COCHIN PORT AUTHORITY

CONSTRUCTION OF JETTIES, LANDSIDE FACILITIES AND ALLIED FACILITIES AT EASTERN AND WESTERN SIDES IN KALPENI ISLAND OF LAKSHADWEEP ON EPC CONTRACT BASIS (TENDER NO.T9/T-2039/2024-C)

ADDENDUM /CORRIGENDUM No. 12

CONTENTS

Sl. No.	Description of Items in Addendum /Corrigendum No.12
1	Details of renumbered / modified / replaced / added / deleted bid clauses
2	Appendix-K Geotechnical Investigation Report [Modified]
3	Appendix-M Draft EMP Report [Modified]
4	Appendix-O Bill of Quantities

COCHIN PORT AUTHORITY

No.T9/T-2039/2024-C **Dated : 08-04-2025**

CONSTRUCTION OF JETTIES, LANDSIDE FACILITIES AND ALLIED FACILITIES AT EASTERN AND WESTERN SIDES IN KALPENI ISLAND OF LAKSHADWEEP ON EPC CONTRACT BASIS (TENDER NO.T9/T-2039/2024-C)

ADDENDUM /CORRIGENDUM No. 12

The following clauses in the Bid Document stand renumbered / modified / replaced / added / deleted as below:

Sl. No.	Section / Clause No./ Page No.	Renumbered as / Modified as / Replaced with / additional details / deleted
1	Notice Inviting Tender (NIT) e-Tender [Modified] Clause 21 (Page xii) and Vol. I – Appendix I Annex – V Proforma of Integrity Pact – Section 8 (Page 164)	1. Shri. M.J. Joseph, ICAS (Retd.), 37,Da Costa Square, 3rdcross, Cooke Town, Bangalore -560084. Email: joseph.iem@cochinport.gov.in 2. Shri. Punati Sridhar, IFoS (Retd.), 8C, Block-4, 14-C Cross, MCHS Colony, HSR 6th Sector, Bangalore-560 102 E-mail id: sridhar.iem@cochinport.gov.in ***is modified as*** 1. Shri. Harishwar Dayal, IDSE (Retd.) H-2, Lawyer Colony, Bypass Road, Agra – 282005 (UP) Email: dayalagra@gmail.com 2. Shri. Deepak Chaturvedi, ITS (Retd.), Flat No. 1, Sanchar Vihar, C-58/4, Sector-62, Uttar Pradesh, Noida – 201301. Email: chaturvedideep@rediffmail.com
2	Vol. I – Section – 4 Instructions to Bidders Clause 4.7 (Page 20)	Reference numbers of Codes or any Standards stipulated in the Tender Document shall be deemed to mean the latest revisions of such Codes or Standards current at the time of issue of this Bid Document. ***is modified as*** Reference numbers of Codes or any Standards stipulated in the Tender Document shall be deemed to mean the latest revisions of such Codes or Standards current at the time of **submission** of the Bid.
3	Vol. I – Section – 4 Instructions to Bidders Clause 4.22.1.5 (Page 28)	***New Clause 4.22.1.5 is added as follows:*** **4.22.1.5** If the Bid, which results in the lowest evaluated Bid Price, is seriously low in the opinion of the Authority (usually 10% or more below the Estimated cost), the Authority may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, taking into consideration the schedule of estimated Contract payments, the Authority may reject the Bid or require that the amount of the Performance Security be increased at the expense of the Bidder to a level sufficient to protect the Authority against financial loss in the event of default of the successful Bidder under the Contract. The bidder shall not be permitted to revise its Bid after such determination.

4	Vol. I – Section – 6 Special Conditions of Contract (SCC) Clause 3.9 of Article 3 (Page 131)	iii) The Contractor will have to provide, within 15 days of commencement of Work fully equipped and furnished air-conditioned office accommodation (porta cabin) at site at two convenient locations, at eastern and western sides, measuring a minimum of 60sq.m complete with lighting, furniture, communication, 2 nos. laptops with 2 Net setters with fibre internet, wifi connectivity, One A3 laser Printer, office stationery and equipment, potable drinking water, pantry, wash-basin, toilet and other office facilities, near the Contractor's work area or at other location as directed and approved by the Authority for the use of Authority's and Authority`s Engineer's Site staff…….. ***is modified as*** iii) The Contractor will have to provide, within 15 days of commencement of Work fully equipped and furnished air-conditioned office accommodation (porta cabin) at site at two convenient locations, at eastern and western sides, measuring a minimum of 60sq.m complete with lighting, furniture, communication, **3** nos. laptops **(Minimum configuration – 3 GHz Processor, 16GB Memory, SSD – 512 GB, 10GB disk space & graphics card) loaded with latest licensed MS Office and AutoCAD softwares** with 2 Net setters with fibre internet, wifi connectivity, One A3 **colou**r laser Printer, office stationery and equipment, potable drinking water, pantry, wash-basin, toilet and other office facilities, near the Contractor's work area or at other location as directed and approved by the Authority for the use of Authority's and Authority`s Engineer's Site staff……..
5	Vol. I – Section – 6 Special Conditions of Contract (SCC) Clause 3.9 of Article 3 (Page 132)	(iv) In addition, the contractor will, at his own cost and within 15 days of commencement of Work place at the disposal of the Authority and Authority`s Engineer 2(two) (1 for Authority's representative and 1 for Authority's Engineer) chauffeur-driven air-conditioned car to seat minimum 4 persons for the use of Authority`s Engineer and its Personnel for supervision of the Works. ***is modified as*** (iv) In addition, the contractor will, at his own cost and within 15 days of commencement of Work place at the disposal of the Authority and Authority`s Engineer **3 (three)** [one for Authority's representative and two for Authority's Engineer] chauffeur-driven air-conditioned car to seat minimum 4 persons for the use of Authority`s Engineer and its Personnel for supervision of the Works. One car shall be deployed at the Authority`s office at Kochi.
6	Vol. II – Part – I Employer's Requirements Clause 1.1.1.3 (Page 3)	The scope of the work includes development of the project site which includes levelling and filling of all low lying area within the project site to be raised to about (+)5m CD on the Eastern Side. ***is modified as*** The scope of the work includes development of the project site which includes levelling and filling of all low lying area within the project site to be raised to about **(+)4m CD** on the Eastern Side.

<table>
<tr><td>7</td><td>Vol. II – Part – I
Employer's Requirements
Clause 1.1.2.5
(Page 6)</td><td><u>The following sentence stands deleted:</u>

Apart from the Boat Landing Facility, a parking area for the boats as transfer bay and workshops for fishing boats will be provided</td></tr>
<tr><td>8</td><td>Vol. II – Part – II
Technical Specifications
Clause 2.1.3 (v)
(Page 5)</td><td>On top of the Deck structure for the Eastern and western side jetty and Approach trestles shall be finished with a Screed Concrete layer of 50mm using M25 grade with secondary reinforcement with high quality Polypropylene fibres (4.5 kg/m3 for polypropylene fibres conforming to IRC SP 046) from reputed suppliers such as Recron 3s from Reliance or its equivalent.

<u>is modified as</u>

On top of the Deck structure for the Eastern Jetty, Western Jetty, Finger Jetty and Approach Trestles shall be finished with a Screed Concrete layer conforming to MORTH specifications of 75mm average thickness using M25 grade with secondary reinforcement with high quality Polypropylene fibres (1.5kg/m3 for polypropylene fibres) from reputed suppliers such as Recron 3s from Reliance or its equivalent. Also, the surface of screed layer shall be finished with floor hardener of approved quality like Nitoflor Hardtop Standard from Fosroc or equivalent @ 5kg/m2 to provide highly abrasion resistant surface. Steel reinforcement of 8 mm diameter at 150mm spacing in both directions shall be provided at mid depth of the wearing coat. In a length of 1m near the expansion joint additional reinforcement of 8mm diameter bars shall be provided in both directions to make the spacing as 75mm.</td></tr>
<tr><td>9</td><td>Vol. II – Part – II
Technical Specifications
Clause 2.1.4 (A)
(Page 5)</td><td>A) Eastern Jetty
Design seabed level : (-) 13.00m CD (Available nearest contours)

<u>is modified as</u>

A) Eastern Jetty
Design seabed level : (-) 15.00m CD (Dredge level of (-)13m + 2m dredge tolerance)</td></tr>
<tr><td>10</td><td>Vol. II – Part – II
Technical Specifications
Clause 2.1.9.3.1
(Page 9)</td><td>Following vessel will berth in Eastern jetty
Eastern Jetty Vessel Data
<table>
<tr><th>Vessel Size</th><th>5000 DWT</th><th>10,000DWT</th></tr>
<tr><td>LBP (m)</td><td>200</td><td>300</td></tr>
<tr><td>Beam (m)</td><td>28</td><td>37.60</td></tr>
<tr><td>Fully Laden Draught (m)</td><td>7</td><td>12.4</td></tr>
</table>
<u>is modified as</u>

Following vessel will berth in Eastern jetty
Eastern Jetty Vessel Data
<table>
<tr><th>Vessel Size</th><th>5000 DWT</th><th>10,000DWT</th></tr>
<tr><td>Length (m)</td><td>211</td><td>290.2</td></tr>
<tr><td>Beam (m)</td><td>31</td><td>35.5</td></tr>
<tr><td>Fully Laden Draught (m)</td><td>7.1</td><td>8.2</td></tr>
<tr><td>Displacement Tonnage for Cruise Ship</td><td>32,509</td><td>61,000</td></tr>
<tr><td>GRT for cruise vessel</td><td>48,600</td><td>1,15,000</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>11</td><td>Vol. II – Part – II
Technical Specifications
Clause 2.2.1.3 (b) (a)
(Page 14)</td><td>The following sentence under Clause 2.2.1.3 - Specifications of Fenders stands deleted:
a) Protector (Frontal) Panels Frame shall be made of rolled steel to ASTM A441 or equivalent</td></tr>
<tr><td>12</td><td>Vol. II – Part – II
Technical Specifications
Clause 2.2.2
(Page 17)</td><td>Add the following sentence under Clause 2.2.2 – Specifications of Bollards:
Pipe bollard shall be used for Lee side of Eastern, Western and Finger Jetty. All other bollards shall be Tee Bollards.</td></tr>
<tr><td>13</td><td>Vol. II – Part – II
Technical Specifications
Clause 2.3.3
(Page 22)</td><td>The years of publication against various standards, referred in this specification, correspond to the latest standards as on date of preparation of this specification. During the use of this specification in future, the latest publication as on date shall be referred to.
<u>is modified as</u>
The years of publication against various standards, referred in this specification, correspond to the latest standards as on date of submission of the Bid. During the use of this specification in future, the latest publication as on date of submission of the Bid shall be referred to.</td></tr>
<tr><td>14</td><td>Vol. II – Part – II
Technical Specifications
Clause 2.4.5.1
(Page 30)</td><td>The following sentence stands deleted:
The material for filling behind the berths shall be excavated from the dredged material available at western side of the LNG tank farm.</td></tr>
<tr><td>15</td><td>Vol. II – Part – II
Technical Specifications
Clause 2.4.19
(Page 54)</td><td><u>New row is added at Clause 2.4.19 as follows:</u>
Minimum diameter and founding level of piles to be used for the marine works shall be as follows:
<table><tr><th>Sl. No.</th><th>Structure</th><th>Min. Dia of Pile (mm)</th><th>Min. Pile Founding Level irrespective of pile dia</th></tr><tr><td>5</td><td>Western Side Finger Jetty</td><td>900mm</td><td>(-)15.0m CD</td></tr></table></td></tr>
<tr><td>16</td><td>Vol. II – Part – II
Technical Specifications
Clause 2.4.19.5
3rd Para
(Page 56)
Sl. Nos. 36, 195, 196 & 262 of Addendum/Corrigendum No.6
Sl. No.114 of Addendum/Corrigendum No.7</td><td>Casing or liner plates shall be provided from cut-off level up to 5m below the Existing Bed Level or 1m below Final Dredge Level whichever is maximum.
<u>is modified as</u>
The minimum thickness of permanent MS liner shall be 8mm. Casing or liner plates shall be provided from cut-off level up to 5m below the Existing Bed Level (or) 2m below Design seabed level (or) refusal, whichever is lower.</td></tr>
<tr><td>17</td><td>Vol. II – Part – II
Technical Specifications
Clause 2.4.19.6
(Page 56)</td><td><u>New sentence is added at Clause 2.4.19.6 as follows:</u>
The minimum SPT N value shall be considered 50 at the pile termination level.</td></tr>
<tr><td>18</td><td>Vol. II – Part – II
Technical Specifications
Clause 8.5.4.2
(Pages 342)</td><td><u>The following sentence stands deleted:</u>
……For Foam lines, Stainless Steel 316L shall be used. ……</td></tr>
</table>

19	Sl. No. 112 of Addendum/Corrigendum No.6 Pre Bid Queries & CoPA's responses thereon	Considering the acid and salt content of the proposed water source, RO of total capacity of about 28kLD shall be established by the Contractor as part of the project scope. In addition to this, RO Water coolers of 500L capacity two numbers in each floor will have to install in the Passenger Facilitation Centres in both Eastern and Western side. Please refer Volume II – Part I – Employer"s Requirement of the Bid Document. ***is modified as*** Considering the acid and salt content of the proposed water source, one number of RO plant of about 20kLD shall be established by the Contractor as part of the project scope. In addition to this, 3 nos. inbuilt RO Water coolers of 80L capacity with hot, cold and normal, shall be installed at appropriate locations in each in the Passenger Facilitation Centres in both Eastern and Western side.
20	Addendum/Corrigendum No.6 Appendix K – Geotechnical Investigation Report	Appendix K – Geotechnical Investigation Report ***is replaced with*** Appendix K – Geotechnical Investigation Report [Modified] (Need not submit Appendix K – Geotechnical Investigation Report uploaded along with Addendum/Corrigendum No.7 at the time of bid submission)
21	Addendum/Corrigendum No.6 Appendix M – Draft Environmental Management Plan Report	Appendix M – Draft Environmental Management Plan Report ***is replaced with*** Appendix M – Draft Environmental Management Plan Report [Modified] (Need not submit Appendix M – Draft Environmental Management Plan Report uploaded along with Addendum/Corrigendum No.7 at the time of bid submission)
22	Bill of Quantities	**Bill of Quantities** for information purpose is annexed at ***Appendix – O***

Sd/-

CHIEF ENGINEER

ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR CRZ CLEARANCE FOR CONSTRUCTION OF PASSENGER JETTY AND ASSOCIATED LANDSIDE FACILITIES ON THE EASTERN SIDE OF THE KALPENI ISLAND, LAKSHADWEEP

PROJECT CODE: 892062425

For

सत्यमेव जयते

U.T. ADMINISTRATION OF LAKSHADWEEP

Through

COCHIN PORT AUTHORITY (CoPA)
KOCHI

April 2025

INDOMER COASTAL HYDRAULICS (P) LTD.

(ISO 9001: 2015 CERTIFIED, QCI – NABET & NABL ACCREDITATED)
63, GANDHI ROAD, ALWAR THIRUNAGAR, CHENNAI 600 087.
Tel: + 91 44 2486 2482 to 84; (M) (+91) 96000 56652/ 99629 37397
Web site: www.indomer.com, E-mail: ocean@indomer.com

4. IMPACT ASSESSMENT AND MITIGATION MEASURES

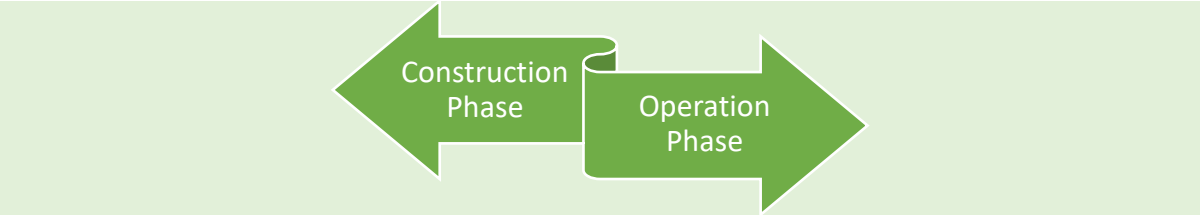
At present the eastern side of Kalpeni Island has a existing breakwater and harbour which is designed to handle small passenger boats and it was observed that the breakwater was initially constructed without the roundhead, and the breakwater had incurred severe damage during the Ockhi cyclone. Efforts were made to restore the breakwater to the possible extent but due to the steep slope of the seabed on the seaside, the tetrapod units placed were sliding down. The existing facilities on are not sufficient to accommodate larger vessels. To address navigational concerns and meet berthing requirements, a development plan for Kalpeni Island has been proposed. More details are mentioned in Chapter 2.

The proposed activities are only the construction of the port facilities in lieu of the dilapidated facilities. The existing facility did not show any noticeable impact on the marine environment over the last years. Therefore, it is expected that the construction of proposed facilities both in marine as well as land not to have significant impact on the environment

In this particular project, the sizable impact will primarily occur during the construction of the berthing jetty and approach trestle and the construction of the landside facilities will have only have a minimal environmental impact. The development covers: construction of 360 m long berthing Jetty, 130 m long approach trestle on the marine environment and a passenger facilitation center, development of warehouse, security cabin, and road connectivity on the land of eastern side of Kalpeni Island. The anticipated impacts and the corresponding mitigation measure due to the proposed activities are discussed. In reference to **Fig. 1.3.**

4.1. Identification of Impacts

Impacts are identified with respect to two stages of the project viz., i) Construction phase and ii) Operation phase.



a. Construction Phase

Construction phase in the present project involves activities like excavation, raw material transportation, stacking piling, foundation work, deck construction, building construction, installation of fenders & lighting buoys etc.

Due to the sensitive ecosystem, which are mainly made up of coral reefs and lagoons, building a jetty on a Kalpeni Island during the construction phase is likely to have a significant negative impact on the marine environment. These effects could include coral reef damage, increased turbidity, sediment disturbance, noise pollution, possible oil spills and disruption of local marine life. During construction period the impact on environment will be of short term, temporary and localized. However, to limit the impact on valued environmental components, mitigation measures are suggested.

b. Operation Phase

During the operational phase of a jetty, key activities include vessel berthing and departure, cargo loading and unloading, passenger boarding, mooring operations, pilotage, security checks, waste management etc.

Operations near jetty can have impact on the coral reef with vessel anchors and movement. The pollution due to leakage of wastes may affect the marine life close to jetty corridor.

4.2. Anticipated Environmental Impacts

Based on the proposed development, the impacts due to the following activities are discussed.

Impact on terrestrial environment	Impact on marine environment
Impact on Air Environment Impact on Noise Environment Impact on Water Environment Impact on Land and Soil Environment Impact on Socio Economic Environment	Impact due to construction of Jetty and approach trestle Impact due to handling of cargoes Impact due to movement of vessels Impact on planktons Impact on benthos Impact on fish Impact on corals

4.3. Terrestrial Environment

4.3.1. Air Environment

a. Construction phase

Possible Impacts:

The construction activities for the proposed passenger jetty, approach trestle and associated structure including site preparation, excavation, construction of piles, operation of construction equipment, handling and transportation of construction materials, operation of DG sets and pumps, etc. could contribute to air pollution. On the other hand, the order of impact on terrestrial environment is limited to only during construction phase. The identified impacts are due to the following.

- **Construction dust** – Arisen from handling construction materials/debris in open area influenced by coastal wind during the construction activities.
- **$PM_{2.5}$** – Emission from exhausts of generator sets, vehicles and heavy equipment.
- **Noxious vapours** – Oils, glues, thinners, paints, treated woods, plastics, cleaners, other hazardous chemicals, generator sets, vehicles and heavy equipment.
- **Volatile Organic Compounds (VOCs)** – Depending on the construction materials used, emissions of VOCs from paints, adhesives, and other chemicals.

Mitigation:

- *Construction materiasl at site and carried on the vehicle/ vessel have to be properly covered.*
- *Sprinkling of water every day at periodic intervals on the ground on piled up construction materials are to be done.*
- *Dust barriers such as poly screens around the site boundaries have to be provided to create buffer against propagation of dust.*
- *The equipment used at the site have to be properly maintained.*
- *Construction work should be stopped during high wind time.*

b. Operation phase

Possible Impacts:

During the operation of jetty, the air environment can slightly get affected due to release of pollutants, but it will be restricted to the hours of vessel arrival time. The particulate matter (PM), sulphur oxides (Sox) and carbon monoxide (CO) from vessel engine emissions are anticipated during loading and unloading activities.

Mitigation:

- *Implementing stricter emission standards for vessels*
- *Providing shore power to docked vessels to reduce engine idling emissions.*
- *Improving cargo handling practices to minimize the dust generation and spills.*
- *Regular monitoring of air quality around jetties to identify emission hotspots and implement necessary mitigation measures.*

Impact on the air environment is limited for a period during construction phase. Mitigation measures will be followed during both construction and operation phase to reduce the possible impact on air environment.

4.3.2. Noise Environment

a. Construction phase

Possible Impacts:

There can be an increase in noise from various machinery like pile drivers, excavators, barges, and other construction equipment, which can disturb nearby residential areas and marine life, particularly during the active construction phases.

Mitigation:

- *Personal protective gear has to be provided to workers while involving in high noise generating works.*
- *Highly efficient and regularly maintained equipment has to be used.*
- *Choice of generators and construction machinery/equipment will be restricted as per usage requirements.*
- *Special attention has to be given to the preservation of biodiversity around the jetty location.*

b. Operation phase

Possible Impacts:

Noise generation from movement of vessel and during handling of passenger cargoes in the jetty area are the only anticipated noise generation during the operation phase.

Mitigation:

- *Installing sound barriers or acoustic enclosures around the walk way region.*
- *Encouraging the use of quieter vessels and operating procedures.*

- *All machines must be lubricated and maintained regularly and located inside acoustic enclosures only.*

The construction and operation of Jetty may emit noise from machinery. However, the noise emitted due to the operation will be confined within the jetty premises.

4.3.3. Water Environment

a. Construction phase

Possible Impacts:

- Construction materials like paints, oils, cement mortar, sand etc. may fall inside the sea or may be carried into sea with runoff water leading to contamination.

Mitigation:

- *Construction material has to be stored in a closed place.*
- *Domestic wastewater has to be discharged into a septic tank soak pit arrangement.*
- *There should not be any dumping into the waterfront areas.*

b. Operation phase

- Drinking Water requirement during the operational phase will be met from the LTTD plant.
- Care to be taken that *sewage from facilitation centre, do not mix with Ground water or surface water.*
- *Domestic wastewater generated during operation phase has to be treated with STP.*

There is no significant impact anticipated on the water environment due to the construction and operation of Jetty.

4.3.4. Land and Soil Environment

a. Construction phase

Possible Impacts:

- Soil contamination can occur by deposition of uncovered construction materials exposed to wind and suspended load-laden runoff water.
- Improper drainage systems leading to leakage or overflow of wastewater and littering at the site by workers can result in land soil contamination.
- Alteration in the topsoil for site preparation and foundation can cause a change in the soil profile.

Mitigation:

- *Proper management of construction materials and activities have to be ensured. Loose materials such as cement and sand have to be stored in a closed place and adequately covered.*

- *Any construction material remained after completion of the construction activities for the proposed project must be removed from the site.*
- *Bins have to be provided separately for recyclable and non-recyclable wastes at strategic places which will be periodically emptied, and the waste disposed of adequately.*
- *Workers have to be made aware of the need for proper waste disposal.*
- *Excess excavated material will be properly stored and subsequently used for site levelling, approach road construction, landscaping, as required.*

b. Operation phase

Possible Impacts:

Operation of proposed facilities will not have major impact on land environment. Any other solid waste generated from the jetty has to be disposed of as per the Solid Waste Management Rules, 2016.

The impact of the proposed project on the land environment is expected to be low. Municipal solid waste produced during construction and operation phase have to be properly disposed.

4.3.5. Socio–Economic Environment

Development of Lakshadweep islands are essential for the regional and national economic development by way of safe movement of passengers, transportation of goods, developing new infrastructure etc. The development of Kalpeni island will attract international tourists which is one of the major economic engines for the country and gain considerable amount of foreign exchange. Sustainable port operations should aim at inclusive development along with the local community.

Negative Impact

No specific negative impacts are foreseen on social aspects.

Positive Impact

- The issues pertaining to resettlement and rehabilitation are not envisaged in this project, as there is no land acquisition involved, as the proposed development is within the existing boundary of Kalpeni Island.
- There are no cultural and heritage site which could be affected due to the proposed construction along on close proximity to the study area.
- Community development with the successful passenger jetty operation may lead to the development of supporting infrastructure such as housing, schools, roads and healthcare facilities which can benefit the local community.
- The proposed project could attract more tourists, boosting local tourism industries.
- The construction of a jetty and associated facilities can improve access to essential services like healthcare and education for coastal communities.

The proposed construction will have more positive impact on the socio-economic aspects of the Kalpeni island by upgrading the safety and economy of Islanders.

4.4. Marine Environment

The marine component of the proposed project includes construction of passenger and cargo handling jetty, approach trestle and driving of piles. Evidently, the project would have impacts on the marine environment during its construction as well as operations. The impacts can potentially influence the local ecology given in **Table 4.1.** in the short- as well as long-term if appropriate mitigations are not in place as illustrated below. But the impact will be confined within the corridor outlined in **Fig. 4.1.**

Table 4.1. Different ecology sensitive area affected due to the project

Facility Name	Ecologically Sensitive Area	Total no. of Piles	Area (m^2)
Approach Trestle	Sandy Area (Sandy Beach/ Sand Sheet)	26	6.4
	Lagoon (Deep/Intermediate/Shallow)		2.56
	Coral Reef (Flat/Slope/Crest)		7.68
Jetty	Coral Reef (Flat/Slope/Crest)	224	297.92
Total area of Coral sub zone		**250**	**314.56**

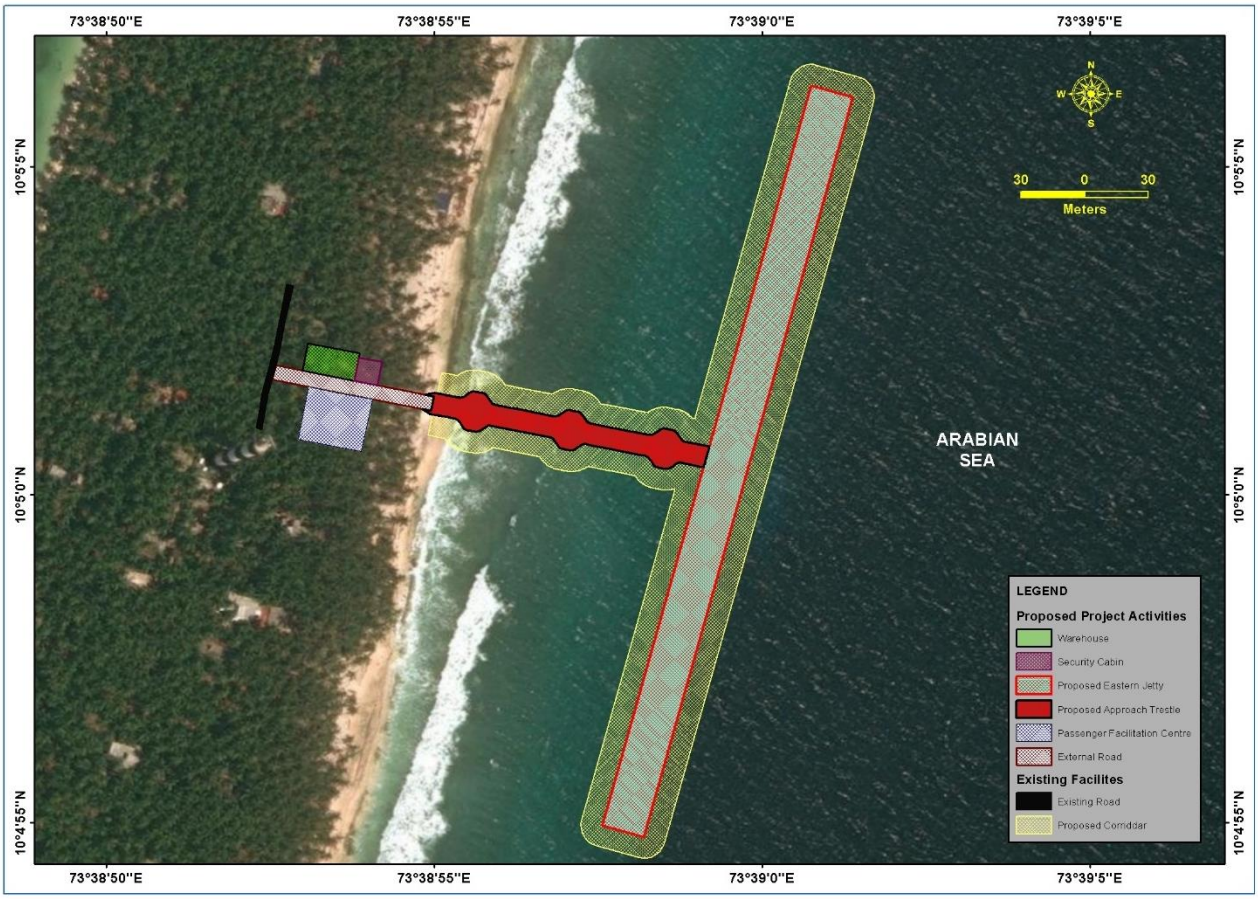


Fig. 4.1. Buffer corridor of the proposed development

4.4.1. Impact due to construction of Jetty and approach trestle

Construction of jetty and approach trestles will have more effect on marine environment compared to land environment.

4.4.1.1. Construction phase

The construction activity of jetty and approach trestle will consist of RCC deck (precast and in-situ) supported on bored cast in-situ reinforced concrete piles. The cross section of the jetty and approach trestle is given in Chapter 2.

Possible Impacts:

Disturbance to the marine habitation

(i) **Pile driving:** Piling will be required for the construction of jetty and approach trestle. Piles will be initially erected into the sea floor up to depth where hard stratum is available. The soil inside the pile will be dredged off and the same portion will be refilled with R.C.C concrete. Concrete mixing and construction debris in the marine environment are envisaged during the construction activity. Due to the pile driving activity the impact on following environmental parameters are anticipated:

Marine/coastal ecology: Disturbance from construction activities may cause displacement of fishery resources and other mobile bottom biota. Piling removes bottom biota and material covers bottom habitat, both of which may reduce fishery resources. Settlement of re-suspended sediments on fragile marine fauna and flora damages the ecosystem particularly coral reefs, which are formed by the extracellular product of symbiotic plants. The organisms attached to submerged structures need dissolved oxygen for respiration and the plants need sunlight for photosynthesis. Piles, concrete surfaces, rubble mounds and other similar structures in water could form new habitats, which may introduce undesirable species.

Construction materials, such as ship hulls, ballast water, and the structure of the jetty itself, can serve as vectors for the introduction of invasive species, which may outcompete or prey on native species.

Impact on Seawater and Seabed sediments: Resuspension of sediments in water leads to an increase in the level of suspended solids and concentration of organic matter, possibly toxic or harmful levels. This will cause temporary impact to seawater quality near proposed berthing jetty location. Contaminated bottom sediments (contained with heavy metal concentration) may lead to significant impact to seawater quality during piling. However, baseline data suggests that there is no heavy metal concentration build up in the seabed sediments.

Impact on benthos: Piling and other water side construction will cause loss/displacement to bottom habitat and its associated animal and plant life. Footprint on bottom habitat and associated life will be limited to area of piling. The turbidity induced during driving of piles will also have impact on the community structure and distribution of other marine life. However, the bottom will readily be recolonized by replacement of benthic organisms within few seasons.

Fishes: One of the major impacts of pile driving operations on the marine organisms especially on fishes is the underwater sound pressure waves generated during hammering of the piles. Pile driving may result in 'agitation' of fish indicated by a change in swimming behaviour.

The various factors which are known to influence the impact on fish are: (i) size and force of hammer strike; (ii) distance from the pile; (iii) depth of the water around the pile; (iv) depth at which fish swim in water column; (v) entrapped air in the water; (vi) oscillation of water level, (vii) geological composition of seabed, (viii) size of the fish; (ix) species of the fish; (x) presence of swim bladder; (xi) physical condition of the fish and (xii) effectiveness of sound/pressure attenuation technology used to minimize the impacts.

Plankton: The proposed project activity like piling may not have any direct bearing on plankton. It is expected that the plankton will drift away from the disturbed area leading to minimal loss to plankton. Further, compared to the abundance of the plankton in the site, the loss will be moderate and temporary.

Since the sediment texture is mainly comprised of fine sand, the noise due to piling is expected to be low. As the baseline data suggests there are varieties of fish species and green turtles are observed within the project area, the impact of piling is expected to be limited to benthos. However, these animals will usually return to the area once the disturbance ceases.

Corals: Construction activity near coral reefs can damage coral ecosystems by causing physical harm, increasing turbidity (cloudiness) from sediment plumes, and disrupting water flow, which in turn reduces the amount of food available to corals and ultimately affects their growth and survival. **Quantification of impacts on coral is given in Chapter 9.**

Mitigation measures

- *Existing roads in the Kalpeni island shall be used for transportation of construction materials.*
- *Trucks transporting the materials will be covered to avoid susceptible for fugitive suspension.*
- *Vehicles having Pollution Under Control (PUC) certificates will be used. All vehicles used for transportation shall comply with CPCB emission norms.*
- *All workers, technicians and supervisors should make use of all safety equipment such as masks, goggles, helmets, safety belts, earmuffs safety shoes, lifesaving jackets, etc., as required, during the construction phase. Proper security arrangements will be made during nights to avoid any accidents due to unauthorized entry of workers, or civilians.*
- *The hazardous materials anticipated to be stored at the site during construction include gas for welding, fuel for operating construction equipment, paint, etc. All these and other materials of a dangerous or hazardous nature will be stored as per the norms.*
- *Clean and efficient construction techniques should be adopted.*
- *Piling should not be carried out during fish breeding season.*
- *Screening must be provided during piling activity.*
- *The construction schedule should be strictly followed, and no over runs should be ensured. Reducing the construction time with efficient techniques will rescue the period of impact.*
- *The scrap and waste construction materials should not be disposed into the seawater.*
- *Proper lubrication of pile driving machinery will ensure less noise.*
- *After pile driving and construction, continued monitoring of the affected area will be carried out.*
- *Continuous monitoring of coral reefs before, during, and after construction will be*

4.4.1.2. Operation phase

Possible Impacts:

During operation of jetty, major impact on marine environment is only due to the increase in vessel movement for handling Passenger and domestic cargo handling. Which will only have minimal impact to the marine environment. However, appropriate mitigation measures will be followed in order to reduce the impact on marine environment during operational phase.

