WORKSHEET 1A. EXAMINE CATEGORY 1 CLIMATE-SMART DESIGN CONSIDERATIONS: *CLIMATE CHANGE EFFECTS ON TARGET STRESSORS*

BLACK DUCKS-WETLANDS

A1	A2	A3	A4	A5	A6	A7
Action number	**Existing Management Action**	**Target Stressor(s)**	**Climate change effects on stressor(s): (direction, magnitude, mechanism, uncertainty)**	**Timing of climate change effects**	**Implications for effectiveness metrics and how to measure them**	**Notes**

1	**Chesapeake Rivers Conservation Phase II**: Conservation easements and habitat protection & restoration.	Loss of habitat due to:
		• Residential development & habitat fragmentation
		• Drainage of wetlands for agriculture
		• Sea level rise
		• Invasive species (nutria, phragmites, etc.)
			• There is little direct effect of climate changes on human residential development & habitat fragmentation, but the projected increase in frequency and intensity of rainstorms could increase effects of development, e.g.:
			  ○ Flashier runoff from impervious surfaces.
			  ○ Increased runoff of sediments from disturbed land (including agricultural lands contained within the project area).
			• There is little direct effect of climate change on agricultural drainage in this area. Indirect effects could be through greater demand for irrigation because of the longer growing season and less summer precip. Disincentives to use conservation practices if corn prices go up.
				• Climate changes in precipitation, runoff, and sea level rise and severe storms are already occurring.	**Effectiveness metrics:** Acres of wetland habitat remaining undeveloped (looking at tracking patch size and using an average score to compare to size that would be related to habitat quality, or some other score related to ecological flows, or in-tactness, or resilience). Some measure of wetland function or quality (as phragmites, or as high quality habitat that supports black duck energetics), e.g species diversity, sediment accretion, subsidence (elevation changes), rate of change in sea level. Number of nesting or feeding waterfowl. Pore water salinity, vegetation composition, distribution and abundance, energetic carrying capacity. Restoration of hydrology – monitor for those hydrologic factors targeted for restoration to see whether they are	Sea level rise includes salt water intrusion, subsidence, storm surge
						
						Be prepared for extreme events to engage with local communities about vision for communities and how to get there.

					functioning as intended under climate change. Fluctuation in ground water (variability within and across years). Observation of success of species with different temperature tolerances. **Targets for metrics:** **Implications for how to measure metrics**: Monitoring protocols with fixed timing or locations may need to be modified to account for shifts in habitat use or changes in phenology.	
2	**Nanticoke Watershed Improvement Project (Maryland**): *Phragmites* eradiation.	• Invasion by *Phragmites australis,* will be exacerbated by changing temps, CO2 and nutrient conditions	-Changing temps, CO2 and nutrient conditions will make it more hospitable to phragmites invasion. -Copes better with SLR than native grasses -Benefits from runoff (increased nutrients, etc.)		**Effectiveness metrics:** **Targets for metrics:** how much phragmites remain post removal, and other species present on parcels after removal **Implications for how to measure metrics:**	-If you kill phragmites, do you have something that will come in and replace it? Could lose the marsh. Monitor and learn whether marsh rebuilding keeps up with SLR, and if not, change strategy. -keep in front of everyone what the objective is for all projects (columns on "objective", "management action", "target stressor"…)
3	**Rappahannock River Conservation Partnership Phase I**: Conservation easements & habitat management.	• Development and habitat fragmentation; the Davis property may be sold for further development if not purchased for conservation easement.			**Effectiveness metrics:** **Targets for metric:** **Implications for how to measure metrics:**.	

