

Attachment D: Wetland/Coral Nursery Restoration Monitoring Plan

This monitoring plan is intended to guide restoration monitoring efforts resulting from the *2019 NFWF Emergency Coastal Resilience Fund*. While project design and implementation is proposed over a three-year period, this plan includes baseline data collection - proposed in phase one - as well as post-implementation monitoring for a five-year period. Final monitoring plan shall be developed collaboratively by the project partners, and shall conform to DEQ Water Quality Sampling Protocols, NFWF Monitoring Protocols and NOAA coastal habitat monitoring guidance (*Science-Based Restoration Monitoring of Coastal Habitats, Volumes One and Two*).

DEQ Monitoring

Goal: Assess water quality improvement as a result of wetland and coral reef restoration in the CNMI.

Approach: Project will support (1) baseline data collection, (2) restoration design and implementation, and (3) monitoring phases at two wetland sites and at least one coral outplanting site in Saipan, CNMI.

As described below, DCRM/DEQ will use existing and collect new baseline and ongoing monitoring data to assess water quality improvement over a five-year period. Water quality sampling will be conducted to measure nutrients (nitrogen and phosphorus), total suspended sediment, pH, dissolved oxygen, and turbidity, as well as other chemical indicators. Water quality sampling will be conducted by DCRM/DEQ monthly or weekly in the Phase One baseline data collection period until coral outplanting or invasive species removal and revegetation begins.

At wetland sites where open-water is restored, water quality data including turbidity, pH and other chemical parameters will also be collected. Once invasive removal and re-planting is complete, monthly monitoring will continue for soluble nutrients including nitrogen and phosphorus. Data shall be compiled regularly, with annual reports comparing observations at the two wetland sites. A final report summarizing findings shall be published at the close of the first five-year monitoring period. If additional funding or support from local community organizations or schools is available, monitoring and reporting at these sites may continue.

At the coral outplanting site, monthly baseline water quality sampling will occur prior to project implementation. Parameters included in the baseline monitoring will be nutrients (nitrogen and phosphorus), total suspended sediment, pH, dissolved oxygen, and turbidity, as well as other chemical indicators. Following project implementation the same water quality parameters will be measured monthly to document changes in water quality over the course of the five-year monitoring period.

Phase One: Baseline Data

At wetland restoration sites, gather baseline data using water quality sampling at two or more flagged and GPS-marked locations at each of the two wetland sites. Additional baseline sampling

will be done at wetland outfalls if some of this data already exists. Water quality sampling will be conducted by DCRM/DEQ weekly in the Phase One baseline data collection period until invasive species removal and revegetation begins.

At the coral outplanting site, monthly baseline sampling will begin as soon as possible preceding coral outplanting, even if baseline data for this site already exists. Baseline water quality data will consist of total suspended sediment, nutrients (nitrogen and phosphorous), pH, salinity, turbidity, dissolved oxygen, temperature, and Enterococci.

Phase Two: Design and Implementation

At wetland restoration sites, water quality sampling will be conducted by DCRM/DEQ on a monthly basis once invasive species removal begins. At the coral outplanting site(s), water quality sampling will continue once coral outplanting begins. Monitoring activity will not take place if there is possibility that sediment would be disturbed during restoration activities.

Phase Three: Monitoring

At the wetland restoration sites, DCRM/DEQ will conduct water quality sampling weekly at each site for the first month post-restoration, and monthly for the following year until final reports are due at the close of the NFWF Emergency Coastal Resilience Fund budget period. After that time, DCRM/DEQ will continue monitoring on at least a quarterly basis to produce five years of data from project initiation to completion. DCRM/DEQ anticipates that five years of water quality data will show water quality improvement, especially with nutrient and total suspended sediment levels as a result of the wetland restoration.

At the coral outplanting site, water quality sampling will continue on a monthly basis in the first six months following the project implementation. Following the first six months, water quality sampling will occur at least on a quarterly basis. Similarly to the wetland restoration, DCRM/DEQ anticipates that five years of water quality data will allow will show an improvement in water quality, which would also be associated with reductions in macroalgal cover on seagrass and coral habitat, improving their function.

