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BMB Technical Bulletin  
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**SUBJECT: GENERAL CONSIDERATIONS FOR CORAL REEF  
ECOSYSTEMS RESTORATION/REHABILITATION**

Pursuant to Section 9 of DENR Administrative Order No. 2016-26, "Guidelines for the Implementation of the Coastal and Marine Ecosystems Management Program (CMEMP)", in consonance with DENR Administrative Order No. 2013-12, "Guidelines for the Implementation of the Sustainable Coral Reef Ecosystems Management Program (SCREMP)", this Technical Bulletin on the conduct of coral reef ecosystems rehabilitation is hereby issued for the information and guidance of all concerned.

**Section 1. Objectives.** This Technical Bulletin aims to provide the Protected Area managers, Local Government Units and other field implementers, a strategic, sustainable, and ecosystem-based approach in protecting and rehabilitating degraded coral reef ecosystems in their respective areas. This will also serve as a guide in assessing/evaluating past and ongoing efforts on coral reef rehabilitation, as well as an aid in reviewing future rehabilitation/restoration plans—both within National Integrated Protected Areas System (NIPAS) and non-NIPAS areas.

**Section 2. Scope.** This Technical Bulletin shall be used in areas with coral reef ecosystems under NIPAS Marine Protected Areas (MPAs) nationwide, and may also be used for identified Marine Key Biodiversity Areas (MKBAs), identified priority seascapes and critical habitats, and other coastal and marine conservation areas with coral reef ecosystems.

**Section 3. Definition of terms.** For the purposes of this Technical bulletin, the following terms shall be construed to mean as:

- a. **Rehabilitation** -The act of partially or fully replacing structural or functional characteristics of an ecosystem that have been lost, or the substitution of alternative qualities or characteristics than those originally present, provided that they have more social, economic or ecological value than existed in the disturbed or degraded state.
- b. **Restoration** -The act of bringing a degraded ecosystem back into, as nearly as possible, its original condition.
- c. **Indirect/Passive Intervention** - a strategy for rehabilitation/restoration which involved removing anthropogenic stressors (e.g., unsustainable and destructive fishing practices, pollution, etc.) that impede ecosystem's natural recovery. These are management techniques and activities that are often done as part of broader integrated coastal management, or local management intervention strategies, with the aim of promoting the natural recovery of reef such as designating a damaged coral reef area as a no-take MPA/ strict protection zone for recovery purposes.
- d. **Direct/Active Intervention** - a strategy for rehabilitation/restoration which involved direct measures such as establishment of in-situ nursery, employing culture technologies for coral propagules from eggs and larvae (sexual coral reproduction / larvae reseeded), coral transplantation, re-attachment of dislodged biota employed

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usually in the case of ship groundings and damages due to typhoon/ storm surges<sup>1</sup>, and substrate stabilization.

For the purposes of this Technical Bulletin, it shall be noted that the terms “rehabilitation” and “restoration” are usually used interchangeably by the public and in most of the references. However, in most cases, it only refers to “rehabilitation” since full “restoration” goals may be farfetched due to global climate change impacts compounded by local anthropogenic pressures.

#### **Section 4. Considerations in the rehabilitation/restoration of coral reef ecosystem.**

- a. Presence of threats - In order to restore/rehabilitate an ecosystem effectively, the threats and drivers of degradation must first be reduced or eliminated.
- b. Condition of Coral Reefs in the area - Presence and history of the coral reefs, as well as types and diversity of coral life forms present at the site are of vital considerations. If historically there is no existing coral reef at the area, it is best not to try and create one, as the abiotic environment conditions may not support a coral community.
- c. Environmental conditions - Effective rehabilitation requires an understanding of ecological concepts and environmental conditions in the area such as presence of suitable substrate, good water quality, optimum wave action, depth and exposure, and presence of reef -associated fish and invertebrate (e.g. functional herbivores).
- d. Effective management in place - The effective management and protection of the area is necessary to allow reef ecosystems to recover either naturally or assisted. The proposed rehabilitation intervention needs to be considered in the context of local social and economic resources with a view to its sustainability.
- e. Stakeholders' participation - Since addressing the threats requires collaborative efforts, cooperation of multi-sectoral stakeholders is needed for planning and execution. It is important that these stakeholders be involved as early as in the preparatory phase so that they understand where the threats originated, how to address them and what practical rehabilitation strategies can be employed.

