SARASOTA BAY
ESTUARY PROGRAM
Restoring Our Bays

Climate Vulnerability Assessment Stakeholder Forum 1

I. Introduction

The Sarasota Bay Estuary Program (SBEP) is tasked with revising its Comprehensive Conservation and Management Plan (CCMP) to minimize the vulnerabilities of Program goals to future climate change. The first step of this process is to determine the risks that climate change stressors may pose to six SBEP Goals, as outlined in its CCMP:

1. Improve water transparency.
2. Manage the quantity and improve the quality of stormwater runoff to Sarasota Bay.
3. Restore shoreline and wetland habitats and eliminate further losses.
4. Restore and sustain fish and other living resources in Sarasota Bay.
5. Provide increased levels of managed access to Sarasota Bay and its resources.
6. Engage, educate, and encourage environmental stewardship of Sarasota Bay and its resources.

SBEP's partner organizations harbor significant knowledge about the Sarasota Bay watershed and its water management infrastructure that is essential to conducting the vulnerability assessment. The Science and Environment Council of Southwest Florida (SEC), a consortium of 30 leading science-based environmental organizations in the region, was engaged to convene and facilitate two Climate Vulnerability Assessment Stakeholder Forums in partnership with SBEP. The goal of the forums is to facilitate knowledge transfer from SBEP partner organizations, committees, boards, and other relevant stakeholders to inform assessment of CCMP vulnerabilities to climate change.

The first forum, held November 10, 2016, was jointly organized by SBEP and SEC to obtain stakeholder input about regional vulnerabilities to potential climate change stressors. Fifty-five participants from 24 stakeholder organizations participated in one large group discussion facilitated by meeting and process facilitators, real time recording and eleven subject matter experts. Forum structure and management was designed to provide participants a general introduction to the purpose and objectives of SBEP's Climate Vulnerability Assessment, then generate a broad list of reasonably foreseeable ways that climate change stressors could impact SBEP's ability to achieve its Program Goals. Each of six Program Goals was addressed in turn with participants asked to brainstorm the question: "With respect to the specific climate

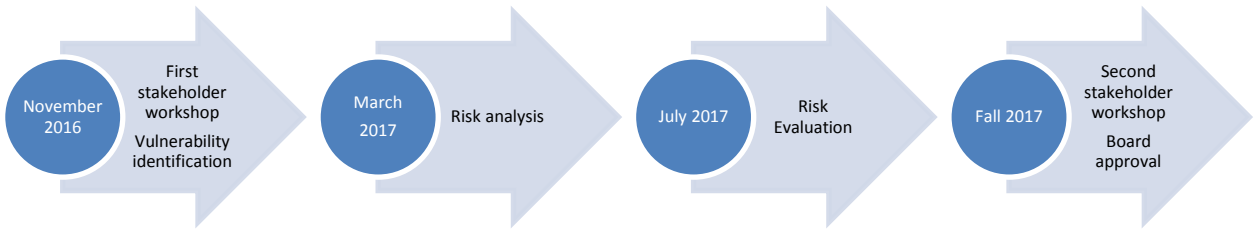
changes stressors of sea level rise, increased temperature, altered precipitation patterns and ocean acidification, what are the possible threats from climate change that could impact achieving the Goal?"

II. Vulnerability Matrix

Over 100 participant responses were recorded and projected on a large screen during the facilitated discussion. Responses were organized by Program Goal into a matrix of vulnerabilities coded by the relevant climate change stressor(s). For each vulnerability, a statement of the threat is followed by the process or proximate cause of the threat. For example, "Emergency releases of partially treated wastewater from overloaded treatment plants (threat) due to stormwater inflow through manholes and infiltration into sewer laterals (process)." Thus, the vulnerability statement identifies the path by which the climate stressor(s) might lead to an unrealized Program Goal. Results are shown in Matrices 1-6.

