Annex-3 : Economic analysis

Building Climate Resilient Safer Islands in the Maldives

Economic Analysis

Table of Contents

1 Introduction

According to page numbers 149-150 and Table 32 of the GCF Programming Manual (July 2020), economic and financial analyses are required in Annex 3 to assess the viability of the project and programme, also the analyses are divided into two categories, i.e., 1) direct assessment and 2) indirect assessment.

The former, an assessment of the efficiency and effectiveness of the investment criterion, is based predominantly on the economic and financial analyses in terms of cost effectiveness, cost-benefit ratio (CBR), economic internal rate of return/financial internal rate of return (EIRR/FIRR), and long-term economic and financial viability. The latter, the economic and financial analyses can form part of the assessment of the impact potential, paradigm shift potential, sustainable development potential, and needs of the recipient.

Based on the conditions aforementioned, criterion/factors that were analyzed for each component were presented as shown in Table 1.1. It is noted that for Component 1 (Establishment of ICZM), direct assessment was not conducted due to the difficulties in evaluation of effectiveness quantitatively because the component aims to implement non-physical (soft) measures such as establishing policies and plans. Results of the assessment for each item are shown in the corresponding sections as shown in the table.

Table 1.1 Assessment Factors Evaluated for Each Component

Category	Investment Criterion/Indicative Assessment Factors			
	Component 1	Component 2	Component 3	Component4
Indirect assessment	Impact potential /number of direct and indirect beneficiaries (Sec. 2.1.1)	Impact potential /number of direct beneficiaries (Sec. 2.2.1)	Impact potential /number of beneficiaries of coverage (Sec. 2.3.1)	-
	Paradigm shift potential/scalability and replicability/ transformation (Sec. 2.1.1)	Needs of the recipient/absence of alternative sources of financing (Sec. 2.2.2)	-	-
Direct assessment	-	Efficiency and effectiveness/cost-effectiveness (Sec. 2.2.3 and Chap.3)	Efficiency and effectiveness/cost-effectiveness (Sec. 2.3.2)	Efficiency and effectiveness/long-term economic and financial viability (Sec. 2.4.1)

Source: JICA

2 Assessment for Each Component

2.1 Component 1: Establishment of the Integrated Coastal Zone Management (ICZM)

The proposed Component 1 consists of the following activities (see FP main text for details).

Activity 1.1: Inventory study for risk assessment on present coastal and coral reef conditions
Activity 1.2: Preparation of basic policy of ICZM at the national level
Activity 1.3: Preparation of concrete ICZM Plan at representative inhabitant island as case study
Activity 1.4: Capacity development and information sharing of the relevant organizations for establishment of the ICZM

2.1.1 Impact Potential/Number of Direct and Indirect Beneficiaries

Direct beneficiaries: 5,346 people
In Activity 1.3, the ICZM Plan that will be prepared through Activities 1.1 and 1.2 will be practiced and examined as case studies in Gan in Addu Atoll and Fonadhoo Island in Laamu Atoll. The activities include the following: 1) Establishment of coastal and reef conservation plan, 2) Establishment and implementation of sediment budget control plan, 3) Study for strengthening measures on land use planning, 4) Study on coastal management system and its implementation, and 5) Study on regulation and law at island level.
The population of the two islands where the practices and case studies will be implemented are considered to be direct beneficiaries of Component 1. Based on the Census 2014, the number of direct beneficiaries is evaluated at 5,909, which is the sum of population at both Gan (3,080) and Fonadhoo (2,266) islands.

Indirect beneficiaries: 196,000 people
The ICZM basic policy and guidelines will be developed at the national level and the Government of Maldives (GoM) intends to incorporate the policies and guidelines into the planning and implementation of coastal conservation measures in the future.
Based on the State of Environment 2016, it was assumed that 52% of the national population lives either in reclaimed area or area with coastal protection measures implemented, which are already protected. The remaining population (i.e. 48% of total population of 407,660), therefore, was estimated as indirect, potent beneficiaries of ICZM concept.

- 407,660 x 48% = 196,000 people

2.1.2 Paradigm Shift Potential/ Scalability and Replicability/Transformation

Scalability and replicability: High

The draft regulations developed in the target islands (Gan in Addu Atoll and Fonadhoo in Laamu Atoll), identified as necessary for practicing the ICZM through case studies, are submitted for approval of the mayors of the islands during the implementation period. To start the formulation process of the ICZM guidelines at the national level, a public office/department in charge of finalizing the ICZM guidelines shall be appointed. The training for concerned agencies include "cascade" training to enable the trained officials to provide valuable advice during the replication stage. Further, the employment of the local consultants will be discussed by the Project Steering Committee, who will play an important role during the implementation of the case studies in the concerned agencies. With these activities, practicing the ICZM at the other islands is expected, therefore, the scalability and replicability of Component 1 are evaluated as high.

Transformation of the concept of coastal protection: High potential

One of the most serious factors of coastal vulnerability against climate hazard is the artificialization of the coast by the construction of harbors, reclamation, and other coastal facilities. These structures constructed along the coastal line or in shallow water areas usually prevent and

change the manner of the original sediment transport and causes coastal erosion and even accelerate flooding caused by waves in the surrounding area. Component 1 aims to identify such issues on the coastal area in the Maldives through Activity 1.1 and prepare a new concept for coastal protection. These are part of the basic policy and concrete plan of ICZM to avoid or minimize such negative impact in the future. In addition, capacity development on ICZM will be implemented, through Activity 1.4, for relevant organizations who will be in charge of planning and design of the coastal conservation in the future. With these activities, it is expected that the concept of coastal protection by GoM will be transformed from protection-oriented to environment-conscious through Component 1 in terms of, for example, the layout of coastal facilities and ports and the way to select coastal protection measures.

2.2 Component 2: Implementation of Coastal Conservation/Protection Measures against Coastal Erosion

The proposed Component 2 consists of the following activities (see FP main text for details).

Activity 2.1: Detailed design of coastal conservation measures and capacity development of stakeholders
Activity 2.2: Implementation of coastal conservation/protection measures
Activity 2.3: Implementation of beach maintenance, establishment of structure and capacity development of stakeholders

2.2.1 Impact Potential/Number of Direct Beneficiaries

Direct beneficiaries: 9,071 people

Table 2.2.1 shows the islands where coastal conservation measures will be designed and implemented through the Activity 2.2. Direct beneficiaries are evaluated at 9,071 by summation of the islands' population where coastal conservation measures will be implemented.

Table 2.2.1 Target Islands and Proposed Measures

Atoll	Island	Population	Coastal Conservation Measures to be Applied	Fund Source
Laamu	Maamendhoo	896	・Beach nourishment and groins ・Revetment and reclamation	GCF
	Fonadhoo	2,266	・Beach nourishment and groins	GCF
	Gan	3,080	・Revetment	GoM
	Ishdhoo	958	・Revetment	GoM
Addu	Meedhoo	1,871	・Beach nourishment and groins	GCF and GoM
Total		9,071		

Source: JICA

2.2.2 Needs of the Recipient/ Absence of Alternative Sources of Financing

Insufficient budget for coastal conservation:

The Maldives, as a Small Island Developing State (SIDS), is highly vulnerable to climate change. Each year, the GoM allocates approximately USD 5 million to USD 11 million for coastal protection with a total expenditure of USD 30 million from 2013 to 2017.

On the other hand, the necessary budget for coastal protection works for the inhabited areas within the Maldives is estimated to be from USD 3.3 billion to USD 55 billion. Since the population is scattered across 188 inhabited islands, many of which have less than 1,000 inhabitants, the limited resources at

the government's disposal are insufficient to provide a lasting solution to the coastal erosion issues that these islands face.

Insufficient international assistance:

GoM published the Maldives's Intended Nationally Determined Contribution in 2015, raised coastal protection as one of the priority climate change adaptation measures, and requested for international assistance. However, the only assistance including structural measures announced by the international aid agency as of September 2018 is the Coastal Protection Project at Gn. Fuvahmulah (total project cost of USD 22 million) by the Netherlands (grant) and Kuwait Fund (loan). With this situation, expecting to obtain assistance from other international aid agencies would be difficult.

2.2.3 Efficiency and Effectiveness/ Cost-effectiveness

The benefit that is to be expected through the implementation of Component 2 is summarized in Table 2.2.2. The benefit at Maamendhoo and Fonadhoo was able to be evaluated in monetary value because the protection effect of residential property can be quantitatively evaluated using some reference unit of values. On the other hand, the effectiveness for the other three islands, namely; Gan, Ishdhoo, and Meedhoo, it is difficult to evaluate the effect quantitatively due to the difficulties in setting an appropriate unit for evaluation. Therefore, monetary benefit expected at Maamendhoo and Fonadhoo were directly used for cost-benefit analysis in this section.

Table 2.2.2 Benefit and Evaluation Methods by Measures

Atoll	Island	Measures	Effectiveness	Monetary Value
Laamu	Maamendhoo	・ Beach nourishment and groins ・ Revetment and reclamation	Protection of residential property against flooding and erosion	Evaluated
	Fonadhoo	・ Beach nourishment and groins		
	Gan	・ Revetment	Protection of heritage site and cultural site from flooding and/or erosion	Not evaluated
	Ishdhoo	・ Revetment		
Addu	Meedhoo	・ Beach nourishment and groins		

Source: JICA

The evaluation was carried out assuming two cases, namely: with and without the project as shown in Table 2.2.3. It was assumed that the damage, in case of without the Project, will be prevented by the implementation of the Project, and the damage was considered to be equivalent to the benefit of the Project. The economic analysis was carried out according to the Guidelines for Cost and Benefit Analysis of Coastal Protection (In Japanese, June 2004, Ministry of Agriculture, Forestry and Fisheries, and Ministry of Land, Infrastructure, Transport and Tourism)

Table 2.2.3 Assumptions for Economic Analysis

Cases	Description
Without case	No coastal project will be implemented 1) Existing national land will keep eroding 2) Flooding occurs at hinterland due to wave overtopping
With case	Coastal conservation project will be implemented 1) Existing national land will be protected from erosion 2) Hinterland will be protected against flooding and safety is improved

Source: JICA

(1) Benefit

Chapter 3 of this Annex contains the detailed evaluation procedures of the benefit for Maamendhoo and Fonadhoo. The results of the expected annual benefit in each representative year for both erosion prevention and flooding protection are summarized in Table 2.2.4. The benefits expected for the other years were estimated by linear approximation based on values presented in the table and were used for the cashflow of the economic analysis.

Table 2.2.4 Expected Annual Benefit (USD/year)

Target Island	2019	2030	2050	2100
Maamendhoo	599,316	887,831	3,427,310	686,178
Fonadhoo	797,709	945,925	1,768,727	2,727,362
Total	1,397,025	1,833,756	5,196,037	3,413,540

Source: JICA

(2) Cost

The project cost for Component 2 used for the analysis is shown in Table 2.2.5. The cost includes the construction and the consultant for the whole Component 2 (see Annex 4 for details). The construction cost includes 20% contingency cost considering uncertainty of implementation such as material and machine procurement, price escalation, and construction schedule.

Table 2.2.5 Project Cost by Year for Component 2

Unit: 1,000 USD

2021	2020	2023	2024	2025
167	84	1,402	9,122	11,128
2026	2027	2028	**Total**	
7,447	241	441		**30,031**

Source: JICA

2.3 Component 3: Development of Disaster Warning and Information Dissemination

The proposed Component 3 consists of the following activities (see FP main text for details).

Activity 3.1: Installment of Terrestrial Digital Broadcasting System
Activity 3.2: Establishment of Disaster Early Warning and Information Broadcasting System

2.3.1 Impact Potential/Number of Beneficiaries of Coverage

Beneficiaries of coverage: 372,000 people
Based on the preparatory survey report*, the proposed terrestrial broadcasting will cover 172 islands out of the 201 inhabitant islands. The coverage corresponds to 91.23% of the total population of the Maldives. Therefore, the number of beneficiaries of the coverage is estimated at 372,000, which is 91.23% of the total population (407,660 from the Census 2014) of the Maldives.

* Preparatory Survey Report on the Project for the Digital Terrestrial Television Broadcasting Network Development in the Republic of Maldives (October 2016, JICA)

2.3.2 Efficiency and effectiveness/cost-effectiveness

The benefit expected through the implementation of Component 3 is evaluated by the following procedures focusing on effect by the disaster warning system. Since there are very few knowledge and studies on the valuation of the system, this evaluation was conducted mostly refereeing to a case study in Samoa[1] to evaluate the benefit.

In the article[1], a benefit type due to EWS (early warning system) was estimated as a damage reduction by removal of items during the lead time, such as household items, possessions, money, machinery equipment, office equipment and furniture.

According to the article, monetary benefit due to EWS was evaluated by the Equation 1 and the damage amount, which corresponds to D in the equation, was applied from the damage estimation by Cyclone Evan in 2012. Since the damage by Cyclone Evan was reported by kind of industry, the benefits were also evaluated by industry basis in Samoa case.

$$B = D \times R \times F \times P \quad \text{(Equation 1)}$$

B: Annual benefit (USD/year)

D: Damage amount (USD/ disaster)

R: Damage reduction ratio by EWS (estimated as 25% based on interview survey)

F: Frequency (times/year, once in five years)

P: Probability of correct forecast (0.9, 9 out of 10 cases)

In this study for Maldives, however, available and/ or reliable data for actual damage in details by past disasters such as storm surge and high wave is rather limited.

With conditions and limitations aforementioned, this analysis had to take an “indirect” approach to evaluate the damage in Maldives by referring to those reported in Samoa case. As shown in Table 2.3.1, ratio of the damage to GDP was calculated by industry in Samoa, then the same ratio was applied to estimate damage in Maldives by multiplying with its GDP by industry. It should be noted that a “direct”

[1] Bapon S.H.M. Fakhruddin, Lauren Schick (2019). Benefits of economic assessment of cyclone early warning systems – A case study on Cyclone Evan in Samoa

approach with site specific conditions is more desirable in future stage such as detailed design if relative conditions and data are available.

Table 2.3.1 Damage Estimation in Maldives based on Samoa Case

	Samoa			Maldives	
Representative industry	(1) GDP[1] (SAT mil.)	(2) Damage [2] (SAT mil.)	(3) Percentage (2) / (1)	(4) GDP[1] (USD mil.)	(5) Damage[3] (USD mil.) (4) x (3)
Agriculture	152.6	4.64	3%	55.6	1.7
Fishery	36.4	2.07	6%	180.6	10.8
Manufacturing	110.2	17.25	16%	109.6	17.5
Tourism	697.53	27.7	4%	1,317.5	52.7
Total					**82.7**

[1] 2018 for Samoa and 2019 for Maldives with exchange rate of 1MVR=0.065USD
[2] Estimated damage for each industry by Cyclone Evan (2012), considered as the event with 5-year return period
[3] Assumed damage by sector for Maldives by a disaster with similar return period of Cyclone Evan (i.e. 5-year return period)

Assuming that the damage estimated in Maldives will occur with similar frequency of Cyclone Evan, i.e. once in five years, the frequency of occurrence was simply estimated as 0.2 times/year. The population coverage of the system in Component 3, 91.23% was also considered to evaluate benefit. Finally, monetary benefit for Component 3 was calculated as follows. This estimated benefit is incorporated with the economic analysis in Chapter 4.

B= D x R x F x P x 0.9123(population coverage)

= 82.7 (mil USD/ disaster) x 0.25 x 0.2 (times/year) x 0.9 x 0.9123

= 3.395 (mil USD/year)

2.4 Component 4: Development of Basic Data Collection and Sharing System Related to Climate Change

The proposed Component 4 consists of the following activities (see FP main text for details).

Activity 4.1: Development of wave and sea level monitoring system
Activity 4.2: Development of beach, coral reef, and land use monitoring system

2.4.1 Efficiency and Effectiveness/ Long-term Economic and Financial Viability

The wave and sea level monitoring system that will be installed in this component aims to collect long-term data of at least ten years that is statistically reliable for analysis of wave characteristics at designated regions. The analysis will be applied to evaluate the degree of coastal risk due to climate change and to aid in the detailed design of coastal protection measures. The wave and sea level recorders which will be installed at offshore locations are exposed to solar rays and sea waves and thus, they require frequent maintenance and replacement of parts done by professional technicians during the monitoring period. To make the monitoring system sustainable in terms of finance, maintenance items required in the long term (i.e., ten years) as well as the yearly maintenance plan of the wave recorder should be prepared, as shown in Table 2.4.1. The costs required for equipment and professional technicians are all included in the budget plan for the Component 4.

Table 2.4.1 Maintenance Plan for Wave and Sea Level Recorder for Ten Years

Year		First five years					Latter five years				
		Initial installation	1	2	3	4	5	6	7	8	9
Overhaul Maintenance		-				Y					
Exchange	Electric accumulator	-			Y			Y			Y
	Rubber gasket	-	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Hood	-			Y			Y			Y
	Metallic material	-	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Packing	-	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Spacer	-	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Anticorrosion plate	-	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Float	-			Y			Y			Y
	Rope	-	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Shackle	-		Y		Y		Y		Y	

Y: Maintenance or exchange required
Source: JICA

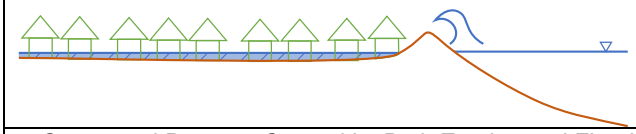
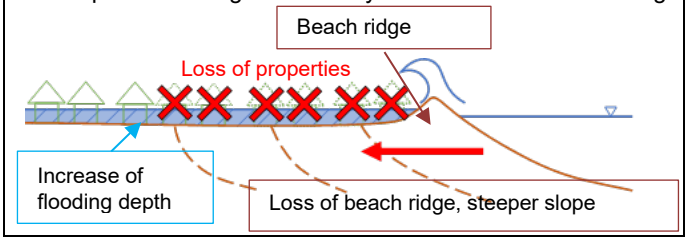
3 Benefits Estimated by the Implementation Measures against Coastal Erosion and Flooding

3.1 Overview of the Compound Damage by Coastal Erosion and Flooding

The schematic figure for the compound damage of coastal erosion and flooding is shown in Table 3.1.1. The following impacts are expected to accelerate due to this phenomenon:

- The beach ridge, which is a wave-deposited ridge parallel to the shoreline, is generally formed and developed after experiencing high waves. However, once the beach ridge erodes and disappears due to coastal erosion, the protection function of the beach would be reduced.
- The beach scarp, which is a steep slope or miniature cliff formed by wave action, will develop as coastal erosion progresses, and this will increase the wave overtopping at the hinterland.
- In addition to the abovementioned phenomenon, the wave force acting on the shore will increase and would further accelerate coastal erosion.

Table 3.1.1 Schematic Figure of the Compound Damage of Coastal Erosion and Flooding

Schematic Figure of the Compound Damage	Description
● Damage Solely by Coastal Erosion 	• National land will be lost due to coastal erosion. • In case there are properties such as houses, their value will also be lost due to erosion.
● Damage Solely by Flooding 	• Flooding will occur at the hinterland due to severe wave overtopping at the shore. • Properties located inside the flood area will suffer damage depending on the degree of flood depth.
● Compound Damage Caused by Both Erosion and Flooding 	• The beach ridge will be lost, and the beach slope will become steeper as coastal erosion progresses. • This will weaken the protection function that the beach used to have and will increase wave overtopping at the hinterland. • The wave force acting on the shore will increase and will increase the rate of coastal erosion.

Source: JICA

Considering the above, the compound damage was evaluated and the damage maps are shown in Figure 3.1.1 for Maamendhoo and in Figure 3.1.2 for Fonadhoo. Table 3.1.2 shows the evaluation condition for the compound damage. (See Chapter 6 of Annex 2 for the setting of evaluation condition)

The coastal erosion rate was set as the summation of the 1) maximum annual erosion rate from the shoreline change analysis using past satellite images (see Section 6.2.2 of Annex 2) and 2) the acceleration rate of erosion due to sea level rise (SLR) (see Section 6.2.3 of Annex 3). In general, the erosion rate is set as either the average rate of the target area or one of the maximum rates. In this study, the latter was adopted to evaluate the risk at the maximum side.

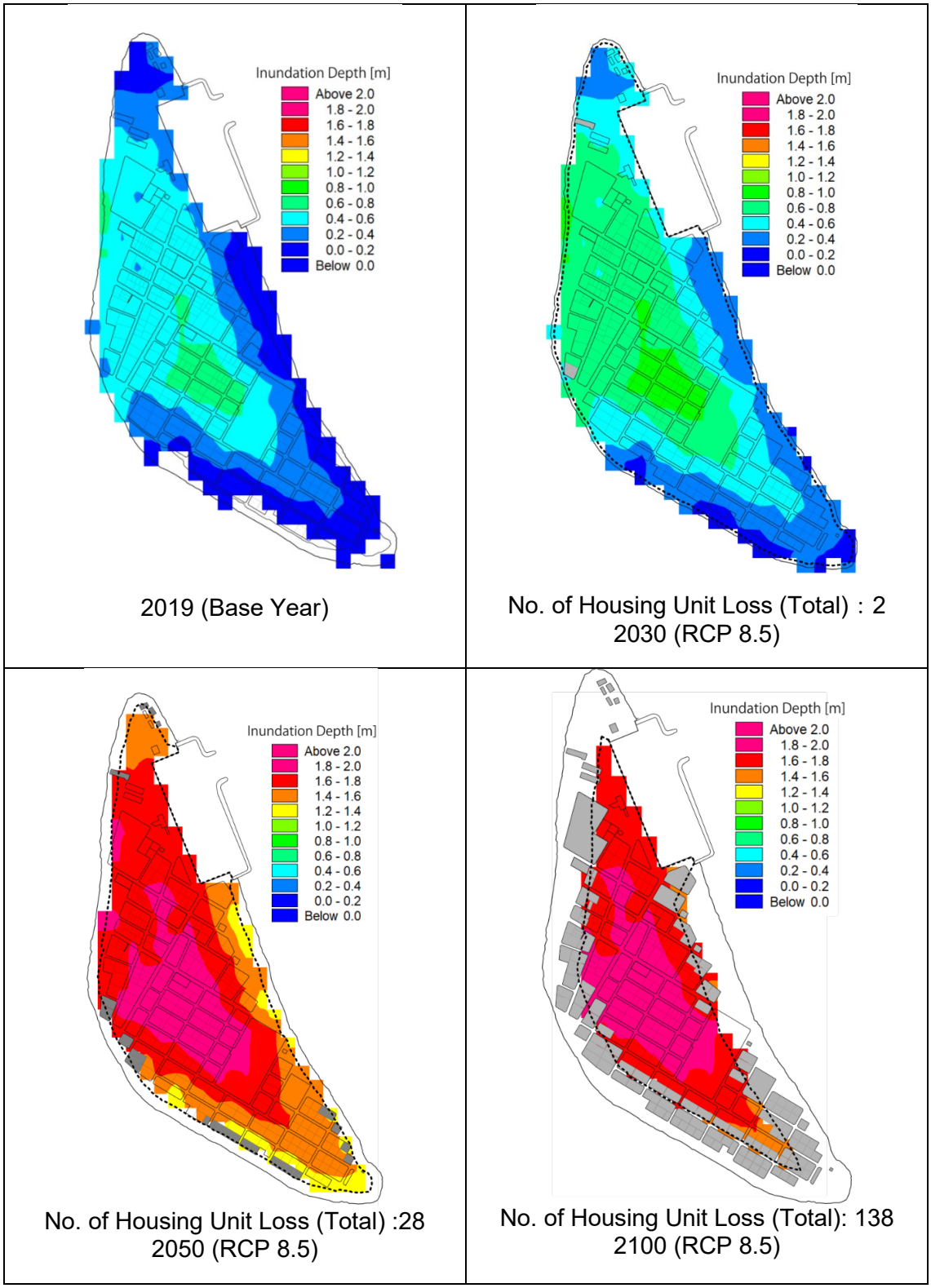
Table 3.1.2 Evaluation Condition for the Compound Damage of Erosion and Flooding

		2019	2030	2050	2100
Tide Level：H.W.L.		+0.64 m			
SLR (RCP 8.5)		－(Base)	0.04 m	0.17 m	0.65 m
Offshore Wave Height	Maamendhoo	$H_{1:10}$= 2.0 m, T= 10 s			
	Fonadhoo	$H_{1:10}$= 3.0 m, T= 16 s			

Erosion Rate	Maamendhoo	0.55 m/year	0.55 m/year	0.60 m/year	0.84 m/year
	Fonadhoo	0.47 m/year	0.47 m/year	0.67 m/year	0.92 m/year

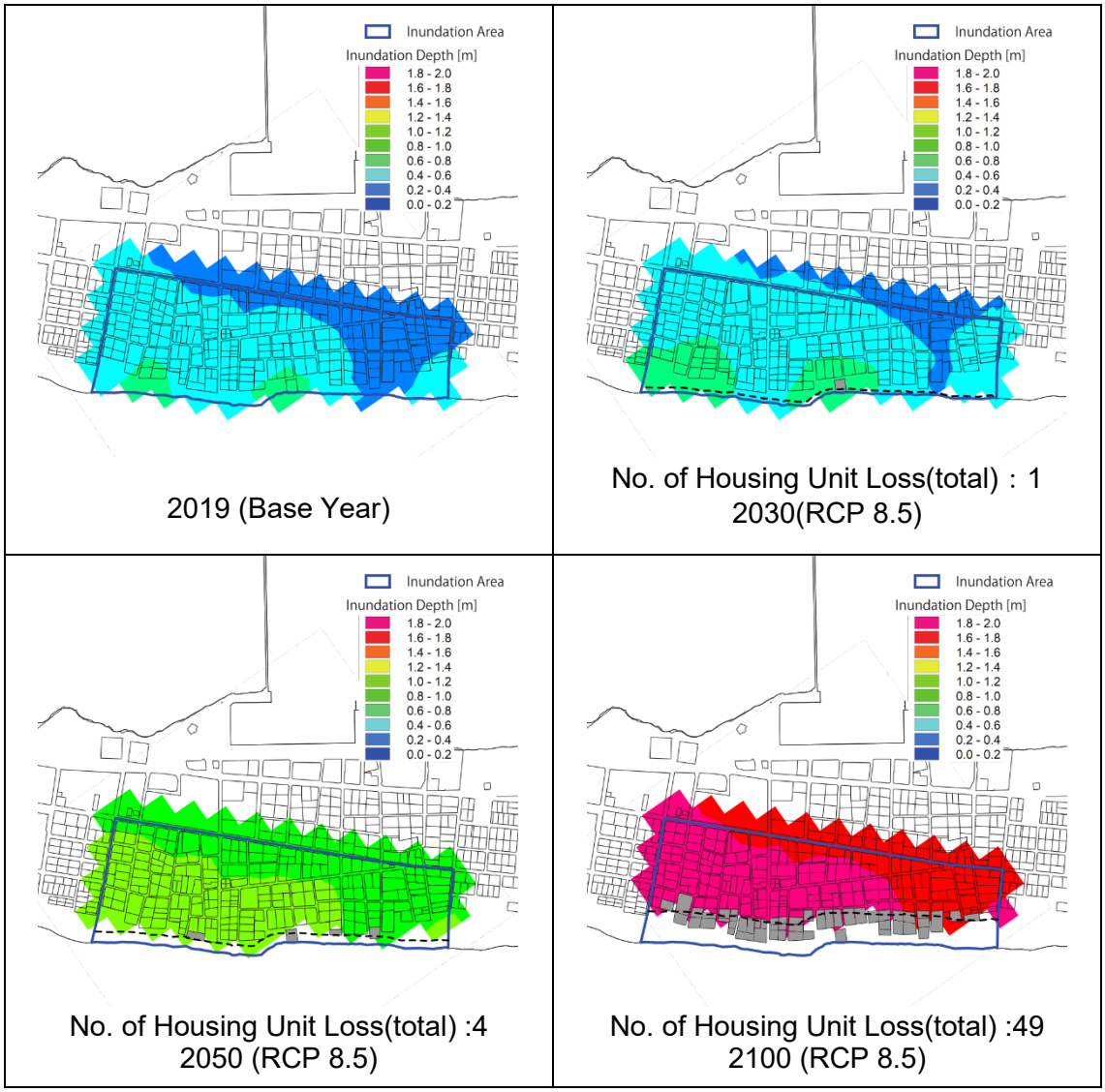
Source: JICA

With the evaluation condition shown in Table 3.1.2, erosion and flooding analysis was conducted for Maamendhoo and Fonadhoo in each target year and the results are shown in Figures 3.1.1 and 3.1.2, respectively (See Sec. 6.3.2 of Annex 2 for procedures of the analysis).



*Black dotted line: Eroded shoreline, Gray highlighted: Houses lost
Source: JICA

Figure 3.1.1 Compound Damage Map Due to Erosion and Flooding with SLR for Maamendhoo



*Black dotted line: Eroded shoreline, Gray highlighted: Houses lost。

Source: JICA

Figure 3.1.2 Compound Damage Map Due to Erosion and Flooding with SLR for Fonadhoo

3.2 Classification and Calculation of the Compound Damage

(1) Classification of the Compound Damage

The compound damage caused by coastal disasters (coastal erosion and flooding due to high wave) was classified into the four groups listed in Table 3.2.1. In the study, items marked with "Y" in the table were evaluated in monetary value while items marked with "–" were not evaluated quantitatively due to difficulties in assuming the primary unit required for calculation.

Table 3.2.1 Classification of the Compound Damage

Damage Type	Item	Quantitative Evaluation
1) Physical Damage	Flooding damage on properties (houses)	Y
	Erosion damage on properties (loss of houses)	Y
	Erosion damage on national land (loss of land)	Y
2) Damage on People's Lives	Resettlement forced due to loss of houses	Y
	Difficulties and inconvenience on beach use	-
3) Economic Damage	Loss of work opportunities due to business suspension	Y
	Damage on island's economic function such as logistics and tourism	-
4) Environmental Damage	Damage on biological environment	-

Y: Calculated in this study
- : Not calculated
Source: JICA

(2) Calculation of Damage Amount

1) Physical Damage

As shown in Table 3.2.1, the physical damage was classified into damage due to coastal erosion (properties and national land) and flooding.

i) Flood Damage

Assumption : It was assumed that the hinterland was flooded due to high wave under extreme weather condition and properties (houses and household commodities) would be affected in accordance with the degree of flood depth.

Calculation Overview : Flood damage was calculated based on the assumed flood area and flood depth (see Figure 3.1.1 for Maamendhoo and Figure 3.1.2 for Fonadhoo), with mainly three items listed in Table 3.2.2.

Table 3.2.2 Items Used for the Calculation of Damage

Item	Description
a) Value of asset (house)	Interview survey results were used to determine value of houses as there was no statistical data available. → USD 30,000/house (Since no official construction cost per house available, this figure was set based on average construction cost per house from the interview survey results by the JICA Expert Team)
b) Damage rate by inundation depth	Cited from the Guidelines for Cost and Benefit Analysis (Refer to Table 3.2.3)
c) Probability of occurrence	Cited from the Guidelines for Cost and Benefit Analysis

(flooding)	(Refer to Table 3.2.4)

Source: JICA

Table 3.2.3 Damage Rate of Property by Inundation Depth

Degree of Flooding / Property	Below Floor Level	Above Floor Level				
		Below 50 cm	50-99 cm	100-199 cm	200-299 cm	Above 300 cm
House	0.045	0.151	0.229	0.480	1.000	1.000
Household Product	0.021	0.189	0.489	0.889	1.000	1.000

Source：The Guidelines for Cost and Benefit Analysis of Coastal Protection (Japanese, June 2004, Ministry of Agriculture, Forestry and Fisheries, and Ministry of Land, Infrastructure, Transport and Tourism)[10)]

Table 3.2.4 Probability of Occurrence and Damage

Return Period	Probability of Exceedance	Expected Damage	(1) Annual Ave. of Occurrence Probability	(2) Annual Ave. of Expected Damage	Expected Annual Damage With the Probability (1) × (2)
1-year return period	N_1=1	L_1(=0)	N_1-N_{10} (=1-1/10)	(L_1+L_{10})/2	((N_1-N_{10})×(L_1+L_{10}))/2
10-year return period	N_{10}=1/10	L_{10}			

Source：The Guidelines for Cost and Benefit Analysis of Coastal Protection[10)]

ii) Coastal Erosion Damage

A) Loss of Properties (Houses)

Assumption : It was assumed that property (house) will be lost due to coastal erosion as the basement of the house would be affected by erosion. Once lost, the property will be eliminated from the damage evaluation to avoid overestimation.

Calculation Overview : Prosperity was counted as lost when the eroded shoreline reaches the property. The damage amount due to loss was calculated based on the value of the assets shown in Table 3.2.2.

B) Loss of National Land

Assumption：It was assumed that the land area inside the present shoreline is all national land, and coastal erosion across this border was evaluated as loss of national land. Once lost, the land will be eliminated from the damage evaluation to avoid overestimation.

Calculation Overview：The damage amount was calculated using the formula below. Land unit value was set at USD 5/m^2 referring to the guidelines* as a reliable statistical value was not available in the Maldives.

* The Guidelines for Cost and Benefit Analysis of Coastal Protection (Japanese, June 2004, Ministry of Agriculture, Forestry and Fisheries, and Ministry of Land, Infrastructure, Transport and Tourism)

<Calculation Formula>

Damage of loss of national land (USD/year) = Annual erosion rate (m/year) × Shoreline distance (m) × Land unit value (USD/m^2)

iii) Calculation Results of the Compound Damage

The calculation results are shown in Table 3.2.5 for Maamendhoo and Table 3.2.6 for Fonadhoo.

Although the damage amount is generally presented on an annual basis, the accumulative damage over the years was also presented for coastal erosion as reference. Even though the damage due to erosion is much smaller than that of flooding on an annual basis, it should be noted that coastal erosion is a type of irreversible disaster that progresses slowly. In fact, if evaluated as accumulated damage, as shown in Figure 3.2.1, the damage due to erosion is not negligible even compared with the damage due to flooding. Thus, it is indicated that taking specific countermeasures against coastal erosion is essential especially in the long term.

In Figure 3.2.1, a slight decrease of damage due to flooding is observed from 2050 to 2100. This is because the number of properties affected by flooding decreased during the period due to coastal erosion. On the other hand, damage due to erosion increased during the same period.

Table 3.2.5 Estimated Damage for Maamendhoo (RCP 8.5, $H_{1/10}$)

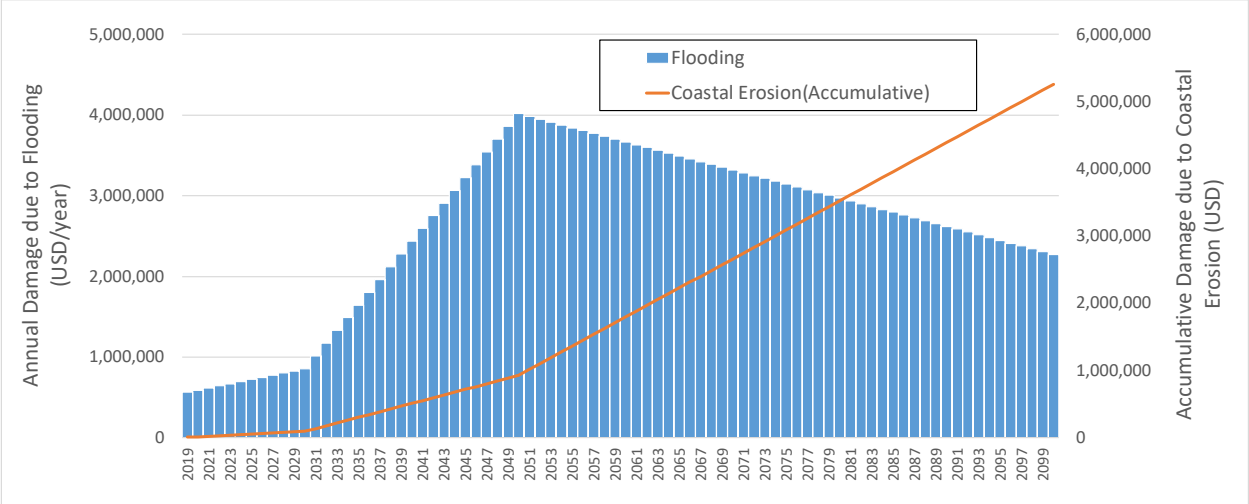
Damage	Unit	2019	2030	2050	2100
Flooding	USD/year	564,084	855,900	4,017,074	2,273,225
Erosion	USD/year	7,909	7,909	41,700	69,794
	USD (Accumulative)	7,909	94,909	928,909	4,418,615

Source: JICA

Table 3.2.6 Estimated Damage for Fonadhoo (RCP 8.5, $H_{1/10}$)

Damage	Unit	2019	2030	2050	2100
Flooding	USD/year	555,498	664,686	1,568,133	2,753,744
Erosion	USD/year	4,736	4,736	7,348	31,550

Source: JICA



Source: JICA

Figure 3.2.1 Comparison of Damage Amount for Maamendhoo Case: Flooding (USD/year) VS Coastal Erosion (USD, Accumulative)

2) Damage on People's Lives

Assumption: In case houses and housing land would be lost due to coastal erosion, the owner would be obliged to resettle to other areas or island because reconstruction of the house at the original area would not be realistic in terms of the physical and safety aspects.

Calculation Overview: The damage was estimated using the equation below considering the reconstruction cost required for the number of lost properties (houses).

<Calculation Formula>

B=A×C

B: Annual damage (USD/year)
A: Number of affected properties
C: Value of asset (USD 30,000/house, cited in Table 3.2.7)

Table 3.2.7 Estimated Damage on People's Lives (RCP 8.5, $H_{1/10}$)

Target	Unit	2019	2030	2050	2100
Maamendhoo	USD/year	5,455	5,455	39,000	66,000
Fonadhoo	USD/year	2,727	2,727	4,500	27,600

Source: JICA

3) Economic Damage

Assumption: If a house was affected by flooding, this will affect the resident's work environment and force residents to spend a certain period of time before getting back to work as usual. The lack of work opportunities during this period was evaluated as the damage to the economy.

Calculation Overview: The damage was estimated using the formula below. In the formula, income per capita was used as the unit to estimate economic loss. Thus, it is interpreted that the damage contains losses on industries such as fishery and tourism.

<Calculation Formula>

B=A×C×D×R×P

B: Annual damage (USD/year)
A: Income per capita, USD 10,626/person (National Accounts (Maldives) - Analysis of Main Aggregates, United Nations, 2019)
C: Number of affected people (number of people inside the flooding area)
D: Period for loss of work opportunities (assumed to be six months at the maximum, classified by flooding depth)
R: Damage rate by flooding depth (The Guidelines for Cost and Benefit Analysis of Coastal Protection (Japanese, June 2004, MAFF and MLTI))
P: Probability of occurrence (associated with return period of offshore wave)

Table 3.2.8 Estimated Damage on Economy (RCP 8.5, $H_{1/10}$)

Target	Unit	2019	2030	2050	2100
Maamendhoo	USD/year	254,936	363,834	1,170,850	723,207
Fonadhoo	USD/year	234,748	273,776	422,446	858,411

Source: JICA

(3) Summary of Estimated Annual Damage and Damage Reduction Effect by Countermeasures

Table 3.2.9 and Table 3.2.10 show the summation of the damage for Maamendhoo and Fonadhoo, respectively. The estimated damage amount rapidly increases due to SLR. The annual damage is estimated to be about USD 5 million/year from 2050 to 2100 for each island.

Table 3.2.9 Estimated Annual Damage for Maamendhoo (USD/year)

Damage Type	Items	2019	2030	2050	2100
Physical Damage	Flooding	564,084	855,900	4,017,074	2,273,225
	Coastal erosion (loss of properties and national land)	7,909	7,909	41,700	69,794
Damage on People's Lives	Resettlement	5,455	5,455	39,000	66,000
Economic Damage	Loss of work opportunities	254,936	363,834	1,170,850	723,207
Total		832,384	1,233,098	5,268,624	3,132,226

Source: JICA

Table 3.2.10 Estimated Annual Damage for Fonadhoo (USD/year)

Damage Type	Items	2019	2030	2050	2100
Physical Damage	Flooding	555,498	664,686	1,568,133	2,753,744
	Coastal erosion (loss of properties and national land)	4,736	4,736	7,348	31,550
Damage on People's Lives	Resettlement	2,727	2,727	4,500	27,600
Economic Damage	Loss of work opportunities	234,748	273,776	422,446	858,411
Total		797,709	945,925	2,002,427	3,671,305

Source: JICA

Table 3.2.11 and Table 3.2.12 show the damage amount estimated in case the proposed countermeasures were implemented for Maamendhoo and Fonadhoo, respectively (see Chapter 9 of Annex 2 for the details of the countermeasures).

Damage due to erosion was estimated to be zero assuming that the shoreline would not erode inland from the existing shoreline using the following two measures: 1) Beach nourishment with about 30 m beach width at high water level (H.W.L.) and 2) technology transfer program to realize future adaptive measures by applying stockpiled sand.

No damage is estimated in 2019 (present) and 2030 if the said countermeasures were implemented. Certain degree of damage will be estimated after 2050. However, the damage will be greatly reduced due to the countermeasures.

Table 3.2.11 Estimated Annual Damage with Countermeasures for Maamendhoo (USD/year)

Damage Type	Items	2019	2030	2050	2100
Physical Damage	Flooding	0	0	338,364	1,652,157
	Coastal erosion (loss of properties and national land)	0	0	0	0
Damage on People's Lives	Resettlement	0	0	0	0
Economic Damage	Loss of work opportunities	0	0	170,106	560,644
Total		0	0	508,470	2,212,801

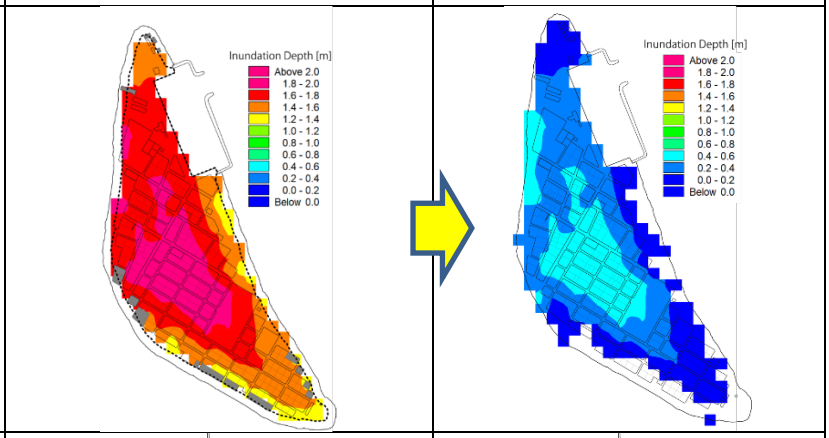
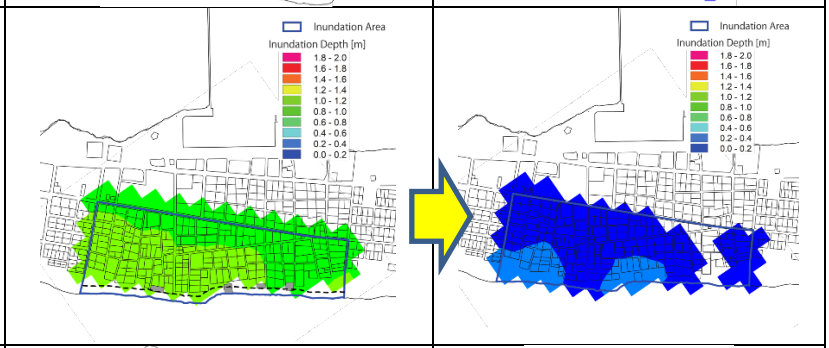
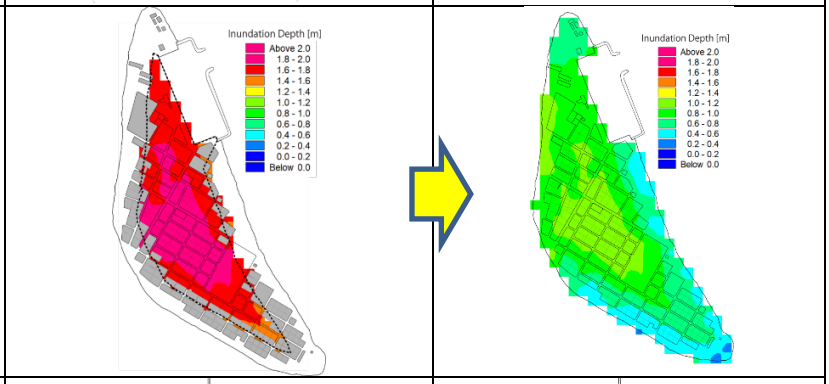
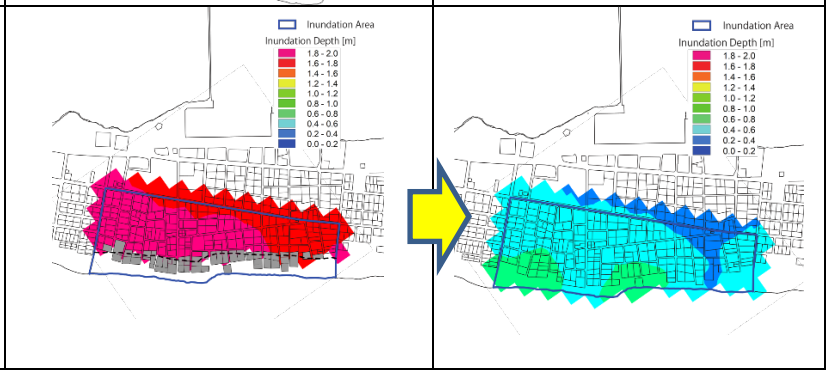
Source: JICA

Table 3.2.12 Estimated Annual Damage with Countermeasures for Fonadhoo (USD/year)

Damage Type	Items	2019	2030	2050	2100
Physical Damage	Flooding	0	0	146,124	670,167
	Coastal erosion (loss of properties and national land)	0	0	0	0
Damage on People's Lives	Resettlement	0	0	0	0
Economic Damage	Loss of work opportunities	0	0	87,577	273,776
Total		0	0	233,701	943,943

Source: JICA

Table 3.2.13 Comparison of Flood Depths With and Without Countermeasures (RCP 8.5)

Year	Target	Without Countermeasures	With Countermeasures
2050	Maamendhoo		
	Fonadhoo		
2100	Maamendhoo		
	Fonadhoo		

Source: JICA

Table 3.2.14 (Maamendhoo) and Table 3.2.15 (Fonadhoo), which illustrate the damage reduction effect through the implementation of the proposed countermeasure, were derived from the difference of Table 3.2.9 and Table 3.2.11, and Table 3.2.10 and Table 3.2.12, respectively. These values were used as benefit for the cost-benefit analysis. It is noted that the effect for Maamendhoo used for the cost-benefit analysis was evaluated considering the coverage ratio of the coastal protection measure to avoid overestimation of the benefit. The ratio was calculated to be 72% based on the length of coastal conservation measures (1,440 m) out of total coast line distance (2,000 m).

Table 3.2.14 Damage Reduction Effect of the Proposed Countermeasures (Maamendhoo)

Damage Type	Items	2019	2030	2050	2100
Physical Damage	Flooding	564,084	855,900	3,678,710	621,068
	Coastal erosion (loss of properties and national land)	7,909	7,909	41,700	69,794
Damage on People's Lives	Resettlement	5,455	5,455	39,000	66,000
Economic Damage	Loss of work opportunities	254,936	363,834	1,000,743	162,563
(1) Total		832,384	1,233,098	4,760,153	919,425
(2) Total (Applied in cost-benefit analysis) (1) X 72%		599,316	887,831	3,427,310	661,986

Source: JICA

Table 3.2.15 Damage Reduction Effect of the Proposed Countermeasures (Fonadhoo)

Damage Type	Items	2019	2030	2050	2100
Physical Damage	Flooding	555,498	664,686	1,422,009	2,083,577
	Coastal erosion (loss of properties and national land)	4,736	4,736	7,348	31,550
Damage on People's Lives	Resettlement	2,727	2,727	4,500	27,600
Economic Damage	Loss of work opportunities	234,748	273,776	334,870	584,635
Total		797,709	945,925	1,768,727	2,727,362

Source: JICA

4 Economic Analysis for the Whole Project

Economic analysis using cost-benefit analysis was employed in order to evaluate the economic feasibility of the whole Project which consists of the components in the Table below. The purpose of the economic analysis is to evaluate the proposed project from the viewpoint of the national economy. Economic analysis is evaluated using the CBR, EIRR, and net present value (NPV).

(1) Cost and Benefit Condition

Cost and benefit conditions used in the analysis were shown in the following tables.

Table 3.2.1 Cost and Benefit used for Economic Analysis by Component

Project Component	Cost (1,000 USD)	Monetary Benefit
Component 1 (ICZM)	2,255 (3%)	N/A
Component 2 (Coastal Conservation Measure)	30,031 (46%)	2030: 1.83 mil USD/year 2050: 5.20 mil USD/year (See Chap.2.2 and 3)
Component 3 (Digital Broadcasting and Disaster Warning system)	29,500 (45%)	3.395 mil USD/ year (See Chap.2.3)
Component 4 (Data acquisition)	800 (1%)	N/A
Project Management Component	3,421 (5%)	N/A
Total	66,008 (100%)	

Table 3.2.2 Project Cost by Year (1,000 USD)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Sub Total
Comp. 1	-	-	103	748	748	656	-	-	-	-	2,255
Comp. 2	-	-	167	84	1,402	9,122	11,128	7,447	241	441	31,416
Comp. 3	463	12,392	15,258	925	463	-	-	-	-	-	29,500
Comp. 4	-	-	59	249	249	243	-	-	-	-	800
PM	-	-	110	492	740	567	513	509	412	78	3,421
										Total	66,008

Source: Annex 4 Detailed Budget Plan

(2) Calculation Conditions

The following conditions are used for the economic analysis:

- Base year for evaluation: 2019
- Beginning year of benefit：2027 for Component 2 and 2024 for Component 3
- Duration period of benefit：
  - Component 2: 50 years (a general evaluation period for coastal conservation measure)
  - Component 3: 30 years based on the preparatory survey report
- Discount rate：5%

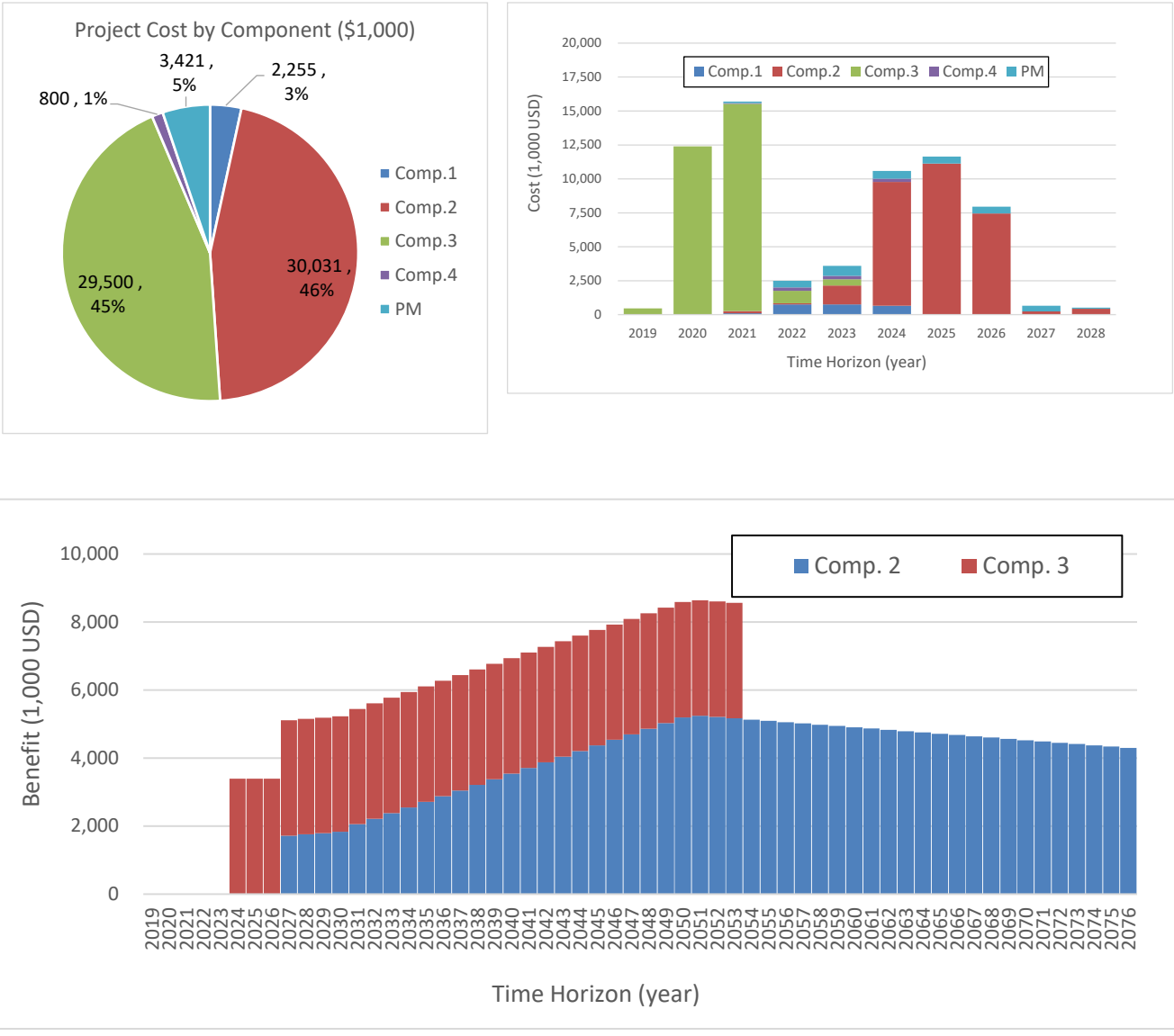
  Discount rate of 0%-4% is proposed for public works as countermeasures against climate change*. In this study, a discount rate of 5% was applied as a safety side of the evaluation.

  *Ref) Economic Costs and Benefits of Climate Change Impacts and Adaptation to the Maldives Tourism Industry (2015)

- Maintenance cost:
  - Component 2: Beach nourishment in general needs periodic sand replenishment after the initial implementation. Frequency of replenishment usually ranges from every three to ten years, while five years was adopted as an intermediate value for this evaluation. Maintenance cost was estimated at 0.5% of total construction cost, which is usually applied for coastal projects in Japan. Since frequency and cost for maintenance are quite site specific, a detailed study will be needed to estimate concise maintenance costs.
  - Component 3: According to JICA report, the maintenance cost for 30 years will be covered by revenue from the system, therefore, maintenance cost is not included in this analysis.

(3) Result of Economic Analysis

Time series of cost and benefit is shown in Figure 3.2.1 and the analysis result is shown in Table 3.2.3, where B/C ratio is 1.58 and the EIRR is 8.00%, which shows viability for implementation as public works.



Source: JICA

Figure 3.2.1 Time Series of Annual Cost (upper) and Benefit (lower) (Without Discount Rate)

Table 3.2.3 Economic Analysis Result

ECONOMIC ANALYSIS

The Whole Project:

- **Component 1: Establishment of ICZM**
- **Component 2: Implementation of Coastal Conservation Measure**
- **Component 3: Development of Disaster Warning System**
- **Component 4: Development of Basic Data Collection**
- **Project Management(PM) Component**

Discount rate	5%
Analysis year	2019
Total Project Period	(10 years)
Start	2019
Complete	2028

Analysis Result	
CBR(B/C)	1.58
NPV(B-C)	31,958
	(x $.1000)
EIRR	8.00%

No	Year	Project Cost					Monetary Benefit		Net Benefit	Discount rate		Cost Based on 2019	Benefit Based on 2019
		Comp.1	Comp.2	Comp.3	Comp.4	PM	Comp. 2	Comp. 3		multi-plier	Value		
		(x $.1000)	(x $.1000)	(x $.1000)	(x $.1000)	(x $.1000)	(x $.1000)	(x $.1000)	(x $.1000)			(x $.1000)	(x $.1000)
	Total	2,255	30,031	29,500	800	3,421	203,643	101,850	238,102	–	-	55,360	87,318
0	2019	-	-	463	-	-	-	-	(463)	0	1.00	463	-
1	2020	-	-	12,392	-	-	-	-	(12,392)	1	0.95	11,802	-
2	2021	103	167	15,258	59	110	-	-	(15,698)	2	0.91	14,238	-
3	2022	748	84	925	249	492	-	-	(2,497)	3	0.86	2,157	-
4	2023	748	1,402	463	249	740	-	-	(3,602)	4	0.82	2,963	-
5	2024	656	9,122	-	243	567	-	3,395	(7,192)	5	0.78	8,296	2,660
6	2025	-	11,128	-	-	513		3,395	(8,246)	6	0.75	8,687	2,533
7	2026	-	7,447	-	-	509	-	3,395	(4,561)	7	0.71	5,654	2,413
8	2027	-	241	-	-	412	1,715	3,395	4,457	8	0.68	442	3,458
9	2028	-	441	-	-	78	1,754	3,395	4,631	9	0.64	334	3,319
10	2029	-					1,794	3,395	5,189	10	0.61	-	3,186
11	2030	-					1,834	3,395	5,229	11	0.58	-	3,057
12	2031	-	138				2,052	3,395	5,309	12	0.56	77	3,033
13	2032	-					2,218	3,395	5,613	13	0.53	-	2,976
14	2033	-					2,383	3,395	5,778	14	0.51	-	2,918
15	2034	-					2,549	3,395	5,944	15	0.48	-	2,859
16	2035	-					2,714	3,395	6,109	16	0.46	-	2,799
17	2036	-	138				2,879	3,395	6,136	17	0.44	60	2,738
18	2037	-					3,045	3,395	6,440	18	0.42	-	2,676
19	2038	-					3,210	3,395	6,605	19	0.40	-	2,614
20	2039	-					3,376	3,395	6,771	20	0.38	-	2,552
21	2040	-					3,541	3,395	6,936	21	0.36	-	2,490
22	2041	-	138				3,707	3,395	6,963	22	0.34	47	2,428
23	2042	-					3,872	3,395	7,267	23	0.33	-	2,366
24	2043	-					4,038	3,395	7,433	24	0.31	-	2,305
25	2044	-					4,203	3,395	7,598	25	0.30	-	2,244
26	2045	-					4,369	3,395	7,764	26	0.28	-	2,183
27	2046	-	138				4,534	3,395	7,791	27	0.27	37	2,124
28	2047	-					4,700	3,395	8,095	28	0.26	-	2,065
29	2048	-					4,865	3,395	8,260	29	0.24	-	2,007
30	2049	-					5,031	3,395	8,426	30	0.23	-	1,949
31	2050	-					5,196	3,395	8,591	31	0.22	-	1,893
32	2051	-	138				5,245	3,395	8,502	32	0.21	29	1,813
33	2052	-					5,207	3,395	8,602	33	0.20	-	1,719
34	2053	-					5,169	3,395	8,564	34	0.19	-	1,630
35	2054	-					5,132		5,132	35	0.18	-	930
36	2055	-					5,094		5,094	36	0.17	-	879
37	2056	-	138				5,056		4,917	37	0.16	23	831
38	2057	-					5,018		5,018	38	0.16	-	786
39	2058	-					4,980		4,980	39	0.15	-	743
40	2059	-					4,942		4,942	40	0.14	-	702
41	2060	-					4,904		4,904	41	0.14	-	663
42	2061	-	138				4,866		4,728	42	0.13	18	627
43	2062	-					4,829		4,829	43	0.12	-	592
44	2063	-					4,791		4,791	44	0.12	-	560
45	2064	-					4,753		4,753	45	0.11	-	529
46	2065	-					4,715		4,715	46	0.11	-	500
47	2066	-	138				4,677		4,539	47	0.10	14	472
48	2067	-					4,639		4,639	48	0.10	-	446
49	2068	-					4,601		4,601	49	0.09	-	421
50	2069	-					4,563		4,563	50	0.09	-	398
51	2070	-					4,526		4,526	51	0.08	-	376
52	2071	-	138				4,488		4,349	52	0.08	11	355
53	2072	-					4,450		4,450	53	0.08	-	335
54	2073	-					4,412		4,412	54	0.07	-	317
55	2074	-					4,374		4,374	55	0.07	-	299
56	2075	-					4,336		4,336	56	0.07	-	282
57	2076	-	138				4,298		4,160	57	0.06	9	266

Source: JICA

Annex-5：Implementation timetable

Annex 5 Implementation Timetable

Project/Programme Title:

COMPONENTS/ACTIVITIES	SUB-ACTIVITIES/PERFORMANCE INDICATOR	2019 Q1	2019 Q2	2019 Q3	2019 Q4	2020 Q1	2020 Q2	2020 Q3	2020 Q4	2021 Q1	2021 Q2	2021 Q3	2021 Q4	2022 Q1	2022 Q2	2022 Q3	2022 Q4	2023 Q1	2023 Q2	2023 Q3	2023 Q4	2024 Q1	2024 Q2	2024 Q3	2024 Q4	2025 Q1	2025 Q2	2025 Q3	2025 Q4	2026 Q1	2026 Q2	2026 Q3	2026 Q4	2027 Q1	2027 Q2	2027 Q3	2027 Q4	2028 Q1	2028 Q2	2028 Q3	2028 Q4	DELIVERABLES*
Component 1: Establishment of the Integrated Coastal Zone Management (ICZM)																																								
Milestone* (Baseline:2019, Mid-term:2023, Final:2028)	**Level of ICZM integration**	▽	Level0																			Level1																Level3			▼	
Expected Results*: Institutional capacity building and policy support for realization and enforcement of ICZM	**Activity1.1: Inventory study for risk assessment on present coastal and coral reef conditions**	Sub-activity 1.1.1: Conducting inventory study												1	1																										Current situation, risks, problems, and issues in each island investigated are compiled as an "inventory survey report".
		Sub-activity 1.1.2: Identification of issues												1	1																										
		Sub-activity 1.1.3: Summary of results													1	1																										
	Activity1.2: Preparation of basic policy of ICZM at the national level	Sub-activity 1.2.1: Establishment of basic policy for coastal management														1	1																										Basic policy of ICZM (including coastal and reef conservation plan, sediment budget control plan, land-use plan) is prepared at the national level as the basis for mid- to long-term management in accordance with the characteristics of each island as classified by pattern, which is compiled as the "Basic policy of ICZM" and a visual material.
		Sub-activity 1.2.2: Study on regulation and law related to the ICZM															1	1																								
		Sub-activity 1.2.3: Summary of results																1	1																								
	Activity1.3: Preparation of concrete ICZM Plan at representative inhabitant island as case study	Sub-activity 1.3.1: Establishment of coastal and reef conservation plan at the target islands																1	1	1																							
		Sub-activity 1.3.2: Establishment and implementation of sediment budget control plan at the target islands																1	1	1																							
		Sub-activity 1.3.3: Study for strengthening measures on land use planning at the target islands																	1	1	1																							Through conducting case studies, the results of the sub-activities 1) to 5) for implementing concrete ICZM actions by the island government are compiled as the "ICZM Plan" and visual material. In order to horizontally spread to other inhabited islands that have the same problems and to share the information with related organizations in other islands, workshops and site visits will be conducted regularly during the implementation period.
		Sub-activity 1.3.4: Study on coastal management at inhabited island																		1	1																						
		Sub-activity 1.3.5: Study on regulation and law at island level																		1	1	1	1																				
		Sub-activity 1.3.6: Summary of results																				1	1																				
	Activity1.4: Capacity development and information sharing of the relevant organizations for establishment of the ICZM	Sub-activity 1.4.1: Capacity development of practitioners of central and island governments													1	1	1	1	1	1	1	1	1	1	1																	Conducting the abovementioned activities (inventory study, ICZM, and case studies) through OJT, which involves related agencies, will benefit the Maldivian government with experiences from establishing to implementing ICZM. Through seminars and workshops, such achievement can be shared within the Maldives, presenting reference case for lateral spread in the future. Opportunities to be created allow young officers to participate in external training sessions and seminars, while providing information and making presentation.
		Sub-activity 1.4.2: Holding periodical seminars and workshops on the ICZM														1		1		1		1		1																	
		Sub-activity 1.4.3: Creation of opportunities for trainings and study abroad on coastal planning and management for junior officials															1		1		1		1		1																	
Component 2: Implementation of Coastal Conservation/Protection Measures against Coastal Disasters																																								
Milestone* (Baseline:2019, Mid-term:2023, Final:2028)	**Evacuation area created**	▽	0 ha																			0 ha																2.2ha			▼	
	Number of people saved by the evacuation area	▽	0 people																			0 people																896 people			▼	
Expected Results*: Protection of coastal communities and infrastructure exposed to coastal erosion	**Activity2.1: Detailed design of coastal conservation measures and capacity development of stakeholders**	Sub-activity 2.1.1: Detailed design of coastal conservation/protection measures										1	1	1				1	1	1																					Outcomes of detailed study and planning for implementation of coastal conservation and protection are compiled as the "Report on study and planning for coastal conservation and protection programs". The detailed planning and designs for areas in urgent need of coastal conservation and protection conducted through OJT, which involves related agencies, will be accumulated as certain experience in line with the concept of ICZM in the Maldivian government.
		Sub-activity 2.1.2: Capacity development of related officials on survey, planning and design of coastal project										1	1	1				1	1	1																					
	Activity2.2: Implementation of coastal conservation/protection measures	Sub-activity 2.2.1: Coastal conservation measures and creating evacuation area at Maamendhoo Island in Laamu Atoll (funded by GCF)																			1	1	1	1	1	1	1	1	1	1	1											
		Sub-activity 2.2.2: Coastal conservation measures at ocean side of Fonadhoo Island in Laamu Atoll (funded by GCF)																			1	1	1	1	1	1	1	1	1	1	1											
		Sub-activity 2.2.3: Coastal conservation measures at Meedhoo Island in Addu Atoll (Sub-set of activity financed by GoM)																						1	1	1	1	1	1	1	1											Measures regarding coastal conservation and protection are implemented.
		Sub-activity 2.2.4: Coastal protection measure at Gan Island in Laamu Atoll (Sub-set of activity financed by GoM)																								1	1	1	1	1											
		Sub-activity 2.2.5: Coastal protection measure at Ishdhoo Island in Laamu Atoll (Sub-set of activity financed by GoM)																								1	1	1	1	1											
	Activity2.3: Implementation of beach maintenance, establishment of structure and capacity development of stakeholders	Sub-activity 2.3.1: Implementation and establishment of adaptive management																						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
		Sub-activity 2.3.2: Implementation of community-based beach maintenance for comfortable beach use and environment													1			1		1		1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			Beach maintenance consisting of adaptive management and daily maintenance for nourished beach in the project is implemented by the concerned stakeholders such as island government, residents, NGOs.
		Sub-activity 2.3.3: Public education, enlightenment, public relations to residents and capacity development on beach maintenance and management													1			1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			Local education, awareness-raising, and public relations are implemented.
Component 3: Development of Disaster Warning and Information Dissemination																																								
Milestone* (Baseline:2019, Mid-term:2023, Final:2028)	**Coverage of population with reception of ISDB-T digital broadcasting services, and avoided economic loss**	▽	0% 0 USD																			91.20% 3.4 million USD/year																91.20% 3.4 million USD/year			▼	
Expected Results*: Strengthened multi hazard early warning system services	**Activity3.1: Installment of terrestrial digital broadcasting system**	Sub-activity 3.1.1: Standardization of disaster warning and information dissemination system			1	1	1	1																																Facilities and equipment for digital terrestrial broadcasting services Improved capacities of PSM and other related organizations in operation of the system
		Sub-activity 3.1.2: Awareness raising on disaster warning and information dissemination (Laamu Atoll)						1	1	1	1	1	1	1	1																										
	Activity3.2: Establishment of Disaster Early Warning and Information Broadcasting System	Sub-activity 3.2.1: Examination of operational system for disaster warning and information dissemination			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																				Manual(s) for data broadcasting programing Guideline(s) and manual(s) for EWBS operation
		Sub-activity 3.2.2: Establishment of the structure to operate disaster warning and information dissemination through the terrestrial digital broadcasting system								1	1	1	1	1	1	1	1	1	1																					Improved capacities of related organizations in the operation of the system
Component 4: Development of Basic Data Collection and Sharing System Related to Climate Change																																								
Milestone* (Baseline:2019, Mid-term:2023, Final:2028)	**Completion Report for technical transfer by Consultant**	▽	Level0																			Level1																Level3			▼	
Expected Results*: Improved observations and monitoring of long-term wave, sea level, coastline, coral reef and land use	**Activity4.1: Development of wave and sea level monitoring system**	Sub-activity 4.1.1: Development of wave and sea level monitoring system (three representative locations)												1	1	1	1	1	1	1	1	1	1	1	1																Establish stationary observation system for wave, sea level, and water temperature. Through technological transfer regarding data analysis and system operation to related agency (MMS), real-time data is used as the source of early emergency warning. Through technological transfer regarding data accumulation and system operation, data is continuously and regularly accumulated.
		Sub-activity 4.1.2: Technical transfer on data processing, analysis, and operation													1	1	1	1	1	1	1	1	1	1																
	Activity4.2: Development of beach, coral reef and land use monitoring system	Sub-activity 4.2.1: Development of wide-area monitoring system applying satellite images and GIS system, and capacity development													1	1	1	1	1	1	1	1	1	1	1																Establish wide-area monitoring system by using satellite images and GIS, with technological transfer regarding system operation to related agency (Land and Survey), which will help understand the long-term change in national territory. Establish monitoring system in specific area by applying UAV technology, with technological transfer regarding system operation to related agency (Land and Survey), which will help understand changes in the relevant area.
		Sub-activity 4.2.2: Development of monitoring system utilizing the UAV technology at specific area, and capacity development													1	1	1	1	1	1	1	1	1	1	1																
Component 5: Project Management Component												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Project Monitoring*														Incept ion Report				APR				APR			Inter m Evalu ation	APR				APR				APR				APR			Final Evalu ation	***refer to the Funding Proposal E5, E6**

Annex-6-a：Environmental and social safeguards report

Environmental and social safeguards report form pursuant to para. 17 of the IDP

Basic project or programme information	
Project or programme title	[Building Climate Resilient Safer Islands in Maldives]
Existence of subproject(s) to be identified after GCF Board approval	[Yes]
Sector (public or private)	Public
Accredited entity	[Japan International Cooperation Agency (JICA)]
Environmental and social safeguards (ESS) category	Category B
Location – specific location(s) of project or target country or location(s) of programme	[Republic of Maldives]
Environmental and Social Impact Assessment (ESIA) (if applicable)	
Date of disclosure on accredited entity's website	Tuesday, January 1, 2019
Language(s) of disclosure	English
Explanation on language	The stakeholders will be able to understand and provide any feedback in English.
Link to disclosure	[__]
Other link(s)	[__]
Remarks	Provision for an ESIA consistent with the requirements for a Category B project is contained in the "Environmental and Social Management Framework."
Environmental and Social Management Plan (ESMP) (if applicable)	
Date of disclosure on accredited entity's website	Tuesday, January 1, 2019
Language(s) of disclosure	English
Explanation on language	The stakeholders will be able to understand and provide any feedback in English.
Link to disclosure	[__]
Other link(s)	[__]
Remarks	An ESMP consistent with the requirements for a Category B project is contained in the "Environmental and Social Management Framework."
Environmental and Social Management (ESMS) (if applicable)	
Date of disclosure on accredited entity's website	Tuesday, January 1, 2019
Language(s) of disclosure	[__]
Explanation on language	[__]
Link to disclosure	[__]
Other link(s)	[__]
Remarks	[__]
Any other relevant ESS reports, e.g. Resettlement Action Plan (RAP), Resettlement Policy Framework (RPF), Indigenous Peoples Plan (IPP), IPP Framework (if applicable)	
Description of report/disclosure on accredited entity's website	Stakeholder Engagement Plan/Tuesday, January 1, 2019

Language(s) of disclosure	English
Explanation on language	The stakeholders will be able to understand and provide any feedback in English.
Link to disclosure	[__]
Other link(s)	[__]
Remarks	N/A
Disclosure in locations convenient to affected peoples (stakeholders)	
Date	Tuesday, January 1, 2019
Place	Web links (URL) of Environmental and Social Management Framework and Stakeholder Engagement Plan were shared with the Ministry of Environment and other relevant organizations of the Republic of Maldives. Physical copies were made available to the target islands through the local authorities, and were displayed at the office of the Local Islands Council.
Date of Board meeting in which the FP is intended to be considered	
Date of accredited entity's Board meeting	Wednesday, January 22, 2020
Date of GCF's Board meeting	Wednesday, June 30, 2021

Note: This form was prepared by the accredited entity stated above.

Annex-6-b：Environmental and social management plan

Building Climate Resilient Safer Islands in Maldives

Environmental and Social Management Framework (ESMF)

Table of Contents

Lists of Tables and Figures

Attachment:

Abbreviation

AE	Accredited Entity
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
dBA	A-weighted decibels
DO	Dissolved Oxygen
EE	Executing Entity
EPA	Environmental Protection Agency
EPPA	Environmental Protection and Preservation Act
EIA	Environmental Impact Assessment
EMP	Environmental Monitoring Plan
EPZ	Environment Protected Zone
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESS	Environmental and Social Safeguards
EWBS	Early Warning Broadcast System
GBRMPA	Great Barrier Reef Marine Park Authority
GBV	Gender-based Violence
GCF	Green Climate Fund
GOM	Government of Maldives
ICZM	Integrated Coastal Zone Management
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ILO	International Labour Organization
IP	Indigenous People
IPCC	Inter-governmental Panel on Climate Change
ISDB-T	Integrated Services Digital Broadcasting-Terrestrial
JICA	Japan International Cooperation Agency
ME	Ministry of Environment/ Ministry of Environment, Climate Change and Technology
MEE	Ministry of Environment and Energy
MMS	Maldives Meteorological Service
MNPI / MPI	Ministry of National Planning and Infrastructure / Ministry of Planning and Infrastructure
MPA	Marine Protected Areas
MSL	Mean Sea Level
NBSAP	National Biodiversity Strategy and Action Plan
NCPE	National Commission for the Protection of the Environment
NEAP	National Environmental Action Plan
OJT	On the Job Training
OSH	Occupational Safety and Health

PMU	Project Management Unit
PPE	Personal Protective Equipment
PSC	Project Steering Committee
PSM	Public Service Media
SAP	Strategic Action Plan
SLR	Sea Level Rise
TSDH	Trailer Sanction Hopper Dredger
UAV	Unmanned Aerial Vehicle
UN	United Nations
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization

1. Introduction

This Environmental and Social Management Framework (ESMF) has been prepared in support of a project proposal for "Building Climate Resilient Safer Islands in the Maldives" by the Government of the Maldives to the Green Climate Fund (GCF). As this project is supported by the Japan International Cooperation Agency (JICA) in its role as a GCF Accredited Entity (AE), the project has been screened against JICA's Social and Environmental Standards Procedure and deemed a Category B project (medium risk in the GCF/ World Bank/ International Finance Corporation Category). As such, an Environmental and Social Management Framework has been prepared for the project.

1.1 Background

The Republic of Maldives consists of 26 atolls and 1,192 islands in the range of around 90,000 km^2 in the Indian Ocean, southwest of Sri Lanka. The Maldives is one of the world's most geographically dispersed sovereign states as well as the smallest Asian country by land area and population. The total area of the national land is 298 km^2, where the length of the coastline is 644 km. The population of the country is 451,738 people with a population density of 1,506 people/km^2.The islands of the Maldives are classified into 1) inhabited islands, 2) resort islands, and 3) industrial islands. The number of these inhabited islands is 188. Around 44% of the residential areas and 47% of infrastructure facilities are located within 100 m of the coastline. As of 2017, there were 135 resort islands out of the 1,192 islands[1].

Under such circumstances, the Maldives is one of the most vulnerable countries in the world, and the issues on climate change in the Maldives are i) the increase in coastal disaster risk and land loss due to acceleration of coastal erosion influenced by climate change, ii) the acceleration of coastal erosion by artificial change in the coastal areas, iii) the loss of natural beaches due to coastal protection measures by hard facilities and the deterioration of coast/reef environment due to the decrease of people's interaction with the coast, and iv) the insufficient understanding, analysis, and impact assessment regarding coast and reef environment data as well as the lack of information sharing among concerned stakeholders.

As of 2014, 116 islands out of the 188 inhabited islands have coastal erosion and 38% of which were in serious coastal erosion situations[2]. Under the RCP8.5 scenario, the smaller the island area, the greater the rate of area loss is. For example, Maamendhoo Island of Laamu Atoll, with a land area of 0.2 km^2, will lose 36% of land in the year 2100. According to the tide level observation records over the past 33 years on Gan Island in Laamu Atoll, a mean sea level (MSL) of + 0.84 m was observed as the highest tide level and an average tide level of 3.2 mm/year was recorded. This is higher than the average sea level rise (1.7 mm/year, 1901-2010) in the world[3]. A high tide level will frequently occur due to the sea level rise caused by climate change in the future and inundation damage by high waves will occur on a daily basis.

1.2 Overview of the Project

1.2.1 Summary of Activities

The proposed project is composed of four (4) components as shown below:

[1] Ministry of Tourism, 2017: Tourism Yearbook 2018
[2] Ministry of Environment and Energy, 2016: Second National Communication of Maldives
[3] 5th IPCC (Inter-governmental Panel on Climate Change) Assessment Report

Table 1.1 Project Components

Component		Funded by
Component 1: Establishment of Integrated Coastal Zone Management (ICZM)		
Activity 1.1:	Inventory study and risk assessment on present coastal and coral reef conditions	JICA
Activity 1.2:	Preparation of basic policy of ICZM at the national level	JICA
Activity 1.3:	Preparation of concrete ICZM Plan at representative Inhabitant Island as case study	JICA
Activity 1.4:	Capacity development and information sharing of the relevant organizations for establishment of the ICZM	JICA
Component 2: Implementation of coastal conservation/protection measures against coastal disasters		
Activity 2.1:	Detailed design of coastal conservation measures and capacity development of stakeholders	GCF, JICA
Activity 2.2:	Implementation of coastal conservation/ protection measures	GCF, Maldives's co-finance
Activity 2.3:	Implementation of beach maintenance, establishment of structure and capacity development of stakeholders	GCF, JICA
Component 3: Development of disaster warning and information dissemination		
Activity 3.1:	Installment of terrestrial digital broadcasting system	JICA
Activity 3.2:	Establishment of disaster early warning and information broadcasting system	JICA
Component 4: Development of basic data collection and sharing system related to climate change		
Activity 4.1:	Development of wave and sea level monitoring system	JICA
Activity 4.2:	Development of beach, coral reef, and land use monitoring system	JICA

Source: JICA (2019)

(1) Summary of proposed activities under Component 1

This component, as a sub-set of activity financed by JICA, aims to establish ICZM along with the capacity development of government officials responsible for the enforcement of the ICZM:

- Activity 1.1: Inventory study for risk assessment on present coastal and coral reef conditions

  Some 200 inhabited islands are categorized by different topographical characteristics, hazard characteristics, socio-economic characteristics and living environment. Several islands are then selected from each categorized island for a field survey. The current problems, issues, and climate change risks in the different types of islands are sorted out.

- Activity 1.2: Preparation of basic policy of ICZM at the national level

  The basic policy for Integrated Coastal Zone Management (ICZM) at the national level will be examined, based on the current problems, issues, and climate change risks in the different types of islands, which are exposed as the results of Activity 1.1. For the purpose of realization of coastal management based on the ICZM policy, basic plans for strengthening governance of coastal administration of the GoM and coastal management on each inhabited island will also be developed. Regulations and legal systems necessary for realization of ICZM are also examined, and the support for their enforcement is provided. The ICZM Guideline (Policy phase) will be prepared as the result of this activity.

- Activity 1.3: Preparation of concrete ICZM Plan at representative Inhabitant Island as case study

  To promote such concrete efforts based on the national ICZM concepts and plans, the concrete action for the island level of the ICZM will be examined based on the national level of the ICZM as a case study. The activity is included 1) Establishment of coastal and reef

conservation plan, 2) Establishment and implementation of sediment budget control plan, 3) Study for strengthening measures on land use planning, 4) Study on coastal management system and its implementation, and 5) Study on regulation and law at island level. Gan and Fonadhoo islands in Laamu Atoll are assumed as the example of representative inhabited islands for case study. The ICZM Guideline (Practice phase) will be prepared as the result of this activity.

- Activity 1.4: Capacity development and information sharing of the relevant organizations for the establishment of the ICZM

  For basic common understanding between the relevant agencies at the central and island levels on the above activities, as well as cooperation between the island councils and residents who are the main users of the coastal area. This activity will carry out capacity building, education and public relation programs for the practitioners of the relevant organizations of the central ministries and agencies and island councils, island community, NGO, schools and educational institutions, etc.

  Capacity development at the relevant agencies will be conducted mainly through the on the job training (OJT) during the implementation period. To share and expand the understanding and knowledge to other inhabited islands, ICZM Guidelines, which are prepared as the results of Activity 1.2 and 1.3, will be utilized through conducting seminar and workshop in several times at other inhabited islands.

The proposed activities at each target area in the Component 1 are shown below:

Table 1.2 Project Components at Each Island under Component 1

Atoll	Island	Project Component	Funding Source	Abbreviation
All	For all inhabited islands	Categorization into pattern by existing information and extraction of issues (Activity 1.1) Formulation of national-level ICZM (Activity 1.2)	JICA's co-finance	-
	6-9 islands (2-3 islands per pattern x 2-3 patterns)	Field surveys to grasp and confirm the current situations (Activity 1.1)	JICA's co-finance	-
Laamu	Fonadhoo	Formulation of island-level ICZM as the case study (Activity 1.3)	JICA's co-finance	L-FND
	Gan	ditto	JICA's co-finance	L-GAN

Source: JICA (2019)

(2) Summary of proposed activities under Component 2

This component, as a sub-set of activity financed by GCF, partially by GoM in Activity 2.2 and by JICA in Activity 2.1 and 2.3, aims to implement the coastal conservation/protection measures and to maintain sustainably in order to protect the communities and infrastructures at hinterland exposed to coastal erosion.

