Northern Virginia Regional Commission

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Resilience Risks and Resilience Impacts

Military Installation Resilience (MIR) is defined as 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**.

The Department of Defense Office of Local Defense Community Cooperation (OLDCC) has provided grant funds to NVRC to work with communities to develop strategies to protect resources necessary to enhance resilience at three military installations: Joint Base Myer-Henderson Hall, Fort Belvoir, and Marine Corps Base Quantico.

Key elements of the program are **Resilience Risks** and **Resilience Impacts**.

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Military Installation Resilience

Resilience Risks:

- Flooding (Regional Issue) & Tidal Surge (Fort Belvoir and Quantico Issue)
- Wind (Regional Issue)
- Drought (Low Priority Regional Issue)
- Wildfire (Low Priority Installation Issue)
- Earthquake (Low Priority Regional Issue)

Resilience Impacts: (Regional and Installation Issues)

- Water Availability
- Stormwater
- Wastewater
- Installation Energy
- Operational Energy (logistics infrastructure)
- Transportation (Logistics)
- Installation Access
- Communications

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OLDCC MIRR Goals

Form a Policy Committee and Technical Review Committee that are representative of the three bases and the community.

Gather Data and Documents to include the GIS Data layers for compatible use analysis and/or map production to be provided to OLDCC in the Esri File Geodatabase format (*.gdb) or Esri Shapefile format (*.shp). Data will be readable within standard Geographic Information Systems (GIS) software (e.g., Esri's ArcMap, etc.), and it will be limited to the Northern Virginia area around the three bases. The three military bases and the community will confirm that all geospatial data are publicly releasable prior to delivery. All geospatial data will include metadata.

Measures of progress are:
1) the outcomes arising from your engagement with the military installation and the number of interactions that occurred;
2) any deliverables from the project and their benefits for reducing impairments to the local mission or improvements to the resilience of the installation; and,
3) actions from the project that will be or have been carried out regardless of whether Federal funds are supporting it.

Complete Military Installation Resilience Review Study with:
- Executive Summary with high level summary recommendations
- Supporting documents
- Presentations on final report

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Meetings with Counties and Installations

NVRC personnel have met with County and Installation staff to discuss the goals of the grant:

Joint Base Myer-Henderson Hall	October 15 and 20, 2021
Fort Belvoir	October 18 and 26, 2021
Arlington County	November 1, 2021
Marine Corps Base Quantico	November 3 and 30, 2021
Fairfax County	November 10, 2021
Prince William County	November 12, 2021
Stafford County	November 16, 2021

A formal kick-off meeting with NVRC, the Counties, the Installations, and OLDCC was held 27 Jan 2022.

Virtual and in-person site visits, Technical Review Committee and Policy Committee meetings, and Workshops will be held monthly or bi-monthly until January 2023. The final project report is due March 2023.

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Resilience Projects Identified at Installations

Fort Belvoir
Joint Base Myer Henderson Hall
Marine Corps Base Quantico

Energy Security, Flooding, Shoreline Erosion
Ingress/Egress, Failing Infrastructure, Stormwater Flooding
Flooding, Shoreline Erosion, Utility Redundancy

Main Gate Flooding at Quantico

Shoreline Erosion at Quantico

Road Flooding at Belvoir

Sea-level Rise Flooding at Belvoir

Flooding at JBMHH 2019

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Workshops and Technical Review Committee Meetings

Workshop 1 held 23-24 Mar identified and ranked Climate Threats and Hazards:

High Priority Hazards
- High Temperatures
- Energy Demand
- Coastal/Tidal Flooding
- Pluvial Flooding
- Fluvial/Inland Flooding

Medium Priority Hazards
- Wind
- Winter Weather

Low Priority Hazards
- Drought
- Wildfire

Technical Review Committee meetings were held 3-5 May. Topics for discussion were:
- Climate scenario and hazard recap
- Review vulnerability assessment methodology and criteria
- Preview climate mapping

Policy Committee Meeting Update 19 May 2022
Workshop 2 – Vulnerability Analysis held 14-16 June 2022

