Stantec

Maryland Defense Forum
Association of Defense Communities

Installation Resilience Planning Community Partnerships in Action

Military Installation Resiliency Review

City of Annapolis | Anne Arundel County | NSA Annapolis

June 6, 2023

Moderator

Cyrena Chiles Eitler, AICP
Senior Principal | Strategic Planning Advisor
Stantec Consulting Services Inc.
Fairfax, VA

Panelists

Zoë P. Johnson
Community Planning Liaison Officer
NSA Annapolis, MD

Jacqueline Guild, Esq.
Deputy City Manager
Resilience & Sustainability
City of Annapolis, MD

Dan Nees, Director
Policy and Finance
Throwe Environmental, LLC
Fulton, MD

Military Installation Resilience

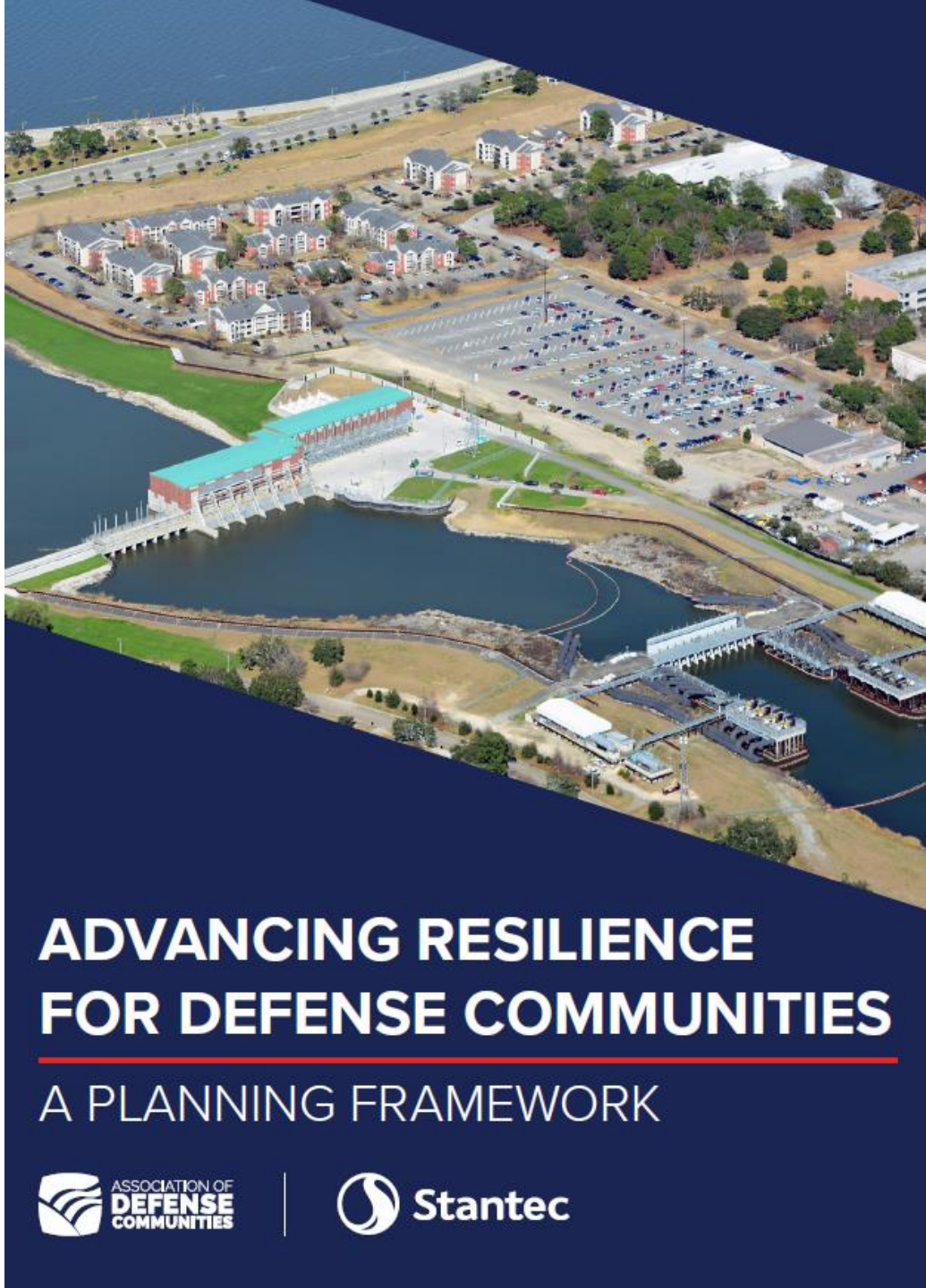
"The capability of a military installation to avoid, prepare for, minimize the effect of, adapt to, and recover from extreme weather events, or from anticipated or unanticipated changes in environmental conditions that do, or have the potential to, adversely affect the military installation or essential transportation, logistical, or other necessary resources outside of the military installation that are necessary in order to maintain, improve, or rapidly reestablish installation mission assurance and mission-essential functions."

Source: FY 2019 National Defense Authorization Act

Project Approach

- Resilience is about making our communities and installations stronger, now and in the future, for everyone

- Resilience planning framework will enable the region, together with NSA Annapolis, to assess shared vulnerabilities and risks with special attention given to unique resilience requirements for NSA Annapolis



NSA Annapolis/U.S. Naval Academy Military Installation Resilience Plan

Maryland ADC Defense Forum

06 June 2023

United States Naval Academy

INSTALLATION RESILIENCE PLAN

February 2022

Purpose

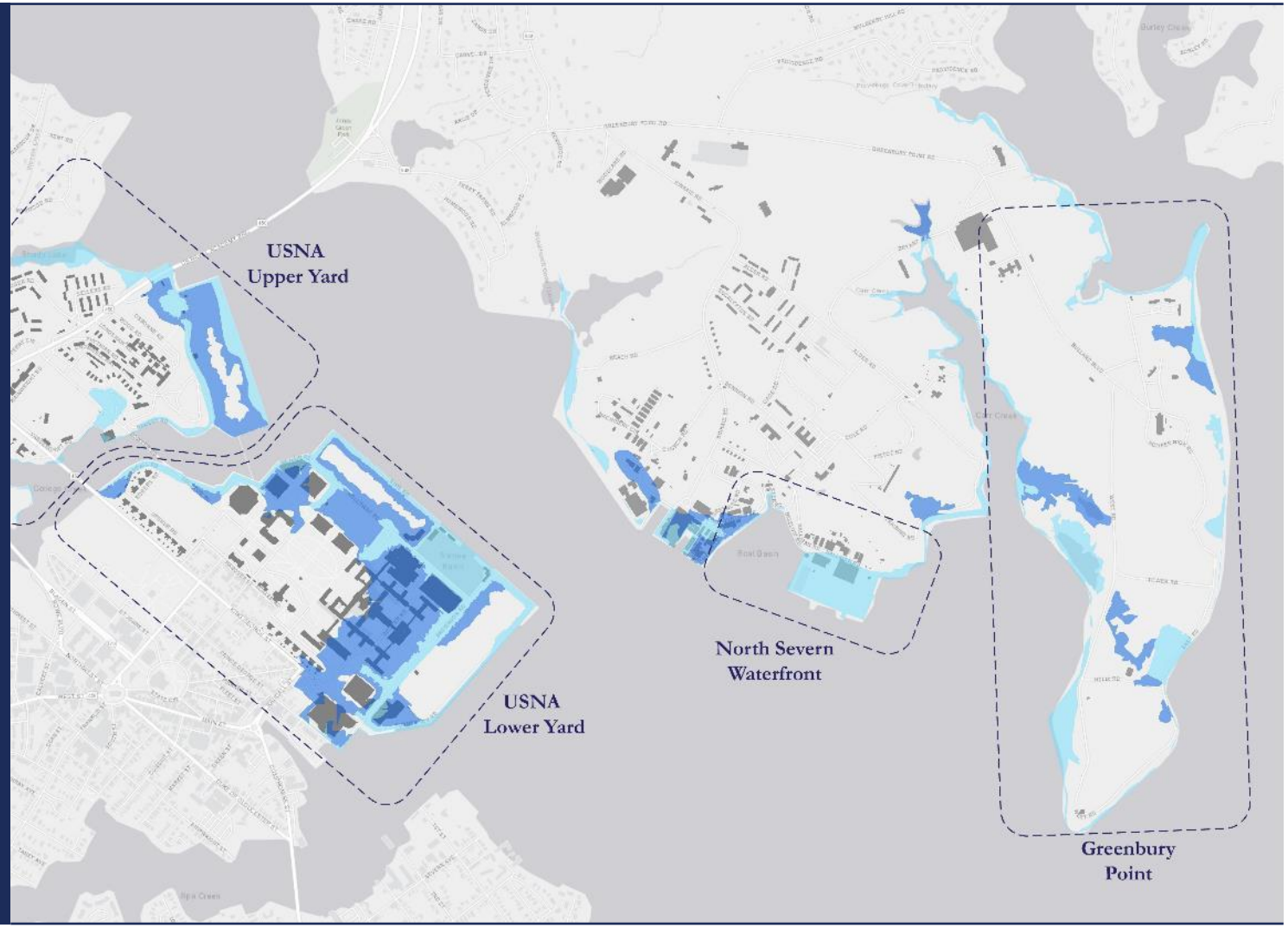
Develop a comprehensive plan, project portfolio, and year-to-year execution strategy to cohesively address and mitigate the combined effects of flooding caused by land subsidence, sea level rise, storm surge, and changes in groundwater elevations.