- Activity 2.1: Detailed design of coastal conservation measures and capacity development of stakeholders

  This activity consists of two sub-activities, which are detailed design of coastal conservation/ protection measures as described in Activity 2.2 (sub-activity 2.1.1) and capacity development of related officials on survey, planning and design of coastal project (sub-activity 2.1.2).

The detailed design includes the coastal conservation measures at two target islands in Laamu Atoll, namely, Maamendhoo and Fonadhoo islands, which are funded by GCF, as well as coastal conservation measures at Meedhoo Island in Addu Atoll, which are implemented as a sub-set of activity financed by GoM. It also includes the detailed design of coastal protection measures at Gan and Isdhoo islands in Laamu Atoll financed by GoM. The study items for this activity is as follows:

i) Conducting detailed survey

ii) Conducting detailed design (including construction plan and cost estimate)

iii) ESIA support

iv) Preparation of bid document and support for bidding

Capacity development for the related officers in the Maldives to obtain knowledge of coastal engineering, planning and design skills are required for the planning and design of appropriate coastal measures autonomously against future climate risks. The most effective way for the capacity development is for the related officers in the Maldives to work together with the consultant team under OJT.

- Activity 2.2: Implementation of coastal conservation/protection measures

  Under this activity, the coastal conservation measures at the two target islands of Maamendhoo and Fonadhoo islands in Laamu Atoll funded by GCF, and the coastal conservation measures at Meedhoo Island in Addu Atoll and the coastal protection measures at Gan and Isdhoo islands in Laamu Atoll funded by the GoM will be implemented.

  GoM will also make in-kind contribution for procurement of sand to be used for beach nourishment at three sites and for reclamation material in both GCF- and GoM-funded construction sites.

- Activity 2.3: Implementation of beach maintenance, establishment of structure and capacity development of stakeholders

  Appropriate coastal maintenance in accordance with actual changes in coastal conditions is essential in order to sustainably maintain the project beaches after the beach nourishment carried out in Activity 2.2. The required coastal maintenance after the beach nourishment is mainly divided into two items, which are 1) adaptive management aimed to maintain the beaches in accordance with the change of beach profile due to wave action, and 2) daily maintenance aimed to maintain the good condition of the beach for the beach use and environment. As cooperation between the island governments and communities in cooperate with NGOs is essential for the sustainable maintenance of the beach, Activity 2.3 is aimed to establish the beach maintenance system and develop the capacity of both island government officers and residents for beach maintenance by conducting the actual activities after the implementation of beach nourishment in Activity 2.2 in collaboration with the island government and residents.

The proposed activities at each target area in the Component 2 are shown below:

Table 1.3 Project Components at Each Island under Component 2

Atoll/ City	Island	Project Component	Funding Source	Abbreviation
Laamu	Fonadhoo	Beach nourishment and groins for the eastern coast (ocean side)	GCF fund	L-FND
	Maamendhoo	Beach nourishment and groins for the eastern and western side coast, and reclamation for evacuation place at the north-western top	GCF fund	L-MMD
	Ishdhoo	Sea walls to protect historical sites at the ocean side coast at the north top	Maldives's co-finance	L-ISD
	Gan	Sea walls to protect the historical sites at the ocean side at the middle of the island	Maldives's co-finance	L-GAN
Addu	Meedhoo	Beach nourishment and groins for the eastern coast (northern coast)	Maldives's co-finance	S-MED
-	Above 5 islands	Beach maintenance, establishment of structure and the capacity development of stakeholders (Activity 2.3)	JICA's co-finance	

Source: JICA (2019)

(3) Summary of proposed activities under Component 3

This component, co-financed by JICA, will build a system dissemination of disaster warning/ information covering nationwide, and support capacity development of government officials responsible for operating the system, aiming at protecting residents' lives through appropriate evacuation activities to be taken by the residents themselves.

- Activity 3.1: Installment of terrestrial digital broadcasting system

  Integrated Services Digital Broadcasting-Terrestrial (ISDB-T) television network will be installed, with network operation center (in Male) and transmitting station equipment (in nationwide level), to allow broadcasting digital television broadcasts throughout the Maldives. Target atolls for installment of transmitting station can be referred below (Section 1.2.2) and Annex 2. This system, implemented through a co-financed grant aid project by JICA, will serve as a platform of Early Warning Broadcast System (EWBS).

- Activity 3.2: Establishment of Disaster Early Warning and Information Broadcasting System

  EWBS, the nationwide disaster warning and information broadcasting services, will be established through a co-financed technical cooperation project by JICA. Public Service Media (PSM), responsible for operation of public broadcasting services in the country, will develop operation manual for EWBS and implement operation training in collaboration with related organizations. Due to these activities, it is expected that PSM will obtain necessary techniques and equipment (such as digital signages) for operation and maintenance of EWBS.

  Pilot evacuation drills with test transmission of EWBS will be organized in selected towns, with participation of municipalities and local residents so that they familiarize themselves with, as well as raise awareness of, the categories and contents of warning/information and appropriate responsive actions. When issuing an alarm through EWBS, real-time wave information obtained from wave observation system proposed in the Component 4 will be utilized.

The proposed activities at each target area in the Component 3 are shown below:

Table 1.4 Project Components at Each Island under Component 3

Activity / Facility	Quantity	Island / Atoll
Network operation center	1 atoll	Villingili (Male) (K)
Microwave relay stations	3 atolls	Maafushi (K), Feeali (F), Fiyoari (GDh)
Digital transmitting stations	18 atolls	Dhidhdhoo (Ha), Kulhudhuffushi (HDH), Funadhoo (Sh)*1, Manadhoo (N), Ungoofaaru (R), Eydhafushi (B), Naifaru (Lh)*2, Villingili (Male) (K), Felidhoo (V), Dhangethi (ADh), Nilandhoo (F), Gan (L), Guraidhoo (Th), Gadhadhoo (GDh), Thinadhoo (GDh)*3, Villigili (Ga), Fovammulah (Gn), Hithadhoo (S) *Note: *1: Funadhoo (Sh) was replaced with Maaungdhoo (Sh), *2: Naifaru (Lh) was replaced with Hinnavaru (Lh), *3: Thinadhoo (GDh) was cancelled.*

Source: JICA (2019)

(4) Summary of proposed activities under Component 4

This component, financed by JICA, assists GoM with a system for obtaining and sharing basic data related to climate change, and capacity development of the government officials responsible for operating the system by transferring technical skills. The government agencies to sufficiently and commonly share the understanding of actual situation and impact of climate change and thereby to implement most appropriate measures" by implementing the following two Activities

- Activity 4.1: Development of wave and sea level monitoring system

  A long-term wave and sea level monitoring system will be developed and necessary technical transfer will be provided in order to obtain the long-term external forces related to climate change. Three representative sites, Hanimadhoo, Male, and Gan in Addu Atoll, are assumed as a fixed observation points, where Maldives Meteorological Service (MMS) executes sea level observation.

- Activity 4.2: Development of beach, coral reef and land use monitoring system

  This component is divided into two types of monitoring systems: long-term monitoring for coastline, coral reef and land use for a wide area; and detailed monitoring for change in beach profile and coral reefs at a specific area. The monitoring system applying satellite images and GIS system will be developed in order to monitor the long-term change in coastline, coral reefs, and land use for wide areas. UAV technology will be applied in the examining visual changes of beach profile and coral reefs at specific areas which required detailed monitoring.

The proposed activities at each target area in the Component 4 are shown below:

Table 1.5 Project Components at Each Island under Component 4

Atoll	Island	Project Component	Funding Source	Abbreviation
Haa Dhaalu	Hanimaadhoo	Installation of long-term monitoring and observation system of for waves and sea level	JICA's co-finance	-
Male	Male			-
Addu	Gan			S-GAN
-	Main inhabited islands	Introduction of beach profile, coral reef, and land use system (Activity 4.2)	JICA's co-finance	-

Source: JICA (2019)

1.2.2 Proposed Activities that have potential Environmental and Social Impacts

(1) Proposed activities under Component 1

This component, as a sub-set of activity financed by JICA, aims to establish ICZM along with the capacity development of government officials responsible for the enforcement of the ICZM. The following considerations are examined for the proposed measures under Component 1:

a) The proposed adaptation measures do not include the physical development but include the formulation and development of ICZM Plan and capacity development of relevant organizations, therefore, there are no adverse impacts for the natural environment.

b) The concrete action for the island level of the ICZM will be examined based on the national level of the ICZM as a case study at two islands in Laamu Atoll.

c) The to-be-developed ICZM Plan as case studies may include 1) establishment of coastal and reef conservation plan, 2) establishment and implementation of sediment budget control plan, 3) review of EPZ (Environment Protected Zone), 4) examination of the island government's approach to coastal management, and 5) examination of the island-level systems and regulations necessary for implementing the activities above as well as support for their implementation. However, the details of coastal and reef conservation plan have not yet decided.

More detail information of measures are shown in another Annex (Annex-2) under this Funding Proposal.

(2) Proposed activities under Component 2

Among all the activities under four components, the Component 2 has the physical measures. The following considerations are examined for the proposed adaptation measures under Component 2:

a) The proposed adaptation measure is to enforce the protection function and to maintain the relationship between the local people and coasts.

b) In order to provide a sustainable coast management, the proposed measures are to maintain the sand supply for the reef coast and to keep the natural protection function as much as possible.

c) By referring the uncertainty of the climate change scenario, the proposed adaptation measures are to be flexible against the future climate change.

The proposed adaptation measures under Component 2, which are funded by the GCF fund and co-financed by GOM, and the proposed layout plans and typical cross sections of the proposed adaptation measures are shown below. More detail specifications and information of proposed adaptation measures are shown in another Annex (Annex-2) under this Funding Proposal.

Table 1.6 Adaptation Measures in Target Coasts under Component 2

a) Adaptation measures to be funded by GCF fund

Atoll	Target Islands	Location	Coastal Adaptation Measure
Laamu	Maamendhoo	East coast (300 m)	Beach nourishment + Groin
		West coast (600 m)	Beach nourishment + Groin
		North coast	Reclamation + Perimeter revetment
	Fonadhoo	East coast (850 m)	Beach nourishment + Groin

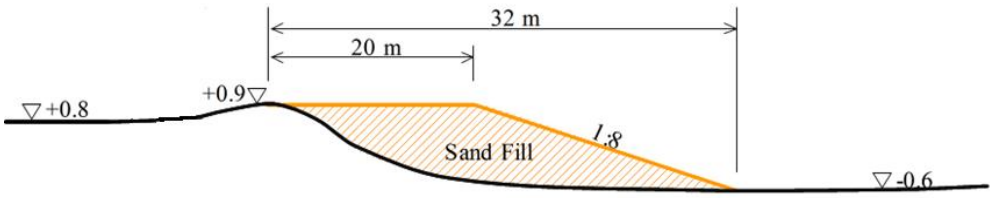
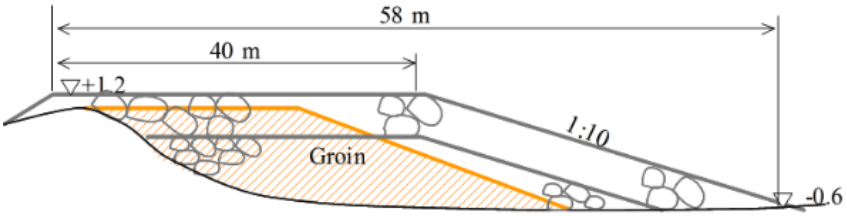
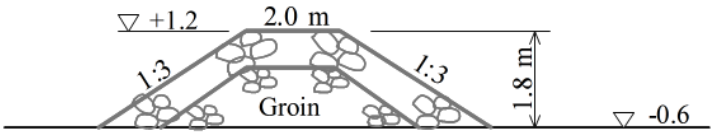
b) Adaptation measures to be co-financed by GOM

Atoll	Target Islands	Location	Coastal Adaptation Measure
Laamu	Gan	East coast (270 m)	Rubble type revetment
	Ishdhoo	Northern coast (270 m)	Rubble type revetment
Addu	Meedhoo	North coast (1,500 m)	Beach nourishment + Groin

Source: JICA (2019)

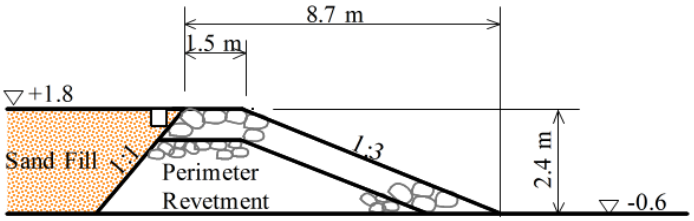
Source: JICA (2019)

Figure 1.1 Layout plan at Maamendhoo Island, Laamu Atoll under Component 2

Location	Typical Cross Section
Typical Cross Section View of the Beach	
Typical Cross Section View of the Groin	
Standard Profile of the Groin	

Source: JICA (2019)

Figure 1.2 Cross Section View of Beach and Groin at the Maamendhoo East Coast, Laamu Atoll under Component 2

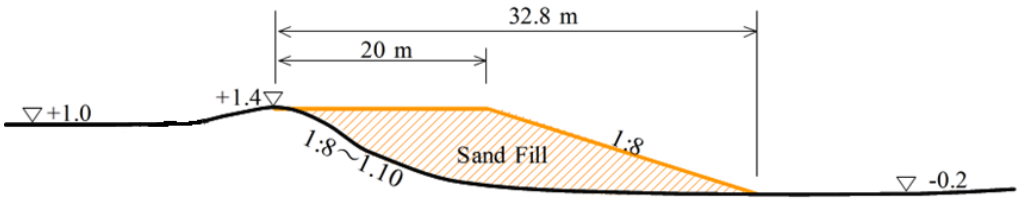
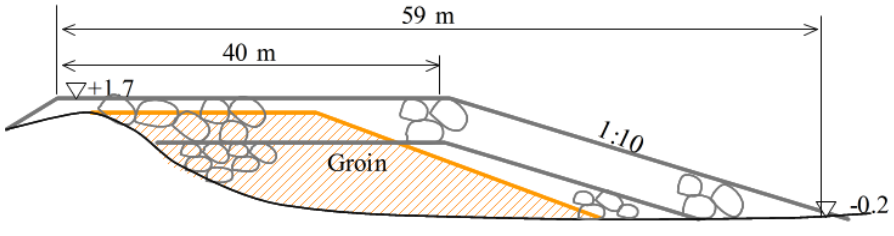
Location	Typical Cross Section
Typical Cross Section View of the Revetment	

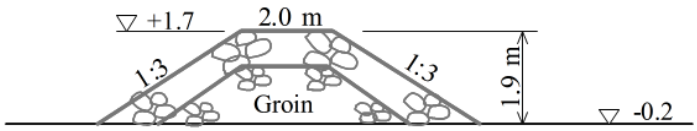
Source: JICA (2019)

Figure 1.3 Cross Section View of Perimeter Revetment at the Maamendhoo North Coast, Laamu Atoll under Component 2

Source: JICA (2019)

Figure 1.4 Layout plan at Fonadhoo Island, Laamu Atoll under Component 2

Location	Typical Cross Section
Typical Cross Section View of the Beach	
Typical Cross Section View of the Groin	

Location	Typical Cross Section
Standard Profile of the Groin	

Source: JICA (2019)

Figure 1.5 Cross Section View of Beach and Groin at the Fonadhoo East Coast, Laamu Atoll under Component 2

Source: JICA (2019)

Figure 1.6 Layout plan at Gan Island, Laamu Atoll under Component 2

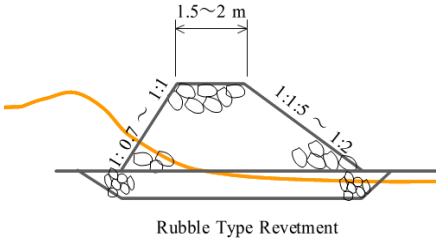
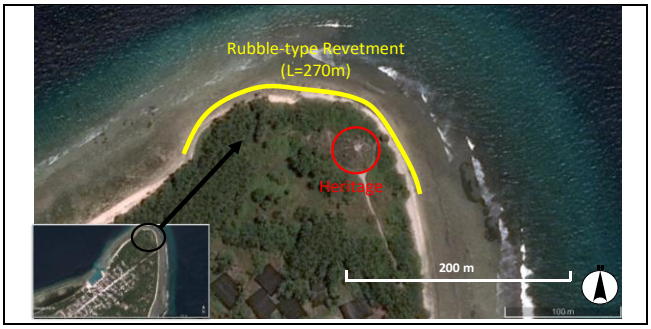
Location	Typical Cross Section
Typical Cross Section View of the Revetment	

Image of Typical Cross Section

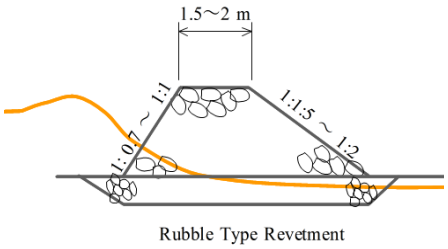
Source: JICA (2019)

Figure 1.7 Cross Section View of Coastal Protection Measure at Gan Island in Laamu Atoll under Component 2 (Maldives's co-finance)



Source: JICA (2019)

Figure 1.8 Layout plan at Ishdhoo Island, Laamu Atoll under Component 2

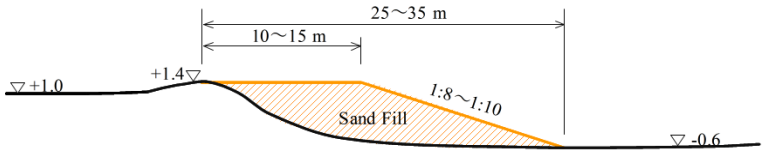
Location	Typical Cross Section
Typical Cross Section View of the Revetment	 Rubble Type Revetment Image of Typical Cross Section

Source: JICA (2019)

Figure 1.9 Cross Section View of Coastal Protection Measure at Ishdhoo Island in Laamu Atoll under Component 2 (Maldives's co-finance)

Source: JICA (2019)

Figure 1.10 Layout plan at Meedhoo Island, Addu Atoll under Component 2

Location	Typical Cross Section
Typical Cross Section View of the beach conservation measure	 Beach nourishment with Groins Image of Proposed Beach Conservation Measure (Just Image)

Source: JICA (2019)

Figure 1.11 Cross Section View of Coastal Conservation Measure at Meedhoo Island in Addu Atoll under Component 2 (Maldives's co-finance)

(3) Proposed measures under Component 3

The objective of the Component 3 is to enhance the accessibility to information and to alleviate information disparities among islands in the Maldives through the development of the digital terrestrial television broadcasting network, thereby contributing to the mitigation of vulnerability and further social-economic development in Maldives. The following considerations are examined for the proposed measures under Component 3:

a) The proposed measures are not located in sensitive areas in the Maldives.

b) The proposed measures do not have sensitive characteristics nor fail into sensitive sectors.

The proposed measures under Component 3, which are co-financed by JICA are shown in the following tables. More detail specifications and information of proposed adaptation measures are shown in another Annex (Annex-2) under this Funding Proposal.

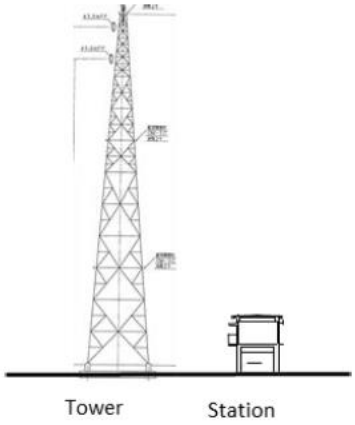
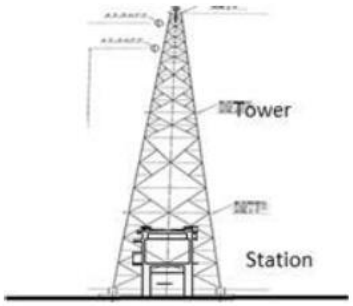
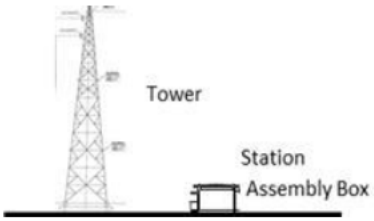
Table 1.7 Measures on establishment of disaster warning and information dissemination system, which will be co-financed by JICA under Component 3

No	Island	Atoll	Type of building			Remarks
			T1	T2	T3	
1	Dhidhdhoo	Ha	A			
2	Kulhudhuffushi	HDH	A			
3	Funadhoo	Sh	A			Cancelled, and replaced with Maaungdhoo (Sh).
4	Manadhoo	N	A			
5	Ungoofaaru	R	B			
6	Eydhafushi	B	A			
7	Naifaru	Lh	A			Cancelled, and replaced with Hinnavaru (Lh).
8	Villingili (Male)	K	A		X	
9	Maafushi	K	C	X		
10	Felidhoo	V	A			
11	Dhangethi	ADh	A			
12	Feeali	F	C	X		
13	Nilandhoo	F	A			
14	Gan	L	A			
15	Guraidhoo	Th	A			
16	Villigili	Ga	A			
17	Gadhadhoo	GDh	A			
18	Fiyoari	GDh	C	X		
19	Thinadhoo	GDh	A			
20	Fovammulah	Gn	A			
21	Hithadhoo	S	A			

Source: JICA (2019)

Note:

1) *Type of building*
   T1: Construction of a tower and a digital transmitting station
   T2: Construction of a tower and a microwave relay station
   T3: Construction of the network operation centre
2) *Combination type under T1*
   A: A tower and a digital transmitting station will be constructed separately.
   B: A digital transmitting station house will be constructed below the tower
   C: A tower and a digital transmitting station/ microwave relay station house will be constructed separately

Type	Typical Cross Section	Tentative Location	
A		1 2 3 4 6 7 8 10 11 13 14 15 16 17 19 20 21	Ha. Dhidhdhoo HDh. Kulhudhufushi Sh. Funadhoo N. Manadhoo B. Eydhafushi Lh. Naifaru K. Vilingili (Male) V. Felidhoo ADh. Dhangethi Nilandhoo L. Gan Th. Guraidhoo Ga. Viligili GDh. Gadhdhoo GDh. Thinadhoo Gn. Foammulah S. Hithadhoo
B		5	R. Ungoofaaho
C		11 12 18	K. Maafushi F. Feeali GDh. Fiyoari

Source: EIA for the Proposed Digital Terrestrial Television Broadcasting Network Development Project, Energy Consultancy Pvt. Ltd. (2018)

Figure 1.12 Combination type tower and station for Component 3

Table 1.8 Planned number of antenna towers, which will be co-financed by JICA under Component 3

	Facilities to be constructed	Quantities
(1)	90-meter antenna tower	1 set
(2)	80-meter antenna tower	7 sets
(3)	70-meter antenna tower	5 sets
(4)	60-meter antenna tower	3 sets
(5)	50-meter antenna tower	3 sets
(6)	30-meter antenna pole	1 set
(7)	20-meter antenna pole	1 set
	Total	21 sets

Source: JICA (2017)

(4) Proposed measures under Component 4

The proposed measures under Component 4, which are co-financed by JICA, are the technical cooperation, and the main objectives for Component 4 are observation of ocean characteristics, such as waves and sea level, by installing the observation equipment, and trainings to monitor and analyze the obtained data. There are no considerations to be examined for Component 4.

1.2.3 Need and Justification for the Project

The coastal protection measures, which are implemented in the Maldives, are mainly the physical measures, such as stone revetment and land reclamation. The issues to be solved by physical measures are as follows:

- Most of the islands in the Maldives have been formed by sediment of coral sand and rock, which are supplied from the reef areas. The supply of the coral sand and rock from the reef and formation processes of the islands are not considered by the present physical measures.
- Most of coastal erosion in the Maldives are due to the unbalanced sand movement to and from the coasts, derived from the decrease of supply of coral sand to the coastal areas by constructed facilities and/or human interventions. The present physical measures are just protecting the specific parts of the coasts. These become one of the causes of coastal erosion.
- The target sites in the islands for Component 2 are suffering from coastal erosions, whilst there exist the natural coasts. The present physical measures prevent the local residents in nearby coasts to utilize the coastal areas. When the natural coasts would be changed to accommodate the physical measures, it will be difficult to recover the natural coast.

1.2.4 Construction Material and Equipment

As for the construction materials for Component 2, there are two main construction materials: 1) rock and 2) sand. The rocks/stones will be imported mainly from India, as there are no rock mining in the Maldives. Those rocks/stones will be utilized for rock revetment and groins.

For beach nourishment, the sand will be collected from the bottom of the sea, far from the coasts and from the areas, which will not affect the existing corals. It is planned to dredge sand from the bottom of the sea, about a few kilometers far from the coasts inside the lagoon sides of the Laamu Atoll.

Table 1.9 Design Volumes of Coral Sand to be used for the Component 2

Atoll/ City	Island	Construction Work	Design Volume (m^3)	Remarks
Lammu	Fonadhoo	Beach fill	27,200	
		Sand stock pile for beach fill	30,000	Planned to be stocked on the land
	Maamendhoo	Beach fill	27,000	
		Sand stock pile for beach fill	30,000	Planned to be stocked on the to-be-reclaimed area
		Reclamation	80,000	
Addu	Meedhoo	Beach fill	36,000	Maldivian co-financed project
		Stock pile for beach fill	40,000	

Source: JICA (2019)

In order to dredge the coral sand from the sea bottom, the Trailer Sanction Hopper Dredger (TSHD) with 10,000 m^3 level will be utilized. This TSHD is planned to be transported from India. Apart from the TSDH, heavy machineries, such as backhoe, trucks, and operation boats will

also be used. The coral sand and gravel dredged from the sand borrow sites in the lagoon by TSHD will be transported to the sites by the TSHD and will be discharged to the target areas for beach nourishment and land reclamation directly through the sand discharge pipe.

In order to select the borrow areas, Dredging and Reclamation regulation (2013/R-15) and its Amendment (2014) shall be followed to protect and preserve the natural environment, biodiversity, resources and beauty of the country, and necessary measures to avoid and mitigate such adverse impacts shall be taken.

As for the construction materials for Component 3, all the materials and equipment will be exported from outside of Maldives; i.e. Japan and other third countries.

1.3 Environmental and Social Risk Assessment

1.3.1 Evaluation Results

(1) General

As this project is supported by JICA in its role as a GCF Accredited Entity, the project has been screened against JICA's Environmental and Social Consideration Procedure [4]. The Environmental and Social Screening Template was prepared and the project deemed to be a Category B (medium risk) project, as their potential adverse impacts on the environment and society are less adverse than those of Category A (high risk) projects. Discussions on the impact assessment are provided in the Environmental and Social Screening Template, which provided the rationale for the project being classified as a moderate risk. The results of evaluation of each component are shown in the following table, and this ESMF provides further discussion below, especially for the Component 2.

Table 1.10 Evaluation results per Component

Component	Evaluation	Remarks
Component 1	Category B	Planning of ICZM will be conducted as the case study, and no actual (physical) implementation will be included.
Component 2	Category B	Dredging sand for beach nourishment shall be considered.
Component 3	Category B	JICA has conducted screening and GoM has conducted screening and EIA
Component 4	Category C	

Source: JICA (2019)

An impact risk assessment was undertaken using JICA's Environmental and Social Screening Procedure to assess the impact of the risk (critical, severe, moderate, minor, and negligible). From this, a significance value was attributed to the potential impact (negligible, low, medium, high, and extreme).

(2) Evaluation results of Component 1

All the activities under Component 1 are implemented by JICA as the co-financed project, and the activities will be screened against JICA's Environmental and Social Consideration Procedure. The Environmental and Social Screening Template is tentatively prepared and the activities deem to be a Category B (medium risk) project, as all the project sites are not located in sensitive areas, nor sensitive characteristics, nor fall into sensitive sectors under the JICA guidelines for Environmental and Social Considerations, and potential adverse impacts on the environment are not likely to be significant.

[4] JICA (2010): JICA Guidelines for Environmental and Social Considerations

Table 1.11 Impacts and Mitigation Measures per Environmental Item for Component 1

1) Pollution Control

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
1	Air Quality	No adverse effects to the air quality at the target sites would be occurred, as there are no sources by the activities.		D	D	
2	Water Pollution	For the implementation of sediment budget control plan, the water quality may be affected in some extent, due to the improper implementation.	Proper implementation of sediment budget control plan and adequate management of the sediment may be necessary.	C	C	
3	Soil Pollution	No adverse effects to the soil pollution at the target sites would be occurred, as there are no sources by the activities.		D	D	
4	Waste Management	No adverse effects to the waste management at the target sites would be occurred, as there are no sources by the activities.		D	D	
5	Noise and Vibration	No adverse effects to the noise and vibration at the target sites would be occurred, as there are no sources by the activities.		D	D	
6	Subsidence	No adverse effects to the subsidence at the target sites would be occurred, as there are no sources by the activities.		D	D	-
7	Odor	No adverse effects to the odor at the target sites would be occurred, as there are no odor sources by the activities		D	D	-
8	Sediment	For the implementation of sediment budget control plan, the sediment may occur in some extent, due to the improper implementation.	Proper implementation of sediment budget control plan and adequate management of the sediment may be necessary.	C	C	
9	Accidents	No adverse effects to the accidents at the target sites would be occurred, as there are no sources by the activities.		D-	D	

2) Natural Environment

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
1	Protected Areas	There are no protected areas and Marine Protected Areas (MPA) around the proposed project sites.		D	D	-
2	Ecosystem and Fauna/Flora	No adverse effects to the ecosystem and fauna/ flora at the target sites would be occurred, as there are no activities which affect to ecosystem and fauna/ flora.		D	D	
3	Geology and Geomorphology	No adverse effects to the accidents at the target sites would be occurred, as there are no activities which affect to geology and geomorphology.		D	D	
4	Soil Erosion	For the implementation of sediment budget control plan, the sand discharge may occur in some extent, due to the improper implementation.	Proper implementation of sediment budget control plan and adequate management of the sediment may be necessary.	C-	C	
5	Groundwater	No adverse effects to the groundwater at the target sites would be occurred, as there are no extraction of a large volume of groundwater by the activities.		D	D	-
6	Hydrology	No adverse effects to the hydrology at the target sites would be occurred, as there are no activities which affect to the hydrology.		D	D	
7	Coastal Areas	For the establishment of coastal and reef conservation plan and implementation of	Proper establishment coastal and reef conservation plan, implementation of sediment	C	C	

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
		sediment budget control plan, the marine system in the coastal areas may be affected in some extent, due to the improper implementation.	budget control plan and adequate management of the sediment may be necessary.			
8	Climate	No adverse effects to the climate at the target sites would be occurred, as there are no activities which affect to the climate.		D	D	-
9	Climate Change	No adverse effects to the climate change at the target sites would be occurred, as there are no activities which affect to the climate.		D	D	-

3) Social Environment

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
1	Resettlement	No involuntary resettlement will be occurred by implementing any proposed projects, as there are no residents and residential areas at all the project sites.		D	D	
2	Living and Livelihood	If the target areas are used by the local people regularly, there will be possibilities for the local people not to be able to use the areas for their livelihood activities due to the coastal and reef conservation plan.	Proper arrangement and management of the areas under the coastal and reef conservation plan is necessary to mitigate and reduce unfairness to their livelihood activities.	C	C	
3	Heritage	As there is the heritage site along the coast in one target island (L-GAN), there would be a risk that the future ICZM Plan may raise any impacts to the existing heritage site, if not properly planned.	The ICZM Plan should be examined and planned properly and adequately in order for the heritage site not to be suffered from any adverse impacts from the planned activities of the future ICZM	C	C	
4	Landscape	No adverse effects to the landscapes at the target sites would be occurred, as all the projects are in small scale.		D	D	
5	Ethnic Minorities and Indigenous Peoples	If the target areas are used by the local people regularly, there will be possibilities for the local people not to be able to use the areas for their livelihood activities due to the coastal and reed conservation plan.	Proper arrangement and management of the areas under the coastal and reed conservation plan is necessary to mitigate and reduce unfairness to their livelihood activities.	C	C	

Source: JICA (2019)

A+/-: Significant positive/negative impact is expected, B+/-: Positive/negative impact is expected to some extent, C: Extent of impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses) and D: No impact is expected.
Note: BC: Before Construction, DC: During Construction, OP: Operation Phase

(3) Evaluation results of Component 2

Detailed design of coastal conservation measures and capacity development of stakeholders (Activity 2.1) and implementation of beach maintenance, establishment of structure and capacity development of stakeholders (Activity 2.3) will be implemented by JICA as the co-

financed project, and implementation of coastal conservation/protection measures (Activity 2.2) will be implemented by GoM as GCF-funded project and Maldives' co-financed projects.

The activities have been screened against JICA's Environmental and Social Consideration Procedure. The Environmental and Social Screening Template was prepared and the project deemed to be a Category B (medium risk) project, as all the project sites are not located in sensitive areas, nor sensitive characteristics, nor fall into sensitive sectors under the JICA guidelines for Environmental and Social Considerations , and potential adverse impacts on the environment are not likely to be significant.

Table 1.12 Impacts and Mitigation Measures per Environmental Item for Component 2

1) Pollution Control

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
1	Air Quality	During the construction stage, the adverse effects would be occurred to the air quality by using the large machineries, i.e. dredging machine.	Large machineries to be used shall be maintained properly, in order not to emit the unnecessary exhaust gas.	C	C	L-FND, L-MMD, S-MED
2	Water Pollution	During the construction stage, the adverse effects would be occurred to the water quality by using the large machineries, i.e. dredging machine, backhoes, etc.	Large machineries to be used shall be maintained properly, in order to prevent the water pollution.	B-	C	L-FND, L-MMD, L-ISD, L-GAN, S-MED
		During the construction stage, the adverse effects would be occurred to the water quality by inadequate water drainage and soil spill into the sea.	During the construction stage, the adequate drainage water treatment shall be done, i.e. installing silt protectors and sand bunds.	B-	C	L-FND, L-MMD, L-ISD, L-GAN, S-MED
		For the beach nourishment and land reclamation, the adverse effects would be occurred to the water quality by inadequate soil spill into the sea, during the operation stage.	During the operation stage, the community-based maintenance and monitoring will be done through the project.	B-	C	L-FND, L-MMD, L-ISD, L-GAN, S-MED
3	Soil Pollution	During the construction stage, the adverse effects would be occurred to the soil quality, by oil leaking from the large machineries.	During the construction stage, such measures as preparation of the construction accident prevention manual, installation of oil treatment mat, shall be conducted.	C	C	L-FND, L-MMD, L-ISD, L-GAN, S-MED
4	Waste Management	During the construction stage, there will be possibility to appear garbage and harmful waste.	During the construction stage, the adequate waste management shall be conducted.	C	C	L-FND, L-MMD, L-ISD, L-GAN, S-MED
5	Noise and Vibration	During the construction stage, the noise and vibration would be occurred by using the large machineries, i.e. dredging machine, backhoes, etc.	During the construction stage, the noise-cut large machineries and generators shall be used. During the construction stage, the large machineries shall not	C	C	L-FND, L-MMD, L-ISD, L-GAN, S-MED

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
			be used during the night time nearby the residential areas.			
6	Subsidence	No adverse effects to the subsidence at the target sites would be occurred, as there are no extraction of a large volume of groundwater by the project.		D	D	-
7	Odor	No adverse effects to the odor at the target sites would be occurred, as there are no odor sources by the projects.		D	D	-
8	Sediment	For the beach nourishment and land reclamation, the adverse impact may occur for the subsistence (sea bed) during the construction and operation.	For the beach nourishment and land reclamation, the existing situations/ conditions of the sediment shall be confirmed before construction. During the construction stage, such measures to prevent from the adverse effects, shall be considered, i.e. installing silt protectors and sand bunds.	B-	B-	L-FND, L-MMD, S-MED
			During the operation stage, the community-based maintenance and monitoring will be done through the project.	C	C	L-FND, L-MMD, S-MED
9	Accidents	There will be possibilities that accidents would occur during the construction.	The accident prevention manual shall be prepared and danger forecast shall be considered.	B-	D	L-FND, L-MMD, L-ISD, L-GAN, S-MED
		Accidents may occur during dredging the construction materials.	The accident prevention manual shall be prepared and danger forecast shall be considered. During the dredging the sand, special attentions shall be taken in order not to suffer from the accidents.	B-	D	L-FND, L-MMD, S-MED

2) Natural Environment

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
1	Protected Areas	There are no protected areas and Marine Protected Areas (MPA) around the proposed project sites.		D	D	-
2	Ecosystem and Fauna/Flora	During the construction and/or operation stages, there will be possibilities for the marine ecosystem to be suffered from the adverse effects.	Adequate measures to be taken for the marine ecosystems, especially for the corals inhabiting areas, and migrant birds utilizing. During the construction stage, adequate measures to be taken for the coastal vegetation not to be suffered from the construction, and if any adverse effects, necessary measures to be taken to recover the coastal vegetation.	B-	B-	L-FND, L-MMD, L-ISD, L-GAN, S-MED

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
			During construction stage, the sand borrow sites shall be carefully selected in order to avoid damages/ disturbances to the marine ecosystem.			
3	Geology and Geomorphology	For the construction of beach nourishment and land reclamation, there will be possibilities that the nearshore currents and waves would be changed after the construction.	Necessary considerations and measures to be taken about changes of nearshore currents and waves after the construction for the beach nourishment and land reclamation.	C	C	L-FND, L-MMD, S-MED
4	Soil Erosion	For the construction of beach nourishment and land reclamation, there will be possibilities that coastal sand discharge would be occurred by the normal waves and high surges.	For the beach nourishment and land reclamation, necessary measures to be taken for the constructed facilities not to be eroded by the ordinal waves and high surges after the construction. In case of erosion occurrence, necessary measures to be considered.	B-	C	L-FND, L-MMD, S-MED
5	Groundwater	No adverse effects to the groundwater at the target sites would be occurred, as there are no extraction of a large volume of groundwater by the projects.		D	D	-
6	Hydrology	For the construction of beach nourishment and land reclamation, there will be possibilities that the nearshore currents and waves would be changed after the construction.	Necessary considerations and measures to be taken about changes of nearshore currents and waves after the construction for the beach nourishment and land reclamation.	C	C	L-FND、L-MMD, S-MED
7	Coastal Areas	During the construction and/or operation stages, there will be possibilities for the marine ecosystem and coastal areas to be suffered from the adverse effects.	Adequate measures to be taken for the marine ecosystems, especially for the corals inhabiting areas, and migrant birds utilizing.	C	C	L-FND, L-MMD, L-ISD, L-GAN, S-MED
8	Climate	No adverse effects to the groundwater at the target sites would be occurred, as all the projects are in small scale.		D	D	-
9	Climate Change	No adverse effects to the groundwater at the target sites would be occurred, as all the projects are in small scale.		D	D	-

3) Social Environment

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
1	Resettlement	No involuntary resettlement will be occurred by implementing any proposed projects, as there are no residents and residential areas at all the project sites.		D	D	-
2	Living and Livelihood	If the target areas are used by the local people regularly, there will be possibilities for the local people not to be able to use the areas during	Dissemination of the objectives and contents of the proposed projects to the local people shall be done before commencement of the	C	C	L-FND, L-MMD, S-MED

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
		construction.	construction, and their understandings shall be secured.			
3	Heritage	There will be no adverse effects for the heritage sits, as there are no heritages at all the project sites and all the concerned projects (L-ISD and L-GAN) would be the facilities to protect such heritage sites nearby the project sites.		D	B+	L-GAN, L-ISD
4	Landscape	No adverse effects to the landscapes at the target sites would be occurred, as all the projects are in small scale.		D	D	-
5	Ethnic Minorities and Indigenous Peoples	If the target areas are used by the local people regularly, there will be possibilities for the local people not to be able to use the areas during construction.	Dissemination of the objectives and contents of the proposed projects to the local people shall be done before commencement of the construction, and their understandings shall be secured.	C	C	L-FND、L-MMD, S-MED

Source: JICA (2019)

A+/-: Significant positive/negative impact is expected, B+/-: Positive/negative impact is expected to some extent, C: Extent of impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses) and D: No impact is expected.
Note: BC: Before Construction, DC: During Construction, OP: Operation Phase

(4) Evaluation results of Component 3

The Installment of terrestrial digital broadcasting system (Activity 3.1) is implemented by JICA as the co-financed project, the project has been screened against JICA's Environmental and Social Consideration Procedure. The Environmental and Social Screening Template was prepared and the project deemed to be a Category B (medium risk) project, as all the project sites are not located in sensitive areas, nor sensitive characteristics, nor fall into sensitive sectors under the JICA guidelines for Environmental and Social Considerations , and potential adverse impacts on the environment are not likely to be significant.

The establishment of Disaster Early Warning and Information Broadcasting System (Activity 3.2) are also implemented by JICA as the co-financed project. The activities deem to be a Category C (low risk) activity, as all the proposed activities include the trainings and capacity development for the stakeholders.

Table 1.13 Impacts and Mitigation Measures per Environmental Item for Component 3

1) Pollution Control

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
1	Air Quality	During the construction stage, using heavy machinery for the construction work will raise extensive amount of emission from the vents of heavy machineries. It	Large machineries to be used shall be maintained properly, in order not to emit the unnecessary exhaust gas.	B	D	
2	Water Pollution	During the construction stage, the adverse effects would be occurred to the water quality by using the	Large machineries to be used shall be maintained properly, in order to prevent the water pollution.	B-	D	

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
		large machineries, i.e. backhoes, etc.				
3	Soil Pollution	During the construction stage, heavy machinery uses heavy and dense fuel which may become a pollutant and may cause a disaster.	The hazardous material such as heavy oil and any flammable material shall be stored safely in barrels or appropriate containers with appropriate label and sign place outside of it.	B	D	
4	Waste Management	During the construction stage, most of the green waste would be produce.	Any solid waste and the green waste from removal of grass shall be properly disposed at island waste management center. Any used oil or leftover paints and other chemical shall be leak proof packed and stored till it is transported to Thilafushi or any other such designated area.	B	D	
5	Noise and Vibration	During the construction stage, noise and vibration could be prone to be occurred.	In order to reduce the noise pollution, the work on site may not commence during the night. All the heavy vehicles and equipment's shall be well serviced and maintained to reduce the unnecessary emission and incomplete combustion of the fuel.	B	C	
6	Subsidence	During the construction stage, the dewatering would accelerate the horizontal flow of the groundwater. This will have an impact on the groundwater depletion and subsidence of the ground.	In case surface soil subsiding occurs, the depth of the steal pile needed to be adjusted before commencing the dewatering.	B	D	
7	Odor	No adverse effects to the odor at the target sites would be occurred, as there are no odor sources by the projects.		D	D	
8	Sediment	No adverse effects to the sediment at the target sites would be occurred, as there are no sediment sources by the projects.		D	D	
9	Accidents	There will be possibilities that accidents would occur during the construction.	The accident prevention manual shall be prepared and danger forecast shall be considered. When the workers present at the construction site, the safety helmet and safety shoes needed to be worn at all time.	B-	D	

2) Natural Environment

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
1	Protected Areas	There are no protected areas and Marine Protected Areas (MPA) around the proposed project sites.		D	D	-
2	Ecosystem and Fauna/Flora	During the construction stage, most of the vegetation would be cleared and an immediate and most adverse environmental impact on the vegetation will arise.	Adequate measures to be taken for the ecosystem and fauna/ flora; i.e. any tree that could be replanted, shall be replanted in a different location, try to avoid cutting down of or uprooting of unnecessary vegetation.	B-	D-	
		During the operation stage, birds may be suffered from the antennas and indicator lights on the posts/ antennas.	The indicator light on all the tower shall be red light and the light shall be lit continuously throughout the night. This will reduce the confusion arise in the bird community.	D	B	
3	Geology and Geomorphology	No adverse effects to the geology and geomorphology at the target sites would be occurred, as all the projects are in small scale.		D	D	
4	Soil Erosion	During the construction stage, with extensive dewatering, it may collapse the adjoining ground. If the dewatering is taking place near any existing facilities, this collapsing of ground may lead to physical damage to the existing facility.	It is impossible to completely cutoff the horizontal flow, therefore great care need to be taken on monitoring the surrounding soil. If subsiding occurs in the vicinity, the dewatering needed to be stop immediately.	B-	C	
5	Groundwater	In the construction stage, the reversible short-term impact of dewatering would be a significant impact. The dewatering would accelerate the horizontal flow of the groundwater. This will have an impact on the groundwater depletion.	In order to address the adverse impacts arise by extensively draining water from groundwater lens by dewatering, steal piling would be used to enclose excavation area.	B	D	
6	Hydrology	No adverse effects to the hydrology at the target sites would be occurred, as all the projects are in small scale.		D	D	
7	Coastal Areas	No adverse effects to the coastal areas at the target sites would be occurred, as all the projects are not located along the coast.		D	D	
8	Climate	No adverse effects to the groundwater at the target sites would be occurred, as all the projects are in small scale.		D	D	
9	Climate Change	No adverse effects to the groundwater at the target sites would be occurred, as all the projects are in small scale.		D	D	

3) Social Environment

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
1	Resettlement	No involuntary resettlement will be occurred by implementing		D	D	

	Environmental Item	Issues	Measures	Evaluation		Objective projects
				BC/DC	OP	
		any proposed projects, as there are no residents and residential areas at all the project sites.				
2	Living and Livelihood	No adverse effects to the living and livelihood at the target sites would be occurred, as all the projects are in small scale.		D	D	
3	Heritage	There will be no adverse effects for the heritage sites, as there are no heritages at all the project sites		D	D	
4	Landscape	No adverse effects to the landscapes at the target sites would be occurred, as all the projects are in small scale.		D	D	
5	Ethnic Minorities and Indigenous Peoples	No adverse effects to the ethnic minorities and indigenous peoples at the target sites would be occurred, as all the projects are in small scale.		D	D	

Source: EIA for the Proposed Digital Terrestrial Television Broadcasting Network Development Project, Energy Consultancy Pvt. Ltd. (2018a, 2018b), compiled by JICA (2020)

A+/-: Significant positive/negative impact is expected, B+/-: Positive/negative impact is expected to some extent, C: Extent of impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses) and D: No impact is expected.
Note: BC: Before Construction, DC: During Construction, OP: Operation Phase

(5) Evaluation results of Component 4

All the activities under Component 4 are implemented by JICA as the co-financed project, and the activities will be screened against JICA's Environmental and Social Consideration Procedure. The Environmental and Social Screening Template is tentatively prepared and the activities deem to be a Category C (low risk) project, as the proposed activities include the observation of the environmental data and information, and information sharing.

1.3.2 Assumptions Underpinning the Development of the Environmental and Social Management Framework

The following assumptions have been made in the preparation of this ESMF:

a. None of the facilities and activities will require the displacement of people (including economic), either temporary or permanent;

b. There will be no resettlement or land acquisition;

c. The facilities and activities that are to be conducted in the protected areas or sensitive locations will be undertaken in full consideration of the need to ensure full protection, if any;

d. Appropriate erosion and sediment control will be undertaken during all stages of the projects;

e. There will be no release of pollution and/or chemicals as a result of the projects; and

f. No unnecessary dredging for securing sand materials for beach nourishment will be undertaken.

1.3.3 Purpose and Objectives of the Environmental and Social Management Framework

An ESMF is a management tool used to assist in minimizing social and environmental impacts and establish a set of environmental and social objectives. To ensure the environmental and social objectives of the projects are met, this ESMF will be used by the project implementers to

structure and control the environmental and social management safeguards that are required to avoid or mitigate adverse effects on the environment and affected communities.

The environmental and social objectives of the projects are:

a. To mitigate coastal flooding risks in the target areas in each island in Laamu Atoll and Addu City;
b. To address the broader climate change adaptation challenges impacting in the area through the introduction of an integrated coastal zone management planning process;
c. To encourage good management practices through planning, commitment, and continuous improvement of environmental practices and the impacts of climate change; and
d. To strengthen the capacity of the Maldivian government and communities to manage the flooding impacts of climate change-induced SLR on coastal communities;

The environmental and social objectives of the ESMF are:

a. To encourage good management practices through planning, commitment and continuous improvement of environmental practices;
b. To minimize or prevent the pollution of land, air, and water;
c. To protect existing flora, fauna, and important ecosystems from additional impacts;
d. To provide for the development of monitoring programs to assess any changes in environmental and social matters including protected areas, water quality, etc.;
e. To comply with applicable laws, regulations, and standards for the protection of the environment;
f. To adopt the best practicable means available to prevent or minimize environmental impact;
g. To identify key environmental and social indicators;
h. To engage with relevant stakeholders to manage their concerns;
i. To describe monitoring procedures required to identify impacts on the environment;
j. To provide an overview of the obligations of the project implementers; and
k. To provide a grievance system to manage potential complaints and/or grievances.

The ESMF will be updated from time to time by the implementing Project Management Unit (PMU)/ JICA/ contractor(s) in consultation with the project board to incorporate changes in the detailed design phase of the projects.

1.3.4 Economic Displacement and Livelihood Restoration

No economic displacement, either temporary or permanent, is expected during the implementation of the project.

1.3.5 Land Issues

The lands, which are planned to be the project areas, are along the coasts. For the adjacent areas from the target sites, the residential houses are constructed even within the setback areas. However, there are no residential houses within the setback areas, which are stipulated by regulation for the target areas. As such, there is no requirement for any compulsory land

acquisition and/or compensation to be paid. Current uses of the lands are mainly for recreational activities by residents, traditional medical treatment, and the collection of natural resources.

1.3.6 Indigenous Peoples

As part of due diligence, analysis and consultation are undertaken as to the probability of any of the project's activities involving indigenous people and/or ethnic minorities. No indigenous people and/or ethnic minorities such as Giraavaru are known to live in any of the proposed locations as identified and discussed in Table 3.25.

1.4 Overview of Institutional Arrangements for the Environmental and Social Management Framework Plan

The ESMF will be assessed by the ME and JICA prior to any works being undertaken. The ESMF identifies potential risks to the environment and social matters from the projects and outlines strategies for managing those risks and minimizing undesirable environmental and social impacts.

The ME, together with EPA, will be responsible for the supervision of the ESMF. JICA will gain the endorsement of the ME and will ensure the ESMF is adequate and followed. The PMU will ensure that timely remedial actions are taken by the contractor when necessary.

1.4.1 Administration

The ME will be responsible for the revision or updates of this document during the course of the work. It is the responsibility of the person to whom the document is issued to ensure it is updated.

The Safeguard Officer in the GCF-PMU will be responsible for the regular environmental inspections of the construction site.

The contractor will maintain and keep all administrative and environmental records which would include a log of complaints together with records of any measures taken to mitigate the cause of the complaints. The contractor will be responsible for the day to day compliance of the ESMF.

2. Legal and Institutional Framework for Environmental and Social Matters

2.1 Relevant Environmental Legislation

2.1.1 Environmental Protection and Preservation Act (Act No. 4/93)

The Environmental Protection and Preservation Act of the Maldives (EPPA) (Law No. 4/93), provides the basic framework for environmental management including the Environmental Impact Assessment (EIA) process in the Maldives, which is currently being implemented by the Environmental Protection Agency (EPA) on behalf of the Ministry of Environment and Energy (MEE).

The project conforms to the requirements of EPPA. The EIA should be undertaken in accordance with the EIA Regulation 2012 of Maldives, together with the succeeding amendments, by registered consultants. Furthermore, it adheres to the principles underlined in the regulations, action plans, programmes, and policies of the Ministry of Environment and Energy (MEE), Ministry of Planning and Infrastructure (MPI), and relevant local councils.

Articles 2, 4, 5, 6, 7, and 8 of the law are relevant to the coastal protection projects in Addu City and Laamu Atoll.

Clause 2 of the EPPA mandates the Ministry of Environment and Energy to formulate policies, rules, and regulations regarding the environment.

Clause 5 of the EPPA specifically provides for an environmental impact assessment (EIA), a tool implemented to attempt to integrate environmental issues into development decisions. According to Clause 5 (a) of the Act, an Environmental Impact Assessment study shall be submitted to the Ministry of Environment before implementing any development project that may have a potential impact on the environment. According to Clause 5 (b), the Ministry of Environment shall formulate the guidelines for the EIA and shall determine the projects that need such assessment as mentioned in paragraph (a) of this clause.

Clause 6 of the EPPA gives the Ministry of Environment and Energy the authority to terminate any project that has an undesirable impact on the environment.

Clause 7 of the EPPA refers to the disposal of oil, waste, and poisonous substances in the Maldivian territory. According to this clause, any type of waste, oil, toxic gas, or any substance that may have harmful effects on the environment should not be disposed within the Maldivian territory. If, however, the disposals of such substances become absolutely necessary, the clause states that they should be disposed only within the areas designated for that purpose and if incinerated, appropriate precautions should be taken to avoid harm on the health of the population.

Clause 8 of the EPPA (4/93) states that Hazardous, Toxic, or Nuclear Waste that is harmful to human health and the environment shall not be disposed anywhere within the territory of the country.

Furthermore, Clause 9 sets a fine form MVR 5 to MVR 500 for minor offenses in breach of this law and a fine of not more than MVR 100 million for major offenses. The fine shall be levied by the Ministry of Environment and Energy or by other government authorities designated by that ministry in case of minor offenses.

Finally, Clause 10 of the EPPA gives the Government of the Maldives the right to claim compensation for all damages caused by activities that are detrimental to the environment. The Clause 3 of the Environment Act has been amended by Law No. 12/2014, which now states that environmental protection, including conservation of biological diversity, protection of groundwater resources and related environments including mangroves, swamps found in the islands, protection of the environment from waste and hazardous gases as well as to formulate

relevant policies, regulations, standards, and implementation of such in consultation with other government agencies shall be a responsibility of the ministry assigned for implementing environmental policies.

The proposed project will fully abide to the Environmental Preservation and Protection Act. All mitigation measures will be implemented in the interest of the environment

2.1.2 Employment Act (Act No. 2/2008)

The Employment Act, the legal framework to govern the rights and responsibilities of the migrant workers in the Maldives, is included in the Employment Act (2/2008). The Employment Act provides for the creation of a Labour Relations Authority, an Employment Tribunal and an Advisory Board on wages. To date, four amendments have been brought to the Employment Act (2/2008). All contractors shall be required to undertake ethical recruitment and responsible employment of workers during the construction stage of the project. During the operation stage, an ethical recruitment and responsible employment policy and system will be developed and implemented and amendments were made through the following Acts: 14/2008; 12/2010; 3/2014; 14/2015.

2.2 Relevant Regulations and Guidelines

2.2.1 Protected Areas and Sensitive Areas

Under Article 4 of the Environment Protection and Preservation Act, the Ministry of Environment is vested with the responsibility of identifying and registering protected areas and natural reserves and drawing up of rules and regulations for their protection and preservation. For the target areas for Component 2 in Addu City and Laamu Atoll, there are no protected areas nearby the target areas. For Component 3, all the target areas are not located in the sensitive areas.

As part of the Environmental Regulation, EPA has established a list of ‘sensitive sites’ in the Maldives. Although not formalized as a regulation, the sensitive list is mentioned in the recent Regulation on Dredging and Reclamation (Regulation number 2014/R-13). The sensitive sites, according to EPA are sites in the Maldives (islands, reefs, mangroves, inter-tidal areas) where developments ought to be restricted, regulated, or controlled. Some view those sites mentioned in the sensitive list have no meaning because there is no evidence to show any ‘sensitive features’ of the areas.

2.2.2 Environmental Impact Assessment Regulation 2012

The Ministry of Housing and Environment issued the EIA regulation in May 2012, which guides the process of undertaking the Environmental Impact Assessment in the Maldives. This guideline also provides a comprehensive outline of the EIA process, including the roles and responsibilities of the consultants and the proponents. This regulation outlines every step of the EIA process beginning from the application to undertake an EIA, details on the contents, minimum requirements for consultants undertaking the EIA, format of the EIA/IEE report, and many more. The guidance provided in this Regulation was followed in the preparation of this EIA report. The EIA has also been prepared by registered consultants.

(1) First Addendum to the Environmental Impact Assessment Regulation 2012 (Regulation 2013/ R-18)

This first addendum was gazetted on 9th April 2013. This amendment stipulates that the responsible authority has to check the submitted EIA report for everything mentioned in the

Regulation's article (Kaafu) and inform the proponent whether the EIA Report has been accepted or rejected within two working days. The penalty for repetitive offenses has also been updated in this amendment of the regulation.

(2) Second Addendum to Environmental Impact Assessment Regulation 2012 (Regulation 2015/R-174)

The second amendment gazetted on 30th August 2015 includes the following important points:

- Some procedural changes have been made to the EIA process: e.g., shifting the tourism related developmental project EIAs to the Ministry of Tourism, ii) changes in the process like finalization of the Terms of Reference during the scoping meeting, and iii) changes in the fees structure for the review process have been made to include three different categories.
- Article 8 (a) of the amendment of the decision for the screening form is as follows:
    1) Environmental Management Plan
    2) Initial Environmental Examination
    3) Environmental Impact Assessment
    4) Approval to go forward with the screened project
    5) Approval to go forward with the project with as per the mitigation measures proposed by EPA.
- Article 9(b) of the amendment for the decision for IEE is as follows:
    1) Environmental Impact Assessment Report if the project anticipated to have major environmental impacts
    2) Environmental Management Plan
    3) Approval to go forward with the project if the project is not anticipated to occur major environmental impacts

(3) Third Addendum to the Environmental Impact Assessment Regulation 2012 (Regulation 2016/R-66)

The third amendment gazetted on 11th August 2016 includes the following important points:

- The point system for consultants, categories of the consultants, and amendment of the penalties to consultants and proponents who fail to follow the regulation. This EIA report was prepared by a Category A registered EIA consultant

(4) Fourth Addendum to the Environmental Impact Assessment Regulation 2012 (Regulation 2017/R-7)

The fourth Amendment gazetted on 19th January 2017 includes the following points:

- The projects that can be preceded without an Environmental Impact Assessment when the proponent requests to the Ministry of Environment and Energy in writing along with commitments or guarantee that the Proponent will carry out the mitigation measures that may impact the Environment due to such projects. A list of such projects given in the amendment is as follows:
    1) Removal of deposited sand inside the harbor
    2) Trees and palms present on lands left for the purpose of building houses need to be taken by the owner of the land.

3) If trees/palms present on lands left for building purposes obstruct the roads need to be removed. (Such cases will be handled by the council of the island).

4) Creating boreholes on land for the uptake of water.

5) On lands, which are connected to naturally formed islands, projects that are carried out before three years since the reclamation of land.

6) On lands, which are newly reclaimed in the middle of a lagoon, projects which are carried out for before five years since the reclamation.

Even on the lands mentioned in numbers 5 and 6 of clause a) of this regulation, if people habituate, development projects should be carried out under EIA regulation (2012). It can only be carried out after submitting an EIA and with the permission of the Ministry of Environment and Energy.

- Even on the lands mentioned in numbers 5 and 6 of clause a) of this regulation, the projects listed down below can only be carried out under the EIA regulation (2012) with the approval of the ministry.

1) Projects involving hazardous/toxic chemicals

2) Projects involving the storage of oil

3) Projects involving the usage of incinerators

4) Projects which would release any kind of toxic fumes into the atmosphere

(5) Fifth Addendum to Environmental Impact Assessment Regulation 2012 (Regulation 2018/R-131)

The fifth amendment gazetted in 2018 includes the following points:

- Some procedural changes have been made to the EIA process. The main change is the re-inclusion of the tourism related developmental project EIAs to the Ministry of Environment from the Ministry of Tourism: i.e., 36) Development of tourist resorts, and 37) development of tourist guesthouse. Accordingly, the following projects are those which need EIAs:

Table 2.1 List of Projects which Need EIA in the Maldives

No.	Projects which Need EIA
1	Commercial aquaculture projects
2	Fish processing facilities
3	Artificial reefs
4	Agriculture projects
5	Livestock and animal husbandry
6	Large-scale deforestation
7	Construction and dredging of harbours
8	Cutting, dredging and maintenance of channels
9	Construction of jetties (without water channel)
10	Development of yacht marinas
11	Land reclamation projects
12	Sea defense structures (such as seawalls, revetments, marine installation, offshore breakwaters, groines)
13	Beach nourishment
14	Sand mining using machinery
15	Construction of major roads
16	Development of airports
17	Helipads and seaplane hubs
18	Major housing projects

No.	Projects which Need EIA
19	Building structures, with more than 10 storeys (excluding the foundation raft) or higher than 31 meters.
20	Buildings with foundation structures that cater for more than 10 storeys
21	Buildings with basements
22	Buildings with foundations deeper than five feet or a foundation of a unique structure
23	Development of factories (with initial investments of more than MVR 100,000, and those registered with the relevant government authorities)
24	Waste incinerators
25	Landfills
26	Unofficial translation
27	Large-scale waste storage and separation facilities
28	Bottling plants
29	Drinking water supply network systems
30	Sewerage projects
31	Marine outfall pipes
32	Power plants
33	Oil, fuel and gas storage, handling and refining facilities
34	Desalination plants of capacity larger than 150 tonnes
35	Hospitals
36	Development of new tourist hotel or resort
37	Additions and large-scale developments to tourist hotels and resorts

Sources: Modified by the JICA, based on the Environmental Impact Assessment Regulation (2012), the Second Amendment (2015) and the Fifth Amendment (2018)

Note: The tourism related developmental projects: i.e., No. 36 and No. 37 in the above table, were listed as target projects No. 1 and No. 2 in the Environmental Impact Assessment Regulation in 2012, however, those two projects were shifted to the Ministry of Tourism through the Second Amendment (2015). Through the Fifth Amendment (2018), those two tourism related projects have been re-added to the projects under managing of EPA.

2.2.3 Dredging and Reclamation Regulation (Regulation 2013/R-15)

The regulation of Dredging and Land Reclamation was published on 2 April 2013 with the aim of minimizing environmental impacts associated with dredging activities in islands and reefs across the Maldives. This regulation explains in detail about the situation of dredging and reclamation. The followings are the outlines of the regulation:

- The regulation defines the rationales acceptable for dredging as those related to the approved development activities on inhabited islands and economic islands. It defines that those activities should be of utmost necessity for dredging to be considered.
- All dredging and reclamation activities must be approved by EPA in writing. The process includes the submission of project information to EPA along with a scaled before and after map. The regulation defines rationales for reclamation as those absolutely necessary for social, economic, or safety purposes.
- Dredging is restricted in the following areas:
    a) 500 m from the ocean side reef edge;
    b) 50 m from any island vegetation line;
    c) An environmentally sensitive site;
    d) Land reclamation is restricted within 200 m of a sensitive area; and

e) Land reclamation cannot exceed 30% of the house reef area.

- The regulation requires producing scaled-maps of the island before and after the proposed intervention. Land use plan and the details of essential requirement should be submitted to the Implementation Agency. Along with these details, a geo-referenced scale map (1:10,000) should be submitted and permission should be obtained from the Implementation Agency.
- Special provisions have been made on protected and sensitive area restricting changes to the environment of the islands.

(6) First Amendment to the Dredging and Reclamation Regulation

This amendment to the regulation came into force on 9 February 2014 and has brought changes to Clause 13 (d) of the Dredging Regulation. The amendment explains that the developmental projects planned under the cabinet decision or run under government developmental projects can be preceded even after it falls under Clause 13 (d) number 4 along with the conditions given in the First Amendment. The proponent shall apply to the Implementation Agency for such activities like sand mining, while dredging and reclamation and shall be carried out only after obtaining permission from the Implementation Agency. The conditions given in the amendment are as follows:

a) Carry out a study on the existence of living flora, fauna, and threatened species.

b) Submit a plan and obtain permission for such plans on how to transfer, shift, and farm the threatened species.

c) Develop a natural area not smaller than the existing area with the existing characteristics or develop an area with such characteristics that are instructed by the Implementation Agency as per the policy, regulation, and standards and set arrangements to protect, manage, and monitor such areas.

d) Carry out a study to monitor the impact on the existing aquifer and to take mitigation measures to prevent the occurrence of likely impacts. Additionally, these activities should be monitored by the implementation Agency.

e) Carry out a study on possible flooding and implement a suitable drainage system as a mitigation measure. This project can be preceded as per the regulations and its amendments where mitigation and monitoring are explained in relevant sections.

2.2.4 Cultural and Historical Places and Objects Act (Act No.27/79)

The Law on Cultural and Historical Places and Objects of the Maldives (27/79) prohibits destroying or damaging any historical and cultural places, sites, objects, and artifacts belonging to the sovereign area of the Maldives.

a) The cultural sites mentioned in this regulation are things or places used by locals or foreign ancestors who had resided in the Maldives. These things reflect the lifestyles of the ancestors of the locals.

b) Monuments or idols, which have been created in honor of certain personalities or idols that people used to worship in the past, are also protected under this regulation.

c) However, with the permission from the relevant authorities of the government, cultural sites are allowed to be touched and studied in such a way that their original identity is not lost.

2.2.5 Regulation on Cutting Down and Export of Trees and Coconut Palms (Regulation No. 7-R/2014)

The Regulation on Cutting Down and Export of Trees and Palms (Regulation No. 7-R/2014) specifies that the cutting down, uprooting, digging out, and export of trees and palms from one island to another can only be done if it is absolutely necessary and if there is no other alternative. It further states that for every tree or palm removed in the Maldives two more should be planted and grown in the island.

The regulation prohibits the removal of the following tree types;

- The coastal vegetation growing around the islands extending to about 15 meters into the island;
- All the trees and palms growing in mangrove and wetlands spreading to 15 meters of land area;
- All the trees that are in a government designated protected areas;
- Trees that are being protected by the government in order to protect species of animal/organisms that live in such trees; and
- Trees/palms that are abnormal in structure.

2.2.6 Coral and Sand Mining Regulation

Coral mining from house reef and atoll rim has been banned through a directive from the President's Office dated 26 September 1990. Additionally, the Regulation on Sand and Coral Mining was issued by the Ministry of Fisheries, Agriculture, and Marine Resources (MOFA) on 13 March 2000.

This regulation covers sand mining from uninhabited islands that have been leased; sand mining from the coastal zone of other uninhabited islands; and aggregate mining from uninhabited islands that have been leased and from the coastal zone of other uninhabited islands. Sand should not be mined from any parts of the existing island, beach, or the newly reclaimed island beach. Sand should also not be mined from within 100 feet of the shoreline.

2.3 Environmental Impact Assessment in the Maldives

2.3.1 Environmental Impact Assessment Process

(1) EIA Process

Under Article 5 (a) of the EPPA, an Environmental Impact Assessment (EIA) has to be submitted by the developer of a project, which may have potential impacts on the environment, to ME for approval before the commencement of the project. The EIA process is coordinated by the Environment Protection Agency of MEE in consultation with other relevant government agencies and the National Commission for the Protection of the Environment (NCPE).

The EIA process is initiated when the proponent submits a Screening Form to the ministry. This stage identifies if the project requires an Initial Environmental Examination (IEE) or a full Environmental Impact Assessment (EIA). Subsequently, the scope of the EIA will be discussed in a Scoping Meeting attended by representatives from the ministry and the proponent. Once the scope is identified, baseline surveys will be carried out and a report submitted to the ministry according to the guidelines provided in the EIA Regulation. The main components of the report are project description, existing environment, public consultation, impact assessment, alternatives, mitigation, and monitoring. A decision statement is then issued by the ministry

stating whether the project is approved, needs further information, or is rejected. The EIA process is schematically shown on Figure 2.1. The proposed activities under this Funding Proposal: i.e., land reclamation, sea wall construction projects, beach nourishment projects, and sand mining using machinery are included in the list of activities requiring an EIA (Schedule D) of the EIA Regulations).

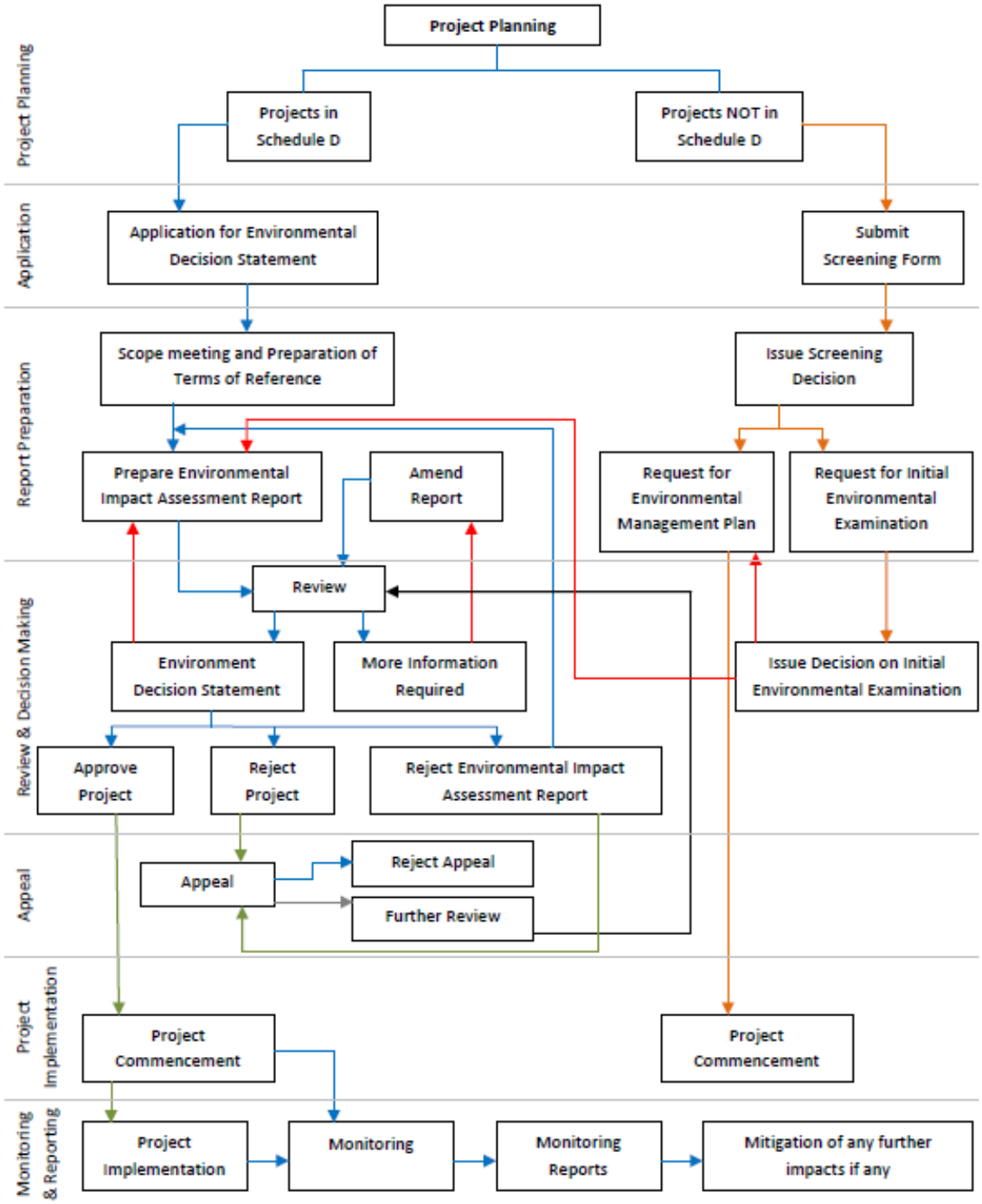


Figure 2.1 EIA Process in the Maldives
Source: Environmental Impact Assessment Regulation 2012

2.4 Guiding Policies and Documents

2.4.1 National Biodiversity Strategy and Action Plan (2016-2025)

One of the most recent policy documents, which are connected with the proposed projects, is the National Biodiversity and Strategy and Action Plan (NBSAP 2016-2025). This seeks to ensure that threats to biodiversity are addressed, biodiversity is conserved, sustainably used and benefits arising from them are shared equitably. It also encompasses ways of addressing gaps, challenges, and constraints highlighted in earlier sections. The proponent has committed on conservation and protection of the environment while undertaking this proposed project.

2.4.2 National Framework for Development 2009-2013/ 2014-2020

The National Framework for Development 2009-2013 consists of ten policies. It is the important environmental policy guidance given in the Strategic Action Plan (SAP). The environmental policies outlined in the SAP include the following:

- Policy 1: Strengthen EIA process with an emphasis on EIA monitoring.
- Policy 2: Conserve and sustainably use biological diversity and ensure maximum ecosystem benefits.
- Policy 3: Develop resilient communities addressing impacts of climate change, disaster mitigation and coastal protection.
- Policy 4: Strengthen adaptation and mitigation responses for beach erosion and develop a system to assist communities where livelihood and property are affected by beach erosion.
- Policy 5: Ensure management of solid waste to prevent impact on human health and environment through approaches that are economically viable and locally appropriate.
- Policy 6: Ensure protection of people and the environment from hazardous waste and chemicals.
- Policy 7: Improve air quality to safeguard human health.
- Policy 8: Enable a fully functional decentralized environmental governance system.
- Policy 9: Develop a low carbon economy to achieve carbon neutrality by 2019.
- Policy 10: Inculcate environmental values in the society and enable environmentally friendly lifestyle.

This policy encourages strengthening EIA process and EIA monitoring including conservation and sustainability of biological diversity. Based on this plan, relevant laws, regulations, and amendments to such regulations have been done to improve the processes and the relevant laws and regulations are covered under the Policy, Legal, and Administrative Framework of this report.

2.4.3 3rd National Environmental Action Plan, 2009-2013

The 3rd National Environmental Action Plan (NEAP 3) sets out the agenda for environmental protection and management in the Maldives for the five-year period of 2009 – 2013. This plan is targeted to achieve measurable environmental results that matter to the people of the Maldives. The aim of developing NEAP 3 is to protect and preserve country's environment and properly manage natural resources for the sustainable development of the country. This should encompass the ten principles with six strategic results with targeted goals to be achieved under each result. The key principles of the NEAP 3 are as follows:

- Principle 1: Environmental protection is the responsibility of every individual
- Principle 2: Achieve results
- Principle 3: Promote and practice sustainable development
- Principle 4: Ensure local democracy
- Principle 5: Inter-sectoral coordination and cooperation
- Principle 6: Informed decision making
- Principle 7: Precaution first
- Principle 8: Continuous learning and improvement
- Principle 9: Right to information and participation
- Principle 10: Environmental protection complements development

2.4.4 National Solid Waste Management Policy, 2007

As waste management has been identified as a key environmental issue in the Maldives, a National Solid Waste Management for the Republic of Maldives was developed in 2007 as an important step towards mainstreaming waste management in the country. The aim of the waste management policy is to formulate and implement guidelines and means for solid waste management in order to maintain a healthy environment. Accordingly, the key elements of the policy include: i) ensuring a safe disposal of solid waste and encouraging the recycling and reduction of waste generated; ii) developing guidelines on waste management and disposal and advocating to enforce such guidelines through inter-sectorial collaboration; and iii) ensuring the safe disposal of chemical, hazardous, and industrial waste.

The proponents of this project must be aware of the policy and all solid and hazardous waste produced in this project should be disposed according to the Environmental Management Plan for the project, which reflects the principles of the Waste Management Policy.

2.4.5 Waste Management Regulations

Waste Management Regulation (No. 2013/R-58) put on gazette in August 2013 came into force in February 2014. The regulation provides a set of comprehensive guidelines on collecting, storing, transporting, and managing waste as well as the management of hazardous waste. The aim of Waste Management Regulation is to implement the national waste policy that contains specific provisions to (a) implement measures to minimize impacts on human health; (b) formulate and implement waste management standards; (c) implement an integrated framework for sustainable waste management (d) encourage waste minimization, reuse, and recycling (e) implement Polluter Pays Principle; and (f) introduce Extended Producer Responsibility.

The Waste Management Regulation identifies the areas prohibited from the dumping of waste; protected areas under the Environmental Protection and Preservation Act, mangroves, lagoons of islands, coral reefs, sand banks, beaches of islands, coastal vegetated areas of islands, harbors, parks, and roads. Additionally, the Waste Management Regulation states that those involved in waste management must be permitted by the Environmental Protection Agency.

2.4.6 Decentralization Act

The main objectives of decentralizing the Administrative Divisions of the Maldives is to allow the island communities to make their own decisions in a democratic and accountable manner. These include the improvement of people's living standards through social, economic, and cultural development, the emancipation of the people, the increase in scope that will bring the services closer to the people, and the creation of an environment conducive for peace and prosperity.

In order to provide for decentralized administration, Atoll Councils, Island Councils, and City Councils are established. This project will be monitored and overlooked by PMU, in close relationship with the representatives of councils in Addu City and Laamu Atoll. The project was also formulated and finalized together with inputs from the local councils.

2.5 Multilateral Agreements and Biodiversity Protocols

2.5.1 United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol

The Maldives is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol to the UNFCCC. The objective of the convention is to achieve, in accordance with the relevant provisions of the convention, the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

The IPCC defines mitigation "as an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases." The greenhouse gas inventory of the Maldives forms an integral part of the First National Communication of the Maldives to the UNFCCC. In March 2009, the President of the Maldives announced the target to make Maldives carbon neutral by 2020. Hence, in the implementation of the project, careful attention needs to be given to ensure energy efficiency and reduce transport related fuel consumption. Furthermore, planting of beach vegetation would help in mitigation of greenhouse gas emissions from the project.

The IPCC defines adaptation "as an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects." Various types of adaptation include anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation. The adaptation policies and strategies of the Maldives are given in the Maldives National Adaptation Programme of Action (NAPA). The replenishment of the beach can be considered as a long-term adaptation measure against beach erosion caused by rising sea levels.

2.5.2 United Nations Convention on Biological Diversity (UNCBD)

The Maldives is a party to the United Nations Convention on Biological Diversity and has prepared the National Biodiversity Strategy and Action Plan in 2002. The objectives of the UNCBD are "the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources." The Convention entered into force on 29 December 1993.

The proposed projects in this funding proposal do not fall on any areas recognized for its ecological value, even when there are some coral inhabiting areas. However, it is unlikely that

there will be a significant loss of biodiversity. Therefore, it is recommended that the project ensures that mitigation measures are followed while executing works on land and in the marine environment to protect the marine biodiversity.

2.5.3 United Nations Convention to Combat Desertification (UNCCD)

The objective of the UNCCD is to "combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa, through effective action at all levels, supported by international cooperation and partnership arrangements, in the framework of an integrated approach, which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in affected areas (Article 2)." To achieve this goal, the Convention focuses on improving land productivity, rehabilitation of land, and the conservation and sustainable management of land and water resources. The Convention was adopted in Paris on 17 June 1994 and entered into force on 26 December 1996. The Maldives has acceded to the Convention in 2002.

2.5.4 United Nations Convention on the Law of the Sea (UNCLOS)

UNCLOS refers to several United Nations events and one treaty. This treaty provided new universal legal controls for the management of marine natural resources and the control of marine pollution. UNCLOS provides a legal order for the seas and oceans that will facilitate international communication, and will promote the peaceful uses of the seas and oceans, the equitable and efficient utilization of their resources, the conservation of their living resources, and the study, protection, and preservation of the marine environment

2.6 Institutional Framework

2.6.1 Ministry of Environment, Climate Change and Technology (ME)

The Ministry of Environment, Climate Change and Technology (ME), restructured and renamed from the Ministry of Environment and Energy (MEE), is the primary environmental institution in the Maldives. ME is mandated with formulating policies, strategies, laws, and regulations concerning environmental management, protection, conservation, and sustainable development for the effective implementation of the Environmental Protection Act of the Maldives and has the statutory power over issues related to the environment. ME is also responsible for formulating relevant laws and regulations, policies, and strategies concerning energy, water, sanitation, and waste management. It has the central control over environmental protection, management, conservation, and environmental emergencies. The ministry operates mainly at a policy level and the more regulatory and technical assessment activities are mandated to the Environmental Protection Agency (EPA). In this respect EPA has now been mandated to manage all issues relating to the Environmental Impact Assessment of individual projects.

2.6.2 Environmental Protection Agency (EPA)

The Environment Protection Agency (EPA) of the Ministry of Environment, Climate Change and Technology has responsibilities for the efficient operation of the EIA process. This encompasses a number of tasks, including screening of projects and provision of general procedural advice to the project EIA for any kind of development projects in the Maldives. The EPA manages the review of the EIA report and is responsible for any approvals or recommendations associated

with the EIA. It is also responsible for verifying that environmental protection measures are properly implemented by undertaking environmental audits in collaboration with other governments as well as non-government agencies with a role for environmental protection and preservation.

2.6.3 Addu City Council and Laamu Atoll Council

Under the Decentralization Act, the Maldives is grouped into 20 administrative areas under a new local governance system. In line with this, Addu Atoll has an elected City Council located on Hithadhoo Island, while Laamu Atoll has an elected Atoll Council located in Fonadhoo Island. The Council Offices are the main focal point of the Government Ministries and they coordinate and liaises with the Government Ministries and elected island councils on all issues relating to the atoll.

