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Reclaiming an Industrial Waterfront: New Haven Connecticut

A Design Proposal

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Abstract

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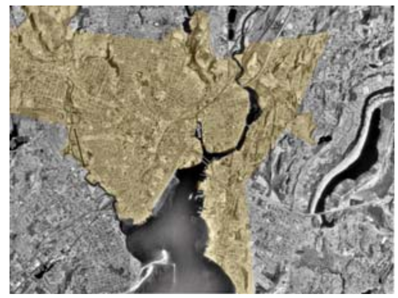
Reclaiming an Industrial Waterfront: New Haven Connecticut

The city of New Haven, Connecticut has identified a plan for redeveloping underused industrial land. The defined project area is bisected by River Street in the neighborhood of Fair Haven. Once part of the industrial core of the city, the River Street project area has become underused, visually deteriorated, environmentally contaminated, and a barrier for public access to the Quinnipiac River. This is a proposal for a design solution that will integrate a linear public waterfront park as part of a greenway system with new light marine industrial land uses. There is an opportunity for an interpretive design solution that acknowledges the natural and cultural history of the area for the enhancement of place identity and civic pride.

Introduction



The city of New Haven has proposed to redevelop a series of abandonded industrial properties in the neighborhood of Fair Haven. The major initiatives of the plan are to create new light industrial uses, along with mixed-use development, and a linear waterfront park.

The project area is located on the southern tip of the Fair Haven peninsula, a peninsula formed by the confluence of the Mill River and the Quinnipiac River. The project area is bounded by Chapel Street to the north and Ferry Street to the east. An existing park with a ball field, basketball courts, and a playground, bounds the west while the Quinnipiac River makes up the south facing shore. River Street bisects the existing properties in the project area and runs in an east and west direction.

Existing Conditions

The River Street vicinity of Fair Haven is relatively flat and much of the project area is within the 100-year floodway. The bedrock beneath the site is red rock or Connecticut Valley Arkos Sandstone. Mainly fluvial and glacial deposits consisting of cobbles, sand and silt make up the soil above. Much of the soil between River Street and the Quinnipiac River is urban fill. The water table generally fluctuates between four and ten feet below the surface.

The project area was once home to New Haven’s oldest industrial corridors. In recent years decline in industrial activities have created vacant and underused land. Currently, over 41% of all land in the project area is now vacant (City of New Haven, 2002). These blighting influences have impaired the economic viability of the area while degrading visual quality and environmental conditions. The most notable traces of the industrial past include the abandoned tank farm associated with a gas terminal of which most recently was owned and run by Amerada Hess Corporation. The Hess Gas Terminal shut down during the year of 2000 (City of New Haven, 2002). Other notable remains include the Bigelow Company factory building and the National Pipe Bending Complex where boilers and their parts had been produced since the beginning of the Industrial Revolution. Recent activities on these abandoned factory properties consisted of outdoor scrap metal storage and shipping.

Past heavy industrial use of this land has created soil and groundwater contamination in much of the area south of River Street. Several of the properties in the project area have been officially designated as brownfields. Phase 1 environmental site assessments identify the likelihood of soil contaminants. Conclusions suggest further investigation for the verification of contamination types and concentrations (Facility Support Services, 2001). Possible pollutants include heavy metals and petroleum fuel products (Gigliotti, 2005).

Fair Haven

Outside the project area is the Fair Haven residential neighborhood. This neighborhood is of relatively high density and accounts for approximately 15% of New Havens total residents. Fair Haven ranks second in total residents, out of the twenty-one neighborhoods that make up the city. It ranks third out of twenty-one neighborhoods in residential density. Fairhaven is ethnically comprised of fifty-two percent Hispanic, twenty-three percent African American, and twenty percent white (US Census Bureau, 2000). This neighborhood is often characterized as a low-income neighborhood where seven percent of the residents are unemployed, and thirty-six percent have incomes below the poverty level. Many of the area's living wage jobs are in home repair and construction, as well as, in manufacturing and material transportation. According to the census 2000, census tract 1423, of which is the River Street area of Fair Haven, roughly thirteen percent of housing units were vacant. Out of the occupied units, seventy-seven percent were renter-occupied.

River Street MDP

The environmental contamination, visual deterioration and subsequent neighborhood erosion, are issues that the city plans to address through the redevelopment of the project area. The city's planning department has created a document called the River Street Municipal Development Plan. The main goal of the redevelopment will be to "build on the existing economic base and to revitalize River Street in a well-designed manner with opportunities for resident employment and public access to the Quinnipiac River" (City of New Haven, 2002). As part of this overall goal the city proposes these five core initiatives:

- The redevelopment of significant vacant land for new light industrial and manufacturing uses.
- The restoration and adaptive reuse of the historic bigelow building
- The development of a waterfront park and linear trail along the Quinnipiac riverfront
- Improvement of public infrastructure
- The implementation of new design controls, to create a more appealing and sustainable environment.