III. Next Steps

The next step in the Climate Change Vulnerability Assessment is Risk Analysis. The identified vulnerabilities will be analyzed and ranked with scores based upon their probability (likelihood of occurrence) and consequence (degree of impact to our goals). The results of the Risk Analysis will be sent out for expert peer review. Then in Fall 2017, the second Stakeholder meeting will be convened to present the results of the Risk Analysis and to gather Stakeholder input on prioritizing vulnerabilities for action. Adaptation strategies will then be developed for the highest priority vulnerabilities. All of this information will directly inform our comprehensive plan rewrite in 2018-2019.



IV. Participants

Around The Bend Nature Tours	Karen Willey
Charlotte Harbor National Estuary Program	Jaime Boswell
City of Bradenton	Catherine Hartley
City of Sarasota	Gerald Boyce
City of Sarasota	Stevie Freeman-Montes
Conservation Foundation of the Gulf Coast	Lee Amos
Conservation Foundation of the Gulf Coast	Debi Osborne
Florida Fish & Wildlife Research Institute	Dr. Tim MacDonald
Florida House	John Lambie
Florida Native Plant Society	Dave Feagles
Manatee County	Charlie Hunsicker
Manatee County	Nan Summers
Marie Selby Botanical Gardens	Dr. Bruce Holst
Marie Selby Botanical Gardens	Mike McLaughlin
Marie Selby Botanical Gardens	Jeannie Perales
Marie Selby Botanical Gardens	Jennifer Rominiecki
Mote Marine Laboratory	Aly Busse
Mote Marine Laboratory	Dr. Jim Culter
Mote Marine Laboratory	Dr. Kellie Dixon
Mote Marine Laboratory	Dr. Emily Hall
Mote Marine Laboratory	Barbara Lausche
Mote Marine Laboratory	Jason Robertshaw
Mote Marine Laboratory	Brad Tanner
New College of Florida	Danielle Husband
Ringling College of Art + Design	Tim Rumage
Sarasota Bay Estuary Program	Mark Alderson
Sarasota Bay Estuary Program	Cheryl Dexter
Sarasota Bay Estuary Program	Dr. Jay Leverone
Sarasota Bay Estuary Program	Christine Quigley
Sarasota Bay Estuary Program	Darcy Young
Sarasota Bay Estuary Program - CAC	Wayne Douchkoff
Sarasota Bay Estuary Program - CAC	Lesley Fleming
Sarasota Bay Estuary Program - CAC	Marion Kuster

Sarasota Bay Estuary Program - CAC	Jack Merriam
Sarasota Bay Estuary Program - CAC	Lou Newman
Sarasota Bay Estuary Program - CAC	Tommy Vaughan-Birch
Sarasota Bay Estuary Program - CAC	Rob Wright
Sarasota Bay Watch	Dr. Larry Stults
Sarasota County	Lee Hayes Byron
Sarasota County	Joe Kraus
Sarasota County	Brooke Langston
Sarasota County	Jon Robinson
Sarasota County	Alyssa Vinson
Sarasota County	Molly Williams
Sarasota County	Shawn Yeager
Sarasota Audubon	Julie Byrne
Science and Environment Council	Dr. David Shafer
Science and Environment Council	Dr. Jennifer Shafer
South Florida Museum	Samantha Sprague
Southwest Florida Regional Planning Council	Jim Beever
Southwest Florida Water Management District	Patricia Robertshaw
Tampa Bay Estuary Program	Maya Burke
Town of Long Boat Key	Juan Flourensa
Venice Area Audubon	Bob Clark
Venice Area Audubon	Ann O'Leary

