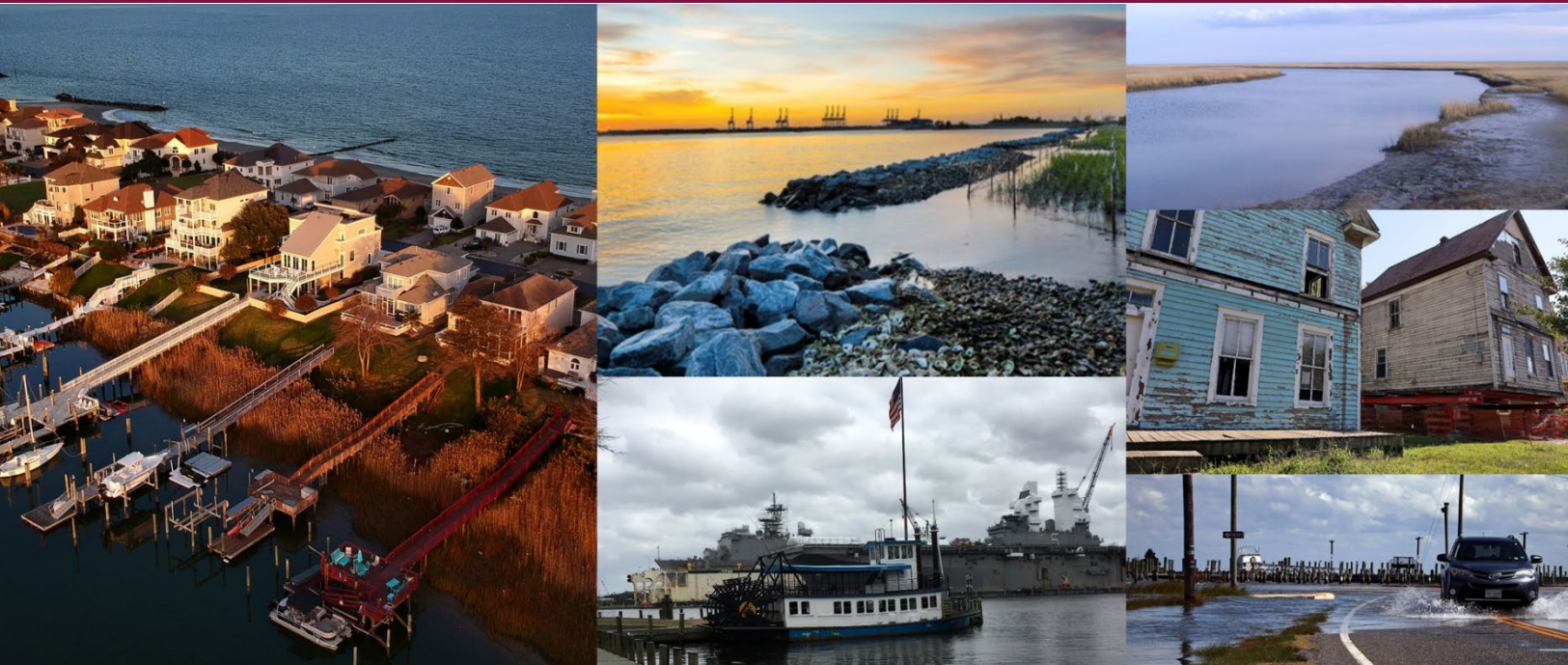


# VIRGINIA COASTAL RESILIENCE MASTER PLAN

Task 5: Adaptation Strategies and Prioritization:  
Project and Capacity Building Schema, Suitability Matrix

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# 1. INTRODUCTION

## 1.1 BACKGROUND

Integral to the Prioritization Approach is the definition of a CRMP “project,” a mechanism for classifying projects for purposes of evaluation, and an inventory of projects across the Commonwealth. The following sections provide an overview of the project identification and inventory process that provides the basis for project prioritization.

### 1.1.1. DEFINITION OF “PROJECT”

The Virginia CRMP Leadership Team, in coordination with the Project Identification (PI) and Project Evaluation (PE) subcommittees and the Virginia CRMP consultant team, established the following definition for what constitutes a “project” for consideration and evaluation for the CRMP:

#### CRMP Projects

“Projects” involve activities that would lead to the implementation of on-the-ground treatments/installations or land use controls that reduce flood impacts and associated hazards in Virginia’s coastal communities. These projects can include conceptual or preliminary designs, continued and expanded stakeholder engagement efforts, detailed cost estimates, final design and permitting, and implementation.

“Coastal Communities” are defined as the counties, cities, towns, and tribal territories that are located within the eight coastal Planning District Commissions (PDCs) and regional Commissions (RCs) as defined in the CRMP Framework.

### 1.1.2. CAPACITY BUILDING AND PLANNING NEEDS

The ability to recognize future flood threats and implement physical adaptation projects that adequately reduce these risks requires significant money, time, and expertise. Coastal localities have varying levels of resources available to them that affect their capacity to propose, develop, implement, and manage adaptation projects. Capacity-building and planning initiatives give regions and localities the tools they need to efficiently and effectively understand their risks and take concrete actions to protect their residents and assets from the threats posed by coastal hazards.

### 1.1.3. INFORMATION COLLECTION

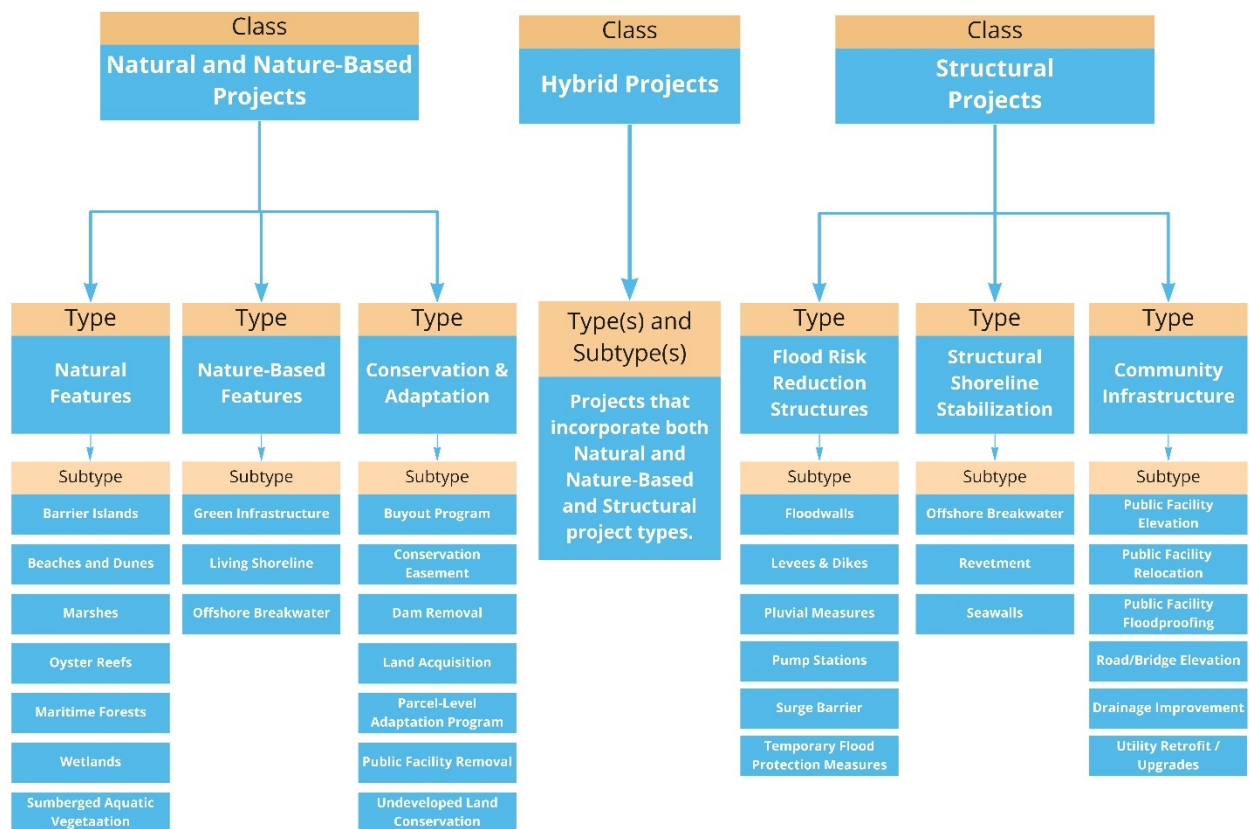
The Virginia CRMP Leadership Team, in coordination with the Project Identification (PI) subcommittee and the CRMP consultant team, engaged in a data collection effort with local, county, and tribal governments and Planning District Commissions (PDCs) and

Regional Commissions (RCs) to better understand the progress coastal communities are making to build capacity, plan, and identify resilience projects. These efforts are further discussed in the following sections.