ANNEX 1 illustrates the decision matrix to serve as guide for coral reef managers to deliberate above mentioned considerations, and to decide whether to opt for direct/active or indirect/passive management interventions before starting any coral reef rehabilitation/restoration initiatives.

**Section 5. Phases of coral reef ecosystem rehabilitation/restoration.** The rehabilitation/restoration intervention can be divided into two stages: design phase and implementation phase.

- a. Design Phase (Preparatory Activities)
  1. **Baseline Assessment.** Baseline information, as well as historical data and reports about the degraded area including its bio-physical and socio-economic baseline data, financial resources, management body in place, and guidance on appropriate coral reef restoration/rehabilitation technology and techniques are all necessary for a successful reef rehabilitation project. In the absence of baseline information (biophysical and socioeconomic profile) for the past 5 years, baseline and/or damage assessment, should be conducted. BMB Technical Bulletin 2017-05

provides a list of recommendations for conducting a baseline assessment. An assessment team may be formed to assess the target site and prepare the assessment report. In case of assessing damages to corals brought by typhoon/ ship grounding, a separate technical bulletin/ guideline for the damage assessment, response, remediation/restoration and monitoring shall be developed.

## 2. Initial site selection and Situational Analysis.

- Situational Analysis Workshop. Degraded areas for possible restoration/rehabilitation activities are identified based on the results of the baseline assessment. A scoping workshop can be conducted to identify problems, threats, and drivers of degradation, and analyze issues and situations in order to determine the most appropriate and practical option to rehabilitate the area. Prior activities, as well as the history of the site, should be discussed to understand the present condition of the ecosystems. Information gathered in the workshop will help set objectives of the rehabilitation project.
- Review and documentation of past and existing initiatives related to coral resources management and coral reef restoration/rehabilitation: This can be done parallel to the situational analysis activity. Stakeholders should be consulted (local communities, local government officials, relevant national agencies, etc.) about the history of these initiatives, especially about the success or failure of past reef rehabilitation efforts. Information regarding local criteria for determining success or failure of rehabilitation efforts should be gathered. Once information and findings are consolidated and reviewed, specific rehabilitation strategies can already be identified to address the specific needs of the area.

## 3. Restoration/ Rehabilitation Management Planning<sup>2</sup>.

- Goals and objective setting. The goals and objectives for coral reef rehabilitation activity should be defined. In considering the appropriate rehabilitation options to be employed, function of the specific coral reef area should be identified first, followed by setting of realistic goals, attainable objectives, potential risks to the proposed activity and practical action/implementation plans.
- Identification of specific coral reef rehabilitation strategies. During the rehabilitation management planning, identification of specific and appropriate rehabilitation strategies can be done. Strategies can be an indirect (passive), or direct (active) intervention or a combination of both.
  - i. **Indirect (Passive) Intervention.** This shall include, but not limited to the following activities:
    - Identification of disturbances and modifications that occurred in the coral reef environment and currently preventing natural recruitment of corals. If possible, removal of disturbances that might prevent the natural succession of coral reef in that area, as well as the potential and existing chronic stresses on the location should be done.
    - Establishment of protection measures on coral reef ecosystems such as designating the area as strict protection zone, regular patrolling, installation of mooring buoys to prevent anchor damage and small boat groundings, and other similar activities;