ACTION PLAN: Wastewater Treatment and Reclamation

GOAL: Improve water transparency

	Vulnerability	Stressor			
		SLR	temp	precip	OA
1	Emergency releases of partially treated wastewater from overloaded treatment plants due to stormwater inflow through manholes and infiltration into sewer laterals	X		X	
2	Emergency release from wastewater system in advance of forcasted storms due to inadequate capacity.			X	
3	Septic system failure due to ground saturation. In some cases, rising water level in drain field may *reduce* nitrogen transport due to adsorption of ammonia to sediments.	X		X	
4	Changes in nitrogen transport and denitrifiction due to higher ground water levels. Models not calibrated to new baselines.	X		X	
5	Changes in bacterial and algal growth, affecting nutrient cycling and reducing transparency, increase in HABs		X		X
6	Reduced capacity of spray fields to absorb wastewater during wet season			X	
7	Failure of low lying lift stations due to inundation	X		X	
8	Reduced use of reclaimed water due to elevated salinity from infiltration of pipes	X			
9	Surface water discharge permits mismatched to future stormwater volume			X	
10	Increased runoff leading to higher color levels, reduced light penetration at depth leading to retreat of segrass.			X	
11	Increased survival of bacteria and viruses due to warmer water temperatures		X		
12	Failure of underground storage tanks and industrial waste storage ponds	X		X	

ACTION PLAN: Stormwater Treatment and Prevention

GOAL: Manage the quantity and improve the quality of stormwater runoff

	Vulnerability	Stressor			
		SLR	temp	precip	OA
1	Greater episodic freshwater volume and velocity and more nutrient, bacterial and sediment pollution due to flash flooding			X	
2	Increased solubility and/or toxicity of pollutants in stormwater		X		
3	Flooding due to inefficient drainage and capacity of stormwater pipes as sea level rises above outfalls	X			
4	Increased fertilizer runoff into bay			X	
5	Increased nutrient loading due to increased residence time in bays and stormwater ponds	X		X	
6	Failure of stormwater ponds due to decrease in depth of underlying water table level limiting water percolation into underlying soils	X			
7	Increased solids in the bay due to increased coastal erosion and overloaded stormwater system components			X	
8	Increase in metal ions in the bay from CO2 related acid rain and acidic erosion of metal stormwater pipes				X
9	Reduced efficiency of nutrient removal by coastal stormwater ponds due to salt stress on aquatic and littoral plants	X			
10	Existing storwmater pond maintenance practices ineffective under new conditions	X	X	X	
11	Reduced capacity of mangroves to buffer against upstream sediment and nutrient inputs due to changing habitat availability	X			
12	Increased volume and reduced treatment of stormwater due to increased pervious surfaces from population growth and new development			X	
13	Increased algal blooms in stormwater ponds impacting human and ecosystem health downstream		X	X	
14	Increased nutrients in stormwater from use of reclaimed water for landscaping irrigation			X	
15	Increased atmospheric deposition of nitrogen directly to waterbodies and indirectly via runoff from land (esp. from power plants)		X	X	
16	Increased run offf of pet waste and trash (especially plastics)			X	
17	Increased chemical runoff from agriculture due to change in farming practices		X	X	
18	Increased denitrification in saturated soils leading to redeuced nutrient loading			X	
19	Increased concentration of pollutants in runoff after being concentrated during prolonged periods of draught followed by storm flooding and overflows from underdesigned stormwater system components.			X	
20	Stress to organisms due to change in dynamic of saline to freshwater transitions including reduced dissolved oxygen due to stratification of fresh on top of saltwater layers			X	
21	Increased concentration of nutrients in stormwater ponds leading to increased algal blooms and increased chemical treatments which short-circuits the efficiency of biotic nutrient removal			X	
22	Increased input of fertilizer and pesticides to landscaping due to temperature and draught stress		X	X	
23	Increased growth rate of bacteria, reduced dissolved oxygen		X		
24	Inundation/wash-out of coastal stormwater vaults, retention ponds, bioswale or vegetated areas	X			
25	Lack of appropriate sites for relocating stormwater control structures	X		X	
26	Deficiencies in Land Development Regulations that do not address changing runoff volume, groundwater elevations and salinity barriers	X		X	

