



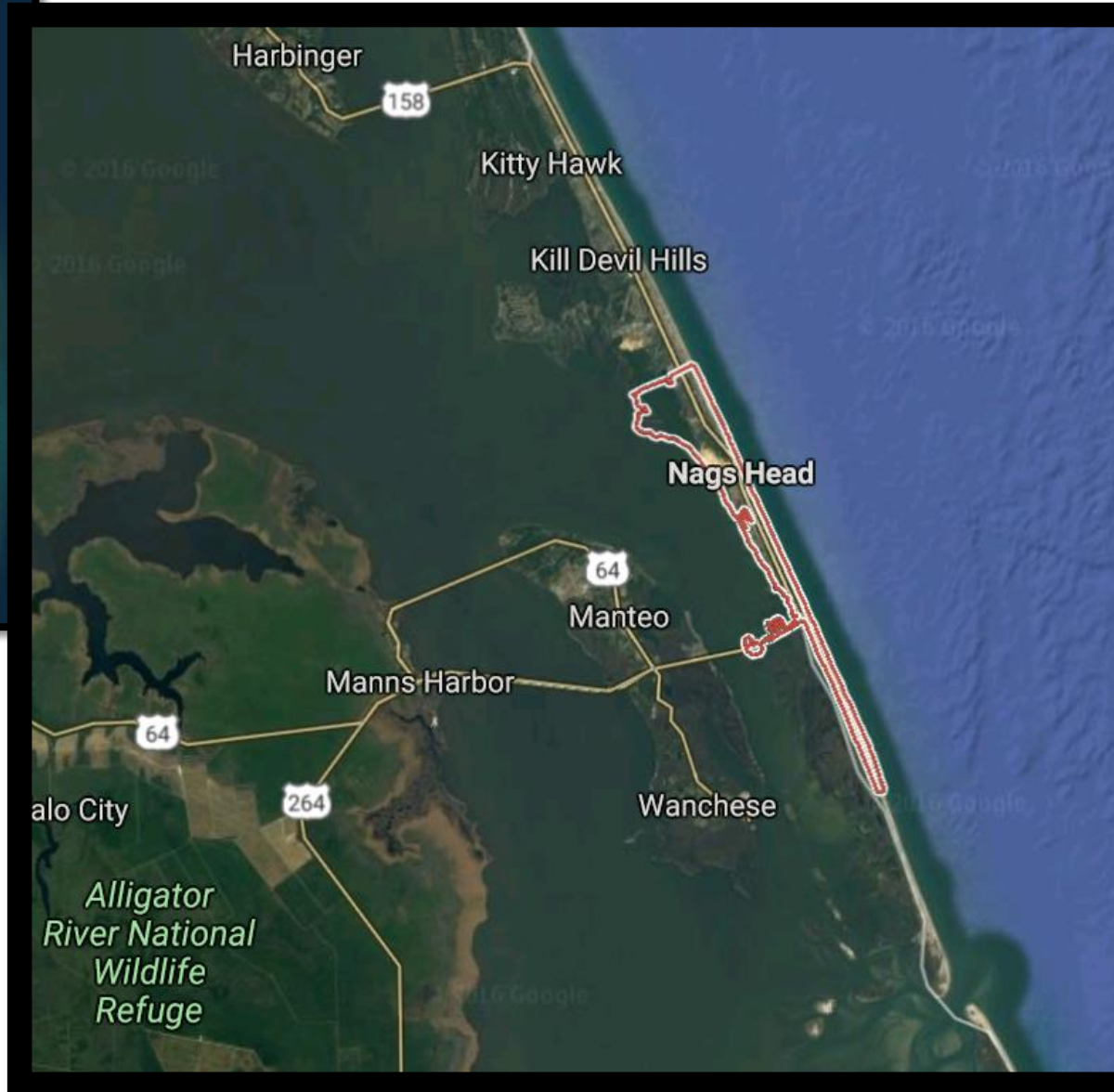
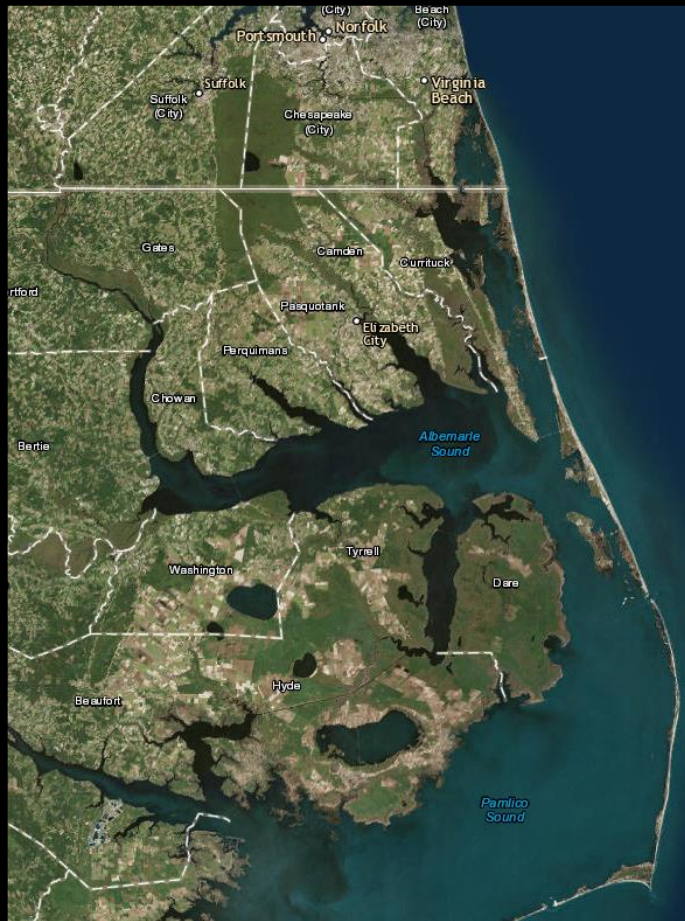
From Planning to Action: Mainstreaming Adaptation Strategies in Nags Head, NC