A portion of the greenway trail system that has been proposed for the Fair Haven area has been completed just north of the River Street project area. Figure 1, provided by the City of New Haven's Plan for Greenways and Cycling Systems, shows the proposed greenway. The photograph below shows the completed section of the greenway as part of Brewery Square Walkway. At this location, a historic industrial building has been preserved and transformed into commercial offices and residential condominiums. The River Street plan is different in that the proposed land use that will be adjacent to the greenway is light marine industrial.

Figure 1

Design

The remainder of this proposal deals with the design aspect of this project. The intent is to prepare a design solution that will be of potential use for the city, in addition to, the fulfillment of academic requirements and the exploration of personal interests.

The mission of this design project will be to integrate interpretive public space with new light industrial uses, in a way that enhances place identity and civic pride. To accomplish this mission, the following project goals are provided:

- Provide a design solution that fulfills the program requirements proposed for the project area by the city of New Haven.
- Increase public awareness of site-specific natural process and cultural history.
- Improve the overall environmental quality of the area
- Improve the overall visual quality of the area.

In order to provide a design solution that will be of potential use for the city, decisions will adhere to the program that the New Haven Planning Department has outlined in The River Street Municipal Development Plan. One major objective to be addressed through design will be the integration of the proposed waterfront greenway with new marine industrial land uses. This objective is unique in the fact that the proposed land uses will likely require access to the Quinnipiac River, as will the public space associated with the linear park and greenway trail.

A major component of this design project will be to increase the public awareness of site-specific natural process and cultural history. I believe that illuminating such elements is an important component to enhancing the identity of the local area, the neighborhood and possibly the city. Reconnecting the Fair Haven neighborhood with its natural resources, and cultural history goes along with initiatives set out by the city. This reconnection will enhance civic pride and give the River Street neighborhood a new sense of place. This civic pride and sense of place are fundamental building blocks in the process of neighborhood revitalization.

Intentions for the final design also include an improvement to the overall visual quality of the site. The neighborhood of Fair Haven and other area residence have been denied access to the Quinnipiac River waterfront along this industrial corridor. Years of heavy industrial processes, followed by years of vacancy have lead to the current degraded visual state of the site. The design solution will allow for public access and capitalize on waterfront views as a means for reconnecting the public with its natural and cultural resources. Vegetation will be reintroduced to enhance these waterfront views. Findings of human landscape preferences, as biological responses to certain environments will be applied to improve visual quality.

The design will also incorporate remediation for the soils that have been contaminated by historic and recent industrial use. It will be assumed that traditional remediation techniques will be applied, where identified localized areas, (hot spots), of contamination exist. The soil to a depth of at least four feet will be removed and replaced with clean fill (Gigliotti, 2005). However, natural groundwater systems are interconnected often allowing for contamination to exist outside the areas of soil replacement. Therefore, phyto-remediation techniques may be incorporated as an ongoing soil-cleansing component.

Process

The final design solution will rely heavily on uncovering, revealing or abstracting site-specific characteristics as means of enhancing place identity and civic pride. These site-specific characteristics will include natural processes and cultural history. The site is rich with layers of historical use, natural process and the interaction between the two. Extracting these site-specific elements will lead to the formulation of a design concept that eventually informs the final design. How these elements are extracted becomes the process for understanding the site.

The basic framework of the “Four Trace Concepts”, created by Christophe Girot, has been chosen as a process for understanding the site. The mission that has been declared for this project requires a design solution that goes beyond program, aesthetics and environment. The design will impact the users on an emotional level and will require an exceptional understanding of site history and process. The four trace concepts, will allow for this deep understanding. “The primary purpose of this highly intuitive and experiential approach to working with sites is to draw as much as possible from the potential of any given place and to assess which existing landscape elements might be of real significance for the design yet to come” (Girot, 1999).

The four trace concepts are landing, grounding, finding, founding and according to Girot they “must follow sequentially so as to enable the site to emerge in a comprehensible manner” . This process is largely based on intuitive and experiential investigation. This process will be explained as I have interpreted it and as I intend to apply it (Girot, 1999).

Landing is essentially the first encounter that a designer has with a site. It is exploration, discovery and observation, driven by “wonderment and curiosity, with subjective and interpretive eyes” (Girot, 1999). It is also driven by chance. A first impression of a site may depend on the season, the time of day, or the elements, and this is what separates it from traditional analysis. It becomes a personal journey that reveals the "experiential potential of the site", which likely lasts throughout the design process (Girot, 1999).

