

# N.C. Resilient Coastal Communities Program (Phase 1 & 2)

N.C. Division of Coastal Management

PREPARED FOR

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Town of Duck  
Department of Community  
Development  
1200 Duck Road  
Duck, NC 27949

PREPARED BY

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JUNE 2022

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# 1

## Introduction

The Town of Duck (Town) is an approximately 2.42-square mile beach community located in Dare County. The abundance of natural resources (beach, maritime forest, willow swamp) contributes to Duck’s high quality of life and need for a focused resiliency strategy. The Town was recently successful in being selected as one of the communities in the new N.C. Division of Coastal Management’s (DCM) Resilient Coastal Communities Program (RCCP). The RCCP is assisting local communities with technical and financial assistance to advance coastal resilience efforts.

This report documents the Town’s efforts for Phases 1 and 2 of the program. As the Town has been proactive in planning for a resilient future, much of the information has been integrated from adopted plans, current initiatives, and Town’s annual budget.

# 2

## Phase 1: Community Engagement and Risk/Vulnerability Assessment

### 2.1 Community Action Team

The Town has a history of strong community engagement with its previous efforts in developing plans for its future. There were other significant initiatives underway in the Town prior to and during the RCCP effort. To ensure the RCCP captured these other initiatives and prevented engagement fatigue, the Town’s staff was identified as serving as the Community Action Team (CAT).

The staff for the Town of Duck is multi-disciplinary with a wide range of expertise and longstanding knowledge of Town efforts. The roles of the CAT were presented to the staff and they accepted serving as the CAT for this effort. Multiple presentations were made to both the public and the Town Board to review and get feedback on project materials.

### 2.2 Vision and Goals

The Town has undertaken significant efforts to prepare for the future, as detailed in Section 2.3 below, through adopted local plans and other initiatives. These existing documents were reviewed to prepare a vision for this effort that emphasizes local values. The Town of Duck Comprehensive and CAMA Land Use Plan, 2021 (Land Use Plan) contains the following vision for the Town’s future:

“In 2027, the Town of Duck, North Carolina, is a thriving coastal community. We respect and value our delicate, yet dynamic barrier island environment – clean waters and beaches, maritime forests, wetlands, and dunescapes. Residents and visitors alike are drawn to neighborhoods that reflect our small town atmosphere. Our village is a source of pride, offering diverse experiences by way of a cohesive and eclectic mix of independent businesses, shops, and restaurants. At the hub of

our community is the Town Hall and Park, where we interact, share ideas, and build connections. Duck’s vitality, founded on grassroots engagement, encourages meaningful participation from all of its stakeholders. Long-term financial stability, sustainable services, measured growth and a focus on quality of life distinguish Duck as a preeminent destination for everyone.”

As part of achieving this vision, the Town outlines six distinctive goals to work toward in the Land Use Plan:

- Duck and Our Village – Duck Village is the heart of Duck. Our collection of small shops, restaurants, offices, parks and boardwalks together shape the Duck experience. The Village has a continuous coastal residential style that creates an energetic and walkable experience. Our quality of life is enhanced through innovative solutions that preserve the Village’s unique character.
- Enhanced Movability – Duck is a pedestrian first community that is safe and easy to navigate by walking and cycling. Our multi-use trail, sidewalks, soundside boardwalk, and beach provide a variety of ways to explore and discover Duck. Collaboration with various organizations enables us to optimize our traffic flow in our unique seasonal environment.
- Vibrant Thriving Business Community – Duck’s business community plays an essential role in creating the Duck experience. A high level of collaboration and coordination ensures that we have a vibrant town where each and every individual can enjoy our unique recreation, arts, music, shopping, dining, and lodging.
- Environmental Stewardship – Residents and visitors respect Duck’s fragile, extraordinary environment. We protect and preserve opportunities for our residents and visitors to enjoy our ocean, sound, and natural coastal habitats. Our pristine, safe, uninterrupted beaches are our most valuable asset. Our resilience and adaptability, guided by environmental awareness and forward thinking, ensure our sustainability as a community.
- Active Engaged Community – Duck is built on participation. We are an inclusive community that welcomes and embraces the diversity, talents, and expertise of all of our stakeholders. Pride and ownership are felt by all who live, work, and visit here. People feel connected by a shared motivation to preserve the unique nature of this special place.
- Responsive Responsible Leadership – Duck maintains a responsive and responsible government. Council, staff, and the community work together to offer high quality services that add value to the Town. We have an educated, experienced and motivated staff to execute the Town’s objectives. Duck is an innovative and respected leader within the Outer Banks region. Continuity of leadership preserves our established values and vision.

The vision for the Town stated in the Outer Banks Regional Hazard Mitigation Plan, 2020 (Hazard Mitigation Plan) is to:

“Maintain its unique quality of life and sense of place while planning and preparing for resilience in the face of future hazards.”

Common themes were also found in the goals of the local plans, including:

- Resiliency;
- Education and outreach;

- Unconventional solutions;
- Preservation;
- Importance of data collection and tracking;
- Partnerships;
- Contingency plans; and
- Adaptation.

Goals for this project were also pulled from existing plans and discussions that focus on the triple-bottom line approach to resilience (considering social, environmental, and economic factors):

- Preserve our community's unique lifestyle.
- Protect our critical natural resources and coastal ecosystem.
- Build and promote a sustainable economy that supports residents and visitors.
- Plan for orderly and sustainable growth and redevelopment.
- Maintain a well-run and efficient government that provides high quality and cost-effective services.

## 2.3 Existing Local Plans and Efforts

As previously indicated, the Town has numerous plans that were recently adopted and current initiatives supporting the effort to be a more resilient community, including:

- Comprehensive and CAMA Land Use Plan (Comprehensive Plan) (adopted)
- Hazard Mitigation Plan (adopted)
- Coastal Hazards Infrastructure Vulnerability Assessment (adopted)
- Floodplain Damage Prevention Ordinance
- Annual Budget

## 2.4 Community Engagement

The Town closely coordinates with the community during all planning initiatives and has high levels of virtual engagement. Each of the local plans and efforts detailed in Section 2.3 included comprehensive community engagement. Specifically, the Comprehensive Plan, adopted in 2021, included extensive stakeholder and public engagement, with 800 survey respondents and open house opportunities. <sup>1</sup>

Specifically, for this RCCP effort, multiple presentations were made at the Town Council meetings throughout the project phases. Project updates and information were also included on the project-specific page on the Town's website. The project team coordinated with the Currituck Sound Coalition to gain feedback on the program and understand priorities for the Coalition.

In addition, a community survey was circulated to gain input regarding critical assets and hazards in April 2022. The survey had 42 respondents and a detailed summary is provided in Appendix A. Approximately half of the respondents to the online survey noted represented a population that either lives in Duck part time or own a rental property. To get additional feedback, the project team participated in the Town’s 20<sup>th</sup> Anniversary Celebration on May 1, 2022, which was an in-person event.



**Photographs of May 1, 2022, Outreach Event**

The outreach event on May 1, 2022, was extremely successful with over 50 engaged participants and significant community interest. The same questions were asked at the outreach event that were included in the online survey. The compiled information from the outreach event and online survey was used as part of the prioritization process for the potential solutions.

## 2.5 Critical Assets and Natural Infrastructure

Critical assets are those assets in the Town that are critical to maintaining safety, health, and productivity in the community. FEMA defines these critical assets as community lifelines that “enables the continuous operation of critical business and government functions and is essential to human health and safety or economic security” (FEMA, 2019). The components of lifelines include:

- Safety and security (law enforcement, emergency management services, government services);
- Food, water, and shelter;
- Health and medical;
- Energy (power grid and fuel);



- Communications (infrastructure, emergency dispatch and responders);
- Transportation; and
- Hazardous materials.

Critical assets and/or locally significant places in the Town are described and mapped in the Hazard Mitigation Plan:

- Caffey's Inlet Lifesaving Station;
- NC Route 12;
- 16 acres of wetlands (NWI, Hazardous Mitigation Plan); and
- Fire station and treatment plant.

Other critical assets were considered during this evaluation based on coordination with the Town and feedback from the community including:

- Infrastructure;
- Fire Stations/EMS;
- Small Businesses;
- Food Markets;
- Parks & Town Rec Sites;
- Town Municipal Facilities;
- Cultural Landmarks;
- Pharmacies; and
- Gas Stations.

