



Protecting Southwest Florida's unique natural environment and quality of life ... now and forever.

June 7, 2023

United States Army Corp of Engineers
Norfolk District
803 Front Street
Norfolk, VA 23510
Email: Collier-csrn@usace.army.mil

RE: NEPA scoping comments for the Collier County Coastal Storm Risk Management Feasibility Study (CSRSM)

Dear Ms. Katherine Perdue and USACE staff:

The Conservancy of Southwest Florida (Conservancy), on behalf of our over 6,500 supporting families, is pleased to provide you with our NEPA scoping comments for the reinitiated Collier County Coastal Storm Risk Management Feasibility Study (CSRSM). For nearly 60 years, the Conservancy has been a leading environmental organization dedicated to protecting Southwest Florida's unique wildlife, natural environment, and quality of life for current and future generations. The Conservancy supports climate adaptation and mitigation strategies that protect our natural environment as well as the people who enjoy our area and call it home.

Conservancy science and policy staff attended the April 2023 public meetings and stakeholder charrettes. At the culmination of the meetings, we were pleased to learn that the United States Army Corps of Engineers (USACE) will provide a new array of plan alternatives. We believe the previous recommended plan, from 2020, would have had serious detrimental impacts to Collier County's coastal environment, wildlife, and our economy. We also appreciate USACE staff's dedication to providing additional public input opportunities, which will be especially important after USACE staff develops and puts forth the new array of alternatives. In addition, we are thankful that USACE staff acknowledged that there was significant public support for the use of nature-based solutions to reduce storm risk, over a reliance on large structural measures.

While not exhaustive, our comments pose fundamental questions, raise issues, and provide information or recommendations to explore. Below is a summary of topics covered:

1. Address compound flooding issues and water quality impacts as a central focus of the CSRSM;
2. Expand the study area to include all coastal areas of Collier County. Comprehensive regional planning and scientific analysis is necessary to develop effective adaptation strategies;

3. Sufficient coordination is key to creating the most effective and efficient storm risk management plan;
4. Engage USACE's Engineering with Nature (EWN) team throughout the entire study and planning process;
5. Protect Critical Habitat Designated Areas;
6. Address the effects of beach armament on the shoreline and wildlife;
7. Quantify the impacts of inlet structures, including hydrologic effects and impacts to flora and fauna;
8. Integrate nature-based solutions and natural and nature based features;
9. Increase the use of non-structural measures;
10. Consider the costs or benefits from the proposed measures on the coastal economy;
11. Include a cost-benefit analysis of ecosystem services; and
12. Provide additional public information if structural measures are proposed.

1. Address compound flooding issues and water quality impacts as a central focus of the CSRM.

If the County requests that USACE address compound flooding, what approach will USACE utilize? A watershed approach? If not, how can the County ensure that unintended flooding of any type will not result from the alternatives proposed in the Plan?

Collier County faces numerous flooding issues beyond infrequent storm surge events, including, sea level rise, inland flooding from torrential rains, saltwater intrusion, and flooding associated with tidally influenced rivers, inlets and estuaries. If Collier County agrees to move forward on a storm resilience plan, the costs could be in the billions of dollars, based on the \$2.2 billion cost of the previous tentatively selected plan (USACE, 2020, Appendix C). A storm risk reduction plan of this magnitude and cost should address comprehensive flooding impacts, not just storm surge.

While it is understood that USACE will focus primarily on storm surge, unless Collier County requests inclusion of compound flooding, measures proposed only to address storm surge could exacerbate other types of flooding. Hydrodynamic modeling, with and without the project, could determine whether any proposed hardened structures would cause or exacerbate storm surge impacts in the areas adjacent to or near the structure. Further modeling should also examine the potential flooding risks, due to impoundment of stormwater runoff, to inland areas and areas behind the structure that the project was intended to protect.

To avoid unintended consequences, the study should utilize scientific analysis that weighs risk versus reward, and investigates potential negative impacts of employing each protective measure. The following should be assessed in a project versus no project analysis to determine

whether hardened structures, if proposed, could result in any negative causation effects, within, adjacent to, or upstream of the project:

- Potential of inland flooding and stormwater runoff impoundment to communities inland of any proposed floodwalls, if storm surge is compounded by heavy inland stormwater flow during storm events. As example, if the US41 floodwall were to be built and the gates were closed, Bayfront and River Park communities have the potential become flooded due to impoundment of stormwater after torrential hurricane rains.
- Hydrologic consequences to the developed and/or natural areas adjacent to or on either side of any proposed structures.
- Examine flooding effects seaward of any proposed floodwall and gates. For example, in the USACE 2020 CSRSM tentatively selected plan, the installation of a proposed two-and-a-half-mile floodwall along U.S.41 could have had significant flooding consequences for parts of downtown Naples, Tin City, Aqualane Shores, Port Royal, Windstar, Royal Harbor, Bayshore, and other communities seaward of the wall. When the gates are closed, the floodwall would block the surge from flowing up Naples Bay and to the Gordon River, thereby increasing flooding south of the floodwall.
- Potential for beach erosion, seaward flooding, storm surge stacking, and wave displacement seaward of any proposed structures, coinciding with a hurricane or coastal storm.
- Flooding associated with tidally influenced portions rivers, bays, or estuaries.
- Potential water quality impacts as a result of hardened structures and gate closures.
- Estuarine impacts from alteration of tidal flow, salinity regimes, sediment transport, and water impoundment, etc.
- If structures are proposed, there would be a potential for an increase in longshore current sediment transport in the nearshore areas contributing to more pass/inlet sand deposition and possible pass/inlet closures. Effects of the project on inlet dynamics, evolution, and stability should be considered in the evaluation.
- If structures are proposed, possible failure and/or submersion of inland gravity-fed stormwater systems and pumping stations, due to stormwater impoundment, resulting from project alignment.
- Possible effects to surface/groundwater connectivity due to structure anchoring points deep into the substrate.
- Potential of the structure to exacerbate or have negative impact on the drinking water aquifer, septic systems, wastewater plants or other utility infrastructure.

The Conservancy respectfully asks that any selected plan be holistic, considering all possible implications of the plan to ensure that any actions do not exacerbate conditions inland or seaward

of development or environmental communities. We recommend that USACE formulate alternatives per Section 8106 of the Water Resources Development Act, even if the study costs more and will take longer. Furthermore, robust flood modeling, with input provided by local scientists and engineers, should be completed in concert with CSRSM plan development and modeling to prevent unintended comprehensive flood risk.