ACTION PLAN: Freshwater & Saltwater Wetland Restoration

GOAL: Restore shoreline and wetland habitats and eliminate further losses

	Vulnerability	Stressor			
		SLR	temp	precip	OA
1	Spread of invasive species	X	X		
2	Inadequate light penetration due to increasing depth	X			
3	Loss of shallow coastal habitat, including seagrass, mangroves, salt marsh and beaches.	X			
4	Habitat loss due to ineffective design standards for coastal restoration (e.g. 4:1 slope versus 10:1 slope)	X			
5	Habitat loss and poor habitat quality due to continuing hardened shoreline maintenance practices	X			
6	Loss of coastal habitat due to shoreline hardening in response to sea level rise	X			
7	Loss of wetlands due to inadequate research on and commercial supply of plants adapted to future conditions needed for wetland restoration	X	X	X	X
8	Slow adoption of living shorelines due to difficult permitting	X			
9	Loss of native species due to temperature intolerance, especially under other stressors such as improper pruning (e.g., mangroves)		X		
10	Permanent loss of ephemeral freshwater wetlands due to oxidation of soils during prolonged draught			X	
11	Change in wetland species composition	X	X	X	
12	Change in plant and animal pests and diseases	X	X	X	
13	Loss of coastal habitat due to upland barriers to migration	X			
14	Reduced coastal habitat function and restoration opportunities due to abandoned coastal structures	X			
15	Change in microclimates created by forested wetlands		X	X	

ACTION PLAN: Fisheries and Other Living Resources

GOAL: Restore and sustain fish and other living resources

	Vulnerability	Stressor			
		SLR	temp	precip	OA
1	Spread of exotic and invasive species, parasites and disease	X	X	X	
2	Change in fish, crustacean and bivalve species composition (and distribution)	X	X	X	X
3	Reduction in juvenile and adult fish recruitment, growth, survival, behavior and sensory systems due to changes in water temperature, salinity and pH (aquatic and marine)	X	X	X	X
4	Reduction in bivalve and crustacean growth, survival and fitness due to changes in water temperature, salinity and pH	X	X	X	X
5	Reduction in scallops growth, survival and fitness due to changes in temperature, salinity and pH	X	X	X	X
6	Change in seagrass cover due to changes in water clarity, temperature, depth and pH	X	X	X	X
7	Loss of bird feeding and breeding habitat	X	X	X	
8	Loss of localized forage fish for birds (seasonal timing and distribution out of synch)		X	X	
9	Loss of nestig habitat for sea turtles	X			
10	Increase in growth and toxicity of harmful algal blooms		X		X
11	Increase in algal growth on seagrass		X		
12	Loss of juvenile fish habitat and food source (seagrass, mangroves, tidal creeks), especially spotted sea trout and common snook	X			
13	Increased wildfire and increased difficulty and risk with prescribed fire due to longer dry periods		X	X	
14	Change in distribution of Manatees due to changing spring and seagrass conditions and water temperature	X	X		
15	Reduced nursury habitat in streams and rivers due to compressed isohaline zones from sea level rise and increased freshwater flow	X		X	
16	Increaed fungal infections, lesions and tumors in fish due to increased discharge into waterbodies	X		X	
17	Reduced genetic recruitment and dispersal due to stress on regional populations, not just local	X	X	X	X
18	Oxygen depletion with higher temp		X		
19	Reduced fish habitat in tidal creeks due to erosion and shoreline hardening	X		X	
20	Change in upland habitat distribution for sensitive species such as gopher tortoise and scrub jay			X	
21	Change in reptile sex ratio		X		
22	Refugia for sensitive organisms with seagrass icrobuffering of pH				X
23	Increased carbon sequestration in mangroves, seagrass, marsh				X
24	Loss of temperate species at southern end of geographic range (bluefish, scallops, etc)		X		
25	Impacts to benthic species due to increased sedimentationand lower dissolved oxygen		X	X	