October 30, 2018

NC Sea Grant & Town of Nags Head



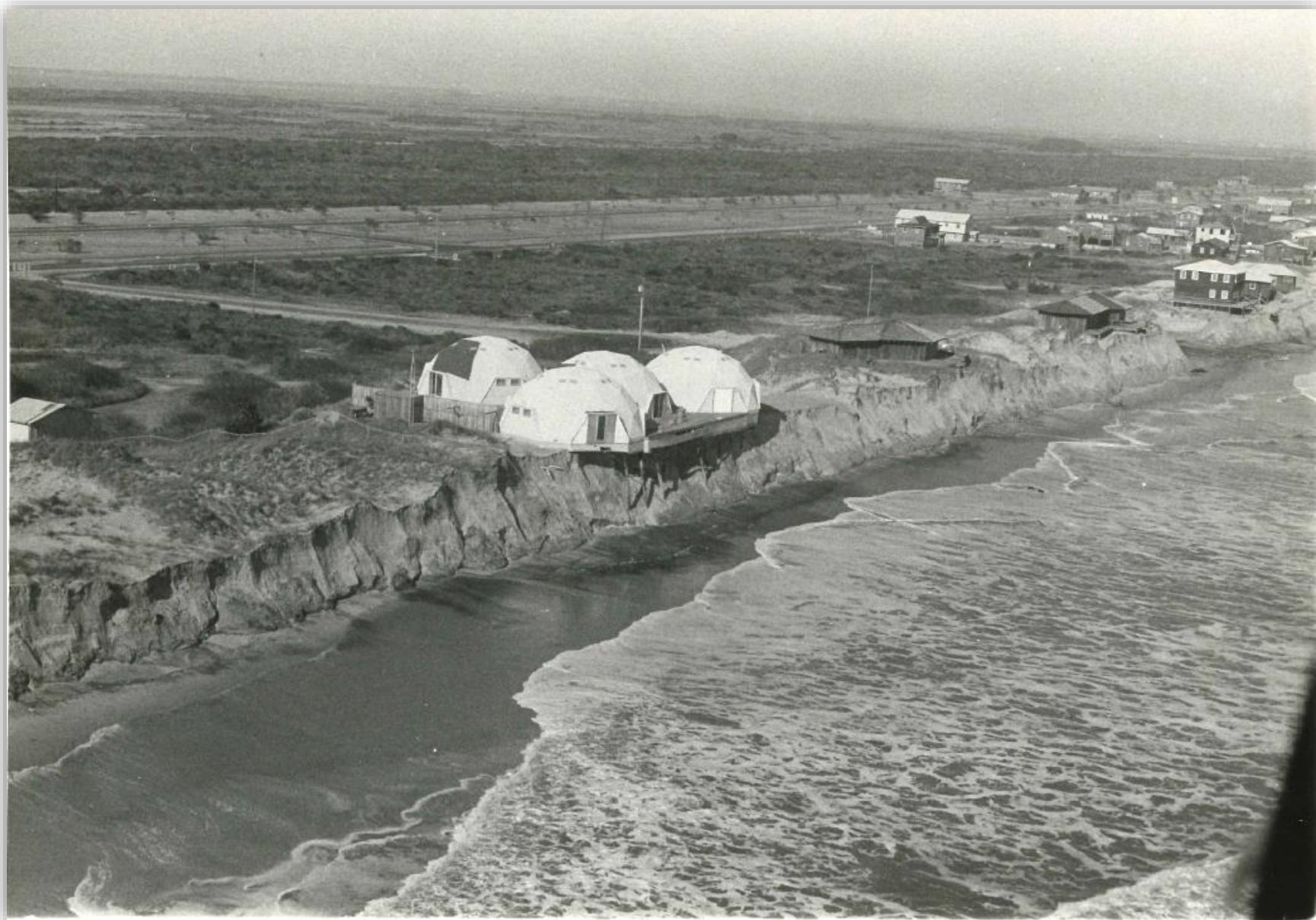
Nags Head



Setting

- Population
 - 2,954 (year round)
 - 40,000 (seasonal)
- 11 miles of shoreline
- 85% of Town on septic
- Key Dates-
 - Incorporated 1961
 - Land Development Plan 1964
 - Zoning, Subdivision, Flood Maps 1970's





