

**XVI. Appendix B. Climate Vulnerability Assessment Matrix.** This matrix evaluates vulnerabilities of the five-year CCMP strategies to impacts related to a changing climate, not necessarily restricted to the five-year duration of this Plan, but extending into the next decade and beyond

<b>EST</b>	<b>ECOSYSTEM STATUS AND TRENDS: Goals &gt; Objectives &gt; Climate Risks</b>	<b>SLR</b>	<b>T</b>	<b>P</b>	<b>OA</b>	<b>Consequence</b>	<b>Likelihood</b>	<b>Risk</b>
<b>EST-1: Increase availability/use of data related to coastal ecosystems and their services' responses to man-made stresses.</b>								
1.1	Establish a Data Management and Usage Strategy.							
	N/A							
1.2	Maintain or improve existing level of monitoring and data analysis to assess trends in coastal ecosystem health at a watershed-scale.							
	N/A							
1.3	Promote consistent system-wide monitoring to assess trends in coastal ecosystem health.							
	N/A							
<b>EST-2: Establish a process for measuring, analyzing, and communicating change in marine, estuarine, and freshwater ecosystem condition.</b>								
2.1	Synthesize monitoring data to develop a watershed condition index to track and communicate trends in watershed restoration and management.							
	N/A							
<b>EST-3: Model and predict connections between ecosystem condition and the ecosystem services people value.</b>								
3.1	Manage system for multiple services.							
	Increase in difficulty of achieving the multiple ecosystem services that people value due to degraded ecosystem condition from climate stressors.	X	X	X	X	M	M	<b>M</b>

**SCORING:**

**Consequence:** What is the effect of the threat on the Goal and Objective of the Action Plan?

LOW – not as important as other problems. The impact or challenge is not much worse than current or non-climate related challenges.

MEDIUM – a serious challenge. The impact negatively affects and degrades coastal habitats and wildlife.

HIGH – major disruption and challenge; goal may be impossible to achieve. The impact results in loss of coastal habitats and/or priority species.

**Likelihood:** What is the probability that the threat will occur?

LOW - it could happen

MEDIUM - it probably will happen

ERP	ECOSYSTEM RESTORATION AND PROTECTION: Goals > Objectives > Climate Risks	SLR	T	P	OA	Consequence	Likelihood	Risk
<b>ERP-1: Develop comprehensive management plans for all coastal watersheds (at the 12-digit hydrologic-unit-code scale).</b>								
1.1	Develop 12 new coastal watershed management plans for those basins discharging into priority fishery nursery areas.							
	Increased concentration of pollutants (nutrients, chemicals, bacteria, and trash) in runoff after prolonged periods of drought.			X		M	H	H
	Changes in nutrient cycling and primary productivity beneficial for harmful algae.		X		X	M	H	H
	Emergency releases of partially-treated wastewater from treatment facilities overloaded by inflow and infiltration during storm events.	X		X		M	H	H
	Increase in survival and growth of bacteria, viruses, and harmful algae.		X			M	H	H
	Septic system failures due to ground water saturation.	X		X		M	M	M
	Failure of low-lying wastewater lift stations and other wastewater conveyance infrastructure due to flooding.	X		X		M	M	M
	Decrease in function of stormwater structures to detain floodwater and pollutants due to increase in flashy stormwater volume and elevated water table or saltwater intrusion.	X		X		M	M	M
	Wash-out of coastal stormwater vaults, retention ponds, bioswales or vegetated areas, and lack of appropriate sites for relocation.	X		X		M	M	M
	Failure of underground storage tanks and industrial waste storage ponds.	X		X		M	M	M
	Inefficient drainage and capacity of stormwater pipes due to sea level rising above the level of outfalls.	X				L	H	M
	Increased direct and indirect atmospheric deposition of nitrogen originating from power plants experiencing increased demand.		X	X		M	L	L
	Increased concentrations of pollutants due to increased solubility with temperature and ocean acidification.		X		X	M	L	L
	Increased use of chemical treatments in stormwater ponds to reduce more frequent algae blooms.		X	X		L	M	L
1.2	Prioritize watersheds and seek funding for watershed management plans in other non-tidally influenced coastal watersheds.							
	see ERP-1.1							
1.3	Update existing watershed plans to include new watershed planning criteria.							
	N/A							
<b>ERP-2: Implement comprehensive watershed management plans with a focus on priority habitats.</b>								
2.1	Develop a Coastal Alabama Habitat Restoration Plan to guide watershed management plan implementation.							
	a. N/A							
	b. Freshwater wetlands							
	Changes in freshwater wetland hydrology (e.g., locations, quality, and types) due to extended drought, increased evapotranspiration and/or flooding.		X	X		H	M	H
	Loss of native plant and animal species due to temperature intolerance.		X			H	M	H
	Changes in plant pests and diseases leading to species and habitat loss.		X	X		H	M	H