## 1.2 PROJECT CLASSIFICATION SCHEMA

A project classification schema was established to aid in the categorization and evaluation of projects. This schedule is also presented and fully documented in

The classification schema has three levels of hierarchy: Project Class, Project Type, and Project Subtype. These levels are diagrammed in Figure 2. Project Class is the highest level in the classification of projects.



The three main project classes were established in coordination with the 2021 Grant Manual for the Virginia Community Flood Preparedness (CFPF) Fund<sup>1</sup>. They are defined as follows:

<sup>1</sup> Commonwealth of Virginia 2021 Grant Manual for Virginia Community Flood Preparedness Fund (CFPF) - <https://www.dcr.virginia.gov/dam-safety-and-floodplains/document/2021-CFPF-Manual.pdf>.

**“Natural and Nature-Based Projects”** reduce the impacts of flood and storm events using environmental processes and natural systems. A nature-based solution may provide additional benefits beyond flood control, including recreation opportunities and improved water quality. For the CRMP, nature-based projects include those that reduce flood impacts by restoring, creating, or emulating natural features, as well as projects that allow for the continuation of natural processes and allow inundation; strategic retreat of existing land uses from areas vulnerable to flooding; the conservation or enhancement of natural flood resilience resources; or acquisition of structures, provided the acquired property will be protected in perpetuity from further development.

**“Structural Projects”** encompasses engineered flood risk reduction measures that can include the protection of individual assets or the blocking of flood pathways, preventing coastal or riverine flooding of inland areas. For the CRMP, structural projects include permanent or deployable flood defense systems like seawalls and levees, as well as retrofit or relocation strategies for built infrastructure for which protection is not practical.

**“Hybrid Projects”** are projects that incorporate project types and/or subtypes from both the Natural and Nature-Based and Structural project classes. The project class is intended to capture multi-faceted projects.

See Appendix A of this report for definitions of project types and associated subtypes for both Nature-Based and Structure Projects.

### **1.3 CAPACITY BUILDING AND PLANNING NEEDS CLASSIFICATION SCHEMA**

A classification schema was established to aid in the categorization of capacity building and planning initiatives. The classification schema has three levels of hierarchy: Class, Type, and Subtype. These levels are diagrammed in Figure 2 and defined as follows:

**“Studies and Data Tools”** include efforts that improve the jurisdiction's understanding and knowledge of relevant current and future coastal flood hazards, vulnerabilities, and risks, and options to adapt to future risks to improve outcomes for community, economic, and ecosystem resilience.

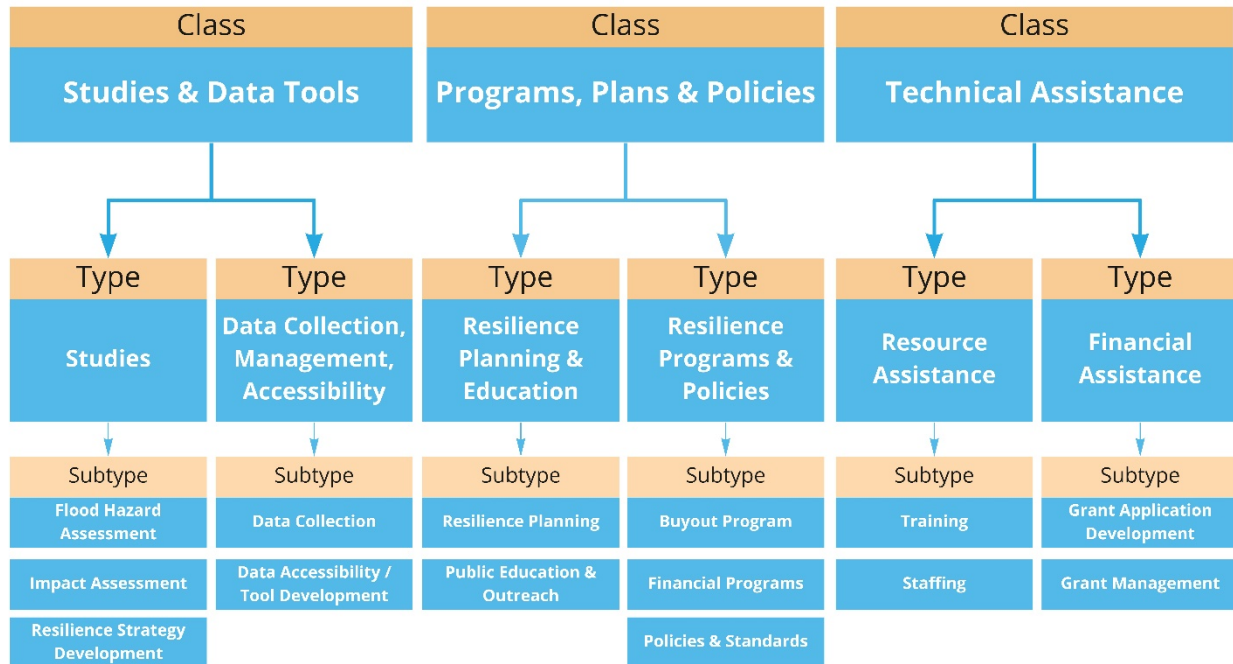
**“Programs, Plans, and Policies”** include efforts that improve the jurisdiction's ability to implement and engage in coastal adaptation and resilience planning.

**“Technical Assistance”** includes efforts to improve the jurisdiction's ability to execute and fund coastal adaptation and resilience efforts.

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It should be noted that the list of project types presented within the 2021 CFPF does not encompass the full suite of project types within the CRMP project classification schema. These schemas could be aligned in the future for improved congruency between the two.

See Appendix C of this report for a list and definitions of types and associated subtypes of Capacity Building and Planning Needs.



## 1.4 PROJECT DATABASE & ATTRIBUTES

The CRMP Project Database was designed in alignment with the project and capacity building classification schemas to capture and standardize the key attributes required for evaluation and prioritization. While several data collection efforts have captured some flood resilience projects and capacity building needs, none included the full range of attributes necessary to understand and validate specific projects, and most still require verification by localities for accuracy. To address this data gap, a survey tool was developed using ESRI's Survey123 software to build and populate the CRMP Database.

- Project Database – participants were asked to complete a survey in alignment with the needs of the Prioritization Approach. The survey is organized into two sections:
  - Required Fields - attributes that are essential to characterize projects and evaluate their effectiveness.
  - Optional Fields - project attributes that are desirable and would help better assess the merits of a project, which could improve its chances of being funded.

- Capacity Building & Planning Need – participants were asked to identify ongoing or planned capacity building and planning initiatives including a description of the effort, estimated costs, and other details.
- Existing Capacity & Other Capacity Needs – participants were asked to complete one survey per locality/organization to self-assess their agency's existing and needed capacity to engage and plan for coastal resilience.

A copy of the Project Information and the Capacity Building and Planning Needs survey forms are provided in Appendix B, and C of this document, respectively.

## 2. PROJECT SUITABILITY MATRIX

### 2.1 PROJECT ALTERNATIVES ANALYSIS

The Commonwealth desired to develop a suitability matrix to assist localities with the initial identification of potential alternatives to build resilience. The suitability matrix is intended to incorporate factors such as flood hazards addressed, benefitting assets, adaptive capacity, time scale of benefits, and relative costs. An initial draft of a suitability matrix is provided here. This resource is only intended for a high-level evaluation of options and to begin narrowing down project alternatives for more thorough evaluation.

