

# Student Investigations into Historic City Dock Sea Level Rise Design

Nathan Collier, Mark Dennis, Maria Espinoza,  
Dylan Reilly, Vincent Yi

Under the supervision of Professor Victoria Chanse

LARC 748: Advanced Special Topics Studio  
The University of Maryland – College Park  
Fall 2016



PALS - Partnership for Action Learning in Sustainability  
An initiative of the National Center for Smart Growth

Gerrit Knaap, NCSG Executive Director  
Uri Avin, PALS Director  
Kimberly Fisher, PALS Manager

## Contents

### Introduction

|                           |   |
|---------------------------|---|
| Course Overview .....     | 2 |
| Project Overview .....    | 2 |
| Existing Conditions ..... | 3 |

### Student Proposals

|  |    |
|--|----|
| Blue Green Approach – Mark Dennis .....          | 5  |
| Annapolis Maritime Harbor – Maria Espinoza ..... | 7  |
| Making Waves – Vincent Yi .....                  | 10 |
| Tidal Promenade – Dylan Reilly.....              | 13 |
| Annapolis in an Elevator – Nathan Collier .....  | 16 |
| Acknowledgments .....                            | 18 |

## Introduction

### Course Overview

The advanced special topics design studio, LARC748, is the final studio for graduate students in the Master of Landscape Architecture program. This studio's projects address the outcomes of stormwater and sea level rise design and planning, and incorporate stakeholder and community feedback into the design process. Other aspects of the assignments involve cross-disciplinary perspectives (civil engineering, architecture, ecology, and planning). To address these dimensions, students develop design investigations at different scales. They also develop an applied understanding of how stakeholder involvement informs design.

This studio course used the inquiry-based project learning approach. One key part of this studio format is the iterative interaction between students and the instructor during each phase of the design process. In addition to scheduled class times, students had field trips, community workshops, meetings with special guests, and gave presentations. The course was taught in a studio/lecture format with lectures at the beginning of the studio period. Class time was used for fieldwork, desk critiques, lectures, discussions, exercises, invited guest lectures/critiques, reviews of in-process projects, student presentations, and field trips. Interim and final presentations to the City of Annapolis and stakeholders provided guidance and feedback to students.

### Project Overview

As a project with the Partnership for Action Learning in Sustainability, the students developed conceptual plans and designs for the Annapolis Historic City Dock area. The purpose of this work was to identify a range of potential solutions for absorbing coastal floodwaters during storm surges and sea level rise on the Historic City Dock in a way that preserves the historic waterfront character of the site.

Specific tasks included:

- Mapping and analyzing the study area, including sea level rise and storm surge assessments for the project site and adjacent areas at different scales and in section/perspectives. This included incorporation of existing reports and data given to the faculty member and students by the City, including the Regulatory Response to Sea Level Rise and Storm Surge Inundation report developed by Whitney Bailey Cox & Magnani, LLC.
- Developing alternative design concepts to address sea level rise and storm surge.



Figure 1: City Dock in 2016

- Review and critique of the projects throughout site analysis and initial concept development from civil engineering, historic preservation, and design faculty and students (depending on their availability and time), in addition to critiques from design professionals and related stakeholders (Maryland Department of Natural Resources and others).
- Preliminary and final master plans including implementation projects and strategies.

City staff from the offices of Historic Preservation, Public Works, and Planning and Zoning gave the students the freedom to be visionary with their designs. They were asked to consider historic features, but had flexibility with non-contributing assets. Their designs should account for the next fifty years and incorporate the long-term aspects of sea level rise. The following section discusses existing conditions common to all five student designs, and the design summaries are presented from the least to the most intensive and costly—e.g., from minimal grade changes to raising up building platforms and structures around the dock.

## Existing Conditions

The area under consideration comprises roughly 13 acres in the eastern section of downtown Annapolis, stretching from Compromise Street across the traffic circle at Main Street, and around the slip area known as Ego Alley, on to Prince George Street, alongside property of the U.S. Naval Academy. The streets nearest City Dock feature primarily commercial and institutional uses, including shops, restaurants, hotels, and government buildings. Historic residential neighborhoods can be found to the dock’s north and south.



Figure 2: Aerial view of the City Dock area and nearby features

According to the 2013 *Annapolis City Dock Master Plan*, this key place of beauty and civic importance at the water's edge can be traced back to the 1695 Annapolis city plan. Radial streets and open vistas created a long view from along Main Street to the Chesapeake Bay that endures to this day. Maritime buildings and commercial enterprises arose during the 18<sup>th</sup> and 19<sup>th</sup> centuries, with the construction of the Market House and the addition of trees and a traffic circle ushering in a formal public space. Several decades later, automobile traffic reshaped circulation patterns around City Dock. By the middle of the 20<sup>th</sup> century, many of the buildings on the north side had been replaced with the parking lots that are still there today, a condition that undervalues the historic area.