- 2. Expand the study area to include all coastal areas of Collier County. Comprehensive regional planning and scientific analysis is necessary to develop effective adaptation strategies.***

While it is understood that the USACE resiliency planning scope has limitations due to regulations, Collier County must ensure that other geographic areas currently not covered by the study are included in the planning process, as they are equally important to the County's prosperity and sustainability. It is inherent, that storm surge will affect the coastal areas first, however care must be taken that plan alternatives do not expose vulnerable low topographical neighborhoods within or outside the project area to increased flood risk. Resiliency planning is crucial for shorelines not covered by the CSRSM. At the charrettes, coastal areas within Area 99 were mentioned, but not directly discussed. These coastal areas along portions or south of U.S. 41 include Everglades City, Chokoloskee and other low topographic areas such as Copeland, Port of the Isles, Isles of Capri, Bayshore, and other communities that are vulnerable to storm surge or inland flooding.

Could the USACE please describe the project scope for Area 99?

- 3. Sufficient coordination is key to creating the most effective and efficient storm risk management plan.***

The in-person charrettes that were held during April 25 through April 27 were a huge step forward towards collaboration with local experts. We encourage USACE to continue to accept input from the local scientific community, resilience planning experts, and the public in collaboration with government agencies, as this is essential to a successful CSRSM plan development. We also encourage USACE to continue to make use of the best available science and available tools that are focused on local conditions to guide initiatives and provide feedback. Many County resilience initiatives are concurrently being developed by organizations such as Rookery Bay and the SWFL Mangrove Monitoring Network. Plan effectiveness and resource efficiency could be compromised if USACE efforts are pursued in isolation to other resiliency efforts. Working together to develop resilience plans that address future climate challenges will help to prevent overlap or working at cross-purposes.

We encourage USACE to embrace the template of the Interagency Performance Evaluation Taskforce (IPET) developed by USACE to determine the performance of the New Orleans Flood Protection System in response to effects of Hurricane Katrina. The IPET study evaluated flood

control measures and performance, consequences and risk. Furthermore, the IPET taskforce engaged other federal agencies who had overlapping authorities in coastal flood mitigation and coastal resilience, along with the help of National Academies, to form an external peer review Committee to evaluate the IPET study. Once the CSRMs alternatives are developed, a Committee made up of similar entities could significantly enhance the scientific robustness and overall quality of the CSRMs project, while instilling public confidence in the plan.

4. Engage USACE’s Engineering with Nature (EWN) team throughout the entire study and planning process.

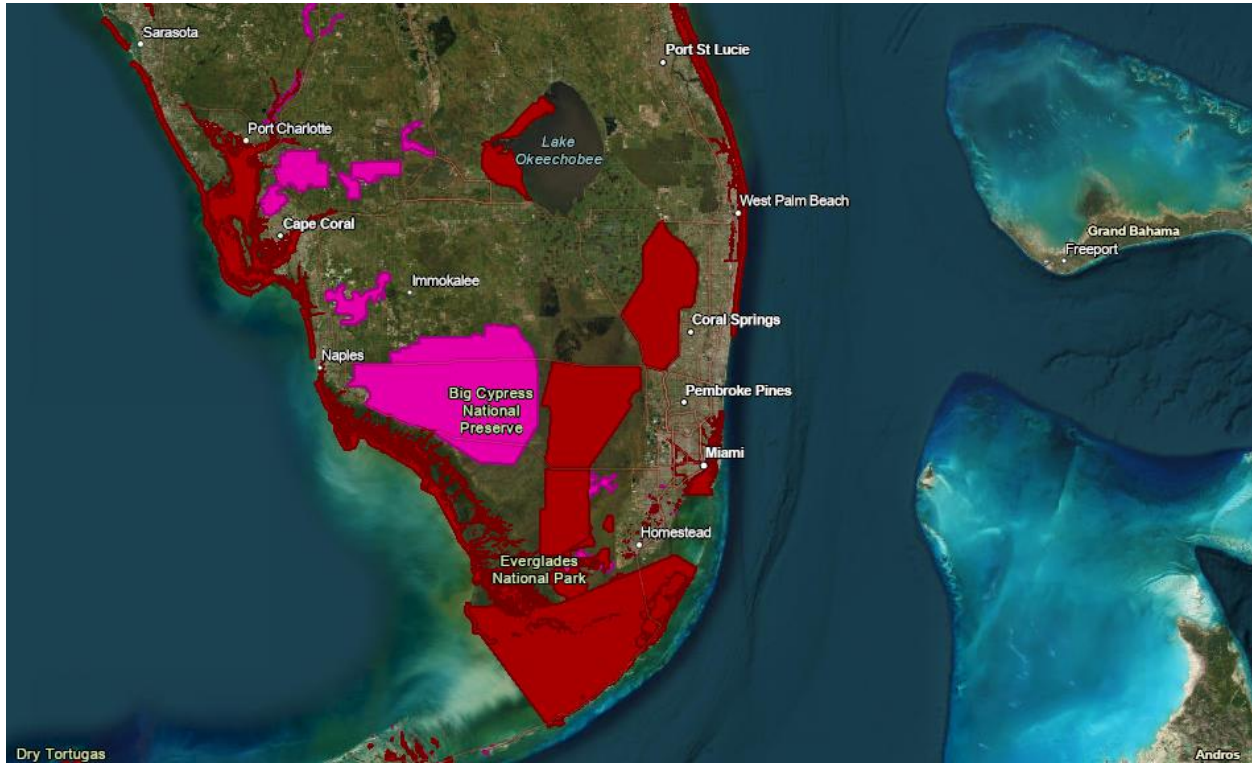
The Conservancy was pleased to learn at the charrettes that USACE’s team of scientists, engineers, and practitioners who work for the “Engineering with Nature” (EWN) program will be invited to work on Collier CSRMs. Because the EWN team has experience integrating engineering nature based solutions and features into storm resilience plans, it is our hope that they will become an integral part of the study and planning process, and that the EWN team will work in conjunction with our local scientists, engineers, and landscape architects.

5. Protect Critical Habitat Designated Areas.

How will USACE address critical habitat designations to ensure that these areas are protected?

The project area includes beaches with critical habitat designations (Figures 1 and 2). These areas require a thorough investigation into possible environmental impacts and are inappropriate for large structural alternatives. The purpose of this designation is to protect listed species by prohibiting federal agencies from permitting, or funding anything that adversely modifies the designated area (USFWS, 2022). These designations include Collier County beaches and nearshore areas and provide protective measures for the physical and biological resources required to support the listed species.