3. Environmental and Social Assessment

3.1 Environmental Profile of the Project Area

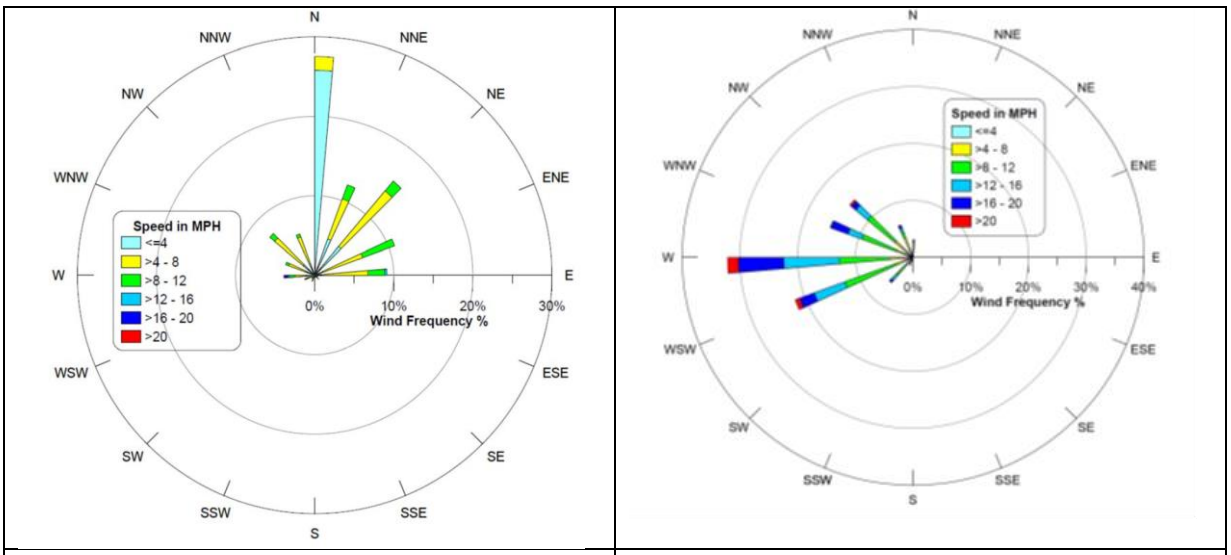
3.1.1 Climate

The Maldives has a warm and humid tropical climate. The weather is dominated by two monsoon periods: the South-West (SW) monsoon from May to September (rainy period) and the North-East (NE) monsoon from December to April (dry period), when winds blow predominantly from either of these two directions.

The relative humidity ranges from 73% to 85%. Daily temperatures in the country vary very little throughout the year with a mean annual temperature of 28°C.

3.1.1.1 Wind Conditions

Water Solutions (2014) explains that wind directions are connected to the monsoons regime. Winds from the NE and ENE are predominant during December to February. During March and April, the direction varies with the general direction being westerly. But strong winds are associated with the SW monsoon season, as shown in the following figure. During the dry season, winds from N and NE are dominant with less than 4 MPH, whilst winds from W and SSW are dominant in the rainy season with 12-20 MPH at Gan Island, Laamu Atoll.



February 2017 (Dry Season) | August 2017 (Rainy Season)

Figure 3.1 Wind Direction at Gan Island, Laamu Atoll

Source: MMS Weather Report (2017)

3.1.1.2 Precipitation

Precipitation varies from the two different monsoon seasons, with high precipitation during the south-west monsoon in May to September. Precipitation increases from the northern area to the southern area, with an average precipitation (during 1992 and 2012) of 1,779 mm in the northern area and 2,218 mm in the southern area[5].

3.1.1.3 Cyclones in the Maldives

The islands of Maldives are less prone to tropical cyclones. The northern islands of the country are affected by weak cyclones that form in the southern part of the Bay of Bengal and the

[5] Second National Communication of Maldives (2016)

Arabian Sea. The number of cyclones directly crossing Maldives is small. Only 11 cyclones, which were formed during the months of October to January, crossed the islands in a span of 128 years from 1877 to 2004 and only one event over the central Maldives. All of these events were of category-1 cyclones. There have been no cyclonic events since 1993. Fonadhoo Island in Laamu Atoll is located in a second least cyclonic hazard zone with a probable maximum cyclone wind speed of 55.9 knots (UNDP, 2006). The Maldives has not been affected by cyclones since 1993.

3.1.1.4 Currents

CDE (2018)[6] explains that in general, currents that affect the sea areas around the reef system of the islands can be the result of one or more of tidal currents, wind-induced currents, and wave-induced currents. It is presumed that the dominating two monsoon season winds have a greater effect on both oceanic currents and lagoon currents around the Maldives. Westward flowing currents are dominated from January to March and eastwardly from May to November. During the transition months, the currents are variable. Ocean currents flowing through channels between the atolls are driven by the monsoon winds. Current speeds from 1 to 1.5 knots are reported in the Admiralty pilot. However, the current in the E/W channels of the Maldives may attain up to 5 knots.

3.1.1.5 Offshore Wave Conditions (in deep water)

The swells and wind waves experienced by the Maldives are conditioned by the prevailing biannual monsoon and are typically strongest during April and July in the SW monsoon period. During this season, swells generated north of the equator with heights of 2 to 3 meters and periods of 18 to 20 seconds have been reported in the region[7].

JICA (2019) conducted the wave and swell height surveys from February 2019 at Hithadhoo Island and from December 2019 at Meedhoo Island, Addu City and at Fonadhoo and Maamendhoo islands from August 2019. The wave and swell height data will be updated after the analyses.

3.1.1.6 Tidal Datum

Tide data is an important information in any costal development project as it determines the elevation of the structures relative to a datum. Water Solutions (2014)[8] explains that a permanent tidal record station has been established at Ibrahim Nasir International Airport by Maldives Meteorological Services. The maximum tidal range recorded at this tide station is 1.20 m. The highest astronomical tide level is +0.64 m (MSL) and the lowest astronomical tide level is -0.56 m (MSL).

3.1.1.7 Tidal Levels

Water Solutions (2014)[9] the tidal regime is semi-diurnal with diurnal inequalities (twice daily). That means two high tides and two low tides per day, both with different heights. Typical spring and neap tidal ranges are approximately 1.0 m and 0.3 m, respectively.

[6] CDE, 2018: Environment Impact Assessment for the Proposed Harbour Redevelopment at Fonadhoo, Laamu Atoll
[7] Water Solutions, 2014: Environmental Impact Assessment - L. Gan – L. Fonnadhoo, Link Road Development Project
[8] Water Solutions, 2014: Environmental Impact Assessment - L. Gan – L. Fonnadhoo, Link Road Development Project
[9] Water Solutions, 2014: Environmental Impact Assessment - L. Gan – L. Fonnadhoo, Link Road Development Project

According to the tide level observation records over the past 33 years on Gan Island of the Maldives, the mean sea level (MSL) of + 0.84 m was observed as the highest tide level and an average tide level of 3.2 mm/year was observed. It is higher than the average sea level rise (1.7 mm/year, 1901-2010) in the world, which is shown in the 5th IPCC (Inter-governmental Panel on Climate Change) Assessment Report.

3.1.2 Ecology

3.1.2.1 Background

The Activities under Component 2 are located in the four islands in Laamu Atoll and one island in Addu Atoll as shown in the following table. Most of them are located at the ocean sides of each island. As the ocean sides of the islands, the widths of the reefs are not so wide compared with the lagoon sides. Most of the sites contain sparse vegetation due to the continuous erosion.

Table 3.1 Project Components at Each Island for Component 2

Atoll/ City	Island	Project Component	Funding Source	Abb.
Laamu	Fonadhoo	Beach nourishment and groins for the ocean side coast	GCF	L-FND
	Maamendhoo	Beach nourishment and groins for the south-western side coast and reclamation for a place for evacuation at the north-western top	GCF	L-MMD
	Ishdhoo	Sea walls to protect historical sites at the ocean side coast at the north top	Co-finance by Maldives	L-ISD
	Gan	Sea walls to protect the historical sites at the ocean side at the middle of the island	Co-finance by Maldives	L-GAN
Addu	Meedhoo	Beach nourishment and groins for the northern coast (ocean side)	Co-finance by Maldives	S-MED

Source: JICA (2019)

The Activities under Component 3 are not located along the coasts, but inland areas, and most of them are to be constructed at the same places of existing facilities as the replacement.

The following sections present a description of the ecological characteristics of the wider areas in relation to the five project sites for Component 2 and in proximity to the areas where construction material might be obtained. The common habitats in proximity to the project sites for Component 2 are presented in the following table.

Table 3.2 Natural Habitats of the Four Project Sites for Component 2

Atoll/ City	Island	Reef	Sandy Beach	Sand Dunes	Salt Marshes
Laamu	Fonadhoo	X	X		
	Maamendhoo	X	X		
	Ishdhoo	X			X
	Gan	X			X
Addu	Meedhoo	X	X		

Source: JICA (2019)

3.1.2.2 Terrestrial flora

The coastal areas of each target island for Component 2 consist primarily of sandy beaches, rock beaches, and salt marshes with a sparse vegetation cover composed mostly of coastal

shrubs. This shrub-vegetation-cover traps wind-drifting sand and acts as a barrier. According to the existing EIA reports for other projects implemented at targeted islands, the periphery of the site includes mainly Ruh and coconuts (*Cocos nucifera*). The projects sites at Ishdhoo and Gan islands have significant vegetation cover compared with other islands.

Most of the sites for Component 3 are cleared for the existing facilities, and some sites are cleared for the existing vegetation to install at the new sites.

3.1.2.3 Avian Fauna

CDE (2018)[10] explains that there are not so many birds recorded, except for the common crow (*Corvus linnaeus*).

3.1.2.4 Terrestrial Mammals

CDE (2018)[11] explains that some other common species such as the Rat (*Rattus* sp.), the common garden lizard (*Calotes versicolor*), Fruit Bats (*Pteropus giganteus ariel*), and other small fauna are found in Fonadhoo Island, Laamu Atoll.

3.1.2.5 Marine Ecology

Line transect surveys were carried out at around the proposed project sites of target islands in Laamu Atoll and Addu City. The general status of the sea bottom conditions was recorded along the lines and special attention was given to different types of corals. In addition, environmental conditions that may affect marine life was also recorded.

The survey results for four islands in Laamu Atoll and one island in Addu City are shown in the following tables. The live corals are observed only in three lines in Maamendhoo island, Laamu Atoll, with 19% coverage areas, and two lines in Meedhoo island, Addu City, with 13% coverage areas, while 10% to 79% areas are covered by coral rock and coral pebbles, 21% to 77% by seaweed (with coral rock/ sand). Massive-type and plate-type corals are inhabiting along three lines in Maamendhoo island.

Table 3.3 Sediment Conditions in the Target Islands in Laamu and Addu Atolls

		Laamu		Laamu		Laamu	
	Sediment condition	Maamendhoo		Fonadhoo		Ishdhoo	
		Survey lines: 9		Survey lines: 9		Survey lines: 3	
		Total Length (m)*	%	Total Length (m)*	%	Total Length (m)*	%
1	Coral	130	19%	0	0%	0	0%
2	Coral rock	162	23%	180	21%	99	79%
3	Sand + Seaweed	240	35%	344	40%	0	0%
4	Coral rock + Seaweed	0	0%	0	0%	26	21%
5	Seaweed	58	8%	0	0%	0	0%
6	Sand	103	15%	326	38%	0	0%
7	Rock	0	0%	0	0%	0	0%
	Total	693	100%	850	100%	125	100%

[10] CDE, 2018: Environment Impact Assessment for the Proposed Harbour Redevelopment at Fonadhoo, Laamu Atoll
[11] CDE, 2018: Environment Impact Assessment for the Proposed Harbour Redevelopment at Fonadhoo, Laamu Atoll

		Laamu		Addu	
	Sediment condition	Gan		Meedhoo	
		Survey lines: 2		Survey lines: 4	
		Total Length (m)*	%	Total Length (m)*	%
1	Coral	0	0%	50	13%
2	Coral rock	155	72%	40	10%
3	Sand + Seaweed	60	28%	165	41%
4	Coral rock + Seaweed	0	0%	145	36%
5	Seaweed	0	0%	0	0%
6	Sand	0	0%	0	0%
7	Rock	0	0%	0	0%
	Total	215	100%	400	100%

Note: * Total length of each conditions in line with the surveyed line transect.
Source: JICA

CDE (2018-1)[12] explains that massive- and plate-type corals, such as Favites and Platygyra species, are inhabiting the Maradhoo Islands, near Hithadhoo Island, and CDE (2018-2)[13] explains that there exist several coral species, such as the *Acroporidae*, *Faviidae*, *Poritidae*, etc., inside the reef at the southwestern part of Fonadhoo Harbor at Laamu Atoll.

Corals of Addu City were tremendously affected by the coral bleaching of 1998 where the coral cover at the lagoon side of Gan Island decreased to only a few percentage. After the coral bleaching of 1998, the coral covers have increased to 20% in 2009[14], even after the coral bleaching of 2016. The coral cover data of Meedhoo Island, Addu City, assume the recovery of coral growth in the area has not been seen.

There are no mangrove vegetation inside and around the project sites in Laamu and Addu atoll.

3.1.2.6 Protected areas

For Component 2, there are no protected areas and Marine Protected Areas (MPA) in Laamu Atoll. In Addu City, there is one protected area in Hithadhoo Island, Addu City, which is located about 13 km west of the proposed project site in Meedhoo Island.

All the target sites for Component 3 are nor in sensitive areas nor in protected areas.

3.1.2.7 Endangered species

According to the existing EIA reports for other projects implemented at targeted islands, there are no description on the existence of endangered species.

3.1.3 Marine and Surface Water Quality

3.1.3.1 Background

The five project locations that lie within the setback distance (up to 20 m) from the coastline, and within 40 m towards the reef for the beach nourishment areas and land reclamation site.

[12] CDE (2018-1): Environment Impact Assessment for the Proposed harbour Redevelopment at Maradhoo Island, Addu City
[13] CDE (2018-2): EIA for the proposed Harbour Redevelopment Project at Laamu Fonadhoo

[15] Great Barrier Reef Marine Park Authority (GBRMPA) (2009). Water quality guidelines for the Great Barrier Reef Marine Park, Great Barrier Reef Marine Park Authority, Townsville.Australia.

For the project locations targeting beach nourishment and land reclamation, the project activities may affect marine water quality at Fonadhoo, Maamendhoo, and Ishdhoo islands in Laamu Atoll and Meedhoo Island in Addu City.

The optimum conditions of water quality parameters for the coral growth stipulated by EPA and the monitoring parameters for water and sediment quality of International Finance Corporation (IFC) are shown in the following tables.

Table 3.4 Optimum Conditions of Water Quality Parameters for the Coral Growth

	Parameter	Optimum Range	Remarks
1	Temperature	18 °C ~ 32 °C	GBRMPA (2009)[15]
2	Salinity	3.2% ~ 4.2%	GBRMPA (2009)
3	pH	8.0 ~ 8.3	Levels below 7.4 pH cause stress for the coral growth
4	Turbidity	3 ~ 5 NTU	>5NTU cause stress for the coral growth Cooper *et al.* (2008)[16]
5	Sedimentation	Max. mean annual rate: 3mg/cm^2/day Daily max rate: 15mg/cm^2/day	
6	Nitrates	< 5mg/l NO_3N	UNESCO/WHO/UNEP (1996)[17]
7	Ammonia	Max. 2-3 mg/l N	UNESCO/WHO/UNEP (1996)
8	Phosphate	0.005-0.020 mg/l PO_4P	UNESCO/WHO/UNEP (1996)
9	Sulphate	2-80 mg/l	UNESCO/WHO/UNEP (1996)
10	BOD	<2 mg/l O_3	UNESCO/WHO/UNEP (1996)
11	COD	<20 mg/l O_2	UNESCO/WHO/UNEP (1996)

Source: EIA Data Collection Guidelines

Table 3.5 Water and Sediment Quality Monitoring Parameters

	Parameter	Units	Guideline Value	Source
1	Temperature		-	
2	Salinity		0.5-10	2 (*2)
3	pH	pH	6-9	1
4	Turbidity	NTU	1-20	2
5	Sedimentation		-	-
6	Total nitrogen	mg/l	10	1
7	Ammonia	µg N/l	1-10	2 (*1)
8	Total phosphorous	mg/l	2	1
9	Sulphate		-	-
10	DO	mg/l	>5	2 (*3)
11	BOD	mg/l	30	1
12	COD	mg/l	125	1
13	Total suspended solids (TSS)	mg/l	50	1

Source:
1: Table 1.3.1 of Environmental, Health, and Safety General Guidelines (2007)
2: Table 1 of Environmental, Health, and Safety Guidelines for Ports, Harbors, and Terminals (2017) and The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Chapter 3 Aquatic Ecosystems) (2000).
- 2(*1) Table 3.3.4 and Table 3.3.5 for the Tropical Australia
- 2(*2): Table 3.3.9 for South central Australia - low rainfall area
- 2(*3): Table 4.4.2

[15] Great Barrier Reef Marine Park Authority (GBRMPA) (2009). Water quality guidelines for the Great Barrier Reef Marine Park, Great Barrier Reef Marine Park Authority, Townsville.Australia.
[16] Cooper, T.F, Ridd, P.V., Ulstrup, K.E., Humphrey, C., Slivkoff, M. and Fabricius, K.E. (2008). Temporal dynamics in coral bioindicators for water quality on coastal coral reefs of the Great Barrier Reef, Marine and Freshwater Research, 59 (8), 703–716.
[17] Water Quality Assessments - A Guide to Use of Biota, Sediments and Water in Environmental Monitoring, 2nd Ed.,

3.1.3.2 Water Quality at the Coasts of Lagoon Sides and Ocean Sides

According to the water quality surveys done by JICA in 2019, the water quality of the marine water at the project locations are as follows:

a. The mean pH ranges between 5.47–5.92 along the coast of lagoon side of Addu City, and 6.16-6.25 along the coast of the lagoon side of Laamu Atoll, which indicate that the water is at a very acidic level to cause stress for the coral growth;

b. The mean salinity ranges from 27-35%, along the coast of the lagoon side of Addu City, and 35 -26% along the coast of the lagoon side of Laamu Atoll, showing close to the standard levels;

c. The mean turbidity is relatively high due to sediment transport from the freshwater outlets; and

d. The mean dissolved oxygen (DO) recorded level is 2.26–6.63 along the coast of the lagoon side of Addu City, and 6.17–6.25 along the coast of the lagoon side of Laamu Atoll, showing most of them within the optimum ranges.

3.1.3.3 Surface Waters at Construction Locations

According to the water quality surveys done by the JICA in 2019, the water quality of the surface water at the project locations are as follows:

a. The mean pH ranges between 5.44–5.83 for the groundwater at Addu City, and 5.28-6.25 for the groundwater at Laamu Atoll, which indicate that the water is at a very acidic level to cause stress for the coral growth; and

b. The mean salinity ranges between 0.01–0.05%, for the groundwater at Addu City, and 0.15-0.23% for the groundwater at Laamu Atoll, showing close to the standard levels.

3.1.4 Air Quality

3.1.4.1 Background

The two project locations, which will be funded by GCF, and one location, which will be planned to be funded by the Maldivian co-finance, for Component 2, include the beach nourishment and land reclamation to which the coral sand will be filled by using the TSDH and such coral sand will be dredged from the lagoon by TSDH For the project locations targeting beach nourishment and land reclamation, the project activities may affect air quality at Fonadhoo, Maamendhoo, and Ishdhoo islands in Laamu Atoll and Meedhoo Island in Addu City.

The Maldives lacks the necessary environmental standards for the measurement of ambient air and noise quality. Therefore, for these quality standards, typically IFC/ WHO standards or international standards or standards of developed countries are referred, as shown in the following tables.

Table 3.6 WHO Ambient Air Quality Guidelines

	Parameter	Averaging Period	Guideline value in mg/m^3	Remarks
1	Sulfur dioxide (SO_2)	24-hour mean 10-minute mean	20 $\mu g/m^3$ 500 $\mu g/m^3$	
2	Nitrogen dioxide (NO_2)	1-year mean 1-hour mean	40 $\mu g/m^3$ 200 $\mu g/m^3$	
3	Particulate Matter (PM10)	1-year mean 24-hour mean	20 $\mu g/m^3$ 50 $\mu g/m^3$	
4	Particular Matter (PM2.5)	1-year mean 24-hour mean	10 $\mu g/m^3$ 25 $\mu g/m^3$	
5	Ozone	8-hour mean	100 $\mu g/m^3$	

Source: World Health Organization (WHO) (2005) Air Quality Guidelines Global Update
IFC (2007) Environmental, Health, and Safety General Guidelines

3.1.4.2 Air quality impacts

All construction activities have the potential to cause air quality impacts. The expected adverse air quality levels at the two target atolls are:

a. Fonadhoo Island, Laamu Atoll: expected to have the lowest adverse air quality level since the project location is a bit far from the main link road.

b. Maamendhoo Island, Laamu Atoll: adverse air quality sources impacting the ambient levels at this area include the Maamendhoo Harbour and the coastal road.

c. Gan Island, Laamu Atoll: expected to have the lowest adverse air quality level since the project location is a bit far from the main link road.

d. Ishdhoo Island, Laamu Atoll: expected to have the lowest adverse air quality level since the project location is a bit far from the main roads.

e. Meedhoo Island, Addu City: adverse air quality sources impacting the ambient levels at this area include the Meedhoo Harbour and the coastal road.

Workers involved in construction and operation activities should be familiar with the methods for minimizing the impacts of deleterious air quality and alternative construction procedures.

3.1.5 Noise and Vibration

3.1.5.1 Background

There is no available data for continuous noise and vibration monitoring in the target islands in Laamu Atoll and Addu City. Existing sources of ambient noise may include: roads, harbors, power stations, general urban noise. The expected ambient noise levels at the two target atolls for Component 2 are:

a. Fonadhoo island, Laamu Atoll: Noise sources impacting the ambient levels at this area include the Trailer Sanction Hopper Dredger for beach nourishment.

b. Maamendhoo island, Laamu Atoll: Noise sources impacting the ambient levels at this area include the Maamendhoo harbour and the Trailer Sanction Hopper Dredger for beach nourishment.

c. Gan Island, Laamu Atoll: expected to have the lowest ambient noise level since the only noise source close to the project location is a bit far from the main link road.

d. Ishdhoo Island, Laamu Atoll: expected to have the lowest ambient noise level since the only noise source close to the project location is a bit far from the main roads.

e. Meedhoo Island, Addu City: Noise sources impacting the ambient levels at this area include the Meedhoo Harbour and the Trailer Sanction Hopper Dredger for beach nourishment. CDE (2016)[18] explains that noises were measured at the levels of 60-80 dB (A) along the coast and near Meedhoo Harbour.

The use of heavy machinery or introduction of noise/vibration generating facilities could have adverse effects on the environment and residents if not appropriately managed.

Contractors involved in construction activities should be familiar with the methods of controlling noisy machines and alternative construction procedures as contained within specific Maldivian legislation. Potential noise sources during construction may include:

a. Heavy construction machinery/vehicles including the backhoe;

b. Power tools, generators, and pumps; and

c. Dredges and trucks when collecting and unloading construction materials.

The Maldives lacks the necessary environmental standards for the measurement of noise quality. Therefore, for these quality standards, typically IFC/ WHO standards or international standards or standards of developed countries are referred, as shown in the following tables. Noise impacts should not exceed the levels presented in the following table or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 3.7 Noise Level Guidelines

	Receptor	One Hour L_{Aeq} (dBA)		Remarks
		Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00	
1	Residential; institutional; educational	55	45	
2	Industrial; commercial	70	70	

Source: IFC (2017) Environmental, Health, and Safety Guidelines for Ports, Harbors, and Terminals

3.1.6 Bathymetry

3.1.6.1 Background

The topographic surveys and water depth surveys were conducted by JICA in 2019 in order to know typical vertical topography from the land area to the sea area for some lines at Fonadhoo, Gan and Maamendhoo islands in Laamu Atoll.

In case of Gan Island, Laamu Atoll, the ridge on the ocean side is higher than the ridge on the lagoon side, but this is due to the fact that the wave on the ocean side and the wave run up height are larger than those on the lagoon side. From the coastal area to the reef area of the sea, it is a typical terrain found on the coral reef coast that leads from the back beach to a flat reef flat, reef edge, steep reef slope with several hundred mails.

The detail analysis of the topographic profiles for Fonadhoo and Maamendhoo islands are shown in the Annex 2 of the Funding Proposal.

However, in order for the detail design of the beach nourishment, the detail bathymetry surveys will be conducted during the Detail Design.

[18] CDE (2016): First Addendum to the Environmental Impact Assessment of Oceanside Channel Dredging Project in Meedhoo Island, Addu City

For the sand borrow areas for dredging the sands for the beach nourishment, the detail surveys for the candidate borrow sites will also be conducted during the Detail Design survey.

3.1.7 Erosion and Sediment Control

3.1.7.1 Erosion

The Maldives is inherently vulnerable to coastal disasters such as high waves, flooding, and tsunami. In recent years, the coastal erosion problem has become serious, mainly in inhabited islands. As of 2014, 116 islands out of the 188 inhabited islands have coastal erosion and 38% of which were in serious coastal erosion situations[19]. Along the coast in the Maldives surrounded by coral reefs, the wave reaching the coast increases in proportion to the water depth along with sea level rising due to climate change. Further acceleration of coastal erosion resulted from two factors: sea level rising due to climate change and increase of wave.

3.1.7.2 Flooding and Saltwater Intrusion

The sea level rise and the accompanying acceleration of coastal erosion contribute to the damage caused by high waves and the inundation in hinter land. They also impede the safety and security of the island residents and damage critical infrastructure. The Maldives with low land has frequently suffered high waves and inundation damage. The frequency of high waves and inundation will increase significantly due to sea level rise because of climate change.

3.1.7.3 Sediment

The distribution of sediment composition depends on the equilibrium between gravity of sediments and water forces. Among the proposed activities under Component 2, coral sand will be deposited along the coasts off to about 20 m for beach nourishment at Fonadhoo and Maamendhoo islands, Laamu Atoll as GCF-funded project and Meedhoo Island, Addu City, as the Maldives co-financing project. Due to the deposition of the coral sand, sediment situations will change from the current situations. JICA (2019) conducted soil texture analyses for the sediments of offshore areas nearby the target sites. The sediment texture analyses data will be updated after the analyses.

Around half volumes of the dredged coral sands will be utilized to fill the beaches for beach nourishment and land reclamation, as mentioned in the Section 1.2.4, and around half of them will be stocked at stock piles for supplemental beach filling during operation stage. After excavation to install groins and revetment walls, those excavated soils and rocks will be utilized to fill into the backfilling, so that there would be less soils unused.

3.1.8 Waste Management

3.1.8.1 Background

Based on the strategy and plan in the Maldives, the Waste Management Centers have been constructed in most of the target islands in Maldives, including Laamu Atoll and Addu City for Component 2.

[19] Ministry of Environment and Energy, 2017: State of Environment 2016

3.1.8.2 Industrial waste during the construction stage

For Component 2, as there are no construction works to use cement, except for drainage works for reclamation works, much amount of the industrial wastes from formworks and concrete works will not occur. For revetment works at existing sea walls areas, after demolishing the existing old sea walls, those materials will be used as the core materials to install the new revetment works, so that there would be quite less waste from the construction.

3.1.9 Presence of Endemic Vector-borne disease

The most common and endemic vector-borne diseases in the Maldives are Zika fever, dengue fever and chikugunya fever, which are transmittable from mosquitos. Risk of Chikungunya transmission is present throughout the Maldives, especially in North Central, South Central, and Upper South Provinces. Risk of Dengue transmission is present throughout the Maldives, with peak transmission occurring during the rainy season, from April to September. The Maldives have a history of previous Zika Virus transmission. There is currently no evidence of an ongoing Zika Virus outbreak. However, there is limited information available and there may be delays in detecting and reporting new cases. [20]

3.2 Social Profile of the Project Area

3.2.1 Demography

3.2.1.1 Demography

Residential population of Laamu Atoll in 2014 was 12,676 (male: 6,648 and female: 6,028), of which 11,795 Maldivians (male: 5,859 and female: 5,936) and 881 foreigners (male: 789 and female: 92). Annual population growth rate is 0.10. Population data of each island in Laamu Atoll are shown in the following table. Gan Island has the highest population but the population density is quite low.

Table 3.8 Residential Population of Administrative Islands in Laamu Atoll

Island/Locality	Resident (person)	Area (ha)	Density (person/ha)	Annual Population Growth Rate
Dhabidhoo	647	53.2	12.2	1.73
Fonadhoo	2,266	162.6	13.9	2.07
Gaadhoo	178	69.1	2.6	-3.33
Gan	3,080	663.0	4.6	1.36
Hithadhoo	1,007	112.6	8.9	1.99
Isdhoo	958	145.5	6.6	-6.35
Kunahandhoo	650	91.7	7.1	0.50
Maabaidhoo	649	59.2	11.0	-1.49
Maamendhoo	896	18.7	47.9	-0.27
Maavah	1,530	38.4	39.9	0.23
Mundoo	236	23.6	10.0	-6.07
Kalaidhoo	579	27.1	21.3	-
Total	12,676	1,464.8	8.7	0.10

Source: Population & Housing Census 2014

Residential population of Addu City in 2014 was 19,829 (male: 9,441 and female:10,388), of which19,319 Maldivians (male: 9,195 and female: 10,124) and 1,956 foreigners (male: 1,780 and female: 176). Annual population growth rate is 1.23. Population data of each island in Addu

[20] International Association for Medical Assistance to Travellers: https://www.iamat.org/country/maldives

City are shown in the following table. Hithadhoo Island has the highest population but the Feydhoo island has high density.

Table 3.9 Residential Population Data of Administrative Islands in Addu City

Island/Locality	Resident (person)	Area (ha)	Density (person/ha)	Annual Population Growth Rate
Meedho	1,871	184.3	17.3	2.33
Feydhoo	3,431	63.9	53.7	1.87
Hithadhoo	11,129	548.0	20.3	1.11
Maradhoo	2,374	57.9	41.0	0.84
Maradhoofeydhoo	1,228	33.6	36.6	1.44
Hulhudhoo	1,242	122.2	10.2	-0.41
Total	21,275	1,009.9	21.1	**1.23**

Source: Population & Housing Census 2014

Residential population of the target islands for Component 3 is shown in the following table.

Table 3.10 Residential Population Data of Target Islands for Component 3

	Island/Locality	Resident (person)	Area (ha)	Density (person/ha)	Annual Population Growth Rate
1	Ha. Dhidhdhoo	2,854	57.1	50.0	0.63
2	HDh. Kulhudhufushi	8,440	234.9	35.9	1.90
3	Sh. Funadhoo	2,104	88.9	23.7	2.74
4	N. Manadhoo	1,397	106.5	13.1	1.03
5	R. Ungoofaaho	1,501	33.1	45.4	-9.02
6	B. Eydhafushi	2,658	31.0	85.6	0.69
7	Lh. Naifaru	4,103	54.3	75.5	0.56
8	K. Vilingili (Male)	7,988	31.7	252.0	0.91
9	K. Maafushi	3,025	36.5	82.9	3.23
10	V. Felidhoo	506	14.2	35.6	-0.25
11	ADh. Dhangethi	824	24.2	34.1	1.57
12	F. Feeali	839	15.3	54.8	1.05
13	Ga. Nilandhoo	600	59.8	10.0	-0.75
14	L. Gan	3,080	663.0	4.6	1.36
15	Th. Guraidhoo	1,280	37.4	34.1	0.75
16	Ga. Viligili	2,837	102.9	27.6	3.02
17	GDh. Gadhdhoo	1,502	60.0	25.0	-0.37
18	GDh. Fiyoari	737	79.1	9.3	0.28
19	GDh. Thinadhoo	5,230	118.9	44.0	0.59
20	Gn. Foammulah	8,510	493.0	17.3	0.69
21	S. Hithadhoo	11,129	548.0	20.3	1.11

Source: Population & Housing Census 2014

3.2.2 Land Use

3.2.2.1 Land use

The main land uses of each island are residential area, commercial area, agricultural area, and natural forests. There is one large-size fish processing plant in Meedhoo Island and there are a few fish dry factories in other islands.

For the high density islands, such as Fonadhoo and Maamendhoo islands, there are some areas of which the setback is less than 20 m. On the other hand, in the other islands, the setback

from the coast lines is wider than 20 m. Most of setback areas are designated as the protection areas.

Large scale industry in Laamu Atoll is a fishery processing factory in Maandhoo. Small scale bonito flakes factories can be seen at coastal area of the other inhabited islands, but the impact of the bonito flakes factories to living environment at residential areas is not significant.

Along the coast areas, there is one sea cucumber cultivation pond, operated by the local people, in Fonadhoo island, Laamu Atoll, and coastal beaches and reef areas are used as the recreation areas by the local people in most of the islands.

3.2.2.2 Settlement within the proposed project sites

Setback from the coastal line is less than 20 m at the ocean side of Fonadhoo and the western part of Maamendhoo. These islands have fairly higher population density and residential areas have expanded from land side to sea side. The other islands such as Gan and Isdhoo secure set back more than 20 m.

There are no settlement within the proposed project sites in Fonadhoo and Maamendhoo islands of Laamu Atoll and Meedhoo island of Addu City for beach nourishment, and Gan and Ishdhoo islands for seawall (revetment).

3.2.2.3 Ownership status of the lands where the seawalls will be constructed and at the quarry sites.

The ownership status of the lands where the seawalls will be constructed at Gan and Ishdhoo islands of Laamu Atoll are national land, and there are no quarry sites for .seawall construction, as all the materials for seawall will be imported from India or other countries.

3.2.3 Archaeological and Cultural Heritage

3.2.3.1 Background

For Component 2, there are archaeological and cultural heritages in Gan and Ishdhoo islands in Laamu Atoll and the proposed activities, which will be funded by the Maldivian governments, are to protect those cultural heritages. All of them are the artificial mounds by the coral stones to bury the ancient Buddhist statues and temples. As these artificial mounds are located around 10-15m inland from the coastal lines, to which the interventions will be done, there are no adverse impacts to these areas from the interventions.

For Component 3, such cultural heritages have not been reported in the EIA reports for the selected target islands[21][22]

3.2.4 Livelihood activities

3.2.4.1 Background

Based on the secondary data, the following livelihood activities are confirmed for the three islands in Laamu and Addu Atolls, to which the beach nourishment is to be planned under the Component 2.

[21] Energy Consultancy Pvt. Ltd. (2018a): EIA for the Proposed Digital Terrestrial Television Broadcasting Network Development Project (for 9 sites)
[22] Energy Consultancy Pvt. Ltd. (2018b): EIA for the Proposed Digital Terrestrial Television Broadcasting Network Development Project (for 3 sites)

CDE (2018)[23] reported that there are 50 shops, 9 cafés and 7 workshops in the island. The main use of land resources is for agriculture (40 farmers) and the main use of marine resources is for fisheries with Fonadhoo island of Laamu Atoll, accommodating 30 fishermen and 5 fish processing units. The total working population of Fonadhoo is 946 according to census 2014. The main employment sector of Fonadhoo is the Civil Service (198 locals working) and transportation sector (158 locals working).

CDE (2017)[24] reported that the total number of employed population in Maamendhoo of Laamu Atoll in 2014 was 381. Amongst them 86 are employed in fishing, 75 in manufacturing, 43 in trade, 42 in education, and 40 in accommodation and food services.

CDE (2019)[25] reported that the 4 main employment sectors in Meedhoo island of Addu City according to census 2014 are tourism & food services (16%) manufacturing (16%), construction (14%) and education (10%). Other main economic sectors include wholesale and retail trade, public administration and construction.

Along the coast areas, there is one sea cucumber cultivation pond, operated by the local people, in Fonadhoo island, Laamu Atoll. There are several small fish factories along the coasts in Fonadhoo island, Laamu Atoll and there is one large fish can company at Maandhoo island, Laamu Atoll.

The further information on livelihood activities will be collected during the Detailed Design survey in the future.

3.2.5 Labor issues, occupational health and safety

3.2.5.1 Background

The ministry responsible for labour administrations does not collect or publish national labour statistics and it mainly keeps the statistics and records of foreign workers since Maldives is such a country where a huge number of foreigners work in different fields like construction, agriculture and fishing. Up to 2019, “A guide to health and safety at construction site” published by MACI (Maldives association of construction industry) was the sole guideline to assist all employers, workers and clients in the construction industry in the Maldives, since there were not any specific act towards Occupational Health and Safety (OHS) in Maldives.

In 2019, the specific regulation related to OHS was enacted; namely Health and Safety Regulation for Construction Industry (2019/R-156). The aim and objective of this regulation is to provide minimum standard for safety and security of the community and labour force[26].

3.2.6 Indigenous peoples and vulnerable groups in the project site

3.2.6.1 Background

There are no indigenous peoples living in and around the proposed project sites.

There are some vulnerable groups, such as people with disability, elders and children living in the islands, however, there are no people living inside the vicinity of the proposed project sites.

[23] CDE (2018): Environment IMPACT Assessment for the Proposed Harbour Redevelopment at Fonadhoo, Laamu Atoll
[24] CDE (2017): Maamendhoo Island Waste Management Center Environmental Management Plan
[25] CDE (2019): Environment Impact Assessment for the Proposed Harbour Redevelopment at Meedhoo, Addu City
[26] Ministry of Environment (2020): Labour Management Procedures (for the Accelerating Renewable Energy Integration and Sustainable Energy (ARISE) Project)

As identified and discussed in Table 3.24, 3.28, and 3.32, there may be a restriction however on the use of the area for their livelihood activities during construction and due to the coastal and reef conservation plan.

3.3 Environmental Risks and Impacts and Mitigation Options

Environmental risks and potential impacts relating to GCF's Environmental and social safeguards (ESS) standards: i.e. ESS1, ESS3, ESS4, and ESS6 are assessed and discussed below.

3.3.1 Environmental Risks and Impacts and Mitigation Options for Component 1

3.3.1.1 ESS1: Environmental and Social Risks and Impact

Table 3.11 Assessment of risks and potential impacts related to ESS1 for Component 1

	Item	Risks and Potential impact	Mitigation options
1	Climate	No adverse effects to the climate at the target sites would be occurred, as there are no activities which affect to the climate.	
2	Climate Change	No adverse effects to the climate change at the target sites would be occurred, as there are no activities which affect to the climate.	
3	Management of ES risks in the pilot/case study implementation of ICZM Plans.	ICZM Plan is unable to address key drivers of coastal resource degradation Loss of access to livelihood and restriction of traditional economic activities	The formulation of ICZM shall be based on a detailed and comprehensive study of coastal ecosystem and economic activities and the main drivers of resource degradation (e.g. overfishing, over abstraction of freshwater, coral harvesting, sand mining, natural cycles, etc. in addition to climate change). The ICZM Plan should include management measures for potential adverse risks and impacts of the implementation of the ICZM Plan to the coastal communities such as restriction of access, loss of livelihood, etc.). Management measures may be in the form of alternative livelihood development (See also Table 3.24)

Source: JICA (2020)

3.3.1.2 ESS3: Resource Efficiency and Pollution Preventions.

Table 3.12 Assessment of risks and potential impacts related to ESS3 for Component 1

	Item	Risks and Potential impact	Mitigation options
1	Air Quality	No adverse effects to the air quality at the target sites would be occurred, as there are no sources by the activities.	
2	Water Pollution	For the implementation of sediment budget control plan, the water quality may be affected in some extent, due to the improper implementation.	Proper implementation of sediment budget control plan and adequate management of the sediment may be necessary.
3	Soil Pollution	No adverse effects to the soil pollution at the target sites would be occurred, as there are no sources by the activities.	
4	Waste Management	No adverse effects to the waste management at the target sites would be occurred, as there are no sources by the activities.	
5	Noise and Vibration	No adverse effects to the noise and vibration at the target sites would be occurred, as there are no sources by the activities.	
6	Subsidence	No adverse effects to the subsidence at the target sites would be occurred, as there are no sources by the activities.	
7	Odor	No adverse effects to the odor at the target sites would be occurred, as there are no odor sources by the activities	

	Item	Risks and Potential impact	Mitigation options
8	Sediment	For the implementation of sediment budget control plan, the sediment may occur in some extent, due to the improper implementation.	Proper implementation of sediment budget control plan and adequate management of the sediment may be necessary.
9	Groundwater	No adverse effects to the groundwater at the target sites would be occurred, as there are no extraction of a large volume of groundwater by the activities.	
10	Hydrology	No adverse effects to the hydrology at the target sites would be occurred, as there are no activities which affect to the hydrology.	
11	Coastal Areas	For the establishment of coastal and reef conservation plan and implementation of sediment budget control plan, the marine system in the coastal areas may be affected in some extent, due to the improper implementation.	Proper establishment coastal and reef conservation plan, implementation of sediment budget control plan and adequate management of the sediment may be necessary.
12	Soil Erosion	For the implementation of sediment budget control plan, the soil erosion may occur in some extent, due to the improper implementation.	Proper implementation of sediment budget control plan and adequate management of the sediment may be necessary.

Source: JICA (2020)

3.3.1.3 ESS4: Community Health, Safety and Security.

Table 3.13 Assessment of risks and potential impacts related to ESS4 for Component 1

	Item	Risks and Potential impact	Mitigation options
1	Gender discrimination and GBV	Discrimination based on gender, marital status, age, or any other physical or mental attribute.	Staff will be made aware of the avenues available at the Ministry for victims of sexual harassment. Staff will be able to lodge complaints to the Sexual Harassment Prevention Committee at the Ministry, established under Prevention of Sexual Harassment Act (16/2014).
		Sexual harassment. Many such cases have come to light in the Maldives and across the world recently.	
		Physical and verbal harassment and workplace bullying.	
		Discrimination in relation to opportunity/access for training and self-development.	Equal training opportunity will be available to all staff working in the project without discrimination, based on gender or otherwise, as specified in the Employment Act. It is responsibility of the Project Manager and the Project Director to ensure that such discrimination does not exist.
		Lack of availability of incentives available to staff at other organizations employed at similar capacity can lead to demotivation and ultimately poor staff retention.	All staff will be made aware of grievance redress mechanism. Provide health insurance packages to all project staff, equivalent to that given by other government companies and institutions working in similar capacities.

Source: JICA (2020)

3.3.1.4 ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

Table 3.14 Assessment of risks and potential impacts related to ESS6 for Component 1

	Item	Risks and Potential impact	Mitigation options
1	Protected Areas	There are no protected areas and Marine Protected Areas (MPA) around the proposed project sites.	

	Item	Risks and Potential impact	Mitigation options
2	Ecosystem and Fauna/Flora	No adverse effects to the ecosystem and fauna/ flora at the target sites would be occurred, as there are no activities which affect to ecosystem and fauna/ flora.	
3	Geology and Geomorphology	No adverse effects to the accidents at the target sites would be occurred, as there are no activities which affect to geology and geomorphology.	

Source: JICA (2020)

3.3.2 Environmental Risks and Impacts and Mitigation Options for Component 2

3.3.2.1 ESS1: Environmental and Social Risks and Impact

Table 3.15 Assessment of risks and potential impacts related to ESS1 for Component 2

	Item	Risks and Potential impact	Mitigation options
1	Climate	No adverse effects to the groundwater at the target sites would be occurred, as all the projects are in small scale.	
2	Climate Change	No adverse effects to the groundwater at the target sites would be occurred, as all the projects are in small scale.	
3	Site-specific assessment and management	All site development activities will be subject to ES Screening and the government's environmental clearance and permitting process. This would involve a more detailed ES assessment and formulation of site-specific management plans. The scope of the assessment and plans will cover all issues relating to the GCF ESSs (ESS2-8).	

Source: JICA (2020)

3.3.2.2 ESS3: Resource Efficiency and Pollution Preventions.

Table 3.16 Assessment of risks and potential impacts related to ESS3 for Component 2

	Item	Risks and Potential impact	Mitigation options
1	Air Quality	During the construction stage, the adverse effects would be occurred to the air quality by using the large machineries, i.e. dredging machine.	Large machineries to be used shall be maintained properly, in order not to emit the unnecessary exhaust gas.
2	Water Pollution	During the construction stage, the adverse effects would be occurred to the water quality by using the large machineries, i.e. dredging machine, backhoes, etc.	Large machineries to be used shall be maintained properly, in order to prevent the water pollution.
		During the construction stage, the adverse effects would be occurred to the water quality by inadequate water drainage and soil spill into the sea.	During the construction stage, the adequate drainage water treatment shall be done, i.e. installing silt protectors and sand bunds.
		For the beach nourishment and land reclamation, the adverse effects would be occurred to the water quality by inadequate soil spill into the sea, during the operation stage.	During the operation stage, the community-based maintenance and monitoring will be done through the project.
3	Soil Pollution	During the construction stage, the adverse effects would be occurred to the soil quality, by oil leaking from the large machineries.	During the construction stage, such measures as preparation of the construction accident prevention manual, installation of oil treatment mat, shall be conducted.
4	Waste Management	During the construction stage, there will be possibility to appear garbage and harmful waste.	During the construction stage, all the waste materials produced from the construction shall be disposed at Island Waste Management Centers. The

	Item	Risks and Potential impact	Mitigation options
			harmful wastes shall be disposed to Thilafushi island. These materials shall not be disposed to any costal area or any eroded area without prior consent of Environmental Protections Agency (EPA).
5	Noise and Vibration	During the construction stage, the noise and vibration would be occurred by using the large machineries, i.e. dredging machine, backhoes, etc.	During the construction stage, the noise-cut large machineries and generators shall be used. During the construction stage, the large machineries shall not be used during the night time nearby the residential areas.
6	Subsidence	No adverse effects to the subsidence at the target sites would be occurred, as there are no extraction of a large volume of groundwater by the project.	
7	Odor	No adverse effects to the odor at the target sites would be occurred, as there are no odor sources by the projects.	
8	Sediment	For the beach nourishment and land reclamation, the adverse impact may occur for the subsistence (sea bed) during the construction and operation.	For the beach nourishment and land reclamation, the existing situations/ conditions of the sediment shall be confirmed before construction. During the construction stage, such measures to prevent from the adverse effects, shall be considered, i.e. installing silt protectors and sand bunds.
			During the operation stage, the community-based maintenance and monitoring will be done through the project.
9	Land and General Landscape	Land degradation, landscape/beach deformation, landslip and erosion	Proper siting of quarry/borrow sites and compliance with regulation. Alternative sites should be considered and assessed in terms of least ES impacts. The detailed ESIA should develop siting criteria for borrow sites.
10	Soil Erosion	For the construction of beach nourishment, there will be possibilities that sand discharge would be occurred, and sands stocked at stockpiles for the supplementary beach filling would be eroded by the rains and normal waves.	Detailed simulation and calculation should be taken in order to reduce sand discharge by installing the groins for the beach nourishment at the planning stage. For the beach nourishment, regular monitoring should be conducted to check the situations of the nourished beaches, and if sand discharge would be occurred, supplementary sand filling should be conducted, if necessary. in order for the sands stocked at stockpiles for the supplementary beach filling not to flow into the sea due to the rain and waves, such sand stockpile should be installed inland from the coastal area, and surrounded by the fences, if necessary.
11	Groundwater	No adverse effects to the groundwater at the target sites would be occurred, as there are no extraction of a large volume of groundwater by the projects.	

	Item	Risks and Potential impact	Mitigation options
12	Hydrology	For the construction of beach nourishment, there will be possibilities that the nearshore currents and waves would be changed after the construction.	Detailed simulation and calculation should be taken in order to reduce changes of nearshore currents and waves by installing the groins for the beach nourishment at the planning stage.
13	Coastal Areas	During the construction and/or operation stages, there will be possibilities for the marine ecosystem and coastal areas to be suffered from the adverse effects.	Adequate measures e.g. installing silt protectors and sand bunds, to reduce the turbidity, to be taken for the marine ecosystems, especially for the corals inhabiting areas, and migrant birds utilizing.
14	Geology and Geomorphology	For the construction of beach nourishment, sand discharge would be occurred by the normal waves. .	**Planning stage:** Detailed simulation and calculation should be taken in order to reduce sand discharge by installing the groins for the beach nourishment at the planning stage. For the beach nourishment, regular monitoring should be conducted to check the situations of the nourished beaches, and if sand discharge would be occurred, supplementary sand filling should be conducted, if necessary..

Source: JICA (2020)

3.3.2.3 ESS4: Community Health, Safety and Security.

Table 3.17 Assessment of risks and potential impacts related to ESS4 for Component 2

	Item	Risks and Potential impact	Mitigation options
1	Construction safety hazard	Exposure of residents to construction health and safety hazards, including equipment traffic hazards.	Provisions of adequate warning signages in dangerous areas at the construction sites Information and awareness campaigns among residents of the hazards Fencing of deep excavations
2	Health Hazard	Potential increase incidence or outbreak of diseases due to presence of migrant workers Exposure of residents to dusts and noise	Medical screening of workers Information and awareness campaigns about disease hazards such as HIV/AIDs Dust suppression and avoidance of work during nighttime
3	Security	Potential increase in criminality and vices, including GBV Possible conflict between contractor workers with local communities	Project to require contractors to adopt a Code of Conduct for workers

Source: JICA (2020)

3.3.2.4 ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

Table 3.18 Assessment of risks and potential impacts related to ESS6 for Component 2

	Item	Risks and Potential impact	Mitigation options
1	Protected Areas	There are no protected areas and Marine Protected Areas (MPA) around the proposed project sites.	
2	Ecosystem and Fauna/Flora	During the construction and/or operation stages, there will be possibilities for the marine	Adequate measures; e.g. installing silt protectors and sand bunds, to reduce the turbidity, to be taken for the marine ecosystems, especially for the corals

	Item	Risks and Potential impact	Mitigation options
		ecosystem to be suffered from the adverse effects.	inhabiting areas, and migrant birds utilizing. During the construction stage, adequate measures to be taken for the coastal vegetation; i.e. any tree that could be replanted, shall be replanted in a different location, try to avoid cutting down of or uprooting of unnecessary vegetation. During construction stage, the sand borrow sites shall be carefully selected in order to avoid damages/ disturbances to the marine ecosystem.

Source: JICA (2020)

3.3.3 Environmental Risks and Impacts and Mitigation Options for Component 3

3.3.3.1 ESS1: Environmental and Social Risks and Impact

Table 3.19 Assessment of risks and potential impacts related to ESS1 for Component 3

	Item	Risks and Potential impact	Mitigation options
1	Climate	No adverse effects to the groundwater at the target sites would be occurred, as all the projects are in small scale.	
2	Climate Change	No adverse effects to the groundwater at the target sites would be occurred, as all the projects are in small scale.	
3	Assessment	Inadequate assessment and management of impacts and risk	Conduct of site-specific ESIAs or other forms of assessment Updating of existing ESIAs based on latest engineering design and filling in gaps vis-a-vis issues relating to GCFs ESS2-8.

Source: JICA (2020)

3.3.3.2 ESS3: Resource Efficiency and Pollution Preventions

Table 3.20 Assessment of risks and potential impacts related to ESS3 for Component 3

	Item	Risks and Potential impact	Mitigation options
1	Air Quality	During the construction stage, using heavy machinery for the construction work will raise extensive amount of emission from the vents of heavy machineries. It	Large machineries to be used shall be maintained properly, in order not to emit the unnecessary exhaust gas.
2	Water Pollution	During the construction stage, the adverse effects would be occurred to the water quality by using the large machineries, i.e. backhoes, etc.	Large machineries to be used shall be maintained properly, in order to prevent the water pollution.
3	Soil Pollution	During the construction stage, heavy machinery uses heavy and dense fuel which may become a pollutant and may cause a disaster.	The hazardous material such as heavy oil and any flammable material shall be stored safely in barrels or appropriate containers with appropriate label and sign place outside of it.
4	Waste Management	During the construction stage, most of the green waste would be produce.	Any solid waste and the green waste from removal of grass shall be properly disposed at island waste management center. Any used oil or leftover paints and other chemical shall be leak proof packed and stored till it is transported to

	Item	Risks and Potential impact	Mitigation options
			Thilafushi or any other such designated area.
5	Noise and Vibration	During the construction stage, noise and vibration could be prone to be occurred.	In order to reduce the noise pollution, the work on site may not commence during the night. All the heavy vehicles and equipment's shall be well serviced and maintained to reduce the unnecessary emission and incomplete combustion of the fuel.
6	Subsidence	During the construction stage, the dewatering would accelerate the horizontal flow of the groundwater. This will have an impact on the groundwater depletion and subsidence of the ground.	In case surface soil subsiding occurs, the depth of the steal pile needed to be adjusted before commencing the dewatering.
7	Odor	No adverse effects to the odor at the target sites would be occurred, as there are no odor sources by the projects.	
8	Sediment	No adverse effects to the sediment at the target sites would be occurred, as there are no sediment sources by the projects.	
9	Soil Erosion	During the construction stage, with extensive dewatering, it may collapse the adjoining ground. If the dewatering is taking place near any existing facilities, this collapsing of ground may lead to physical damage to the existing facility.	It is impossible to completely cutoff the horizontal flow, therefore great care need to be taken on monitoring the surrounding soil. If subsiding occurs in the vicinity, the dewatering needed to be stop immediately.
10	Groundwater	In the construction stage, the reversible short-term impact of dewatering would be a significant impact. The dewatering would accelerate the horizontal flow of the groundwater. This will have an impact on the groundwater depletion.	In order to address the adverse impacts arise by extensively draining water from groundwater lens by dewatering, steal piling would be used to enclose excavation area.
11	Hydrology	No adverse effects to the hydrology at the target sites would be occurred, as all the projects are in small scale.	
12	Coastal Areas	No adverse effects to the coastal areas at the target sites would be occurred, as all the projects are not located along the coast.	

Source: JICA (2020)

3.3.3.3 ESS4: Community Health, Safety and Security.

Table 3.21 Assessment of risks and potential impacts related to ESS4 for Component 3

	Item	Risks and Potential impact	Mitigation options
1	Construction safety hazard	Exposure of residents to construction health and safety hazards, including equipment traffic hazards.	Provisions of adequate warning signages in dangerous areas at the construction sites Information and awareness campaigns among residents of the hazards Fencing of deep excavations
2	Health Hazard	Potential increase incidence or outbreak of diseases due to presence of migrant workers Exposure of residents to dusts and noise	Medical screening of workers Information and awareness campaigns about disease hazards such as HIV/AIDs Dust suppression and avoidance of work during nighttime

	Item	Risks and Potential impact	Mitigation options
3	Security	Potential increase in criminality and vices, including GBV Possible conflict between contractor workers with local communities	Project to require contractors to adopt a Code of Conduct for workers

Source: JICA (2020)

3.3.3.4 ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

Table 3.22 Assessment of risks and potential impacts related to ESS6 for Component 3

	Item	Risks and Potential impact	Mitigation options
1	Protected Areas	There are no protected areas and Marine Protected Areas (MPA) around the proposed project sites.	
2	Ecosystem and Fauna/Flora	During the construction stage, most of the vegetation would be cleared and an immediate and most adverse environmental impact on the vegetation will arise.	Adequate measures to be taken for the ecosystem and fauna/ flora; i.e. any tree that could be replanted, shall be replanted in a different location, try to avoid cutting down of or uprooting of unnecessary vegetation.
		During the operation stage, birds may be suffered from the antennas and indicator lights on the posts/ antennas.	The indicator light on all the tower shall be red light and the light shall be lit continuously throughout the night. This will reduce the confusion arise in the bird community.
3	Geology and Geomorphology	No adverse effects to the geology and geomorphology at the target sites would be occurred, as all the projects are in small scale.	

Source: JICA (2020)

3.3.4 Environmental Risks and Impacts and Mitigation Options for Component 4

There are no environmental risks and impacts for Component 4.

3.4 Social Risks and Impacts and Mitigation Options

Social risks and potential impacts relating to GCF's ESS2, ESS5, ESS7 and ESS8 are assessed and discussed below, especially impacts to, and benefits accruing to, vulnerable groups.

3.4.1 Social Risks and Impacts and Mitigation Options for Component 1

3.4.1.1 ESS2: Labor and Working Conditions.

Table 3.23 Assessment of risks and potential impacts related to ESS2 for Component 1

	Item	Risks and Potential impact	Mitigation options
1	Accidents	No adverse effects to the accidents at the target sites would be occurred, as there are no sources by the activities.	

Source: JICA (2020)

3.4.1.2 ESS5: Land Acquisition and Resettlement.

Table 3.24 Assessment of risks and potential impacts related to ESS5 for Component 1

	Item	Risks and Potential impact	Mitigation options
1	Resettlement	No involuntary resettlement will be occurred by implementing any proposed projects, as there are no residents and residential areas at all the project sites.	
2	Living and Livelihood	If the target areas are used by the local people regularly, there may be	Proper arrangement and management of the areas under the coastal and reef

	Item	Risks and Potential impact	Mitigation options
		possibilities of restrictions for the local peoples' livelihood, such that people cannot collect natural resources temporarily or be able to use the areas for their livelihood activities temporarily, etc. due to the coastal and reef conservation plan.	conservation plan, such as collection and resolution of options, intentions and complaints of the local people and ensuring mutual understandings among them, is necessary to mitigate and reduce unfairness to their livelihood activities.

Source: JICA (2020)

3.4.1.3 ESS7: Indigenous people

Table 3.25 Assessment of risks and potential impacts related to ESS7 for Component 1

	Item	Risks and Potential impact	Mitigation options
1	Ethnic Minorities and Indigenous Peoples	There will be no impacts on Indigenous People as there are no IP communities/ groups in the project areas.	

Source: JICA (2020)

3.4.1.4 ESS8: Cultural Heritage

Table 3.26 Assessment of risks and potential impacts related to ESS8 for Component 1

	Item	Risks and Potential impact	Mitigation options
1	Heritage	There is the heritage site along the coast in Gan island, Laamu Atoll, which is one of the targeted islands for implementation of ICZM Plan, and for which the protection measures will be implemented through the Component 2. Therefore, there would be a risk that the future ICZM Plan may raise any impacts to the existing heritage site, if not properly planned.	The ICZM Plan should be examined and planned properly and adequately in order for the heritage site not to be suffered from any adverse impacts from the planned activities of the future ICZM; e.g. regular monitoring, proper maintenance, etc.
2	Landscape	No adverse effects to the landscapes at the target sites would occur, as Component 1 does not involve any civil work or construction of structure.	

Source: JICA (2020)

3.4.2 Social Risks and Impacts and Mitigation Options for Component 2

3.4.2.1 ESS2: Labor and Working Conditions.

Table 3.27 Assessment of risks and potential impacts related to ESS2 for Component 2

	Item	Risks and Potential impact	Mitigation options
1	Worker's rights	Denial of basic rights by the project or its contractors to all workers or to some category of workers	Project should adopt the ILO standard for granting workers rights; Contractors should be bound by as part of the contract to abide by the same standard.
2	Gender discrimination and GBV	Potential gender discrimination in hiring of workers by the project and contractors Potential occurrence of gender-based violence in the workplace (GBV)	Project must adopt and implement a policy of non-discrimination on the basis of gender in hiring of workers; Contractors shall also be required to adopt the same policy.

	Item	Risks and Potential impact	Mitigation options
			Project and contractors shall conduct awareness campaign against GBV among their workers.
		Discrimination based on gender, marital status, age, or any other physical or mental attribute. Sexual harassment. Many such cases have come to light in the Maldives and across the world recently. Physical and verbal harassment and workplace bullying.	Staff will be made aware of the avenues available at the Ministry for victims of sexual harassment. Staff will be able to lodge complaints to the Sexual Harassment Prevention Committee at the Ministry, established under Prevention of Sexual Harassment Act (16/2014).
3	Occupational Health and Safety	Exposure of workers to occupational health and safety hazards during construction	The project and contractors shall adopt OSH standards of the government as well as the IFC or the World Bank group. Workers should be provided with PPEs where required. Construction sites shall be subject to periodic OSH audit by the Implementing Entity, and/or the AE.
		Discrimination in relation to opportunity/access for training and self-development.	Equal training opportunity will be available to all staff working in the project without discrimination, based on gender or otherwise, as specified in the Employment Act. It is responsibility of the Project Manager and the Project Director to ensure that such discrimination does not exist.

Source: JICA (2020)

3.4.2.2 ESS5: Land Acquisition and Resettlement.

Table 3.28 Assessment of risks and potential impacts related to ESS5 for Component 2

	Item	Risks and Potential impact	Mitigation options
1	Resettlement	No involuntary resettlement will be occurred by implementing any proposed projects, as there are no residents and residential areas at all the project sites.	
2	Damage to Private Properties	Potential damage to private properties during construction	Damages to private properties/assets shall be restored and/or compensated at replacement cost. Damages incurred by contractors during construction that are not anticipated in the project design shall be the responsibility of the contractor. Damages that are identified in the project design shall be the responsibility of the Maldives government.
3	Livelihood activities of local communities	Temporary disruption of economic activities of local communities due to loss of access to the site during construction period.	Identify and consult the affected communities/ groups. Provide assistance based on the consultation.

Source: JICA (2020)

3.4.2.3 ESS7: Indigenous people

Table 3.29 Assessment of risks and potential impacts related to ESS7 for Component 2

	Item	Risks and Potential impact	Mitigation options
1	Ethnic Minorities and Indigenous Peoples	There will be no impacts on Indigenous People as there are no IP communities/groups in the project areas.	

Source: JICA (2020)

3.4.2.4 ESS8: Cultural Heritage

Table 3.30 Assessment of risks and potential impacts related to ESS8 for Component 2

	Item	Risks and Potential impact	Mitigation options
1	Cultural Heritage	The sea walls to be constructed in Gan and Ishdhoo islands are intended to protect historical sites. However, there is a risk that the structure, if not designed properly, may alter the original landscape of the historical sites and/or render them inaccessible to public.	The design of the wall should be cleared by proper authorities and experts in the government. Local communities using or visiting the sites should be consulted before the design is approved and finalized.

Source: JICA (2020)

3.4.3 Social Risks and Impacts and Mitigation Options for Component 3

3.4.3.1 ESS2: Labor and Working Conditions.

Table 3.31 Assessment of risks and potential impacts related to ESS2 for Component 3

	Item	Risks and Potential impact	Mitigation options
1	Worker's rights	Denial of basic rights by the project or its contractors to all workers or to some category of workers	Project should adopt the ILO standard for granting workers rights; Contractors should be bound by as part of the contract to abide by the same standard.
2	Gender discrimination and GBV	Potential gender discrimination in hiring of workers by the project and contractors Potential occurrence of gender-based violence in the workplace (GBV)	Project must adopt and implement a policy of non-discrimination on the basis of gender in hiring of workers; Contractors shall also be required to adopt the same policy. Project and contractors shall conduct awareness campaign against GBV among their workers.
3	Child Labor	The project and/or its contractors may exploit children especially in the local communities by hiring them in the project.	The project and/its contractors must adopt the ILO/UN standards for hiring of underage population. That is, no person below the age of 14 should be hired in the project. If persons below the age of 18 is hired, he/she should not be assigned hazardous and/or heavy tasks.
4	Occupational Health and Safety Risk	Exposure of workers to occupational health and safety hazards during construction	The project and contractors shall adopt OSH standards of the government as well as the IFC or the World Bank group. Construction sites shall be subject to periodic OSH audit by the Implementing Entity, and/or the AE.

Source: JICA (2020)

3.4.3.2 ESS5: Land Acquisition and Resettlement.

Table 3.32 Assessment of risks and potential impacts related to ESS5 for Component 3

	Item	Risks and Potential impact	Mitigation options
1	Land Acquisition	Construction/Installation of Component 3 Facilities may displace or damage private dwellings, other structures, crops and other private assets.	All Component 3 facilities shall be constructed on existing government lands
2	Involuntary Resettlement		

Source: JICA (2020)

3.4.3.3 ESS7: Indigenous people

Table 3.33 Assessment of risks and potential impacts related to ESS7 for Component 3

	Item	Risks and Potential impact	Mitigation options
1	Ethnic Minorities and Indigenous Peoples	No adverse effects to the ethnic minorities and indigenous peoples at the target sites would be occurred, as there are no indigenous people communities or groups in the project areas.	

Source: JICA (2020)

3.4.3.4 ESS8: Cultural Heritage

Table 3.34 Assessment of risks and potential impacts related to ESS8 for Component 3

	Item	Risks and Potential impact	Mitigation options
1	Heritage	The transmission tower and other facilities to be constructed under Component 3 may displace, destroy, damage or render inaccessible cultural heritage sites; there is also a possibility that excavations during construction of these facilities may uncover archeological artefacts or paleontological objects.	No transmission facilities shall be constructed within or near any cultural, religious or historical sites such that it will affect displace, damage, destroy or alter such sites. The project shall adopt a simple procedure for chance archaeological/ paleontological finds during construction.

Source: JICA (2020)

3.4.4 Social Risks and Impacts and Mitigation Options for Component 4

There are no social risks and impacts for Component 4.

4. Generic Environmental and Social Management Plan (ESMP)

Based on the preliminary assessments of environmental and social risks and potential impacts relating to GCF's ESS from ESS1 to ESS8, the Generic Environmental and Social Management Plan is examined as follows:

4.1 ESS1: Environmental and Social Risks and Impact

(1) Performance Criteria

The following performance criteria are set for the construction of the projects:

a) There will be no adverse impacts on climate and climate change.

b) All site-specific activities undergo further ES screening and/or assessments and mitigation planning in a form of ESIA, depending upon the requirements of the Maldives EPA and this ESMF as outlined in Section 4 below; The assessments cover all GCF ESSs

c) Each activity shall comply with government regulations and international good practice

d) Each major physical activity has a site-specific Environmental and Social Management Plan (ESMP) which is prepared based on this generic ESMP and the findings of the detailed site-specific ES assessments.

e) Each activity shall be monitored for compliance with their respective site-specific ESMPs

4.2 ESS2: Labor and Working Conditions.

(1) Performance Criteria

a) The following performance criteria are set for the project: Compliance with ILO's labor standards by the project organization and contractors

b) Absence of unresolved labor-related complaints

c) Compliance with the World Bank Group's Health and Safety Standards

d) OSH audit performance of contractors and other project entities at construction sites

(2) Monitoring and Reporting

ME shall conduct periodic compliance monitoring on Labor and Working Conditions standards, including OSH audit of construction sites. A report on the monitoring and audit shall be prepared by the ministry and submitted to JICA. The specific situations and actions related to gender are described in Annex 8a (Gender Assessment) and 8b (Gender Action Plan) of the Funding Proposal, respectively.

Table 4.1 Labor and Working Conditions Management Measures

Issue	Control Activity (and source)	Action Timing	Responsibility	Frequency
M2.1: Worker's rights	M2.1.1: Monitor the working conditions to be compliance with ILO standard.	During construction	PMU/ Atoll Council/ contractor	Maintain records
	M2.1.2: Ensure compliance with the Grievance Redress Mechanism	During construction	PMU/ Atoll Council/ contractor	Maintain records
M2.2: Gender discrimination and GBV	M2.2.1: Monitor whether equal opportunities granted regardless of gender	During construction	PMU/ Atoll Council/ contractor	Maintain records

Issue	Control Activity (and source)	Action Timing	Responsibility	Frequency
	M2.2.2: Ensure compliance with the Grievance Redress Mechanism	During construction	PMU/ Atoll Council/ contractor	Maintain records
M2.3: Occupational Health and Safety	M2.3.1: Ensure the implementation of security measures and fair and healthy working conditions	During construction	PMU/ Atoll Council/ contractor	Maintain records
	M2.3.2: Ensure compliance with the Grievance Redress Mechanism	During construction	PMU/ Atoll Council/ contractor	Maintain records

Source: JICA (2019)

4.3 ESS3: Resource Efficiency and Pollution Preventions.

4.3.1 Marine and Surface Water Quality

(1) Performance Criteria

The following performance criteria are set for the construction of the projects:

a) No significant decrease in water quality as a result of construction activities;

b) No significant decrease in water quality as a result of dredging activities;

c) No overflow during dredging activities;

d) No significant decrease in the quality and quantity of surface water as a result of construction activities in proximity to the projects; and

e) No offsite impact will occur through the release of sand for nourishment into the marine environment.

(2) Monitoring

Marine and surface water samples will be collected from a range of locations for analysis of pH, turbidity, salinity, dissolved oxygen (DO), and other relevant parameters. A water quality sampling and analysis program will be prepared prior to the construction activities during the Detailed Design stage. The monitoring will be implemented by the Detailed Design before and after construction, and also by the contractor(s) during construction, at the target sites and sand borrow sites.

(3) Reporting

All water quality monitoring results and/or incidents will be tabulated and reported as outlined in the ESMP. The PMU must be notified immediately in the event of any suspected instances of material or serious environmental harm, or if a determined level with respect to water quality is exceeded.

Table 4.2 Marine and Surface Water Quality Management Measures

Issue	Control Activity	Action Timing	Responsibility	Frequency
M3.1: Adverse effects to the water quality of marine and surface water	M3.1.1: Designated areas for storage of fuels, oils, chemicals or other hazardous liquids should have compacted impermeable bases and be	During construction	All Personnel	Weekly with reporting to PMU

Issue	Control Activity	Action Timing	Responsibility	Frequency
	surrounded by a bund to contain any spillage.			
	M3.1.2: All machineries shall be well maintained for the prevention of the spillage of oil, chemicals, and other hazardous liquids into the sea.	During construction	Contractor, PMU/ Atoll Council	Maintain daily records
	M3.1.3: Conduct regular surface water quality monitoring in locations where the surface water is likely to be affected. This includes the assessment of the changes in surface water quality.	During construction	PMU/ Atoll Council	Weekly and as required with reporting to PMU
	M3.1.4: Construction materials will not be stockpiled in proximity to the aquatic environment that may allow release into the environment.	During construction	Contractor, PMU/ Atoll Council	Maintain daily records
	M3.1.5: Ensure all residual contaminated sediments are not released into the environment.	During construction	Contractor, PMU/ Atoll Council	Maintain daily records
	M3.1.6: Install the silt protectors for beach nourishment.	During construction	Contractor, PMU/ Atoll Council	Maintain daily records
	M3.1.7: Implement adequate management and monitoring for the beach nourishment and land reclamation project.	During operation	PMU/ Atoll Council, community	Monthly and as required with reporting to PMU

Source: JICA (2019)

4.3.2 Air Quality Impacts and Management Measures

(1) Performance Criteria

The following performance criteria are set for the construction of the projects:

a) Corrective action to respond to complaints and/or grievances is to occur;

b) Inspect and approve efficient equipment only;

c) Minimize equipment movements through proper planning of activities;

d) Apply dust suppression; and

e) Apply vehicle speed limit, particularly on unpaved roads.

(2) Monitoring

An air quality will be measured through the Detailed Design and also by the contractor(s) during the construction stage. This shall include vehicles and machinery emissions – visual monitoring, measurements to be carried out when deemed excessive.

(3) Reporting

Air quality monitoring results and/or incidents will be tabulated and reported as outlined in the ESMF. The PMU must be notified immediately in the event of any suspected instances of material or serious environmental harm or if a determined level with respect to air quality is exceeded.

Table 4.3 Air Quality Management Measures

Issue	Control Activity	Action Timing	Responsibility	Frequency
M3.2: Increase in vehicle/ machinery emissions	M3.2.1: Ensure vehicles/ machines are maintained, switched off when not in use and that only required vehicles are operated onsite.	During construction	Contractor, PMU/ Atoll Council	Daily and maintain records
	M3.2.2: Ensure that construction vehicles and machinery are properly maintained and operated in accordance with the design standards and the manufacturers' maintenance manuals.	During construction	Contractor, PMU/ Atoll Council	Daily and maintain records
	M3.2.3: Develop and implement an induction program for all site personnel, which include as a minimum an outline of the minimum requirements for environmental management relating to the site.	Before and during construction	Contractor, PMU/ Atoll Council	Daily and maintain records

Source: JICA (2019)

4.3.3 Noise and Vibration Management Measures

Performance Criteria

The following performance criteria are set for the construction of the projects:

a) Selection of efficient equipment and maintenance in accordance with manufacturers manuals;

b) As much as possible, small compactor units shall be used instead of heavy compactors;

c) Proper Personal Protective Equipment (PPE), such as ear plugs, are to be used by workers near noise/vibration generating equipment;

d) No noisy equipment or machines are to be used during night hours; and

e) Corrective action to respond to complaints and/or grievances is to occur within 48 hours.

(2) Monitoring

Ambient noise levels will be measured at the nearest residential areas from each project site. The baseline data will be measured during the Detailed Design stage and measurement will be continued by the contractor(s) during the construction stage.

(3) Reporting

All noise monitoring results and/or incidents will be tabulated and reported as outlined in the ESMF. The PMU must be notified immediately in the event of any suspected instances of material or serious environmental harm or if a determined level with respect to noise is exceeded.

Table 4.4 Noise and Vibration Management Measures

Issue	Control Activity	Action Timing	Responsibility	Frequency
M3.3.1: Increased noise levels	M3.3.1.1: Select equipment and machinery to ensure that noise emissions are minimized during construction including all compaction and pumping equipment.	Pre and during construction	Contractor	Maintain records
	M3.3.1.2: Utilize specific noise reduction devices such as silencers and mufflers.	During construction	Contractor	Maintain records
	M3.3.1.3: Restrict noise generating activities to daytime hours near the residential areas, as much as possible.	During construction	Contractor	Maintain Records
	M3.3.1.4: Consultation with nearby residents in advance of construction activities particularly if noise generating construction activities are to be carried out outside of 'daytime' hours.	During construction	Contractor	Daily and maintain records
	M3.3.1.5 All incident complaints and non-compliances related to noise shall be reported in accordance with the site incident reporting procedures and summarized in the register.	During construction	Contractor	Maintain records
	M3.3.1.6: The contractor shall conduct employee and operator training to improve awareness of the need to minimize excessive noise in work practices.	During construction	Contractor	Maintain Records
M3.3.2: Vibration due to construction	M3.3.2.1: Identify properties, structures, underground services, and habitat locations that will be sensitive to vibration impacts resulting from the construction and operation of the project.	Pre and during construction	Contractor	Maintain records
	M3.3.2.2: Design to give due regard to temporary and permanent mitigation measures for noise and vibration from construction vibration impacts.	Pre-construction	Contractor	Maintain records

Issue	Control Activity	Action Timing	Responsibility	Frequency
	M3.3.2.3: All incidents, complaints, and non-compliances related to vibration shall be reported in accordance with the site incident reporting procedures and summarized in the register.	During construction	Contractor	Maintain records

Source: JICA (2019)

4.3.4 Erosion and Sediment Control

(1) Performance Criteria

The following performance criteria are set for the project:

a) No build-up of sediment in the aquatic environments as a result of construction activities;

b) No erosion from the beach nourishment areas and land reclamation areas as a result of the construction activities; and

c) No contaminated sediment will be used in the construction works.

(2) Monitoring

A sediment control monitoring program will be developed for the projects. The program is subject to review and update at least every two months from the date of issue. The PMU will be required to conduct site inspections on a monthly basis or after heavy rainfall events.

(3) Reporting

All sediment and erosion control monitoring results and/or incidents will be tabulated and reported as outlined in the ESMF. The PMU must be notified immediately in the event of any suspected instances of material or serious environmental harm, or if a determined level with respect to erosion and sediment control is exceeded.

Table 4.5 Erosion Control Management Measures

Issue	Control Activity (and source)	Action Timing	Responsibility	Frequency
M3.4.1: Loss of soil material and sedimentation to the surface water systems from the site due to earthwork activities	M3.4.1.1: Existing situations/ conditions of the sediment shall be confirmed before construction	Pre-construction	Contractor, PMU/ Atoll Council	Maintain records
	M3.4.1.2: Planning of adequate specification of groins (intervals/ numbers, length, etc.) shall be considered to mitigate the filled sand for beach nourishment.	Before construction	Consultant	Detailed Design
	M3.4.1.3: Avoid sand flow into the sea or onto the roads from the planned soil stock piles for beach nourishment	During construction and operation	Contractor, PMU/ Atoll Council	Maintain records
M3.4.2: Soil contamination	M3.4.2.1: Drainage control measures to ensure runoff does not contact contaminated areas	Entire construction stage	All Personnel	Daily and maintain records

Issue	Control Activity (and source)	Action Timing	Responsibility	Frequency
	and is directed/diverted to stable areas for release.			
	M3.4.2.2: Avoid importing fill that may result in site contamination and lacks accompanying certification/documentation.	Entire construction stage	All Personnel	Daily and maintain records
	M3.4.2.3: Install the silt protectors for beach nourishment and land reclamation.	During construction	Contractor, PMU/ Atoll Council	Maintain daily records
	M3.4.2.4: Implement adequate management and monitoring for the beach nourishment and land reclamation project.	During operation	PMU/ Atoll Council, community	Monthly and as required with reporting to PMU

Source: JICA (2019)

4.3.5 Waste Management

(1) Performance Criteria

The following performance criteria are set for the construction of the projects:

a) Waste generation is minimized through the implementation of the waste hierarchy (avoidance, reduce, reuse, recycle);

b) No litter will be observed within the project areas or its surroundings as a result of activities by site personnel;

c) No complaints received regarding waste generation and management;

d) Any waste from on-site portable sanitary facilities will be sent off site for disposal by a waste licensed contractor;

e) Waste oils will be collected and disposed through the Waste Management Centers for recycling at each island;

f) Immediate response and reporting for any spill or leakage;

g) Wastes of hazardous nature to be disposed of through licensed contractors under a complete chain-of-custody system;

h) Prepare waste and hazardous waste registers for all project activities, in accordance with the requirements of Law 4 for 1993 on Environment Protection and Preservation Act; and

i) Prepare and maintain a waste management plan that takes into consideration all the points mentioned above.

(2) Monitoring

Monitoring of waste volumes and ensuring that they match the chain-of-custody, particularly for wastes of hazardous nature. Monitoring/patrolling waste storage and handling on site.

(3) Reporting

The PMU must be notified immediately and PMU will take action in the event of any serious environmental harm due to improper waste management.

Table 4.6 Waste Management Measures

Issue	Control Activity (and source)	Action Timing	Responsibility	Frequency
M3.5: Production of wastes and excessive use of resources	M3.5.1: The use of construction materials shall be optimized and where possible a recycling policy adopted.	During construction	Contractor, PMU/ Atoll Council	Weekly and maintain records
	M3.5.2: Separate waste streams shall be maintained at all times i.e., general domestic waste, construction, and contaminated waste.	During construction	Contractor, PMU/ Atoll Council	Weekly and maintain records
	M3.5.3: Any contaminated waste shall be disposed of at an approved facility.	During construction	Contractor, PMU/ Atoll Council	Weekly and maintain records
	M3.5.4: Recyclable waste (including oil and some construction wastes) shall be collected separately and disposed of correctly.	During construction	Contractor, PMU/ Atoll Council	Weekly and maintain records
	M3.5.5: Disposal of waste shall be carried out in accordance with the Government of the Maldives's requirements.	During construction	Contractor, PMU/ Atoll Council	Weekly and maintain records
	M3.5.6: Fuel and lubricant leakages from vehicles and machinery shall be immediately rectified.	During construction	Contractor, PMU/ Atoll Council	Daily and maintain records
	M3.5.7: Major maintenance and repairs shall be carried out off-site whenever practicable.	During construction	Contractor, PMU/ Atoll Council	Weekly and maintain records

Source: JICA (2019)

4.4 ESS4: Community Health, Safety and Security.

(1) Performance Criteria

The following performance criteria are set for the project:

a) Coordinate project implementation schedule with communities.

b) Long-term social benefits are achieved.

c) Complaint and grievance mechanisms are put in place and proactively managed.

d) Local stakeholders and community members have a key role to play in the implementation and monitoring of the project.

e) Consultation with stakeholders will continue.

PMU will be responsible for advisory support and extensions services to local beneficiaries along with being responsible for distributing material inputs and providing technical training in the implementation of project activities

(2) Monitoring and Reporting

ME shall conduct periodic compliance monitoring on Labor and Working Conditions standards., including OSH audit of construction sites. A report on the monitoring and audit shall be prepared by the ministry and submitted to JICA.

Records of all consultations are to be kept and reported on a monthly basis.

PMU must be notified in the event of any individual or community complaint or dissatisfaction and ensure the Grievance Redress Mechanism is complied with.

Table 4.7 Community Health and Safety Management Measures

Issue	Control Activity (and source)	Action Timing	Responsibility	Frequency
M4: Public nuisance caused by construction/ operation activities (e.g., noise and dust)	M4.1: Carry out community consultation on the purpose and benefits of making changes to land use	Before and during construction	PMU/ Atoll Council	Maintain records
	M4.2: Ensure compliance with the Grievance Redress Mechanism process	Before and during construction	PMU/ Atoll Council	Maintain records
	M4.3: Implement appropriate management plans (refer to other sections of the ESMF)	Before and during construction	PMU/ Atoll Council	Monthly and maintain records

Source: JICA (2019)

4.5 ESS5: Land Acquisition and Resettlement.

(1) Performance Criteria

The following performance criteria are set for land acquisition and involuntary resettlement related to the project:

a) The project will not involve any land acquisition as construction sites are already government owned.

b) All activities shall be assessed, as part of the site-specific ESIA or ES Screening, for potential land acquisition and displacement issues and damage to private properties.

c) Any damage to private properties whether planned or unintentional shall be properly and fairly compensated.

d) No activity involving displacement of entire private dwellings and business establishments shall be pursued.

e) People whose livelihoods become restricted or disrupted during the project implementation shall be consulted and compensated and/or provided assistance

4.6 ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

(1) Performance Criteria

The following performance criteria are set for the construction of the projects:

a) Locations will be surveyed for sensitive or critical habitats prior to the works, if any;

b) No clearance of vegetation outside of the designated clearing boundaries;

c) No death to native fauna as a result of clearing activities;

d) No deleterious impacts on marine environments and terrestrial habitats;

e) No impacts on migrant bird species which utilize reefs;

f) No introduction of new weed species as a result of construction activities;

g) Fill material from all locations will be chemically and biologically analyzed to minimize introduction of alien species; and

h) A flora and fauna management program will be implemented.

(2) Monitoring

Seasonal checks of coral environment, if identified in the pre-construction survey, will be conducted for comparison with baseline conditions.

Seasonal monitoring of existing surrounding flora and fauna (birds, reptiles, mammals and marine life) for identification of any trends that may be related to introduction of the project structures.

