



SUMMER ACADEMY 2016
COASTAL RESILIENCY PLAN
OAKWOOD BEACH NEIGHBORHOOD
NEW YORK STATEN ISLAND



State University of New York
College of Environmental Science and Forestry



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In September 2016 an »International Summer Academy Landscape Architecture« took place for the fourth time. This is an exchange between the State University of New York, College of Environmental Science and Forestry (SUNY ESF) and University of Applied Sciences of Osnabrück, Faculty of Agricultural Sciences and Landscape Architecture (UAS AuL). These exchanges are meant to foster direct interaction between the two universities, for the purpose of developing a mutual understanding and working relationship between faculty and students. To stage another charrette this year, eleven students and two professors from the UAS Osnabrück flew to New York to meet the group of eight American students and two professors.

The venture took place in the greater New York region, on Staten Island. The Oakwood Beach project was initiated by the New York State Department of Environmental Conservation (NYSDEC) in consultation with SUNY ESF. This was an area hit hard by superstorm Sandy, hurricane Irene, and tropical storm Lee and has been undergoing several changes in response to the catastrophic damage from Sandy. The DEC is currently working with the state and federal governments on programs in the area, including a buyout program as part of the New York Rising program.

The two colleges have held joint workshops together since 2012 enhancing their relationship

over the years. (It all started with an exploration trip in 2011 of Osnabrück professors ensued by the first charrette.) In the following year, students of the ESF together with their professor visited Osnabrück in the autumn. Right at the outset the synergies of both teams matched perfectly. A similar understanding in research and teaching led to a productive collaboration. When German students visited the American group in Syracuse a year later, keywords such as renaturation, recreation and urban development and planning were linked to redesigning a river course. At the third workshop the focus was on climate and nature protection, renewable energy along with tourism and handling cultural heritage.

The subjects this time were community design, coastal resiliency, ecological restoration, stormwater management, and sustainability. The charrette was held August 1 - 6 at the William H. Pouch Boy Scout Camp on Staten Island. The camp, which also housed the groups, was made available to the universities via the DEC's relationship with camp. This location provided an opportunity for faculty and students from both institutions to focus on the project, away from the distractions of home. The New York City area also offered several new and interesting examples of architecture that were worthwhile for students and faculty alike to visit.

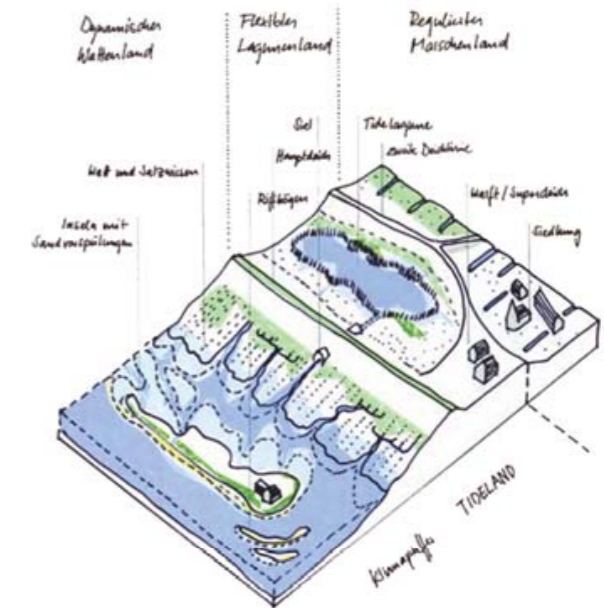
By staying on Staten Island, the project

provided opportunities for observation of the interaction between the community and environment - an interest of both universities - and an ability to directly engage the project site. There was also the benefit that this area lacked any existing plans that addressed the community aspects of the project, and therefore the student's work would be a valuable addition to the discussions of what could happen in the future there.

The issues discussed in this years charrette were current global matters. So in order to understand the processes going on in the Oakwood Beach neighborhood much better, it was important to take a look at the larger context.

As a result of climate change the number of extreme weather conditions increased over the last decades. The weather has become more unpredictable and changes more often (www.br.de). At all times, the state of global warming which leads to the melting of the glaciers and poles is present. Coastal areas in particular struggle with the consequences, such as hurricanes and superstorms, flooding and sea-level rise. Especially densely populated regions are facing a big problem in the next couple of years. Due to major cities being built directly on the waterfront, there is a lack of environmental resiliency in coastal areas (www.spiegel.de). A very important buffer zone is missing. There are a lot of global projects and organizations trying to react to the upcoming problems. In the following report some of these will be introduced as representative examples.

Along the coast of Denmark, Germany and the Netherlands the Wadden Sea „is a highly dynamic natural landscape and Unesco World Heritage Site that is unique in its form and extent“ (RABE & STOKMAN 2014). To protect and use the adjacent region the first dikes were built in medieval times (www.ndr.de). With the constant sealevel rise, a lot of ideas are floating around to secure the existing settlements on the one hand and the unique landscape of the Wadden Sea on the other. One idea is just to increase the height of the dikes. That would mean that the residents of the houses would lose their view and they might get a feeling of being trapped.



1a A future perspective of the Wadden Sea (RABE & STOKMAN 2014)

Another one is to raise the artificial mounds on which the buildings stand. But that is expensive and takes much longer so it would be a long-term project. In the meantime, maintaining the existing dikes is very important (RABE & STOK-MAN 2014). The graphic shows how the future dike design might look. In July 2011, large parts of Denmark's capital

Copenhagen were flooded by heavy rainfall. In order to avoid catastrophes like that in the future, the city together with Ramboll Studio Dreiseitl, a landscape architecture studio from Germany, developed a, 'Cloudburst Concretization Masterplan'. This includes combining safety zones and flood zones in eight catchment areas allowing people to pass through the city even



1b Combining Safety an Floodzone

during intense rain. By lowering a green boulevard strip in between streets, a so called flood pathway was generated. Combining urban environment issues and flood management not an easy undertaking but this project proved that it is possible (www.landezine.com). The whole plan is designed to control and guide the water throughout Copenhagen as you can see in the illustration. An example for an involved organization is The Flood Resilience chair group (FRG) of the UNESCO-IHE Institute for Water Education. It is a multi-disciplinary research group with an established national and international reputation in (urban) flood resilience. Rooted in Dutch and European funded research projects and with strong ties to Delft University of Technology, FRG has recently extended its focus into a global perspective, including the developing countries mainly in Asia.' (www.unesco-ihe.org)

Another current project shows that regions all over the world are affected by the consequen-

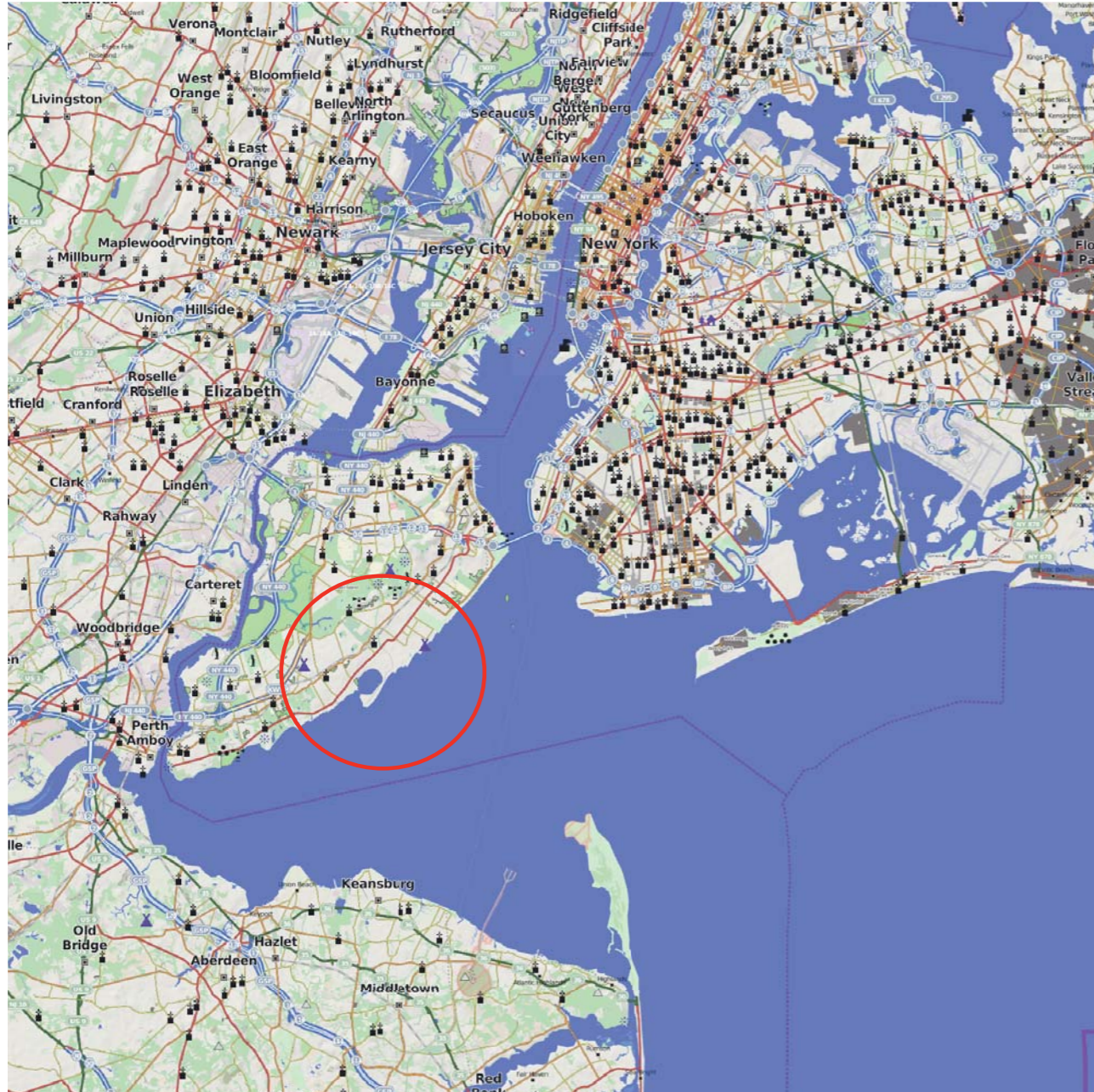
ces of climate change and extreme weather conditions. In Vietnam, the Red Cross works together with local communities and administrations to improve the disaster preparedness and risk management. Over the last couple of years, fields and settlements have been flooded with increasing frequency. One attempt is to advance the dewatering system especially in costal areas. The Red Cross focuses also on education and sensitization of the local people to make sure that they can handle future flood events much better (drk.de)

It is important to say, that dealing with the consequences of global warming, sealevel rise and acurances of extreme weather conditions is not just an American or European problem. These are many projects on thees subjects worldwide. In the following reports the attention is focused on the New York region and Staten Island in particular.