By one calculation, about 12.4 acres or 94.9 percent of the surrounding land is impervious. Given its bayside location, City Dock is vulnerable to nuisance flooding and the long-term threat of sea level rise. Future decisions to adapt this asset must therefore also consider environmental and physical implications beyond those that affect the everyday user. Among its design objectives, the 2013 Plan calls for a new central market square at Market House; a walkable public space in the form of a promenade; more public art, green spaces, and shade; and a transportation balance that favors pedestrians and reallocates parking areas to flood protection infrastructure and sidewalks. Several of these features can be found in the student proposals that follow, along with new ideas for transforming City Dock into an even greater and more resilient amenity for Annapolitans and visitors in the decades ahead.

## Student Proposals

### Blue Green Approach – Mark Dennis

This design acknowledges the presence of nuisance flooding but deals with rising seawater in a manner that allows it to be cleaned and enjoyed. In its current state, City Dock’s market area is divided from the waterfront by Randall Street and by parking areas that limit pedestrian connections. As Annapolis grows, this historic asset must be better leveraged. Design changes will protect City Dock but also permit residents and visitors to engage with the water, including during flood events, while also making its adjacent streetscape more inviting with tree plantings and “blue/green infrastructure.” The Blue Green Approach has as its primary goals:

- to push back against sea level rise
- to detain (pull) stormwater upland
- to maintain the character of City Dock.



Figure 3: Rendering of streetscape conversions on Main Street

Mitigating upland runoff is essential to promoting a more resilient downtown Annapolis because of the significant downward-sloping elevation change toward City Dock. Streetscape conversions including tree plantings and new gutter systems that would collect much of the upland stormwater rather than allowing it to flow into the low-lying harbor area. Nevertheless, the Blue Green Approach assumes that City Dock will flood at times, and embraces the opportunity for residents to wade in and interact with the water.

The main precedent is Copenhagen, Denmark, where a 2014 cloudburst flooded the city with stormwater and combined with a tidal surge in a very short time period. As a response, Copenhagen explored a distributed detention system that

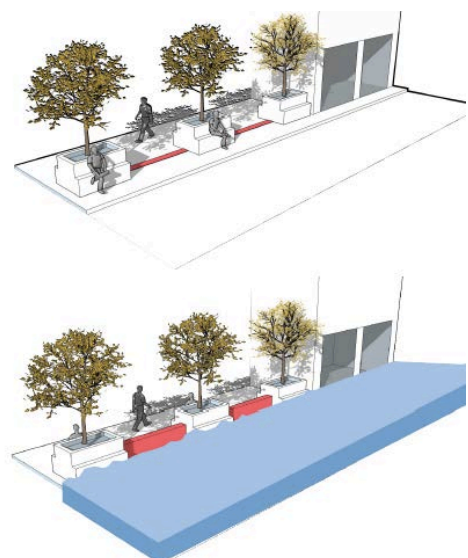


Figure 4: Hydraulic barriers rising between tree planters



incorporates stormwater management in spaces that, when dry, function as parks, recreation areas, and passageways for automobiles, bicycles, and pedestrians. Another precedent is Canal Walk in the master-planned Korean city of Songdo, where hard and soft edges alongside canal structures promote interaction with the water.



Figure 5: Blue Green Approach site plan with street section

On City Dock itself, existing features would be reused or replicated with new components designed to resist storm surge. Tree planters along the dock are popular areas for visitors to congregate and rest. This design incorporates barriers that would rise between the planters during a flood event to block rising water. Acting as a sea wall, these hydraulic barriers would extend around Ego Alley from the intersection of Main and Compromise Streets to an expanded park stretching to the end of the dock. Flood proofing the structures on Compromise Street would save the City from having to install barriers wrapping around the entire dock area. Floating docks replace the existing boat slips, becoming a permanent feature that is less vulnerable to sea level rise. Rounding out the design are vegetative beds and buffers on either side of the plaza and a new shared street concept in front of the Market House, each adding further protective and pedestrian-friendly elements to this historic area.