S. Nags Head- 1980

2015



2018





Hurricane Matthew ~ 2016



Multiple Decision-Makers

- Dare County:
 - Drinking water
 - Environmental Health
 - Emergency management

- State of North Carolina:
 - Roads, drainage in South Nags Head, Hwy 64
 - Jockey's Ridge State Park
 - CAMA/Floodplain Management
 - Inlet management

- Federal Government:
 - Nat'l Park Service marshes in South Nags Head
 - Inlet management

- Other:
 - Nature Conservancy- Nags Head Woods

**Adaptation Planning in the
Town of Nags Head:
Vulnerability, Consequences, Adaptation, Planning
Scenarios (VCAPS) Report**



Photo by Matt Lusk

August 2017



**NC STATE
UNIVERSITY**



**BINGHAMTON
UNIVERSITY**
STATE UNIVERSITY OF NEW YORK



TOWN OF
Nags Head
NORTH CAROLINA



Comprehensive Plan
July 5, 2017



1. FOCUS Comprehensive Plan

→ All policy issues- land use, environmental, transportation, economic development, municipal services

Establishes vision, strategic, action oriented, policy document rooted in community & stakeholder input.

2. VCAPS Project (Vulnerability, Consequences, Adaptation, Planning, Scenarios)

→ Sea level rise, other coastal hazards, & adaptation strategies

Community & stakeholder driven process, identified vulnerabilities, explore adaptation options, & assess community knowledge

Key Community Members & Groups

- * *Local Business Committee*
- * *Planning Board*
- * *Dare County Representatives*
- * *Building Community*
- * *Oceanfront property owners*
- * *Recreation*
- * *Historic Nags Head*
- * *Accommodations*
- * *Town Staff*
- * *Board of Commissioners*
- * *Churches and Non-profits*
- * *Commercial Overlay District/Event Site Area*
- * *Individuals with Institutional Knowledge*
- * *Outer Banks Visitors Bureau*

FOCUS:
70+ individual
interviews

VCAPS:
19 individual
interviews



Committees

Represent a broad range of interests, backgrounds, and points of view

○ FOCUS Advisory Committee

Representation:

- * Board of Commissioners Member*
- * Planning Board Member*
- * Full Time residents with geographic representation*
- * Engineer/Architect*
- * Development/Building Community*
- * Business/Service Community*
- * Finance*
- * Real Estate/Insurance*
- * Retail*
- * Food Service*
- * Arts/Culture*
- * Environment*
- * Public Safety*
- * Recreation*
- * Tourism*
- * Non-Profit*

○ Sea Level Rise Committee

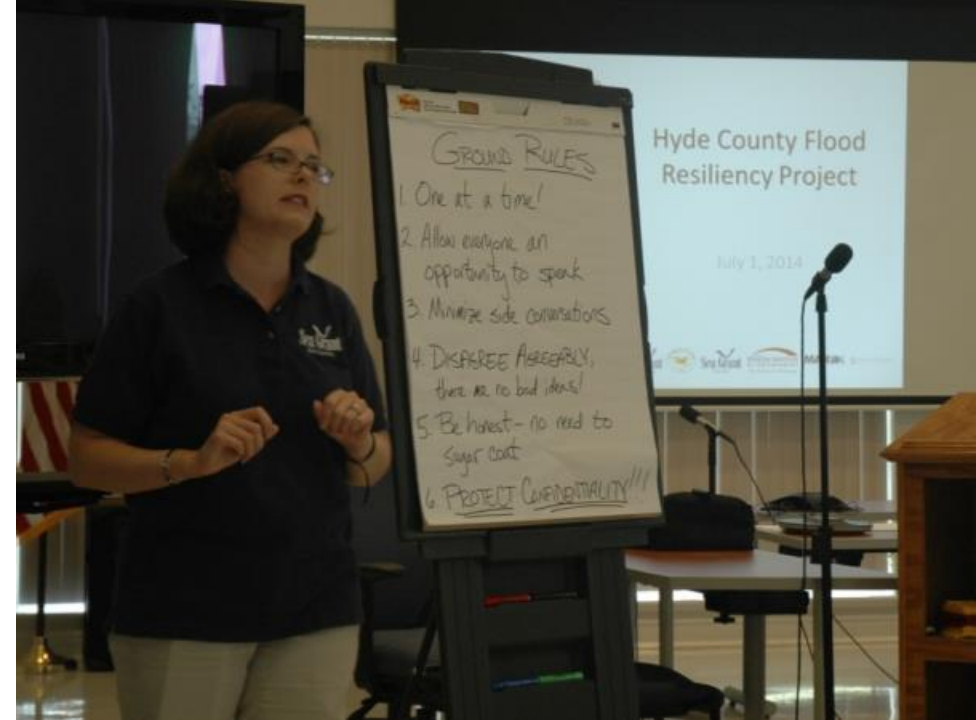


NC Sea Grant Partnership

- **Vulnerability, Consequences, and Adaptation Scenario Process (VCAPS)**
 - Dialogue about hazards, e.g., sea level rise, flooding, coastal storms.
 - How do these hazards impact Nags Head?
 - What factors that make consequences better or worse for the Town?
 - What actions (public & private) can be undertaken?
- VCAPS captures and documents current and potential actions~ *both desired and not desired.*