- Implementation of UNEP-initiated project called "Green Fins Code of Conduct" on Responsible Diving as reflected in BMB Technical Bulletin 2017-13, and other science-based information aid technologies for coral reef protection and rehabilitation;
  - Regular conduct of maintenance, monitoring, evaluation and reporting of the rehabilitation and protection measures implemented in the area.
- ii. **Direct (Active) Intervention.** This shall only be applied/implemented, only if found necessary based on the decision matrix.
- **Site suitability assessment and cost benefit analysis.** Despite the restoration/ rehabilitation technique being effective elsewhere, failed coral reef rehabilitation projects are often linked to poor site assessment and to lack of knowledge on coral reef ecology. Specific surveys should examine the site according to its geography, oceanographic characteristics including wave actions/exposure, type of substrate, structural and biological complexity, and level of disturbance, among others. Presence and history of the coral reefs at the site is of major consideration. Capacity and resources, including people, equipment, time and finances to implement and complete a coral reef restoration/rehabilitation activity should also be checked.
  - **Scientific studies.** This could be an option when conducting full/thorough restoration/rehabilitation activity. Genetic modeling, laboratory experiments, coral propagation in ex-situ nurseries should be carried out by credible organizations/institutions or the academe to determine the appropriate restoration/rehabilitation techniques to employ.
  - **Active coral restoration/rehabilitation techniques and options.** In evaluating appropriate coral reef restoration/rehabilitation alternatives to be applied in the area, considerations must be based, at minimum, on the following:
    - The cost to carry out the alternative.
    - The extent to which each alternative is expected to meet the goals and objectives of returning the damaged area and services to baseline and/or compensate for interim losses.
    - The likelihood of success of each alternative.

Depending on the management objectives and results of scientific site suitability assessment, active restoration/rehabilitation can be classified into structural/physical and biological reef rehabilitation.

- **Structural/Physical rehabilitation** involves construction of artificial reefs in adjacent or in areas with coral reef system already, relocation of dead coral heads, establishment of mid-water coral nurseries or mineral accretion devices, etc. It also addresses the conditions in which the corals are growing to improve their health, growth rates, or fecundity. The objective is to increase the amount of reef structure and habitat available for the corals and other reef organisms to grow on.
- **Biological rehabilitation** involves regrowing corals where populations have been diminished or lost, and improving the biodiversity in reef areas where structure/substrate is already

available. This is done through sexual restoration (e.g culturing coral larvae, larvae reseeding) and or asexual restoration (e.g. coral fragmentation gardening, or transplanting living coral colonies).

It is important to note that there is no single formula that is applicable to all candidate sites for rehabilitation. In areas where the threats to the corals are still present, or the ecosystem has completely collapsed, biological restoration may not be effective and could even have negative consequences to surrounding reefs. In these areas, restoration techniques that address the physical conditions can be employed first. Different sites will require varied approaches and may include various techniques and combinations thereof.

b. Implementation Phase

1. **Addressing threats and drivers of degradation effectively.** In order for the rehabilitation efforts to be successful, management measures must be implemented first to ameliorate or remove the chronic anthropogenic stressors/ threats (e.g. sediment run-offs, sewage, improper boat anchorage, overfishing etc).
2. **Implementation of the rehabilitation/restoration plan.** Once rehabilitation/restoration plan is already ecologically and socio-economically acceptable and approved by the concerned stakeholders, rehabilitation activities can be implemented already. Identified rehabilitation strategies/ activities must be done in parallel to managing potential risks identified during the planning stage.
3. **Monitoring and Evaluation.** In order to capture critical lessons learned and evaluate the success of the rehabilitation activity, annual scientifically-based monitoring carried out for a minimum of five (5) years (preferably longer) after the completion of restoration/rehabilitation should be undertaken by the proponent and field implementers. Monitoring should include both regular systematic surveys to measure progress of the intervention, and routine checks on the rehabilitated corals and environmental conditions at the rehabilitation site. Systematic monitoring should form part of any rehabilitation plans and should be focused to 1) track progress towards objectives, 2) enable adaptive management approach, and 3) provide feedback to stakeholders.

ANNEX 2 provides the list of recommended references for the full-blown manual for coral reef restoration/rehabilitation.