A more robust project alternatives analysis would involve reviewing site-specific information to determine which project type, or combination of project types, is most appropriate. There are several Virginia-specific available to help stakeholders evaluate what combination of strategies are suitable for a particular site. VIMS [Living Shoreline Design Guidelines for Shore Protection in Virginia's Estuarine Environments](#) provides guidance on how to conduct a site evaluation and alternatives analysis incorporating a variety of site-specific information such as shoreline characteristics, erosion at the site, natural features, site-specific flood hazards, among other factors. VIMS' [Shoreline Assessment Mapper](#) provides a variety of geospatial datasets that can be used to support suitability assessments. Another useful tool is VIMS' regional [Shoreline Management Model](#) for Virginia that can be used to guide evaluation of alternatives.

After an alternative is selected, preliminary design involves conducting more detailed engineering analysis to evaluate feasibility, constructability, construction costs, project effectiveness, and potential adverse impacts. Once a feasible and cost-effective alternative is identified, the project can move to the final design phase where engineering plans, material specifications, and cost estimates are developed, and permit applications are prepared and submitted. Public and regulatory stakeholders should be involved throughout the design process to gather feedback on design elements and ensure support.

### 2.2 PROJECT SUITABILITY MATRIX ELEMENTS

The following text outlines the factors considered in the initial draft suitability matrix. The draft matrix can be found in Appendix C.

**Flood Hazards Addressed:** Each project type was matched to the potential type of flood hazards addressed. It should be noted that the appropriate type of strategy not only depends on the flood hazards the project needs to address, but also the flood hazards the project is exposed to. Natural and nature-based strategies are typically recommended along sheltered coasts with gentle slopes and lower wave energy, whereas structural strategies are typically more suitable along the open coast exposed to larger wave energy or steeper shoreline slopes.



**Benefiting Assets:** The CRMP Impact Assessment categorizes impacts into three themes based on the types of assets affected. These themes focus on different elements of the Commonwealth’s unique coastal landscapes and what is at stake due to escalating flood hazards. Each project type was matched to one or more of the three themes: Community Resources, Critical Sectors, and Natural Infrastructure, defined as follows:

<b>Community Resources Theme</b>	Includes impacts on physical assets that contribute to coastal Virginia’s unique economy and social environment. This theme examines impacts on residential populations, residential and non-residential buildings, tribal-owned lands, and agricultural lands.
<b>Critical Sectors Theme</b>	Includes impacts on assets, systems, and networks that are vital to everyday functions, and if damaged or destroyed, would have debilitating effects on the economy, public health, safety, and/or security. This theme examines impacts on transportation; communications; commercial and critical manufacturing facilities; military installations; energy infrastructure; health and emergency services; government facilities; and waste, water and wastewater systems.
<b>Natural Infrastructure Theme</b>	Includes impacts on natural coastal and aquatic environments that provide fish and wildlife habitat, water quality and flood reduction benefits, and numerous ecosystem services to the surrounding region. This theme examines impacts on tidal habitat, aquatic habitat, upland habitat, and beaches and dunes.

Generally, natural and nature-based projects are anticipated to provide benefits to Community Resources and Natural Infrastructure, with some potential benefits to Critical Sectors depending on the specific type of project. Structural projects typically provide benefits to Community Resources and Critical Sectors.

**Adaptive Capacity:** Adaptive capacity refers to the ability of a project to adjust to potential changes to the environment. Three levels of adaptive capacity were established to allow for comparison between project subtypes:

<b>Low</b>	Projects that have minimal ability to deal with or adjust to increasing hazards over its design life
<b>Medium</b>	Projects that have some ability to deal with or adjust to increasing hazards over its design life
<b>High</b>	Projects that have the greatest ability to deal with or adjust to increasing hazards over its design life

Natural and nature-based projects generally have higher capacity to adjust to changing conditions, given adequate room to migrate inland in response to rising water levels. Structural projects generally have lower adaptive capacity given fixed hard structural elements. However, innovative approaches such as modular and adaptive design intended to be updated in response to changing conditions can add resilience to structural projects and increase adaptive capacity.

**Timescale of Benefits:** The timescale of benefits any particular project will depend on several project-specific factors such as design criteria and plans for adaptive management and maintenance to ensure the project continues to function as intended throughout its design life. The anticipated timescale of benefit for different project types was grouped into near-, mid- and long-term in alignment with the three CRMP future planning time horizons: 2040, 2060, and 2080.

<b>Near-Term</b>	The project is anticipated to provide benefits over the next 20 years (2040)
<b>Mid-Term</b>	The project is anticipated to provide benefits over the next 40 years (2060).
<b>Long-Term</b>	The project is anticipated to provide benefits over the next 60 years (2080).

**Relative Cost:** Cost is another important factor that should be considered when evaluating alternatives. Individual project costs are highly dependent on site conditions, size of the project, availability of materials, need for ongoing operations and maintenance, among many other considerations. To enable relative cost comparisons between various types of natural and structures shoreline stabilization measures, the U.S. Army Corps of Engineers (USACE) has established average unit costs as outlined below.<sup>2</sup>

<b>Low</b>	Up to \$1,000 per linear foot
<b>Medium</b>	\$1,001 to \$2,000 per linear foot
<b>High</b>	\$2,001 to \$5,000 per linear foot
<b>Very High</b>	\$5,001 - \$10,000 per linear foot

These unit costs were related to each project subtypes to provide a relative unit cost comparison. Not all of the USACE natural and structural shoreline stabilization measures

<sup>2</sup> USACE Natural and Structure Measures for Shoreline Stabilization - <https://coast.noaa.gov/data/digitalcoast/pdf/living-shoreline.pdf>

matched with the CRMP project subtypes, such as those in the Conservation and Adaptation and Community Infrastructure project type category. Relative costs for these project subtypes were assigned across the “Medium”, “High”, and “Very High” categories given the high variability of costs associated with these types of projects.

### **2.3 CONCLUSIONS AND NEXT STEPS**

Further development is needed to improve the draft suitability matrix. Areas for improvement include monitoring coastal resilience projects overtime to develop Virginia-specific relative unit cost estimates, typical design life/timescale of benefits, and evaluate cost-effectiveness and adaptive capacity of different approaches. As the science and body of knowledge on performance of coastal resilience projects across the commonwealth grows, this matrix can be updated and refined to better support localities with the initial identification of potential alternatives to build resilience.

# APPENDIX A – PROJECT CLASSIFICATION SCHEMA

## 2.4 PROJECT CLASS, TYPE, AND SUBTYPE FOR NATURE-BASED PROJECTS

Class: Natural and Nature-Based Projects	
Project Type: Natural Features - evolved over time through processes operating in nature.	
Project Subtype	Subtype Definition
<b>Barrier Island Restoration</b>	A variety of restoration techniques, such as the placement of dredged material to increase island height and width, the placement of structures to protect the island from erosive forces, and the placement of sand-trapping fences, which are used in conjunction with vegetation plantings on barrier island beaches.
<b>Dune Creation and Restoration with Beach Nourishment</b>	Creation and restoration of dune systems that match the natural dune pattern in accordance with the natural processes that lead to dune establishment. Dune creation and restoration can be done in concert with beach nourishment, which involves the addition of sand onto or directly adjacent to an eroding beach to combat erosion and increase beach width to protect the dune system and upland coastal habitats.
<b>Hydrologic Connectivity and Floodplain Restoration</b>	Restoration or mimicking natural connections that have been disrupted by infrastructure such as roads and levees. These projects remove barriers to flow (e.g., old flood control structures) or install structures like culverts to enable water to flow under or around an existing barrier.
<b>Maritime Forest Restoration</b>	Manipulation of a degraded forest habitat to restore functions that attenuate and dissipate waves and reduce shoreline erosion. A maritime forest is a coastal wooded habitat found on higher ground than dune areas within the range of salt spray.
<b>Oyster Reef Restoration</b>	Projects to rebuild or restore oyster reefs. Techniques include reef construction using natural or nature-based materials, oyster gardening, and stock enhancement.
<b>Submerged Aquatic Vegetation (SAV) Restoration</b>	Underwater grass beds, known as Submerged Aquatic Vegetation (SAV), are comprised of rooted flowering plants that have colonized primarily soft sediment habitats in coastal, estuarine, or freshwater habitats like the Chesapeake Bay. SAV restoration involves improving conditions for SAV survival or active restoration such as seed dispersal and plantings.
<b>Wetland Creation</b>	Construction of a wetland on a site that never was a wetland. These projects are only feasible with site conditions that can produce and sustain a wetland.