Figure 1: Critical Habitat for listed species in southwest Florida



Source: <https://fws.maps.arcgis.com/home/webmap>

Figure 2. Loggerhead sea turtles are one of the many species that has critical habitat designations on our shorelines (USFWS, 2014).



6. Address the effects of beach armament on the shoreline and wildlife.

It is estimated that ninety-four percent of Florida's beaches have already experienced some degree of anthropogenic coastal modifications (Hirsch et al., 2022). Florida Department of Environmental Protection (FDEP) estimated that anthropogenic and natural impacts have critically eroded over fifty percent of Florida's coastline to the extent that "upland development, recreational interests, wildlife habitat, or important cultural resources are threatened or lost" (FDEP, 2022).

Beach armoring is defined, for the purposes of this comment letter, as a man-made structure that is placed and/or anchored parallel to the shoreline for the purpose of protecting development from storm surge. Armoring includes, but is not limited to: vertical seawalls, sloped revetments, reinforced sand dunes, wooden walls, and other containment options. While armoring is intended to prevent erosion in the short-term, in the long-term armoring can accomplish the opposite by increasing longshore currents, displacing sand as waves hit the armament and flattening beaches, and by scouring effects (Pilkey Jr. et al., 1984, Morton, 1988, and Hall and Pilkey, 1991). Armoring can increase the potential for beach erosion, seaward flooding, storm surge stacking and wave displacement seaward of structures. Pros and cons of seawalls and their effects on beaches have been widely debated. In some locations, environmental concerns and the increased use of beaches for recreation and tourism are considered when assessing shoreline protective measures, whereas they were not included as factors a century ago (William, et al., 2016). When these factors are considered, solutions such as beach renourishment and/or submerged offshore structures are often replacing armaments (William, et al., 2016).

Collier County's beaches are typically narrower, (Collier County's natural and renourished beaches typically range from 30 ft. to less than 100 ft. respectively), in comparison to Florida's east coast beaches. Narrow beaches are typically not suitable for armoring, as the wave energy on narrow beaches tends to exacerbate erosion adjacent to and behind fixed structures. Other factors that would make armament of Collier County's beaches less suitable include, but are not limited to environmental, recreational, and economic impacts.

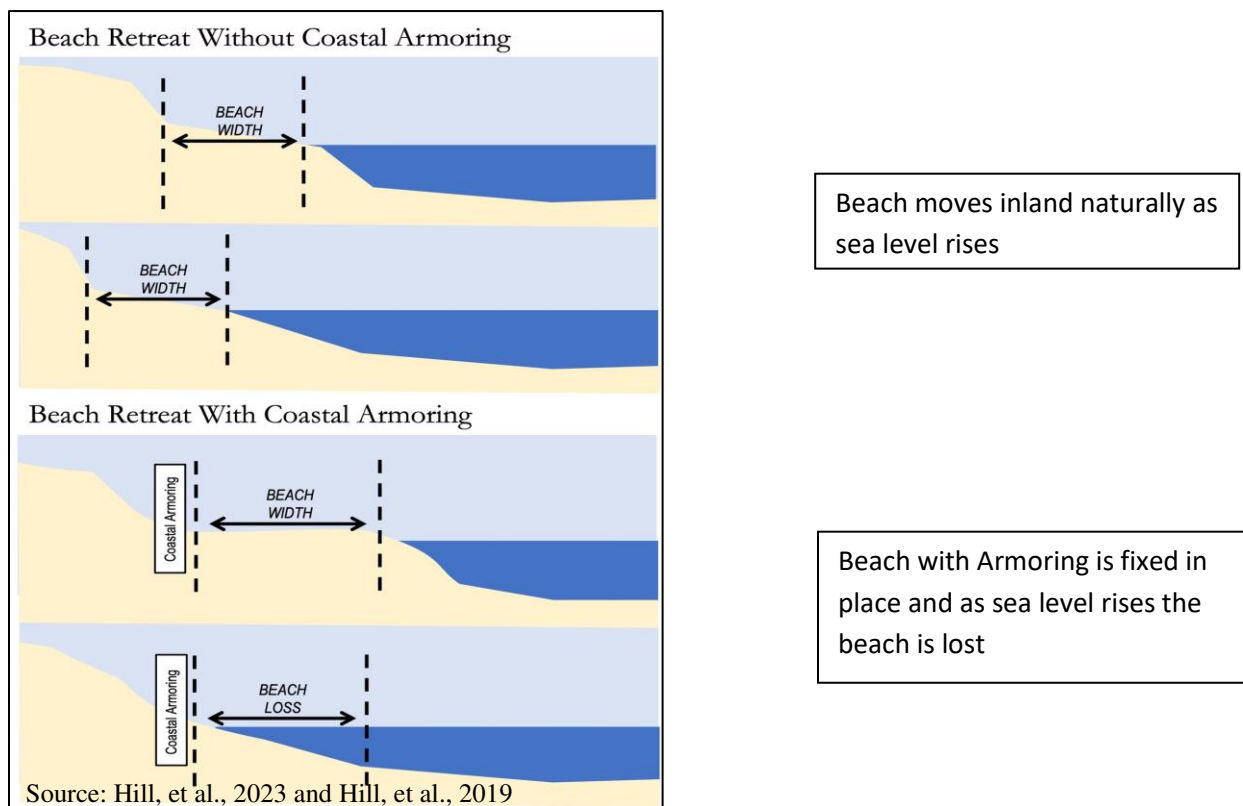
No matter the methodology or material, beach armoring is recognized by sea turtle biologists, worldwide, as the greatest threat to sea turtle nesting success, over all other anthropogenic coastal threats including shoreline development (Hirsch et al., 2022). The use of armored structures often has a negative effect on nesting behavior and ultimately nest success, particularly on narrow beaches like Collier County.

There are three species of sea turtles that have been documented nesting on Collier County beaches. Loggerhead (*Caretta caretta*)¹ make up the bulk of the nesting in Collier County,

¹ Loggerhead sea turtles are Federally listed as an Endangered species by the IUNC, and a Threatened species by the Federal Endangered Species Act, by Florida's Endangered and Threatened Species Rule, and by Florida's Marine Turtle Protection Act (379.2431, Florida Statutes).

followed by occasional nesting by green (*Chelonia mydas*)² and rarely by nesting leatherback (*Dermochelys coriacea*)³ sea turtles. Studies have indicated that armoring shorelines significantly lowers the nest density and reproductive success of these animals, likely in part due to habitat loss and physical encounters with the structure. Armaments typically compromise the dunes' ability to move inland (Figure 3) resulting in less available nesting habitat, which can increase egg predation and spread microbial infection that can arise from close nest proximity. Nests can even be destroyed by other nesting sea turtles when the nesting area is decreased in width due to coastal squeeze between rising seas and immovable armored shores (Mazaris et al., 2009). Additionally, if the barrier limits or alters the consistency of suitable nesting substrate this can deter the sea turtle from laying eggs, or if they do lay eggs in sub-optimal areas, hatching success can be compromised.