1c Project work in Phu Yen, Vietnam (www.drk.de)



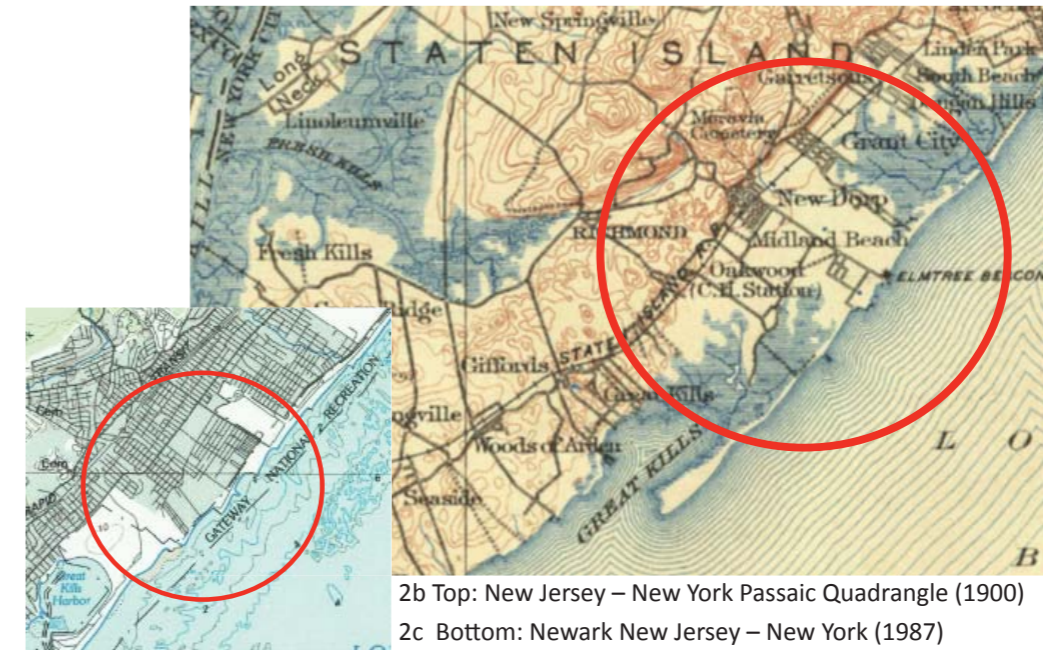


2a New York Overview

Staten Island, one of the boroughs of New York City, was farmland for much of its development history. As the city grew, pressure for development converted much of this land to residential development, which turned Staten Island into a bedroom community for people working in the New York region. As inland areas were built on and the demand for more housing space grew in the 1940s, the boroughs development shifted to the coastal regions as well as the lower lying wetland areas which circle the island.

During the span of approximately one year (2011-2012) Tropical Storm Lee, Hurricane Irene and Superstorm Sandy all hit the New York City area, bringing extensive flooding, damage and death. The regions lower lying districts were hit hard by Sandy, with a 16" storm surge that submerged these areas, including those on Staten Island.

As a result, the New York State established the New York Rising Program.



2b Top: New Jersey – New York Passaic Quadrangle (1900)

2c Bottom: Newark New Jersey – New York (1987)

The program offers assistance to communities affected by flooding and storm-related issues. The New York Rising Program aims to increase the resiliency of those communities so that they are able to withstand further weather-related issues. This is mostly important for coastal communities as climate change based predictions of rising sea levels and increasing intensity storm events leave coastal communities particularly vulnerable. One facet of the Staten Island Masterplan developed by NY Rising is the construction of a sea wall planned to stretch along the eastern shores of Staten Island. With an elevation of 19' the wall would extend across the neighborhood near the shoreline, and would form a barrier to future storm surges. As of today, the seawall has not yet been approved for neither funding nor construction.

A second facet of the NY Rising is a buyout program. The Federal Emergency Management Agency (FEMA) will pay property owners pre-storm market rates to buy their land. The land is then reassigned to a public entity such as Town of Oakwood Beach and is then permanently converted to open space. The buyout option is voluntary so each property owner can individually decide whether to participate or not. Once the property is sold it cannot be resold. Any original structures (paving, buildings etc.) are leveled.

Since the program is voluntary not everyone participated, which lead to a highly fragmented neighborhood. Public services to these properties must remain, however, a cohesive feeling of a neighborhood was lost.

Currently, over 95% of the Oakwood Beach community is participating in the buyout program. The 14 remaining properties (out of over 500) are scattered throughout the Oakwood Beach area. The DEC is currently clearing the buildings, and establishing a base cover planting via seeds over the sites. *Phragmites australis* (Common Reed Grass) is dominating in most open areas, particularly the wetland spaces.



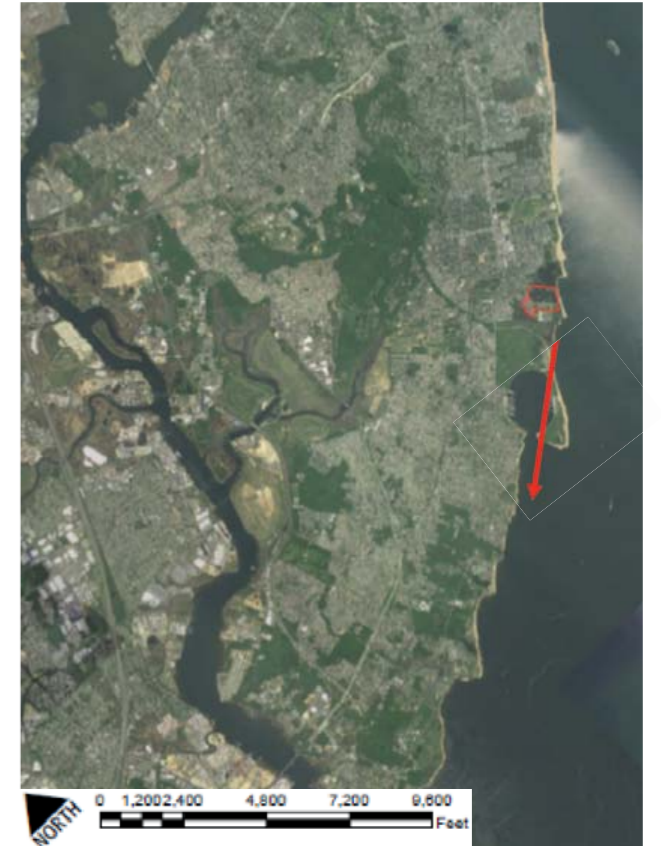
2d Phragmites australis cover

PROJECT AREA

The project area is defined by Fox Beach Ave., Kissam Ave., Fox Lane and Tarlton Street. Mill Road borders the northern edge of the site except for a few blocks in the northeast around Delwit Ave., Riga and Aviston Street. The Project area totals around 90 acres. The residential units were mostly single family homes as well as apartment buildings. A large area in the center of the site as well as numerous smaller lots were previously undeveloped which is assumed to be because of the wetlands in those low lying areas.

The north site of Mill Road is mostly made up of single family homes. To the east of the project area and at the heart of the site between Fox lane and Kissam Ave, large undeveloped wetlands are to be found. Mentioned areas are almost exclusively covered with *Phragmites*. The plant creates closed view shields because of its height which makes observing the actual size of the planning site quite difficult.

Several roads lead from the inner parts of Staten Island lead towards the Oakwood Beach area. The Staten Island Bluebelt (natural drainage corridors such as streams, ponds and other wetland areas which are part of a storm water management program for one third of Staten Islands Land area), as well as the Staten Island Railroad interrupt these roads in some locations



2e Overview Staten Island



2f Overview Oakwood Beach

which does not, in fact, complicate the accessibility of the project site.

The wetlands have very little topography and lie in general very low. The dominant reed grass decreases the actual quality of the wetlands. This is a problem throughout the area. Given the aggressive nature of the species, efforts to control and manage the population are very time consuming as well as expensive. Two waterways are located within the project site. A drainage channel, which eventually merges with another stream, which runs west of the wastewater treatment facility in the southwestern corner of the site. The streams empty into the Atlantic Ocean.

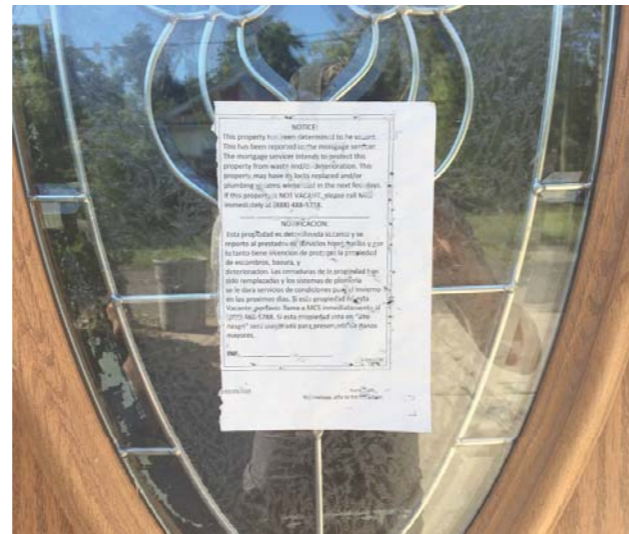
The shore is currently separated from the Oakwood neighborhood by a sandbag sleeve system which is supposed to protect the Oakwood areas in case of rising water levels. The wastewater treatment facility will remain and be protected against future flooding with a proposed seawall project. The treatment plan does not have a high visual or physical impact on the site due to its setback to Mill Road and remaining properties within the area. Wastewater from Staten Island is transferred to the treatment facility by a main sewer line that runs parallel to the shore.

The manhole structures along the line must remain accessible with any future projects. The shoreline is only accessible by traversing

over the sandbags. Unfortunately, a lot of garbage and debris has accumulated on the shoreline which contributes to the general desolate feeling that the area emits.

Houses Remaining

Between Kissam Ave. and Talton Street there are a few buildings (10 +/-) that are boarded up and/or are marked with red dots, indicating their participation in the buyout program. These will be demolished in the near term. Several apartment buildings in the northwestern corner also sit vacant and are waiting to be removed. The proximity to remaining houses creates uncomfortable neighboring situations especially when the buildings are abutting.