**Project Type: Nature-Based Features** - created by human design, engineering and construction for specific services such as coastal hazard risk reduction

Project Subtype	Subtype Definition
<b>Wetland Restoration</b>	Manipulation of a former or degraded wetland's physical, chemical, or biological characteristics to return its natural functions. Restoration practices include re-establishment (the rebuilding of a former wetland) and rehabilitation (repairing the functions of a degraded wetland).
<b>Green Infrastructure</b>	Stormwater control practices that minimize runoff and use engineered soils and vegetation to reduce runoff volumes and remove stormwater pollutants. Examples of green infrastructure include imperviousness minimization, conservation of existing vegetation, soil restoration and deployment of stormwater controls such as bioretention filters, permeable pavement, and vegetated swales.
<b>Living Shoreline</b>	Shoreline management practices, such as living shorelines, that control erosion; protect, restore, and enhance shoreline habitat; and maintain coastal and fluvial processes through strategic placement of plants, stone, sand fill, and organic structural materials.

**Project Type: Conservation & Adaptation** – Activities that remove flood-exposed infrastructure, conserve natural flood buffers, allow for flood inundation, or provide migration potential for natural systems.

Project Subtype	Subtype Definition
<b>Buyout Program</b>	Acquisition of properties that have been damaged or are prone to damage caused by storms or storm-related flooding, or acquisition of land and property that may protect other lands or assets from damage.
<b>Conservation Easements</b>	A conservation easement is a voluntary, legal agreement that permanently limits the uses of the land to protect its conservation value and reduce flood damage.
<b>Dam Removal</b>	Dam removal is the process of demolishing a dam to restore natural flows in river and provide flood control and ecosystem benefits.
<b>Land Acquisition</b>	Acquisition of land for flood protection, prevention and conservation purposes, or public access.
<b>Parcel-Level Adaptation Program</b>	Community-scale flood mitigation actions such as structural elevations, floodproofing, or reconstruction to reduce flood damage. Parcel-scale programs that include projects on private property must show greater public benefit for health, safety, and community welfare beyond the benefits to individual property owners.
<b>Public Facility Relocation</b>	Relocation of a public building or other infrastructure puts it out of reach of floodwaters.
<b>Undeveloped Land Conservation</b>	Permanent conservation of undeveloped lands identified as having flood resilience value by ConserveVirginia's Floodplain and Flooding Resilience layer or similar data-driven analytics.

## 2.5 PROJECT CLASS, TYPE, AND SUBTYPE FOR STRUCTURAL PROJECTS.

Class: Structural Projects	
Project Type: Flood Risk Reduction	
Project Types	Project Type Definition
<b>Floodwalls</b>	An engineered, primarily vertical barrier that contains the floodwaters of a river or other waterway. Floodwalls are typically used where space constraints do not allow construction of levees or where there are conflicts with existing buildings or infrastructure.
<b>Levees</b>	Compacted earth structures designed to block floodwaters of a river or other waterway from moving into the protected area behind.
<b>Pump Stations</b>	Stormwater pump stations help protect areas by pumping away large volumes of rainwater, thereby preventing the occurrence of flooding.
<b>Pluvial Measures</b>	Pluvial flood protection measures include regrading slopes to reduce flow, collecting and/or diverting runoff from the face of a slope, conveying runoff from impermeable surfaces, and maintaining vegetation to filter and store water during extreme rainfall events.
<b>Surge Barrier and Tide Gates</b>	A surge barrier is a structural intervention designed to prevent a storm surge or high tide from flooding the protected area behind the barrier. Tide gates can be closed or open depending on tidal elevation and anticipated storm conditions.
<b>Temporary Flood Protection Measures</b>	Temporary flood barriers that can be raised in advance of flood risk and lowered to permit access when flood waters subside
Project Type: Structural Shoreline Stabilization	
Project Types	Project Type Definition
<b>Offshore Breakwater</b>	Large gapped structures offshore to maintain beaches and dunes
<b>Revetment</b>	A sloped structure constructed with large heavy stone, often in two layers, used to anchor the base of the upland bank. The size of a revetment is dictated by the energy of the shoreline environment where it is proposed.
<b>Seawalls</b>	An engineered barrier built parallel to the shore with a primary function to prevent erosion of the shoreline. Although their primary function is erosion control, they can protect against coastal flooding. associated with waves and storm surge.

## Project Type: Community Infrastructure

Project Types	Project Type Definition
<b>Public Facility Elevation</b>	Elevating a public building or other infrastructure puts it out of reach of floodwaters.
<b>Public Facility Floodproofing</b>	Public buildings or other infrastructure can be protected from floodwaters through measures such as dry floodproofing, wet floodproofing, material replacement, deployable flood barriers, and facility ring dikes that enclose a facility.
<b>Public Facility Relocation</b>	Relocation of a public building or other infrastructure puts it out of reach of floodwaters.
<b>Road/Bridge Elevation</b>	Elevating roadways and bridges may be necessary to allow continuity of access and transportation during flooding events. In some situations, elevation is necessary to avoid pressure flow and scour impacts to structures. Strategies include pier additions, embankment reinforcement, low and high chords retrofits, and bridge replacement.
<b>Stormwater Drainage Improvements</b>	Drainage improvements are retrofits and upgrades necessary to improve the conveyance capacity of drainage infrastructure (e.g., manholes, catch basins, outfalls, conduits, and stormwater controls) to handle the combined occurrence of rain and of coastal flooding, for example tailwater effects due to storm surge, waves, and tides.
<b>Utility Retrofit/Upgrades</b>	Above ground and subsurface utility retrofits to protect against the impacts of flooding. Measures include armoring, localized and corridor-wide measures, relocation, or improved installation.

# APPENDIX B – PROJECT INFORMATION SURVEY

The Data Call Form for Flood Resilience Projects is provided on the following pages:



## Virginia CRMP Data Call: Flood Resilience Projects

### What is the purpose of this survey?

The Commonwealth of Virginia is preparing a Coastal Resilience Master Plan (CRMP) that will serve as a roadmap to flood resilience. The purpose of this survey is to gather details about projects that your locality or organization may have identified to address flooding problems.

The Virginia Coastal Resilience Master Plan Leadership Team, in coordination with the TAC and Project Identification (PI) and the Virginia Coastal Resilience Master Plan consultant team, have identified two main categories: Capacity Building and Planning and Flood Resilience Projects defined as follows:

1. "Capacity Building and Planning" includes engaging stakeholders through community outreach and education, improving the ability of local governments through training of existing staff, hiring personnel, contracting with consultants or advisors, and other related actions that identify and mitigate risk and flood impacts.
2. Flood Resilience Projects" involve activities that would lead to the implementation on-the-ground projects, acquisition of land, or implementation of land use controls that reduce flood risks and impact coastal communities. These projects can include conceptual or preliminary designs, continued and expanded stakeholder engagement efforts, detailed cost estimates, and final design and permitting.

This survey is for [Flood Resilience Projects](#). To submit a Community Capacity Building initiative, please use this survey: <https://arcg.is/0z4nL4>.

### Isn't this information available already?

Yes! Some information is available but it is incomplete or outdated. Some information was provided by third or fourth parties rather than directly by contributors, and some did not contain key project attributes to enable project evaluation and prioritization.

The Commonwealth wants your projects represented correctly and equitably, and this can only happen if the information about them is accurate and current.

### How will this information be used?

The submitted project information will be evaluated according to the CRMP guiding principles for possible inclusion in the CRMP.

## What is the minimum information that I need to provide?

This survey is organized into two sections, Required and Optional.

- *Required Fields* - attributes that are essential to characterize your projects and evaluate their effectiveness. While some projects might not be fully ready to answer some of these questions, please provide your best guess.
- *Optional Fields* - project attributes that are desirable and would help better assess the merits of your project, which could improve its chances of being funded.