Infrastructure, fire/police/EMS stations, and small businesses were identified as the most important community assets during the public outreach period.

An interactive map of the Town's critical assets and identified hazards was created to analyze the location of the critical assets and potential risk to the hazards. This map was included on the Town's website for reference and feedback during the community engagement period. This map will be available for the Town to use in the future for planning purposes.

## 2.6 Risk and Vulnerability Assessment

As stated in the RCCP handbook, vulnerability of critical assets and natural infrastructure to a hazard is a function of the "exposure, sensitivity, and adaptive capacity":

- Exposure - probability of physical contact between an asset and a hazard;
- Sensitivity - degree to which an asset is impacted by a hazard; and
- Adaptive Capacity - ability of an asset to change its characteristics or behavior in response to a hazard.

The Hazard Mitigation Plan documented that the Town is especially vulnerable to hazards resulting from flooding, coastal hazards (e.g., erosion), and wildfire.

Flooding is a major concern, particularly with low ground elevations and/or high groundwater tables in some areas, with as much as 3 feet of ponding during heavy rainfall events and limited drainage features. Flooding not only causes public safety hazards due to flooded roadways but can also be a public health hazard if septic tanks and drainfields become covered.

Per the Hazard Mitigation Plan, there are three types of Special Flood Hazard Areas in the town: the VE zone, the AE zone, and the AO zone. The AE zone includes areas subject to flooding from the 100-year storm event. The VE zone includes areas subject to flooding from the 100-year storm event as well as wave action of three feet or more. The AO zone includes areas of shallow flooding. The town also includes areas vulnerable to flooding beyond the Special Flood Hazard Areas.

Key concerns included erosion on both the ocean front and soundside (lost homes and need to move roads), rising groundwater, need for education and awareness, loss of protective dune barriers, heavy rainfall events, runoff from increased impervious surfaces, and intrusion of salt water into groundwater. While the majority of the Duck oceanfront coastline is experiencing erosion—with more severe erosion in the northern areas of the Town—a few areas in the Town have historically experienced accretion, including a portion of the coastline between Olde Duck Road to the south and the US Army Corps of Engineers Field Research Facility to the north.

The community feedback demonstrated concerns with similar hazards, beach/soundside erosion, hurricanes and tropical storms, ocean/soundside flooding, and sea level rise ranking as the most concerning hazards.

The Town is experiencing growth in population. Regarding social vulnerability, including income, gender, race and ethnicity, age, and access, the Town ranks as having a low level of vulnerability in the CDC's Social Vulnerability Index (SVI). The Hazard Mitigation Plan also identified Duck as having a low SVI (also based on the CDC's tool). To confirm the CDC's SVI ranking, the NCDOT Equity and Transportation Disadvantage Screening Tool was used. This is a screening tool that includes interactive maps and dynamic dashboards to display equity analyses at the Census block group level for an Environmental Justice (EJ) Index and a Transportation Disadvantage Index (TDI) using population data from the U.S. Census 2015-2019 5-Year American Community Survey (ACS). NCDOT's screening tool also indicated a low score for environmental justice transportation disadvantaged populations in the Town.

It is important for the Town to consider social vulnerability when planning for resiliency. For example, knowing how to staff emergency personnel, where to put any potential temporary emergency shelters, populations that may have special needs for evacuation during and after a hazardous event is critical for success.

The Hazard Mitigation Plan documented building count and value to identify asset exposure. The Plan also noted 86 critical infrastructure and key resources in the Town by type, and 33 high potential loss properties in the Town, primarily residential and commercial. There were no chemical and hazardous, EM, nuclear reactors, materials and waste or postal and shipping resources. There were also no industrial, agricultural, or utilities identified as high potential loss properties in the Town.

Seventy-one percent of the Town's 1,510 total acres is developed (including 767 acres of single-family residential, 57 acres of multi-family residential, 88 acres of commercial, and 159 acres of

institutional development). Of the remaining 439 acres, 197 acres are comprised of rights-of-way and easements, leaving only 16 percent, or 242 acres, of undeveloped space for potential future development. Per the Town’s Comprehensive Land Use Plan, the community’s satisfaction with the current land use balance in Duck as well as both environmental constraints and a lack of greenfield development opportunities indicate that future development within Duck will follow present development trends. Though both the permanent and seasonal populations of the Town are expected to grow, there is enough housing in Duck to accommodate this growth if some current seasonal housing is converted to permanent status and vacant land is developed. In addition, the amount of commercially zoned space available within Duck is adequate to support this population growth.

According to the Hazard Mitigation Plan, there are two small clusters of moderate to high potential fire intensity in Duck. Both areas are within the Wildfire Urban Interface (WUI) but and have a low burn probability. Therefore, these are the areas of greatest wildfire risk in the Town.

During the Hazard Mitigation Plan process, the Town ranked themselves as moderate to high in most capability categories. The Town ranked themselves as high capability in Plans, Ordinances, Codes and Programs and Education and Outreach Capability. Administrative and Technical Capability, Fiscal Capability, and Political Capability all received a Moderate self-assessment score. Mitigation Capability received a Limited rating. Overall, the Town rated themselves as Moderately capable.

## 2.6.1 Vulnerability Index

The vulnerability of critical assets was evaluated, building off of the work contained in the previous efforts discussed above. For instance, the Hazard Mitigation Plan states that most critical facilities exposed to flooding are commercial facilities. The table below considers the assets that were determined most important based on engagement with Town staff, the Planning Board, and community feedback.

<b>Asset</b>	<b>Exposure</b>	<b>Sensitivity</b>	<b>Adaptive Capacity</b>	<b>Overall Vulnerability</b>
Infrastructure (roads, bridges, stormwater conveyance – ditches)	3	3	1	<b>7</b>
Fire Stations/Police Station/Emergency Medical Services	2	2	2	<b>6</b>
Small Businesses	2	2	2	<b>6</b>
Parks and Town Recreation Facilities	2	2	2	<b>6</b>

Scores were developed based on the methodology suggested in the RCCP Handbook. 0-3 score represents lowest to highest, except for “adaptive capacity” where 0 represents high adaptive capacity and 3 represents no adaptive capacity. The highest score overall score represents the most vulnerable assets.

## 2.6.2 Estimate Risk

The Hazard Mitigation Plan, adopted in 2020, used NCEM's iRISK data for building footprints and values on critical facilities. Coastal hazards (such as erosion), flood, and wildfire were rated as a higher priority for the Town than for the region as a whole.

It is important to note that the information provided in the Hazard Mitigation Plan was based on 2006 flood maps, which were since updated and adopted in June 2020. However, there are issues with the 2020 flood maps, and therefore it may be valuable for the Town to update the estimated damages of exposed critical facilities in the future using updated flood maps.

### 2.6.2.1 Risk to Flood

As detailed in the Hazard Mitigation Plan, most of the Town's oceanfront coastline is experiencing erosion, with more severe erosion in the northern areas of Town. Over 60 percent of the Town falls within the mapped 1%-annual-chance floodplains (remainder falls within the 0.2 percent annual chance floodplain).

Tables excerpted from the Hazard Mitigation Plan regarding estimated risk associated with flooding:

**Table C.14 – Recent Development at Risk to Flood, Town of Duck**

Recent Development at Risk		Percent of Total Recent Development	
Count of Parcels	Value of Parcels	Percent of Parcels	Percent of Values
29	\$10,632,000	37.2%	43.2%

Source: Parcel data retrieved November 2019; FEMA 2006 DFIRM

**Table C.15 – Critical Facilities Exposed to Flooding, Town of Duck**

Sector	Number of Buildings at Risk	Estimated Damages
Commercial Facilities	22	\$1,262,679
Critical Manufacturing	1	\$86,464
Transportation Systems	1	\$1,688
<b>All Categories</b>	<b>24</b>	<b>\$1,350,831</b>

Source: NCEM Risk Management Tool

**Table C.16 – High Potential Loss Properties Exposed to Flooding, Town of Duck**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	1	\$135,780
Residential	10	\$2,275,582
<b>All Categories</b>	<b>11</b>	<b>\$2,411,362</b>

Source: NCEM Risk Management Tool

While most of the Town is located within floodplains (1% annual chance and 0.2% annual chance), much of the critical infrastructure is located in the southern portion of the Town, with more severe erosion in the northern part of the Town. Ocean and estuarine shorelines and wetlands were rated as highly vulnerable and continue to be impacted by this erosion.

