

COASTAL RESILIENCE STUDY OVERVIEW

Tyndall Air Force Base
30 September 2020





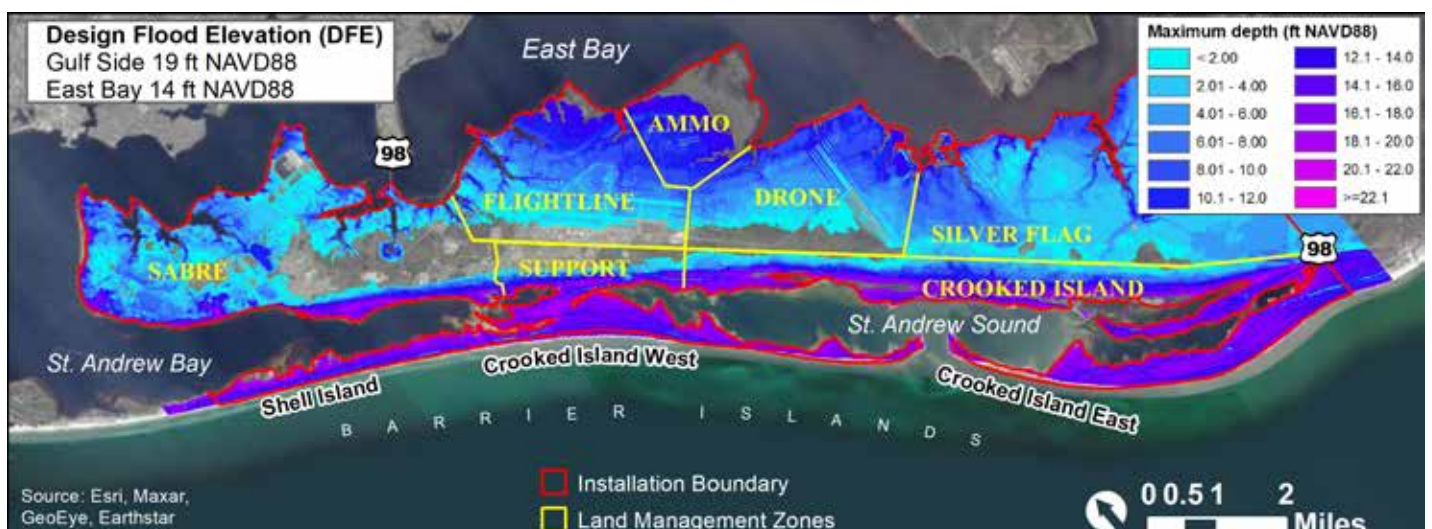
Beacon Beach at Tyndall AFB

Introduction

In October 2018, Tyndall Air Force Base (AFB) was severely impacted by Hurricane Michael, which quickly escalated from a Category 2 storm to one of the most devastating hurricanes to hit the Florida Panhandle. With sustained winds of more than 160 miles per hour and storm surge reaching more than 15 feet at nearby Mexico Beach, Hurricane Michael caused catastrophic damage to Tyndall AFB and the surrounding communities—an impact that can still be seen today as the region continues to rebuild and restore “normal” operations.

Tyndall AFB sits on a Florida Panhandle peninsula surrounded by the Gulf of Mexico, St. Andrew Bay, St. Andrew Sound, and East Bay. Its geographic position makes the base a critical training location for the U.S. Department of Defense, but also extremely vulnerable to sea level rise and extreme weather that can produce high winds, extensive rainfall, and storm surges. As Tyndall AFB rebuilds after Hurricane Michael, which damaged or destroyed all of the base’s nearly 500 facilities, the primary focus is on creating the *Installation of the Future* by leveraging resilient, sustainable, and SMART systems to perform at the nexus of mission assurance, cost efficiency, and social and environmental sustainability. Stronger standards are now in place for wind speed and coastal flooding. In addition to these more robust requirements for the built environment, a range of nature-based flood defense solutions have been investigated. The main aim of these solutions, which use or enhance a variety of habitats, is to prevent or reduce the amount of marine water that floods onto the base during storms.