**Section 6. Role of DENR.**

- a. Within NIPAS sites. Any coral reef rehabilitation/restoration interventions not included in the PA Management Plan should be approved by the concerned Protected Area Management Board (PAMB). Collection and transport of species shall be governed by the RA 9147 and relevant Fisheries Laws. The DENR Field implementers should also refer to other existing guidelines, such as the Joint DENR-DA-DILG-DND Memorandum Order No. 2000 – 01 dated July 05, 2000 on the Guidelines on the Establishment, Management and Utilization of Artificial Reefs in the Municipal Waters.

The CENROs and PENROs, together with the Regional Offices may also undertake assessment/ evaluation of the past and existing coral restoration/rehabilitation efforts in their respective areas, especially those initiatives conducted during SCREMP, following the guidance stipulated in this Technical Bulletin. Corrective measures shall be undertaken based on the results of the review/evaluation.

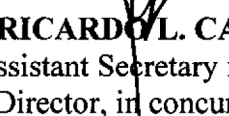
- b. Outside NIPAS sites. For initiatives to be conducted outside the NIPAS areas, and or led by other entities such as Civil Society Organizations (CSOs), duly organized and registered People's Organizations (POs), research institutions and private sectors, the DENR field implementers, in coordination with reputable research and academic institutions, may provide technical guidance in the proper conduct and processes of coral reef rehabilitation as suggested in this Technical Bulletin, whenever applicable. There is an option to formalize the coral rehabilitation activity by engaging all stakeholders in a ceremony or signing of a Memorandum of Agreement. This will increase community stewardship, raise attention to the area, and identify accountable/responsible sectors for the management of the rehabilitation activity.

**Section 7. Reporting.** Rehabilitation and assessment/evaluation reports should form part with the submission of the regular quarterly PAMO, CENRO and PENRO reports, for consolidation of the Regional Offices. The Regional Offices shall prepare and submit periodic reports on the progress and status of implementation to the Undersecretary of Policy and Planning copy furnished the BMB Director.

The BMB, through its Coastal and Marine Division, shall coordinate with BFAR and relevant marine scientific research institutions to develop a Monitoring, Evaluation and Learning Guide relative to the nationwide rehabilitation and/or restoration of coral reef ecosystems. The results of the regular monitoring of the conditions of rehabilitated reef areas undertaken by the field implementers shall be published or disseminated.