### 2.6.2.2 Risk to Wildfire

The Hazard Mitigation Plan identified that the highest potential fire intensity is concentrated in two clusters in Duck—one on the northern side of town and one on the southern. Figure C.8 below from the HMP shows these clusters.

Figure C.8 – Fire Intensity Scale, Town of Duck



Source: Southern Wildfire Risk Assessment

Outer Banks  
Regional Hazard Mitigation Plan  
2020

The Plan further states that while these two clusters coincide with areas in the Wildland Urban Interface (WUI) (where housing development is built near or among vegetation that may be prone to wildfire), they both have a low burn probability. In addition, the rest of the Town is not burnable and therefore there is no significant wildfire risk to the Town.

Tables excerpted from the Hazard Mitigation Plan regarding estimated risk associated with potential wildfire:

**Table C.18 – Critical Facilities Exposed to Wildfire, Town of Duck**

Sector	Number of Buildings at Risk	Estimated Damages
Banking and Finance	1	\$394,507
Commercial Facilities	24	\$14,529,486
Communications	1	\$737,800
Critical Manufacturing	1	\$450,700
Food and Agriculture	1	\$188,557
Transportation Systems	2	\$1,309,144
<b>All Categories</b>	<b>30</b>	<b>\$17,610,194</b>

Source: NCEM Risk Management Tool

**Table C.19 – High Potential Loss Properties Exposed to Wildfire, Town of Duck**

Category	Number of Buildings at Risk	Estimated Damages
Commercial	3	\$3,879,200
Religious	1	\$2,259,555
Residential	7	\$10,202,884
<b>All Categories</b>	<b>11</b>	<b>\$16,341,639</b>

Source: NCEM Risk Management Tool

# 3

## Phase 2: Planning, Project Identification, and Prioritization

### 3.1 Potential Solutions

Based on existing information, coordination with Town staff and other project teams, feedback from the Planning Board, and community input, a list of potential solutions was compiled, and each identified as:

- Infrastructure and nature-based measures
- Local policy and regulations
- Local and regional plans
- Education, awareness, and incentive programs

The community response to the project survey overwhelmingly (over 90% of survey respondents) supports infrastructure and nature-based projects for the Town to be more resilient. The matrix of potential solutions is included in Appendix B.

### 3.2 Prioritized Projects Portfolio

Many of the projects included in the project matrix were pulled from existing plans and initiatives. These projects aim to reduce exposure and sensitivity and increase adaptive capacity to hazards. It is

important to note that these other efforts included prioritization exercises for possible implementation.

The potential project solutions were evaluated based on feedback received from Town staff, the Town Council, and community input, in addition to how the potential solution addressed the critical asset type determined to be the most vulnerable. These projects were further characterized by high-level cost, advancement of prior efforts, technical soundness, co-benefits, long-term impact, and capacity to implement.

Below is the list of the prioritized projects based on community engagement and analysis in Phase 1 and 2 of the RCCP.

Project 1:

<b>Project Name</b>	Beach Nourishment – Project currently planned and funded
<b>Project Description</b>	Implement beach nourishment to improve and maintain the Town’s beaches as one of Duck’s most valuable natural resources.
<b>Hazard(s) addressed by project</b>	Erosion
<b>Type of Solution</b>	Natural Infrastructure
<b>Project Estimated Cost</b>	\$7,394,516
<b>Potential Implementation Funding Sources</b>	Dare County Beach Nourishment Fund, Federal and State Grants, Town Funds
<b>Estimated Timeline</b>	9/1/2022-10/31/2022
<b>Priority Rating</b>	High (1)
<b>Project Map</b>	See Appendix C



## Project 2:

<b>Project Name</b>	Soundside Shoreline Management Study
<b>Project Description</b>	Identify ways to enhance the function and natural beauty of the Town’s soundside shoreline.
<b>Hazard(s) addressed by project</b>	Flooding, Erosion
<b>Type of Solution</b>	Natural Infrastructure
<b>Project Estimated Cost</b>	TBD
<b>Potential Implementation Funding Sources</b>	Grant funds, Town/County Match
<b>Estimated Timeline</b>	TBD
<b>Priority Rating</b>	High (2)
<b>Project Map</b>	Town’s soundside shoreline

## Project 3:

<b>Project Name</b>	Neighborhood Stormwater Management Study
<b>Project Description</b>	Conduct a study to identify problem areas and make recommendations for solutions to localized flooding of the stormwater network.
<b>Hazard(s) addressed by project</b>	Flooding
<b>Type of Solution</b>	Infrastructure and Nature Based recommendations
<b>Project Estimated Cost</b>	\$103,000
<b>Potential Implementation Funding Sources</b>	Grant funds Town match
<b>Estimated Timeline</b>	FY 2022-2023 (12-month duration)
<b>Priority Rating</b>	High (2)
<b>Project Map</b>	See Appendix C

Project 4:

<b>Project Name</b>	Living Shoreline Opportunities
<b>Project Description</b>	Explore opportunities to implement living shoreline solutions within Duck.
<b>Hazard(s) addressed by project</b>	Flooding, Coastal and Soundside Erosion
<b>Type of Solution</b>	Natural Infrastructure
<b>Project Estimated Cost</b>	TBD
<b>Potential Implementation Funding Sources</b>	Grant funds Town match
<b>Estimated Timeline</b>	TBD
<b>Priority Rating</b>	High (4)
<b>Project Map</b>	TBD

Project 5:

<b>Project Name</b>	Sea Level Rise Analysis
<b>Project Description</b>	Analyze the effect of rising sea levels on the Town’s infrastructure to better prepare for mitigation and solutions to the problem.
<b>Hazard(s) addressed by project</b>	Sea Level Rise, Flooding
<b>Type of Solution</b>	Non-Regulatory Program
<b>Project Estimated Cost</b>	TBD
<b>Potential Implementation Funding Sources</b>	Grant funds Town match
<b>Estimated Timeline</b>	TBD
<b>Priority Rating</b>	High (5)
<b>Project Map</b>	Town-wide

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## Appendix

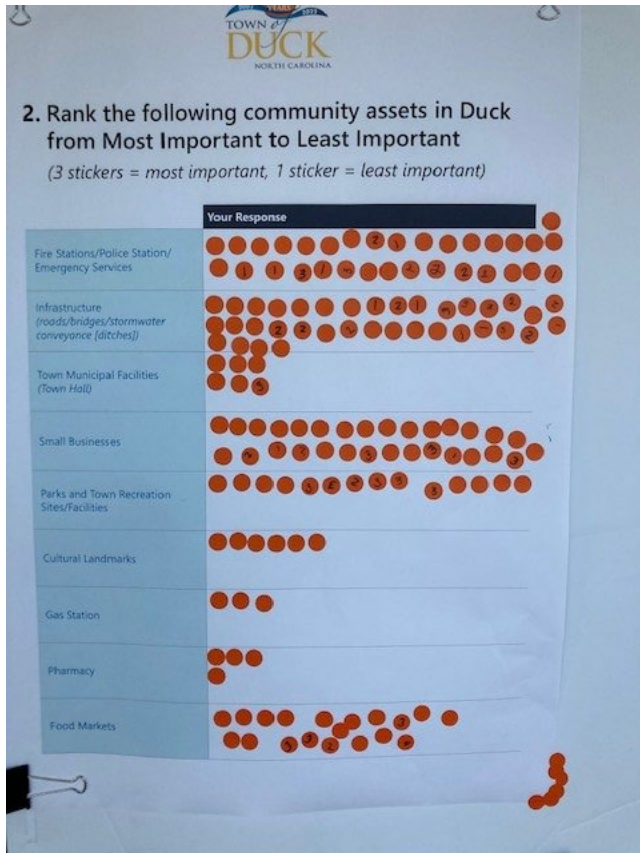
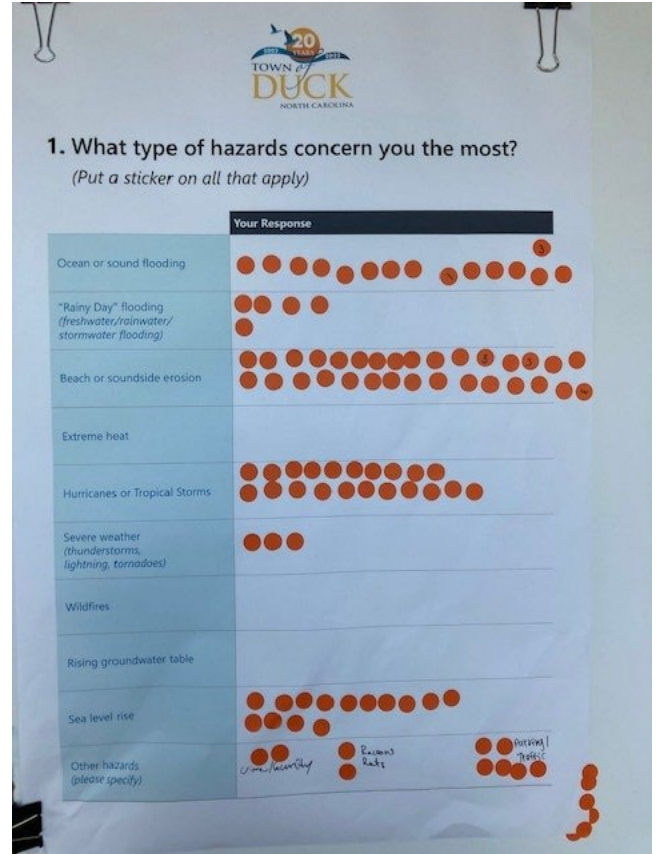
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# Appendix A