The delivery organization will, when undertaking works, compile a monthly report to the PMU:

a) Any non-conformances to this ESMF; and

b) Details of the corrective action undertaken.

(3) Reporting

All monitoring results of flora and fauna, including coral environment, and/or incidents will be tabulated and reported as outlined in the ESMF. The PMU must be notified in the event of any suspected instances of death to native fauna and where vegetation is detrimentally impacted.

Table 4.8 Flora and Fauna Management Measures

Issue	Control Activity	Action Timing	Responsibility	Frequency
M6: Habitat loss and disturbance of marine ecosystem including terrestrial flora and fauna	M6.1: Survey the target areas for critical habitats	Before construction	PMU/ Council Atoll Council / JICA	Once, prior to construction
	M6.2: Limit vegetation clearing and minimize habitat disturbance through adequate protection and management of retained vegetation.	During construction	Contractor/ PMU/ Atoll Council	Weekly and shall maintain records
	M6.3: Ensure that all site personnel are made aware of the sensitive fauna/habitat areas and the requirements for the protection of these areas.	During construction	Contractor/ PMU/ Atoll Council	Weekly and shall maintain records
	M6.4: Monitoring of existing surrounding flora and fauna (birds, reptiles, mammals and marine life) for identification of any trends that may be related to introduction of the project structures	During construction	Contractor/ PMU/ Atoll Council	Weekly and shall maintain records and reports

Source: JICA (2019)

4.7 ESS7: Indigenous people and vulnerable groups

(1) Performance Criteria

There are no indigenous communities in the project area and hence the project is not expected to affect indigenous people. The following performance criteria are set for issues relating to indigenous people and vulnerable group:

a) There will be no adverse impacts on Indigenous people

b) All site-specific activities shall be assessed as part of the site-specific ESIA or ES Screening, for impacts to vulnerable groups; vulnerable groups in the project sites should be identified and consulted; and given special attention in terms of mitigation measures.

4.8 ESS8: Cultural Heritage

(1) Performance Criteria

The following performance criteria are set for cultural heritage issues related to the project:

a) Activities that cause adverse impacts on important archaeological, indigenous, and/or cultural heritage sites shall not be pursued unless protection/conservation measures are developed and/or approved by competent authorities/experts with consultation of the communities are included in the provided as part of the project.

b) For the proposed sea walls intended to protect the historical sites, the walls should not degrade the sites, block or render them inaccessible. Design of the walls should be consulted upon with the local communities.

c) Chance archaeological finds shall follow the procedures provided in the Table below.

(2) Monitoring

Observation of the existing cultural heritages during pre-construction and construction activities.

Local stakeholders and community members have a key role to play in the implementation and monitoring of the project.

Consultation with stakeholders will continue. This will help ensure that stakeholders continue to be aware of the project, its progress, and any changes in the project. It will also assist in identifying any issues as they arise.

PMU will be responsible for advisory support and extensions services to local beneficiaries along with being responsible for distributing material inputs and providing technical training and backstopping in the implementation of project activities.

(3) Reporting

Records of all consultations are to be kept and reported on a monthly basis.

The PMU must be notified immediately and the PMU will take action in the event of any serious damage due to improper construction.

Table 4.9 Archaeological Management Measures

Issue	Control Activity (and source)	Action Timing	Responsibility	Frequency
M8: Damage or disturbance to significant	M8.1: Should any important archaeological/indigenous and/or cultural heritage sites	Before and during construction	Contractor, PMU/ Laamu Atoll	Weekly, maintain records and

Issue	Control Activity (and source)	Action Timing	Responsibility	Frequency
important archaeological, indigenous and/or cultural heritage during the earth disturbances and land clearing activities	be damaged, immediately cease work within the area that the site has been observed and consult with the Maldivian government and PMU/JICA.			immediately notify PMU, JICA of any findings
	M8.2: Should any important archaeological, indigenous and/or cultural heritage sites be found, immediately cease work within the area that the site has been observed and consult with the Maldivian government and PMU/JICA.	Before and during construction	Contractor, PMU/ Laamu Atoll	Weekly, maintain records and immediately notify PMU, JICA of any findings

Source: JICA (2019)

5. Activity/Site-Specific Assessments, Mitigation Planning and Implementation

5.1 Component 1: Establishment of Integrated Coastal Zone Management (ICZM)

5.1.1 Project activities that will be subject to assessments

For the sub-activities under Component 1, there are no activities, that will be subject to assessments.

Table 5.1 Necessary assessments for activities under Component 1

Activity		Necessary Assessment
Activity 1.1	Inventory study for risk assessment on present coastal and coral reef conditions	No need
Activity 1.2	Preparation of basic policy of ICZM at the national level	No need
Activity 1.3	Preparation of concrete ICZM Plan at representative inhabitant island as case study	IEE (including screening)
Activity 1.4	Capacity development and information sharing of the relevant organizations for establishment of the ICZM	No need

Source: JICA (2020)

5.1.2 Government Permitting requirements

There are no government permitting requirements required for all the activities under Component 1.

5.1.3 The scope of the assessments

According to the Environmental and Social Management Plan (ESMP) in the Section 3.5, the necessary actions should be arranged and conducted for GCF's ESS 3 under environmental profiles, and ESS 5 under social profiles.

The Component 1 activities and target areas to be assessed are as follows:

Table 5.2 Component 1 activities that will be subject to an ESIA

Atoll/ City	Island	Component 1 Activity	Funding Source
Laamu	Fonadhoo	Preparation of concrete ICZM plan as case study for ICZM plan under Activity 1.3	JICA co-finance
	Gan	Preparation of concrete ICZM plan as Case study for ICZM plan under Activity 1.3	JICA co-finance

Source: JICA (2020)

5.1.4 Institutional Arrangements for the preparation of the ESIA and for implementing and monitoring the site-specific mitigation/management plans

The necessary institutional arrangement for the preparation of the ESIA shall be arranged as below, and the site-specific mitigation/ management plans shall be implemented and monitored according to the following table.

Table 5.3 Institutional arrangements for preparation of the ESIA for Component 1

Item	Maldives side	Japan side
Proponent	MPI	JICA (AE)
Environmental assessment (IEE/ ESIA)	Will be conducted by MPI/ME through consulting company.	Will be reviewed by JICA (AE), and necessary assistances will be done by JICA (AE), if necessary.
Approval of ESIA	Will be approved by EPA, and EIA Decision Statement will be issued by EPA.	Necessary assistances will be done by JICA (AE).

Item	Maldives side	Japan side
Monitoring	Monitoring will be conducted by PMU.	Monitoring will be assisted and monitored by JICA (AE).

Source: JICA (2020)

5.1.5 Activity/Site-Specific Assessments and Mitigation Planning

According to the consideration through the analysis in the above table, the impacts and mitigation measures for each proposed activity are summarized in the following table. The Chapter 3 of the ESMF provides more detail impacts and mitigation measures.

Table 5.4 Summary of the Impacts and Mitigation Measures for Component 1

Proposed Activity	Impact	Mitigation Measures	Rank
(1) Case study for establishment of coastal and reef conservation plan at Gan and Fonadhoo Islands, Laamu Atoll (Activity 1.3)	Inadequate arrangement and management of coastal and reef conservation plan may facilitate the unfairness on utilization of the coastal and reef areas for the livelihood activities by the local people.	In order to prevent/ mitigate such adverse effects on the livelihood, adequate measures should be done to reduce assumed unfairness on utilization.	Rank: B
(2) Establishment and implementation of sediment budget control plan at Gan and Fonadhoo Islands, Laamu Atoll (Activity 1.3)	Inadequate arrangement and management of sediment budget control plan may facilitate inadequate sand quarry and sediment, decrease in water quality, and adverse effect to marine ecosystem and coastal areas.	In order to prevent/ mitigate such adverse effects on the water quality and marine ecosystem and coastal areas, adequate measures, such as establishment of regulations and management structures, examination of alternative quarry sites, etc., should be done to reduce inadequate sediment control.	Rank: B

Source: JICA (2020)

5.2 Component 2: Implementation of coastal conservation/protection measures against coastal disasters

5.2.1 Project activities that will be subject to assessments

For the activities under Component 2, those activities will be subject to assessments.

Table 5.5 Project Components required for ESS under Component 2

Atoll/ City	Island	Project Component	Funding Source
Laamu	Fonadhoo	Beach nourishment and groins for the eastern coast (ocean side)	GCF fund
	Maamendhoo	Beach nourishment and groins for the eastern and western side coast, and reclamation for evacuation place at the north-western top	GCF fund
	Ishdhoo	Sea walls to protect historical sites at the ocean side coast at the north top	Maldives's co-finance
	Gan	Sea walls to protect the historical sites at the ocean side at the middle of the island	Maldives's co-finance
Addu	Meedhoo	Beach nourishment and groins for the eastern coast (northern coast)	Maldives's co-finance

Source: JICA (2020)

In addition to the physical intervention, the sand borrowing sites have not yet been decided for collecting sand for the beach nourishment, and it is planned to be assessed and decided during

the detail design and/or the construction stage. Therefore, the necessary environmental procedures should be arranged and proceeded at that time.

5.2.2 Environmental Permits Required for the Project

5.2.2.1 Concept Approval

The proposed beach nourishment and coastal protection concept (Activities 2.1 and 2.2) has been approved by ME, Addu City Council and Laamu Atoll Council on 4 September 2019, and the Minister of ME on January 2020.

5.2.2.2 Dredging and Land Reclamation Approval

Prior to any coastal works that require dredging or reclamation, a special permit has to be taken from EPA. A specific form published by EPA has to be completed and submitted for the approval. EIA application form will only be accepted when the form is submitted with the costal modification approval given by EPA in writing. Dredging and reclamation approval for this project will be issued by EPA at the time of issuing. This will be done by either the consultants or the contractor(s).

5.2.2.3 EIA Decision Statement

The most important environmental permit to initiate the project works would be a decision regarding the EIAs, which will be conducted based on this ESMP by ME and JICA. The EIA Decision Note, as it is referred to, shall govern the manner in which the project activities must be undertaken. The EIA reports will assist decision makers in understanding the existing environment and potential impacts of the project. Therefore, the Decision Note may only be given to the Proponent after a review of these documents from which the ministry may request for further information or provide a decision if further information is not required.

5.2.3 The scope of the assessments

The assessment will comply with the government regulations on EIA/ESIA. In addition, the assessment will cover all the GCF Environmental and Social Safeguards (ESS) Standards, particularly the following issues and requirements:

ESS1 (Assessment and Management of Environmental and Social Risks and Impacts):

- Consultations/ stakeholder engagements/ grievance mechanism
- Presence of vulnerable group within the project communities and impacts of the activities on these groups
- Environmental and Social Management Plan

ESS2 (Labor and Working Conditions):

- Worker rights issues
- Child labor issues/Employment of minors
- Worker discrimination issues
- Occupation health and safety issues

ESS3 (Resource Efficiency and Pollution Control):

- Air and water quality impacts
- Soil/sand/sediment erosion
- Construction waste management/disposal

ESS4 (Community Health and Safety)

- Exposure of residents to construction site and traffic safety and health hazards
- Disease outbreak/Spread of diseases due to influx of migrant labor
- Crime and violence including GBV

ESS5 (Land Acquisition and Resettlement)

- Land requirements/need to acquire private land
- Displacement of/damage to private dwellings, structures and/or crops
- Disruption/loss/restriction of livelihood

ESS6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources)

- Presence of sensitive natural habitat at site and impacts of the activities on the habitat
- Presence of sensitive species and impact of the activities on the species

ESS7 (Indigenous People):

- Presence of indigenous communities within the influence area of the activity
- Impacts of the activity to these communities

ESS8 (Cultural Heritage)

- Impact of the activities on cultural heritage/historical/religious sites

5.2.4 Institutional Arrangements for the preparation of the ESIA and for implementing and monitoring the site-specific mitigation/management plans

The necessary institutional arrangement for the preparation of the ESIA shall be arranged as below, and the site-specific mitigation/ management plans shall be implemented and monitored according to the following table.

Table 5.6 Institutional arrangements for preparation of the ESIA for Component 2

- GCF funded project

Item	Maldives side	Japan side
Proponent	ME	JICA (AE)
Environmental assessment (IEE/ ESIA	Will be conducted by ME through consulting company.	Will be reviewed by JICA (AE), and necessary assistances will be done by JICA (AE), if necessary.
Approval of ESIA	Will be approved by EPA, and EIA Decision Statement will be issued by EPA.	Necessary assistances will be done by JICA (AE).
Monitoring	Monitoring will be conducted by PMU.	Monitoring will be assisted and monitored by JICA (AE).

Source: JICA (2020)

- Maldives co-financed project

Item	Maldives side	Japan side
Proponent	MPI	JICA (AE)

Item	Maldives side	Japan side
ESIA	Will be conducted by MPI/ME through consulting company.	Will be reviewed by JICA (AE), and necessary assistances will be done by JICA (AE), if necessary.
Approval of ESIA	Will be approved by EPA, and EIA Decision Statement will be issued by EPA.	Necessary assistances will be done by JICA (AE).
Monitoring	Monitoring will be conducted by PMU.	Monitoring will be assisted and monitored by JICA (AE).

Source: JICA (2020)

5.2.5 Activity/Site-Specific Assessments and Mitigation Planning

According to the consideration through the analysis in the above table, the impacts and mitigation measures for each proposed activity are summarized, based on the general assessment in Section 3 of this document, in the following table. The Chapter 3 of the ESMF provides more detail impacts and mitigation measures. More detailed and site-specific impacts and mitigation measures will be prepared during the conduct of ESIAs for each of the activities.

Table 5.7 Summary of the Impacts and Mitigation Measures for Component 2

Proposed Activity	Impact	Mitigation Measures	Rank
(1) Beach nourishment and groins for the ocean side coast at Fonadhoo Island, Laamu Atoll	The construction of coastal protection measures can have numerous environmental and social impacts. This site has been suffering from the coast erosion naturally and unnaturally in the past. Environmentally, construction includes the movement of sediment into the marine environment which could result in smothering of any corals and seagrasses. Socially, construction is likely to hamper the accessibility to the beach for the ordinal users during the construction.	In order to prevent/mitigate such adverse effects on the water quality and marine ecosystem and flora/fauna, adequate measures should be done to reduce spilling the uncontrolled waste water into the sea, conduct proper management of the construction materials (sands for nourishment). Socially and regarding pollution, proper management and arrangement of wastes derived from the construction should be properly implemented.	Rank: B
(2) Beach nourishment and groins for the south-western side coast, and reclamation for evacuation place at the north-western top at Maamendhoo Island, Laamu Atoll			Rank: B
(3) Sea walls to protect historical sites at the ocean side coast at the north top at Ishdhoo Island, Laamu Atoll	The construction of coastal protection measures can have some environmental and social impacts. These sites have been suffering from the coast erosion naturally and unnaturally in the past. Environmentally, construction includes the revetment wall along the coasts, which could result in changing the marine and coastal ecosystem.	In order to prevent/mitigate such adverse effects on the ecosystem and flora/fauna, adequate measures should be done to decrease such damages through the proper management of the construction.	Rank: C
(4) Sea walls to protect the historical sites at the ocean side at the middle of the island at Gan Island, Laamu Atoll			Rank: C
(5) Beach nourishment and groins for the norther coast at Meedhoo Island, Addu City	The construction of coastal protection measures can have numerous environmental and social impacts. This site has been suffering from the coast erosion naturally and unnaturally in the past.	In order to prevent/mitigate such adverse effects on the water quality and marine ecosystem and flora/fauna, adequate measures should be done to reduce spilling the uncontrolled waste water into	Rank: B

Proposed Activity	Impact	Mitigation Measures	Rank
	Environmentally, construction includes the movement of sediment into the marine environment which could result in smothering of any corals and seagrasses. Socially, construction is likely to hamper the accessibility to the beach for the ordinal users during the construction.	the sea, conduct proper management of the construction materials (sands for nourishment). Socially and regarding pollution, proper management and arrangement of wastes derived from the construction should be properly implemented.	

Source: JICA (2019)

5.3 Component 3: Development of disaster warning and information dissemination

5.3.1 Project activities that will be subject to assessments

For the activities under Component 3, those activities will be subject to assessments.

Table 5.8 Necessary assessments for activities under Component 3

Activity		Necessary Assessment
Activity 3.1	Installment of terrestrial digital broadcasting system	ESIA
Activity 3.2	Establishment of disaster early warning and information broadcasting system	IEE

Source: JICA (2020)

5.3.2 Environmental Permits Required for the Project

5.3.2.1 Environmental screening procedures conducted by JICA (EE)

The facilities under Component 3 are constructed by JICA through its Grant Aid as the co-financed project. The project has been screened against JICA's Environmental and Social Consideration Procedure. The Environmental and Social Screening Template was prepared and the project deemed to be a Category B (medium risk) project, as all the project sites are not located in sensitive areas, nor sensitive characteristics, nor fall into sensitive sectors under the JICA guidelines for Environmental and Social Considerations (April 10), and potential adverse impacts on the environment are not likely to be significant. The result of the screening has been disclosed in the website of JICA[27].

5.3.2.2 ESIAs conducted by the proponent

Based on the results of JICA's Environmental screening, GoM conducted the Screening procedures in 2015 to 2017, and nine (9) sites, out of 21 candidate sites, were screened out for the further procedure: i.e. conducting EIA, on November 2015, and two (2) and one (1) sites were screened out for conducting EIA on April 2016 and September 2017, respectively. And as two (2) sites (Maaungdhoo (Sh), Hinnavaru (Lh)) are replaced from the existing sites, those sites were also screened out.

Table 5.9 Screening results on the sites for Component 3 by GoM

Document #	Issued date	Results	Concerned Islands/ Atolls
203-ADMIN/ PSM/2015/#	2015/11/16	EIA is necessary	Dhidhdhoo (Ha), Kulhudhuffushi (HDH), Funadhoo (Sh), Manadhoo (N), Felidhoo (V), Dhangethi (ADh), Gan (L), Guraidhoo (Th), Fiyoari (GDh)

27 https://www.jica.go.jp/english/our_work/social_environmental/id/asia/south/maldives/c8h0vm000096mxo9.html

Document #	Issued date	Results	Concerned Islands/ Atolls
		No need to do EIA	Ungoofaaru (R), Eydhafushi (B), Naifaru (Lh), Villingili (Male) (K), Maafushi (K), Feeali (F), Nilandhoo (F), Villigili (Ga), Gadhadhoo (GDh), Fovammulah (Gn)
203-EIARES/ PSM/2016/#	2016/4/5	EIA is necessary	Thinadhoo (GDh), Hithadhoo (S)
203-EIARES/ PSM/2017/#	2017/9/20	EIA is necessary	Nilandhoo (GA)
N/A	N/A	EIA is necessary	Maaungdhoo (Sh), Hinnavaru (Lh)

Source: JICA (2020)

Based on the results of the screening by GoM, the EIAs were conducted by the EIA consultant in 2018. In addition, three (3) sites are additionally selected for further procedures.

Table 5.10 List of Islands for which EIAs were conducted for Component 3

	Atoll	Island	Remarks
1	Ha	Dhidhdhoo	Screening: 203-ADMIN/PSM/2015/# on November 2015 EIA: Energy Consultancy Pvt. Ltd. (2018a[28]) Decision Statement (Approval of Environmental Impact Assessment): No. 203-EIARES/PSM/2018/3 (date of issue: 9 May 2018) *1 Funadhoo was cancelled and replaced to Maaungdhoo (Sh).
2	HDH	Kulhudhuffushi	
3	Sh	Funadhoo *1	
4	N	Manadhoo	
10	V	Felidhoo	
11	ADh	Dhangethi	
14	L	Gan	
15	Th	Guraidhoo	
17	GDh	Fiyoari	
18	GDh	Thinadhoo *2	Additionally selected. Screening: 203-EIARES/PSM/2016/# on April 2016 and 203-EIARES/PSM/2017/# on September 2017 EIA: Energy Consultancy Pvt. Ltd. (2018b[29]) Decision Statement (Approval of Environmental Impact Assessment): No. 203-EIARES/PSM/2018/4 (date of issue: 4 June 2018) *2 Thinadhoo (GDh) was cancelled.
21	S	Hithadhoo	
	Ga	Nilandhoo	
	Sh	Maaungdhoo	Maaungdhoo has been replaced from Funadhoo (above), and Hinnavaru has been replaced from Naifaru, which was not subject to EIA. As of April 2021, the additional EIA is being conducted for these two sites.
	Lh	Hinnavaru	

Source: JICA (2020)

5.3.3 The scope of the assessments (GCF's ESS2 to ESS8)

In the existing EIAs for Component 3, the following issues and mitigation measures are planned during construction and operation stages.

Table 5.11 List of issues/ impacts and mitigation measures, planned in the existing EIAs for Component 3

(1) Mobilization and site clearance

Item	Issues/ Impacts	Mitigation
Vegetation	Most of the vegetation would be cleared and an immediate and most adverse	Any tree that could be replanted, shall be replanted in a different location.

[28] Energy Consultancy Pvt. Ltd. (2018a): EIA for the Proposed Digital Terrestrial Television Broadcasting Network Development Project (for 9 sites)
[29] Energy Consultancy Pvt. Ltd. (2018b): EIA for the Proposed Digital Terrestrial Television Broadcasting Network Development Project (for 3 sites)

Item	Issues/ Impacts	Mitigation
	environmental impact on the vegetation will arise during the construction stage.	
Green waste	During this stage most of the green waste would be produced. If it is not properly handled, due to these wastes the following adverse impacts may occur. - Nuisance to the community - Loss of land due to the waste dump - Increase of biological growth (such as fungi)	If any tree is cut and disposed as green waste, then the parts of the tree such as bark of it needed to be chopped down to smaller pieces and disposed it. Try to avoid cutting down of or uprooting of unnecessary vegetation.

(2) Construction of the facility

Item	Issues/ Impacts	Mitigation
Dewatering	The reversible short-term impact of dewatering would be a significant impact, which would accelerate the horizontal flow of the groundwater. This will have an impact on the groundwater depletion. However, with extensive dewatering, it may collapse the adjoining ground. If the dewatering is taking place near any existing facilities, this collapsing of ground may lead to physical damage to the existing facility.	To address the adverse impacts arise by extensively draining water from groundwater lens by dewatering, steal piling would be used to enclose excavation area. As it is impossible to complete cutoff the horizontal flow, grate care needed to be taken on monitoring the surrounding soil. If subsiding occurs in the vicinity, the dewatering needed to be stop immediately. In case surface soil subsiding occurs, the depth of the steal pile needed to be adjusted before commencing the dewatering.
Hazardous material	Using heavy machinery for the construction work will raise extensive amount of emission from the vents of heavy machineries. It also uses heavy and dense fuel which may become a pollutant and may cause a disaster.	The hazardous material such as heavy oil and any flammable material shall be stored safely in barrels or appropriate containers with appropriate label and sign place outside of it. The used oil and other such material must be contained in appropriate containers with leakage proof, till it can be safely transported to Thilafushi island for disposal.
Noise pollution	Sound pollution could be prone during the construction phase.	No work during the night. All the heavy machineries should be well serviced and maintained to reduce the unnecessary emission and incomplete combustion of the fuel.
Work safety	Accidents could be prone during the construction phase.	When the workers and visitors present at the construction site, the safety helmet and safety shoo needed to be wear at all time. No personal shall climb a height no more than 12 feet without a safety belt. Sign boards, information boards and warning shall be displayed on the construction site in a way that people can see it easily. It shall be the responsibility of the site supervisor to supervise the safety of

Item	Issues/ Impacts	Mitigation
		the workers and stored oil and chemical at the site on daily basis.
Waste material	Waste disposal and accidental spills could be prone during the construction phase.	All the waste material produced during construction shall be disposed at Island Waste Management Center. After backfilling the foundations, the excess excavated material shall be disposed to the Thilafushi island. These materials shall not be disposed to any costal area or any eroded area without prior consent of Environmental Protections Agency (EPA)

(3) Operation of the facility

Item	Issues/ Impacts	Mitigation
Radio wave signal with low frequency.	During the operation of Digital Terrestrial Television Broadcasting Network, its function is sending, receiving and relaying a radio wave signal with low frequency. This band of the frequency cannot be detected by human. For the biodiversity present in these islands, these waves will not have any significant impact.	
Light impact to bird community	Each antenna will be equipped with indicator lights may have direct impact on bird community. Birds that are attracted to tower lights and aggregate in the lighting zone, circle the tower and collide with the tower, other birds, or fall to the ground from exhaustion	The indicator light on all the tower shall be red light and the light shell be lit continuously throughout the night. This will reduce the confusion arise in the bird community.

Source: Energy Consultancy Pvt. Ltd. (2018a[30] and 2018b[31])

The Environmental Monitoring Plan (EMP) is planned in the existing EIAs for Component 3 to monitor or control environmental effects. Environmental items to be monitored during construction and operation stages are planned. The concerned sections of the Environmental Monitoring Plan (EMP) in the existing EIAs for Component 3 are attached herewith as Attachments.

According to the Section 4 in the Environmental and Social Management Plan (ESMP), the necessary actions should be arranged and conducted for GCF's ESS Standards 1 to 8, and the ESMPs for these sites will be updated during the construction stage based on the detailed engineering design of the facilities, and to fill in the gaps with respect to the issues relating to ESS Standards 1 to 8.

[30] Energy Consultancy Pvt. Ltd. (2018a): EIA for the Proposed Digital Terrestrial Television Broadcasting Network Development Project (for 9 sites)
[31] Energy Consultancy Pvt. Ltd. (2018b): EIA for the Proposed Digital Terrestrial Television Broadcasting Network Development Project (for 3 sites)

5.3.4 Institutional Arrangements for the preparation of the ESIA and for implementing and monitoring the site-specific mitigation/management plans

The necessary institutional arrangement for the preparation of the ESIA shall be arranged as below, and the site-specific mitigation/ management plans shall be implemented and monitored according to the following table.

Table 5.12 Institutional arrangements for preparation of the ESIA for Component 3

Item	Maldives side	Japan side
Proponent	PMS	JICA (EE)
Environmental assessment (IEE/ ESIA	Have been conducted by PMS through consulting company. During project implementation, the PMU will update the ESMPs of the various facilities will be updated based on the approved detailed engineering design and to fill in the gaps in terms of issues relating to the GCF ESS Standards 1-8.	Have been reviewed by JICA (EE). The JICA ensure that ESMPs will be updated and will review the updated ESMPs.
Approval of ESIA	Have been approved by EPA, and EIA Decision Statements have been issued by EPA.	JICA will give clearance to the updated ESMPs.
Monitoring	Monitoring will be conducted by PMS.	Monitoring will be assisted and monitored by JICA (EE).

Source: JICA (2020)

5.4 Component 4: Development of basic data collection and sharing system related to climate change

5.4.1 Project activities that will be subject to assessments

For the sub-activities under Component 4, there are no activities, that will be subject to assessments.

Table 5.13 Necessary assessments for activities under Component 4

Activity		Necessary Assessment
Activity 4.1	Development of wave and sea level monitoring system	No need
Activity 4.2	Development of beach, coral reef, and land use monitoring system	No need

Source: JICA (2020)

5.4.2 Government Permitting requirements

There are no government permitting requirements required for all the activities under Component 4.

5.4.3 The scope of the assessments

There are no assessments required for all the activities under Component 4.

5.4.4 Institutional Arrangements for the preparation of the ESIA and for implementing and monitoring the site-specific mitigation/management plans

There are no institutional arrangement required for all the activities under Component 4.

5.5 Capacity building and training

In the Component 2, the consultant for the detailed design/construction supervision, procured by PMU, will play an important role for the capacity development of the human resources of the Maldives. Those national consultants are to be trained through on-the-job trainings, while working with technical international consultants.

If the human resources in the government agencies in the Maldives are sufficient, it is desirable to target the officials of ME, MNPI and the local council being dispatched to the Project as full-time PMU members, however, the government agencies are constantly understaffed, they may be dispatched as part-time basis. So that,

In order for that purpose, all project staff, especially the PMU, and members of the Project Board will be required to attend an induction training that: (i) covers substantive matters relevant to the ESMF requirements, (ii) explains the responsibilities of all the relevant parties for matters of monitoring, reporting and assurance related to social and environmental impacts and mitigation measures; and (iii) covers the operational mechanisms related to public transparency and accountability as well as those mechanisms to be used for ensuring coordination and information sharing among ME, JICA and GCF as well as with local councils, private sector actors and other partners with contract responsibilities

6. Budget for ESMF Implementation

A budget has been prepared for the implementation of the ESMF as follows:

Table 6.1 List of Tentative Budget for the ESMF

Item	Component	Sub item	Q'ty	Unit	Unit Cost (USD)	Amount (USD)	Remarks
Capacity building							
	1,2,3,4	Capacity building of project staff on E&S safeguards	1	L.S	10,000	10,000	Cost for PMU and Detailed Design.
Sub-total						10,000	
E&S Screening and Assessment							
	1,2,4	ESMF Updating and Auditing	1	L.S	20,000	20,000	Cost for PMU and Detailed Design.
	2	Conduct of ESIA	1	L.S	30,000	30,000	Maldives
		EIA support	1	L.S	30,000	30,000	Cost for Detailed Design (JICA)
		Assessment for sand borrowing sites	1	set	30,900	30,900	Cost for Detailed design
			1	set	20,000	20,000	Cost for Construction
	3	Conduct of ESIA	1	L.S		already done	
Sub-total						130,900	
Monitoring and Reporting							
	2	Water Quality Monitoring	20	set	4,000	80,000	Cost for Construction
	2	Sediment Sample Field Testing					
	2	Erosion and Sediment Control					
	2	Biodiversity					
	3	Groundwater monitoring	10	Set	500	5,000	Cost for Construction
	3	Vegetation monitoring	10	Set	500	5,000	
	3	Noise level monitoring	10	set	500	5,000	
Sub-total						95,000	
General ESMF Expenses							
	1,2,4	Hiring ES staff (PMU)	17	month	1,800	30,600	Cost for PMU
	1,2,4	Hiring ES staff (Pro A)	5	month	28,000	140,000	Cost for Detailed design
	1,2,4	Hiring ES staff (Pro B/ Environment)	15	month	1,800	27,000	Cost for Detailed design
	1,2,4	Hiring ES staff (Pro B: Social consideration)	18	month	1,800	32,400	Cost for Detailed design
Sub-total						230,000	
Stakeholder engagement							
	1,2,3,4	Consultation meetings	15	times	1,000	15,000	Cost for PMU
	1,2,3,4	Stakeholder meetings	7	times	1,000	7,000	Cost for PMU
Sub-total						22,000	
Total						487,900	

Source: JICA (2020)

Attachment

Attachment 1 Environmental Monitoring Plan in the EIA for the Proposed Digital Terrestrial Television Broadcasting Network Development Project (for 9 sites)

EIA for the Proposed Digital Terrestrial Television Broadcasting Network Development Project

Prepared by:

Energy Consultancy Pvt Ltd

Prepared for:

Public Service Media

13. Environmental Monitoring

The purpose of environmental monitoring plan (EMP) is to monitor or control the environmental effects of the proposed project. It is very vital to carryout proper Environmental Monitoring. Through the monitoring plane the potential negative impacts would be minimized. The unanticipated impacts that may occur during the construction period would also be mitigated through the monitoring. The purpose of the monitoring is to provide information that will aid impact management, and secondarily to achieve a better understanding of cause-effect relationship and to improve impact prediction and mitigation methods. The monitoring plane include noise level and groundwater.

During construction period, the following monitoring is conducted as shown in *Table 13.1*

Table 13.1: Monitoring Plan for Construction Period

Environmental Item	Major contents to be conducted or inspected)
Air quality	Measurement and Control of SPM, CO, No2, SO2
Waste	Ensuring of disposal to the designated landfill
Soil contamination	Inspection of oil leakage maintenance, Collection and disposal of soil contaminated
Noise, Vibration	Measurement and Control of noise and vibration
Protected area	-
Ecosystem	Management of dewatering and emission from construction equipment and machines
Livelihood	Management of interference of residents path
Working condition	Instruction of occupational safety and wearing of safety tools
Accident	Formulation and instruction of safety role, implementation of safety measures for residents

Apart from the parameters in *Table 13.1*, the *Table 13.2* shows the monitoring plan for both construction and operational phase of the project

Table 13.2: Monitoring Plan

Parameter	Indicators	Baseline	Method	Responsible / cost in USD	Reporting
Groundwater	Changes in Electrical Conductivity and Salinity	Baseline to be reestablished immediately after construction is complete	In-situ and laboratory measurement	Born by the constructor 500 dollars per trip	• Monitoring Report 1 – at the start of the project • Monitoring Report 2 –
Vegetation	Changes in the height of	Baseline to be reestablished	Onsite observation	Born by the proponent /	

	grass	immediately after construction is complete		operator 500 dollars per trip	during the project implementation
Noise level	Noise level at monitoring locations	Baseline to be reestablished immediately after construction is complete	Measuring noise levels using noise meter	Contractor/MHI 500 dollars per trip	• Monitoring Report 3 – 6 months after completion of the project

13.1. Monitoring Report

An environmental monitoring report would be compiled and submitted to the EPA six months after the completion of the project, based on the data collected for the monitoring the parameters included in the monitoring plan given in the EIA. The annual environmental monitoring report will include details of the site, strategy of data collection and analysis, quality control measures, sampling frequency and monitoring analysis and details of methodologies and protocols followed.

13.2. Cost of monitoring

It is estimated that during the project implementation phase, the monitoring cost would be US$ 15,000

Attachment 2 Environmental Monitoring Plan in the EIA for the Proposed Digital Terrestrial Television Broadcasting Network Development Project (for 3 sites)

EIA for the Proposed Digital Terrestrial Television Broadcasting Network Development Project

Prepared by:

Energy Consultancy Pvt Ltd

Prepared for:

Public Service Media

April 2018

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Protected area	-
Ecosystem	Management of dewatering and emission from construction equipment and machines
Livelihood	Management of interference of residents path
Working condition	Instruction of occupational safety and wearing of safety tools
Accident	Formulation and instruction of safety role, implementation of safety measures for residents

Apart from the parameters in *Table 13.1*, the *Table 13.2* shows the monitoring plan for both construction and operational phase of the project

Table 13.2: Monitoring Plan

Parameter	Indicators	Baseline	Method	Responsible / cost in USD	Reporting
Groundwater	Changes in Electrical Conductivity and Salinity	Baseline to be reestablished immediately after construction is complete	In-situ and laboratory measurement	Born by the constructor 500 dollars per trip	• Monitoring Report 1 – at the start of the project • Monitoring Report 2 –
Vegetation	Changes in the height of grass	Baseline to be reestablished immediately after	Onsite observation	Born by the proponent / operator	

		construction is complete		500 dollars per trip	during the project implementation
Noise level	Noise level at monitoring locations	Baseline to be reestablished immediately after construction is complete	Measuring noise levels using noise meter	Contractor/MHI 500 dollars per trip	• Monitoring Report 3 – 6 months after completion of the project

13.1. Monitoring Report

An environmental monitoring report would be compiled and submitted to the EPA six months after the completion of the project, based on the data collected for the monitoring parameters included in the monitoring plan given in the EIA. The annual environmental monitoring report will include details of the site, strategy of data collection and analysis, quality control measures, sampling frequency and monitoring analysis and details of methodologies and protocols followed.

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Annex-7：Summary of consultations and stakeholder engagement plan

(DRAFT)

Building Climate Resilient Safer Islands in the Maldives

Summary of Consultations and Stakeholder Engagement Plan

Table of Contents

Abbreviation

AE	Accredited Entity
EE	Executing Entity
EPA	Environment Protection Agency
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
GCF	Green Climate Fund
GRM	Grievance Redress Mechanism
ICZM	Integrated Coastal Zone Management
JICA	Japan International Cooperation Agency
LGA	Local Government Authority
ME/ MEE	Ministry of Environment (Ministry of Environment, Climate Change and Technology)/ Ministry of Environment and Energy
MGF	Ministry of Gender and Family
MGFSS	Ministry of Gender, Family and Social Services
MLG	Ministry of Law and Gender
MLSA	Maldives Land and Survey Authority
MMS	Maldives Meteorological Service
MNPI	Ministry of National Planning and Infrastructure
MSL	Mean Sea Level
NDMA	National Disaster Management Centre
NGOs	Non-governmental Organizations
PMU	Project Management Unit
PSC	Project Steering Committee
PSM	Public Service Media
SEO	Social Environmental Officer
SEP	Stakeholder Engagement Plan
WDC	Women Development Committee

Annex VII: Summary of Consultations and Stakeholder Engagement Plan

1 Introduction

This Summary of Consultation and Stakeholder Engagement Plan (SEP) has been prepared in support of a project proposal for "Building Climate Resilient Safer Islands in the Maldives (referred to hereinafter as "the Project")" by the Government of the Maldives to the Green Climate Fund (GCF). As this project is supported by Japan International Cooperation Agency (JICA) in its role as a GCF Accredited Entity (AE), this document has been prepared based on JICA's Social and Environmental Standards Procedure (2014) and GCF's guidance on stakeholder engagement (2019)[1].

1.1 Project Overview and Purpose

The Republic of Maldives consists of 26 atolls and 1,192 islands in the range of around 90,000 km^2 in the Indian Ocean, southwest of Sri Lanka. The Maldives is one of the world's most geographically dispersed sovereign states as well as the smallest Asian country by land area and population. The total area of national land is 298 km^2, where the length of the coastline is 644 km. The population of the country is 451,738 people with a population density of 1,506 people/km^2.The islands of Maldives are classified into 1) inhabited islands, 2) resort islands, and 3) industrial islands. The number of these inhabited islands is 188. Around 44% of residential areas and 47% of infrastructure facilities are located within 100 m of the coastline. As of 2017, there are 135 resort islands out of 1,192 islands.

Under such circumstances, the Maldives are considered as one of the most vulnerable countries with regard to climate change. The issues on climate change in Maldives are the following; i) increase in coastal disaster risk and land loss due to acceleration of coastal erosion influenced by climate change, ii) accelerated coastal erosion by artificial change in coastal areas, iii) loss of natural beaches due to coastal protection measures by hard facilities and the deterioration of coast/reef environment due to the decrease of people's interaction with the coast, and iv) insufficient understanding, analysis, impact assessment regarding coast and reef environment data as well as a lack of information sharing among concerned stakeholders.

As of 2014, 116 islands out of 188 inhabited islands have coastal erosion and 38% of which were categorized as serious coastal erosion situations. Under RCP8.5 scenario, the smaller the island area, the greater the rate of area loss is. For example, Maamendhoo Island of Laamu Atoll, having a land area of 0.2 km^2, will lose 36% of the land in the year of 2100. According to the tide level observation records over the past 33 years on Gan Island in Laamu Atoll, the mean sea level (MSL) of + 0.84 m was observed as the highest tide level, and an average tide level of 3.2 mm/year was observed. It is higher than the average sea level rise (1.7 mm/year, 1901-2010) in the world. The high tide level will frequently occur in the future due to the sea level rise caused by climate change, and inundation damage caused by high waves will occur on a daily basis.

Under such situations, the project focuses on the following four components.

Table 1.1 Project Components

Component		Funded by
Component 1: Establishment of Integrated Coastal Zone Management (ICZM)		
Activity 1.1:	Inventory study for risk assessment on present coastal and coral reef conditions	JICA
Activity 1.2:	Preparation of basic policy of the ICZM at the national level	JICA

[1] GCF, 2019: Sustainability Guidance Note: Designing and ensuring meaningful stakeholder engagement on GCF-financed projects

Component		Funded by
Activity 1.3:	Preparation of concrete ICZM Plan at representative Inhabitant Island as case study	JICA
Activity 1.4:	Capacity development and information sharing of the relevant organizations for establishment of the ICZM	JICA
Component 2: Implementation of coastal conservation/protection measures against coastal disasters		
Activity 2.1:	Detailed design of coastal conservation measures and capacity development of stakeholders	GCF, ‘JICA
Activity 2.2:	Implementation of coastal conservation/ protection measures	GCF, Maldives’s co-finance
Activity 2.3:	Implementation of beach maintenance, establishment of structure and capacity development of stakeholders	GCF, JICA
Component 3: Development of disaster warning and information dissemination		
Activity 3.1:	Installment of terrestrial digital broadcasting system	JICA
Activity 3.2:	Establishment of disaster early warning and information broadcasting system	JICA
Component 4: Development of basic data collection and sharing system related to climate change		
Activity 4.1:	Development of wave and sea level monitoring system	JICA
Activity 4.2:	Development of beach, coral reef, and land use monitoring system	JICA

Source: JICA (2019)

The proposed activities at each target area in the four components are shown below:

Table 1.2 Project Components at Each Island under Component 1

Atoll	Island	Project Component	Funding Source	Abbreviation
All	For all inhabited islands	Categorization into pattern by existing information and extraction of issues (Activity 1.1) Formulation of national-level ICZM (Activity 1.2)	JICA’s co-finance	
-	6-9 islands (2-3 islands per pattern x 2-3 patterns)	Field surveys to grasp and confirm the current situations (Activity 1.1)	JICA’s co-finance	
Laamu	Fonadhoo	Formation of island-level ICZM as the case study (Activity 1.3)	JICA’s co-finance	L-FND
	Gan	ditto	JICA’s co-finance	L-GAN

Source: JICA (2019)

Table 1.3 Project Components at Each Island under Component 2

Atoll	Island	Project Component	Funding Source	Abbreviation
Laamu	Fonadhoo	Beach nourishment and groins for the eastern coast (ocean side)	GCF fund	L-FND
	Maamendhoo	Beach nourishment and groins for the eastern and western side coast, and reclamation for the evacuation place at the north-western top	GCF fund	L-MMD
	Ishdhoo	Sea walls to protect historical sites at the ocean side coast at the north top	Maldives’s co-finance	L-ISD
	Gan	Sea walls to protect the historical sites at the ocean side at the middle of the island	Maldives’s co-finance	L-GAN
Addu	Meedhoo	Beach nourishment and groins for the northern coast (ocean side)	Maldives’s co-finance	A-MED

Atoll	Island	Project Component	Funding Source	Abbreviation
	Above 5 islands	Beach maintenance, establishment of structure and the capacity development of stakeholders (Activity 2.3)	JICA's co-finance	

Source: JICA (2019)

Table 1.4 Project Components at Each Island under Component 3

Activity / Facility	Quantity	Island / Atoll
Activity 3.1 (JICA's co-finance)		
Network operation center	1 atoll	Villingili (Male) (K)
Microwave relay stations	3 atolls	Maafushi (K), Feeali (F), Fiyoari (GDh)
Digital transmitting stations	18 atolls	Dhidhdhoo (Ha), Kulhudhuffushi (HDH), Funadhoo (Sh)*1, Manadhoo (N), Ungoofaaru (R), Eydhafushi (B), Naifaru (Lh)*2, Villingili (Male) (K), Felidhoo (V), Dhangethi (ADh), Nilandhoo (F), Gan (L), Guraidhoo (Th), Gadhadhoo (GDh), Thinadhoo (GDh)*3, Villigili (Ga), Fovammulah (Gn), Hithadhoo (S) *Note: *1: Funadhoo (Sh) was replaced with Maaungdhoo (Sh), *2: Naifaru (Lh) was replaced with Hinnavaru (Lh), *3: Thinadhoo (GDh) was cancelled.*
Activity 3.2 (JICA's co-finance)		
Establishment of disaster early warning and information broadcasting system	20 atolls	Ditto
Awareness raising on disaster warning and information	1 atoll	Gan (L)

Source: JICA (2019)

Table 1.5 Project Components at Each Island under Component 4

Atoll	Island	Project Component	Funding Source	Abbreviation
Haa Dhaalu	Hanimaadhoo	Installation of long-term monitoring and observation system of for waves and sea level	JICA's co-finance	
Male	Male			
Addu	Gan			S-GAN
-	Main inhabited islands	Introduction of beach profile, coral reef, and land use system (Activity 4.2)	JICA's co-finance	

Source: JICA (2019)

1.2 Stakeholder Engagement

This stakeholder engagement plan will apply to all components of the proposed project and all third parties are expected to adhere to this as they execute their assigned activities.

Objectives

The objectives of the stakeholder engagement plan are;

- To identify all project stakeholders including their priorities and concerns;
- To identify strategies for information sharing and communication to stakeholders as well as consultation of stakeholders in ways that are meaningful and accessible throughout the project cycle;
- To specify procedures and methodologies for stakeholder consultations, documentation of the proceedings and strategies for feedback;

- To establish an accessible, culturally appropriate, transparent and responsive grievance mechanism for the project; and
- To develop a strategy for stakeholder participation in the monitoring of project impacts and reporting or sharing of results among the different stakeholder groups.

2 Regulations and Requirements

The Stakeholder Engagement Plan is developed as a result of the need to comply with the Environmental Protection and Preservation Act (Act No. 4/93), Environmental Impact Assessment Regulation (2012), Gender Equality Act (2016), and JICA's Environmental and Social Consideration Procedure (2014). All these instruments unanimously advocate for the meaningful involvement of project stakeholders in the decisions that affect them, in participatory planning, and in transparent grievance management mechanisms.

3 Previous Stakeholder Engagement

During the preparation of the feasibility study, many kinds of stakeholders were consulted through coordination meetings, public consultation meetings, gender assessment consultation meetings, and individual meetings in order to discuss the design and scope of the Project and in order to collect their opinions (see Table 3.1).

During the various consultations, the project objective and activities were briefly explained by the study team, and the following topics were addressed by the participants and the findings incorporated into the feasibility study:

- Situations: coastal erosion, disappearance of sandy beach, vulnerability to climate change, inadequate waste management, necessity of capacity development on coastal management,
- Measures: desire to recover the sandy beaches (beach nourishment), unnecessity of revetment along the coasts, land reclamation for evacuation
- Gender: voluntary coast cleaning (by women), involvement of women development group to the coastal monitoring and cleaning, inequity on access to the coasts (to vulnerable persons).
- Disaster prevention: insufficient information dissemination system on the disaster, difficulties to evacuate for the vulnerable persons (women, children, disables).

Table 3.1 List of Meetings with Various Stakeholders

Atoll	Meeting	Location	Date	Participants	Remarks
Laamu	Public consultation meeting	Fonadhoo	25/Feb/2019	15	
		Fonadhoo	15/May/2019	15	
		Fonadhoo	10/Sep/2019	16	
		Ishdhoo	-	-	
	Gender assessment Consultation meeting	Fonadhoo (Female)	10/Sep/2019	13	
		Fonadhoo (Male)	27/May/2019	7	
		Maamendhoo (Female)	28/May/2019	13	
		Maamendhoo (Male)	28/May/2019	7	
		Ishdhoo (Female)	10/Sep/2019	12	
		Ishdhoo (Male)	10/Sep/2019	7	
Addu	Public consultation meeting	Hithadhoo	14/Feb/2019	13	
		Hithadhoo	15/May/2019	8	
		Hithadhoo	29/Aug/2019	31	
		Meedhoo	29/Aug/2019	11	

Atoll	Meeting	Location	Date	Participants	Remarks
	Gender assessment consultation meeting	Hithadhoo (Female)	20/May/2019	6	
		Hithadhoo (Male)	21/May/2019	12	
		Meedhoo (Female)	11/Dec/2019	10	
		Meedhoo (Male)	11/Dec/2019	8	

Source: JICA (2019)

4 Project Stakeholders

4.1 Stakeholder Analysis

Stakeholder engagement is essential at all stages of project, programme and policy development when the planned activities aim to trigger a paradigm shift, thus having major impact on society. Stakeholders in this context include all individuals and entities that are directly affected by the proposed activities or that can have an impact on their successful design and implementation. Who they are depends on the planned activities and national circumstances, but they usually include the national and international organizations from government, non-government, academic, policy makers, private sector and civil society. The Maldives needs to identify key stakeholders and their potential roles within the GCF to receive support for scaled up climate action in order to contribute towards national climate change priorities. There are two levels of stakeholders: i) Affected or likely to be affected by the project (project affected parties); and ii) May have an interest in the project (other interested parties). Table 4.1 presents the key stakeholders of GCF and potential areas of their engagement and involvement in the GCF process.

Table 4.1 Stakeholder Analysis Matrix

Key Stakeholder	Key Characteristics	Potential Roles in the Project
Ministry of Environment, Climate Change and Technology (ME) (former Ministry of Environment and Energy (MEE))	Overall responsibility for the management and development of environment and energy resources in the country.	Responsible for chairing the PSC. Main implementing agency (Executing Entity (EE)) of Component 2 in the project and Counterpart organization of Components 1, 3 and 4 in the project. .
Ministry of National Planning and Infrastructure (MNPI)	Overall responsibility for the planning and development of infrastructure in the country.	Involvement in the project as PSC member. Main implementing agency (EE) of Component 2 in the project (Maldives co-financed portions) and C/P organization of Components 1 and 4.
National Disaster Management Authority (NDMA)	Responsible for processes of hazard identification and mitigation, community preparedness, integrated response efforts, and recovery within a risk management context	Involvement in the project as PSC member. Supporting organization for Component 1 and C/P organization for Component 3.
Maldives Meteorological Service (MMS)	Responsible for the seismological and meteorological services in Maldives.	Involvement in the project as PSC member. Supporting organization for Component 1 and C/P organization for Components 3 and 4.
Public Service Media (PSM)	Responsible to provide television, radio and online	C/P organization for Component 3

Key Stakeholder	Key Characteristics	Potential Roles in the Project
	media services to the general public; along with creating media personnel.	
Maldives Land and Survey Authority (MLSA), MNPI	Responsible to centralize management of land Information and consolidate land research	C/P organization for Component 4.
Ministry of Home Affairs	Responsible for maintaining law and order in the Maldives at the national level	Jurisdiction authority of Public Service Media (PSM), which is the main C/P organization for Component 3.
Local Government Authority (LGA)	Administrative body for the local governments	Involvement in the project as PSC member. Supporting organization for Component 1.
Atoll Council	Administrative body for the atoll	Involvement in the project as PSC members
Island Council	Administrative body for the island	Involvement in the project as coordinators with PMU One of the main implementing agency of Component 1
Ministry of Gender, Family and Social Services (MGFSS) [2]	Overall responsibility for enforcement of laws and gender issues in the country	Supervision and management of gender action plan for the project
Local communities	All of the local communities are located along the coasts, so they are vulnerable to the climate change: coastal erosion. Such groups, who use coastal areas, as women, children, elders.	Direct beneficiaries and affected or likely to be affected by the project (project affected parties);. Participation in developing proposals and implementation of the project.
Women Development Committee (WDC)	Important opinion leader and activities for women group.	Direct beneficiaries of short, mid and long-term coastal management, and affected or likely to be affected by the project (project affected parties);. Participation in developing proposals and implementation of the project.
Non-government Organizations (NGOs), citizens groups	Important opinion leaders on the community level	Involvement in opinion collection and sharing to the project
Private sector (fishery, tourism developers)	Sustainable production in the areas.	Direct beneficiaries of short-, mid- and long-term coastal management, and affected or likely to be affected by the project (project affected parties), if any.

[2] When the new (current) government formed its cabinet on November 2018, they reformed the Ministry of Gender and Family (MGF) (the former Ministry of Law and Gender (MLG)) to the Ministry of Gender, Family and Social Services (MGFSS). https://presidency.gov.mv/Government/Cabinet/16 (accessed on March 11, 2021)

Key Stakeholder	Key Characteristics	Potential Roles in the Project
Japan International Cooperation Agency (JICA)		AE for the whole project. Main implementing agency (EE) of Components 1, 3 and 4 in the project, and one of activities in Component 2 will be implemented in line with Component 1

Source: JICA (2019)

4.2 Stakeholder Involvement in Project Management

Key stakeholders will be invited to the Project Steering Committee meeting for the Project, which will be held by the Project Steering Committee (PSC). In order for various agencies share the Project information and cooperate to strengthen the long-term and sustainable resilience of the national land against climate change, the PSC will be established in the Project thereby effectively implementing the components and facilitating discussions towards project replications in the country.

It is mandatory to involve all institutional stakeholders, according to their responsibilities, in the project preparation and implementation. The following strategic and operational stakeholders need to be consulted, involved, and represented in the coordination meetings for the Project:

- Ministry of Environment, Climate Change and Technology (ME) – Chairperson,
- Ministry of National Planning and Infrastructure (MNPI)
- Ministry of Gender, Family and Social Services (MGFSS)
- Local Government Authority (LGA)
- Laamu Atoll Council and Addu City Council
- National Disaster Management Authority (NDMA)
- Maldives Meteorological Service (MMS)
- Japan International Cooperation Agency (JICA)
- Project Management Units (PMUs)

For the implementation of the Project, the Project Management Unit (PMU) that is responsible for the implementation of each component will be established. The PMU is reporting to the PSC that oversights the whole Project via each of the Executing Entity (EE) such as ME, MNPI and JICA.

4.3 Stakeholder Involvement during Implementation

During the implementation of the Project, the Women Development Committees (WDC), Non-government Organizations (NGOs), citizens groups, shall be consulted through public consultation meetings and/or individual meetings.

Since all Project activities will be implemented along the coasts in the target islands and would require the active participation of the beneficiaries (mainly residents), stakeholder involvement and engagement would have to take place in all islands and communities involved in Project activities.

5 Stakeholder Engagement Plan

The stakeholder engagement plan (SEP) for directly financed projects should have:

- A detailed process for effective engagement with communities and individuals, including vulnerable and marginalized groups and individuals, who are affected or

potentially affected by proposed GCF-supported activities, including co-financed activities;

- A description of how information will be disclosed; the process by which meaningful consultation and informed participation will occur in a culturally appropriate and gender responsive manner; and, in certain circumstances, steps that will be taken to obtain the fee, prior and informed consent of indigenous peoples; and
- A process for receiving and managing concerns and grievances at the project level that has been designed in consultation with stakeholders and complements the AE's grievance redress mechanism and GCF Independent Redress Mechanism.

The stakeholder engagement plan will focus on through the project period, from the feasibility study of the project through implementation phase. The SEP should be confirmed together with the feasibility study, the Environmental and Social Management Framework (ESMF) and Gender Assessment/Gender Action Plan, which elaborate on the interaction between the different institutions during the implementation phase. The SEP will mainly focus on project engagement with lower level stakeholders that are not part of the project organization; i.e., PSC and PMU. The main activities include the following:

- Mobilization of beneficiaries from the project commencement to implementation (information, sensitization, participation);
- Identification of critical issues (erosion, land, vulnerable groups);
- Grievance management;
- Supervision and monitoring during implementation stage; and
- Implementation of the Environmental and Social Management Framework.

Engaging relevant stakeholders increases their ownership of the project, and can contribute to replicating and/or transferring actions, methodologies or technologies that are employed in the activity. From the proposal preparation stage, efforts are undertaken to engage stakeholders during project preparation and how engagement should continue during implementation. In order to achieve such continued engagement, feedback mechanisms can be built into the project design. In addition, ME can play an important role in facilitating stakeholder engagement from an early stage.

Engagement of relevant stakeholders in all stages is key to successful design and implementation of activities.

5.1 Objectives of the SEP

The objectives of the SEP are:

- To offer opportunities for stakeholders to raise their concerns and submit their opinions.
- To create avenues for complaints handling and grievance management.
- To create opportunities for information sharing and disclosure.
- To create a mechanism for giving feedback to the stakeholders.
- To create an avenue for participatory project impacts monitoring.
- To foster strong project community relationships.
- To promote social acceptability of the project.
- To ensure meaningful consultation and the consideration of expectations and concerns into the implementation arrangements for the project.

5.2 Stakeholder Engagement Process

In order to conduct more meaningful stakeholder engagement, the following points are to be considered.

- Processes are designed to be flexible, adapting and responding to national and local conditions and activity requirements;
- Project budgets include resources for stakeholder engagement activities, including salaries or fees for qualified staff and/or consultancy expertise to carry them out;
- Engagement begins early enough to identify key issues and influence related decisions;
- Communication flows two ways, allowing all sides an opportunity to listen, exchange views and have their concerns addressed;
- Processes are inclusive; and should take into account that women, men and members of different ethnic groups may have different needs and perspectives, as well as different approaches to engaging and decision-making;
- Engagement activities are free from coercion or manipulation;
- Meetings are well documented to keep track of the information disclosed, the groups and individuals who have been engaged, when and where meetings took place, key issues raised, commitments and agreements, and how stakeholder concerns have been addressed; and
- Clear and mutually agreed processes are well prepared for timely reporting of actions taken, with clarification regarding upcoming steps.

Table 5.1 summarizes the stakeholders for the project and details of the stakeholder engagement plan including the type of stakeholder based on ESS10 classification, anticipated issues and interest, stages of involvement, methods of involvements, proposed communications and responsible party.

Table 5.1 Stakeholder Engagement

#	Stakeholder	Type of Stakeholder	Anticipated interests	Stage of Involvement	Methods of Involvement	Proposed Communications/ Information Disclosure	Responsible Parties
1	Ministry of Environment, Climate Change and Technology (ME)	Interested Party	- Reduction of threats from natural disaster - Long-term maintenance	- During project preparation - During site selection - While undertaking any feasibility studies - While preparing ESIA/ESMP - During project implementation	- Project Steering Committee - Consultative meetings	- Project updates shared with ME routinely - Identifying a project focal point from the councils for easy communications regarding the project. - Make arrangements to ensure that project information is available from ME	PMU, ME, JICA
2	Ministry of National Planning and Infrastructure (MNPI)	Interested Party	- Reduction of threats from natural disaster - Long-term maintenance - Impacts on overall development policy of the government	- During project preparation - During site selection - While undertaking any feasibility studies - While preparing ESIA/ESMP - During project implementation	- Project Steering Committee - Consultative meetings	- Project updates shared with ME routinely - Identifying a project focal point from the councils for easy communications regarding the project. - Make arrangements to ensure that project information is available from ME	PMU, ME, JICA
3	National Disaster Management Authority (NDMA)	Interested Party	- Installation of necessary facilities - Development of necessary programms	- During project preparation - During site selection - While undertaking any feasibility studies - While preparing ESIA/ESMP - During project implementation	- Project Steering Committee - Consultative meetings	- Project updates shared with ME routinely - Identifying a project focal point from the councils for easy communications regarding the project. - Make arrangements to ensure that project information is available from ME	PMU, ME, JICA
4	Maldives Meteorological Service (MMS)	Interested Party	- Obtain the necessary data - Installation of necessary facilities	- During project preparation - During site selection - While undertaking any feasibility studies - While preparing ESIA/ESMP - During project implementation	- Project Steering Committee - Consultative meetings	- Project updates shared with MMS routinely - Identifying a project focal point from the councils for easy communications regarding the project. - Make arrangements to ensure that project information is available from MMS	PMU, ME, JICA
5	Public Service Media (PSM)	Interested Party	- Installation of necessary facilities - Development of necessary programms	- During project preparation - During site selection - While undertaking any feasibility studies - While preparing ESIA/ESMP - During project implementation	- Consultative meetings	- Project updates shared with MMS routinely - Identifying a project focal point from the councils for easy communications regarding the project. - Make arrangements to ensure that project information is available from MMS	PMU, ME, JICA

#	Stakeholder	Type of Stakeholder	Anticipated interests	Stage of Involvement	Methods of Involvement	Proposed Communications/ Information Disclosure	Responsible Parties
6	Maldives Land and Survey Authority (MLSA), MNPI	Interested Party	- Impacts on land use	- During project preparation - While undertaking any feasibility studies - During project implementation	- Consultative meetings	- Project updates shared with ME routinely - Identifying a project focal point from the councils for easy communications regarding the project. - Make arrangements to ensure that project information is available from ME	PMU, ME, JICA
7	Ministry of Home Affairs	Interested Party	- Installation of necessary facilities - Development of necessary programms	- During project preparation - While undertaking any feasibility studies - During project implementation	- Consultative meetings	- Share project information through MMS	PMU, ME, JICA
8	Environment Protection Agency (EPA)	Interested Party	- Environmental impacts due to the project	- During site selection - During preparation of ESIA/ESMP - During monitoring of ESIA/ESMP	- Consultative meetings	- Share project information - Submit to attain ESIA/ESMP approval - Submit ESIA/ESMP monitoring	PMU, ME, JICA
9	Local Government Authority (LGA)	Interested Party	- Impacts on councils (indirect)	- During site selection - During any project implementation	- Project Steering Committee - Consultative meetings	- Project updates shared with the ministry routinely -	PMU, ME, JICA
10	Atoll Council	Interested Party	- Reduction of threats from natural disaster - Long-term maintenance	- During site selection - During preparation of ESIA/ESMP - During any project implementation	- Project Steering Committee - Consultative meetings	- Project updates shared with the council routinely - Identifying a project focal point from the councils for easy communications regarding the project.	PMU, ME, JICA
11	Island Council	Affected Party	- Reduction of threats from natural disaster - Long-term maintenance	- During site selection - During preparation of ESIA/ESMP - During any project implementation	- Consultative meetings	- Project updates shared with the council routinely - Identifying a project focal point from the councils for easy communications regarding the project.	PMU, ME, JICA
12	Ministry of Gender, Family and	Interested Party	- Reduction of adverse impacts related to gender	- During site selection - During preparation of ESIA/ESMP	- Consultative meetings	- Project updates shared with the ministry routinely	PMU, ME, JICA

#	Stakeholder	Type of Stakeholder	Anticipated interests	Stage of Involvement	Methods of Involvement	Proposed Communications/ Information Disclosure	Responsible Parties
	Social Services (MGFSS)		by the project implementation	- During any project implementation			
13	Local communities	Affected Party	- Reduction of threats from natural disaster - Long-term maintenance - Any additional direct and indirect benefits	- During site selection - During preparation of ESIA/ESMP - While undertaking any feasibility studies for the project - During ESIA monitoring - During any project implementation	- Public Consultation meetings	- Project Information Leaflets - Project information - Provide information regarding grievance redress mechanism - Awareness sessions on ICZM - Information sessions regarding the project	PMU, ME, JICA
14	Women Development Committee (WDC)	Affected Party	- Reduction of threats from natural disaster - Long-term maintenance - Any additional direct and indirect benefits	- During site selection - During preparation of ESIA/ESMP - While undertaking any feasibility studies for the project - During ESIA monitoring - During any project implementation	- Public Consultation meetings	- Project Information Leaflets - Project information - Provide information regarding grievance redress mechanism - Awareness sessions on ICZM - Information sessions regarding the project	PMU, ME, JICA
15	Non-government Organizations (NGOs), citizens groups	Interested Party	- Contribution of the project to increase awareness	- During project implementation	- Provide project information and updates	- Project leaflets and newsletters sent to NGOs routinely	PMU, ME, JICA
16	Private sector (fishery, tourism developers)	Affected Party	- Reduction of threats from natural disaster - Any additional direct and indirect benefits	- During project implementation	- Provide project information and updates	- Project information - Provide information regarding grievance redress mechanism -	PMU, ME, JICA
17	Japan International Cooperation Agency (JICA)	Interested Party	- Proper project implementation	-	- Project Steering Committee	-	

Source: JICA (2019)

5.3 Incorporation of Views of Vulnerable Groups

5.3.1 Definition and Identification of Vulnerable Groups

The people who are disadvantaged compared with mainstream population in terms of their share of the benefits or their burden of the costs from the project; e.g. elderlies, women- headed households, the poorest of the poor, indigenous people, household with small children, people with disabilities, etc. are defined as the vulnerable groups.

5.3.2 Women

Traditionally, the communities of the Maldives have depended on natural resources, particularly marine resources, for their food and livelihood security. Maldivian men have proven their skills as fishermen, harvesting from the lagoons and oceans. Maldivian women have traditionally played a major role in agricultural, household production, childcare, drying and processing of fish, and producing handicrafts.

The project will assist women in order for them to benefit from the project activities either directly or indirectly. The project needs to take into account the situation of women in the Maldives. Through the Gender Assessment Consultation Meetings which was held for each target island, the project has found the various limitations that women experience as follows:

(1) Access to business opportunity

- Even in economic organizations, the involvement of men is greater than that of women. It was suggested that the reason could be that women are the primary care givers in the household.
- Regarding the community-based management of the site, the workload would increase for women in terms of maintaining the cleanliness of the area. Should the area be appropriate, there would be business opportunities which men would grab.

(2) Access to decision making

- In the family, women as well as men decide to buy what they need in case of those of inexpensive items by themselves, however, in case of buying expensive items, women do need to wait for the decision of men.
- One-third of the government staff are women. However, women make up only a few percentage of the local council representatives, and seats in national parliament.

5.4 Incorporation of Proceedings into Management Decisions

The results from the public consultation meetings, gender assessment consultation meetings and information sharing meetings will be shared with the project management organization (PSC and PMU) as background information to facilitate decision making. The information and comments from the target groups will be used as basis on which interventions will be developed or revised.

During project inception stage, project-related documents (annual plan, etc.), technical guidelines, and monitoring and evaluation system (complaints mechanisms, ESMF, Gender Action Plan, etc.) will be prepared or refined. Also, gender aspects shall be included while preparing the said documents.

6 Resources and Responsibilities

The SEP implementation is necessary for the implementation of the ESMF. As noted in the feasibility study of the project (Annex 2 of the Funding Proposal), the composition of the PMU personnel includes a Social Environmental Officer (SEO), who will manage overall environmental and social consideration issues, including gender-related issues and stakeholder engagement. The staff of the local councils will maintain close relationships with all stakeholders in each target area, including the directly affected communities.

As one social environmental specialist will be hired as one of the members of PMU, all the costs will be borne by the GCF funds. Due to the necessity, short-term consultants are to be mobilized to handle the stakeholder engagement and gender issues.

7 Timetable

The following table attempts to give indicative deadlines within which the SEP activities should be completed if it is to be effective.

Table 7.1 Time table for the Stakeholder Engagement Plan

No.	Activity	Project Phase	Timeline	Responsibility	Location
1	Submission of ESMF report to GCF	Planning	2020	ME, JICA	-
2	Publication of ESMF on JICA Website	Planning	2020	ME, JICA	-
	Conduct of detailed ESIAs	Planning	2021	ME, JICA	-
	Disclosure/publication of the ESIAs	Planning	2021	ME, JICA	
3	Establishment of the Project Steering Committee (PSC)	Planning	2021	ME, MNPI, JICA	Male
4	Establishment of the Project Management Unit (PMU) for GCF-financed project and Maldives co-financed project	Inception	2021	ME, MNPI	Male
5	Appointment of Social Environment Officer (SEO) for PMU	Inception	2021	PMU	Male
6	Mobilization of Atoll Councils/ Island Councils (through kick-off meetings)	Inception	2021	ME, PMU	Laamu/ Addu
7	Formulation of grievance mechanism	Inception	2021-2022	PMU	Male
8	Identification and training of target council officers being in charge of community mobilization	Inception	2021-2022	PMU	Laamu/ Addu
9	Identification of stakeholders and creation of stakeholder database	Inception	2021-2022	PMU (inputs from Councils)	PMU
10	Community mobilization and sensitization	Inception	2021-2022	PMU, Councils	Atolls/ Islands
11	Update of Gender Assessment and Gender Action Plan	Implementation	2022-2027	PMU, Consultant	Male
12	Periodic stakeholder update meetings (for atolls)	Implementation	2022-2027	PMU, Councils	Atolls/ Islands
13	Periodic stakeholder meetings (for central)	Implementation	2022-2027	PSC, PMU JICA-1&4, JICA-3	Atolls/ Islands
14	Monthly grievance resolution sessions	Implementation	2022-2027	PMU, JICA-1&4, JICA-3, affected Councils	Atolls/ Islands
15	Quarterly monitoring of the Implementation of agreed upon strategies	Implementation	2022-2027	PMU	Atolls/ Islands

Source: JICA (2019)

Among the necessary activities for the SEP, the central-level stakeholder meetings will be held seven times during the project period as shown below.

Table 7.2 Detail plan of the central-level Stakeholder Meetings

Meeting	Timing (Tentative)	Discussion Topics (Tentative)
1st Stakeholder Meeting	Q3 2021	Plan of the overall project, including ESIAs
2nd Stakeholder Meeting	Q2 2022	Plan of detailed survey and design of Component 2
3rd Stakeholder Meeting	Q1 2023	Result of detailed survey and design of Component 2 Plan of implementation of coastal protection/prevention measures of Component 2
4th Stakeholder Meeting	Q2 2024	Results of the overall activities of Component 1
5th Stakeholder Meeting	Q3 2025	Plan of community-based beach monitoring of Component 1
6th Stakeholder Meeting	Q1 2026	Result of implementation of coastal protection/prevention measures of Component 2
7th Stakeholder Meeting	Q3 2027	Result of overall project

Source: JICA (2019)

8 Grievance Mechanism

8.1 Grievance Mechanism

A grievance redress mechanism becomes integral part of stakeholder engagement process. The mechanism needs to take into special consideration vulnerable groups and how easy access to the grievance mechanism is ensured to such parties. Handling of grievance is the responsibility of PMU, EEs (JICA-1&4 and JICA-3) and the local councils.

The objectives of the grievance mechanism will be:

- To create a mechanism where affected people can address their grievances or complaints; and
- To create a mechanism through which the project will be able to pick-up all the complaints and grievances. The project will systematically, promptly and exhaustively respond to the peoples' complaints.

A three-tier system will be established under the project to ensure a fair process for addressing grievances. This Grievance Redress Mechanism (GRM) is developed based on the experience of ME and JICA.

8.2 Complaints Handling Process (Project Management and Implementation)

Grievances related to project implementation should be resolved within the project implementation structure through a three-tier system. All affected stakeholders will be expected to submit their complaints to either of the following collection points as of Tier 1:

- Community leader
- Local councils (atoll/ island)

All the grievances or complaints by a group of people who have been directly affected by the adverse impacts through the failure of the project will be filed and registered in the PMU's database by the LGA officer. The concerned officers will then investigate the validity of the grievance and plan the way forward. A factfinding mission will be conducted together with the

complainant, community leader and a PMU officer (Atoll based officer/ SEO). Proposals on how the grievance can be resolved will be discussed and the complainant will be advised accordingly. The GRM information will be given to the stakeholders during the project consultative meetings. Furthermore, the GRM will be displayed in council notice board, website and a notice board highlighting the process will be installed in each project site.

Table 8.1 Three-tier Grievance Redress Mechanism

Tiers of Grievance Mechanism	Nodal Person for Contact	Communication and other facilitation by the project	Timeframe to address grievance
First Tier (Tier 1): (Atoll/City Council/ Island Council/ Community Advisory board)	Atoll Councils/ City Council will be the first point of contact for any grievances. Once the community advisory board is formed, complaints received by the Atoll/ City council will be sent to the community advisory board for advice.	- In the Council Offices and at the project locations, there will be an Information Board listing the names and contact telephones/emails. - Grievances can be addressed informally by contacting the Councils. - If the grievance cannot be resolved informally, an aggrieved party must submit a complaint on the Tier 1 Complaint Form. A copy of the form should be provided to the aggrieved party as evidence of receipt. The complaint form should be available from the website of ME and from the Atoll/ City Councils. - For those who cannot write, a council staff will assist them to fill the form. - The council may pass the grievance to the Community Advisory Board for comments and input. - A meeting (if required, a public meeting) must be held by the Community Advisory Board to discuss a complaint submitted on a Complaint Form. - If the complaint is resolved within 15 days, the Atoll/ City Council must communicate the decision to the aggrieved party in writing. - The aggrieved party must acknowledge the receipt of decision and submit their agreement or disagreement with the decision within 10 days. - If no acknowledgement is submitted from the aggrieved party, then the decision will be considered as accepted. - If a complaint requires more time to address, this requirement must be communicated to the aggrieved party in writing and the aggrieved party must consent and sign-off the request for the extension to take effect. An extension can be made to an additional 15 days.	15 days
Second Tier (Tier 2): (Ministry of Environment and Energy)	Ministry of Environment, Climate Change and Technology (ME), Social Environmental and Gender Office (SEGO) at the Project Management Unit (PMU) will be the focal point.	- If the grievance cannot be resolved through Tier 1, an aggrieved party must submit a complaint on the Tier 2 Complaint Form. A copy of the form should be provided to the aggrieved party as evidence of receipt. The complaint form should be available from the website of ME and the Atoll/ City Councils and from city council office. - ME will forward the grievance to PMU. - PMU will screen the grievance to determine if it is related to the GCF project. If it is unrelated, the aggrieved party must be notified in writing and the way forwarded must be outlined to them including the necessary government institutions to follow up, like the Police. - Social Environmental and Gender Officer at the PMU will be the contact person in processing a grievance through the Tier 2. - If required, the ME must arrange a public meeting to address the Tier 2 grievance and notify the nature of the grievance and the meeting venue to the aggrieved party.	15 days

Tiers of Grievance Mechanism	Nodal Person for Contact	Communication and other facilitation by the project	Timeframe to address grievance
		- ME may also visit the site and hold onsite discussions and meetings. - The PMU will be responsible to ensure that there is no cost imposed on the aggrieved person, due to the grievance mechanism at the second tier. - If the complaint is resolved within 15 working days, the PMU must communicate the decision to the aggrieved party in writing. - The aggrieved party must acknowledge the receipt of decision and submit their agreement or disagreement with the decision within 10 days. - If no acknowledgement is submitted from the aggrieved party, then the decision will be considered as accepted. - If the grievance is not resolved to the satisfaction of the aggrieved party within 15 working days of submission of the grievance to Tier 2 then the aggrieved party may notify the ME, in writing, of the intention to move to Tier 3.	
Third Tier (Tier 3): Judiciary Power / Assistance to Vulnerable Persons beyond the Project's Grievance Redress Mechanism	An individual has the option of going to established judiciary system of the country	- The legal system is accessible to all aggrieved persons. - Assistance from the GCF project is available only for vulnerable person(s) as per this grievance mechanism. - In cases where vulnerable person(s) are unable to access the legal system, the Attorney General´s office will provide legal support to the vulnerable person(s). The PMU must assist the vulnerable person(s) in getting this support from Attorney General´s Office. PMU must also ensure that there is no cost imposed on the aggrieved person if the person belongs to the vulnerable groups. The list of vulnerable groups is as defined in the footnote but may be further defined by ME. - The verdict of the Courts will be final.	As per the judicial procedure of the Maldives.

Source: JICA (2019)

9 Participatory Monitoring and Evaluation

Successful stakeholder engagement plans shall include a proper monitoring process to understand not only how well engagement activities are working and why, but also to respond to unexpected events that may introduce new environmental and social risks and impacts or elevate the level of risks and impacts.

Evaluation should be included as part of the overall engagement strategy, with monitoring activities being undertaken at regular intervals involving communities and stakeholders through participatory processes throughout the project life.

The approach of the monitoring of stakeholder engagement should align with key provisions of the GCF Environmental and Social Policy, Gender Policy, JICA's Environmental and Social Consideration Guideline, and the ESMF of the project.

Monitoring and evaluation of stakeholder engagement processes and outputs consider the following factors:

- Number and diversity of stakeholders participating in various engagements;
- Feedback from stakeholders on the effectiveness of the plan, satisfaction with the level of engagement and outputs, and disclosure and provision of information about the activity;
- Completion of agreements and commitments; and ·

- Extent of involvement of women, vulnerable or minority groups.

The monitoring of stakeholder engagement will be conducted jointly by the PMU, EEs and the beneficiaries of the project to assess to what extent impacts have incurred as planned and the effectiveness of mitigation measures.

Evaluation of the monitoring results will be conducted by PMU and EEs in accordance with the ESMF. The evaluation criteria include (a) which aspects of the engagement plan are contributing to success or failure, and (b) which aspects need improvement.

The design of the monitoring and reporting procedures, including the evaluation criteria, will be prepared in parallel with the preparation of the first annual work plan for the project.

Annex-8-a : Gender assessment

Building Climate Resilient Safer Islands in the Maldives

Gender Assessment

Table of Contents

Abbreviation

CEDAW	UN Convention on the Elimination of All Forms of Discrimination
DHS	Demographic and Health Survey
EFA	Education for All
GCF	Green Climate Fund
GDI	Gender Development Index
GGGI	Global Gender Gap Index
GII	Gender Inequality Index
HDI	Human Development Index
ICCPR	International Covenant on Civil and Political Rights
ICESCR	International Covenant on Economic, and Social and Cultural Rights
ICZM	Integrated Coastal Zone Management
JICA	Japan International Cooperation Agency
LFP	Labor Force Participation
MDGs	Millennium Development Goals
ME/ MEE	Ministry of Environment, Climate Change and Technology/ Ministry of Environment and Energy
M&E	Monitoring and Evaluation
MGFSS	Ministry of Gender, Family and Social Services
MLSA	Maldives Land and Survey Authority
MMS	Maldives Meteorological Service
MNPI	Ministry of National Planning and Infrastructure
NDMA	National Disaster Management Centre
NMCC	National Ministerial Coordination Committee
OP-CEDAW	Optional Protocol to UN Convention on the Elimination of All Forms of Discrimination
PMU	Project Management Unit
PSC	Project Steering Committee
PSM	Public Service Media
SAARC-UNIFEM	South Asian Association for Regional Cooperation - United Nations Fund for Women
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
UNDRR	United Nations Office for Disaster Risk Reduction
WDC	Women Development Committee

Annex VIII: Gender Assessment and Project/Programme-level Action Plan

1. Introduction

This gender assessment aims to provide an overview of the gender situation in the Maldives, with a specific focus on protecting and increasing the resilience of groups in vulnerable situations, particularly women and children from the adverse impact of climate change on rising sea levels and coastal erosion in Addu and Laamu Atolls, which are main atolls for the project "Building Climate Resilient Safer Islands in the Maldives (hereinafter referred to as "the Projecr"". The assessment will highlight gender issues that have a bearing on the Project, as well as opportunities to empower women through gender responsive adaptation, mitigation, and risk reduction measures. The assessment is based on both primary and secondary sources. Primary sources include information collected from the implementation of gender assessment consultation meetings. Secondary sources include research and studies conducted by the Government of the Maldives, donor agencies, multilateral development banks, academia, and civil society. Data gathering activities will focus on:

(1) Aligning the proposed project approach with the Maldives's national priorities as reflected in the Seventh National Development Plan 2006-2010 and the Manifesto of the Maldivian Democratic Party – Alliance 2008-2013.
(2) Synthesizing and building on information obtained and lessons learned from past interventions and gender assessments.
(3) Engaging women who might be potentially affected by project activities which includes their voice into this assessment, as well as that of other vulnerable groups (the elderly, disabled persons, and the children).
(4) Formulating gender sensitive project output and outcome indicators.
(5) Designing mainstreaming and equity activities targeting women which promotes their agency and leadership.

2. Resilience of Communities in Vulnerable Situations in the Addu and Laamu Atolls and their Response to the Increasing Threat of Rising Sea Levels and Coastal Erosion

The Republic of Maldives, one of the small island developing states (SIDS) is located in the Indian Ocean, covering a land area of 298 km^2 in a territory of over 90,000 km. Thus, it is one of the most geographically dispersed nations in the world, consisting of approximately 1,200 islands within 19 administrative atolls.

The Maldives's vulnerability to climate change and extreme weather events remains as a serious concern, as a low-lying archipelago, with an average elevation of 1.5 m over the sea-level, where the country has also been identified as one of the most vulnerable to threats posed by climate change and more than 80% of inhabited islands are easily suffered from the serious coastal erosion. Lack of disaster resilience and environmental sustainability is also perceived as threat to development.

While the country has rarely experienced major disasters, with the exception of the Indian Ocean Tsunami in 2004, small-scale and recurrent hazards such as increased rainfall, cyclonic winds, storm surges, saltwater intrusion, coastal floods, and erosions have been causing damages, losses of natural resources, and social entities in the recent years. Over 90% of the islands have been reported to flood annually, 97% are reporting shoreline erosion, and 64% of the islands experiencing erosion reported the issue as severe (Nachmany, et al., 2015).

The Maldives has experienced rapid economic development in the recent years, largely as a result of nature-based tourism, and is now classified as a middle-income country. Fisheries and tourism are two

main pillars of the Maldives's economy and there are a few manufacturing sectors in this country, wherein almost all kinds of materials are needed to be imported from other countries. Also the scattered islands, consisting in more than 1,000 islands, are also one of the vulnerabilities of the Maldives. Apart from the local populations, tourists, who may lack knowledge of local hazards, are also equally exposed to sudden-impact events in remote resort islands which depend on their own infrastructure (Nguyen, et al., 2016).

The frequencies, magnitude, and ranges of the natural disaster would be increased due to the climate change and global warming. Ocean acidification and sea surface temperature anomalies are also one of the causes to the natural disaster and adverse effects to the natural environment, especially to the vulnerable marine biodiversity. Environmental degradation is another significant issue which increases the communities' exposure; for example, the expansion of land surface for the population growth has resulted in extensive coral mining and degradation of natural defenses, thus increasing the risks of coastal flooding (UNDRR, 2019)[1].

Therefore, the disaster risk reduction measures should be established especially for all the inhabited islands (187 islands in 2014) and resort islands (128 islands in 2104) in order to tackle with the natural disaster.

