaker, 1972). This quote by theatrical lighting design pioneer Jean Rosenthal, emphasizes the powerful impact that lighting has on every aspect of everyday life. From the moment we wake up in the morning until we go to bed at night, we are interacting with light, whether it is natural or man-made. Applying this idea to public spaces suggests that lighting design plays a crucial role in shaping our experience and understanding of the environment we are interacting with. We rely on light not only to see but to understand our surroundings. Visual perception accounts for almost 80% of *all* sensory perception, making light the element with the most significant influence over how we understand a space and ultimately engage with the world around us (Ahn, 2019).

Yet when designing landscapes, lighting is often taken for granted, and its potential impact on the overall design is overlooked. Many times, lighting is an afterthought, added only for safety, security, and utility, rather than what it could be, which is art. This is the case with the site explored in this thesis, the FDR Beach and Boardwalk in the New York City borough of Staten Island. A crucial public space in my own neighborhood, the site offered my family and I respite from the strain of the COVID-19 lockdown during the day. But as the sun went down, the space became uncomfortable, unsafe, and therefore unusable at night. This experience is what led me to contemplate the guiding question of this thesis: How can lighting be used to

create a memorable nocturnal experience that engages users and strengthens connections to their landscapes?

In answering this question, I will establish the importance of lighting by first examining its use throughout history and its impact on human culture. Next, I will explore lighting's ability to engage people's emotions and perceptions through the lens of light art and identify artists, past and present, who have used light to transform spaces and create sensory experiences. I will also emphasize the how lighting activates public spaces by discussing the ways in which it can be used to provide legibility, orientation, and wayfinding within a space, how it enhances the nighttime experience, and how it creates a sense of identity within a community.

After a review of this existing literature, an exploration and reflection of precedent lighting projects will be introduced. Incorporated into the analysis of precedent studies is a lighting typology framework that has been developed to aid in identification and organization of distinct characteristics found among existing lighting projects. I will then use this framework alongside a detailed site inventory and analysis, including the context, history, existing, and future conditions of the project site, to inform my own design process.

The redesign on the FDR Beach and Boardwalk uses lighting to create a memorable nocturnal experience that engages users and strengthens connections to their landscapes: those existing, those endangered, and those lost. This is done through lighting techniques that allow for entertainment, education, and reflection throughout the project site.

Chapter 2 : The History and Cultural Significance of Lighting

Mastering Light

Light has long played a significant role in the development of human culture. The glow of the night sky, from the stars to the moon, experienced by our ancestors has inspired everything from science, religion, philosophy, art, and literature (International Dark Sky Association, n.d.). The history of manufactured lighting, however, begins with the discovery and mastery of fire. One of the first inventions of mankind, manufactured light signaled a turning point in human history, changing the way people lived and shaping the course of civilization (Cohen, 2018). Not only did controlling fire allow our ancestors to stay warm, cook food, live in harsher climates, and see in the dark, but it also had social impacts, encouraging people to gather in groups and stay up later (Ibid.). Once reliant on the sun and stars as a primary source of illumination, humans now had the ability to create light on demand.

Research shows that some of the earliest evidence of the controlled use of fire has been discovered at Gesher Benot Ya'agov in Israel, showing traces of burned seeds, wood, and flint, from nearly 790,000 years ago (Goren-Inbar et al., 2004). Some studies push this timing back by 300,000 years, citing microscopic traces of wood ash alongside animal bones and stone tools found in a layer dated to one million years ago at the Wonderwerk Cave in South Africa (Berna et al., 2012).

As humans evolved, so did the need for improvement in artificial lighting (Yglesias, 2014). Fire was made portable for the first time with the invention of fat-burning lamps by Ice Age humans in Europe some 40,000 years ago (de Beaune &

White, 1993). The initial lamp was created using a non-flammable object, such as a shell or hollow rock, which was filled with a combustible substance like dried grass or wood and coated with animal fat as a means of ignition (Brox, 2010). Over time there were gradual improvements in the design with turned-over lips on terra cotta cups to prevent spills, cloth placed within wick channels to keep flames steady, and enclosed reservoirs to protect the oil and provide safety (Ibid.).

Ancient Romans are credited with the creation of the wicked candle around 500 BCE (Baker et al., n.d.; Brox, 2010; National Candle Association, 2020). Rolled papyrus was dipped repeatedly in melted tallow or animal fat, and the resulting candles were used to light homes, aid travelers in the dark, and conduct religious ceremonies (National Candle Association, 2020). It wasn't until the 1500s that beeswax was introduced as an alternative to tallow (Baker et al. n.d). These candles burned brighter, longer, and more consistently than any other before them (Brox, 2010). However, beeswax was rare and costly, meaning it could only be used by the wealthy upper classes and the Roman Catholic Church (Baker et al., n.d; Brox, 2010).

Extending the Night

With each innovation in artificial lighting came a new way to experience the dark. Prior to the 17th century, public outdoor lighting was essentially nonexistent (Brox, 2010). This created a vastly different urban environment from what we have come to know today. During the day, cities bustled with activity, with people conducting trade, working, and socializing in the open spaces (Ibid.). However, as soon as the sun went down, the streets of these cities, towns, and villages became dark, quiet, and dangerous. In fact, movement after dark was strictly regulated by

authorities. In the early Middle Ages curfew bells would sound soon after dark, forcing people to retire to their homes early in the evening and lock themselves in for the night (Ibid.).

As cities grew and commerce increased, lighting allowed daily life to extend later into the night. By the late 1600s, authorities in European and American cities began to require households to hang lamps or place candles on their street-facing window sills (Brox, 2010). Although these early light sources were prone to flickering and provided only a dim light, easily extinguished by wind or rain, they marked the start of a new relationship with the dark (Ibid.)

The night grew livelier as more dependable lighting methods were invented. Oil lamps were introduced in the West in 1783, gas lamps in 1792, and coal lamps in 1804 (Yglesias, 2014). In the 1700s, places like London, Paris, New York, Turin, Copenhagen, and Amsterdam introduced stationary street lighting, replacing residents' lamps with citywide lighting (Brox, 2010). By the 19th century, lighting not only extended the hours of the day into the night, but seemed to have "created life out of absence" (Ibid. p.75). It was then that the word "night," once associated with darkness and fear, transformed into "nightlife" (Ibid. p.75).

Electricity signaled a significant breakthrough in artificial lighting (Yglesias, 2014). The first electric carbon arc lamp was introduced by Sir Humphrey Davy in 1801 and experimentation with electricity by Michael Faraday in 1831 led to the development of the electric lightbulb (Ibid.). Gaslight, which in and of itself greatly altered the way people were able to interact with their surroundings in the night, was slowly being replaced by electric lighting by the end of the 19th century (Holden,

1992). Thomas Edison installed the first electric street lamps in Menlo Park, New Jersey, in 1879 (Ygelsias, 2014).

Electric lighting, a technological marvel at this point in time, captivated the public with its endless opportunities for nighttime innovation. This fascination came to a head at the 1893 World's Fair in Chicago. Also known as the Columbian Exposition, the Fair was a showcase of industrial progress and a symbol of modernity (Holden, 1992). 100,000 incandescent lamps illuminated what came to be called the 'White City,' illuminating the Exposition's neoclassical buildings, fairgrounds, and exhibits (Johnson, 2013). Attendees were astonished by the dazzling white bulbs that defined the fair's after dark experience. Stated best by Holden in *Lighting the Night: Technology, Urban Life and the Evolution of Street lighting*, "Electric lighting became America's collective vision for its future" (Holden, 1992, p. 58).

As the use of electric lighting became more widespread in cities across the world, the light it emitted continued to get brighter and brighter. New light sources were introduced including low-pressure sodium (LPS), high-pressure sodium (HPS), metal halide, and more recently light emitting diodes (LEDs) (International Dark Sky Association, n.d.). The primary concern surrounding public lighting was safety and security (Schwendinger et al., 2015). Darkness elicits a primal fear in human beings, making it no surprise that we would attempt to use light to cast away shadows and mitigate anxieties about the unknown (Petresin, 2015). But this has led people to incessantly associate an increase in lighting with an increase in safety, which is not only incorrect, but has had severe consequences on the health and wellbeing of the

environment and life on earth (International Dark Sky Association, n.d.; Schwendinger et al., 2015).

It is true that places that are lit at night will be safer than those that are left dark (Schwendinger et al., 2015). However, there is no clear scientific evidence that increased outdoor lighting improves safety and deters crime, even if it may feel that way (International Dark Sky Association, n.d). As the International Dark Sky Association summarizes, a 2011 study on London street lighting showed no evidence that crime was reduced by the amount of lighting in the area observed (Ibid.). Similarly, a 2015 study on street lighting across England and Wales found that lighting, whether dimmed, substituted, or completely off, had no impact on crime or accident prevention (Ibid.). In fact, too much light can make spaces *more* dangerous as it can reduce the eyes ability to adapt to darkness (Schwendinger et al., 2015).

Overdependence on lighting has led to the significant light pollution we see today (International Dark Sky Association, n.d.). According to the International Dark Sky Association (IDA), there are four main components to light pollution: Glare, skyglow, light trespass, and clutter. Glare refers to the excessive brightness of a light source that causes visual discomfort (Ibid). Skyglow is the overall brightening of the night sky over inhabited areas (Ibid.). Light trespass refers to light that spills where it is neither intended nor needed (Ibid). Clutter is the amalgamation of bright light sources grouped together, causing confusion and discomfort (Ibid.).

Light pollution has many negative impacts on human beings, wildlife, and the planet (NYIDA, n.d.). This includes the disruption of natural patterns of plants and animals who rely on cycles of light and dark for reproduction, nourishment, sleep,

and protection from predators (International Dark Sky Association, n.d.). Light also alters the nocturnal patterns of humans. Exposure to light, particularly to blue light, commonly used in outdoor LEDs, disturbs our circadian rhythm causing interruptions in sleep and leading to health problems (International Dark Sky Association, n.d.; Harvard Health Publishing, 2020). Excessive light is also a waste of energy adding to an increased output of greenhouse gasses like carbon dioxide (International Dark Sky Association, n.d.). Due to light pollution we are also losing our ability to experience the wonders of the night sky (Ibid.). In many urban and suburban areas, the twinkling stars that once guided and inspired our ancestors are nowhere to be seen.

However, this does not mean we cannot use lighting to create beautiful, active, and safe public spaces. To do so, we must take into consideration a balance between light and darkness. As recommended by the Illuminating Engineering Society and the International Dark Sky Association, when lighting outdoor spaces, we must make sure that the light we use is useful, targeted, low, controlled, and an ideal



Figure 2.1. Recommendations for Responsible Outdoor Lighting (International Dark Sky Association, n.d.)

color (Figure 2.1). This way we can design spaces that allow us to reap all the benefits that lighting has to offer, rather than battle its constraints.

Spirituality & Tradition

After thousands of years, light has remained a valuable cultural symbol. This is evidenced by its significant role in human spirituality, cultural expression, religious tradition, and celebration around the world (Rhys, 2021).

For some cultures light is a sign of wisdom and divinity. For example, one of the main religious festivals in Hinduism is Diwali, or the Festival of Lights, celebrating the spiritual "victory of light over darkness, good over evil, and knowledge over ignorance" (Asian American & Pacific Islander Cultural Center, n.d.). During this celebration, people will light candles and diyas, or small decorative clay lamps filled with oil, and place them around the home and outdoors to symbolize themes of the festival and invite prosperity, blessing, and peace (Ibid.).

In other religious traditions, light is associated with the idea of enlightenment and spiritual awakening. In Buddhism, the lighting of lamps or candles is a common form of offering performed during religious ceremonies. The act of offering light symbolizes the removal of ignorance and, therefore, the attainment of wisdom (Rinpoche, 2016). In Christianity, the phrase "light of the world" refers to Jesus, who is seen as a source of spiritual guidance and truth (Achtemeier, 1963). Believers are also referred to by Jesus as "the light of the world," as it becomes their duty to spread said wisdom and bring guidance to a world that is often shrouded in darkness (Ibid.).

For other cultures, light is a sign of hope and renewal. In Judaism, Hanukkah, also known as the Festival of Lights, is celebrated by lighting the menorah for eight

days, an action representing the miracle of the oil that burned for eight days during the rededication of the Second Temple of Jerusalem (Zeitlin, 1938). Commemorating this rededication of the Temple by the Maccabees in the 2nd century BCE, the holiday is an opportunity for reflection serves as a reminder of the triumph of light over darkness, freedom over oppression, and perseverance (Ibid.). In Chinese culture, the Lantern Festival celebrates family and gathering during the Lunar New Year (Huang, 1991). In this tradition dating back thousands of years to the Han Dynasty, people light beautifully decorated hanging, floating, and flying lanterns that symbolize new beginnings, happiness, and hope (Ibid.).

Chapter 3 : Engaging Perceptions and Emotions

Lighting has long played an integral role in art, being used as a powerful tool for engaging human emotions and challenging perceptions (Jackson, 2015). From the sky and the flame to the electric lamp and the camera, artists have used lighting to create atmospheres impacts how people both view and experience their work (Ibid). Artists have manipulated light historically, as a subject, and more recently as a medium, as a way to bring depth, detail, and dimension into their pieces (Hakimi & Knop, 2020).

The Perception of Light

Light acts as a driver of cognitive, emotional, and behavioral responses by the perceiver in different experiential contexts of everyday life (Tomassoni et al., 2015). Through its intensity, color, and direction, light can influence the perceiver's mood and, in turn, their physical state. Light can offer feelings of relaxation, clarity, privacy, excitement, and productivity, but at the same time has the ability to induce stress, sleepiness, sadness, restlessness, and anxiety (Ibid.). These psychophysiological responses are dependent on the exposure to the extremes of a light source, for example, whether light is bright or dim, central or perimeter, uniform, or non-uniform, warm or cool (Ibid.).

Humans do not see light but rather by way of light (Moyer, 2005; Tomassoni, et al., 2015). What the eye sees are images of brightness, or the amount of light perceived to be reflected off the surface of an object (Moyer, 2005). As light enters the eye it strikes the retina, a layer of light-sensitive cells along the back wall of the

eye. The retina has two types of photoreceptors: cones, which are high-light-level receptors, and rods, which are low-light-level receptors (Ibid.). These general photochemical reactions travel along the optic nerve to the brain, which collects these signals and translates them into images. A light-reflective object may appear to emit light of its own, but as explained by Tomassoni et al. (2015), the human eye is not able to distinguish between the reflection of an object and its real light emanation. It only receives the final result, the intensity of light perceived within the visual field by the individual. There are three factors that influence the amount of light that an object will reflect: color, texture, and finish (Moyer, 2005). Light colors reflect more than dark colors, smooth textures reflect more than rough surfaces, and shiny surfaces reflect more than matte surfaces.

This perceived brightness is also dependent on the brightness of the surrounding area and how they contrast (Moyer, 2005). Research shows that when moving from a brightly lit space into a dark space it takes approximately 20 to 30 minutes for a person to fully adapt to their new environment (Ibid.). This process is quicker when shifting from low to high light levels, requiring anywhere between seven to twelve minutes for full adaptation. Artists can and have taken advantage of the eye's ability to adapt to its surroundings and used lighting to elicit emotional and perceptual responses (Rahimi & Steen, 2020).

Light as an Art Medium

'Light art' is an art form in which the main medium of expression is light (Birgisdottir, 2019.). What is interesting about this form is that focus is not necessarily placed on *what* is being illuminated, but *how* this illumination is

impacting a space (Rahimi & Steen, 2020). Artists attempt to challenge the boundaries of a space, making impressions on viewers that alter their experiences both visually and sensationally, through the manipulation of light, color, and shadow (Ibid.). This has been the goal of light artists like Dan Flavin, who in the late 20th century popularized the idea of immersive, site-specific installations that invited people to explore their own sensory perceptions (Ibid.). While many of the following examples of light artists don't necessarily create installations for the landscape, they represent my own exploration of how light has been used historically and today as a medium of art that transforms spaces.

The Pioneers of Light Art

A key figure in establishing a history of light art is Danish-born inventor and musician Thomas Wilfred (1889-1968). After years of experimenting with light as an artistic medium, in 1921 Wilfred invented his own color organ, calling it the clavilux, from the Latin clavi (key) and lux (light), thus “light played by key” (Snow & Zycherman, 2018). By doing so, Wilfred invented a new art form that fused modern art and technology (Smithsonian American Art Museum, 2017). This series of works, which Wilfred referred to collectively as “Lumia”, consisted of reflective mirrors, hand-painted glass discs, and bent pieces of metal all set in a screened wooden cabinet to manipulate beams of light



Figure 3.1. Thomas Wilfred's Lumia, Unit #86. Metal, glass, electrical and lighting elements, and an illustration-board screen in a wood cabinet. Photo: Smithsonian American Art Museum (Wilfred, 1930)

produced by a series of lamps and lenses (Silverthorne, 2018). In this machine, a series of changing colors danced against a black background to create what the Smithsonian describes as “an aurora borealis over the night sky” (Smithsonian American Art Museum, 2017.). As Snow and Zycherman (2018), explain in their publication, *Conserving Thomas Wilfred’s Lumia Suite*, to the seven traditional arts, painting, sculpture, literature, architecture, theater, film, and music, Wilfred added a new, eighth medium: light. Light was not *in* his art, light *was* his art.

One of the first object-based light sculptures was made by Laszlo Moholy-Nagy (1895 - 1946), a painter, photographer, and professor at the Bauhaus school (Harvard Art Museums, 2023). Years of experimentation at the Bauhaus led to the piece, “Light Prop for an Electric Stage” (1930), with which Moholy-Nagy explored the use of technology, materiality, and light (Ibid.). The goal of Moholy-Nagy’s work centered around revolutionizing human perception and emphasizing to viewers the wonders of the modern technological world (Ibid.). “Light

Prop,” powered by an electric motor, consisted of a rotating device that projected light through a series of moving perforated disks, casting light and shadow on the surrounding environment, and creating an ever-changing colored light show (Guggenheim, 2016). With this piece, Moholy-Nagy captured the dynamic interplay of light and shadow (Ibid.).