## What projects should I focus on first?

Please submit all projects you want to be included as part of the CRMP evaluation process by **Friday, August 13**. This survey will remain open to collect projects past that date, but may not be evaluated if entered after that date.

### Required Fields

#### Submitter Name\*

Please provide the name of the person familiar with the project planning who can answer questions; typically, an employee of—or agent for—the project owner. The submitter should be the contact person providing the information for this data call.

#### Submitter contact Info\*

Please provide the project contributor's email address, in case we need to reach them to clarify information about the project.

#### Project Owner\*

Enter the locality, agency, entity, sponsor, or person that will be responsible for implementing the project, regardless of land ownership. If a locality will implement the project, the owner is the locality. If a government agency will implement the project, the owner is the government agency. If a private entity will implement the project, the owner is the sponsor of that private entity.

### Project Name\*

Please provide a short, descriptive name that will distinguish it from other project proposals

**Please use underscores between each word in your Project Name, as shown below.**

Enter\_Project\_Name\_Here

### Related Initiative?\*

Is the project related to a capacity building and planning need that you submitted / will submit on the Capacity Building and Planning data call?

**Please ensure the Project Name is the same on both forms.**

Yes

No

### Description\*

Please provide a brief description of the project. This should be two sentences long in most cases. The first sentence should clearly state the scope and goals of the project. The second sentence should state the expected outcome from the project and its relevance to the CRMP.

1000

### Project Footprint\*

Use the map tool below to draw the approximate geographic footprint of the project.

Polygon - this is the term used for the shape of your project location. It is made up of multiple vertices (i.e. points).

Tips:

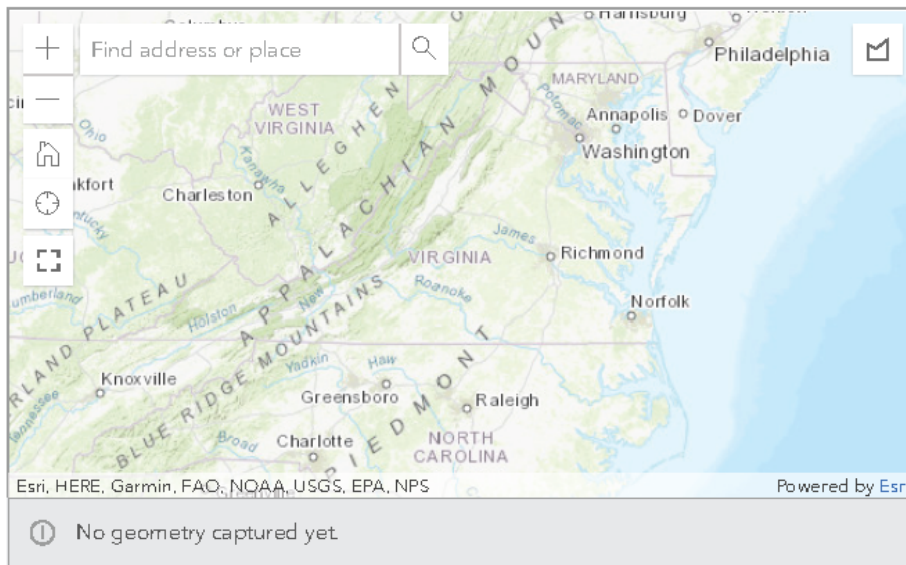
1. Expand the window to make it larger and easier to use.
2. Navigate to the location where you will be creating your polygon by using the Zoom In/Out feature or the 'Find address or place' search bar.
3. Click the Area widget, located at the top-right of the screen.
4. Move your mouse to the map. Click once to create the first vertex. Move your mouse to the next place you want to place another vertex. Continue placing vertices until you are

ready to close the polygon. To finish, double click.

5. You can use the Undo, Reset, Cancel, Delete and Edit tools to revise your polygon.
6. When you are finished, click the "X" button in the upper-righthand corner.

The footprint will depend on the type and scale of your project. A few examples include:

- A project footprint for a structural or natural infrastructure project should represent the estimated extent of the project, once it has been implemented.
- A project footprint for a land conservation strategy (e.g. acquisition or conservation easement) would represent the area of land (e.g. parcel)
- A project footprint for a stormwater infrastructure or utility infrastructure would be the service area the project is intended to cover.



### Scale of Benefits\*

Estimate the area predicted to benefit from the project, once implemented.

Use [this map](#) if you need assistance locating the HUC boundaries referenced in the choices below. Click 'content' to turn off and on the layers.

### Purpose and Need\*

What types of coastal hazards is the project intended to reduce? Select all that apply:

 Tidal Flooding - flooding caused by daily or extreme high tides

Storm Surge Flooding - flooding caused by coastal storms including nor'easters and hurricanes

Riverine/Fluvial Flooding - flooding caused by overflowing of rivers and streams

Stormwater/Pluvial Flooding - flooding caused by lack of drainage or overflowing drainage systems due to intense rainfall

Land Degradation - loss or displacement of land, vegetation, or sediment along the coastline

Groundwater Impacts - changes in the boundary between freshwater and saltwater or rising water tables in response to sea level rise

Other

#### Future Condition Considerations\*

The design standards of the project to account for existing and future flood hazards. Select all that apply:

The project considers the SLR Scenario in alignment with the CRMP (defined as the NOAA 2017 Intermediate-High sea level rise projection)

Local Standards that are higher and more risk-averse than the CRMP SLR Scenario

Local Standards that are lower and less risk-averse than the CRMP SLR Scenario

The project considers increased rainfall

The project does not consider future sea level rise or rainfall conditions

## Project Subtypes\*

Please select the project subtype(s) that best characterize your project. Multiple subtypes can be selected, if appropriate.

Barrier Island Restoration - A variety of restoration techniques, such as the placement of dredged material to increase island height and width, the placement of structures to protect the island from erosive forces, and the placement of sand-trapping fences, which are used in conjunction with vegetation plantings on barrier island beaches.

Buyout Program - Acquisition of properties that have been damaged or are prone to damage caused by storms or storm-related flooding, or acquisition of land and property that may protect other lands or assets from damage.

Conservation Easements - A conservation easement is a voluntary, legal agreement that permanently limits the uses of the land in order to protect its conservation value related to flood protection and prevention.

Dune Creation and Restoration with Beach Nourishment - Creation and restoration of dune systems that match the natural dune pattern in accordance with the natural processes that lead to dune establishment. Dune creation and restoration can be done in concert with beach nourishment, which involves the addition of sand onto or directly adjacent to an eroding beach to combat erosion and increase beach width to protect the dune system and upland coastal habitats.

Dam Removal

Flood Wall - Concrete structures designed around a city of major residential area that blocks floodwaters from reaching the area behind the structure.

Green Infrastructure - Green infrastructure is designed to move urban stormwater away from the built environment and treat stormwater at its source while delivering environmental, social, and economic benefits. Examples of green infrastructure approaches include maintaining green space, strategically installing vegetation to slow runoff and spread water to promote infiltration, and

installing rain gardens

Hydrologic Connectivity and Floodplain Restoration - Restoration or mimicking natural connections that have been disrupted by infrastructure such as roads and levees. These projects remove barriers to flow (e.g., old flood control structures) or install structures like culverts to enable water to flow under or around an existing barrier.

Land Acquisition - Acquisition of land for flood protection and prevention conservation purposes and/or public access.

Levees & Dikes - Compacted earthen structures designed to block water from moving into the protected area behind.

Living Shoreline - A living shoreline is a management practice that provides erosion control benefits; protects, restores, and enhances natural shoreline habitat; and maintains coastal/fluvial processes through strategic placement of plants, stone, sand fill, and other structural organic materials. Living shorelines typically include a low-profile stone structures (e.g. marsh or oyster sill) to maintain tidal marsh and attenuate waves.

Maritime Forest Restoration - Manipulation of a degraded forest habitat to restore functions that attenuate and dissipate waves and reduce shoreline erosion. A maritime forest is a coastal wooded habitat found on higher ground than dune areas within the range of salt spray.

Offshore Breakwaters - Large gapped structures offshore to maintain beaches and dunes

Oyster Reef Restoration - Projects to rebuild or restore oyster reefs. Techniques include reef construction using natural or nature-based materials, oyster gardening, and stock enhancement.