4	**Dragon Run, Phase I (Virginia)**: Conservation easements.	Loss of black duck habitat due to: • Residential development & habitat fragmentation • Hardwood harvesting	.		**Effectiveness metrics:**. **Targets for metric** **Implications for how to measure metrics:**.	
5	**Chesapeake Rivers Conservation Phase I**: Conservation easements & habitat protection.	• Development • Intensive sylviculture			**Effectiveness metrics:** **Targets for metric:** **Implications for how to measure metrics**:	

WORKSHEET 1B. EXAMINE CATEGORY 2 CLIMATE-SMART DESIGN CONSIDERATIONS: *IMPACTS OF CLIMATE CHANGE ON MANAGEMENT ACTIONS*

BLACK DUCKS-WETLANDS

B1	B2	B3	B4	B5	B6	B7	B8
Action number	Existing management action	Changes in effectiveness of management action due to: climate impacts on target stressor	Changes in effectiveness of management action due to: climate impacts on management action	Time frame or constraint for using the action and implementation (e.g., urgency, longer or shorter term)	What changes are needed to adapt the action (place, time, and engineering design)	Climate-Smart Management Action	Notes
1	**Chesapeake Rivers Conservation Phase II**: --- Conservation easements (perpetual and term), acquisitions and habitat protection & restoration. -Water control structures - Buffers - Berms - Contouring	- Flashier runoff from impervious surfaces. -Increased runoff of sediments from disturbed land (including agricultural lands contained within the project area). - Indirect effects could be through greater demand for irrigation because of the longer growing season and less summer precip. Disincentives to use conservation practices if corn prices go up. -Sea level rise affects longevity of sites as black duck habitat.	A variety of climate change impacts including flooding, salt marsh migration, salinity changes, large storm events, sea level rise, could affect quality, area, and location of wetlands & upland habitats intended for preservation. -Protecting a single place in perpetuity is not necessarily protecting habitat, so do you lock up property permanently (acquisition) or make it an easement? -If bluffy site versus low elevation, slr won't have as significant impacts. If not upland/above bluff, would want to think of more passive restoration rather than berms and water control structures. -High marshes	• The urgency comes primarily from the threat of development. • Not a time constraint, but have to be opportunistic about land that becomes available. Those parcels may or may not be in places that would be chosen for easements ideally.	• Plantings need to account for changing climate conditions. • Will have all low marsh habitat and not much high marsh habitat in the long term, so may need to build water control structures, dikes, etc., now for high marsh habitat. • Conduct experiments such as removal of trees from high marsh areas to inform on future decisions to support inland migration of marshes. • Use climate considerations to develop roadmap for where practices could be done and then make policy changes to target investments to incentivize conservation practices on ag lands • Discuss with NRCS the inputs to their		This piece of land isn't worth as much if sea level rise inundates the property, but has potential value for SAV habitat; is valuable in short term as high quality black duck habitat to buy time. USDA NRCS specs for runoff controls are likely over-designed and could handle climate-induced changes in runoff from ag lands

B1	B2	B3	B4	B5	B6	B7	B8
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					engineering design (designs are based on standards; can standards be changed or are waivers for specific projects permitted?		
2	**Nanticoke Watershed Improvement Project (Maryland)**: *Phragmites* eradiation.	-might make it harder to control phragmites	Eradicating phragmites might make it harder to maintain (build up) salt marsh to keep up with SLR	Timing of application of glyphosphate to affect phragmites and not other vegetation under climate change because of longer growing season and higher temps. (How does the growing season for phragmites change vis-à-vis other marsh vegetation?)	-Plan to limit erosion and encourage development of marshland after eradication. -Monitor to check on rates of erosion. -Monitor growing season and growth of other plants (i.e., lengthening of season and growth period of other marsh plants); revisit timing of spraying to see whether it should be delayed and how long.	-Focus on subwatersheds with all Phragmites and spray; monitor to evaluate need for additional management (i.e., post eradiation planting of natives, if they don't re-establish after phragmites removal). -Prioritize areas for phragmites removal where SLR is projected to be slower.	• Changes in effectiveness of management actions using glyphosphate?
3	**Rappahannock River Conservation Partnership Phase I**: Conservation easements & habitat management.					.	
4	**Dragon Run, Phase I (Virginia)**: Conservation easements.			.			
5	**Chesapeake Rivers Conservation Phase I**: Conservation						

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	easements & habitat protection.						