## Annapolis Maritime Harbor – Maria Espinoza

In addition to combating sea level rise and storm surge, this design aims to enhance event spaces, maintain a functional waterfront, and build connections between City Dock’s maritime history and traditional downtown harborside retail. The new features it recommends are meant to serve and expand on the 12 annual events held on the dock, as well as enhance the experience for boaters in the harbor area. Precedents include Greece’s artful Thessaloniki waterfront promenade, Sweden’s multi-layered Hornsbergs Strandpark, and the commemorative nautical sculptures in coastal Boston and London. The primary goals of this approach are:

- to celebrate Annapolis’s maritime history through the use of art installations
- to create multilayered spaces that can be used for different year-round events
- to increase boat docking and the connection to the water’s edge
- to protect the City Dock area from sea level rise impacts and nuisance flooding events.

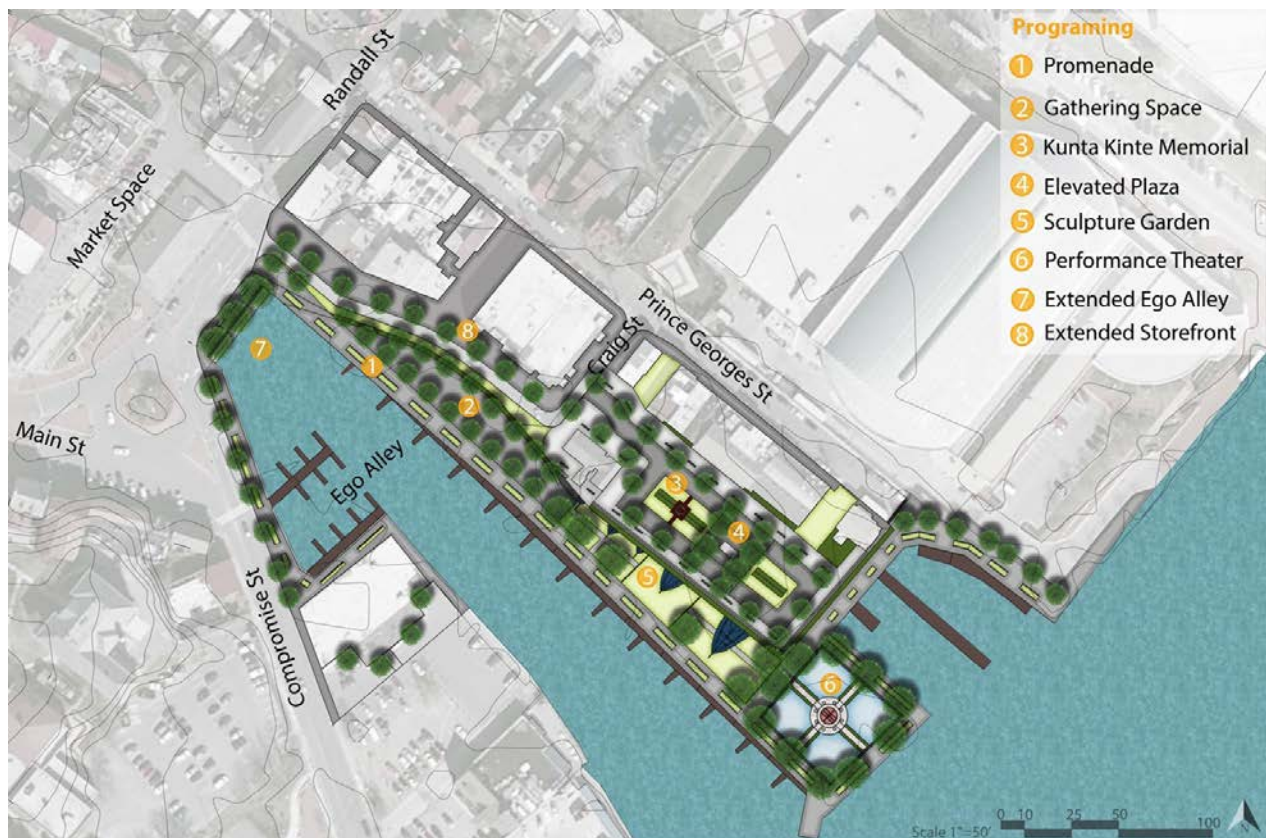


Figure 6: Annapolis Maritime Harbor site plan

The site plan area includes a 20-foot wide promenade along the entire northeastern edge of Ego Alley, off of which a gathering space and sculpture garden would replace the previously dominant parking lot. The Kunta Kinte memorial and the Memory Wall would move to the upper plaza to protect them from future sea level rise flooding. These new activated areas feature kinetic public art pieces that are able to endure occasional floodwater, while higher areas nearest to the storefronts stay protected. At the end of an



extended City Dock is a multi-layered peninsular performance theater, parts of which remain visible and usable during storms. Ego Alley is would extend into a current parking area on Compromise Street, allowing for new boat slips that encourage more use of the waterfront.