Probing questions, integrative discussion

- What impacts do floods have in your community?
- Why do you care about the impacts? What is the result?
- What makes these impacts better, worse, larger, smaller?
- What can you do to prevent or mitigate this?



VCAPS...

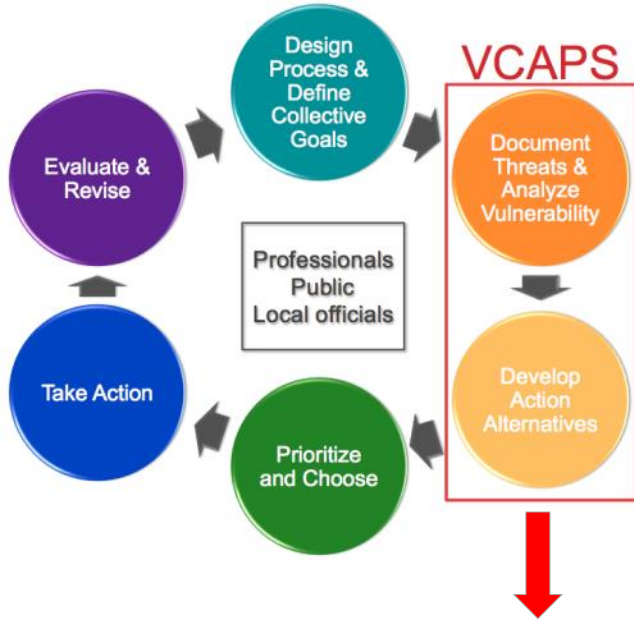
- Helps people think about flood hazards...
 - Structure discussions using conceptual frameworks
 - Analytic-deliberative process
 - Causal structure of hazards
 - Vulnerability (sensitivity, adaptive capacity, resilience)
 - Utilize visualization techniques
 - AKA “influence diagrams” or “causal pathway diagrams”



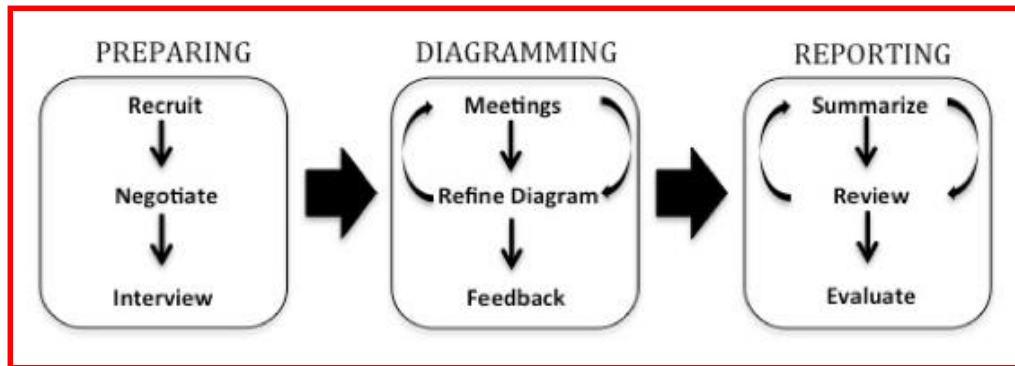
VCAPS...

- Efficiently...
 - Reasonable (and flexible) demands on time and resources
- Produces “useable knowledge.”
 - Focus on what is relevant to participants and decisions
 - Co-construction of scenarios
 - Allow exploration of (local) complexities and uncertainties



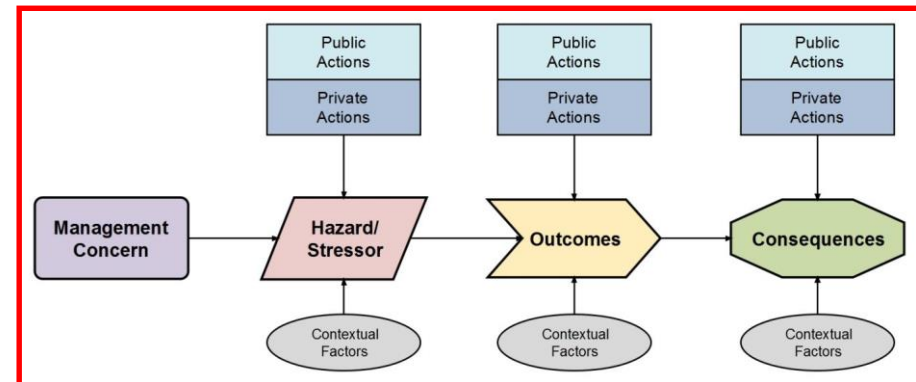


VCAPS supports initial phases of resilience planning and implementation...