Mitigation measures

- *Vessels coming near the Berthing jetty should not discharge anything into the sea.*
- *Waste in the jetty premises should be handled as per PCB norms.*
- *Tourists and Operators must be continuously educated for preservation of the Island ecosystem.*
- *Use low-impact, quieter equipment during operations and limit activities during critical times for marine species (e.g., during breeding or migration seasons).*

4.4.2. Impact on marine environment due to handling of various cargoes

4.4.2.1. Construction phase

During construction phase of jetty, approach trestle, passenger facilitation center -waiting hall warehouse, security building, road and associated facilities all the construction materials such as cement, steel, boulders, sand and other construction related materials will be transported from the mainland using vessels and it will be handled in the existing jetty area and then it will be transported to the storage place away from CRZ zones through existing roads of Kalpeni Island. This handling of construction materials cargo will create minor impact on the marine water quality and marine habitat due to spillage while handling of construction materials. The various impacts are listed below:

- Accidental spill of powdered construction materials such as cement and sand on the marine environment will pollute the water quality, increase the sediment concentration, affecting the marine habitat. The release of cement particles during mixing and placement can contribute to turbidity and potential chemical contamination.
- Accidental release of plastic debris during construction can contribute to marine plastic pollution.
- Machinery used to transport and handle materials at the jetty may leak oils or fuels, which can spread on the water surface and create oil slicks and harming marine life.
- Materials like sand, gravel, or concrete are handled, there can be runoff into the water, causing increased turbidity.
- Handling dry construction materials, such as cement or sand, can create airborne dust that can affect air quality in nearby areas. This dust can be harmful to marine ecosystems.

Mitigation measures

- *Selecting appropriate vessel type to handle construction materials based on its weight and material type.*
- *Make sure that construction equipment is not overloaded or operated in a manner that could result in unnecessary sediment disturbance.*
- *Proper packing, sealing and labelling of construction material to avoid spillage of construction materials.*

- *Using proper handling equipment (closed handling) to avoid accidental spillage*
- *Using non-toxic, eco-friendly materials and coatings to reduce the risk of water contamination.*
- *Regularly monitoring water quality and marine life populations to assess the impact of construction.*
- *choose for construction materials that have a lower environmental impact, such as recycled aggregates, sustainable timber, or other green alternatives to reduce waste and minimize the environmental footprint.*

4.4.2.2. Operation Phase

After the construction the jetty will also be used to handle domestic cargo (food grains, fruits and vegetables, cereals, provisions, etc.) which comes from the mainland. Since the proposed berth is a multipurpose one and the nature of cargo will vary, it is proposed to provide one hydraulic lifting crane of 25 T lifting capacity at the eastern jetty.

- Accidental spillage of cargoes due to improper handling.
- Improper packing of bulk grain cargo can injure workers.
- Packaging materials, such as plastic, cardboard, and crates, may be discarded improperly, contributing to marine litter and pollution.

Mitigation measures

The impact due to the handling of cargo will be minimal and will not have much impact on the marine environment.

4.4.3. Impact on plankton

a. Construction phase

Construction of Berthing Jetty will affect the plankton community as they are weak against the turbidity generated in the water due to construction activities. The impacts on these communities are directly linked to the extent up to which turbidity persist. It is anticipated that area of construction will be induced with turbidity may have localized effect on plankton.

b. Operation phase

There will be no impact on plankton community during operation phase.

4.4.4. Impact on benthos

a. Construction phase

Major impact to benthos is anticipated during the construction stage as well as during operational stage. During operational stage, impact to benthos is anticipated only due to movement of vessels. Other likely impact to benthos includes unwanted disturbance in the intertidal area of project site. Strict guidelines to workers should be given to avoid unwanted disturbance to tidal flats. The impact will be localized, and benthos will start recolonizing after the construction period.

b. Operation phase

There will be negligible impact on benthos community during operation phase.

4.4.5. Impact on fish

a. Construction phase

Due to construction of Berthing jetty, impact on fishes are also anticipated. However, since fishes are mobile, they tend to move away from under water disturbances. Thus, no significant impact on fishes is anticipated. The fishes will usually return to the original area once the construction activity is stopped.

Mitigation Measures

b. Operation phase

There will not be any significant impact on fishes during operation phase.

Impact on fishing activity

The development of berthing jetty will not disrupt fishing activity in the vicinity.

Mitigation Measures

Regular monitoring of the turbidity, sediment concentration and the heavy metals in the water column shall be carried out to observe the rise in concentration.

4.4.6. Impact on corals

Kalpeni Islands is well known for its corals because of the coral reefs that surround the islands and the unique way they were formed. The construction of a jetty and approach trestle can significantly impact coral reefs throughout its construction and operation phase.

However, the impact on corals will be confined within the corridor mentioned in **Fig. 4.1.** and the total length of the approach trestle is 130 m from shore and length of the jetty 360 m. The piled foundation would take up only a small footprint of about 0.9 m dia. in trestle area and 1.3 m dia. in the jetty area. Totally 314.56 m^2 of reef will be possible to impact during the pile foundation.

4.4.6.1. Construction Phase

- Heavy machinery and construction equipment may crush or fragment coral formations.
- Prolonged exposure to sediment can hinder coral metabolism and calcification processes.
- Stress from construction activities can make corals more vulnerable to thermal stress and bleaching.
- Damage to reefs impacts fish populations that depend on coral habitats, affecting local fisheries.

4.4.6.2. Operation Phase

- Increased Turbidity due to movement of vessels will increase the sediment resuspension which will affect corals ecosystem.

- Anchors, propellers, and hulls of vessels can break or crush coral structures.
- Coral damage affects species dependent on reefs for shelter, feeding, and breeding, leading to a decline in biodiversity.
- Excessive lighting from the jetty at night can disrupt the behaviour of reef organisms, including corals, fish, and invertebrates.

Mitigation Measures

- Detailed coral Assessments study was carried out to identify and avoid ecologically critical coral reef zones during site selection.
- Ensure proper collection and disposal of construction debris to prevent contamination.
- Relocate affected coral colonies to nearby healthy reefs or artificial structures before construction begins.
- Construct artificial reefs to provide alternative habitats for displaced marine organisms.
- Prohibit the disposal of hazardous materials and regulate the use of antifouling paints on vessels to prevent leaching of toxins.
- Impose speed limits for vessels in proximity to coral reefs to reduce wake and sediment disruption.
- Establish a monitoring program to track coral health, water quality, and biodiversity around operational areas.

A detailed conservation plan on coral management is given in Chapter 9.

4.4.7. Impact on Seagrass bed

During the study, no seagrass bed were observed in the proposed project location. Seagrass distribution was mainly concentrated on the shoreline of the western part of Kalpeni island. Therefore, the project site is devoid of seagrass. Hence, no impact.

4.4.8. Impact on Coastal Vegetation

Project site and surroundings are devoid of coastal vegetation.

4.4.9. Impacts on mangroves

Mangroves are only present in the south end of the island. The existing mangroves are observed 3 km south of proposed project location. Therefore, there is no direct impact on existing mangroves present in the southern end of island. Hence, no impact.

4.4.10. Impact on turtles

The beaches on the eastern side of Kalpeni Island have limited possible sites for turtle nesting compared to the western side and north of island. Although the proposed jetty is 130 m from the shore, the mobility and congregation of turtles will not be impacted by the construction of proposed jetty. Hence, no impact.

7. ADDITIONAL STUDIES

7.1. RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

7.1.1. Introduction

Emergency/ disaster is an undesirable occurrence of events of such magnitude and nature that adversely affect operations, cause loss of human lives and property as well as damage to the environment. Coastal infrastructure is vulnerable to various kinds of natural and manmade disasters. Examples of natural disaster are flood, cyclone, tsunami, earthquake, lightning, etc., and manmade disasters are like major fire, explosion, sudden heavy leakage of toxic/ poisonous gases, civil war, nuclear attacks, terrorist activities, sabotage, etc. It is impossible to forecast the time and nature of disaster, which might strike a common user infrastructure. An effective disaster management plan helps to minimize the losses in terms of human lives, assets and environmental damage and resumes working condition as soon as possible.

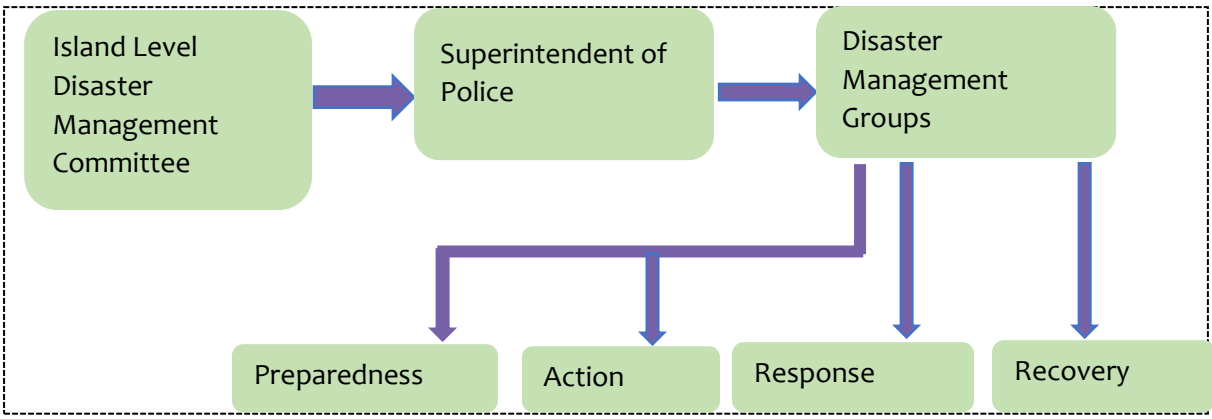
7.1.2. Risk Assessment

Risk is the probability that injury to life or damage to property and the environment will occur. The extent to which risk is either increased or diminished is the result of the interaction of a multitude of causation chains of events. The man-made disasters like fire and accidents also can occur during construction as well as operation phases which would cause the burns, injuries and even loss of human life and property, disrupt services like overhead power and communication lines. Potential impacts due to accidents include injuries and burns which demand surgical interventions, poisoning or exposure to toxic material, trauma and even loss of human life, property damage includes damage/loss of fishing vessels/crafts and other surface vehicles, mechanical devices and equipment used during construction and operational phases. Vessel collision, sinking of boats due to unattended leaks and damages are potential risks. Probability of any hazardous incident and the consequent damage also depend on:

- Wind speed,
- Wind direction,
- Atmospheric stability,
- Source of ignition

7.1.3. Disaster Management Plan

Emergency/disaster is an undesirable occurrence of events of such magnitude and nature that adversely affect operations, cause loss of human lives and property as well as damage to the environment. Coastal infrastructure is vulnerable to various kinds of natural and manmade disasters. Examples of natural disaster are Flood, Cyclone, Tsunami, Earthquake etc., and manmade disasters like major fire, explosion, sudden heavy leakage of toxic/poisonous gases, etc. An effective disaster management plan helps to minimize the losses in terms of human lives, assets and environmental damage.



Overall Disaster Management Hierarchy

Objective of Risk Assessment and Disaster Management Plan

DMP should be developed to make best possible use of the resources available in the operational area as well as outside available resources like Fire Services, Police, Civil Defence, Hospitals, Civil Administration, neighbouring institution and industries.

The objectives of Disaster Management Plan are:

- To contain and control the incident.
- To rescue the victim and treat them suitably in quickest possible time.
- To safeguard other personnel and evacuate them to safer places.
- To identify personnel affected/dead.
- To give immediate warning signal to the people in the surrounding areas in case such situation arising.
- To inform relatives of the casualties.
- To safeguard important records & information about the organization.
- To preserve damaged records & equipment needed as evidence for any subsequent enquiry.
- To rehabilitate the affected areas.
- To restore the facilities to normal working condition at the earliest.

7.1.4. Disaster Identification

a) Natural disaster

A disaster occurs when a hazard such as Earthquake, Flood or Cyclone coincides with a vulnerable situation. Based on project details, geography, environmental setting of the study area and available information following hazards have been identified which may possibly lead to disaster. The probability/seasonality of hazard is listed below **Table 7.1.**

Table 7.1. Probability/seasonality of hazard

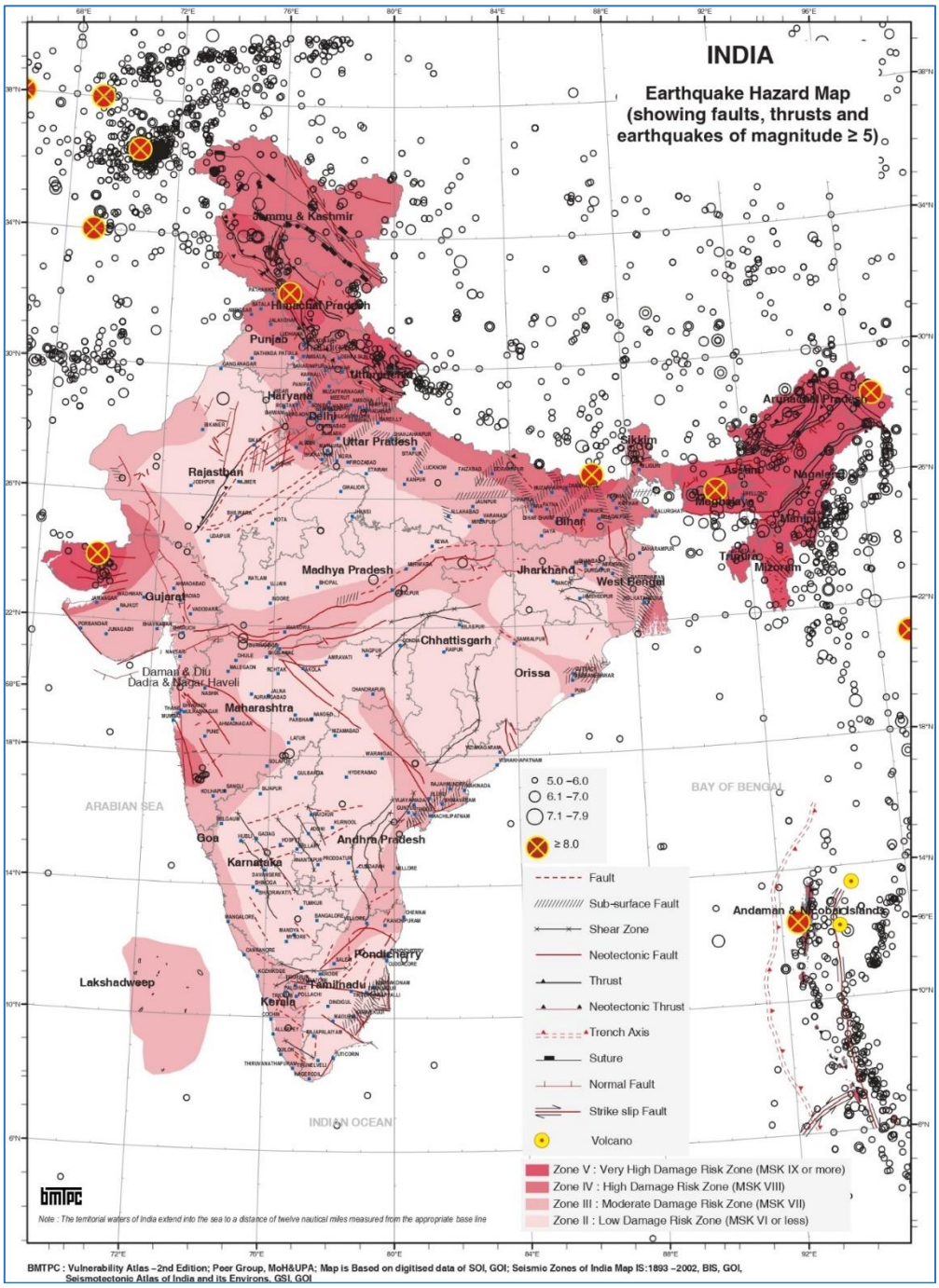
Identified natural hazards in the study area			
Sl. No.	Hazard	Project area	Findings
1	Earthquake	✓	Zone III (moderate risk zone)
2	Cyclone	✓	Wind speed of 2.5 m/sec.
3	Tsunami	✓	Moderate Damage Risk Zone B
4	Flood	x	Low (may occur due to very heavy rainfall, sea surge or tsunami)
5	Drought	x	Moderate Drought

(Source: NDMA - 2019 & 2016)

Disaster identification suggests that the project site is vulnerable to natural hazards. According to District Disaster Management Plan, probability of flood in the island is low and it may occur only in the event of very heavy rainfall, sea surge or tsunami. Among the identified impacts, Cyclone, Sea surge and Earthquake are most probable to occur in the vicinity of project area.

(i) Earthquake

As per Indian Seismic Zone Map, the Kalpeni Island lies in Moderate Damage Risk Zone III where earthquakes of moderate intensity can be expected. Earthquake map is given below.



Earthquake zone map

Action Plan

During Earthquake:

- Evacuate to safest place by following emergency exist route.
- Hold onto a firm object.
- If outside, stay outside.
- If there is no place to take cover, then move to and brace against an inside wall.

After Earthquake:

- Collect report of damages from every division immediately after the event of earthquake.
- Inspection of affected area by Disaster Management Team.
- Procurement of emergency power in case of power failure.
- Inform Island authorities about the damage.
- Take necessary actions for the speedy recovery of operations.

(ii) Cyclones

Based on tracks of cyclones passed in Indian coastal region, the tracks of cyclones which have crossed the coast near Lakshadweep during 1924 to 2023 as documented by the Indian Meteorological Department (IMD) are presented in **Table 7.2.** and the track of cyclones is shown below. It indicates that totally 10 storms had occurred in the vicinity of the project region in the last 100 years. The occurrence of storms in this region are more frequent in December (04) followed by May (03) and November (03). More details are given in Chapter 3.

Table 7.2. Number of cyclones crossed over project area (1924 – 2023)

Month	Cyclones crossed over project area
January	-
February	-
March	-
April	-
May	03
June	-
July	-
August	-
September	-
October	-
November	03
December	04
Total	10

Source: cyclone e-atlas published by IMD – 2023

Action plan

In case of warning received from India Metrological Department, following action shall be taken immediately:

Before Cyclone

- Control room shall monitor low pressure formation, cyclone and IMD published details and warnings regularly.

- In case of any warnings, the same shall be reported to onsite disaster management head, HSE and group heads etc.
- Onsite Disaster Management team shall conduct a meeting, if possible, immediately after the warning to recollect the facilities and action to be taken.
- All preparations before the onset of cyclone, actions during cyclone shall be reviewed.

During Cyclone:

- Sound Emergency alarm/siren.
- Inform all staffs about the occurrence of event.
- Adequate manpower with tools, welding sets, ropes etc. shall be maintained during cyclone for rescue operation.

After Cyclone: Immediate attending of work area and report damage if any to higher authority. Immediate attending of damages and record should be kept for quick recovery as soon as possible.

(iii) Tsunami

Tsunami is a series of wave train generated in the ocean by a hydraulic impulsive force that vertically displaces the water column. Earthquakes, landslides, volcanic eruptions, explosions and even the impact of cosmic bodies taking place in the ocean can generate Tsunami waves with long periods (≈ 30 min), long wavelength (≈ 100 km) with a high velocity of propagation (≈ 700 km/hr).

Tsunamis are shallow water waves which propagate with phase velocity equal to the square root of the product of the acceleration due to gravity and the water depth. For example, in the Pacific Ocean, where the typical water depth is about 4000 m, the Tsunami wave travels at about 700 km/hr. Because the rate at which the wave loses its energy is inversely related to its wavelength, Tsunami not only propagates at high speed, but it can also travel great transoceanic distances with limited energy losses and reach different continents in shorter time i.e., the energy propagating with Tsunami waves remain nearly constant.

Among the various factors causing the occurrence of Tsunami, the large vertical movements of the earth's crust is more predominant and it can occur at tectonic plate boundaries. The plates that interact along these boundaries are called faults. Around the margins of the faults, the denser oceanic plates slip under the continental plates in a process known as subduction. Such subduction earthquakes are particularly very effective in generating the devastating Tsunamis.

The energy flux due to Tsunami is proportional to its velocity of propagation and height and it remains nearly constant till reaching the coast. Consequently, the velocity of propagation gets retarded when it enters shallower water and its height gets amplified. Because of this shoaling effect, the Tsunami that is imperceptible at Deep Ocean close to centimetre height may rise up to several metres near the coast called run up.

When Tsunami finally reaches the coast, the crest of the wave appears as rapidly risen water mass gushing into the coastline as a bore with a crashing velocity of 700 km/hr for more than 10 - 30 min. The trough of the wave will appear as the withdrawal of water mass with same speed back into the ocean swallowing everything on the land and dragging back into the ocean.

In worst case, if a Tsunami occurs then there will be surging of Tsunami waves with a speed of > 60 kmph into the shore and the run-up will be > 4 m. The gushing of water will sweep and flood the areas having elevation < 3 m MSL.

Disaster Management Plan for Tsunami and Storm Surge

Cyclone, Tsunami and Storm surge are the most destructive force among the natural devastations. It causes instant disaster and burial of lives and destruction to entire coastal properties. The damage and loss can be minimized if appropriate preparedness plan is formulated. The following statutory guidelines are recommended by National Disaster Management Authority (NDMA) to minimize the impact due to Cyclone, Tsunami and storm.

- Developing sand dunes along the coast with shrubs or Casuarina trees for stabilization of the sand dunes (Tsunami Mound).
- Raising the ground level (above the design water level) with natural beach sand so as to rehabilitate the coastal region.
- Development of coastal forest (green belt) by planting casuarinas and coconut trees along the coastline to cover minimum of about 500 m width of the beach.
- Adopting natural beach nourishment to create steep beach face.
- Creation of sandy ramps at close intervals along the coast.

In addition to the guidelines by NDMA, it is also necessary to adopt various preventive actions in the coastal region of the project site.

Preparedness Plan

The preparedness plan shall contain details about: i) warning that should be given ii) Protective measures to contain the effect of surging water level and iii) Other precautionary measures to be taken. The following measures are the key aspects in the preparedness plan.

i) Coordination with International and National Agencies
ii) Vigilant online monitoring
iii) Emergency Evacuation

Coordination with National Agencies

After the 2004 Tsunami affected the Indian sub-continent, the following organizations are involved on watch and cautioning the government and public in the event of possibility of occurrence of Tsunami. As a part of Tsunami hazard mitigation, warning systems have been established in India by the coordination of the following organizations.

i) Indian National Centre for Ocean Information Services (INCOIS), Hyderabad.
ii) National Disaster Management Authority (NDMA), New Delhi.
iii) Indian Meteorological Department (IMD), New Delhi.
iv) National Institute of Ocean Technology (NIOT), Chennai.

The contact details of National agencies are given below:

Organization	Address	Email ID	Contact Number
Lakshadweep Collectorate	Kavaratti	lk-coll@nic.in	04896 - 262256
Suptd.of Police	Kavaratti	lak-sop@nic.in	04896 - 262750

Vigilant online monitoring and emergency alarm

INCOIS in collaboration with NIOT has deployed DART buoys at 3 locations in the deep ocean along the fault plane of Andaman plate and Indonesian plate.

The online monitoring is capable of raising alarm in case of instantaneous change in surface elevation exceeding centimetre which can be caused by the generation of Tsunami. IMD interacts with the above institutions and takes the responsibility of broadcasting the disaster through various Medias. In case of a Tsunami, the warning is usually broadcast based on the earthquake occurred in the nearby ocean. Irrespective of definite occurrence of Tsunami, the possibility to occur is also considered as equally vulnerable and accordingly the warning news is instantly flashed through Radios and TVs. The notification is followed by orders from the local Government Authorities on reinforcing evacuation, prohibition to enter the demarcated risky zone and mobilizing facilities for easier evacuation and augmenting medical facilities.

There are a variety of evacuation notification systems in case of Cyclone, Tsunami and Storm surge. They include sirens, weather radio, Emergency Alert System, Telephones, Emergency Weather Information Network etc. In each system, it should be noted that the application and message is consistent as well as continuous with repetition of messages with periodicity at short time interval. It should be ensured that the warning reaches immediately to all people prone to the devastation.
The time at which the cyclone, storm surge or Tsunami may reach the coast can be predicted with sufficient lead time. The destruction can be minimized if the coastal populations are warned and evacuated to elevated place and inland in time. Therefore, keeping vigil on the warning is the very important aspect in protecting the lives.

A vigilant team must be created. An Emergency Alarm should be in place in all the islands. If warning is given instantly activate the emergency alarm and give caution to the vigilant team so that they can immediately start the rescue operation.

The vigilant team should have proper knowledge about the warning systems and should have attended the training programs conducted by the Tsunami warning centres. The training should be given periodically to update the system and methods of warning. The team should take the responsibility of giving immediate warning to the people in and around the power plant in case of Tsunami and they have to undertake the Emergency Preparedness Action. Safety drills should be conducted periodically.

Operational and emergency preparedness procedures should be planned meticulously in order to act on the warning and to disseminate it rapidly and effectively to the public.

Emergency Evacuation

Evacuation of people from risk areas is the first priority when early warning is received or the natural warning sign indicates the immediate arrival of cyclone, Tsunami wave or rise of storm surge.

Evacuation plan describes the time span available before and during the Tsunami or storm surge event. When facing local threat, evacuation procedures most possibly will have the character of a 'runaway effort' and people should not expect to receive much institutional support. The primary objective should be bringing as many people as possible out of the reach of the wave's impact to safe or 'relatively safe' areas. Therefore, necessary steps have to be taken in advance to enable and support the community at risk to protect themselves at any time

(iv) Flood

In general, Lakshadweep Island is not prone to flood.

MASS RESCUE OPERATIONS

The Union Territory of Lakshadweep has formulated a Mass Rescue Operation (MRO) Contingency Plan to ensure a coordinated response during large-scale maritime disasters. The MRO plan is designed to utilize all available local resources and enhance inter-agency coordination within the maritime jurisdiction of the UT. The region is also highly vulnerable to natural disasters such as cyclones, thunderstorms, erosion, and occasional earthquakes, which have historically caused substantial loss of life and property, as seen in major storms recorded in 1847, 1891, 1922, 1963, 1977, 2004, and 2017. Due to the geographical isolation of the islands and their dependence on shipping for connectivity, efficient disaster preparedness, rapid response, and seamless cooperation among various resource agencies are crucial in mitigating risks and ensuring effective mass rescue operations at sea.

A Mass Rescue Operation (MRO) is a large-scale emergency response that occurs when the number of people in distress exceeds the normal Search and Rescue (SAR) capabilities. While MROs are rare compared to regular SAR operations, they can arise from flooding, earthquakes, ship or aircraft accidents, hazardous material incidents, or terrorist attacks, requiring immediate and coordinated action. The primary objective in any MRO is lifesaving, followed by environmental protection and property safety, driven by moral, legal, and public expectations. These operations demand rapid, large-scale mobilization of resources, involving multiple agencies working under a clear command structure to ensure seamless coordination. Effective communication systems, trained personnel, and extensive logistical support are crucial to sustaining rescue efforts, sometimes for weeks. MROs require intensive pre-planning, collaboration, and real-time execution.

The Mass Rescue Operation (MRO) Contingency Plan for Lakshadweep is designed to provide a structured and coordinated response to large-scale maritime emergencies. Its primary objective is to ensure an efficient and flexible rescue strategy in the Search and Rescue Region (SRR) of Lakshadweep, covering rescue procedures, training, documentation, and media coordination.

The Indian Coast Guard (ICG) is designated as the lead agency, with distress reports relayed to the Coast Guard District No.12 at Kavaratti, the District Collector, and other stakeholders for immediate action. Aerial and sea-based search operations are crucial for assessing incidents and launching timely rescue efforts.

The Mass Rescue Operation (MRO) Contingency Plan outlines a structured approach to managing large-scale rescue efforts at sea. On-scene responsibilities are shared between the On Scene Commander (OSC) and the ship's master or aircraft pilot, who oversee safety, medical care, and evacuation procedures. In most cases, passengers and crew should remain on board unless the vessel is in immediate danger. The Search and Rescue Mission Coordinator (SMC) designates the OSC, ensuring effective communication, resource mobilization, and coordination with all agencies involved.

The plan prioritizes tracking and accounting for all people, utilizing lifeboats, helicopters, and naval vessels for rescue operations. Ship companies are encouraged to have helicopter landing areas and hoist-winch systems for more efficient evacuations. Depending on circumstances, towing survival craft to shore may be safer than removing passengers at sea. The MRO is

coordinated by Rescue Coordination Centers (RCCs) but may escalate to higher authorities if international support is needed.

Key considerations in MRO planning include incident command structures, resource mobilization, immediate activation protocols, personnel deployment, survivor care, media management, and security control. The plan also emphasizes preparedness through regular training, communication systems, and logistical support to ensure an effective response. Practical recommendations include quick mobilization, use of larger vessels for evacuation, controlling airspace, securing debris for investigation, and integrating support services like the Red Cross and crisis management teams. Pre-planning and collaboration among government, military, and private agencies are essential to maximizing efficiency and saving lives in a mass rescue scenario.

9. ENVIRONMENTAL MANAGEMENT PLAN

9.1. Introduction

Development of any infrastructure in the coastal environment includes both social and environmental impacts. To address the anticipated impacts and to implement the mitigation measures, Environment Management Plan (EMP) needs to be formulated. EMP identifies the approach, procedures and methods that will be used to control and minimize the environmental and social impacts of construction and operational activities associated with project development. It is intended to reduce the negative impact and to enhance the positive benefits from the project.

The main objectives of Environmental Management are to:

- Identify key environmental issues anticipated to be encountered during construction and operation phases of the project
- Provide guidelines for appropriate mitigation measures
- Ensure the mitigation measures are implemented
- Establish systems and procedures for implementing mitigation measures
- Monitor the effectiveness of mitigation measures
- Take necessary prompt action when unforeseen impacts occur

The proposed project involves construction of jetty with approach trestle, passenger facilitation centre modern amenities, navigational aids, development of warehouse and road connectivity to existing road and development of auxiliary infrastructures. The impacts due to construction and operation of the proposed development were described in **Chapter 4**.

9.2. Environmental Management Plan

The various impacts in any project development can be categorized as mitigable and non-mitigable and it is essential to list the impacts accordingly. The key activities or aspects of the proposal that may potentially affect habitat of flora and fauna and require application of management controls include,

- Construction of the approach trestle: Site preparation, construction of piling/foundation, storing of construction materials, construction of service utilities, construction of footpath.
- Construction of berth: Site preparation, constructions of deck slab, fixing of precast deck slab construction of long beams, construction of piling/foundation, storing of construction materials,
- Construction facilitation centre: Site preparation, construction of waiting hall including foundation, flooring etc., construction of security cabin, construction of warehouse.

Labour Management Plan

The total number of workers to be employed during construction phase will be around 18000 nos. Most of the labor will be recruited from the mainland, and a temporary labor camp may be set up during the construction period. The basic facilities required for the labours at the workplace as per the Contract Labour (Regulation & Abolition) Act, 1970 will be made available.

Sanitation Facility

There should be one latrine for every 25 males or females. Every latrine shall be under cover and so partitioned off as to secure privacy and shall have a proper door and fastenings. "For Men

only" and "For Women only" must be displayed in the local language in the door of the latrines. The notice shall also bear the figure of a man or of a woman, as the case may be. Sanitation facility should be provided to the workers during construction.

Solid Waste Management

Construction waste consisting of bricks, stones, pipes, concrete waste, steel waste, etc. will be generated during the construction phase. The waste will be properly disposed or recycled.

Transportation and heavy machineries

- All vehicles used will have a valid Pollution Under Control Certificate.
- Regular servicing and maintenance of machineries as well as vehicles to control unwanted air pollutant emission.

Marine Environment

- Periodic monitoring on the seawater, seabed sediment and marine ecology will be carried out in the coastal region and the report will be submitted to the statutory bodies as required.

9.3. Coral Management Plan

Coral reefs are one of the most diverse and highly productive ecosystems in the coastal zone and contribute to the sustenance of the country through fisheries, tourism, etc., and also protect the shore from erosion and natural calamities by buffering of waves and currents. Coral reefs play a major role in climate change, by fixing atmospheric nitrogen, regulating CO_2 and Ca levels. Reefs also offer shelter to various organisms, including ornamental fishes, crabs, shrimps, sea cucumbers, sea urchins, octopuses, eels, etc.

Besides hard stony coral reefs, soft corals also exist in coral reef ecosystems, in clear, warm tropical seas. Hard corals produce a rigid skeleton made of calcium carbonate ($CaCO_3$). The calcium carbonate of corals provides a hard outer structure that protects the soft parts of the coral. Colonial hard corals are made up of hundreds to hundreds of thousands of individual coral polyps that cement themselves together by the calcium carbonate they secrete.

Soft corals do not produce rigid calcium carbonate skeletons and do not form reefs, though they are found in reef ecosystems. Like hard corals, most soft corals are also colonial; what appears to be a single large organism is actually a colony of individual polyps that form a larger structure. Visually, soft coral colonies tend to resemble trees, bushes, fans, whips, and grasses.

In India, a total number of 585 species (108 genera, 23 families) of Scleractinian fauna has been reported (De *et al*, 2020). Highest number of species (523 species belonging to 95 genera and 23 families), was reported from Andaman and Nicobar Islands, followed by Gulf of Mannar (169 species of 46 genera and 16 families), Lakshadweep Islands (165 species of 54 genera and 17 families) and Gulf of Kachchh (76 species of 30 genera and 11 families).

Among the Indian reefs, 298 species (52.6 %) occur only in Andaman and Nicobar Islands, and are not found in other reefs. Likewise, 28 scleractinian species (5 %) are unique to Gulf of Mannar, followed by 7 unique species (1.2 %) in Lakshadweep Islands. In Gulf of Kachchh, only one unique species (0.2 %), namely *Acanthastrea simplex* occurs.

Among the total number of 585 species, 36 scleractinian species (6.4 %) are common and present in all the four major reef regions.

Lakshadweep Islands

In the south-western part of India, Lakshadweep reef archipelago is located 200-400 km away from the Indian mainland and is formed by a series of coral atolls. This Lakshadweep Chagos ridge supports the longest chain of true atolls and supports divergent ecosystems characterized by a rich diversity of corals and associated marine organisms. The submarine ridge that supports the islands, rises from a depth ranging from 1500 to 4000 m. There are 6 tiny islands, 12 atolls, 3 reefs and 5 submerged banks, covering an area of 32 km^2 with lagoons occupying about 4200 km^2. Only 11 of the 36 islands are inhabited (Venkatraman, 2006).

In the Lakshadweep Islands, among the 17 families, Acroporidae (51 species, 5 genera), Merulinidae (34 species, 14 genera), and Poritidae (17 species, 2 genera) form the major species assemblage. At the genera level, *Acropora* contributes 36 species, followed by *Porites* (14 species) and *Montipora* (9 species).