*Figure 7: Kinetic sculpture garden*

This design ensures that City Dock is protected at two-to-five-foot inundation, while a five-to-ten-foot inundation scenario would result in less impact than the current layout does. Raised areas become the primary protective measure, with the major commercial buildings and the surrounding streetscape being elevated by six-to-seven feet. Removable seawalls allow visitors to remain connected and close to the water's edge, and bioretention areas installed throughout City Dock would serve as an additional line of defense. More than 500 parking spaces are retained, albeit in areas outside of the dock itself, while boat slips nearly double in number.



*Figure 8: Proposed performance space, before and after a storm event*

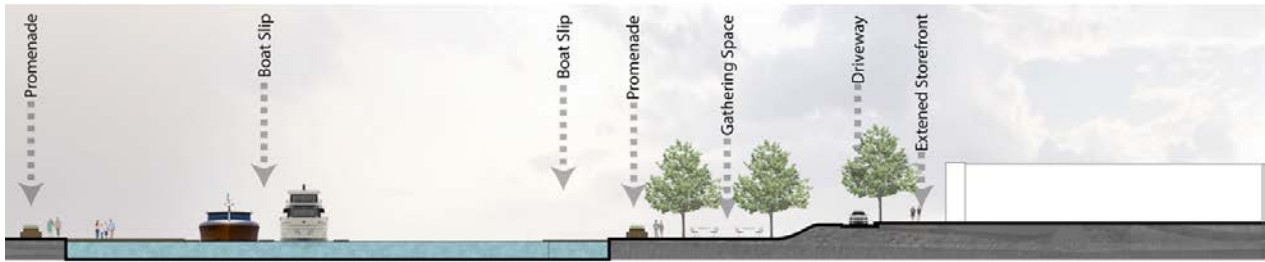


Figure 9: Annapolis Maritime Harbor street section A

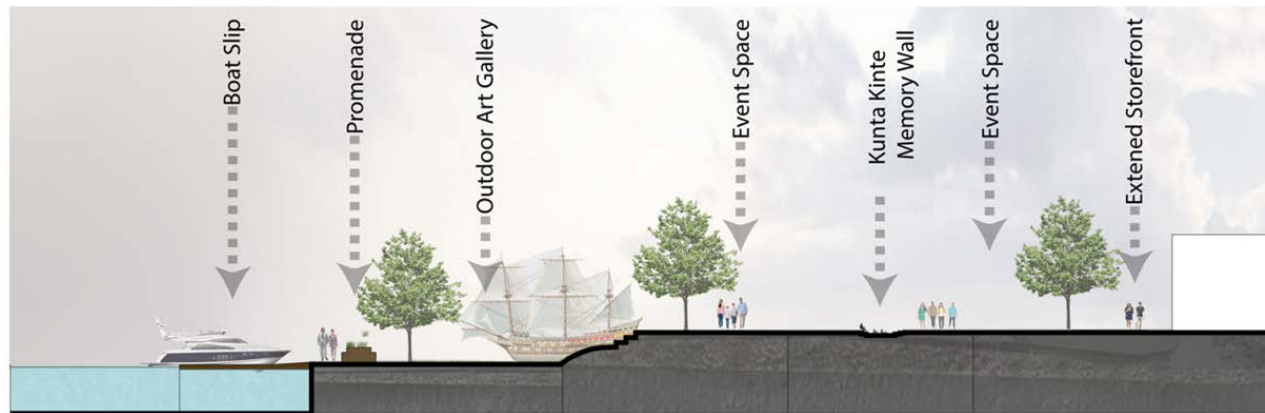


Figure 10: Annapolis Maritime Harbor street section B



## Making Waves – Vincent Yi

This design addresses the prevalent impervious cover surrounding City Dock and better connects downtown visitors to the water. Currently, the seawall separates pedestrians from the waterfront, and most of the dock area is designated for parking despite prevalent transit and nearby walkable neighborhoods. Furthermore, the existing plaza does not accommodate unorganized activities while the nearby city park is largely unused by visitors. Finally, the heat trapped by paved areas and the lack of tree canopy is uncomfortable for pedestrians. Though it will require sacrificing some valued parking spots, a reimagined City Dock can deal with these issues at the same time as it counters the threat of nuisance flooding and sea level rise. The primary goals for this design are:

- safe and walkable streets
- addressing rising sea level
- increased permeability
- enhancing existing cultural and historical amenities.