Figure 3.2. László Moholy-Nagy, *Light Prop for an Electric Stage* Aluminum, steel, nickel-plated brass, other metals, plastic, wood, and electric motor. Photo: Harvard Art Museums (Moholy-Nagy, 1930)

From the Dada, Constructivist, and later the Kinetic Art movements of Moholy-Nagy's time stemmed the Minimalism movement, where we begin to see the rise of renowned light artists such as the late Dan Flavin in the 60s. Flavin used light's inherent radiance to blur the contrast between objects and their surroundings, often using fluorescent tubes as his sculptural element (Artsy Institutions, 2015; Birgisdottir, 2019). In the 1970s, leaders of the Light and Space Art Movement such as Robert Irwin and James Turrell explored the relationship between light and space, using unconventional materials and geometric patterns to activate and engage viewer perception and participation (MasterClass, 2021). In the early 70s the movement was expanded following the exhibition of work by a group of LA based light artists, including Peter Alexander, Larry Bell, Robert Irwin, and Craig Kauffman and further reinforced by the works of Mary Corse, Frederick Eversley, Helen Pashgian, De Wain Valentine (MasterClass, 2021; Wallace, 2014). Work during the movement ranged from site-specific installations projecting radiant neon light off a wall, to tubular glowing columns placed in a darkened room (Ibid.). Reflectivity was a common theme that was explored and materials like glass, resin, and acrylic were often used to emphasize this quality of light. The artists emphasized to viewers how light reflects off of, passes through, and bends around these common objects (Ibid.).

The work created during the Light and Space Movement of the 1970s had an influence on contemporary artists around the world and were the precursor to the merger between light and technology that we see today (Wallace, 2014). These

contemporary artists include Icelandic–Danish sculptor Olafur Eliason, Chilean artist Ivan Navarro, and American neo-conceptual artist Jenny Holzer (Birgisdottir, 2019).

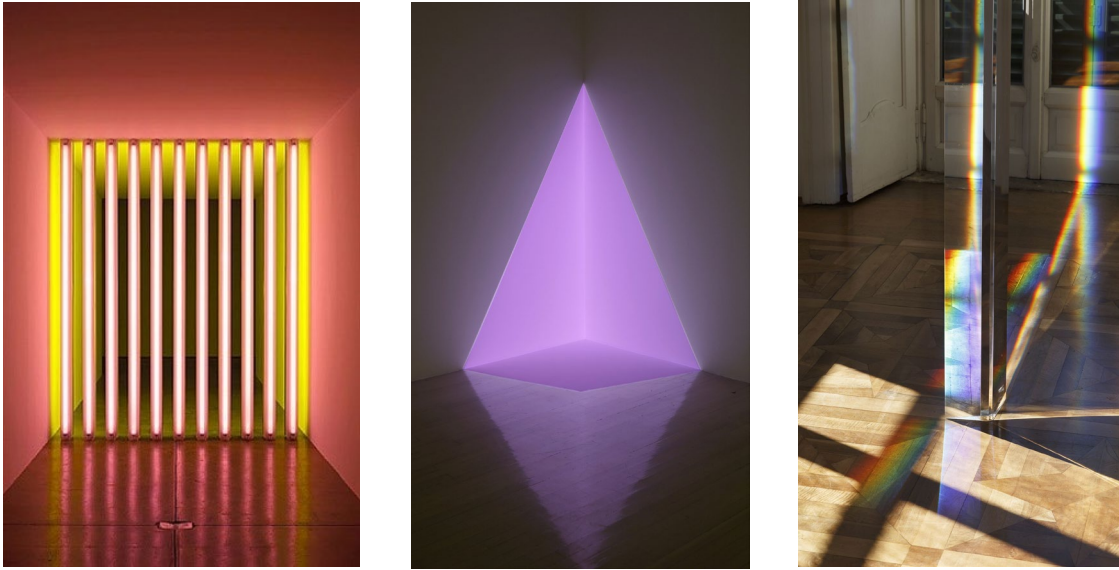


Figure 3.3.

Left: Dan Flavin, Untitled. Photo: Paula Cooper Gallery. (Flavin, 1972 – 1975)

Middle: James Turrell, Alta (Pink). Photo: Kerry Ryan McFate, Pace Gallery (Turrell, 1968)

Right: Robert Irwin, Untitled. Photo: Spruth Magers Gallery (Irwin, 2011)

A relatively recent innovation in light art is the use of light-emitting diodes or LEDs (Jamison, 2022). LEDs did not appear in electrical lighting application until 1962 when the red LED was developed, the first on the visible light spectrum (ES Lighting, 2019). However, these early LEDs were weak and inefficient and their power had not yet been realized by artists. Gradually, scientists were able to create semiconductor diodes across the entire color spectrum (Ibid). Experimenting with substrate materials, they produced bright green, orange-red, orange, and yellow LEDs by the early 1990s and in 1994 developed the ultra-bright blue LEDs that served as the foundation for today's commercial LEDs (Jamison, 2022).

As LED lighting became more commonplace, it found widespread application in art galleries, where it was used to illuminate the artworks held within, and later act as the artwork itself (Hakimi & Knop, 2020). With the boom of LEDs and the exponential growth of digital technology in the 21st century, light art and tech have become inherently intertwined and the ways in which light art can be experienced have been revolutionized. Light artists today are using these new technologies, from coding to AI, to their advantage, creating pieces that promote interactive, immersive, data-driven experiences, challenging the perception of the viewer and encouraging participation, just as the artists before them had aimed to do. These include New York based light artist Leo Villareal, new media artist Maja Petric, contemporary artist Jim Campbell, and Japanese collective of artists, programmers, and engineers teamLab (Birgisdottir, 2019).

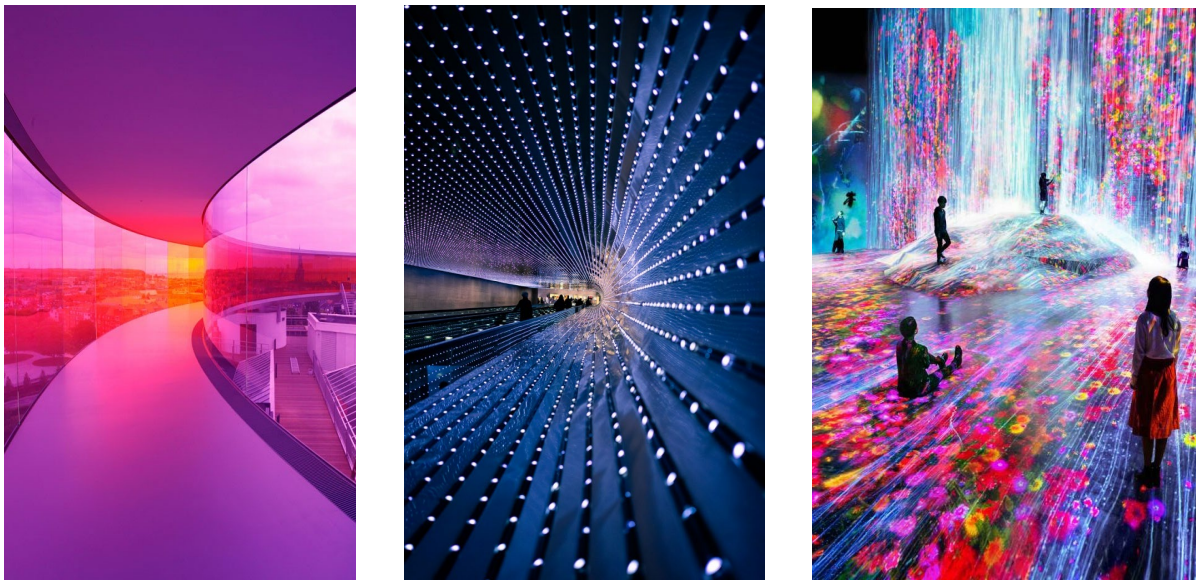


Figure 3.4.

Left: Olafur Eliasson, Your Rainbow Panorama, Aarhus Museum. Photo: Studio Olafur Eliasson (Eliasson, 2011)

Middle: Leo Villareal, Multiverse, National Gallery of Art. Photo: Angela B. Pan (Villareal, 2008)

Right: teamLab, Universe of Water Particles on a Rock Where People Gather. (teamLab, 2018)

Chapter 4 : Activating Public Spaces

Lighting activates public spaces at night. From city centers to neighborhood streets, lighting is the very element that allows us to engage with these spaces beyond daylight hours and experience meaningful interactions within them (Davoudian & Kelly, 2019; Jackson, 2015).

Perhaps most obviously, lighting improves the visibility of a space, helping increase feelings of safety and security (Davoudian & Kelly, 2019; Moyer, 2005; Schwendinger et al., 2015). But oftentimes, this is the *only* purpose of lighting in our landscapes. Traditionally, public spaces have been planned around the daytime experience, meaning the impact of illumination on these places has become simply an afterthought, with lighting added only for its utilitarian use (Schwendinger et al., 2015).

But lighting *can* and *should* be used for much more than just its functional abilities. Beautiful, artful, and purposeful lighting can engage public spaces by providing legibility, aiding in wayfinding, enhancing the night-time experience, and creating a sense of identity (Jackson, 2015; MK Illumination, 2019; Project for Public Spaces, 2008; Schwendinger et al., 2015)

Providing Legibility, Orientation, & Wayfinding

As light patterns change in a space, a person's reaction will change along with it (Tomassoni et al., 2015). This response is a result of the sensitivity of both the eyes and the brain to light. The brain is constantly organizing information arriving through the eyes in an attempt to produce order and meaning from the assortment of sensory

data received in order to translate these stimuli into valuable information about our surroundings, such as shape, size, texture, depth, motion, and position (Ackerman, 1992; Moyer, 2005). Even in low-light conditions, the brain can construct a compositional layout thanks to a memory capability that stores information about previous experiences, allowing people to interpret objects familiar to them. As lighting designer Janet Moyer (2005) explains, in the dark, the eye is not able to distinguish color very easily, but thanks to a phenomenon called color constancy, the brain can remember that a brick wall is red and that grass is green, helping people maintain a consistent perception of their surroundings. In this way, light acts as a “cognitive map,” helping make sense of unknown environments and aiding in orientation and daily wayfinding (Tomassoni et al., 2015).

Kaplan & Kaplan’s (1989) research in environmental cognition provides insight into why this is important and demonstrates the need for good lighting practice in strengthening people’s relationships with their landscapes. These researchers sought to understand the factors that drive people’s preference for their environments. They found that people prefer environments that are legible and coherent, but provide enough excitement so as to not become dull (Wilson-Doenges, 2017). At the same time, people want to be engaged, in environments that encourage exploration and provide complexity, but not to the point that they become overwhelming (Ibid.). When people are exposed to a new environment, they tend to cognitively try and find a match in their memory that fits these new surroundings (Wilson-Doenges, 2017; Tomassoni, et al. 2015). An understanding of the psychology behind visual perception in the field of environmental cognition provides

a basic framework for lighting designers and landscape architects as they design spaces for different purposes.

Outdoor lighting helps improve this perception and legibility of outdoor spaces at night (Davoudian & Kelly, 2019). By improving visibility in the dark, it allows users to orient themselves in the landscape. But when utilitarian factors are the only ones being considered, lighting can have the opposite effect on legibility of a space. Often too bright for the sake of improving “safety”, this type of lighting creates new and confusing visual conditions, causing defamiliarization within a space and resulting in general discomfort (Ibid). Good lighting, however, helps people navigate their surroundings. Illuminating elements like pathways, benches, signs create new landmarks and focal points on a site, not only help guide people through a space, but draw them to a destination.

Enhancing the Nighttime Experience

The way we experience our environment changes at night (Davoudian & Kelly, 2019; Schwendinger et al., 2015). Darkness alters what and how we see the world around us. Given this, lighting becomes a powerful tool that can emphasize and encourage exploration of this new landscape. As stated in the report *Cities Alive: Rethinking the Shades of Night*, “The impression of a place is created through what is illuminated” (Schwendinger et al., 2015, p. 23). By highlighting certain aspects of a landscape at night, while hiding others, lighting allows for an entirely new atmosphere to take shape (Moyer, 2005). This allows people to perceive and interact with their surroundings in ways that are distinct from the daytime.



Figure 4.1. Colorful Fountains at Granary Square. Photo: John Sturrock (Townshend Landscape Architects, 2012)

In *Urban Lighting for People: Evidence-Based Lighting Design for the Built Environment* (2019), lighting designer Isabel Kelly and lighting researcher Dr. Navaz Davoudian, discuss a case study in which they observed the way lighting affected how people used London's Granary Square before and after nightfall. From these observations, the researchers found that during the day the Square was used for a variety of activities, from sitting and laying to walking and biking (Figure 4.2). However, the space was populated primarily by people engaging in *necessary* activities, such as their daily commute. Based on activity maps provided by the researchers, it appears as though one of the primary functions of the site during daylight hours was the facilitation of movement (Ibid.).

This wide range of activities extended into the night, however, the purpose and patterns of use changed as the sun went down (Davoudian & Kelly, 2019). At 9:30 pm, four recessed banks of fountains located in the center of the square turned

on. More than 1,000 jets, illuminated by vibrant LED lights animated the nightscape. Engagement with the site changed from necessary activities to leisure, recreation, relaxation, and even sightseeing, or *optional* activities (Figure 4.3). Even the pace at which people walked through the site noticeably slowed (Ibid.). While the number of occupants in the square decreased as it got later, activities continued late into the night. The atmosphere was energized by the illuminated square. Lighting also activated spaces that were underutilized during the day. For example, the seating area beneath the trees on the west side of the Square became a popular destination at night, with people sitting or socializing for prolonged periods of time (Ibid.).

Through this study, Kelly and Davoudian determined that lighting design is critical in determining how people engage with public spaces at night. They state:

Nighttime design and lighting can make a public space more accessible, attractive and sociable by night, while adding to the positive daytime reputation and image of that public space. Vibrant, decorative, interactive forms of lighting promote activity for longer periods after dark. (pg. 96)



Figure 4.2. Granary Square Activity Map: Daylight Conditions (7:30 - 9:30 pm, July 26 & 27, 2016) (Davoudian & Kelly, 2019, p.100).



Figure 4.3. Granary Square Activity Map: Nighttime Conditions (9:30 - 1:30 pm, July 26 & 27, 2016) (Davoudian & Kelly, 2019 p. 101)

Naturally, the warmer summer and spring seasons allow for more activity in public spaces. But what happens in the winter, when the days get colder and the nights become longer? Well, these conditions offer the perfect opportunity to incorporate fun, artful, immersive, and interactive lighting into a space. In Granary Square’s open plaza for example, temporary lighting installations are introduced around the holiday season as tools for public engagement, encouraging interaction and socialization in outdoor spaces that would otherwise sit desolate for months at a time. From abstract Christmas trees to glowing arches (Figure 4.4), dynamic installations in the Square define its vibrant atmosphere. They become key landmarks, bright “beacons of light” that draw visitors deeper into the space (Studio Mieke Meijer, 2020).

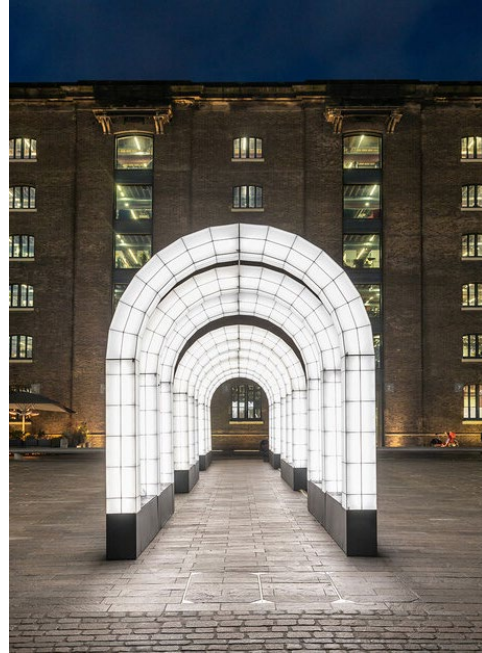
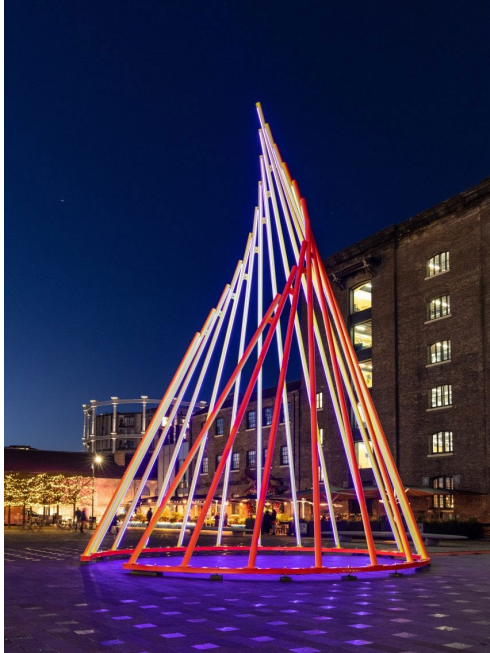


Figure 4.4.

Left: 'Temenos' by Liliane Lijn in Granary Square (Lijn, 2021)

Right: 'Space Frames' by Studio Mieke Meijer in Granary Square (Studio Mieke Meijer, 2020)

Temporary Installations

This ephemeral quality of light installations offers another opportunity for the engagement of public spaces. Illumination does not have to be permanent to be effective. As evidenced by the work of light artists discussed in Chapter 3, temporary installations are a powerful way to transform spaces, to engage perceptions and emotions, and to use light as an art medium (Schwendinger et al., 2015).

Temporary installations introduce art into a community, peak seasonal or even event specific interest, and offer opportunities for local artists to get involved (Douglas, 2001). In public spaces, they become “exhibits without walls,” acting as galleries right there in the neighborhood (Ibid., p. 63). Because they are temporary, these installations may not be limited by restrictions of permanent infrastructure that must consider practicality in the long run. Constantly changing, public light art

installations have the opportunity to tell a myriad of stories, make statements on contemporary issues, and teach a variety of lessons.

Light festivals are a popular example of how temporary installations are being used around the world to elevate urban areas and satisfy the human wonder for art (Schwendinger et al., 2015). Cities and towns, big and small, host these events every year, typically during the winter months. ‘Fete des Lumieres’ is a festival in Lyon, France that dates all the way back to the 17th century and today attracts over one million visitors per night (Jackson, 2015). ‘Luminale’ in Frankfurt, Germany is the world’s largest annual light event celebrating art and urban design and ‘Vivid’ in Sydney is the second largest light festival, recognized for its grand projections on the Sydney Opera House (Ibid). Festivals like ‘GLOW’ in Eindhoven and ‘Georgetown GLOW’ in Washington DC set a city-wide stage for local and national artists to present their innovative light art designs. ‘Luci D’artista’ in Salerno, Italy makes the city a winter attraction by filling nearly 17 miles of its streets with light art from regional creators (MK Illumination, n.d.). In 2017, it was reported that Salerno received an estimated 3 million visitors during the festival, highlighting the ability of these events to draw people to cities, enhance promotion, and thus generate economic activity (MK Illumination, 2019; Schwendinger et al., 2015). A magnet for local communities as well as tourists, light art creates a unique and distinct experience of public spaces (Schwendinger et al., 2015).

Creating Identity

Lighting creates a sense of identity by bringing uniqueness to a place, highlighting local characteristics, elevating civic pride and creating shared

experiences among community members (MK Illumination, 2019). This is evident at just about every scale, from the largest cities, to the quaintest streets.