Grounding comes after landing and is the reading and understanding of a site through repeated visits and investigation. It is basically site analysis, however unlike the traditional method of site analysis, it is investigation based on intuitive observations that occur during landing or grounding. Therefore, the analysis is directly connected to the experience.

Finding is the "thing discovered". It may be an accidental discovery or it may be a discovery found through searching or calculating. It can be as simple as discovering an object, or it could be less obvious and rather "intangible". "Finding usually discloses the evidence to support one's initial intuitions about a place" (Girot, 1999).

The final stage of Girot's landscape discovery is Founding. Founding is what informs the design. What the designer has found will become an integral part of the solution. It is a synthesis of the information gathered during landing, grounding, and finding. "It comes at a moment when the prior three acts are synthesized into a new and transformed construction of the site. Founding may be conservative—referring to some past event or circumstance—or innovative—importing something new to a place. Whatever the case the act of founding is always a reaction to something that was already there" (Girot, 1999).

I believe that this process of rigorous, hands-on, experiential site analysis will allow for a deep understanding of the natural processes and cultural history that make up the site. This exceptional understanding of the site will be essential in creating a place with identity for visitors and local residence to take pride in.

History of Fair Haven

The peninsula of land formed by the confluence of the Mill and Quinnipiac Rivers, what is now called the neighborhood of Fair Haven, was once inhabited by the Quinnipiac Native American Tribe. The tribe's main village was located on the tip of the peninsula, surrounded by water on all sides, in and around the vicinity of existing River Street. This village served as a stop "on the major coastal Indian trail" (Dunning, 1995).

The Quinnipiac tribe relied on the natural cycles of the river and the land. Plots of land burned for crop growing were rotated for maximum yields and reforestation. The tribe also harvested oysters from the surrounding waters (Gorman, 1997).

The Quinnipiac Tribe created the "legend of sleeping giant" for the mountain visible from the Quinnipiac River, upstream from Fair Haven. Now known as Sleeping Giant State Park, its name was derived based on the legend passed down from generations of Quinnipiac Indians. The legend essentially states that a big powerful chief once ate so many oysters that he needed to lay down and take a nap on his journey home. A spell was cast and he never awoke. Trees and grass eventually grew over him and created what is now Sleeping Giant Mountain (Dunning, 1995).

Colonists settled the New Haven area around 1637. The Quinnipiac Tribe, weakened by years of fighting with neighboring Pequots and Mohawks, were glad to give up land to the colonists in exchange for protection. Eventually, culture differences and resource competition drove the Quinnipiac Indians out of Fair Haven (Rass, 2005).

The first settlers of Fair Haven imitated the Native Americans in that they began farming the peninsula's fertile soil as well as collecting and eating oysters. "Mounds of oyster shells left by the Indians were a common sight around the harbor" (Rass, 2005). During this time, oysters covered the mudflats in the area and were available for picking during low tide. This lead to the creation of the Fairhaven neighborhood, very separate from downtown New Haven, a small fishing village largely dependent on the oysters in the river. By 1808, supported mainly by the oyster industry, Fairhaven had roughly 50 homes, for 150 people (Rass, 2005).

Throughout the 1800s oysters remained the trade of the neighborhood. The oyster industry expanded to include many other factions other than harvesting. Such activities included, packing and shipping, and the manufacturing of oyster kegs and tins (Rass, 2005). In 1838, Fair Haven was described as "a flourishing village…containing 1,000 inhabitants" all partaking in the oyster business (Townsend, 1976).

As a result of the expanding oyster industry, shipbuilding became Fair Haven's second leading industry during the mid 1800s. The oysterman's vessel of choice was the "Sharpie" (Dunning, 1995). This boat was built in Fair Haven and was tailored for harvesting oysters from the shallow mudflats and tidal marshes (Rass, 2005).

Oyster populations began to decline due to the rigorous harvesting during the mid 1800s. By 1858, the native New England Oyster was nearly extinct, however, that year, shipments of oysters were brought to New Haven harbor for reseeding the diminished oyster beds. The industry shifted from harvesting only, to the science of cultivating and seeding. This shift created a revitalized booming industry that exported oysters to locations as far as Chicago and the West Indies at its peak during the 1890s (Rass, 2005).

The Oyster industry once again began to decline as the industrial revolution increasingly influenced the Fair Haven neighborhood. Initially, manufacturing activities served the oyster industry through ship building and packaging. Eventually, the river and harbor access, along with the existing railroads, fishing infrastructure, and a strong base of skilled workers, created an unavoidable opportunity for new heavy industrial uses (Gorman, 1997). Numerous factories were built, attracting immigration from Europe with low living costs and new job opportunities. The Bigelow Company was one of the first factories to be built on the southern tip of Fair Haven and its expansion and success paved the way for the eventual industrial core of New Haven.