Figure 3. Natural Beach Response in Comparison to Armored Beach Response to Sea Level Rise Overtime



Sea turtle nesting sites are generally situated in the dunes, close to the vegetation or above the mean high water line to prevent the nest from being overwashed. Other studies suggest that

² Green sea turtles are Federally listed as an Endangered species by the Federal Endangered Species Act, by the IUCN, by Florida's Endangered and Threatened Species Rule, and by Florida's Marine Turtle Protection Act (379.2431, Florida Statutes).

³ Leatherback sea turtles are listed as Critically Endangered by the IUCN and Federally listed as an Endangered species by the Federal Endangered Species Act, by Florida's Endangered and Threatened Species Rule, and by Florida's Marine Turtle Protection Act (379.2431, Florida Statutes).

armorings shorelines negatively impacts these animals by the resulting energy loss from multiple nesting attempts that result in false crawls.

Loggerheads have a tendency to lay their eggs closer to the water if they encounter a hardened structure. This will substantially increase the probability of tidal overwash nest inundation which reduces hatching success by compromising embryo development, or if prolonged results in nest mortality (Witherington et al., 2011, Foley et al., 2006, Ware and Fuentes, 2018, and Limpus et al., 2020). Green sea turtles tend to prefer nesting in the upper portions of the beach in vegetated areas of the dune, which are often absent from armored shores and likely result in substantially reduced nesting success (Whitmore and Dutton, 1985 and Hirsch et al., 2022). Leatherback sea turtle nests are a rare occurrence on Collier County beaches, however, since this species nests anywhere on open beaches they would be the least impacted from shoreline hardening (Whitmore and Dutton, 1985).

The Florida Fish and Wildlife Conservation Commission has no evidence, to date, that the loggerhead sea turtle population in Florida is recovering and they recommend maintaining a high level of protection (Ceriani, et al., 2019). This is one of the many reasons shoreline hardening should not be considered on Collier County beaches.

Sea turtles are not the only wildlife species that could be impacted by hardening shorelines. Shorebirds, specifically those that use Collier County beaches and nearshore habitats for foraging, resting, nesting, or migratory stopovers should be evaluated for impacts resulting from any proposed structural measures. Loss of habitat from erosion and the loss of beach and dune migration due to structural features will likely result in less space for the birds to utilize. Dugan, et al., 2008 concluded that the upper sections of the beach were eroded and the middle sections were narrower in areas that were armored in comparison to those areas that were devoid of hardened structures. They also reported that the armored beachfront areas had significantly lower macroinvertebrates in the upper reaches of the beach thereby decreasing the available forage for shorebirds, resulting in lower avian species richness.

Several avian species have special designations and will need to be assessed, as these species will likely be impacted if any shoreline hardening structures are installed. These include species that have special species conservation measures and permitting guidelines such as the federally threatened piping plover, (*Charadrius melodus*) and red knot (*Calidris canutus rufa*); and state threatened least tern (*Sternula antillarum*), American oystercatcher (*Haematopus palliatus*), black skimmer (*Rynchops niger*), and snowy plover (*Charadrius nivosus*). Roseate terns (*Sterna dougallii*) are federally threatened and protected by the U.S. Migratory Bird Treaty Act, the Federal Endangered Species Act, and by Florida's Endangered and Threatened Species Rule. Other state threatened species include little blue heron (*Egretta caerulea*), reddish egret (*Egretta rufescens*), roseate spoonbill (*Platalea ajaja*), tricolored heron (*Egretta tricolor*) and wood stork (*Mycteria americana*), while the brown pelican (*Pelecanus occidentalis*) is still under state

management. Snowy egrets (*Egretta thula*) and white ibis (*Eudocimus albus*) are protected under the Federal Migratory Bird Treaty Act and state Rule 68A-16.001, F.A.C.

7. *Quantify the impacts of inlet structures, including hydrologic effects and impacts to flora and fauna.*

Should USACE consider storm surge barriers and gates for any of Collier County's inlets, we ask that the following information be considered. The potential impacts and secondary consequences of implementing flood gates at small inlets, such as those present in Collier County, that typically have shallow draft recommendations (≤ 3 ft.), and are part of an estuarine system, outweigh any benefits derived from their installation. Potential hydrologic negative effects include, but are not limited to the following:

- Seaward effects such as beach erosion, seaward flooding, storm surge stacking, and wave displacement seaward of the inlet gates to areas both inland, seaward, and adjacent to the gate and associated structural supports.
- Elevated risk of compound flooding inland of the inlet gates during storms as stormwater is unable to exit and becomes impounded.
- Water quality degradation due to stormwater impoundment. Subsequent impoundment of stormwater during gate closures has a high probability of degrading the water quality behind the gate. This elevates the potential of algal blooms, and exacerbates any red tide present in the vicinity when the gates are opened.
- Pre and post storm inlet gate operations are likely to have numerous negative effects on the environment, the estuary, and its inhabitants.

Impacts on aquatic resources and habitats from structures:

The following section outlines a few of our comments and concerns regarding anticipated impacts from the use of inlet gates and associated infrastructure on aquatic resources and habitats, however, this is in no way an exhaustive summary.

Mangroves have proven their worth ecologically and economically and are vital to Florida's future. Mangrove forests support a variety of life, from bacteria that break down their detritus, to higher trophic levels via intricate food webs (Teas, 1979). They provide nurseries for commercial and recreational fisheries, provide habitat and shelter for a variety of organisms, and serve as an indicator of overall estuarine health (Johansson and Greening, 2000). Any activities that alter the hydrology of an area can have severe consequences to adjacent native habitats. For example, hydrologic alteration that prevents above and below ground tidal flushing have caused mangrove die-offs in Collier County, including within the Clam Pass - Clam Bay estuary in 1992 and 1995. Prolonged closure of Wiggins Pass and Clam Pass would cause increased stress and mangrove mortality. Mangroves cannot tolerate extended hydroperiods, high flood levels, and/or water

impoundment for an extended length of time, as their oxygen storage and exchange becomes compromised and mortality is often the result (Worley, 2005). Any protective measures considered for the inlets that are part of a mangrove estuary should not have the possibility of causing undue stress or any die-backs or die-offs.