# Town of Duck - Community Engagement Event

May 1, 2022

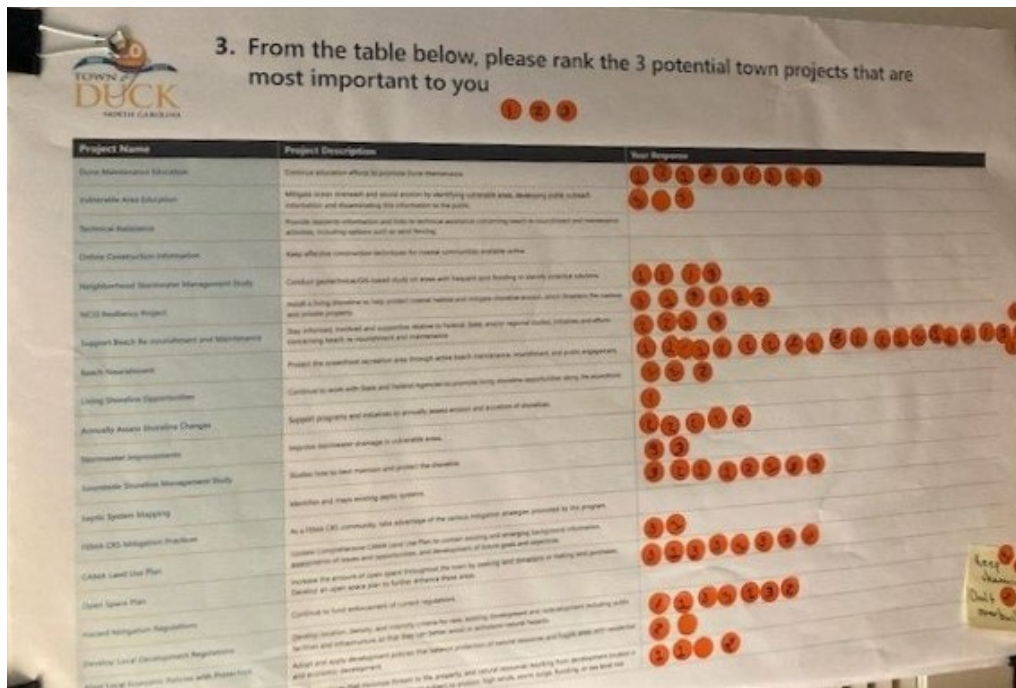
What type of hazards concern you the most?	
<b>In-Person Community Event</b>	<b>Count</b>
Ocean & Soundside Flooding	15
"Rainy day" flooding (freshwater, rainwater, stormwater flooding)	5
Beach or soundside erosion	31
Extreme Heat	0
Hurricanes & Tropical Storms	21
Severe weather (thunderstorms, lighting, tornadoes)	3
Wildfires	0
Rising groundwater table	0
Sea Level Rise	14
Other Hazards:	
Crime/security	2
Raccoons/rats	2
Parking/traffic	6



Most important critical assets	
<b>In-Person Community Event</b>	<b>Count</b>
Fire Stations/EMS	32
Infrastructure	36
Town Municipal Facilities	6
Small Business	30
Parks & Town Rec Sites	14
Cultural Landmarks	6
Gas Station	3
Pharmacy	4
Food Markets	19

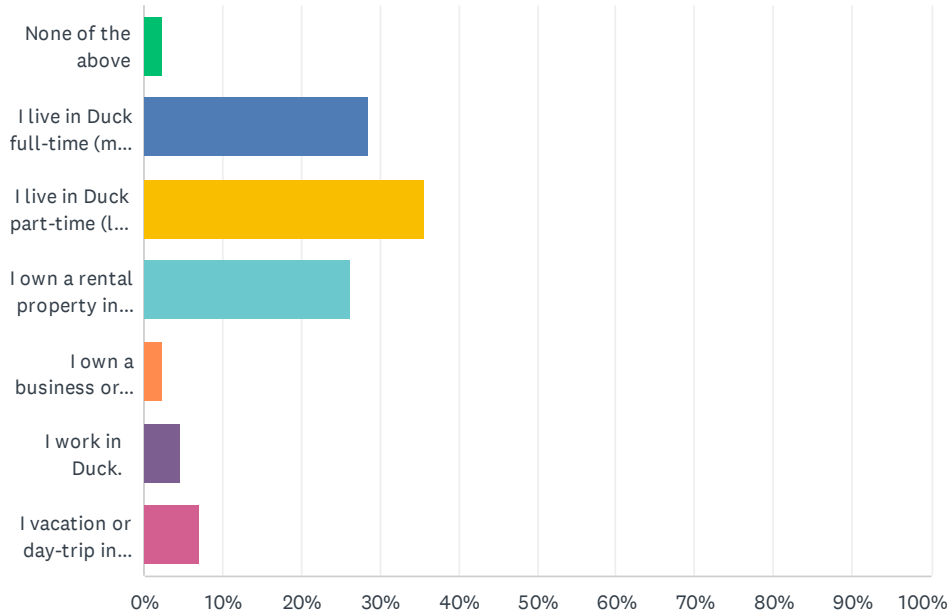
Q4. List the 3 potential Town projects most important to you.	Online Survey				Community Event			
	1	2	3	Total	1	2	3	Total
1 Dune Maintenance Education	1	0	5	6	4	2	3	9
2 Vulnerable Area Education	1	2	1	4	1	0	2	3
3 Neighborhood Stormwater Management Study	5	1	1	7	2	0	2	4
4 NC 12 Resiliency Project	4	4	5	13	2	2	2	6
5 Support Beach Re-nourishment & Maintenance	2	4	1	7	0	2	2	4
6 Beach Nourishment	11	4	2	17	13	7	2	22
7 Living Shoreline Opportunities	5	2	2	9	0	2	1	3
8 Stormwater Infrastructure Improvements	1	6	3	10	0	5	0	5
9 Soundside Shoreline Management Study	6	4	3	13	0	0	2	2
10 Septic System Mapping	1	0	3	4	3	2	3	8
11 Open Space Plan	0	1	4	5	1	3	4	8
12 Sea Level Rise Analysis	3	7	4	14	0	0	0	0
13 Climate Adaptation Plan	2	2	5	9	0	0	0	0
14 Develop Local Development Regulations	0	1	3	4	2	2	3	7
15 Align Local Economic Policies with Protection of Natural Resources	0	4	2	6	1	1	0	2
16 Develop Hazard Area Development Policies	0	0	1	1	2	2	0	4
Total	42	42	45					