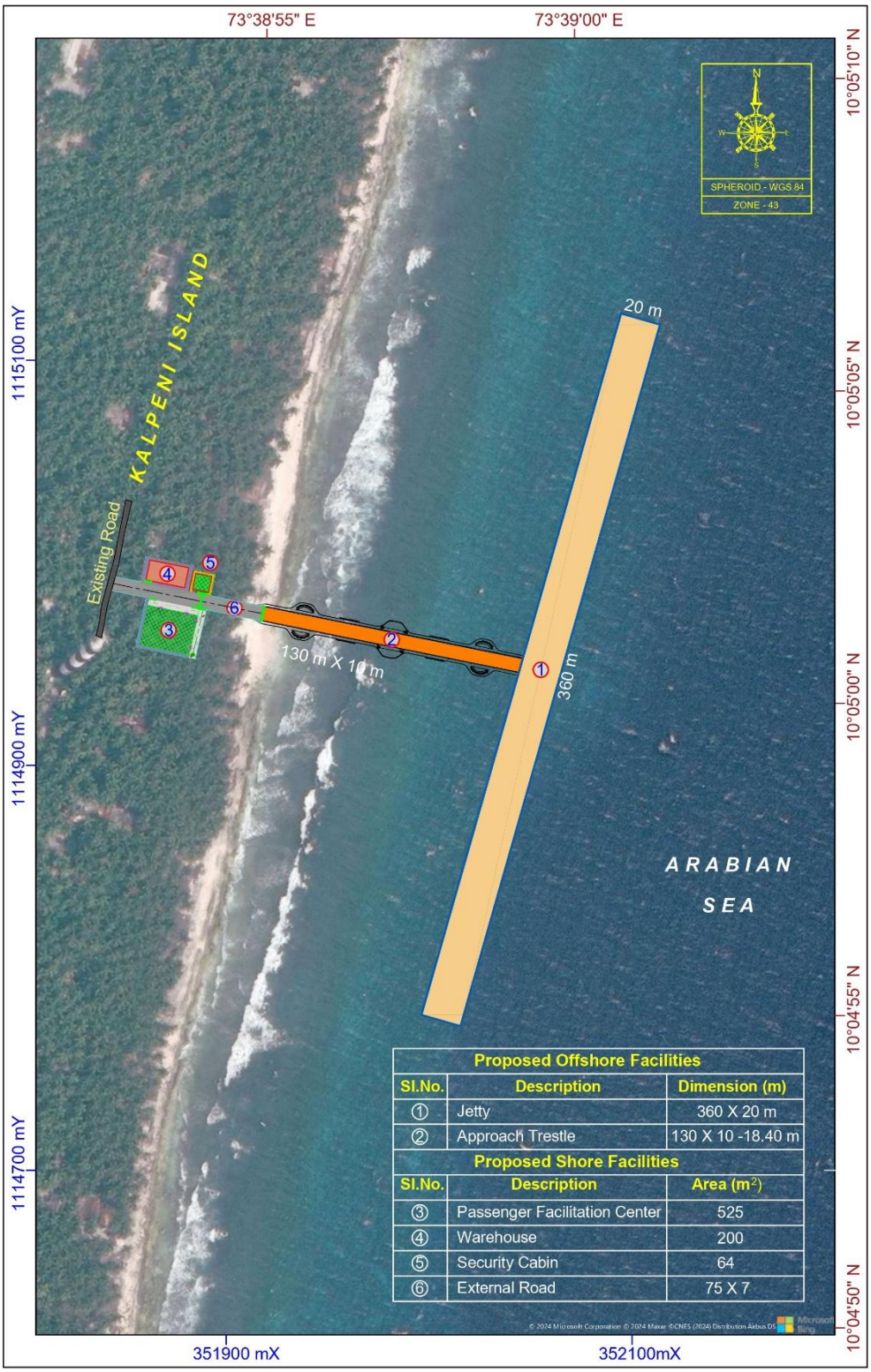
Department of Environment and Forest, Lakshadweep (2023), has recently compiled the database on hard corals and has listed 80 species of corals, belonging to 34 genera. They are *Acropora (21 species), Porites (6), Favites (5), Favia (3), Fungia (3), Pocillopora (3), Turbinaria (3), Astreopora (2), Galaxea (2), Montipora (2), Cyphastrea (2), Montastrea (2), Platygyra (2), Goniastrea (2), Goniopora (2), Lobophyllia (2), Isopora (1), Echinopora (1), Diploastrea (1), Leptoria (1), Plesiastrea (1), Merulina (1), Hydnophora (1), Mycedium (1), Pectinia (1), Pavona (1), Gardineroseris (1), Herpolitha (1), Polyphyllia (1), Symphyllia (1), Stylophora (1), Psammocora (1), Tubastrea (1)* and *Heliopora (1)*.

Kalpeni Island

In Kalpeni island, in a survey carried out in 2016, a total of 69 species belonging to 26 genera and 13 families, including 2 non-scleractiinian coral genera *Heliopora* and *Millepora* were reported. In terms of species diversity, the genus *Acropora* dominated with 16 species followed by *Porites* (5 species). The genera *Platygyra, Favites* and *Pocillopora* were next in abundance, each with 4 species (Jasmine *et al*., 2017).

Project Region

The project site is located on the eastern side of Kalpeni. In the project site, both the offshore and onshore facilities have been proposed. The offshore facilities include the jetty and approach trestle. The onshore (land) facilities include passenger facilitation center, warehouse, security cabin and external road.



Proposed facilities in Kalpeni Island - Eastern side

Description:

Proposed project area was mostly with dead coralline rocks. The upper intertidal area is characterized by coralline rubble / sandy patch of about ~ 5 m width both on the northern and southern sides of the proposed jetty area. The mid intertidal area is characterized mostly by dead coral rocks, rubbles, etc. In the backshore, where the facilities are proposed, mostly coconut trees occur.

The mid and low intertidal areas mostly consist of dead coral rocks / rubbles and are exposed in low tide. Small live coral colonies (20 nos. / 2 m^2) were also observed with sparse distribution. Live coral species include *Psammocora contigua, Pocillopora* sp. *etc.*

Further, some live coral colonies were observed on the northeastern tip of Kalpeni island. The northeast tip is located at about 2.32 km from the proposed eastern jetty. These coral colonies were observed among the coralline rocky pools when exposed in the low tide. The corals belong to *Acropora* sp., *Acropora gemmifera, Pocillopora* sp., etc.

Kalpeni East Jetty - north side

Kalpeni East Jetty - south side

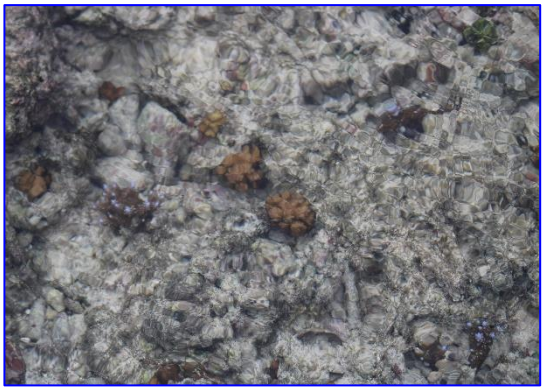
Kalpeni East Jetty – rocky areas

Kalpeni East Jetty – land side

Few coral colonies observed

Psammocora contigua

Pocillopora sp.



Live coral colonies – northeast tip

Acropora sp. on northeast tip

Acropora gemmifera -northeast tip

Kalpeni – northeast tip

Habitat Analysis based on video transects

Methodology

This study utilized underwater video footage to assess benthic habitat composition along transects.

1. **Transect Establishment:**
    - Transects were established with a defined length of 100 meters.
2. **Video Acquisition:**
    - Underwater video footage was collected along each transect with the help of SCUBA Diving / Snorkelling.

Coral study at proposed eastern jetty of Kalpeni island

SCUBA diving at eastern side of Kalpeni island

3. **Data Collection:**

- 100 frames were randomly selected from each video (in case of multiple videos appropriate number of frames based on duration of video were extracted).

- For each frame:
  - The dominant benthic habitat within the frame was identified.
  - Due to the inherent variability in camera angle and distance from the substrate, the largest habitat observed within the frame was assumed to represent the dominant habitat at that specific point along the transect.

- The percentage composition of each benthic class was determined based on the frequency of occurrence of each class within the 100 frames.

Majority habitat is **Algae** followed by **DCA**

Majority habitat is **Sand**

Majority habitat is **DCA** followed by CM

Kadmat E (T7) majority habitat is **Sand**

Experts involved in the coral study

Coral management plan has been prepared by the subject experts of Indomer. In order to meet specific requirements of this plan, the following subject experts are involved in the study. Dr. Deepak Apte, (Marine Ecology, Former Director of Bombay Natural History Society (BNHS), Dr. T. Balasubramanian, (Marine Biology, Former Dean and Director, C.A.S. in Marine Biology, Annamalai University), Dr. S. Sundaramoorthy, (Former Scientist F, ICMAM-PD, MoES, Chennai), Dr. P. Chandramohan, (Ocean Engineering, Former Scientist, CSIR-NIO, Goa), Dr. P. Venkadeswaran, (Plant Taxonomy and Ecology & Biodiversity) and Dr. G. Idayachandiran, (Marine Biology).

Habitat Classes used for analysis (Depends on location)

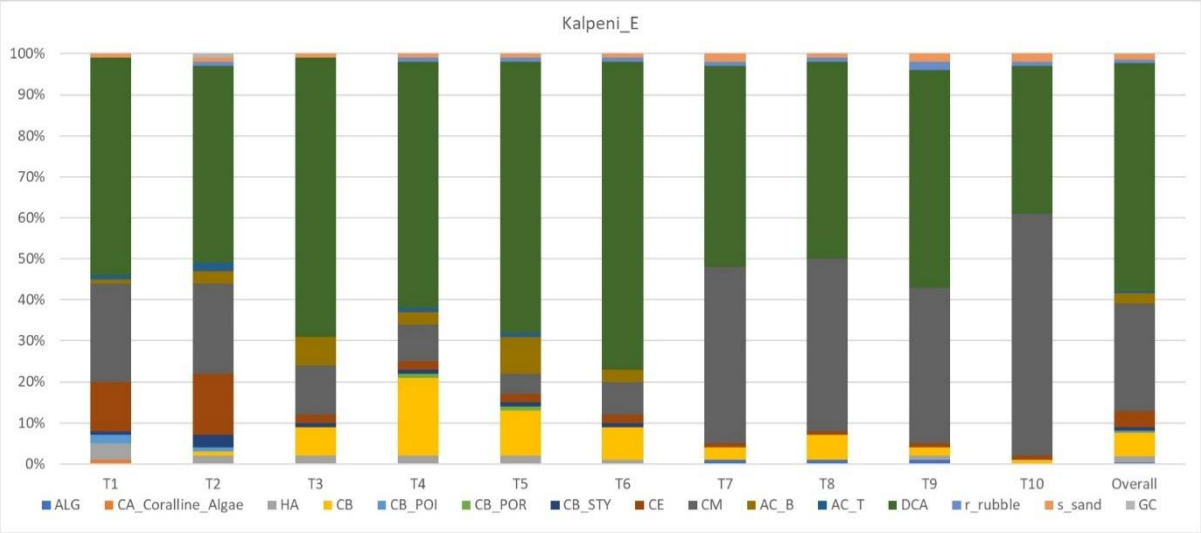
Higher class	Class Name (Code)	Class Information
Algae	ALG	Algae - turf
Algae	CA	Coralline algae (Pink)
Algae	HA	Halimeda
Dead Coral – Acropora with algae	DC_ACA	Dead Coral *Acropora* with algae
Dead Coral – with algae	DCA	Dead Coral with algae
Live Coral	AC_B	*Acropora* Branching
Live Coral	AC_D	*Acropora* Digitate
Live Coral	AC_SM	*Acropora* - Submassive
Live Coral	AC_T	*Acropora* Tabular
Live Coral	CB	Coral Branching
Live Coral	CB_POI	Coral Branching - Pocilloporid
Live Coral	CB_POR	Coral Branching - *Porites*
Live Coral	CB_STY	Coral Branching – *Stylophora* and allied
Live Coral	CE	Coral encrusting
Live Coral	CF	Coral Foliose
Live Coral	CM	Coral Massive
Live Coral	SC_soft coral	Soft corals
Other	GC	Giant clams
Other	SC	Sea cucumber
Rubble	R	Rubble
Sand	S	Sand

Assumptions and Limitations:

- **Dominant Habitat Assumption:**
  - The methodology relies on the assumption that the largest habitat observed in a frame accurately represents the dominant habitat at that point. This assumption may introduce bias, especially in areas with complex or heterogeneous benthic communities.

- **Camera Angle and Distance:**
  - Variations in camera angles and distance from the substrate can significantly influence the apparent size and visibility of different habitats. These factors were not explicitly accounted for in the analysis.

- **Random Frame Selection:**
    - The method assumes that the 100 frames selected are representative of the entire transect. However, the randomness of frame selection may introduce some degree of variability in the results.



Dominant Habitat Components:

- **Dead Coral with Algae (DCA):** This appears to be the most dominant habitat component across many of the locations. It suggests a significant presence of dead coral that is now covered by algae. This indicates potential disturbances or stressors that have led to coral mortality.

- **Coral Massive (CM):** This appears to be the second most dominant habitat component across many of the locations. It suggests a significant presence of large live boulder coral.

Other Significant Components:

- **Live Corals:** Various types of live corals are present, including Acropora (AC_B, AC_D, AC_T), branching corals (CB), and encrusting corals (CE). These contribute to the overall coral cover and biodiversity, although their abundance is lower compared to DCA.

    - T5 has 30%; T4- 36%; T1, T9 has 41% of live corals; T2, T7 has 47%; T8 has 49% and T10 has 61% of live coral cover which is maximum for the sample area.
- **Algae:** Algae are also a significant part of the habitat, with different types present such as turf algae (ALG) and coralline algae (CA_Coralline_Algae).

- **Rubble and Sand:** These components are present in varying amounts across the locations, suggesting areas with sediment accumulation or disturbance.

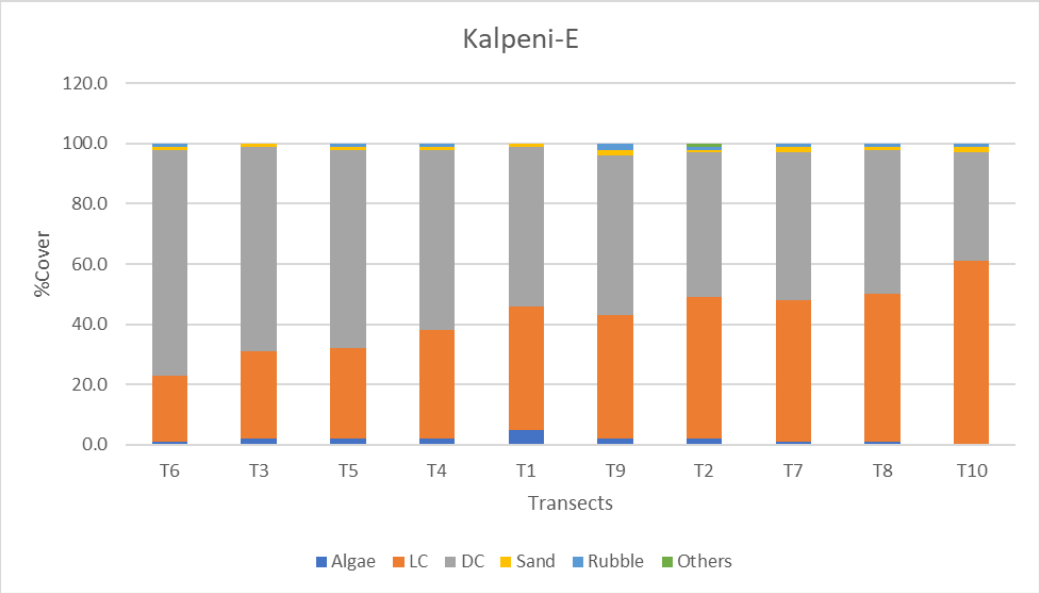


Figure 1. Percent coverage of major benthic habitats at Kalpeni-E
(Arranged as per Coral coverage [LC- Orange colour])

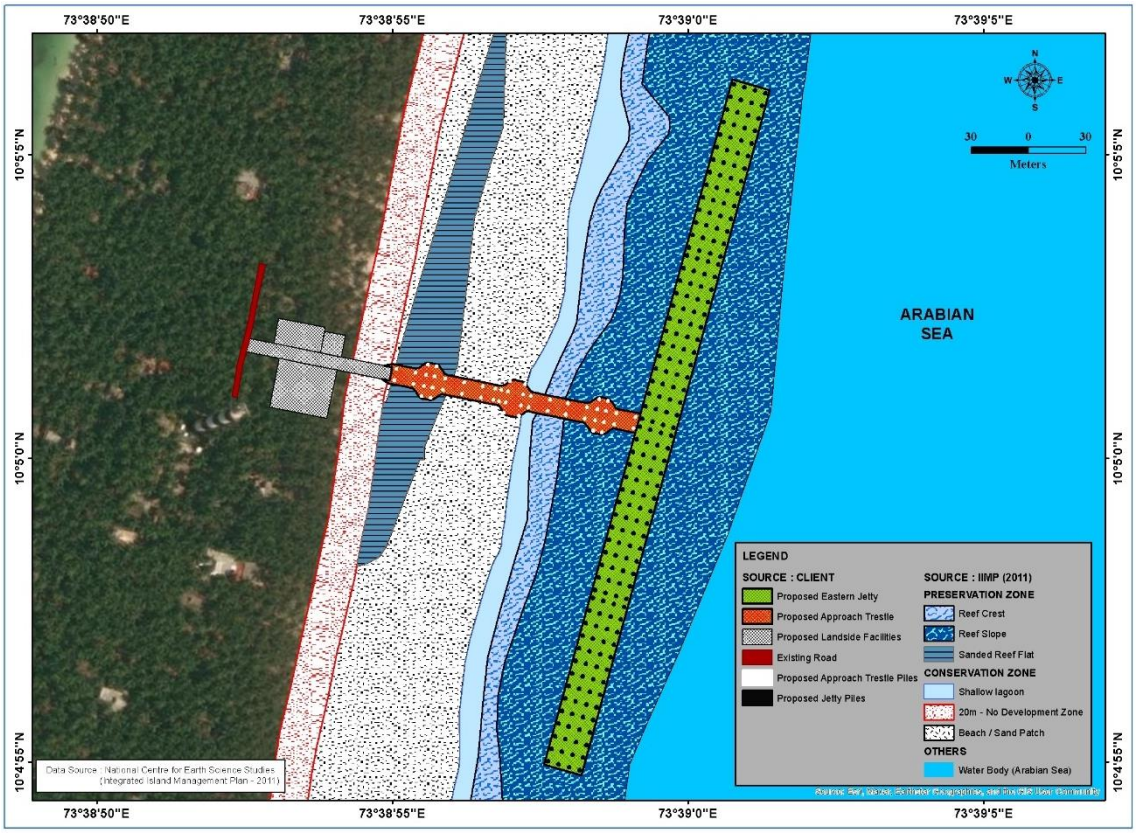
Overall Habitat Characteristics:

The habitat appears to be dominated by dead coral with algae (DCA) indicating a potentially degraded state and Massive Corals (CM) with large boulders which are resilient and alive. While live corals are present (CM, CE and other corals), their abundance is relatively low compared to DCA. The presence of rubble and sand suggests areas with sediment accumulation or disturbance.

Coral management plan

Eastern side

Corals are few compared to the western side (Lagoon side) of Kalpeni island. According to the CRZ map, in the approach trestle region, sandy area, lagoon and coral reefs are found; and in jetty area, coral reefs are observed.



Proposed piles (both approach trestle and jetty) over the coral subzones

Impact on reef during pile foundation

Total length of the approach trestle is 130 m from shore and length of the jetty 360 m. The pile foundation would take up only a small footprint of about 0.9 m dia. in approach trestle area and 1.3 m dia. in jetty area. There will be 2 piles in Reef Crest, 16 piles in Reef Slope, 14 piles in the Sanded Reef Flat in approach trestle and 224 piles in Reef Slope of proposed jetty area. Totally 318.4 m^2 of coral reef will be impacted during the pile foundation. The details of respective coral reef subzone areas that will be impacted are given in below table.

Details of coral reef subzone areas likely to be impacted

Facility Name	Ecologically Sensitive Area	Area (m^2)
Approach Trestle	Reef Crest	1.28
	Reef Slope	10.24
	Sanded Reef Flat	8.96
Jetty	Reef Slope	297.92
Total area of Coral sub zone		**318.4**

Impact on corals

Pile construction activities may cause physical damage to the reef, either through direct contact or sediment movement.

Water turbidity will be increased by the suspended sediments produced by piling operations. Because symbiotic algae (zooxanthellae) are necessary for coral life, their ability to photosynthesis is restricted by high turbidity, which decreases light penetration.

The coral ecosystem may get contaminated if fuels, lubricants, or other chemicals used in piling operations flow into the nearby coral environment. Corals may be impacted from improperly handled cement and other building materials that change the nearby water environment.

Mitigation measures

Before the piling operation, any live corals observed in the proposed piling activity area, shall be relocated to a neighbouring environment using the techniques described in the coral conservation methods mentioned below.

Appropriate silt curtains shall be used during piling operations, in order to minimize/ contain the turbidity / suspended sediment levels, of the ambient water environment.

Closed grab excavator shall be used for all piling constructions, and double casings with Y-shaped funnels installed will keep any muddy water spills contained within the casing, and additional protection from the Y-shaped funnel to prevent affecting the reef environment outside the work area.

The proposed pile foundation has sufficient spacing, limiting hydrodynamic changes in the flow regime and preventing negative impact on water quality while operation.

Threats to corals

Coral reefs are subjected to various natural and anthropogenic stressors, including climate change, (such as rising seawater temperatures), diseases, cyclonic disturbance, declining water quality (turbidity, pollution, pathogens, etc.,), sedimentation, destructive fishing methods, over-exploitation of reef fauna, tourism, physical damage due to anchor drop, etc. In addition to climatic causes, primarily high seawater temperatures, the uncontrolled and growing dumping of untreated residential sewage into the reef habitat are also major threats to the corals (Thinesh *et al.,* 2009).

Climate change

Climate change, especially sea surface temperature, is one of the main factors influencing the health of coral ecosystem. Corals have a low capacity for adaptation and are susceptible to thermal stress. Unless there is thermal adaptation or adaptation by corals, increases in sea surface temperature of around 1-3°C are predicted to cause more frequent coral bleaching events and widespread death (Eakin *et al.,* 2008).

Coral disease

Diseases are major secondary stressors causing coral mortality in the reefs. Diseases may cause irreversible damage to the corals structure and functioning. Diseases affecting hard corals have become the most important factor in the decline of coral reefs in some regions (Weil, 2004). Reproduction, growth, community structure, species diversity, and many other animals linked with reefs can all be significantly altered by coral disease.

In an earlier study of coral diseases in Gulf of Mannar and Lakshadweep Islands (Kavaratti, Agatti) during 2011, nine coral diseases (white band, white pox, white plague, pink line syndrome, pink spot, yellow band, fungal blotch, black band and necrotic patches) were observed. Coral disease prevalence was higher in coral reefs of Gulf of Mannar than in the Lakshadweep islands (Kavaratti and Agatti) (Thangaradjou *et al*., 2016).

In a recent study (Jan. 2016 - Nov. 2018), on coral diseases in Chetlat island, six coral diseases were observed and reported to cause mortalities in hard corals. The six coral diseases observed were Black Band Disease (BBD), White Syndrome (WS), Pink Line Syndrome (PLS), Porites Ulcerative White Spot (PUWS), White Band Disease (WBD) and Porites Peeling Tissue Loss (PorPTL) disease, affecting different genera of reef building corals. Among the affected genera, *Porites* hosted the highest number with six coral diseases, followed by *Pavona* with two diseases and the remaining genera were affected by one disease each (Thaha and Rathod, 2019).

Coral Management

Coral reef conservation aims to preserve biological productivity and diversity, provide traditional and sustainable uses (such as fisheries and tourism), and shield the reefs' aesthetic, historical, biological, and geological value from human interference. Protecting coral reefs by reducing or eliminating the stressors causing degradation should be important for their conservation. Development of coral nursery and transplantation are the ideal techniques for increasing the coral cover in the islands.

Pollution control

Maintaining the health and richness of coral reef ecosystem depends on preventing pollution in these reef ecosystems. Sewage waste should be treated before it is released into the sea, to prevent harmful chemicals, nutrients, and pathogens causing damage to coral reefs. By limiting the use of single-use plastics and encouraging recycling initiatives, plastics can be kept out of the ocean, where they can damage marine life and destroy coral reefs.

Shipboard pollution

Coral reefs are affected by shipboard pollution, which is mostly caused by harmful materials that ships release into the ocean. Marine pollution can be caused by ships improperly disposing of their waste material, particularly plastics. Plastics can introduce harmful compounds, block sunlight, and physically damage corals. Ballast water from ships frequently contains contaminants, disease causing pathogens, and invasive species that can damage coral reefs and other marine life by disturbing the local marine ecosystem.

The proposed project on jetty construction is for increasing the passenger and cargo traffic to the islands. The passengers in ships need to be cautioned about prevention of pollution by disposal of solid / liquid wastes to the marine environment. The vessel crew by default shall adhere to the standard norms.

Prevention of oil spill

Coral reefs are impacted by oil spills both directly and indirectly, which can degrade ecosystems, reduce biodiversity, and make recovery difficult in the long term. Corals obtain their energy from symbiotic interactions with algae (zooxanthellae). These algae can be damaged by oil pollution, which causes coral bleaching, a condition in which the corals expel the algae, losing their colour and vitality.

Oils, especially diesel, petrol, aviation fuel, kerosene, etc., are likely to be transported in significant quantities to the islands. Standard safety precautions shall be taken for loading, transporting and unloading the above items. Standard oil spill contingency plans shall be prepared according to the passenger / cargo ships quantum, and shall be implemented accordingly, in case of any oil spill, or leakage, etc.

Invasive species management

Certain invasive species, such as predatory starfish (like the crown-of-thorns starfish), cause direct impact to coral colonies and degrade reefs by feeding on coral polyps. Because they modify nutrient cycling, reduce the amount of food available to the marine organisms, or alter the physical structure of the reef, invasive species are able to alter the way ecosystem's function. In order to preserve coral reefs and their biodiversity, it is essential to stop the spread of invasive species through improved ballast water management and appropriate fishing methods.

Conservation methods

In Lakshadweep archipelago, the corals have been degraded / threatened by a range of natural and anthropogenic stressors, like cyclones, climate change, and anthropogenic interventions (Riyas *et al*. 2020). These threats necessitate the development and implementation of active coral restoration programs.

Transplantation of corals can serve as an ideal management strategy for development of coral colonies in the reef. Coral restoration can be achieved by transplanting fast-growing and healthy coral fragments. Massive corals have also been recommended for transplantation due to their lower susceptibility to damage and mortality. Therefore, both branching and non-branching corals shall be used for coral restoration.

Coral rescue program

The live coral colonies, both branching and massive corals, likely to be damaged at the proposed project area, shall be collected and relocated in a suitable nearby location, for survival at natural conditions. The live coral colonies alongwith the substrate (e.g., dead coral rock, on which the live coral colony has developed), can also be removed as such and translocated. Suitable sites may be identified prior, in and around the island for such coral rescue programs. Further, these also should be monitored for their survival percentage.

Coral translocation

Coral translocation is the technique of relocating corals, usually to improve coral populations in places under stress from the environment or rehabilitate damaged reefs. The main objective is to relocate coral colonies to more favourable conditions where they have a better chance of survival. Coral fragments or entire colonies are carefully removed and then moved to restoration areas.

Coral transplantation

Obtaining coral larvae or fragments from healthy populations, raising them in controlled conditions (like coral nurseries), and then relocating them to damaged reefs is a method of transplantation.

In Lakshadweep islands, large extents of dead coral reefs and rocky intertidal areas are observed. In these islands, transplantation of corals can serve as an ideal management strategy for conservation and development of new coral colonies.

A recent study was conducted by Department of Science and Technology, Lakshadweep Administration, with an aim to develop an effective transplantation method by establishing a coral nursery in the Kavaratti lagoon, focusing on the use of fast-growing coral species to facilitate the rapid restoration of degraded reefs.

Coral nursery development

Coral fragments were collected from different locations of the lagoon, including the intertidal zone, inner reef lagoon, reef crest of the atoll, etc., to obtain different fragments grown in different conditions and locations in the lagoon. Coral fragments of both acroporid and non-acroporid corals that naturally grew in the lagoon and other areas were collected and placed in artificial substrates (concrete blocks) and monitored for their survival and growth rates for 2-year period during Jan.2016 – Jan.2018 (Riyas *et al*., 2024). Growth rate of acroporid corals was higher than non-acroporid corals. It was reported that establishment of a coral nursery also led to increased habitat for marine life and fish aggregation, contributing to enhanced biodiversity and ecosystem resilience.

Coral nursery can be developed in the lagoon area using both acroporid and non-acroporid coral species. Coral transplantation can be taken up in suitable locations around the island and in lagoon areas, for coral restoration of the island (Ramesh *et al*. 2020).

Transplanted coral fragments deployed in the lagoon bed at Kavaratti (2016 to 2018)

Well-developed coral colonies in the transplantation site after two years (2016 to 2018)

Source: *Riyas et al. (2024) Successful establishment of a coral nursery for active reef restoration in Kavaratti Island.*

Creating awareness

Knowledge and awareness of economic / ecological importance of coral reefs is crucial to their preservation and long-term management. Such awareness should be created to the stakeholders, including general public, students, fishermen, tourist operators, government and non-government organisations, etc.

In order to educate the community on the importance of coral reefs, including their role in biodiversity, coastal protection, and livelihoods (such as fishing and tourism), workshops, seminars, and school programs should be organized. Also, locals should be involved in coral conservation initiatives, such as restoration projects, reef monitoring, and sustainable fishing methods, in order to cultivate a sense of responsibility and involvement.

Recommendations

- It is recommended that coral nursery may be developed in the lagoon of Kalpeni Island. Establishment of a coral nursery has been demonstrated successfully in Kavaratti Island lagoon.
- Coral restoration / transplantation program shall be implemented in suitable sites, in order to improve coral reef coverage.
- Restoration / increase of coral cover will improve fish aggregation, increasing ecological stability and biodiversity.
- Restored coral reefs will also result in increase of fish populations, benefiting local fishing communities and promoting eco-tourism and livelihood opportunities.
- The expertise of Zoological Survey of India also can be used to implement coral conservation plan.

Budget Estimate for Coral Transplantation

Budget required for coral transplantation for five years was worked out to be Rs. 40,00,000/- and the details are given below.

S. No.	Budget for corals Transplantation	In Rupees
	Boat rent charges	
1	Boat rent collecting site (Rs. 5000 per day X 20 days)	1,00,000
2	Boat rent recipient site (Rs. 5000 per day X 20 days)	1,00,000
3	Boat rent for three years monitoring (Rs. 5000 per day X 120 days)	6,00,000
	Total	**8,00,000**
	Labour charges	
1	Labour charge for collections and packing (20 days)	2,50,000
2	Labour charge for recipient site (20 days)	2,50,000
	Total	**5,00,000**
	Staff charges	
1	Scientists (1 X 50000 X 24)	12,00,000
2	Assistant (1 X 20000 X 24)	4,80,000
	Total	**16,80,000**
	Major equipment	

S. No.	Budget for corals Transplantation	In Rupees
1	SCUBA gears (4 nos.)	6,00,000
2	Air Compressor (1 no)	1,40,000
3	Underwater camera with housing (2 nos.)	2,00,000
4	Maintenance / Service of Equipments / accessories	80,000
	Total	**10,20,000**
	Grand Total	**40,00,000**

*In total, a sum of **Rs.40 lakhs** is allocated for 5 years for the coral conservation plan.*

Conclusion

In the present study, dead coral with algae and coral massive habitats were observed. According to the CRZ map, the proposed approach trestle and jetty area piles will pass over coral reef subzones (Reef Crest, Reef Slope and Sanded Reef Flat). The piling operation will impact an area of about 318.4 m^2 of coral reef subzone area. However, for conservation purposes, the area affected by the piling operation will be considered as triple of actual area (955.2 m^2).

In order to increase coral cover, coral transplantation of coral fragments at suitable sites is recommended. For this purpose, Rs. 40,00,000 shall be allotted for five years.

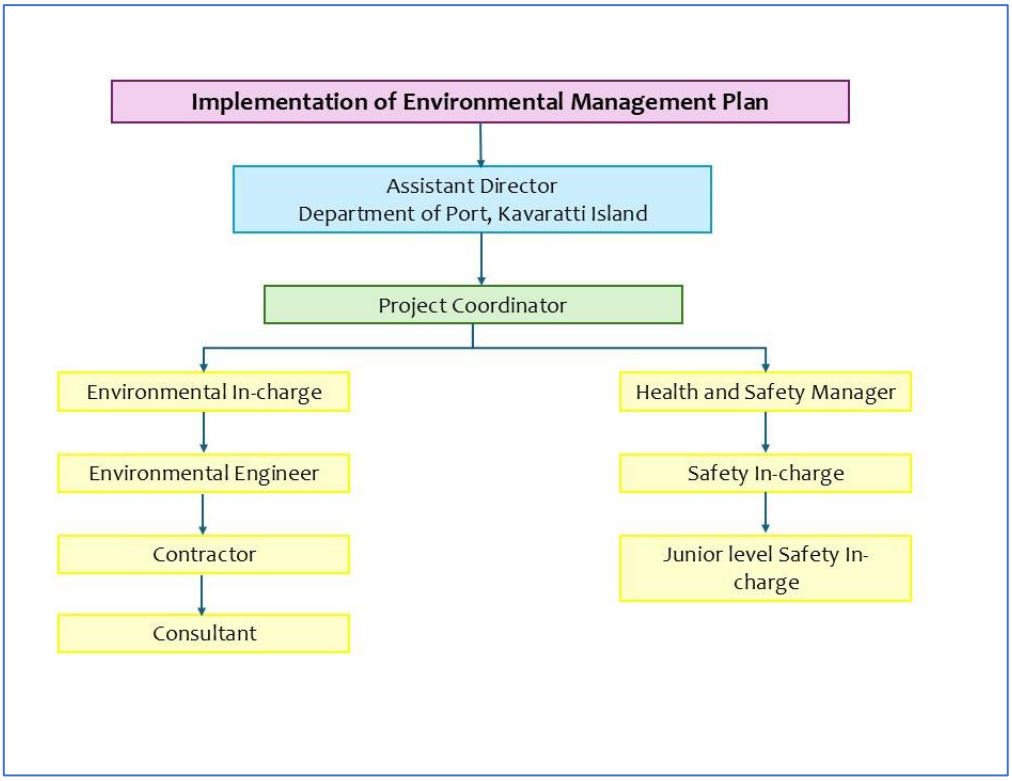
9.4. Environment Management Cell

EMC will be headed by the person who have qualification and reported to the MoEF&CC committee.