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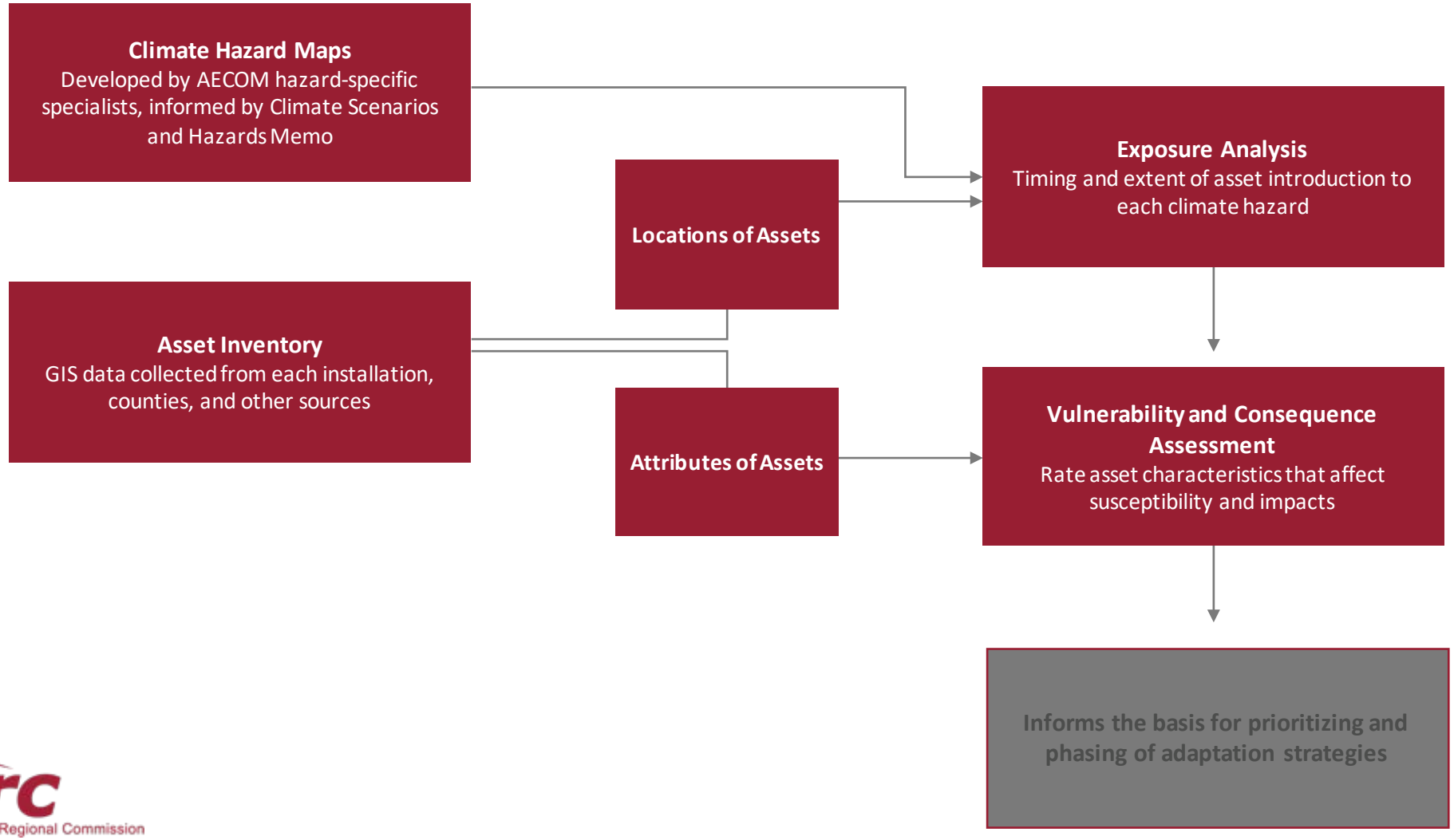
Vulnerability Assessment Methodology