2g Notice on left Houses

Remaining Houses

Remaining houses are in varied conditions. Some storm damage appears to have been substantially repaired and signs of occupation are present within most of the buildings. Even though a few buildings have had their elevations raised, which indicates a long term investment in staying in the area, it should be noted that elevation level of these homes is still well below the storm surge levels which were present during Superstorm Sandy.

Vegetation

The process of clearing the project site involves removing remaining structures and stabilizing the site, which is usually done by bringing out a wetland seed mix. The mix is made up of a variety of plant species. Including *Carex vulpinoidea* (Fox Sedge), *Elymus virginicus* (Virginia Wildrye), *Helianthus annuus* (Sunflower) as well as *Mimulus auranticus* (Monkey Flower), *Heteranthera reniformis* (Kidney-leaf Mud Plantain) and *Onclea sensibilis* (Sensitive Fern). Since some of the seeds are dormant, they will sprout not before spring 2017 therefore leaving early cover crop species to stabilize the site. Plants from home owners such as hedges and trees remain in some parts of the project area. In general, tree covered spaces within the area are sparse.

CHAPTER_3_CHARETTE PROCESS

VISION

WHAT DOES THIS PLACE WANT TO BECOME?

PLANS

REFINED PLANS FOR SITE & DETAILED PLANS FOR KEY/CRITICAL SPACES.

GOALS

OBJECTIVES & STRATEGIES

WHAT ARE THE THINGS YOU WANT TO DO TO ACHIEVE THE VISION?

ILLUSTRATE

CREATE SECTIONS, AXONS, PERSPECTIVES & OTHER DRAWINGS & GRAPHICS THAT COMMUNICATE YOUR IDEAS

FRAMEWORK

WHAT IS THE GENERAL CONFIGURATION OF THE SITE, FOCUSING ON BIG MOVES & GESTURES?

ORGANIZE

PRESENT

Pre-Charrette Activities

Post superstorm Sandy, and prior to the charrette, several plans had been produced that explored options for the area. These included a report by NY Rising (NY Rising Community Reconstruction Program: East & South Shores Staten Island), documenting a broad series of plans for the island to address deficiencies in the face of future catastrophic storms. There was also an engineering report (Oakwood Beach Flood Attenuation Feasibility Study, produced by Dewberry) for the construction of a 19" seawall to protect against future storm surges. The proposed wall was identified in the NY Rising study, and has been conceptually designed but not yet approved or funded for construction.

Even with these studies, there were still no specific recommendations for how to address the community design aspects of things like the FEMA buyout program. The DEC, in response to its participation in facilitating the cleanup portions of the buyout program, then provided the basic direction for the charrette of addressing the immediate needs of residents who have chosen to remain. Given the fragmentation of the neighborhood, this was deemed critical to maintaining the security and connectedness for

those residents who will still live in the neighborhood. This was considered Phase 1 of the proposed plans, with the goal of providing some sense of place after the site clearing and stabilization activities had ended.

ESF and Osnabruck expanded upon the DEC's program to evaluate long term options for the site. As the proposed seawall had not yet been constructed, and as the engineering did not fully address the relationship of the site to the local community or ecology, it was felt there was some opportunity to rethink long term impacts of change in the project area. This was considered Phase 2 of the proposed plans. The goals for this aspect of the study include reconsiderations for storm surge protection and to explore alternatives that better linked the surrounding community to the site and to the ocean. The charrette was held September 1 to September 6, 2016. The DEC arranged lodging for the 11 students and faculty at the William H. Pouch Boy Scout Camp on Staten Island. This location was ideal due to its proximity to the project area, and as it provided both lodging and working space for the five day charrette. Prof. Dirk Junker and Prof. Stefan Taeger (HS Osnabrück) and Prof. Tim Toland and Prof. Douglas M. Johnston (SUNY ESF) ran the whole process.

The Charrette

The project was introduced to the students on the morning of the first working day and groups organized merging Osnabruck and ESF students into teams. In total, there were four groups, generally with two Osnabruck students and two ESF students in each. These groups were to work collectively to provide a proposal to address both phases 1 and 2 as discussed above. Faculty from both universities would rotate between the groups throughout the project.

Following questions should be answered in each project group :

- How can the remaining property owners maintain a sense of community and security while the neighborhood changes around them?
- In both the short and long term, what opportunities exist to make this area an asset for the adjacent neighborhoods and for the communities on Staten Island while also contributing to the resiliency of the island?
- How can the NYRCRP Staten Island Plan recommendations, particularly for the large scale infrastructure, be developed in a way so they contribute to a sense of place for the area?

The teams toured the project area and its surroundings with Christopher Lang, a DEC staff member. He gave background information, his and DEC's impressions and observations on the project issues, and answered questions from the students and faculty. He was also able to answer questions on the contextual issues of the project, and on thoughts on activities in the greater NYC area.

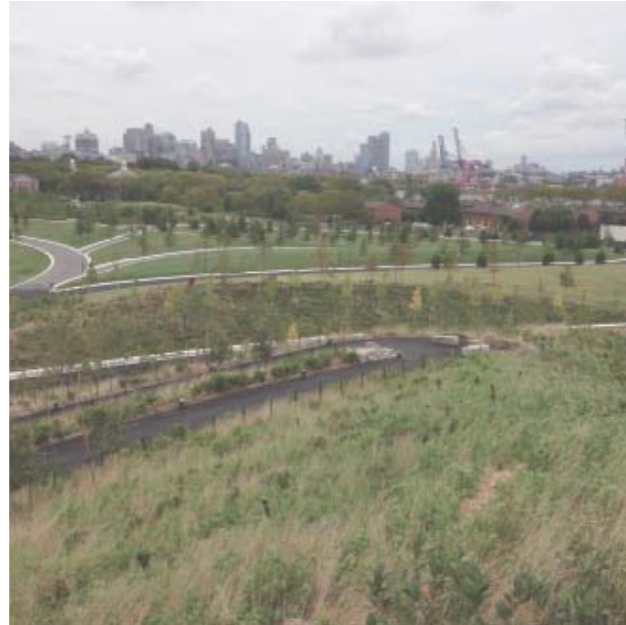


3a Coastline in projektarea

The first afternoon included group work to review preliminary impressions of the site and the program, with students encouraged to brainstorm and record any and all thoughts. These impressions were reviewed during presentations given by the group to each other. To inform the student's projects regarding designing in urban environments, and to learn from built work. The second day of the charrette provided an exploration of sites in the NYC area. These included trips to Governor's Island, Brooklyn Bridge Park, World Trade Center, and the High Line Park. Students observed how people work and interact with each other, and got a sense of site design elements that cater to different user groups. Students were asked to take these observations and consider how they could be incorporated into their work.

The first stop an Governor's Island. The Governor's Island Park designed by West 8, located in the Upper New York Bay, 30 acres of park and public space. The Governor's Island Park gives a good overview over the skyline of New York and the liberty Statue. The site was especially interesting in its coastline development and public use, but also the fact that majority of the island was lifted out of the flood zone, creating a resiliency in the fact of rising water.

After that the Students visited the Brooklyn Bridge Park, running from the north of the Manhattan Bridge to Atlantic Avenue. Connec-



3b View from Govenors Island



3c Short break in Brooklyn Bridge Park

ting neighborhoods with each other, the Brooklyn Bridge Park is a well used public space, bringing nature to a former industrial site. Comparing the two landscape parks with each other, they give good (and different) examples how public use can function in different areas. The next station was the National (WTC). This symbolic place in the middle of the city showed very well how landscape architecture make a sign in people minds. On this site, there can be found parallels to the Oakwood beach project, of a place with a legacy/memorial feeling where should be picked up the topic. For the last stop, the students decide to visit the High-Line Park, at the old Meatpacking district in Manhattan. The park, built on old train tracks, it is an innovative and interesting solution for bringing nature into an abandoned city area. The re-use of the rails also connected different neighborhoods and districts. Doing something new from something old is an important topic for the Oakwood Beach project and the High-Line Park is an impressive example Part of the discussion was for the student groups to identify their group's goals and objectives for each phase of the project and to provide a vision statement for their work. These products were intended to help guide their work, and to inform the DEC as to the intent of the proposals.

The next two days of the charrette were devoted to working in groups to make more in-depth

site designs. Frequent table discussions with faculty helped to identify and overcome obstacles, and to provide direction for work. Periodic group-wide deadlines were set to keep work on pace. Given the working site, all work was completed using hand drawing and rendering. Students were directed to produce at least one plan view for each phase, with supporting drawings as needed to illustrate their ideas.

A formal presentation of ideas was given to DEC staff on the last day of the charrette. Each group had the opportunity to present their vision, goals and objectives, plans and graphics for the project via a series of boards. Three staff members (Chistopher Lang, Joanna Field, and Rodney Rivera) participated and provided feedback to the students (see Conclusion chapter for more discussion on the comments).



3d Groupwork in William H. Pouch Boy Scout Camp

Post-Charrette

To document the project for both the DEC and for the respective universities, a planning report had to be compiled. Tasks for the completion of this report were divided between students and faculty at both universities. The final charrette drawings were scanned and processed at SUNY-ESF, with the writing and layout work completed via Dropbox, Google Docs, and email exchange.

SUNY-ESF students will also follow up on the project by revisiting the charrette results, considering the feedback from the DEC staff at the presentation, and crafting more refined proposals for the project. These will be completed in fall 2016.



3e Final presentation with DEC staff



GROUP 1

ORIGINAL THOUGHTS AND VISION

“The new Oakwood Beach provides protection, strengthens connections and creates a dynamic and adoptable landscape.”

Upon arriving, group one immediately identified the opportunity to make Oakwood Beach not only a buffer against large storms, but also an asset to current and future Oakwood communities. Although the residents know that they are not safe in this area anymore, some do not want to leave their homes. For example one of the remaining inhabitant of Oakwood Beach said, that her home is a lovely place and that she would like to stay there forever (Kensinger, 2015). Therefore, group one thought about how the community could be protected without building an engineered seawall that creates a physical, psychological and metaphorical barrier. They aimed to protect and embrace the existing wetlands, connect the community to the ocean shoreline, and better integrate Oakwood Beach with surrounding communities through physical connections. Through the use of education and community engagement, they hoped to reduce the fear or negative associations Superstorm Sandy left behind.