some respondents included multiple projects for third choice



### Q1 Please indicate which of the following applies (check all that apply)

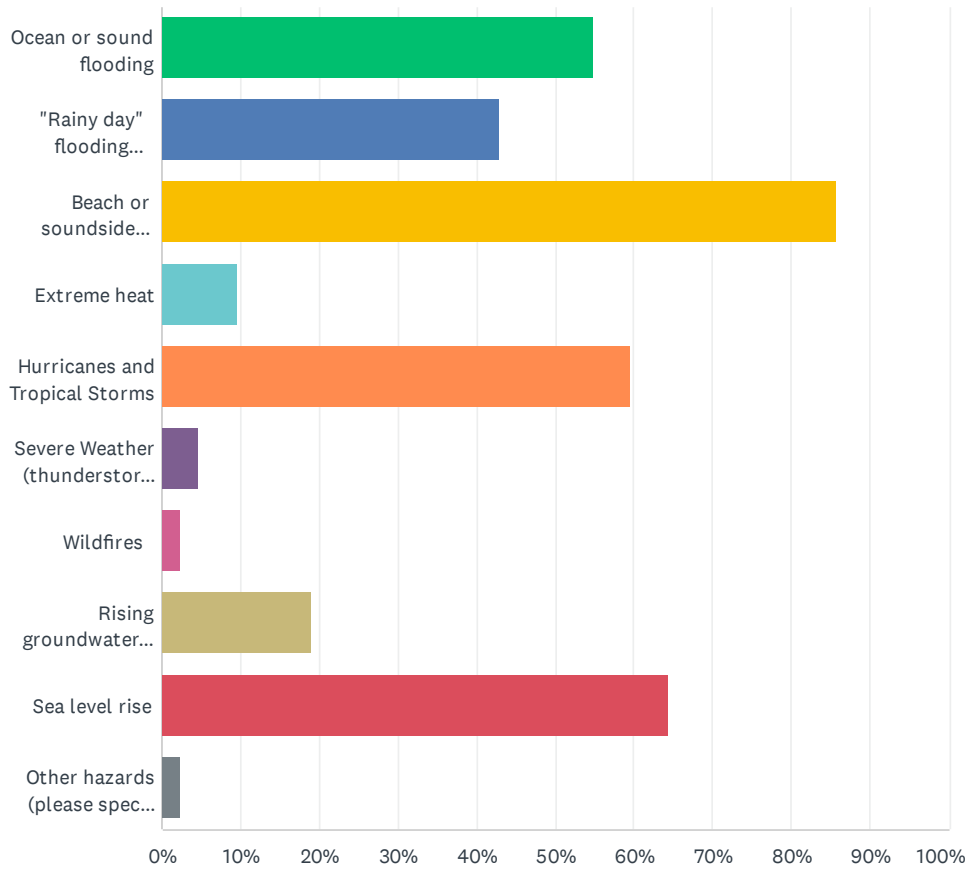
Answered: 42 Skipped: 0



ANSWER CHOICES	RESPONSES	
None of the above	2.38%	1
I live in Duck full-time (more than 6 months per year).	28.57%	12
I live in Duck part-time (less than 6 months per year).	35.71%	15
I own a rental property in Duck, but am not a full or part-time resident.	26.19%	11
I own a business or commercial property in Duck.	2.38%	1
I work in Duck.	4.76%	2
I vacation or day-trip in Duck.	7.14%	3
Total Respondents: 42		

## Q2 What type of hazards concern you the most? (Check all that apply)

Answered: 42 Skipped: 0

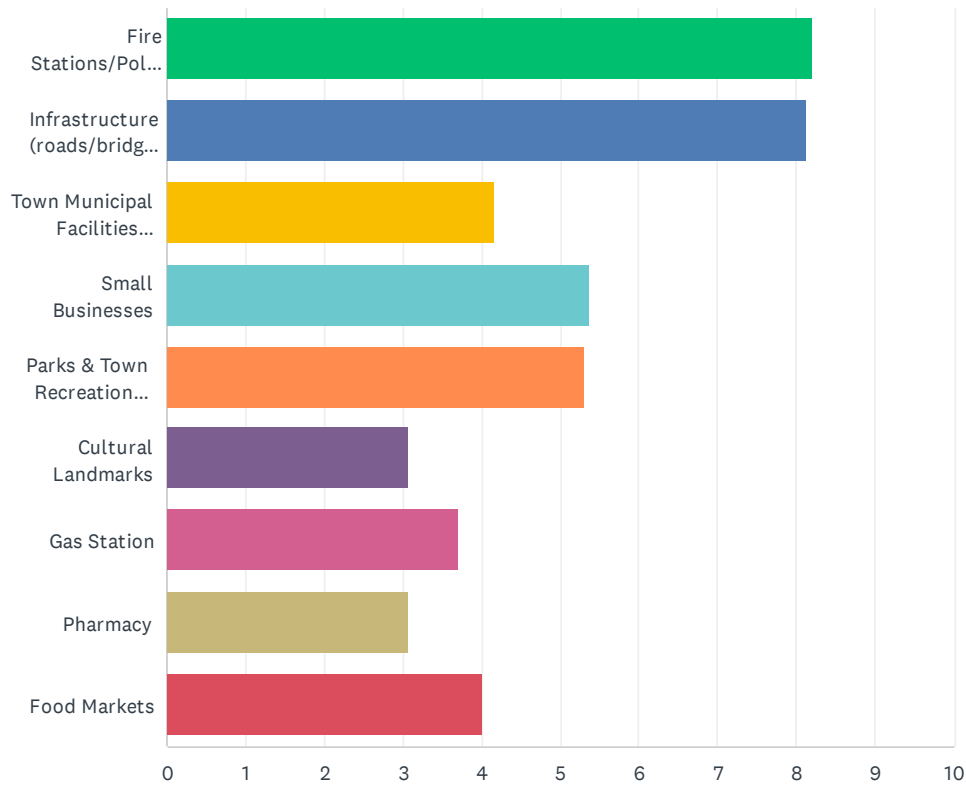


ANSWER CHOICES	RESPONSES	
Ocean or sound flooding	54.76%	23
"Rainy day" flooding (freshwater/rainwater/stormwater flooding)	42.86%	18
Beach or soundside erosion	85.71%	36
Extreme heat	9.52%	4
Hurricanes and Tropical Storms	59.52%	25
Severe Weather (thunderstorms, lighting, tornados)	4.76%	2
Wildfires	2.38%	1
Rising groundwater table	19.05%	8
Sea level rise	64.29%	27
Other hazards (please specify in comment box below)	2.38%	1
Total Respondents: 42		



## Q3 Rank the following community assets in Duck from MOST IMPORTANT to LEAST IMPORTANT

Answered: 41 Skipped: 1



	1	2	3	4	5	6	7	8	9	TOTAL	SCORE
Fire Stations/Police Station/Emergency Medical Services	53.66% 22	29.27% 12	4.88% 2	7.32% 3	4.88% 2	0.00% 0	0.00% 0	0.00% 0	0.00% 0	41	
Infrastructure (roads/bridges/stormwater conveyance [ditches])	36.59% 15	48.78% 20	7.32% 3	4.88% 2	2.44% 1	0.00% 0	0.00% 0	0.00% 0	0.00% 0	41	
Town Municipal Facilities (Town Hall)	0.00% 0	0.00% 0	20.00% 8	10.00% 4	17.50% 7	12.50% 5	12.50% 5	12.50% 5	15.00% 6	40	
Small Businesses	2.50% 1	7.50% 3	27.50% 11	17.50% 7	15.00% 6	7.50% 3	12.50% 5	5.00% 2	5.00% 2	40	
Parks & Town Recreation Sites/Facilities	2.50% 1	5.00% 2	20.00% 8	20.00% 8	17.50% 7	22.50% 9	7.50% 3	2.50% 1	2.50% 1	40	
Cultural Landmarks	2.56% 1	2.56% 1	0.00% 0	10.26% 4	5.13% 2	17.95% 7	15.38% 6	12.82% 5	33.33% 13	39	
Gas Station	0.00% 0	2.50% 1	5.00% 2	17.50% 7	15.00% 6	10.00% 4	12.50% 5	20.00% 8	17.50% 7	40	
Pharmacy	0.00% 0	0.00% 0	5.13% 2	5.13% 2	10.26% 4	15.38% 6	17.95% 7	28.21% 11	17.95% 7	39	
Food Markets	0.00% 0	2.50% 1	12.50% 5	10.00% 4	12.50% 5	15.00% 6	22.50% 9	17.50% 7	7.50% 3	40	

Q4 From the table above, please list the 3 potential Town projects (by project number) that are most important to you.