Consider the lights that glow along the New York City skyline. Lighting here helps define the distinctive characteristics of the city's architectural image, recognized by people around the world (Figure 4.5). Lights on the Eiffel Tower emphasize the structure's historic facade. Thousands of bulbs, sparkling in the night sky, define the iconic symbol of Paris (Figure 4.6). Urban centers illuminate their streets, from building facades to vegetation, to mark the holiday season. For example, in Kansas City annual 'Plaza Lights,' transform 15 blocks of the city's shopping district into an architectural lighting display (Visit KC, 2023). A tradition since 1925, this lighting has become a beloved yearly spectacle (Figure 4.7).

Something as simple as the glow from a neon sign in front of your favorite local bar can signal a space for gathering and socializing (Figure 4.8). String lights on a neighborhood street can designate a vibrant, active community, while also providing safety and security (Figure 4.9). The focus of this thesis is lighting at the community scale. Through the analysis of precedents studies as well as site inventory in the following chapters, I will consider ways to use the aforementioned power of light - its ability to activate, to orient, to engage, and to place make to transform a threatened public space



Figure 4.5. An Iconic Skyline. A view of the Manhattan skyline showing the UN Building, the Empire State Building, and the Chrysler Building (Elias, 2017)



Figure 4.6. A Historic Landmark. View of the Eiffel Tower (Toureiffel.Paris, n.d.)



Figure 4.7. A Winter Tradition. View of the Kansas City Plaza Lights (The Kansas City Star, n.d.)



Figure 4.8. A Local Staple. Neon sign in front of the White Horse Tavern in New York City (Solares, 2015)

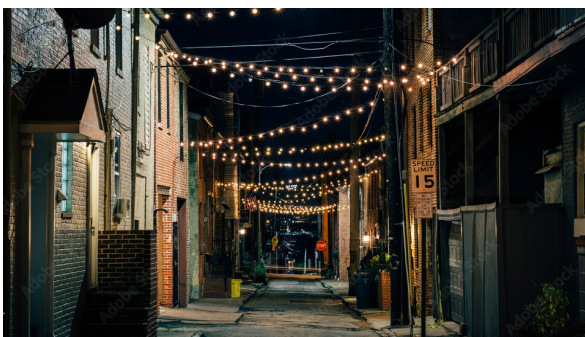


Figure 4.9. A Community Effort. String lights over Chapel Street in the Butchers Hill neighborhood of Baltimore, MD (Bilous, n.d.)

Chapter 5 : Precedent Studies & Lighting Framework

The process of answering my research question: How can lighting be used to create a memorable nocturnal experience that engages users and strengthens connections to their landscapes began with an exploration and reflection of precedent lighting projects in the landscape to inform the development of a lighting typology framework (Figure 5.1).

This framework was used to identify and organize the distinct characteristics of existing lighting installations that could then be used alongside my site inventory and analysis to develop the design program for this thesis. After analysis of many precedent studies, I identified 3 specific categories that helped define my understanding of each lighting installation. These categories were: The goal of the light project, the light type used, and the light duration.

- Light Goal: This category was quite broad and included words like entertainment, joy, immersion, interaction, education, contemplation.
- Light Type: This category described the primary effect of the installation and whether it came from a light that was emitted, projected, or reflected. These are defined below:
 - Emitted: The effect of the installation is drawn from the light itself
 - Projected: The effect of the installation is drawn from its projection onto a secondary surface (e.g., a wall, the ground)
 - Reflected: The effect of the installation is drawn from its reflection off another surface or material

- **Light Duration:** This category defined whether the project was a permanent fixture in the landscape or a temporary light installation.

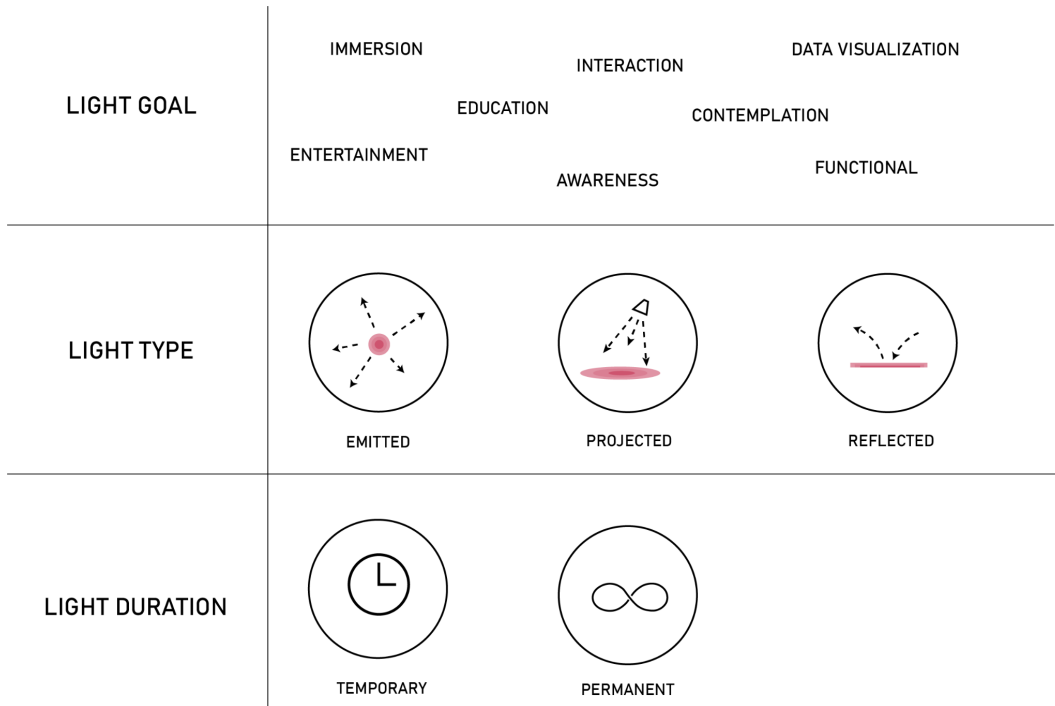


Figure 5.1. Lighting Typology Framework Diagram

Through my exploration of precedents, I came to notice that the definitions within these categories were not mutually exclusive. For instance, projects that were fun and immersive could also be educational and those geared towards awareness could also be contemplative. The installations could also use more than one light type, for example, both emitted and projected.

However, to better understand and apply the lighting typology framework to my own goal of using lighting for entertainment, education, and reflection, I further sorted the precedent I found based on these three objectives. The following is a study

of eight precedent projects whose primary light goals I identified to be “entertainment,” “education,” and “reflection.”

Entertainment

The projects that fall under the entertainment category spark feelings of joy and amusement and elicit a sense of awe and wonder from the user. They can be immersive and interactive, peaking users’ curiosity and encouraging feelings of pleasure and engagement with the space. The projects in this category can exhibit a wide range of characteristics and often achieve other objectives such as promoting education and raising awareness.

Pulse | Philadelphia, PA | Janet Echelman



Figure 5.2. People interacting with the colorful lighting and mist of 'Pulse' at Dilworth Park. Photo: Sean O'Neill, Melvin Epps, Sahar Coston-Hardy. (Echelman, 2018)

“Pulse” is a permanent light art installation that transforms downtown Philadelphia’s historic Dilworth Park, just outside of Philadelphia City Hall, into what artist Janet Echelman described as “a living X-ray of the city’s circulatory system” (Studio Echelman, n.d.). The plaza was the location of the original waterworks for Philadelphia, and later the location of the original Broad St Station. Speaking about the goals of her piece, Echelman said, “I wanted to bring together the story of the industrial period of this city” (Crimmins, 2018).

Inspired by the site’s historic associations with water and transportation, Echelman designed flowing four-foot-tall curtains of mist, colored with light, that move across the park’s 11,600 square foot fountain (Studio Echelman, n.d.). The mist mimics the steam rising from the city’s first water pumping station that was located on the site at the beginning of the 19th century. Rising from curving pathways that cut through fountains, it mirrors the form of the train lines and trolley system directly below, triggered by the movement of these cars (Ibid.). Projected onto the mist are multicolored LEDs, with each hue created by Echelman to reflect the color of the train and trolley lines, green, blue, and orange.

For this project, I identified the light goal as entertainment, the light type as emitted and projected, and the light duration as permanent.

Field of Light |Site Specific | Bruce Munro



Figure 5.3. Field of Light in Uluru, Northern Territory, Australia (Munro, 2016)

Field of Light is an immersive light installation that features thousands of glass spheres illuminated through fiber optics (Bruce Munro Studio, n.d.). Mimicking blooming flowers arranged throughout an undulating landscape, this piece creates an otherworldly experience for its viewers. Completely transforming the landscape, this installation accentuates and reveals its shifting topography, which would otherwise be left in the dark.

As Munro explains, the inspiration for this installation came from a journey to Uluru in the Red Desert of central Australia in 1992 (Bruce Munro Studio, n.d.). Feeling a significant connection to the energy, heat, and brightness of the landscape, Munro wanted to embody this energy through his work. The artist states, “I wanted to create an illuminated field of stems that, like the dormant seed in a dry desert, would

burst into bloom at dusk with gentle rhythms of light under a blazing blanket of stars” (Ibid.).

For this project, I identified the primary light goal as entertainment, the light type as emitted, and the light duration as temporary.

Education

The projects that fall under the education category aim to display information in an engaging way and bring awareness to the existing characteristics of the space that would otherwise remain unseen. These installations can use light to convey the history of the site, teach viewers about the natural processes occurring in the environment around them, and can even be used to visualize raw data.

Waterlicht | Site-Specific | Daan Roosegaarde



Figure 5.4. Waterlicht Installation at Museumplein in Amsterdam, NL (Roosegaarde, 2022)

“Waterlicht” is a large-scale light installation created by Dutch artist, Daan Roosegaarde, to illuminate the “power and poetry of water,” as explained by the artist (Studio Roosegaarde, 2023.). Translated in English as water light, this immersive installation creates a “virtual flood” portraying the vulnerability of the landscape to water and drawing attention to rising global sea levels due to climate change (Ibid.).

In a large open space, LEDs and lenses are used to project a wave of constantly shifting blue light right above the heads of its viewers. The collective experience highlights just how high the water levels have the potential to reach without human intervention (Studio Roosegaarde, 2023.).

First created for Amsterdam’s Dutch District Water Board Rijn & Ijssel in 2015 to demonstrate what the Netherlands might look like without its waterworks, the installation has been exhibited around the world in cities such as Oberhausen, London, Toronto, Paris, Rotterdam, Dubai, and New York (Studio Roosegaarde, 2023.) About the installation Dan Roosegaarde said, “Waterlicht is an activator to create a better future. Experience the vulnerability and the power of living with water” (Studio Roosegaarde, 2023.).

For this project, I identified the primary light goal as education/awareness, the light type as projected, and the light duration as temporary.



Figure 5.5. Light and Mist Marking the Remains of the Castellum in the Domplein. Utrecht, NL. Photo: Ben ter Mull. (Okra Landschapsarchitecten, 2010)

In the Dutch city of Utrecht, Okra Landschapsarchitecten used light to honor the city's past. In the central square, called the Domplein, lie the remains of a castellum, or a fortress, built by the Romans upon their founding of Utrecht some 2000 years ago (Okra Landschapsarchitecten, 2010). The remains of the castellum, lying four meters underground, are brought to the surface through this light installation. The design consists of a line of Corten steel, etched into the surface of the Domplein, directly above the original castellum wall (Ibid.). This marking emits colored light and patches of mist, emphasizing the user's transition into the city square. Also engraved into the steel are parts of the border of the Roman Empire (Ibid.).

Through lighting, Okra Landschapsarchitecten tells the story of the ancient city (Okra Landschapsarchitecten, 2010). Not only does this demarcating line make Utrecht's past visible but makes it experienceable, allowing visitors to interact with and immerse themselves into the city's history.

For this project, I identified the primary light goal as awareness, the light type as emitted, and the light duration as permanent.

Reflection

The projects that fall under this category use lighting to create spaces that allow for reflection, contemplation, and meditation. Lighting in these projects is often subtler, creating places that individuals can observe quietly and independently. In some installations, it is the interplay between illumination and shadow that elicits the emotional tone of the project, where the absence of light can be just as crucial as its presence.

Pershing Park | Washington, DC. | M. Paul Friedberg & Associates

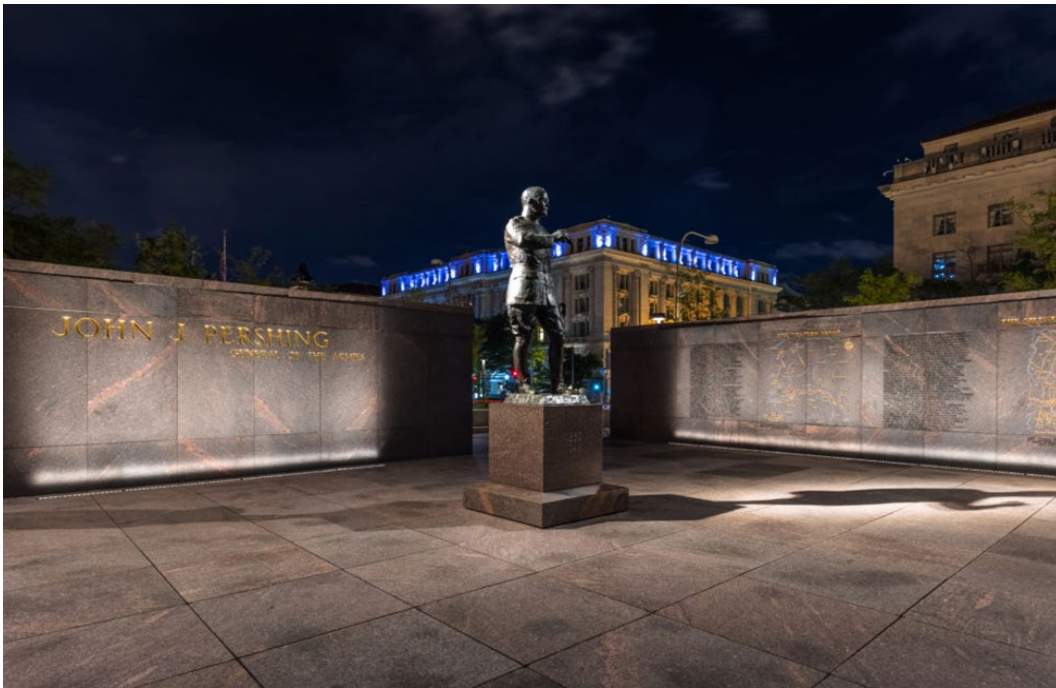


Figure 5.6. Gold Inscriptions on Granite Walls behind a Statue of John Pershing. Photo: Andy Feliciotti. (Friedberg, 1981)

Pershing Park, located on Pennsylvania Ave in the center of Washington D.C, offers an example of how lighting can be used to accentuate the reflective qualities of different materials.

The park, opened in 1981 as a dedication to World War I Army General John Pershing, has recently been redeveloped into a World War I memorial (U.S. National Park Service, 2018). The original park, designed by M. Paul Friedberg, complete with berms, fountains, a concession stand, and pool that doubled as a skating rink fell into disarray due to poor management by the National Park Service in the 1990s. (Flanagan, 2020). In 2015, the World War I Centennial Commission launched a competition to establish a new memorial in the nation's capital (U.S. National Park

Service, 2018). The conversion, started in 2019, and unveiled in 2021, turns the park into a contemplative, educational space, with a sculpture wall, quotations, and a victory medallion, that conveys the significance of World War I to national history (Ibid).

What first caught my attention on my visit to Pershing Park at night was the battle map inscribed into the memorial's Dakota mahogany granite wall. The inscription, a remnant of the old Pershing Park, was coated in a reflective gold paint. Soft up lighting below the memorial illuminated this map and its text, making them appear as if they were glowing from within. This project inspired me to think beyond emitted and projected lighting and encouraged me to consider how different surfaces with intrinsically reflective qualities could be used with lighting to create beautiful, engaging spaces.

For this project, I identified the primary light goal as both contemplation and awareness, the light type as reflected, and the light duration as permanent.

Korean War Veterans Memorial Sculptures | Washington, DC. | Frank Gaylord



Figure 5.7. States of Soldiers at the Korean War Veterans Memorial. Photo: Mindie Burgoyne (Gaylord, 1995)

The Korean War Veterans Memorial, located on the National Mall in Washington, D.C., is a striking example of lighting used to create a dramatic composition. In fact, it is the strategically placed, minimal use of lighting that emphasizes darkness and shadow that tells a story and sets a mysterious and contemplative atmosphere.

The memorial is a commemoration of the 5.8 million Americans who served in the US armed forces during the Korean War from 1950 to 1953 (American Battle Monuments Commission, n.d.). The memorial consists of five parts: The Mural Wall, the Pool of Remembrance, the United Nations Curb, the Dedication Stone, and the Field of Service Statues (US Department of Defense, n.d.)

On my visit to the memorial at night, it was the lighting of these statues that caught my eye. Said to be perhaps the most iconic feature of the memorial, the 19 stainless steel statues, all about seven feet tall, stand among patches of Juniper bushes that represent Korean rice paddies (US Department of Defense, n.d.).

Through meticulous lighting, the statues appear as silhouettes emerging from the fields, the details on their faces obscured by the darkness of the night. The relationship between dark and light cast on the statues gives them a bold, yet ominous presence, making it appear as though the soldiers are moving under the moonlight. In this precedent, the absence of light is therefore perhaps even more significant than its existence and demonstrates the way such a lighting composition can alter perceptions and emotions.

For this project, I identified the primary light goal as contemplative, the light type as emitted, and the light duration as permanent.

Waterfront Lighting

Through analysis of the projects in this category, I was able to extend my exploration of lighting installations to the waterfront setting. In the following precedents I was inspired by the ability of waterfront lighting to create active, engaging, and cohesive public spaces, while maintaining views of a beautiful natural landscape. ÅF Lighting, the lighting designers behind both waterfront projects, demonstrate that oftentimes more frequent, but minimized lighting, is more effective than fewer, but brighter features. They show that lighting does not have to be

overpowering to activate a space. It can be subtle, all while being beautiful and functional.

**Helsingborg Seafront Promenade |Helsingborg, Sweden | Thing Brandt
Landskab & ÅF Lighting**



Figure 5.8. Lighting at the Helsingborg Waterfront (ÅF Lighting, 2004 - 2010)

In Helsingborg, landscape architects Thing Brandt Landskab, worked with ÅF Lighting to create what is described as a “sea and sky” concept for this waterfront promenade (Jackson, 2015). Using fiber optic lights embedded into the hardscape, the lighting designers capture the essence of stars in the night sky. Circles of ripples projected onto the paving from upgraded light posts support the concept of water being translated onto the surface of the promenade. Using these new lighting

elements, the designers aimed to avoid glare and light barriers that might interrupt any ocean views.