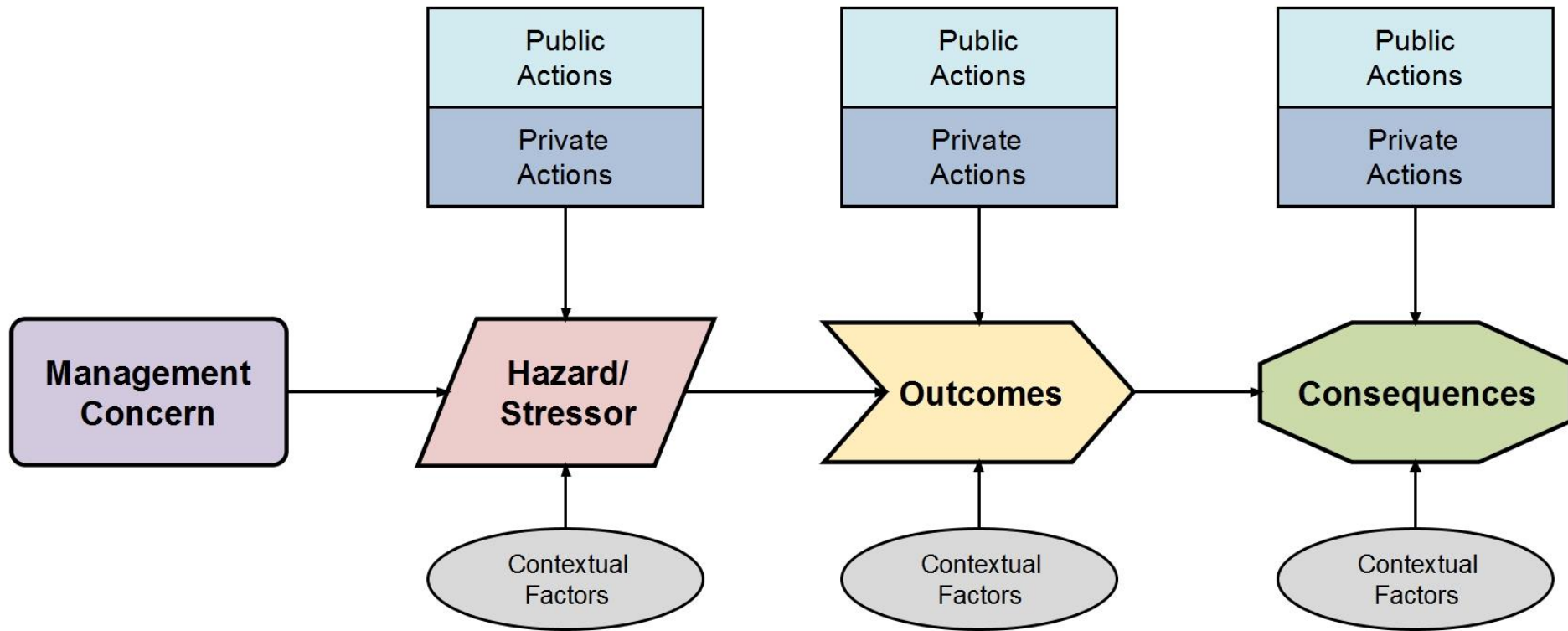


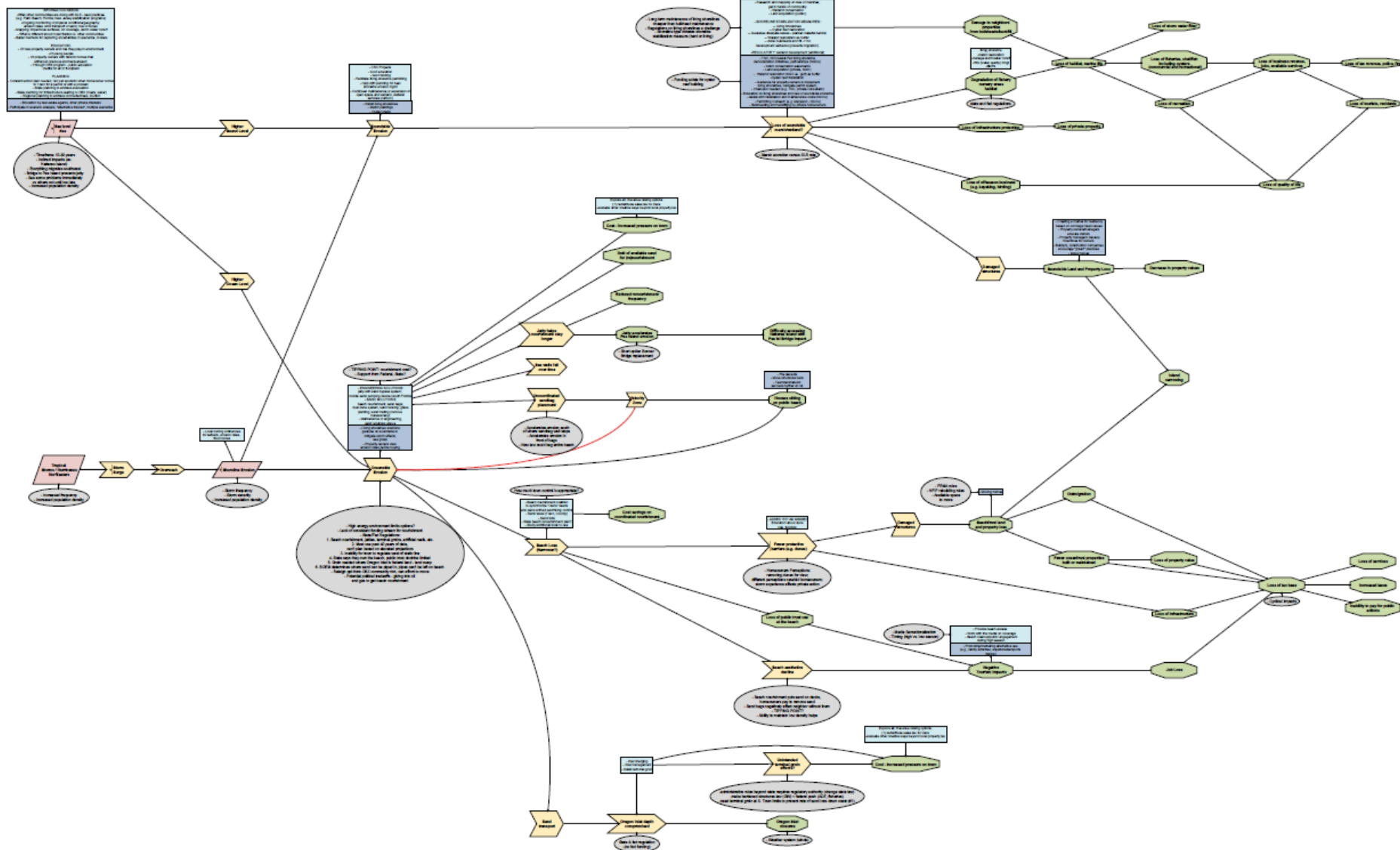
...through group discussion and learning...

...supported by real-time diagramming.



VCAPS Diagrams: Building Blocks





- Maintain/expand public Septic Health Program
- Gov't Standards
- Gov't Assistance to Retrofi
- Local Zoning Ordinances
- CAMA Setback Rules
- Plant vegetation
- Use fill on property

Decrease in unsaturated zone

- Distance to water table
- TIPPING POINT: when does Town intervene?

- Higher standard for separation of ground water, mean high water below a septic drain field

Less recovery time

- Distance between water table and lines
- Contractors observing need to set well points more often

Septic System Malfunctions

- Type #1: elevated groundwater/inundation
- Type #2: Lack of maintenance
- Type #3: Life exceeded or not designed to current code
- Type #4: Ocean or sound-side overwash (direct damage)

- SEPTIC MONITORING AND TREATMENT:**
- Septic maintenance
 - Determine sound-side strategy
 - marsh filtration
 - Offsite septic systems
 - cluster septic systems for small neighborhoods
 - increased set-back
 - central sewer systems
 - incentives for water efficiency (septic health incentives - pump, low int loan replacement)
 - transition to mandatory (currently voluntary) septic inspection program
 - onsite --> intermediate small --> community
 - Increase fill on property
 - Maintain septic system
 - Septic technologies (already in use at residential scale)
 - Advanced on-site WWT (\$\$)
 - Neighborhood (smaller) scale by design (inc. cost efficiency)
 - Water efficiency technologies

- Septic system location
- Determine timeline for threshold exceedence

- Low density via septic system regulation
- Low interest loans to owners to help with pumping
- Ensure rental houses not overoccupied
- Private entity takes septic water, cleans it, and sends it back to private property tank
- Realtors, prop managers educate on septic overoccupancy/use

Septic Systems Fail

- Overloading bedrooms; Too many people
- Can't regulate number of bedrooms - state law
- Contractors won't pump when systems keep refilling

- Building code or septic system or condemnation
- Town encourage moving homes before beach renourishment
- Town purchase beachfront properties
- all private
- apply for town permit
- private repairs

Houses condemned

- Cost of repairs
- Beach renourishment frequency

Fecal coliform contamination

- Animal vs. human waste
- TIPPING POINT: SLR threshold when human waste a problem?