Answered: 42 Skipped: 0

ANSWER CHOICES	RESPONSES	
1st Project	100.00%	42
2nd Project	100.00%	42
3rd Project	100.00%	42
Other Project Not Listed	9.52%	4

**Q5 Provide any additional comments on the Project List above.**

Answered: 6 Skipped: 36

### Q4 From the table above, please list the 3 potential Town projects (by project number) that are most important to you.

Answered: 42 Skipped: 0

ANSWER CHOICES	RESPONSES	
1st Project	100.00%	42
2nd Project	100.00%	42
3rd Project	100.00%	42
Other Project Not Listed	9.52%	4

#	1ST PROJECT	DATE
1	4	4/25/2022 2:33 PM
2	7	4/23/2022 6:32 PM
3	7	4/22/2022 4:18 PM
4	3	4/21/2022 8:02 PM
5	12	4/21/2022 9:29 AM
6	5	4/21/2022 6:58 AM
7	3	4/19/2022 9:28 PM
8	6	4/19/2022 8:49 PM
9	6	4/19/2022 8:46 PM
10	6	4/19/2022 8:33 PM
11	7	4/19/2022 6:55 PM
12	4	4/19/2022 6:18 PM
13	9	4/19/2022 5:49 PM
14	12	4/19/2022 5:13 PM
15	6	4/19/2022 5:00 PM
16	6	4/19/2022 4:51 PM
17	6	4/19/2022 4:11 PM
18	9	4/19/2022 10:46 AM
19	4	4/18/2022 7:42 AM
20	3	4/17/2022 12:02 PM
21	6	4/17/2022 7:29 AM
22	4-NC12 Resiliency Project	4/16/2022 9:58 PM
23	1	4/16/2022 12:49 PM
24	9	4/15/2022 2:28 AM
25	7 living shorelines	4/14/2022 5:34 PM
26	9	4/13/2022 9:44 AM

Town of Duck - Community Assets & Risks from Natural Hazards

27	10	4/13/2022 9:33 AM
28	#9 sound side shoreline management	4/13/2022 9:02 AM
29	Beach Nourishment 5	4/13/2022 8:53 AM
30	3	4/13/2022 8:48 AM
31	8	4/13/2022 8:47 AM
32	6	4/13/2022 7:01 AM
33	6	4/12/2022 6:26 PM
34	Beach nourishment	4/12/2022 5:23 PM
35	12	4/12/2022 5:14 PM
36	2	4/12/2022 4:57 PM
37	Soundside Shoreline Management Study	4/12/2022 4:33 PM
38	Living shoreline	4/12/2022 4:28 PM
39	13	4/12/2022 4:22 PM
40	3	4/12/2022 4:17 PM
41	6	4/12/2022 9:18 AM
42	13	4/11/2022 8:37 PM
<b>#</b>	<b>2ND PROJECT</b>	<b>DATE</b>
1	8	4/25/2022 2:33 PM
2	8	4/23/2022 6:32 PM
3	9	4/22/2022 4:18 PM
4	8	4/21/2022 8:02 PM
5	9	4/21/2022 9:29 AM
6	7	4/21/2022 6:58 AM
7	6	4/19/2022 9:28 PM
8	4	4/19/2022 8:49 PM
9	15	4/19/2022 8:46 PM
10	5	4/19/2022 8:33 PM
11	15	4/19/2022 6:55 PM
12	6	4/19/2022 6:18 PM
13	13	4/19/2022 5:49 PM
14	13	4/19/2022 5:13 PM
15	5	4/19/2022 5:00 PM
16	4	4/19/2022 4:51 PM
17	12	4/19/2022 4:11 PM
18	4	4/19/2022 10:46 AM
19	6	4/18/2022 7:42 AM
20	8	4/17/2022 12:02 PM
21	7	4/17/2022 7:29 AM

Town of Duck - Community Assets & Risks from Natural Hazards

22	6-Beach Nourishment	4/16/2022 9:58 PM
23	2	4/16/2022 12:49 PM
24	2	4/15/2022 2:28 AM
25	9 sound side shoreline management study	4/14/2022 5:34 PM
26	12	4/13/2022 9:44 AM
27	5	4/13/2022 9:33 AM
28	#12 sea level rise analysis	4/13/2022 9:02 AM
29	Stormwater 3 or 8	4/13/2022 8:53 AM
30	12	4/13/2022 8:48 AM
31	14	4/13/2022 8:47 AM
32	15	4/13/2022 7:01 AM
33	4	4/12/2022 6:26 PM
34	Sea level rise analysis	4/12/2022 5:23 PM
35	15	4/12/2022 5:14 PM
36	5	4/12/2022 4:57 PM
37	Open Space Plan	4/12/2022 4:33 PM
38	Local policy	4/12/2022 4:28 PM
39	9	4/12/2022 4:22 PM
40	8	4/12/2022 4:17 PM
41	12	4/12/2022 9:18 AM
42	12	4/11/2022 8:37 PM
<b>#</b>	<b>3RD PROJECT</b>	<b>DATE</b>
1	4	4/25/2022 2:33 PM
2	9	4/23/2022 6:32 PM
3	13	4/22/2022 4:18 PM
4	4	4/21/2022 8:02 PM
5	1	4/21/2022 9:29 AM
6	8	4/21/2022 6:58 AM
7	8	4/19/2022 9:28 PM
8	14	4/19/2022 8:49 PM
9	13	4/19/2022 8:46 PM
10	1	4/19/2022 8:33 PM
11	12	4/19/2022 6:55 PM
12	12	4/19/2022 6:18 PM
13	4	4/19/2022 5:49 PM
14	6	4/19/2022 5:13 PM
15	8	4/19/2022 5:00 PM
16	13	4/19/2022 4:51 PM

Town of Duck - Community Assets & Risks from Natural Hazards

17	13	4/19/2022 4:11 PM
18	14	4/19/2022 10:46 AM
19	10	4/18/2022 7:42 AM
20	4	4/17/2022 12:02 PM
21	12	4/17/2022 7:29 AM
22	11-Open Space Plan	4/16/2022 9:58 PM
23	5	4/16/2022 12:49 PM
24	10	4/15/2022 2:28 AM
25	13 climate adaption plan	4/14/2022 5:34 PM
26	16	4/13/2022 9:44 AM
27	12	4/13/2022 9:33 AM
28	#10 septic system mapping	4/13/2022 9:02 AM
29	Shoreline 9	4/13/2022 8:53 AM
30	15	4/13/2022 8:48 AM
31	1	4/13/2022 8:47 AM
32	11	4/13/2022 7:01 AM
33	3	4/12/2022 6:26 PM
34	Nc 12 resiliency	4/12/2022 5:23 PM
35	1	4/12/2022 5:14 PM
36	7	4/12/2022 4:57 PM
37	Align Local Economic Policies with Resource Protection	4/12/2022 4:33 PM
38	Soundside shore management	4/12/2022 4:28 PM
39	1&2	4/12/2022 4:22 PM
40	6,14	4/12/2022 4:17 PM
41	11	4/12/2022 9:18 AM
42	11	4/11/2022 8:37 PM
<b>#</b>	<b>OTHER PROJECT NOT LISTED</b>	<b>DATE</b>
1	Evaluate effect of dune top structures (i.e., Barrier Island ramp) on sand migration (erosion, longshore drift, etc.) and implement policies that permit only structures with least impact	4/21/2022 9:29 AM
2	Public Beach Access	4/21/2022 6:58 AM
3	7	4/15/2022 2:28 AM
4	New Bridge Connecting Corolla to mainland	4/12/2022 5:23 PM