Aalborg Waterfront | Aalborg, Denmark | C.F. Møller Architects & ÅF Lighting



Figure 5.9. Lighting at the Aalborg Waterfront (ÅF Lighting, 2004 - 2022)

In Aalborg, C.F. Møller Architects partnered with AF Lighting to activate the city's open waterfront and connect it to the character of the surrounding area. The masterplan for the Aalborg Waterfront aimed to link the city's center with the adjacent fjord, which had previously been difficult to access due to industrial traffic (C.F. Møller Architects, n.d.). With a tree lined boulevard, recessed terraces, urban gardens, and play spaces, the site becomes a newly engaging urban space. In this design, lighting is used to connect all these spaces, creating a coherent identity along the waterfront through custom designed streetlamps, digital gobo projections, and vibrant colors (Ibid.).

Chapter 6 : Site Inventory & Analysis

To be able to apply the lighting typology framework to my own design, I conducted a thorough site inventory and analysis, looking at the site context, its history, its existing conditions, and the proposed conditions for the site.

The Study Area

The site chosen for this thesis is the Franklin D. Roosevelt Beach and Boardwalk located on Staten Island in New York City. This waterfront site is a vital public space that provides the surrounding community with open areas for recreation, relaxation, and reflection. In a city that is so densely populated with limited natural landscapes, this waterfront has become a valuable landscape that New Yorkers and especially Staten Islanders can experience.



Figure 6.1. FDR Beach and Boardwalk in Relation to NYC

The FDR Boardwalk is a 2.5 mile stretch of spacious beachfront located on the Eastern Shore of Staten Island, the southernmost borough of New York City

(NYC Parks, n.d.-a). The coastal site is situated in Lower New York Bay, a section of the larger New York Harbor, a tidally influenced estuary where the Hudson River, Raritan River, and Arthur Kill empty into the Atlantic Ocean (NYC Mayor's Office of Environmental Coordination, 2014).

The boardwalk consists of a forty-foot-wide wooden promenade that sits at an elevation of approximately 16.5', which can range from around 6' - 10' above the surrounding area. Approximately 1.5 miles from its start at Fort Wadsworth, the raised wooden path gradually ramps downward to meet an asphalt promenade at grade, which continues for another mile until it reaches Miller Field.

Between the boardwalk and adjacent road, Father Capodanno Blvd, sit a series of recreation areas that include multiple baseball fields, basketball, handball, and bocce courts, playgrounds, a skatepark, and a soccer pitch. Among these spaces are several large parking lots, plazas, and swaths of unutilized green space characterized by short grasses and trees. Extruding from the boardwalk and towards the bay is an 835-foot-long pier that provides ample seating, space for year-round fishing, and offers view of the water, the Verrazano Narrows Bridge, and south Brooklyn across the way.

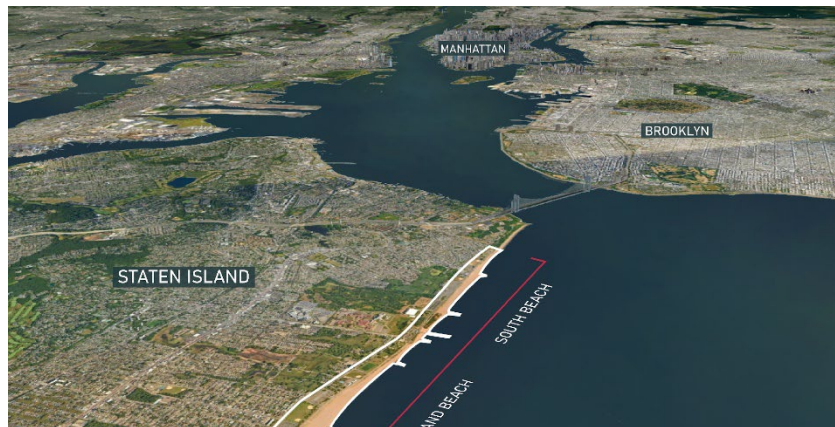


Figure 6.2. FDR Beach and Boardwalk Aerial Photo

History

Pre-Colonial History



Figure 6.3. People of the Lenni-Lenape Tribe, North America (Collection of the Staten Island Museum, n.d.)

Prior to its colonization by European settlers in the 1600s, Staten Island was home to the Lenni-Lenape people, also known as the Lenape, or Delaware people, a name given to all natives living along the Delaware River by Europeans (Staten Island Borough Historian, 2023b). The Lenape, a name meaning “The People” or “Original People” were some of the first tribes living in North America, with settlements dating back to around 10,000 BC. Their homeland, known as Lenapehoking, spanned from Western Connecticut to Eastern Pennsylvania, with New York City at its center (Brooklyn Public Library, n.d.). There were three tribes of the Lenape nation living on and near Staten Island, primarily on the West Shore, the Tappens, Hackensacks, and Raritans (Staten Island Borough Historian, 2023b).

The Lenape relied heavily on Staten Island’s natural hydrography for sustenance (Tiner, 2000). Wetlands were critical habitats in providing food and water

as well as producing a wealth of natural products such timber and reeds for use in creating tools and shelters (Ibid.). Many wetlands were active points of groundwater discharge, such as the “Twin Streams of the Lenape” in Tottenville, which provided freshwater sources for the Native people and the life they hunted. Estuarine systems such as Raritan Bay on the Island’s southeast shore and Arthur Kill on the west were sources of fish shellfish (Ibid.). During the warmer months the Lenape would collect oysters along the shores and fish using seines and weirs made from marsh plants.

The Lenape’s first encounter with European colonists occurred in April 1524 when Italian explorer Giovanni da Verrazano passed through the Narrows (Staff, 2015). The Island continued to be inhabited primarily by the Lenape tribes until around 1630 when the Dutch attempted to establish settlements on the land they called “Staaten Eylandt” (Staten Island Borough Historian, 2023b). In response to Native hesitation towards settlers, the Dutch instigated several wars over the next three decades, the Pig War (1641), the Whisky War (1642) and the Peach War (1655), causing bloodshed on both sides (Ibid.). By 1661 the Dutch established their first lasting colony on Staten Island called Oude Dorp, or Old Town, in what is now known as South Beach, the site of this thesis.

European Settlers

By 1670, most Native people had left the Island and the last Lenape were seen sometime around 1682 (Somma-Hammel, 2021). Many tribes moved north toward Ontario and west towards Oklahoma, where the only two federally recognized Delaware tribes in the US exist today. Lenape remains have been found at two burial sites in West Brighton on the north shore of Staten Island. Skeletons were recovered

in 1903 with various objects found buried with them including beads and shells (Ibid.).

In 1664, the English seized the Island, renaming it in honor of the Duke of Richmond, the son of King Charles (Staten Island Borough Historian, 2023a). Staten Island is still known as Richmond County today. By the end of the 17th century, the Island had a population of approximately one thousand, with most people being Dutch, English, and French. In these early days, Richmond was a rural community, with growing farm, mill, and fishing industries (Ibid.).

The 18th century saw further growth on the Island. In 1740, Staten Island's first ferry, established by Thomas Stilwell, debuted between the east shore and Bay Ridge in Brooklyn, its first official connection to New York City (Staten Island Borough Historian, 2023a). Staten Island officially became a part of NYC in 1898 (Ibid.).

A Summer Resort Destination



Figure 6.4. Postcard from Midland Beach, n.d. (Irma and Paul Milstein Division of United States History, Local History and Genealogy, The New York Public Library, n.d.)

Remaining a primarily agricultural and fishing community into the 19th century, the Island's population grew slowly. It wasn't until the post-Civil War period that rapid development began, exclusively on the eastern shore (Durkovic, 2014). South and Midland Beach, the areas of focus for this thesis, became popular beachfront resorts, with people traveling from all over the country to vacation on the bay. According to Durkovic (2014), real estate prices on the Island were relatively cheap compared to the neighboring boroughs of New York City, primarily due to its isolated nature and lack of subway connections to the larger city. Investors quickly took advantage of the market and began building hotels, bathing pavilions, beer gardens, theaters, and casinos. The 1880s saw increased visitation to the Island, with people lining the once quaint streets with summertime bungalows. By the 1920s approximately 5,000 summer homes stood in the beachfront colony (Ibid.).

In 1906, a 15-acre amusement park called Happyland opened at what is now the location of the FDR Boardwalk in South Beach (Durkovic, 2014). Opening day attracted a crowd of 30,000 people, a number that continued to rise summer after summer. This new waterfront destination offered a variety of amusements with carousels, concession stands, Vaudeville shows, skating rinks, and shooting galleries (NYC Parks, n.d.-a).

In 1924, a massive fire in Midland Beach destroyed Happyland Amusement Park, signaling a permanent shift in the character of the waterfront site. Homes and businesses were threatened, with many people being forced to vacate their properties (Durkovic, 2014). With near destruction to Happyland and no insurance, the Midland Beach Amusement Company who operated the resort, announced that the park would not be rebuilt (Ibid.). In the coming years, more fires, worsening water pollution, and the Great Depression further destroyed the neighborhood, leaving it deserted. An area once bustling with activity, bringing unprecedented economic gain to Staten Island, was left to become a lost memory.

In 1935, NYC acquired the beachfront property and tore down any deteriorating hotels and amusements that remained. As part of the Works Progress Administration under President Franklin D. Roosevelt, a 2.5-mile boardwalk was proposed to restore the once thriving beach to its former glory and “greatly benefit Staten Island” (“Boardwalk Plans in Richmond Ready,” 1935). The redevelopment would attract thousands of new visitors, encourage new businesses, and raise realty values. In July of 1937, after two years, Borough President Joseph A. Palma announced the opening of the \$2,210,00 FDR Boardwalk. However, more fires soon

threatened the site, with a massive fire burning down nearly 300 bathhouses at the north end (“300 Bathhouses Burned,” 1937).

From Resorts to Suburbs



Figure 6.5. Robert Moses at the Ribbon-Cutting Ceremony of the Verrazano-Narrows Bridge, November 21, 1964. Photo: Unknown

By 1953 another plan was once again presented to redevelop the waterfront on South Beach (Durkovic, 2014). Robert Moses, infamous American urban planner and “Master Builder” of New York City, along with Staten Island Borough President Edward G. Baker, submitted a proposal that aimed to mimic the plan that had “proved to be successful at Rockaway Beach” (“South Beach Plan Presented to City,” 1953). Stating bad conditions and trends of deterioration within the area, Moses and Baker believed this redevelopment, at a cost of \$5,600,000 would “eliminate cheap, dilapidated seasonal bungalows” (Ibid.). Moses called for the creation of a “beautiful boulevard” behind the boardwalk, complete with space for 6,000 vehicles,

bathhouses, concession stands, and areas for play. He also proposed charging 25 cents for parking and 10 cents to enter the boardwalk. This improvement, he said, would attract up to 2.4 million people within 30 years (Ibid). To prevent any growth of what he called “beach shanties,” Moses recommended rezoning the beachfront, prohibiting all parking on the streets within walking distance of the beach (Ibid.).

The waterfront improvement project, fully completed in the 60s, coincided with the construction of what is now Father Capodanno Blvd and the planning of a series of expressways that would connect isolated parts of the Island through vehicular traffic (NYC Parks, 2001). With the construction of the Verrazano Bridge completed in 1964, Staten Island became directly connected to the rest of New York City. Rapid suburbanization occurred as people moved to the Island and beachfront bungalows once characterizing the South and Midland beach neighborhoods became the larger single and multi-family homes that exist in the area today (NYC Department of City Planning, n.d.-b). According to Durkovic (2014), between 1960 and 1980, Staten Island’s population rose from 221,991 to 352,121, a 58.6% increase in just 20 years. By the early 80s, the Island was the fastest growing county in New York State (Ibid.).

Deterioration



Figure 6.6. *Warning of Polluted Water at South Beach, Staten Island (Tress, 1973)*

Despite revitalization efforts, the beachfront never reached the levels of success it once had during the Happyland days. Decline continued through the 60s 70s due to worsening water pollution, multiple arson attempts, and a high concentration of drug use on the boardwalk (Dziemianowicz et al., 2003). The 1990s saw major investments to revive the neglected boardwalk with additions of new facilities, programs, and general cleanup of the waterfront. In 1998 the Island Borough President's Office donated an installation called the Fountain of the Dolphins, a light sculpture containing six bronze dolphins sitting on wave shaped rails containing fiber-optic cables and water jets that emit blue, green, and white lights at night (NYC Parks, n.d.-a). Though improved, neglect and pollution continued to affect the beach and boardwalk. A 2004 report created by the Committee on Oversight and Investigations called *Swimming in Trash? A Look into Cleanliness at NYC Beaches*, noted extensive trash and general uncleanness at South and Midland Beaches (Allen, 2004). Litter floating on the water made it inaccessible for

swimming. Hypodermic needles, food wrappers, cigarette buds, dead rodents were scattered along the water and the sand, making the beaches not just unpleasant, but unsafe. In fact, out of the seven city beaches observed, investigators stated that South Beach was “by far the worst beach surveyed” (Ibid., p. 10). The Parks Department continued to maintain the waterfront, with renovations occurring throughout the 2000s with additions such as playgrounds and a skate park. While significantly better today, the effects of deterioration can still be felt at the beaches. In 2017, South and Midland Beaches received significantly less visitors than other NYC beaches like Coney Island in Brooklyn and Rockaway in Queens (Kadet, 2017). While Coney Island attracted nearly 6.7 million people and Rockaway around 2 million, South and Midland Beaches saw only 334,000 visitors, according to the City (Ibid.)

Impacts of Hurricane Sandy



Figure 6.7. Rescue workers check homes on Buel Ave. in Ocean Breeze, Staten Island (Lyons, 2012)

On October 29, 2012, New York City was hit by Hurricane Sandy, devastating Staten Island and leaving an impact on its residents to this day. The storm, coinciding with high tide in New York Harbor, caused record breaking flooding throughout the city with the tide reaching 14 ft above mean lower low water levels (the average height of the lowest tide recorded at a tidal station each day (Virginia Institute of Marine Science, n.d.)) in lower Manhattan (NYC Special Initiative for Rebuilding and Resiliency, 2013, pg. 11). On this night, there wasn't just a high tide, but a "spring" tide, meaning it was at the very peak of its cycle, up to half a foot higher than the average high tide, and nearly five and a half feet higher than water levels at low tide (Ibid.). With water levels along the coast already elevated, the massive storm (3 times the size of Hurricane Katrina by area) hit the city with unprecedented power, battering the coastline, destroying buildings, and damaging critical infrastructure (Ibid.). The city's transportation and telecommunications services came to a halt for weeks and in some cases months (Greenhalgh, 2013). The storm caused \$19 billion in damage and killed 43 people in NYC. 24 people died on Staten Island, more than any other New York City Borough, with 10 people found in the Midland Beach neighborhood alone (NYC Special Initiative for Rebuilding and Resiliency, 2013, pg. 14). Ages of the victims ranged from 2 to 89 years old, with most lost to drowning caused by rapidly rising waters due to storm surge (Zaffarano, 2022).

On the East Shore, many areas flooded due to their low elevation (NYC Special Initiative for Rebuilding and Resiliency, 2013, pg. 276). The higher elevation of Father Capodanno Blvd compared to the area inland created a "bowl" effect,

exacerbating flooding. Once the storm surge surpassed the boulevard, flood levels rose quickly damaging these low-lying neighborhoods (Ibid.). USGS high water mark indicated flood waters reached 7.9 above ground level on Staten Island (Blake, 2013). Hundreds of homes on the East Shore were damaged or destroyed (NYC Department of City Planning, 2017). The low-rise buildings and winterized bungalows, characteristic of the South and Midland Beach neighborhoods, were especially vulnerable with many being washed off their foundations entirely. (NYC Special Initiative for Rebuilding and Resiliency, 2013, pg. 278).

The FDR Boardwalk was also damaged, with everything from support beams to planks having to be repaired (Paulsen, 2013). The boardwalk was closed for 9 months after the storm and began gradually reopening the following spring and summer (Ibid).

The East Shore Seawall

In an interview with National Geographic, Daniel Zarrilli, special advisor for climate and sustainability at Columbia University, stated that “When Sandy hit, New York City had zero coastal protections” (Gibbens, 2022). This exacerbated the impacts of the storm, but also became a wakeup call for the city. The destruction caused by Hurricane Sandy became a dark foreshadowing of what was to come if action was not taken. With worsening climate change, storms like Sandy are expected to increase in frequency and intensity, meaning investment in resiliency initiatives and climate policies had to happen immediately (Ibid.).

One such initiative, and a major driver of the design considerations behind this thesis, is the US Army Corps of Engineers East Shore Seawall Project proposed

in 2015. In all, the \$615 million project would include interventions such as a buried seawall, an earthen levee tie-in, a vertical flood wall, natural storage, ponding areas, and tidal wetlands (Figure 6.8) (Liotta, 2022).

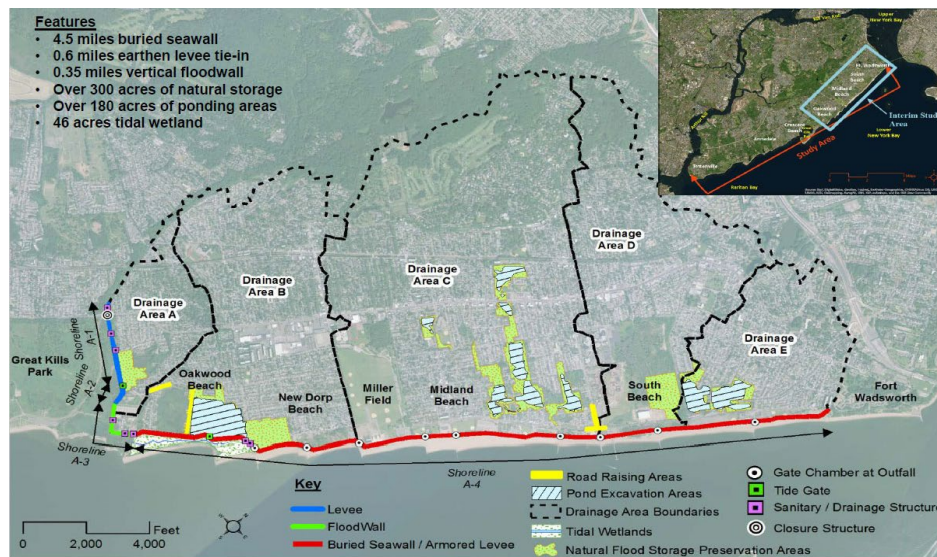


Figure 6.8. South Shore of Staten Island Coastal Storm Risk Management Project: Fort Wadsworth to Oakwood Beach (USACE, n.d.)