4_1a Section of dune landscape and wetlands

GOALS AND OBJECTIVES

Group one’s goals can be subdivided into three main words. Protection, connection and dynamic landscape. They are brought together in 2 phases.

Protection

Revisiting the idea of a physical barrier, the implementation of sand dunes will protect the remaining homes and surrounding neighborhoods during minor and major storms. At 16 feet above sea level, these dunes will protect from storms like superstorm Sandy. The sand dunes will extend northeast to meet with the FDR boardwalk and continue south to meet the higher elevation adjacent to Great Kills Harbor. The dunes will incorporate a series of channels with floodgates which allow saltwater to mix with the freshwater wetland. Dunes will also be vegetated to provide protection against erosion and reinforced with steel backing. The vision of using sand dunes is to create a physical barrier that will translate to a softer wall. The existing wetlands should be extended and function as a buffer zone, that stores the water.

Connection

Oakwood Beach lacks connectivity and appears to be very isolated despite its ideal location along the east coast of Staten Island. It is sandwiched between two parks and has the potential to tie into the greenbelt. Connections are to be made from the FDR boardwalk extending to Great Kills Park. This connection will be made along the dunes in the form of a trail and when necessary wooden boardwalks will be used. Boardwalks within the wetland will tie into the dune trail creating connections to Mills Road and the adjacent neighborhood. This connection will allow community members to easily and safely explore the beach and access the connective dune trail. Lastly, connections between New Dorp Center and Oakwood Beach are also

proposed. These connections will not necessarily be a trail system or a bike/pedestrian lane, but with design cues, and signage, people can easily find their way down to the shore.

Dynamic Landscape

This site lends itself to an adaptable and dynamic landscape with its location on the ocean and freshwater wetlands. With the use of channels and floodgates, saltwater from the ocean will mix with the freshwater in the wetland and create an exchange that will eradicate the phragmites and allow for new saltwater species to move in. The exchange will come and go with the tides and the new species will symbolize a new Oakwood beach.



4_1b Orthophoto of Oakwood Beach and surroundings

PHASE 1

The plan will be implemented in two phases. Phase 1 will consist of improving infrastructure for the remaining homes, and begin restoring wetland. Phase 1 will also include the construction of dunes which will provide protection for remaining homes and surrounding neighborhoods. The early stages of phase 1 will engage the community and raise awareness of the importance of this construction. Along with the construction of the dunes, connections will be made between FDR boardwalk at Miller Field and Great Kills Park. Beach cleanup, and beach access will be included in phase 1. The image shows, how such connections could look.



4_1cConnection to Great Kills Park

PHASE 2

Phase 2 will commence with the buyout and demolition of remaining homes, which would be required for major infrastructure improvement (i.e. the installation of the line of protection provided by the dunes). At this point, wetland reconstruction can extend into areas where previously there were homes. Phase 2 will also include a trail system through the wetland which also connects to the dunes and oceanfront. This trail system is shown in the masterplan in the color red. The black lines show possible trails through the wetlands, but these will be defined later. The masterplan shows the trails in the wetlands, so the connections to

the surrounding attractions are not shown here. Additionally, access and visibility from New Dorp commercial district will be addressed, creating connectivity between the oceans and highly visited shopping area.



4_1d Masterplan

The sand dunes will extend northeast to meet with the FDR boardwalk and continue south to meet the higher elevation adjacent to Great Kills Harbor. The dunes will incorporate a series of channels with floodgates which allow saltwater to mix with the freshwater wetland. Dunes will also be vegetated to provide protection against erosion and reinforced with steel backing. The vision of using sand dunes is to create a physical barrier that will translate to a

softer wall.

Connections will be made along the dunes in the form of a trail and when necessary wooden boardwalks, creating connections to Mills Road and the adjacent neighborhood. These connections will allow community members to easily and safely explore the beach and wetlands. The connections between New Dorp Center and Oakwood Beach are proposed not necessarily as a trail system or a bike/pedestrian lane, but with design cues, and signage,

people can easily find their way down to the shore.

This site lends itself to an adaptable and dynamic landscape with its location on the ocean and freshwater wetlands. With the use of channels and floodgates, saltwater from the ocean will mix with the freshwater in the wetland and create an exchange that will eradicate the phragmites and allow for new saltwater species to move in. The exchange will come and go with the tides and the new species will symbolize a new Oakwood beach.

The detail of the dune landscape shows how the area could look. All houses and roads are gone and nature is taking those places back. The combination of wetland and dunes is a retreat for animals, as well as for local residents. So the natural atmosphere allows an escape from the noise and bustle of the city.

At the sea it is planned to build a large viewpoint in the form of a footbridge. This place invites the inhabitants of Oakwood to linger and even offers space for a pick-nick.

Oakwood beach and its unique social and geographical qualities will serve Staten Island and inspire communities with similar struggles. The improvements will bring a broken community together and highlight an asset that was feared and neglected for a long time.



4_1e Animals in the Wetlands



4_1f Perspective of a footbridge

CONCLUSION

For further planning it is necessary to consider how exactly the exchange of salt and freshwater works. A possible solution could be a kind of sluice. In addition, there is an area included, which is not located in the planning in public

ownership. Therefore the next step is to examine whether the owner is ready to sell the land. Otherwise there alternatives must be found, which allow implementation without buying the private area.

GROUP 2

ORIGINAL THOUGHTS AND VISION

"A focus of the work would be on local connections to the site and to give back a sense of place to the local community and was to create a resilient local legacy."

After spending a day on the site of Oakwood Beach, group two concluded there was high potential to revitalize this community which was affected by several storms. Superstorm Sandy "was the tipping point in a long sequence of coastal storms that for many decades have latently threatened Mid-Atlantic coastal and estuarine communities from Chesapeake Bay, to New York Harbor, to Long Island Sound, and beyond, as far inland as Albany, Trenton and Philadelphia" (Jacob, page 1). Given this history of devastation, there were multiple layers of sensitivity to be understood and incorporated. A focus of the work would be on local connections to the site and to give a sense of place back to the local community as part of the recovery from the experience of the disaster. Group two decided the vision for the redesign of Oakwood Beach was to create a resilient local legacy. A focus is set on local, to give back to the local community, after experiencing a disaster. In addition, resilience against next superstorms has to emphasize the new site having capabilities to evolve and being able to withstand future disturbances. Finally, a legacy of

stewardship will be created to honor the people who participated in the Federal Emergency Management Agency (FEMA) Buyout Program in order to restore their neighborhood back to open land. This created the idea of stewardship of the land and the community. This message has incredible power to neighboring coastal communities as well as Staten Island which describes one of our main goals. This vision also looks forward to consider future generations' safety and connection to the site.

GOALS AND OBJECTIVES

The master plan of Group 2 for Oakwood Beach has three main goals that are broken up into short term and long term phases. The three goals that will be seen throughout both phases are safety and resilience, community experience and restored eco systems.

PHASE 1

Phase one will focus on healing the remaining community members who are still staying in their houses as well as the adjacent existing community which describes a very important point in shaping an acceptable solution for everyone. There are still living people who love their community and would like to stay there

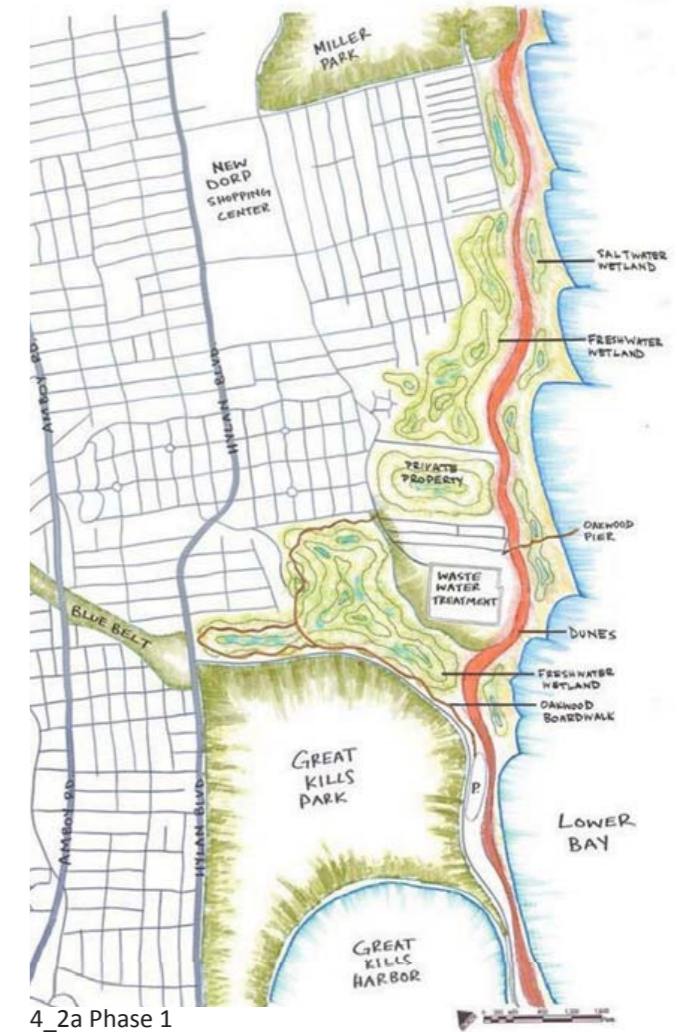
forever (Kensinger, 2015, page 2). This phase of the master plan will have short term goals and be implemented within 5-10 years.

The first step will be the restoration of a natural dune system reaching 19 feet high in order to protect the community against sea level rise and future storms which is labeled in orange color in the plan. Natural dune based systems were considered more ecologically and aesthetically sensitive. They would of course need to be engineered to provide a secure barrier.

Second step will begin regrading and redirecting flows between the existing and new wetlands north and south of the Oakwood Beach community to create a more connected system. By connecting the wetlands from the Bluebelt down towards the shoreline, stormwater runoff from the developed area southeast of Hylan Boulevard, which is drawn in gray, can be handled via natural systems and lessen burdens on the piped system. A healthier ecological community will also be established that will function during storm events. Setting the dunes inland in certain areas will allow the creation of saltwater wetlands as well to contribute to the environmental buffer.

Finally, the third step will be a focus on community revitalization. When looking at the context map, there is the Great Kills Park to the south and Miller Park to the north. Great Kills Park has access to the harbor and a network of trails. Miller Park

has a collection of recreation fields. In order to connect the Oakwood Beach community, the first stretch of boardwalk access will connect south to Great Kills Park.