There is a paucity of research regarding aquatic species' migratory responses to storm events. Thus, the scientific understanding of species-specific response in advance of a storm is not well understood. However, based on the available literature, the likelihood of whether or not an aquatic species will leave the estuary or inlet in advance of a storm is species specific, driven by innate responses to an environmental cue or cues, such as the drop in barometric pressure, prey base availability changes, and/or life stage.

Some aquatic species are known to leave prior to a storm, but the timing of these migrations is variable, even within the same species. For example, juvenile bull sharks (*Carcharhinus leucas*) and blacktip sharks (*Carcharhinus limbatus*) left shallow estuarine waters in advance of Hurricane Irma for deeper waters, but individuals varied in the timing of their movements. Some bull sharks exited the inlet days prior to the storm, while others waited until just prior to landfall (Strickland, et al., 2020 and Heupel, et al., 2003). Therefore, the likelihood of entrapment will be dependent upon when the gates are closed. It is our understanding that gates will be closed well in advance of the storm, which would trap many species, lowering their survival rates.

Florida manatees (*Trichechus manatus latirostris*) on the other hand showed minimal movement prior to Hurricanes Charley, Katrina, and Wilma (Langtimm, et al., 2006). However, post-storm entrapment could cause injuries or prove deadly if the animals are forced by inland stormwater flows into the gate; or swept away once the gate is opened; or suffer from starvation if their forage supply was severely impacted and the gates remained shut for an extended period of time.

Some fish species also migrate out of estuaries and inlets in response to changes in barometric pressure prior to and during storm events. Fish species such as gulf flounder (*Paralichthys albigutta*) and the common snook (*Centropomus undecimalis*) are known to exhibit these behaviors (Massie, et al., 2020 and Patrick, et al., 2007). Fish diversity and abundance could be adversely impacted if their innate migratory instincts prior to, during, and post storms are restricted by inlet gates (Stevens, et al., 2006).

Post-storm related hypoxic events often occur within estuaries following storm events. The dramatic increase in precipitation that often accompanies storm systems introduces large volumes of stormwater in a short period of time into rivers and estuaries (Patrick, et al., 2020). This occurrence, in turn, causes hypoxic and hyposaline conditions within the estuary that subsequently results in changes in the faunal species abundance and diversity (Stevens, et al., 2006). The lack of tidal flushing imposed on the system if inlet gates are shut pre-storm will further deteriorate estuarine post-storm conditions by exacerbating anoxic conditions. These anoxic conditions would negatively affect the survivability of aquatic faunal species that are not adapted to tolerate low

oxygen levels. Studies have reported either short-term effects or long-term estuary recovery dependent on the severity of the hypoxic event (Stevens, et al., 2006). However, with the added stress of extended impoundment on estuarine conditions and their inhabitants due to inlet gate closures, recovery could be delayed or severely compromised.

Environmental impacts from surge barriers could become even greater than expected, due to the potential for more frequent gate closures than anticipated. Studies show that closure frequencies have increased over time for the Thames Barrier in Britain and the New Bedford Hurricane Barrier in the United States, in response to sea level rise (Orton, 2022). This potential for increased closure events should be factored into all impact analyses.

8. Integrate Nature Based Solutions and Natural and Nature Based Features.

The Conservancy appreciates that USACE is open to revisiting nature-based solutions and we hope that ideas presented by local stakeholders in the charrettes can be included in the plan. Nature-based solutions are the best option for Collier County in the short-term and long-term, and any plan proposed should not be a reaction to one storm event. In seventy-two years, only two storms have caused significant damage from storm surge (Hurricane Ian (2022) and Hurricane Donna (1960)). Whereas, numerous storm related events have caused damage from wind, precipitation flooding, and/or nuisance flooding. Based upon assessments of storm type and frequency from previous hurricanes that have impacted Collier County, probability favors more future wind and inland flooding events than storm surge events. Therefore, it is prudent and more cost-effective to plan for moderate storm surge events and more frequently incurred precipitation and nuisance flooding events.

At the public meetings and charrettes, the majority of the public that voiced opinions were in favor of nature-based solutions and opposed structural elements like walls along the shoreline or inlet gates. We believe all plan alternatives should integrate nature-based solutions (NBS) and Natural and Nature Based Features (NNBF), provided they are planned and implemented in the right way and in the proper locations. NBS/NNBF are often more cost effective measures for flood and storm risk reduction than hardened infrastructure (FEMA, 2022 and Beck et al., 2022), and they provide ecosystem services and wildlife habitats. NBS/NNBF also produce economic and social benefits. For instance, in addition to providing protection from wind and waves, mangroves are nurseries for fish, they sequester carbon, they provide erosion control, and they increase tourism and recreation. Furthermore, storm risk plans that work with nature will help to protect the county's tourism-based economy, which generates a \$2.6 billion economic impact for Collier County and supports over 30,000 jobs (Yanes, 2022).

Conservation and restoration of mangroves, barrier islands, salt marshes, coral and oyster reefs are nature-based alternatives that require serious consideration. These alternatives would provide a moderate level of protection and ensure our tourist-based economy, fisheries, wildlife, recreation,

and local aesthetics are protected, while also protecting the community from storms by attenuating the wind, waves, erosion, and flooding.

Mangrove Restoration and Rehabilitation

Mangrove dominated barrier islands are our first line of defense. Rookery Bay National Estuarine Research Reserve and the Ten Thousand Islands National Wildlife Refuge together form a natural “wall” protecting inland and coastal areas. These mangrove islands have protected Collier County from numerous storm events, particularly those storms that move inland from the south, southwest, southeast and the east. The City of Naples and inland Collier County would have experienced more damage by recent storms, such as Hurricanes Wilma (2005) or Irma (2017) and to some extent Ian, if not for those mangrove islands. Extreme weather is predicted to increase in the future (USGCRP, 2018) and the years between higher category storms shorten. Major hurricanes have increased by 8% per decade since 1979 (Michener, et al., 1997) and numbers and intensities in the Atlantic basin storms seem to be trending upward (Walsh, et. al., 2015). This could be very dangerous locally, as there might not be enough time in between storms for mangrove systems to recover sufficiently to protect communities. Barrier islands provide enormous storm impact absorption benefits, but subsequent restoration may be needed to expedite recovery and bolster resilience in between storm events.