Running along 5.2 miles of the Eastern Shore, this wall will create severe consequences for this project site. The entirety of the existing FDR Boardwalk would be removed. Once the seawall is constructed, a new boardwalk would sit atop it, 5 feet higher than the existing structure (NYC Parks, 2017). The wall, 23.4' high, will drastically change the connection between the community and the waterfront, and sever people's relationship to the water altogether. Concrete slabs will tower over the existing lower spaces, dominating the atmosphere and compromising any feeling of serenity, safety, and security. The wall's proposed location will also displace existing features on the site including concession stands, ball fields, comfort stations, and shade structures (Ibid.). Before and after images rendered by the USACE (Figures 6.9

& 6.10), demonstrate how the wall will alter the character of the site. It is the goal of this thesis to use artful lighting design to better integrate the seawall into its park context and to create active, engaging public spaces despite the new burden.



Figure 6.9. Image of Existing Boardwalk Conditions (USACE, 2022)



Figure 6.10. Rendering of Future Boardwalk Conditions After Incorporation of the East Shore Seawall (USACE, 2022)

Cultural Attributes

Neighborhood Profile

The FDR Boardwalk runs through two neighborhood tabulation areas (NTA) on the Eastern Shore (NYC Department of City Planning, n.d.-a). The first NTA, referred to as simply “South Beach” hereinafter, comprises the smaller neighborhoods of Grasmere, Arrochar, South Beach, and Dongan Hills. The



Figure 6.11. South and Midland Beach Neighborhoods Map

second NTA, referred to as “Midland Beach” hereinafter, comprises the neighborhoods of New Dorp and Midland Beach.

According to the 2020 census, the population of the two NTAs, comprising several smaller census tracts, is approximately 65,342, with 24,314 households (NYC Department of City Planning, n.d.-a) This population is primarily white non-Hispanic, with the demographic making up 61.3% of residents. This is followed by Asian Non-Hispanic with 16.8%, Hispanic-Latino (of any race) with 15.7%, and Black/African American with 3.5%.

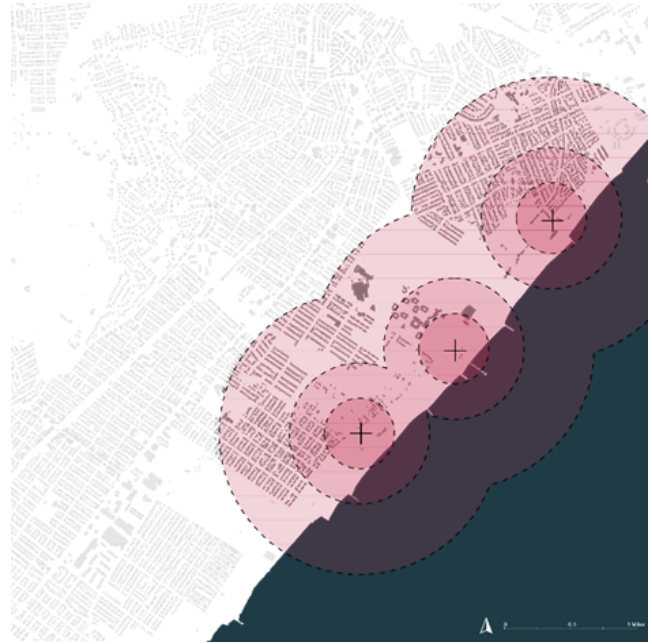


Figure 6.12. 15-Minute Walking Distance Map

To assess the neighborhood's walkability with respect to the waterfront, I computed the number of households located within a one-mile radius or a 15-minute walking distance from six access points. About 8,053 households, which represents 33% of the total households, are situated within this one-mile radius.

Key Roadways

Running parallel to the FDR Boardwalk is a four-lane road called Father Capodanno Blvd, the primary north-south artery connecting the neighborhoods of South and Midland Beach. Intersecting the Blvd, are key arterial roads, Sand Ln, Seaview Ave, and Midland Ave, anchoring the community along the coast to Hylan

Blvd, a heavily trafficked, major commercial corridor. This continuous road begins on the north shore, spans the entirety of the east shore, and concludes at the southern tip of Staten Island. Established along these roads are vital community assets, including dozens of locally owned businesses, grocery retailers, religious institutions, and healthcare facilities.

All of these roads are served by several MTA NYCT bus routes, both local and express, offering service not only in Staten Island, but to Brooklyn and Manhattan as well (Metropolitan Transportation Authority, 2023). The FDR Boardwalk can be easily accessed by bus stops along Father Capodanno Blvd. Local routes include: S51, S52, and S81, all terminating at the St. George Ferry Terminal, which provides connection to Manhattan (Ibid.). Express routes include: SIM5, SIM6 and SIM9, all traveling to Manhattan. Local buses offer 24-hour service on weekdays and late-night service on the weekends, making the site accessible to those relying on public transportation not only during the day, but after dark as well. Express service is only offered on weekdays but offers service as late as 8:30 – 9:00 pm (Ibid.).

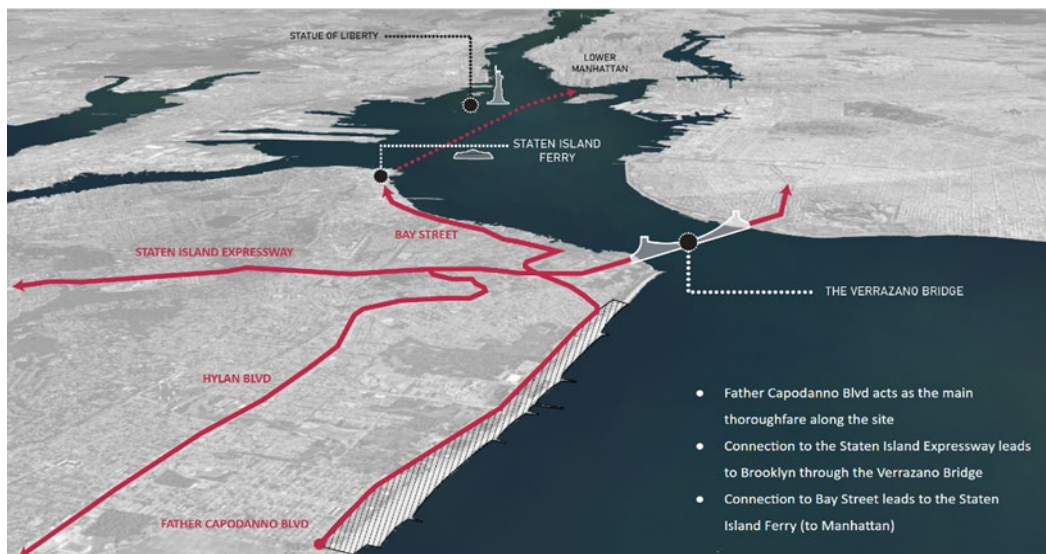


Figure 6.13. Key Roadways and Opportunities for Connection to Brooklyn and Lower Manhattan

Zoning

Much of the study area is zoned for residential use. Most are zoned R3-1, a low-density district, that allows for one and two family detached and semi-detached homes (NYC Department of City Planning, n.d.-b). Some areas are zoned R3- 2, which is the lowest-density zoning district that allows for multiple dwelling buildings (NYC Department of City Planning, 2017). There are also areas zoned R3A and R3X, which are lower-density districts that allow for one- and-two family detached homes. Commercial overlays within residential districts, zoned C1 and C2, allow for small scale services, such as grocery stores and dry cleaners, to serve the local communities. Most of these can be found near the intersections of Father Capodanno Blvd, and the arterial roads, Sand Ln and Midland Ave. There is a small C4 district in Midland Beach, on the opposite side of Miller Field, that allows for larger stores, theaters, and offices, where more traffic may be generated. C8-1 zoning districts



Figure 6.14. Neighborhood Zoning Map

mapped along Hylan Boulevard permit automotive and commercial services. There is also a small M1-1 manufacturing district zoned for light industries.

Community Assets

Due to zoning restrictions, most community assets are limited to clusters of land along Father Capodanno Blvd, Sand Ln and Midland Ave. These include restaurants, grocery stores, delis, senior centers, and religious institutions. There are also key public healthcare facilities located on Seaview Ave. Both the Staten Island University Hospital and the South Beach Psychiatric Center campuses line almost the entire north side of the street from Father Cap. to Hylan Blvd. These facilities are within the one-mile radius or 15-minute walking boundary of an FDR Boardwalk access point.

Adjacent to the medical facilities is the ‘Ocean Breeze’ Track and Field Complex, a large track facility and recreation center, whose sports events service not only the local community, but the entire region. (NYC Parks, n.d.-b). The facility sits on a vast, 110-acre park by the same name. Ocean Breeze Park, once part of a tidal meadow through which a network of creeks and channels passed, offers lightly paved paths for walking and biking through grasslands and shrub forest.

Parks

The FDR Boardwalk and Beach is owned and operated by the NYC Department of Parks and Recreation. The city owned land is situated between two federally owned historic sites that are part of the National Gateway Recreation Area. Established in 1972 to offer a national park service to urban audiences, ‘Gateway’

spans two states: New York and New Jersey, and three NYC boroughs: Queens, Brooklyn, and Staten Island (US National Park Service, 2022b). At the northeastern boundary of the FDR Boardwalk, a 226-acre site known as Fort Wadsworth offers users the opportunity to observe one of the nation's oldest military installations, while providing a scenic route for biking, running, or walking with its tree lined paths and views of the New York Harbor (US National Park Service, 2022a). At the southwest boundary of the boardwalk sits Miller Field. Once owned as farmland by the wealthy Vanderbilt family, the grounds were sold to the US government in the early 1900s to be used as a military airfield until it was decommissioned in the late 1960s (US National Park Service, 2022c). Today the park is one large sports facility, with several baseball, softball, soccer, and cricket fields, as well as picnic areas and a Swamp White Oak Forest. While there are other parks located in the study area, the



Figure 6.15. Neighborhood Parks Map, Federal and City-Owned

FDR Beach and Boardwalk is open later than any other. While the federal parks close to the public after 9 and 10 pm, this site remains available to use through the night.

Physical Attributes

Coastal Zone Boundary & The Comprehensive Waterfront Plan

The study area sits within what is known as a Coastal Zone Boundary (CZB) (NYC Department of City Planning, n.d.-c). The CZB is a boundary that defines the geographic scope of New York City's Waterfront Revitalization Program (WRP) and encompasses all the land and water the city deems to have direct and significant impacts on

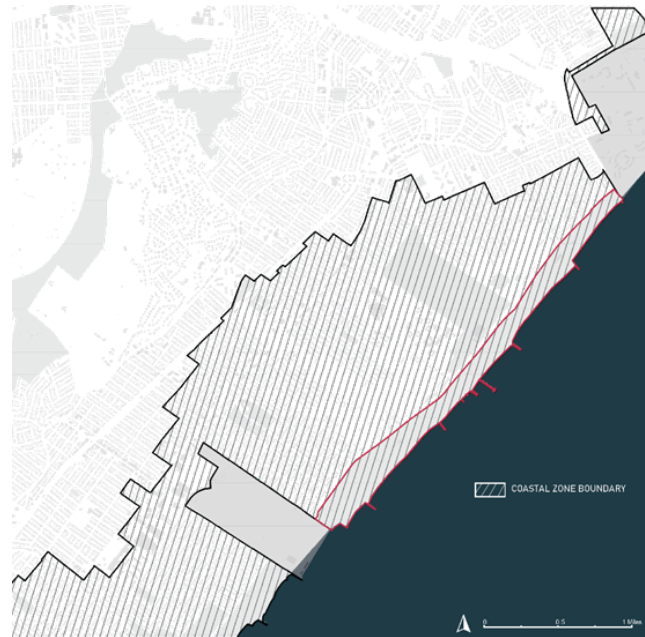


Figure 6.16. Coastal Zone Boundary Map

coastal water (Ibid.). The WRP is NYC's guiding document regarding policies and guidelines for waterfront planning. The primary goal of the program is to optimize the benefits derived from sustainable development, public access, and environmental protection, in order to promote economic growth and enhance the quality of life for New Yorkers (Ibid.).

To guide planning and policies for its waterfront, NYC has released a series of comprehensive waterfront plans over the decades that assess the condition of the

city's waterfront sites to establish long term goals that promote sustainability, resiliency, and accessibility. The first such document, "Reclaiming the Edge," was released in 1992 and the second, "Vision 2020: New York City Comprehensive Waterfront Plan," was released in 2011 (NYC Department of City Planning, n.d.-c). The strategies laid out in these plans have generated revisions in the Waterfront Revitalization Program to offer a more detailed contemporary set of policies to better address the City's coastal conditions.

Addressing the Goals of the Waterfront Plan

The most recent publication, called "New York City Comprehensive Waterfront Plan," (CWP) was released in 2021 (NYC Planning, 2021). It develops a framework to ensure that the waterfront can continue to play an important role in the lives of New Yorkers for decades to come (Ibid.). Despite the abundance of parks on Staten Island, the South and Midland Beach neighborhoods are limited in their access to these spaces which are located primarily inland. The waterfront area of the FDR Boardwalk, the study area of this thesis, is the most significant open space option within walking distance for people living in these communities.

The CWP mentions two objectives that I felt were particularly relevant to this thesis, and that I will use as the overarching goals to hold my ideas accountable to. The first is to enhance the pedestrian connection to the waterfront, emphasizing accessibility for all people, to strengthen the role of these places as "community gathering areas, nodes of civic engagement, and educational spaces" (NYC Planning, 2021, p. 121). The second objective is to maximize the visual accessibility of the waterfront by providing clear, unobstructed sightlines to the water.

The FDR Boardwalk is accessible through several entry points, however, this “waterfront access,” has historically emphasized vehicular, rather than pedestrian movement. Visitors must access the space from a busy four lane road and enter through parking lots. At these key entry points, it seems like the design of the lot is prioritized over the design for the human experience. Though visual connection currently exists in certain areas, this second goal is especially threatened by plans to build the seawall. With the boardwalk significantly raised, any remaining connection between the public open spaces and the water will be permanently severed. The proposed design in this thesis will aim to use artful lighting to support the vision of the CWP and enhance accessibility and connectivity along the waterfront, despite the future barrier.

Educational Aspect of the Plan

This thesis also has the unique opportunity to address the key foundational goal of the climate resiliency and adaptation portion of the CWP. This goal is to “broaden awareness of climate risks and how New Yorkers living and working on the waterfront can take action to adapt to the impacts of climate change” (NYC Planning, 2021, p. 102). Strategies to reach this goal are to build a common understanding of local climate risks through conversations and to expand access to information and other resources for community members. Lighting in this thesis can be used as an educational component, and the very piece that triggers these conversations, offering information through interaction and immersion. According to the UN, “Education is a critical agent in addressing the issue of climate change” (United Nations, n.d.)

Education helps change people's attitudes, empower them, and ultimately motivates them to become stewards for change (Ibid.).

This educational component will not only apply to awareness around climate change, but to the entire local ecology. The study area is teeming with landscapes that are not only endangered but have been lost. According to the NYC Wetlands Strategy Plan (2012), education and outreach are important components of wetland protection. It states, that "The City's efforts would be enhanced if more community members, landowners, and property managers recognized the values of wetlands and the biodiversity that depend on them" (PlaNYC, 2012, p.39). The design proposed in this thesis can be one way to address this issue.

Wetlands

The remnant wetland ecology of Staten Island's Eastern shore provides us with a glimpse into the rich history of a fading extensive natural resource network and diverse coastal ecosystem. As some of the most distinct features on the Island, tidal wetlands were once a vast resource, with nearly 5600 acres present in 1870 (Tiner, 2000). Today, only about 1800 acres, or 32% of these original coastal wetlands remain. Nearly 3500 acres have been filled entirely and data compiled from the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) shows that in the South and Midland Beach neighborhoods nearly 300 acres of former tidal wetlands have become non-tidal freshwater marshes or swamps due to flow restrictions (Tiner, 2000). The development that occurred on Staten Island in the 50s and 60s led to widespread filling and polluting of wetlands.

Many of these remnant wetlands can be found adjacent to the FDR Boardwalk, directly across Father Capodanno Blvd. According to the NWI maps, the fragmented wetland bodies in this study area are all classified as palustrine, which are nontidal wetlands dominated by trees, shrubs, emergent mosses, or lichens (US Fish & Wildlife Service, n.d.). Though predominantly vegetated marshes and swamps, they can include freshwater ponds (Tiner, 2000). There are three classes of palustrine wetlands here, as mapped by the New York State Department of Environmental Conservation. The most common are freshwater emergent wetlands, which are characterized by erect, rooted, herbaceous aquatic plants (US Fish & Wildlife Service, n.d.). Found here is an invasive species of large perennial grass called *Phragmites australis*, known for its dense stems, wide leaves, and towering height of over 15 feet (New York Sea Grant, 2019). These wetlands are seasonally flooded, meaning surface water is present for extended periods of time during the growing season, but is absent by the end of the season (US Fish & Wildlife Service, n.d.).

Also in the study area, are freshwater forested/shrub wetlands, freshwater ponds, and riverine wetlands (New York State Department of Environmental Conservation, n.d.). Freshwater forested/shrub are characterized by deciduous woody vegetation that is six meters tall or taller. They are temporarily flooded with surface water present for brief periods during the growing season, but with the water table usually lying below the ground surface for most of the season (US Fish & Wildlife Service, n.d.). Ponds on the other hand are permanently flooded with water covering the substrate throughout the year in all years. Lastly, the riverine system includes all wetlands and deep-water habitats contained within a channel, defined as an open

conduit either naturally or artificially created which periodically or continuously contains moving water, or forms a connection between two bodies of standing water.

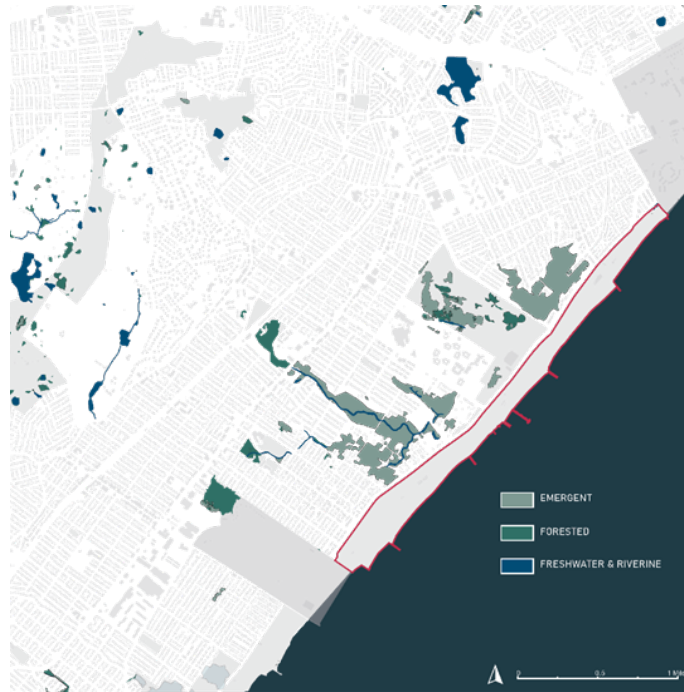


Figure 6.17. Neighborhood Wetlands Map

A 2000 report published by the National Wetlands Inventory Publication, called *Wetlands of Staten Island, New York: Valuable Vanishing Urban Wildlands*, provides a comprehensive list of flora, fauna, and endangered species depending on the Island's wetland ecosystem (Tiner, 2000). These species are identified below.