4_2a Phase 1



4_2b Boardwalk system



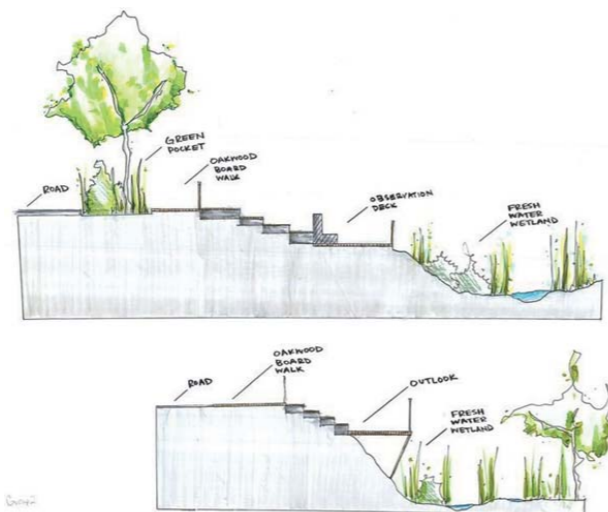
4_2c View Dunes with wetlands



4_2d Outlook View of the wetland

The sketch of the boardwalk shows that it will be wide enough for walking, running and biking and will follow the edge of the newly constructed wetland. It will have numerous meeting and seating decks to allow for points with captivating views of the diverse wetland.

The boardwalk will also contain signage on wetland ecology, native fauna, native flora, and history of Oakwood Beach. The second part of this step will be the reconstruction of the Oakwood Beach Pier to provide the community with safe access to the beach.



4_2e Sections: Boardwalk with outlooks and observation deck



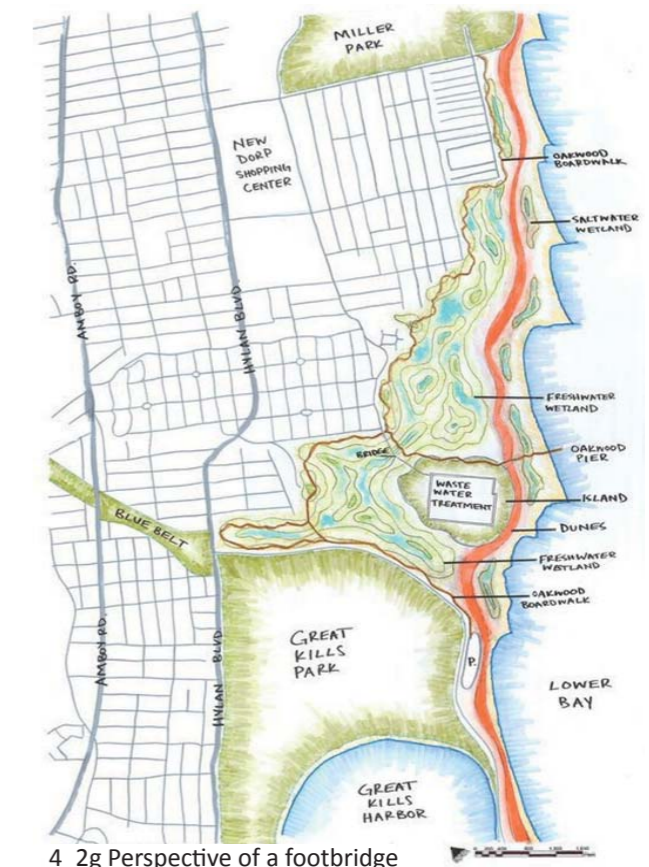
4_2f Section: Boardwalk system and dunes

PHASE 2

Phase two will emphasize coastal resiliency. The main goals will be to connect and restore the wetland system as a whole when the final privately owned lots become available. The projected timeline for phase two will be 20-30 years.

Step one will be final grading and wetland restoration with topographic changes to create diverse ecosystems. This is an important point because one of the NYRCRP's (New York Rising Community Reconstruction Plan) strategies "is restoring ecological function to parts of the island, particularly to the low lying areas of the island that will always be in danger of flooding" (Oakwood Charrette Project Statement, page 1). In this process, the Wastewater Treatment Center will become an island, protected by the Dewberry proposed wall and its higher elevation. This allows the creation of one freshwater wetland system as a functional buffer to super storms and sea level rise and that is what the Oakwood Community essentially needs (Oakwood Charrette Project Statement, page 2). With this unified system, the Wastewater Treatment Center island will be reached by a bridge that will also provide an overlook to the newly created wetland ecology as shown in the perspective (fig. 4_2h) and on the more detailed site plan.

The second step of Phase two will be to finish the boardwalk connection north to Miller Park and the Oakwood Beach Pier as shown on the map for this phase. It will be accompanied by further gathering areas, overlooks, and educati-



4_2g Perspective of a footbridge



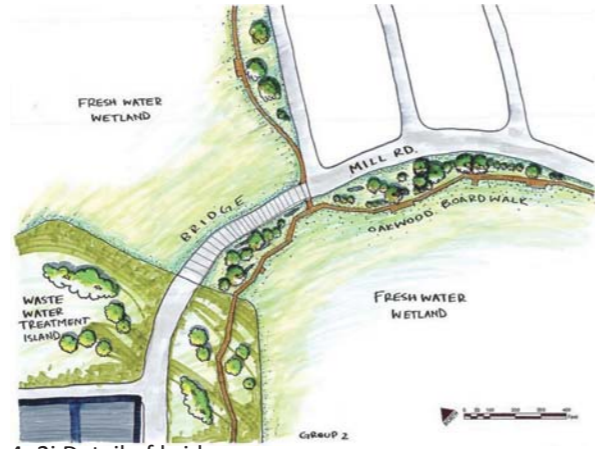
4_2h Perspective Bridge to Wastewater Treatment Center

CONCLUSION

Looking back at the results of the cooperation, they noticed that they had really good ideas in developing their concept but there are some points that could have been thought out more intensively if the time had existed. Therefore, the points mentioned above are to be seen as the intermediate stage of the whole project work.

In creating the natural dune system, they should think about a double dune system that may be more efficient (jury comments). The jury also recommend consider in combinations of dunes and engineered structures, for example a dune with a sheet pile core (jury comments).

There is also the fact that they did not think in detail about how the water from the commu-



4_2i Detail of bridge

nity gets into the sea. In this connection the jury also asked for a "line of protection" and challenged whether the sand dunes will truly be offering protection for the flooding (jury comments). If they had have had more time to go into detail they could have thought about technical aspects like this. In addition, the jury noticed that there needs to be a "phasing between the major flooding event and everyday flooding events" (jury comments). If the dune system is not as high as the projected flood event, then there will be houses behind that will be flooded. They should have thought about the question whether the cost of a sea wall is not as costly as the potential damage to some of those residential areas for that rare event (jury comments).

On the other hand, the jury really liked their idea of creating a boardwalk with outlooks and sitting areas and a place to enjoy (jury comments). In addition, they judged the planning of a bridge to the Waste-

water Treatment Center favourably and think that this "brings connection of areas" (jury comments).

Another important point in reflecting the group results, is that they used the private property in the middle of the site for their planning in the second phase although this is not part of the buyout program. In a next step they should think about how much the implementation of the plan depends on it and maybe provide a solution without using this property (jury comments).

If they had had more time to concentrate on details, they could have also thought about the construction of the boardwalk and application of materials.

With these opportunities making Oakwood Beach a new experience for residents and tourists, group two would like to set a new example for the future. In addition to the main elements safety and resilience, it is essential to honor the people who identify with this place. In the future, Oakwood Beach will not be in the shadow of its past but should confront it and stand by it.

GROUP 3

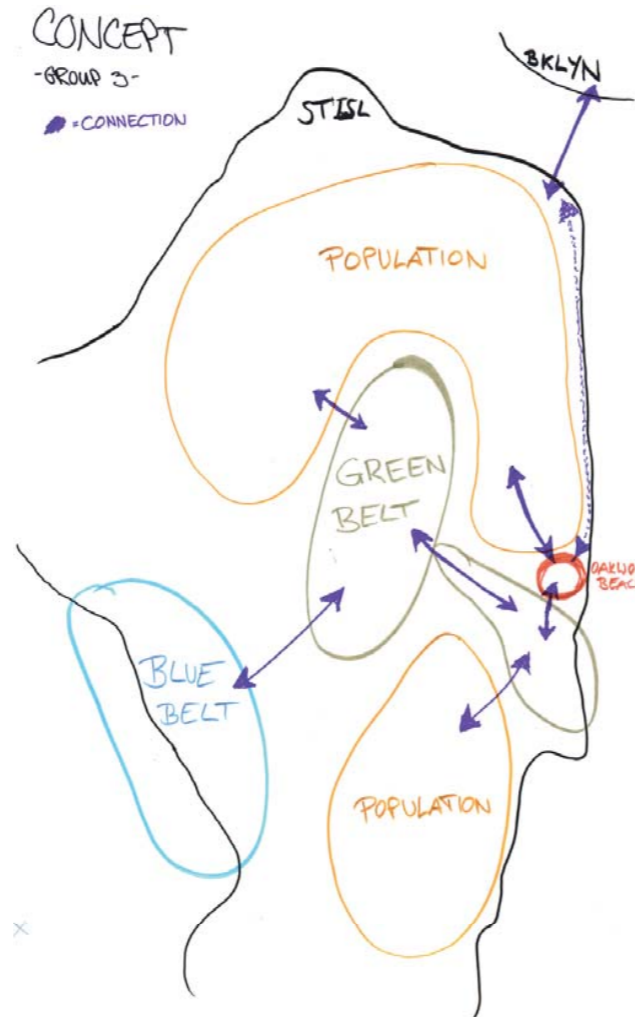
ORIGINAL THOUGHTS AND VISION

"The vision of group three is to improve and create access to the beach and to existing infrastructure in the neighborhood in order to connect the people from all over Staten Island and greater New York City area and that's why this masterplan is called 'Connectivity'."

This region has one great advantage. It can be used as a piece of a puzzle to physically connect Oakwood Beach with surrounding neighborhoods.

After checking what attractions are already in the neighborhood, group three came to the solution that the community should get a renewed sense of place after Sandy by building an educational ecosystem and through the establishment of a place of interest which it should be a secure solution with regard to a sustainable coastal resiliency.

Realizing these visions would be a great opportunity for Oakwood Beach, and also for Staten Island as the 'greenest' borough, to continue building on an identity as a separate entity from New York City.