Installation Resilience

The capability of a military installation to avoid, prepare for, minimize the effect of, adapt to, and recover from extreme weather events, or from anticipated or unanticipated changes in environmental conditions, that do, or have the potential to, adversely affect the military installation or essential transportation, logistical, or other necessary resources outside of the military installation that are necessary in order to maintain, improve, or rapidly reestablish installation mission assurance and mission-essential functions (10 U.S. Code §101).

Problem Statement

What adaptation and resilience measures can be taken to address present-day and likely 2035, 2065 and 2100 impacts in order to protect Mission-Essential infrastructure and facilities.



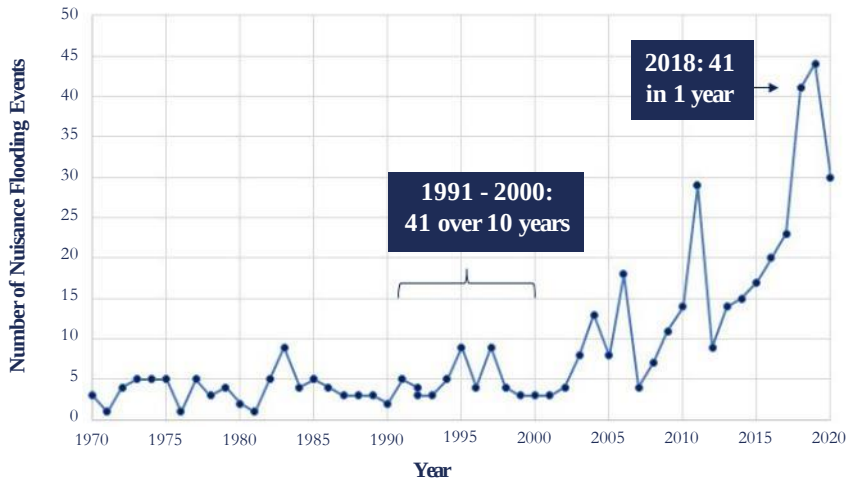
NAVFAC
Climate Change Planning Handbook

- The intent of this Handbook is to provide the analytical framework and methodology to help Navy Master Development Planners understand how to consider climate change in their plans and projects.
- A series of Stages are provided to help planners identify and assess adaptation action alternatives to manage potential impacts to current and planned infrastructure.

- Includes a detailed methodology for evaluating various scenarios, assessing potential impacts and developing adaptation action alternatives.

Sea Level Rise Trends and Projections

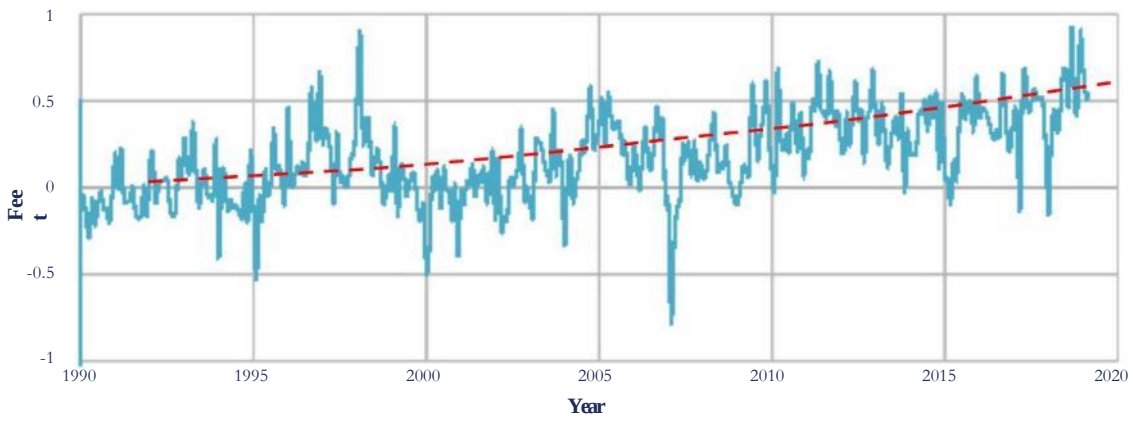
Annual Nuisance/High-Tide Flood Events at USNA



Nuisance or high tide flooding is defined as "flooding that leads to public inconveniences such as road closures (NOAA)." Nuisance flooding is often unrelated to a specific storm but is commonly influenced by sustained wind events, storm systems or astrological phases. Future sea level rise may increase these flood events at USNA: a 6-inch rise will likely result in approximately 90 events/year; and with a 12-inch increase, that number increases to about 340 events/year.

Source: USNA Sea Level Rise Advisory Council

Relative Sea Level Trends (Annapolis, MD)



Monthly mean sea level in Annapolis has risen approximately 0.5 feet in the past 25 years (faster than the long-term linear trend of 1.2 feet per century). This acceleration is consistent with observations of sea level rise at other locations on Chesapeake Bay.