- Biomats in drainfield?
- 50 ft between high water and drain to go back (high water mark)
- with SLR when will not be able to be repaired?
- how much mounding will Health Dept allow? (if interior, so far has always been able to be repaired, modify (mound) or replaced)
- Costs
- Land area - lot depth
- System age
- Code at time of construction
- Soil type, peat system presence
- > install GW pump system [COST]

Outcomes

Actions fit into major categories:

1. Ocean shoreline management
2. Estuarine shoreline management
3. Stormwater management
4. Water (ground/surface) management



Ocean Management

VOTE	NODE	TYPE	ACTION BIN	ACTION	
				Public	Private
5	Negative tourism impacts	Consequence	Education	Work with the media on coverage <i>- local partnerships</i>	
	Beach loss (Narrower?)	Outcome	Implementation	Sand taxes (Town, County)	
	Houses sitting on public trust beach	Consequence	Implementation		File lawsuits
10	Houses sitting on public trust beach	Consequence	Implementation	<i>Shut down - wait on courts</i> <i>- High Impact Bill - local red zones</i>	Teardown, and rebuild set further back on lot
7	Negative tourism impacts	Consequence	Implementation	Beach cleanup and public engagement during high season <i>Clean Beach</i>	
	Negative tourism impacts	Consequence	Implementation	Provide beach access	
12	Beach loss (Narrower?)	Outcome	Information needs	Study additional engineering, financial tools to use to mitigate against beach loss	
	Beach loss (Narrower?)	Outcome	Planning	State renourishment plan	
12	Beach loss (Narrower?)	Outcome	Policy	Establish beach nourishment coalition to synchronize Towns' needs and plans without sacrificing control <i>- just began to get</i> <i>- State Shoreline</i> <i>- just at the beginning of the study</i>	

Septic/Drinking Water

VOTE	NODE	TYPE	ACTION BIN	ACTION	
				Public	Private
3	Septic system failure	Outcome	Education	Incorporate education on SLR and water table on Septic Health Initiative	Healers, property owners educate on septic overcapacity/use
2	Changes in drinking water availability	Consequence	Implementation	Use Fresh Pond as a Source	
	Decrease in unsaturated zone	Outcome	Implementation	Government assistance for septic retrofits	
	Decrease in unsaturated zone	Outcome	Implementation		
	Houses condemned	Consequence	Implementation		Plant native vegetation
	Houses condemned	Consequence	Implementation	town purchase beachfront properties	
	Houses condemned	Consequence	Implementation		Apply for Town Permit
	Septic system failure	Outcome	Implementation		Private repairs
	Septic system malfunctions	Outcome	Implementation	Centralized sewer	Use private entity to take septic water, clean it, and send it back to private tank
	Septic system malfunctions	Outcome	Implementation	Offsite cluster <i>cluster</i> and cluster septic systems for small neighborhoods	Use neighborhood scale by design to increase cost efficiency
	Septic system malfunctions	Outcome	Implementation	Septic maintenance	Maintain septic systems
	Septic system malfunctions	Outcome	Implementation		Advanced onsite wastewater treatment systems
	Water quality decline	Outcome	Implementation		Septic technologies (already in use at residential scale)
	Water table rises	Outcome	Implementation	Groundwater lowering system	
	Water table rises	Outcome	Implementation		Innovative new construction
	Recreational water access advisory or closure	Consequence	Information needs	Water Quality Monitoring Program (Beachside AND Soundside)	Raise infrastructure elevation
	Septic system malfunctions	Outcome	Information needs	<i>Water Quality Monitoring Program</i> <i>Water Quality Monitoring Program</i> <i>Water Quality Monitoring Program</i>	
	Water table rises	Outcome	Information needs	Determine sound side strategy	
2	Water table rises	Outcome	Information needs	Erosion rate maps	
	Water table rises	Outcome	Information needs	First floor elevation database	
	Water table rises	Outcome	Information needs	GIS "hotspot" analysis	
	Water table rises	Outcome	Information needs	Monitor septic use - <i>your don't put the manual</i>	
	Water table rises	Outcome	Information needs	NC building codes	
	Water table rises	Outcome	Information needs	NC Floodplain Mapping efforts	
	Decrease in unsaturated zone	Outcome	Policy	CAMA setback rules	
	Decrease in unsaturated zone	Outcome	Policy	Government standards	
	Decrease in unsaturated zone	Outcome	Policy	Local zoning ordinances	
5	Decrease in unsaturated zone	Outcome	Policy	Maintain and expand Septic Health Initiative	
	Houses condemned	Consequence	Policy	Building code or septic system for condemnation	
	Houses condemned	Consequence	Policy	Town encourage moving homes before beach renourishment	
	Less recovery time	Outcome	Policy	Higher standard for separation of groundwater and mean high water before a septic drainfield	
	Septic system failure	Outcome	Policy	Ensure rental houses not overoccupied	
	Septic system failure	Outcome	Policy	Low density development via septic system regulation	
	Septic system malfunctions	Outcome	Policy	Low interest loan for pumping septic systems	
	Septic system malfunctions	Outcome	Policy	Incentives for water efficiency septic health initiatives - pump	implement water efficiency technologies
3	Septic system malfunctions	Outcome	Policy	Low interest loan for replacement increased setback	
	Septic system malfunctions	Outcome	Policy	Transition to mandatory septic inspection program	
	Water quality decline	Outcome	Policy	Alternative systems allowed - peat media, low pressure pipe, advance	
	Water quality decline	Outcome	Policy	Public health department needs to maintain, enforce rigorous standards	
2	Water table rises	Outcome	Policy	Enforce septic regulations	
	Water table rises	Outcome	Policy	Zoning restrictions for buildings that need repairs	