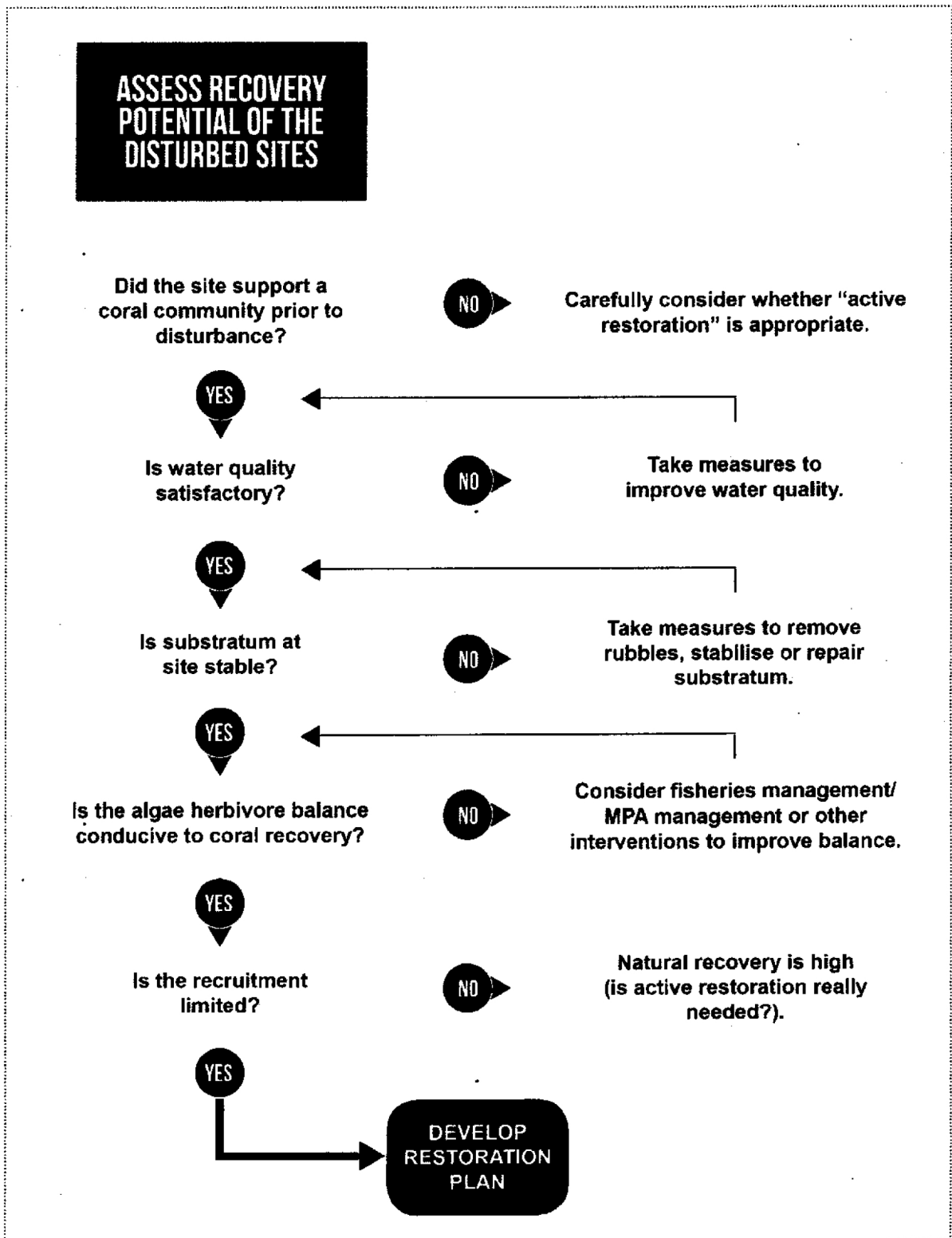
**Section 8. Funding.** The DENR Field Offices shall allocate necessary funding for the rehabilitations of the coral reef ecosystems, when necessary.

**Section 9. Effectivity Clause.** This Technical Bulletin shall take effect immediately and shall be circulated for the information and guidance of all concerned.

  
**RICARDO L. CALDERON**  
OIC Assistant Secretary for Staff Bureaus  
and Director, in concurrent capacity



**ANNEX 1: Decision Tree Guide in Conducting Coral Reef Restoration Project as adopted from Edwards, A.J., Gomez, E.D., 2007.**



**ANNEX 2. List of References of Suggested Full-Blown Manual for Rehabilitation/  
Restoration of Coral Reef Ecosystems**

Edwards, A.J., Gomez, E.D. (2007). *Reef Restoration Concepts and Guidelines: making sensible management choices in the face of uncertainty*. Coral Reef Targeted Research & Capacity Building for Management Programme: St Lucia, Australia. iv + 38 pp (available online at this link: <http://www.vliz.be/imisdocs/publications/119964.pdf>)

Edwards, A.J. (ed.) (2010). *Reef Rehabilitation Manual*. Coral Reef Targeted Research & Capacity Building for Management Program: St Lucia, Australia. ii + 166 pp.  
(available online at this link:  
[https://ccres.net/images/uploads/publications/3/reef\\_rehabilitation\\_manual\\_web.pdf](https://ccres.net/images/uploads/publications/3/reef_rehabilitation_manual_web.pdf))

Precht, W. ed., (2006). *Coral Reef Restoration Handbook*. CRC Press .+ 384 pp. (Available at:  
<http://dx.doi.org/10.1201/9781420003796> )

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