Upon its opening in 1869, the Bigelow Company produced portable engines that were used in the gold mines and oil fields in Pennsylvania. The factory also produced cutters and milling machines for sugar cane in the Caribbean (Gorman, 1997). The Bigelow Company concentrated their manufacturing to boiler making, and in 1905 a new factory covering many acres on the Quinnipiac River front, made it the largest manufacturer of steam boilers in New England (Gorman, 1997). Hobart Bigelow, the founder, also had his hand in the creation of the National Pipe-Bending complex just next to the boiler factory. The pipe-bending complex was the sole producer of the feed water heater, used to heat water feeding steam boilers. The pipe-bending complex also produced the tubes that comprised the largest portion of the boilers that were manufactured at the factory down the street. These two major factories established the

River Street area of Fair Haven as a “center of the metal fabricating industry” (New Haven Preservation Trust, 2002).

Part of the success of the metal manufacturing industries that eventually lined the southern tip of the Fair Haven peninsula, was the access to the river and for shipping. Around the turn of the century, deep-water access for larger vessels was granted when congress authorized dredging for a channel twelve feet deep and 200 feet wide (Rass, 2005). This dredging occurred despite much opposition from the remaining oystermen of Fair Haven. Eventually the mudflats and tidal marsh areas that buffered River Street from the river were filled to allow for this deep-water access. The three maps displayed, depict the outward progression of the shoreline beginning at the top with a map produced in 1888 to a map produced in 1911. The aerial photograph shows the present shoreline.

The dredging, filling and pollution associated with the heavy industrial processes together squandered the oyster industry. By 1930 the oyster industry was at its all time low and nearly wiped out except for one company, which still operates today, the Long Island Oyster Company (Rass, 2005). The decline in the heavy industrial uses of land along the Quinnipiac River coupled with recent improvement to pollution regulations, has allowed for the area waters to support oysters once again. “In an interesting twist of fate, this industrial decline, combined with more rigorous pollution control, has revived the area’s once thriving oyster-industry” (Triplett, 1999).

Brownfield Redevelopment

The U.S. Environmental Protection Agency (EPA) has defined brownfield sites as “abandoned, idled or under-used industrial and commercial facilities, where expansion or redevelopment is complicated by real or perceived environmental contamination" (EPA, 2001). Brownfield sites are often associated with derelict industrial facilities that have been abandoned and vacant for a significant period of time. The industrial abandonment has influenced the deterioration of adjacent neighborhoods, usually correlating brownfield sites with low-income, deteriorating urban areas (Davis, 1997). Because these industrial sites once relied on water access but are no longer in operation, they are also often associated with urban waterfront development opportunities.

Realizing and acting on these opportunities has been difficult. Associations attached to brownfield redevelopment are high costs and risks due to the deterioration of neighborhoods and the environmental contamination issues. Developers can see out plans much easier with sites that don't have these draw backs, such as a forested parcel outside the city. "One needs money to buy, test, and clean up the land before construction can start. Yet few investors want to lend money to clean up a contaminated property" (Baerny, 2004).

Despite these difficulties, it is very important that the opportunities that brownfield sites present are realized. It is vital to curbing suburban sprawl and revitalizing urban centers. "The hope is that the reclamation of these sites will lessen the need for developers to build on the suburban fringe" (Sprawl Guide, 2001). Recent progress has been made for government funding of such sites. The Clinton Administration developed an aggressive brownfields initiative managed under the EPA. Former Vice president Al Gore wrote in his preface to Brownfields: A Comprehensive Guide to Redeveloping Contaminated Property: "The estimated hundreds of thousands of abandoned and contaminated properties that are littered across our poorest communities—known as brownfields—present a significant barrier to economic revitalization in our nation's cities. By encouraging the cleanup and redevelopment of these brownfields, the Clinton administration is forging new ways to empower distressed communities and create jobs for their residents" (Davis, 1997).

Contamination

One of the major obstacles of brownfield redevelopment is the existing contamination of soil, surface water and groundwater as a result of historic industrial processes. Typically soil with high concentrations of contamination on brownfield sites is removed to certain depths below the surface and replaced with clean fill. This process can be very costly, but is an immediate solution. Recent research has been conducted on a less expensive, more long-term approach to contamination remediation. This approach is called phytoremediation and deals with the contaminants through the use of plants. Certain plants have the ability to break down contaminants, store contaminants, or impede the spreading of contaminants through the up-take of ground water (EPA, 2001).