	Changes in wetland species composition and zonation, including spread of invasive species.		X	X		M	H	H
	Increase in development pressure in the upper watershed due to hazards of coastal	X		X		M	M	M
	b. Streams, rivers, and riparian buffers.							
	Increase in sedimentation due to greater erosion and scour from tributaries.			X		H	H	H
	Increase or decrease in episodic volume and velocity of freshwater to tidal creeks and the bay, affecting salinity and life cycles of dependent fish and shellfish.			X		H	M	H
	Increase in salinity upstream that compresses isohaline zone and reduces low salinity habitat that provides fish nursery and refuge zones.	X				H	M	H
	Increase in growth rates of bacteria and algae in waterways.		X	X	X	M	H	H
	Increased difficulty in restoring natural/historic hydrology due to sea level rise, seasonal shifts, flashiness, increased storm intensity, and increased demand for consumptive water use.	X	X	X		M	M	M
	Increase in salinity upstream affecting zonation and species composition of riparian plants.	X				M	M	M
	OA, nutrient, and low dissolved oxygen hot spots in creeks, canals and bayous due to decomposing organic matter, including HABs.		X		X	M	M	M
	Increase in creeks and waterways clogged by invasive plants.		X			L	M	L
	b. Intertidal marshes and flats.							
	Loss of shallow intertidal habitat due to upland barriers to migration.	X				H	H	H
	Reduced capacity of salt marsh to buffer against upstream sediment and nutrient inputs due to loss of habitat.	X				H	H	H
	Reduced seagrass cover and epiphytes due to changes in water clarity, temperature, depth, and pH.	X	X	X	X	H	H	H
	Decrease in juvenile fish, shellfish, and bird feeding, breeding and refuge habitat.	X	X	X	X	H	H	H
	Increase in shellfish harvest closures.		X	X		M	H	H
	Decrease in fitness and growth of oysters and other shellfish.				X	M	M	M
	b. Uplands adjacent to coastal habitats to accommodate landward migration due to sea level rise.							
	Increase in community priority to protect property with shoreline hardening and resistance to removal of barriers.	X		X		H	H	H
	Reduced coastal habitat function and restoration opportunities due to abandoned coastal structures.	X		X		M	M	M
<b>ERP-3: Improve ecosystem function and resilience through protection, restoration, and conservation along shorelines of coastal Alabama beaches, bays, and backwaters.</b>								
3.1	Develop a Comprehensive Regional Shorelines Plan for stabilization and protection.							
	Increased coastal erosion and loss of beaches and coastal wetlands.	X		X		H	H	H
	Decrease in juvenile fish, shellfish, and bird feeding, breeding and refuge habitat due to loss of natural shorelines.	X				H	H	H
	Increase in community priority to protect property with shoreline hardening and resistance to removal of barriers.	X		X		H	H	H