Parcel-Level Flood Adaptation Program - Community-scale flood mitigation actions such as structural elevations, floodproofing, or reconstruction to reduce

flood risks. Parcel-scale programs that include projects on private property must show greater public benefit for health, safety, and community welfare beyond the benefits to individual property owners.

Pluvial Measures - Pluvial flood protection measures include regrading slopes to reduce flow, collecting and/or diverting runoff from the face of a slope, conveying runoff from impermeable surfaces, and reservoirs or holding tanks to store extra water during extreme rainfall events.

Pump Stations - Stormwater pump stations help protect areas by pumping away large volumes of water, thereby preventing the occurrence of flooding.

Public Facility Elevation - Elevating a public building or other infrastructure puts it out of reach of floodwaters without alternating the frequency of inundation events.

Public Facility Removal or Relocation - Removal or relocation of a public building or other infrastructure puts it out of reach of floodwaters without alternating the frequency of inundation events.

Public Facility Floodproofing - Public buildings or other infrastructure can be protected from floodwaters through measures such as dry floodproofing, wet floodproofing, material replacement, deployable floodwalls, and facility ring dikes that enclose a facility and prevent that facility from flood damages even when adjacent portions of the property are inundated.

Roads/Bridge Elevation - Elevating roadways and bridges may be necessary to ensure continuity of access and transportation during flooding events due to multiple sources. In some situations, this will be necessary to avoid pressure flow and scour impacts to structures, which will challenge the long-term sustainability and performance of the structures and accessories associated with bridges. Strategies include pier additions, embankment reinforcement, low and high chords retrofits, and bridge replacement, if necessary.

Revetment - A sloped structure constructed with large heavy stone, often in two layers, used to anchor the base of the upland bank. The size of a revetment is



dictated by the energy of the shoreline environment where it is proposed.

- Seawall - An engineered barrier, typically constructed parallel to the shoreline and with a vertical face. The principal function of a seawall is preventing overtopping by waves and flooding, and erosion associated with waves and storm surges.
- Submerged Aquatic Vegetation (SAV) Restoration - SAV is defined as rooted plants found in shoal areas of Chesapeake Bay or other shallow habitats that provide important ecological roles, such as providing food, shelter, and oxygen as well as trap sediment and dissipate wave energy. SAV restoration involves improving conditions for SAV survival or active restoration such as seed dispersal and plantings.
- Surge Barrier - A structural intervention designed to prevent a storm surge or high tide from flooding the protected area behind the barrier. Tide gates can be closed or open depending on tidal elevation and anticipated storm conditions.
- Stormwater Drainage Improvements - Drainage improvements are defined as retrofits/upgrades necessary to address the peak flow and volume requirements of drainage infrastructure (manholes, catch basins, outfalls, conduits, and stormwater controls) due to the individual or combined occurrence of coastal flooding (tailwater effects due to storm surge, waves, and tides), and precipitation events.
- Temporary Flood Protection Measures - Temporary flood barriers can be raised in advance of flood risk but lowered to permit access when flood risk is absent
- Utility Retrofit/Upgrades - Above ground and subsurface utility infrastructure that need to be protected against the impacts of flooding. Measures include armoring, localized and corridor-wide measures, relocation, or improved installation.
- Undeveloped Land Conservation - permanent conservation of undeveloped lands identified as having flood resilience value by ConserveVirginia Floodplain and Flooding Resilience layer or similar data-driven analytic tool.

Wetland Creation - Construction of a wetland on a site that never was a wetland. These projects are only feasible with site conditions that can produce and sustain a wetland.

Wetland Restoration - Reestablishment of wetland characteristics and functions where they have ceased to exist, or exist in a substantially degraded state.

Other

### Project Status\*

What is the current (2021) status of the project?

-Please Select-

### Total Implementation Cost\*

Please enter the total estimate of all planning, engineering, permitting, mitigation, and construction costs. This cost represents the total financial commitment by the Project Owner to proceed from initial project conception to ribbon cutting. The total implementation cost does not include estimated annual operations and maintenance costs. Additional cost breakdowns may be provided as optional fields.

12<sup>3</sup>

### Optional Fields

#### Project Identifier

Is there a unique identifier that your organization uses to track this project internally?

#### Owner Classification

Use the drop-down to select the most appropriate owner classification.

-Please Select-

### Estimated Start Date

What is the estimated start date for spending on this project, including planning, engineering, and permitting lead time?

### Estimated End Date

What is the estimated completion date for the project (when the project will be implemented or constructed and is fully functional)?

### Information Link

Is there an Internet URL (webpage address) where interested parties can read more online about the project? This link could lead to a webpage, PDF report, ArcGIS online story map, or similar resource.

### Design Life

What is the expected design/service life of the project?

### Planning, Engineering, and Permitting Cost

Enter the estimated cost for planning, engineering, and permitting. This value typically will be a fraction of the Total Implementation Cost. The Planning, Engineering, and Permitting Cost plus the Construction Implementation Cost plus the Easement Land Cost should not exceed the Total Implementation Cost.

### Construction Implementation Cost

Enter the estimated cost of construction or implementation. This value will typically be a

fraction of the Total Implementation Cost. The Planning, Engineering, and Permitting Cost plus the Construction Implementation Cost plus the Easement Land Cost should not exceed the Total Implementation Cost.

### Average Annual Operations & Maintenance Cost

Enter the estimated average annual operations and maintenance cost for the project. This value is separate from the other cost information presented above. It is NOT a portion of the Total Implementation Cost.

### Permitting Status

What is the current (2021) status of any required permitting?

### Funding - Cost-Share Requirements

Identified projects will be assessed for potential sources of funding. Oftentimes, these funding programs require a cost-share/matching requirement. Does the submitting organization have the ability to raise or collect funding to pay for any cost-share requirements?

 Yes  No

### Funding - Application Costs

Does the submitting organization have the resources to complete funding applications (e.g. grant applications, etc.)?

 Yes  No

### Special Consideration Notes

Is there additional clarifying information or context about the extent of project benefits.? This additional information will help the team better evaluate benefits and/or match your project

with potential sources of funding. This field may be blank if there is no need for clarification. Examples of additional information or special considerations include:

- Has the community the project is located in had a major natural disaster, other than COVID-19, under Stafford Act in the last seven years?
- Are there neighborhoods/populations/communities within your project's impact area that you would consider particularly vulnerable to the impacts of climate change and coastal hazard?
- Does the project involve the beneficial use of dredged materials?
- Water quality benefits - does the proposed project include implementation of one or more best management practices with a nitrogen, phosphorus, or sediment reduction efficiency established by the Virginia Department of Environmental Quality or the Chesapeake Bay Program Partnership in support of the Chesapeake Bay TMDL Phase III Watershed Implementation Plan?
- Other benefits that this survey might have not captured?

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# APPENDIX C – CAPACITY BUILDING AND PLANNING NEEDS CLASSIFICATION SCHEMA

## TYPES AND SUBTYPES FOR STUDIES & DATA TOOLS CLASS

Class: Studies and Data Tools	
<b>Type: Studies</b> – structured research efforts that help to improve understanding of coastal hazards, vulnerability/risk, and options to increase resilience and adapt to future coastal hazards.	
Subtype	Subtype Definition
<b>Flood Hazard Assessment</b>	Structured research efforts that serve to enhance the understanding of flood risk and related coastal hazards.
<b>Impact Assessment</b>	Structured research efforts that serve to enhance the understanding of exposure, vulnerability, and risk.
<b>Resilience Strategy Development</b>	Structured research efforts that serve to enhance the understanding of options to increase resilience and adapt to future coastal hazards.
<b>Type: Data Collection, Management, and Accessibility</b> – the collection, processing, management, or publication of data relating to coastal flood hazards and resilience.	
Subtype	Subtype Definition
<b>Data Collection</b>	Efforts to collect, process, manage, and/or publish data relating to coastal hazards and resilience to support the utilization of the best available data in research, planning, and design and/or increase public data accessibility.
<b>Data Accessibility / Tool Development</b>	Developing applications and tools to identify, aggregate, or display information on flood risk. This project subtype does not include updating or creating web pages or content for outreach and education (selection the Public Education & Outreach above for these activities).