3. Comparative Summary of Key Gender Equality Indicators

Key Gender Equality Indicators for Maldives

Table 3.1 Key Gender Equality Indicators for Maldives

(1) Population of Maldives

Type of Population	Total	Male	Female
Total	407,660	230,453	177,207
Residents	402,071	227,749	174,322
Maldivians (Residents)	338,434	171,962	166,472
Foreigners	63,637	55,787	7,850
Non-residents	5,589	2,704	2,885

Source: National Bureau of Statistics (2014) Population & Housing Census 2014

(2) Population by age category of Maldives

Type of Population	Total	Male	Female
All ages	402,071	227,749	174,322
0-14	94,613	48,920	45,693
15-24	79,246	45,317	33,929
25-64	211,721	124,756	86,965
over 64	16,491	8,756	7,735

Source: National Bureau of Statistics (2014) Population & Housing Census 2014

(3) Other main factors

Items	Data
Life Expectancy at Birth	Female: 74.8, Male: 73.1
%/Number of male or female-headed households	Female: 43.0%, Male: 56.4%, not stated: 0.7%

[1] UNDRR, 2019: Disaster Risk Reduction in Republic of Maldives: Status Report 2019. Bangkok, Thailand, United Nations Office for Disaster Risk Reduction (UNDRR), Regional Office for Asia and the Pacific

Items	Data
Infant Mortality Rate (under 1)	8 per 1,000 live births
Mortality rate (under 5)	10 per 1,000 live births
Labour Force Participation	Total: 63.2%, Females: 47.4%, Males: 78.5%
Government employees	Total: 24,883, Females: 13,336 (53%), Males: 11,547 (47%)
Unemployment Rate	Total: 5.21%, Females: 5.91%, Male: 4.79%
Enrolment in Primary Schools	Total: 37,519, Females: 18,271 (49%), Males: 19,248 (51%)
Enrolment in Lower Secondary Schools	Total: 16,434, Females: 8,104 (49%), Males: 8,330 (51%)
Enrolment in Higher Secondary Schools	Total: 6,294, Females: 3,177 (50%), Males: 3,117 (50%)
Enrolment in Diploma	Total: 4,625, Females: 2,917 (63%), Males: 1,708 (37%)
No. of males/ females in Parliament	Total: 87, Females: 4 (5%), Males: 83 (95%) (19th Parliament) Total: 85, Females: 5 (6%), Males:80 (94%) (18th Parliament)
Gender-based Violence (GBV)	

Source: National Bureau of Statistics (2014)Population & Housing Census 2014

4. The Gender Context in the Maldives

Compared to most of South Asia, Maldivian women face little discrimination in basic aspects of life such as education, health, and survival; however, gender inequality still exists. Specifically, the Maldives exhibits a classic case of a relatively prosperous country where gender inequalities in basic well-being are largely diminished but where other social and cultural gendered restrictions, especially on women's roles within and outside the home, persist and may be expanding.[2]

Furthermore, poverty and climate change are interrelated. The poorest and most disadvantaged groups are more liable to depend on climate sensitive livelihoods such as agriculture and fishing which makes them particularly vulnerable to the impacts of climate change.[3] In rural areas, these difficulties are compounded by fewer opportunities for work in the formal sector, high rates of illiteracy, restricted mobility, and limited access to resources, services, and decision-making. All of these inequalities combine to diminish their adaptive capacity.

4.1 Gender Inequality Index

Several indices have developed to quantify the concept of gender inequality. The United Nations Development Programme uses the Gender Inequality Index (GII) and Gender Development Index (GDI).[4]

GII presents a composite measure of gender inequality using three dimensions: reproductive health, empowerment, and the labor market. The GII can be interpreted as the loss in human development due to inequality between female and male achievements in the three GII dimensions. The Maldives had a GII of 0.360 in 2018 and ranks 81 out of 162 countries assessed.[5]

[2] El-Horr, Jana, and Rohini Prabha Pande. 2016. Understanding Gender in Maldives: Toward Inclusive Development. Directions in Development. Washington, DC: World Bank. doi: 10.1596/978-1-4648-0868-5. License: Creative Commons Attribution CC BY 3.0 IGO

[3] Overview of Linkages between Gender and Climate Change, NDP Asia-Pacific Human Development Report 2011. http://www.undp.org/content/dam/undp/library/gender/Gender%20and%20Environment/PB1-AP-Overview-Gender-andclimate-change.pdf

[4] United Nations Development Programme. Human Development Report. http://hdr.undp.org/en/content/table-4-gender-inequality-index.

[5] UNDP, 2019: Human Development Report 2019, Inequalities in Human Development in the 21st Century, Briefing note for countries on the 2019 Human Development Report, Maldives

Table 4.1 Gender Inequality Index for Maldives between 2010 and 2018

Description	2010	2014	2018
Gender Inequality Index (GII)	0.424	0.387	0.360

Source: UNDP (2019) Human Development Report 2019

The Gender Development Index is based on the sex-disaggregated Human Development Index (HDI) which defines as a ratio of women to the men HDI. The GDI, based on the sex-disaggregated Human Development Index, is defined as a ratio of the female to the male HDI. The GDI measures gender inequalities in achievement in three basic dimensions of human development: health (measured by female and male life expectancy at birth), education (measured by female and male expected years of schooling for children and mean years for adults aged 25 years and older), and command over economic resources (measured by female and male estimated GNI per capita). The 2018 female HDI value for the Maldives is 0.689 in contrast with 0.734 for males, resulting in a GDI value of 0.939, placing it into a group of 3 out of 166 countries.[6]

Table 4.2 Gender Development Index (GDI) and Human Development Index (HDI) for Maldives between 2010 and 2018

Description	2010	2014	2018
Gender Development Index (GDI)	0.919	0.930	0.939
Human Development Index (HDI), female	0.635	0.671	0.689
Human Development Index (HDI), male	0.691	0.722	0.734

Source: UNDP (2019) Human Development Report 2019

The Global Gender Gap Index (GGGI) of the World Economic Forum examines the gap between men and women in four categories: economic participation and opportunity, educational attainment, health and survival, and political empowerment. The Maldives records are somewhat larger-than-before gender gap in labor force participation, due to updated data availability, which has led to a fall in ranking despite counterbalancing positive developments such as greater gender parity on estimated earned income and in the share of legislators, senior officials, and managers. Out of 149 countries, the Maldives's rank based on GGGI in 2014, 2018 and 2020 are shown below[7]:

Table 4.3 Global Gender Gap Index (GGGI) for Maldives between 2010 and 2018

Description	2014		2018		2020	
	Score	Rank	Score	Rank	Score	Rank
Economic participation and opportunity	0.590	110	0.622	101	0.518	131
Educational attainment	0.994	58	1.000	27	1.000	1
Health and survival	0.966	125	0.953	144	0.953	147
Political empowerment	0.072	120	0.072	132	0.111	115
Gender Gap Index	0.656	105	0.662	105	0.646	123

* Inequality = 0.00; Equality = 1.00. Source: The Global Gender Gap Report 2014. 2018 and 2020

Source: UNDP (2019) Human Development Report 2019

4.2 Poverty

The proportion of the Maldivian population living below the national poverty line of MVR 22 per day decreased from 21% in 2003 to 15% in 2010[8].

Unemployment status continues to be higher amongst females except in the administrative islands. The unemployment rate for females in the Maldives decreased from 7.4% (2006) to 5.9% (2014).

[6] UNDP, 2019: Human Development Report 2019, Inequalities in Human Development in the 21st Century, Briefing note for countries on the 2019 Human Development Report, Maldives
[7] World Economic Forum, 2018 and 2020. The Global Gender Gap Report 2018, and The Global Gender Gap Report 2020.
[8] MEE 2017b, Voluntary National Review for the High Level Political forum on Sustainable Development 2017

Even though unemployment decreased among females, the unemployment rates are still highest for females, especially for females in Male' island, and remained so between 2006 and 2014.

4.3 Health

The strategic framework for the government's National Reproductive Health Strategy for 2014–2018 includes gender equality as a key underlying value and principle.

In regard to maternal health, significant progress has been made in improving maternal and child health services and family planning in the Maldives. The Maldives Health Statistics shows that during the period of 2006-2015 the infant mortality rate decreased from 16 to 9 per 1,000 live births. During this period, fewer than five mortality rates also decreased from 18 to 11 per 1,000 live births. Maternal mortality ratio has decreased from 69 per 100,000 births in 2006 to 13 per 100,000 births in 2012.

Reproductive health needs of young people deserve special attention. As such, a more holistic approach towards access to adolescent friendly health services including reproductive health services is needed. This includes issues of sexual and gender-based violence, sexual diversity, discrimination, relationship issues, and fears and concerns about sex and sexuality.

4.4 Education

The Maldives is also among the few developing countries in the world that had fully achieved all six of the Education for All (EFA) goals by 2015. The government's Education Master Plan 2007–2011/2016 and its Education for All (EFA) mid-decade assessment highlight gender parity and quality of education as the key cross-cutting issues which is important to improve education in the Maldives[9]. Health policy documents recognize health as a human right and mandate health care for all citizens[10].

Literacy rates for women (98.0%) were high and equal to men (97.4%) in 2014. The disadvantages in educational attainment arise at the tertiary level. According to the Population and Housing Census 2014, the sex ratio (males per 100 female) of school attendance across all ages was 104 male to every 100 female, while the ratio among those attending training institutions was 133 male to every 100 female. The ratio of male attendance to other modes of study was lower than females with 75 male to every 100 female. Sex ratio of school attendance across all ages in the atolls was 105 male per 100 female11.

4.5 Political Representation and Decision Making

Household decision making appears to be relatively gender-egalitarian in the Maldives. A national representative sample of married women surveyed by Maldives's 2009 Demographic and Health Survey (DHS) found that the husband and wife make most household decisions jointly. However, gender assessment consultation meetings conducted in February to September 2019 reaffirmed that major household purchases are decided mainly by men.

[9] ADB 2014: Maldives—Gender Equality Diagnostic of Selected Sectors
[10] El-Horr, Jana, and Rohini Prabha Pande. 2016. Understanding Gender in Maldives: Toward Inclusive Development. Directions in Development. Washington, DC: World Bank.
[10] UNDP, 2018: Human Development Indices and Indicators: 2018 Statistical Update
[11] National Bureau of Statistics, 2014: Population and Housing Census 2014

The government is the largest employer in the Maldives and employs two-thirds males while one-third females. However, women make up only 5.1% of island council representatives, only 0.5% of atoll council representatives are women and less than 6% of seats in the national parliament.

Greater efforts are required in increasing women's participation in political and public life and increasing their representation in decision-making levels. Currently, 4.6% of parliament members are women in the 2020 Local Council Elections, decreased from 5.9% in 2018, and women comprise increased to 28.0% in 2020 from 17.6% in 2018 among the Ministers of State[12].

Table 4.4 Women in parliament Maldives between 2014 and 2020

Description	2014		2018		2020	
	Score	Rank	Score	Rank	Score	Rank
Women in parliament	6.0%	129	5.9%	141	4.6%	148
Women in ministerial positions	18.0%	61	17.6%	80	28.0%	45

Source: World Economic Forum, 2014, 2018 and 2020

The 2019 amendment to the Decentralization Act 7/2010 allocated quotas for women in City, Atoll and Island councils for the first time. The first elections since this amendment is scheduled for early 2021. This provides an opportunity for elevating the role of women in local level decision making.

4.6 Labor Force

The 2008 Employment Act outlines the provisions for equal access to employment for men and women, prohibits the use of sex or marital status as grounds for dismissal from any job and includes generous provisions for maternity leave. Given that women are more likely than men to be juggling professional and familial responsibility, this provision is especially important for legal equality of employment opportunity for men and women. Other laws provide for women's participation in cooperatives and women's representation on corporate boards[13].

As one of the key aspects of female disadvantage in the Maldives, females in the Maldives receive disadvantages such as (1) female Labor Force Participation (LFP) is lower than men at all ages, (2) women work in less lucrative public sector, while men in more lucrative tourism and fisheries, (3) higher unemployment for women at most ages, and (4) 13% of women, but only 1% of men, do not work because of household chores.[14]

At the national level, the education sector employs the highest number of females (68%) and following human health and social works (65%), and manufacturing (60%)[15]. Women, especially in the islands are primarily engaged in home-based income generating activities. Nearly half the employed females in the atolls and 40% of employed females in the Male' island fall into the category of home-based own-account workers or contributing family workers.

4.7 Access to Resources

Maldivian men have advantage in ownership and control of household assets in Maldivian families. According to the 2006 Maldives's Census, only 31.3% of recorded homeowners were women and 65.5% are male sole owners. This statistics is in part due to gender-differentiated property

[12] World Economic Forum, 2014, 2018 and 2020. The Global Gender Gap Report 2014, 2018 and 2020.
[13] ADB 2014. Maldives—Gender Equality Diagnostic of Selected Sectors
[14] El-Horr, Jana, and Rohini Prabha Pande. 2016. Understanding Gender in Maldives: Toward Inclusive Development. Directions in Development. Washington, DC: World Bank.
[15] National Bureau of Statistics, 2014: Population and Housing Census 2014

ownership rights under Sharia Law that disadvantage women and in part likely reflects that men are the main decision makers about ownership of household assets and other resources.

The Family Law Act (2001) was the first law enacted which specifically relates to gender relations, marriage, and family life. It sets men's right to divorce based on reciting a verbal formula was rescinded.

4.8 Gender-based Violence

Ministry of Gender and Family (2007)[16] reveals the sobering statistic that one in every three Maldivian women aged 15-49 experienced "physical and/or sexual violence at some point in their lives, including childhood sexual abuse. Index of child marriage, which shows percentage of women married by age 18, is 4% and indices of violence against women ever experienced with intimate partner and non-intimate partner are 19.5% and 6.2%, respectively, and two of the three indices in "Violence against girls and women" are ranked in "top third" and the rest in "middle third" in the country grouping.[17]

Several key legislations including the Gender Equality Act 18/2016, Domestic Violence Prevention Act 3/2012, Sexual Offences Act 17/2014, and Anti-Sexual Harassment Act 16/2014 were enacted to empower women, raising awareness on gender-based violence and provided framework for women's rights and protection of women against harassment, violence, and abuse. However, there are still discrimination against women, gender-based violence and abuse, and lack of women at the decision-making level or in a political position.[18]

5. Legal and Administrative Framework Protecting Women and Protecting Gender Equality

5.1 International Gender Framework

(1) International Commitments to Gender Equality[19]

The Maldives became a signatory to the UN Convention on the Elimination of All Forms of Discrimination (CEDAW) in 1993 and in 2005, the Maldives ratified the Optional Protocol to CEDAW (OP-CEDAW).

The Maldives is signatory to a number of international instruments addressing gender equality and a party to all major human rights treaties: i.e., International Covenant on Civil and Political Rights (ICCPR) 1966 (signatory 2006), ICCPR Optional Protocol 1966 (signatory 2006), International Covenant on Economic, and Social and Cultural Rights (ICESCR 1966) (signatory 2006).

The Maldives is also a party to the Commonwealth Action Plans on Gender Equality and regional initiatives such as SAARC Convention on Preventing and Combating Trafficking in Women and Children for Prostitution and SAARC-UNIFEM Project on the Gender Infobase.

(2) The Millennium Development Goals (MDGs)20

The Maldives is committed to the achievement of the MDGs by 2015 and the Maldives achieved five of the eight MDGs before 2015, making it the first 'MDG plus (+) country in the South-Asia

[16] Ministry of Gender and Family, 2007, The Maldives Study on Women's Health and Life Experiences
[17] UNDP, 2018: Human Development Indices and Indicators: 2018 Statistical Update
[18] UN Women, 2018. Communication Strategy and Action Plan 2019 - 2023
[19] UNDP, 2010, Power, Voice and Rights: A Turning Point for Gender Equality in Asia and the Pacific Human Development Report , Indicators
[20] Sustainable Development Goals Division, Ministry of Environment and Energy. 2017: Voluntary National Review for the High Level Political Forum 2017

region. However, MDG Goal 3: Promote Gender Equality and Empower Women was not achieved and additional efforts and emphasis needs to be placed on SDG Goal 5.

(3) Sustainable Development Goals (SDGs)

A new global developmental agenda, known as the 2030 Agenda of Sustainable Development, was adopted on 25 September 2015. A Sustainable Development Goals Division has been established at the Ministry of Environment and Energy in May 2016. The division is mandated to coordinate, monitor, and report the implementation process of SDGs in the Maldives. In order to facilitate the implementation of the SDGs in the Maldives, a National Ministerial Coordination Committee (NMCC) was formed to provide policy guidance and feedback from their respective agencies and other areas of knowledge and ensure the integration of economic, environmental, governance, and social aspects in the implementation.

One of the main tasks for the year 2018/2019 includes integration of the SDGs into the budgetary process through program budgeting. Some sectors, namely; education, health, energy, waste management, fisheries, water and sanitation, and local governance, have incorporated the SDGs into respective policy documents and action plans. In local governance, the Local Government Authority has aligned its Five-year Development Plan (2017-2021) with SDGs, which will be implemented by the island councils. [21]

5.2 National Gender Frameworks

(1) Government Structures to Address the Gender Issues

The government structures to address gender issues have shifted multiple times over the last 25 years. A Gender Committee formed in 1979 was declared a Gender Department in 1989 and it grew to be the Gender Ministry in 1993. However, since then, the name of the Gender Ministry, its mandate and its work portfolios have continued to shift (Department of National Planning 2012; Hope for Women 2012). The Ministry of Law and Gender was established in 2014 to be responsible for gender policy[22], and renamed to Ministry of Gender and Family. When the new (current) government formed its cabinet on November 2018, they reformed it to the Ministry of Gender, Family and Social Services (MGFSS) [23].

The general missions of MGFSS are as follows:

- To improve the lives of children, women, elderly and persons with disabilities with programs and services that inform, educate and empower them;
- To provide immediate support and protection to those affected by neglect, abuse and violence; and
- To strengthen legislative and institutional services by cultivating values of mutual respect, peace and equality; and to create and strengthen partnerships with local and international bodies to work towards the rights of vulnerable groups.

(2) National Commitments to Gender Equality

All persons are guaranteed the same rights and freedoms under the Constitution of the Republic of Maldives (2008).

[21] Sustainable Development Goals Division, Ministry of Environment and Energy. 2017: Voluntary National Review for the High Level Political Forum 2017
[22] El-Horr, Jana, and Rohini Prabha Pande. 2016. Understanding Gender in Maldives: Toward Inclusive Development. Directions in Development. Washington, DC: World Bank.
[23] https://presidency.gov.mv/Government/Cabinet/16 (accessed on March 11, 2021)

Economic empowerment of women, women and environment, special needs and concerns of women, women's participation in development, temporary special measures/ affirmative action to facilitate women's equal access to available opportunities, harassment of women and gender-based violence, women and non-traditional non-stereotypical work, women in politics and decision-making, and fundamental freedoms were emphasized as the government's policy on women and gender equality.

(3) National Gender Equality Policy

The National Gender Equality Policy and Framework for Action (Draft 1) consolidates President Mohamed Nasheed's women's policy framework which was announced in the International Women's Day (2009) statement into public policy. The draft includes recommendations for an effective NWM/ Lead Agency for gender mainstreaming and the tools for gender mainstreaming, and is targeted at realizing change through coherent, focused, strategic, rights-based, and result-oriented action for gender equality.

The policy is founded on the fundamental principle of Equality of All enshrined in the Constitution of the Republic of Maldives (2008). The purpose of the National Gender Equality Policy is to translate the commitment and vision of President Mohamed Nasheed into coherent public policy directives to translate commitment to action. International commitments of the Maldives are used as a standard of reference and following global good practice models, emphasis is placed on a dual approach to Gender Equality through gender mainstreaming and empowerment of women.

The National Gender Equality Policy (Draft 1) outlines the vision, guiding principles, policy goals, and strategies to attain gender equality in the Maldives.

The vision of the National Gender Equality Policy is a just society where equality of women and men are upheld, women enjoy fundamental rights and freedoms on a basis of equality of men and women, and both women and men are able to realize their full potential and participate in and benefit from democracy and development of both in public and private life.

There are four guiding principles and four policy goals that underlie the vision;

Guiding Principles	Policy Goals
1. Equality of women and men 2. Recognition that traditional, customary, and cultural practices that negatively affect women and girls are a violation of human rights 3. Recognition that public and private are not separable spheres of life 4. Women's entitlement to the right of integrity and security of person	1. To develop and activate the necessary policy, legislative, and institutional framework for gender equality, so that women and men enjoy fundamental human rights and rewards of democracy on a basis of equality of men and women; 2. To empower women to facilitate their equal access to available opportunities with equal outcomes/ results on a basis of equality of men and women; 3. To cultivate a culture of non-discrimination and respect for women's human rights, so that women enjoy human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field on a basis of equality of men and women; and 4. To eliminate all forms of discrimination against women.

(4) Gender Equality Act

Gender Equality Act was enacted on 23 August 2016. The Act delineates provisions of general principle to achieve gender equality in the Maldives, policies to prohibit discrimination based on

gender in Maldives and the duties and responsibilities of the state institutions and other relevant parties to achieve gender equality in the Maldives.

There are nine objectives of the Act;

(a) To ensure that every person enjoys, without discrimination based on sex or gender, the fundamental rights and freedoms guaranteed by the Constitution of the Republic of Maldives, as provided by Article 17 of the same constitution which determines the rights and freedoms to everyone, without discrimination of any kind, including sex or gender and as provided by Article 20 of the same Constitution which states that every individual is equal before and under the law, and is entitled to equal protection and equal benefit of the law.
(b) To facilitate all steps towards prevention of discrimination based on gender and prevention of all ideas and practices that promote discrimination between men and women, in conformation with the Convention on the Elimination of All Forms of Discrimination Against Women and the Optional Protocol to the Convention on the Elimination of All Forms of Discrimination Against Women.
(c) To ensure that women enjoy equal terms with men, human rights, fundamental rights, and equal opportunities in their economic, social, cultural, civil, and political life in the Maldives. In conformation with the Convention on the Elimination of All Forms of Discrimination Against Women and the Optional Protocol to the Convention on the Elimination of All Forms of Discrimination Against Women.
(d) To protect human dignity.
(e) To establish principles of gender equality in the conduct of state institutions, businesses, civil society organizations, employers, other legal entities, and individuals.
(f) To establish gender equality principles in making social, economic, political and cultural policies.
(g) To end all forms of violence against women and girls.
(h) To take special steps to establish gender equality.
(i) To establish a culture of empowerment, provide equal opportunities, and an enabling environment to achieve results on gender equality.

(5) Decentralization Act (7/2010)

the Decentralization Act (7/2010) was enacted on 2010. The Act and its subsequent amendments ensures the participation of women in decision making in the local islands. Under the Act, local level decision making is delegated to City Councils, Atoll Councils and Island Councils, in which one third of seats are allocated for women following its amendment in 2019.

In addition, the Women's Development Committees (WDCs) of each island established under the Act will be engaged in project decision making processes to ensure that women's concerns and priorities are taken onboard. The Act also stipulates WDCs shall be consulted by the local councils in the formulation of local regulations.

6. Gender Issues in Response to the Projected Climate Induced Coastal Flooding Risks in Addu and Laamu Atolls

The specific issues and difficulties that women face in responding to the adverse impacts of climate induced rising sea levels are collected through the gender assessment consultation meetings and public consultation meetings, and recommendations are provided. The following and another Annex (Annex VII) to this proposal will be referred to understand the full results from the stakeholder consultations outlining the human security threats that affect women as a result of climate change.

According to the information collected through the gender assessment consultation meetings in Addu and Laamu Atolls, the human security threats are the most adverse impacts to women, children, and disable persons in case of disaster, because they would not be able to evacuate from their houses due to the fears against the disaster.

6.1 Gender Analysis

The gender analysis undertaken at the onset and design of this project serves as an entry point for gender mainstreaming throughout implementation. The Gender Assessment Consultation Meetings were held at several target islands in Addu and Laamu Atolls during May and December 2019. Results from the consultations are summarized below and the Gender Action Plan is included in full as an additional annex to this proposal.

The gender analysis, through stakeholder engagement and consultation enabled:

- Engagement, development, and input into the design of the "Building Climate Resilient Safer Islands in the Maldives" project and the approach to move forward;
- Demonstration of the need and value of collecting sex-disaggregated data and developing gender sensitive indicators to establish a baseline in which to measure improvements and identify areas of focus; and
- Formulation of actionable recommendations to incorporate into the Gender Action Plan.

6.2 Results of Qualitative Assessments

(1) Stakeholder Engagement

The stakeholder consultations and engagement of women's organizations promote gender equality at the local as well as the national level. The involvement of women's organizations in the project design, aided in identifying relevant gender issues within the country's social context, and implementing and monitoring the gender aspects of the project. The gender assessment consultation meetings were held for each target island and specific issues raised are as follows:

Table 6.1 Schedules of the Gender Assessment Consultation Meetings

Atoll	Island	Target (gender)	Implementation Date	No. of Participants
Laamu	Fonadhoo	Female	September 10, 2019	13
		Male	May 27, 2019	7
	Maamendhoo	Female	May 28, 2019	13
		Male	May 28, 2019	7
	Ishdhoo	Female	September 10, 2019	13
		Male	September 10, 2019	7
Addu	Hithadhoo	Female	May 20, 2019	6
		Male	May 21, 2019	12
	Meedhoo	Female	December 11, 2019	10
		Male	December 11, 2019	7

Source: JICA (2019)

(2) Specific issues raised include:

The followings are the issues raised during the meetings, per project component and/or per mutual issues:

1) Issues related to all/ several component:

- Even in economic organizations, the involvement of men is greater than that of women. It was suggested that the reason could be that women are the primary caregivers in households.

- Women are provided the opportunity legally, but there are barriers which they have to overcome in terms of proving themselves worthy to the public compared with men.

2) Issues related to Component 1:

- Regarding the community-based management of the site, many women and men mentioned that the workload would increase for women in terms of maintaining the cleanliness of the area.
- The Women's Development Committee (WDC) would be most likely to do the work as men would not be interested in doing such work voluntarily.

Box: Main comments from the participants

- *(Female: Maamendhoo) The overall workload of women would increase with the development of the area in terms of managing the cleanliness of the area as women are the people who are actively working in the NGOs responsible for maintaining the cleanliness of the entire island.*
- *(Male: Ishdhoo) The workload for women will be increased due to the proposed interventions.*
- *(Male: Fonadhoo) The Women's Development Committee (WDC) would be most likely to do the work as men would not be interested in doing such work voluntarily, unless it comes in the form of job opportunities. Another suggested solution was that to find interested youth from the island to work on the community-based management of the area.*
- *(Male: Fonadhoo) When it comes to the community-based management of the site, the workload would increase for women in terms of maintaining the cleanliness of the area. Moreover, should the area be appropriate, there would be business opportunities which men would grab. The area could be used for volunteerism and other social work.*
- *(Female: Ishdhoo) Woman will take care of the place (coastal area) more.*
- *(Female: Maamendhoo) The coastal area was previously used as a defecating site, prior to toilets being established at homes. Women are the people who mostly utilize the area to spend time with kids on the beach, but if there is a boat being harbored for maintenance or building, then men would also use the area. So it was agreed that the overall use is equal among men and women.*
- *(Male: Maamendhoo) The political decisions are majorly made by men but that women also have the opportunity and there are some active women in the field.*

3) Issues related to Component 2:

- Due to the coastal erosion, most participants, regardless gender, think that many sandy beaches, coastal roads, and coastal vegetation were eroded away, and now it is difficult for them to go to the coastal areas easily for many purposes: e.g. for men to do fishing and surfing, and for women to walk with children, collect coconuts, and also for conduct traditional medical treatment.
- Women worry about inequality in access to the eroded sites because people with disabilities and people of old age have difficulties accessing the area due to the erosion that has taken place in the area, whilst men think that there are no inequalities in social group accessibility except for people with disabilities.

Box: Main comments from the participants

- *(Female: Meedhoo) Many roads have eroded away. Within the past three years, roads in close proximity have been repaired due to erosion.*
- *(Male: Fonadhoo) The erosion process has been accelerated and that people have only started to care now, and the concern was not observed previously, which resulted in the soil eventually eroding. The people are a lot more aware of the situation that they were years back.*
- *(Male: Fonadhoo) The islanders are faced with many difficulties, mainly due to rain which leads to flooding, erosion and falling of trees in the area as a result.*
- *(Female: Addu): Pebble mining is also a huge reason of the current coastal situation and there still is a huge demand and market for pebbles for the home yards.*
- *(Male: Meedhoo) Due to climate change both gender have had impact from sea bounty such as reef gaining and fishing.*
- *(Female: Ishdhoo) Now we are not able to come from the beach area due to the erosion.*
- *(Male: Maamendhoo) There are no inequalities when it comes to different social groups and all have equal access to the area.*

4) Issues related to Component 3:

- The evacuation plans are not planned, or even planned, they are not well disseminated to the people. Most of participants indicated that the island councils/ disaster management committees are those who would decide how to manage (evacuate) in case of disaster. However, for some islands, information dissemination methods used by the council is not effective.
- Overall, it is difficult for women to evacuate from the home in case of disaster, because they would not be able to move due to the fear, and also they need to take care of children and elders in their houses. On the contrary, it is much easier for men to evacuate from the home even in case of disaster.

Box: Main comments from the participants

- *(Male: Maamendhoo) The authorities, council, disaster management center as well as the government work together in instructing the civilians on how to act during a disastrous situation.*
- *(Female: Maamendhoo) Overall, in the case of a disaster, which can as be as much as king surges which might flood a home, women would find it most difficult to deal with the situation due to the difficulty in managing the fear. Men would find it more easy to deal with the situation and find a way to salvage the belongings and people in the event of a natural disaster.*
- *(Male: Fonadhoo): Regarding the way to set the evacuation procedures of the island, there is no existing evacuation plan, but announcements on how to act are made when the disaster takes place. However, there are some trained personnel in the island.*
- *(Female: Addu) Trainings for disaster management are to be conducted by the Disaster Management Centre of the Maldives. However, despite conducting different training programmes in various islands each week, Addu has never been part of any trainings conducted. The early warning systems were not implemented and utilized properly and the public has no knowledge of how to prepare for bad weather at the least, except for small directions provided by MNDF.*

5) Issues related to Component 4:

- There are no specific issues raised during the consultation meetings for the activities under Component 4.

(3) Considerations from the results of the qualitative assessments to the Project

- Participation of women and other vulnerable groups into decision making is essential for the project initiatives. In order for that, the specific mechanisms to select the participants and make them involve in the decision making are to be examined; e.g. equall numbers between men and women, schedule arrangement of the meetings to make women be able to attend, etc.
- Most of participants to conduct beach cleaning are women and children, and very few men participate at this moment. “Cleaning the island” is considered as the traditional activities for women, however, Island cleaning is no longer perceived to be done as well as before, notably by a few male participants.[24] In order to diversify the participants for such activities, proper facilitation to men and promotion of the importance and necessity of such activities are to be conducted.
- As 100% of the population of the Maldives are Muslim, the special attention to the Muslim are to be considered for proper implementation of the Project; i.e. time arrangement of the activities, including meetings, especially during Ramadan period, etc.
- The radical systematic changes, especially in relation to gender equality and women’s empowerment, may cause discontentment among both men and women. Therefore, the gradual mutual understandings among women and men are to be needed to build confidence among stakeholders, including men.
- The WDCs also provide another entry point to take women’s concerns on board, and their role in the project decision making process could be further enhanced. As the strengthening the role of WDCs are one of the mandates of MGFSS, the Project will need to coordinate with MGFSS on the strengthening and involvement of WDCs into the Project activities.

7. Recommendations

(1) Necessary activities for mainstreaming gender into the Project activities

In order for the Project to increase awareness and understanding of the Project and mitigation measures through prior consultation and dissemination, and to secure commitment and accountabilities on all Project-related activities, the following components are included in the Project for mainstreaming gender into the Project activities:

- Conduct of community-level consultations ensuring that all segments of the population, including women, youth, the elderly, and the disabled are equitably represented during the construction stage, as planned in the Stakeholder Engagement Plan (SEP) and Gender Action Plan (GAP).
- Setting of explicit rules in the tendering process to ensure gender equality and equal participation of women in the contracting schemes.
- Establishment of grievance mechanisms, accessible for both women and men, to be able to voice complaints during the Project construction stage.
- Development and implementation of capacity building trainings, processes on information dissemination and awareness raising in relation to gender and social inclusion mechanisms.

[24] IFS, 2015, Qualitative Assessment: Perceptions about Women’s Participation in Public Life in the Maldives

- Involvement of national gender-based institutions and organizations as main stakeholders of the Project.
- Development and revision of SEP, as well as gender assessment and GAP, and ensuring equitable representation of women and men in the development of the ICZM plan.
- Ensuring empowerment of women through women-led community organizations, such as Women Development Committees, tasked with shoreline protection and stabilization, cleaning of coasts, creation of coastal green buffer zones, and maintenance of beach and beach vegetation.
- Implementation, during Project implementation, of monitoring activities for the GAP to evaluate qualitatively and quantitatively the gender-specific benefits that can be directly associated with the Project. The results of such monitoring will be incorporated into the Annual Performance Report, Interim Evaluation Report, and Final Evaluation Report.
- Development of qualitative and quantitative indicators to evaluate the achievement of the Project objectives in relation to gender equality. These will include, but not to be limited to: i) equal accessibility between men and women to the Project targets (nourished beach, coastal protection measures, etc.), ii) number of men and women employed from the jobs created by the Project and number of women and men who were trained through the Project, and iii) knowledge management and information dissemination.

Addressing gender dimensions within the project design and implementation, this proposal works to identify and integrate interventions to provide gender responsive and transformative results. As women are key players in managing basic household resources, as caretakers, as well as participants in income generating activities, this proposal seeks to address the cultural, the physical, as well as the information and capacity related obstacles preventing women from being actively engaged in, supporting, promoting, and maintaining the mitigation and adaptation solutions that the project will be implementing, i.e., “Involving them in the transformation agenda.”

It is recommended that the project design will take into consideration gender and social inclusion implications including the level of awareness, accordingly commitment, and accountability of macro and meso-level stakeholders in ensuring the equitable participation by women and other vulnerable groups in the climate resilience processes.

Based on the above, the following recommendations are proffered:

- To conduct micro-level consultations in the hotspot governorates ensuring that all segments of the population, including women, youth, the elderly, and the disabled are equitably represented.
- To develop an awareness raising campaign and messages in relation to gender and social inclusion mechanisms that are contextually relevant to the subject of climate change while being both culturally and gender sensitive.
- To involve the National Gender Machinery as main stakeholder and ensure engagement between NCW, the EOUs, and climate change units in the relevant ministries.

During project implementation, qualitative assessments will be conducted on the gender-specific benefits that can be directly associated to the project. This will be incorporated in the annual Annual Performance Project Implementation Report, Interim Evaluation Mid-Term Report, and Final End of Project Evaluation Report. Indicators to quantify the achievement of project objectives in relation to gender equality will include men and women who had access to affordable solutions, number of men and women employed from the jobs created by the project, number of women and men who were trained, knowledge management and information dissemination.

(2) Monitoring and Evaluation

Through onset analysis, data has been collated to establish a baseline. This data shall be monitored against the baseline throughout implementation and evaluation. The analysis identified the differences between men and women within at-risk populations. In order to monitor and evaluate progress of the project, the following indicators will be used:

- Quantitative outcomes:
  - Number of women and other vulnerable groups included in project consultations, and community-driven decisions, plans, implementation and M&E on ICZM;
  - Number of women and other vulnerable groups engaged in adaptation and resilience activities;
  - Number of vulnerable women and other vulnerable groups who changed their mindset on coast protection through reached by project project-related capacity development activities and awareness raising;
  - Number of women and other vulnerable groups who will understand the importance of the community-based management and monitoring activities and be involved in the community-based management and monitoring activities; and
  - Number of women and other vulnerable groups, including people with disabilities, who will be able to reach to the proposed sites and enjoy the blessings of on accessibilities to the proposed sites.
- Qualitative outcomes:
  - Involvement in community affairs by women and other vulnerable groups as a result of their engagement of women in adaptation, resilience, and other project–related activities in all the component; and
  - Awareness of the economic and social impacts of climate change as reported by women.

Annex-8-b：Gender and social inclusion action plan

Gender and Social Inclusion Action Plan (DRAFT)

This Gender Action plan provides suggested entry points for gender-responsive actions to be taken under each of the Activity areas of the project. In addition, specific indicators are also proposed to measure and track progress on these actions at the activity level. This can be incorporated into the detailed M&E plan which will be developed at the start of implementation, and provides concrete recommendations on how to ensure gender (including disaggregated data) continues to be collected and measured throughout implementation. Below is the initial gender action plan for the JICA/GCF project in the Maldives to be further reviewed and finalized during the project inception phase.

Activities	Indicators and Targets	Timeline	Responsibilities	Costs
Impact Statement: To benefit women, children and other vulnerable populations by constructing climate resilient investments in coastal protection, establishing the ICZM system, and developing disaster warning systems. **Outcome Statement:** Reduced risks to coastal hazards and the effects of climate change, and increased coverage of disaster warning messages to 3,000 women.				
Output(s) Statement: Component 1: Establishment of Integrated Coastal Zone Management (ICZM): Establishment of ICZM plan and monitoring plan Component 2: Implementation of coastal conservation/protection measures against coastal disasters: Implementation of coastal protection measures Component 3: Development of disaster warning and information dissemination: Improved disaster warning and information dissemination system for population at risk in target islands, Component 4: Development of basic data collection and sharing system related to climate change: Establishment of collection and sharing system				

Activities	Indicators and Targets	Timeline	Responsibilities	Costs
Overall				
(i) Establish a gender-sensitive grievance redress mechanism	- Baseline: no gender-sensitive grievance redress mechanism - A gender sensitive grievance redress mechanism will be established.	- By the 3rd year of the project	Laamu and Addu Atoll Council, each island councils, PMU (Social Environmental and Gender Officer), ME, JICA	The costs will be budgeted in the PMU's cost and/or JICA's co-financed project.
Component 1: Establishment of Integrated Coastal Zone Management (ICZM)				
(i) Organize stakeholder consultations in each target island to explain the importance of the component for the community and the Maldives	- Baseline: no consultation is held. - At least once in a year per target island consultations will be held	- Every year	Laamu Atoll Council, each island councils, PMU (Social Environmental and Gender Officer), JICA	The costs will be budgeted in the PMU's cost and/or JICA's co-financed project. (appx. 15 times x USD 1,000
	- Baseline: 0%	- Every year		

Activities	Indicators and Targets	Timeline	Responsibilities	Costs
	- 40% of participants are women in target island participate in the stakeholder consultations			= USD 15,000)
	- Baseline: 0% - 25% of women in target island participate in the stakeholder consultations	- Every year		
(ii) Develop capacity building trainings plan for communities on ICZM system	- No specific overall capacity building training plan - Overall capacity building training plan	- By 2nd year	PMU (Social Environmental and Gender Officer), JICA	The costs will be budgeted in JICA's co-financed project. (appx. 1 L.S x USD 10,000 = USD 10,000)
(iii) Conduct orientation and training on community-based monitoring of the constructed measures	- Baseline: no consultation is held. - At least once in a year per target island trainings will be held	- Every year	Laamu Atoll Council, each island councils, PMU (Social Environmental and Gender Officer), JICA	The costs will be budgeted in JICA's co-financed project. (appx. 5 L.S x USD 10,000 = USD 50,000)
	- Baseline: 0% - 40% of participants are women in target island participate in the trainings	- Every year		
	- Baseline: 0% - 25% of women in target island participate in the trainings	- Every year		
	- Baseline: 0% - 50% of participated women reporting on improved ability to implement ICZM	- By the end of the project		

Activities	Indicators and Targets	Timeline	Responsibilities	Costs
	requirement			
Component 2: Implementation of coastal conservation/protection measures to coastal disasters				
(i) Gender balanced employment materialized by liaising with the local Island Councils, Women's Development Committees and PMU to help inform women of the availability of jobs (direct and indirect) during construction	- Baseline: no consultation is held. - At least once in a month the liaison with concerned parties will be held at each island	- Every year	Laamu and Addu Atoll Councils, each island councils, Women Development Committees of each island, Contractor	The costs are budgeted in the costs for PMU. (appx. 5 times x USD 1,000 = USD 5,000)
	- Baseline: 0% - At least 30% labors are women during the construction with the condition of "equal pay for equal work performed"	- By the 3rd year of the project		
(ii) Organize stakeholder consultations in each target island to explain the importance of the component for the community and the Maldives	- At least once in a year per target island consultations will be held	- Every year	Laamu and Addu Atoll Councils, each island councils, Women Development Committees of each island, PMU (Social Environmental and Gender Officer)	The costs are budgeted in the costs for PMU. (appx. 15 times x USD 1,000 = USD 15,000)
	- Baseline: 0% - 40% of participants are women in target island participate in the stakeholder consultations	- By the 3rd year of the project		
	- Baseline: 0% - 25% of women in target island participate in the stakeholder consultations	- By the end of the project		
Component 3: Development of disaster warning and information dissemination				
(i) Organize stakeholder consultations in each target island to explain the importance of the component for the community and the Maldives	- Baseline: no consultation is held. - At least once in a year per target island consultations will be held	- By the 3rd year of the project	Public Service Media (PSM), Laamu and Addu Atoll Councils, each island councils, Women Development Committees of each island, PMU (Social	The costs will be budgeted in the JICA's co-financed project. (appx. 10 times x

Activities	Indicators and Targets	Timeline	Responsibilities	Costs
	- Baseline: 0% - 40% of participants are women in target island participate in the stakeholder consultations	- By the 3rd year of the project	Environmental and Gender Officer), JICA	USD 1,000 = USD 10,000)
	- Baseline: 0% - 25% of women in target island participate in the stakeholder consultations	- By the end of the project		
(ii) Develop system for disaster warning and information dissemination	- Baseline: 0% - At least 50% of women receive public education and publicity on appropriate evacuation actions	- By the end of the project	National Disaster Management Centre (NDMA), Maldives Meteorological Service (MMS), Public Service Media (PSM), PMU (Social Environmental and Gender Officer), JICA	
(iii) Establish operational system for disaster warning and information dissemination (Laamu Atolls)	- Baseline: 0% - At least 50% of women receive disaster warning and information in each island (as trial basis)	- By the end of the project	National Disaster Management Centre (NDMA), Maldives Meteorological Service (MMS), Public Service Media (PSM), Laamu Atoll Council, each island councils, PMU (Social Environmental and Gender Officer), JICA	
Component 4: Development of basic data collection and sharing system to climate change				
(i) Development of soft and hard measures on monitoring system for coast, coral reef, and land use through the trainings on wave measurement (approximately 16 times) and coast monitoring system (approximately 15 times)	- Baseline: 0% - At least 25% of participants/ trainees are female who receive capacity development	- By the end of the project	ME, Maldives Land and Survey Authority (MLSA), MNPI, Maldives Meteorological Service (MMS), PMU (Social Environmental and Gender Officer), JICA	The costs will be budgeted in JICA's co-financed project. (appx. 1 L.S x USD 10,000 = USD 10,000)

Annex-9：Legal due diligence

9.A Legal Due Diligence

Please provide the following information:

- *Details of any government or regulatory approvals, licenses or permits required for implementing and operating the project/programme, the relevant issuing authority, and the date of issuance or expected date of issuance.*

  In the implementation of the project, the existing coastal areas will be modified to recover / protect the residents and their lives against the climate impact. To implement a construction work, approvals for environmental impact assessment by MEE will be required before commencement of the construction work. Also, the permissions for closing the construction area by local councils, approvals for project license by MNPI, permission for importing the construction equipment by Customs and, if applicable, permission for UAV operation at the restricted area by Civil Aviation Authority and Maldives National Defense Force will be required. These permissions are applied via submission of application letters, according to the progress of the activities.

  In the execution of the Funding Activity Agreement with GCF, JICA as AE shall secure authorization from the Government of Japan / Ministry of Foreign Affairs of Japan to negotiate and sign the FAA in accordance with the Accreditation Master Agreement (AMA) on May 17 2018.

  As the project is a government project, regulatory approval, licenses or permits are not required. MEE as well as the other concerned government agencies play each of their roles according to their legal mandate.

  MEE, as the EE, is a ministry of the GoM and has the capacity to enter into contract on its own name. Pursuant to the letter number 1-CBO(PAR)/438/2019/43 (26 March 2019) on the Responsibility of the Ministry of Environment and Energy.

  MEE will be the EE and will lead the Project's implementation, in coordination with MNPI, LGA, Laamu Atoll Council, NDMA, and MMS. JICA as AE will sign a Subsidiary Agreement with MEE to start implementing the project.

- *Describe applicable taxes (or exemptions thereof) and foreign exchange regulations related to the project/programme.*

  There is no foreign exchange regulations related to the project. VAT and other domestic taxes of goods/equipment directly procured/imported from other countries are expected to be exempted.

  Since the Project is financed through GCF grant, no foreign exchange approvals are required for JICA to receive or transfer funds to/from GCF in USD.

- *Details of any insurance policies or requirements related to the project/programme.*

  To implement the Project which includes civil work and importation of equipment, MEE recommends a comprehensive insurance plan which covers general liabilities, worker's compensation and commercial automotive insurance, which shall be secured in a form of bank guarantee commonly provided by contractors before the commencement of each activities.

Annex-10：Procurement plan

Accredited Entity: JICA

Procurement Plan

I. General

1. **Project information**: Building Climate Resilient Safer Islands in Maldives

2. **Version of the Plan**: Version 3.0 dated 20 February 2021

3. **Approval Date of the procurement Plan**: Procurement Plans are to be approved biannually by the Project Steering Committee (PSC)

4. **Date of General Procurement Notice**: TBC

5. **Period covered by this procurement plan**: 01/11/2021 –30/04/2023

6. **Other Arrangements**: (**Example:** The project will provide grants to the Government of Maldives (GoM). The Accredited Entity (AE)'s approved Procurement and Consultant Guidelines reviewed and accepted by the Fund as part of the accreditation process will apply for AE's procurement and the AE's approved Public Procurement System of Public Finance Regulation of GoM will apply for Executing Entity (EE)'s procurement under these grants. Procurement will be carried out by AE and EE, and procurement plan will be agreed between the AE and EE.

II. Goods, Works and non-consulting services.

1. Prior Review Threshold: Procurement Decisions subject to Prior Review by the AE/Fund: Not Applicable

	Procurement Method	Threshold for use of method	Prior Review Threshold	Comments
1.	International tender (open tender)	US$166,667 or more	US$10 million or more	
2.				
3.				
4.				
5.				

6				
7				

2. Prequalification (for complex Civil Works)

It is agreed with EE to carry out prequalification for the procurement of the civil works which includes coastal conservation/protection measures when the cost of the package exceeds US$10 million to ensure appropriate contractors will participate the bids.

3. Procurement Packages with Methods and Time Schedule

1	2	3	4	5	6	7	8	9	10	11	12	13
Ref. No.	**Contract (Description)**	**Source of Funds**	**Planned vs Actual**	**Estimated Cost in US$**	**Procurement Method**	**Pre qualification (yes/no)**	**Domestic Preference (yes/no)**	**Review by AE/Fund (Prior / Post)**	**Date of issuance of doc's**	**Bid-Opening Date**	**Date of contract /order signature**	**Comments**
1												
2			**Planned**									
			Actual									
3			**Planned**									
			Actual									
Total For Goods												

III. Selection of Consultants

1. **Prior Review Threshold**: Selection decisions subject to Prior Review by AE/Fund:

	Selection Method	Prior Review Threshold	Comment
1.	International tender (open tender)	USD 500,000	
2			
3.			

2. **Short list comprising entirely of national consultants**: Short list of consultants for services, estimated to cost less than $ USD 16,667 equivalent per contract, may comprise entirely of national consultants in accordance with the Fund's interest in encouraging the development and use of National Consultants from partner countries of operation.

3. **Any Other Special Selection Arrangements:** [including advance procurement and retroactive financing, if applicable] It is agreed with EE that EE will procure PMU members except Technical Adviser and Senior Procurement Advisor. The exceptional two positions will be procured by AE.

4. Consultancy Assignments with Selection Methods and Time Schedule

1	2	3	3	4	5	6	7	8	9	10	11	
Ref. No.	**Description of Assignment**	**Source of Funds**	**Estimated Cost in US$**	**Selection Method**	**Review by AE/Fund (Prior / Post)**	**Issuance of Expression of Interest**	**Finalize shortlist and issue RFP**	**Proposals Submission Date**	**Complete Technical Evaluation**	**Complete Financial Evaluation**	**Negotiate and Award**	**Comment**
1	Component 2: Consulting Services for Detail Design, Tender Assistance, Construction Supervision and Operation and Management	GCF	4,733,000	QBS	Post	Yes	01/12/2022	01/01/2023	31/01/2023	28/02/2023	01/04/2023	

1	2	3	3	4	5	6	7	8	9	10	11	
Ref. No.	**Description of Assignment**	**Source of Funds**	**Estimated Cost in US$**	**Selection Method**	**Review by AE/Fund (Prior / Post)**	**Issuance of Expression of Interest**	**Finalize shortlist and issue RFP**	**Proposals Submission Date**	**Complete Technical Evaluation**	**Complete Financial Evaluation**	**Negotiate and Award**	**Comment**
2	Component 5 Technical Adviser of PMU	GCF	213,300	IC	Procured by AE	Yes	1/7/2022	31/7/2022	31/8/2022	31/8/2022	30/9/2022	Selection by CV
3	Component 5 Senior Procurement Adviser of PMU	GCF	160,000	IC	Procured by AE	Yes	1/7/2022	31/7/2022	31/8/2022	31/8/2022	30/9/2022	Selection by CV
4	Component 5 Project Manager of PMU	GCF	131,600	IC	Post	Yes	1/7/2022	31/7/2022	31/8/2022	31/8/2022	30/9/2022	Selection by CV
5	Component 5 Social Environmental Officer of PMU	GCF	47,400	IC	Post	Yes	1/7/2022	31/7/2022	31/8/2022	31/8/2022	30/9/2022	Selection by CV
6	Component 5 Knowledge Management Officer of PMU	GCF	50,000	IC	Post	Yes	1/7/2022	31/7/2022	31/8/2022	31/8/2022	30/9/2022	Selection by CV
7	Component 5 Procurement / Contract Manager of PMU	GCF	34,200	IC	Post	Yes	1/7/2022	31/7/2022	31/8/2022	31/8/2022	30/9/2022	Selection by CV
8	Component 5 Office Administrator of PMU	GCF	52,300	IC	Post	No	1/7/2022	31/7/2022	31/8/2022	31/8/2022	30/9/2022	Selection by CV
9	Component 5 Accountant of PMU	GCF	50,300	IC	Post	No	1/7/2022	31/7/2022	31/8/2022	31/8/2022	30/9/2022	Selection by CV
10	Component 5 Document Controller of PMU	GCF	37,500	IC	Post	No	1/7/2022	31/7/2022	31/8/2022	31/8/2022	30/9/2022	Selection by CV
11	Component 5 Secretary of PMU	GCF	50,300	IC	Post	No	1/7/2022	31/7/2022	31/8/2022	31/8/2022	30/9/2022	Selection by CV

1	2	3	3	4	5	6	7	8	9	10	11	
Ref. No.	**Description of Assignment**	**Source of Funds**	**Estimated Cost in US$**	**Selection Method**	**Review by AE/Fund (Prior / Post)**	**Issuance of Expression of Interest**	**Finalize shortlist and issue RFP**	**Proposals Submission Date**	**Complete Technical Evaluation**	**Complete Financial Evaluation**	**Negotiate and Award**	**Comment**

Competitive Methods are the following:

- Quality Cost Based Selection method (QCBS)
- Quality Based Selection (QBS)
- Fixed Budget Selection (FBS)
- Least Cost Selection (LCS)
- Consultants Qualifications Selection (CQS)
- Individual Consulting (IC)

Annex-11-a：Indicator, baseline and target

Method to set baseline

1. If relative quantitative data in past available, then set baseline based on them: *mainly applied to climate hazards and vulnerability*
2. If not available, then estimate possible quantities/ damage up to present. Estimation was made mainly from the interview survey on past disaster to island councils and communities, and site investigation: *mainly applied to socio- and economic- vulnerability.*

Table 1 Baseline for Each Indicator at Target Five Islands

Evaluation category	Evaluation items (for the period or annually)	Means of Verification (MoV)	Baseline and target	Target Island					Description
				Addu Atoll	Laamu Atoll				
				Meedhoo	Gan	Fonadhoo	Isdhoo	Maamendhoo	
Observed climate hazards and vulnerability of ecosystems	1 S.L.R (cm)	Tide monitoring data in Gan, Laamu Atoll (Government data)	Baseline (2019)	16.1	16.1	16.1	16.1	16.1	S.L.R. from 1969 (more than 50 years) estimated based on observed tide data in Gan, Laamu Atoll.
			Midterm (2023)	17.7	17.7	17.7	17.7	17.7	
			Final (2028)	19.3	19.3	19.3	19.3	19.3	
	2 Increase of offshore wave height ($H_{1/3}$, cm)	Reanalysis wave data (ERA5) (Other (website))	Baseline (2019)	24	24	24	24	24	Increase from 1979 (more than 40 years) estimated based on reanalysis data near Addu Atoll
			Midterm (2023)	26	26	26	26	26	
			Final (2028)	29	29	29	29	29	
	3 Average frequency of flooding due to swell wave(times/year)	Annual records on loss/ damage due to coastal disaster prepared by Atoll or Island councils. (Government data)	Baseline (2019)	1<	1<	1<	1<	2<	Baseline: based on interview survey to local government and communities in 2019. At residential area: Fonadhoo and Maamendhoo At coastal road or heritage site: Meedhoo, Gan, Ishdhoo
			Midterm (2023)	1<	1<	1<	1<	2<	
			Final (2028)	0	0	0	0	0	
	4 Observed	Annual records	Baseline	D <30	D <30	D <30	D <30	D <30	Based on interview survey to

	maximum flooding depth(D,cm) and distance toward inland (I,m)	on loss/ damage due to coastal disaster prepared by Atoll or Island councils. (Government data)	(2019)	I <150	I <150	I <150	I <150	I <150	local government and communities in 2019.
			Midterm (2023)	D <30 I <150	D <30 I <150	D <30 I <150	D <30 I <150	D <30 I <150	
			Final (2028)	0	0	0	0	0	
	Coral coverage on reef	Monitoring report to be prepared by Contractor (Document review)	Baseline (2019)	Level 2	Level 1	Level 1	Level 1	Level 2	Coverage level from line-transect survey and reports on coral bleaching event in Maldives: 1: 0-9% (very severe), 2: 10-24% (severe), 3: 35-49% (moderate), 4. 50-74% (well), and 5: 75-100% (very well)
			Midterm (2023)	Level 2	Level 1	Level 1	Level 1	Level 2	
			Final (2028)	Level 2	Level 1	Level 1	Level 1	Level 2	
	5 Turbidity of sea water on reef	Monitoring report to be prepared by Contractor (Document review)	Baseline (2019)	<3	<3	<3	<3	<3	Water quality survey results in 2019 Optimum conditions of turbidity for coral growth is <3-5 NTU, and >5NTU causes stress for the coral growth, based on the EIA Data Collection Guideline, EPA, Maldives.
			Midterm (2023)	<3	<3	<3	<3	<3	
			Final (2028)	<3	<3	<3	<3	<3	
	6 Retreat (m)	Monitoring report to be prepared by Consultant (Document review)	Baseline (2019)	0-10	—	5-10	—	10-15	Baseline: shoreline change observed from satellite images and Google Earth. Final: No retreat from the baseline expected after intervention implemented.
			Midterm (2023)	0-10	—	5-10	—	10-15	
			Final (2028)	0	—	0	—	0	
	Remaining width of beach (m)	Monitoring report to be prepared by	Baseline (2019)	5-10	0	5-15	0	0-10	Baseline: observed from site investigation
			Midterm	5-10	0	5-15	0	0-10	Final: beach width after beach

		Consultant (Document review)	(2023)						nourishment above mean sea level (M.S.L)
			Final (2028)	29	0	31	0	27	
	Erosion area (m2)	Monitoring report to be prepared by Consultant (Document review)	Baseline (2019)	7,000	—	6,400	—	11,300	Baseline, midterm: shoreline distance(m) x observed retreat(m) Final: No erosion from baseline expected
			Midterm (2023)	7,000	—	6,400	—	11,300	
			Final (2028)	0	—	0	—	0	
Observed impact of climate change on socio-economic development (socio-economic vulnerability)	Live loses (lives per flood)	Annual records on loss/ damage due to coastal disaster prepared by Atoll or Island councils. (Government data)	Baseline (2019)	0	0	0	0	0	No live losses reported in the past
			Midterm (2023)	0	0	0	0	0	
			Final (2028)	0	0	0	0	0	
	Number of people who don't have access to evacuation (per flood)	Site investigation on evacuation area (Field observation visits)	Baseline (2019)	—	—	—	—	896	Baseline: interview survey to island council on past flooding event Final: Evacuation site secured by implementation
			Midterm (2023)	—	—	—	—	896	
			Final (2028)	—	—	—	—	0	
	7 Loss of national land (USD)	Monitoring report to be prepared by Consultant (Document review)	Baseline (2019)	35,000	—	32,000	—	56,500	Baseline: observed erosion area(m2) x unit value Final: No erosion from baseline expected
			Midterm (2023)	35,000	—	32,000	—	56,500	
			Final (2028)	0	—	0	—	0	
	8 Number of properties/ facilities exposed to damage (per flood)	Annual records on loss/ damage due to coastal disaster	Baseline (2019)	1.4 km of coastal road and parks	1 heritage site	199 houses	1 heritage site	261 houses	Baseline: interview survey to island councils on regional characteristics and past flooding event

		prepared by Atoll or Island councils. (Government data)	Midterm (2023)	1.4 km of coastal road and parks	1 heritage site	199 houses	1 heritage site	261 houses	Final: Flooding will be prevented by intervention
			Final (2028)	0	0	0	0	0	
	9 Damage on properties(houses) due to flooding (USD/year)	Annual records on loss/ damage due to coastal disaster prepared by Atoll or Island councils. (Government data)	Baseline (2019)	—	—	555,000	—	564,000	Baseline: since no detailed records available, estimated as possible damage up to present based on interview survey to island councils on past flooding event. Damage on heritage and coastal road was not evaluated due to difficulties in evaluation Final: Flooding will be prevented by intervention
			Midterm (2023)	—	—	555,000	—	564,000	
			Final (2028)	—	—	0	—	0	
	10 Income loss at island due to flooding (USD/year)	(same as above) (Government data)	Baseline (2019)	—	—	235,000	—	255,000	(same as above)
			Midterm (2023)	—	—	235,000	—	255,000	
			Final (2028)	—	—	0	—	0	
	11 Tourism income loses per flood (USD)	(same as above) (Government data)	Baseline (2019)	5,000	64,000	49,000	—	—	Baseline: since no detailed records available, estimated as possible damage up to present based on interview survey to island councils on past flooding event. Final: Flooding will be prevented by intervention
			Midterm (2023)	5,000	64,000	49,000	—	—	
			Final (2028)	0	0	0	—	—	
	12 Fishery production loses per flood (ton)	(same as above) (Government data)	Baseline (2019)	—	—	130	—	<100	(same as above)
			Midterm	—	—	130	—	<100	

			(2023)						
			Final (2028)	—	—	0	—	0	
	13 Agricultural production loses per flood (USD)	(same as above) (Government data)	Baseline (2019)	<100	—	950	—	<100	(same as above)
			Midterm (2023)	<100	—	950	—	<100	
			Final (2028)	0	—	0	—	0	

Annex-11-b：Monitoring and evaluation plans

Annex 11 Monitoring and evaluation plans

Monitoring				
Data/Source	Collection Tool	Frequency	Indicator	Indicative Budget
Fund-level impacts indicator				
Annual records on loss/ damage due to coastal disaster prepared by Atoll or Island councils.	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	*A1.1 Change in expected losses of lives and economic assets (US$) due to the impact of extreme climate-related disasters*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Independent socioeconomic survey results, disaggregated by sex.	*Document review*	- *Mid-term (2023)* - *Final (2028)*	*A1.2 Number of males and females benefiting from the adoption of diversified, climate resilient livelihood options (including fisheries, agriculture, tourism, etc.)*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Government asset ledger	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	*3.1 Number and value of physical assets made more resilient to climate variability and change, considering human benefits (reported where applicable)*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Government asset ledger	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	*A4.1 Coverage/scale of ecosystems protected and strengthened in response to climate variability and change*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Fund-level outcome indicator				

Published ICZM Guideline, government plans, strategies and policies *Coast Guard equipment ledger and MMS wave database*	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	*Number of technologies and innovative solutions transferred or licensed to support low-emission development as a result of Fund support.*	*Part of JPY8,000 thousand* *(Consultants for Mid-term and Final Evaluation)*
Published policy of ICZM and ICZM Plan	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	*A5.2 Number and level of effective coordination mechanisms*	*Part of JPY8,000 thousand* *(Consultants for Mid-term and Final Evaluation)*
Completion report for technical transfer by consultant	*Other (please specify)*	- *Mid-term (2023)* - *Final (2028)*	*A6.1 Use of climate information products/services in decision-making in climate sensitive sectors*	*Part of JPY8,000 thousand* *(Consultants for Mid-term and Final Evaluation)*
Implementation progress report by contractor	*Other (please specify)*	- *Mid-term (2023)* - *Final (2028)*	*A7.2 Number of males and females reached by [or total geographic coverage of] climate-related early warning systems and other risk reduction measures established/strengthened*	*Part of JPY8,000 thousand* *(Consultants for Mid-term and Final Evaluation)*
Fund-level results indicator				
Published government plans, strategies and policies	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	1. *Level of ICZM integration*	*Part of JPY8,000 thousand* *(Consultants for Mid-term and Final Evaluation)*
Government asset ledger	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	2. *Evacuation area created and number*	*Part of JPY8,000 thousand*

			of people saved	*(Consultants for Mid-term and Final Evaluation)*
Monitoring report to be prepared by Consultant	*Document review*	- *Mid-term (2023)* - *Final (2028)*	*3. Remaining width of beach (m) at target islands (*1)*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Monitoring report to be prepared by Consultant	*Document review*	- *Mid-term (2023)* - *Final (2028)*	*4. Erosion Area (m2) at target islands (*1)*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Monitoring report to be prepared by Consultant	*Document review*	- *Mid-term (2023)* - *Final (2028)*	*5. Coral coverage on reef at target islands (*1)*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
PSM technical data / baseline and endline surveys on sample households	*Survey/questionnaire*	- *Mid-term (2023)* - *Final (2028)*	*6. Coverage of population with reception of ISDB-T digital broadcasting services, and avoided economic loss*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Completion Report for technical transfer by Consultant	*Other (please specify)*	- *Mid-term (2023)* - *Final (2028)*	*7. Proficiency in Monitoring*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*

Evaluation			
Type	Timing	Independent/Self-evaluation	Indicative Budget/JPY
Process	**Mid-term Review (end of year 3)**	**Independent**	**4,000 thousand**
Outcome	**Final Evaluation (end of year 7)**	**Independent**	**4,000 thousand**

Appendix: additional project level indicators for Result 2: Protection of coastal communities and infrastructure exposed to coastal erosion

Tide monitoring data in Gan, Laamu Atoll	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	1. *S.L.R (cm) at target islands (*1)*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Reanalysis wave data (ERA5) (website)	*Other (please specify)*	- *Mid-term (2023)* - *Final (2028)*	2. *Increase of offshore wave height (H1/3, cm) at target islands (*1)*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Annual records on loss/ damage due to coastal disaster prepared by Atoll or Island councils.	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	3. *Average frequency of flooding due to swell wave(times/year) at target islands (*1)*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Annual records on loss/ damage due to coastal disaster prepared by Atoll or Island councils.	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	4. *Observed maximum flooding depth(D,cm) and distance toward inland (l,m) at target islands (*1)*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Monitoring report to be prepared by Contractor	*Document review*	- *Mid-term (2023)* - *Final (2028)*	5. *Turbidity of sea water on reef at target islands (*1)*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Monitoring report to be prepared by Consultant	*Document review*	- *Mid-term (2023)* - *Final (2028)*	6. *Retreat (m) at target islands (*1)*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Monitoring report to be prepared by Consultant	*Document review*	- *Mid-term (2023)* - *Final (2028)*	7. *Loss of national land (USD) at target islands (*1)*	*Part of JPY8,000 thousand (Consultants for Mid-term and Final Evaluation)*
Annual records on loss/ damage due to coastal disaster prepared by Atoll	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	8. *Number of properties/ facilities exposed to damage (per*	*Part of JPY8,000 thousand*

or Island councils.			*flood) at target islands (*1)*	*(Consultants for Mid-term and Final Evaluation)*
Annual records on loss/ damage due to coastal disaster prepared by Atoll or Island councils.	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	*9. Damage on properties(houses) due to flooding (USD/year) at target islands (*1)*	*Part of JPY8,000 thousand* *(Consultants for Mid-term and Final Evaluation)*
Annual records on loss/ damage due to coastal disaster prepared by Atoll or Island councils.	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	*10. Income loss at island due to flooding (USD/year) at target islands (*1)*	*Part of JPY8,000 thousand* *(Consultants for Mid-term and Final Evaluation)*
Annual records on loss/ damage due to coastal disaster prepared by Atoll or Island councils.	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	*11. Tourism income loses per flood (USD) at target islands (*1)*	*Part of JPY8,000 thousand* *(Consultants for Mid-term and Final Evaluation)*
Annual records on loss/ damage due to coastal disaster prepared by Atoll or Island councils.	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	*12. Fishery production loses per flood (ton) at target islands (*1)*	*Part of JPY8,000 thousand* *(Consultants for Mid-term and Final Evaluation)*
Annual records on loss/ damage due to coastal disaster prepared by Atoll or Island councils.	*Government data/records*	- *Mid-term (2023)* - *Final (2028)*	*13. Agricultural production loses per flood (USD) at target islands (*1)*	*Part of JPY8,000 thousand* *(Consultants for Mid-term and Final Evaluation)*

Note 1: (*1) Target islands include Meedhoo in Addu Atoll, Gan, Fonadhoo, Isdhoo and Maamendhoo in Laamu Atoll

Note 2: The baseline and target value for the indicators from No.1 to No.13 of the Fund-level results are shown in the separately attached file “Indicators and baseline and targets OPM-1”

Annex-13：Co-financing commitment letter

بسم الله الرحمن الرحيم

PREVENT DOMESTIC VIOLENCE

Ministry of Environment
Male', Republic of Maldives.

ހިނިތުންވެރިކަމާއި ތަރައްޤީގެ ވަޒާރާ
މާލެ، ދިވެހިރާއްޖެ.

8 April 2021

No: 438-CCD/PRIV/2021/163

Mr. Mitsuyoshi Kawasaki
Resident Representative
JICA Maldives Office
5th Floor, Farukani,
Neeloafaru Magu, Galolhu,
Male' 20131

Dear Mr. Kawasaki,

Co-financing commitment letter for Building Climate Resilient Safer Islands in the Maldives project

I refer to the letter referenced 13-N1/PRIV/2020/122 (5 February 2020) from the Ministry of Finance, expressing our commitment to the Building Climate Resilient Safer Islands in the Maldives project proposed for GCF funding.

I am writing to confirm that in addition to our earlier confirmation of commitment to provide USD 5.2 million from the national budget should the proposed project be approved, we commit to provide an additional contribution of USD 549,420, as per the revised project budget.

Thank you.

Yours sincerely,

Ajwad Musthafa,
Permanent Secretary

Green Building, Handhuvaree Hingun,
Maafannu, Male', 20392, Republic of Maldives.
+(960) 301 8300
www.environment.gov.mv

ގްރީން ބިލްޑިން، ހަންދުވަރެ ހިންގުން،
ދާރުއްދު، ފަ.ކ 20392، ދިވެހިރާއްޖެ.
secretariat@environment.gov.mv
www.twitter.com/MoEnvMv
www.facebook.com/environment.gov.mv

Japan International Cooperation Agency

Ref.: JICA(GE) 3 - 18004
Date: March 18, 2021

To: The Green Climate Fund (GCF)

Re: Co-financing Commitment Letter for
'Building Climate Resilient Safer Islands in Maldives' Project

Dear Madam/Sir,

I am writing to express our commitment to support 'Building Climate Resilient Safer Islands in Maldives' Project in the Maldives that was proposed to the Green Climate Fund for funding.

This is to confirm the contribution in technical cooperation of Japan International Cooperation Agency to co-finance the Project, should the proposal be approved, with a tentative value of USD34,751,280 in total.

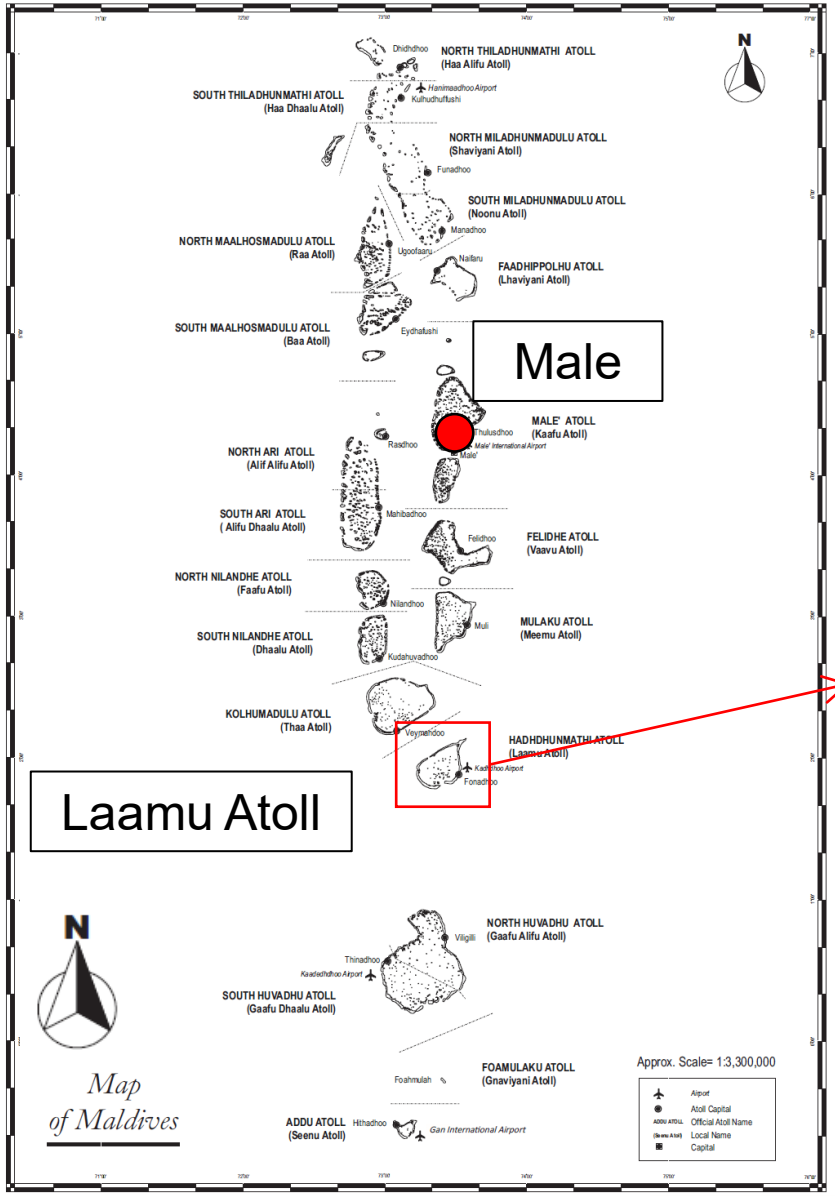
Sincerely Yours,

松元秀亮

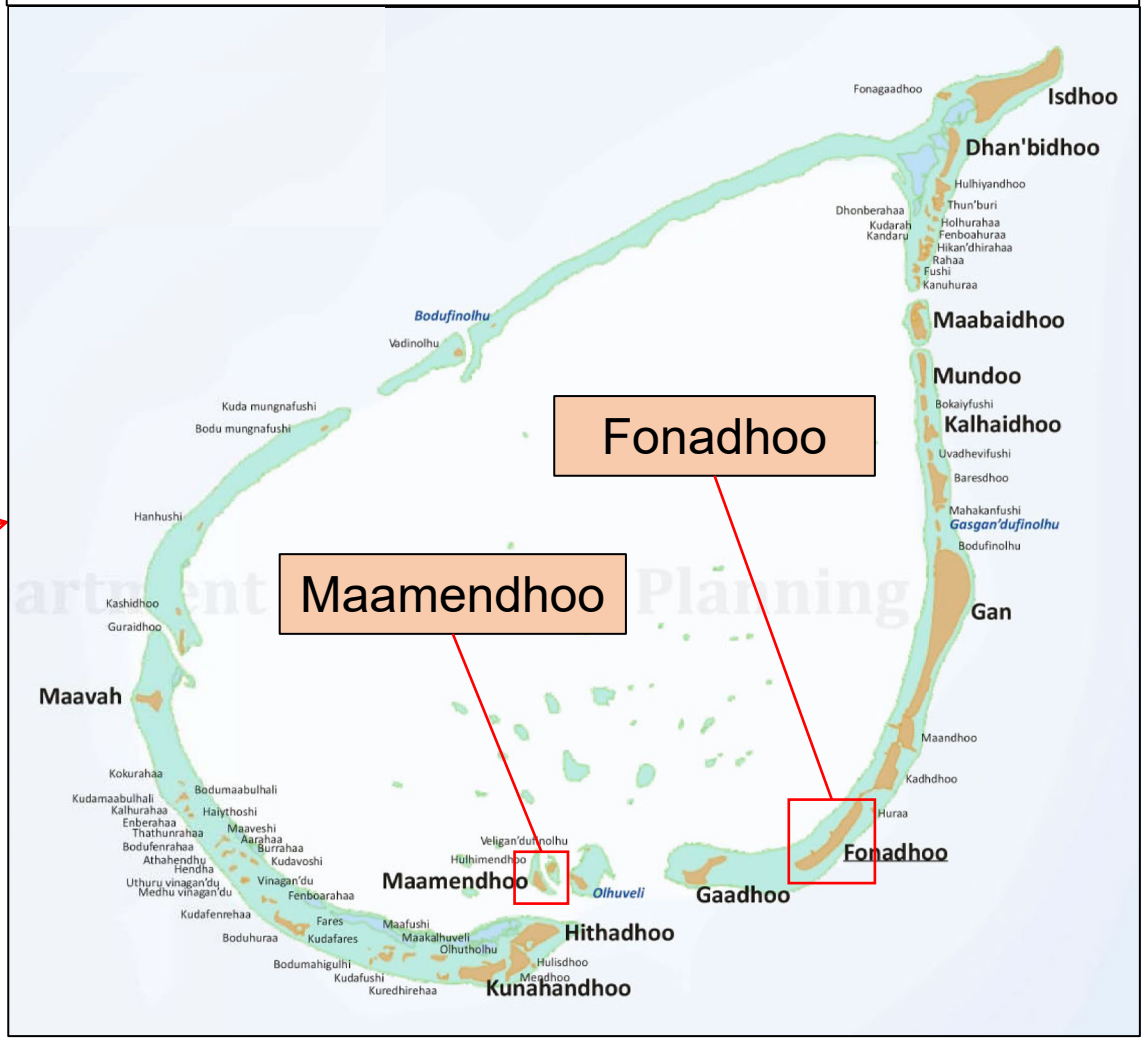
MATSUMOTO Hideaki
Director of Disaster Risk Reduction Team 2, Disaster Risk Reduction Group
Global Environment Department
Japan International Cooperation Agency (JICA)
Tokyo, Japan

Annex-16：Maps indicating the location of proposed interventions

Annex 16 : Maps indicating the location of proposed interventions



Target Islands for Coastal Adaptation Measures



Maamendhoo Island

1. East Coast (300m) : Beach Nourishment + Groins
2. West Coast (600m) : Beach Nourishment + Groins
3. North Coast : Reclamation + Perimeter Revetment

Fonadhoo Island

1. East Coast (850m) : Beach Nourishment + Groins

別添資料-B

海岸保全関連案件に関する資料

『海岸保全関連案件に関する資料』

- 目次 -

＜Part 1 ：基礎編＞

＜Part２：実施事業の概要＞

＜Part　1：基礎編＞

第1章　はじめに

東南アジア諸国のインドネシア、フィリピン、ベトナム等の諸国では、最近の急激な経済発展に伴い、特に沿岸域への人と資産、重要インフラ施設の集中化が加速し、また沿岸域での活発な開発が加速している。また南大洋州をはじめとする各小島嶼国においても、特定の島への人口集中や、これに伴う沿岸域の開発・集中が加速している。さらに近年では気候変動の影響と見られる波浪等の外力の変化・増大や、海面上昇、等が顕在化しつつあり、これらの影響については、特に標高が低く、狭小な島々の多いサンゴ礁起源の小島嶼国では、国の存続に関わる深刻な国家的問題として、早急な対応が求められており、日本をはじめとする先進国への支援の要請が高まっている。

代表的な沿岸災害として、高波・高潮被害、および海岸侵食が挙げられる。海岸侵食は、侵食による国土減少・消失を招くとともに、沿岸域に集中する居住地や、各種インフラ施設の損害および人々の安全・安心な暮らしを剥奪する。また海岸侵食により、高波・高潮災害等、他の海岸災害に対する脆弱性を更に高めることになる。

特に現在経済発展過程にある中進国では、経済開発とそれに伴う沿岸開発を優先し、海岸侵食問題に対する配慮が一般的に欠落している。そしてこれらの沿岸開発がなされる過程において、あるいはそれが完了した後に、深刻な海岸侵食問題に気づき、事後対策として、海岸侵食対策を実施する、というパターンがほとんどである。

日本においても､特に高度成長期時代までにおいて､経済開発を優先した沿岸開発が盛んに行われ、その結果、各地域で海岸侵食による砂浜の急激な減少・消失が生じ、ブロックが護岸・堤防による構造物対策により、多くの自然の海浜が失われてきた。

現在、中進国や島嶼国で生じている海岸侵食は、日本がこれまでたどってきた沿岸開発と海岸侵食助長の変遷と類似しており、そのような変遷を経験してきた日本が、その教訓を踏まえ、現在海岸侵食が進行しつつあるこれらの諸国に対して、海岸侵食や海岸保全に対する理解向上と、できるだけ早い段階からの海岸保全施策を提案･実施していくことが望ましい。

本資料は、海岸侵食に対する理解向上を図るために、海岸侵食の基本的理解、海外の海岸侵食の状況、およびこれまで貴機構が実施してきた本分野の事業の概要と成果をまとめたものである。

第2章　海岸侵食の基礎理解

2.1　海岸侵食の代表的なパターン

現在、中進国や小島嶼国で生じている海岸侵食の代表的なパターンとして以下に８つのケースを示す。

ケース１：河川からの土砂供給の減少による海岸侵食

ケース２：サンゴ礁の環境悪化や人為的な土砂採掘によるサンゴ砂礫の供給減少による海岸侵食

ケース３：沿岸域での大規模インフラ施設構築に伴う波・流れの変化による海岸侵食

ケース４：沿岸域でのインフラ施設構築による沿岸漂砂阻止に伴う海岸侵食

ケース５：リーフ上でのインフラ施設構築による沖側からの漂砂移動阻止に伴う海岸侵食

ケース６：前浜域での海岸防護施設（護岸）構築による砂浜の消失

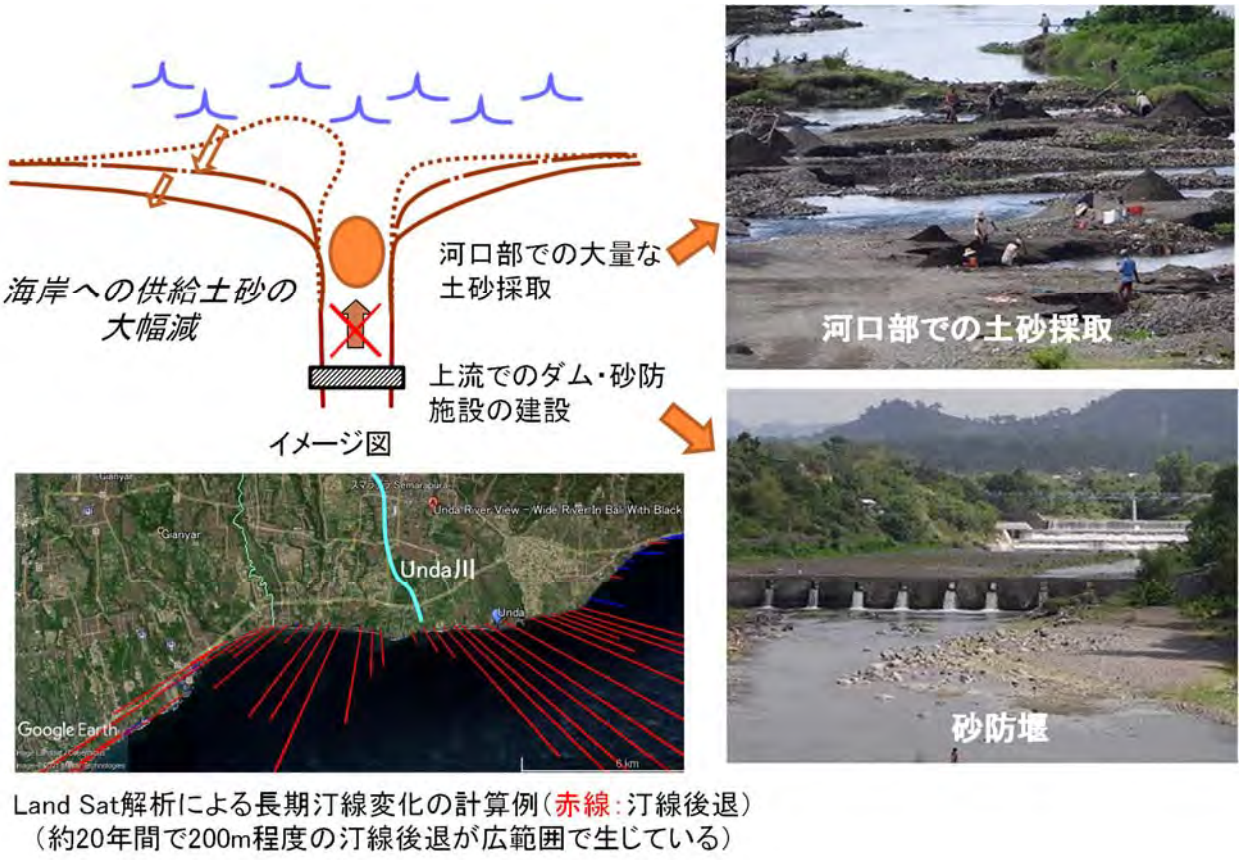
ケース７：気候変動による外力変化（増大）による海岸侵食の助長

ケース８：気候変動による海面上昇（SLR）による海岸侵食の助長

ここで、ケース１～６は、沿岸域における人為的作用に起因した海岸侵食、ケース７，８は気候変動に起因した海岸侵食である。これより、現在生じている海岸侵食のそのほとんどの要因としては、人為的作用により生じているものである。