‘Making Waves’ taps into the City’s intrinsic relationship with sailing and the Bay. The design significantly alters the form of the dock as it wraps around Ego Alley, creating thematically and physically engaging features on either side such as a seating/stage area, play mound, boardwalk, bleachers, and promenade. These new elements activate City Dock with amenities for play and relaxation, water sports, and outdoor dining. On the northeast side of the dock, wave-shaped walls function both as protective barriers and programmable infrastructure for initiatives such as bike share, rock climbing, or public art. This concept was borrowed from a successful precedent in Toronto. In a flood event, barriers rise between the wave bleachers and their highest points can still be occupied. The adjacent promenade has space for ping-pong and a rain garden. Extending south from the barriers is a grassy wave lawn, continuing this design’s play on the physical embodiment of waves on City Dock. Further along the dock is a boardwalk and overlook area that mimics the Toronto waterfront’s Sugar Beach, an example of an urban park reclaimed from a former parking lot.



Figure 11: Renderings of recreational areas and the 'Wave Bleachers'

# Re-imagining the Annapolis City Dock



Figure 12: Making Waves site plan



To defend against storm surge from the harbor, flood-proofing would be implemented for the buildings on Compromise Street and nearest to the Naval Academy. Permanent occupiable barriers, including the wave-bleachers, flank the innermost parts of City Dock and Ego Alley, with the normally unwalled areas slated for deployable barriers. Rain gardens and permeable paver cisterns are placed strategically along the promenade, near the Market House, and behind the Compromise Street facilities, to catch and drain stormwater runoff from the surrounding streets.

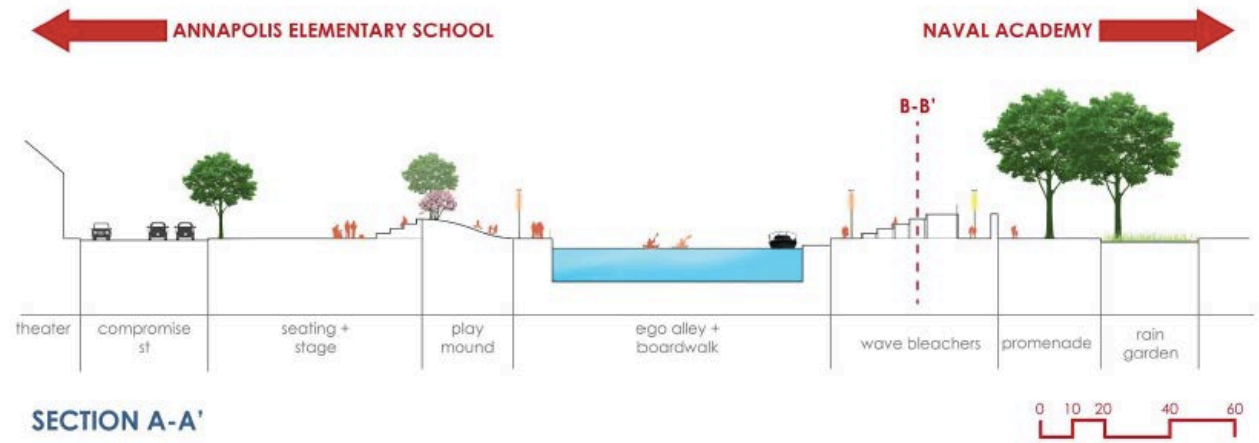
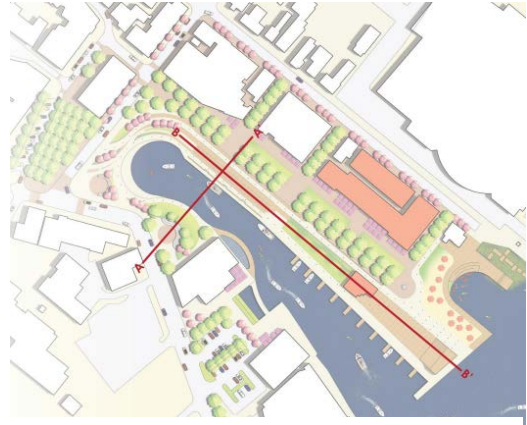


Figure 13: Making Waves street section (A - A')