Key Species of Flora

Dominant species in marsh wetlands, such as those found in the South and Midland Beach neighborhoods, include common reed, cattails, purple loosestrife, rose mallow, water-willow, bur-reed, buttonbush and rice cutgrass (Tiner, 2000). Remnant

vegetation from preexisting estuarine marshes may also be found, including salt marsh fleabane, marsh orach, and creeping bentgrass.

Key Species of Fauna

Staten Island wetlands act as breeding grounds for wetland-dependent animals such as spotted salamanders, snapping turtles, green frogs, and bullfrogs (Tiner, 2000). Fish also rely on these ecosystems for feeding and as nursery grounds. These include bluefish, striped bass, Atlantic silversides, menhaden flounder, American eel, killifish, and carp. Thousands of invertebrates also live here, including dragonflies, mosquitoes, aquatic beetles, water striders, and certain butterflies.

Perhaps the most noticeable animals relying on Staten Island's wetlands are birds (Tiner, 2000). Typical species include herons (great blue and green), night herons (black-crowned and yellow-crowned), egrets (great and snowy), glossy ibises, waterfowl (wood ducks, mallards, Canada geese, moorhens, and pied-billed grebes), belted kingfishers, ospreys, and herring gulls. Many songbirds feed, nest, and raise their young here as well, such as the swamp sparrow, song sparrow, yellow warbler, yellowthroat, gray catbird, and northern oriole (Ibid.).

Mammals like muskrats, meadow voles, cottontail rabbits, raccoons, opossums, and white-tailed deer are observed in these wetlands as well (Tiner, 2000).

Rare and Endangered Species

According to Tiner (2000), an estimated 43 percent of the nation's threatened and endangered species rely directly or indirectly on wetlands for their survival. Among the state-listed rare and endangered species that Staten Island supports

include three trees: willow oak, sweet bay, and swamp cottonwood; two shrubs: possum haw and American strawberry-bush; four herbs: primrose-leaf violet, soapwort gentian, square-stemmed spike-rush, and eastern gamagrass; two parasitic herbaceous vines: buttonbush dodder and southern dodder; and one aquatic floating plant: American featherfoil. Federally listed endangered species have also been spotted in Staten Island wetlands including the American burying beetle and sea beach tiger beetle (Ibid.).

The Need for Awareness

Wetlands serve vital ecological functions, including surface and groundwater protection, erosion control, and pollutant treatment as well as providing fish and wildlife habitat (Tiner, 2000). They are vital for maintaining biodiversity not only in the city, but also in the state, by supporting a wide variety of species from flora to fauna including state-listed rare and endangered species. Wetlands also provide flood and stormwater control, a function critical to neighborhoods like South and Beach where flooding is often substantial.

This thesis will aim to highlight the importance of wetlands and the species that depend on them to the public. Light will tell the story of the wetlands: what they have been and what they are now. Through this awareness it will serve as a caution to the public of what the wetlands can become, emphasizing their benefits and reliance on plants and animals. Light will encourage people to become stewards for change and protect this fragile environment.

Chapter 7 : Design Process

Due to the large nature of the FDR Beach and Boardwalk, it was determined that to produce a design that is more comprehensive and intricate, attention must be directed towards a smaller, more intimate section. The process for choosing a specific site, within the 2.5-mile stretch involved:

1. Analyzing significant roads and intersections (Figure 7.1).
 - a. What amenities make these roads main thoroughfares?
 - i. Businesses, facilities, and bus routes
2. Identifying main entrance points (Figure 7.1).
 - a. Where were the access points to the boardwalk?
 - b. Is the access point just a parking lot or is there a defined entryway?
3. Looking at the activated vs non-activated spaces (Figure 7.1).
 - a. Did the space have areas programmed for specific actions?
 - b. Would this space be considered a destination or somewhere to walk through to get somewhere else?



Figure 7.1. Identifying Roads & Intersections (Left), Identifying Main Entrance Points (Middle), Identifying Activated vs. Non-Activated Spaces (Right)

Analyzing these significant roads helped identify high trafficked intersections along the site, which indicated how and where people were accessing it from Father Capodanno. Whether the entrance from Father Capodanno had a direct connection to a corresponding boardwalk ramp, defined their characterization as an accessible entryway. Taking into consideration these entry nodes, their proximity to major intersections, and finally an analysis of activation at each of these access point, I was able to identify 3 key spaces along the 2.5-mile site that offered the best opportunity for redesign and light application (Figure7.2):

1. The Sand Ln site
2. The Seaview Ave site
3. The Jefferson Ave site



Further analyzing existing conditions on each site, as well as taking into consideration future conditions due to construction of the sea wall, I identified opportunities and constraints for each area. Upon doing so, I identified the Seaview Ave site as having the greatest potential for this thesis design.

The Seaview Ave Site

The Seaview Ave Site is approximately 42 acres and with a half-mile long boardwalk (Figure 7.3).



Figure 7.3. Aerial Map of the Seaview Ave Site

Opportunities

One opportunity identified for this site is its high engagement. According to a community engagement report conducted by Starr Whitehouse Landscape Architects in June 2022, out of 46 attendees, 60% stated that they enjoyed visiting the Midland

Beach area, which included Seaview Ave more than other sites on the shoreline (Starr Whitehouse Landscape Architects and Planners, 2022). During this meeting, community members also stated their desire to see more lighting along the promenade and throughout the parkland. Participants want to see improved lighting year-round so they can visit the park after work and in the winter when it gets darker earlier (Ibid.).

Other opportunities of the Seaview Ave site included the existing events and partnerships that happen on the open plaza on the site, such as summer concert series. There is also potential for connection here to the Ocean Breeze Athletic Complex, to the existing wetlands in the area, and to the medical campus adjacent to the site.

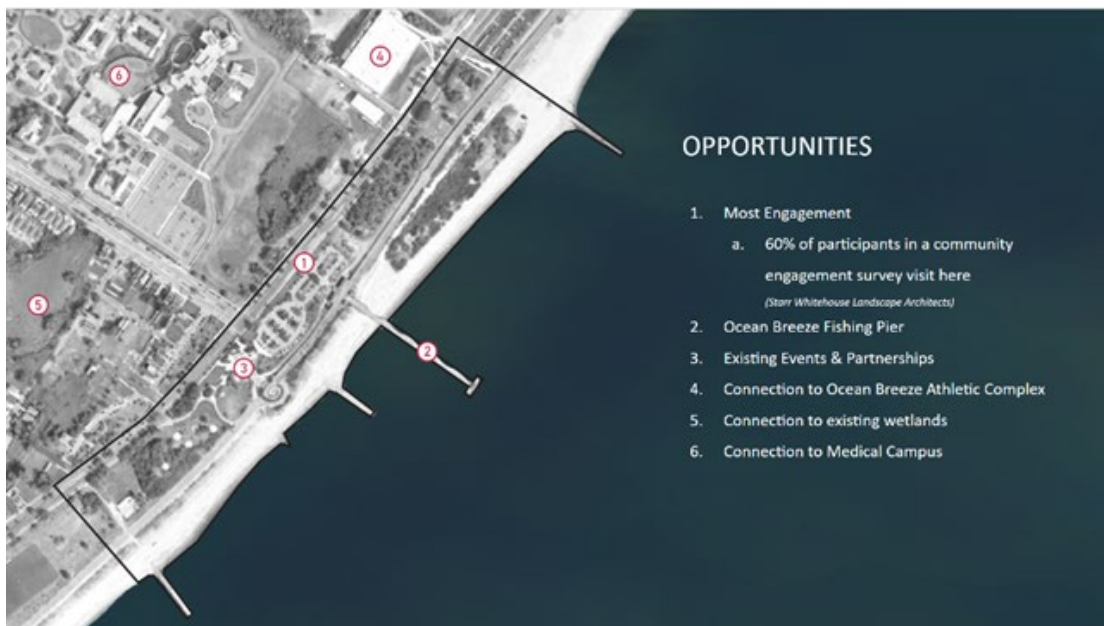


Figure 7.4. Main Opportunities of the Project Site

Constraints

Constraints identified for the Seaview Ave site included first and foremost the USACE Seawall, which will be the greatest threat to the site's feeling of safety, security, and overall atmosphere. As shown in Figure 7.5, the boardwalk will be

raised from 16.5' to 23.4'. This will significantly impact how people will access the boardwalk and interact with the pier, as well as how they experience the park space between Father Capodanno Blvd and the boardwalk which will remain at grade.

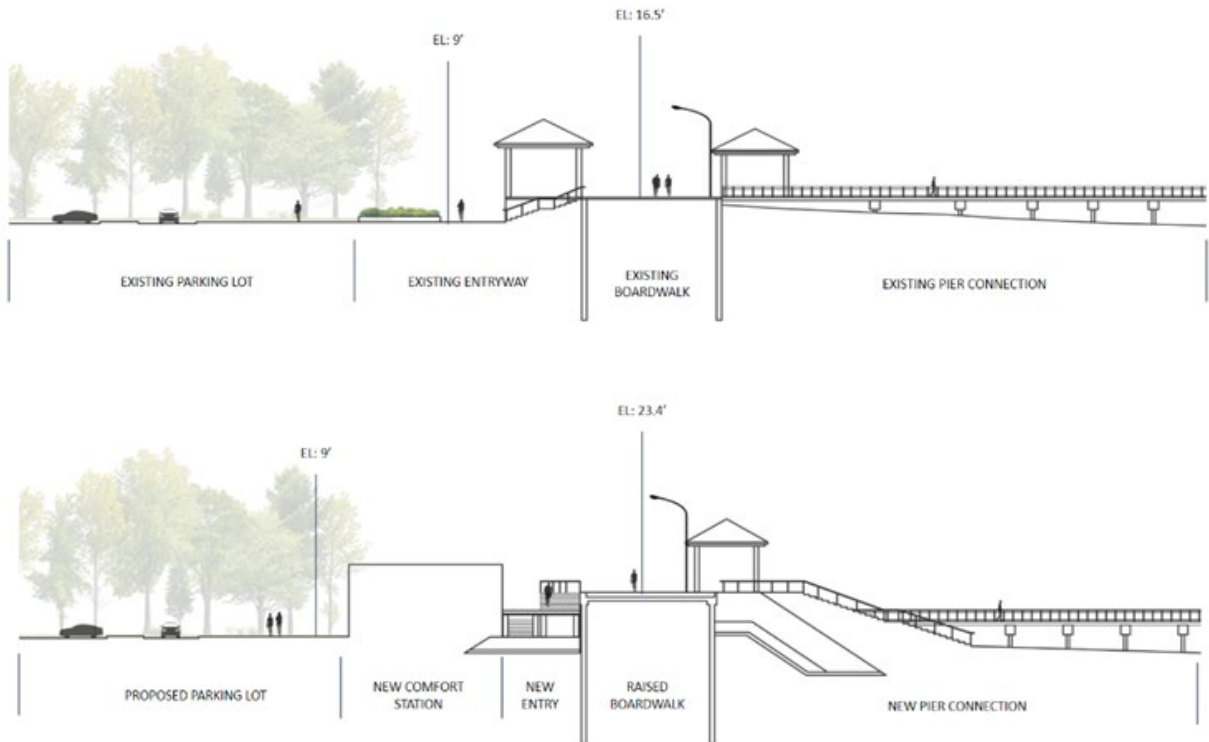


Figure 7.5. Sections Illustrating Existing Conditions on the Site (Top) and Proposed Conditions for the Site (Bottom) (Section of Proposed Conditions Courtesy of Starr Whitehouse Landscape Architects)

Another main constraint was light spilling onto the site from Father Capodanno Blvd which warrants consideration of how lighting proposed in one space will interact with another. Parking configuration also had to be considered here. While the placement of the existing lot is convenient, its location in the center of the site leaves surrounding areas disconnected from each other and prevents cohesion. A balance between parking and the pedestrian experience would have to be addressed.

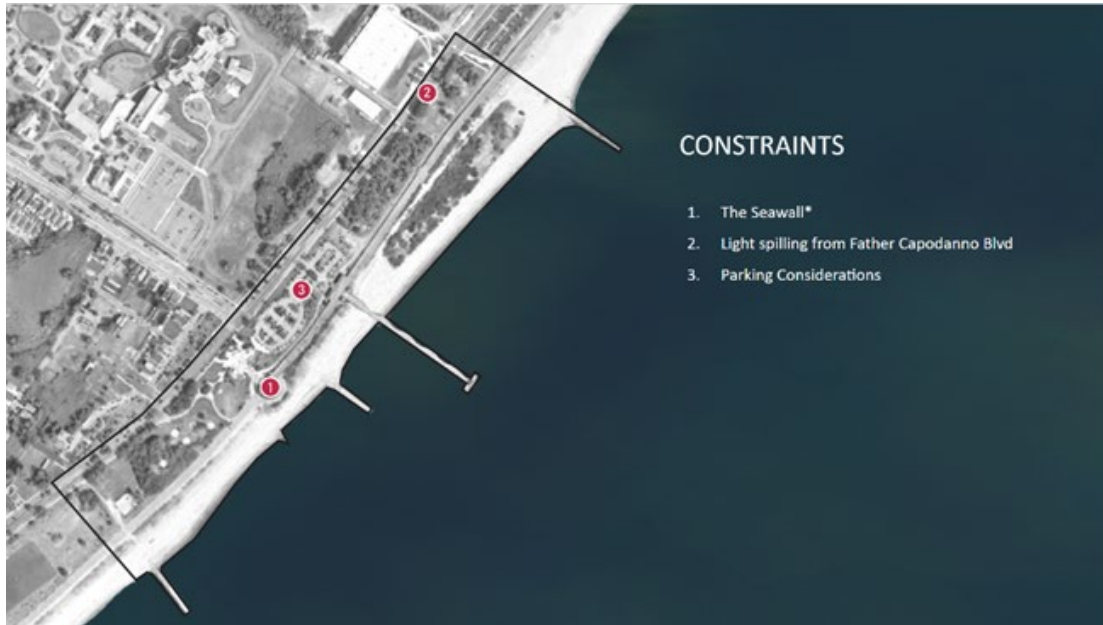


Figure 7.6. Main Constraints of the Project Site

Entryway

The Seaview Ave site has several key features. One being this entrance to the north of the Seaview Ave intersection. There is no official pedestrian entryway, and the parking lot serves as the welcome area (Figure 7.7).

Gathering

Spaces for gathering and activity include the 835 ft ocean breeze fishing pier, as well as an open plaza that offers a splash plaza in the summer months and is often used for events like concerts. A small lawn area offers space for leisure and recreation. (Figure 7.8).

Movement

Movement through the site is facilitated by the elevated boardwalk, which sits at 8' above ground level. A spiral ramp connects the boardwalk to a promenade at grade to the southwest. The USACE seawall will raise both the boardwalk and promenade to an elevation of 23.4'. A 12' pedestrian path, also doubling as a bike lane, runs adjacent to the elevated boardwalk at grade and joins the promenade around the plaza. (Figure 7.9).

Unutilized Space

Also, on the site are large amounts of unutilized space. They are characterized by trees and overgrown grass, with some parts even completely fenced off to the public. (Figure 7.10).



Figure 7.7. Parking Lot & Entry Space

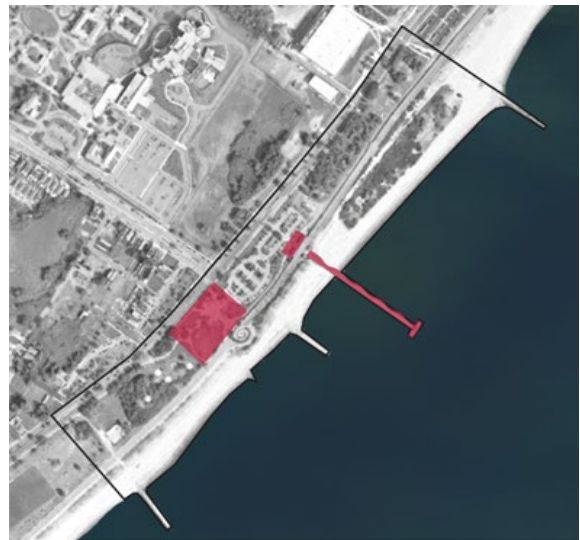


Figure 7.8. Gathering and Recreation Space



Figure 7.9. Elevated Boardwalk, Spiral Ramp, and Promenade at Grade



Figure 7.10. Unutilized Space

Existing Qualities of Light

Based on New York City Department of Transportation Street Design Manual, the existing lighting infrastructure on the majority of the site appear to be Standard Street Lights (SSL) characterized by a tapered steel Octagonal pole, combined with an LED Cobra Head luminaire, or light fixture (NYC DOT, 2020a). These standard lights are used throughout the city on wide roadways, commercial areas, residential streets, and pedestrian arms (Ibid.). According to measurements taken from Google Earth, these lights are placed approximately 120' apart along the boardwalk and promenade. They are also found in the parking lots across the site and along the pedestrian path/bike lane adjacent to the boardwalk.

Lighting infrastructure along the pier and in the open plaza appear to be Type B Pedestrian Poles, which offer a more traditional design for areas such as parks, plazas, and pedestrian bridges (NYC DOT, 2020b).

However, this is a clear example of the overarching issue of lighting being an afterthought in the design of our landscapes, rather than an integral part of the planning process. Lighting on the site was clearly chosen for practical purposes, trying to maximize utility and provide a base level of security. This is also evidenced by the security cameras affixed to the light poles as shown in Figure 7.11.

Lighting throughout the site is inconsistent and uncomfortable. During my site visits I noted that many light fixtures were either flashing, inefficiently dim, or simply not on. Those that did work were excessively bright causing significant glare, leading to visual discomfort. Both the cobra head luminaires and the Type B pedestrian lamps spilled light across the landscape in a process also called light trespass, where light falls where it is not intended or needed, as seen in Figures 7.12 and 7.13 (International Dark Sky Association, n.d.-c). More photographs of lighting conditions on the site during the day and at night can be viewed in Appendix A.