- Preparation and implementation of Environmental Supervision Plan during construction.
- Ensuring adequate training and education to all staff involved in environmental supervision.
- Implement Environmental Monitoring Plan during construction and operation.
- Ensure effective communication and explanation of the content and requirements of the EMP to contractors and subcontractors.
- Provide appropriate and adequate resources allocated for the effective implementation and maintenance of the EMP.
- Review of EMP performance and implementation of corrective actions, or stop work procedures, in the event of breaches of EMP conditions, that may lead to serious impacts on local communities or affect the reputation of the project.
- Report any major environmental incidents that may have a significant impact on the surrounding environment.
- Evaluating the efficacy of the EIA, mitigation measures as stipulated in the EMP.
- Coordination with Lakshadweep Pollution control boards for prevention and control of environmental pollution.
- Carryout half yearly monitoring program and preparation of compliance report.
- To implement Environmental Clearance condition stipulated by MOEFCC.
- Maintain environmental monitoring records.

9.5. Implementation of EMP

Overall implementation of EMP will be the responsibility of EMC. Various implementation items, description, and appropriate time to implement EMP are listed below.



EMP Implementation flow diagram

9.6. Communication and reporting

Training: Training shall be given to the workers during the construction and operation phase for identification of various hazards, methods to combat and responsiveness to emergency preparedness etc.

Communication: Information with respect to any untoward incidences during the construction and operation of the project shall be communicated to local Gram Panchayat, local village workers, and other project-related individuals. Environmental issues should be communicated to the concerned Govt. agencies such as LCZMA, Lakshadweep Pollution Control Board (LPCB), Forest and Environment Department, District Collector etc.

Reporting: The EMC will be responsible for conducting environment monitoring, compilation, and review of monitoring data, filling up the statutory forms/returns, maintenance of records regarding hazardous waste, environment awareness activities, submission of compliances six months EC compliance to State Pollution Control Board and MoEFCC regional office.

9.7. Environmental Monitoring and review

The EMC will continually review the EMP, and implementation of the mitigation measures described in Chapter 4 to assess the effectiveness of the proposed measures. The management will conduct periodic review to ascertain effectiveness of the EMP as follows:

- Take routine annual review of the EMP.
- Review of EMP after an accident or significant non-compliance is reported.
- Examine report and findings of the post project monitoring results and evaluation submitted by the EMC from time to time.
- Assess feedback from workers/stake holders and take action where necessary.

9.8. EMP Budget

The adequate budget allocation to operate EMP is necessary to make resource available for its effective implementation.

Based on the EMP for the proposed project discussed in above, the budget allocation required is estimated to be about ₹ 2.15 Crore The break-up of the proposed budget is given below.

Sl. No.	Environment Management Plan	Cost/year (₹.)
1	Environmental Monitoring Programme	25,00,000
2	Environment Management Cell	25,00,000
3	Labour, Safety and Cleanliness Management	25,00,000
4	Solid waste management	25,00,000
5	Post project monitoring	25,00,000
6	Turtle Conservation Plan	25,00,000
7	Marine Mammale Conservation Plan	25,00,000
8	Coral Management Plan	40,00,000
Total		2.15 Crore

ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR CRZ CLEARANCE FOR CONSTRUCTION OF PASSENGER JETTY AND ASSOCIATED LANDSIDE FACILITIES ON THE WESTERN SIDE OF THE KALPENI ISLAND, LAKSHADWEEP

PROJECT CODE: 892062425

For

सत्यमेव जयते

U.T. ADMINISTRATION OF LAKSHADWEEP

Through

सत्यमेव जयते

COCHIN PORT
कोचिन पत्तन प्राधिकरण
Cochin Port Authority

COCHIN PORT AUTHORITY (CoPA)
KOCHI

April 2025

INDOMER COASTAL HYDRAULICS (P) LTD.

(ISO 9001: 2015 CERTIFIED, QCI – NABET & NABL ACCREDITATED)
63, GANDHI ROAD, ALWAR THIRUNAGAR, CHENNAI 600 087.
Tel: + 91 44 2486 2482 to 84; (M) (+91) 96000 56652/ 99629 37397
Web site: www.indomer.com, E-mail: ocean@indomer.com

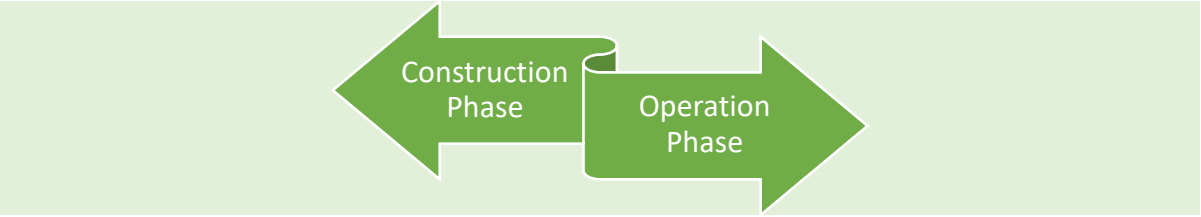
4. IMPACT ASSESSMENT AND MITIGATION MEASURES

Presently the western side of Kalpeni Island has a southern and northern jetty in the lagoon region. However, the existing jetty is in a dilapidated condition and lived its design life. The reinforcements jetties are exposed and have been corroded which have affected the strength of the structure. Hence it is proposed to construct another new jetty south of the existing one, which will be a multipurpose jetty that will cater to all the berthing requirements. It is also proposed to utilize the existing channel for navigation inside the lagoon to and from the Jetty. Therefore, the existing facilities on are not sufficient to accommodate larger vessels. To address navigational concerns and meet berthing requirements, a development plan for Kalpeni Island has been proposed. More details are given in Chapter 2.

In this particular project, the sizable impact will primarily occur during the construction of the berthing jetty and approach trestle and the construction of the landside facilities will have only have a minimal environmental impact. The development covers: construction of 70 m long berthing Jetty, 225 m long approach trestle, 50 m finger jetty and 75 m long boat landing center on the marine environment and a passenger facilitation center, development of boat repair shed, ice plant, fuel station, pump house ,fish collection yard and road connectivity to the jetty and boat landing center on the land of western side of Kalpeni Island. The anticipated impacts and the corresponding mitigation measure due to the proposed activities are discussed. In reference to **Fig. 1.3.**

4.1. Identification of Impacts

Impacts are identified with respect to two stages of the project viz., i) Construction phase and ii) Operation phase.



a. Construction Phase

Construction phase in the present project involves activities like excavation, raw material transportation, stacking piling, foundation work, deck construction, building construction, installation of fenders & lighting buoys etc.

Due to the sensitive ecosystem, which are mainly made up of coral reefs and lagoons, building a jetty on a Kalpeni Island during the construction phase is likely to have a significant negative impact on the marine environment. These effects could include coral reef damage, increased turbidity, sediment disturbance, noise pollution, possible oil spills and disruption of local marine life. During construction period the impact on environment will be of short term, temporary and localized. However, to limit the impact on valued environmental components, mitigation measures are suggested.

b. Operation Phase

During the operational phase of a jetty, key activities include vessel berthing and departure, cargo loading and unloading, passenger boarding, mooring operations, pilotage, security checks, waste management etc.

Operations near jetty can have impact on the coral reef with vessel anchors and movement. The pollution due to leakage of wastes may affect the marine life close to jetty corridor.

4.2. Anticipated Environmental Impacts

Based on the proposed development, the impacts due to the following activities are discussed.

Impact on terrestrial environment	Impact on marine environment
Impact on Air Environment Impact on Noise Environment Impact on Water Environment Impact on Land and Soil Environment Impact on Socio Economic Environment	Impact due to construction of Jetty and approach trestle Impact due to handling of cargoes Impact due to movement of vessels Impact on planktons Impact on benthos Impact on fish Impact on corals

4.3. Terrestrial Environment

4.3.1. Air Environment

a. Construction phase

Possible Impacts:

The construction activities for the proposed passenger jetty, approach trestle and associated structure including site preparation, excavation, construction of piles, operation of construction equipment, handling and transportation of construction materials, operation of DG sets and pumps, etc. could contribute to air pollution. On the other hand, the order of impact on terrestrial environment is limited to only during construction phase. The identified impacts are due to the following.

- **Construction dust** – Arisen from handling construction materials/debris in open area influenced by coastal wind during the construction activities.
- **$PM_{2.5}$** – Emission from exhausts of generator sets, vehicles and heavy equipment.
- **Noxious vapours** – Oils, glues, thinners, paints, treated woods, plastics, cleaners, other hazardous chemicals, generator sets, vehicles and heavy equipment.
- **Volatile Organic Compounds (VOCs)** – Depending on the construction materials used, emissions of VOCs from paints, adhesives, and other chemicals.

Mitigation:

- *Construction materiasl at site and carried on the vehicle/ vessel have to be properly covered.*
- *Sprinkling of water every day at periodic intervals on the ground on piled up construction materials are to be done.*
- *Dust barriers such as poly screens around the site boundaries have to be provided to create buffer against propagation of dust.*
- *The equipment used at the site have to be properly maintained.*
- *Construction work should be stopped during high wind time.*

b. Operation phase

Possible Impacts:

During the operation of jetty, the air environment can slightly get affected due to release of pollutants, but it will be restricted to the hours of vessel arrival time. The particulate matter (PM), sulphur oxides (Sox) and carbon monoxide (CO) from vessel engine emissions are anticipated during loading and unloading activities.

Mitigation:

- *Implementing stricter emission standards for vessels*
- *Providing shore power to docked vessels to reduce engine idling emissions.*
- *Improving cargo handling practices to minimize the dust generation and spills.*
- *Regular monitoring of air quality around jetties to identify emission hotspots and implement necessary mitigation measures.*

Impact on the air environment is limited for a period during construction phase.
Mitigation measures will be followed during both construction and operation phase to reduce the possible impact on air environment.

4.3.2. Noise Environment

a. Construction phase

Possible Impacts:

There can be an increase in noise from various machinery like pile drivers, excavators, barges, and other construction equipment, which can disturb nearby residential areas and marine life, particularly during the active construction phases.

Mitigation:

- *Personal protective gear has to be provided to workers while involving in high noise generating works.*
- *Highly efficient and regularly maintained equipment has to be used.*
- *Choice of generators and construction machinery/equipment will be restricted as per usage requirements.*
- *Special attention has to be given to the preservation of biodiversity around the jetty location.*

b. Operation phase

Possible Impacts:

Noise generation from movement of vessel and during handling of passenger cargoes in the jetty area are the only anticipated noise generation during the operation phase.

Mitigation:

- *Installing sound barriers or acoustic enclosures around the walk way region.*
- *Encouraging the use of quieter vessels and operating procedures.*

- *All machines must be lubricated and maintained regularly and located inside acoustic enclosures only.*

The construction and operation of Jetty may emit noise from machinery. However, the noise emitted due to the operation will be confined within the jetty premises.

4.3.3. Water Environment

a. Construction phase

Possible Impacts:

- Construction materials like paints, oils, cement mortar, sand etc. may fall inside the sea or may be carried into sea with runoff water leading to contamination.

Mitigation:

- *Construction material has to be stored in a closed place.*
- *Domestic wastewater has to be discharged into a septic tank soak pit arrangement.*
- *There should not be any dumping into the waterfront areas.*

b. Operation phase

- Drinking Water requirement during the operational phase will be met from the LTTD plant.
- Care to be taken that *sewage from facilitation centre, do not mix with Ground water or surface water.*
- *Domestic wastewater generated during operation phase has to be treated with STP.*

There is no significant impact anticipated on the water environment due to the construction and operation of Jetty.

4.3.4. Land and Soil Environment

a. Construction phase

Possible Impacts:

- Soil contamination can occur by deposition of uncovered construction materials exposed to wind and suspended load-laden runoff water.
- Improper drainage systems leading to leakage or overflow of wastewater and littering at the site by workers can result in land soil contamination.
- Alteration in the topsoil for site preparation and foundation can cause a change in the soil profile.

Mitigation:

- *Proper management of construction materials and activities have to be ensured. Loose materials such as cement and sand have to be stored in a closed place and adequately covered.*

- *Any construction material remained after completion of the construction activities for the proposed project must be removed from the site.*
- *Bins have to be provided separately for recyclable and non-recyclable wastes at strategic places which will be periodically emptied, and the waste disposed of adequately.*
- *Workers have to be made aware of the need for proper waste disposal.*
- *Excess excavated material will be properly stored and subsequently used for site levelling, approach road construction, landscaping, as required.*

b. Operation phase

Possible Impacts:

Operation of proposed facilities will not have major impact on land environment. Any other solid waste generated from the jetty has to be disposed of as per the Solid Waste Management Rules, 2016.

The impact of the proposed project on the land environment is expected to be low. Municipal solid waste produced during construction and operation phase have to be properly disposed.

4.3.5. Socio–Economic Environment

Development of Lakshadweep islands are essential for the regional and national economic development by way of safe movement of passengers, transportation of goods, developing new infrastructure etc. The development of Kalpeni island will attract international tourists which is one of the major economic engines for the country and gain considerable amount of foreign exchange. Sustainable port operations should aim at inclusive development along with the local community.

Negative Impact

No specific negative impacts are foreseen on social aspects.

Positive Impact

- The issues pertaining to resettlement and rehabilitation are not envisaged in this project, as there is no land acquisition involved, as the proposed development is within the existing boundary of Kalpeni Island.
- There are no cultural and heritage site which could be affected due to the proposed construction along on close proximity to the study area.
- Community development with the successful passenger jetty operation may lead to the development of supporting infrastructure such as housing, schools, roads and healthcare facilities which can benefit the local community.
- The proposed project could attract more tourists, boosting local tourism industries.
- The construction of a jetty and associated facilities can improve access to essential services like healthcare and education for coastal communities.

The proposed construction will have more positive impact on the socio-economic aspects of the Kalpeni island by upgrading the safety and economy of Islanders.

4.4. Marine Environment

The marine component of the proposed project includes construction of passenger and cargo handling jetty, approach trestle and driving of piles. Evidently, the project would have impacts on the marine environment during its construction as well as operations. The impacts can potentially influence the local ecology given in **Table 4.1.** in the short- as well as long-term if appropriate mitigations are not in place as illustrated below. But the impact will be confined within the corridor outlined in **Fig. 4.1.**

Table 4.1. Different ecology sensitive area affected due to the project

Facility name	Ecologically sensitive area	Area (m^2)	
Approach trestle	Seagrass	16.64	37.76
	Shallow lagoon	14.72	
	Deep lagoon	6.4	
Jetty	Seagrass	5.46	25.74
	Deep lagoon	20.28	
Finger jetty	Seagrass	2.56	6.4
	Shallow lagoon	3.84	
Total		**69.9**	**69.9**

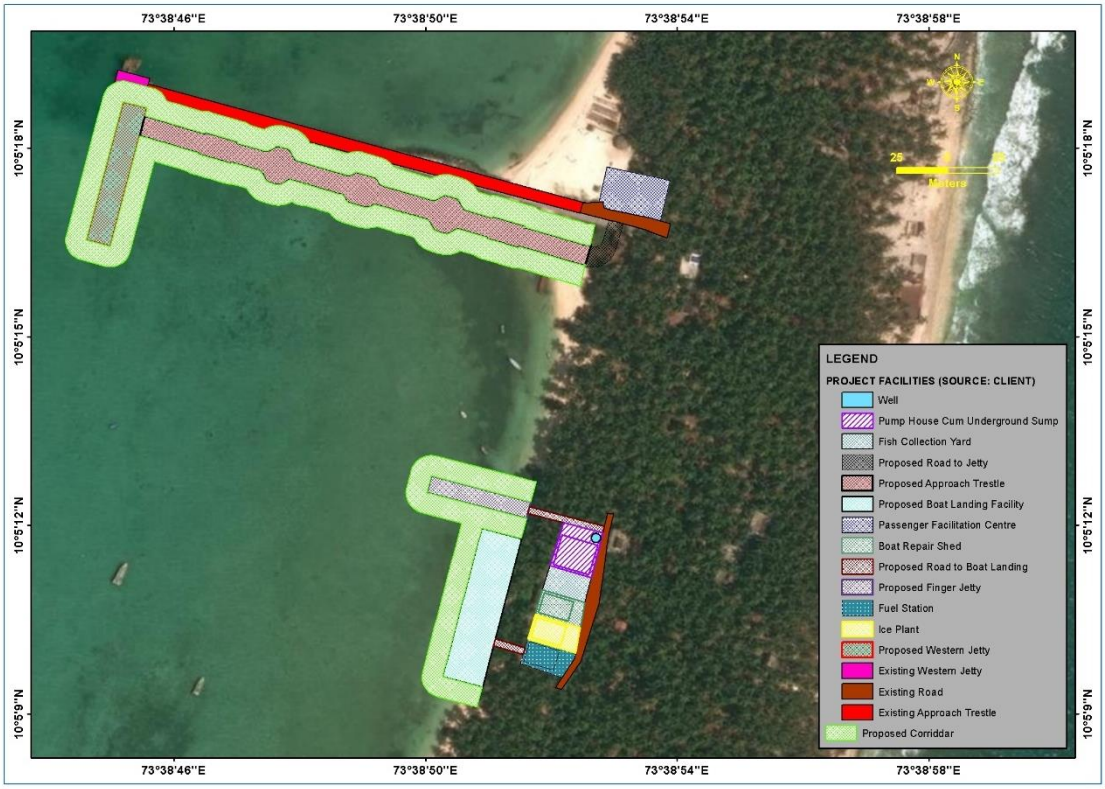


Fig. 4.1. Buffer corridor of the proposed development

4.4.1. Impact due to construction of Jetty and approach trestle

Construction of jetty and approach trestles will have more effect on marine environment compared to land environment.

4.4.1.1. Construction phase

The construction activity of jetty and approach trestle will consist of RCC deck (precast and in-situ) supported on bored cast in-situ reinforced concrete piles. The cross section of the jetty and approach trestle is given in Chapter 2.

Possible Impacts:

Disturbance to the marine habitation

(i) **Pile driving:** Piling will be required for the construction of jetty and approach trestle. Piles will be initially erected into the sea floor up to depth where hard stratum is available. The soil inside the pile will be dredged off and the same portion will be refilled with R.C.C concrete. Concrete mixing and construction debris in the marine environment are envisaged during the construction activity. Due to the pile driving activity the impact on following environmental parameters are anticipated:

Marine/coastal ecology: Disturbance from construction activities may cause displacement of fishery resources and other mobile bottom biota. Piling removes bottom biota and material covers bottom habitat, both of which may reduce fishery resources. Settlement of re-suspended sediments on fragile marine fauna and flora damages the ecosystem particularly coral reefs, which are formed by the extracellular product of symbiotic plants. The organisms attached to submerged structures need dissolved oxygen for respiration and the plants need sunlight for photosynthesis. Piles, concrete surfaces, rubble mounds and other similar structures in water could form new habitats, which may introduce undesirable species.

Construction materials, such as ship hulls, ballast water, and the structure of the jetty itself, can serve as vectors for the introduction of invasive species, which may outcompete or prey on native species.

Impact on Seawater and Seabed sediments: Resuspension of sediments in water leads to an increase in the level of suspended solids and concentration of organic matter, possibly toxic or harmful levels. This will cause temporary impact to seawater quality near proposed berthing jetty location. Contaminated bottom sediments (contained with heavy metal concentration) may lead to significant impact to seawater quality during piling. However, baseline data suggests that there is no heavy metal concentration build up in the seabed sediments.

Impact on benthos: Piling and other water side construction will cause loss/displacement to bottom habitat and its associated animal and plant life. Footprint on bottom habitat and associated life will be limited to area of piling. The turbidity induced during driving of piles will also have impact on the community structure and distribution of other marine life. However, the bottom will readily be recolonized by replacement of benthic organisms within few seasons.

Fishes: One of the major impacts of pile driving operations on the marine organisms especially on fishes is the underwater sound pressure waves generated during hammering of the piles. Pile driving may result in 'agitation' of fish indicated by a change in swimming behaviour.

The various factors which are known to influence the impact on fish are: (i) size and force of hammer strike; (ii) distance from the pile; (iii) depth of the water around the pile; (iv) depth at which fish swim in water column; (v) entrapped air in the water; (vi) oscillation of water level, (vii) geological composition of seabed, (viii) size of the fish; (ix) species of the fish; (x) presence of swim

bladder; (xi) physical condition of the fish and (xii) effectiveness of sound/pressure attenuation technology used to minimize the impacts.

Plankton: The proposed project activity like piling may not have any direct bearing on plankton. It is expected that the plankton will drift away from the disturbed area leading to minimal loss to plankton. Further, compared to the abundance of the plankton in the site, the loss will be moderate and temporary.

Since the sediment texture is mainly comprised of fine sand, the noise due to piling is expected to be low. As the baseline data suggests there are varieties of fish species and green turtles are observed within the project area, the impact of piling is expected to be limited to benthos. However, these animals will usually return to the area once the disturbance ceases.

Corals: Construction activity near coral reefs can damage coral ecosystems by causing physical harm, increasing turbidity (cloudiness) from sediment plumes, and disrupting water flow, which in turn reduces the amount of food available to corals and ultimately affects their growth and survival. **Quantification of impacts on coral is given in Chapter 9.**

Mitigation measures

- *Existing roads in the Kalpeni island shall be used for transportation of construction materials.*
- *Trucks transporting the materials will be covered to avoid susceptible for fugitive suspension.*
- *Vehicles having Pollution Under Control (PUC) certificates will be used. All vehicles used for transportation shall comply with CPCB emission norms.*
- *All workers, technicians and supervisors should make use of all safety equipment such as masks, goggles, helmets, safety belts, earmuffs safety shoes, lifesaving jackets, etc., as required, during the construction phase. Proper security arrangements will be made during nights to avoid any accidents due to unauthorized entry of workers, or civilians.*
- *The hazardous materials anticipated to be stored at the site during construction include gas for welding, fuel for operating construction equipment, paint, etc. All these and other materials of a dangerous or hazardous nature will be stored as per the norms.*
- *Clean and efficient construction techniques should be adopted.*
- *Piling should not be carried out during fish breeding season.*
- *Screening must be provided during piling activity.*
- *The construction schedule should be strictly followed, and no over runs should be ensured. Reducing the construction time with efficient techniques will rescue the period of impact.*
- *The scrap and waste construction materials should not be disposed into the seawater.*
- *Proper lubrication of pile driving machinery will ensure less noise.*
- *After pile driving and construction, continued monitoring of the affected area will be carried out.*
- *Continuous monitoring of coral reefs before, during, and after construction will be carried out.*

4.4.1.2. Operation phase

Possible Impacts:

During operation of jetty, major impact on marine environment is only due to the increase in vessel movement for handling Passenger and domestic cargo handling. Which will only have minimal

impact to the marine environment. However, appropriate mitigation measures will be followed in order to reduce the impact on marine environment during operational phase.

Mitigation measures

- *Vessels coming near the Berthing jetty should not discharge anything into the sea.*
- *Waste in the jetty premises should be handled as per PCB norms.*
- *Tourists and Operators must be continuously educated for preservation of the Island ecosystem.*
- *Use low-impact, quieter equipment during operations and limit activities during critical times for marine species (e.g., during breeding or migration seasons).*

4.4.2. Impact on marine environment due to handling of various cargoes

4.4.2.1. Construction phase

During construction phase of jetty, approach trestle, passenger facilitation center road and associated facilities all the construction materials such as cement, steel, boulders, sand and other construction related materials will be transported from the mainland using vessels and it will be handled in the existing jetty area and then it will be transported to the storage place away from CRZ zones through existing roads of Kalpeni Island. This handling of construction materials cargo will create minor impact on the marine water quality and marine habitat due to spillage while handling construction materials. The various impacts are listed below:

- Accidental spill of powdered construction materials such as cement and sand on the marine environment will pollute the water quality, increase the sediment concentration, affecting the marine habitat. The release of cement particles during mixing and placement can contribute to turbidity and potential chemical contamination.
- Accidental release of plastic debris during construction can contribute to marine plastic pollution.
- Machinery used to transport and handle materials at the jetty may leak oils or fuels, which can spread on the water surface and create oil slicks and harming marine life.
- Materials like sand, gravel, or concrete are handled, there can be runoff into the water, causing increased turbidity.
- Handling dry construction materials, such as cement or sand, can create airborne dust that can affect air quality in nearby areas. This dust can be harmful to marine ecosystems.

Mitigation measures

- *Selecting appropriate vessel type to handle construction materials based on its weight and material type.*
- *Make sure that construction equipment is not overloaded or operated in a manner that could result in unnecessary sediment disturbance.*
- *Proper packing, sealing and labelling of construction material to avoid spillage of construction materials.*
- *Using proper handling equipment (closed handling) to avoid accidental spillage*
- *Using non-toxic, eco-friendly materials and coatings to reduce the risk of water contamination.*
- *Regularly monitoring water quality and marine life populations to assess the impact of construction.*

- *choose for construction materials that have a lower environmental impact, such as recycled aggregates, sustainable timber, or other green alternatives to reduce waste and minimize the environmental footprint.*

4.4.2.2. Operation Phase

After the construction the jetty will also be used to handle domestic cargo (food grains, fruits and vegetables, cereals, provisions, etc.) which comes from the mainland. Since the proposed berth is a multipurpose one and the nature of cargo will vary, it is proposed to provide one hydraulic lifting crane.

- Accidental spillage of cargoes due to improper handling.
- Improper packing of bulk grain cargo can injure workers.
- Packaging materials, such as plastic, cardboard, and crates, may be discarded improperly, contributing to marine litter and pollution.

Mitigation measures

The impact due to the handling of cargo will be minimal and will not have much impact on the marine environment.

4.4.3. Impact on plankton

a. Construction phase

Construction of Berthing Jetty will affect the plankton community as they are weak against the turbidity generated in the water due to construction activities. The impacts on these communities are directly linked to the extent up to which turbidity persist. It is anticipated that area of construction will be induced with turbidity may have localized effect on plankton.

b. Operation phase

There will be no impact on plankton community during operation phase.

4.4.4. Impact on benthos

a. Construction phase

Major impact to benthos is anticipated during the construction stage as well as during operational stage. During operational stage, impact to benthos is anticipated only due to movement of vessels. Other likely impact to benthos includes unwanted disturbance in the intertidal area of project site. Strict guidelines to workers should be given to avoid unwanted disturbance to tidal flats. The impact will be localized, and benthos will start recolonizing after the construction period.

b. Operation phase

There will be negligible impact on benthos community during operation phase.

4.4.5. Impact on fish

a. Construction phase

Due to construction of Berthing jetty, impact on fishes are also anticipated. However, since fishes are mobile, they tend to move away from under water disturbances. Thus, no significant impact on fishes is anticipated. The fishes will usually return to the original area once the construction activity is stopped.

Mitigation Measures

b. Operation phase

There will not be any significant impact on fishes during operation phase.

Impact on fishing activity

The development of berthing jetty will not disrupt fishing activity in the vicinity.

Mitigation Measures

Regular monitoring of the turbidity, sediment concentration and the heavy metals in the water column shall be carried out to observe the rise in concentration.

4.4.6. Impact on corals

Kalpeni Islands is well known for its corals because of the coral reefs that surround the islands and the unique way they were formed. The construction of a jetty, approach trestle and finger jetty can significantly impact coral reefs throughout its construction and operation phase.

However, the impact on corals will be confined within the corridor mentioned in **Fig. 4.1.** and the total length of the approach trestle is 225 m from shore and length of the jetty 70 m. The piled foundation would take up only a small footprint of about 0.9 m dia. in trestle area and 1 m dia. in the jetty area. Totally 69.9 m^2 of reef will be possible to impact during the pile foundation.

4.4.6.1. Construction Phase

- Heavy machinery and construction equipment may crush or fragment coral formations.
- Prolonged exposure to sediment can hinder coral metabolism and calcification processes.
- Stress from construction activities can make corals more vulnerable to thermal stress and bleaching.
- Damage to reefs impacts fish populations that depend on coral habitats, affecting local fisheries.

4.4.6.2. Operation Phase

- Increased Turbidity due to movement of vessels will increase the sediment resuspension which will affect corals ecosystem.
- Anchors, propellers, and hulls of vessels can break or crush coral structures.
- Coral damage affects species dependent on reefs for shelter, feeding, and breeding, leading to a decline in biodiversity.
- Excessive lighting from the jetty at night can disrupt the behaviour of reef organisms, including corals, fish, and invertebrates.

Mitigation Measures

- Detailed coral Assessments study was carried out to identify and avoid ecologically critical coral reef zones during site selection.
- Ensure proper collection and disposal of construction debris to prevent contamination.
- Relocate affected coral colonies to nearby healthy reefs or artificial structures before construction begins.
- Construct artificial reefs to provide alternative habitats for displaced marine organisms.
- Prohibit the disposal of hazardous materials and regulate the use of antifouling paints on vessels to prevent leaching of toxins.
- Impose speed limits for vessels in proximity to coral reefs to reduce wake and sediment disruption.
- Establish a monitoring program to track coral health, water quality, and biodiversity around operational areas.

A detailed conservation plan on coral management is given in Chapter 9.

4.4.7. Impact on Seagrass bed

During the study, seagrass species of *Halodule uninervis* and *Thalassia hemprichii* were observed in the proposed project location. Seagrass cover is more and in healthy condition at northwest area of helipad of Kalpeni island. Hence, the development activity will have minimal impact on seagrass beds.

4.4.8. Impact on Coastal Vegetation

Project site and surroundings are devoid of coastal vegetation.

4.4.9. Impacts on mangroves

Mangroves are only present in the south end of the island. The existing mangroves are observed 3.3 km south of proposed project location. Therefore, there is no direct impact on existing mangroves present in the southern end of island. Hence, no impact.

4.4.10. Impact on turtles

In the western coastal region of island, south of proposed jetty, series of groynes (and sandy beaches) are observed at regular intervals along the coast, for protection of shores. These sandy beaches may attract turtles during the nesting period. However, the length of the proposed jetty is 225 m from the shore, therefore the proposed construction will not affect the turtle movement and their congregation. Hence, no impact.

7. ADDITIONAL STUDIES

7.1. RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

7.1.1. Introduction

Emergency/ disaster is an undesirable occurrence of events of such magnitude and nature that adversely affect operations, cause loss of human lives and property as well as damage to the environment. Coastal infrastructure is vulnerable to various kinds of natural and manmade disasters. Examples of natural disaster are flood, cyclone, tsunami, earthquake, lightning, etc., and manmade disasters are like major fire, explosion, sudden heavy leakage of toxic/ poisonous gases, civil war, nuclear attacks, terrorist activities, sabotage, etc. It is impossible to forecast the time and nature of disaster, which might strike a common user infrastructure. An effective disaster management plan helps to minimize the losses in terms of human lives, assets and environmental damage and resumes working condition as soon as possible.

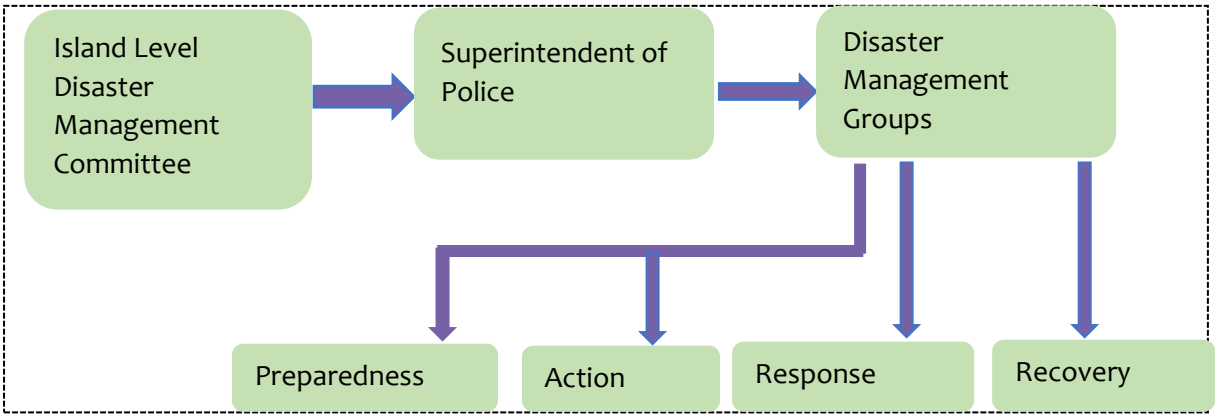
7.1.2. Risk Assessment

Risk is the probability that injury to life or damage to property and the environment will occur. The extent to which risk is either increased or diminished is the result of the interaction of a multitude of causation chains of events. The man-made disasters like fire and accidents also can occur during construction as well as operation phases which would cause the burns, injuries and even loss of human life and property, disrupt services like overhead power and communication lines. Potential impacts due to accidents include injuries and burns which demand surgical interventions, poisoning or exposure to toxic material, trauma and even loss of human life, property damage includes damage/loss of fishing vessels/crafts and other surface vehicles, mechanical devices and equipment used during construction and operational phases. Vessel collision, sinking of boats due to unattended leaks and damages are potential risks. Probability of any hazardous incident and the consequent damage also depend on:

- Wind speed,
- Wind direction,
- Atmospheric stability,
- Source of ignition

7.1.3. Disaster Management Plan

Emergency/disaster is an undesirable occurrence of events of such magnitude and nature that adversely affect operations, cause loss of human lives and property as well as damage to the environment. Coastal infrastructure is vulnerable to various kinds of natural and manmade disasters. Examples of natural disaster are Flood, Cyclone, Tsunami, Earthquake etc., and manmade disasters like major fire, explosion, sudden heavy leakage of toxic/poisonous gases, etc. An effective disaster management plan helps to minimize the losses in terms of human lives, assets and environmental damage.



Overall Disaster Management Hierarchy

Objective of Risk Assessment and Disaster Management Plan

DMP should be developed to make best possible use of the resources available in the operational area as well as outside available resources like Fire Services, Police, Civil Defence, Hospitals, Civil Administration, neighbouring institution and industries.