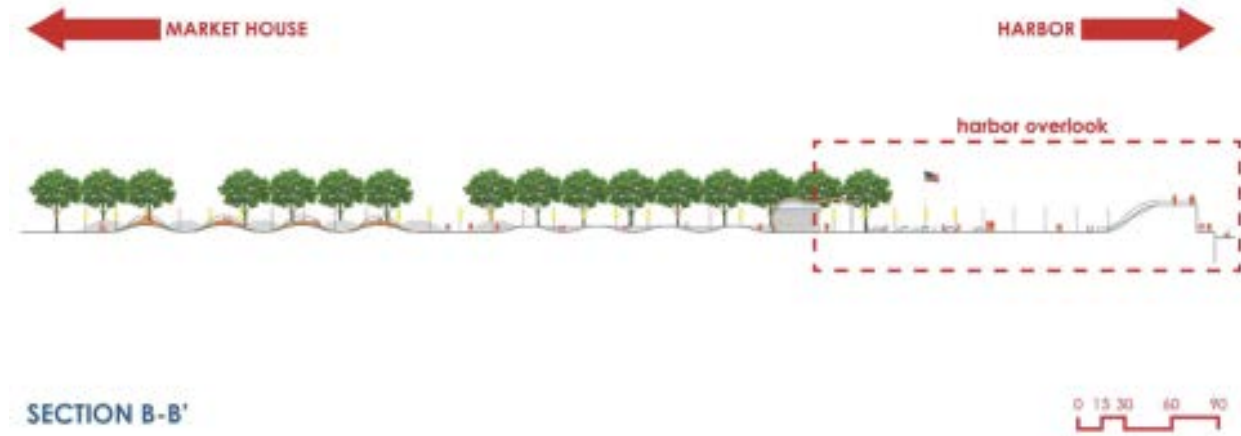


Figure 14: Making Waves street section (B - B')

## Tidal Promenade – Dylan Reilly

Using a range of precedents from modern beachfront concepts in Rio de Janeiro to grand structures in the Netherlands, as well as design elements borrowed from the Chicago Riverwalk, Baltimore Inner Harbor, and the island of Manhattan, the Tidal Promenade has an expansive scale and breadth. While keeping nuisance flooding in mind, this design also aims to:

- protect City Dock from 3-foot sea level rise (2050) and 7-foot storm surge (Isabel)
- use plantings and forms to mimic coastal ecologies
- improve the pedestrian experience at City Dock.

The site plan adds a splash-pad and plaza area beside the Market House, creating a more active space at the key transitional intersection between Main Street and City Dock. While retaining some of Dock Street’s angled parking area, much of the dock itself is reclaimed as public space with a beautified promenade, expanded outdoor dining area, a Sailing Plaza to honor the city’s boating traditions and complement the nearby Sailing Hall of Fame, an urban beach and recreational lawn, and a formal Flag Circle monumental space that maintains the current harbor view. Through these changes, the site not only becomes more decorated but also more functional and inviting. The addition of brackish marshes on either side of the central dock area also presents an opportunity to collect tidal water surges while providing more picturesque ecological features. The marsh on the dock’s southwest side could even extend into the existing city park in the event of a land swap.



Figure 15: Renderings of the urban beach and Flag Circle

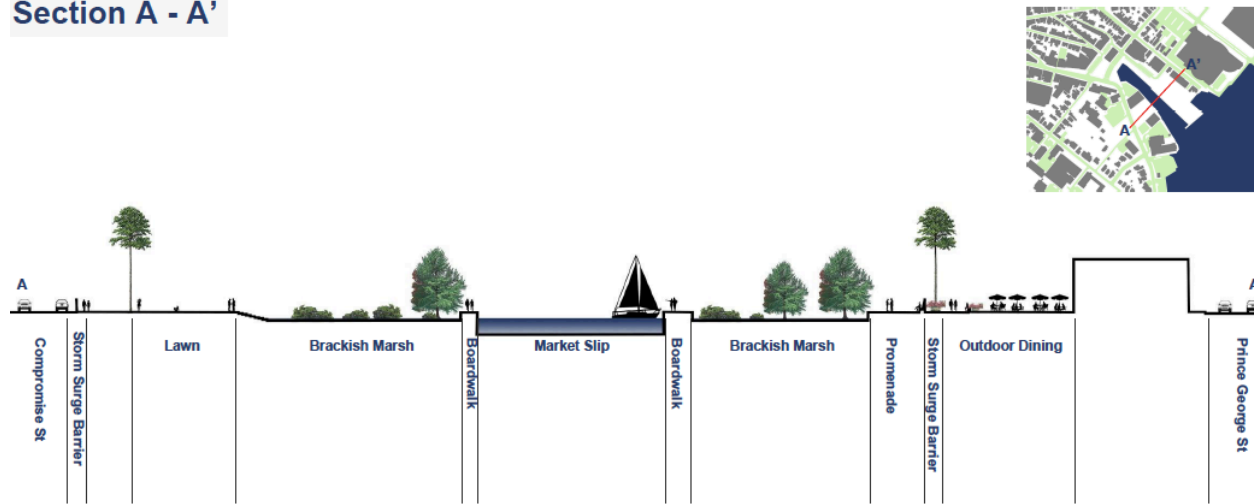
As for flood resiliency measures, a seawall similar to the one currently in place would line the perimeter of Ego Alley and the southeastern edge of City Dock. High seawalls would extend to areas beyond, such as around the Naval Academy. A hydrostatic storm surge barrier would surround all of City Dock and be raised in anticipation of a flood, while several buildings around the north and east sides would be elevated by two to three feet. Flood-proofing tactics would be used on the properties that fall inside the barrier area, including the Market House, Sailing Hall of Fame, and buildings along Compromise Street. Despite being left vulnerable to flooding and ten-foot inundation, constructing a barrier in front of these assets would completely obstruct their harbor views. Compromise Street would remain accessible in a flood event. About half of the parking in areas immediately adjacent to City Dock is retained.