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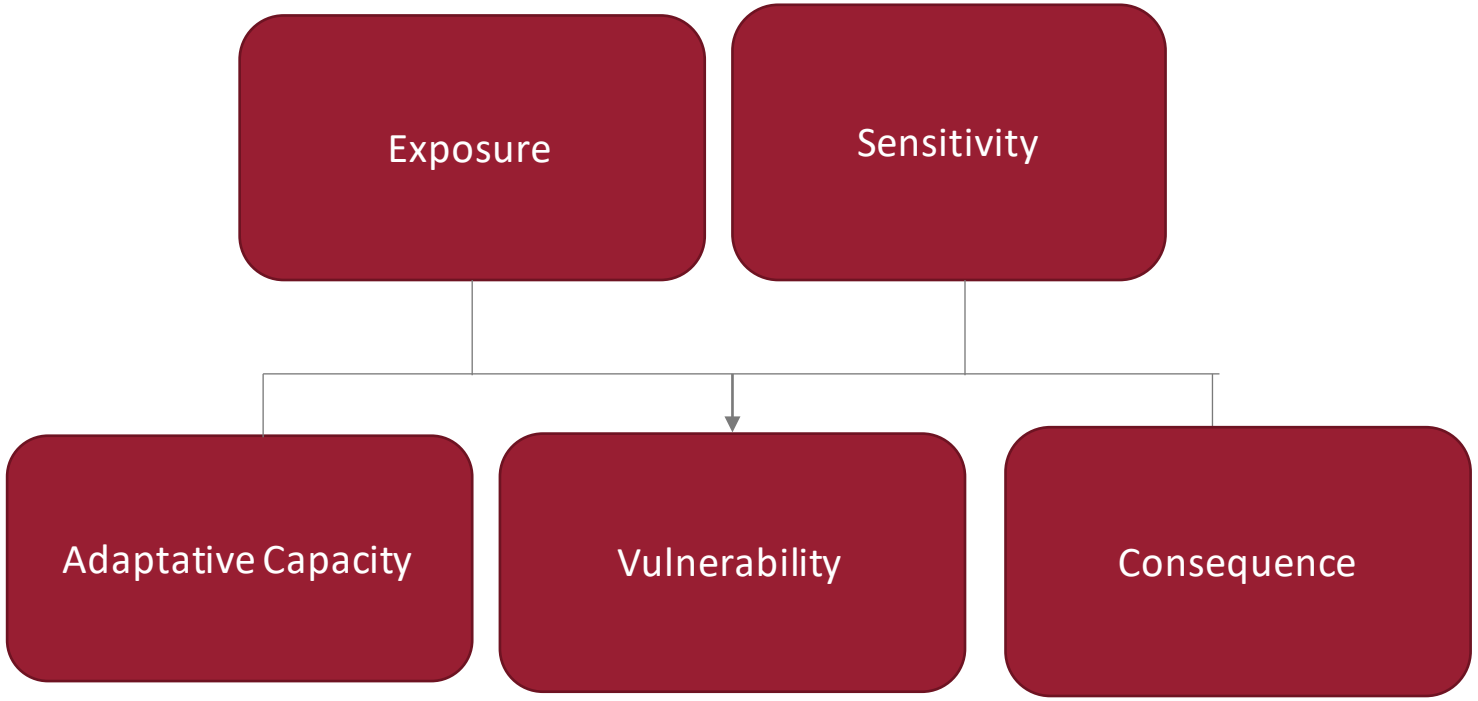
Vulnerability Assessment Methodology



Informs the basis for prioritizing and phasing of adaptation strategies

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Strategy Framework

- Little Creek Flooding Mitigation
- Fort Belvoir Substation
- Floating Solar for the Water Treatment Plant
- Battery Back-up and Microgrids for Installations and the Communities

Table 1. MIRR Strategy Framework

Hazards	Theme	Sub-Themes
Coastal and Inland Flooding	Physical	Fortify
		Accommodate
		Retreat
	Non-Physical	Governance/Policy/Informational
Energy Demand	Physical	Asset Capacity and Condition
		Alternate/Redundant Supply Paths
		Backup Generator Systems
		Distributed Energy Resources
		Infrastructure Hardening
	Non-Physical	Governance/Policy/Informational
Extreme Heat	Physical	Tree Canopy
	Non-Physical	Governance/Policy/Informational
Winter Weather	Physical	Infrastructure Hardening
	Non-Physical	Governance/Policy/Informational
Wind	Physical	Infrastructure Hardening
	Non-Physical	Governance/Policy/Informational
Wildfire	Physical	Fuels Treatments
	Non-Physical	Governance/Policy/Informational
Drought	Non-Physical	Governance/Policy/Informational
Other (affected by multiple hazards or not attributed to a specific hazard)	Physical	Water and Wastewater Service
	Non-Physical	Regional Connectivity and Access
		Emergency Management
		Governance/Policy/Informational