Source: USNA Sea Level Rise Advisory Council

Future Sea Level Rise Induced Flood Levels
(feet above NAVD88)

YEAR	MHHW	5-YR	20-YR	50-YR	100-YR
*ARP	N/A	20%	5%	2%	1%
2022	0.7	3.7	4.6	5.6	6.3
2035	2.0	5.0	5.9	6.9	7.6
2050	2.7	5.6	6.6	7.6	8.3
2065	3.3	6.3	7.2	8.2	8.9
2100	5.1	8.1	9.0	10.0	10.7

MHHW =Mean Higher High Water
NAVD88 =North America Vertical Datum of 1988

*Annual Recurrence Probability
Source: DoD Regional Sea Level (DRSL) Database

Projected Inundation

Sea-Level Rise Modeling Results

Current MHHW: 0.66 feet above NAVD88

Projected MHHW: 2.5 feet above NAVD88

Projected MHHW: 3.3 feet above NAVD88

Projected MHHW: 5 feet above NAVD88

MHHW =Mean Higher High Water
NAVD88 =North America Vertical Datum of 1988

Projected Inundation

Sea-Level Rise + 5-Year Storm Event

Current 5-Year Storm Water Level: 3.66 feet above NAVD88

Projected 5-Year Storm Water Level: 5.5 feet above NAVD88

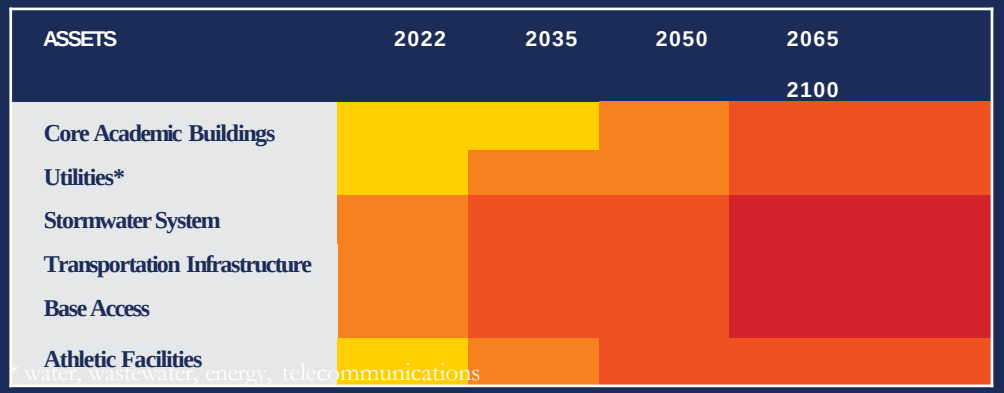
Projected 5-Year Storm Water Level: 6.3 feet above NAVD88

Projected 5-Year Storm Water Level: 8.0 feet above NAVD88

NAVD88 =North America Vertical Datum of 1988

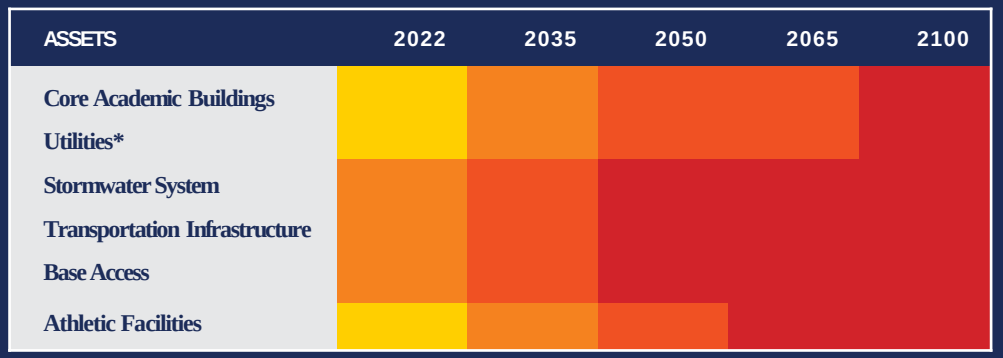
Mission Vulnerability

NUISANCE FLOODING



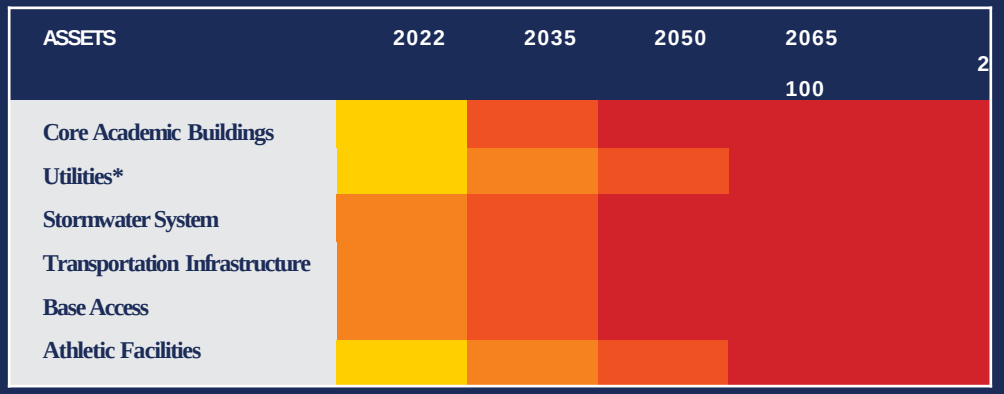
* water, wastewater, energy, telecommunications

5-YEAR STORM

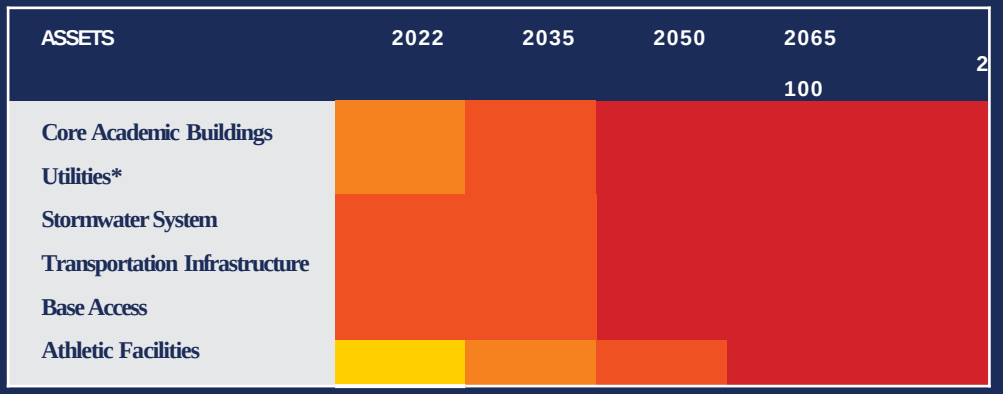


* water, wastewater, energy, telecommunications

50-YEAR STORM



100-YEAR STORM



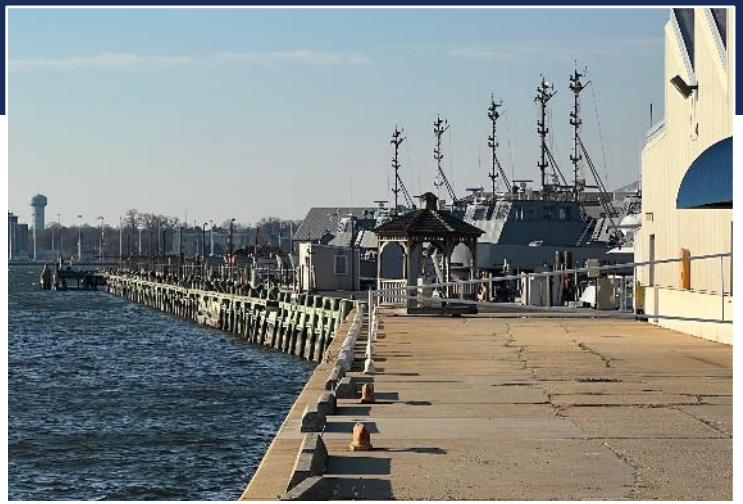
- Low Vulnerability: Localized infrastructure service disruption; no permanent damage
- Medium Vulnerability: Widespread infrastructure damage and loss of service; damage recoverable by minor repair
- High Vulnerability: Extensive infrastructure damage and loss of service; significant repairs required
- Extreme Vulnerability: Permanent damage and/or loss of infrastructure service

United States Naval Academy

INSTALLATION RESILIENCE PLAN

Integrated Adaptation Framework

Revetment



Waterfront Infrastructure

Engineered Defenses

These permanent or deployable engineered flood risk reduction infrastructure can be designed to block specific flood pathways, preventing coastal or riverine floodwaters from passing into inland areas.

Wet and Dry Flood Proofing

Deployable Flood Barrier across Roadway

Adapted Structures

Buildings and infrastructure systems can be sited, built, and retrofitted to withstand a flood event, helping to manage the residual risk that exists even behind protective infrastructure.