It would be prudent for USACE and Collier County to investigate and include restoration of mangrove die-off areas in storm resiliency planning, where appropriate. Additionally, revitalization of mangrove islands following storms is recommended to assist in their recovery, where warranted and where there is a high probability of success. Many of our mangrove systems are stressed not just from hurricanes, but from anthropogenic causes such as coastal development, agriculture and aquaculture, tree harvesting and climate change (IUNC, 2016). Revitalization projects to increase the health of these systems will be a sound investment in our future.

Dune Restoration and Rehabilitation

Similar to mangrove forests, dune systems are a natural defense system against storms. Their ability to naturally recover following a storm depends on whether the dune can accumulate enough sand before the next storm arrives. Erosion of the beach and dune can occur over hours or days during a storm, but it can take years to decades to recover (Rodgers and Nash, 2016) and thus may require revitalization. Natural dune and beach migration is restricted as beach ecosystems are boxed in by development, which also causes loss of coastal strand communities (Williams, 2007). The position of the Coastal Construction Control Line (CCCL) throughout most of Collier’s coast is immediately behind the existing foredune. Thus, multiple dune ridges or dunes of considerable width or height are not appropriate for Collier County beaches. Additionally, this coastal region is typically a low wave energy system and storm-induced landforms, such as overwash fans, inlets, and damaged foredunes, occur less commonly than on high-energy coasts on Florida’s east coast (Harvey, et al., 2021). Therefore, if dunes suffer substantial damage following a storm, efforts to

restore them should mimic the geomorphology of a typical eolian foredune found along the Southwest Florida coast of modest amplitude (8 – 10 feet above NAVD88). Communities behind the foredune would accept some risk of disaster, though the probability of risk would be less costly and less frequent. The foredune should be vegetated in an ecologically and geologically meaningful way to impede storm surge and stimulate vegetative regrowth following storms. Furthermore, beach nourishment could be configured in a way to enhance natural dune growth by building dune segments at oblique angles to the shoreline (i.e., finger dunes).

Offshore Protective Features

One of the problems we are facing in the urban zone is that development replaced areas that were historically mangrove dominated barrier islands. Thus, the shorelines no longer operate as a buffer to the mainland and there are no significant offshore protective features from Barefoot Beach to Gordon Pass.

Investigations into the viability of constructing offshore barrier islands or other features such as oyster reefs, should be considered as part of the green-gray hybrid design to protect the urban zone. Any proposed green-gray features would need to avoid the hardbottom, located an estimated 500-1000 ft. offshore at depths of 11-18 ft., which are critical habitats for numerous commercial and recreational fish and listed species (McAlpin, et al., 2016).

Working with Nature

In summary, Beach and Coastal Management Plans should be developed that balance the need for storm protection and human uses with the needs of the rare, threatened, and endangered species that depend on these habitats for their survival. Ecosystems are recognized for their ability to mitigate storm surge and wind damage and therefore should be included in the formulation of project alternatives. We ask that you consider the following:

- Work with nature, not against nature.
- Consider natural protective feature enhancements such as dune and mangrove restoration and re-vitalization, and other nature-based alternatives.
- Prioritize natural solutions that are more apt to respond to changing conditions than hardened structures, which are static and inflexible.
- Employ a Multiple Line of Defense Strategies similar to Best Management Practices (i.e. stormwater treatment trains). Investigate the utility of a layered approach that combines natural and engineered approaches to enhance resilience in both developed and natural areas.
- Protect land where possible and acquire land that is listed for sale in strategic areas. Land acquisition, especially of wetlands, can provide additional protection against both inland and coastal flooding by permanently conserving environmental resources and limiting additional asset accumulation.

9. Increase the use of non-structural measures.

It is important for Collier County not only to mitigate flood risk, but also to adapt to flood risk. Thus, the Conservancy appreciates that USACE is committed to incorporating non-structural measures in the final array of alternatives. Not only are non-structural measures for storm risk management less impactful on the environment than structural measures, but non-structural measures can be very effective at saving lives.

We noticed that the previous study alternatives and tentatively selected plan included only elevation, dry flood proofing, and acquisition as non-structural solutions (USACE 2020, Appendix G). However, USACE's "[Field Guide for Nonstructural Assessments](#)" lists thirteen types of non-structural measures, including the following:

USACE Physical Nonstructural measures include:

- Elevation
- Relocation
- Acquisition
- Dry floodproofing
- Wet floodproofing

USACE Non-physical Nonstructural measures include:

- Flood Warning Systems
- Flood Insurance
- Floodplain Mapping
- Flood Emergency Preparedness Plans
- Land Use Regulation
- Zoning and Building Codes
- Evacuation Plans
- Risk Communication/Outreach

There appeared to be no information or discussion within the 2020 CSRMs documents, explaining why only a few nonstructural measures were considered. However, USACE presentation slides from a January 17, 2020 meeting to Collier County stated that some of the non-structural measures were considered "outside the scope of work". Why would those measures be outside the scope when [USACE's National Non-Structural Committee](#) endorses the above measures?

FEMA, Collier County's Emergency Management division, and other Collier County programs provide many of the non-physical nonstructural measures described above, that would benefit from additional funding and program improvements. Were there lessons learned from Hurricane Ian that could improve Collier County's flood emergency preparedness? As example, could there be several locations for the public to fill sandbags to deter flooding or to obtain plywood for home storm protection? Could evacuation plans be modified to provide assistance to those who would

like to evacuate but have mobility issues or do not have the financial means to leave the area? Is there a potential to improve flood risk communication/outreach in areas that experience chronic flooding or areas where English is the second language? Can flood warning systems be improved to reach more people in rural areas?