	Alterations to island geomorphology (e.g. overwash or loss of barrier islands) and changes to water exchange and bay circulation.	X		X		M	M	M
<b>ERP-4: Improve mangement of invasive species through coastal Alabama watersheds.</b>								
4.1	Develop invasive species management plans (ISMPs) for coastal watersheds.							
	Spread of existing and new invasive species.		X	X	X	M	H	H
	Increase in viral, bacterial, fungal, and parasitic infections of fish, bivalves, crustaceans, and seagrasses.		X	X	X	M	H	H
<b>ERP-5: Restore and expand human connections to nature as a mechanism for improving environmental protection.</b>								
5.1	Protect and conserve priority habitats for public benefit and access by acquisition or easement.							
	Decrease in lands available for conservation due to inundation and transition of coastal lands to submerged or intertidal habitats.	X				M	H	H
5.2	Create seven new access points, at least five in Mobile County, incorporating environmental and cultural themes into each site's interpretive signage.							
	Reduced and/or restricted public access to beaches, coastal parks, and natural areas due to shoreline stabilization measures, tide control structures, reduced clearance under bridges, and flooding.	X		X		M	H	H

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TAC	TECHNICAL ASSISTANCE AND CAPACITY BUILDING: Goals > Objectives > Climate Risks	SLR	T	P	OA	Consequence	Likelihood	Risk
	<b>TAC-1: Build capacity of water-dependent industries to improve sustainability of working waterfronts and preserve fishing communities.</b>							
1.1	Conduct a comprehensive assessment of the current status of all safe harbors, including, but not limited to, USACE-designated locations.							
	Fewer choices in appropriate locations due to higher tides and increased flooding that reduces bridge clearance and access to docks and pull-outs.	X				M	L	L
1.2	Pilot a peer lending program to support fishing business investment in best practices.							
	N/A							
1.3	Promote the assessment, improvement, and designation of estuary ports as "Green Ports."							
	N/A							
1.4	Develop planning tools to balance multiple uses of marine, estuarine, and freshwater resources.							
	Increase in difficulty of balancing multiple uses due to degraded ecosystem condition from climate stressors.	X	X	X	X	M	M	M
<b>TAC-2: Build capacity of the business community to support ecosystem protection and restoration.</b>								
2.1	Engage the business community in support of implementation of the CCMP.							
	Difficulty in motivating businesses to get involved due to conflicting social and political considerations for prioritizing environmental protection.	X	X	X	X	M	M	M
2.2	Engage businesses in influencing local resource management decision-making.							
	Difficulty in motivating businesses to get involved due to conflicting social and political considerations for prioritizing environmental protection.	X	X	X	X	M	M	M
<b>TAC-3: Build capacity of local governments to manage and enhance coastal environmental resources.</b>								
3.1	Support implementation of eight coastal watershed management plans.							
	Higher project design, implementation, and maintenance costs due to changing baseline conditions.	X	X	X	X	M	M	M
	More difficulty permitting projects due to increased uncertainty around future environmental conditions.	X	X	X	X	L	L	L
3.2	Support establishment and operation of watershed plan partnerships and task forces to ensure local ownership of implementation activities.							
	Reduced citizen support, cooperation, and action due to feelings of hopelessness or fear over climate change impacts.	X	X	X	X	L	L	L
3.3	Improve elected officials', planning commissions', and other land-use decision-makers' understanding of the relationships between land-use, water resources management decisions, and environmental impacts.							
	N/A							
3.4	Improve regulatory framework to better protect coastal resources.							
	Difficulty in motivating elected officials to prioritize response to environmental impacts due to other competing social and infrastructure needs.	X	X	X	X	M	M	M

3.5	Support actions to protect and restore coastal habitats, increasing community and economic resilience.							
	Increase in community demand to protect property with shoreline hardening and resistance to removal of barriers resulting in loss of coastal habitat.	X		X		M	H	H
	Reduced coastal habitat function and restoration opportunities due to abandoned coastal structures.	X		X		M	M	M
3.6	Inform elected officials and the public about changing climatic conditons and sea level rise.							
	N/A							
<b>TAC-4: Advocate integration of watershed management plans into community and economic development.</b>								
4.1	Advocate integration of environmental protection into community and economic development.							
	Difficulty in motivating elected officials to prioritize response to environmental impacts due to other competing social and infrastrucutre needs.	X	X	X	X	M	M	M
4.2	Advocate inclusion of better building practices in long-range planning to improve environmental and community resilience.							
	Difficulty in motivating elected officials to prioritize response to environmental impacts due to other competing social and infrastrucutre needs.	X	X	X	X	M	M	M
	Perception of higher initial project design, implementation, and maintenance costs.	X	X	X	X	M	M	M
<b>TAC-5: Build capacity of grassroots groups and citizens to create more resilient and environmentally-responsible communities.</b>								
5.1	Support and promote opportunities to expand grassroots capacity development.							
	Reduced citizen support, cooperation, and action due to feelings of hopelessness or fear over climate change impacts.	X	X	X	X	M	L	L
5.2	Develop comprehensive strategy for volunteer water quality monitoring to expand citizen science and community engagement programs to inform status and trends.							
	Reduced citizen support, cooperation, and action due to feelings of hopelessness or fear over climate change impacts.	X	X	X	X	M	L	L