This approach, however, does not produce immediate results and is useful for areas with low concentrations of contamination. According to the Environmental Protection Agency, "Phytoremediation warrants consideration for cleaning up brownfield sites at which there are relatively low concentrations of contaminants (that is, organics, nutrients, or metals) over a large cleanup area and at shallow depths." (EPA, 2001)

The likely course of action for the River Street project area, will be to identify "hot spots" (areas of high contamination concentrations), and remove the soil to depths of four feet, within these areas, and replace it with clean fill. Low concentrations of contaminants will likely remain in other areas. There is an opportunity to approach this low concentration contamination with phytoremediation. "Phytoremediation offers a unique advantage over other remediation technologies. It provides ecosystem restoration and "green areas" that may be desired by the local community." (EPA, 2001)

It has been identified that the likely most prominent contaminants in the river street project area are heavy metals, and organics (petroleum products) (Facility Support Services, 2001). The organic contaminants are associated with the former Hess Gas Terminal property. The EPA has identified that Indian Mustard was successful in the uptake of heavy metals on a site in Trenton New Jersey, while Hybrid Popular was successful in the degradation of petroleum and organic contaminants as well as for inhabiting contamination migration through groundwater.

Although every site has different physical conditions that determine how effective certain plants are for remediation of contamination, an example pilot study has been chosen based on basic condition similarities to the River Street project area, as a comparison.

Over fifty years of operations associated with a gasoline transfer terminal in Ogden, Utah, created a condition of petroleum contamination. Traditional methods of remediation were estimated to cost approximately one million dollars. Phytoremediation was the approach chosen that would serve as a pilot study to be used by the EPA. After three years, it was found that the vegetation, "especially grasses", (fescues, alfalfa), reduced contamination in the soil. "The mode of action for grasses appears to be enhancement of micro-organisms that degrade contaminants." (Jackson, 2001). The findings of this study also showed the success of poplar trees in degrading petroleum and inhibiting the flow of contaminated ground water. The total cost was 200,000 dollars, twenty percent of the original estimate. (Jackson, 2001)

Experience

Recent landscape architecture projects, dealing with derelict industrial sites, have embraced the historical industrial use to create an experience that recalls the past. An example of such design can be seen in Peter Latz's Duisburg-Nord Landscape Park, where a former steelworks plant was transformed into a public park. "Rather than try to erase the past, which was fiscally irresponsible, if not impossible, Peter Latz recognized that the combination of industry and nature, results in an experience rich with memories, associations, and feelings" (Reed, 2005).

It is the use of the existing structures on the site that are left "virtually unchanged in form" as reminders of the past industry and even the culture of the region (Lubow, 2004). Latz is quoted saying, “Landscape is culture”, in an article written in New York Times Magazine (Lubow, 2004). This cultural reminder is the opposite of subtle. The grand scale of the remaining blast furnaces, gas tanks, and storage bunkers enhances the incredibly moving experience. These remains become “awesome monumental sculptures…as reminders of the site’s history” (Reed, 2005).

This approach to reclaiming vacant industrial properties was first realized by Richard Haag in his design for Gas Works Park located in Seattle Washington. Gas Works Park was constructed in the 1970s on the site of a former coal and oil processing plant. Like Park Duisburg-Nord, Haag used the existing structures as sculptural reminders of the past. “The Chimneys and compressors of the old plant now mirror the Seattle skyline like ruins of a previous civilization” (Lubow, 2004). Once again, the experience is enhanced by the scale of the industrial remains as explained by Elizabeth Meyer, author of the essay, “Siezed by Sublime Sentiments”, but more important, a first hand visitor of Gas Works Park: “In my visit they extracted from me a sense of awe and elation coupled with a sense of dread and fear.” (Meyer, 1998) The industrial remains are left standing as sacred monuments that represent the past industrial use, but even further, the “death” of an era and the progression of our culture.

<u>Landscape Preference</u>

Recently, research has been conducted in the area of visual preference for landscapes. This research has explored visual preferences based on biological explanations. The research has built upon Jay Appleton’s theory of prospect and refuge published in his book, The Experience of Landscape in 1975. The premise of this theory is that humans have a preference for certain landscape settings as a biological response to what they see. This response is an instinctual partiality for the surrounding environment based on safety and survival.

Appleton argues that humans have aesthetic preference for landscapes which allow for hiding, (refuge), from danger and seeing danger from a distance, (prospect)

(Appleton, 1975). Therefore, the most preferred landscapes will be environments that have a balance of prospect opportunities as well as refuge opportunities. This perceived satisfaction for certain environments is a subconscious and instant response to sight and that a key inherent sense, is the sense of satisfaction that one can see and hide at the same time; or "see without being seen" (Appleton, 1975).

The publication of Appleton's Theory sparked further research of landscape preference. Stephen and Rachel Kaplan, in support of the theory of prospect and refuge, claim that humans have evolved with perceptual capacities that allow rapid processing of visual information that is important for survival. "Humans became proficient at extracting information from the environment and storing it in the form of cognitive maps" (Kaplan and Kaplan, 1982). Humans are inherent information gatherers and the more visual information we receive, the higher our chances are for survival.