Actions

1. Maintain and expand the Septic Health Initiative.
2. Develop a comprehensive education and outreach plan on sea level rise and other hazards.
3. Develop an estuarine shoreline management plan
4. Develop a plan for sea level rise that includes a suite of sea level rise scenarios/probability distributions.
5. Develop a long term shoreline management plan.
6. Develop a long range plan for stormwater.
7. Promote and install living shorelines.

Policy

NR-15 Foster partnerships with universities and non-profits to assist the town in identifying risks and making sound scientific based decisions that increase the town's resiliency.

NR-15a: Continue to partner with NC Sea Grant to finalize the VCAPS process and study on Sea Level Rise and Climate Adaptation.

NR-15b: Seek additional partners to assist the town in carrying out the actions of the VCAPS study including the scenario based vulnerability analysis.

Policy

NR-16 Minimize impacts of future sea level rise.

NR-16a: Conduct a vulnerability analysis to determine the town's risk to hazards including sea level rise. This analysis should include future sea level rise scenarios.

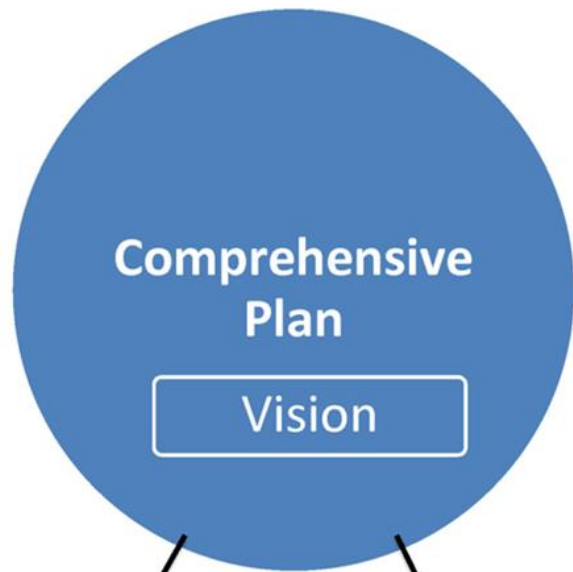
NR-16b: Research and map estuarine marsh migration along Roanoke Sound.

NR-16c: Develop a plan for adaptation that includes a suite of SLR scenario/probability distributions (more up-to-date than CRC).

NR-16d: Develop a comprehensive education and outreach program for K-12 and residents/property owners that includes the follow topics: SLR, storms, sound side & oceanfront erosion, beach nourishment, and CRS.

NR-16e: Maintain and expand the Septic Health Initiative by providing government assistance for septic retrofits, assisting homeowners in maintaining their septic systems, conducting more groundwater sampling, securing additional wells for sampling, developing partnerships to assist with the peer review of existing data, transitioning to a mandatory septic inspection program with incentives, and mapping of groundwater.

NR-16f: Develop an estuarine shoreline management plan that establishes policies, procedures, and an overall management strategy for the town's estuarine shoreline. This plan will work to develop projects and strategies to prevent estuarine flooding in the future. The plan should research, identify and map marsh loss, "soft" stabilization methods that are appropriate for Nags Head's estuarine shoreline, potential opportunities for land acquisition, and potentially restorable wetlands. Additionally, it should develop incentives that can be utilized for the protection of natural shorelines.



Built Environment

Policies

Actions

Additional
Study or
Research

Changes to
Regulations

Capital
Improvements

Staff Level
Projects

Education



Challenges

- Many county, state, federal regulations
- Maintaining water quality
- Maintaining community character and quality of life
- Identifying tipping points
 - Septic system function vs water quality
 - Erosion and real estate market



Challenges

- Range of scenarios and downscaled data: how to make decisions based on what's available?
- How will the Town fund adaptation?
 - Maintenance
 - Cross-scale collaboration to apply for funding
- What about issues not within the Town's jurisdiction?



Keys to Success

1. Community engagement and support of elected officials is paramount.
2. Build on existing processes & plans.
3. Add the extra layer/lens of sea level rise.
4. Identify actions not only for the community for but individual citizens.
5. Network, let others know what you are doing, and how your community needs assistance.
6. Increase focus on estuarine shorelines and relationship between groundwater, stormwater, septic health (water quality), and flooding.



A resilient Nags Head means

- Withstand, respond to, and recover rapidly from disruptions without long-term damage to the economy or environment;
- Requires less government funding to recover, rebuild and redevelop its communities; and
- Sustains the way that natural systems provide *ecosystem services* that directly or indirectly support human survival and quality of life.



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