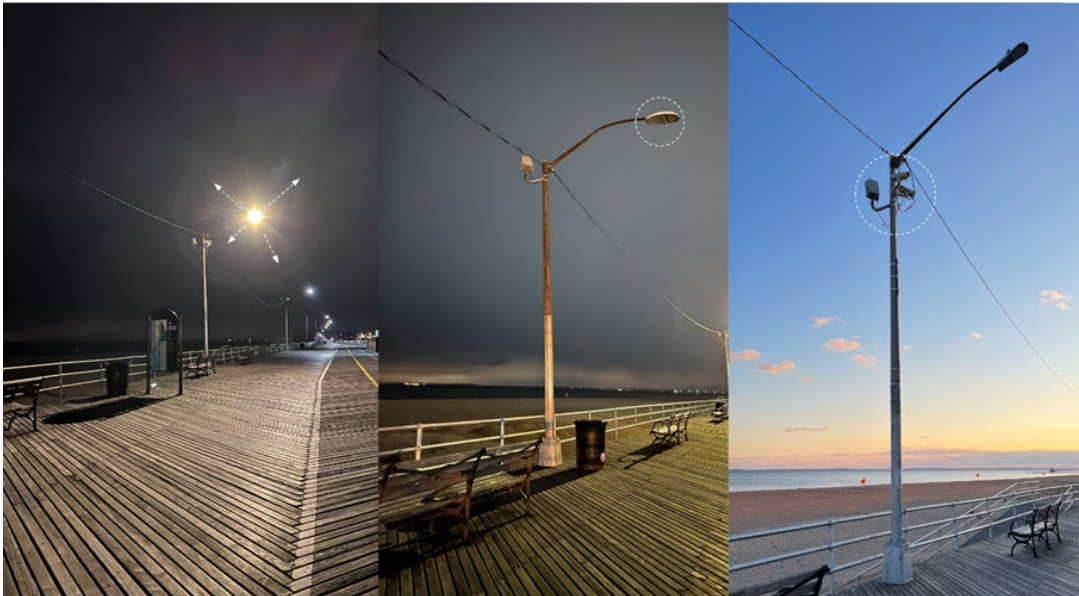


Figure 7.9. Existing Qualities of Light on the Site



Figure 7.10. Image Showing Glare and Light Trespass from Father Capodanno Blvd, the Parking Lot, Ocean Breeze Athletic Complex, and Verrazano Bridge

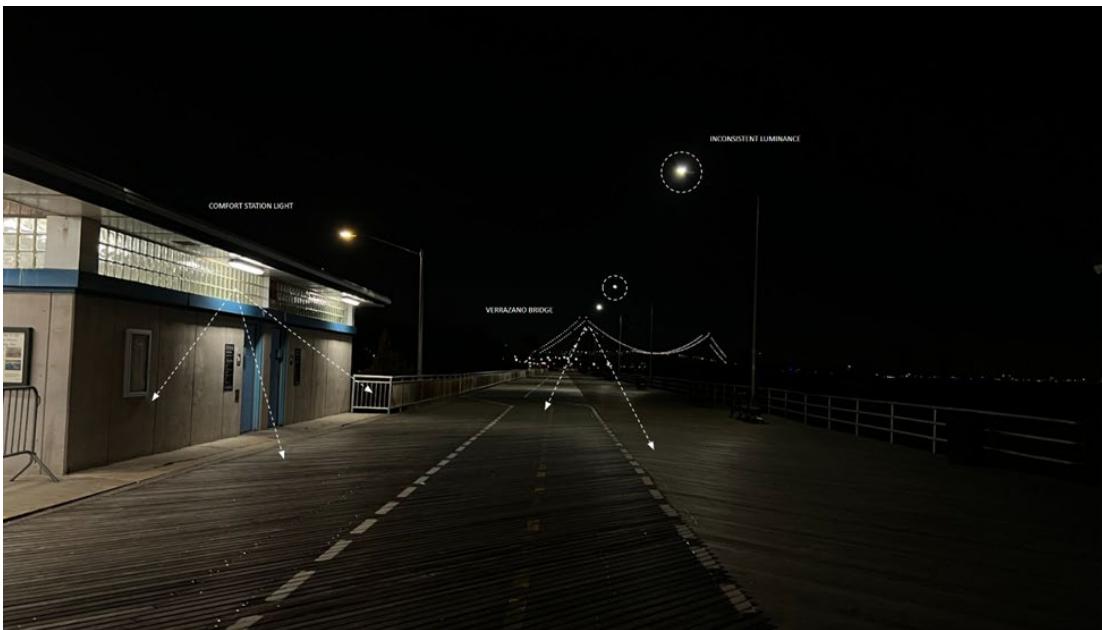


Figure 7.11. Image Showing Inconsistent Lighting and Light Trespass from the Comfort Station and Verrazano Bridge

Chapter 8 : Design Proposal

To design my site, I revisited the earlier lighting typology framework I had created, now with a thorough understanding of my site analysis and goals. Light goals were condensed into three overarching themes of entertainment, education, and reflection. And along with light type, and light duration, consideration of space function was added to the matrix to help determine how these lighting elements would be used in the redesigned landscape and how they would respond to and enhance movement, gathering, and entry points along the site (Figure 8.1).

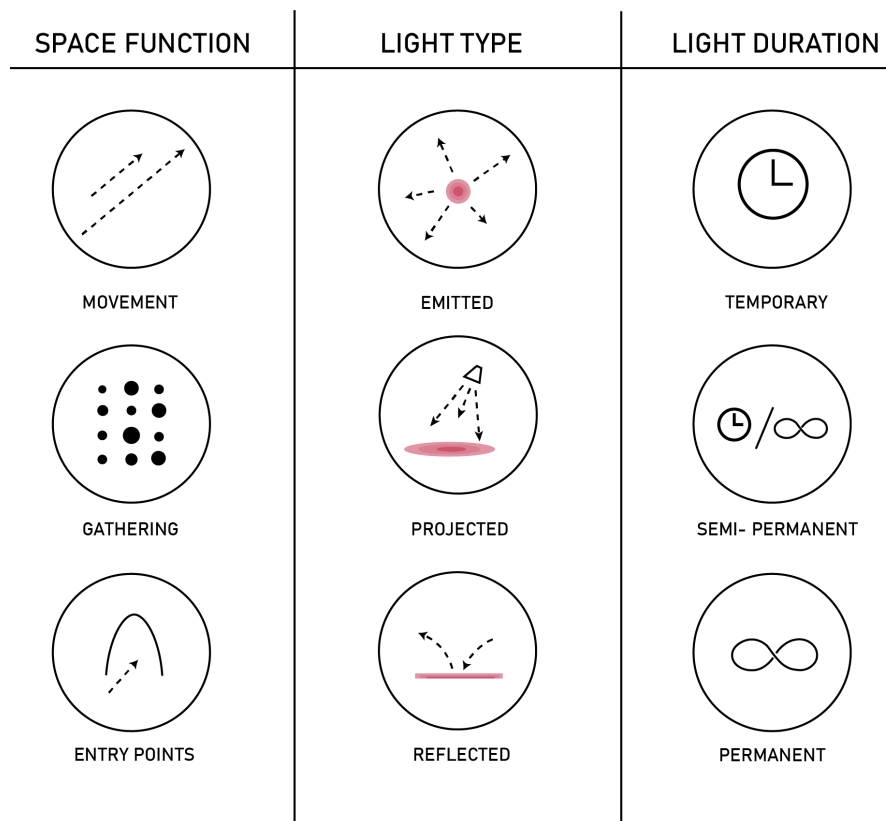


Figure 8.1. Lighting Typology Framework Illustrating Options for Space Function, Light Type, and Light Duration

Site Plan

The plan redesigns the spaces between Father Capodanno Blvd and the newly raised boardwalk into a completely new environment. This series of spaces enhance movement, activate places for gathering, and provide accessibility up to the boardwalk. Including a new canopy walk, open lawn, plazas at different scales, light promenade, nature walk, and reconfigured spiral ramp, these new places will be defined and emphasized through their emitted, projected, and reflected lighting at night, as shown in Figures 8.2 and 8.3.



Figure 8.2. Site Plan Illustrating the Redesign of the Seaview Ave Site



Figure 8.3. Site Plan of the Redesigned Seaview Ave Site at Night Illustrating Proposed Lighting Interventions

Canopy Walk



Figure 8.4. Canopy Walk Rendering

Beginning at the northernmost part of the site, is the new canopy walk. Lighting along the edges of the new elevated pathway illuminates the way forward, facilitating movement through the site and offers a new experience to get up to the boardwalk. While the path is lit, the surrounding canopy provides a contrasting element of darkness and helps strengthen perceptions of darker skies at night. In this way, the canopy walk not only takes into consideration the presence of light but plays on its absence to create a dramatic composition.

Wave Plaza



Figure 8.5. Wave Plaza Rendering

The next space as users move south through the site is the Wave Plaza. The plaza takes the place of the former parking lot, with this new location offering a more purposeful pedestrian entryway and direct visual and physical connection to the boardwalk and pier. The parking lot is moved just south of its previous location, now with a more convenient entry at the Seaview Ave intersection. The lot is reconfigured into a pickup and drop off loop with designated handicap spots with more parking being offered across the street.

The plaza is a fun, programmable space, offering ample opportunities for community events, such as summer concerts, performances, and food trucks, as well as space for placement of larger temporary light installations. The plaza encourages gathering long after the sun goes down. Blue lights embedded into the pavement activate the space, transforming the hardscape into an array of glowing orbs. Users

are further immersed when a “wave show” triggered by the arrival of high tide brings the energy of water into the space. This process is not only engaging but brings to light the natural processes of the landscape we are often not aware of.

Up to the Boardwalk

From the plaza, users have the option to get up to the boardwalk using the new grand steps that double as a space for sitting, gathering, and looking over the wave plaza. A new comfort station will sit adjacent to the steps, with an elevator offering a secondary means of arrival to the elevated boardwalk. At the top, covered seating offers ample space for gathering on the boardwalk itself. Constellation lights embedded at the entrance of the wooded promenade, mimicking the hidden stars of the night sky, will help orient people and direct them to the pier, where light will be kept minimal to emphasize views of the water and the as well as the lights of the Verrazano Bridge.

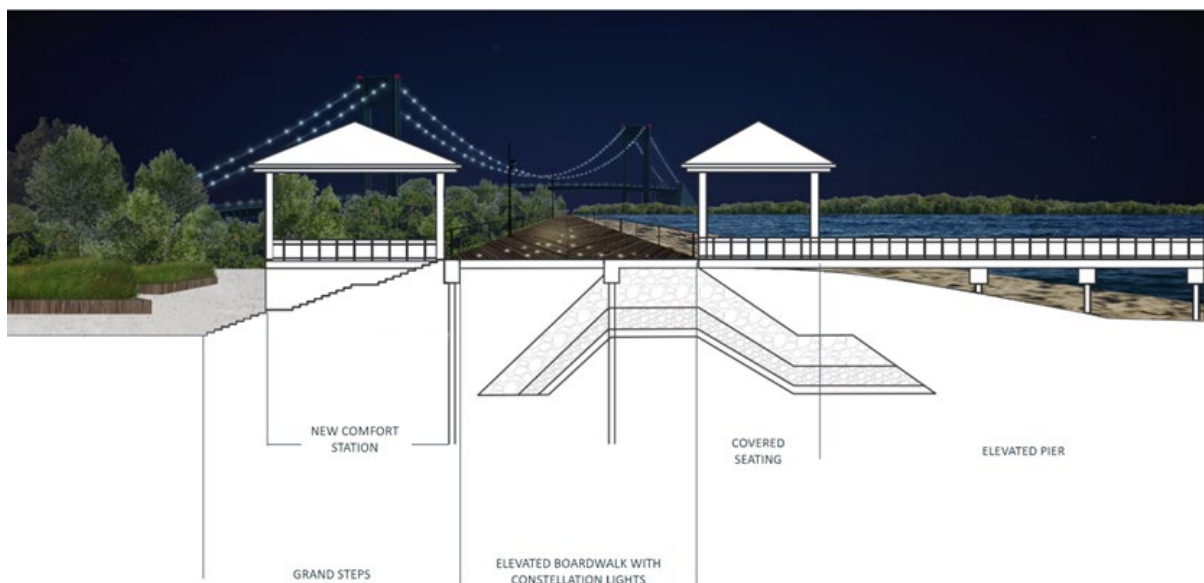


Figure 8.6. Section of the New Grand Plaza Steps, Elevated Boardwalk, and Pier

Light Promenade

From the plaza, users also have the option to walk south through the site, where they will reach the light promenade. During the day, dappled light shining through the trees along the path creates a beautiful, relaxing, and dynamic environment, with patches of light and shadow moving and changing throughout the day. As the sun begins to set, warm light emanating from the benches and light posts set a new mood along the same path. The space offers a calm, and subtle space to stop and sit, before moving on the journey through the rest of the site. When the sun goes down, the light promenade becomes a space for entertainment, joy, and immersion. Digital gobos project an array of colors, shapes, and patterns onto the surface, filling the space with vibrant light. And this experience can change based on the time, the occasion, and of course the season. In the spring these projections may be of flowers, while in the winter, gobos can be programmed to project snowflakes, activating the space, and encouraging engagement during the colder months.



Figure 8.8. Light Promenade During the Day



Figure 8.7. Light Promenade at Sunset



Figure 8.9. Light Promenade at Night (Spring/Summer)



Figure 8.10. Light Promenade at Night (Winter)

Wetland Plaza

As users move further down the site, more natural themes begin to emerge.

The next key feature on the site is the wetland fountain. In this secondary plaza space, etched into the hardscape is a serpentine water feature, mimicking the channels of the tidal wetlands that once covered the site. During the day the water acts as an exciting tactile experience, especially for children. The night, however, reveals a new attribute of the feature. Fountain lights illuminate the strong form, allowing it to truly stand out against the surrounding pavement and drawing users to interact. Signage around this plaza will provide the inspiration behind the pattern and share the story of Staten Island's wetlands. Therefore, this space is not only immersive, but educational.

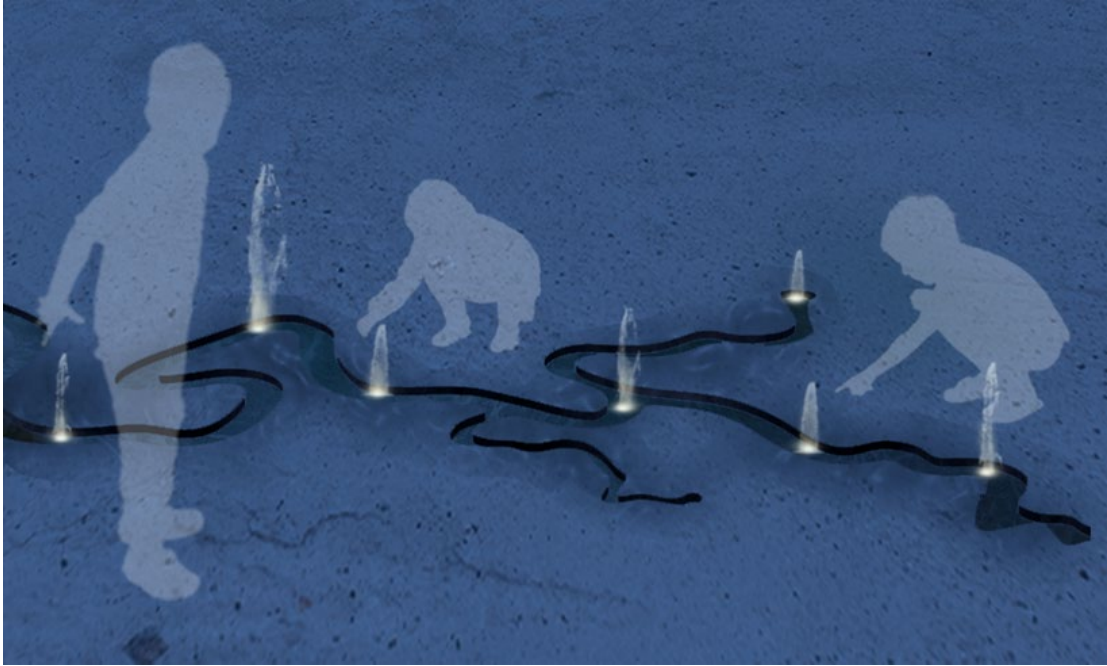


Figure 8.9. Wetland Plaza Light Fountain Rendering

Nature Walk

This space is more natural, allowing people to experience what it might be like to walk through the wetlands. Light emitting from the paths orients users through space and a constructed pond acts as a naturally reflective surface. This space offers the unique opportunity to use this quality of water to reflect surrounding light, reflect the night sky, and offers a place for temporary water installations. With lighting that is subtle, but effective, this space allows for individual contemplation and meditation as well.



Figure 8.10. Nature Walk Lights and Temporary Light Installation Floating on Constructed Pond Rendering

Reconfigured Spiral Ramp

As users make their journey through the site, they reach the final ramp up to the boardwalk. An embodiment of the history of space from tidal marshes to a vulnerable waterfront, the pathway up the new wall tells the story through reflection. Brushed metal panels etched with visual information about key moments of the site's past, are embedded along the ramp. The gold metal glows as the sun hits its surface and continues to be illuminated as the artificial lights in the area come on. As they get

to the top, there is an overlook - seeing the bridge, looking over the water - the light here is kept simple, allowing them to reflect on all they've learned.



Figure 8.11. Metal Panels Reflecting Sunlight Rendering

Reimagining the Wall

While all the previous spaces worked to create beautiful, engaging, and immersive areas between the wall and the road, I also wanted to address lighting along the wall itself. The rendering below shows that the seawall is a dark, massive, overwhelming structure, completely out of place compared to the surrounding environment.

However, through projection of vibrant colors and patterns, the wall becomes an opportunity rather than a constraint. Lighting here can be used to make the wall a destination, a place that attracts people inward and indicates their arrival to the boardwalk. Projections of water under the wall will offer not only general lighting, but providing definition for the edge of the structure, wayfinding for users, creating different effects along its length giving each zone its own character, bringing the concrete barrier down to a human scale (Figure 8.15). It can also be used to spread awareness. The projection of a pink line in this Figure 8.16 represents the height of the old boardwalk and emphasizes just how dramatic the shift has become. This can hopefully be used to further educate viewers about the threats of climate change and sea level rise.