## TYPES AND SUBTYPES FOR THE PROGRAMS, PLANS, & POLICIES CLASS

Class: Programs, Plans, & Policies	
<b>Type: Resilience Planning &amp; Education</b> – development of resilience plan including stakeholder outreach.	
Subtype	Subtype Definition
<b>Resilience Planning</b>	Efforts to create a resilience plan, or integrate coastal resilience and climate change planning considerations into existing plans, programs, and government functions. Planning efforts may include community and stakeholder engagement, intergovernmental coordination, best practice research, and strategy development.
<b>Public Education &amp; Outreach</b>	Projects aimed at educating and empowering the public in relation to coastal hazards and resilience. Activities may include the development of educational materials, hosting public meetings and workshops, conducting surveys, building community partnerships, establishing community-based programs, and analyzing and incorporating findings into relevant planning efforts and programs.
<b>Type: Resilience Programs &amp; Policies</b> – development of programs and policies that would lead to a reduction of impacts of coastal hazards.	
Subtype	Subtype Definition
<b>Buyout Program</b>	Acquisition of properties that have been damaged by or may be prone to incurring damage caused by storms or storm-related flooding or acquisition of land/property which may buffer or protect other lands from such damage.
<b>Financial Programs</b>	Programs to support the funding and financing of resilience projects. Program types may include bonds, taxes, fees, and revolving loan funds.
<b>Policies &amp; Standards</b>	Changes in land use codes, ordinances, zoning, development and design standards, incentive programs, or other local policy to better acknowledge the reality of climate change and/or advance coastal resilience objectives.

## TYPES AND SUBTYPES FOR THE TECHNICAL ASSISTANCE CLASS

Class: Technical Assistance	
<b>Type: Resource Assistance</b> – training existing staff or hiring new staff to improve capacity to identify and mitigate flood impacts.	
Subtype	Subtype Definition
<b>Training</b>	Efforts to institutionalize resilience within an organization by training staff and partners on the principles of climate change, coastal hazards, vulnerability, and/or resilience, and how to apply such principles in their professional roles.
<b>Staffing</b>	Hiring a full-time employee (such as a Chief Resilience Officer) or dedicating staff time to focus on advancing coastal resilience efforts, including project management and program coordination.
<b>Type: Financial Assistance</b> – contracting with expert consultants or advisors to help acquire or manage a grant to support project development or implementation.	
Subtype	Subtype Definition
<b>Grant Management</b>	Assistance for managing a grant or another funding source once it has been secured.
<b>Grant Application Development</b>	Technical writing and application development to garner project funding from federal or non-profit grant programs.



# APPENDIX D – CAPACITY BUILDING AND PLANNING NEEDS SURVEY

The Data Call Form for the Capacity Building and Planning Needs Survey is provided on the following pages:

## Virginia CRMP Data Call: Capacity Building & Planning

### What is the purpose of this survey?

The Commonwealth of Virginia is preparing a Coastal Resilience Master Plan (CRMP) that will serve as a roadmap to flood resilience. The purpose of this survey is to gather information from communities, localities, or other who might not have identified projects and what capacity building and planning is needed to determine future projects.

The Virginia Coastal Resilience Master Plan Leadership Team, in coordination with the TAC and Project Identification (PI) and the Virginia Coastal Resilience Master Plan consultant team, have identified two main categories: Capacity Building and Planning and Flood Resilience Projects defined as follows:

1. "Capacity Building and Planning" includes engaging stakeholders through community outreach and education, improving the ability of local governments through training of existing staff, hiring personnel, contracting with consultants or advisors, and other related actions that identify and mitigate risk and flood impacts.
2. "Flood Resilience Projects" involve activities that would lead to the implementation on-the-ground projects, acquisition of land, or implementation of land use controls that reduce flood risks and impact coastal communities. These projects can include conceptual or preliminary designs, continued and expanded stakeholder engagement efforts, detailed cost estimates, and final design and permitting.

This survey is for Capacity Building and Planning initiatives. If your project is a Flood Resilience Project, please use this survey: <https://arcg.is/100vOm0>.

### How will this information be used?

The contributed capacity building and planning information will be used to understand the knowledge gaps and needs, and inform future planning and research efforts on coastal resilience and flood prevention.

### When should I submit this information?

**Please complete this survey by July 30.**

### Submit a Capacity Building & Planning Need

#### Submitter Name\*

Please provide the name of the person familiar with the capacity building and planning effort who can answer questions; typically, an employee of—or agent for—the owner as defined below. The submitter should be the contact person providing the information for this data call.

**Submitter Contact Info\***

Please provide the contributor's email address, in case we need to reach them to clarify information about the identified capacity building and planning needs.

**Capacity Building & Planning Need Title\***

Please enter a short, descriptive name for the Capacity Building and Planning need.

Examples:

- "[Locality] Resilience Plan"
- "Bathymetric Data Collection for [Locality]"
- "Resilience Public Outreach for [Locality]"

**Description\***

Please provide a brief description of the capacity building and planning need. This should be two sentences long in most cases. The first sentence should clearly state the scope and goals of the capacity. The second sentence should state how the increased capacity will develop future projects that meet the goals of the CRMP.

**Owner\***

Enter the locality, agency, entity, or person that will need increased capacity, regardless of land ownership. If a locality will implement the capacity building and planning, the owner is the locality. If a government agency will implement the capacity building and planning, the owner is the government agency. If a business or non-profit organization will implement the capacity building and planning, the owner is the business or non-profit organization.

**Related Project?**

Is this capacity building and planning need related to a project you have submitted / will submit on the Flood Resilience project data call? If not, please leave this field blank.

**Please enter the related Project Name below, ensuring the name is the same on both forms.**

### Purpose & Need\*

What is the primary purpose and need for the Capacity Building and Planning initiative?  
Select all that apply:

- Community resilience - would increase the capacity of the community to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimal damage to social well-being, health, the economy, and the environment.
- Economic resilience - would increase the capacity to understand the need for protection or adaptation of critical assets, systems, and networks that are vital to everyday functions, that if damaged or destroyed, would have debilitating effects on the economy, public health, and safety, and/or security.
- Ecosystem resilience - increased capacity would lead to improved outcomes for natural resources (e.g., beaches and dunes, wetlands, aquatic vegetation, forests, etc.)
- Risk awareness - the increased capacity would improve your jurisdiction/community/agency/organization's understanding of relevant current and future coastal hazards and risks?
- Adaptation options - the increased capacity would improve your jurisdiction/community/agency/organization's understanding of your options to increase resilience and adapt to future coastal hazards
- Planning capacity - would improve your jurisdiction/community/agency/organization's capacity to engage in coastal adaptation and resilience planning efforts
- Funding capacity - would improve your jurisdiction/community/agency/organization's capacity to fund coastal adaptation and resilience projects.
- Other

### Geographic Location\*

Please list the Virginia locality or localities the Capacity Building and Planning initiative is expected to benefit, i.e., the counties, cities, towns, and tribal territories that comprise the eight coastal Planning District Commissions and Regional Commissions (PDCs/RCs). This directory (<https://www.vandc.org/pdc-directory>) can help you determine which counties

directory (<https://www.pdesa.org/pdesa-directory/>) can help you determine which counties, cities, and towns comprise the Commonwealth's PDCs/RCs.

It can be assumed that Capacity Building would benefit the entire community (e.g. locality or localities) it is intended to serve.

Please enter the names of counties, cities, towns, and tribal territories, separated by commas.

  
1000

### Owner Classification

### Estimated Cost

Please enter the total estimate of all capacity building and planning costs.

### Resilience Considerations

Would the capacity building and planning be used for a relevant planning process? Select all that apply or use the "other" box to add another relevant planning process.

<input type="checkbox"/> Resilience Plan
<input type="checkbox"/> Comprehensive Plan
<input type="checkbox"/> Hazard Mitigation Plan
<input type="checkbox"/> Stakeholder Engagement
<input type="checkbox"/> Other

### Funding - Application Costs

Does the submitting organization have the resources to complete funding applications (e.g. grant applications, etc.) for the identified capacity building and planning needs?

Yes

No

Other

### Special Consideration Notes

Is there additional clarifying information or context about the extent of capacity building and planning needs of your community?