(1) ケース１：河川からの土砂供給の減少による海岸侵食

近年、東南アジアの各国で生じている典型的な海岸侵食の事例であり、日本においても海岸侵食の最も一般的な要因の１つである。一般的な砂浜海岸を校正する砂の供給源として、最も代表的なのが、河川から供給される土砂である。日本においても、高度成長期時代における建設資材調達のための大量の土砂採取が全国各地の河川で行われた。同様の問題が、フィリピン、インドネシア、ベトナム等の、現在経済開発の最中にある国々で生じている。図 2.1.1 は、その事例の１つとして、インドネシア国バリ島東部海岸の Unda 側河口部の様子を示したものである。ここでは近年、建設資材調達のための近年河口部での大量の土砂採取、および上流での砂防ダム、チェックダム、堰等の建設が行われ、河口部から数十キロの範囲での大規模な海岸侵食が生じた。その侵食量は、過去 20 年間で 200 m 以上の汀線の後退が生じた。



出典：JICA 課題別研修(2018)資料を元に修正

図 2.1.1　ケース１：河川からの土砂供給の減少による海岸侵食

(2) ケース２：サンゴ礁の環境悪化や人為的な土砂採掘によるサンゴ砂礫の供給減少による海岸侵食食

ケース２は、サンゴ礁海岸でよく見られる事例である。サンゴ礁（リーフ）の海底面を形成するサンゴ塊やサンゴ砂礫は、サンゴ礁乗であることから水深も浅く容易に採取可能であるため、最も手軽かつ安価な建設資材であった。これより、大量のサンゴ塊、サンゴ砂礫が特にサンゴ礁上の浅い場所から採掘、採取されるケースが多い。特に南大洋州諸国（例えばツバル、キリバス、マーシャル等）や南アジアのモルデイブ国などは、国土がサンゴ砂礫で形成されている小島嶼国であり、基本的に自国で調達できる建設資材として、このような行為が顕著に行われた。サンゴ礁海岸の海岸を形成する土砂は、サンゴ礁から供給されるため、このようなサンゴ礁上での大量な土砂採取は、ケース１と同様、土砂供給源の顕著な減少を引き起こす。また近年は、気候変動によるエルニーニョの頻発化による海水温の上昇や、経済発展に伴う生活排水の増加によるサンゴ礁上の水質悪化等によるによるサンゴの白化・死亡も顕在化している。図 2.1.2 左図は、サンゴ白化・死亡の様子、右図はサンゴ礁上での大規模サンゴ採掘の事例を示す。

出典：JICA 課題別研修(2018)資料

図 2.1.2　ケース２：サンゴ礁の環境悪化や人為的な土砂採掘によるサンゴ砂礫の供給減少による海岸侵食

（右：ツバル国 Fonadoo 島の事例、左：インドネシア国バリ島東部海岸、Candidasa 海岸の事例）

(3) ケース３：沿岸域での大規模インフラ施設構築に伴う波・流れの変化による海岸侵食

ケース３は、大規模インフラ施設構築に伴う波・流れの変化により、局所的な海岸侵食が生じた事例である。ここではサンゴ礁上での滑走路建設に伴う事例を示すが、通常の砂浜海岸においても、同様の要因による局所的な海浜変形（海岸侵食）が生じる。図 2.1.3 はインドネシアバリ島 Kuta 海岸の事例を示すが、ここでは 1960 年代にサンゴ礁上の浅い海域を利用して約 800 m の延長の滑走路が建設された。これにより、波による広域な遮蔽域が形成され、サンゴ礁上における従来の波と流れのパ

ターンが変化し、局所的に顕著な対岸侵食が生じた（右図）。その汀線後退量は、大きいところで 200 m 以上となっている。

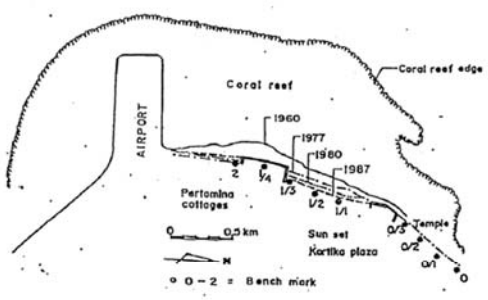


Figure 1.4.5 Longshore Change in Shoreline since1960
(Source: Syamsudin (1993), "Beach Erosion in Coral Reef Beaches and Its Control")

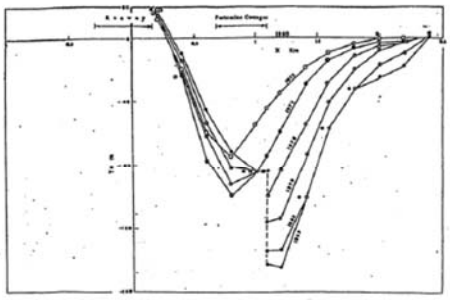


Figure 1.4.6 Longshore Change in Shoreline since1960 at Kuta
(Source: Syamsudin (1993), "Beach Erosion in Coral Reef Beaches and Its Control")

リーフ上での滑走路建設後(1960～)の海岸変化
(出典：Syamsudin, 1993)

出典：Google 画像を元に JICA 調査団で加工

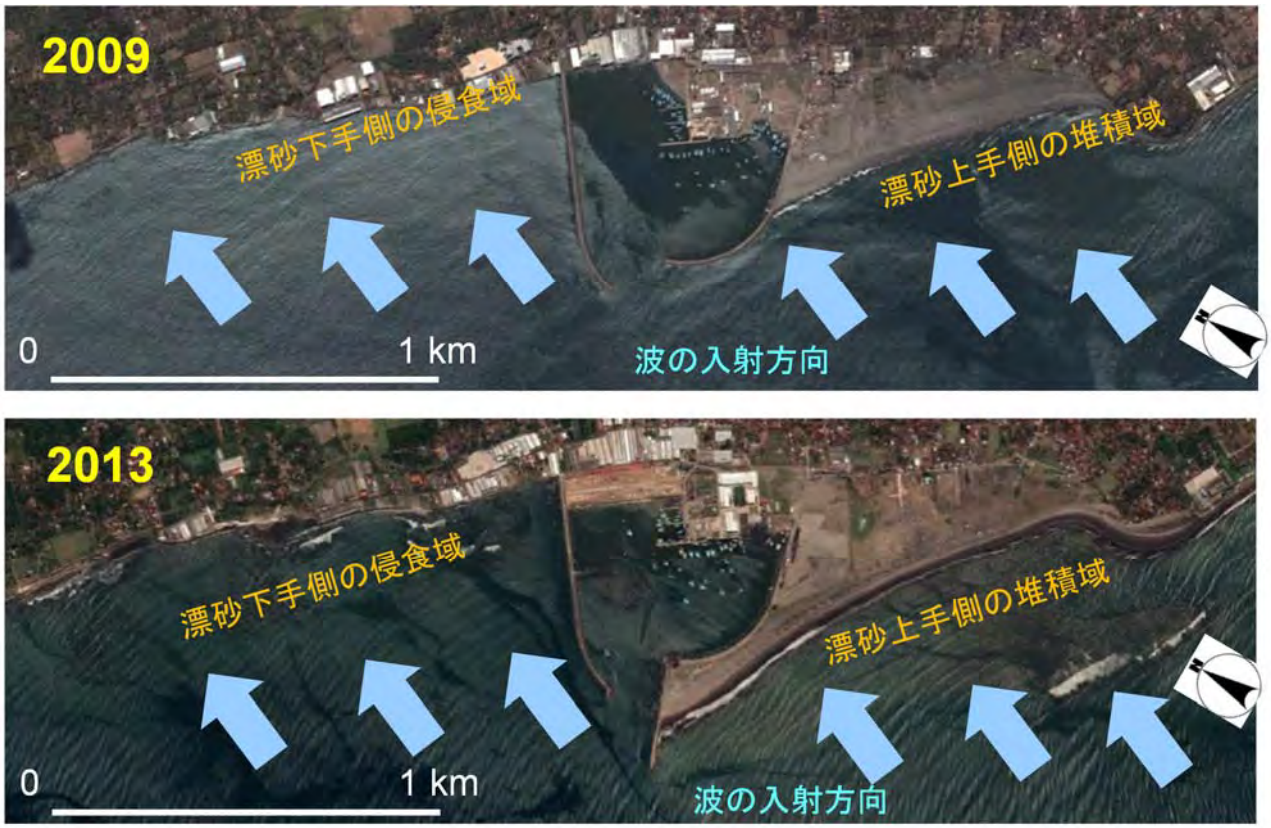
図 2.1.3　ケース３：沿岸域での大規模インフラ施設構築に伴う波・流れの変化による海岸侵食

（インドネシア国バリ島 Kuta 海岸の事例）

(4)　ケース４：沿岸域でのインフラ施設構築による沿岸漂砂阻止に伴う海岸侵食

海岸域に波が斜めから入射すると、沿岸方向への砂移動、すなわち沿岸漂砂が生じる。ほとんどの海岸域では、大なり小なり、この沿岸漂砂が存在する。沿岸漂砂は連続する１つの漂砂系の中では連続的に生じているため、このような海岸に港等のインフラ施設が構築されると、これにより沿岸漂砂の連続性が阻止され、漂砂の下手側への土砂供給が途絶え、上手側での堆積と、下手側での海岸侵食が生じる。沿岸域に港が構築される所のほとんどの海岸で、この要因による海岸侵食が生じている。沿岸漂砂そのものは、波により常に生じているため、一度このような施設が構築されると、下手側での侵食は徐々に更に下手側に拡大し、最終的には連続する漂砂系の端部まで生じることとなる。

図 2.1.4 は、沿岸漂砂の卓越する海岸域で漁港を建設し、漂砂上手側での顕著な堆積と、下手側での侵食が生じている事例である。上手側での堆積域は、漁港泊地内まで達し、漁船の出入港に支障を来していたため、更に防砂堤が建設されている。また下手側での侵食域は徐々に更に下手側に拡大しつつある。



出典：Google 画像を元に JICA 調査団で加工

図 2.1.4　ケース４：沿岸域でのインフラ施設構築による沿岸漂砂阻止に伴う海岸侵食

（インドネシア国バリ島西部海岸ペンガンベガン漁港の事例）

(5)　ケース５：リーフ上でのインフラ施設構築による沖側からの漂砂移動阻止に伴う海岸侵食

サンゴ礁海岸では、リーフ沖側から入射する波は、リーフエッジで砕波し、リーフ内を伝達する。この波の作用により、海岸を形成するサンゴ砂は沖から岸に向かって供給される。このため、リーフ上で、このような砂移動を阻止するような人為的作用があると、岸側に到達するサンゴ砂礫の移動特性に影響を及ぼし、結果として海岸侵食を助長するケースがある。図 2.1.5 は、リーフ上の岸側近くで、大規模な掘削が行われた事例である。掘削により水深が増大し、沖から供給されるサンゴ砂礫がこの深掘部にトラップされてしまう。また水深増大による海岸到達波高の増大も招き、この２つの要因により海岸侵食が助長されることになる。

リーフ上の掘削（モルデイブ Laamu 環礁）

出典：Google 画像を元に JICA 調査団で加工

図 2.1.5　ケース５：リーフ上でのインフラ施設構築による沖側からの漂砂移動阻止に伴う海岸侵食（モルデイブ国 Laamu 環礁の事例）

(6)　ケース６：前浜域での海岸防護施設（護岸）構築による砂浜の消失

一度海岸侵食が顕在化してくると、更なる陸地の消失を防ごうとして護岸を構築する事例が多い。護岸構築で非常に多いのは、できるだけ陸側の背後地を広く確保しようとし、護岸設置位置を可能な限り海側に作る事例である。図 2.1.6 は前浜上に新たに護岸を構築した事例である。前浜域は、波の変動に伴って、常に変動しているゾーンである。この前浜域を潰して護岸を構築することにより、波に対する変動域としての機能を有する前浜が無くなり、波が常に護岸に作用することにより、反射波の増大と、それに伴う前面洗掘、これによる砂浜域の消失を招く。

出典：Google 画像を元に JICA 調査団で加工

図 2.1.6　ケース 6：前浜上での護岸構築およびそれによる海岸侵食の助長

（フィリピン国での事例）

(7) ケース７：気候変動による外力変化（増大）による海岸侵食の助長

近年、気候変動の影響とみられる異常気象、それによる熱帯低気圧や台風、サイクロンの頻度の増大、経路の変化、またその巨大化が生じている。これにより、海岸に到達する波浪の波高増大や入射方向の変化が生じ、これまでとは異なる海浜変形が生じ、新たな海岸侵食問題が生じることが指摘されている。図 2.1.7 は、2013 年 11 月にフィリピン中部に襲来した台風ヨランダによる高潮発生状況、および 2018 年 9 月に日本の四国地方に襲来した台風 21 号の様子を示すものである。ヨランダでは高波・高潮による人災や家屋の甚大な被害が報告されているが、このような異常波浪・異常水位時には砂浜は一気に後退する。また台風 21 号については、襲来経路が従来の経路とは異なり、これによるこれまでとは異なる海浜変形が生じたことが報告されている。

台風21号の経路および波浪状況

台風ヨランダの高潮状況

出典：WEB サイトより

図 2.1.7　ケース７：気候変動による外力変化（増大）による海岸侵食の助長

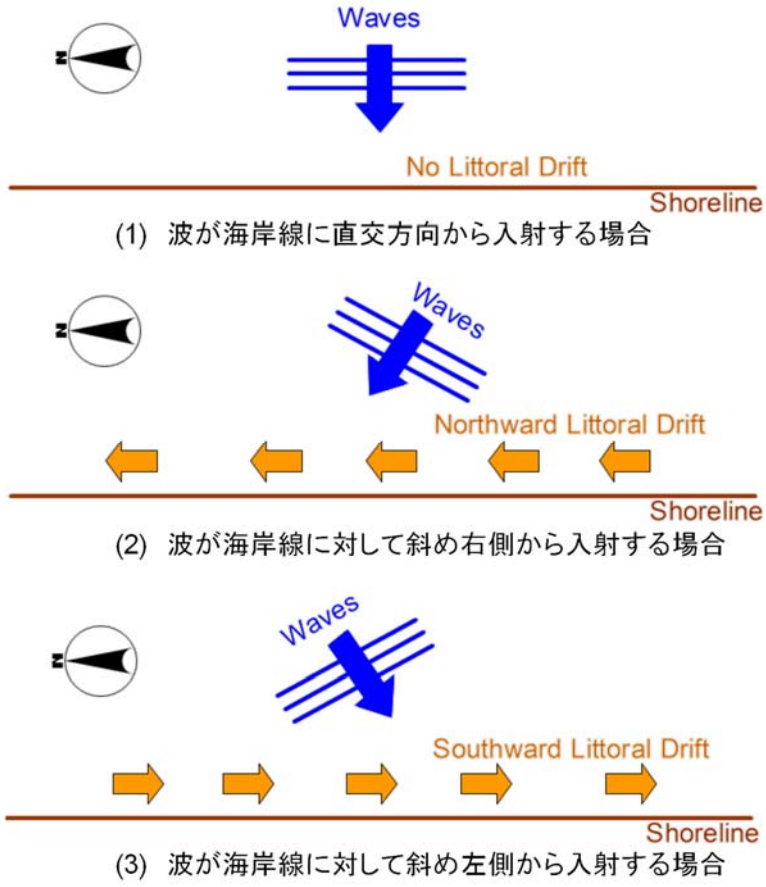
（左図：日本の事例（2018 年台風 21 号）、右図：フィリピンの事例（2013 年台風ヨランダ）

(8) ケース８：：気候変動による海面上昇（SLR）による海岸侵食の助長

IPCC 第５次報告書によると、世界平均の海面上昇量（SLR）は、1902 年～2015 年で平均 0.16 m 上昇したことが報告されている。一方 2006 年～2015 年のみに着目した場合には 3.6 mm/year となっており、上昇量が加速していることが示されている。サンゴ砂礫が堆積して形成されたモルデイブのような小島嶼国においては､海岸に到達する波の波高は､リーフの存在により水深でほぼ規定されるため、このような SLR の影響は大きくなる。試算として、モルデイブで生じている海岸侵食について、これまで生じて着る SLR の影響度を検討した。モルデイブでは 1986 年～2018 年の 33 年間で、10.6 cm の SLR が観測されており、このデータを元に、これまで生じている海岸侵食に対する SLR の影響を推定した結果、海岸侵食の数十%程度の割合は、SLR の影響で生じている可能性があることが示された。ただしこの試算結果はあくまでもいくつかの仮定を元に試算されたものである。

2.2 沿岸漂砂の基本的理解

海岸侵食問題に大きく関わる沿岸漂砂について説明する。沿岸漂砂は、波の入射方向の違いにより生じる沿岸方向に沿った砂移動を示すものである。図 2.2.1(1)に示すように、海岸線に対して波が直交して入射するような場合（図では真東から入射）は、ネットとして海岸沿岸方向の砂移動は生じず、海岸は安定している。つぎに(2)にあるように、波が南東から入射する場合、ネットとして北に向かう砂移動（北向き沿岸漂砂）が生じる。反対に(3)のように、波が北東から入射する場合には、ネットとして南に向かう砂移動（南向き沿岸漂砂）が生じる。

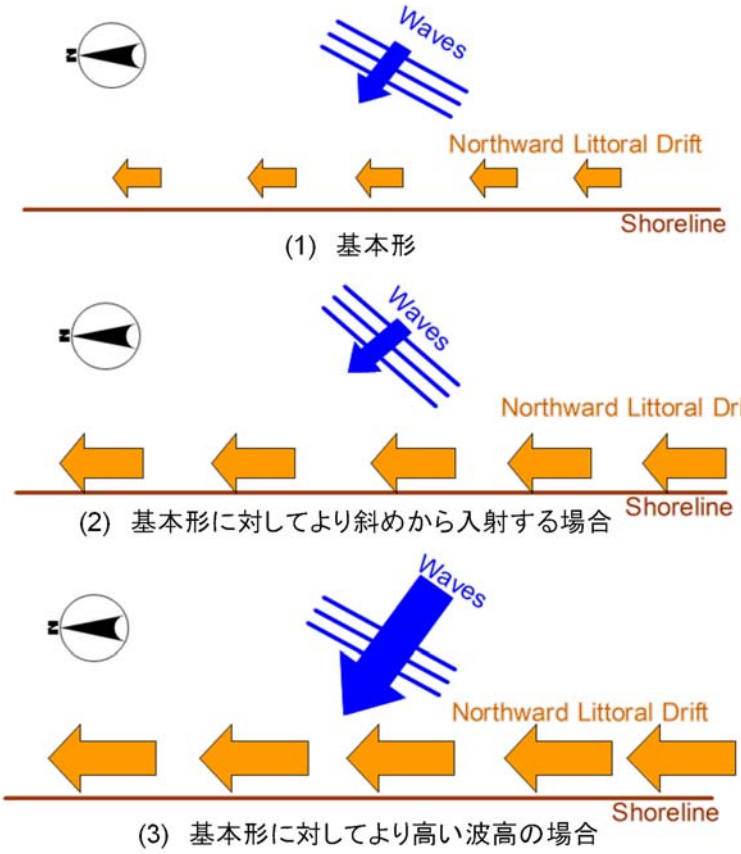


出典： JICA 課題別研修（2018）資料

図 2.2.1 沿岸漂砂の概念

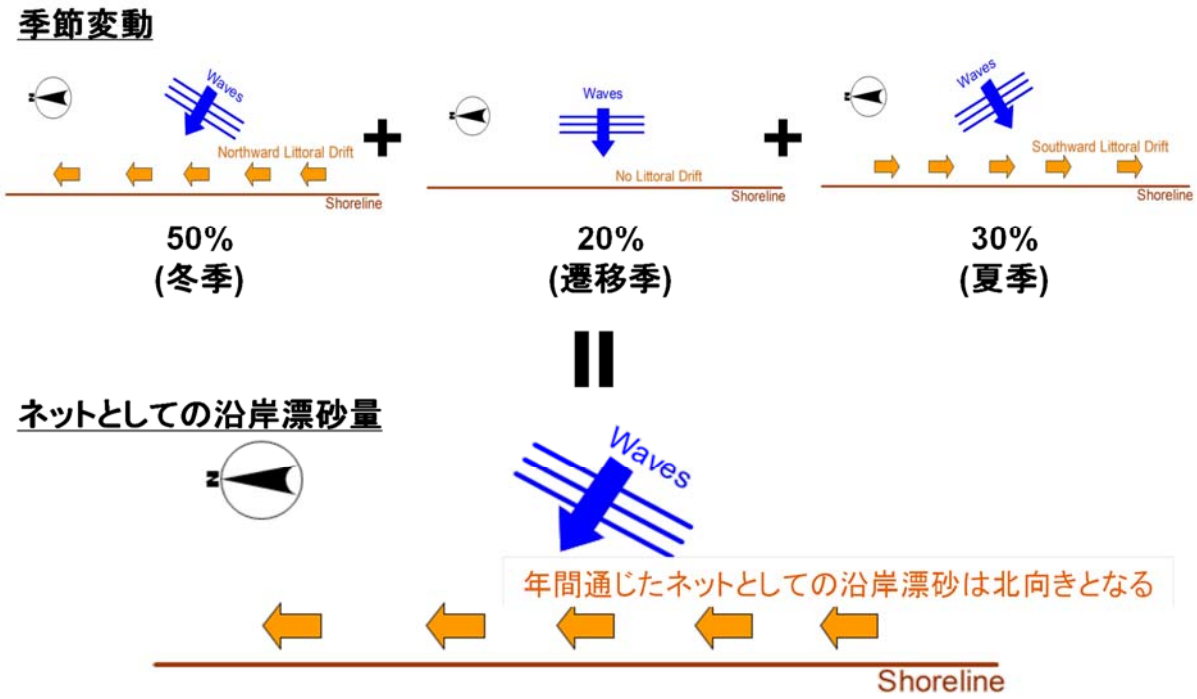
沿岸漂砂は、波のエネルギー（波高の二乗に比例する）および入射波向により、その強度が変わる。図 2.2.2 の(1)を基本形として考えた場合、(2)のように波が更に斜めから入射する場合、沿岸漂砂量は(1)の基本形に比べて大きくなる。また(3)のように、(1)の基本形と波向は同じであるが波高が大きくなると、沿岸漂砂量が大きくなる。沿岸漂砂量が大きいほど、例えばそれを阻止するような港等の施設が構築された場合、漂砂上手側での堆積、下手側での侵食がより顕著となる。

実際の現地の海岸では、季節的な気象変化、それによる波浪特性の季節変動により、漂砂移動も変動する。図 2.2.3 にその概念を示す。



出典：JICA 課題別研修（2018）資料

図 2.2.2　沿岸漂砂の大きさの概念図



出典：JICA 課題別研修（2018）資料

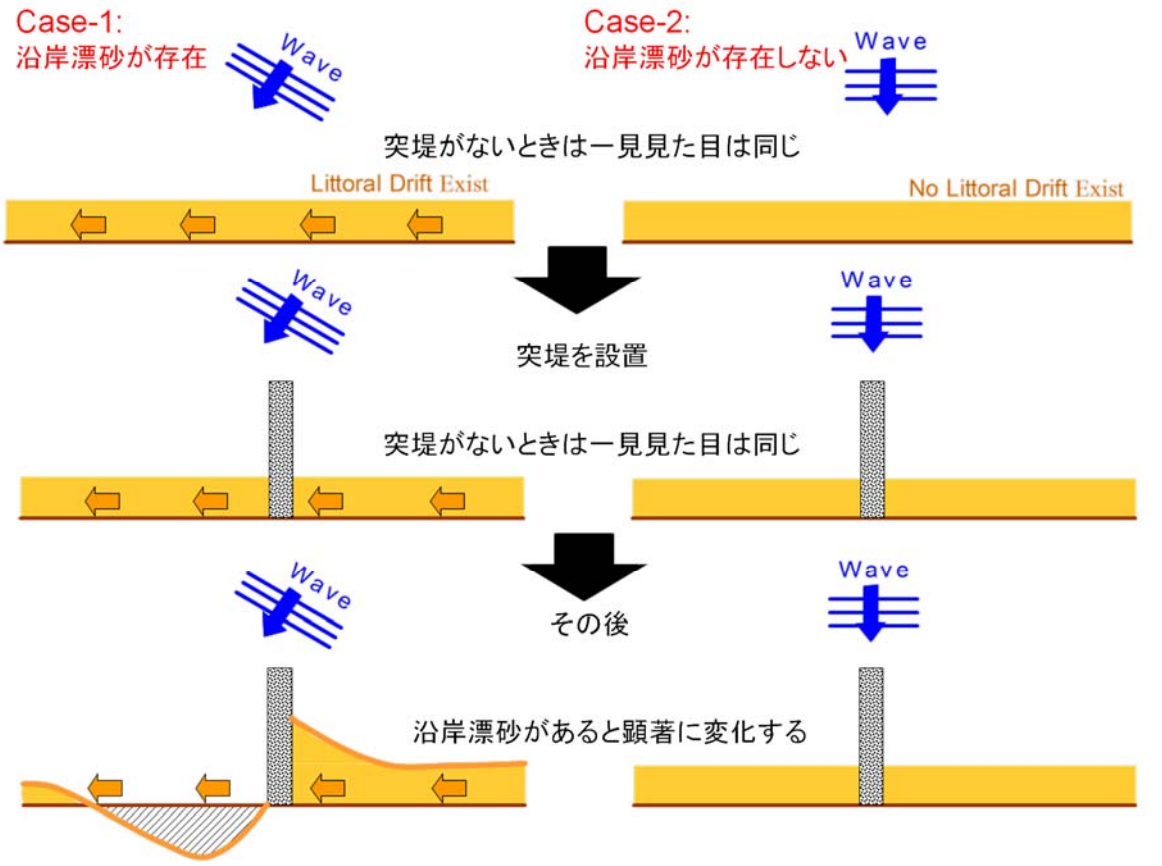
図 2.2.3　沿岸漂砂の季節変動と年間のネットとしての漂砂移動の概念図

図に示すように、例えば冬季の南東方向からの波の入射が 50%、夏季の北東からの入射が 30%、その遷移季では顕著な沿岸漂砂が生じない波向とした場合、年間を通じたネットとしての沿岸漂砂量は数に示すように北向きとなる。

このように、各海岸における沿岸漂砂の強さを推定するとともに、年間を通じた漂砂方向、漂砂量を知ることは、海岸侵食に対する影響度を調べる上で非常に重要となる。

2.3　海浜変形の代表的パターン

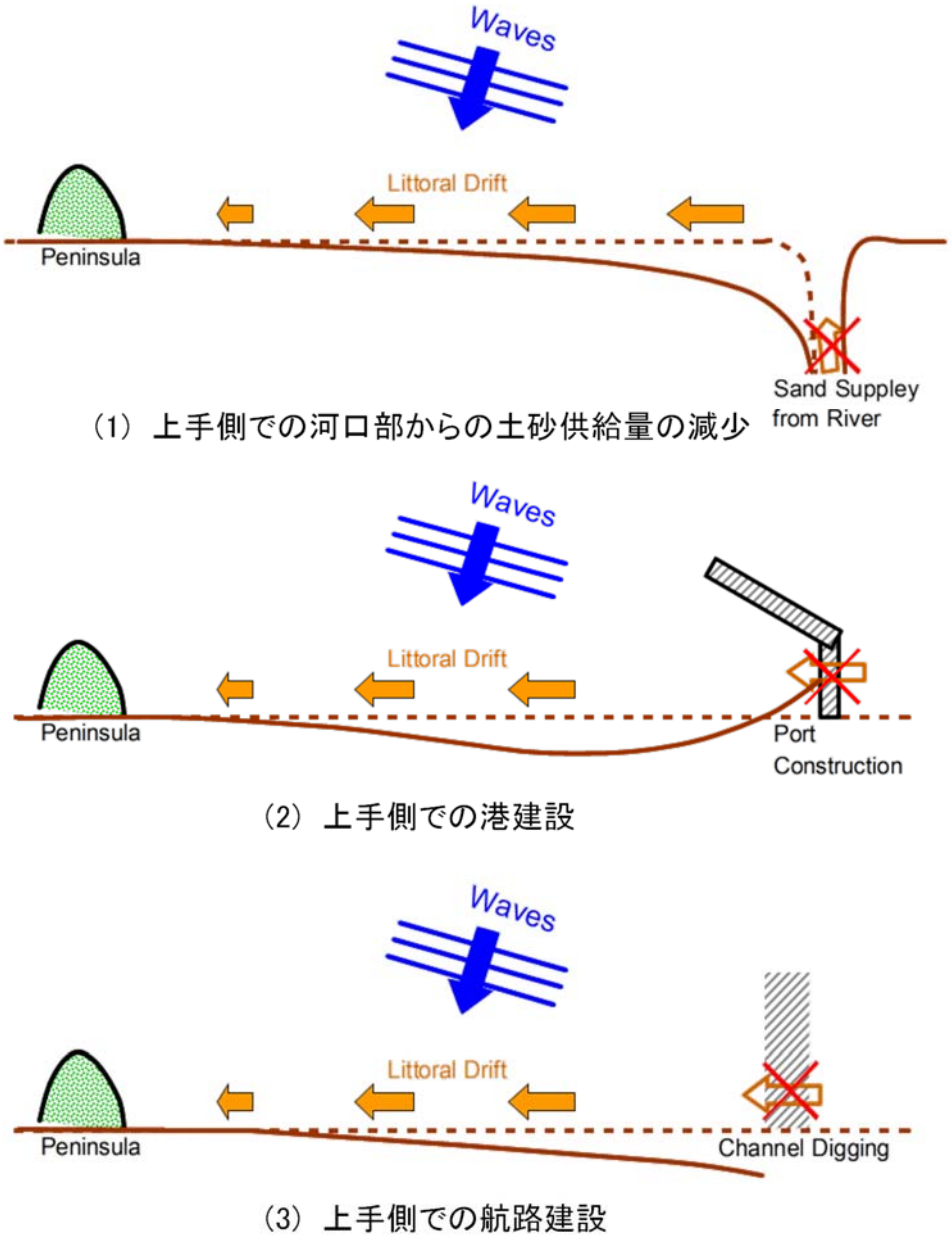
ここでは、代表的な海浜変形パターンを概念図で示す。図 2.3.1 は、突堤建設に伴う周辺海浜変化を概念的に示したものである。比較のため、Case-1 として沿岸漂砂が存在する海岸、Case-2 として存在しない海岸で示す。自然海浜の状態（上図）では、一見、海岸線は両方とも同じで変化が見られない。しかし実際は、Case-1 では常に左に向かう沿岸漂砂が存在し、動的に安定している状態である。一方 Case-2 では砂移動はなく、静的に安定している状態である。このような海岸に突堤を設置すると、Case-1 では上手側での堆積と、下手側での侵食が生じる。一方 Case-2 では突堤を設置しても静的状態が変わらないので変化が生じない。このように、沿岸漂砂海岸では、施設構築等の人為的作用を受けると、必ず周辺での海浜変形が生じる。図 2.3.2 は、このような沿岸漂砂海岸における下手側での侵食パターンの代表的なケースを概念的に示したものである。



出典：JICA 課題別研修（2018）資料

図 2.3.1　突堤設置の影響に対する概念図

(1)は、漂砂上手側に河口部があり、加工からの土砂供給が減少する事例である。以前は土砂供給の存在下で動的に安定状態であったものが、供給量が減少することによりその安定機構が崩れ、下手側で侵食が生じるイメージである。(2)は、漂砂上手側に港等のインフラ施設が構築されたケースであり、これにより上手側からの漂砂の連続性が阻止され、下手側での侵食が生じるイメージである。(3)は、例えば漂砂上手側で航路等の浚渫が行われたようなケースであるが、これによっても上手側からの漂砂が航路内に落ち込み、これにより下手側での侵食が助長される。一方航路側においては、航路埋没問題が生じることになる。



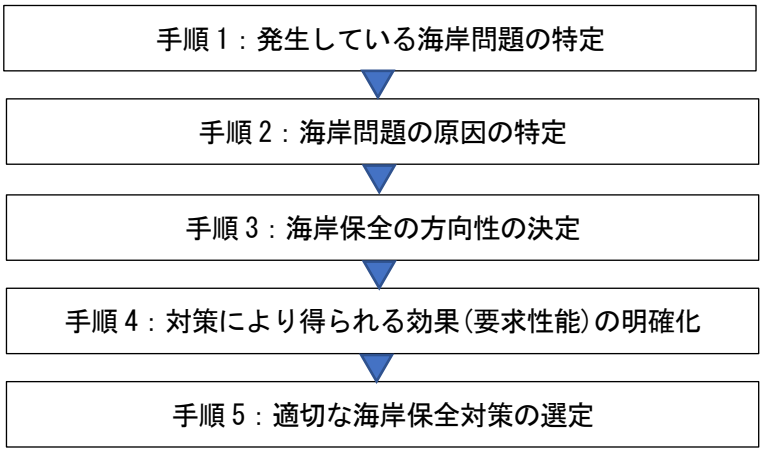
出典：JICA 課題別研修（2018）資料

図 2.3.2　沿岸漂砂下手側での代表的な侵食パターン

第3章　海岸侵食対策の基礎理解

3.1　対策の考え方

海岸域で発生している問題やその発生原因は様々である。海岸保全対策の検討にあたってはまず、発生している海岸問題の現象把握をおこない、その原因を特定することが重要である。原因特定が不十分である場合、適切な対策の計画が困難であるだけでなく、実施した対策が結果的に問題を悪化させるという事態も発生しうる。下記に海岸保全対策を検討するにあたって必要となる検討手順を示す。特に、項目 3 において、海岸が本来持つ機能である防護・利用・環境および気候変動への適応性の 4 側面を考慮したうえで、目標とする効果を明確にしたうえで対策を選定することが重要である。各手順における概要を以降に示す。



出典：JICA 調査団

図 3.1.1　対策の選定に係る手順

(1)　手順 1：発生している海岸問題の特定

海岸の防護・利用・環境の側面で海岸問題を特定する。なお、海岸問題は単独ではなく互いに関連して発生することも多い。下図に典型的な海岸問題として、ツバル国の事例[1]をもとに示す。ツバル国においては、1) 国土の消失、2) 海岸災害のリスクの増大、3) 利用可能な海岸域の消失、4) 海岸域の動植物の消失等の影響が発生していた。

[1] ツバル国沿岸災害対応のための礫養浜パイロットプロジェクト　ファイナル・レポート(2018 年、JICA)

海岸侵食の発生	海岸利用上の支障
	
背後のインフラへの波浪影響	家屋(資産)への波浪影響
	
海岸環境の悪化(衛生・悪臭)	サンゴ環境の悪化

出典：JICA レポート[2]をもとに調査団が作成

図 3.1.2　典型的な海岸問題(ツバル国の事例)

(2)　手順 2：海岸問題の原因の特定

発生している海岸問題に対して、その発生原因について調査・特定する。原因は自然要因や人為的要因、気候変動要因など多岐に渡ることも多い。例えば、海岸侵食の発生する要因は、当該海岸への土砂供給量の減少によるものと考えられるが、その典型的な要因として次が考えられる。原因によってその対策方法も異なってくるため、生じている海岸問題に対する原因の特定をおこなったうえで、その原因を解決しうる対策を検討することが重要である。

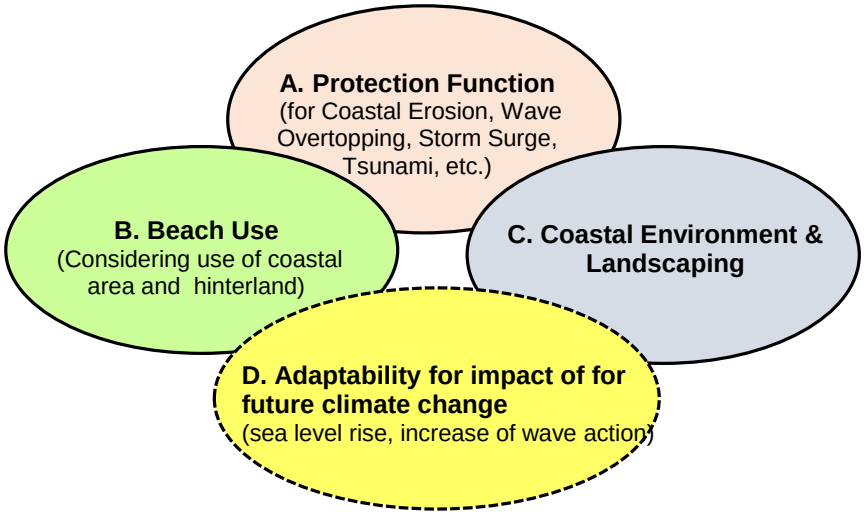
海岸侵食における典型的な原因

1) 河川における土砂採取
2) 河川におけるダム建設
3) 海岸や浅海域における土砂採取
4) 沿岸域における建設(港湾、漁港、突堤、護岸など)
5) 沿岸域の大規模埋立
6) 水深サンゴ礁の掘削(航路造成など)
7) 海水温の上昇によるサンゴ礁の死滅など

[2] ツバル国沿岸災害対応のための礫養浜パイロットプロジェクト　ファイナル・レポート(2018 年、JICA)

(3) 手順 3：海岸保全の方向性の決定

我が国の海岸法では、海岸の機能として防護・利用・環境の 3 種類を考慮した海岸保全対策の必要性が示されている。これに、近年重要度を増している「気候変動への適応性」を加えた 4 つの機能を基本に、それぞれ満たすべき水準を考慮し、海岸保全の方向性を検討することが重要である。



出典：ツバル国沿岸災害対応のための礫養浜パイロットプロジェクト　ファイナル・レポート(2018 年、JICA)

図 3. 1. 3　海岸保全の方向性の検討に考慮すべき 4 つの側面

(4) 手順 4：対策により得られる効果(要求性能)の明確化

対策によって得られる効果(要求性能)を明確化する必要がある。例えば、越波防護の観点では、背後地の重要性に応じて許容する越波量を変更し、海岸侵食の場合は汀線の回復幅の設定などが挙げられる。

許容越波量を小さく設定した場合、護岸の構造は大きくなり背後地と海岸域は大きく分断され、海岸利用に支障が発生する可能性がある。一方、許容越波量を大きく設定した場合、護岸の規模は小さくなり、海岸利用や事業費では有利になる一方、背後地への浸水被害の危険性は高まる。また、汀線の回復幅について、過大に設定した場合は周辺の砂浜や波浪影響に対し不均衡が発生し、費用対効果の低い対策となり、周辺への海岸環境についても悪影響を及ぼす可能性がある。

このように、一般に海岸保全対策は防護・利用・環境・およびコストの側面でトレードオフの関係にあることから、それぞれ特徴を勘案したうえで、対策に求める効果を明確化したうえで、対策を検討する必要がある。

(5) 手順 5：適切な海岸保全対策の選定

以上を踏まえ、いくつかの保全対策を比較・検討したうえで最適案を選定する。比較指標としては、上述の 4 つの機能(防護・利用・環境および気候変動への適応性)や建設コストに加え、対象海岸の地理的特性や社会的特性を考慮した施工性や、長期的な視点での維持管理性能(ライフサイクルコスト含む)などの視点で総合的な評価をおこなうことが望ましい。また、対策によって得られる定量的な効果の大小を評価に加えることも考えられる。

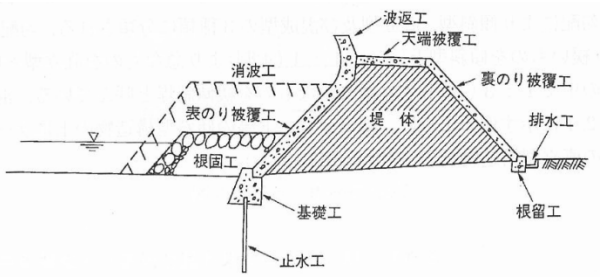
3.2 各対策案の適用性の比較検討

(1) 代表的な海岸侵食対策とその特徴

海岸侵食対策として代表的な工法を以下に示す。なお、ここで示す海岸侵食対策は主に波浪制御に重点をおいた工法も存在し、必ずしも適切な海岸侵食対策とはなり得ないこともあることに留意が必要である。

1) 堤防・護岸

- 機能：設計対象の高潮や高波に対して、海水の侵入を防止する機能を持つ。また、根固め工や基礎工により背後への海岸侵食に対しては抑制する効果を持ちうる。
- 構造形式：1) 傾斜型 (石張り式、コンクリートブロック張式、コンクリート被覆式など)
  2) 直立型 (石積み式、重力式、扶壁式)
  3) 混成型
- 海岸侵食対策としての効果・留意点：消波機能が主となる。施設前面で発生する反射波の影響で、施設前面の海底地形が侵食されやすく、これにより海岸侵食状況を悪化させるケースも多い。

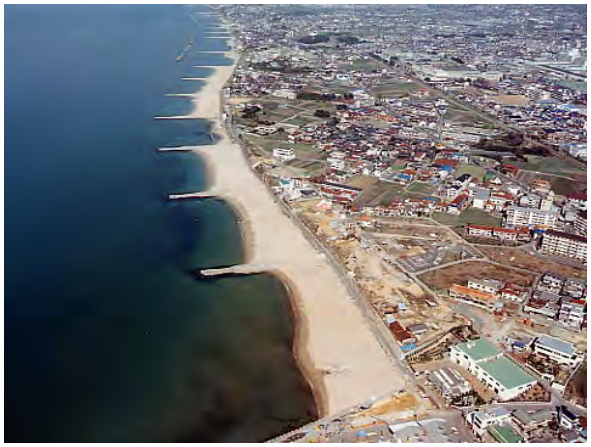
<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>(a) 直立型</td><td>(b) 緩傾斜型</td></tr>
<tr><td>  </td><td> 
</td></tr>
<tr><td>(c) 消波工(直立型の前面に設置)</td><td>(d) 堤防の断面形状</td></tr>
</table>

出典：(a)-(c) 海岸管理の現状について(国土交通省)、(d) 海岸保全施設の技術上の基準・同解説(平成 30 年、全国農地海岸保全協会ほか)

図 3.2.1 堤防・護岸の一般例

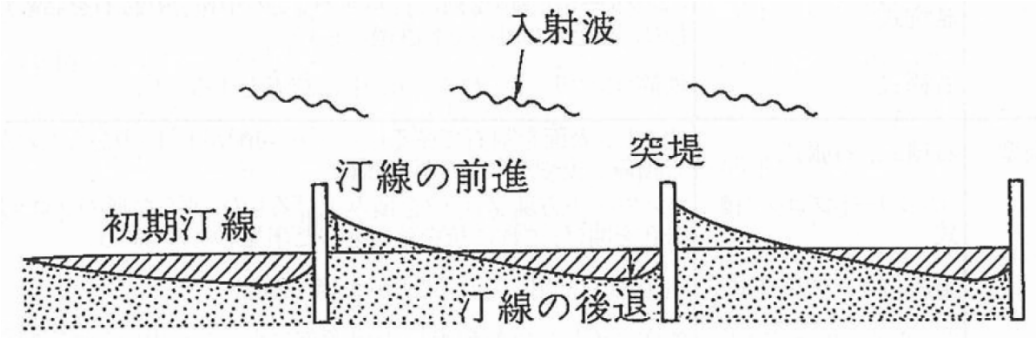
2) 突堤

- 機能：陸上から沖方向に細長く突出した形の構造物で、沿岸漂砂の卓越する海岸において、海岸侵食の防止・軽減および海浜の安定化を図ることを目的として設置される。養浜と合わせて実施することで、汀線の維持・回復を図ることができる。
- 構造形式：1) 透過型 (捨て石式、捨てブロック式等)
  2) 不透過型 (石積み式、石張り式、コンクリートブロック積式)
  3) 断面形状別：直立型(斜面勾配鉛直～1:1)、傾斜型(斜面勾配、より緩やか)
  4) 平面形状別：直線型、T 型、L 型
- 海岸侵食対策としての効果・留意点：突堤のサイズの増大(天端高・天端幅)、不透過型の採用などによって沿岸漂砂を過度に減少させると、突堤に対する沿岸漂砂の下手側では現状よりも汀線の後退が生じる可能性が高くなる。域全体の侵食対策のためには、養浜と合わせて実施する必要がある。



(a) 突堤(直線型)

(b) 突堤(T 型、ヘッドランド)



(c) 突堤による汀線形状の変化

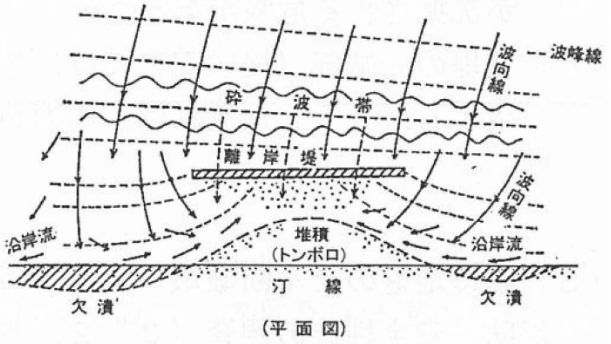
出典：(a)-(b) 海岸管理の現状について(国土交通省)、(c) 海岸保全施設の技術上の基準・同解説(平成 30 年、全国農地海岸保全協会ほか)

図 3.2.2 突堤の一般例

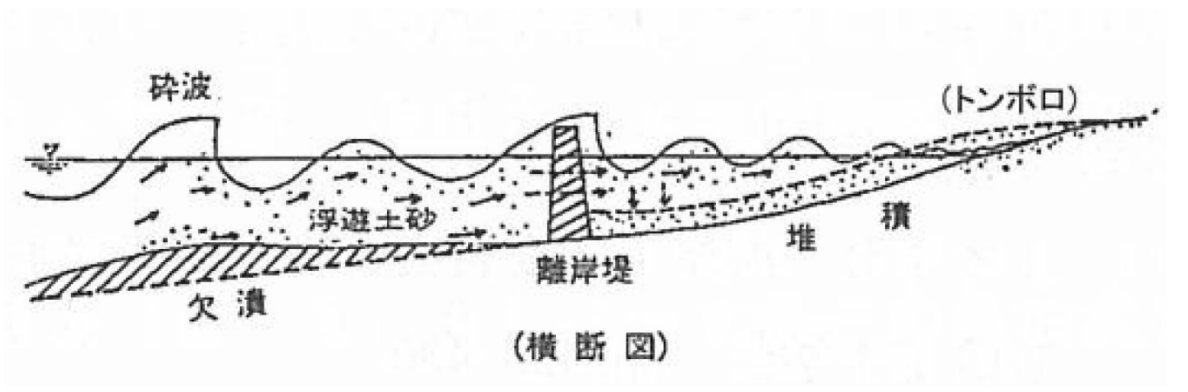
3) 離岸堤

- 機能：天端が海面よりも高く、沖合に汀線と並行に設置される構造物である。直接的には波浪を制御する構造物で、間接的に陸側域の漂砂制御や越波制御の役割を担う。離岸堤背後は波高が減衰し、汀線が前進することで、トンボロ(舌状砂州)が形成される。
- 構造形式：1) 透過型 (捨て石式、捨てブロック式等)
  2) 不透過型 (石積み式、石張り式)
  3) 有脚式・鋼板セル式
- 海岸侵食対策としての効果・留意点：離岸堤背後には堆積域(トンボロ)が形成されるが、その両側においては侵食域が発生し、域全体として凹凸のある不自然な汀線が形成される。土砂共有が枯渇した海岸においてはトンボロの形成が困難な海岸がある。域全体の侵食対策のためには、養浜を併せて実施する必要がある。

(a) 離岸堤



(b) 離岸堤の平面形状



(c) 離岸堤の断面形状

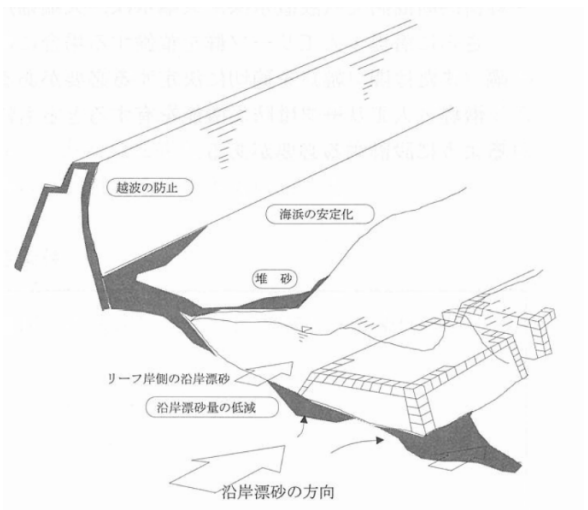
出典：(a)海岸管理の現状について(国土交通省)、(b)-(c) 海岸保全施設の技術上の基準・同解説(平成 30 年、全国農地海岸保全協会ほか)

図 3.2.3 離岸堤の一般例

4) 人工リーフ・潜堤

- 機能：離岸堤と類似の機能を有するが、天端高が没水する構造物であるため、景観を損なうことなく、波浪の静穏化、沿岸漂砂の制御機能を有する。
- 構造形式：1) 透過型 (コンクリートブロック式)
  2) 不透過型 (石張り式など)
- 海岸侵食対策としての効果・留意点：波浪および沿岸漂砂の制御によって、背後に堆砂が期待できる。没水構造物であるため、離岸堤に比べその機能は小さくなるため、比較的自然浜に近い汀線形状を形成することが可能となる。ただし、所要の機能を発揮するためには大規模となり費用が増大することと、高波浪時にはその効果が弱まり、背後の水位上昇など侵食対策面で負の効果が生じることもある。域全体の侵食対策のためには、養浜と合わせて実施する必要がある。

(a) 人工リーフ・潜堤



(b) 人工リーフの概念図

出典：(a) 海岸管理の現状について(国土交通省)、(b) 海岸保全施設の技術上の基準・同解説(平成 30 年、全国農地海岸保全協会 ほか)

図 3.2.4 人工リーフ・潜堤の一般例

5) 養浜

- 機能(防護目的)：砂浜を直接的に回復させることで、来襲する波の砕波等により波のエネルギーを減衰させ、波の打ち上げ高を低くし、あるいは越波流量を減少させる消波機能が期待される。堤防等の洗堀を防止する機能を持つ。
- 機能(環境・利用)：砂浜の回復により、底生生物や曝気作用による海水の浄化、良好な生物の生息・生育環境を形成する等海岸環境上の機能を有する。レクリエーション、スポーツなど利用上の機能も有する。
- 形式：1) 静的養浜 (突堤などの漂砂制御施設の設置により、漂砂量を極力少なくし安定を目指す)
  2) 動的養浜 (沿岸漂砂量の不足を補い、漂砂の下手側への供給源とすることを目的)
  人工的な土砂移動であるサンドバイパスやサンドモーターなどがある(サンドモーターの実施事例についてはコラム１を参照)

3) 材料別：砂、礫等

・ 海岸侵食対策としての効果・留意点：海岸侵食に対する唯一の直接的な対策である。日本の海岸法の目的である防護・利用・環境の調和のためには砂浜は不可欠と考えらており、海岸法第二条で「海岸保全施設」と規定されている。一方、海外の特に途上国においては海岸保全施設として認知されていないケースが多く、採用事例も非常に少ない（ただし、先進諸国では主要な海岸保全対策として認知・採用されている。詳細はコラム 2 を参照）。初期養浜後は一定の養浜材の流失が発生するため、その機能維持のためには定期的なモニタリングや再養浜の実施などの維持管理対策が必要となる。

(a) 養浜実施前　　(b) 養浜実施後

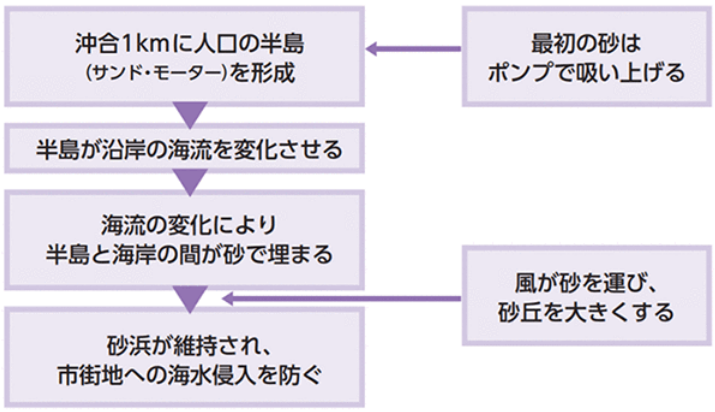
出典：海岸管理の現状について(国土交通省)

図 3.2.5　養浜の実施例

◎ コラム１：オランダ沿岸における動的養浜（サンドモーター）の事例

- 背景：海面水位の上昇による海抜セロメーター地帯の市街地への浸水の防護および海岸侵食の防止
- 対策方針：「自然を活かした沿岸造り」コンセプト。海岸に堆積させた砂を風・波・海流によって自然に拡散させ、失われた海岸を再生。
- 初期養浜量：18.7 百万 m^3(2011 年実施)
- 効果：

1) 砂の投入回数が少ないため、従来の養浜よりコストが抑えられる
2) 周辺域の砂浜域の拡大
   図 3.2.8 のサンドモーター実施後から約 4 年間に渡るモニタリング結果より、中心部の砂域(赤線)は減少している一方、外郭域(青・紫)において砂域が増加している。
3) 多様な砂浜・水域が形成され、観光客増加、沿岸域の動植物が増加
   図 3.2.9 に示す様に多様な砂浜・水域が形成砂され、それに伴う利用者・観光客が増加し、動植物の多様性も増加している。



出典：Website(A-PLAT)

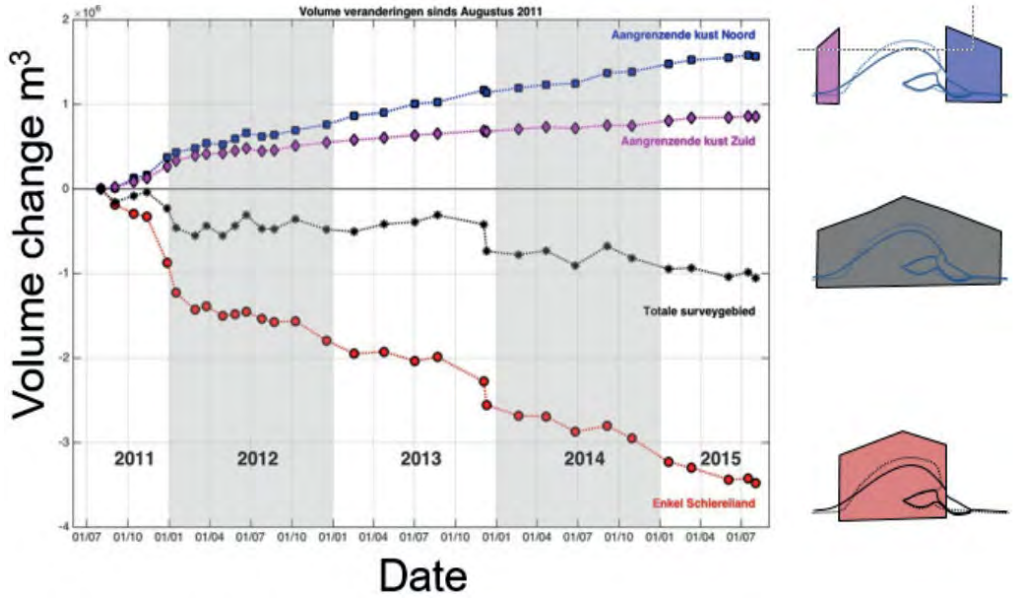
図 3. 2. 6　サンドモーターの仕組み

(次頁へ続く)

2012	2015
2017	2021

出典：Google Map

図 3.2.7　サンドモーターの時系列変化



出典：Development of the Sand Motor (Deltares, 2016)

図 3.2.8　サンドモーターのエリア別の砂量(m³)の変化

(次頁へ続く)

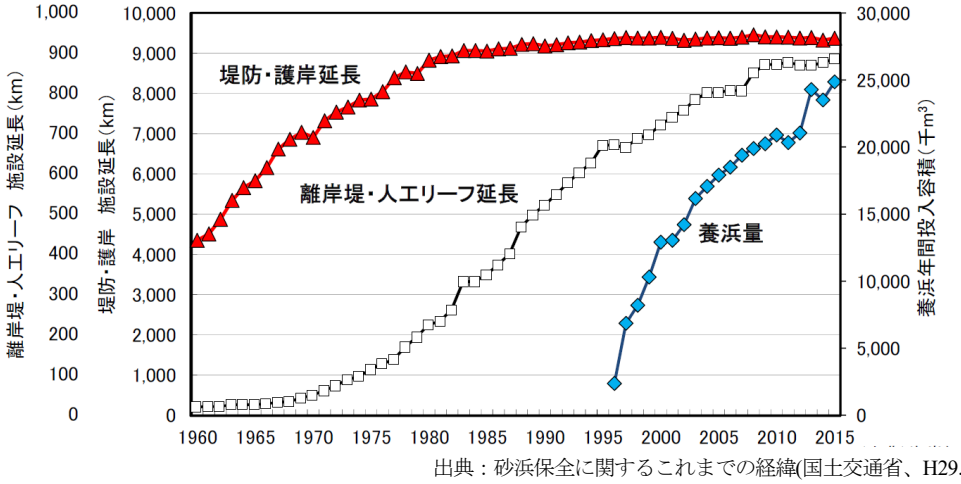
出典：Development of the Sand Motor (Deltares, 2016)

図 3.2.9　形成された砂域・水域の多様性
(ラグーン、低潮位時に現れる砂浜域、植生域、砂丘湖、陸上の砂浜域)

◎　コラム 2：日本および先進諸外国の主要な海岸保全対策

日本

図 3.2.10 に示すように、1960 年代より堤防・護岸が主要な海岸保全対策であり、1980 年代に整備済み延長が約 9,000km を超え、その後は緩やかに増加している。日本の海岸線延長は約 3.5 万 km であるため、その約 4 分の 1 にあたる延長の護岸・堤防が整備されていることになる。その後、堤防・護岸の線的防護から面的防護が採用されるようになり、離岸堤・人工リーフの整備延長が増加した。海岸法が改正された 1999 年(平成 11 年)前後から、毎年の養浜量が大きく増加しており、2015 年における年間の総養浜量は約 25 百万 m^3 となっている。



出典：砂浜保全に関するこれまでの経緯(国土交通省、H29.11.02)

図 3. 2. 10　日本における海岸保全施設の延長等の変遷

先進諸外国

主な先進諸外国における海岸整備手法の特徴を下表に示す。危険地帯の人口が多い、アメリカ、イギリス、オランダにおいても海岸保全対策として「ソフトデフェンス」である養浜が主要対策として用いられている傾向にある。一方、前述のように日本においては近年は養浜対策の量が増加しつつあるものの、多くの海岸線では「ハードデフェンス」である堤防・護岸が整備されている状況にある。

表 3.2.1　先進諸外国における海岸整備手法の特徴

国名	危険地帯の人口[*1](万人)	整備手法の特徴
アメリカ	467	養浜を中心とするソフトデフェンスが中心(90%～95%)。養浜事業でも突堤等の設置は限られている。
オーストラリア	25	国としての具体的な整備手法に関する提示はない。各州が主体的な役割。
ニュージーランド	10	基本的に海岸の自然保護が一義的な目的。問題箇所は、むしろ移転等を進め、海岸に直接的には手をつけない。
フランス	133	受益者の事業実施が原則で、広域的な整備は多くない。ハード、ソフトの組合せによる防護が多い。
スペイン	82	過去から観光客誘致のため養浜を実施。現在は、海岸への直接的整備ではなく、背後土地利用の転換による災害の排除に転換中。海岸は原則自然放置。
イギリス	407	養浜あるいは構造物＋養浜によるソフトディフェンスが主な工法。
オランダ	960	動的海岸防護が採用され、ソフトディフェンスを採用。
日本	287	(前述参照)

[*1] 1,000 年確率の高潮水位以下の地区に居住する人口

出典：海岸管理の国際比較に関する研究(成瀬ら, 海岸工学論文集, 第 47 巻(2000))をもとに調査団が編集

(2)　適応性の比較の一例

前述した海岸侵食対策において、選定にあたっての評価項目とその評価内容を一例を下表に示す。なお、護岸・堤防にあたっては、侵食対策としての効果が低いと判断されるため比較表からは除外した。また、本比較はあくまで一例であり、対策を検討する海岸の自然条件、立地特性、生物環境等によって評価内容は異なることに留意のこと。

表 3.2.2　海岸侵食対策の適応性の比較の一例

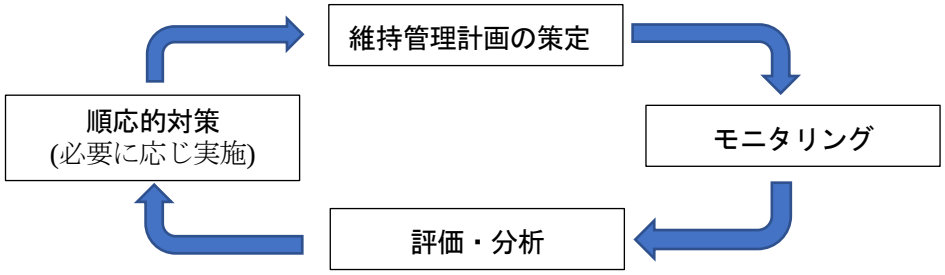
対策	(a) 養浜	(b) 突堤	(c) 離岸堤	(d) 人工リーフ
イメージ写真				
波に対する防護機能	高 自然の砂浜は波に対する防護機能を有する	低 海岸線に直角に伸びる構造である	高 沖合で波を直接的に制御する構造である	普通 沖合での水深を浅くして波を間接的に成業する構造である
侵食防止機能	高 自然の砂浜が回復する	普通 施設の配置位置によって侵食域と堆積域が生じる	普通 施設の配置位置によって侵食域と堆積域が生じる	低 水面下構造物のため侵食防止機能は離岸堤に比べ低い
海岸利用	高 自然海岸と同等の利用性が確保される	普通 自然の砂浜形状が変化するため、利用性は(a)より劣る	普通 ・左記と同様 ・離岸流の発生により前面海域の利用の安全性に影響が出る場合がある（海水浴、漁業）	普通 ・左記と同様 ・離岸流の発生により前面海域の利用の安全性に影響が出る場合がある（海水浴、漁業）
景観（自然の景観）	高 自然の砂浜の景観は維持される	低 自然の砂浜形状が大きく変化して景観が損なわれることがある	低 沖合への構造物設置により景観が損なわれることがある	普通 自然の砂浜形状が変化して景観が損なわれることがある
海生生物の生息環境への負の影響	無し 現在の環境が維持される	有り 構造物の設置により海洋生物の生息環境への影響が懸念される	有り 構造物の設置により海洋生物の生育環境への影響が懸念される	有り 構造物の設置により海洋生物の生育環境への影響が懸念される
建設費	普通~やや高 砂の調達方法に依存	普通	普通	高
維持管理頻度	高 他の対策と比較して砂の流失が多くなるため定期的な砂の投入が必要	普通 構造物によって砂の流出は一定率軽減することが期待される	普通 構造物によって砂の流出は一定率軽減することが期待される	普通 構造物によって砂の流出は一定率軽減することが期待される
気候変動への適応性	有り 海面上昇や波浪の強大化に対し、砂浜高が追随し一定の防護機能を維持する	無し	無し	無し

出典：バングラデシュ国都市機能強化事業準備調査 TECHNICAL GUIDE FOR DETAILED DESIGN (JICA,2021) をもとに JICA 調査団が編集

第4章　海岸管理の基礎理解

4.1　海岸管理とは

海岸管理とは、海岸保全施設(砂浜含む)の機能維持、海岸域の適正な利用等に関して、巡視・点検・モニタリング等により「状況把握」をおこない、必要に応じて適切な「維持管理」をおこなうことを指す。一般的な実施フローは下図に示すとおりである。



出典：JICA 調査団

図 4.1.1　維持管理の実施フロー

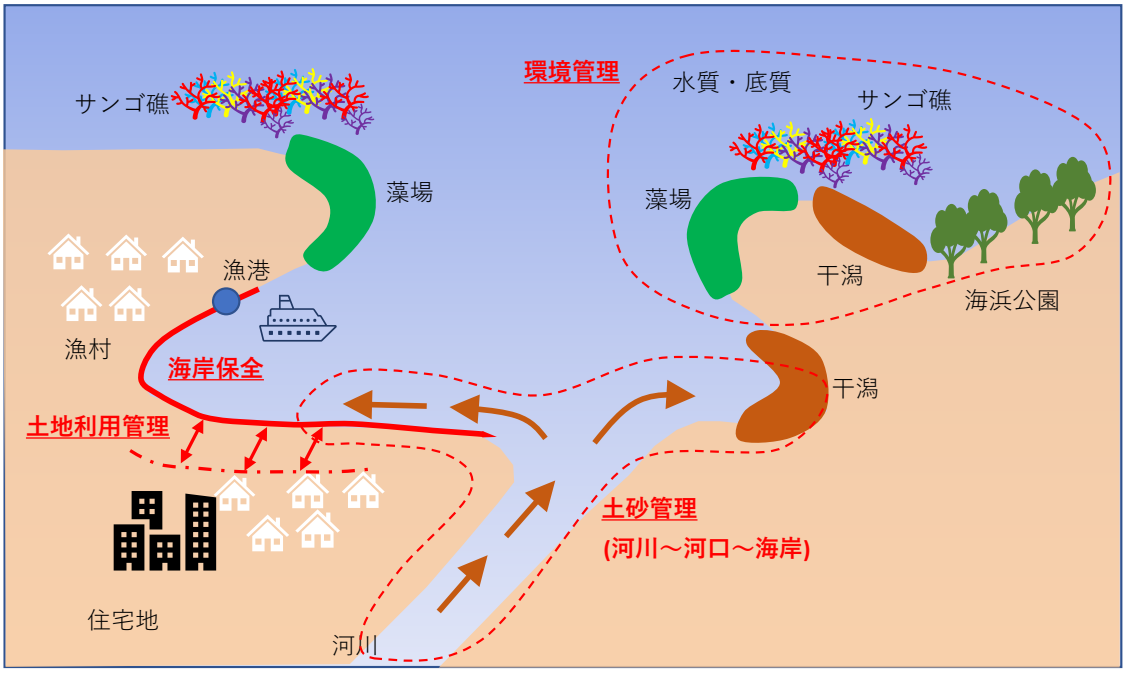
我が国においては、2030 年には完成後 50 年以上経過した海岸保全施設が全体の約 7 割を占めることが見込まれており、海岸維持管理の重要性が増してきている。平成 26 年に交付された「海岸法の一部を改正する法律」においては、南海トラフ地震等に備えた防災・減災対策の強化に加えて、「海岸保全施設の維持・修繕基準の策定」等の海岸管理に係る項目が追加された。これに伴い、海岸保全施設の一つである「砂浜」においては、侵食・堆積量における劣化指標が制定されるとともに、海岸維持管理に関わる活動を促進するため、海岸協力団体の指定制度が設けられた。

4.2　統合的沿岸管理(ICZM)の考え方

沿岸域は、海岸線を挟む陸域から海域に及ぶ区域であり、多様な生物が生息・生育するほか、水産資源の獲得、海上と陸上の人流・物流の拠点、レクリエーション活動に利用される等、多様な機能を有し、また、様々な利用が輻輳している区域でもある[3]。このような沿岸域おいて持続可能な開発を達成するために統合的沿岸管理(ICZM, Integrated Coastal Zone Management)の概念が世界各国で導入されつつある。統合的沿岸管理は、空間的には河川～河口～海岸～沿岸を対象としており、本対象域における「海岸保全」、「土砂管理」、「土地利用」、「環境管理」などを統合的に計画・管理していく概念である。統合的沿岸管理の対象イメージ図を図 4.2.1 に示す。

・海岸保全：防護・利用・環境の調和に基づいた海岸域の保全
・土砂管理：上流(河川)から下流(河口~海岸)における連続的な土砂移動・供給
・土地利用：セットバックルールなどの海岸域における建設や土地利用に係る規制
・環境管理：沿岸域の動植物やサンゴ礁環境、良好な景観等の保全

[3] 沿岸域の総合的管理の取り取組事例集 改定版(2014、内閣官房総合海洋政策本部事務局)



出典：海洋白書 2004 創刊号をもとに調査団が作成

図 4.2.1　統合的沿岸管理(海岸保全、土砂管理、土地利用管理、環境管理)のイメージ図

統合的沿岸管理における「総合性」について、5 つの柱が示されている [4]。各柱に対する考え方および実現における典型的な課題は表 4.2.1 に示すとおりである。

表 4.2.1　統合的沿岸管理における 5 つの柱と実現における典型的な課題

5 つの柱	考え方	実現における典型的な課題
1. 制度・計画の統合性	多岐に渡る国・地方の制度や計画等を調整し、統合していること。	方針と計画の乖離 中央政府レベルで ICZM 方針は規定されている一方、その具体的な実施計画が定められていないもしくは方針と整合が取れていないケースが多い
2. 管理主体の統合性	行政機関等の管理主体間(図 4.2.2 および図 4.2.3 参照)における横の連携が行われていること	連携不足による不適切な沿岸域開発 同一の行政機関内における部署間、都道府県と市町村間の連携不足により、連続した海岸において異なる方針・方法で整備が実施される
3. 関係者の統合性	全ての利用者・関係者の参加が行われていること	関係者の参画・課題の調整不足による不適切な海岸事業の実施 海岸域は多様なステークホルダーの利用・活動が行われる場である。計画立案時にこれら関係者の参画や課題の調整が十分でない場合、関係者の利害が衝突する事業内容になりうる。
4. 対象の統合性	複数の課題や広域の課題の相互関係を明らかにし、調整している こと（例：漁業やレジャー等	

[4] 沿岸域の総合的管理の取り取組事例集 改定版(2014、内閣官房総合海洋政策本部事務局)

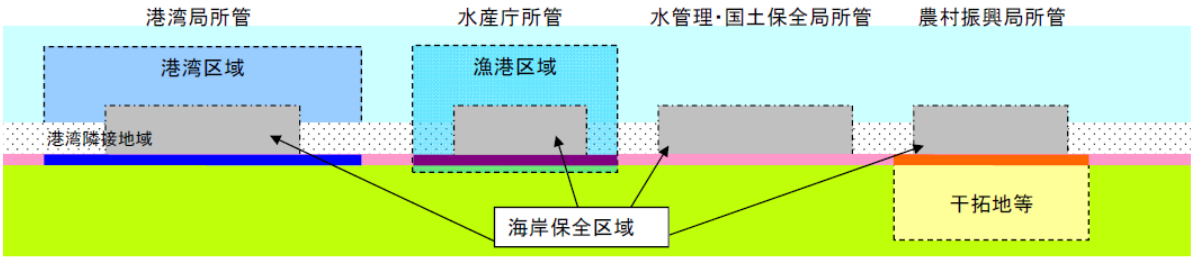
	の沿岸利用の調整、陸域と海域にわたる課題の調整等)	
5. 科学的知見の統合性	科学的知見に基づく情報を関係者間で共有していること	科学的知見の周知不足に起因する不適切な対策の実施 海岸保全対策の選定に際し、海岸現象の問題を把握し、対策の特性を理解したうえで対策の選定を行う必要がある。このような科学的知見が不十分な場合、不適当な対策が選定されてしまう場合がある(例：海岸侵食が問題となっている海岸において、越波を防御する護岸を整備するなど)

出典：沿岸域の総合的管理の取り取組事例集 改定版(2014、内閣官房総合海洋政策本部事務局)をもとに JICA 調査団が作成

区分（通称）	漁港海岸	港湾海岸	農地海岸	共管	建設海岸
海岸の様態	漁港区域内の海岸	港湾区域、港湾隣接区域、公告水域内の海岸	土地改良事業で完成、管理している海岸施設又は計画のある海岸	農地保全のために必要な施設で地方公共団体が管理している海岸施設	左以外の海岸
海岸管理者	漁港管理者である地方公共団体の長（都道府県知事又は市町村長）	港湾管理者の長（都道府県知事又は市町村長）	都道府県知事	都道府県知事（例外的に市町村長）	都道府県知事
国の窓口	水産庁防災漁村課	港湾局防災・海岸課	農村振興局防災課	農林水産省 国土交通省 共管	河川局砂防部保全課海岸室
主務大臣	農林水産大臣	国土交通大臣	農林水産大臣		国土交通大臣

出典：漁港海岸事業の概要(水産庁漁港漁場整備部防災漁村課)

図 4.2.2　海岸の種類：日本の場合、連続した海岸域であっても管理者(事業実施者)が異なる (漁港海岸、港湾海岸、農地海岸、共管、建設海岸)。そのため、統合的な沿岸管理の実現に際しては、管理者間の横のつながりが必要不可欠となる。



出典：海岸管理の現状について(国土交通省)

図 4.2.3　連続した海岸における省庁の役割分担のイメージ図

◎コラム３　ICZM への取り組み　～「静岡県安倍川総合土砂管理計画」の事例～

安倍川の流砂系は、源頭域の大谷崩に代表される重荒廃地を抱える日本屈指の急流河川で、そこからの流出土砂が堆積と移動を繰り返しながら安倍川を流下し、駿河湾に到達して沿岸漂砂となり静岡・清水海岸を形成している。

(1) 安倍川流砂系における課題：

河川の上流から下流域および海岸域において抱える問題が異なり(下記)、それぞれの管理者・事業実施主体も異なる。

① 上流域(土砂生産・流出域)：土砂災害
② 中・下流域：高水敷の侵食・洪水被害
③ 海岸域：海岸侵食、高波被害

出典：安倍川総合土砂管理計画概要版(中部地方整備局)

図 4.2.4　安倍川流砂系における課題

(2) 実施された統合的沿岸管理に係る取り組みの特徴

- 安倍川源流から三保半島に至る流砂系の広大な時空間スケールの土砂動態や土砂問題の調整(通過土砂量を考慮)(図 4.2.5 参照)
- 土砂生産・流出領域・海岸領域など関係者が異なる領域ごとに実施する具体的な事業を検討していくうえでの共通指針の策定
- 各機関に連携の方針と役割分担を明確化(表 4.2.2 参照)

出典：安倍川総合土砂管理計画パンフレット(中部地方整備局)

図 4.2.5　安倍川総合土砂管理計画の概要(目指す姿と土砂管理目標)

表 4.2.2　土砂管理の連携方針と各機関の役割分担

連携の方針	連携を図る主な機関	役割分担
防災、土砂管理全般に向けた連携	国土交通省 静岡河川事務所	砂防事業 河川事業 モニタリング・情報共有
	静岡県 静岡土木事務所	砂防事業 河川事業 海岸事業 モニタリング・情報共有
安倍川流砂系の環境保全に向けた連携	環境部局 (静岡県、静岡市)	情報共有
河川利用者等との連携	安倍川骨材事業協同組合	情報共有
	安倍藁科川漁業協同組合	情報共有
	市民活動団体	情報共有

出典：安倍川総合土砂管理計画パンフレット(中部地方整備局)

4.3 海岸の日常的管理、順応的管理について

(1) 日常的管理

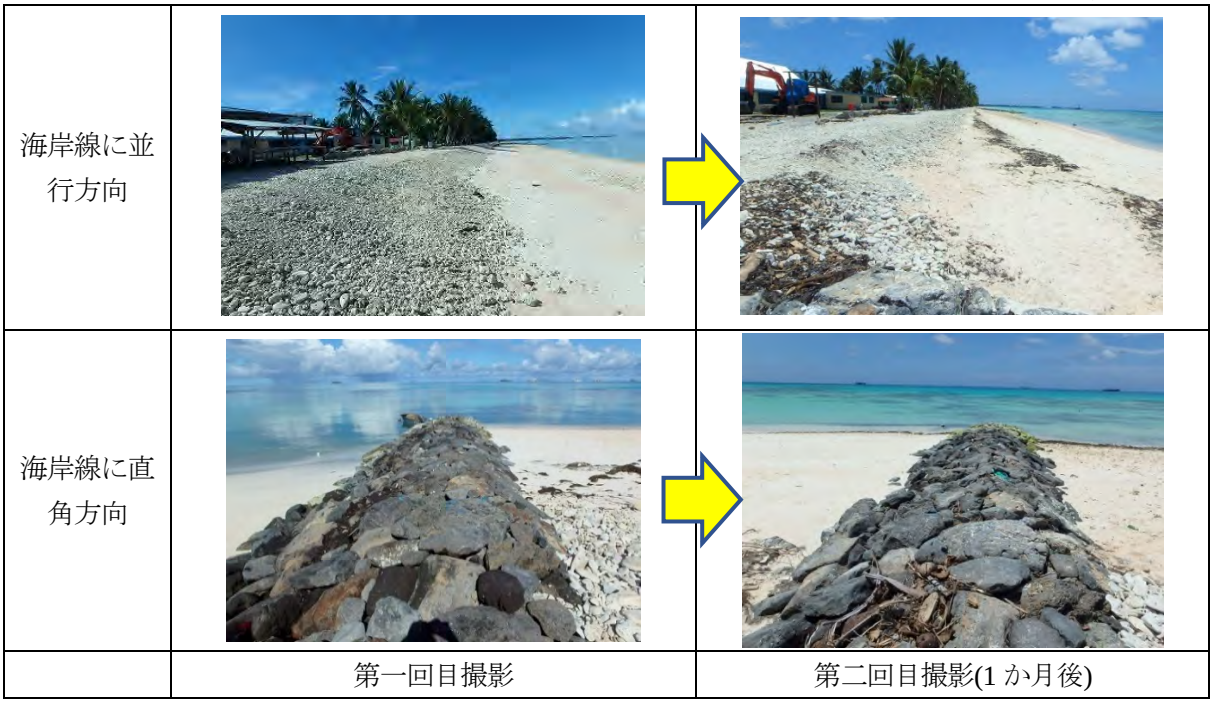
順応的管理は一般に工事を伴うため、行政側による実施が主となることが多い。一方、日常的管理は地方自治体のサポートのもと、地域のコミュニティーや NGOs などが主体で実施をおこなうことが実現性および持続性が高いと考えられる。これは、我が国においても改正海岸法(H26)においても海岸協力団体の追加されているように、我が国の海岸保全においても積極的に進めている取り組みである。

海岸の日常的な管理の代表的な活動として以下が挙げられる。それぞれについて、実施例やイメージについてそれぞれ図に示す。

表 4.3.1 日常的な海岸管理の代表的な活動

代表的な活動	頻度	備考
海岸状況の撮影	毎日～1 回/週	デジタルカメラやスマートフォンのカメラ機能を使用して、定点からの撮影
海岸清掃	毎日～1 回/週	ゴミや打ち上げられた海藻の収集(図 4.3.2 参照)
海岸状況の見回り	毎日～1 回/週	以下のような状況の有無について確認のための見回りをおこない、発見した場合は海岸管理者(地方自治体等)に連絡する。 1. 建設用資材などに目的での資源(砂・礫)の不法採取 2. 背後家屋や海岸利用者によるごみの投棄 3. 海岸域における不法占拠 (私的な埋立・造成、護岸建設、船揚げ場など)

出典：JICA 調査団



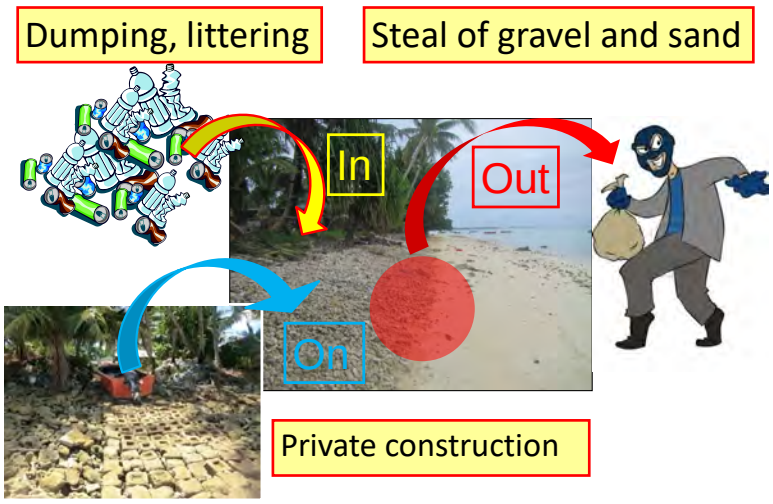
出典：ツバル国沿岸災害対応のための礫養浜パイロットプロジェクト ファイナル・レポート(2018 年、JICA)

図 4.3.1 定点からの海岸のモニタリング写真の事例

上：写真手前位置において砂部および海藻の打ち上げ状況が確認できる
下：突堤左側において砂の堆積が認められ、当該期間の漂砂方向は左→右方向であることが分かる。

出典：ツバル国沿岸災害対応のための礫養浜パイロットプロジェクト　ファイナル・レポート(2018 年、JICA)

図 4.3.2　地域コミュニティーによる海岸清掃活動の様子



出典：ツバル国沿岸災害対応のための礫養浜パイロットプロジェクト　ファイナル・レポート(2018 年、JICA)