Figure 16: Tidal Promenade site plan



### Section A - A'



### Section B - B'

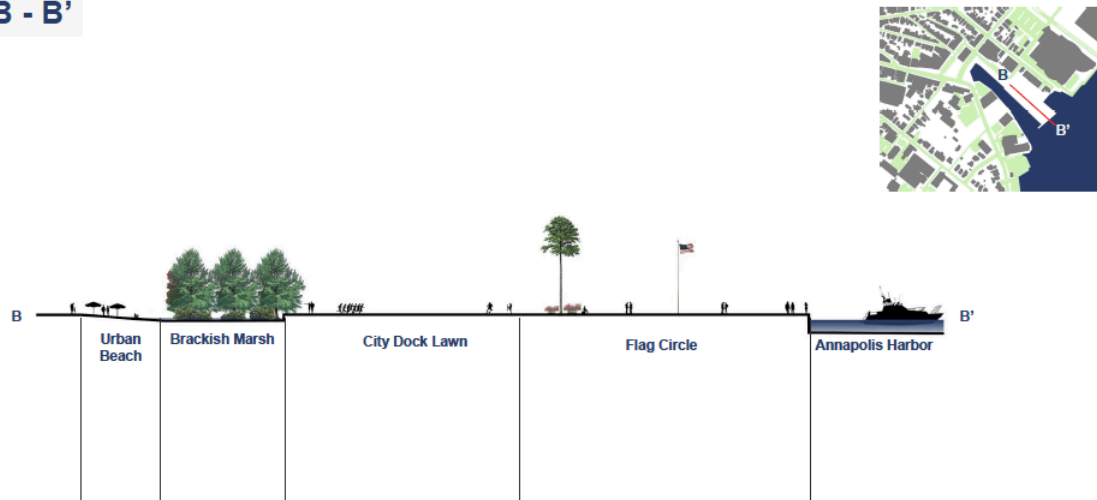


Figure 17: Tidal Promenade street sections



## Annapolis in an Elevator – Nathan Collier

Taking into account the downtown area's topography and flooding patterns, this design prioritizes the strategy of elevation as a solution to the threat of sea level rise and storm surge. The goals are:

- to protect the city dock from sea level rise and storm surge of 8 feet
- to divert nuisance flooding water
- to create multi-layer spaces
- to preserve views
- to improve pedestrian traffic.

Some of the site plan's unique aspects are a recreational wetland park and lawn area, along with a rerouted Dock Street with temporary parking, ensuring adequate circulation is maintained, especially for local business deliveries. Within the Dock Street loop is a new focal event space and an updated location for the Kunta Kinte Memorial and Memory Wall. Boat slips are added to what was a parking area along Compromise Street, and a newly landscaped promenade and extended retail plaza complete the design.



Figure 18: Annapolis in an Elevator site plan

City Dock's elevation would gradually increase as it moves away from Ego Alley, beginning at the current four-foot seawall before rising to six feet at the promenade, eight feet at Dock Street and its sidewalks, and ten feet at the storefronts. This layered approach was drawn from ideas used at the Stranden Waterfront in Oslo, Norway, where a seawall borders a passive seating area followed by an active pathway and commercial area. The event space in the center of the Dock Street area was inspired by the Rome's Piazza Navona in Rome, which features a high degree of activity across facing storefronts. The mid-day closure of Dock Street allows this central space to function as a pedestrian zone without completely stripping it of its functionality for autos. Though sightlines toward the State House would be obstructed, the plaza design does preserve views up Main Street with breaks in the tree cover, and out to the Bay from the top of Ego Alley.