ACTION PLAN: Recreational Use

GOAL: Provide increased levels of managed access to Bay and its resources

	Vulnerability	Stressor			
		SLR	temp	precip	OA
1	Reduced participation in outdoor recreation due to extreme weather conditions		X	X	
2	Reduced participation in water recreation due to reduced water quality (clarity, dissolved oxygen, nutrient pollution)		X	X	
3	Loss of access points and recreational trails along shores including Gulf beaches, bays, rivers	X		X	
4	Loss of boat ramps and marina access	X			
5	Reduced participation in outdoor recreation due to media exposure of negative events (HAB, flesh-eating bacteria, Zika, etc)		X	X	
6	Impacts to recreational fishing opportunity and enjoyment due to loss of recreational species		X	X	X
7	Impacts to birding and ecotourism (except positive if increase in exotic tropical birds) due to loss of species and/or change in migration timing	X	X		
8	Reduced access to beaches due to more frequent renourishment projects	X			
9	Reduced public access due to hardening of shorelines	X			
10	Reduced access and overcrowding of beaches due to smaller beach area and competition with nesting birds and turtles	X			
11	Loss of invertebrate fauna and animal foraging due to increases beach renourishment	X			
12	Reduced participation in coastal recreation due to increase in HABs		X		
13	Reduced access to area cultural and environmental attractions due to increased coastal flooding	X		X	
14	Extended recreational boating season leading to greater resource pressure		X	X	
15	Extended hurricane season		X	X	
16	Changes in access to bay inlet sandbars due to changes in tidal flow, bay circulation and sea level	X			
17	Reduced participation and enjoyment due to invasive noxious plants and pests		X	X	
18	Reduced access to natural areas due to flooding and trail washouts			X	
19	Unstable recreation and ecotourism business conditions due to unpredictable environment	X	X	X	X
20	Loss of boater access upstream and donwstream creeks and rivers due to new tide control structures	X			

ACTION PLAN: Stewardship

GOAL: To educate, engage and encourage environmental stewardship of Bay resources

	Vulnerability	Stressor			
		SLR	temp	precip	OA
1	Reduced participation in outdoor volunteer opportunities due to heat		X		
2	Lack of concern due to slow pace of change and sliding baseline	X			
3	Continual need for education due to growing number of new residents and visitors	X	X	X	X
4	Confusion and message fatigue due to competing priorities and mixed messages in media and outreach	X	X	X	X
5	Pessimism due to negative framing and lack of progress, resources and solutions	X	X	X	X
6	Increased attention on digital environment instead of natural environment with indoor activities favored over outdoor activities	X	X	X	X
7	Lack of opportunities for meaningful and ongoing citizen science and repeat engagement	X	X	X	X
8	Lack of effective education on necessity of prescribed fire for benefit of human safety and environment			X	
9	Lack of curriculum in K-12 schools	X	X	X	X
10	Lack of collaboration and unified voice on response to climate change	X	X	X	X
11	Difficulty encouraging stewardship and support for adaptive measures in people who may not believe in climate change	X	X	X	X
12	Lack of creativity in engaging across sectors to different stakeholders	X	X	X	X
13	Lack of incentive for taking action due to belief that individuals cannot make a difference	X	X	X	X
14	Under engagement due to bias that one individual action (like recycle or changing lightbulbs) is enough	X	X	X	X
15	Lack of knowledge and direction about how to contribute to solutions in order to overcome negative and hopeless feelings	X	X	X	X
16	Lack of concern and urgency due to lack of sense of heritage, history and sense of place	X	X	X	X
17	Changed public perceptions of natural areas and our ability to restore them with threat of Zika and future pathogens		X		
18	Lack of public support for coastal restoration and land acquisition in the face of ongoing sea level rise	X			
19	Lack of appreciation for how novel ecosystems could recreate the services of the habitats and species we might lose		X		
20	Negative public perception of value of coastal restoration if it will all be lost anyway	X			

Unrelated to climate change or unrelated to program goals

	Other Concerns	Related Goal	Stressor
1	Relaxed water quality standards and regulations making it difficult to maintain and exceed current water quality level	wastewater	regulatory/political
2	Misdirected funding priorities for habitat restoration and maintenance	wetlands	regulatory/political
3	Increased infiltration to groundwater	n/a	SLR
4	Need for increased water treatment or identification of new water sources due to upstream migration of salinity wedge to intake pipes in streams and rivers	n/a	SLR