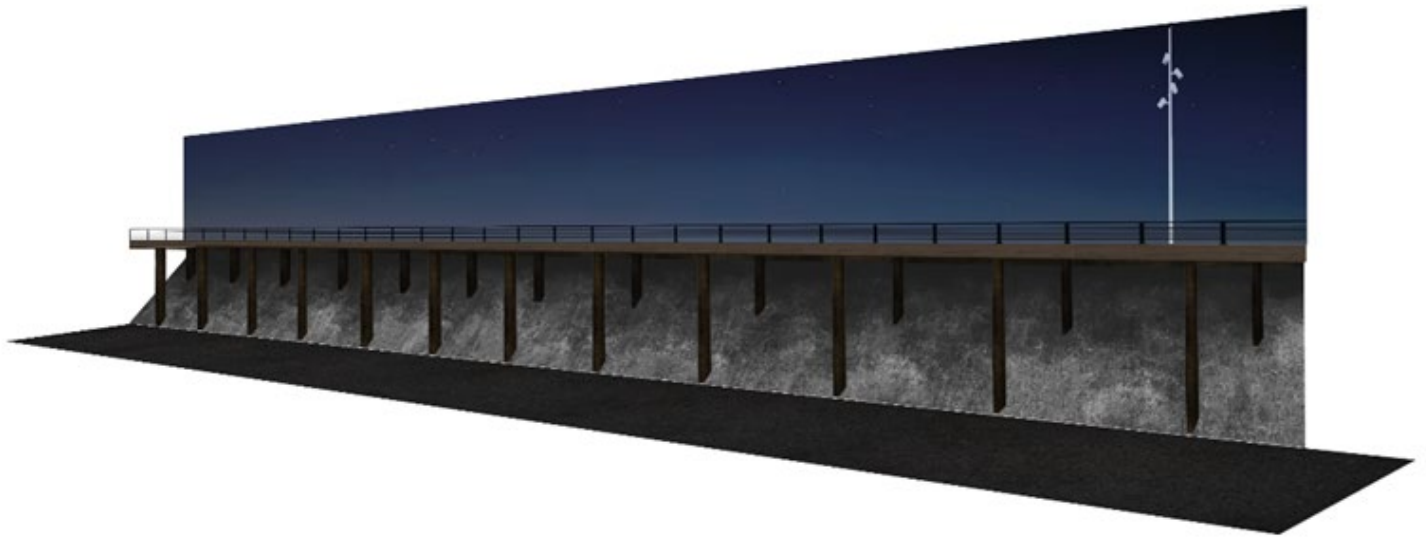


Figure 8.12. Rendering of the East Shore Seawall Prior to Lighting Intervention

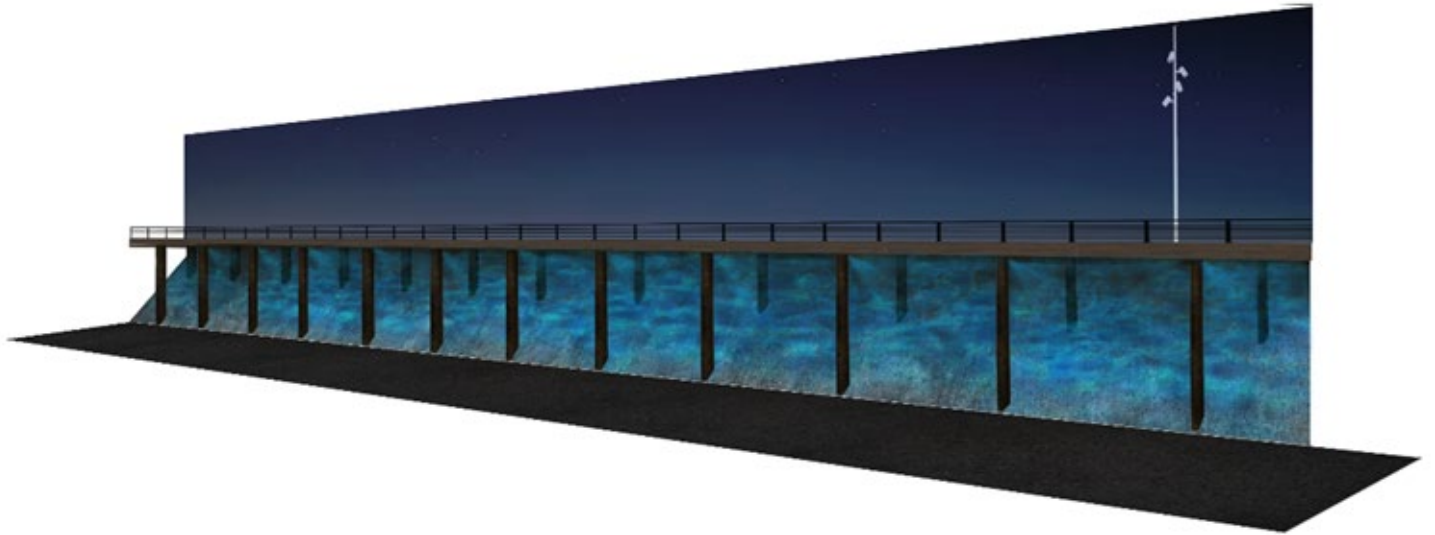


Figure 8.13. Projections of Water Along the Seawall

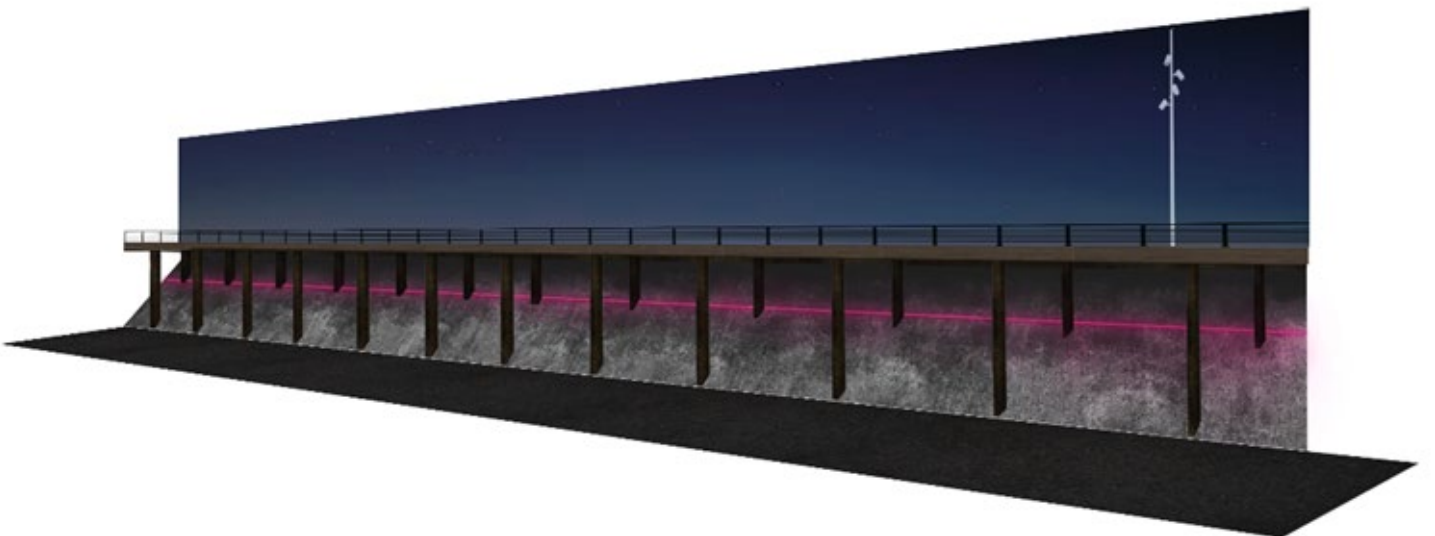


Figure 8.14. Projection of a Pink Line Represents the Elevation of the Old Boardwalk

Creating A Mockup

Lastly, inspired by precedents of temporary lighting installations and their ability to tell powerful stories, I wanted to propose my own installation for the site and simultaneously use this thesis as an opportunity to create a prototype that would allow me to explore the energy of lighting beyond renderings on a screen. To do so, I made a mockup of a lighting installation intended to be placed on the open plaza space. Asking the question, what if there was no wall here? What would happen to this site? Would there even be a site? Using NOAA projections of sea level rise for the northeast United States, in the year 2100, I explored a way to communicate this data through artful light. In this installation, vertical light tubes sit at 3 different elevations: 2', 4', and 7', reflecting scenarios of low carbon emissions, intermediate emissions, and high emissions (Figure 8.18) (Sweet et al., 2022, p. 20). Standing next to the tubes, under the flooding blue light, users become aware of what exactly lies in store for the borough, the city, and frankly the world, if action is not taken to mitigate the effects of climate change. This installation is immersive, transformative, and most importantly educational, encouraging more than just awareness, but stewardship.

	2050	2100	2150
Low	1	2	2.6
Intermediate Low	1.2	2.3	3.9
Intermediate	1.3	3.9	7.2
Intermediate High	1.5	5.5	9.1
High	1.7	7.2	12.7

Figure 8.15. Table Showing Estimated Future Sea Level Rise in 2050, 2100, and 2150 Based on Five Emission Scenarios

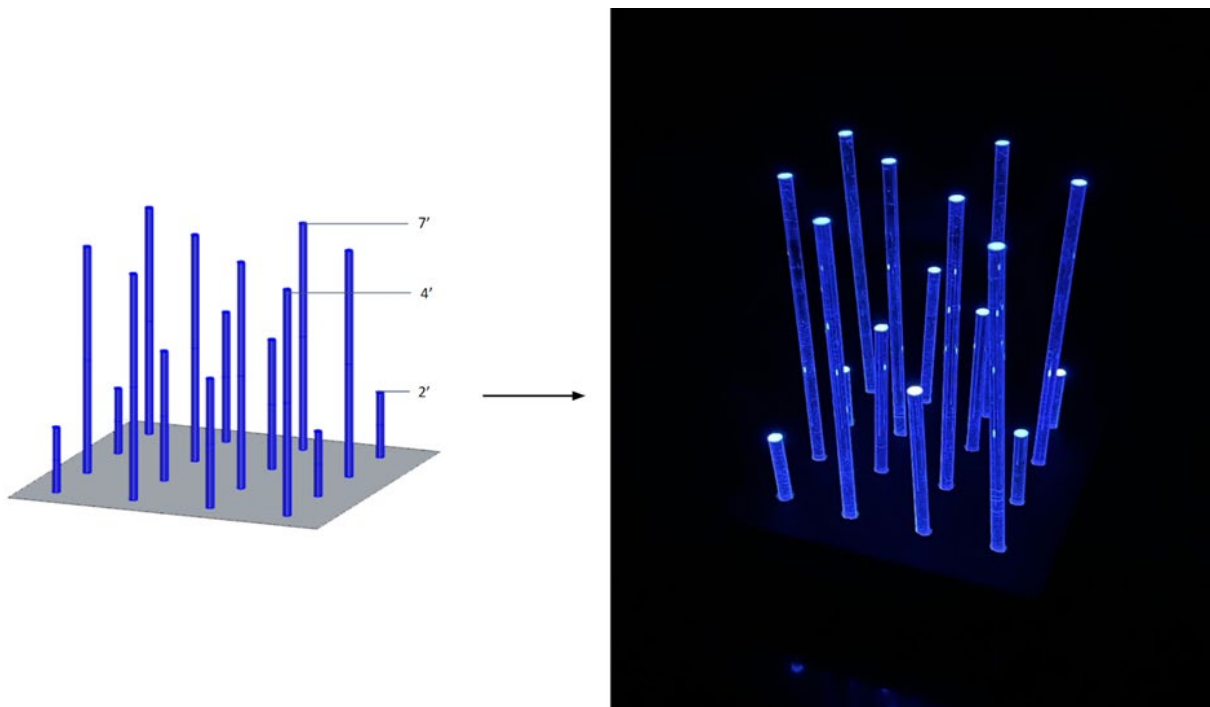


Figure 8.16. Mockup of Temporary Light Installation Made from an LED Light Box and Acrylic Dowel Rods

Chapter 9 : Conclusion

Key Takeaways

In order to create truly successful and comprehensive public spaces, we have to take into consideration the nighttime landscape. Thinking beyond function, we as landscape architects, must integrate artful lighting into our design process to create active, legible, and engaging places.

The FDR Beach and Boardwalk is a precious community space situated along a severely vulnerable waterfront. Worsening climate change threatens its very existence. While the proposed solution may offer coastal protection, it brings an entirely new issue to the forefront. The threat of rising sea levels has become the threat of losing connection to a valuable landscape.

The issues faced by this site will not be unique for long. Climate change will worsen and sea levels will rise, so we should not be surprised to witness more and more coastal communities losing their beloved open spaces to overwhelming, climate-resilient infrastructure. Whether projects like the East Shore Seawall are truly sustainable, or just a temporary band-aid on a much larger issue, they will go up with or without our permission. What we as designers can do is respond accordingly.

This thesis demonstrates how lighting can be used to create a memorable nocturnal experience that engages users and strengthens connections to their landscapes, those existing, those endangered, and those lost, through techniques that offer entertainment, education, and reflection. Lighting is used to activate different spaces throughout the site, honoring its history, its ecology, and most of all its

community. Lighting redefines the atmosphere, creating new opportunities to engage with the water, physically and visually. This thesis is also evidence that beautiful, creative, and immersive lighting *must* become a required component of any future intervention to enhance the experience of the new landscape that will emerge as a result of proposed infrastructure.

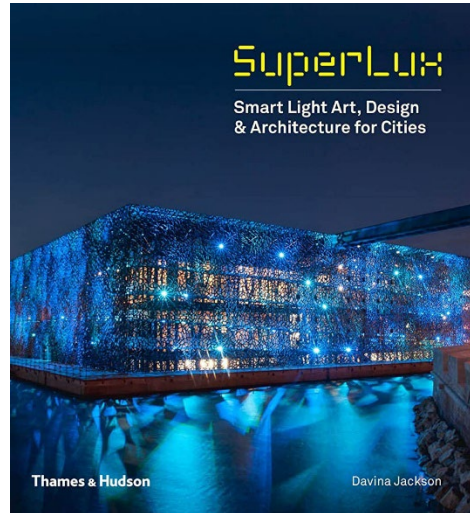
It is my hope that the ideas presented in this project will serve as inspiration for similar waterfront sites whose critical community spaces are threatened by future barriers. To do effectively, further research is needed into the technical aspects of lighting design. Collaboration with lighting designers and engineers will be critical in determining the feasibility of these ideas.

Future iterations of this design must also place emphasis on the network of pedestrian lighting on the site. One assumption made in this thesis is that all lighting throughout the site will follow required ADA guidelines for lighting design to provide spaces that are safe, secure, and accessible. However, for a more comprehensive masterplan, all sources of illumination should be thoroughly analyzed and detailed including the height of luminaires, their type and wattage, spacing of light sources, and arrangement of fixtures. Photometric analysis should be conducted to ensure proper distribution of light throughout the site (Project for Public Spaces, 2008). All design interventions, both future and those proposed in this thesis must follow the recommendations of the International Dark Sky Association where possible to fully harness the benefits of lighting.

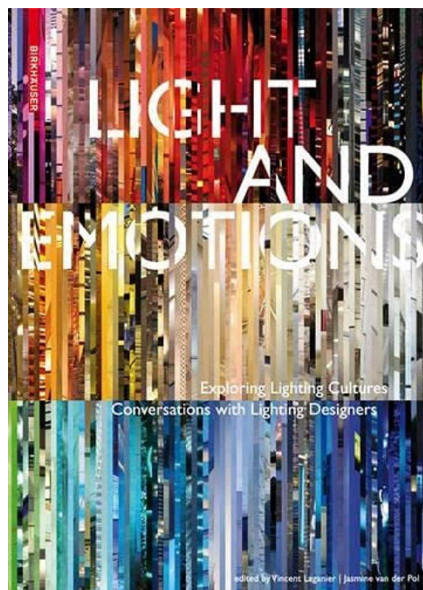
Appendices

Appendix A: Exploration of Precedents – Recommended Materials

SuperLux: Smart Light Art, Design and Architecture for Cities provides hundreds of wonderful examples, from city streets to waterfront, of lighting projects around the world. This book has been integral to my research of artful lighting precedents.

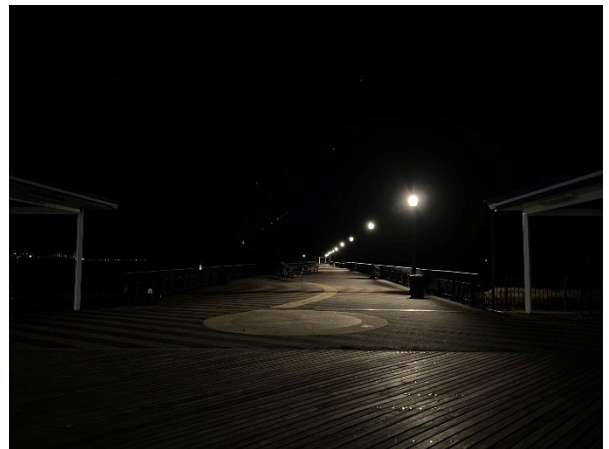
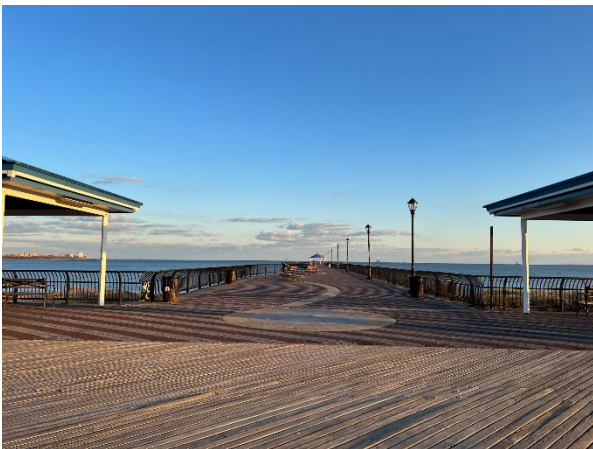


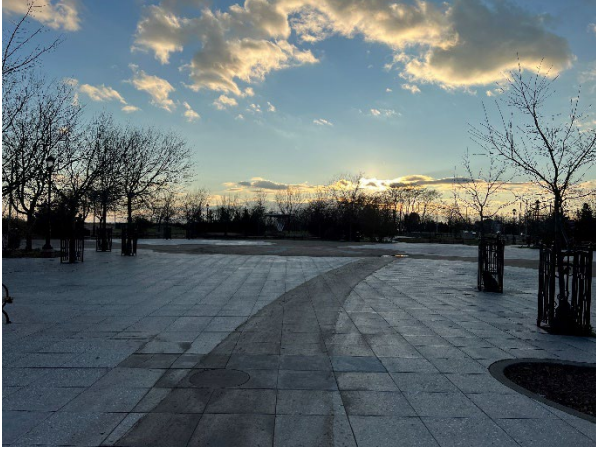
Light and Emotions: Exploring Lighting Cultures, Conversations with Lighting Designers, also offers examples of beautiful lighting projects, but more importantly provides interviews with practicing designers from different backgrounds, who helped me understand the magic of lighting in their own words.



Appendix B: Photographs of Lighting Conditions

Photographs showing lighting conditions on the site during the day and at night.





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