The objectives of Disaster Management Plan are:

- To contain and control the incident.
- To rescue the victim and treat them suitably in quickest possible time.
- To safeguard other personnel and evacuate them to safer places.
- To identify personnel affected/dead.
- To give immediate warning signal to the people in the surrounding areas in case such situation arising.
- To inform relatives of the casualties.
- To safeguard important records & information about the organization.
- To preserve damaged records & equipment needed as evidence for any subsequent enquiry.
- To rehabilitate the affected areas.
- To restore the facilities to normal working condition at the earliest.

7.1.4. Disaster Identification

a) Natural disaster

A disaster occurs when a hazard such as Earthquake, Flood or Cyclone coincides with a vulnerable situation. Based on project details, geography, environmental setting of the study area and available information following hazards have been identified which may possibly lead to disaster. The probability/seasonality of hazard is listed below **Table 7.1.**

Table 7.1. Probability/seasonality of hazard

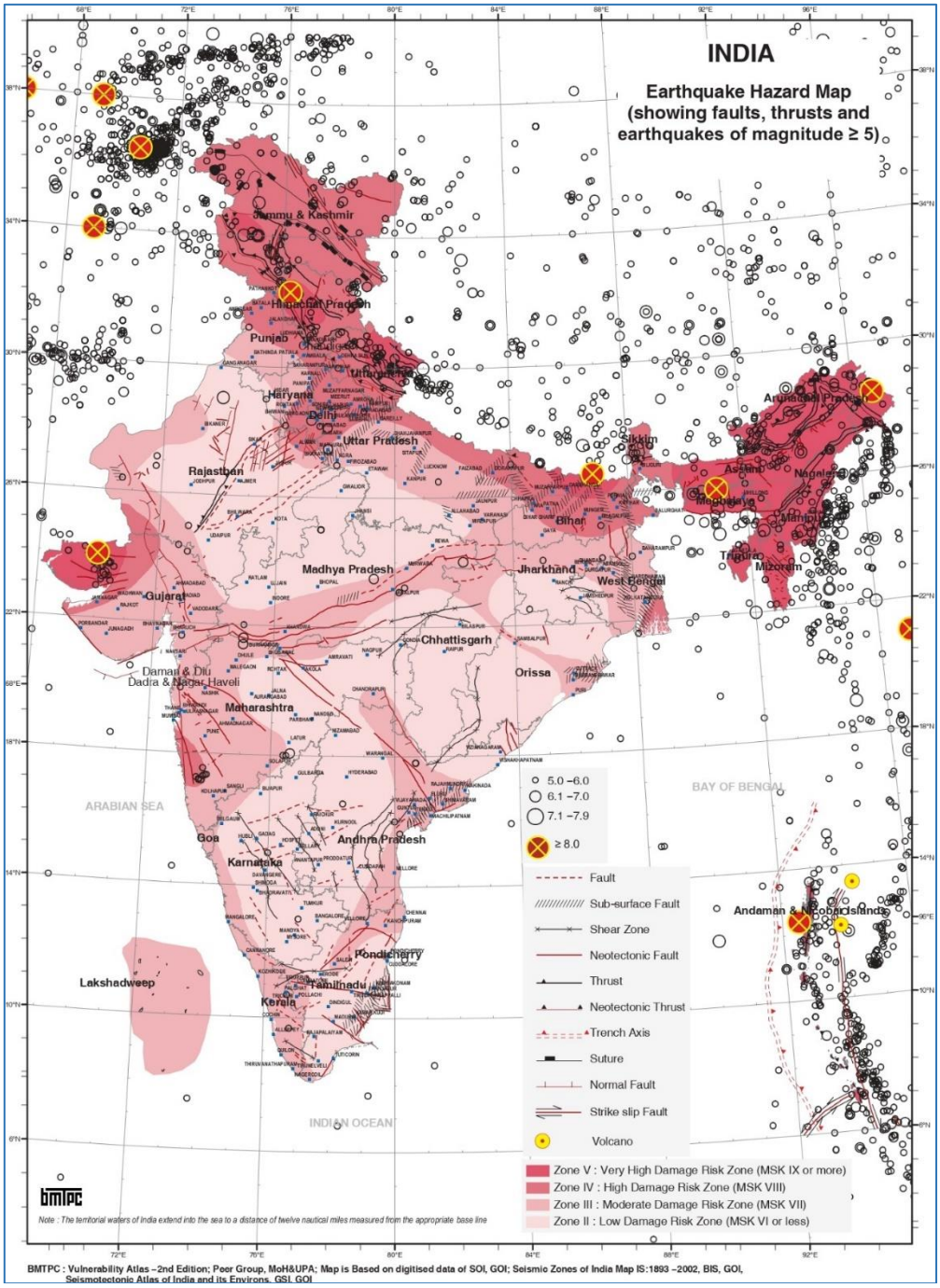
Identified natural hazards in the study area			
Sl. No.	Hazard	Project area	Findings
1	Earthquake	✓	Zone III (moderate risk zone)
2	Cyclone	✓	Wind speed of 2.5 m/sec.
3	Tsunami	✓	Moderate Damage Risk Zone B
4	Flood	x	Low (may occur due to very heavy rainfall, sea surge or tsunami)
5	Drought	x	Moderate Drought

(Source: NDMA - 2019 & 2016)

Disaster identification suggests that the project site is vulnerable to natural hazards. According to District Disaster Management Plan, probability of flood in the island is low and it may occur only in the event of very heavy rainfall, sea surge or tsunami. Among the identified impacts, Cyclone, Sea surge and Earthquake are most probable to occur in the vicinity of project area.

(i) Earthquake

As per Indian Seismic Zone Map, the Kalpeni Island lies in Moderate Damage Risk Zone III where earthquakes of moderate intensity can be expected. Earthquake map is given below.



Earthquake zone map

Action Plan

During Earthquake:

- Evacuate to safest place by following emergency exist route.
- Hold onto a firm object.
- If outside, stay outside.
- If there is no place to take cover, then move to and brace against an inside wall.

After Earthquake:

- Collect report of damages from every division immediately after the event of earthquake.
- Inspection of affected area by Disaster Management Team.
- Procurement of emergency power in case of power failure.
- Inform Island authorities about the damage.
- Take necessary actions for the speedy recovery of operations.

(ii) Cyclones

Based on tracks of cyclones passed in Indian coastal region, the tracks of cyclones which have crossed the coast near Lakshadweep during 1924 to 2023 as documented by the Indian Meteorological Department (IMD) are presented in **Table 7.2.** and the track of cyclones is shown below. It indicates that totally 10 storms had occurred in the vicinity of the project region in the last 100 years. The occurrence of storms in this region are more frequent in December (04) followed by May (03) and November (03). More details are given in Chapter 3.

Table 7.2. Number of cyclones crossed over project area (1924 – 2023)

Month	Cyclones crossed over project area
January	-
February	-
March	-
April	-
May	03
June	-
July	-
August	-
September	-
October	-
November	03
December	04
Total	10

Source: cyclone e-atlas published by IMD – 2023

Action plan

In case of warning received from India Metrological Department, following action shall be taken immediately:

Before Cyclone

- Control room shall monitor low pressure formation, cyclone and IMD published details and warnings regularly.

- In case of any warnings, the same shall be reported to onsite disaster management head, HSE and group heads etc.
- Onsite Disaster Management team shall conduct a meeting, if possible, immediately after the warning to recollect the facilities and action to be taken.
- All preparations before the onset of cyclone, actions during cyclone shall be reviewed.

During Cyclone:

- Sound Emergency alarm/siren.
- Inform all staffs about the occurrence of event.
- Adequate manpower with tools, welding sets, ropes etc. shall be maintained during cyclone for rescue operation.

After Cyclone: Immediate attending of work area and report damage if any to higher authority. Immediate attending of damages and record should be kept for quick recovery as soon as possible.

(iii) Tsunami

Tsunami is a series of wave train generated in the ocean by a hydraulic impulsive force that vertically displaces the water column. Earthquakes, landslides, volcanic eruptions, explosions and even the impact of cosmic bodies taking place in the ocean can generate Tsunami waves with long periods (≈ 30 min), long wavelength (≈ 100 km) with a high velocity of propagation (≈ 700 km/hr).

Tsunamis are shallow water waves which propagate with phase velocity equal to the square root of the product of the acceleration due to gravity and the water depth. For example, in the Pacific Ocean, where the typical water depth is about 4000 m, the Tsunami wave travels at about 700 km/hr. Because the rate at which the wave loses its energy is inversely related to its wavelength, Tsunami not only propagates at high speed, but it can also travel great transoceanic distances with limited energy losses and reach different continents in shorter time i.e., the energy propagating with Tsunami waves remain nearly constant.

Among the various factors causing the occurrence of Tsunami, the large vertical movements of the earth's crust is more predominant and it can occur at tectonic plate boundaries. The plates that interact along these boundaries are called faults. Around the margins of the faults, the denser oceanic plates slip under the continental plates in a process known as subduction. Such subduction earthquakes are particularly very effective in generating the devastating Tsunamis.

The energy flux due to Tsunami is proportional to its velocity of propagation and height and it remains nearly constant till reaching the coast. Consequently, the velocity of propagation gets retarded when it enters shallower water and its height gets amplified. Because of this shoaling effect, the Tsunami that is imperceptible at Deep Ocean close to centimetre height may rise up to several metres near the coast called run up.

When Tsunami finally reaches the coast, the crest of the wave appears as rapidly risen water mass gushing into the coastline as a bore with a crashing velocity of 700 km/hr for more than 10 - 30 min. The trough of the wave will appear as the withdrawal of water mass with same speed back into the ocean swallowing everything on the land and dragging back into the ocean.

In worst case, if a Tsunami occurs then there will be surging of Tsunami waves with a speed of > 60 kmph into the shore and the run-up will be > 4 m. The gushing of water will sweep and flood the areas having elevation < 3 m MSL.

Disaster Management Plan for Tsunami and Storm Surge

Cyclone, Tsunami and Storm surge are the most destructive force among the natural devastations. It causes instant disaster and burial of lives and destruction to entire coastal properties. The damage and loss can be minimized if appropriate preparedness plan is formulated. The following statutory guidelines are recommended by National Disaster Management Authority (NDMA) to minimize the impact due to Cyclone, Tsunami and storm.

- Developing sand dunes along the coast with shrubs or Casuarina trees for stabilization of the sand dunes (Tsunami Mound).
- Raising the ground level (above the design water level) with natural beach sand so as to rehabilitate the coastal region.
- Development of coastal forest (green belt) by planting casuarinas and coconut trees along the coastline to cover minimum of about 500 m width of the beach.
- Adopting natural beach nourishment to create steep beach face.
- Creation of sandy ramps at close intervals along the coast.

In addition to the guidelines by NDMA, it is also necessary to adopt various preventive actions in the coastal region of the project site.

Preparedness Plan

The preparedness plan shall contain details about: i) warning that should be given ii) Protective measures to contain the effect of surging water level and iii) Other precautionary measures to be taken. The following measures are the key aspects in the preparedness plan.

i) Coordination with International and National Agencies
ii) Vigilant online monitoring
iii) Emergency Evacuation

Coordination with National Agencies

After the 2004 Tsunami affected the Indian sub-continent, the following organizations are involved on watch and cautioning the government and public in the event of possibility of occurrence of Tsunami. As a part of Tsunami hazard mitigation, warning systems have been established in India by the coordination of the following organizations.

i) Indian National Centre for Ocean Information Services (INCOIS), Hyderabad.
ii) National Disaster Management Authority (NDMA), New Delhi.
iii) Indian Meteorological Department (IMD), New Delhi.
iv) National Institute of Ocean Technology (NIOT), Chennai.

The contact details of National agencies are given below:

Organization	Address	Email ID	Contact Number
Lakshadweep Collectorate	Kavaratti	lk-coll@nic.in	04896 - 262256
Suptd.of Police	Kavaratti	lak-sop@nic.in	04896 - 262750

Vigilant online monitoring and emergency alarm

INCOIS in collaboration with NIOT has deployed DART buoys at 3 locations in the deep ocean along the fault plane of Andaman plate and Indonesian plate.

The online monitoring is capable of raising alarm in case of instantaneous change in surface elevation exceeding centimetre which can be caused by the generation of Tsunami. IMD interacts with the above institutions and takes the responsibility of broadcasting the disaster through various Medias. In case of a Tsunami, the warning is usually broadcast based on the earthquake occurred in the nearby ocean. Irrespective of definite occurrence of Tsunami, the possibility to occur is also considered as equally vulnerable and accordingly the warning news is instantly flashed through Radios and TVs. The notification is followed by orders from the local Government Authorities on reinforcing evacuation, prohibition to enter the demarcated risky zone and mobilizing facilities for easier evacuation and augmenting medical facilities.

There are a variety of evacuation notification systems in case of Cyclone, Tsunami and Storm surge. They include sirens, weather radio, Emergency Alert System, Telephones, Emergency Weather Information Network etc. In each system, it should be noted that the application and message is consistent as well as continuous with repetition of messages with periodicity at short time interval. It should be ensured that the warning reaches immediately to all people prone to the devastation. The time at which the cyclone, storm surge or Tsunami may reach the coast can be predicted with sufficient lead time. The destruction can be minimized if the coastal populations are warned and evacuated to elevated place and inland in time. Therefore, keeping vigil on the warning is the very important aspect in protecting the lives.

A vigilant team must be created. An Emergency Alarm should be in place in all the islands. If warning is given instantly activate the emergency alarm and give caution to the vigilant team so that they can immediately start the rescue operation.

The vigilant team should have proper knowledge about the warning systems and should have attended the training programs conducted by the Tsunami warning centres. The training should be given periodically to update the system and methods of warning. The team should take the responsibility of giving immediate warning to the people in and around the power plant in case of Tsunami and they have to undertake the Emergency Preparedness Action. Safety drills should be conducted periodically.

Operational and emergency preparedness procedures should be planned meticulously in order to act on the warning and to disseminate it rapidly and effectively to the public.

Emergency Evacuation

Evacuation of people from risk areas is the first priority when early warning is received or the natural warning sign indicates the immediate arrival of cyclone, Tsunami wave or rise of storm surge.

Evacuation plan describes the time span available before and during the Tsunami or storm surge event. When facing local threat, evacuation procedures most possibly will have the character of a 'runaway effort' and people should not expect to receive much institutional support. The primary objective should be bringing as many people as possible out of the reach of the wave's impact to safe or 'relatively safe' areas. Therefore, necessary steps have to be taken in advance to enable and support the community at risk to protect themselves at any time

(iv) Flood

In general, Lakshadweep Island is not prone to flood.

9. ENVIRONMENTAL MANAGEMENT PLAN

9.1. Introduction

Development of any infrastructure in the coastal environment includes both social and environmental impacts. To address the anticipated impacts and to implement the mitigation measures, Environment Management Plan (EMP) needs to be formulated. EMP identifies the approach, procedures and methods that will be used to control and minimize the environmental and social impacts of construction and operational activities associated with project development. It is intended to reduce the negative impact and to enhance the positive benefits from the project.

The main objectives of Environmental Management are to:

- Identify key environmental issues anticipated to be encountered during construction and operation phases of the project
- Provide guidelines for appropriate mitigation measures
- Ensure the mitigation measures are implemented
- Establish systems and procedures for implementing mitigation measures
- Monitor the effectiveness of mitigation measures
- Take necessary prompt action when unforeseen impacts occur

The proposed project involves construction of jetty with approach trestle, passenger facilitation centre with modern amenities, development of boat landing centre with finger jetty, boat repair shed, ice plant and fuel station and road connectivity to existing road and development of auxiliary infrastructures. The impacts due to construction and operation of the proposed development were described in **Chapter 4**.

9.2. Environmental Management Plan

The various impacts in any project development can be categorized as mitigable and non-mitigable and it is essential to list the impacts accordingly. The key activities or aspects of the proposal that may potentially affect habitat of flora and fauna and require application of management controls include,

- Construction of the approach trestle: Site preparation, construction of piling/foundation, storing of construction materials, construction of service utilities, construction of footpath.
- Construction of berth: Site preparation, constructions of deck slab, fixing of precast deck slab construction of long beams, construction of piling/foundation, storing of construction materials
- Construction facilitation centre: Site preparation, construction of waiting hall including foundation, flooring etc.

Labour Management Plan

The total number of workers to be employed during construction phase will be around 18000 nos. Most of the labor will be recruited from the mainland, and a temporary labor camp may be set up during the construction period. The basic facilities required for the labours at the workplace as per the Contract Labour (Regulation & Abolition) Act, 1970 will be made available.

Sanitation Facility

There should be one latrine for every 25 males or females. Every latrine shall be under cover and so partitioned off as to secure privacy and shall have a proper door and fastenings. "For Men only" and "For Women only" must be displayed in the local language in the door of the latrines. The notice shall also bear the figure of a man or of a woman, as the case may be. Sanitation facility should be provided to the workers during construction.

Solid Waste Management

Construction waste consisting of bricks, stones, pipes, concrete waste, steel waste, etc. will be generated during the construction phase. The waste will be properly disposed or recycled.

Transportation and heavy machineries

- All vehicles used will have a valid Pollution Under Control Certificate.
- Regular servicing and maintenance of machineries as well as vehicles to control unwanted air pollutant emission.

Marine Environment

- Periodic monitoring on the seawater, seabed sediment and marine ecology will be carried out in the coastal region and the report will be submitted to the statutory bodies as required.

9.3. Coral Management Plan

Coral reefs are one of the most diverse and highly productive ecosystems in the coastal zone and contribute to the sustenance of the country through fisheries, tourism, etc., and also protect the shore from erosion and natural calamities by buffering of waves and currents. Coral reefs play a major role in climate change, by fixing atmospheric nitrogen, regulating CO_2 and Ca levels. Reefs also offer shelter to various organisms, including ornamental fishes, crabs, shrimps, sea cucumbers, sea urchins, octopuses, eels, etc.

Besides hard stony coral reefs, soft corals also exist in coral reef ecosystems, in clear, warm tropical seas. Hard corals produce a rigid skeleton made of calcium carbonate ($CaCO_3$). The calcium carbonate of corals provides a hard outer structure that protects the soft parts of the coral. Colonial hard corals are made up of hundreds to hundreds of thousands of individual coral polyps that cement themselves together by the calcium carbonate they secrete.

Soft corals do not produce rigid calcium carbonate skeletons and do not form reefs, though they are found in reef ecosystems. Like hard corals, most soft corals are also colonial; what appears to be a single large organism is actually a colony of individual polyps that form a larger structure. Visually, soft coral colonies tend to resemble trees, bushes, fans, whips, and grasses.

In India, a total number of 585 species (108 genera, 23 families) of Scleractinian fauna has been reported (De *et al*, 2020). Highest number of species (523 species belonging to 95 genera and 23 families), was reported from Andaman and Nicobar Islands, followed by Gulf of Mannar (169 species of 46 genera and 16 families), Lakshadweep Islands (165 species of 54 genera and 17 families) and Gulf of Kachchh (76 species of 30 genera and 11 families).

Among the Indian reefs, 298 species (52.6 %) occur only in Andaman and Nicobar Islands, and are not found in other reefs. Likewise, 28 scleractinian species (5 %) are unique to Gulf of Mannar,

followed by 7 unique species (1.2 %) in Lakshadweep Islands. In Gulf of Kachchh, only one unique species (0.2 %), namely *Acanthastrea simplex* occurs.

Among the total number of 585 species, 36 scleractinian species (6.4 %) are common and present in all the four major reef regions.

Lakshadweep Islands

In the south-western part of India, Lakshadweep reef archipelago is located 200-400 km away from the Indian mainland and is formed by a series of coral atolls. This Lakshadweep Chagos ridge supports the longest chain of true atolls and supports divergent ecosystems characterized by a rich diversity of corals and associated marine organisms. The submarine ridge that supports the islands, rises from a depth ranging from 1500 to 4000 m. There are 6 tiny islands, 12 atolls, 3 reefs and 5 submerged banks, covering an area of 32 km^2 with lagoons occupying about 4200 km^2. Only 11 of the 36 islands are inhabited (Venkatraman, 2006).

In the Lakshadweep Islands, among the 17 families, Acroporidae (51 species, 5 genera), Merulinidae (34 species, 14 genera), and Poritidae (17 species, 2 genera) form the major species assemblage. At the genera level, *Acropora* contributes 36 species, followed by *Porites* (14 species) and *Montipora* (9 species).

Department of Environment and Forest, Lakshadweep (2023), has recently compiled the database on hard corals and has listed 80 species of corals, belonging to 34 genera. They are *Acropora (21 species), Porites (6), Favites (5), Favia (3), Fungia (3), Pocillopora (3), Turbinaria (3), Astreopora (2), Galaxea (2), Montipora (2), Cyphastrea (2), Montastrea (2), Platygyra (2), Goniastrea (2), Goniopora (2), Lobophyllia (2), Isopora (1), Echinopora (1), Diploastrea (1), Leptoria (1), Plesiastrea (1), Merulina (1), Hydnophora (1), Mycedium (1), Pectinia (1), Pavona (1), Gardineroseris (1), Herpolitha (1), Polyphyllia (1), Symphyllia (1), Stylophora (1), Psammocora (1), Tubastrea (1)* and *Heliopora (1)*.

Kalpeni Island

In Kalpeni island, in a survey carried out in 2016, a total of 69 species belonging to 26 genera and 13 families, including 2 non-scleractiinian coral genera *Heliopora* and *Millepora* were reported. In terms of species diversity, the genus *Acropora* dominated with 16 species followed by *Porites* (5 species). The genera *Platygyra, Favites* and *Pocillopora* were next in abundance, each with 4 species (Jasmine *et al*., 2017).

Southwest: Some live coral colonies were observed in the southwest tip of the island. These areas are largely devoid of human habitation and other activities. The coral species observed include *Acropora lamarcki, Platygyra* sp., *Favites flexuosa, Psammocora contigua*, etc. The southwestern tip where live corals were observed, is located at an aerial distance of 3.36 km from proposed western jetty.

Acropora lamarcki

Platygyra sp.

Favites flexuosa

Psammocora contigua

Southwest tip

Northern tip: Some live coral colonies were observed in the northern tip of the island. These areas are largely devoid of human habitation and other activities. Few *Acropora* sp., colonies were observed and they were located at an aerial distance of 1.80 km from proposed western jetty.

Acropora sp.


Northern tip

Proposed project area

The project area has wide sandy beach on both the northern and southern sides of proposed approach trestle in the lagoon. The upper high tide area has gentle sloped wide sandy beach. The mid and low intertidal areas mostly are covered under tidal water and sparse seaweeds could be observed. In the backshore, where the facilities are proposed, mostly coconut trees occur. No corals were found in proposed project area.

Proposed West Jetty area

Proposed West Jetty - north side

Proposed West Jetty - south side

Proposed West Jetty - land side

Proposed land facilities area

Proposed land facilities area

Experts involved in the coral study

Coral management plan has been prepared by the subject experts of Indomer. In order to meet specific requirements of this plan, the following subject experts are involved in the study. Dr. Deepak Apte, (Marine Ecology, Former Director of Bombay Natural History Society (BNHS), Dr. T. Balasubramanian, (Marine Biology, Former Dean and Director, C.A.S. in Marine Biology, Annamalai University), Dr. S. Sundaramoorthy, (Former Scientist F, ICMAM-PD, MoES, Chennai), Dr. P. Chandramohan, (Ocean Engineering, Former Scientist, CSIR-NIO, Goa), Dr. P. Venkadeswaran, (Plant Taxonomy and Ecology & Biodiversity) and Dr. G. Idayachandiran, (Marine Biology).

Habitat Analysis based on video transects

Methodology

This study utilized underwater video footage to assess benthic habitat composition along transects.

1. **Transect Establishment:**
    - Transects were established with a defined length of 100 m.

2. **Video Acquisition:**
    - Underwater video footage was collected along each transect with help of SCUBA Diving/ Snorkelling.

Coral study at proposed western jetty of Kalpeni island

SCUBA diving at western side of Kalpeni island

3. **Data Collection:**
   - 100 frames were randomly selected from each video (in case of multiple videos appropriate number of frames based on duration of video were extracted).
   - For each frame:
     - The dominant benthic habitat within the frame was identified.
     - Due to the inherent variability in camera angle and distance from the substrate, the largest habitat observed within the frame was assumed to represent the dominant habitat at that specific point along the transect.
   - The percentage composition of each benthic class was determined based on the frequency of occurrence of each class within the 100 frames.

Majority habitat is **Algae** followed by **DCA**

Majority habitat is **Sand**

Majority habitat is **DCA** followed by **CM**

Kadmat E (T7) majority habitat is **Sand**

Habitat Classes used for analysis (Depends on location)

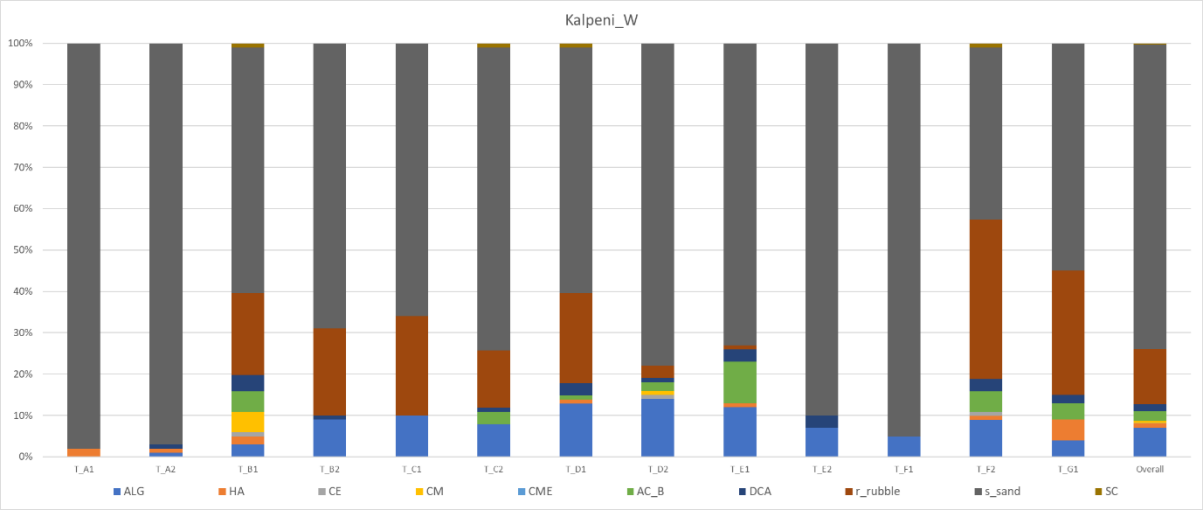
Higher class	Class Name (Code)	Class Information
Algae	ALG	Algae - turf
Algae	CA	Coralline algae (Pink)
Algae	HA	*Halimeda* sp.
Dead Coral – Acropora with algae	DC_ACA	Dead Coral *Acropora* with algae
Dead Coral – with algae	DCA	Dead Coral with algae
Live Coral	AC_B	*Acropora* Branching
Live Coral	AC_D	*Acropora* Digitate
Live Coral	AC_SM	*Acropora* - Submassive
Live Coral	AC_T	*Acropora* Tabular
Live Coral	CB	Coral Branching
Live Coral	CB_POI	Coral Branching - Pocilloporid
Live Coral	CB_POR	Coral Branching - *Porites*
Live Coral	CB_STY	Coral Branching – *Stylophora* and allied
Live Coral	CE	Coral encrusting
Live Coral	CF	Coral Foliose
Live Coral	CM	Coral Massive
Live Coral	SC_soft coral	Soft corals
Other	GC	Giant clams
Other	SC	Sea cucumber
Rubble	R	Rubble
Sand	S	Sand

Assumptions and Limitations:

- **Dominant Habitat Assumption:**
  - The methodology relies on the assumption that the largest habitat observed in a frame accurately represents the dominant habitat at that point. This assumption may introduce bias, especially in areas with complex or heterogeneous benthic communities.

- **Camera Angle and Distance:**
  - Variations in camera angles and distance from the substrate can significantly influence the apparent size and visibility of different habitats. These factors were not explicitly accounted for in the analysis.

- **Random Frame Selection:**
  - The method assumes that the 100 frames selected are representative of the entire transect. However, the randomness of frame selection may introduce some degree of variability in the results.



Dominant Habitat Components:

- **Sand:** This appears to be the most dominant habitat component across many of the locations. It suggests a significant presence of sand substrate.
- **Rubble:** This component is also prevalent in several locations, suggesting areas with sediment accumulation or disturbance.

Other Significant Components:

- **Live Corals:** Various types of live corals are present, including Acropora (AC_B), and encrusting corals (CE). These contribute to the overall coral cover and biodiversity, although their abundance is lower compared to sand and rubble.
    - T_D1 has only 1% Live corals, whereas T_C2 and T_F2 have 3% coral cover. T_D2 and T_G1 have 4 % corals, whereas T_F2 and T_E1 have 6% and 10% respectively. T_B1 has the highest coral cover, i.e. 11%.

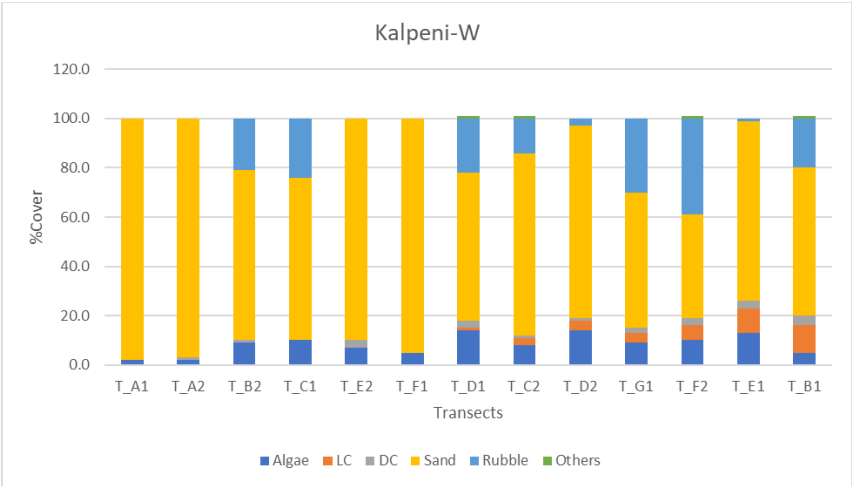


Fig. 9.1. % Coverage of major benthic habitats at Kalpeni-W (Arranged as per Coral coverage [LC-Orange colour])

- **Algae:** Algae are also a significant part of the habitat, with different types present such as turf algae (ALG) and coralline algae (CA_Coralline_Algae).
- **Dead Coral with Algae (DCA):** This component is present in some locations, indicating that there has been some coral mortality, which is now covered by algae.

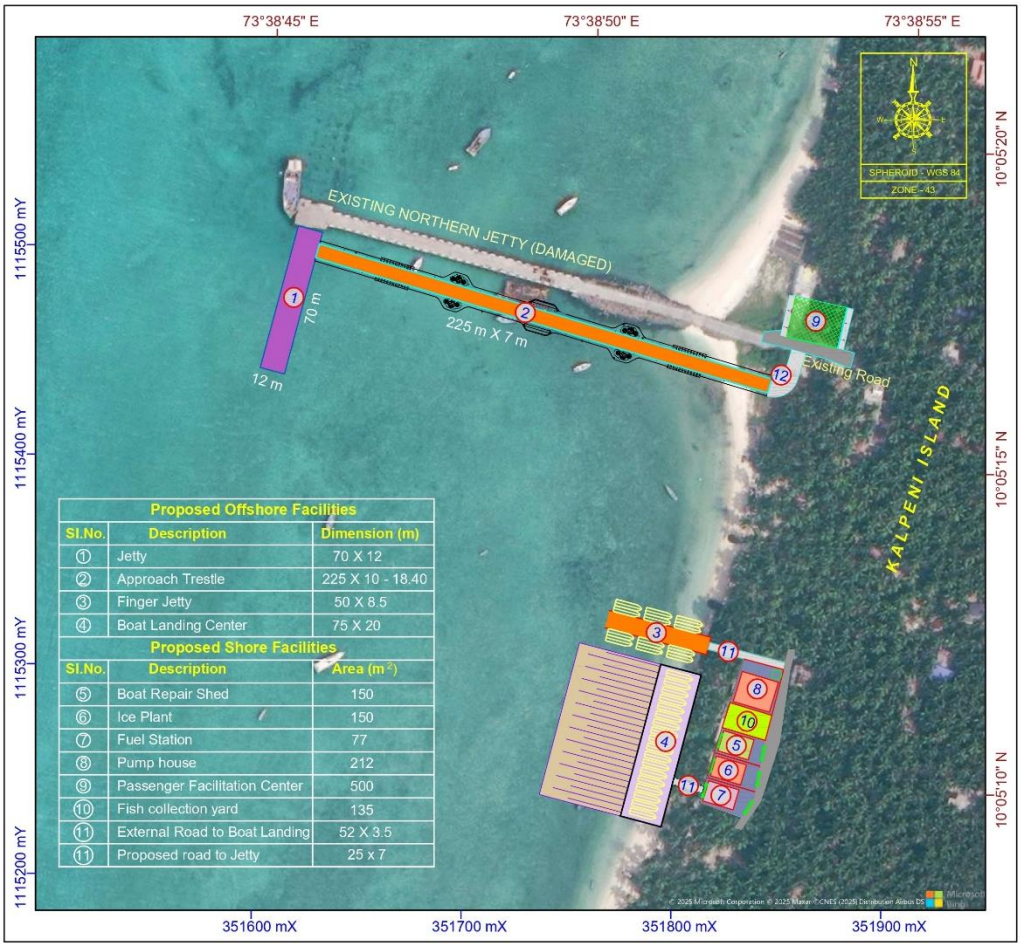
Overall Habitat Characteristics:

The habitat appears to be dominated by sand and rubble, suggesting a potentially disturbed or dynamic environment. The presence of live corals and algae indicates some level of biological activity and habitat complexity. However, the dominance of sand and rubble might suggest a habitat that is more exposed to wave action or currents, leading to sediment accumulation.