4_3a Concept

GOALS AND OBJECTIVES

Group 3 com up with three main goals for Oakwood Beach . To creat connectivity, to create an landscape for all people and to teach how to look after this landscape. They would liked to reach their goals with Phase 1, the short term. Wnd phase 2, two different versions are possible here.

PHASE 1

Kissam Avenue is phased out as an access road, because in the current situation only one house is left at the beginning (cf. red datched line on plan) therefore the rest of the avenue will became fragile because no one uses it. Instead of Kissam Avenue, a new alternate route (cf. red line on plan) will be created which should be extended along the sandbags barrier. This new access can be used by bikers, pedestrians and visitors to the beach. There is also a necessity to have another access to the existing manhole which is currently at the end of Kissam Avenue.

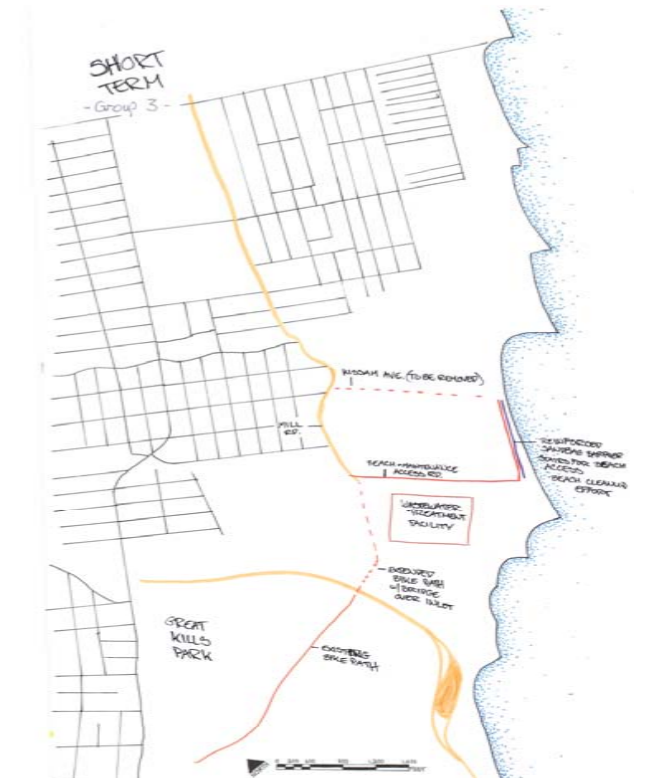
To make an easier access possible for the pedestrians, the construction of beach stairs over the sandbags is needed.

It is necessary that the beach more attractive to people because the beach is very dirty and unsightly with broken bottles and plastic waste lying around. Voluntary work to cleanup the beach is helpful to get a new image and to lure

more citizen to it. The demand to use the beach already exists, for example a few bikers and anglers use it.

The community of Oakwood could be given an understanding of their environment and could improve the connection of each thought other recreational opportunities.

The existing sandbags are need to be reinforced. The existing barrier is not strong enough



4_3b Phase 1

to resist another storm. Furthermore, the barrier should be covered with geotextiles which are impermeable to water to make it more attractive and to prevent flooding.

After this, a reconstruction of an ecological system in the form of a brackish wetland can be established. For that it is necessary to deform the actual relief into a hilly area. At this moment, phragmites spread all over Oakwood Beach because they have the perfect habitat. Although this plant is typical for marshed areas. They had an aggressive growth so that other plants have no chance to grow. This problem can be solved when a balance between dry hills and flooded ground can be created. With this solution the habitat of the phragmites is scaled down and other plants have the possibility to locate themselves. This progress can be started in the area where no houses are left anymore.

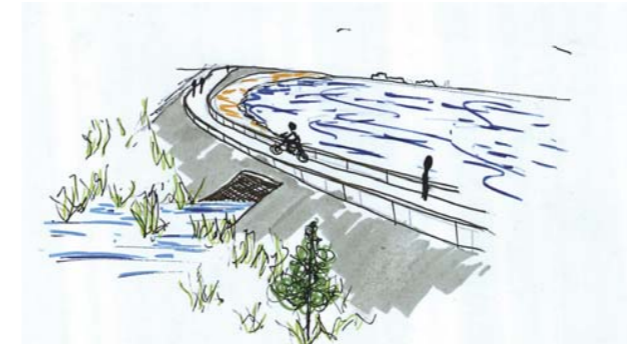
To connect the existing bikeway and trails from Great Kills Park with Oakwood Beach, one path for both activities is to be built to Mill Road (cf. orange dashed line on plan).

PHASE 2

The long-term phase starts when the buyout and acquisition programs, one of the strategies of the New York Rising Community Reconstruction Plan (NYRCRP), are completed so that all of the remaining houses and the infrastructure are removed from in this area. The citizen of Oakwood Beach can accelerate the start of the following masterplan by cooperating with the buyout programs. Otherwise this phase starts when the latest house is given up which could be last a few decades. "The Oakwood Beach neighborhood of Staten Island has been targeted for purchase by the state and designated as buffer land to prevent destruction by future Hurricane Sandy-like storms." (Huang, 2015, page 6). The special aspect of the long-term masterplan from group three is that it is the only masterplan which contains a sea wall as coast protection against flooding and the slowly rising sea level. The East Short Waterfront Vision Plan from the NYRCRP (cf. Toland, 2016, page 1) and the concept by Dewberry also includes the construction of a sea wall. However the community detests this idea of building a big wall along the coastline. They would have the feeling of being cooped up and losing control when they cannot see the changing of the ocean.

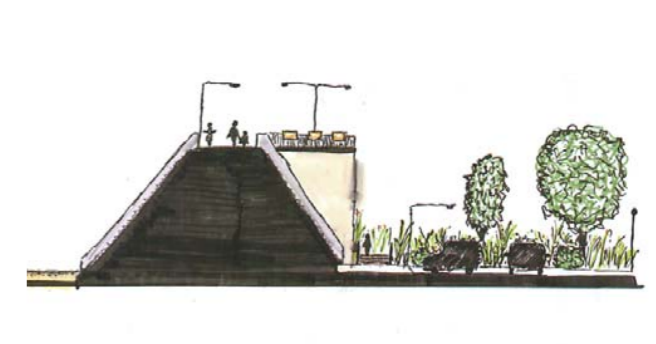
The idea is that the potential negative reputation of the wall changes into a positive for the community by creating a meeting area for visitors and residents at a viewing platform. Everyone can have a look to both sides of the wall and enjoy the view from above.

A three-meter-wide pedestrian and cyclist pathway on top of the sea wall should facilitate this experience. Benches and lighting provide an opportunity to stay whenever they want to. The sea wall is six meters high because the Oakwood Beach "region [...] is only 1.2 to 1.5 meters above sea level" (Toland, 2016, page 2). It looks like a dike with the typical slanting sides. A reason for this form is that "curved seawalls absorb wave energy better reducing deflection of wave forces and scour at the base of the wall." (NYC Planning, page 44). Steps with hand rails allow the people to access and leave the sea wall every 500 meters.