Living Shoreline

Stormwater Retention

Green Infrastructure

Natural features both in the water and on land can directly reduce the magnitude of flooding across the installation by reducing wave action, stabilizing landscapes, and absorbing excess surface floodwater.

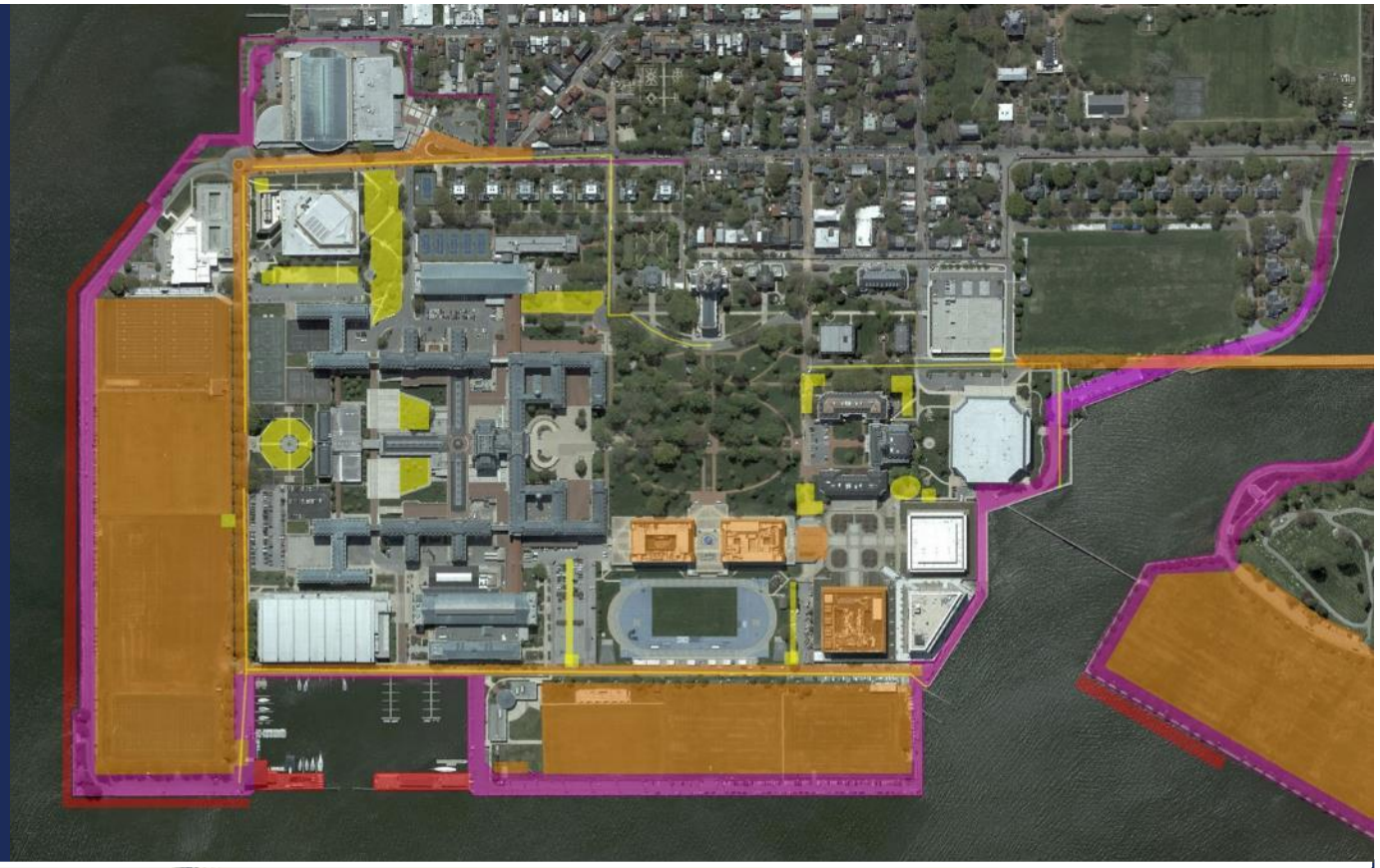
Integrated Adaptation Framework

Exterior Defense
- Wave Attenuation
- Pier Replacement

Perimeter Protection
- Raised Bulkheads
- Flood Walls
- Earthen Berms

Interior Adaptations
- Elevated Roadways
- Athletic Field Drainage Improvements
- Building Retrofits

Sub-Surface Improvements
- Stormwater Upgrades



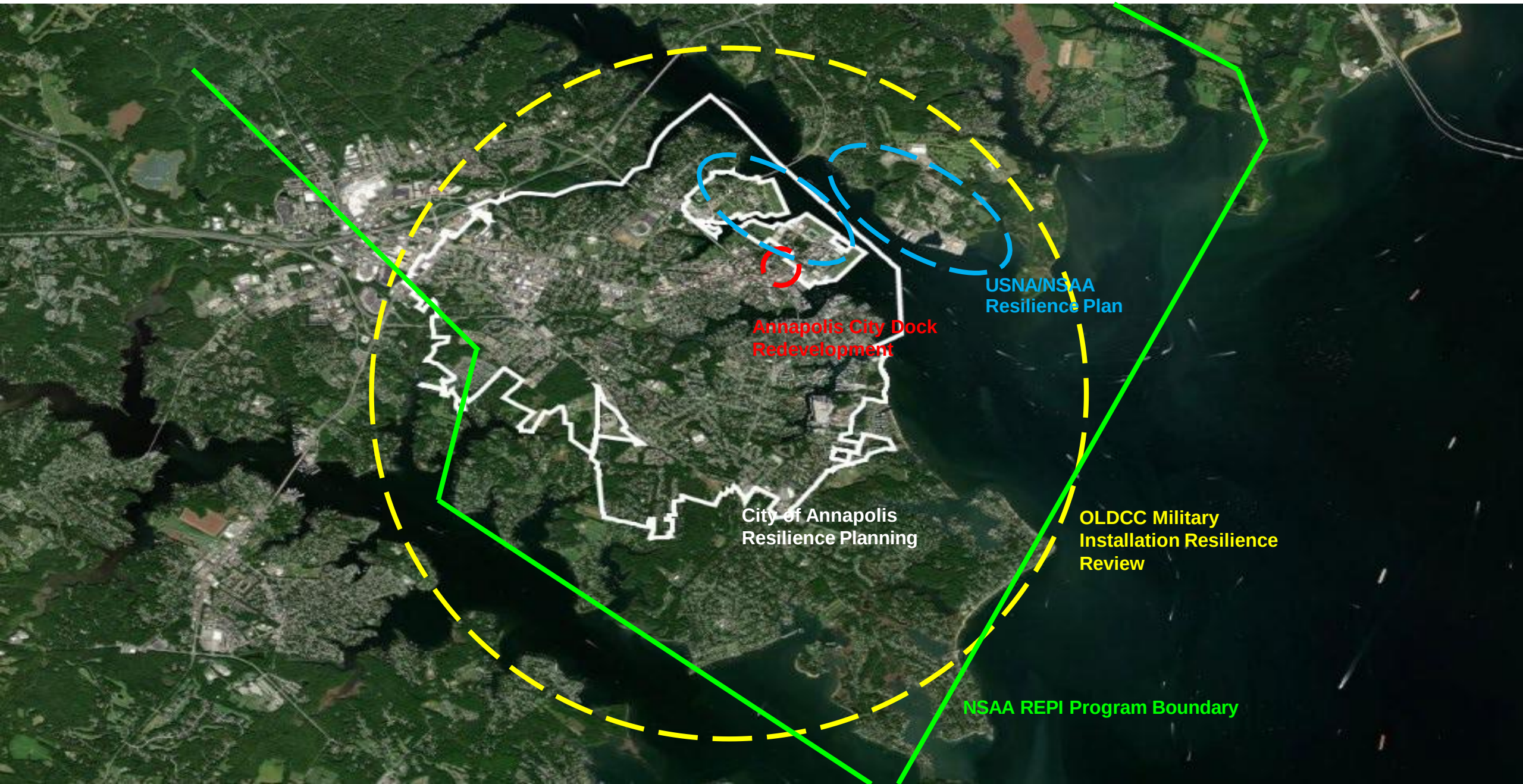
Land Conservation

Community Engagement

Community Preparedness

Open communication with community, city, county and state leaders will enable coordination of resiliency efforts on all levels of local and regional government.