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Mitigation Strategies

- Shoreline Stabilization
- Quantico Electric Grid Improvements
- Floating Solar at Lunga Reservoir and Smith Lake
- Battery Back-up and Microgrids for Installations and the Communities

Table 2. Menu of Potential Physical Flood Mitigation Strategies

Theme	Sub-Theme	Description
Fortify *Resist the Hazard*	Elevate Shoreline	Elevating the shoreline to be above flood waters and installing supporting features, such as berms or elevated walkways.
	Elevate Transportation Features	Elevating transportation features to be above flood waters.
	Backflow Prevention	Adding in-pipe device configured to shut when there is reverse flow in stormwater discharge pipes due to high river or coastal floods.
	Sandbags	Deploying sandbags at flood entryways, such as doorways, low windows, or vents, to block flood waters.
	Deployable Flood Barriers	Constructing flood barriers that can be temporarily installed during storm events.
	Pumps	Adding pumps to help clear large amounts of floodwater that cannot be drained by gravity.
Accommodate *Work with the Hazard*	Living Shoreline	A living shoreline is a protected, stabilized coastal edge made of natural materials such as plants, sand, or rock, that can reduce erosion and provide transitional habitat along areas experiencing erosion.
	Dry Floodproofing	Making a structure watertight to prevent floodwaters from entering, such as armoring vents or waterproof sealant on walls.
	Elevate Structures	Elevating individual structures inland to be above flood waters, with measures like pile supports or elevated foundations.
	Raise Utility Components	Elevating individual utility components to be above flood waters.
	Increase Stormwater Pipe Capacity	Replacing, retrofitting, or re-routing stormwater pipes or culverts to accommodate higher peak flows, limit runoff, and increase water storage.
	On-Site Stormwater Storage	Diffuse inland green infrastructure strategies that absorb stormwater to prevent ponding and reduce peak flows during flood events.
	Green Infrastructure	Using natural features to store, treat, and/or infiltrate stormwater. Examples include rain gardens, bioretention spaces, bioswales, permeable pavement, and rain harvesting.
	Watershed Restoration	Returning a watershed as close as possible to its improved hydrologic, geomorphic, and ecological state.
Retreat *Avoid the Hazard*	Asset Relocation	Relocating individual assets inland, away from flood waters or the shoreline.
	Floodplain Expansion	Making room for floodwaters by acquiring land or restricting development in future modeled floodplains.

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Criteria Scoring

Environmental	**Environmental Regulations**	The strategy supports compliance efforts with relevant environmental regulations.	Positive (+1)	Strategy support compliance with environmental guidelines and goals set by agencies such as the EPA, Army, Navy, and Virginia Department of Environmental Quality.
			Neutral (0)	Strategy does not directly support compliance with environmental guidelines or strategy's impact on alignment with environmental regulations is unknown.
			Negative (-1)	Strategy fails to meet the environmental guidelines and goals set by agencies such as the EPA, Army, Navy, and Virginia Department of Environmental Quality.
	Habitat and Biodiversity	The strategy maintains or creates habitat and biodiversity.	Positive (+1)	Strategy creates habitat and biodiversity.
			Neutral (0)	Strategy maintains / has no impact on habitat and biodiversity or strategy's impact on habitat and biodiversity is unknown.
			Negative (-1)	Strategy harms habitat and biodiversity.

Next Steps

- Refine Strategy and Criteria Framework
- Continue with vulnerability analysis and integrate with strategies
- Prepare for Workshop #3
  - Target week: Oct 25-27, 2022
  - One day dedicated to each installation/county
- **Draft Report Jan/Feb 2023**

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MIRR POC and Questions

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