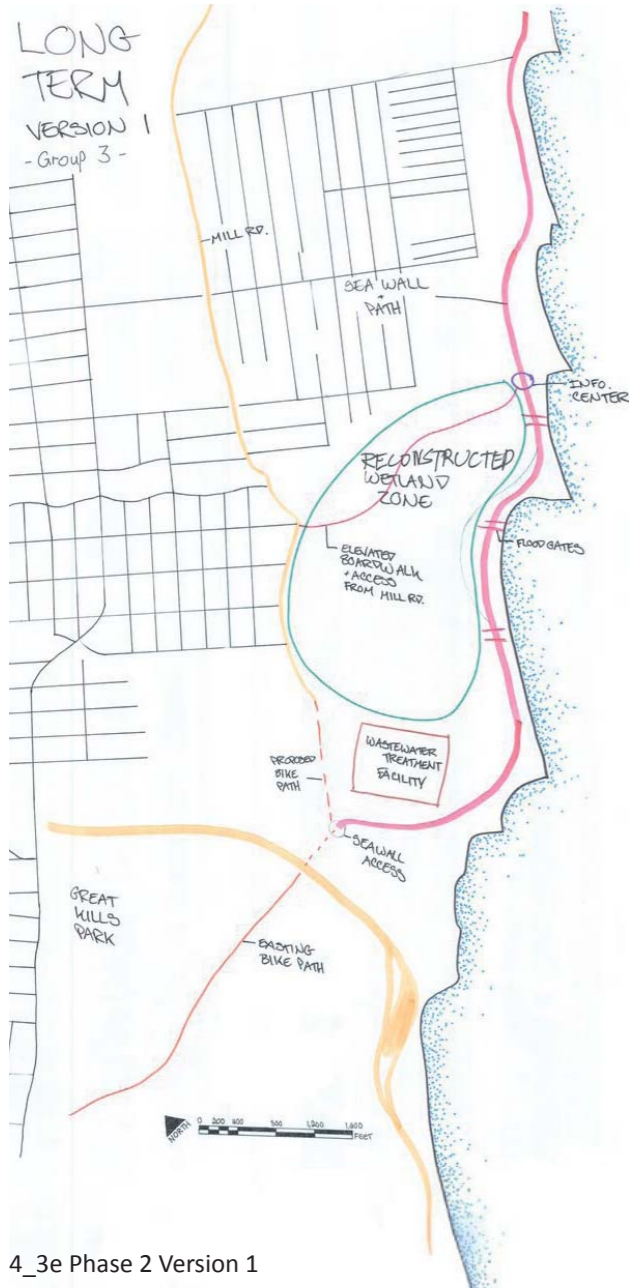


4_3c Perspective Sea Wall

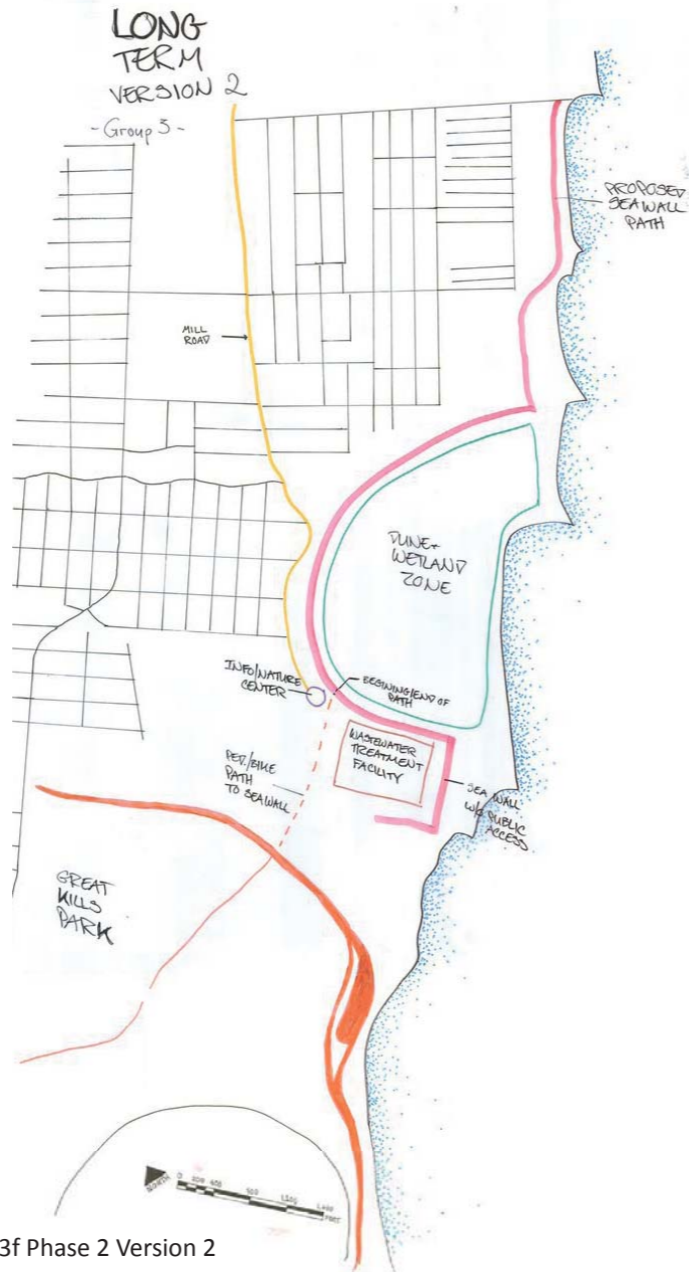
There are actually two versions of a long-term masterplan. The first one (on the left fig. 4_3e) contains the sea wall located along the sea coast, to the second one (on the right fig. 4_3f) shows an exclusion of Oakwood Beach by locating the sea wall from the Oakwood Beach Water Pollution Control Plant along the Mill Road to Cedar Grove Beach Place and the FDR Boardwalk. The group decided to use with version one because in version two there was no solution for finding a suitable place for a rainwater retention basin. In addition to that, the coastal defense adjacent to the city, which would not be much higher than the wall in version one, would create a constrained feeling for all residents. In version one an open area mediates a feeling that like they have enough space to interact with because this space is used as a rainwater retention basin and a resort. It has to be checked if this space is big enough for upcoming rainwater or not.



4_3d Visitor Center and Parking



4_3e Phase 2 Version 1



4_3f Phase 2 Version 2

Within the sea wall, three future flood gates make it possible that salt and fresh water exchange when open. They can be closed in storm events to prevent flooding or to stop the exchange. This aspect makes the flood gates interesting for visitors to the site. Some information boards explain the important function of these elements for the ecological system behind the wall.

The whole area of Oakwood beach is converted "into [...] a 'belt retention pool' of wetlands that will thwart surging water in future storms" (Frew Development Group LLC, 2016, page 2). A brackish wetland develops when salt water comes in contact with fresh water and the dilute solution shows a low-level salinity. This special vegetation zone is a domicile for fitted plants and animals, thus it supports the development of biodiversity. The brackish wetland becomes an interesting resort to interact with and enables an educational destination for every visitor and possibly for secondary schools from New York City. Information boards along the sea wall provide the educational issue. In the north of the sea wall, a small information center and a small parking area can be used by visitors to this area.

Raised boardwalks (cf. masterplan) with a width of 3 meters lead through a section of the wetland to promote an engagement of visitors with their environment and to afford a good vantage

point over the area. Moreover, additional information boards give pedestrians an understanding of the brackish wetland. At the end of the raised boardwalks, steps make it possible to access the pathway on the seawall.



4_3g Masterplan

The extended bikeway (cf. dashed line on masterplan) from Great Kills Park to Mill Road gets one other diversion close to Oakwood Beach Water Pollution Control Plant which leads to a ramp access onto the proposed sea wall and the pathway. Thereby, a connection between the Green Belt and subsequent Blue Belt to the FDR boardwalk exists in the form of trails and surfaced pathways.

Oakwood Beach could become an example of a resilient coastal neighborhood with these measures and aims. It is important for this project that the community gets motivated into involvement and inputs in talks and plans for



4_3h Sketch Wetlands



4_3i Perspective Sea Wall



4_3j Perspective Path in the Wetlands

CONCLUSION

After sketching and presenting our ideas we thought about the reaction of the jury and our opinion of the strategies.

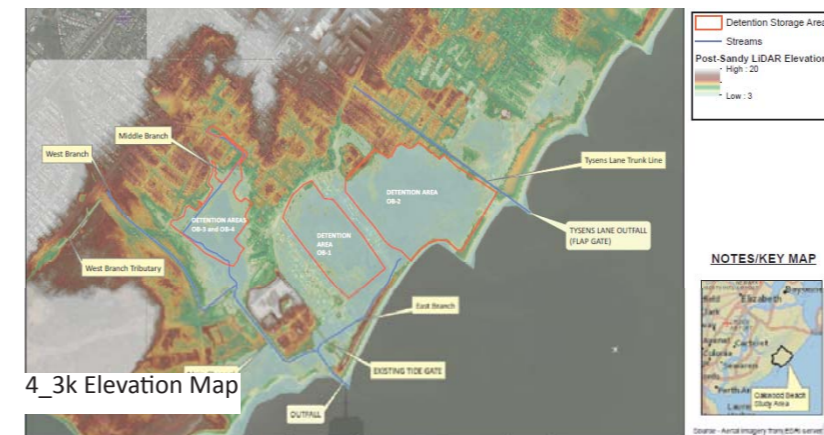
The list of the short term goals could be more precise and wide than the current one. Until the long-term plan comes into effect the area may be better prepared by setting more goals.

The sea wall was at first our best way to deal with the problem of rising sea levels and storms although it looks like a border in the middle of the landscape. At first we placed the wall onto the high-leveled area in front of the beach because this is a natural rise which is curved why the sea wall is that much. Another fact is that it fits into the (future) landscape and the coastline. Although a curved wall is much more expensive than a angled sea wall, but a cornered one would not be an opportunity for this draft.

While drawing the section of the sea wall we didn't think about the width and the correct construction of the wall and the distance from the wall to the ocean. The section conveys that the wall is next to the coastline, but this is flawed because it needs much more space.

We are not sure if people will want to visit this area because of the few attractions we planned for the promenade on the wall. We could improve the quality of time spent on the promenade with more possibilities to interact for example with picnic tables, telescopes or barbecues.

The success of the proposed information center close to the sea wall is questionable since it probably won't attract many tourist and visitors from far away to come to Oakwood Beach. It is possible that it could be interesting for citizen who live next to the area, but the first impression is that it is worthless because the area will be used as a resort.



4_3k Elevation Map

GROUP 4

ORIGINAL THOUGHTS AND VISION

“For group 4 the scope of the project was to create public space in open areas between privately owned property while integrating nature and a sense of place.”

One of the proposals we made for our site was the creation of a raised footpath for better vantage points, lending itself to community safety, a superior view and the rising and falling water levels of the wetlands.

We also proposed creating a more beautiful and desirable beach location by reducing hardscape, through redirection of roads.

The focus of the restoration was on vegetation planting and establishment to provide shade, create habitat and protect soils from water erosion.

The Oakwood Beach community is the last missing puzzle piece to connecting all of Staten Island’s major green spaces, based on the acceptance of natural processes (figure 2) while maintaining community safety. The challenge is that we want to work with nature (figure 3), but the protecting levee, proposed by the Army Corps of Engineers, fights nature.

GOALS AND OBJECTIVES

Group 4 has three main goals for Oakwood Beach, to mimic natural processes, direct people to Oakwood beach and community safely. They wanted to reach with 3 different phases, immediate, once houses are removed, and a variable phase.

The group wanted to mimic natural processes to aid in controlling flood waters and maintain ecological functions, despite seasonal changes and water levels, while creating space that is usable during times of high and low water levels.

The creation of a design language along “connective corridors” to direct people to Oakwood beach and raise awareness of its importance as green space and as a community space would also create better connectivity to surrounding green spaces. Proposing a landscape that is unique to Staten Island and encourages pride and a sense of identity would complete the goals.

COMMUNITY SAFETY

The objective is to create a resilient and functional ecology for changing climate, while establishing identity and sense of place through recognition value by better connectivity to greenspace, city centers and surroundings through the creation of a unique ecological landscape.

METHODS/STRATEGIES

Connectivity is made through the creation of the connective corridors along main roads as well as through the pathways leading to and from other parks and green spaces. Additionally, the proposed, elevated walkways throughout Oakwood Beach include access to the beach, with extended heights to accommodate sand dunes for natural protection and to evoke a feeling of being at the beach.

A strategy to aid in retaining flood waters was to allow the designed brackish wetland to use the storm and ocean water. In order to accommodate these waters, the “bowl” of the wetlands behind the sand dunes was made bigger. A dynamic landscape could be achieved by the use of depression and mounding topography. This will allow community use during times of inundation and during times of low waters.

The elevation of Mill Road could be changed to create a built-in dike mound in place of the proposed sea wall located at the beach. The elevation at Mill Road is higher, which would allow us to achieve the same level of protection but with a shorter wall. It would also allow for connectivity and access.

PHASE 1

Connectivity is provided through the creation of the connective corridors along existing main roads. There would also be new pathways created that lead to and from other parks and green spaces adjacent to the project area.

To deal with the phragmites issues, elevated walkways are proposed throughout the Oakwood Beach project area. These would be situated to provide views above and across the wetlands, including views of the beach. These walkways could also help to provide enhanced beach access.