図 4.3.3　海岸域における違法行為の典型例：1)砂・礫の採取、2)ゴミの投棄、3)私的建設

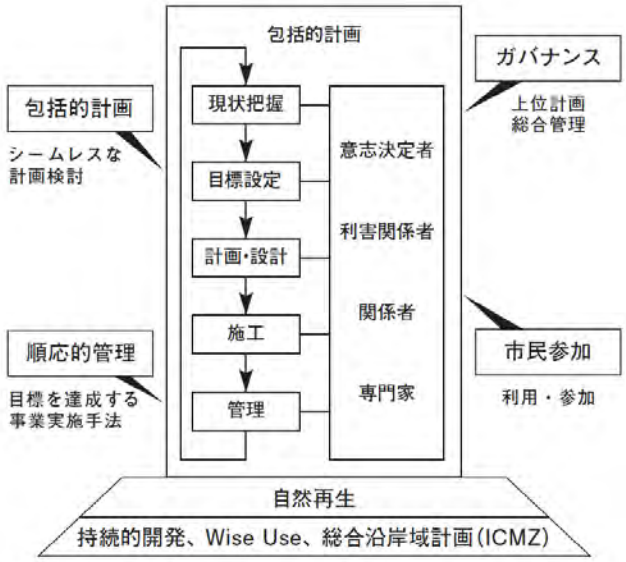
(2)　順応的管理

注釈の文献[5]によると、海岸域の順応的管理は以下のように定義されている。

「順応的管理とは、自然の環境変動により当初の計画では想定しなかった事態に陥ることや、歴史的な変化、地域的な特性や事業者の判断等により環境保全・再生の社会的背景が変動することをあらかじめ管理システムに組み込み、目標を設定し、計画がその目標を達成しているかをモニタリングにより検証しながら、その結果に合わせて、多様な主体との間の合意形成に基づいて柔軟に対応して行く手段である。」

また同文献においては、順応的管理は図 4.3.4 に示すように、持続的開発及び統合的沿岸管理(ICZM)に基づく「包括的計画」を実現するための手法の一つとして考えられている。

[5] 順応的管理による海辺の自然再生(監修：国土交通省港湾局、著：海の自然再生ワーキンググループ)



出典：順応的管理による海辺の自然再生(監修：国土交通省港湾局、著：海の自然再生ワーキンググループ)

図 4.3.4　順応的管理の位置づけ

第 3 章で示した通り、養浜は防護・利用・環境の調和の観点で有効な海岸保全対策であり、先進諸国でも中心的に採用されている実績がある。一方、養浜は自然海浜同様に波浪により常に変動するため、その状況のモニタリング、問題の有無の評価、対策の実施の可否の判断といった、順応的管理の実施が特に重要な海岸保全対策であると言える。下記のコラム 4 および 5 に順応的管理の実施例および計画例を示す。

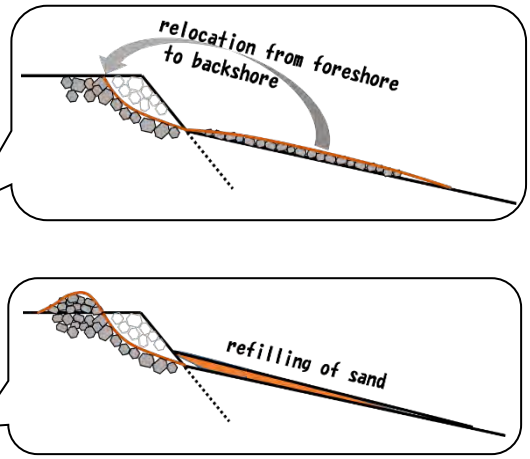
◎コラム４　順応的管理の実施例 ～ツバル礫養浜パイロット事業[6]の事例～

ステップ 1：順応的管理の必要性の確認

- 防護・利用・環境の側面で問題や不具合が生じているか？
- 海岸測量モニタリング結果に基づく定量的評価

ステップ 2：前浜に散乱した礫の収集し、当初の位置へ移動（防護機能の回復）

ステップ 3：砂の再投入と砂面の整形（防護・利用機能の回復）



出典：ツバル国沿岸災害対応のための礫養浜パイロットプロジェクト　ファイナル・レポート(2018 年、JICA)

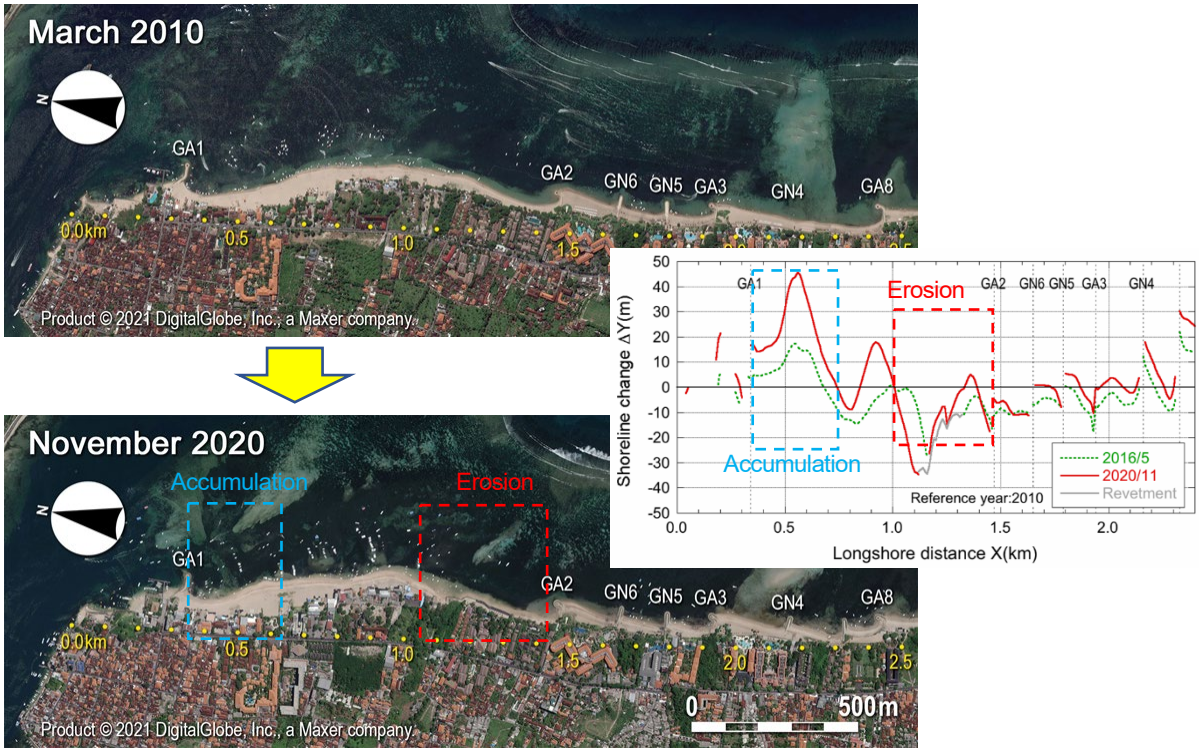
図 4.3.5　順応的管理の実施例

[6] ツバル国沿岸災害対応のための礫養浜パイロットプロジェクト　ファイナル・レポート(2018 年、JICA)

◎コラム 5　順応的管理の計画～バリ海岸保全事業　Phase2 での計画例～

海浜のモニタリング結果(図 4.3.6)より、一連の海岸域において北側で堆積、南側で侵食が発生していることが確認された。これは、当該エリアで卓越する北向きの沿岸漂砂による海岸状況の変化と考えられる。また、同モニタリング結果から一連の海岸域全体での砂の総量は減少していないことが確認された。

これを受け、図 4.3.7 に示すように沿岸漂砂の下手側(堆積域)から上流側(上手側)へ砂を移動するサンドバイパス工法が計画されている。



出典：バリ海岸保全事業 Phase 2 インテリムレポート

図 4.3.6　現地の海岸状況の変化とモニタリング結果

出典：バリ海岸保全事業 Phase 2 インテリムレポート

図 4.3.7　モニタリング結果を踏まえたサンドバイパスの計画イメージ

第5章　養浜

5.1　概要

海岸保全対策工法の１つである養浜は、海岸防護を目的とする護岸、堤防、離岸堤や突堤、等のハード構造物による海岸防護対策とは異なり、海岸防護とともに、海岸利用や海岸環境を改善できる工法として、欧米諸国では1970年代後半より海岸保全対策の主流となっている。日本においても、平成11年の海岸法の改正により、従来の防護のみを目的とした海岸施策から、防護・利用・環境に調和した海岸保全を図っていく方針に変わり、養浜工が海岸対策の１つとして正式に位置づけられることとなった。日本における養浜の実施事例としては、これまでは沖縄や本州の観光エリアにおける観光、または観光と防護を目的とした海岸整備に多用されてきた。しかし最近においては、人々の海岸に対する利用面か環境面に対する意識の高まりや、海岸侵食による砂浜海岸の急激な減少、等により、従来の観光エリアでの養浜に留まらず、一般公共海岸での適用も増している（例えば九十九里浜における養浜事業、等)。また海外諸国における海岸侵食対策や、小島嶼国における国土保全を目的とした養浜事業も徐々に増えつつある（例えば、ツバル、モーリシャス、インドネシア)。

本章では、養浜の概要について、これまでJICAで実施していきた養浜事業の事例を用いて示す。

5.2　養浜の基本的な特徴

養浜の基本的な特性、長所および留意点を以下に示す。

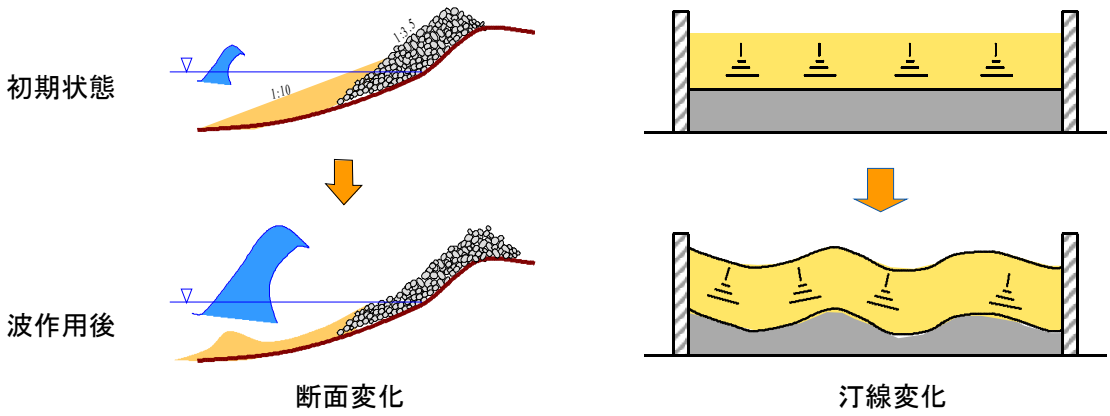
特性

- 自然の砂浜と同様の、防護、利用、環境に調和したEco-friendlyかつuser-friendlyな海岸を形成することができる（図5.2.1)。
- 自然の砂浜と同様、波により断面の変形や砂の移動が常に生じる（図5.2.2)。

構造物対策（護岸）　　非構造物対策（養浜）

出典：ツバル国沿岸災害対応のための礫養浜パイロットプロジェクト　ファイナル・レポート(2018年、JICA)

図5.2.1　構造物対策と非構造物対策



出典：ツバル国沿岸災害対応のための礫養浜パイロットプロジェクト　ファイナル・レポート(2018 年、JICA)

図 5.2.2　波による断面変化・汀線変化

長所

- ハード構造物対策では得られない、防護とともに利用と環境に調和した海岸保全が図れる。
- 周辺海浜に対する影響（新たな海岸侵食の助長等）が、他の構造物対策に比べて相対的に小さい。
- その時々の波に最も安定となる形状に変形することにより、特にまだ未確定要素の多い気候変動影響に対する柔軟性が高い。
- 施工や維持管理に特殊な技術を必要とせず、簡単な工法である。

留意点

- 波による柔軟性を有するということは、すなわち常に変形し砂が移動するため、定期的な維持管理（追加砂投入、断面整形等）が必要となる。特に突堤等の付帯構造物との組み合わせで静的に安定化させる工法ではなく、養浜のみ行う場合（動的安定化工法）の場合には、維持管理は必須である。
- 初期養浜後の適切な維持管理を行っていくための、モニタリング～評価～適応策の実施といったサイクルでの順応的管理の実施が求められる。
- 養浜工法の適用性やどのような養浜工法を選択するかは、各対象地点の波浪や漂砂特性に対する深い理解が不可欠である。

5.3　JICA 事業で実施した養浜事例

JICA 事業として実施した養浜事例を 3 つ示す。養浜材として、砂や礫が用いられる。どのような養浜工法、養浜材料を選択するかについてのポイントを以下に示す。

- 用いる養浜材は、対象エリアの波浪や漂砂特性上、安定性が確保されるか。
- 用いる養浜材は、供給量やコスト面で妥当か。
- 対象エリアにおける海岸利用、景観、環境を考えた上で、適切な工法選択となっているか。
- 周辺海浜への影響はないか。

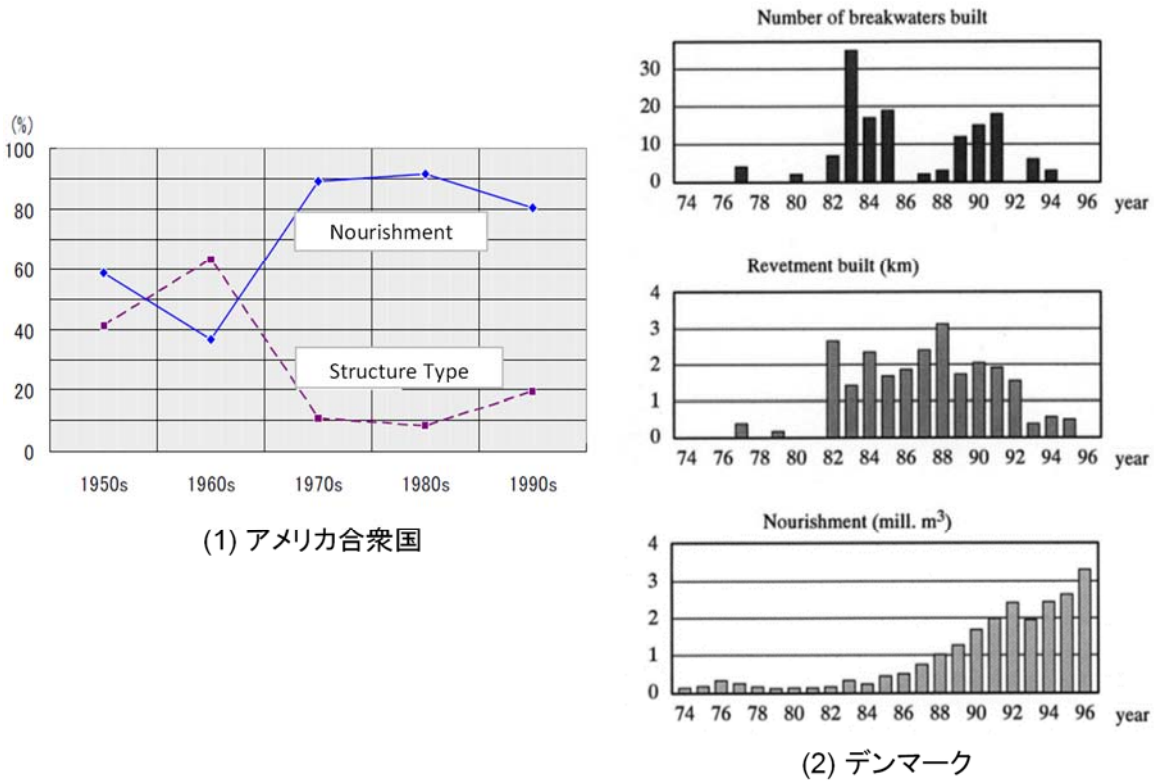
- 養浜材を取得するエリアでの新たな環境問題は生じないか。
- 今後の維持管理や修繕作業を行う上で、材料入手や施工が容易であるか。

出典：国建協案件形成調査プレゼン資料(2018 年、日本工営)

図 5.3.1　JICA 事業で実施した養浜事例

5.4　欧米諸国の養浜事業の推移

欧米諸国では、日本より先んじて、1970 年代より、従来の構造物対策から養浜を用いた非構造物対策への転換が進んできた。



出典：西隆一郎･Robert G. Dean･田中龍児:わが国の養浜規模と養浜材単価に関する一考察, 海洋開発論文集 第 21 巻, pp.355-360, 2005

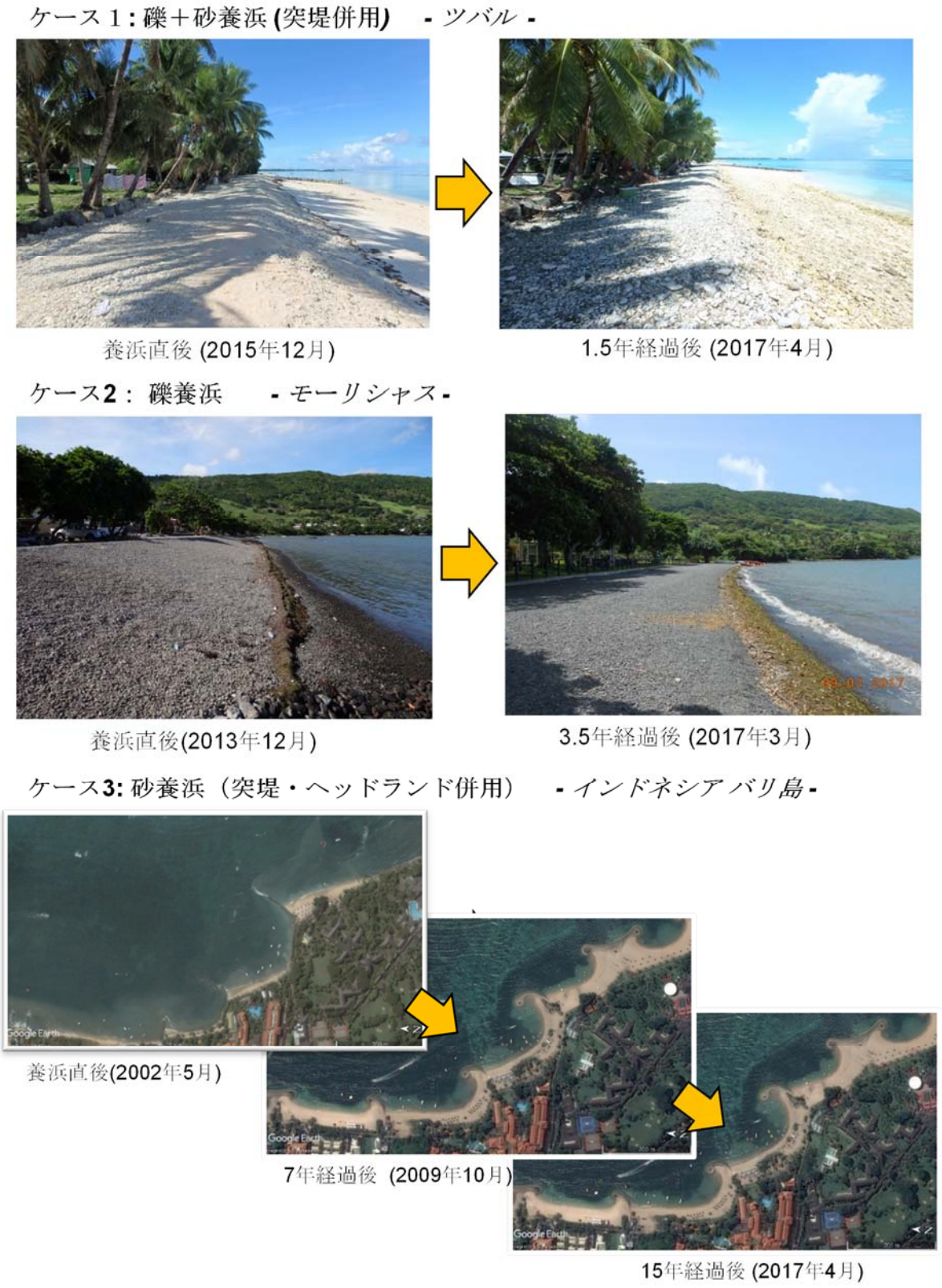
図 5.4.1　欧米諸国の養浜事業の推移

- アメリカ合衆国では、1970 年代より養浜が、他の構造物対策に変わって主流となっている。またデンマークでは、1996 年以降、海岸保全対策は養浜のみとなっており、他の構造物対策は適用されていない。
- 一方、中進国や途上国では、構造物対策がほとんどであり、養浜を適用する事例は非常に限られる。その背景として、

1) 養浜に対する知見、経験が蓄積されていないこと
2) 砂浜を維持していくための維持管理についてのノウハウがない
3) 一般的に、莫大な維持管理費が将来にわたって掛かるとのイメージが強い（中進国や途上国は短期的にもメンテナンスフリーであることを好む傾向がある）。

5.5　養浜実施後の海浜の安定性

養浜の１つの大きな懸念である、養浜後の海浜の安定性について、３つの養浜事業の事例を示す。これより、対象海岸における地形特性、波浪や漂砂特性、海浜形成過程を十分に把握した上での、適切な計画・設計を行うことにより、海浜の高い安定性の確保は可能であると言える。



出典：国建協案件形成調査プレゼン資料(2018 年、日本工営)

図 5.5.1　養浜後の海岸状況

5.6 費用対効果

一般に養浜対策の建設費は、砂の調達コストに大きく影響される。調達可能エリアの違い(陸域か海底か)、作業船の種類・規模、調達可能エリアまでの距離、運搬方法などによってその費用は大きく異なるが、途上国での概ねの参考単価は下表となる。

表 5.6.1　養浜砂の調達単価(参考値)

ケース	砂の調達場所	参考単価 (USD/m^3)
1	同じ島内の陸域	5-10
2	比較的近傍の海底(10km 以内)	8-20
3	比較的近傍の海底(10-50km 以内)	20-50
4	他国からの輸入	100-200

出典：ツバル国沿岸災害対応のための礫養浜パイロットプロジェクト　ファイナル・レポート(2018 年、JICA)をもとに JICA 調査団が作成

養浜は堤防・護岸のようなハード構造物と異なり、自然の砂浜を再生・保全する観点で多様な効果(便益)を見込むことができる。海岸事業の費用対効果分析において、計上可能な便益を対策種類の別で示す。

表 5.6.2　対策種類別の想定される効果

便益(効果)の種類		ハード構造物	養浜
防護	越波防護	○	○
	侵食防止	○	○
利用	海洋性レクリエーション	－	○
	漁業利用	－	○
	観光産業の活性化	－	○
	地域文化の促進	－	○
環境	景観保全	－	○
	生態系の保全	－	○
	海水浄化	－	○

出典：ツバル国沿岸災害対応のための礫養浜パイロットプロジェクト　ファイナル・レポート(2018 年、JICA)をもとに JICA 調査団が作成

養浜対策の費用は、ハード構造物に対して高価となる場合も多い。一方で上表のように計上できる便益項目が多いのも養浜の特徴である。そのため、事業評価において費用対効果比で評価した場合、結果として養浜の方が B/C が高くなるケースも多くなる。対策の種類を検討する際には、費用だけでなくその対策によって期待できる効果にも十分着目して、評価を実施することが重要である。

第6章　気候変動と海岸侵食

6.1　概要

ここでは気候変動の影響が海岸侵食に及ぼす影響について検討する。はじめに、日本における沿岸域（海岸）に対する気候変動の影響検討について、国交省での検討結果を紹介する。つぎに、今後日本が海岸問題で関わる可能性の考えられる代表的な国に対する影響についての所感を述べる。最後に、モルデイブでの本業務で検討した、海面上昇が海岸侵食に及ぼす影響についての検討概要を示す。

6.2　日本における沿岸（海岸）に対する気候変動の影響検討について

日本では、平成 27 年の国交省における『沿岸部（海岸）における気候変動の影響及び適応の方向性検討委員会』にて、日本における沿岸（海岸）での気候変動の影響と適応の方向性についての検討が行われ、その概要が公開されている。ここではその要点を紹介する。

本報告では、特に気候変動に伴う「強い台風の増加による高潮偏差・波浪の増大」及び「中長期的な海面水位の上昇」の発生が懸念されるとの認識が示され、適応策の検討を行うことが適当であると述べられている。また報告書の中では、ＩＰＣＣ第 4 次報告と第 5 次報告との相違点についても示されている。以下はその報告書からの抜粋である。

1) 強い台風の増加による高潮偏差・波浪の増大

IPCC 第 5 次評価報告書では、世界平均地上気温の上昇や海水温の上昇など、台風の発達・勢力維持に影響を及ぼす要因が悪化することが予測されている。強い台風の増加または勢力維持は、台風に伴う高潮偏差及び波浪の増大に影響することから、その海岸への影響を検討する必要がある。

2) 中長期的な海面水位の上昇

気象庁の気候変動監視レポート 2013 によれば、我が国沿岸の海面水位は現在の観測態勢が確立した 1960 年代以降上昇傾向にあるものの、IPCC 第 5 次評価報告書中の全球平均の海面水位に見られるような 100 年規模での一貫した上昇傾向は見られない。しかしながら、IPCC 第 5 次評価報告書では、世界平均海面水位の上昇（RCP8.5 シナリオで世界平均海面水位の上昇量が最大 0.82m）が予測されており、また、気温や海水温が上昇した場合海面水位が上昇することはメカニズムとして明らかであるとともに、海面水位の上昇が顕在化した場合、沿岸部（海岸）に甚大な影響が想定されることから、海面水位上昇量の最大値も考慮に入れて、海岸への影響を検討する必要がある。

3) ＩＰＣＣ第 4 次報告と第 5 次報告との相違点

第 5 次評価報告書では、今世紀末までの世界平均地上気温の変化予測は、1986 年～2005 年平均を基準として 21 世紀末で 0.3℃～4.8℃上昇すると予測されており、シナリオの違いを考慮すれば、1980 年～1999 年を基準として 21 世紀末で 1.1℃～6.4℃上昇すると予測された第 4 次評価報告と類似した結果となっている。また、第 4 次評価報告書で示されなかった海水温の変化予測が示され、21 世紀末までの海面から水深 100m までの海水温の変化は約 0.6℃～約 2.0℃上昇すると予測されている。さらに、21 世紀末までの海面水位の変化予測は、陸氷の影響が考慮された結果、第 4 次評価報告書の最大値 0.59m から、第 5 次評価報告書では最大値 0.82m と予測されている。

気候変動が海浜に与える影響としては、以下の事項が示されている。

- 気候変動による影響により、海面水位の上昇、強い台風の増加に伴う高潮偏差及び波浪の増大の影響が予測され、これらの影響により、汀線の後退が想定される。Bruun 則による砂浜消失率の予測結果では、20cm の海面上昇で 36%、60cm の海面上昇で 83%、 80cm の海面上昇で 91%の砂浜が消失する。
- 海岸侵食は、我が国の貴重な国土の消失であり、砂浜の減少等により良好な海浜環境の形成や海岸利用を阻害するだけでなく、越波の増大や海岸保全施設の耐力を低下させることで、背後地における安全性を低下させる。
- 希少種の減少や消失の可能性、景観の悪化などの環境面への影響と、海水浴場の減少や観光資源としての価値の減少など利用面への影響が懸念される。
- 生態系への影響として、二枚貝類等の減少により、二枚貝類等の海水濾過による干潟の水質浄化機能が著しく低下することが懸念される。また海水温の上昇による植食性動物（ウニ類等）の活性化により、磯焼けが進行することも考えられる。

気候変動に伴う沿岸部（海岸）への影響因子とその影響については、以下に示す図 6.2.1 にまとめられている。

これらの検討結果を踏まえ、適応の基本的な方向性として、以下が示されている。

1) 適応策の目標

強い台風の増加を踏まえた高潮等の浸水による背後地の被害や海岸侵食の増加が懸念されるとともに、中長期的には海面水位の上昇の影響が加わり、背後地の被害増大や汀線の後退が懸念される。これらを踏まえ、適応策の目標としては以下を基本として進めることが示されている。

ア） 高潮等の災害リスク増大の抑制

イ） 海岸における国土の保全

2) 取り組みの方向性

ア） 災害リスクの評価と背後地の重要度に応じた防護水準の設定、進行する海岸侵食への対応強化

イ） 防護水準等を超えた超過外力への対応

ウ） 増大する外力への対応と施策の戦略的展開

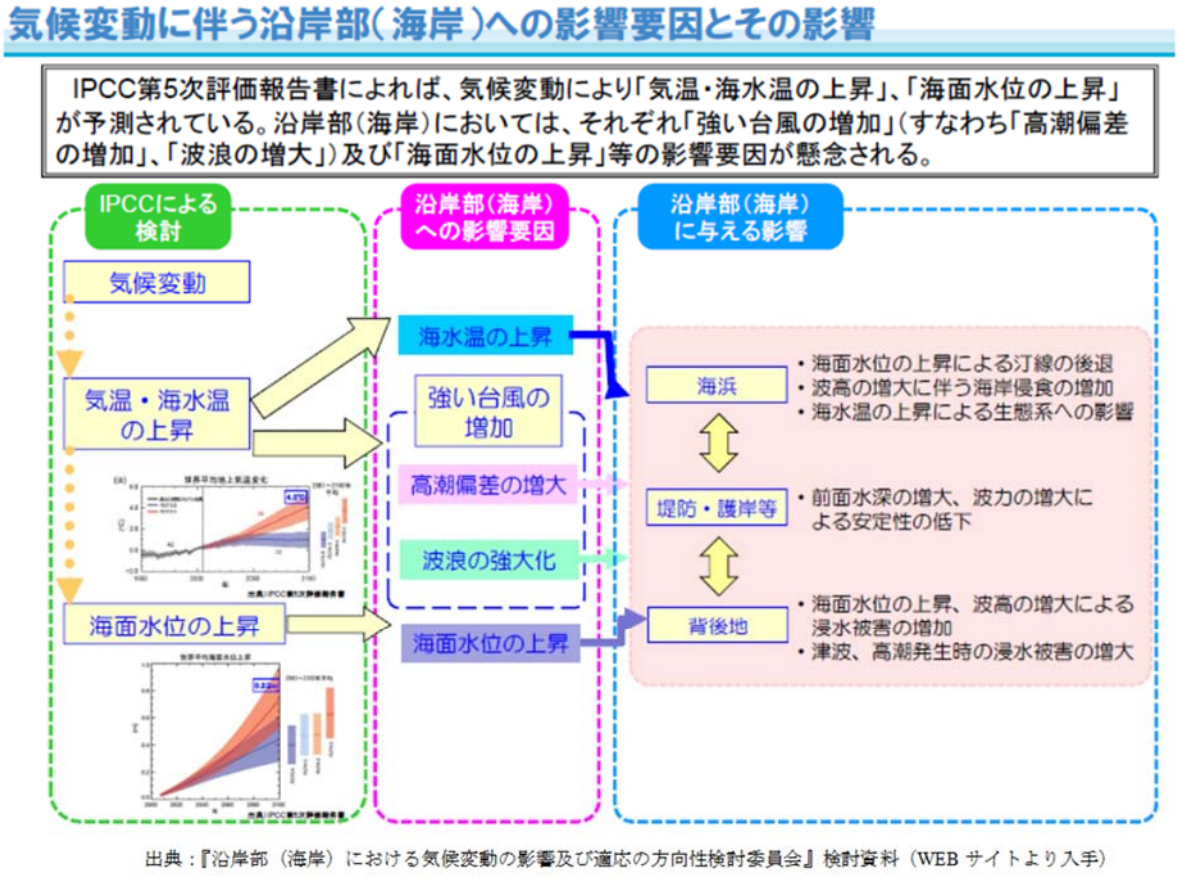
エ） 他分野の施策や関係者との連携等

また最後に取り得る適応策（案）として、海岸侵食に関連する砂浜・国土保全への影響については、

- 海岸保全施設前面の汀線の後退による防護機能の低下
- 砂浜を有する景観の変化・悪化
- 海水浴場の減少などレジャーへの影響、観光資源としての価値の減少

が挙げられ、適応策として、

- 養浜・侵食対策の実施
- 海岸侵食対策にかかる新技術の開発等



出典：『沿岸部（海岸）における気候変動の影響及び適応の方向性検討委員会』検討資料（WEB サイトより入手）

図 6.2.1　気候変動に伴う沿岸部（海岸）への影響因子とその影響

➢　防護ラインのセットバックや都市機能の移転・集約の機会等を捉えた土地利用の適正化が挙げられている。

6.3　関連する諸外国における海岸に対する気候変動影響について

日本が今後、海岸問題に対して主導的に関わると想定される関連諸外国として、特徴の異なる以下の国を代表国として、気候変動影響についての所感を述べる。

1)　フィリピン

7,000 以上の島々からなるフィリピンは、地震、火山、台風等あらゆる種類の自然災害による被害の多発国であり、2020 年版における「世界リスク・インデックス（CRI）」では、日本についで 2 番目にリスクが高い国となっている。なお 1999～2018 年のＣＲＩでは、フィリピンが同４位である。東南アジア諸国は、世界の中でも特に台風や洪水被害等の気象被害の影響を大きく受けるエリアに属するが、その中でもフィリピンは台風の通り道にあり、年間 20 近い台風が襲来している。これより、今後の気候変動影響としては、6.2 に示す日本と同様、特に台風の巨大化、それによる高波・高潮被害の甚大化が最も懸念される。フィリピンは世界第 5 位の海岸線を持つとともに、国土面積に対する海岸線の割合は世界第１位である。また内陸部は山岳地帯が迫っているために、沿岸域に人と資産、インフラ施設が集中しているため、海面水位の上昇による浸水被害の増大も懸念される。またサンゴ礁を有する島々も多く、気候変動とそれによるエルニーニョの頻発化に伴う海水温の上昇によるサンゴ環境の悪化（白化・死亡）が懸念される。更に、フィリピンでは現在、積極的な経済開発、それに伴う都市お

よびその周辺部沿岸エリアでの開発が進められており、海岸侵食が顕在化している。これら人為的影響に加えて気候変動影響が加わることにより、更なる問題の拡大が懸念される。

2) インドネシア

インドネシアは大小約 18,000 の島々からなる島嶼国であり、海岸線は約 55,000 km と、世界第 3 位（東南アジアでは第 1 位）である。インドネシアは、東南アジアの中でも自然災害の多い国であり、地震・津波被害、火山・地滑り、洪水・海岸侵食等の被害が多発している。インドネシアは緯度の関係上、フィリピンやベトナムに比べて熱帯低気圧（台風、サイクロン）の発生頻度は低いものの、最近では度々その被害を受けている。現時点では、直接的な深刻な気候変動影響は相対的に大きくないものの、今後の熱帯低気圧の経路変化や頻発化、巨大化による高波・高潮被害が懸念される。またサンゴ礁を有する島々も多く、気候変動による海水温上昇に伴うサンゴ環境の悪化、海面上昇に海岸到達波浪の増大化が懸念される。また、ジャワ島北海岸エリアでは、元来沿岸域に低標高の湿地帯が広がっていたが、近年地盤沈下が顕著であり、これに気候変動による海水面の上昇が加わることにより、現在既に多発している洪水・浸水被害の増大が懸念される。

3) ベトナム

ベトナムは島嶼国ではないが、南北に約 3500 km の長い海岸線を持ち、東南アジア諸国では、インドネシア、フィリピン、日本に次ぐ長い海岸線を有している。ベトナム沿岸域では、これまでも度々台風による高波・高潮被害に見舞われており、気候変動による台風の巨大化、経路変化、頻度の増大による沿岸災害の甚大化が懸念される。また特にベトナム南部エリアでは、低標高の広大な河口デルタ地帯が広がっているため、海水面の上昇による高波侵入、洪水被害、これによる農作物への被害が懸念される。ベトナム沿岸域においても、現在、積極的なインフラ施設やリゾート開発に伴う沿岸開発が行われ、各地で海岸侵食問題が顕在化している。今後気候変動影響が加わることにより、更なる問題の拡大が懸念される。

4) ツバル、マーシャル、キリバス等の南大洋州の島嶼国

ツバル、マーシャル、キリバス等の南大洋州の島嶼国は、波の作用でサンゴ砂礫が堆積して形成された土地を持つ島嶼国が多く存在する。このため、陸地の平均標高は、平均水位から 2～3 m 程度と極めて低く、海面上昇による影響が、国土の減少・消失に直接的に影響を及ぼすため、他の大陸系の国々や火山起源の島嶼国に比べて、国家レベルの深刻な問題となる。また各島々から、主要島への人口の集中化が生じており、元々十分な陸域がない中で、特定の島への集中による人口の高密度化と、これまで人が住まなかったような沿岸域での居住地の拡大が生じており、沿岸災害リスクが高まっている。このような状況下において、気候変動の特に海面上昇による国土消失、海岸侵食の加速化、高波浸水被害増大の懸念が高まっている。

5) モルデイブ

南アジア地域に位置するモルデイブは、南北約 700 km に 1200 程度の大小の島々から形成される小島嶼国である。上記のツバル、マーシャル、キリバスと同様、国土は波の作用でサンゴ砂礫が堆積して形成され、標高は平均水面から 0.6～2 m 程度と、南大洋州諸国よりも更に低標高である。熱帯低気圧や台風の襲来は他エリアに比べて低く、またそれも北部エリアにほぼ限られる。一方海面上昇の影響は、上述の南大洋州諸国と同様、国の存続に関わる死活問題である。更に近年モルデイブの住民島では、経済開発に伴うインフラ整備を目的とした人為的なサンゴ礁や海岸域の改ざん、環境悪化が特

に顕著であり、元来サンゴ礁海岸が有していた自然の防波機能の低下、これによる海岸侵食が顕在化している。気候変動影響が加わることにより、海岸侵食が更に加速されることが懸念される。

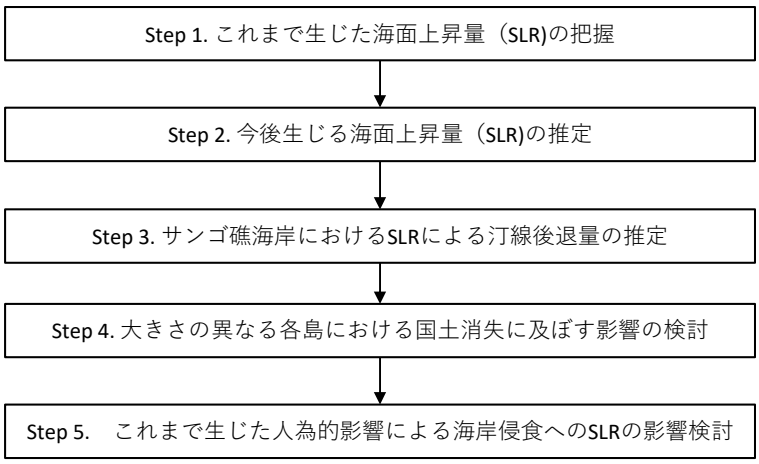
6.4　海面上昇が海岸侵食に及ぼす影響検討

(1)　概要

ここでは、モルデイブでの本業務において検討された、気候変動による海面上昇が海岸侵食に及ぼす影響を事例検討として示す。検討の流れは図 6.4.1 に示すとおりである。

(2)　Step 1　これまで生じた海面上昇量（SLR）の把握

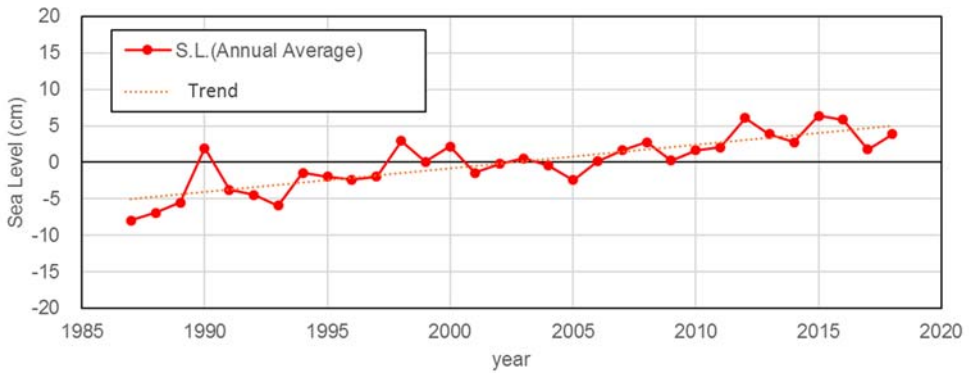
はじめに、これまで生じた SLR について明らかにする。モルデイブでは３エリアにおいて、長期的



出典：JICA 調査団

図 6.4.1　SLR が海岸侵食に及ぼす影響の検討の流れ

な潮位観測が実施されている。このうち、Addu 環礁の Gan 島での 1987 年～2019 年までの潮位観測データが得られている。これを示したものが図 6.4.2 である。これより、1987 年から 2019 年までの 33 年間における SLR は 3.2 mm/年であり、同年代における世界平均の SLR とほぼ同様の値となっている。

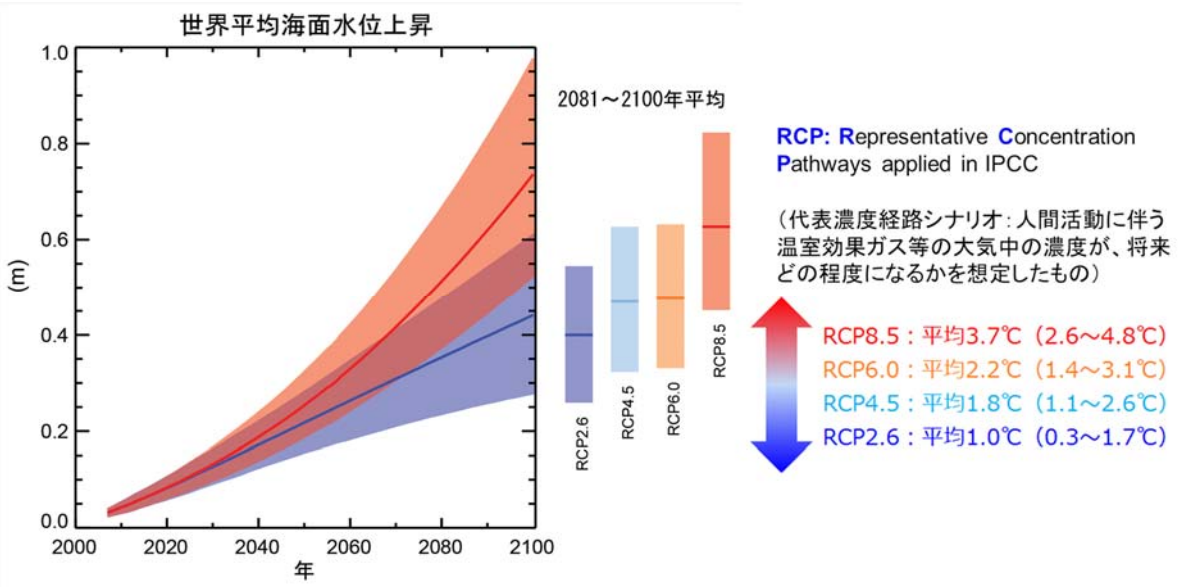


出典：JICA 調査団

図 6.4.2　1987 年～2019 年 (33 年間)での Addu 環礁 Gan 島で観測された海面上昇量（SLR）

(3)　Step 2　今後生じる海面上昇量（SLR)の推定

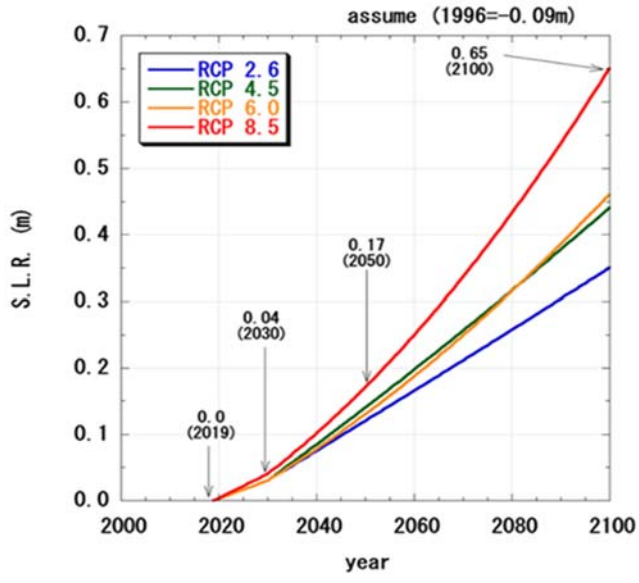
今後の SLR の予測は、IPCC 報告書に示される各 RPC シナリオに対する予測値を参照するケースが多く、本検討でもそれに準じた。図 6.4.3 は、IPCC 第 5 次報告書に示される今後の世界平均海面上昇量（SLR）である。この推定結果の中央値を用い、またモルデイブでの 2019 年までに生じた SLR の実測結果を反映し、モルデイブにおける今後の SLR の予測値（中央値）を示したものが図 6.4.4 である。これよりモルデイブの SLR としては、今世紀末においては、最もリスクの高い RCP8.5 シナリオの場合には、約 65 cm（中央値）の SLR が生じる予測となった。



出典：IPCC 第 5 次報告書からの抜粋

図 6.4.3　IPCC 第 5 次報告書に示される今後の世界平均海面上昇量（SLR）

- Addu 環礁 Gan 島での潮位観測結果より -



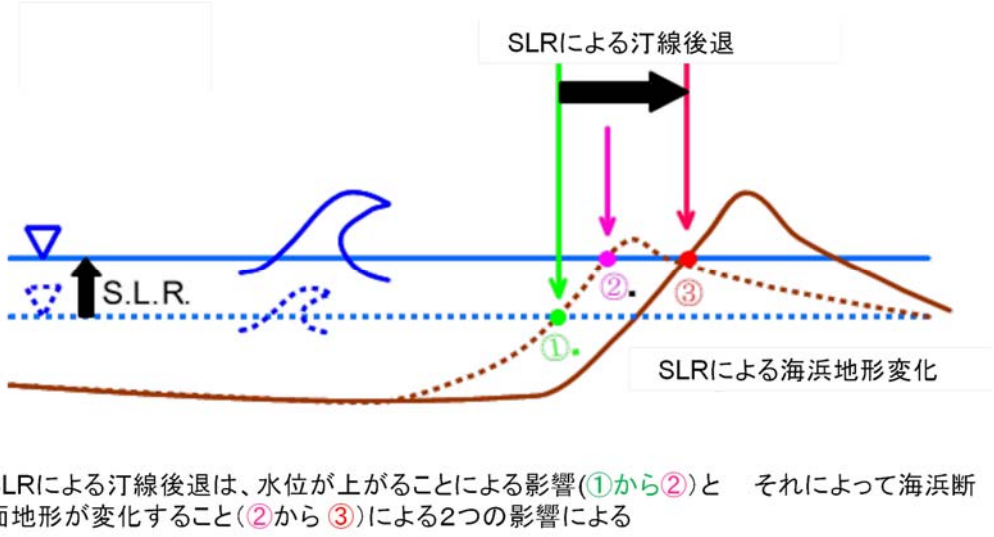
出典：JICA 調査団

図 6.4.4　モルデイブにおける今後の SLR の推定

(4)　Step 3 サンゴ礁海岸における SLR による汀線後退量の推定

海面上昇が海岸侵食（汀線後退量）に及ぼす影響については、Brunn 則[1)]を用いた手法が一般的である。これは砂浜海岸を対象として海面上昇に対する汀線後退量を推定する手法であり、汀線付近の底質粒径と波浪条件から定まる二次元平衡断面地形を仮定した簡易的な推定法である。しかしながら，リーフの発達したサンゴ礁海岸における海浜地形変化は，Brunn 則で仮定する平衡断面地形とは異なり、顕著な地形変化は，主にリーフフラット岸側の海浜部で生じ、Brunn 則の前提条件とは大きく異なる。サンゴ礁海岸におけるＳＬＲによる汀線後退のイメージを示したものが図 6.4.5 である。SLR による汀線後退（①→②）とともに、SLR によるリーフ上の波高増大による海岸の変化（②→③）が生じることにより、汀線は大きく後退することになる。

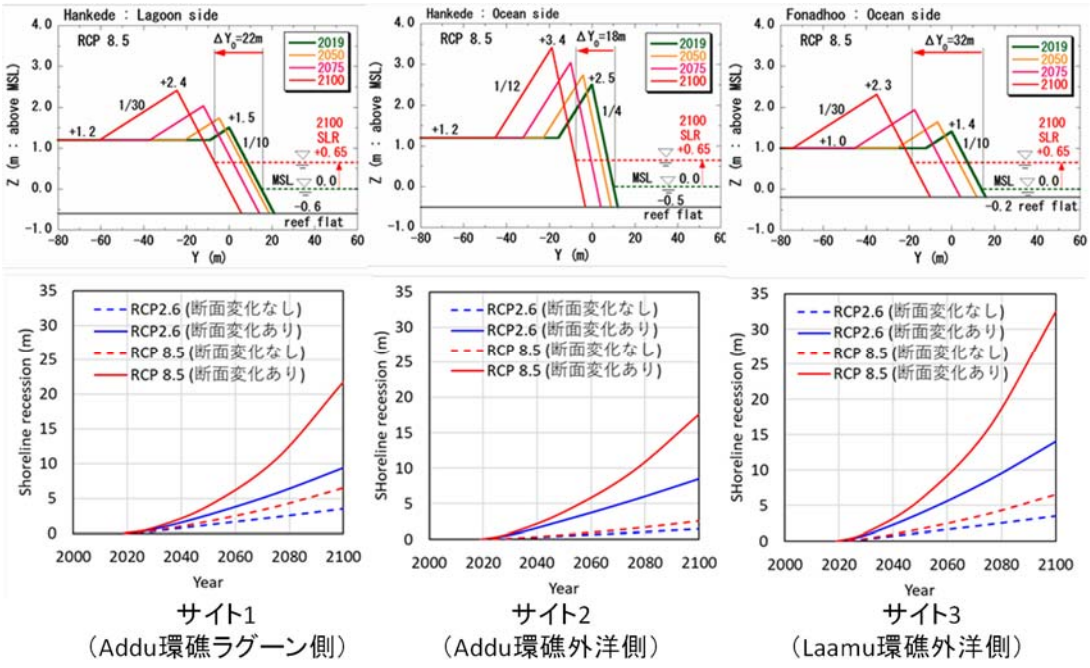
そこで、サンゴ礁海岸における気候変動による海面上昇に対する汀線後退量について，現地で得られる海浜断面に関する基本諸元のみより簡易的に推定する手法を新たに提案し、それを用いて検討を行った（推定法の詳細については参考文献[2)]参照）。



出典：JICA 調査団

図 6.4.5　サンゴ礁海岸におけるＳＬＲによる汀線後退のイメージ

図 6.4.6 は、異なる地形特性を持つ３海岸において、本手法で推定された各 RCP シナリオに対する海浜断面変化（上図）および今後予想される汀線後退量（下図）を示す。汀線後退量は波浪や地形の違いで異なるが、モルデイブでは最もリスクの高い RCP8.5 の場合において、今世紀末に 20～30m 程度の汀線後退が生じる可能性が示された。



出典：JICA 調査団

図 6.4.6　異なる 3 海岸での海浜断面変化（上図）と推定された汀線後退量（下図）

(5)　Step 4　大きさの異なる各島における国土消失に及ぼす影響の検討

つぎに、このような検討を用いて、大きさの異なる各島において、SLR による海岸侵食が国土消失に及ぼす影響について検討を行った。

検討は、Laamu 環礁内の住民島で、大きさの異なる Gan、Fonadhoo, Maamendhoo の３つの島で行った。それぞれの島の基本諸元は表 6.4.1 に示すとおりである。図 6.4.7 にそれぞれの島における、海岸侵食による島の消失面積の割合を示す。これより以下のことが示される。

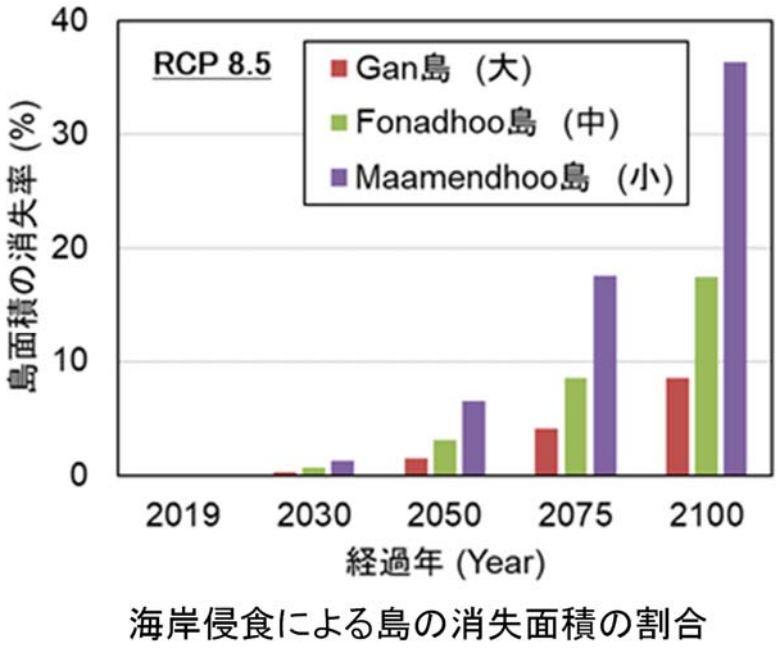
- 島面積が小さいほど、海岸侵食が国土消失に及ぼす影響は大きい
- 島面積の小さい Maamendhoo 島では，海面上昇に伴う海岸侵食により，80 年後の 2100 年には島面積の約 35%が消失する

表 6.4.1　３島の基本情報

島	面積 (km^2)	海岸線延長 (m)	人口*) (人)	人口密度 (人/km^2)
Gan	5.89大	15,590	2,809	477
Fonadhoo	1.58中	8,540	2,266	1,434
Maamendhoo	0.21小	2,360	896	4,267

*）モルディブ国勢調査（2014年）より

出典：JICA 調査団



出典：JICA 調査団

図 6.4.7　海岸侵食による島の消失面積の割合

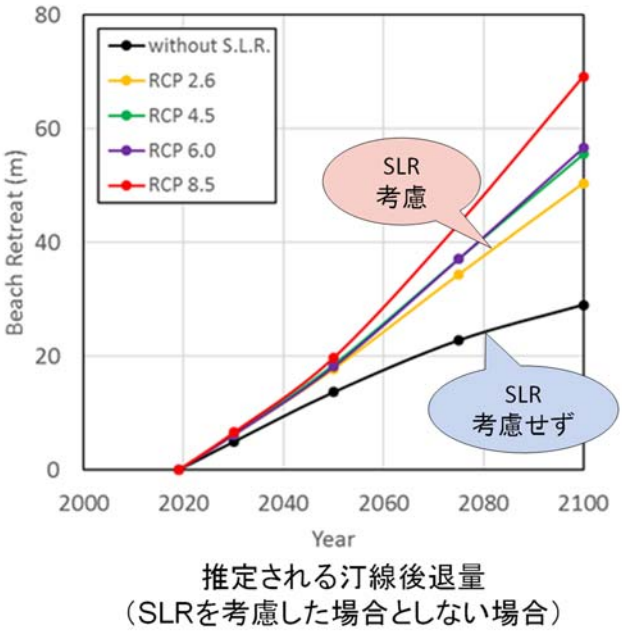
(6)　Step 5　これまで生じた人為的影響による海岸侵食への SLR の影響検討

最後に、既に人為的な影響による海岸侵食が生じている海岸に、さらに SLR による影響が加わった場合についての検討結果を示す。例えば図 6.4.8 に示す Laamu 環礁 Gan 島北部では、2005 年の港建設から 13 年の間に、漂砂下手側の北側海岸で、既に最大 50 m 程度の海岸侵食が生じている。

出典：JICA 調査団が WB 画像を用いて加工

図 6.4.8　港建設前後の汀線変化と下手側の海岸の様子

このような、既に海岸侵食が生じている海岸に、更に SLR による影響が加わった場合の結果を図 6.4.9 に示す。これより、SLR の影響により、このような海岸ではさらに顕著な海岸侵食が生じることが分かる。



出典：JICA 調査団

図 6.4.9　SLR を考慮した場合としない場合の今後の汀線後退量の比較

＜参考文献＞

1) Bruun, P.: Sea-level rise as a cause of shore erosion, *J. Waterways and Harbors Div.*, ASCE, 88 (WW1) , pp.117-130, 1962.
2) 大中　晋，芹沢真澄,，宇多高明，市川真吾，森　智弘，栗津裕太: サンゴ礁海岸における海面上昇による汀線後退量の簡易推定法と島嶼国での影響検討，海岸工学論文集 B2(海岸工学)，vol. 76 No.2，pp.1159-1164, 2020.

＜Part 2：実施事業の概要＞

第１章

バリ海岸保全事業

（円借款事業）

バリ島海岸保全プロジェクト

背景

背景

- インドネシアの観光産業の約3割を担っているバリ島では、その代表的なリゾート地であるサヌール、ヌサドア、クタのサンゴ礁海岸で、1970年代頃より顕著な海岸侵食が進行していた。

- 景勝地およびヒンズー寺院として有名なタナロット海岸では、海岸に突き出した海食崖上に位置するヒンズー寺院が、外海からの荒波の作用により崩壊の危機に瀕していた。

- 地域や各ホテル、政府により行われた無秩序な海岸施設の建設がさらなる海岸侵食、サンゴ環境の悪化、海岸施設の崩壊、景観の悪化を招いていた。

- そこで以前の海岸環境を復元するため、日本のODA（円借款事業）による***「バリ島緊急海岸保全プロジェクト」***が実施された。

バリ島の海岸侵食の実態

波が背後のホテル、レストランエリアまで打ち上がっていた

護岸が崩壊し、侵食は陸域まで及んでいた

海岸侵食の主な要因

1. 1960-70年代に実施された、建材取得のためのサンゴ採掘による波の増大、掘削穴への砂のトラップ
2. 礁池での滑走路建設（クタ）や大規模掘削（サヌール）による波・流れ、漂砂動向の変化
3. 無秩序な海岸施設設置による漂砂バランスの崩れ
4. サンゴ環境悪化による砂供給源の減少
5. 高波浪の増大、海水位の上昇（気候変動による水位上昇、高波浪襲来頻度の増加）

プロジェクト概要

プロジェクトの目的 （4つの視点での保全を図る）

国土保全

観光業の保全・促進

地域文化・生活環境の保全

海岸環境・自然景観の保全

プロジェクト概要（４海岸での事業）

プロジェクトの経緯

◆1987～88年：　フィージビリテイー調査の実施
◆1990年～92年：詳細設計業務の実施

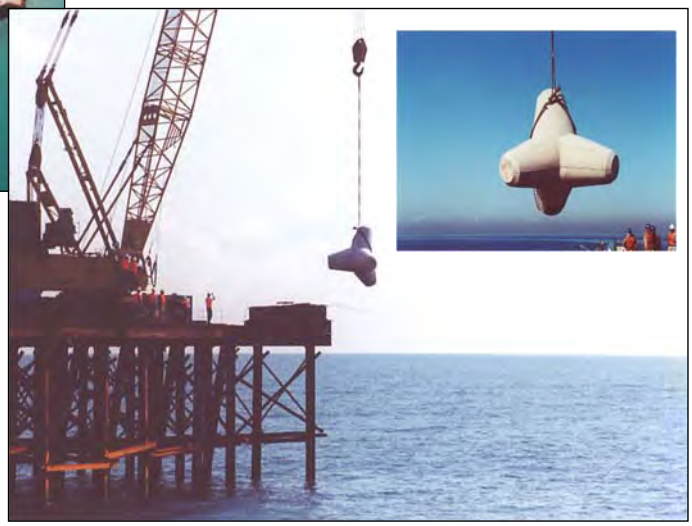
－　その後インドネシアの政変等で一時中断　－

◆1997～98年：　詳細設計業務の再実施
◆2000年 7月～ 03年 2月：　タナロット保全工事
◆2001年 8月～ 04年10月：　ヌサドア海岸保全工事
◆2001年11月～ 04年10月：　サヌール海岸保全工事
◆2006年 6月～ 08年12月：　クタ海岸保全工事

タナロット海岸施工状況　－ 人工リーフ －

ブロック投入用
仮設桟橋

消波ブロック投入



タナロット海岸施工状況　－ 擬岩パネル工 －

擬岩パネル製作

パネル取付け

プロジェクト実施前後の比較 －タナロット海岸 －

実施後

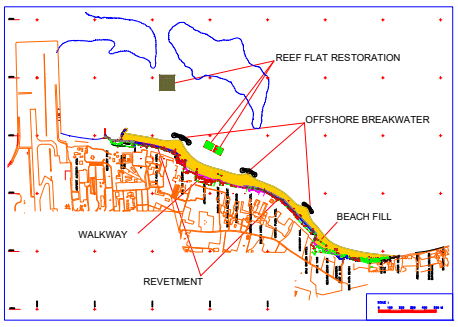
サヌール，ヌサドア海岸で用いた工法

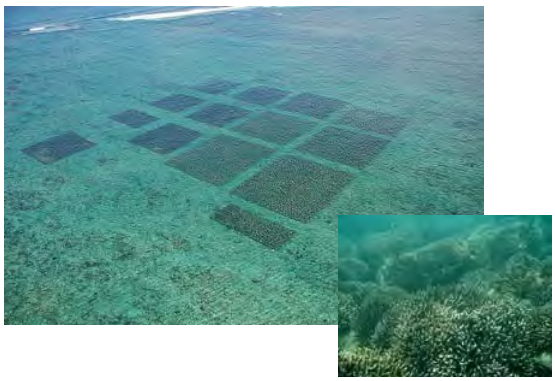
養浜と養浜砂流出低減のための突堤、ﾍｯﾄﾞﾗﾝﾄﾞ等を
組み合わせた静的安定化工法を採用

プロジェクト実施前後の比較　-ヌサドア海岸-

プロジェクト実施前後の比較　-サヌール海岸-

クタ海岸で用いた工法





養浜と島式離岸堤、およびサンゴ修復（捨石投入＋サンゴ移植）を組み合わせた海岸環境保全対策

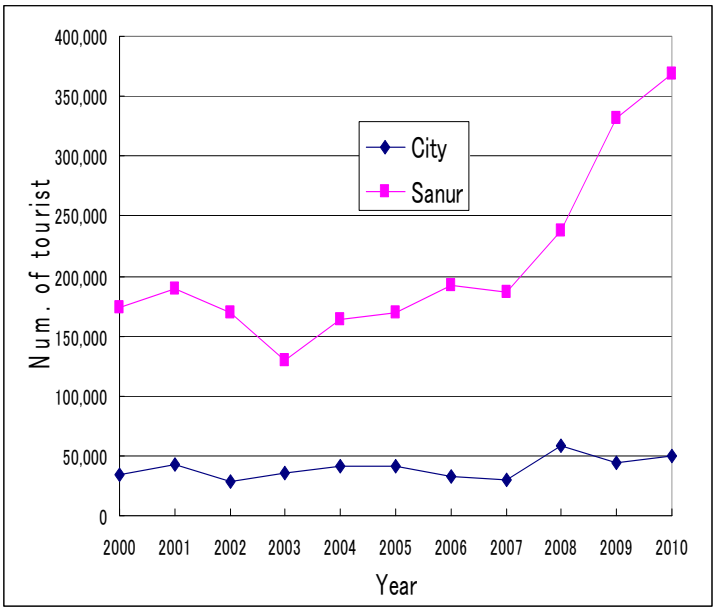
プロジェクト実施前後の比較　-クタ海岸 -

サンゴ礁の修復（サンゴ移植）　-クタ海岸 -

移植方法：　無性生殖による移植
（基盤上へのサンゴ片の固定）
復元対象面積：　1.3 ha
用いた基盤石：　約10000個の1m四方程度の石灰岩
用いたサンゴ片総数：　約11万片

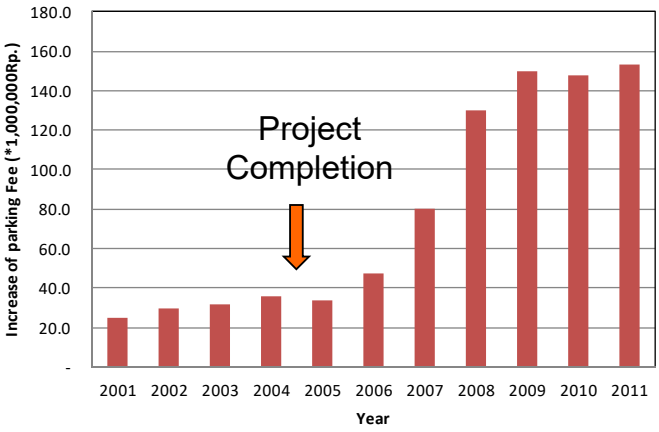
サンゴ環境修復後の豊かな生物環境の形成

海岸整備後の裨益効果　（対観光客）



事業海岸エリアと対象外エリアとの観光客数の比較

海岸整備後の裨益効果　（対地域住民）



パブリックビーチへの来場数

成果と課題

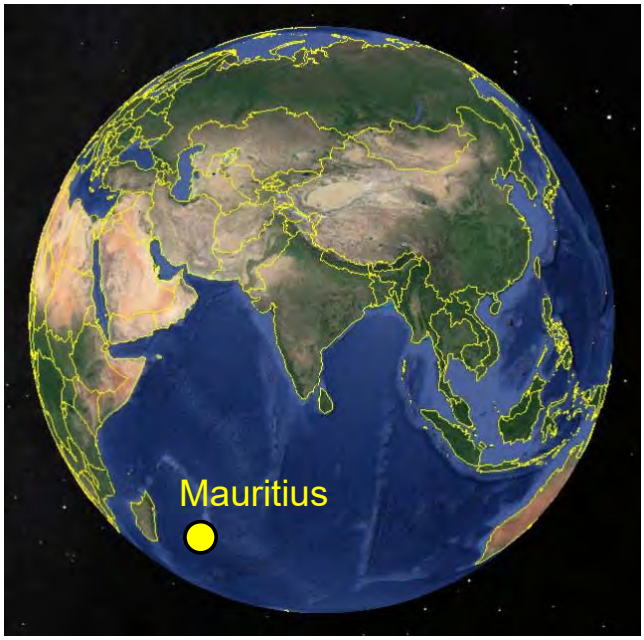
- 現地海岸の現象や海浜機構を把握した上で提案した静的安定化工法による養浜工は、その後の継続的なモニタリング結果からの評価より、全体的には予想以上の海浜の安定化が図られていることが証明された。
- 養浜事業は、バリの観光業の回復に大きく貢献したことが、定量データからも示された。
- 養浜により海岸を復元したことにより、海岸域のホテルやレストラン等も各自でリノベーション等を行い、その相乗効果による観光寄与が認められた。
- 全体的には安定した海浜が得られているものの、部分的にはその後の砂の移動により、追加の砂投入等のメンテナンスが必要な箇所も見られた。
- 養浜後の必要な維持管理のための砂のストックや、維持管理の責任分担の合意を得ていたにも関わらず、適切な維持管理が未だに行われていない。

第 2 章

モーリシャス海岸保全事業

（開発調査型技術協力事業）

モーリシャス海岸保全に関する技術協力事業
– 礫養浜パイロット事業 –



プロジェクト概要

C/P (環境局) および関連機関 ⟷ JICA エキスパート

1. 海岸の現状と海岸機構に関するインベントリー現地調査の実施

3. デモンストレーション事業の実施（礫養浜）

一緒に考え一緒に行動する

2. 優先海岸における海岸保全計画の検討

4. 事業サイトのモニタリング・評価

プロジェクトのゴール

関連機関の海岸保全に関する計画・設計・実施・維持管理能力の向上を図る

モーリシャスにおける海岸対策の課題

◆　海岸が重要な観光資源であるにも関わらず、ハード構造物対策が主流（以前は蛇籠やコンクリート不透過護岸、近年では捨石護岸）

◆必ずしも対策目的や海岸利用上、適した対策とはなっておらず、その結果，海岸域との不連続性，それによる利用・アクセス面の低下，砂浜消失の加速，等，逆に弊害を招いているケースも多く見られる

蛇籠

不透過直立護岸

捨石護岸

モーリシャスにおける海岸対策の課題

◆観光客や地域住民の海岸利用や自然の景観・海岸環境に配慮した保全対策の実現

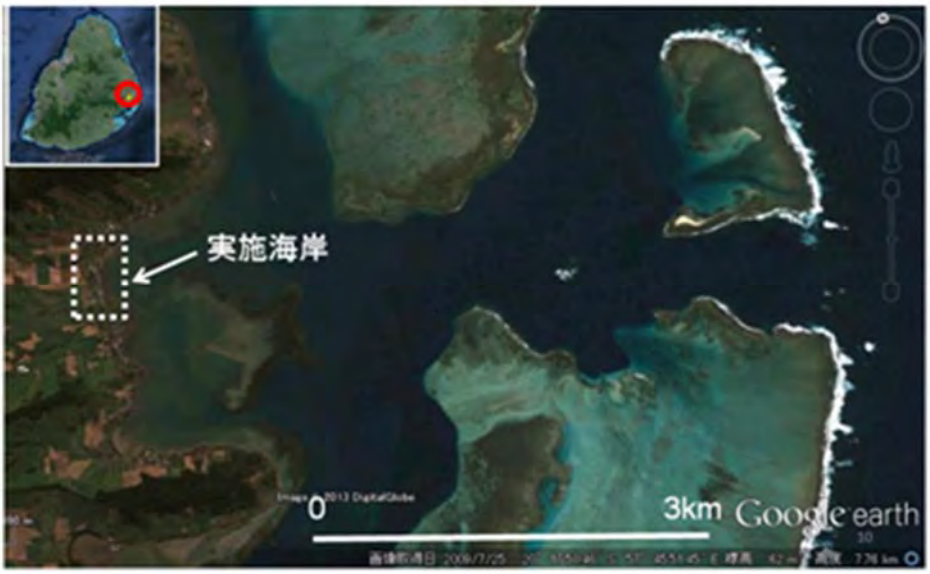
◆対象国の社会・経済レベルに適した対策の提案の必要性

（工法の容易性・経済性の確保）

当国で豊富に産出される石材を有効活用した礫養浜を，高波・越波のリスクに曝されている海岸において，実証事業として実施

実施海岸（Grand Sable）の位置

島南東部の沿岸に位置する居住地エリア。沖には幅3 kmを超える広大なリーフが存在し対象海岸は丁度その切れ目付近に位置する



海岸状況

◆背後に急峻な山が存在し，沿岸域の海抜1～2 m程度の僅かな低標高エリアに海岸道路や居住地が密集

◆高波・越波災害に曝されているとともに，今後の気候変動に伴う更なるリスク増大が懸念されていた

◆海岸のスペースもなく海岸道路で遮断されているため，人々が海岸を利用することはほとんどなく，生活ごみや漂流ごみが散乱する状況

住民およびモーリシャス政府からの要望

◆背後居住域の防護と合わせ、住民の海岸利用を可能とする対策であること

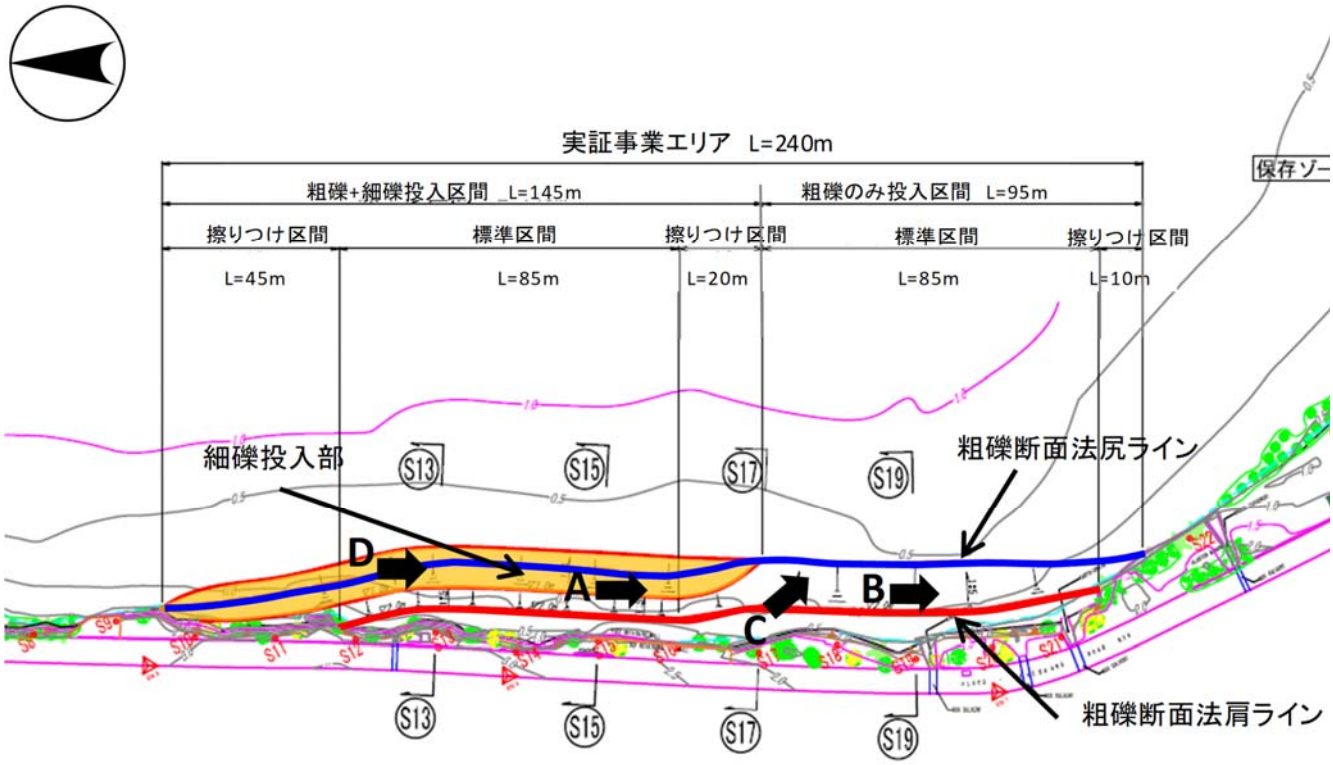
◆今後の気候変動の不確定要素にも対応可能な柔軟性を有する対策であること

＋

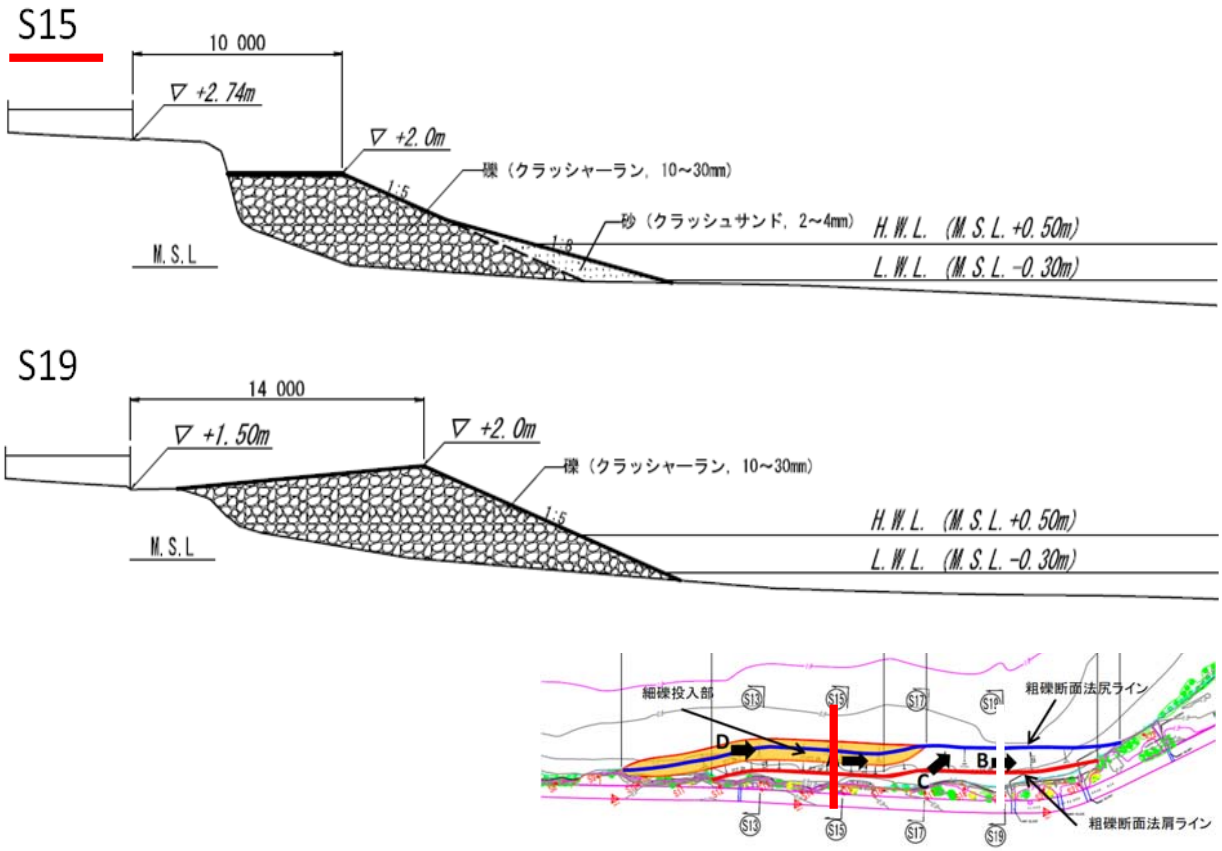
経済性、工法の容易性

ハード＆ソフト対策の比較、ソフト対策としての砂養浜、礫養浜との比較より、礫養浜を選択

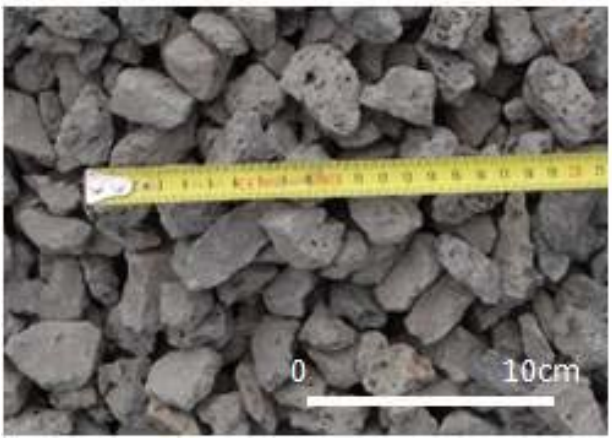
実施範囲



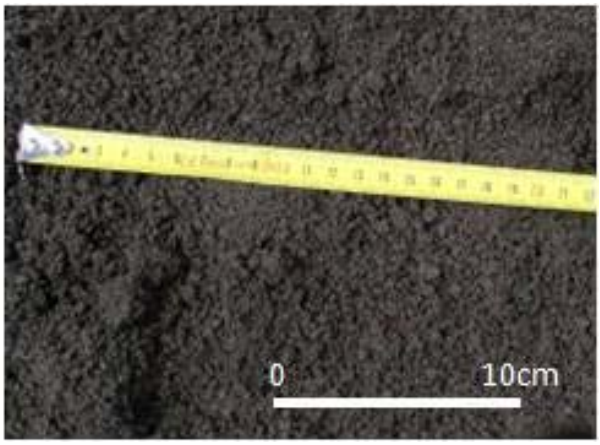
設定した初期礫断面形状



用いた礫材



粗礫（10～30 mm）



細礫（2～4 mm）

◆当国の陸域で豊富に産出されかつ安価な火成岩を砕いた砕石を使用

◆投入量は粗礫が4,600 m3，細礫が340 m3

海岸モニタリングの概要 （1/2）

モニタリング項目：

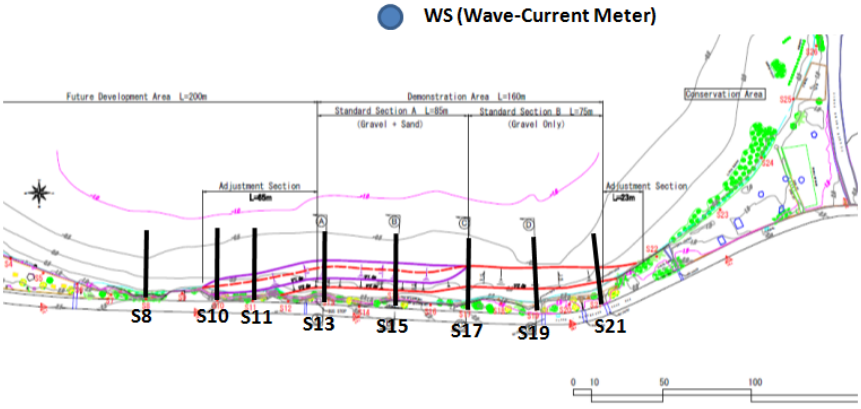
海岸断面測量，定点写真撮影，底質採取，透明度チェック、連続波浪観測

実施頻度：

ほぼ3ヶ月毎に実施

測量方法：

養浜実施エリアを含む約300 m区間に約20 m毎にモニタリングラインを設け，定点写真撮影はこの20 m間隔で，海岸断面測量は40 m間隔で実施



海岸モニタリングの概要 (2/2)