Community Resilience and Preparedness Planning



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Military Installation Resiliency Review

City of Annapolis | Anne Arundel County | NSA Annapolis

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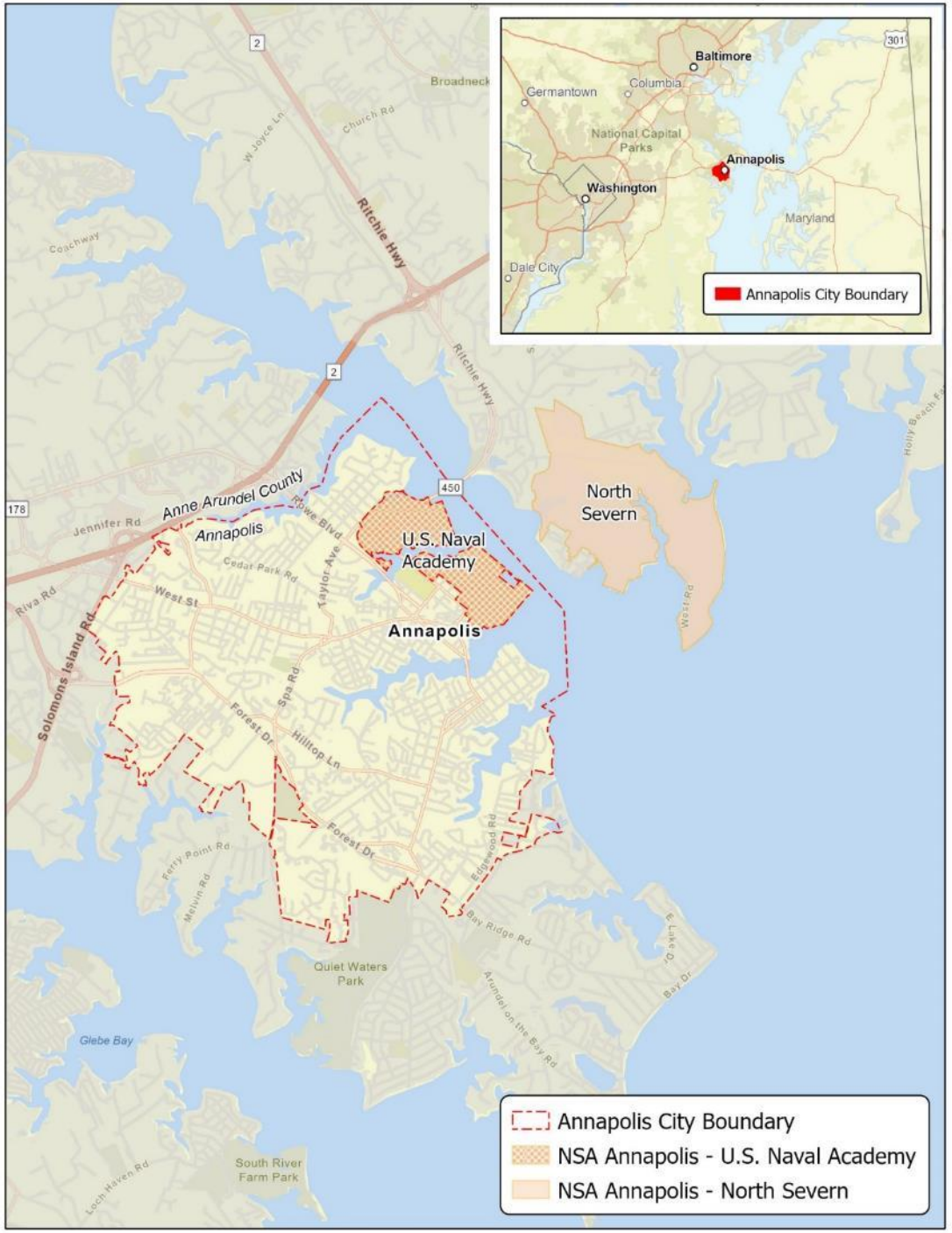
Project Goal

- Identify critical assets that are at risk.
- Recommend actions that will increase resilience for NSA Annapolis, City of Annapolis and Anne Arundel County.

View of City Dock Flooding, Photo Provided by Susan Walsh



Team Overview

Resilience Consultant – Stantec
- Risk/resilience professionals
- Advance project along the resilience planning framework

Project Sponsor – City of Annapolis
- Partners - Anne Arundel County and Naval Support Activity Annapolis
- Convene the right people to identify and address risks
- Serves as DoD Grantee

Policy Committee – Municipal, County, Regional and Military Leaders
- Guide planning process, accept final project deliverables
- Define network of systems, infrastructure, services and people needed to maintain resilience

Technical Committee – Community / Installation Experts
- Represent technical and subject matter experts
- Develop and recommend adaptation strategies and actions

Working Groups
- Transportation Working Group
- Environmental Working Group

Stantec Subject Matter Expert Team

Resilience Assessment
- Rebecca Leitschuh, Resilience Technical Lead
- Paul Carrol, Senior Coastal Engineer
- Christina Hurley, Senior Hazard Mitigation Planner
- Norman Shippee, Senior Climate Scientist
- Matthew Moy, GIS Specialist

Coastal Shoreline Boundaries | City Dock
- John Malueg, Vice President, Resilience Planning and Design
- Aaron Chen, Associate Senior Coastal Engineer
- John Menninger, Senior Principal, Sub-Sector Leader Urban Waterways

NSA Annapolis Access Roads | Traffic Signal Upgrade
- Al Arnold, Senior Principal, Community Development
- Robert Milstead, Senior Traffic Engineer, Associate

County/City Water Treatment Facilities
- Matthew Lieuallen, Principal, Planner
- Nicholas Anderson, Vice President, Wet Weather Flow
- Alexander Cropp, Urban Water Resources Engineer

Anne Arundel County Department of Health and Luminis Health Anne Arundel Medical Center
- Matthew Lieuallen, Principal, Planner