4_4a Section Bikeway



4_4b Phase 1

PHASE 2

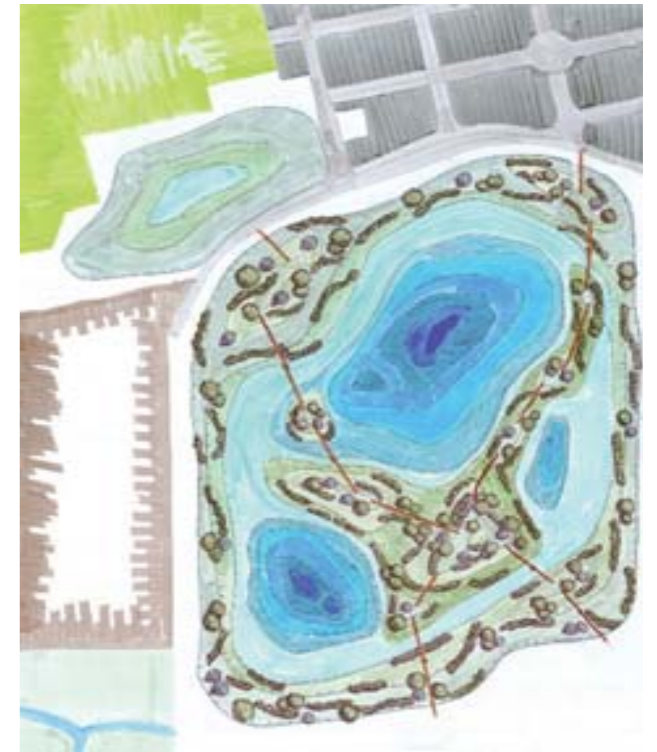
The key move with Phase 2 is to reconsider the seawall concept. It was noted that Mill Road would be elevated somewhat during reconstruction. Given that Mill Road is 12-15 feet above sea level, it could be reconstructed to a 19' elevation (matching the height of the proposed Dewberry seawall), yet would not need to be as high. Mill Road's alignment would need to be shifted away from the existing houses on the north side of the road, but with a lower wall it should take less money to construct and create less of a barrier to the site. The road could carry into the wastewater treatment facility, tying into the wall structure proposed there.

The rest of the site would be a dynamic landscape created by the use of depressions and mounded landforms topography.

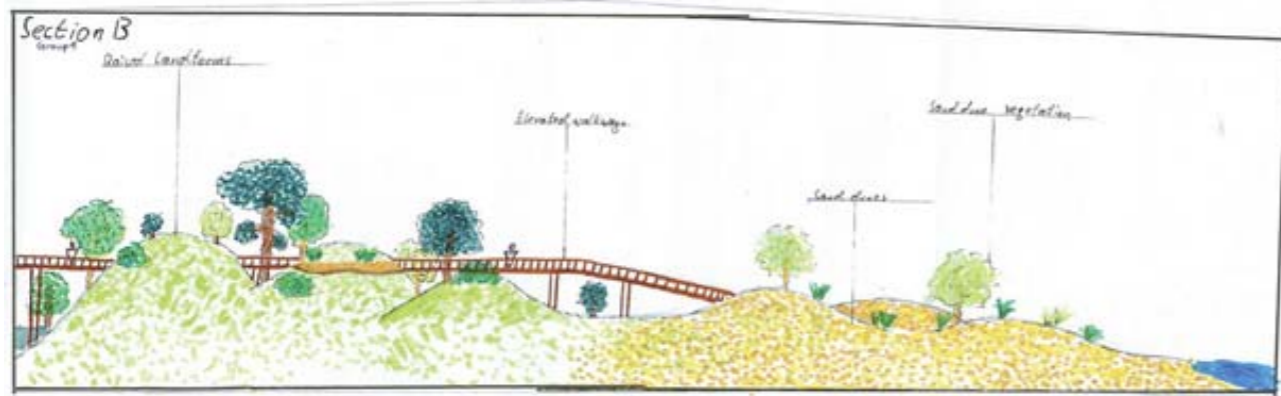


4_4c Section Landforms

A trail system would work in and around these mounds, and spaces created that would allow for use during times of inundation and during times of low waters.



4_4d Phase 2



4_4e Section Coast

The dunes created closer to the beach would be extended into the site, to enhance their use as natural protection. This would also evoke a feeling of being at the beach and draw visitors from the site towards the ocean. Behind the dunes, a “bigger bowl” wetland will aid in retaining flood waters and stormwater runoff. This would then allow for the creation of designed brackish wetlands, also, enhancing the biodiversity of the site.

PHASE 3 - variable phase

During this phase, connectivity to inner town areas and surrounding green space will be improved by establishing a recognizable design language. Regrading would take place during these retrofits and the creation of an elevated roadway that connects Mill Road and continues around the major grade change elevation.



4_4f Perspective Dune Landscape

CONCLUSION

Our approach is to encourage people to interact with a continuously changing landscape. Interacting with their environment will help them to understand the natural processes which are a part of climate change and, as a result, rising sea levels. The unique composition of cityscape set against brackish wetlands, with a view of the ocean, creates an identity for Oakwood as well as Staten Island itself. This area is the missing piece of the puzzle in a connected green space within the Island and it only seems right that the last piece put in place focuses on the changing environment that lies ahead of us.

In conclusion, we can say, that we have reached our goals. Nevertheless, justifiable objections

exist. One objection of the jury was the very expensive construction of sinuous curves in the wall. The organic forms of the dike give the area a feeling of facileness and it adapts perfectly to the surrounding landscape. Therefore, the acceptance by the community was very high, and the construction of the site proposal was widely accepted. The community and site-users feel a sense of integration and identity with the proposed site plan. For a long investigation, the acceptance of the population is indispensable. Finally, the construction proposal may not be the most widely accepted option, but it could influence the direction of the Oakwood Beach community’s site plans in the future.



CASWELL BEACH PROJECT
VISION LOCAL RESIDENT LEAD
GOALS
• OPEN & RESILIENT
• DIVERSIFIED ECONOMY
• PRESERVE ENVIRONMENT
STRATEGIES
• COASTAL RESTORATION
• IMPROVE LOCAL INFRASTRUCTURE
• RESTORE NATURAL RESOURCES
• DEVELOP COMMUNITY-LED PROJECTS
• ENGAGE LOCAL RESIDENTS
• IMPROVE LOCAL INFRASTRUCTURE
• RESTORE NATURAL RESOURCES
• DEVELOP COMMUNITY-LED PROJECTS



The Key to the successful completion of this project was, without doubt, the friendly atmosphere between the students and professors. Despite the different nationalities and native languages, the communication was easily possible. The work on the joint project, shared activities like a trip to Manhattan and cooking together, and the overall conviviality lead to friendships that will hopefully maintain for a long time.

The excellent teamwork between the students made the work on the project and the challenges within easier. Not only did the research on information the provided, but also the work on an unfamiliar scale happened analogously. Photoshop, CAD and InDesign were not in use, only pen and paper.

To get a first impression of the project area of Oakwood-Beach, the Group made a field-trip under the guidance of a DEC (Department of Environmental Conservation) employee. The

experience gained in the field should lead to a further insight into the problems and conditions in the area of Oakwood-Beach and the community within. A sewer system, a Phragmites plague and a dirty beach can't be seen on maps and orthophotos.

The four Groups of up to five students were trying to come up with a short and longterm goal for the area, that satisfy the demands of humans and nature. Especially Encouraging the community was a huge challenge. The buyoutprogram left some big marks in the density of settlements. The few remaining residents, who could not yet be convinced to move, were left without a sense of neighborhood. Missing knowledge of the needs and wishes of those people made it very difficult to integrate them in the planning.

On the other hand, the goals for the designpart were not that hard to find. The students were able to offer alternatives and improvements to existing plans. Repeated short presentation



5a Short Break on the water



5b Presentation in between

in front of the other students and professors in the work process gave the opportunity for a constant feedback for each group. Where some approaches of the groups were quite similar, others were fundamentally different. Dealing with the seawall for example, which was the biggest thorn in the side of every group, was handled quite differently. Three out of four groups designed different kinds of dune landscapes instead of the seawall, while one group came up with a different shape design for the seawall. The Wastewater Treatment Plant also was handled quite differently. Each group came up with individual concepts dealing with this facility.

This generated a high diversity of ideas that

would be presented to an invited audience, consisting of DEC officials. The reaction of this audience was predominantly positive and lead to an intense exchange of questions and answers and a lot of constructive criticism. Overall, the feedback was overwhelmingly positive.

The ESF-students will continue working on this project and have to implement the jury's criticism and questions. The design has to fit the demand of civil protection most of all, combined with the recreational, environmental and hydrological needs. Some plans might be rethought if they are not implementable. A dune might fit the ecological and recreational demands, but will it withstand a 100-year

flood? Does it handle fresh and salt water exchange on a daily bases? The ecological development and possible value is based on the hydrological conditions. The hydrological conditions will be determined by the technological implementation of the design. The complexity of the hydrological influences in the area and its relation to the ecological value is high. The ecological outcome might influence the suitability for a recreational purpose. Is a recreational purpose fulfilled with raised boardwalks through the area or not? A Question like this leads to the next question: What does the community want? The integration of residents in the planning process might be obligatory. Participation could be an opportunity for the community to build identification

with Staten Island and the area. To include every one of those demands in a plan will be challenging, since there is no universal recipe for a solution. The experience gained in this project is going to linger in the memories of the participants. Not only because of the hard work had everyone put in to solve the complicated situation at Oakwood-Beach, but also the friendly atmosphere students and professors experienced every single day. Through creativity, a great fellowship and a common task, a partnership was strengthened. A partnership that might be a beginning for the participating students from different countries, but a successful continuation for the ESF and the HS-Osnabrueck.



5c Break in Brooklyn Bridge Park



5d Group Picture



THANKS TO

At first we would like to thank the SUNY ESF for planing and organizing the charette, espacially Prof. Tim Toland and Prof. Doug Johnston, who were in charge for this project.

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And we would like to thank the New York Department of Environmental Conversation for introducing us to the Site and giving feedback to our work.

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At least we would like to thank all students taking part of this project an producing this brochure.

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Chapter 1

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- f. Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
- g. Own picture

Chapter 3

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- c. Own Picture
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Chapter 4

Group 1

- 1a. Own Picture
- 1b. Material Tim Toland
- 1c. Own Picture
- 1d. Own Picture
- 1e. Own Picture
- 1f. Own Picture

Group 2

- 2a. Own Picture
- 2b. Own Picture
- 2c. Own Picture
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- 2e. Own Picture
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Group 3

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- 3b. Own Picture
- 3c. Own Picture
- 3d. Own Picture
- 3e. Own Picture
- 3f. Own Picture
- 3g. Own Picture
- 3h. Own Picture
- 3i. Own Picture
- 3j. Own Picture
- 3k. Material Tim Toland

Group 4

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Chapter 5

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