The work that has been undertaken to date has developed pilot-scale projects for a number of nature-based solutions and has considered the costs and benefits that could be gained if such solutions were upscaled in the future. The future resilience of the base relies on addressing the risks that arise from coastal flooding and erosion. Lessons learned from the pilots will inform later implementation phases and future solutions. The work to date is pre-decisional and further work would be needed on both the pilots and upscaled projects before work could be undertaken on the ground. This further work includes engagement with Tyndall AFB and other stakeholders, permitting, feasibility and design studies.



Flood Extents for the Combined Gulf and Bay DFE-level Surge

Nature-Based Coastal Resilience

Nature-based coastal resilience solutions were targeted for evaluation because they are potentially less costly than hard defenses, can be self-maintaining, and offer a range of co-benefits associated with natural habitats. These co-benefits include providing habitat for threatened and endangered species and creating recreational opportunities. Nature-based solutions can be used alone or in combination with other approaches to provide multiple lines of defense against storm surge.

Four pilot projects have been developed for Tyndall AFB. These pilot projects provide the opportunity in the short term to begin investing in nature-based solutions and learning lessons to inform a long-term risk reduction strategy for the base involving upscaled measures.

Resilience and Wildlife Benefits



Sand Beaches & Dunes

- Can act as barriers to waves and high water levels generated in storms, helping to protect assets in their rear.
- Presence of vegetation helps reduce overtopping and erosion.
- Provide important habitats for threatened and endangered species such as beach mice and sea turtles.



Coastal Interdunal Swale

- Can assist in reducing coastal flooding by providing helping dissipate waves and reduce sediment erosion.
- Provide important habitats for threatened and endangered species such as beach mice.



Coastal Scrub

- Helps reduce coastal flooding by dissipating waves and reducing sediment erosion, which could help preserve dunes integrity.
- Supports a wealth of species endemic to Florida, many of which are considered rare.



Salt Marshes

- Highly effective at reducing wave energy
- May reduce storm surge levels in some locations.
- Provides important feeding and breeding habitat for a range of species.



Intertidal Flats

- Helps dissipate wave energy and reduce erosion to habitats further landwards.
- Habitats support complex estuarine food webs for a great number of invertebrates and fish.
- Provide resting and feeding areas for indigenous and migratory birds.

Four Coastal Resilience Pilot Projects

The following four nature-based pilot projects were developed to complement the more robust building design standards and reduce risk to the base when fully built to scale.



Pilot 1: Constructed Defenses Construction Project – Gulf Side



- **Dune Construction.** Dune construction trial, located in Zone 4 along St. Andrew Bay just south of the support district, with onshore sand source.
- **Additional Measures.** The potential also exists to pilot the construction of either a living breakwater or oyster reef adjacent to Buck Beach in St. Andrew Sound to reduce coastal erosion. These alternatives would be subject to Air Force and regulatory approvals, further technical feasibility studies, stakeholder buy-in, and funding availability.

Pilot 2: Sand Trapping Construction Project – Gulf Side



- **Sand Fencing.** Trial sand fencing on relic dunes on Crooked Island West. This could be an ideal volunteer event.
- **Vegetation Planting.** Trial plantings on relic dunes on Crooked Island West. This could be an ideal stakeholder engagement event.
- **Woody Debris.** Trial woody debris placement on relic dunes on Crooked Island West.

Pilot 3: Back Bay Feasibility Study – East Bay & Gulf Side



- Evaluation the strategic placement of subtidal sediments in the East Bay and sand placement off the Gulf Coast to enhance natural environments.

Pilot 4: Back Bay Feasibility Study – East Bay



- Evaluation of marsh enhancement, horizontal levees and other potential nature based coastal defense strategies.
- **Additional Measures.** The potential also exists to pilot the construction of marsh enhancement and/or horizontal levees. These alternatives would be subject to USAF and regulatory approvals, further technical feasibility studies, stakeholder buy-in and funding availability.