Coral management plan

Proposed facilities in Project Region

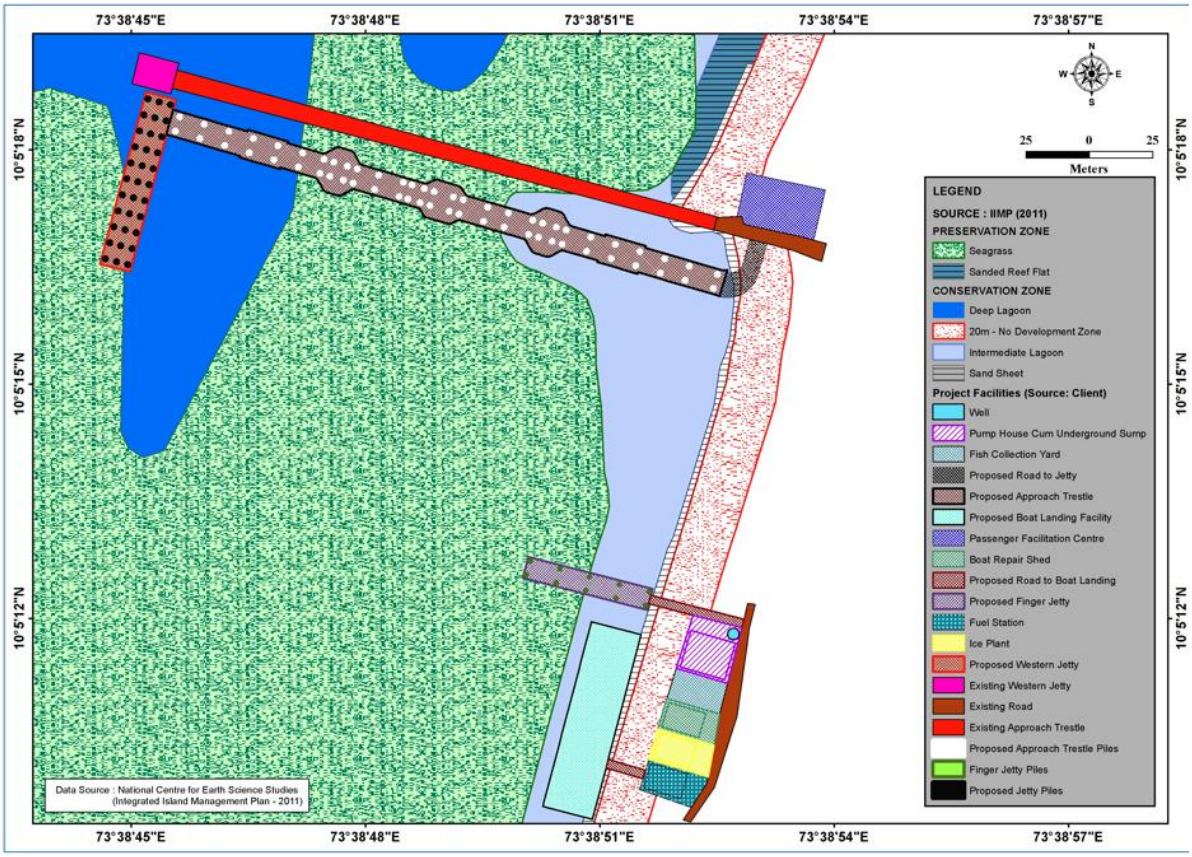
The project site is located on the western side of Kalpeni. In the project site, both the offshore and onshore facilities have been proposed. The offshore facilities include the jetty and approach trestle. The onshore (land) facilities include Passenger facilitation centre, boat landing centre with finger jetty, boat repair shed, ice plant, fuel station and road connectivity to existing road.The existing jetty and approach trestle are damaged. Hence the new jetty and approach trestle are proposed just south of existing damaged jetty and approach trestle.



Proposed facilities in Kalpeni Island - Western side

Western side

According to the CRZ map, the approach trestle, jetty and finger jetty piles pass through shallow lagoon, sea grass and deep lagoon areas.



Proposed piles (approach trestle, jetty and finger jetty)

Impact zones due to pile foundation

The lengths of the approach trestle, jetty and finger jetty are 225 m, 70 m and 50 m respectively. The pile foundation would take up only a small footprint of about 0.9 m dia. in trestle area and 1.3 m dia. In approach trestle area, 59 piles will pass through sea grass (26), shallow lagoon (23) and deep lagoon (10). In jetty area, 33 piles will pass through sea grass (7) and deep lagoon (26). In finger jetty area, 10 piles will pass through sea grass (4) and shallow lagoon (6). Totally, 24.66 m^2 of sea grass area will be impacted during the pile foundation. However, underwater coral transect study indicated live corals in 7 transects (T D1, T C2, T D2, T G1, T F2, T E1 and T B1) out of total 13 transects **(Fig. 9.1.).** The details of areas likely to be impacted by proposed piles foundation are given in table below.

Details of areas likely to be impacted by proposed piles

Facility name	Ecologically sensitive area	Area (m^2)	
Approach trestle	Seagrass	16.64	37.76
	Shallow lagoon	14.72	
	Deep lagoon	6.4	
Jetty	Seagrass	5.46	25.74
	Deep lagoon	20.28	
Finger jetty	Seagrass	2.56	6.4
	Shallow lagoon	3.84	
Total		**69.9**	**69.9**

Impact on corals

Pile construction activities may cause physical damage to the reef, either through direct contact or sediment movement.

Water turbidity will be increased by the suspended sediments produced by piling operations. Because symbiotic algae (zooxanthellae) are necessary for coral life, their ability to photosynthesis is restricted by high turbidity, which decreases light penetration.

The coral ecosystem may get contaminated if fuels, lubricants, or other chemicals used in piling operations flow into the nearby coral environment. Corals may be impacted from improperly handled cement and other building materials that change the nearby water environment.

Mitigation measures

Before the piling operation, any live corals observed in the proposed piling activity area, shall be relocated to a neighbouring environment using the techniques described in the coral conservation methods mentioned below.

Appropriate silt curtains shall be used during piling operations, in order to minimize/ contain the turbidity / suspended sediment levels, of the ambient water environment.

Closed grab excavator shall be used for all piling constructions, and double casings with Y-shaped funnels installed will keep any muddy water spills contained within the casing, and additional protection from the Y-shaped funnel to prevent affecting the reef environment outside the work area.

The proposed pile foundation has sufficient spacing, limiting hydrodynamic changes in the flow regime and preventing negative impact on water quality while operation.

Threats to corals

Coral reefs are subjected to various natural and anthropogenic stressors, including climate change, (such as rising seawater temperatures), diseases, cyclonic disturbance, declining water quality (turbidity, pollution, pathogens, etc.,), sedimentation, destructive fishing methods, over-exploitation of reef fauna, tourism, physical damage due to anchor drop, etc. In addition to climatic causes, primarily high seawater temperatures, the uncontrolled and growing dumping of untreated residential sewage into the reef habitat are also major threats to the corals (Thinesh *et al.,* 2009).

Climate change

Climate change, especially sea surface temperature, is one of the main factors influencing the health of coral ecosystem. Corals have a low capacity for adaptation and are susceptible to thermal stress. Unless there is thermal adaptation or adaptation by corals, increases in sea surface temperature of around 1-3°C are predicted to cause more frequent coral bleaching events and widespread death (Eakin *et al.,* 2008).

Coral disease

Diseases are major secondary stressors causing coral mortality in the reefs. Diseases may cause irreversible damage to the corals structure and functioning. Diseases affecting hard corals have become the most important factor in the decline of coral reefs in some regions (Weil, 2004).

Reproduction, growth, community structure, species diversity, and many other animals linked with reefs can all be significantly altered by coral disease.

In an earlier study of coral diseases in Gulf of Mannar and Lakshadweep Islands (Kavaratti, Agatti) during 2011, nine coral diseases (white band, white pox, white plague, pink line syndrome, pink spot, yellow band, fungal blotch, black band and necrotic patches) were observed. Coral disease prevalence was higher in coral reefs of Gulf of Mannar than in the Lakshadweep islands (Kavaratti and Agatti) (Thangaradjou *et al*., 2016).

In a recent study (Jan. 2016 - Nov. 2018), on coral diseases in Chetlat island, six coral diseases were observed and reported to cause mortalities in hard corals. The six coral diseases observed were Black Band Disease (BBD), White Syndrome (WS), Pink Line Syndrome (PLS), Porites Ulcerative White Spot (PUWS), White Band Disease (WBD) and Porites Peeling Tissue Loss (PorPTL) disease, affecting different genera of reef building corals. Among the affected genera, *Porites* hosted the highest number with six coral diseases, followed by *Pavona* with two diseases and the remaining genera were affected by one disease each (Thaha and Rathod, 2019).

Coral Management

Coral reef conservation aims to preserve biological productivity and diversity, provide traditional and sustainable uses (such as fisheries and tourism), and shield the reefs' aesthetic, historical, biological, and geological value from human interference. Protecting coral reefs by reducing or eliminating the stressors causing degradation should be important for their conservation. Development of coral nursery and transplantation are the ideal techniques for increasing the coral cover in the islands.

Pollution control

Maintaining the health and richness of coral reef ecosystem depends on preventing pollution in these reef ecosystems. Sewage waste should be treated before it is released into the sea, to prevent harmful chemicals, nutrients, and pathogens causing damage to coral reefs. By limiting the use of single-use plastics and encouraging recycling initiatives, plastics can be kept out of the ocean, where they can damage marine life and destroy coral reefs.

Shipboard pollution

Coral reefs are affected by shipboard pollution, which is mostly caused by harmful materials that ships release into the ocean. Marine pollution can be caused by ships improperly disposing of their waste material, particularly plastics. Plastics can introduce harmful compounds, block sunlight, and physically damage corals. Ballast water from ships frequently contains contaminants, disease causing pathogens, and invasive species that can damage coral reefs and other marine life by disturbing the local marine ecosystem.

The proposed project on jetty construction is for increasing the passenger and cargo traffic to the islands. The passengers in ships need to be cautioned about prevention of pollution by disposal of solid / liquid wastes to the marine environment. The vessel crew by default shall adhere to the standard norms.

Prevention of oil spill

Coral reefs are impacted by oil spills both directly and indirectly, which can degrade ecosystems, reduce biodiversity, and make recovery difficult in the long term. Corals obtain their energy from symbiotic interactions with algae (zooxanthellae). These algae can be damaged by oil pollution,

which causes coral bleaching, a condition in which the corals expel the algae, losing their colour and vitality.

Oils, especially diesel, petrol, aviation fuel, kerosene, etc., are likely to be transported in significant quantities to the islands. Standard safety precautions shall be taken for loading, transporting and unloading the above items. Standard oil spill contingency plans shall be prepared according to the passenger / cargo ships quantum, and shall be implemented accordingly, in case of any oil spill, or leakage, etc.

Invasive species management

Certain invasive species, such as predatory starfish (like the crown-of-thorns starfish), cause direct impact to coral colonies and degrade reefs by feeding on coral polyps. Because they modify nutrient cycling, reduce the amount of food available to the marine organisms, or alter the physical structure of the reef, invasive species are able to alter the way ecosystem's function. In order to preserve coral reefs and their biodiversity, it is essential to stop the spread of invasive species through improved ballast water management and appropriate fishing methods.

Conservation methods

In Lakshadweep archipelago, the corals have been degraded / threatened by a range of natural and anthropogenic stressors, like cyclones, climate change, and anthropogenic interventions (Riyas *et al*. 2020). These threats necessitate the development and implementation of active coral restoration programs.

Transplantation of corals can serve as an ideal management strategy for development of coral colonies in the reef. Coral restoration can be achieved by transplanting fast-growing and healthy coral fragments. Massive corals have also been recommended for transplantation due to their lower susceptibility to damage and mortality. Therefore, both branching and non-branching corals shall be used for coral restoration.

Coral rescue program

The live coral colonies, both branching and massive corals, likely to be damaged at the proposed project area, shall be collected and relocated in a suitable nearby location, for survival at natural conditions. The live coral colonies alongwith the substrate (e.g., dead coral rock, on which the live coral colony has developed), can also be removed as such and translocated. Suitable sites may be identified prior, in and around the island for such coral rescue programs. Further, these also should be monitored for their survival percentage.

Coral translocation

Coral translocation is the technique of relocating corals, usually to improve coral populations in places under stress from the environment or rehabilitate damaged reefs. The main objective is to relocate coral colonies to more favourable conditions where they have a better chance of survival. Coral fragments or entire colonies are carefully removed and then moved to restoration areas.

Coral transplantation

Obtaining coral larvae or fragments from healthy populations, raising them in controlled conditions (like coral nurseries), and then relocating them to damaged reefs is a method of transplantation.

In Lakshadweep islands, large extents of dead coral reefs and rocky intertidal areas are observed. In these islands, transplantation of corals can serve as an ideal management strategy for conservation and development of new coral colonies.

A recent study was conducted by Department of Science and Technology, Lakshadweep Administration, with an aim to develop an effective transplantation method by establishing a coral nursery in the Kavaratti lagoon, focusing on the use of fast-growing coral species to facilitate the rapid restoration of degraded reefs.

Coral nursery development

Coral fragments were collected from different locations of the lagoon, including the intertidal zone, inner reef lagoon, reef crest of the atoll, etc., to obtain different fragments grown in different conditions and locations in the lagoon. Coral fragments of both acroporid and non-acroporid corals that naturally grew in the lagoon and other areas were collected and placed in artificial substrates (concrete blocks) and monitored for their survival and growth rates for 2-year period during Jan.2016 – Jan.2018 (Riyas *et al*., 2024). Growth rate of acroporid corals was higher than non-acroporid corals. It was reported that establishment of a coral nursery also led to increased habitat for marine life and fish aggregation, contributing to enhanced biodiversity and ecosystem resilience.

Coral nursery can be developed in the lagoon area using both acroporid and non-acroporid coral species. Coral transplantation can be taken up in suitable locations around the island and in lagoon areas, for coral restoration of the island (Ramesh *et al*. 2020).

Transplanted coral fragments deployed in the lagoon bed at Kavaratti (2016 to 2018)

Well-developed coral colonies in the transplantation site after two years (2016 to 2018)

Source: *Riyas et al. (2024) Successful establishment of a coral nursery for active reef restoration in Kavaratti Island.*

Creating awareness

Knowledge and awareness of economic / ecological importance of coral reefs is crucial to their preservation and long-term management. Such awareness should be created to the stakeholders, including general public, students, fishermen, tourist operators, government and non-government organisations, etc.

In order to educate the community on the importance of coral reefs, including their role in biodiversity, coastal protection, and livelihoods (such as fishing and tourism), workshops, seminars, and school programs should be organized. Also, locals should be involved in coral conservation initiatives, such as restoration projects, reef monitoring, and sustainable fishing methods, in order to cultivate a sense of responsibility and involvement.

Recommendations

- It is recommended that coral nursery may be developed in the lagoon of Kalpeni Island. Establishment of a coral nursery has been demonstrated successfully in Kavaratti Island lagoon.
- Coral restoration / transplantation program shall be implemented in suitable sites, in order to improve coral reef coverage.
- Restoration / increase of coral cover will improve fish aggregation, increasing ecological stability and biodiversity.
- Restored coral reefs will also result in increase of fish populations, benefiting local fishing communities and promoting eco-tourism and livelihood opportunities.
- The expertise of Zoological Survey of India also can be used to implement coral conservation plan.

Budget Estimate for Coral Nursery and Transplantation

Budget required for coral nursery and transplantation for five years period was worked out to be Rs. 50,00,000/- and the details are given below.

S. No.	Budget for corals nursery and transplantation	In Rupees
	Coral nursery development	**10,00,000**
	Boat rent charges	
1	Boat rent collecting site (Rs. 5000 per day X 20 days)	1,00,000
2	Boat rent recipient site (Rs. 5000 per day X 20 days)	1,00,000
3	Boat rent for three years monitoring (Rs. 5000 per day X 120 days)	6,00,000
	Total	**8,00,000**
	Labour charges	
1	Labour charge for collections and packing (20 days)	2,50,000
2	Labour charge for recipient site (20 days)	2,50,000
	Total	**5,00,000**
	Staff charges	
1	Scientists (1 X 50000 X 24)	12,00,000
2	Assistant (1 X 20000 X 24)	4,80,000
	Total	**16,80,000**
	Major equipment	
1	SCUBA gears (4 nos.)	6,00,000
2	Air Compressor (1 no)	1,40,000
3	Underwater camera with housing (2 nos.)	2,00,000
4	Maintenance / Service of Equipments / accessories	80,000
	Total	**10,20,000**
	Grand Total	**50,00,000**

*In total, a sum of **Rs. 50 lakhs** is allocated for 5 years for the coral conservation plan.*

Conclusion

According to the CRZ map, no coral sub zones were demarcated in the approach trestle, jetty and finger jetty areas. However, the present underwater coral transect study indicated live corals in 7 transects (T D1, T C2, T D2, T G1, T F2, T E1 and T B1) out of total 13 transects. The presence of live corals and algae indicates some level of biological activity and habitat complexity.

In order to increase coral cover, coral transplantation of coral fragments at suitable sites are recommended. For this purpose, Rs. 50,00,000 shall be allotted for five years.

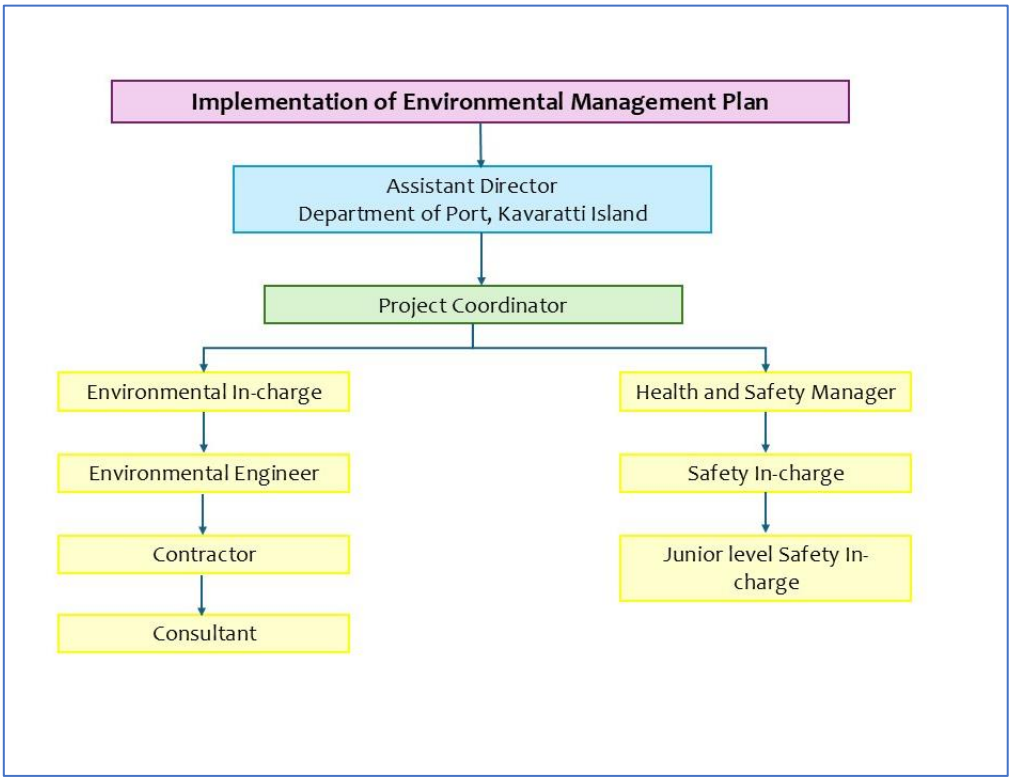
9.4. Environment Management Cell

EMC will be headed by the person who have qualification and reported to the MoEF&CC committee.

- Preparation and implementation of Environmental Supervision Plan during construction.
- Ensuring adequate training and education to all staff involved in environmental supervision.
- Implement Environmental Monitoring Plan during construction and operation.
- Ensure effective communication and explanation of the content and requirements of the EMP to contractors and subcontractors.
- Provide appropriate and adequate resources allocated for the effective implementation and maintenance of the EMP.
- Review of EMP performance and implementation of corrective actions, or stop work procedures, in the event of breaches of EMP conditions, that may lead to serious impacts on local communities or affect the reputation of the project.
- Report any major environmental incidents that may have a significant impact on the surrounding environment.
- Evaluating the efficacy of the EIA, mitigation measures as stipulated in the EMP.
- Coordination with Lakshadweep Pollution control boards for prevention and control of environmental pollution.
- Carryout half yearly monitoring program and preparation of compliance report.
- To implement Environmental Clearance condition stipulated by MOEFCC.
- Maintain environmental monitoring records.

9.5. Implementation of EMP

Overall implementation of EMP will be the responsibility of EMC. Various implementation items, description, and appropriate time to implement EMP are listed below.



EMP Implementation flow diagram

9.6. Communication and reporting

Training: Training shall be given to the workers during the construction and operation phase for identification of various hazards, methods to combat and responsiveness to emergency preparedness etc.

Communication: Information with respect to any untoward incidences during the construction and operation of the project shall be communicated to local Gram Panchayat, local village workers, and other project-related individuals. Environmental issues should be communicated to the concerned Govt. agencies such as LCZMA, Lakshadweep Pollution Control Board (LPCB), Forest and Environment Department, District Collector etc.

Reporting: The EMC will be responsible for conducting environment monitoring, compilation, and review of monitoring data, filling up the statutory forms/returns, maintenance of records regarding hazardous waste, environment awareness activities, submission of compliances six months EC compliance to State Pollution Control Board and MoEFCC regional office.

9.7. Environmental Monitoring and review

The EMC will continually review the EMP, and implementation of the mitigation measures described in Chapter 4 to assess the effectiveness of the proposed measures. The management will conduct periodic review to ascertain effectiveness of the EMP as follows:

- Take routine annual review of the EMP.
- Review of EMP after an accident or significant non-compliance is reported.
- Examine report and findings of the post project monitoring results and evaluation submitted by the EMC from time to time.
- Assess feedback from workers/stake holders and take action where necessary.

9.8. EMP Budget

The adequate budget allocation to operate EMP is necessary to make resource available for its effective implementation.

Based on the EMP for the proposed project discussed in above, the budget allocation required is estimated to be about ₹. 2.35 Crores The break-up of the proposed budget is given below.

Sl. No.	Environment Management Plan	Cost/year (₹.)
1	Environmental Monitoring Programme	25,00,000
2	Environment Management Cell	25,00,000
3	Labour, Safety and Cleanliness Management	25,00,000
4	Solid waste management	25,00,000
5	Post project monitoring	25,00,000
6	Seagrass Conservation Plan	10,00,000
7	Turtle Conservation Plan	25,00,000
8	Marine Mammal Conservation Plan	25,00,000
9	Coral Management Plan	50,00,000
Total		2.35 Crore

Appendix O

Bill of Quantities

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.		DATE
		RP 030 BQ101	Rev A	28-Mar-25
C1221104	Bill of Quantities for Development of Eastern Jetty as immediate development	DESIGNED	CHECKED	PAGE 1
		SWATHY AKILESH	IAN	

SL.No.	Description of Work	Unit	Qty	Rate	Amount Rs in Crs	Reference to Annexure 10.3 - 101
A	**PREAMBLE**					
	1. This BOQ comprises of Quantities for Proposed Eastern Jetty in Kalpeni island, comprising of 360m long 20m wide Multipurpose berth.					
	2. The design has been done as per the latest IS-4651 Part IV 2014.					
	3. Liner thickness of 8 mm is considered for all BCI piles up to Liner Termination level.					
	4. Considering the nature of coral rocks, Pile socket length is considered as 4.5x Pile diameter from rock level					
	5. Average bed level is assumed as (-) 10.0m CD					
	6. Maximum lifting weight of precast unit is 20 Tonnes.					
	7. Refer Drawing for Jetty Dimensions					
	8. Refer Annexure 10.3 - 101 for rate analysis of various components					
B	**EXCLUSIONS**					
	1. Service pipelines and pedestal quantity is not considered in this BOQ.					
C	**MOBILISATION & DEMOBILISATION**					
	Mobilization and Demobilisation of Plant & Equipment and other resources complete for Jetty and Approach trestle	LS	1	5,00,00,000	5.00	Market rate
D	**BILL OF QUANTITIES**					
1	**Substructure**					
	Construction of cast in situ RCC bored piles with M.S. liner including driving liner up to required depth, boring in all types of soil strata, removal of excavated material, stabilizing unlined soil using bentonite or any other approved method, providing reinforcement as per design / drawing, providing and placing M40 grade of concrete by means of tremie method, providing all necessary labour, materials, plant, tools and machinery working platform etc complete to the lines and levels as per the drawings and specifications and as directed by Engineer-In-Charge.					
1.1	**Positioning and Setting up**					
	Positioning and setting up of piling equipment at each pile location, for 1300mm dia piles	Nos	224	1,07,813	2.42	Item No 1
1.2	**Liners**					
	Supply and Fabricating Liners from MS plates of 8mm thickness including additional bottom shoe of 1m high, including transportation, alignment, welding (welding electrodes & welding procedure shall be approved by Engineer-In-Charge before commencement of work) and placing in position, all complete as per drawing, specification and as directed by Engineer-In-Charge, for 1300mm dia piles	MT	1142	2,04,563	23.37	Item No 2
1.3	**Lowering and Pitching**					
	Lowering and Pitching of fabricated cylindrical steel liners at each pile location, for 1300mm dia piles	MT	1142	34,682	3.96	Item No 3
1.4	**Driving**					
	Driving of Liners to any depth as required all complete as per drawing, specification and as directed by Engineer-In-Charge, for 1300mm dia piles					
1.5	**Boring of Piles**					
a	Boring from level formed after dredging to founding level through all types of soil including fresh and slightly weathered rock all complete as per drawing, specification and as directed by Engineer-In-Charge,for 1300mm dia piles	m	2240	34,002	7.62	Item No 4
b	Boring through coral rock all complete as per drawing, specification and as directed by Engineer-In-Charge,for 1300mm dia piles	m	1310	37,969	4.98	Item No 4
1.6	**Dressing of Pile head**					
	Cutting and Dressing Pile head up to to cutoff level (COL) to satisfaction of Engineer-In-Charge as per specification and as as directed by Engineer-In-Charge, for 1300mm dia piles. Rate to include for cutting of steel liners and chipping of concrete above pile cutoff level and cleaning of projected reinforcement. If sound concrete is not met at COL then chipping should be continued till good concrete is met.	Nos	224	22,972	0.51	Item No 6
1.7	**Concreting**					
	BCI Piles: Supply and Placing in position of design mix concrete grade M40 with approved admixtures, in pile shaft by means of tremie and by approved method upto a level indicated in Specifications above pile cutoff level underneath the Bentonite slurry including all testing and recording by approved method, including cost of all labour and material complete and will be measured from COL to Founding Level as per drawing, specification and as directed by Engineer-In-Charge, for 1300mm dia piles	cum	10335	28,541	29.50	Item No 5
1.8	**Reinforcement**					
	BCI Piles: Supply, cutting, bending and placing in position reinforcement including cleaning, wire brushing, straightening, welding with approved electrodes, binding wires etc with all labour and material complete including Laps, chairs, spacers, hooks etc. (Rebar shall be Fe500D of IS 1786-2008, stacking shall be done accordingly) all complete as per drawing, specification and as directed by Engineer-In-Charge, for 1300mm dia piles	MT	3119	1,99,660	62.28	Item No 10
1.9	**Pile Load Test**					
1.9.1	Initial Pile Load Test					
	Conducting initial cyclic vertical load test on test piles on land as per approved methodology, and IS:2911 (Part-IV), including loading platform or by providing anchor piles at his own cost, all necessary arrangement of testing facilities and removal of the same after test etc. as per specification and as directed by Engineer-In-Charge, for 1300mm dia piles. The price shall be inclusive of all installation as may be required for testing. (Test Load 2.5 x Safe load capacity of Pile)	Nos	1	30,00,000	0.30	Market rate
1.9.2	Pile Integrity Test					

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PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep		Document No.		DATE	
			RP 030 BQ101	Rev A	28-Mar-25	
C1221104	Bill of Quantities for Development of Eastern Jetty as immediate development		DESIGNED	CHECKED	PAGE	2
			SWATHY AKILESH	IAN		

SL.No.	Description of Work	Unit	Qty	Rate	Amount Rs in Crs	Reference to Annexure 10.3 - 101
	Conducting non destructive integrity test on working piles to be conducted using low strain sonic diagnostic system as per specifications and as directed by Engineer-In-Charge, for 1300 mm dia piles.	Nos	23	2,176	0.005	DSR 2023 - 20.9

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PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.		DATE
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C1221104	Bill of Quantities for Development of Eastern Jetty as immediate development	DESIGNED	CHECKED	PAGE
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SL.No.	Description of Work	Unit	Qty	Rate	Amount Rs in Crs	Reference to Annexure 10.3 - 101
1.9.3	Routine Pile Load Test					
	Conducting Routine Pile load test as per approved methodology, and IS:2911 (Part-IV). as per specification and as directed by Engineer-In-Charge. The price shall be inclusive of all installation as may be required for testing. (Test Load - 1.5 x Safe capacity of Pile)	Nos	3	15,00,000	0.45	Market rate
II	**Superstructure**					
2.1	**Concreting**					
2.1.1	Precast: Supply, Casting and placing of pre cast units of mix concrete grade M40 with approved admixtures including vibrating, mixing, curing etc complete (including bottom and side shuttering), transportation to the site placing in position to lines and level as per drawing, specification and as directed by Engineer-In-Charge.	cum	4023	36,214	14.57	Item No 7
2.1.2	In-Situ: Supply and placing in position to lines and levels cast in situ design mix cement concrete of grade M40 with approved admixtures for beams, slab etc compacting, curing of concrete complete (including bottom and side shuttering) including installation of inserts, bolts and other embedment with all labour and material as per drawing, specification and as directed by Engineer-In-Charge.	cum	4917	31,111	15.30	Item No 8
2.2	**Reinforcement**					
	Supply, cutting, bending and placing in position reinforcement including cleaning, wire brushing, straightening, welding with approved electrodes, binding wires etc with all labour and material complete including Laps, chairs, spacers, hooks etc. (Rebar shall be Fe500D of IS 1786-2008, stacking shall be done accordingly) all complete as per drawing, specification and as directed by Engineer-In-Charge.	MT	1788	1,77,310	31.70	Item No 11
2.3	**Wearing Coat**					
	Supply and laying in position M30 grade concrete wearing coat with admixture as per approved mix design, approved casting sequence on deck to lines and level including forming slopes, finishing surface, curing etc complete as per drawing, specification and as directed by Engineer-In-Charge.	cum	360	16,622	0.60	Item No 9
III	**Deck Fixtures and Miscellaneous**					
3.1	**Marine Fenders**					
a	Supply and Fixing of Pneumatic Fender (80Kpa) 2500 X 5500 (Trelleborg or Equivalent) fender, including necessary work with high tensile galvanized wrought iron chains, shakles, anchor bolts, hooks and other fixtures, painting etc complete as per drawing, specification and as directed by Engineer-In-Charge.	Nos	24	37,10,329	8.90	Item No 17
b	Supply and Fixing of Tyre fenders complete with other fixtures, painting etc complete as per drawing, specification and as directed by Engineer-In-Charge.	Nos	156	60,977	0.95	Item No 15
3.2	**Bollards**					
a	Supply and Placing of Inserts for Bollards and Fixing 60T Cast Iron Bollards complete with all inserts in position as per Drawings and as directed by the Engineer-in-charge.	Nos	48	75,825	0.36	Item No 12-1
b	Supply, fabricate and Placing of Inserts for Pipe Bollards of 2T capacity made of MS Steel including fixtures in position as per Drawings and as directed by the Engineer-in-charge.	Nos	42	10,976	0.05	Item No 12-2
3.3	**Mooring Rings**					
	Supply and fix in position stainless steel 150mm ID mooring rings made out of 32 dia stainless steel bar and 32 mm dia stainless steel 'U' bolt in deck. (Rate to include for forming recess, hole, etc. in the concrete all complete) as per drawings, specifications and as instructed by Engineer-In-Charge	Nos	8	14,660	0.01	Item No 13
3.4	**Safety Ladders**					
	Supply & Fixing of 6800mm long galvanised steel ladders including steel bolts, connection with deck & piles, resign plug etc. complete as per detailed drawing and as directed by the Engineer-In-Charge	Nos	4	3,25,943	0.13	Item No 16
3.5	**Safety Chains**					
	Supply & Fixing of galvanised Steel Safety Chains including steel bolts, connection with deck & piles, resign plug etc. complete as per detailed drawing and as directed by the Engineer-In-Charge	Nos	8	32,418	0.026	Item No 14
3.6	**Expansion Joint**					
	Supply and place in position, according to the drawings and specification, strip seal type expansion joint for max movement of 100 mm all complete as per drawing and as directed by Engineer-In-Charge.	RM	60	12,188	0.07	Morth - Kerala PWD - MR138
3.7	**Drainage Spouts**					
	Supply and Fixing in position drainage spout arrangements having 100mm dia UPVC pipe fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	84	877	0.007	DSR 2023 - 7758
3.8	**PVC Pipe for Conduits**					
	Supply and Fixing in position 150mm dia PVC pipe for utility purpose, fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	720	1,038	0.07	DSR 2023 - 7745
	Supply and Fixing in position 100mm dia PVC pipe for utility purpose, fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	720	877	0.06	DSR 2023 - 7758
E	Total				213.20	
	Total after deducting 18% GST				**180.68**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.		DATE	
		RP030 BQ102	Rev A	28-Mar-25	
C1221104	Bill of Quantities for Eastern jetty Approach Trestle at Kalpeni	DESIGNED	CHECKED	PAGE	4
		SWATHY AKILESH	IAN		