The Kaplan's theory of landscape preference is based on coherence, complexity, mystery, and legibility. All of these factors contribute to the human ability to process information. Coherence refers to how "easily a scene is organized." Redundancy and repetition are elements that affect a scene's coherence. Complexity refers to the amount of variety in a scene. Legibility refers to the level at which "one could explore without getting lost." Mystery pertains to "the degree to which more information may be gained by proceeding further into the scene" (Gimblet, Itami, Fitzgibbon, 1985). "The more preferred scenes, are very likely to give the impression that one could acquire new information if one were to travel deeper into the scene" (Kaplan and Kaplan, 1982).

The four factors previously mentioned work together in any scene. They are an expansion of the theory of prospect and refuge and an explanation for the preferences humans have. Supporters of this theory argue that it is this biological response that causes the seemingly unanimous preference for the pastoral scene where there are open vistas (prospect) and areas of vegetation (refuge). The findings of these studies can be applied to designed spaces, where attention could be given to such factors as legibility, coherence, complexity, and mystery.

Goals and Objectives

Project Mission: To integrate interpretive public space with new light industrial uses in a way that enhances place identity and civic pride.

Goals and Objectives:

To achieve the project mission, the following goals (1,2,3,4) and objectives (a,b,c…) have been outlined. Each objective is listed under the goal that it pertains to, however, there is some overlap and some objectives work to attain more than one goal.

1. Provide a design solution that fulfills program requirements proposed by the New Haven Planning Department.

    a. Become familiar with the project's program requirements
    b. Understand Greenway Design
    c. Understand marine industrial land use as it pertains to the River Street Project area.
    d. Integrate public greenway park with new marine industrial land uses
    e. Provide a conceptual master plan of the entire River Street project area.
    f. Define parameters of detailed site design with in the project area.

2. Increase public awareness of site-specific natural process and cultural history

    a. Identify site-specific elements of natural processes and cultural history.
    b. Provide a design solution that reveals or abstracts site-specific elements.

3. Improve the overall visual quality of the area.

    a. Understand the theory of prospect and refuge and subsequent research on landscape preference.

b. Apply knowledge of landscape preference when introducing vegetation and built form.

4. Improve the overall environmental quality of the area.

   a. Understand site contamination
   b. Identify and apply appropriate remediation techniques.

Methods

The methods are organized through the framework of the four trace concepts previously mentioned.

Landing

The "landing" portion of the methods is the first site visit. It will be an exploratory experience of observing the project area and its surroundings. A vehicle will be left at Criscolo Park and walking the site will begin at the southwest corner of the site. Observations and thoughts will be recorded through note taking, sketching and digital photographs. Walking will continue out of the project area to the completed section of the greenway (Brewery Square). Exploration will continue into the adjacent neighborhood where finding a place to buy lunch can occur. Upon returning to the vehicle, observations will also be recorded at Criscolo Park.

Grounding

The following "grounding" methods will be used to achieve objective *a* under goal 2: To identify site-specific natural processes and cultural history.

- An investigation of the general history of the Fair Haven Neighborhood through internet searches and possibly library sources
- An investigation of the previous land uses with in the project area using internet searches of specific industries and interviews with the New Haven Planning Department.
- Attain historical maps of the Fair Haven neighborhood and the project area.
- Attain detailed information about the history of the Fair Haven waterfront from the Center for Coastal and Watershed Systems in the Yale School of Forestry.
- Kayak down the Quinnipiac River through the marsh starting at Sackett Point Road in North Haven and ending on the south shore of the site.
- Hike through the project area south of River Street looking for traces of natural and cultural history
- Record observations throughout by taking notes, digital photographs, and sketches.
- Investigate the carbon cycle through internet searches and library sources. More specifically investigate the chemical weathering of rock and the use of carbon by marine organisms.
- Investigate the physics of tides through literature review and internet searches

The following "grounding" methods will be used to achieve objectives *b* and *c* under goal 1: To understand greenway design and marine industrial land use.

- Conduct interview with Planning Department for possible specific land uses and where they might exist.
- Visit and record observations of existing marine industrial land uses in South Norwalk Connecticut, New London Connecticut, similar to what is intended for River Street by the city of New Haven.
- Record observations with note-taking and digital photos.

The following "grounding" methods will be used to achieve objectives *a* under goal 3: To understand the theory of prospect and refuge and landscape preference.

- Investigate research on landscape preference using library sources.

The following "grounding" methods will be used to achieve objectives *a* and *b* under goal 4: Understand site contamination and identify appropriate remediation techniques.