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## Appendix B



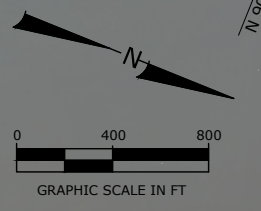
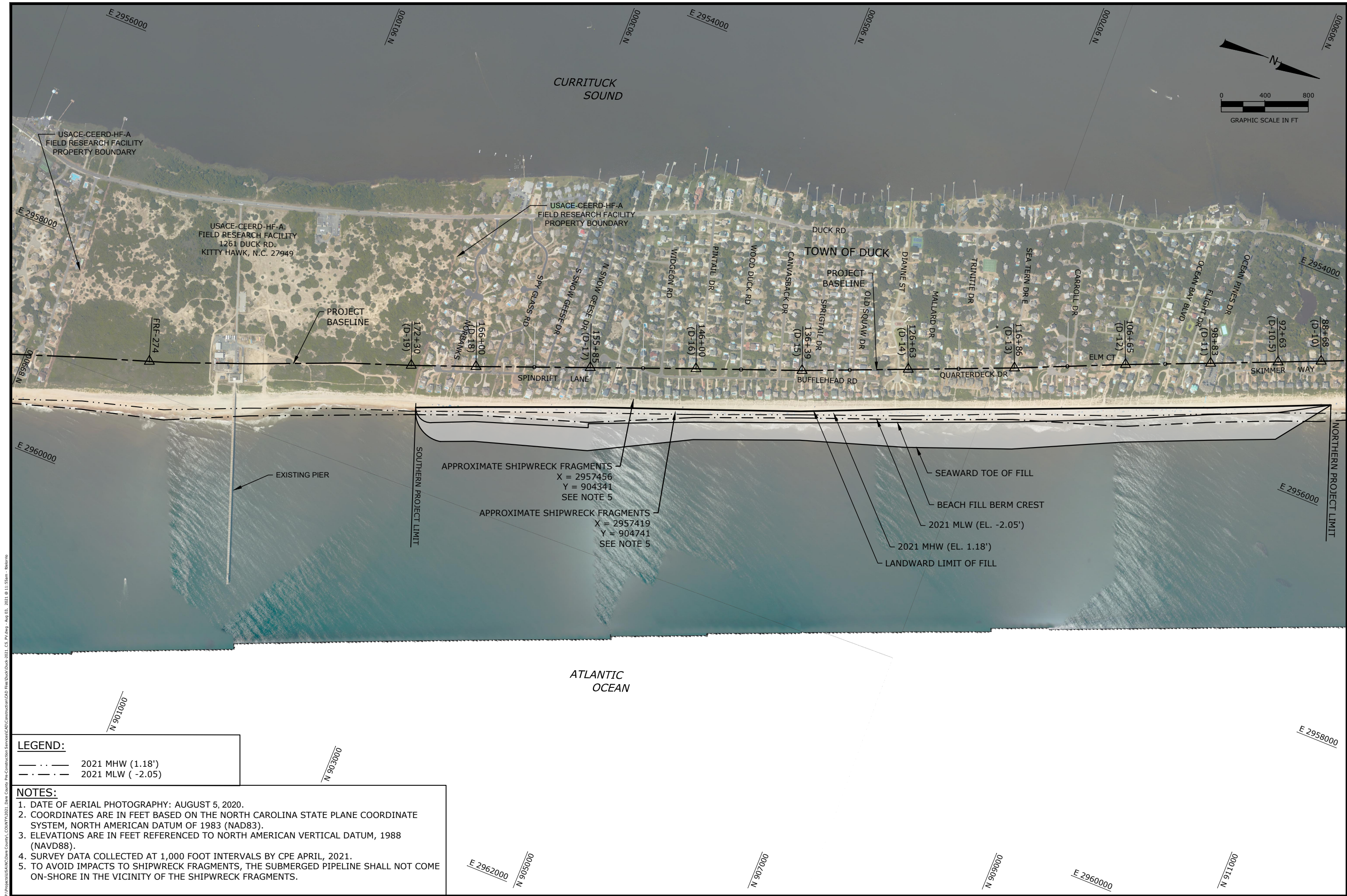
Project Category	Project Name	Project Description	Site Specific	Project Origin
Education, Awareness, & Incentive Programs	Dune Maintenance Education	Continue education efforts to promote Dune Maintenance	No	Town of Duck Comprehensive and CAMA Land Use Plan, Appendix F: Hazard Mitigation Plan (2021)
Education, Awareness, & Incentive Programs	Vulnerable Area Education	Mitigate ocean overwash and sound erosion by identifying vulnerable areas, developing public outreach information and disseminating this information to the public	No	Town of Duck Comprehensive and CAMA Land Use Plan, Appendix F: Hazard Mitigation Plan (2021)
Education, Awareness, & Incentive Programs	Technical Assistance	Provide residents information and links to technical assistance concerning beach re-nourishment and maintenance activities, including options such as sand fencing	No	Outer Banks Hazard Mitigation Plan, 2020 (Duck)
Education, Awareness, & Incentive Programs	Online Construction Information	Keep effective construction techniques for coastal communities available online	No	Town of Duck Comprehensive and CAMA Land Use Plan, Appendix F: Hazard Mitigation Plan (2021)
Infrastructure & Nature-Based Measures	Neighborhood Stormwater Management Study	Conduct geotechnical/GIS-based study on areas with frequent spot flooding in neighborhoods and roadways to identify potential solutions	Yes	Town staff recommendation, proposed SOW from VHB, Town of Duck Comprehensive and CAMA Land Use Plan (2021)
Infrastructure & Nature-Based Measures	NC12 Resiliency Project	Install a living shoreline to help protect coastal habitat and mitigate shoreline erosion, which threatens the roadway and private property. The project includes 988 linear feet of breakwater sills, protection of 21,234 square feet of existing marsh, 12,168 square feet of marsh restoration, and 920 linear feet of riprap revetment.	Yes	Outer Banks Hazard Mitigation Plan, 2020 (Duck), Coastal Hazards Infrastructure Vulnerability Assessment, 2020, Town of Duck Comprehensive and CAMA Land Use Plan (2021) NCDOT Project Info
Infrastructure & Nature-Based Measures	Support Beach Re-nourishment and Maintenance	Stay informed, involved and supportive relative to Federal, State, and/or regional studies, initiatives and efforts concerning beach re-nourishment and maintenance	No	Town of Duck Comprehensive and CAMA Land Use Plan, Appendix F: Hazard Mitigation Plan (2021)
Infrastructure & Nature-Based Measures	Beach Nourishment	Protect the oceanfront recreation area through active beach maintenance, nourishment, and public engagement	No	Town of Duck Comprehensive and CAMA Land Use Plan, Appendix F: Hazard Mitigation Plan (2021)
Infrastructure & Nature-Based Measures	Living Shoreline Opportunities	Continue to work with State and Federal Agencies to promote living shoreline opportunities along the soundfront	No	Outer Banks Hazard Mitigation Plan, 2020 (Duck), Coastal Hazards Infrastructure Vulnerability Assessment, 2020, Town of Duck Comprehensive and CAMA Land Use Plan (2021)
Infrastructure & Nature-Based Measures	Annually Assess Shoreline Changes	Support programs and initiatives to annually assess erosion and accretion of shorelines	No	Outer Banks Hazard Mitigation Plan, 2020 (Duck)
Infrastructure & Nature-Based Measures	Stormwater improvements	Improve stormwater drainage in vulnerable areas	Yes	Town of Duck Comprehensive and CAMA Land Use Plan, Appendix F: Hazard Mitigation Plan (2021)
Infrastructure & Nature-Based Measures	Soundside Shoreline Management Study	Conserve and maintain the wetlands, and other coastal features for their natural storm protection functions, water quality benefits, habitat value, innate beauty, and recreational value, by pursuing efforts to map and restore eroded portions of the Currituck Sound coastline	No	Outer Banks Hazard Mitigation Plan, 2020 (Duck), Coastal Hazards Infrastructure Vulnerability Assessment, 2020, Town of Duck Comprehensive and CAMA Land Use Plan (2021)
Infrastructure & Nature-Based Measures	Septic System Mapping	Explore community-wide septic system and drainfield monitoring, remediation, and continuity of operations planning	No	Town of Duck Comprehensive and CAMA Land Use Plan, Appendix F: Hazard Mitigation Plan (2021)