We encourage an evaluation of current non-structural measures to determine necessary plan improvements. Furthermore, we hope that USACE staff will consider these ideas for non-structural measures:

- Land acquisition: According to USACE’s definition, [“Acquisition”](#) refers only to the purchase of a structure and the land, where the structure is to be demolished or relocated to a site outside the floodplain. The term does not pertain to acquisition of vacant land without a structure. However, conservation acquisition of even a few privately owned vacant parcels could provide flood attenuation and storm resilience benefits to surrounding neighborhoods or downstream properties. USACE could work with Conservation Collier, the county’s willing-seller land acquisition program, to acquire privately owned properties that already provide flood control services, but are vulnerable to development. Appropriate properties could consist of wetlands, forests, agricultural lands and other open space lands. In addition, vacant or abandoned industrial or commercial properties could be acquired to provide flood control service. The more greenspace that Collier County owns, the better the county can adapt to climate change and flooding impacts.
- Transform large non-pervious areas to pervious or porous surfaces. As an example, retrofit large public parking lots, along the beaches, within city parks, or other government facilities, with permeable or porous pavement or pavers.
- Create bioswales or bioretention areas throughout Collier County along streets, parking lots, and sidewalks, or where needed, to hold stormwater run-off and let it percolate into the ground.
- Adaptation Action Area (AAA): Florida’s Department of Economic Opportunity (DEO) provides guidance to local governments for creating [Adaptation Action Areas](#). AAA’s are comprehensive planning area designations for *“areas that experience coastal flooding and are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning.”* While Collier County does not have a designated AAA, at least 25 local governments in Florida have adopted AAA language into their comprehensive plans, including: Miami-Dade County, Broward County, Fort Lauderdale, Indian River County, Jacksonville, Satellite Beach, Vero Beach, Sarasota County, Monroe County, and others (Ankerson et al, 2020). Since USACE recommends zoning and land-use regulations as nonphysical nonstructural measures to “mitigate loss of life as well as existing and future flood damages” (USACE, 2019), USACE could work with the DEO and Collier County to create an AAA designation.

10. Consider the costs or benefits from the proposed measures on the coastal economy.

Tourism, fisheries, the marine industry, and real estate encompass the major sectors of Collier County's coastal economy, which all depend upon the beauty and health of our world-renowned natural coastal resources. A healthy coastal environment is even important for maintaining property values (Florida Association of Realtors, 2015). However, if floodwalls and surge barriers are proposed, this would pose a significant threat to Collier County's coastal economy and way of life. As example, the 2020 CSRSM study document stated that the *“surge barriers, sluice gate, jetties, floodwalls, and associated pump stations would result in . . . temporary to permanent impacts to aquatic resources and habitats that range from moderate to potentially significant”* (USACE, 2020, EIS). Furthermore, the study anticipated *“direct and indirect impacts to Essential Fish Habitats” that “would be both temporary and permanent, ranging from moderate to potentially significant . . .”* (USACE, 2020, EIS).

Although the study acknowledged that there would be environmental impacts to coastal resources from structural measures, the study also stated that the health of the marine ecosystem and fish resources are important for *“support[ing] commercial and recreational fishing as well as various ecotourism activities.”* (USACE, 2020, EIS). The 2020 CSRSM also states, *“Collier County's commercial fisheries are of significant value to the local economy; the number of people employed by the marine economy generally ranges from nearly 17,000 to 26,000, which comprises between 12 and 18 percent of total employment in Collier County”* (USACE, 2020, EIS).

Despite this recognition of the importance of Collier County's coastal environment to the economy, the Economics Appendix from the 2020 CSRSM study did not assess the potential impacts to the coastal economy from the proposed structural measures. The 2020 CSRSM economic study only considered economic benefits of the tentatively selected plan due to beach nourishment projects, but did not consider the negative impacts on the economy due to the structures.

For the reinitiated study, we understand that USACE has a new process for formulating the array of alternatives using a [“benefits focus.”](#) This seems promising because the directive *“seeks to ensure that the . . . **totality of a proposed project's benefits and impacts**”* are to be *“carefully evaluated, calculated, and documented . . . to support USACE recommendations for potential future investments in water resources projects.”* We agree that, in addition to analyzing a project's benefits, impacts must also be considered.

Furthermore, we understand that the new benefits approach to formulating alternatives will encompass *“**regional economics, environmental, and social benefits**”*. (Department of the Army, 2021). It appears, based on the [policy directive document](#), that staff has discretion on how the new policy is applied.

Therefore, *if* an alternative proposes structural measures, we recommend that a cost-benefit analysis on the regional economy is included, and addresses the following:

- Economic impact on commercial and recreational fisheries: Since the previous study assumed the structural measures would result in impacts to fisheries and aquatic habitats, then economic impacts to the commercial and recreational fishing industries should be assessed.
- Economic impact on beach visitation due to structural measures: Collier County's pristine white sand beaches draw tourists from all over the world and contribute millions to the economy. As an example, 773,529 people visit Delnor Wiggins Pass State Park annually, which provides a \$92.8 million economic impact, and supports 1,300 local jobs (Florida State Parks, 2022). How would floodwalls and surge barriers affect visitation to Collier County's beaches, such as Wiggins Pass?

If surge barriers and floodwalls were built along or near the beaches, we believe beach visitation rates would be negatively impacted, due to: (1) reduced beach and inlet areas available to the public where the structures are located, (2) the alteration of the beaches' natural beauty due to the unsightly structures, and (3) potential environmental impacts to the beaches, such as increases in red tide events or other harmful algal blooms, due to gate closures and subsequent point source discharges when reopened.

Proposed structures would likely have a negative regional economic impact on beach visitation. Visitors are apt to visit other beaches that do not have massive concrete structures.

- Economic impact on tourism: If structural measures are proposed for an alternative, then economic impacts to kayak and boating tour or guide businesses, fishing charters, sailboat excursions, sunset cruises, nature tours, boat rental companies, and recreational and fishing operations should be studied. Furthermore, this could lead to a loss of visitors and revenue for hotels, restaurants, and other attractions, which should be studied.
- Economic impact on property values: The previous economic study assessed whether the structural measures were economically justified largely based on the total costs to build the structures compared to the Depreciated Replacement Values (DPR) of the properties. In the 2020 study, Fort Myers' values were used to determine Collier County's DPR. The current study should use Naples real estate values to more closely represent actual values. Additionally, the cost-benefit analysis failed to include other important factors that would affect property values, such as:

- (1) A likely depreciation in real estate values for properties that would have an obstructed or altered view of the coast, bays, or landscaped areas, after construction of the floodwalls or barriers.
- (2) Property losses due to the potential for inland flooding from impoundment of rainwater or other compound flooding issues caused by the structures (See section on compound flooding).
- (3) Likely depreciation of property values along the coast due to sea level rise over the 50-year life cycle of the project.
- (4) Affects to real estate values due to the likelihood of degraded water quality directly or indirectly attributed to the proposed structures. The Florida Association of Realtors reports that water quality issues negatively impact property values (2015).

11. Include a cost-benefit analysis of ecosystem services.

Natural infrastructure is often less expensive than engineered solutions, and may even be free of costs. Nature not only provides protection from wind, waves, erosion, flooding, and storms, but is important for maintaining water quality, providing habitats, and for providing abundant recreational opportunities.