- Review phase 1 and 2 site assessments and interview the city's environmental consultant.
- Investigate phytoremediation techniques through precedent examples, literature, and interviews.

Finding

As previously mentioned, the process framework used as site analysis, is such that the "finding" methods may be realized immediately and take place early on, or may require time for reflection and follow-up research. Some methods have already been carried out in the process previously described. The following research has been done as a follow up to two experiential observations that took place during early site visits. These initial observations may become integral components in the overall design concept. It is my understanding that "finding" as Girot has explained it, is the intuitive processing of what has been observed and the "findings" become the engine that drives the design concept. The process being used, allows for discoveries to occur at any time, so it is possible that "findings" that have not yet been realized could create a different design concept.

The more obvious observation occurred when kayaking down the Quinnipiac River. The waters of the Quinnipiac River, when meandering through the extensive marsh north of the Fairhaven neighborhood, are quite still. When approaching the first narrow train track overpass, flow in the river was noticed and the flow became quite turbulent closest to the bridge. This flow was caused by the outgoing tide. The volume of water being "squeezed" between the bridge abutments, to me, revealed the power and force that tides represent. The understanding of the physics of tides is a small but important part of understanding the natural processes acting on the site.

The second observation, is less obvious, and possesses an intriguing irony. It was of sea gulls dropping oysters on gravel that the existing petroleum storage tank farm sits upon. The gulls pick the oysters from the river and drop them on rocks as a method of breaking them open to eat. Small fragments of shells can be found sporadically littered on the gravel containing the petroleum tanks. The irony of this observation is what each object represents and how they are linked. The tanks represent the human use of oil and the burning of fossil fuels, while the oyster shells represent the "magic" of the carbon cycle, in that the shells are made of carbon, quite possibly the carbon that was emitted into the atmosphere by the burning of fossil fuels. At the time, this observation was intriguing on its own, but has become even more powerful since the background research of the site history began. It is an observation that ties site-specific natural processes with site-specific cultural history. The formation of oyster shells is a natural process that is linked to both the recent land use of petroleum storage and to the long history of oyster harvesting in Fair Haven.

At this stage of the overall process, the above "findings" will potentially inform an interpretive design solution that incorporates natural process and cultural history. Evidence of the carbon cycle acting on the site can be a representation or a reminder of a larger cycle that pertains to the River Street area of Fair Haven, a cycle of humans and nature, a cycle of industry.

Tides

Tides are driven by the gravitational pull of the moon and the sun. As the moon orbits the earth, its gravitational pull, literally pulls water from the surface of the earth toward the moon. This pull creates a bulge of water on the surface of the earth's oceans that continually follows the moon (Ritter, 1995). The land masses on the earth experience the movement of this bulge, which can be recorded in a vertical fluctuation of the water surface. Most coastal areas experience two high and low tides per day as a result of the time that it takes for the moon to orbit the earth. "There is about 12 hours and 25 minutes between the two high tides" (Cooley, 2002).

Tidal fluxes vary based on geomorphic characteristics of certain shorelines. Typically shallow, low sloping shore bottoms contribute to the highest tides due to the minimizing effect of the momentum and inertia of an incoming tide. Steep shore bottoms are conducive to lower tidal fluxes (Ritter, 1995).

Tidal fluxes for a certain location also vary with each tide. Weather systems and surface wind often affect the magnitude of tides, however, fluxes vary based on the position of the moon, the earth and the sun as well. When the earth, sun, and moon are all aligned, (during times of a new moon and full moon), the tidal flux is increased. The gravitational pull of the moon is magnified by that of the sun during this alignment causing this unusually high tide, called the spring tide (Ritter, 1995). Spring tides occur roughly every two weeks and are on average twenty percent higher than average high tides (Ritter, 1995). When the moon is aligned perpendicular to the sun and the earth, the opposite affect occurs creating a lower tidal flux called the neap tide.

Since the moon's orbit around the earth is elliptical, the distance (perigee) between them constantly varies (Cooley, 2002). At its closest perigee, the moon will create higher tidal fluxes. Extra high spring tides occur when the moon, the sun and the earth are aligned and the moon is at its closest perigee. This is called the Proxigean Spring Tide. The patterns of this occurrence are complex and by chance this will occur less frequent than once every 1.5 years (Cooley, 2002).