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Analysis

Once the initial pilot projects were defined, further analysis was requested on four aspects of the proposed pilot projects and their potential upscaled extents.

1. Cost and Time of the Pilot Projects

Rough order of magnitude costs¹ have been derived for the pilot construction projects. Costs range from as low as approximately \$15,000 for planting vegetation on 300 linear feet of relic dunes to promote sand trapping to as high as \$2.0 million for construct 500 linear feet of new sand dunes on top of relic dunes damaged by Hurricane Michael. Construction timing range from 1 to 2 years with 2 years of post-construction. These are rough order of magnitude costs based on a number of high level assumptions that are detailed in the Coastal Resilience Pilot Projects—Additional Information to *Support Project Definitions and Material Sourcing Technical Memorandum* (dated 29 September 2020).

2. Pilot Project Success Factors

The success factors for the pilot projects will focus on lessons that can be learned through the design, construction, and operation of the pilots, relating to the following:

- Knowledge sharing
- Optimize construction techniques
- Innovation
- Speed of sand trapping
- Erosion performance of dunes
- Environmental quality enhancement
- Engagement with stakeholders
- Secure funding

3. Rough Order of Magnitude Estimate for Pilots at Scale

The lifecycle costs range from as low as approximately \$157,000 for 0.7 mile of sand trapping on the barrier islands, to as high as \$680 million to construct 16 miles of horizontal levee along East Bay. Implementation schedules for this work range from 2+ years to 8+ years. These are rough order of magnitude costs based on a number of high-level assumptions that are detailed in the full technical report.

4. Economic Analysis

The analysis shows that the nature-based solutions proposed in the four pilot projects are both economically viable and can offer an enhanced level of protection and performance compared to other alternatives. The analysis also demonstrates that the risk of flooding today is relatively low as most facilities and infrastructure on the base are sited on the higher ground or have been rebuilt to the Design Flood Elevation policy. As such, it might be possible to consider a phased or progressive implementation of nature-based solutions, allowing them to build naturally, rather than having to build them to full scale in the near term. This would be beneficial for reducing costs and creating more established naturally functioning features.

¹ A Rough Order of Magnitude (ROM) estimate is an approximate estimate used very early for planning purposes.