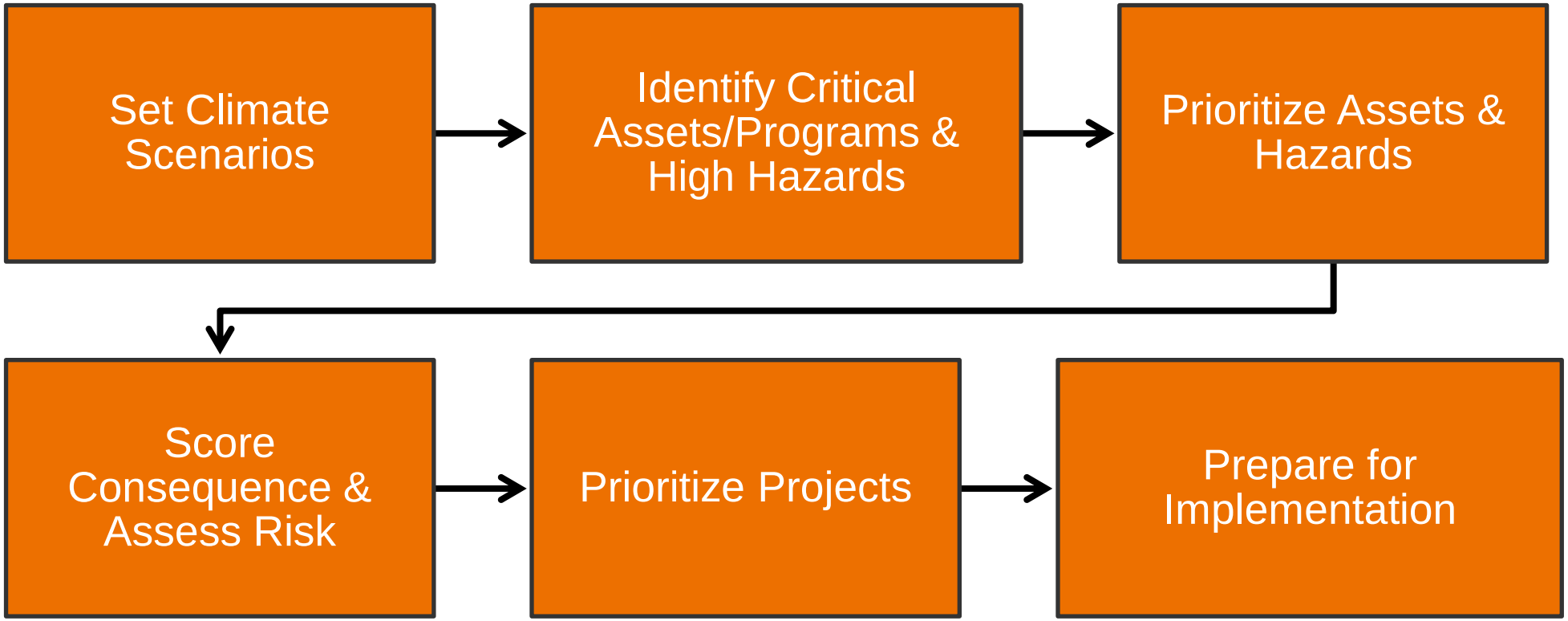
Cybersecurity
- Daniel Tannous, Senior Associate, Information and Communications Technology

Energy
- Tennile Rubin, Senior Principal, Environmental Services
- Doug Sharpe, Regional Sector Lead, Power Delivery US-E
- Mohsen Shojaeion, Distribution and Grid Modernization Team Lead

Annapolis Wastewater Conveyance and Reclamation Facility
- Pat Coleman, Wastewater Practice Leader

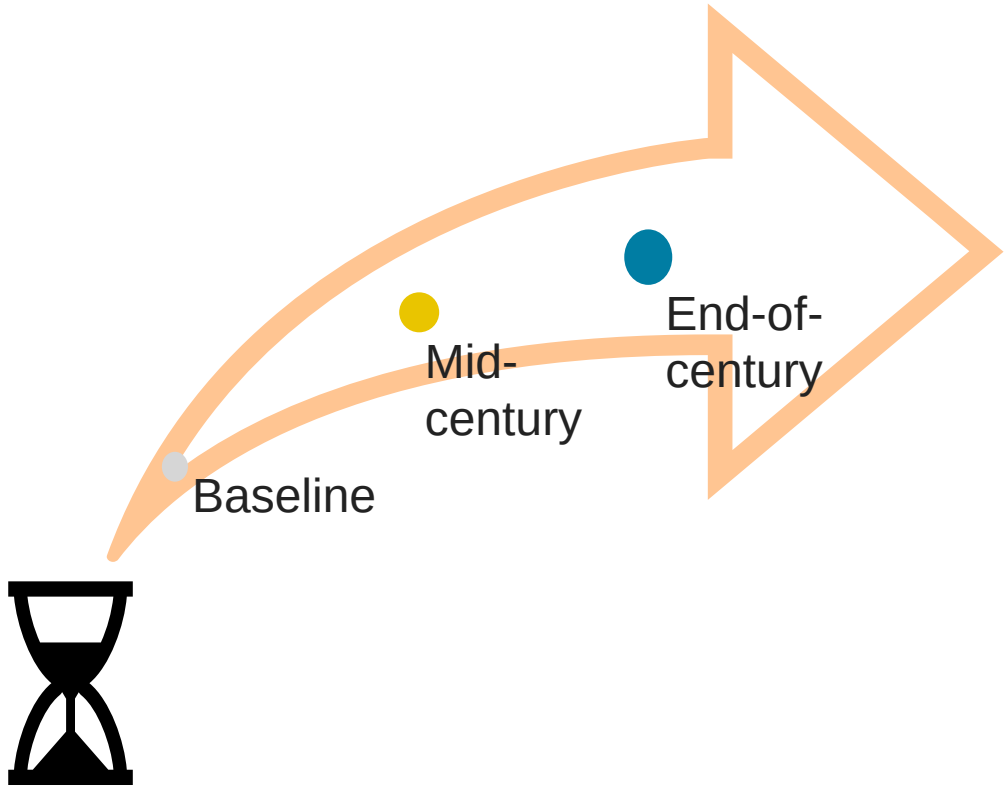
North America Funding Team
- Heidi Peper, Senior Funding Leader
- Kim Pugel, Ph.D., Associate, Policy & Funding Specialist
- Emily Snyder, Senior Manager

Process for Military Installation Resilience Assessment



Time Horizons

- **Climate**: ~30-year average
  - Current climate baseline
  - Mid-century
  - End of century



Hazard Profiles

Focusing on the hazards ranked highest in the hazard survey.

Hazards were verified by the Staff Working Group and Stantec team.

Four hazards used in risk assessment process:

- Coastal Flooding (Includes SLR)
- Hurricanes and Tropical Storms
- Cybersecurity
- Infectious Disease

Hurricane Isabel, NASA/GSFC

Sea Level Rise

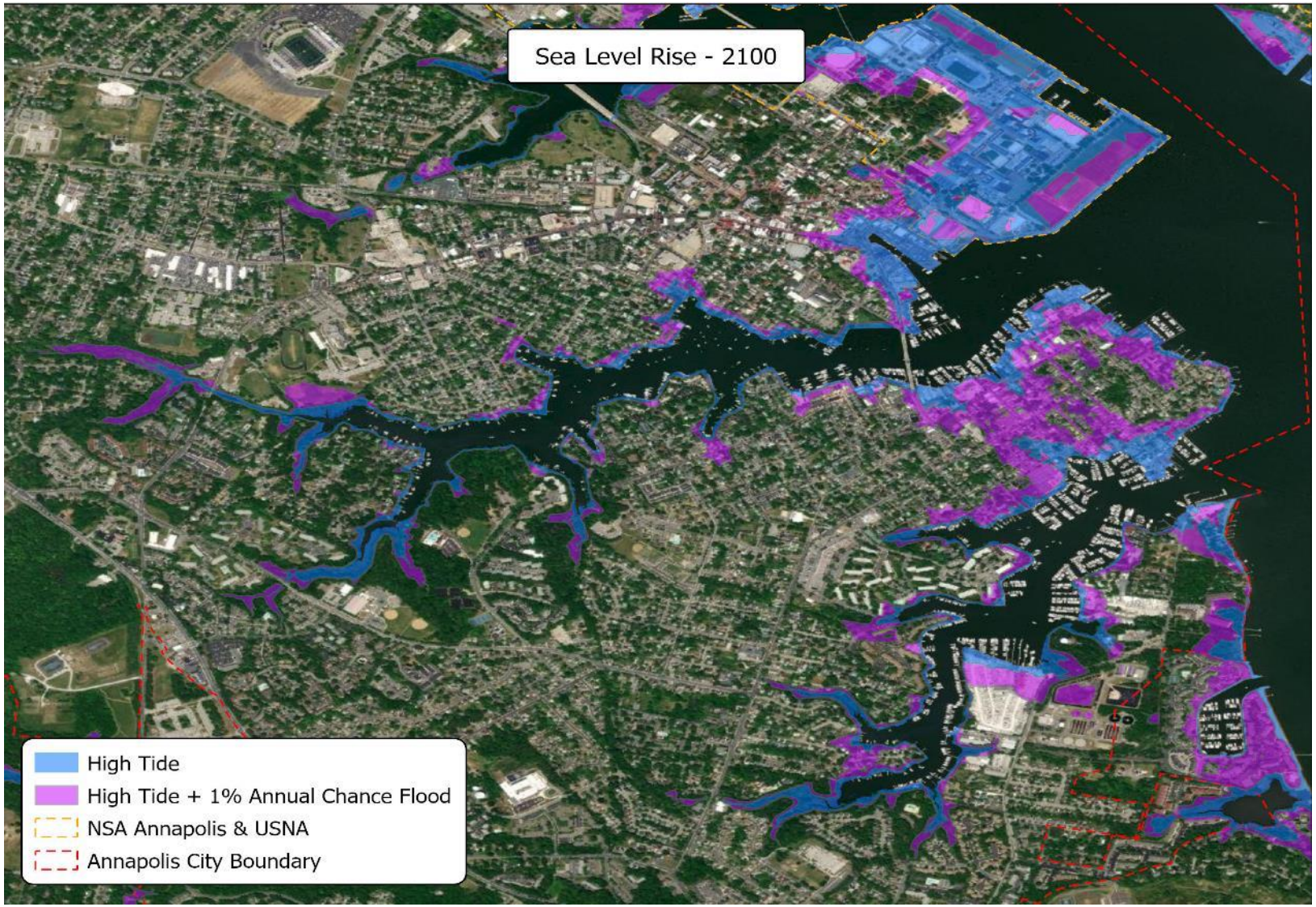
Sea level rise (SLR) was included as a component to the coastal flooding hazard.