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<b>EPI</b>	<b>EDUCATION AND PUBLIC INVOLVEMENT: Goals &gt; Objectives &gt; Climate Risks</b>	<b>SLR</b>	<b>T</b>	<b>P</b>	<b>OA</b>	<b>Consequence</b>	<b>Likelihood</b>	<b>Risk</b>
<b>EPI-1: Improve the business community's understanding of how coastal natural resources and estuaries contribute to economic, cultural, and community well-being.</b>								
1.1	Conduct 15 tours to introduce the private sector to watersheds.							
	Reduced participation in outdoor watershed-related education due to extreme weather conditions, pests, diseases, and reduced water quality.	X	X	X	X	M	L	L
1.2	Develop outreach to improve business community understanding of opportunities for environmental protection.							
	Fewer opportunities to positively frame environmental messages and stories.	X	X	X	X	M	L	L
<b>EPI-2: Increase the business community's involvement in and support for protecting the estuary and coast.</b>								
2.1	Create a minimum of five service opportunities to engage business "teams" in participating in restoration or clean-up efforts.							
	Reduced participation in outdoor watershed-related recreation, volunteering, and education due to extreme weather conditions, pests, diseases, and reduced water quality.	X	X	X	X	M	L	L
	Difficulty in motivating businesses to get involved due to conflicting social and political considerations for prioritizing environmental protection.	X	X	X	X	M	M	M
2.2	Identify and connect business partners to a minimum of three existing projects celebrating the cultural heritage of Alabama's estuaries and coast.							
	N/A							
<b>EPI-3: Improve community understanding of how estuaries and coasts support what people value about living in coastal Alabama.</b>								
3.1	Create and support recreational and educational programs and events that connect more people to local waterways and fish and wildlife.							
	Reduced participation in outdoor watershed-related recreation, volunteering, and education due to extreme weather conditions, pests, diseases, and reduced water quality.	X	X	X	X	M	L	L
	Reduced citizen support, cooperation, and action due to feelings of hopelessness or fear over climate change impacts.	X	X	X	X	M	L	L
3.2	Educate youth about watersheds, water quality, and environmental issues relevant to the CCMP's six values.							
	Fewer opportunities to positively frame environmental messages and stories.	X	X	X	X	M	L	L
<b>EPI-4: Use the Create a Clean Water Future campaign as a framework for encouraging actions to improve water quality.</b>								
4.1	Support Partners for Environmental Progress in launching the CCWF campaign through its business members.							
	Difficulty in motivating businesses to get involved due to conflicting social and political considerations for prioritizing environmental protection.	X	X	X	X	M	M	M
4.2	Engage local governments in adopting the CCWF campaign to promote improved stormwater management and the quality of water flowing throughout the Mobile Bay Watershed and into coastal waters.							
	N/A							
4.3	Create a strategy for implementing the Create a Clean Water Future Campaign at the community level.							
	N/A							

EPI-5: Increase community involvement in and support for stewardship, volunteer, and educational opportunities.									
5.1	Promote environmentally-friendly public events (e.g. parades, sporting events, fishing tournaments, etc.)								
	Reduced participation in outdoor watershed-related events due to extreme weather conditions, pests, diseases, and reduced water quality.	X	X	X	X	M	L	L	

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