Stakeholder Engagement

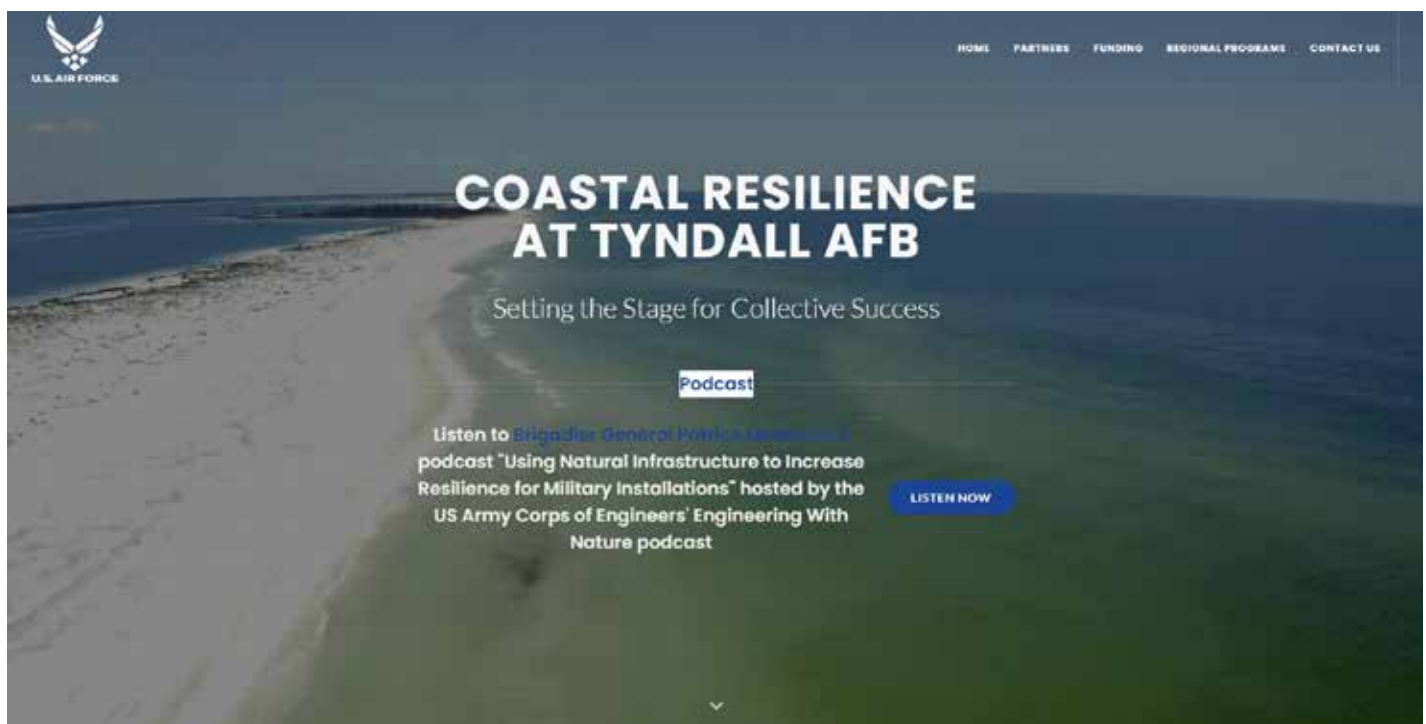
While the pilot case studies were being developed in the spring and summer of 2020, a series of virtual stakeholder workshops were held with federal partners, state and local officials, non-government organizations (NGOs), and members of academia. Because the pilot projects currently are not funded, the stakeholder workshops were necessary to test partnership interest in building regional coastal resilience, evaluating alternative financing and delivery strategies, accelerating program development, and reducing or deferring reliance on Military Construction expenditures to rebuild Tyndall AFB.

These workshops showed there is strong support for using nature-based solutions to achieve coastal resilience at Tyndall AFB and the surrounding communities. An important outcome of the stakeholder meeting was the creation of the Tyndall AFB Coastal Resilience Working Group to take the pilot studies forward.

In addition to forming a stakeholder working group, Tyndall AFB has developed a website for communicating its coastal resiliency program to the broader public and other interested stakeholders at <http://tyndallcoastalresilience.com/>. Interested parties can visit the site to learn more about the work completed to date and plans for advancing coastal resiliency efforts.



TyndallCoastalResilience.com





Conclusion

Current funding and policies to rebuild Tyndall AFB leave some residual coastal flood risks for certain parts of the base infrastructure. The work that has been undertaken to date shows how nature-based coastal resilience solutions have the potential to address some of these residual risks. The coastal resilience pilot projects are the first phase of implementing larger construction projects as part of a base-wide coastal resilience strategy. The scale of these solutions is massive and will require ongoing analysis, design, and permitting, which will be informed by pilot performance and continuous outreach to sustain investment.

Next Steps

With the help of the Working Group, Tyndall AFB is taking on the following tasks:

- Drafting a strategy (including stakeholder engagement and funding) and roadmap for implementing coastal resilience at Tyndall AFB
- Solidifying partners and roles, including leveraging technical expertise
- Identifying, pursuing, and securing new funding for the pilots
- Mapping the regulatory process to be strategic and to streamline the pilot process
- Creating and managing an interactive stakeholder website for expression of interest, expertise, and citizen scientist participation
- Creating key messages for communications, outreach, and progress updates
- Ensuring the commencement of at least one pilot project

Moving forward, it is recommended that Tyndall AFB develop a comprehensive coastal resilience strategy to plan out the mix of risk reduction measures needed to ensure the successful management of flood and erosion risk over the long term. As the stakeholder Working Group evolves, serious consideration should be given to developing a wider regional coastal resilience strategy for Tyndall AFB and its neighbors in the Florida Panhandle.