DFW Monitoring

Goal: Assess habitat and ecosystem function improvement as a result of wetland restoration.

Approach: Project will include (1) DFW bird surveys and (2) wetland site monitoring using NFWF protocols at two wetland restoration sites in Garapan.

Bird Surveys

Bird surveys at the MIHA and AMP wetlands have been conducted biannually during the months of May and November for over 10 years. While all bird species that are detected are recorded, the primary purpose is to document abundance of the endangered Mariana common moorhen. Surveys are conducted starting no earlier than 6:00AM and ending by 10:00AM. Survey duration is based on the size of the wetland and is at least 10 minutes at the MIHA wetland and at least 20 minutes at the AMP wetland. Before each survey, the following data is recorded: (1) site name,

(2) date of survey, (3) observer name, (4) wind speed (0 = No wind, 1 = 1-10 mph, 2 = 11-20 mph), (5) amount of rain (0 = No rain, 1 = mist, 2 = drizzle, 3 = light rain), (6) cloud cover (percentage of total area of sky obscured by cloud), and (7) time. Established listening stations are used along areas where vegetation does not allow for visual observation. Scans with binoculars are used where open water is visible. During each survey, all shorebird, waterfowl, and wader species detected either visually or aurally and the number of each species is recorded. Additionally, the noise level (0 = none, 1 = very little distracting noise, 2 = medium amount of distracting noise (dog barking), 3 = high noise level) during each survey is recorded. When survey is complete, the end time is recorded.

DFW will measure change in the average abundance and frequency of occurrence of Mariana common moorhen at each site before, during, and after restoration activities. Upon receipt of the grant award, DFW will double survey effort, conducting surveys quarterly through the grant period and the next 5 years.

Wetland Restoration Monitoring according to NFWF Protocols

DFW will implement vegetation and hydrology monitoring at the MIHA and AMP wetlands according to the protocol “Metrics and Methods for Monitoring Marsh/Living Shoreline Restoration” found in Appendix A of the 2019 Emergency Coastal Resilience RFP. The protocol provides measures of success for both habitat and ecosystem function. We plan to monitor vegetation on four occasions, pre-restoration, immediately post-restoration, and 12 and 18 months post-restoration, but are open to NFWF recommendations regarding the timing and frequency of monitoring. Metrics for project success including % cover of invasive exotic/native vegetation and water level. Water level data in conjunction with precipitation data provided by the National Park Service will provide an index of flooding. Precipitation data is available from a NPS weather station located at American Memorial Park within 100 meters of the AMP wetland and <500 meters from the MIHA wetland. Post-restoration, if wetlands retain more water and/or for longer periods following rainfall events, we will assume that flooding outside the wetlands is reduced.

DCRM Coral Monitoring

Goal: Assess habitat and ecosystem function improvement as a result of coral out-plantings within the target watershed area, including patch-reef, back-reef, and fore-reef ecosystems.

Approach: From long-term monitoring data, we know the species composition of corals of each reef type. We propose to out-plant 8-10 species at each site at pre-determined densities (1 -.25 m densities). To assess coral cover over time, transects will be established at all out-planting locations. Two to three replicate transects will be surveyed and recorded at least quarterly per site. Additionally, measures of rugosity will be taken to understand overall changes in three dimensional structure of out-planting sites.

Monthly baseline sampling will begin as soon as possible preceding coral out-planting, even if baseline data for this site already exists. Nursery stock and out-planting sites will be monitored at least monthly to establish trends in the following metrics:

- # of fragments in nursery available for out-planting

- total # of species represented in nursery
- # of acres of restored reef (density and survivability of out-plantings)
Changes in rugosity, or three dimensional reef structure.

Milestones:

The following milestones reflect the current proposed monitoring cycle. If additional funding or resources become available, monitoring and QA/QC shall continue beyond this first five-year monitoring cycle.

- 2020-2022– Annual reports shall be compiled to collect and compare data.
- 2022 – Final Report for NFWF Emergency Coastal Resilience Fund Grant shall detail data observations as well as challenges, successes, and lessons learned as applicable.
- 2023 – 2025 – Partners shall continue quarterly or monthly monitoring
- 2025 – Partners shall publish Final Monitoring Report