Carbon Cycle

Carbon exists as a solid, a liquid and a gas within the earth, on its surface and in the atmosphere. Recently there has been increasing amount of attention on the carbon cycle in response to concerns with the issue of global warming. Carbon in the atmosphere as a gas exists as carbon dioxide, a greenhouse gas. This gas allows the sun's short wave radiation to warm the earth's surface, but inhibits the escape of long wave radiation back to space. Human activities such as burning fossil fuels have increased levels of carbon dioxide in the atmosphere from roughly 280 ppm to 370 ppm (Ruddiman, 2001). Observations have shown a direct correlation between this carbon dioxide increase and recent rising average global temperatures. Geologists and climatologists have been able to prove that surface temperatures and carbon dioxide concentrations have been considerably higher than that of the present, at various times throughout earth's history (Ruddiman, 2001). However, it is the rate of which both temperatures and carbon dioxide levels have increased over the past 150 years that alarms experts and strongly suggests that fossil fuel consumption, a non-renewable energy resource, is having an impact (Kump, Brantly, Arthur, 2000).

Through the burning of fossil fuels and the burning of vegetated land for clearing, humans release roughly 7.0 billion tons of carbon dioxide into the atmosphere per year. However, it is estimated that only 3.4 billion tons of carbon dioxide actually accumulates in the atmosphere every year (Liu, Zhao, 1999). "That means that there is an atmospheric carbon dioxide sink of about 3.6 billion tons of carbon per year" (Liu, Zhao, 1999). This carbon sink is referring to the natural cycle of carbon on earth, the transition from carbon as a gas to carbon as a liquid and eventually carbon as solid.

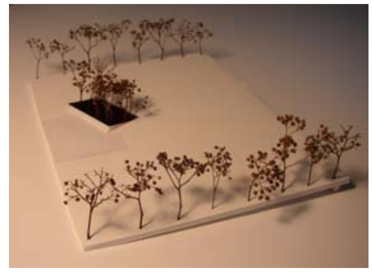
Research suggests that the chemical weathering of rock on the earth's surface is responsible for sequestering a significant amount of atmospheric carbon. Water is naturally made up of slightly charged particles in OH- and H+ (Ritter, 1995). When rainwater mixes with carbon dioxide, either as it falls through the atmosphere or as it percolates through the soil, the mixture becomes slightly acidic and is referred to as carbonic acid. The carbon dioxide molecule joins the negatively charged OH- ion in water, so that the ions that make up carbonic acid are HCO3- and H+ (Summerfield, 1991). The charged ions in solution attract the oppositely charged ions of the rock minerals, stripping them of their compound nucleus. The stripped ions become part of the dissolved mineral while more resistant material is left behind as clay particles (Ritter, 1995). The other byproduct of this reaction is carbon in the liquid state, often as the original HCO3- (Summerfield, 1991). This carbon in solution is transported to the oceans through groundwater, streams and rivers.

In the oceans, marine organisms, such as oysters, use the dissolved carbon to produce shells. The shells generally comprised of calcium carbonate (CaCO3) lock the carbon, which once came from the atmosphere, in its solid state. The organisms die and their shells drop to the ocean floor where they are buried with time with other shells and sediment. Over time the deposition of shells creates limestone bedrock of which stores over 6.1 x 10 to the 7th billion tons of carbon in its solid state, making it the worlds largest reservoir of carbon (Liu, Zhao, 1999). Once in the solid state, carbon will only be released back to the atmosphere when it is heated through volcanic activity (Ruddiman, 2001).

Founding

The following "founding" methods will be used to achieve objectives d, e, f under goal 1: Integrate public greenway park with new marine industrial land uses; Provide a conceptual master plan of the entire project area; Define parameters of detailed site design with in the project area. These methods will also be used to achieve objectives b under goal 2; b under goal 3; b under goal 4: Provide a design solution that reveals or abstracts site-specific elements; Apply knowledge of landscape preference when introducing vegetation and built form; identify and apply appropriate remediation techniques.

- Continually review river street MDP, new haven greenway plan, and latest project developments through interviews with the new haven planning department.
- Identify likely land uses for all properties in River Street project area to inform conceptual master plan.
- Synthesize information and identify nodal areas for site-scale detailed design.
- Synthesize observations and information to generate design ideas.
- Test ideas through study models and peer reviews.
- Refine design ideas – study models, program elements, and drawing.
- Finalize design solution and produce appropriate graphics – plans, sections,
  perspectives, study models, finished models.



Schedule

Task	***January***	***February***	***March***	***April***
Grounding methods pertaining to Identifying site-specific elements	XXXX	XX		
Grounding methods pertaining to Marine industrial and greenways	XXXX	XX		
Grounding methods pertaining to Contamination and remediation		XX		
Founding methods pertaining to Conceptual master plan.		XX	XX	
Founding methods pertaining to Detailed site-design parameters	XX			
Founding methods pertaining to Idea generation	XXXX	XXXX	XX	
Founding methods pertaining to Testing and refining ideas		XXXX	XXXX	
Founding methods pertaining to Final design production			XX	XXX
Reflection and final document Writing				XXX

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