Infrastructure & Nature-Based Measures	FEMA CRS Mitigation Practices	As a FEMA CRS community, take advantage of the various mitigation strategies promoted by this program	No	Town of Duck Comprehensive and CAMA Land Use Plan, Appendix F: Hazard Mitigation Plan
Local & Regional Plans	CAMA Land Use Plan	Update Comprehensive CAMA Land Use Plan to contain existing and emerging background information, assessments of issues and opportunities, and development of future goals and objectives. Key topics include natural resources, community resiliency, economic development, stormwater management, and multi-modal transportation.	No	Town of Duck Comprehensive and CAMA Land Use Plan, Appendix F: Hazard Mitigation Plan (2021)
Local & Regional Plans	Open Space Plan	Increase the amount of open space throughout the town by seeking land donations or making land purchases. Develop an open space plan to further enhance these areas.	No	Outer Banks Hazard Mitigation Plan, 2020 (Duck)
Local & Regional Plans	Sea Level Rise	Research and adopt an anticipated level of sea rise for future years relevant to development projects of varying time horizons (e.g. - 20 years, 50 years, 100 years). Evaluate the impacts of sea level rise and shoreline erosion on the soundfront and oceanfront to improve the long-term resiliency of the community.	No	Town of Duck Comprehensive and CAMA Land Use Plan (2021)
Local & Regional Plans	Climate Adaptation Plan	Improve the community's resiliency to rising seas and climate change by evaluating existing conditions and development, developing spatial projections for the future in the form of a climate adaptation plan, including identification and assessment of vulnerabilities, prioritization of adaptation/mitigation projects and actions (with probable costs), and establishment of timelines for implementation.	No	Town of Duck Comprehensive and CAMA Land Use Plan (2021)
Local Policy & Regulations	Hazard Mitigation Regulations	Continue to fund enforcement of current regulations	No	Outer Banks Hazard Mitigation Plan, 2020 (Duck)
Local Policy & Regulations	Develop Local Development Regulations	Develop location, density, and intensity criteria for new, existing development and redevelopment including public facilities and infrastructure so that they can better avoid or withstand natural hazards.	No	Outer Banks Hazard Mitigation Plan, 2020 (Duck), Coastal Hazards Infrastructure Vulnerability Assessment, 2020, Town of Duck Comprehensive and CAMA Land Use Plan (2021)
Local Policy & Regulations	Align Local Economic Policies with Protection of Natural Resources	Adopt and apply development policies that balance protection of natural resources and fragile areas with residential and economic development	No	Town of Duck Comprehensive and CAMA Land Use Plan, Appendix F: Hazard Mitigation Plan
Local Policy & Regulations	Develop Hazard Area Development Policies	Develop policies that minimize threats to life, property, and natural resources resulting from development located in or adjacent to hazard areas, such as those subject to erosion, high winds, storm surge, flooding, or sea level rise.	No	Town of Duck Comprehensive and CAMA Land Use Plan, Appendix F: Hazard Mitigation Plan

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# Appendix C





**LEGEND:**

— · · —	2021 MHW (1.18')
- - - - -	2021 MLW (-2.05)

- NOTES:**
1. DATE OF AERIAL PHOTOGRAPHY: AUGUST 5, 2020.
  2. COORDINATES ARE IN FEET BASED ON THE NORTH CAROLINA STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD83).
  3. ELEVATIONS ARE IN FEET REFERENCED TO NORTH AMERICAN VERTICAL DATUM, 1988 (NAVD88).
  4. SURVEY DATA COLLECTED AT 1,000 FOOT INTERVALS BY CPE APRIL, 2021.
  5. TO AVOID IMPACTS TO SHIPWRECK FRAGMENTS, THE SUBMERGED PIPELINE SHALL NOT COME ON-SHORE IN THE VICINITY OF THE SHIPWRECK FRAGMENTS.

**COASTAL PROTECTION ENGINEERING  
OF NORTH CAROLINA, INC.**

4038 MASONBORO LOOP RD.  
WILMINGTON, NC 28409  
ENGINEERING LICENSE CERTIFICATE # C-2331  
PH. (910)399-1905

**REVISIONS**

No.	Date	Description

**Reference Files:**

Designed by:	Checked by:
Drawn by:	Reviewed by:
Date:	Submitted by:
Proj. Scale:	Comm. No.:
AS NOTED	AS NOTED

TOWN OF DUCK  
BEACH RENOURISHMENT PROJECT  
DARE COUNTY, NORTH CAROLINA

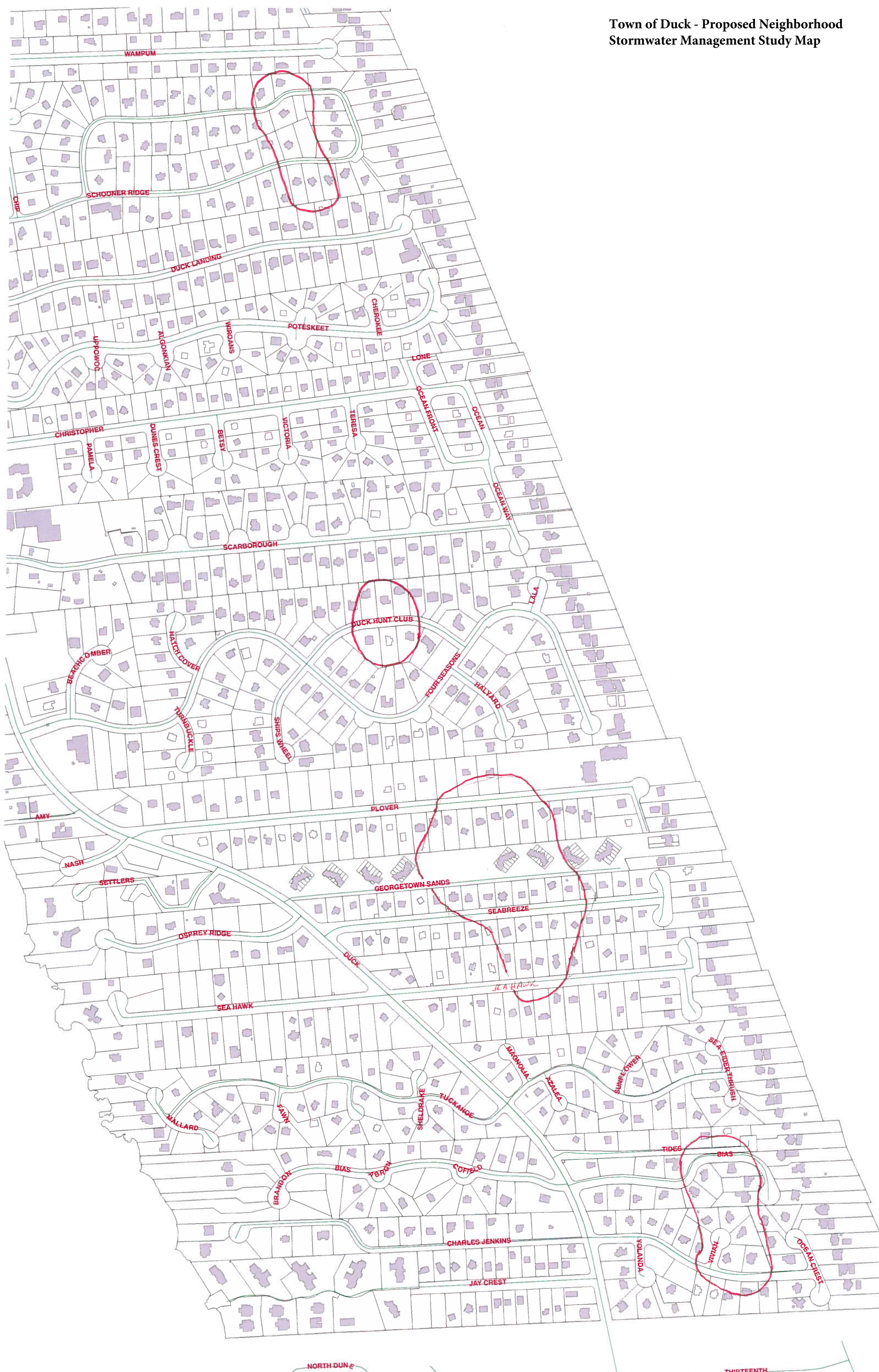
OVERALL PLAN VIEW

DRAWING NO.  
**OV**

SHEET 3 OF 9



Town of Duck - Proposed Neighborhood Stormwater Management Study Map





Town of Duck - Proposed Neighborhood Stormwater Management Study Map