Our SLR projections are based on the NOAA 2022 Sea Level Rise Technical Report.

- Most recent and advanced SLR modeling
- Utilized the Intermediate High scenario projections.
- Uses 1992 Mean Sea Level (MSL) as the base level.

Annapolis SLR Projections		
Timeframe	Sea Level Height Change (SLR in FT)	Hightide Height Change (MHHW in FT relative to MSL)
2050	1.64	2.36
2065	2.54	3.26
2100	5.35	6.07

Sea Level Rise Projections
Spa Creek



Sea Level Rise Projections
US Naval Academy

Community Lifelines

Water:
Groundwater, Water/Wastewater Treatment Plants, Distribution

Safety and Security:
Public Safety Building

Health and Medical:
Hospital, Stormwater Park, Nature-Based Solution, Health System

Education:
Schools, Colleges, Universities

Energy:
Power Grid, Microgrids, Renewables

Communications:
Communication Updates

Transportation:
Road Elevation, Evacuation

Food, Shelter:
Community Housing

What makes an asset critical?

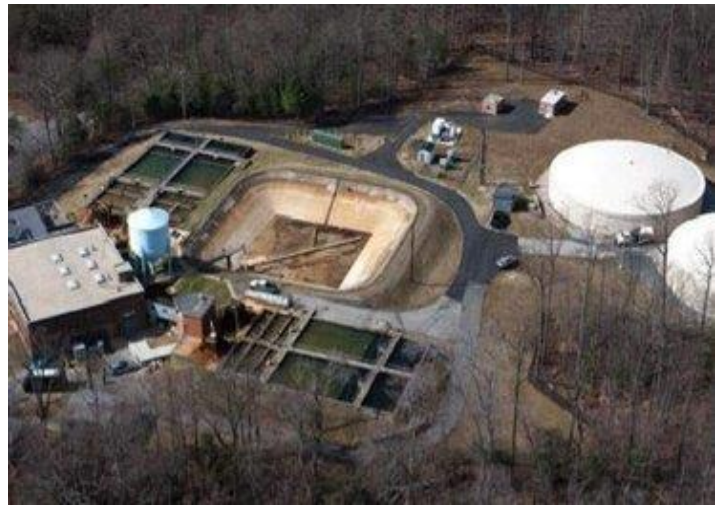
Critical Assets are those whereby loss of functionality could lead to:

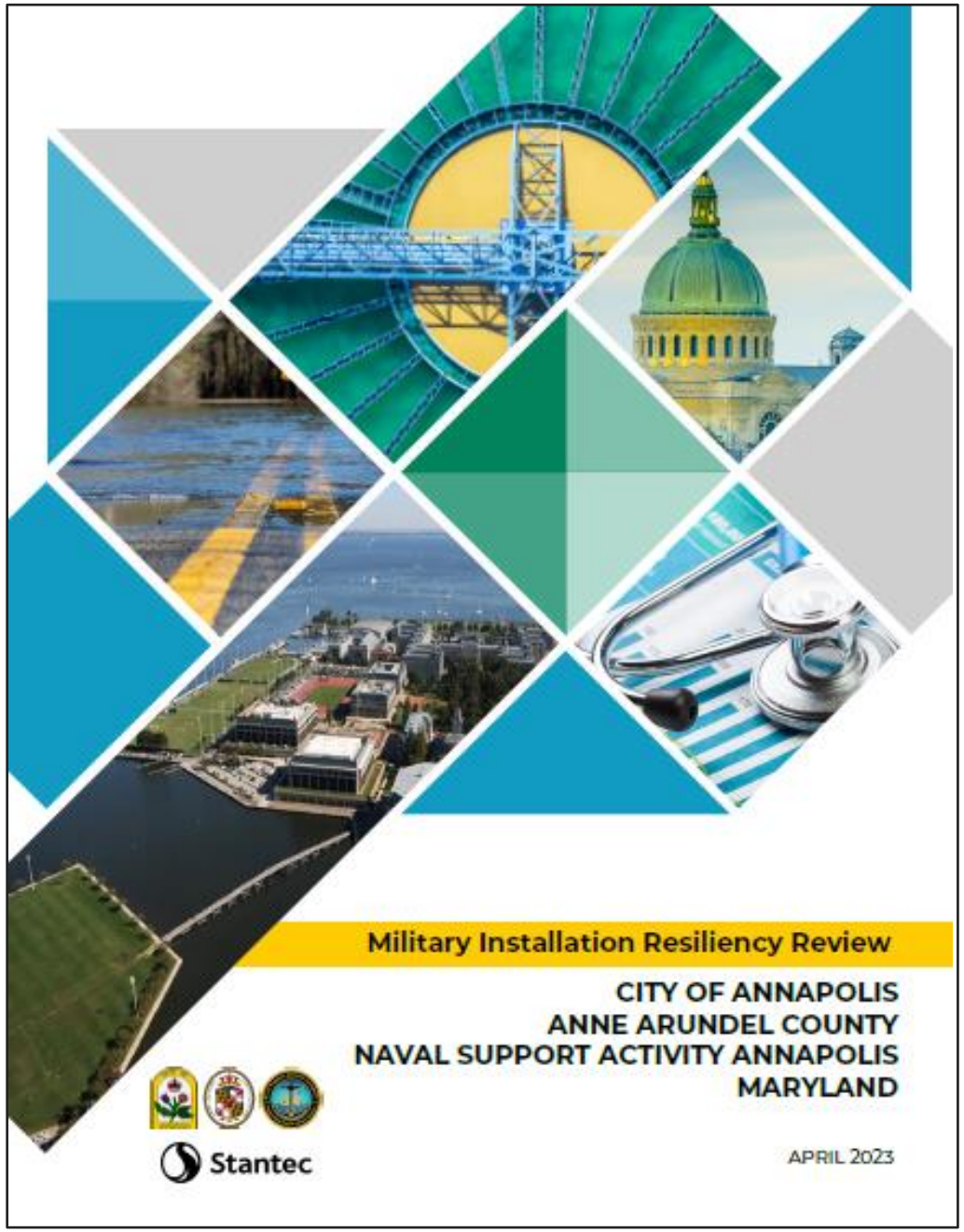
- Loss of life
- Serious injury
- Threatened safety
- Public health impacts
- Quality of life reduction (e.g., long term economic impacts)
- **Adversely impacts installation, mission assurance, readiness**
- **Outside the installation boundary**