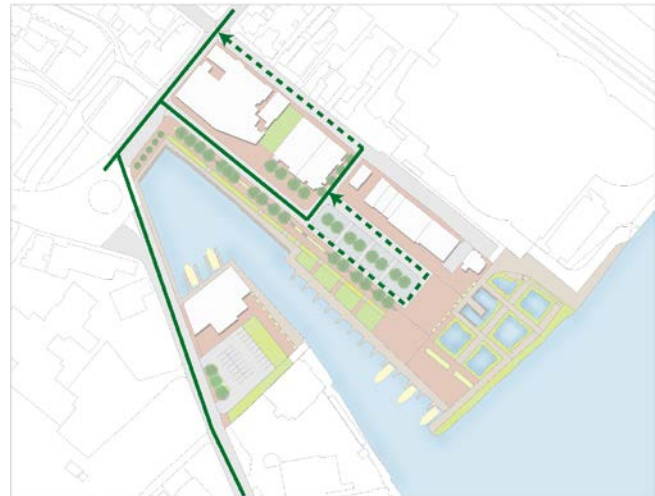


Figure 19: Proposed circulation pattern

Other flood resistance strategies will be put in place to complement the elevation of development. First, a seawall at the street level would surround the entire channel, along Compromise Street, the City Dock promenade, and the new wetland park. A movable barrier would be installed in anticipation of big floods.

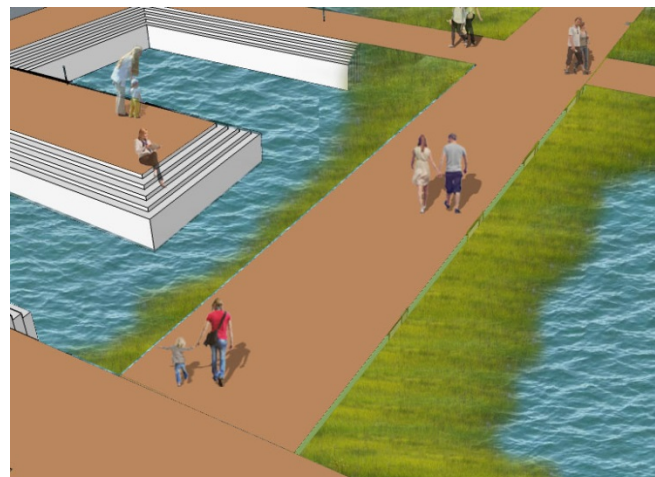


Figure 20: Rendering of the proposed wetland park

Furthermore, based on a precedent in Miami, Florida, pumps would be used to feed water into other small floodable wetland areas along the promenade and other parts of the dock. Finally, the natural barrier provided by the wetland park would grow physically larger over time and continuously improve its functionality as a living shoreline and the first line of defense for this portion of the site.

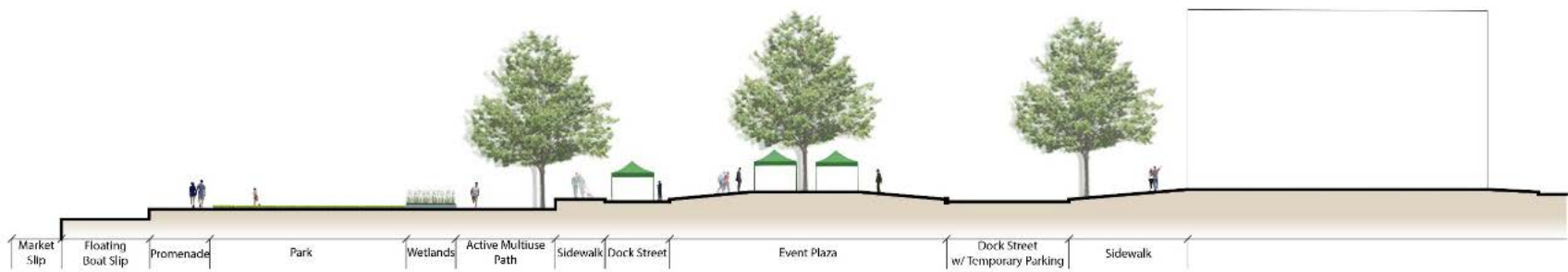


Figure 21: Annapolis in an Elevator street section

## Other Materials

The five student designs feature many more conceptual renderings, precedent images, and other interesting visual elements. All of their presentations are available on the PALS website at <http://smartgrowth.umd.edu/aaaPALS.html>.

## Acknowledgments

- Lisa Craig, Chief of Historic Preservation, City of Annapolis
- Lisa Grieco, P.E. Project Manager, City of Annapolis, Department of Public Works
- Michael J. Dowling, consulting architect
- Alicia Moran, Weather It Together Core Team member
- Pete Gutwald, Director, Planning and Zoning, City of Annapolis
- Shelley Rentsch, Annapolis Landscape Architects
- Deb Schwab, City of Annapolis