SL.No.	Description of Work	Unit	Qty	Rate	Amount Rs in Cr	Reference to Annexure 10.3 - 102
A	**PREAMBLE**					
	1. This BOQ comprises of Quantities for Proposed Eastern Approach Trestle in Kalpeni island, comprising of 130m long					
	2. The design has been done as per the latest IS-4651 Part IV 2014.					
	3. Liner thickness of 8 mm for 900mm pile is considered for all BCI piles up to Liner Termination level					
	4. Pile socket length is assumed as 4.5x Pile diameter					
	5. Maximum lifting weight of precast unit is 20 Tonnes.					
	6. Overall Mobilisation charges for Jetty and Trestle is listed in BQ101					
	7. Refer Annexure 10.3 - 102 for rate analysis of various components					
B	**EXCLUSIONS**					
	1. Electrical, Mechanical and other service fixtures are not considered in this BoQ.					
	2. Service pipelines quantity is not considered in this BoQ.					
C	**BILL OF QUANTITIES**					
1	**Substructure**					
	Construction of cast in situ RCC bored piles with M.S. liner including driving liner up to required depth, boring in all types of soil strata, removal of excavated material, stabilizing unlined soil using bentonite or any other approved method, providing reinforcement as per design / drawing, providing and placing M40 grade of concrete by means of tremie method, providing all necessary labour, materials, plant, tools and machinery working platform etc complete to the lines and levels as per the drawings and specifications and as directed by Engineer-In-Charge.					
1.1	**Positioning and Setting up**					
	Positioning and setting up of piling equipment at each pile location for 900mm dia pile	Nos	50	1,00,269	0.50	Item No 1
1.2	**Liners**					
	Supply and Fabricating Liners from MS plates of thickness 8 mm for 900mm piles, including additional bottom shoe of 1m high, including transportation, alignment, welding (welding electrodes & welding procedure shall be approved by Engineer-In-Charge before commencement of work) and placing in position, all complete as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia pile	MT	160.28	1,95,014	3.13	Item No 2
1.3	**Lowering and Pitching**					
	Lowering and Pitching of fabricated cylindrical steel liners at each pile location for 900 mm dia pile					
1.4	**Driving**					
	Driving of Liners to any depth as required all complete as per drawing, specification and as directed by Engineer-In-Charge	MT	160.28	27,823	0.45	Item No 3
1.5	**Boring of Piles**					
a	Boring from level formed after dredging to founding level through all types of fresh and slightly weathered rock (including Quartzite/Schist and Mica schist/ Slate/ Phylite) all complete as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia piles	m	273	27,277	0.74	Item No 4
b	Boring through coral rock all complete as per drawing, specification and as directed by Engineer-In-Charge,for 900mm dia pile	m	203	29,450	0.60	Item No 4
1.6	**Dressing of Pile head**					
	Cutting and Dressing Pile head up to to cutoff level (COL) to satisfaction of Engineer-In-Charge as per specification and as as directed by Engineer-In-Charge for 900mm dia pile. Rate to include for cutting of steel liners and chipping of concrete above pile cutoff level and cleaning of projected reinforcement. If sound concrete is not met at COL then chipping should be continued till good concrete is met.	Nos	50	19,196	0.10	Item No 6
1.7	**Concreting**					
	BCI Piles: Supply and Placing in position of design mix concrete grade M40 with approved admixtures, in pile shaft by means of tremie and by approved method upto a level indicated in Specifications above pile cutoff level underneath the Bentonite slurry including all testing and recording by approved method, including cost of all labour and material complete and will be measured from COL to Founding Level as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia pile	cum	761	28,690	2.18	Item No 5
1.8	**Reinforcement**					
	BCI Piles: Supply, cutting, bending and placing in position reinforcement including cleaning, wire brushing, straightening, welding with approved electrodes, binding wires etc with all labour and material complete including Laps, chairs, spacers, hooks etc. (Rebar shall be Fe500D of IS 1786-2008, stacking shall be done accordingly) all complete as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia pile	MT	130	1,77,710	2.31	Item No 10
1.9	**Pile Load Test**					
1.9.1	Pile Integrity Test					
	Conducting non destructive integrity test on working piles to be conducted using low strain sonic diagnostic system as per specifications and as directed by Engineer-In-Charge for 900mm dia pile	Nos	5	2,176	0.001	DSR 2023 - 20.9
1.9.2	Routine Pile Load Test					
	Conducting Routine Pile load test as per approved methodology, and IS:2911 (Part-IV). as per specification and as directed by Engineer-In-Charge. The price shall be inclusive of all installation as may be required for testing. (Test Load - 1.5 x Safe capacity of Pile)	Nos	1	15,00,000	0.15	Market rate
II	**Superstructure**					
2.1	**Concreting**					
2.1.1	Precast: Supply, Casting and placing of pre cast units of mix concrete grade M40 with approved admixtures including vibrating, mixing, curing etc complete (including bottom and side shuttering), transportation to the site placing in position to lines and level as per drawing, specification and as directed by Engineer-In-Charge.	cum	718	36,255	2.60	Item No 7
2.1.2	In-Situ: Supply and placing in position to lines and levels cast in situ design mix cement concrete of grade M40 with approved admixtures for beams, slab etc compacting, curing of concrete complete (including bottom and side shuttering) including installation of inserts, bolts and other embedment with all labour and material as per drawing, specification and as directed by Engineer-In-Charge.	cum	877	31,125	2.73	Item No 8
2.2	**Reinforcement**					
	Supply, cutting, bending and placing in position reinforcement including cleaning, wire brushing, straightening, welding with approved electrodes, binding wires etc with all labour and material complete including Laps, chairs, spacers, hooks etc. (Rebar shall be Fe500D of IS 1786-2008, stacking shall be done accordingly) all complete as per drawing, specification and as directed by Engineer-In-Charge.	MT	319	1,78,270	5.69	Item No 11
2.3	**Wearing Coat**					
	Supply and laying in position M30 grade concrete wearing coat with admixture as per approved mix design, approved casting sequence on deck to lines and level including forming slopes, finishing surface, curing etc complete as per drawing, specification and as directed by Engineer-In-Charge.	cum	260	16,711	0.43	Item No 9
III	**Retaining Structures**					
3.1	**Retaining Wall**					
3.1.1	Excavation upto founding level of the Foundation of the Retaining Wall	cum	68	941	0.01	DSR 2023 2.7.1
3.1.2	Supply and placing in position cast in situ design mix cement concrete of grade M40 with approved admixtures for Footing and wall of Retaining Structure compacting, curing of concrete complete (including side shuttering) transportation to the site placing in position to lines and level, with all labour and material as per drawing, specification and as directed by Engineer-In-Charge.	cum	27	31,125	0.08	Item No 8
3.2	**Approach Slab**					
	Supply and placing in position cast in situ design mix cement concrete of grade M40 with approved admixtures for Footing and wall of Retaining Structure compacting, curing of concrete complete (including side shuttering) transportation to the site placing in position to lines and level, with all labour and material as per drawing, specification and as directed by Engineer-In-Charge.	cum	25	31,125	0.08	Item No 8
IV	**Deck Fixtures and Miscellaneous**					
4.1	**Expansion Joint**					
	Supply and place in position, according to the drawings and specification, strip seal type expansion joint for max movement of 100 mm all complete as per drawing and as directed by Engineer-In-Charge.	RM	30	12,188	0.04	Morth - Kerala PWD - MR138
4.2	**Drainage Spouts**					
	Supply and Fixing in position drainage spout arrangements having 100mm dia PVC pipe fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	19	877	0.002	DSR 2023 - 7758
4.3	**Handrail**					
	Supply, Fabricating and fixing in position MS Hand rail posts and Hand railing, Utility trays including paint with surface prepration by copper slag blasting SA 2.5(50-70 micron) and one coat of inorganic zinc silicate primer with zinc content 80% to 90% (total DFT 50 to 75 microns) and one coat of high build MIO (DFT 100 micron) and one final coat of aliphatic acrylic PU1 (DFT 100 micron) of approved make and colour etc. and all fixtures as per drawing, specification and as directed by Engineer-In-Charge.	RM	390	4,595	0.18	Morth -Standard data book for analysis of rate -2019

SL.No.	Description of Work	Unit	Qty	Rate	Amount Rs in Cr	Reference to Annexure 10.3 - 102
4.4	**PVC Pipe for Conduits**					
	Supply and Fixing in position 150mm dia PVC pipe for utility purpose, fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	260	1,038	0.03	DSR 2023 - 7745
	Supply and Fixing in position 100mm dia PVC pipe for utility purpose, fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	520	877	0.05	DSR 2023 - 7758
V	**Architectural work for approach trestle**					
5.1	**Pergolas (2 Nos.)**					
5.1.1	Structural Glazing using toughened laminated DGU	Sqm	416	15000	0.62	Market rate
5.1.2	Structural steel framework using hollow tubular steel sections	Kg.	45760	367	1.68	DSR 2023 : 10.16.1
5.1.3	Polyurethane painting to steel work	Sqm	686	1025	0.07	Market rate
5.2	**Viewing Deck (2 Nos.)**					
5.2.1	Glass Flooring using 35.52 mm thick laminated sandwiched glass	Sqm	60	42500	0.26	Market rate
5.2.2	Curved Stainless Steel ribs SS 316 Grade with laminated toughened glass in curved profile	Kg.	3180	1894.77	0.60	DSR 2023 : 10.28, Add 30% for higher grade
5.2.3	Structural steel framework using hollow tubular steel sections for glass floor	Kg.	6000	367	0.22	DSR 2023 : 10.16.1
5.2.4	Polyurethane painting to steel work	Sqm	90	1025	0.01	Market rate
5.3	**Kiosks (4 Nos.)**					
5.3.1	Glass Flooring using 35.52 mm thick laminated sandwiched glass	Sqm	38	48500	0.18	Market rate
5.3.2	Laminated toughened Glazed Wall in curved profile	Sqm	148	18500	0.27	Market rate
5.3.3	18 mm thick Cement Board for Canopy in Roofing	Sqm	160	3438	0.06	Market rate
5.3.4	PU paint over cement boards	Sqm	400	1025	0.04	Market rate
5.3.5	Glass Roof using 19.52 mm thick laminated sandwiched glass with SS supports	Sqm	56	32000	0.18	Market rate
5.3.6	Structural steel framework using hollow tubular steel sections for structure, floor and roof	Kg.	29180	367	1.07	DSR 2023 : 10.16.1
5.3.7	Polyurethane painting to steel work	Sqm	438	1025	0.04	Market rate
5.4	**Main Entrance Gate (1 NO.)**					
5.4.1	RCC M-40 Grade for Main Gate RCC Column	Cum	6	19461	0.01	DSR 2023 : 5.33.2.4
5.4.2	Sides of columns	Sqm	48	1814	0.01	DSR 2023 : 5.9.6
5.4.3	Steel Reinforcement	Kg	1650	204	0.03	DSR 2023 : 5.22.6
5.4.4	MS Swing gates made out of hollow tubular sections	Kg	1181	367	0.04	DSR 2023 : 10.16.1
5.4.5	Structural steel supporting framework made out of hollow tubular sections	Kg	5550	367	0.20	DSR 2023 : 10.16.1
5.4.6	Polyurethane painting to steel and concrete work work	Sqm	149	1025	0.02	Market rate
5.5	**Deck Area**					
5.5.1	Pre-cast solid block masonry 200mm thick	Cum	48	12000	0.06	Market rate
5.5.2	Textured Paint for Block Work	sqm	263	2079	0.05	Market rate
5.5.3	Stainless Steel Railing SS 316 Grade	Kg	2400	1895	0.45	DSR 2023 : 10.28, Add 30% for higher grade
E	Total				28.25	
	Total after deducting 18% GST				**23.94**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.	
		RP 030 BQ103	Rev A
C1221104	Bill of Quantities for Development of Passenger facilitation centre	DESIGNED	CHECKED
		SWATHY AKILESH	IAN

Sr. No.	Description of Work	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
I	**PASSENGER BUILDING**							
				Floor Ht (in m)				
	Built-up Area	**1143.50**	**Sqm**					
	Ground Floor	522.50	Sqm	4.50				
	1st Floor	597.00	Sqm	4.50				
	Terrace Mumty	24.00	Sqm	2.80				
	Plot Area	**2001.13**	**Sqm**					
	Cost Index of Cochin over CPWD PAR 2023	**1.887**						
	Cost Index of Cochin over CPWD DSR 2023	**1.887**						
A	**CIVIL WORKS**							
I	**SHELL & CORE (SCHEDULED CIVIL WORK ITEMS)**							
1.0	**RCC FRAMED STRUCTURE (Upto Six Storeys)**							
1.1	RCC structure upto 6 storeys							
1.1.1	Floor Height 3.6 mt.	1143.50	Sqm.	30820.00	3,52,42,670		3,52,42,670	(Item no. 1.1.1 of PAR 2023)
	(Rate as per Annexure-I (e) of PAR 2023)							
1.2	**EXTRA FOR**							
1.2.2	Every 0.3 mt or part thereof, additional/ less height of floor above normal floor height of 3.6 meter/3.00 meter (on areas having additional/less Height)	1119.50	Sqm.	1263.00	14,13,929		14,13,929	(Item no. 1.3.2 of PAR 2023)
	((4.50-3.6)/0.30)x421=1263 (For GF & 1st floors)							
	SUB TOTAL				**3,66,56,599**	**-**	**3,66,56,599**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (A) FOR CIVIL WORKS (RS.)				**6,91,71,001**	**-**	**6,91,71,001**	
B	**MEP WORKS**							
I	**HVAC & VENTILATION SYSTEMS**							
1.0	Supplying installation testing and commissioning of Energy Efficient Central AC Plants (For Public areas, offices & the like)	57.06	TR.	90380.00	51,57,517		51,57,517	(Item no. 6.5.1 of Specialized E & M Works PAR 2023)
2.0	Pressurized Mechanical Ventilation (with supply of exhaust blowers) (For toilets, service areas etc.)	80.00	Sqm.	1050.00	84,000		84,000	(Item no. 1.7 of PAR 2023)
	SUB TOTAL				**52,41,517**	**-**	**52,41,517**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (I) FOR HVAC & VENTILATION SYSTEMS (RS.)				**98,90,743**	**-**	**98,90,743**	
II	**ELECTRICAL SYSTEMS**							
1.0	Internal Electrical Installations (12.5% of Building Civil Cost)	3,66,56,598.50	Ls.	12.50%	45,82,075		45,82,075	(Item no. 2.3 of PAR 2023)
2.0	Power wiring and plugs (4% of Building Civil Cost)	3,66,56,598.50	Ls.	4.00%	14,66,264		14,66,264	(Item no. 2.4.1 of PAR 2023)
3.0	Electrical External Service Connections (3.75% of Building Civil Cost)	3,66,56,598.50	Ls.	3.75%	13,74,622		13,74,622	(Item no. 2.2.1 of PAR 2023)
4.0	Lightning conductors (0.25% of Building cost)	3,66,56,598.50	Ls.	0.25%	91,641		91,641	(Item no. 2.4.2 of PAR 2023)
5.0	Telephone conduits (0.25% of Building cost)	3,66,56,598.50	Ls.	0.25%	91,641		91,641	(Item no. 2.4.3 of PAR 2023)
6.0	SUBSTATION EQUIPMENTS							
6.1	Supplying, installation, testing and commissioning of 33kV/0.433kV or 11kV/0.433 kV substation equipments	500.00	per KVA	9,000.00	45,00,000		45,00,000	(Item no. 6.2.1 of Specialized E & M Works PAR 2023)
7.0	DIESEL GENERATOR SETS							
	Supplying, installation, testing and commissioning of Silent Type DG Sets, AMF Panel, Bus Ducting/ Cables..... (100% backup)	500.00	per KVA	11,560.00	57,80,000		57,80,000	(Item no. 6.3.1 of Specialized E & M Works PAR 2023)
8.0	UPS SYSTEM							
8.1	Supplying, installation, testing and commissioning of online 3 phase UPS System with 30 minutes back up including batteries, interconnecting cables, battery racks etc. (20% backup)	100.00	per KVA	21,290.00	21,29,000		21,29,000	(Item no. 6.4.1 of Specialized E & M Works PAR 2023)
9.0	Supply of Aluminium HT Cables, Conductor Screen With Extruded Semi Conducting Compound, XLPE Insulated, Insulation Screening with extruded Semi Conducting Compound in combination with Copper Tape (0.2kA for 1 sec/Core),, innersheath of PVC tape,galvanised flat steel strip armoured and overall PVC Sheathed Cable conforming to IS 7098 / (PART-II) 1985 with latest amendments.	2,200.00	per Mtr	4,265.00		93,83,000	93,83,000	Market Rate
9.1	Laying of one number PVC insulated and PVC sheathed / XLPE power cable of 11KV grade of following size direct in ground including excavaion, sand cushioning, protective covering and refiling the trench etc as required	2,200.00	Mtr	415.00	9,13,000		9,13,000	(Item no. 8.2.2 of DSR E & M 2022
	SUB TOTAL				**2,09,28,244**	**-**	**2,00,15,244**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (II) FOR ELECTRICAL SYSTEMS (RS.)				**3,94,91,597**	**-**	**3,94,91,597**	
III	**PLUMBING & DRAINAGE SYSTEMS**							
1.0	Internal Water Supply & Installations (4% of Building Civil Cost)	3,66,56,598.50	Ls.	4.00%	14,66,264		14,66,264	(Item no. 2.1 of PAR 2023)
2.0	Civil External Service Connections (1.25% of Building Civil Cost)	3,66,56,598.50	Ls.	1.25%	4,58,207		4,58,207	(Item no. 2.2.2 of PAR 2023)
3.0	Hydropneumatic water supply system	240.00	LPM	1,640.00	3,93,600		3,93,600	(Item no. 6.13.1 of Specialized E & M Works PAR 2023)
4.0	Overhead tank without independent staging	10,000.00	Litre	23.00	2,30,000		2,30,000	(Item no. 4.1 of PAR 2023)
	SUB TOTAL				**25,48,071**	**-**	**25,48,071**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (III) FOR PLUMBING & DRAINAGE SYSTEMS (RS.)				**48,08,211**	**-**	**48,08,211**	
IV	**FIRE FIGHTING WORKS**							
1.0	With wet riser & sprinkler system	1,143.50	Sqm	1,200.00	13,72,200		13,72,200	(Item no. 1.5.3 of PAR 2023)
	SUB TOTAL				**13,72,200**	**-**	**13,72,200**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**25,89,341**	**-**	**25,89,341**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep						Document No. RP 030 BQ103	Rev A
C1221104	Bill of Quantities for Development of Passenger facilitation centre						DESIGNED SWATHY AKILESH	CHECKED IAN
V	**FIRE ALARM & FIRE DETECTION SYSTEM**							
1.0	Automatic Fire Alarm System	1,143.50	Sqm	600.00	6,86,100		6,86,100	(Item no. 1.6.2 of PAR 2023)
	SUB TOTAL				**6,86,100**	**-**	**6,86,100**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**12,94,671**	**-**	**12,94,671**	
	SUB TOTAL (B) MEP WORKS				**5,80,74,563**	**-**	**5,80,74,563**	
C	**MISCELLANEOUS ITEMS**							
1.0	IBMS System upto area of 10000 Sqm	1143.50	Sqm	430.00	4,91,705		4,91,705	(Item no.6.12.1 of PAR 2023)
2.0	Access Control System	1143.50	Sqm	220.00	2,51,570		2,51,570	(Item no. 6.11.1 of PAR 2023)
3.0	IP based EPABX System (Excluding common areas)	914.80	Sqm	580.00	5,30,584		5,30,584	(Item no. 6.17.1 of PAR 2023)
4.0	AV System (For Arrival, Departure & Waiting areas on GF)	365.75	Sqm	11,890.00	43,48,768		43,48,768	(Item no. 6.18 of PAR 2023)
5.0	IP based CCTV System (for indoors)	1143.50	Sqm	210.00	2,40,135		2,40,135	(Item no. 6.10.1 of PAR 2023)
6.0	IP based CCTV System (for external surveillance)	1143.50	Sqm	210.00	2,40,135		2,40,135	(Item no. 6.10.2of PAR 2023)
7.0	LAN system (20% of area considered)	228.70	Sqm	560.00	1,28,072		1,28,072	(Item no. 6.16.1 of PAR 2023)
8.0	Illuminated Signages	1143.50	Sqm	250.00		2,85,875	2,85,875	Market Rate
	SUB TOTAL				**62,30,969**	**2,85,875**	**65,16,844**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (C) MISCELLANEOUS ITEMS				**1,17,57,838**	**2,85,875**	**1,20,43,713**	
D	**ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS**							
1.0	Engineered Hardwood flooring	304.50	Sqm	8500.00		25,88,250	25,88,250	Market Rate
2.0	Double charged Vitrified Tiles of tile size greater than 600 x 600 mm for flooring	515.64	Sqm	3497.00		18,03,193	18,03,193	Market Rate
3.0	Deduct for Vitrified Tiles Flooring as per CPWD norms	-820.14	Sqm	1553.45	(12,74,046)		(12,74,046)	(Item no. 11.41.2 of DSR 2023)
4.0	Aluminium (wood finish) coffered ceiling	29.84	Sqm	10000.00		2,98,400	2,98,400	Market Rate
5.0	Aluminium (wood finish) baffle ceiling	258.63	Sqm	14500.00		37,50,135	37,50,135	Market Rate
6.0	Laminated Wooden ceiling with cove	524.10	Sqm	8500.00		44,54,850	44,54,850	Market Rate
7.0	Deduct for Gypsum board false ceiling as per CPWD norms	-812.57	Sqm	1355.80	(11,01,682)		(11,01,682)	(Item no. 12.45.1 of DSR 2023)
8.0	Decorative Wallpaper	60.75	Sqm	900.00		54,675	54,675	Market Rate
9.0	UPVC Fluted Paneling with wooden finish	288.86	Sqm	5500.00		15,88,730	15,88,730	Market Rate
10.0	Brick finish tile cladding	358.60	Sqm	3000.00		10,75,800	10,75,800	Market Rate
11.0	Interior Grade Textured Paint	1075.81	Sqm	2079.00		22,36,609	22,36,609	Market Rate
12.0	Acoustic panel cladding	71.97	Sqm	8750.00		6,29,738	6,29,738	Market Rate
13.0	Anti-bacterial Vitrified Tiles of tile size greater than 600 x 600 mm for cladding	150.15	Sqm	3686.00		5,53,453	5,53,453	Market Rate
14.0	Deduct for Acrylic emulsion paint as per CPWD norms	-1855.99	Sqm	216.75	(4,02,286)		(4,02,286)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
15.0	Deduct for Vitrified Tiles dado as per CPWD norms	-150.15	Sqm	1623.05	(2,43,701)		(2,43,701)	(Item no. 11.46.2 of DSR 2023)
16.0	Stainless Steel Vertical Fins in exterior façade	1922.00	Rmt	11700.00		2,24,87,400	2,24,87,400	Market Rate
17.0	Extra for double glazed/ laminated glass in exterior façade	872.42	Sqm	3500.00		30,53,470	30,53,470	Market Rate
18.0	Deduct for 230 mm thick brick masonry as per PAR norms	-200.66	Cum	9105.95	(18,27,169)		(18,27,169)	(Item no. 6.4.2 of DSR 2023)
19.0	Deduct for 12mm thick internal plaster as per PAR norms	-872.42	Sqm	347.05	(3,02,773)		(3,02,773)	(Item no. 13.1.1 of DSR 2023)
20.0	Deduct for 18 mm thick external plaster as per PAR norms	-872.42	Sqm	537.45	(4,68,882)		(4,68,882)	(Item no. 13.12 of DSR 2023)
21.0	Deduct for internal acrylic emulsion paint as per PAR norms	-872.42	Sqm	216.75	(1,89,097)		(1,89,097)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
22.0	Deduct for exterior acrylic emulsion paint as per PAR norms	-872.42	Sqm	181.25	(1,58,126)		(1,58,126)	(Item no. 13.48A.1 of DSR 2023)
23.0	Extra for adding corrosion inhibiting admixtures in concrete	1.00	Ls	1415100.00		14,15,100	14,15,100	Provisional Sum
24.0	Fixed cabinetry (Casework only)	1.00	Job	1200000.00		12,00,000	12,00,000	Provisional Sum
	SUB TOTAL				**(59,67,763)**	**4,71,89,802**	**4,12,22,039**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (D) ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS				**(1,12,61,169)**	**4,71,89,802**	**3,59,28,633**	
	TOTAL AMOUNT) (RS.)						**17,52,17,910**	
	Total after deducting 18% GST						**14,84,89,754**	
	Total in Rs Crs						**14.85**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.	
		RP 030 BQ104	Rev A
C1221104	Bill of Quantities for Development of Security building	DESIGNED	CHECKED
		SWATHY AKILESH	IAN

Sr. No.	Description of Work	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
II	**SECURITY BUILDING**							
				Floor Ht (in m)				
	Built-up Area	**64.00**	**Sqm**					
	Ground Floor	64.00	Sqm	3.00				
	Plot Area	**64.00**	**Sqm**					
	Cost Index of Cochin over CPWD PAR 2023	**1.887**						
	Cost Index of Cochin over CPWD DSR 2023	**1.887**						
A	**CIVIL WORKS**							
I	**SHELL & CORE (SCHEDULED CIVIL WORK ITEMS)**							
1.0	**RCC FRAMED STRUCTURE (Upto Six Storeys)**							
1.1	RCC structure upto 6 storeys							
1.1.1	Floor Height above 3 mt. upto 3.6 mt.	64.00	Sqm.	30820.00	19,72,480		19,72,480	(Item no. 1.1.1 of PAR 2023)
	(Rate as per Annexure-I (e) of PAR 2023)							
	SUB TOTAL				**19,72,480**	**-**	**19,72,480**	
	COST INDEX OVER PAR 2023				**1.887**	**1.00**		
	SUB TOTAL (A) FOR CIVIL WORKS (RS.)				**37,22,070**	**-**	**37,22,070**	
B	**MEP WORKS**							
I	**HVAC & VENTILATION SYSTEMS**							
1.0	Pressurized Mechanical Ventilation (with supply of exhaust blowers)	64.00	Sqm.	1050.00	67,200		67,200	(Item no. 1.7 of PAR 2023)
	SUB TOTAL				**67,200**	**-**	**67,200**	
	COST INDEX OVER PAR 2023				**1.887**	**1.00**		
	SUB TOTAL (I) FOR HVAC & VENTILATION SYSTEMS (RS.)				**1,26,806**	**-**	**1,26,806**	
II	**ELECTRICAL SYSTEMS**							
1.0	Internal Electrical Installations (12.5% of Building Civil Cost)	19,72,480.00	Ls.	12.50%	2,46,560		2,46,560	(Item no. 2.3 of PAR 2023)
2.0	Power wiring and plugs (4% of Building Civil Cost)	19,72,480.00	Ls.	4.00%	78,899		78,899	(Item no. 2.4.1 of PAR 2023)
3.0	Electrical External Service Connections (3.75% of Building Civil Cost)	19,72,480.00	Ls.	3.75%	73,968		73,968	(Item no. 2.2.1 of PAR 2023)
4.0	Lightning conductors (0.25% of Building cost)	19,72,480.00	Ls.	0.25%	4,931		4,931	(Item no. 2.4.2 of PAR 2023)
5.0	Telephone conduits (0.25% of Building cost)	19,72,480.00	Ls.	0.25%	4,931		4,931	(Item no. 2.4.3 of PAR 2023)

6.0	SUBSTATION EQUIPMENTS							
6.1	Supplying, installation, testing and commissioning of 33kV/0.433kV or 11kV/0.433 kV substation equipments	10.00	per KVA	9,000.00	90,000		90,000	(Item no. 6.2.1 of Specialized E & M Works PAR 2023)
7.0	DIESEL GENERATOR SETS							
7.1	Supplying, installation, testing and commissioning of Silent Type DG Sets, AMF Panel, Bus Ducting/ Cables (100% backup)	10.00	per KVA	11,560.00	1,15,600		1,15,600	(Item no. 6.3.1 of Specialized E & M Works PAR 2023)
8.0	UPS SYSTEM							
8.1	Supplying, installation, testing and commissioning of online 3 phase UPS System with 30 minutes back up including batteries, interconnecting cables, battery racks etc. (20% backup)	2.00	per KVA	21,290.00	42,580		42,580	(Item no. 6.4.1 of Specialized E & M Works PAR 2023)
	SUB TOTAL				**6,57,470**	**-**	**6,57,470**	
	COST INDEX OVER PAR 2023				**1.887**	**1.00**		
	SUB TOTAL (II) FOR ELECTRICAL SYSTEMS (RS.)				**12,40,645**	**-**	**12,40,645**	
III	**PLUMBING & DRAINAGE SYSTEMS**							
1.0	Internal Water Supply & Installations (4% of Building Civil Cost)	19,72,480.00	Ls.	4.00%	78,899		78,899	(Item no. 2.1 of PAR 2023)
2.0	Civil External Service Connections (1.25% of Building Civil Cost)	19,72,480.00	Ls.	1.25%	24,656		24,656	(Item no. 2.2.2 of PAR 2023)
3.0	Hydropneumatic water supply system	50	LPM	1,640.00	82,000		82,000	(Item no. 6.13.1 of Specialized E & M Works PAR 2023)
4.0	Overhead tank without independent staging	1,000	Litre	23.00	23,000		23,000	(Item no. 4.1 of PAR 2023)
	SUB TOTAL				**2,08,555**	**-**	**2,08,555**	
	COST INDEX OVER PAR 2023				**1.887**	**1.00**		
	SUB TOTAL (III) FOR PLUMBING & DRAINAGE SYSTEMS (RS.)				**3,93,544**	**-**	**3,93,544**	
IV	**FIRE FIGHTING WORKS**							
1.0	With wet riser & sprinkler system	64.00	Sqm	1,200.00	76,800		76,800	(Item no. 1.5.3 of PAR 2023)
	SUB TOTAL				**76,800**	**-**	**76,800**	
	COST INDEX OVER PAR 2023				**1.887**	**1.00**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**1,44,922**	**-**	**1,44,922**	
V	**FIRE ALARM & FIRE DETECTION SYSTEM**							
1.0	Automatic Fire Alarm System	64.00	Sqm	600.00	38,400		38,400	(Item no. 1.6.2 of PAR 2023)
	SUB TOTAL				**38,400**	**-**	**38,400**	

	COST INDEX OVER PAR 2023				**1.887**	**1.00**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**72,461**	**-**	**72,461**	
	SUB TOTAL (B) MEP WORKS				**19,78,378**	**-**	**19,78,378**	
C	**MISCELLANEOUS ITEMS**							
1.0	IP based CCTV System (for indoors)	64.00	Sqm	210.00	13,440		13,440	(Item no. 6.10.1 of PAR 2023)
2.0	IP based CCTV System (for external surveillance)	64.00	Sqm	210.00	13,440		13,440	(Item no. 6.10.2of PAR 2023)
	SUB TOTAL				**26,880**	**-**	**26,880**	
	COST INDEX OVER PAR 2023				**1.887**	**1.00**		
	SUB TOTAL (C) MISCELLANEOUS ITEMS				**50,723**	**-**	**50,723**	
D	**ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS**							
1.0	Interior Grade Textured Paint for walls	148.70	Sqm	2079.00		3,09,147	3,09,147	Market Rate
2.0	Deduct for internal acrylic emulsion paint as per PAR norms	-148.70	Sqm	216.75	(32,231)		(32,231)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
3.0	Double charged Vitrified Tiles of tile size greater than 600 x 600 mm for flooring	11.10	Sqm	3497.00		38,817	38,817	Market Rate
4.0	Deduct for Vitrified Tiles Flooring as per CPWD norms	-11.10	Sqm	1553.45	(17,243)		(17,243)	(Item no. 11.41.2 of DSR 2023)
5.0	Interior Grade Textured Paint for ceilings	44.00	Sqm	2079.00		91,476	91,476	Market Rate
6.0	Deduct for Gypsum board false ceiling as per CPWD norms	-44.00	Sqm	1355.80	(59,655)		(59,655)	(Item no. 12.45.1 of PAR 2023)
7.0	Anti-bacterial Vitrified Tiles of tile size greater than 600 x 600 mm for cladding	25.58	Sqm	3686.00		94,288	94,288	Market Rate
8.0	Deduct for Acrylic emulsion paint as per CPWD norms	-25.58	Sqm	216.75	(5,544)		(5,544)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
9.0	Stainless Steel Vertical Fins in exterior façade	319.20	Rmt	11700.00		37,34,640	37,34,640	Market Rate
10.0	Extra for double glazed/ laminated glass in exterior façade	134.40	Sqm	3500.00		4,70,400	4,70,400	Market Rate
11.0	Deduct for 230 mm thick brick masonry as per PAR norms	-30.91	Cum	9105.95	(2,81,483)		(2,81,483)	(Item no. 6.4.2 of DSR 2023)
12.0	Deduct for 12mm thick internal plaster as per PAR norms	-134.40	Sqm	347.05	(46,644)		(46,644)	(Item no. 13.1.1 of DSR 2023)
13.0	Deduct for 18 mm thick external plaster as per PAR norms	-134.40	Sqm	537.45	(72,233)		(72,233)	(Item no. 13.12 of DSR 2023)
14.0	Deduct for internal acrylic emulsion paint as per PAR norms	-134.40	Sqm	216.75	(29,131)		(29,131)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
15.0	Deduct for exterior acrylic emulsion paint as per PAR norms	-134.40	Sqm	181.25	(24,360)		(24,360)	(Item no. 13.48A.1 of DSR 2023)
16.0	Extra for adding corrosion inhibiting admixtures in concrete	1.00	Ls	58100.00		58,100	58,100	Provisional Sum
17.0	Fixed cabinetry (Casework only)	1.00	Job	400000.00		4,00,000	4,00,000	Provisional Sum
	SUB TOTAL				**(5,68,525)**	**51,96,868**	**46,28,343**	
	COST INDEX OVER PAR 2023				**1.887**	**1.00**		
	SUB TOTAL (D) ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS				**(10,72,806)**	**51,96,868**	**41,24,062**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.	
		RP 030 BQ104	Rev A
C1221104	Bill of Quantities for Development of Security building	DESIGNED	CHECKED
		SWATHY AKILESH	IAN

	TOTAL AMOUNT) (RS.)						**98,75,231**	
	Total after deducting 18% GST						**83,68,840**	
	Total in Rs Crs						**0.84**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.	
		RP 030 BQ105	Rev A
C1221104	Bill of Quantities for Development of Warehouse	DESIGNED	CHECKED
		SWATHY AKILESH	IAN

Sr. No.	Description of Work	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
III	**Warehouse**							
				Floor Ht (in m)				
	Built-up Area	**200.00**	**Sqm**					
	Ground Floor	200.00	Sqm	9.95				
	Plot Area	**200.00**	**Sqm**					
	Cost Index of Cochin over CPWD PAR 2023	**1.887**						
	Cost Index of Cochin over CPWD DSR 2023	**1.887**						
A	**CIVIL WORKS**							
I	**SHELL & CORE (SCHEDULED CIVIL WORK ITEMS)**							
1.0	**COMPOSITE (PARTIALLY LOAD BEARING AND PARTIALLY RCC FRAMED) STRUCTURES**							
1.1	Composite structure upto 6 storeys							
1.1.1	Floor Height 3.6 mt.	200.00	Sqm.	30820.00	61,64,000		61,64,000	(Item no. 1.1.1 of PAR 2023)
	(Rate as per Annexure-I (e) of PAR 2023)							
1.2	**EXTRA FOR**							
1.2.2	Every 0.3 mt or part thereof, additional/ less height of floor above normal floor height of 3.6 meter/3.00 meter (on areas having additional/less Height)	200.00	Sqm.	8911.17	17,82,233		17,82,233	(Item no. 1.3.2 of PAR 2023)
	((9.95-3.6)/0.30)x421=8911.17(For GF & 1st floors)							
	SUB TOTAL				**79,46,233**	**-**	**79,46,233**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (A) FOR CIVIL WORKS (RS.)				**1,49,94,542**	**-**	**1,49,94,542**	
B	**MEP WORKS**							
I	**HVAC & VENTILATION SYSTEMS**							
1.0	Pressurized Mechanical Ventilation (with supply of exhaust blowers)	200.00	Sqm.	1050.00	2,10,000		2,10,000	(Item no. 1.7 of PAR 2023)
	SUB TOTAL				**2,10,000**	**-**	**2,10,000**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		