波浪観測：

リーフ外側の水深46m地点でのブイ式波高計（モーリシャス）とリーフ岸側の水深-3 m付近での海底設置型波高波向計でリーフ内外の波浪を観測

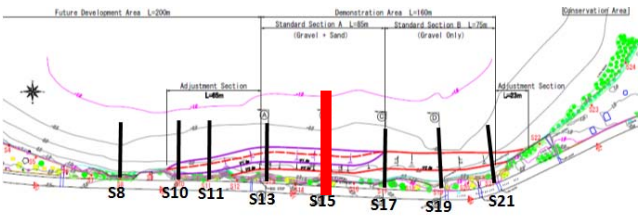
モニタリングの実施：

相手国のカウンターパート（C/P)との共同作業
（現在C/Pのみで継続実施中）

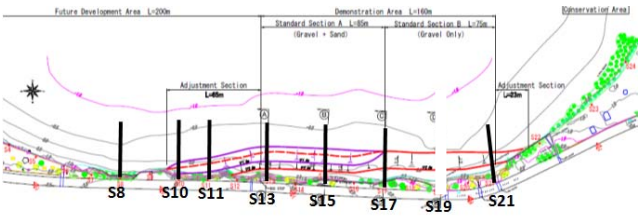
モニタリング期間中での出現波浪

- リーフ外での通常波浪は，有義波高2 m，周期8 s程度、一方リーフ内の波浪は，0.1～0.15 m程度，周期2 s程度
- 約1年半のモニタリング期間中の最大波浪は，リーフ外で4.3 m、リーフ内では0.3 m程度と沖波波高の5～8 %程度

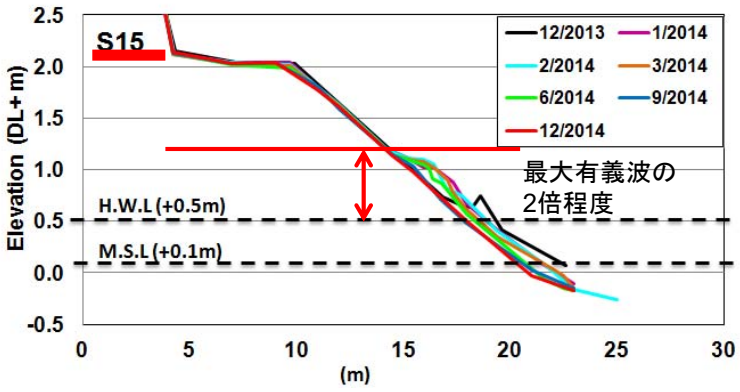
海岸変化状況（S15地点）

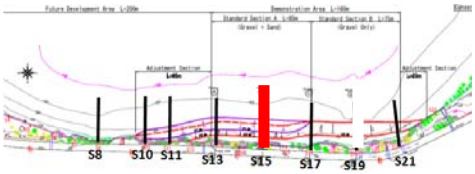


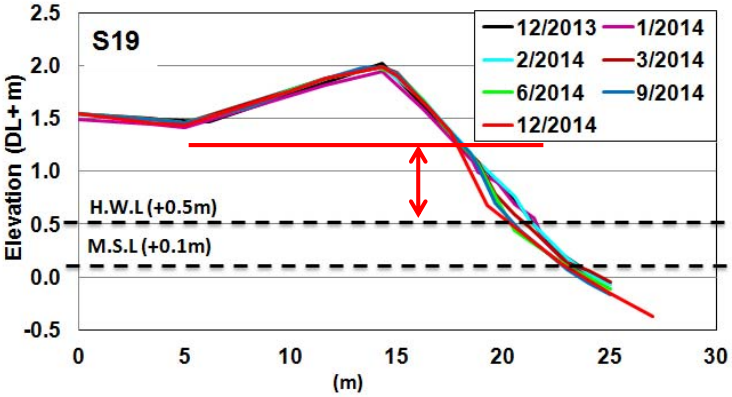
海岸変化状況（S19地点）



断面地形変化

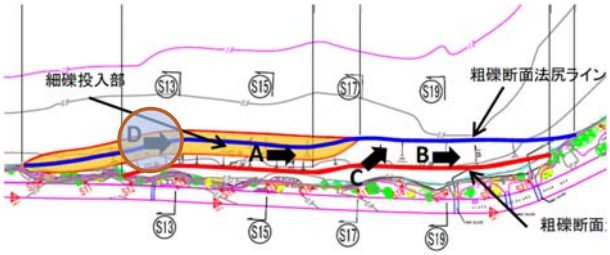






実施後の海岸利用状況

後浜域での自然の植生



得られた成果と課題

◆すべてのプログラムを、C/Pと一緒に検討、実施していくことで、海岸保全や礫養浜、維持管理に関する確実な能力向上が図られた

◆住民対話を重視し、多くの意見交換会により、対象海岸の住民の海岸に対する考えを把握できたとともに、住民側も海岸保全や事業に対する理解の向上が図られた

◆その後モーリシャス政府により、礫養浜の他海岸への積極的な水平展開が図られた。

◆今後，より長期的かつ特異な波浪条件での耐波性を確認するとともに，地域主導による海岸管理が今後も持続的に実施されていくかどうかについて，更なる長期的視点での検討・確認が必要である

第 3 章

ツバル礫養浜事業

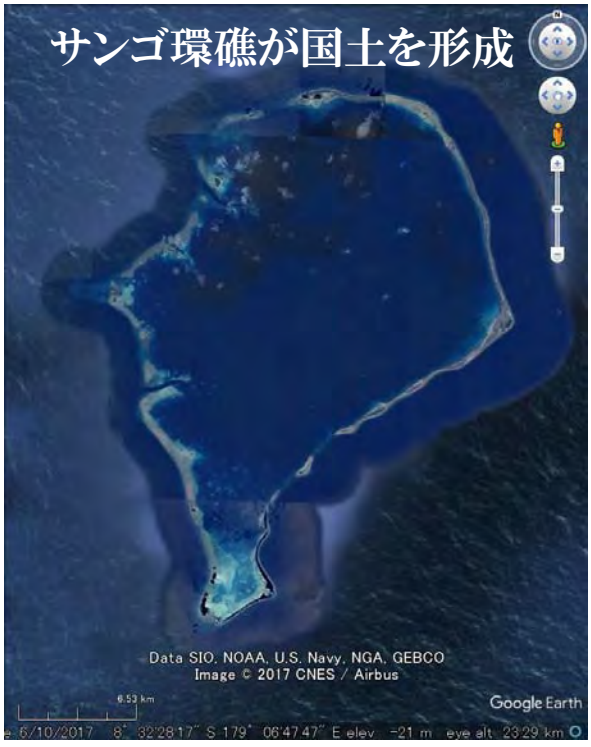
（開発調査型技術協力事業）

ツバル国

- 南大洋州の遠い国(10,000km、3日)
- 9つの「1日で歩いて回れる」島からなる島嶼国
- サンゴ起源の礫・砂が国土を形成
- 山や川は無く、低標高(+3m)

- 人口1万人(世界第2位)
- 首都のフォンガファレ島に約半数が集中し、人口密度は非常に高い

- 沈みゆく国？



事業概要

- 事業名　：ツバル国　沿岸災害対応のための礫養浜パイロットプロジェクト
- 発注者　：JICA(地球環境部)
- 相手国機関　：外務・環境・労働省
- 事業期間　：約4年 (2012年、2015年～現在)
- 事業内容　：フェーズ 1　調査・計画・設計
  フェーズ 2　施工/施工監理 (2015完了)
  フェーズ 3　モニタリング (2016-現在)

①「海岸保全」の目的

自然の海岸の機能(ツバル)

1. 波浪に対する防護機能
2. レクリーションや漁業の場としての利用機能
3. 海生動植物の生育の場としての環境機能

海岸が失われると・・・・

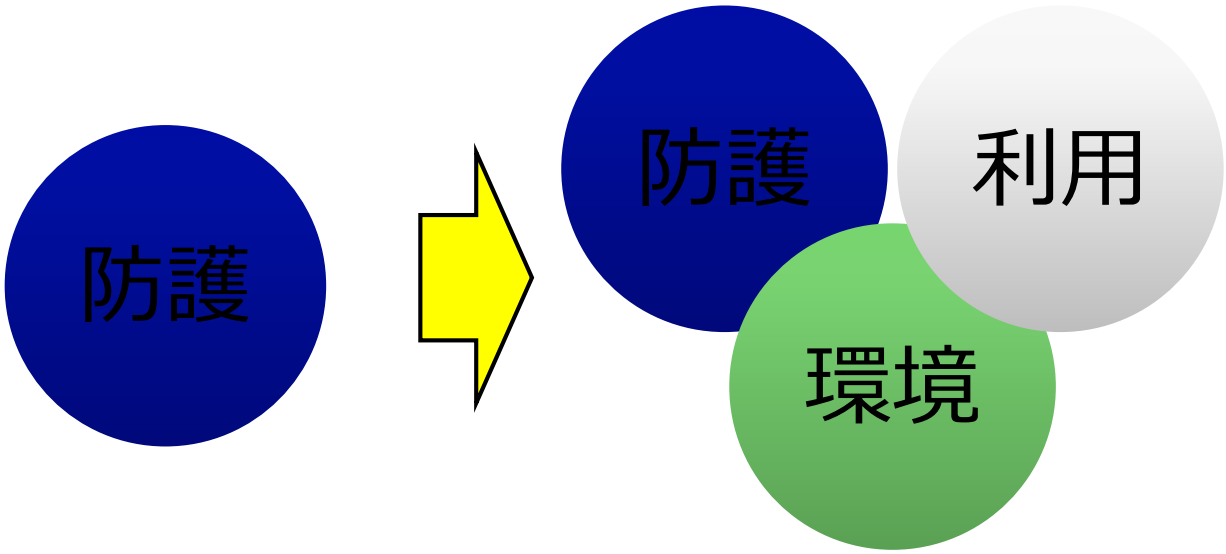
1. 波浪に対する防護機能　⇒　構造物対策
2. 憩いの場・レクリーションの場としての利用機能
3. 動植物の生育の場としての環境機能

海岸が本来の姿から変わっていく

負の連鎖：

建設⇒反射波の増大⇒崩壊⇒再建設

海岸保全の目的



海岸が本来持つ機能をバランスよく回復させる

②「礫養浜」の特徴とその効果

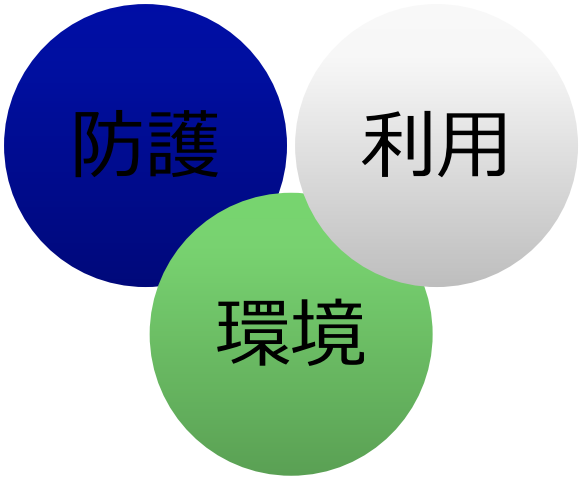
事業実施前の海岸

背後地への波の打上げ

コンクリートブロックの散乱

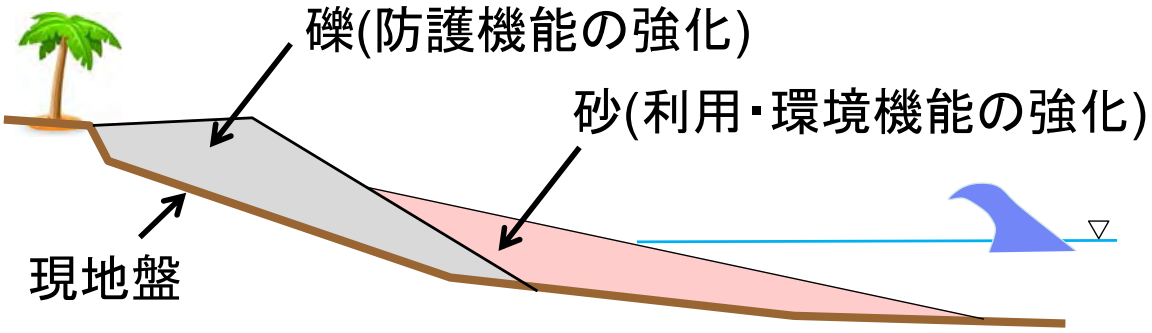
ゴミ・悪臭

対策の基本方針



視点	方針
①防護	異常気象時においても背後地への波の侵入を防ぐ
②利用	人々が昔と同じように利用できる海岸を回復する
③環境	海岸本来の自然環境・景観を回復する

礫養浜の採用



長期的に安定している海岸から学ぶ

＋

- 設計指針(限定的)
- 数値検討

礫養浜の実施前後

礫養浜の実施後

確認された効果(防護)

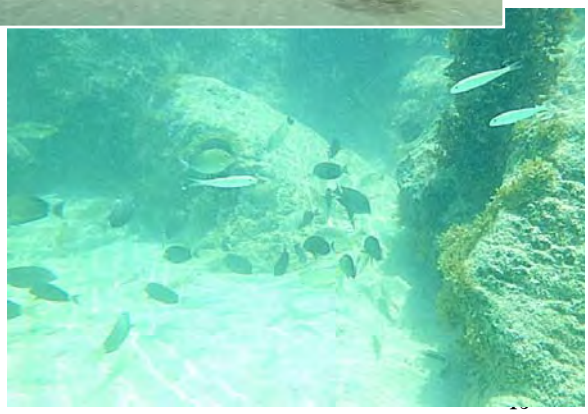
サイクロン来襲時における波浪低減効果

隣接エリア(対策無し)

プロジェクトサイト内

(海岸形状の変形はモニタリング測量で把握)

確認された効果(利用と環境)



③「コミュニティー主導の維持管理」を実現するためのアプローチ

事業実施前の海岸の様子

公共の場である海岸に対する人々の無関心

懸念事項

過去　　現在　　未来？

- 周辺住民や利用者の<u>意識を改善しない限り</u>、将来的に昔の状態へ逆戻りすることが懸念
- 海岸は不特定多数が日常的に利用する場であることから、コミュニティー主導の海岸管理が必要不可欠

段階的取り組み

興味 → 体験・理解 → 行動

海岸保全や事業に係る
広報活動、環境教育活動

コミュニティー主導の
海岸維持管理

広報活動(関心・理解の向上)



活動内容	実施時期	対象	人数
ラジオ放送	全時期	一般	(不明)
住民説明会	計画～施工中	コミュニティー、周辺住民	200名
海岸清掃イベント	計画・設計	コミュニティー、周辺住民	150名
海岸ソングコンテスト	計画・設計	一般	30名
海岸絵コンテスト	計画・設計	小学校	30名
海岸見学ツアー	施工中	小学校	100名
竣工式	施工完了時	政府、コミュニティー等	70名

環境教育活動

- 海岸運動会を中心とした一連の環境教育活動
- 地元の小中学生と保護者(約800名)

Step-1	Step-2	Step-3
環境教育授業	海岸清掃	海岸運動会
「海岸の大切さを学ぶ」	「各自の役割の体験する」	「海岸の楽しさを体験する」

定期イベントとして毎年開催

環境教育活動

STEP-1: 環境教育授業

(海岸環境を守っていくことの大切さを学ぶ)

環境教育活動

STEP-2: 海岸清掃

(海岸を利用するために必要な各自の役割を体験する)

環境教育活動

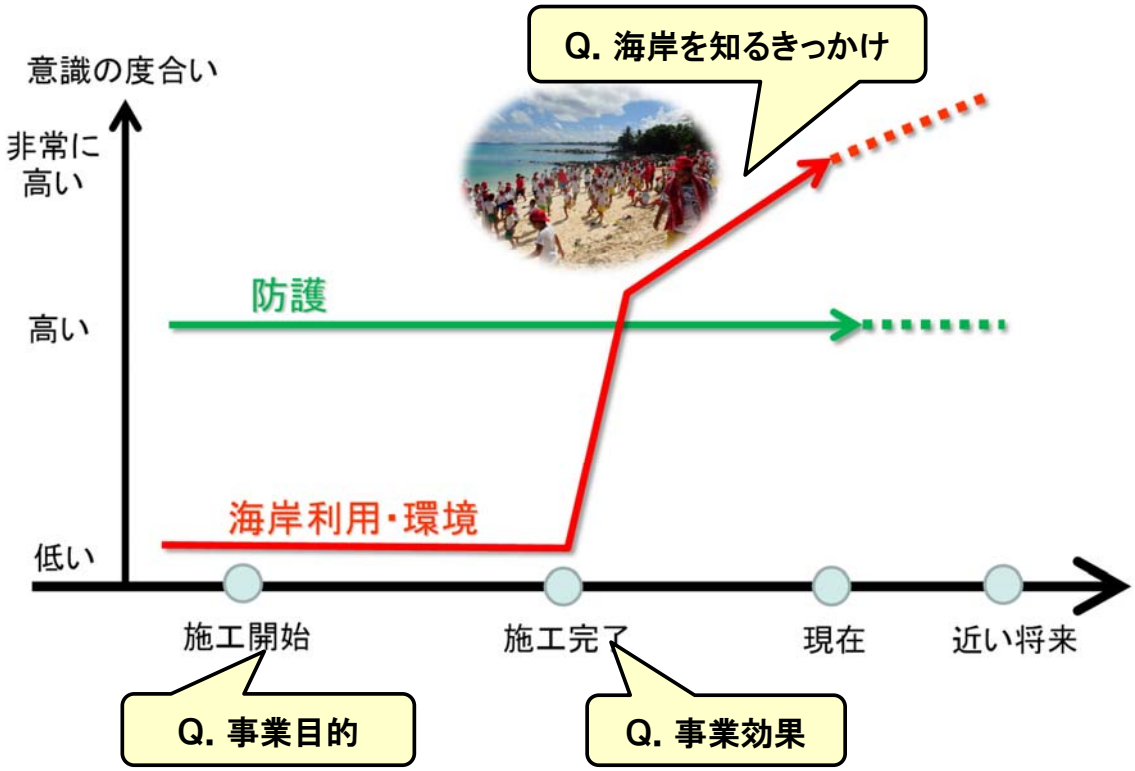
STEP-3: 海岸運動会の開催

(海岸で遊ぶことの楽しさを体験する)

環境教育活動

STEP-3: 海岸運動会の開催

意識の変化(アンケート調査より)



行動の変化(自主的な管理を開始)

海岸清掃への住民の参加

毎週金曜日の海岸清掃

利用マナーの看板の設置

まとめ

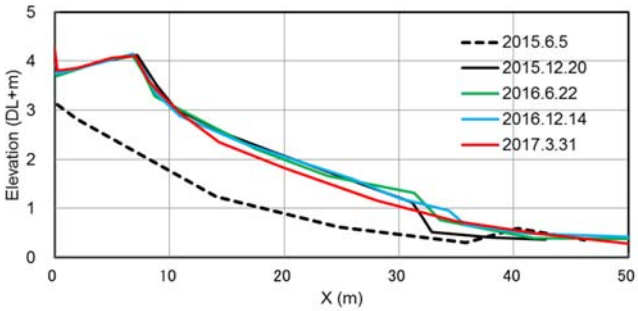
- 礫養浜の実施により、海岸の持つ防護・利用・環境機能における大幅な改善が確認された。

工事完了から約1年半が経過した現時点で、

- コミュニティーが自主的な海岸管理活動を開始し、海岸環境は良好に保たれている。これには、本業務で実施した広報・環境教育活動により人々の意識・理解が向上したことが大きく貢献していると考えられる。

- 海岸地形のモニタリング結果からは、養浜材の顕著な流失は認められない。所要の防護機能を維持できていると評価できる。

モニタリング結果の一例



第 4 章

モルデイブ GCF 事業

（情報収集調査）

モルジブにおけるGCF事業提案の取り組みの概要

1. モルデイブの概況

モルディブの概要

外務省Website モルディブ共和国（Republic of Maldives）基礎データより

1. **国土面積:** 298平方キロメートル（全島総計。東京23区の約半分）。1192の島々より成る。（うち、住民島は188島）
2. **人口:** 53.4万人（2019年モルディブ政府資料）
（内訳は、モルディブ人37.3万人、外国人16.1万人。いずれもモルディブ在住の人口）

3. **首都:** マレ
4. **民族:** モルディブ人
5. **言語:** ディベヒ語
6. **宗教:** イスラム教
7. **主要産業:** 漁業及び観光
8. **名目GDP:** 57.605億米ドル
（2019年モルディブ金融管理局）
9. **一人当たり名目GNI:** 9,140米ドル（2018年世銀資料）
10. **GDP成長率:** 5.9%（2019年モルディブ金融管理局）

モルディブの概要

モルディブ及び代表的な島嶼国の基礎情報

	モルディブ	キリバス	マーシャル	ツバル
人口 (persons)	515,700	115,850	58,410	11,510
面積 (km^2)	298	810	180	30
人口密度 (persons/km^2)	1,719	143	323	38
一人当たりGDP	10,330.6	1,625.3	3,788.2	3,700.7
海岸線延長	644	1,143	370.4	24
単位面積あたり海岸線延長 (km/km^2)	2.14	1.41	2.06	0.80
平均標高 (m)	1.5	2	2	2

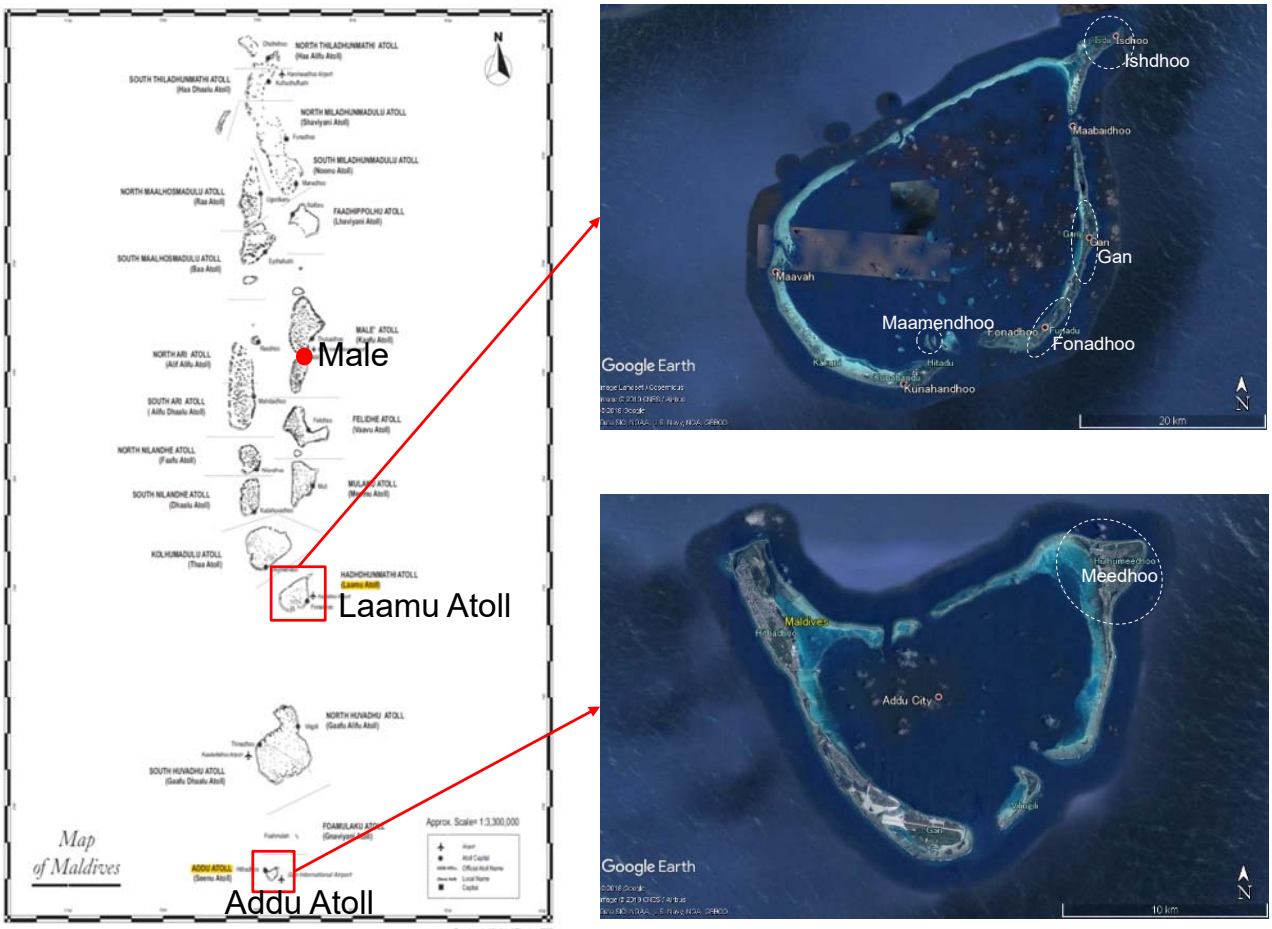
出典:：(1) NBS,(2)World Bank Open Data (2018) (3) CIA The World Factbook (4) High Commission of Maldives

■低平かつ狭隘な土地: 陸域の8割以上が平均水面から1 m以下
■資産が沿岸部に分布: 住居地の44 %、インフラ設備の47 %が海岸線から100m以内に位置する。

モルディブの対象島が抱える問題

1) 気候変動の海面上昇による外力増大と海岸侵食の助長、高波浸水被害の頻発化・甚大化と国土消失の加速化
2) 沿岸域の更なる開発と集中化による居住地、重要インフラの暴露性の増大
3) 経済発展に伴う沿岸開発や不適切な海岸対策による海岸の改変・人工化、それによる砂浜やサンゴ礁の持つ自然防護機能の低下と海岸侵食問題の顕在化
4) 気候変動影響およびその対応を検討する上で必要な基礎情報・データ不足および関係者間での共有不足による「モ」国一体となった気候変動への取り組みの遅れ、またはミスリードとなる危険性
5) 地域住民の海岸および海岸保全への関心低下による海岸環境の悪化、それによる住民レベルでの海岸維持活動への取り組み不足
6) 島民への災害に対する情報入手・伝達、避難手段の不備、および独立した個々の島であるといった避難事情の特異性による災害リスクの増大

2. 住民島における海岸の現状

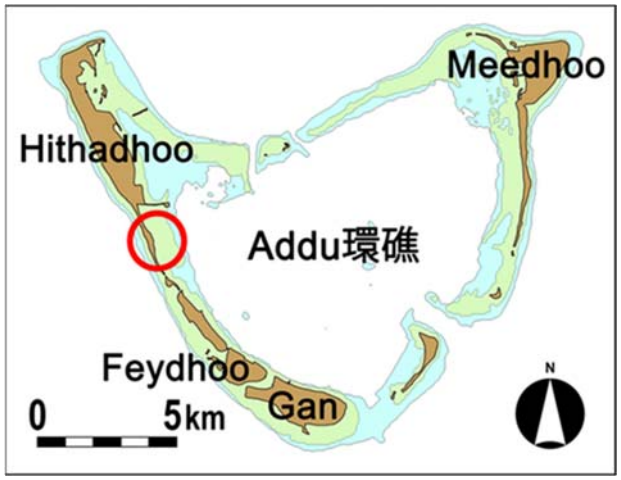


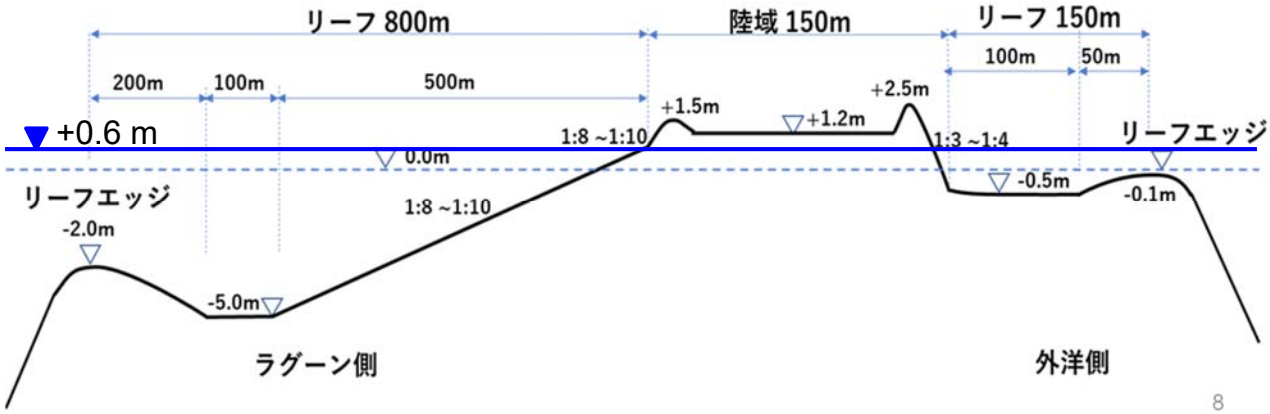
Addu Atoll･Laamu Atoll　事業対象地域　位置図

モルデイブの地形イメージ

（例：南部のAddu環礁）

- ◆ 平均標高は平均海面上1～2m程度だが、南部は1～1.6m程度
- ◆ 平均標高が南部ほど低いのは、陸域は長年の波の作用でサンゴ砂礫が堆積して形成され、熱帯低気圧の発生頻度の高い北部では標高が高く、発生頻度の低い南部で低いため





これまで「モ」国住民島で生じてきた海岸侵食のほとんどは、海岸やリーフ上での人為的改ざんに起因するもの

Case-1: 海岸域での港建設、リーフ上の航路建設

Case-2: リーフ上からのサンゴ砂礫の採掘

Case-3: 海岸からのサンゴ砂・礫の採取

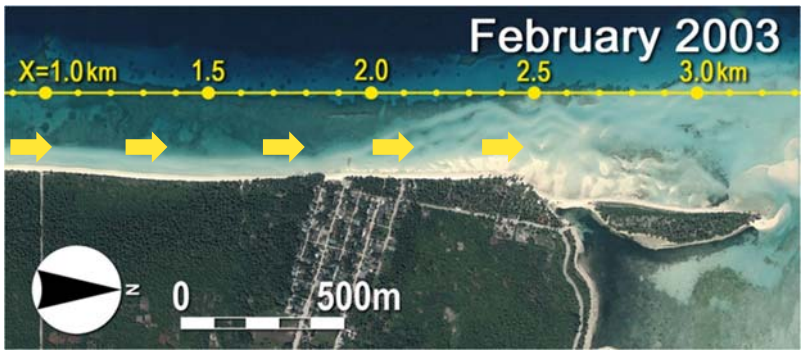
Case-4: 不適切な海岸対策による浜の減少・消失

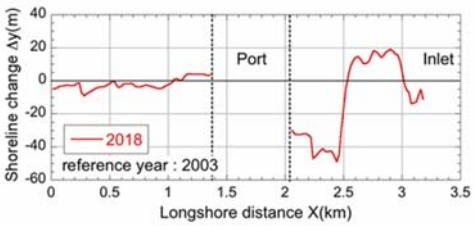
Case-5: 水質の富栄養化によるリーフ上の海草繁茂

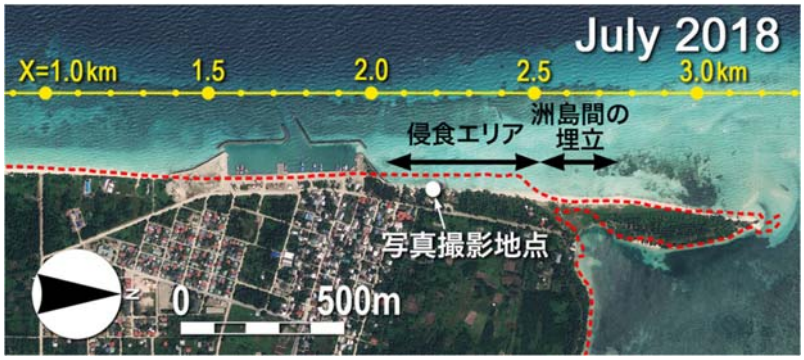
（**Case-6:** リーフ上の大規模埋立て）

Case-1: 港建設による漂砂下手側での侵食

- Gan島（Laamu 環礁）-







Case-1: リーフ上での航路掘削

- Gan島（Addu環礁）-

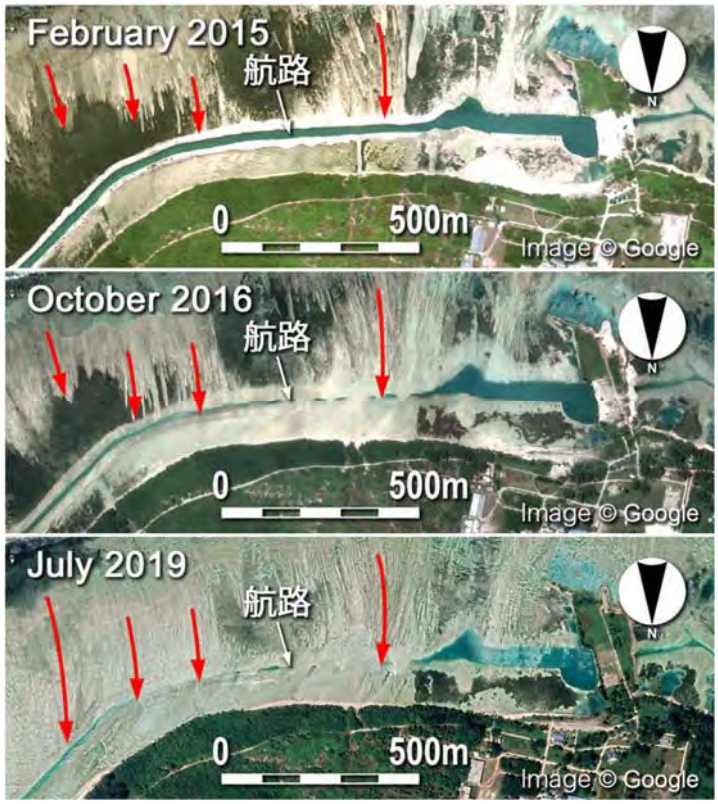
リーフ海岸における海岸の砂はリーフから共有される

↓

リーフ上でびこのような航路建設により

↓

リーフから海岸への砂供給バランスが変わる



Case-2: リーフの滑走路建設、サンゴ砂礫の掘削

- Gan島（Addu環礁）、Gan島（Laamu環礁）-

滑走路建設とリーフ掘削
Gan島（Addu環礁）

建設資材としてのサンゴ砂礫掘削
Gan島（Laamu環礁）

掘削されたサンゴ砂礫の総量は、海岸で消失した砂の総量にほぼ等しい

↓

サンゴ礁から供給される砂の量が限られる中で、このような大規模掘削は、海岸に対するインパクトが大きい

Case-3: 海岸からのサンゴ砂礫採取

-Hithadhoo島（Addu環礁）-

リーフから共有される砂の量は
0.5～1.0 m^3/m/year程度のオーダー

↓

個人（または業者）が海岸から採取する1日当たりの量は限られるが…

↓

これが何十年にわたって行われているとすると

↓

推定されるリーフからのサンゴ砂礫供給量に対して無視できない数量となる

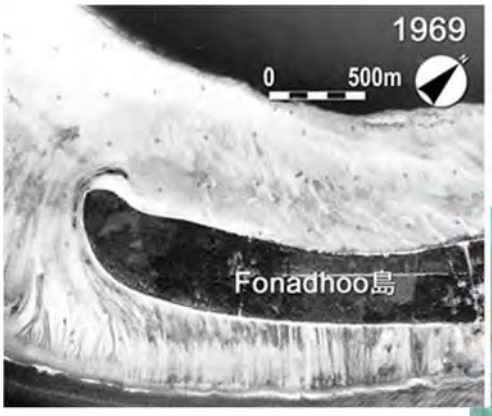
Case-4: 不適切な海岸対策による砂浜の減少・消失

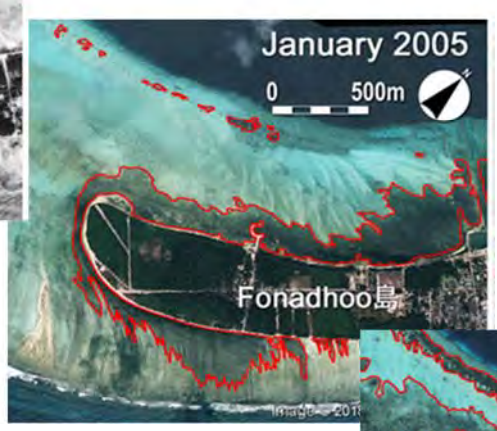
- Meedhoo島（Addu環礁）-

波の遡上や海浜変化に対する緩衝帯(buffer zone)である前浜が、不適切な海岸防護対策により減少（消失）する

Case-5:
水質の富栄養化によるリーフ上の海草繁茂

- Fonadhoo島（Laamu環礁）-





住民島での生活排水による水質の富栄養化

↓

リーフ上での海藻繁茂の拡大

↓

リーフから共有される砂が捕捉

Case-6: リーフ上の大規模埋立て

- Fonadhoo 島 (Laamu 環礁) -

何千年かけて形成されてきた自然のサンゴ礁や海岸が、現世代の僅か数年で人為的に完全に無くなった

↓

経済開発優先でのこのようなやり方が本当にsustainableなのか？

GCF事業としての位置づけ

通常の海岸事業は、このような既に生じてきた海岸侵食等の海岸問題に対処することを目的として事業が形成される

一方GCFの事業形成においては、

1) これまでに気候変動影響によってどのような影響があったのか
2) 気候変動により、今後どのような深刻なリスクが生じる可能性があるのか

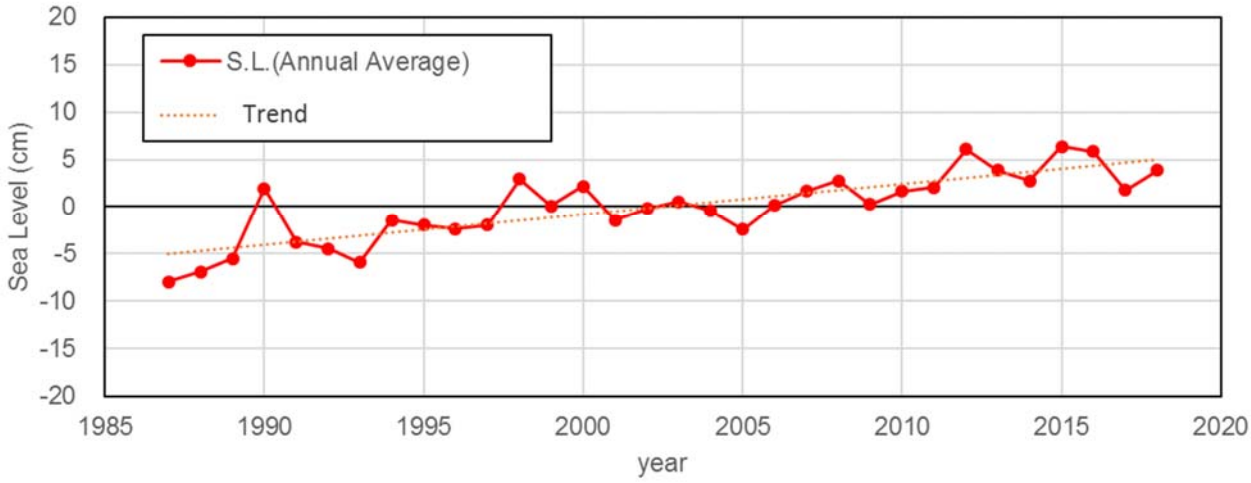
この2点について、論理的かつ理論的に示すことが求められる。

この点が、GCF事業提案における技術検討上のポイント！

3. 気候変動の影響
（海面上昇量（SLR)に着目）

1987年～2019年 (33年間)での観測された海面上昇量

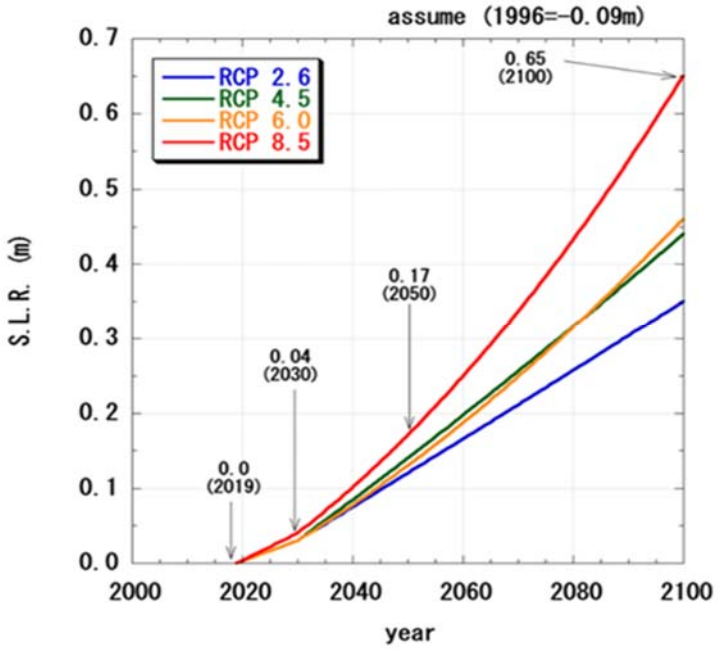
- Addu環礁Gan島での潮位観測結果より -



1987年から2019年までの33年間における海面上昇量は3.2 mm/年

2019年基準の「モ」国の今後想定される海面上昇量(SLR)

（第5次IPCC報告書(2014) RCPシナリオより)

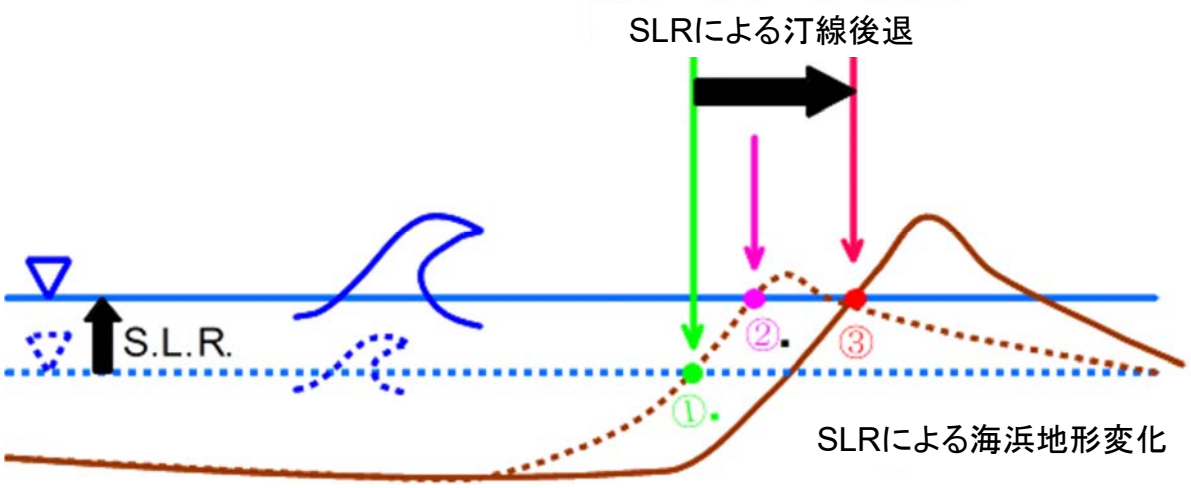


RCP: Representative **C**oncentration **P**athways applied in IPCC

（代表濃度経路シナリオ：人間活動に伴う温室効果ガス等の大気中の濃度が、将来どの程度になるかを想定したもの）

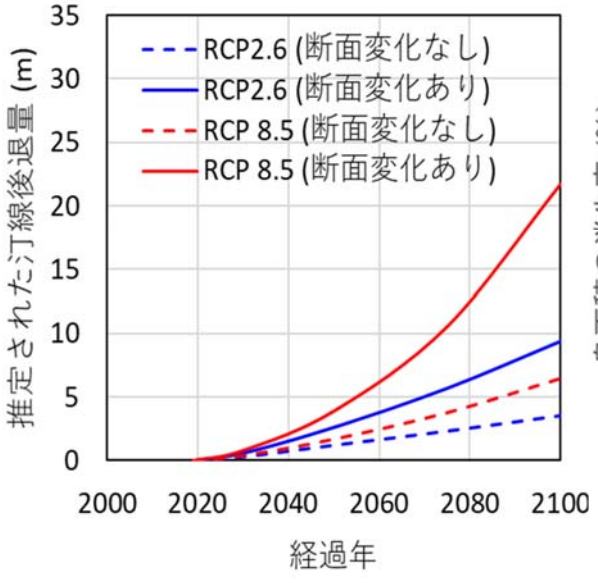
RCP8.5：平均3.7℃（2.6～4.8℃）
RCP6.0：平均2.2℃（1.4～3.1℃）
RCP4.5：平均1.8℃（1.1～2.6℃）
RCP2.6：平均1.0℃（0.3～1.7℃）

SLRによる汀線後退イメージ

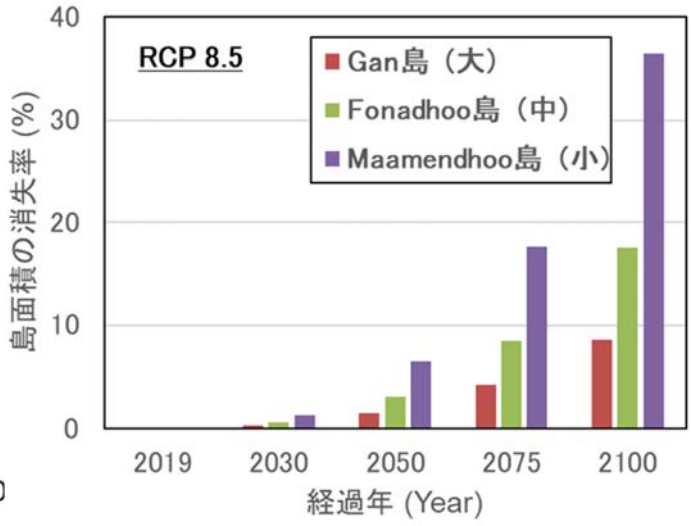


SLRによる汀線後退は、水位が上がることによる影響(①から②)とそれによって海浜断面地形が変化すること(②から ③)による2つの影響による

推定されたSLRによる汀線後退量と大きさの異なる各住民島に対する影響

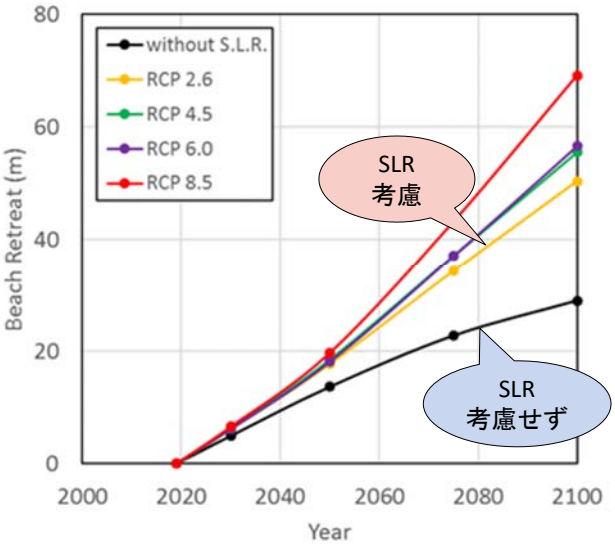


推定されたSLRによる汀線後退量
(Addu環礁ラグーン側のケース)



SLRによる海岸侵食による消失面積の割合

既にず人為的影響で海岸侵食が生じている海岸にさらにSLRの影響が加わった場合



推定される汀線後退量
（SLRを考慮した場合としない場合）

人為的影響で現在生じている海岸侵食が、SLRでさらに助長される

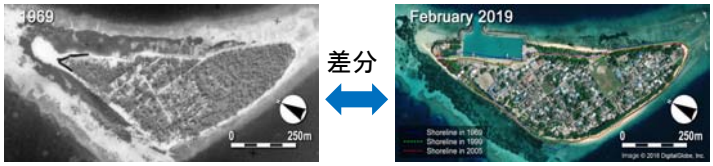
これまで生じている海岸侵食に対するSLRの影響

これまでの海岸侵食が人為的影響のみで生じているものに対する事業提案だとGCF（気候変動）事業としての必要性・必然性がない　（GCF事務局からの指摘）

事業を実施することによる今後の気候変動リスクに対する効果を説明するだけでは不十分であり、これまで生じてきた海岸侵食が、SLRによる影響でも生じてきたことを理論的に示すことが求められた

検討手順

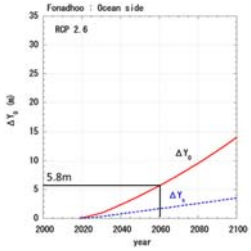
① 1969年～2019年の過去50年の汀線後退量を衛星画像より算出



② その間でのSLRを観測データから算出

対象期間	年	SLR(cm)	備考
1986-2018	33	10.6	実際の観測値
1969-2018	50	16.1	50年間に外挿

③ そのSLRに対する汀線後退量を新たに提案した推定式より推定



④ ①と③を比べることにより、実際の汀線後退量におけるSLRによる汀線後退量の割合を推定

島	場所	期間		汀線後退量 (m)		割合
				実際	SLRによる	
Mamendhoo	西側海岸	1969-2018	50年	5～10	3.2	30～60％
	東側海岸			10～15	5.8	40～60％
Fonadhoo	オーシャン側			5～10	5.8	60～100%

4. 提案する事業コンポーネント

目的:「モ」国のオーナーシップの重視とソフト・ハード面の強化・整備による、気候変動リスクに対する国土保全と住民の安全・安心な暮らしの持続的維持を図る

人為的影響によるサンゴ礁や自然海岸の脆弱性の高まり、劣化を防ぎ、サンゴ礁や砂浜海岸の持つ自然防護機能の長期的保全を図る

JICAコファイナンス

コンポーネント 1:統合的沿岸域管理計画(ICZM)による、海岸保全、リーフ環境保全、土砂管理、土地利用計画の策定

脆弱性の高い海岸での物理(ハード)対策による気候変動リスクの低減を図る

GCF資金

コンポーネント2:3海岸での防護・利用・環境に調和した海岸保全対策(養浜)の実施と、2海岸での海岸防護対策(護岸)の実施

ソフト対策による異常時・災害時の住民の安全を確保

JICAコファイナンス

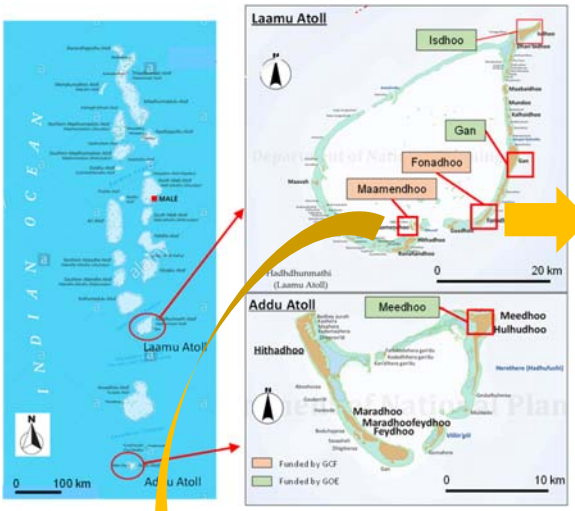
コンポーネント3:情報伝達(早期警戒予報)システムの整備

今後の気候変動施策に活用するための長期データ取得と情報共有の促進

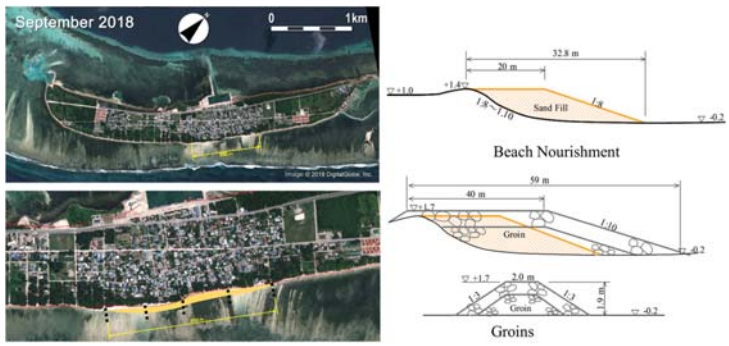
JICAコファイナンス

コンポーネント4: 波浪、リーフ・地形モニタリングシステムの整備

コンポーネント2: 5海岸での海岸保全/防護対策の実施

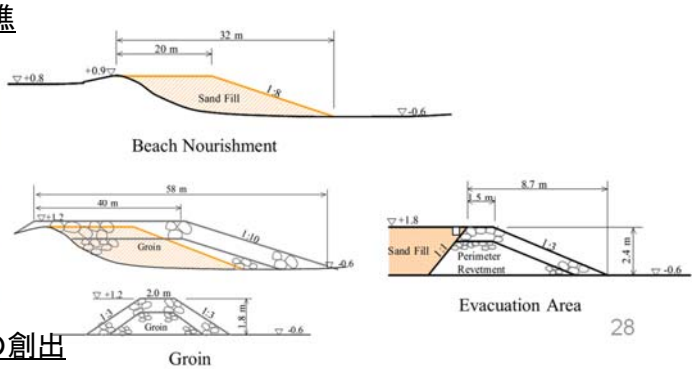


南部のLaamu環礁およびAddu環礁



Fonadhoo島での養浜対策

Fonadhoo島での養浜対策および避難エリアの創出



Funding Proposal作成過程における留意点

- 事業の“ニーズ”や“貢献”とともに、“変革”、“オーナーシップ”、“持続性”が、他事業以上に強く求められる。
- FPのB1：Climate rationalにおける気候変動とその影響に関する最新かつ高度な定量的説明が必要、またB2：Theory of changeでの気候変動事業としての必要性・必然性に対する理論整然とした論理展開が必要。
- GCFの独特の作法がある（Project Management Costの負担上限など）
- GCF事務局はFP本文だけでなく、各Annexの細かい数字や文書間の矛盾点まで細部にわたりチェックする。
- GCF資金以外のコファイナンス部分の記載内容についてもチェックする。
- フォームや記載すべき事項の更新があり、気候変動の研究も年々進んでいるため、過去の事例が通用しない部分もある。＝＞GCFの動きもチェックする必要がある。IPCCのAR6の成果の活用。
- GCFコメント対応：分からないところは遠慮なく聞く。押し返すところは押し返し議論する（例えば、気候変動対策としての養浜工法の妥当性）

第 5 章（1）

東南アジアにおける案件形成調査

（フィリピン）

調査海岸(2014年2月)

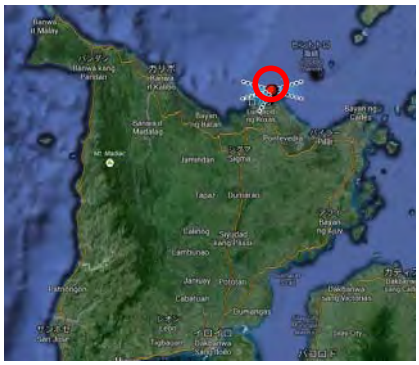
前半（パガイ島北海岸）

Day 1: Tokyo to Manila, Manila to Kalibo
Day2-3: Roxas, New Whashington
Day4: Boracay
Day5-6: Kalibo to Manila, Manila to La Union

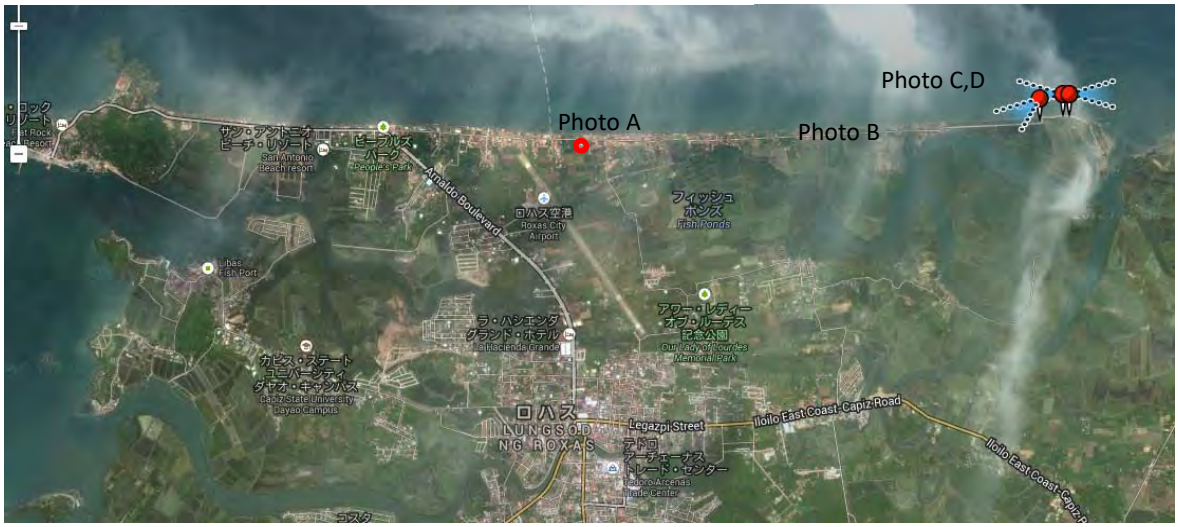
後半（ルソン島北東部）

Day 7: La Union (San Fernando – Agoo)
Day8: Santa, Santa to Manila
Day9: Report to DPWH and JICA
Day10: Courtesy call to Japan Embassy, Manila to Tokyo

1. Roxas, Capiz



➢台風30号による大きな被害が生じたエリアの1つとの報告があり、海岸侵食状況と合わせて調査
➢第5代比国大統領の出身地であり、政治的な優先度の高いエリア
➢約6kmの海岸道路が東西に延び、海岸沿いに多くの居住地（漁業従事者が中心）が存在



町中の様子

台風30号による被害（内陸なので風による被害と思われる）

海岸中央部（A地点）付近

海岸は細砂で非常に緩勾配

台風30号の高波で傾いた砂浜上の住居

東部（B地点）付近

以前存在した海岸道路が侵食により消失

内側のラグーンに新たに設置された道路

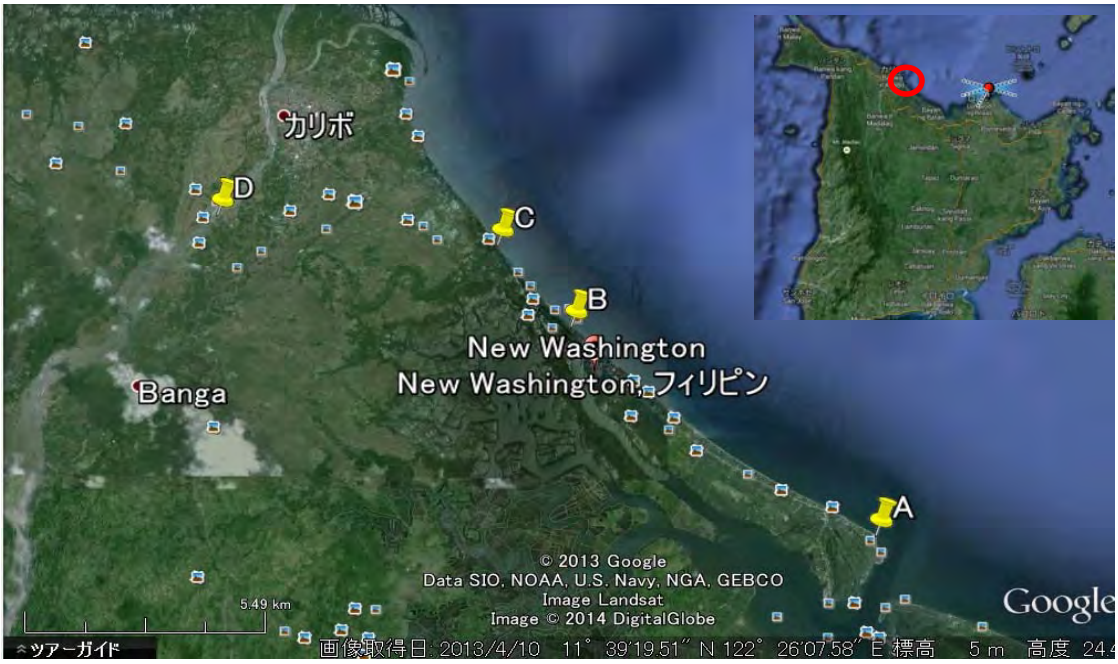
東橋（C地点）付近

海岸侵食による海岸道路護岸の崩壊

海岸侵食による海岸道路の被災

2. New Washington, Aklan

➢フィリピンにおける深刻な海岸侵食問題が生じている海岸の1つ
➢カリボ川の東側に形成された河口砂嘴上に位置する
➢砂嘴上の海岸線に沿って東西に延びる海岸道路が存在し、その周辺に多くの集落が存在



砂嘴東側（地点A付近）


以前存在した海岸道路は既に消失


海岸侵食により小学校は既に3回移転

砂嘴西側（地点B付近）


DPWHが実施した居住地防護のための護岸のほとんどは既に崩壊

砂嘴西側（地点B付近）

海岸侵食により護岸陸側の住居も既に崩壊

台風30号による建物被害

海岸侵食による既存護岸の崩壊

砂嘴西側（地点C付近）

最近改修された護岸だが、高潮位時には越波が生じていた

昨年改修された護岸は天端高が60cm嵩上げされた（明確な根拠なし）

3. Boracay, Aklan

◆世界的なビーチリゾートで、政府も現在最も重視するビーチリゾートエリア。
◆近年の観光客数の増加が著しく、1998年の6万人から昨年（2013年）は130万人以上の観光客が訪れた。
◆外国人観光客と国内観光客の比率はほぼ半々。最も多い外国人観光客は、韓国、次いで中国。（日本人観光客は700人/年程度）
◆観光エリアの中心は西側エリアであり、多くのホテル、レストラン、店舗が密集する。東側エリアは買いとサーフィン等マリンスポーツエリアとして、また北側エリアは近年高級リゾートエリアとして開発が進められている
◆台風30号の被害はまったくなかったとのこと

ホテルによる応急的な防護対策

数年前までは家の前の椰子林で
海岸は見通せなかったとのこと

以前はマンホールと同じ高さに
砂浜が存在

西海岸　地点C

➢フィリピン観光開発の最重要エリアとして、現在Re-Developmentの施策を実施中。
➢昨年、観光局・法務局・自治局・環境局によるタスクフォースチームが結成され、海岸美観・景観保持活動の1つとして、既存護岸の撤去が進められている（各オーナーの費用）
➢撤去後の挙動ついては明確にされていない


政府の指導により既存護岸が撤去されたが、既に浜崖が形成　（低潮位時）


高潮位時の様子
（背後の建物直前まで波が進入）

西海岸　地点D


浜崖の形成と応急対策としての砂袋の設置

東海岸の様子


聞き取り調査では明らかとされなかったが、侵食傾向

4. La Union
(Bauang- Aringay – Agoo)

- フィリピンにおける深刻な海岸侵食問題が生じている海岸の1つ
- Bauang川およびAringay川の河口部および河口から南側に延びる砂嘴が形成されている海岸エリアに居住地が密集する。
- DPWHにより、侵食対策として60基程度の突堤が既に設置されているが、沿岸漂砂の下手側(南側)での新たな侵食問題が発生している。
- 海岸侵食の発生により、一部海岸道路の崩壊が発生しており、周辺集落へのアクセスに支障が生じている。
- サーフィンや海水浴等の海岸レクリエーションとして利用。


地点A付近

漂砂の下手側における新たな海岸侵食


地点B付近

突堤と下手側での新たな海岸侵食


地点C付近

市によって整備されたアメニティー施設


地点D付近

突堤下手側での海岸侵食による海岸道路の被災

5. Santa, Ilocos Sur

- フィリピンにおける深刻な海岸侵食問題が生じている海岸の1つ（DPWH(RO No. 1)より、踏査を強く依頼された）。
- 100mのオーダーで侵食が発生しているとのこと。Abra川の河口デルタ地帯に位置し長期的な変動が大きいと想定。
- 波浪が直接入射する地形特性により来襲波浪が大きい。2009年Ondoy台風で既設の護岸が崩壊。
- DPWHが護岸の応急復旧を実施(現在600m)。予算確保が困難である事から、今後の復旧事業の継続が難航。

調査海岸の特徴まとめ

	Roxas, Capiz	New Washington, Aklan	Boracay, Aklan	Bauang-Caba-Agoo, La Union	Santa, Ilocos Sur
海岸の特徴					
砂の供給源	河川(黒砂)	河川(黒砂)	サンゴ礁(白砂)	河川(黒砂)	河川(黒砂)
台風被害が最も大きかった年	2005年	2005年, 2008年(Frank)	2007年(Seniang)	ー	2009年(Ondoy)
侵食オーダー※	30m～50m(1960s～)	100m	20m(2007～)	数百m	100m
主な背後資産	民家および集落へのアクセス道路	民家、小学校および漁港・集落へのアクセス道路	ホテル、レストラン	民家、小学校および集落へのアクセス道路	民家、道路
主な海岸の利用	漁業利用(干場)	漁業利用(漁船置き場)	観光利用、海水浴、日光浴、ビーチスポーツ等	一部でサーフィン、レクリエーション利用	漁業利用(漁船置き場)
比国政府によるこれまでの対応					
被災に対する応急対策	道路護岸(コンクリート板、設計根拠無し)	コンクリート護岸(設計根拠無し)	政府指導による既設護岸の撤去。撤去効果の根拠および撤去後の対策方針はなし。	石積み突堤、石積み護岸(設計根拠なし)	コンクリート護岸の再整備(設計根拠無し)
上記の防護対象	背後資産 (民家、道路)	背後資産 (民家、道路)	砂浜、背後資産 (ホテル、レストラン)	砂浜、背後資産 (民家、道路)	背後資産 (民家)
今後事業を実施する場合の費用対効果					
効果(Benefit)	中 (資産防護)	大 (資産防護、経済活動の保全)	特大 (観光寄与・資産防護)	大 (一部の観光寄与・資産防護)	中 (資産防護)
費用(Cost)	大 (低平地・住宅地全域)	大 (低平地・住宅地全域)	中 (限定された観光地エリア)	大 (低平地・住宅地全域)	大 (低平地・住宅地全域)
B/C	小	中	大	中	小

※Boracayは現地痕跡より推定、その他地域は住民ヒアリングに基づく(精査が必要)

問題点・課題点のまとめ (1/2)

・比国では現在多くの海岸で、海岸侵食によるインフラ施設の被害や沿岸域の居住地の消失等が顕在化しており、海岸防災に対するニーズが増している。

・海岸侵食により海岸域での災害に対する脆弱性が高まっていた中で、今回のような台風による高波・高潮が生じると、被害は更に拡大する(例:New Washington)。

・今回訪れた海岸侵食問題の多くは河口部周辺で生じていたが、その侵食要因については更なる検討が必要(河川からの土砂供給量の減少による影響は他国に比べて大きくない可能性。また近年の気候変動による襲来波浪特性の変化が、海岸問題に影響を及ぼしている可能性)。

・海岸整備の実施機関であるDPWHは、海岸侵食による施設の崩壊や住民移転、等が生じた後にその復旧対策を実施するといった、モグラ叩き的進め方である。その施設は技術的根拠なしに構築されており、海岸整備に不可欠な、現象の理解に基づく計画・設計能力が明らかに不足している。また技術ガイドラインもない。さらに実施後の維持管理も行われていない。更に実施した対策が新たな海岸侵食問題を引き起こしている事例も見られた(例:La Union)。

問題点・課題点のまとめ (2/2)

・国際的なビーチリゾートとして知名度の高いボラカイでは、最も重要な観光資源である白砂の砂浜の侵食が生じている。観光の中心的エリアである西海岸では、全体的に海岸線の後退が生じている

・急激な観光開発に伴うサンゴ環境の悪化が主な侵食要因として挙げられているが、現地での海岸状況のチェックおよび現地ヒアリング結果より、2000年以降における台風襲来等による外力（波浪）の影響による可能性も示唆された。

・ボラカイは政府の戦略的なリゾート再開発の代表的海岸として挙げられており、この政策にそって、昨年から既存護岸の撤去や砂浜上の施設の撤去が実施されている。しかし、その技術的根拠が乏しく、護岸は撤去したものの、その後の現象や対策についての戦略、計画なしに進められている。

第 5 章 (2)

東南アジアにおける案件形成調査

（ベトナム）

1. 調査概要

1. 調査概要

(1) 目的

◆ベトナムの海岸侵食の実態（現象面および海岸管理面）を調べ、対策の必要性・緊急性、およびその要因を検討する(2016年9月に実施)

(2) 調査対象海岸

<u>選定の背景</u>
◆現在深刻な海岸侵食問題に直面していること
◆経済効果の高い海岸であること（観光地）

<u>選定された調査対象海岸</u>
1)クアダイ （世界遺産ホイアンに位置するビーチリゾート）
2)ニャチャン（ベトナム最大のビーチリゾート）
3)ファンテイエット（南部の代表的なビーチリゾート）

(3) 調査行程

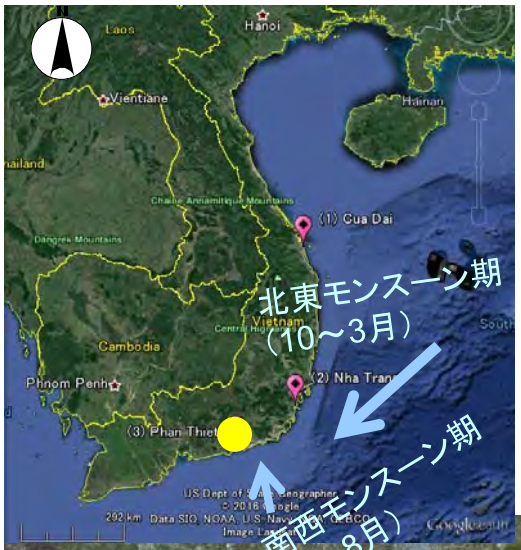
主な協議先機関

1) 関連政府機関
•MARD(6日、16日)
•MONRE(7日)
•水利研究所（6日）
•DARD:
Binh Thuan (7日)
Quang Nam, (13日)
•DONRE:
Khang Hoa (9日)
・PMU Quang Nam (13日)

2) ベトナム海岸工学有識者
•Dr. Viet(Central region college of Tec.)
•Dr. Thao(Ho Chi Minh City Univ. of Tec.)
•Dr. Long (Institute of Oceanology)

3) JICA、大使館
•JICAベトナム事務所(16日)
•在ベトナム日本国大使館（16日）

2. 海岸状況

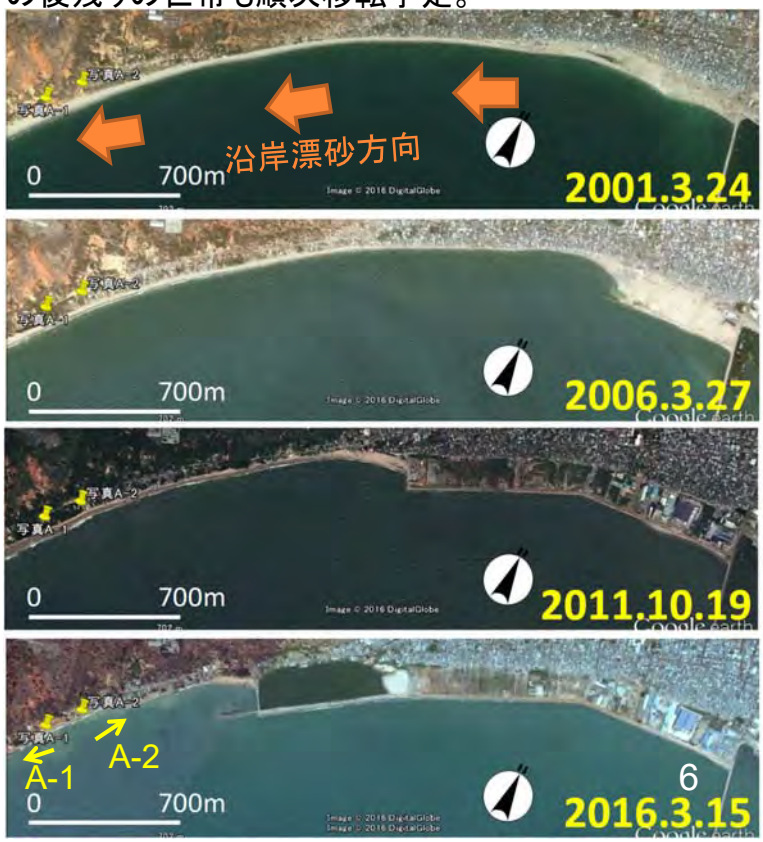


① ファンテイエット

◆南部の代表的ビーチリゾートエリア。リゾートエリアと居住エリア（漁村）が混在。
◆漁業から観光業への転換が図られており、新たなホテルやリゾート開発が精力的に進められている。
◆北東からの波浪が海岸に対して顕著な斜め入射となるため、西方向への顕著な沿岸漂砂が存在（西に延びる砂嘴、砂丘が発達している）
◆顕著な流入河川は見られず、背後域に存在する広大な丘陵からの崖侵食が土砂供給源と推定される
◆DARDが南部水利研究所に依頼し、ビントゥアン省沿岸域のMP（2011～20)を作成（中味は沿岸域の土地利用計画と、侵食域の特定程度）

(A) 埋立地の漂砂下手側での大規模侵食とそれによる住民移転

- ここ10年程度で海岸線が約100～150m侵食し、既に200世帯の家屋が消失
- 40 世帯の背後への移転が開始。その後残りの世帯も順次移転予定。
- 埋立地の延伸に伴い、侵食エリアが西側へ拡大。



(B) 各ホテルによる個別対策の実施とその悪影響

- 海岸域がホテルや民間開発業者の土地である場合、所有地内での海岸域の開発、施設構築は基本的に民間の裁量で行われる（DARDの許可が必要とのことであるが、その詳細や効力については再確認する必要）。

ケース1：個別の突堤建設

●各ホテルが自身のホテル前の砂浜を確保するため、突堤を建設。その後砂浜が消失したため、2008年に当ホテルでも突堤を建設

ケース2：個別の護岸対策

●ホテルの敷地を広く取るために、出来るだけ海側に護岸を設置する事例が非常に多い。

●その結果、反射波の増大、洗掘の助長により浜が完全に消失してしまっている

(C) 政府（DARD）による前浜を潰しての護岸対策

- 公共工事としての海岸整備はビントゥアン省では主にDARDが担っており、そのほとんどは護岸対策である。
- 2000年当初は、侵食対策としてのジオチューブの採用が多く見られたが、いずれも効果がなく、現在は殆ど採用していない模様。現在はコンクリートブロック傾斜護岸タイプが多い。
- 多くは、変動域である前浜部を潰しての護岸建設の事例が多く、これが更に侵食を助長している

最近建設された護岸（前浜上に建設）

2012年頃に整備された傾斜護岸（前浜上に建設）

② ニャチャン

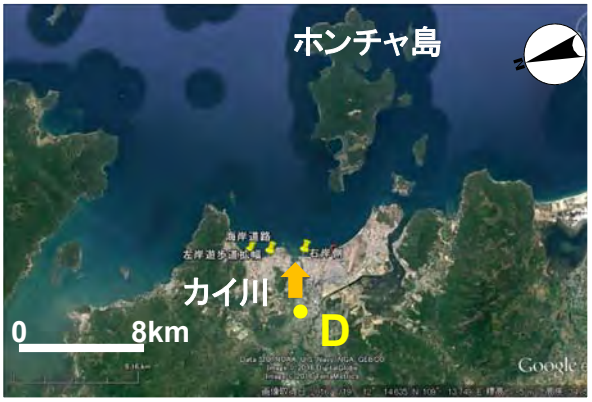
◆年間100万人以上の観光客が訪れる、ベトナム最大のビーチリゾートエリア。主に中国およびロシアからの観光客が多い。

◆当海岸はカイ川河口部に位置し、右岸側では自然海浜が約4.3km間に渡り存在し、そこが観光の中心エリアとなっている。

◆一方河口部左岸側でも現在積極的なリゾートエリアの拡大を図っている。

◆当海岸の入射波浪はホンチャ島の遮蔽の影響を大きく受ける。北東モンスーン時と南西モンスーン時の波浪特性の違いで海岸状況も季節変化が大きい。

◆カイ川からの流入土砂が当海岸の主な土砂供給源と推定される。ニャチャンの海岸侵食は他海岸にくらべ激しいものではないが、近年の土砂流入量の減少が海岸に影響している可能性がある。



(A) 政府による前浜を潰しての海岸道路建設、その後の砂浜消失

◆2003年に約20m幅の海岸道路を前浜部に建設。その後波が直接当たることによる反射波増大、先掘助長により砂浜が消失

◆ここに砂浜を再生し、南側と同様のリゾートエリアとすることを計画中とのこと。

(B) 前浜上での遊歩道建設

◆2006年～2009年の間に約12m幅の遊歩道を前浜上に建設。

◆現時点では前面に砂浜が存在するが、前述(A)と同様の現象が今後生じると考えられる。

(C) 河口砂州の消失とそれに伴う陸域の構造物への被害

砂州消失に伴う護岸の崩壊

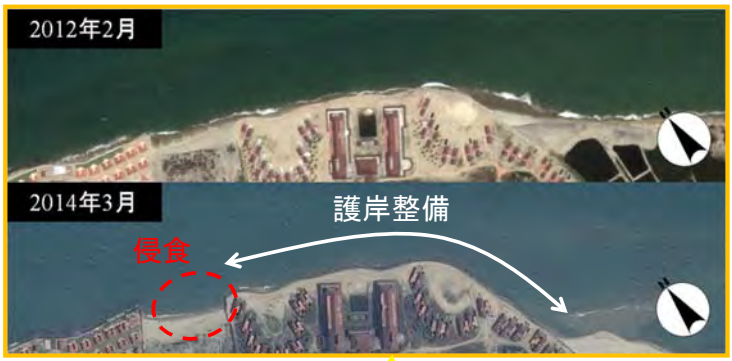
修復後(2016.9撮影)

(D) 潮止め堰建設に伴う流化土砂減少（の可能性）

③ クアダイ

- 世界遺産の都市ホイアンに位置するリゾート海岸で海岸域のリゾートホテルは2005年頃より建設
- 現在沿岸域のリゾート開発が20km北に位置するダナンまでの間で精力的に行われている
- ツボン川からの土砂供給により海岸が形成されている
- 左岸側、特に河口から4km程度の範囲で深刻な海岸侵食が発生。なお右岸側の海岸は特に侵食問題は生じていない

(A) 海浜変化過程を無視したホテル開発による侵食の助長と施設崩壊



上手側 開発・侵食対策
侵食 → 個別対策
下手側 侵食 ……繰り返し

(B) 沿岸漂砂下手側での急速な侵食の拡大

下手側へ拡大しつつある侵食エリアの状況

地点A

地点B

台風襲来前後の
1日での変化

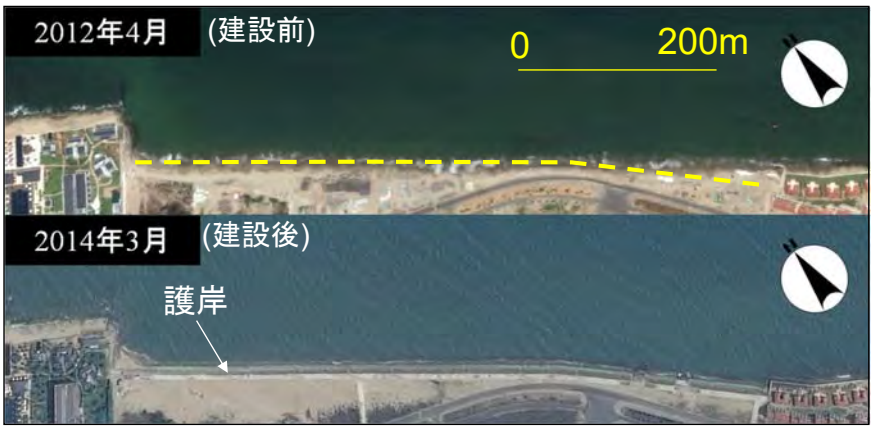
(C) リゾート地での海岸利用と景観への配慮に欠けた対策の実施

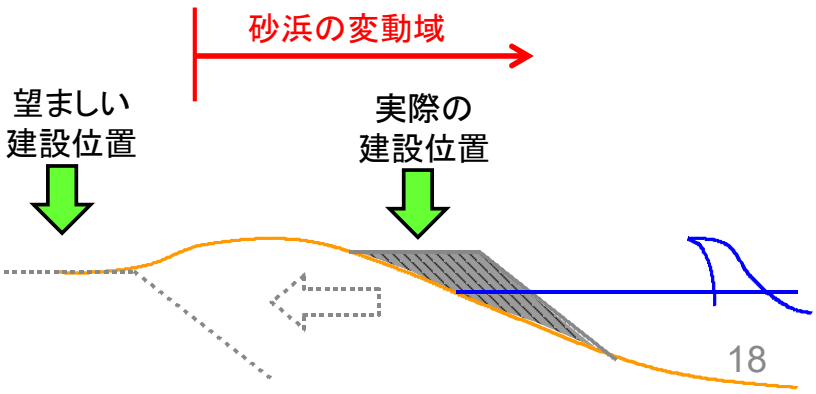
- 水辺へのアクセスが困難(水辺と背後地の分断)
- 反射波の増大による洗掘の助長(いずれは崩壊の可能性)

(比較) ニャチャン右岸側での良好な砂浜

(D) 政府(DARD)による前浜を潰しての護岸対策

砂浜の消失
(洗掘の助長により将来的に崩壊の可能性)





ツーボン川流域における砂利採取

- 河川には多くの砂利運搬船が係留され、河川沿いに砂利の集積場が存在。
- DARDは砂利採取の実態に関する情報は有していない。
- 砂利採取の規制は存在している。（2008年のDirective（No: 29/2008/CT-TTg）では年間5,000m3以下）

ダイロック堰付近（出水時の状況）

- 出水時には掃流砂もある程度流下している可能性がある

河口付近橋梁（Cua Dai Bridge）付近の状況

- Cua Dai Bridge工事用ヤードが残置されており、流れに影響を与えている可能性がある。
- ヤードはMARDによって撤去するよう勧告が出されている。

Cua Dai Bridge上流側

Cua Dai Bridge下流側