FEMA states that NBS (Nature-based solutions) “promotes adaptation and resilience”, but also provides additional services and benefits such as:

- Combat climate change
- Reduce flood risk
- Improve water quality
- Protect coastal property
- Restore and protect wetlands
- Stabilize shorelines
- Reduce urban heat
- Add recreational space

While the 2020 CSRSM study valued NBS and NNBFs (Natural and Nature Based Features) only as a compliment to the structural and non-structural measures,⁴ the Conservancy is hopeful that the updated plan formulation process, with a benefits focus, will *prioritize* NBS and NNBF for all planning areas.

We understand that the policy directive for the new planning process requires the following:

⁴ The 2020 CSRSM study stated that justifying such measures was “new and untested in USACAE studies” thus “NNBF measures would be “added to and evaluated with the alternatives *after* the TSP has been identified.” US. Army Corps of Engineers Norfolk District. (2020, July). *Collier County Coastal Storm Risk Management Feasibility Study. Plan Formulation Appendix A*, pgs. A-4 and A-7 and p. 186 of draft EIS.

*“PDTs must evaluate and provide a complete accounting, consideration and documentation of the **total benefits** of alternative plans across all benefit categories. Total benefits involve a **summation of monetized and/or quantified benefits**, along with a complete accounting of **qualitative benefits, for project alternatives across national and regional economic, environmental and social benefit categories.**”* (Department of the Army, 2021).

The Conservancy believes that this new language, pertaining to **regional environmental and social benefits**, allows for an evaluation of ecosystem service benefits, provided by NBS and NNBF, when formulating plan alternatives. Since the 2020 CSRSM study did not account for ecosystem services,⁵ NBS/NNBF’s were not valued for their storm protective benefits nor for their recreational and environmental benefits. However, if ecosystem services are valued and quantified for the *total* benefits they provide, then NBS and NNBF could be prioritized.

Furthermore, there are available methods to quantify ecosystem services so that the benefits of NBS and NNBF can be compared to engineering solutions. As example, the Nature Conservancy found that mangrove forests protected more 626,000 Floridians from flooding due to Hurricane Irma and prevented \$1.38 billion of property damage just within Lee and Collier County (Narayan, 2022). In addition, the U.S. Geological Survey found that coral reefs provide \$675 million in flood protection every year in Florida (Storlazzi et al, 2019).

USACEs’ Institute for Water Resources’ document called, “[Using Information and Ecosystem Goods and Services in Corps Planning: An examination of Authorities, Policies, Guidance, and Practice](#)”, seems to imply that an analysis of ecosystem benefits is possible. The document states:

The inclusion of EGS [Ecosystem Goods and Services] in plan formulation and evaluation has the potential to provide a broader, more accurate view of project effects; more directly illustrate the societal value of ecosystem restoration; and provide for more transparent consideration of the benefits and costs of proposed projects.

We encourage USACE staff to include a cost-benefit analysis of ecosystem services when formulating plans.

12. Provide additional public information if structural measures are proposed.

If structural measures are proposed within the plan alternatives, we believe the following information should be provided and questions answered to improve transparency:

- Provide the public with renderings of any proposed structural measures to scale.

⁵ The Army Corps stated, “[W]e have not included an evaluation on ecosystem services for this project U.S. Army Corps of Engineers Norfolk District. (2020, July). *Environmental Appendix D. Collier County Coastal Storm Risk Management Feasibility Study*. pdf page 287 of 296. <https://usace.contentdm.oclc.org/utis/getfile/collection/p16021coll7/id/14944>

- Provide an estimated timeframe detailing the construction process.
- Provide a description of the construction process for each measure, including answers to the following questions:
 - If alternatives still propose surge barriers at Wiggins Pass and Doctors Pass, would the channels and flows be cut-off during the construction process? If so, for how long?
 - What are the anticipated ecological effects of doing so?
 - Would roads need to be built within Wiggins Pass State Park and along Doctors Pass to allow construction and maintenance workers to access the surge barrier structure and the pumps?
 - What would be the anticipated footprint for a pump station at Wiggins Pass be, including new roads to access the pump station for construction and maintenance, and the acreage of direct and indirect mangrove impact?
- What is the estimated gallons per minute capacity of the pumps for the various structures?
- Which streets would need modified ingress/egress points to provide access to properties and businesses due to the proposed locations of the floodwalls?
- The previous plan stated that, *“The local sponsor should be prepared to carry out maintenance activities on all flood control structures every year”* (USACE, 2020, Appendix B.) What is the estimated cost of yearly maintenance with each alternative?
- If structures are proposed, is there an initial estimate of the costs?
- What conditions would trigger gate closures? How long are the gates proposed to be closed? Will sea level rise encourage more frequent gate closures?

If structural measures are proposed, we believe this information should be provided prior to the Tentatively Selected Plan milestone, so that the Board of County Commissioners, County staff, the state and federal agencies, and the public all have a full understanding of what is being proposed, in order to submit comments that accurately pertain to the plan alternatives.

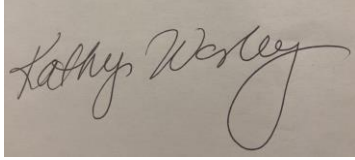
Conclusion:

We appreciate the open dialogue with USACE staff and we look forward to continued collaboration on the re-initiated CSR. Once the array of alternatives are proposed, the Conservancy will provide additional comments.

In addition to comments by our staff at the Conservancy, we have enclosed a memorandum from Cheryl Hapke, Ph.D. of Integral Consulting, Inc. Dr. Hapke is a coastal geologist with 25 years of experience studying coastal processes and works on coastal climate risk and resilience issues. The Conservancy hired Dr. Hapke to provide high-level input for the CSR and provide alternative solutions for the Naples Bay area.

Thank you for your time and consideration.

Sincerely,

A handwritten signature in black ink on a light brown background. The signature reads "Kathy Worley" in a cursive script.

Kathy Worley
Director of Environmental Science and Biology

A handwritten signature in blue ink on a light yellow background. The signature reads "April Olson" in a cursive script.

April Olson
Sr. Environmental Planning
Specialist

Enclosure:
Memorandum from Integral Consulting, Inc.

While our organizations are independently submitting comments, the Conservancy of Southwest Florida, Environmental Defense Fund, Growing Climate Solutions and Sanibel-Captiva Conservation Foundation continue to work in partnership on the Collier County CSR M Feasibility Study, and we are supportive of each other's contributions to both the NEPA scoping process and the CSR M Feasibility Study planning process.

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