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### Existing Capacity & Other Capacity Needs

**Note** - this section only needs to be complete once per locality/organization. If this information has been previously entered in a different capacity building and planning form, this section can be left blank.

#### Existing Capacity

Please select the areas where your locality/organization CURRENTLY has capacity. Multiple areas can be selected, as appropriate.

Data Collection & Management - Efforts to collect, process, manage, and publish coastal hazard and resilience data to support research, planning, and design and improve public access to data.

Financial and Grant Management - Assistance for determining programs and grant options for funding and financing of resilience projects and managing a grant or another funding source once it has been secured.

Flood Hazard Assessment - Structured research efforts that serve to enhance the understanding of flood risk and related coastal hazards.

Grant Application Development - Application development to obtain project funding from federal or non-profit grant programs.



Impact Assessment - Structured research efforts that serve to enhance the



Public Education & Outreach - capacity building and planning aimed at educating and empowering the public in relation to coastal hazards and resilience. Activities may include the development of educational materials, hosting public meetings and workshops, conducting surveys, building community partnerships, establishing community-based programs, and analyzing and incorporating findings into relevant planning efforts and programs.



Policies & Standards - Changes in land use codes, ordinances, zoning, development and design standards, incentive programs, or other local policy to improve flood resilience. May also include bonds, taxes, fees, and revolving loan funds.



Resilience Planning - Efforts to create a resilience plan, or integrate coastal resilience and climate change planning considerations into existing plans, programs, and government functions. Planning efforts may include community and stakeholder engagement, intergovernmental coordination, best practice research, and strategy development.



Staffing - Hiring full-time employees (such as a Chief Resilience Officer) or dedicating staff time to focus on advancing coastal resilience efforts, including project management and program coordination.



Strategy Development - Structured research efforts that enhance the understanding of options to increase resilience to current and future coastal hazards.



Tool Development - Development of applications and tools to identify, aggregate, or display information on flood risk. This type of activities does not include updating or creating web pages or content for outreach and education (see Public Education & Outreach above for these activities).



Training - Efforts to institutionalize resilience within an organization by training staff and partners on the principles of climate change, coastal hazards, vulnerability, and resilience, and how to apply such principles in their professional roles.



Other

## Other Capacity Needs

Please rank the areas that best characterize your locality/organization's additional capacity planning and building NEEDS and priorities. Drag the items below according to the importance they have to your organization.



Data Collection & Management - Efforts to collect, process, manage, and publish coastal hazard and resilience data to support research, planning, and design and improve public access to data.



Financial and Grant Management - Assistance for determining programs and grant options for funding and financing of resilience projects and managing a grant or another funding source once it has been secured.



Flood Hazard Assessment - Structured research efforts that serve to enhance the understanding of flood risk and related coastal hazards.



Grant Application Development - Application development to obtain project funding from federal or non-profit grant programs.



Impact Assessment - Structured research efforts that serve to enhance the understanding of exposure, vulnerability, and risk.



Public Education & Outreach - capacity building and planning aimed at educating and empowering the public in relation to coastal hazards and resilience. Activities may include the development of educational materials, hosting public meetings and workshops, conducting surveys, building community partnerships, establishing community-based programs, and analyzing and incorporating findings into relevant planning efforts and programs.



Policies & Standards - Changes in land use codes, ordinances, zoning, development and design standards, incentive programs, or other local policy to improve flood resilience. May also include bonds, taxes, fees, and revolving loan funds.



Resilience Planning - Efforts to create a resilience plan, or integrate coastal resilience and climate change planning considerations into existing plans, programs, and government functions. Planning efforts may include community and stakeholder engagement, intergovernmental coordination, best practice research, and strategy development.



Staffing - Hiring full-time employees (such as a Chief Resilience Officer) or dedicating staff time to focus on advancing coastal resilience efforts, including project management and program coordination.





Strategy Development - Structured research efforts that enhance the understanding of options to increase resilience to current and future coastal hazards.



Tool Development - Development of applications and tools to identify, aggregate, or display information on flood risk. This type of activities does not include updating or creating web pages or content for outreach and education (see Public Education & Outreach above for these activities).



Training - Efforts to institutionalize resilience within an organization by training staff and partners on the principles of climate change, coastal hazards, vulnerability, and resilience, and how to apply such principles in their professional roles.

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# APPENDIX E – PROJECT SUITABILITY MATRIX

An initial draft for a high-level matrix of options is presented on the following page to assist entities to begin narrowing down project alternatives for more thorough evaluation. Further development and review is needed to improve this product.

Strategies are highly specific to the socio- and physio-graphic characteristics of any given area. Specific consideration by a professional should be given to identify the most appropriate strategy given project goal, objectives, site, life-cycle, and cost constraints.

Project Class	Project Type	Project Subtype	Flood Hazards Addressed				Benefiting Assets			Adaptive Capacity			Time Scale of Benefits/Design Life			Relative Unit Cost			
			Coastal Flooding	Riverine Flooding	Rainfall-Driven Flooding	Erosion*	Community Resources	Critical Sectors	Natural Infrastructure	High	Med.	Low	Near-Term	Mid-Term	Long-Term	Low	Medium	High	Very High
Natural and Nature-Based Projects	Natural Features	Barrier Island Restoration	X			X	X	X	X	X			X	X				X	
		Dune Creation and Restoration with Beach Nourishment	X			X	X	X	X	X			X	X				X	
		Stream/Floodplain Restoration		X		X	X		X	X			X	X		X	X		
		Maritime Forest Restoration	X*				X		X	X			X	X		X	X		
		Oyster Reef Restoration	X*				X		X	X			X	X		X	X		
		Submerged Aquatic Vegetation (SAV) Restoration	X*				X		X	X			X	X		X	X		
		Wetland Creation	X*				X		X	X			X	X		X	X		
		Wetland Restoration	X*				X		X	X			X	X		X	X		
	Nature-Based Features	Green Infrastructure			X		X	X	X	X			X	X			X		
		Living Shoreline	X*				X	X	X	X			X	X			X		
	Conservation & Adaptation	Buyout Program	X	X	X	X	X	X	X	X					X		X	X	X
		Conservation Easements	X	X	X	X	X	X	X	X					X		X	X	X
		Dam Removal		X	X	X	X		X	X					X		X	X	X
		Land Acquisition	X	X	X	X	X	X	X	X					X		X	X	X
		Public Facility Removal	X	X	X	X	X	X	X	X					X		X	X	X
		Parcel-Level Adaptation Program	X	X	X	X	X	X	X	X					X		X	X	X
Structural Projects	Flood Risk Reduction	Floodwalls	X	X			X	X			X	X	X	X	X				X
		Levees	X	X			X	X			X		X	X	X				X
		Pump Stations			X		X	X			X		X	X	X			X	
		Pluvial Measures			X		X	X			X	X	X	X	X		X	X	
		Surge Barrier and Tide Gates	X				X	X			X	X	X	X	X				X
		Temporary Flood Protection Measures	X	X	X		X	X			X		X	X	X			X	
	Structural Shoreline Stabilization	Offshore Breakwater				X	X	X			X	X	X	X	X				X
		Revetment	X			X	X	X			X	X	X	X	X				X
		Seawalls	X			X	X	X			X	X	X	X	X				X
	Community Infrastructure	Public Facility Elevation	X	X	X	X	X	X			X		X	X	X		X	X	X
		Public Facility Floodproofing	X	X	X	X	X	X			X		X	X	X		X	X	X
		Public Facility Relocation	X	X	X	X	X	X			X		X	X	X		X	X	X
		Road/Bridge Elevation	X	X	X	X	X	X			X	X	X	X	X		X	X	X
		Stormwater Drainage Improvements			X		X	X			X	X	X	X	X		X	X	X
	Utility Retrofit/Upgrades	X	X	X		X	X			X	X	X	X	X		X	X	X	

\*Erosion could include coastal shoreline erosion, bank/bluff erosion, riverbed/lakebed erosion, or upland erosion. This matrix does not distinguish between these types. Different measures may be needed to mitigate different types of erosion.

\*\*Vegetation helps attenuate wave energy and flow velocities; level of flood reduction depending on project size, design features, and storm event. Typically, natural features provide flood reduction benefits during smaller storm events.