High Medium Low

Resilience Actions

- Coastal Shoreline Boundaries | City Dock
- Installation Access Roads | Traffic Signal Upgrades
- Annapolis Water Reclamation Facility
- Energy
- Cybersecurity
- County/City Water Treatment Facilities
- Anne Arundel County Health Department
- Luminis Health Anne Arundel Medical Center





Military Installation Resiliency Review Report

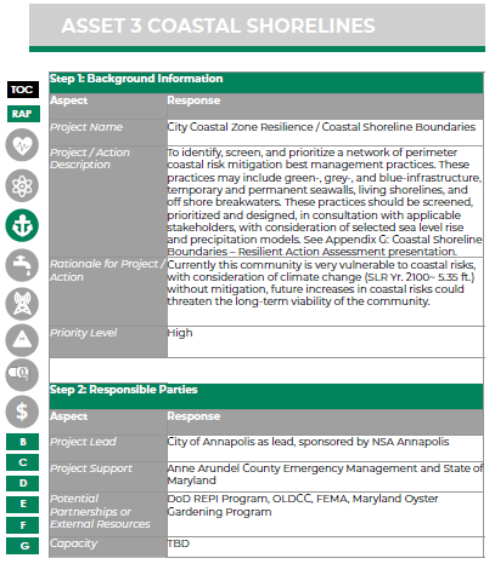
- **Executive Summary**
- **Technical Report**
- **Resilience Action Plan**

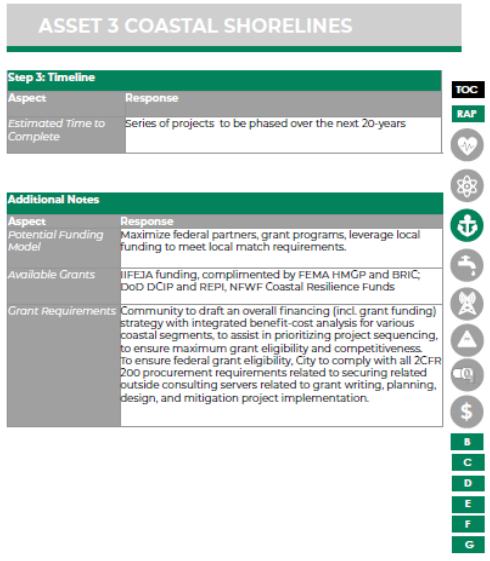
Funding Sources Alternatives Analysis

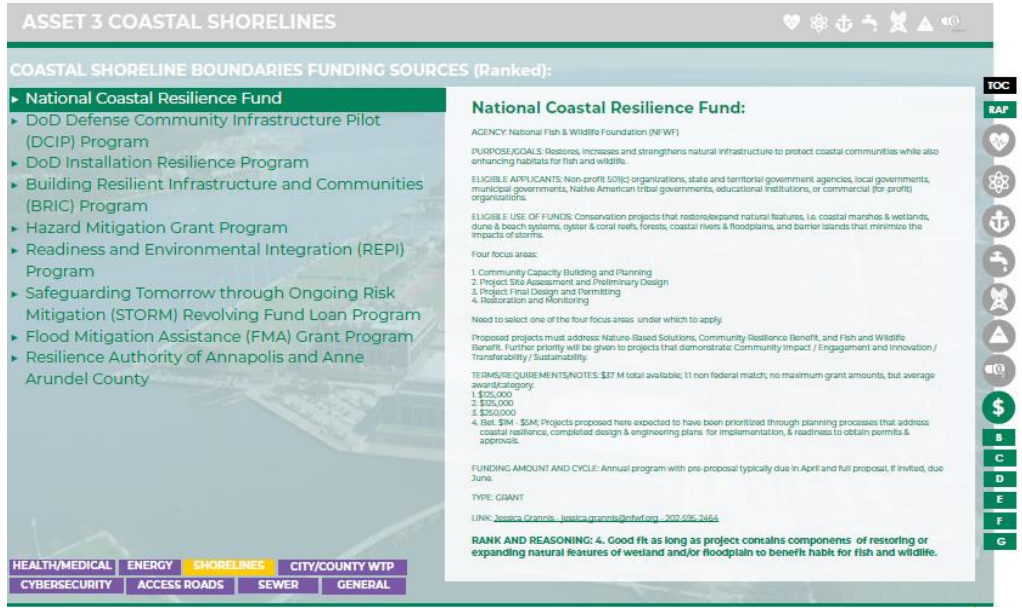
Community Resilience Needs & Project Characteristics

Funding Sources Goals, Criteria, and Requirements

Eligibility and Best Candidates for Success







Resilience Action Plan

Funding Sources for Identified Priority Critical Assets

- Reviewed Federal and State of Maryland funding opportunities and criteria.
- Assessment of which funding programs were “best fit” and considerations for pursuing, such as packaging projects together.
- Some programs support multiple projects, others a single project.

DELIVERING RESILIENCE

The Resilience Authority of Annapolis and Anne Arundel County

Matthew Fleming, Director
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The warning

The pace and scale of climate action are insufficient to tackle climate change

Sixth Assessment Report from the International Panel on Climate Change

RESILIENCE AUTHORITY
Annapolis and Anne Arundel County

The Resilience Authority of Annapolis and Anne Arundel County

With 530 miles of coast here in Anne Arundel County, storm surges and sea level rise are a threat to our public infrastructure and private property. That's why we created and funded the nation's first multi-jurisdictional Resilience Authority in 2021.

Steuart Pittman
Anne Arundel County Executive, Maryland

There is no capital city in America that faces a more serious threat from sea level rise than Annapolis. The Resilience Authority adds another tool to our toolbox to help us meet the infrastructure needs of the next Century.

Gavin Buckley
Annapolis City Mayor, Maryland

Delivering Resilience | June 2023

RESILIENCE AUTHORITY
Annapolis and Anne Arundel County

How we Work

- ✓ As an independent body, The Authority is uniquely suited to tackle expensive, long-term infrastructure projects because we can operate outside of the county and city's budgets and debt ceiling restrictions.
- ✓ We have our own procurement policies and the ability to draw on a range of funding options for resilience projects.
- ✓ We can charge and collect non-tax related fees, issue or sell state or local tax-exempt bonds, and utilize local, state, nonprofit funding to provide capital for projects.
- ✓ We can also combine any of these funding mechanisms and are not restricted geographically, allowing for infrastructure investments to facilitate climate adaptation on a regional scale

RESILIENCE AUTHORITY
Annapolis and Anne Arundel County

An opportunity to shape thinking and practice…

Accelerate project implementation

Provide equitable solutions

Reduce stress on local budgets

Scale investment

Integrate mitigation and adaptation

RESILIENCE AUTHORITY
Annapolis and Anne Arundel County

Thank You

The Resilience Authority of
Annapolis and Anne Arundel County

Matthew Fleming, Director
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References

Resilience Authority of Annapolis and Anne Arundel County
https://resilienceauthority.org/#

City of Annapolis Ordinance O-14-21
https://library.municode.com/md/annapolis/codes/code_of_ordinances?nodeId=TIT2AD_CH2.58REAUANANARCO

Anne Arundel County Bill No. 31-21

City of Annapolis NSA Annapolis Military Installation Resilience Study
https://www.annapolis.gov/1917/NSA-Annapolis-Military-Installation-Resi


Questions & Comments