Sr. No.	Description of Work	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
	SUB TOTAL (I) FOR HVAC & VENTILATION SYSTEMS (RS.)				**3,96,270**	**-**	**3,96,270**	
II	**ELECTRICAL SYSTEMS**							
1.0	Internal Electrical Installations (12.5% of Building Civil Cost)	79,46,233.33	Ls.	12.50%	9,93,279		9,93,279	(Item no. 2.3 of PAR 2023)
2.0	Electrical External Service Connections (3.75% of Building Civil Cost)	79,46,233.33	Ls.	3.75%	2,97,984		2,97,984	(Item no. 2.2.1 of PAR 2023)
3.0	Lightning conductors (0.25% of Building cost)	79,46,233.33	Ls.	0.25%	19,866		19,866	(Item no. 2.4.2 of PAR 2023)
4.0	SUBSTATION EQUIPMENTS							
4.1	Supplying, installation, testing and commissioning of 33kV/0.433kV or 11kV/0.433 kV substation equipments	20.00	per KVA	9,000.00	1,80,000		1,80,000	(Item no. 6.2.1 of Specialized E & M Works PAR 2023)
5.0	DIESEL GENERATOR SETS							
5.1	Supplying, installation, testing and commissioning of Silent Type DG Sets, AMF Panel, Bus Ducting/ Cables..... (50% backup)	10.00	per KVA	11,560.00	1,15,600		1,15,600	(Item no. 6.3.1 of Specialized E & M Works PAR 2023)
6.0	UPS SYSTEM							
6.1	Supplying, installation, testing and commissioning of online 3 phase UPS System with 30 minutes back up including batteries, interconnecting cables, battery racks etc. (20% backup)	2.00	per KVA	21,290.00	42,580		42,580	(Item no. 6.4.1 of Specialized E & M Works PAR 2023)
	SUB TOTAL				**16,49,309**	**-**	**16,49,309**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (II) FOR ELECTRICAL SYSTEMS (RS.)				**31,12,245**	**-**	**31,12,245**	
III	**PLUMBING & DRAINAGE SYSTEMS**							
1.0	Internal Water Supply & Installations (4% of Building Civil Cost)	79,46,233.33	Ls.	4.00%	3,17,849		3,17,849	(Item no. 2.1 of PAR 2023)
2.0	Civil External Service Connections (1.25% of Building Civil Cost)	79,46,233.33	Ls.	1.25%	99,328		99,328	(Item no. 2.2.2 of PAR 2023)
	SUB TOTAL				**4,17,177**	**-**	**4,17,177**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (III) FOR PLUMBING & DRAINAGE SYSTEMS (RS.)				**7,87,213**	**-**	**7,87,213**	
IV	**FIRE FIGHTING WORKS**							
1.0	With wet riser & sprinkler system	200.00	Sqm	1,200.00	2,40,000		2,40,000	(Item no. 1.5.3 of PAR 2023)
	SUB TOTAL				**2,40,000**	**-**	**2,40,000**	

Sr. No.	Description of Work	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**4,52,880**	**-**	**4,52,880**	
V	**FIRE ALARM & FIRE DETECTION SYSTEM**							
1.0	Automatic Fire Alarm System	200.00	Sqm	600.00	1,20,000		1,20,000	(Item no. 1.6.2 of PAR 2023)
	SUB TOTAL				**1,20,000**	**-**	**1,20,000**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**2,26,440**	**-**	**2,26,440**	
	SUB TOTAL (B) MEP WORKS				**49,75,049**	**-**	**49,75,049**	
C	**MISCELLANEOUS ITEMS**							
1.0	IP based CCTV System (for indoors)	200.00	Sqm	210.00	42,000		42,000	(Item no. 6.10.1 of PAR 2023)
2.0	IP based CCTV System (for external surveillance)	200.00	Sqm	210.00	42,000		42,000	(Item no. 6.10.2 of PAR 2023)
	SUB TOTAL				**84,000**	**-**	**84,000**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (C) MISCELLANEOUS ITEMS				**1,58,508**	**-**	**1,58,508**	
D	**ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS**							
1.0	Structural Steel Work (in lieu of RCC roof)							
1.1	Riveted, Bolted or welded in built up Hot Rolled sections	7200.00	Kg	133.70	9,62,640		9,62,640	(Item no. 10.2 of DSR 2023)
1.2	Hollow tubular sections- welded type	10800.00	Kg	194.40	20,99,520		20,99,520	(Item no. 10.16.1 of DSR 2023)
2.0	Aluminium Standing seam roofing	219.82	Sqm	12000.00		26,37,888	26,37,888	Market Rate
3.0	Flashings in Roofing	60.00	Rmt	1500.00		90,000	90,000	Market Rate
4.0	Gutters in Roofing	40.00	Rmt	18000.00		7,20,000	7,20,000	Market Rate
5.0	Fall Arrest System	60.00	Rmt	9500.00		5,70,000	5,70,000	Market Rate
6.0	Deductions for RCC roof							
6.1	RCC work	-62.00	Cum	10011.35	(6,20,704)		(6,20,704)	(Item no. 5.33.2.2 of DSR 2023)
6.2	Shuttering work	-527.00	Sqm	843.07	(4,44,298)		(4,44,298)	(Weighted avg. rate of 5.9.3, 5.9.5 & 5.9.6 of DSR 2023)
6.3	Steel reinforcement	-10850.00	Kg	107.85	(11,70,173)		(11,70,173)	(Item no. 5.22.6 of DSR 2023)
6.4	Terrace Waterproofing	-219.82	Sqm	1684.60	(3,70,316)		(3,70,316)	(Item no. 22.7.1 of DSR 2023)
7.0	Zincalume sandwiched Insulated Wall & column Panel cladding from the inside	501.86	Sqm	9900.00		49,68,414	49,68,414	Market Rate
8.0	Exterior Aluminium composite panel cladding	481.46	Sqm	5015.05	(24,14,546)		(24,14,546)	(Item no. 8.32 of DSR 2023)

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.	
		RP 030 BQ105	Rev A
C1221104	Bill of Quantities for Development of Warehouse	DESIGNED	CHECKED
		SWATHY AKILESH	IAN

Sr. No.	Description of Work	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
9.0	Structural Steel purlins & supports for wall panels	22379.70	Kg	194.40	43,50,614		43,50,614	(Item no. 10.16.1 of DSR 2023)
10.0	Deduct for 230 mm thick brick masonry as per PAR norms	-115.43	Cum	9105.95	(10,51,080)		(10,51,080)	(Item no. 6.4.2 of DSR 2023)
11.0	Deduct for 12mm thick internal plaster as per PAR norms	-501.86	Sqm	347.05	(1,74,171)		(1,74,171)	(Item no. 13.1.1 of DSR 2023)
12.0	Deduct for 18 mm thick external plaster as per PAR norms	-501.86	Sqm	537.45	(2,69,725)		(2,69,725)	(Item no. 13.12 of DSR 2023)
13.0	Deduct for internal acrylic emulsion paint as per PAR norms	-501.86	Sqm	216.75	(1,08,778)		(1,08,778)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
14.0	Deduct for exterior acrylic emulsion paint as per PAR norms	-501.86	Sqm	181.25	(90,962)		(90,962)	(Item no. 13.48A.1 of DSR 2023)
15.0	Anti-microbial Epoxy flooring including concrete screed sub-base	162.00	Sqm	3300.00		5,34,600	5,34,600	Market Rate
16.0	Deduct for Vitrified Tiles Flooring as per CPWD norms	-162.00	Sqm	1553.45	(2,51,659)		(2,51,659)	(Item no. 11.41.2 of DSR 2023)
17.0	Anti-bacterial Vitrified Tiles of tile size greater than 600 x 600 mm for cladding	25.20	Sqm	3686.00		92,887	92,887	Market Rate
18.0	Deduct for Acrylic emulsion paint as per CPWD norms	-25.20	Sqm	216.75	(5,462)		(5,462)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
19.0	Interior Grade Textured Paint for ceiling of office	19.08	Sqm	2079.00		39,667	39,667	Market Rate
20.0	Deduct for Gypsum board false ceiling as per CPWD norms	-19.08	Sqm	1355.80	(25,869)		(25,869)	(Item no. 12.45.1 of PAR 2023)
21.0	Stainless Steel Vertical Fins in exterior façade	589.00	Rmt	11700.00		68,91,300	68,91,300	Market Rate
22.0	Extra for adding corrosion inhibiting admixtures in concrete	1.00	Ls	138600.00		1,38,600	1,38,600	Provisional Sum
23.0	Fixed cabinetry (Casework only)	1.00	Job	600000.00		6,00,000	6,00,000	Provisional Sum
	SUB TOTAL				**4,15,033**	**1,72,83,357**	**1,76,98,390**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (D) ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS				**7,83,168**	**1,72,83,357**	**1,80,66,524**	
	TOTAL AMOUNT) (RS.)						**3,81,94,623**	
	Total after deducting 18% GST						**3,23,68,325**	
	Total in Rs Crs						**3.24**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.	
		RP 030 BQ106	Rev 0
C1221104	Bill of Quantities for Development of Utilites and Services	DESIGNED	CHECKED
		SWATHY AKILESH	IAN

Sr. No.	Description of Work	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
VII	**EXTERNAL SERVICES**							
1.0	**EXTERNAL LIGHTING**							
1.1	Supply and fixing of 70W LED Aesthetically designed IP 66 LED post Top Made up of Pressure Die Cast aluminium body and opal PC cover. IP 66 and IK 07 rating ensures it stands tall amid varied , input voltage AC 220 - 260 Volts with PF>0.9, Surge protection: 2KV,THD<10%, with inbuilt driver and cover CCT: 3000K.etc., complete.	38.00	Nos	47500.00		18,05,000	18,05,000	HAVELLS TYCOONPT70WLED730PSYMTOPC
1.2	Supply and fixing of decorative hot dipped galvanised mild steel step pole with grey powder finish. Compatible for all post top range. Window - Plasma cut & duly chamfered opening window of 300x110 mm for terminal connections & mounting accessories. Window cover is fitted with allen screws to the pole..etc., complete.	38.00	Nos	7750.00		2,94,500	2,94,500	Havells-2023 3.5M POLE ,HSNE-7308
1.3	Supply and Erection of Highmast (30 Metre) with 12 Nos. 400W LED Fitting directed by the field engineers during execution with all accessories and labour charges complete.	4.00	Nos	11,41,200.00		45,64,800	45,64,800	Market Rate
	FEEDER PILLAR							
2.1	Supply and fixing of suitable out door type street light and landscape lighting feeder pillar box made with 14 SWG CRCA sheet after 7 tank process including S & F 40-63A FP MCB, 6 Nos SP MCB's, din chanel, bus bars, 6 Sqmm 3 core copper cable for internal wiring, contactor, connectors and provision for energy meter etc., complete for finished item of work. [Makes : Legrand / Schnieder / L&T]							
2.2	Mini pillar box	1.00	Nos	23,377.00	23,377		23,377	(Item no. 1521 of DSR 2022 E&M
2.3	Timer switch	1.00	Nos	10,597.00	10,597		10,597	(Item no. 15.4.3 of DSR 2022
2.4	3P 6A MCCB	50.40	Nos	1,007.00	50,753		50,753	(Item no. 2.10.4 of DSR 2022
2.5	3P 10A MCCB	6.00	Nos	1,007.00	6,042		6,042	(Item no. 2.10.4 of DSR 2022
3	**CABLING**							
3.1	Supply of Aluminium HT Cables, Conductor Screen With Extruded Semi Conducting Compound, XLPE Insulated, Insulation Screening with extruded Semi Conducting Compound in combination with Copper Tape (0.2kA for 1 sec/Core),, innersheath of PVC tape,galvanised flat steel strip armoured and overall PVC Sheathed Cable conforming to IS 7098 / (PART-II) 1985 with latest amendments.	2,390.00	Mtr	4,265.00		1,01,93,350	1,01,93,350	Market Rate

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.	
		RP 030 BQ106	Rev 0
C1221104	Bill of Quantities for Development of Utilites and Services	DESIGNED	CHECKED
		SWATHY AKILESH	IAN

Sr. No.	Description of Work	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
3.2	Laying of one number PVC insulated and PVC sheathed / XLPE power cable of !!KV grade of following size direct in ground including excavaion, sand cushionn=ing, protective covering and refiling the trench etc as requird	2,390.00	Mtr	415.00	9,91,850		9,91,850	(Item no. 8.2.2 of DSR 2022
4.0	**Earthing**							
4.1	Providing independent earthing with copper earth plate 600X600X3 by excavating a pit to a depth of 2.1 m with 0.3 m dia in soil using 40 mm dia 'B' class GI pipe of 2.5 m length having staggered holes, filling up the surrounding space around the pipe with Bentonite powder up to 1.8 m from the bottom and remaining space of the pit with loose earth and fixing hume pipe ring (3 mm Thick) with necessary accessories and proper connections including cost, conveyance of all materials, and labour charges etc., complete.	10.00	Nos	13,838.00	1,38,380		1,38,380	(Item no. 5.6 of DSR 2022
4.2	Providing independent earthing by excavating a pit to a depth of 2.1 m with 0.3 m dia in soil using 40 mm dia 'B' class GI pipe of 2.5 m length having staggered holes, filling up the surrounding space around the pipe with Bentonite powder up to 1.8 m from the bottom and remaining space of the pit with loose earth and fixing hume pipe ring (3 mm Thick) with necessary accessories and proper connections including cost, conveyance of all materials, and labour charges etc., complete.	10.00	Nos	6,855.00	68,550		68,550	(Item no. 5.2 of DSR 2022
2.0	**EXTERNAL WATER SUPPLY & DRAINAGE**							
2.1	External Sewerage	1.00	Ls	10,00,000.00		10,00,000	10,00,000	Market Rate
2.2	Filtered water supply distribution lines	1.00	Ls	15,00,000.00		15,00,000	15,00,000	Market Rate
2.3	Unfiltered water supply distribution lines	1.00	Ls	5,00,000.00		5,00,000	5,00,000	Market Rate
3.0	**EXTERNAL FIREFIGHTING**							
3.1	External hydrants, pumps, piping work & appurtenances	1.00	Ls	30,00,000.00		30,00,000	30,00,000	Market Rate
4.0	IT, communication, External CCTV	1.00	LS	30,00,000.00		30,00,000	30,00,000	Market Rate
5.0	Navigational Aids	2.00	nos	2,82,718		5,65,436	5,65,436	Ref Annexure 10.3-103-Rate Analysis Utilities
6.0	Handling equipments	1.00	no	1,07,42,242.00		1,07,42,242	1,07,42,242	Ref Annexure 10.3-103-Rate Analysis Utilities
7.0	Compund wall	297.00	m	9,160.00	27,20,520		27,20,520	(Item no. 5.8.2 of PAR 2023)
	SUB TOTAL				40,10,069	3,71,65,328	3,84,54,877	
	COST INDEX OVER PAR 2023				1.887	1.00		
	TOTAL AMOUNT (RS.)				75,67,000	3,71,65,328	4,47,32,328	
	Total after deducting 18% GST						**3,79,08,752**	
	Total in Rs Crs						**3.79**	

ASSYSTEM INDIA LIMITED						
PROJECT No.	**Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep**		Document No.		DATE	
			RP 030 BQ107	Rev 0	22-Mar-25	
C1221104	Bill of Quantities for Development of Connecting Roads				PAGE	
SL No	**Description of work**	**Unit**	**Total Quantity**	**Rate**	**Amount**	Remarks
1	Cement Concrete Pavement (Construction of un-reinforced, dowel jointed, plain cement concrete pavement over a prepared sub base with 43 grade cement @ 400 kg per cum, coarse and fine aggregate conforming to IS 383, maximum size of coarse aggregate not exceeding 25 mm, mixed in a batching and mixing plant as per approved mix design, transported to site, laid with a fixed form or slip form paver, spread, compacted and finished in a continuous operation including provision of contraction, expansion, construction and longitudinal joints, joint filler, separation membrane, sealant primer, joint sealant, debonding strip, dowel bar, tie rod, admixtures as approved, curing compound, finishing to lines and grades as per drawing)	Cum	188.96	6575.32	12,42,498.77	Refer Item 6.2 of 10.3-104-Rate Analysis Roads
2	Seperation Membrane	sqm	629.88	already included in PQC Cost		
3	Dry Lean Cement Concrete Sub- base (Construction of dry lean cement concrete Sub- base over a prepared sub-grade with coarse and fine aggregate conforming to IS: 383, the size of coarse aggregate not exceeding 25 mm, aggregate cement ratio not to exceed 15:1, aggregate gradation after blending to be as per table 600-1, cement content not to be less than 150 kg/ cum, optimum moisture content to be determined during trial length construction, concrete strength not to be less than 10 Mpa at 7 days, mixed in a batching plant, transported to site, laid with a paver with electronic sensor, compacting with 8-10 tonnes vibratory roller, finishing and curing.)	Cum	94.48	3715.21	3,51,020.47	Refer Item 6.1 of 10.3-104-Rate Analysis Roads
4	Granular Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method (Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401) for grading-III Material	Cum	94.48	2,638.08	2,49,251.07	Refer Item 4.1A of 10.3-104-Rate Analysis Roads
5	Construction of Subgrade (Construction of subgrade with approved material obtained from borrow pits with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2)	Cum	314.94	335.3	1,05,599.38	Refer Item 3.18 of 10.3-104-Rate Analysis Roads
6	Excavation in Soil using Hydraulic Excavator and Tippers with disposal upto 1000 metres. (Excavation for roadwork in soil with hydraulic excavator including cutting and loading in tippers, trimming bottom and side slopes, in accordance with requirements of lines, grades and cross sections, and transporting to the embankment location within all lifts and lead upto 1000m)	Cum	182.67	50.2	9,169.93	Refer Item 3.6 of 10.3-104-Rate Analysis Roads
7	Embankment Construction with Material Obtained from Borrow Pits (Construction of embankment with approved material obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement of table 300-2)	Cum	156.99	332.3	52,166.48	Refer Item 3.16 of 10.3-104-Rate Analysis Roads
8	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	Sqm	42.95	605	25,987.17	Refer Item 8.13 of 10.3-104-Rate Analysis Roads
9	Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of high intensity grade sheeting vide clause 801.3, 2mm thick aluminium sheeting, 3mm/4mm thick Aluminum composite material sheet depending on the size of the sign fixed over back support frame of min 25x25x3mm Angle mounted on a mild steel circular pipe 65 NB ,3.2 mm thicknness firmly fixed to the ground by means of properly designed foundation with M25 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing.				-	
i	600mm Triangle	Nos	2.00	3137	6,274.00	Refer Item 8.4 of 10.3-104-Rate Analysis Roads
ii	600mm Circular	Nos	2.00	3227	6,454.00	
iii	600x450mm Rectangle	Nos	8.00	3206	25,648.00	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep		Document No.		DATE	
			RP 030 BQ107	Rev 0	22-Mar-25	
C1221104	Bill of Quantities for Development of Connecting Roads				PAGE	

SL No	Description of work	Unit	Total Quantity	Rate	Amount	Remarks
8	Construction of Drain	Nos			-	
i	Excavation for Structures (Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom and backfilling with approved material.)	Cum	23.96	73	1,749.26	Refer Item 9.1 of 10.3-104-Rate Analysis Roads
ii	Plain/Reinforced Cement Concrete in Open Foundation complete as per Drawing and Technical Specifications. PCC Grade M15	Cum	11.25	6385	71,831.25	Refer Item 9.14 of 10.3-104-Rate Analysis Roads
iii	Plain/Reinforced Cement Concrete in Open Foundation, wall & slab complete as per Drawing and Technical Specifications. RCC Grade M25	Cum	69.75	7804	5,44,329.00	Refer Item 9.15 of 10.3-104-Rate Analysis Roads
iv	Supplying, Fitting and Placing un-coated HYSD bar Reinforcement in Foundation, Wall & Slab complete as per Drawing and Technical Specifications.	MT	4.19	79802	3,33,971.37	Refer Item 9.16 of 10.3-104-Rate Analysis Roads
v	Steel Gratings	Nos	30.00	773	23,177.51	
	Total Cost as per CPWD 2023				30,49,127.66	
	Applying island factor @ 1.887				57,53,703.89	
	Total after deducting 18% GST				**48,76,020.25**	
	Total Cost in Rs Crs				**0.49**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.		DATE
		RP 031 BQ101	Rev A	28-Mar-25
C1221104	Bill of Quantities for Development of Western Jetty as immediate development	DESIGNED	CHECKED	PAGE
		SWATHY AKILESH	IAN	1

SL.No.	Description of Work	Unit	Qty	Rate	Amount Rs in Crs	Reference to Annexure 10.3 - 101
A	**PREAMBLE**					
	1. This BOQ comprises of Quantities for Proposed Western Jetty in Kalpeni island, comprising of 70m long 12m wide Multipurpose berth.					
	2. The design has been done as per the latest IS-4651 Part IV 2014.					
	3. Liner thickness of 8 mm is considered for all BCI piles up to Liner Termination level.					
	4. Considering the nature of coral rocks, Pile socket length is considered as 4.5x Pile diameter from rock level					
	5. Average bed level is assumed as (-) 3.1m CD					
	6. Maximum lifting weight of precast unit is 20 Tonnes.					
	7. Refer Drawing for Jetty Dimensions					
	8. Refer Annexure 10.3 - 101 for rate analysis of various components					
B	**EXCLUSIONS**					
	1. Service pipelines and pedestal quantity is not considered in this BOQ.					
C	**MOBILISATION & DEMOBILISATION**					
	Mobilization and Demobilisation of Plant & Equipment and other resources complete for Jetty and Approach trestle	LS	1	5,00,00,000	5.00	Market rate
D	**BILL OF QUANTITIES**					
1	**Substructure**					
	Construction of cast in situ RCC bored piles with M.S. liner including driving liner up to required depth, boring in all types of soil strata, removal of excavated material, stabilizing unlined soil using bentonite or any other approved method, providing reinforcement as per design / drawing, providing and placing M40 grade of concrete by means of tremie method, providing all necessary labour, materials, plant, tools and machinery working platform etc complete to the lines and levels as per the drawings and specifications and as directed by Engineer-In-Charge.					
1.1	**Positioning and Setting up**					
	Positioning and setting up of piling equipment at each pile location, for 1000mm dia piles	Nos	33	1,02,547	0.34	Item No 1
1.2	**Liners**					
	Supply and Fabricating Liners from MS plates of 8mm thickness including additional bottom shoe of 1m high, including transportation, alignment, welding (welding electrodes & welding procedure shall be approved by Engineer-In-Charge before commencement of work) and placing in position, all complete as per drawing, specification and as directed by Engineer-In-Charge, for 1000mm dia piles	MT	56	1,98,418	1.10	Item No 2
1.3	**Lowering and Pitching**					
	Lowering and Pitching of fabricated cylindrical steel liners at each pile location, for 1000mm dia piles	MT	56	30,256	0.17	Item No 3
1.4	**Driving**					
	Driving of Liners to any depth as required all complete as per drawing, specification and as directed by Engineer-In-Charge, for 1000mm dia piles					
1.5	**Boring of Piles**					
a	Boring from level formed after dredging to founding level through all types of soil including fresh and slightly weathered rock all complete as per drawing, specification and as directed by Engineer-In-Charge,for 1000mm dia piles	m	330	29,663	0.98	Item No 4
b	Boring through coral rock all complete as per drawing, specification and as directed by Engineer-In-Charge,for 1000mm dia piles	m	149	32,727	0.49	Item No 4
1.6	**Dressing of Pile head**					
	Cutting and Dressing Pile head up to to cutoff level (COL) to satisfaction of Engineer-In-Charge as per specification and as as directed by Engineer-In-Charge, for 1000mm dia piles. Rate to include for cutting of steel liners and chipping of concrete above pile cutoff level and cleaning of projected reinforcement. If sound concrete is not met at COL then chipping should be continued till good concrete is met.	Nos	33	20,479	0.07	Item No 6
1.7	**Concreting**					
	BCI Piles: Supply and Placing in position of design mix concrete grade M40 with approved admixtures, in pile shaft by means of tremie and by approved method upto a level indicated in Specifications above pile cutoff level underneath the Bentonite slurry including all testing and recording by approved method, including cost of all labour and material complete and will be measured from COL to Founding Level as per drawing, specification and as directed by Engineer-In-Charge, for 1000mm dia piles	cum	541	23,661	1.28	Item No 5
1.8	**Reinforcement**					
	BCI Piles: Supply, cutting, bending and placing in position reinforcement including cleaning, wire brushing, straightening, welding with approved electrodes, binding wires etc with all labour and material complete including Laps, chairs, spacers, hooks etc. (Rebar shall be Fe500D of IS 1786-2008, stacking shall be done accordingly) all complete as per drawing, specification and as directed by Engineer-In-Charge, for 1000mm dia piles	MT	163	1,68,200	2.75	Item No 10
1.9	**Pile Load Test**					
1.9.1	Initial Pile Load Test					
	Conducting initial cyclic vertical load test on test piles on land as per approved methodology, and IS:2911 (Part-IV), including loading platform or by providing anchor piles at his own cost, all necessary arrangement of testing facilities and removal of the same after test etc. as per specification and as directed by Engineer-In-Charge, for 1000mm dia piles. The price shall be inclusive of all installation as may be required for testing. (Test Load 2.5 x Safe load capacity of Pile)	Nos	1	30,00,000	0.30	Market rate
1.9.2	Pile Integrity Test					

SL.No.	Description of Work	Unit	Qty	Rate	Amount Rs in Crs	Reference to Annexure 10.3 - 101
	Conducting non destructive integrity test on working piles to be conducted using low strain sonic diagnostic system as per specifications and as directed by Engineer-In-Charge, for 1000 mm dia piles.	Nos	4	2,176	0.001	DSR 2023 - 20.9
1.9.3	Routine Pile Load Test					
	Conducting Routine Pile load test as per approved methodology, and IS:2911 (Part-IV). as per specification and as directed by Engineer-In-Charge. The price shall be inclusive of all installation as may be required for testing. (Test Load - 1.5 x Safe capacity of Pile)	Nos	1	15,00,000	0.15	Market rate
II	**Superstructure**					
2.1	**Concreting**					
2.1.1	Precast: Supply, Casting and placing of pre cast units of mix concrete grade M40 with approved admixtures including vibrating, mixing, curing etc complete (including bottom and side shuttering), transportation to the site placing in position to lines and level as per drawing, specification and as directed by Engineer-In-Charge.	cum	540	31,220	1.69	Item No 7
2.1.2	In-Situ: Supply and placing in position to lines and levels cast in situ design mix cement concrete of grade M40 with approved admixtures for beams, slab etc compacting, curing of concrete complete (including bottom and side shuttering) including installation of inserts, bolts and other embedment with all labour and material as per drawing, specification and as directed by Engineer-In-Charge.	cum	660	26,144	1.73	Item No 8
2.2	**Reinforcement**					
	Supply, cutting, bending and placing in position reinforcement including cleaning, wire brushing, straightening, welding with approved electrodes, binding wires etc with all labour and material complete including Laps, chairs, spacers, hooks etc. (Rebar shall be Fe500D of IS 1786-2008, stacking shall be done accordingly) all complete as per drawing, specification and as directed by Engineer-In-Charge.	MT	240	1,68,750	4.05	Item No 11
2.3	**Wearing Coat**					
	Supply and laying in position M30 grade concrete wearing coat with admixture as per approved mix design, approved casting sequence on deck to lines and level including forming slopes, finishing surface, curing etc complete as per drawing, specification and as directed by Engineer-In-Charge.	cum	63	12,257	0.08	Item No 9
III	**Deck Fixtures and Miscellaneous**					
3.1	**Marine Fenders**					
a	Supply and Fixing of Arch Fender 1000 E 1.1 (Trelleborg or Equivalent) fender, including necessary work with high tensile galvanized wrought iron chains, shakles, frontal frame, anchor bolts, hooks and other fixtures, painting etc complete as per drawing, specification and as directed by Engineer-In-Charge.	Nos	10	8,61,196	0.86	Item No 17
b	Supply and Fixing of Tyre fenders complete with other fixtures, painting etc complete as per drawing, specification and as directed by Engineer-In-Charge.	Nos	11	60,920	0.07	Item No 15
3.2	**Bollards**					
a	Supply and Placing of Inserts for Bollards and Fixing 10T Cast Iron Bollards complete with all inserts in position as per Drawings and as directed by the Engineer-in-charge.	Nos	9	45,335	0.04	Item No 12-1
b	Supply, fabricate and Placing of Inserts for Pipe Bollards of 2T capacity made of MS Steel including fixtures in position as per Drawings and as directed by the Engineer-in-charge.	Nos	6	10,976	0.01	Item No 12-2
3.3	**Mooring Rings**					
	Supply and fix in position stainless steel 150mm ID mooring rings made out of 32 dia stainless steel bar and 32 mm dia stainless steel 'U' bolt in deck. (Rate to include for forming recess, hole, etc. in the concrete all complete) as per drawings, specifications and as instructed by Engineer-In-Charge	Nos	4	14,660	0.01	Item No 13
3.4	**Safety Ladders**					
	Supply & Fixing of 6800mm long galvanised steel ladders including steel bolts, connection with deck & piles, resign plug etc. complete as per detailed drawing and as directed by the Engineer-In-Charge	Nos	2	3,25,943	0.07	Item No 16
3.5	**Safety Chains**					
	Supply & Fixing of galvanised Steel Safety Chains including steel bolts, connection with deck & piles, resign plug etc. complete as per detailed drawing and as directed by the Engineer-In-Charge	Nos	4	32,418	0.013	Item No 14
3.7	**Drainage Spouts**					
	Supply and Fixing in position drainage spout arrangements having 100mm dia UPVC pipe fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	40	877	0.004	DSR 2023 - 7758
3.8	**PVC Pipe for Conduits**					
	Supply and Fixing in position 150mm dia PVC pipe for utility purpose, fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	140	1,038	0.01	DSR 2023 - 7745
	Supply and Fixing in position 100mm dia PVC pipe for utility purpose, fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	140	877	0.01	DSR 2023 - 7758
E	Total				21.25	
	Total after deducting 18% GST				**18.01**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.		DATE
		RP031 BQ102	Rev A	28-Mar-25
C1221104	Bill of Quantities for Western jetty Approach Trestle at Kalpeni	DESIGNED	CHECKED	PAGE 3
		SWATHY AKILESH	IAN	

SL.No.	Description of Work	Unit	Qty	Rate	Amount Rs in Cr	Reference to Annexure 10.3 - 102
A	**PREAMBLE**					
	1. This BOQ comprises of Quantities for Proposed Western Approach Trestle in Kalpeni island, 225m long					
	2. The design has been done as per the latest IS-4651 Part IV 2014.					
	3. Liner thickness of 8 mm for 900mm pile is considered for all BCI piles up to Liner Termination level					
	4. Pile socket length is assumed as 4.5x Pile diameter					
	5. Maximum lifting weight of precast unit is 20 Tonnes.					
	6. Overall Mobilisation charges for Jetty and Trestle is listed in BQ101					
	7. Refer Annexure 10.3 - 102 for rate analysis of various components					
B	**EXCLUSIONS**					
	1. Electrical, Mechanical and other service fixtures are not considered in this BoQ.					
	2. Service pipelines quantity is not considered in this BoQ.					
C	**BILL OF QUANTITIES**					
1	**Substructure**					
	Construction of cast in situ RCC bored piles with M.S. liner including driving liner up to required depth, boring in all types of soil strata, removal of excavated material, stabilizing unlined soil using bentonite or any other approved method, providing reinforcement as per design / drawing, providing and placing M40 grade of concrete by means of tremie method, providing all necessary labour, materials, plant, tools and machinery working platform etc complete to the lines and levels as per the drawings and specifications and as directed by Engineer-In-Charge.					
1.1	**Positioning and Setting up**					
	Positioning and setting up of piling equipment at each pile location for 900mm dia pile	Nos	70	99,479	0.70	Item No 1
1.2	**Liners**					
	Supply and Fabricating Liners from MS plates of thickness 8 mm for 900mm piles, including additional bottom shoe of 1m high, including transportation, alignment, welding (welding electrodes & welding procedure shall be approved by Engineer-In-Charge before commencement of work) and placing in position, all complete as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia pile	MT	123.01	1,93,443	2.38	Item No 2
1.3	**Lowering and Pitching**					
	Lowering and Pitching of fabricated cylindrical steel liners at each pile location for 900 mm dia pile	MT	123.01	27,673	0.34	Item No 3
1.4	**Driving**					
	Driving of Liners to any depth as required all complete as per drawing, specification and as directed by Engineer-In-Charge					
1.5	**Boring of Piles**					
a	Boring from level formed after dredging to founding level through all types of fresh and slightly weathered rock (including Quartzite/Schist and Mica schist/ Slate/ Phylite) all complete as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia piles	m	732	27,131	1.98	Item No 4
b	Boring through coral rock all complete as per drawing, specification and as directed by Engineer-In-Charge,for 900mm dia pile	m	284	29,450	0.83	Item No 4
1.6	**Dressing of Pile head**					
	Cutting and Dressing Pile head up to to cutoff level (COL) to satisfaction of Engineer-In-Charge as per specification and as as directed by Engineer-In-Charge for 900mm dia pile. Rate to include for cutting of steel liners and chipping of concrete above pile cutoff level and cleaning of projected reinforcement. If sound concrete is not met at COL then chipping should be continued till good concrete is met.	Nos	70	19,190	0.13	Item No 6
1.7	**Concreting**					
	BCI Piles: Supply and Placing in position of design mix concrete grade M40 with approved admixtures, in pile shaft by means of tremie and by approved method upto a level indicated in Specifications above pile cutoff level underneath the Bentonite slurry including all testing and recording by approved method, including cost of all labour and material complete and will be measured from COL to Founding Level as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia pile	cum	950	30,759	2.92	Item No 5
1.8	**Reinforcement**					
	BCI Piles: Supply, cutting, bending and placing in position reinforcement including cleaning, wire brushing, straightening, welding with approved electrodes, binding wires etc with all labour and material complete including Laps, chairs, spacers, hooks etc. (Rebar shall be Fe500D of IS 1786-2008, stacking shall be done accordingly) all complete as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia pile	MT	162	1,77,000	2.87	Item No 10
1.9	**Pile Load Test**					
1.9.1	Pile Integrity Test					
	Conducting non destructive integrity test on working piles to be conducted using low strain sonic diagnostic system as per specifications and as directed by Engineer-In-Charge for 900mm dia pile	Nos	7	2,176	0.002	DSR 2023 - 20.9
1.9.2	Routine Pile Load Test					
	Conducting Routine Pile load test as per approved methodology, and IS:2911 (Part-IV). as per specification and as directed by Engineer-In-Charge. The price shall be inclusive of all installation as may be required for testing. (Test Load - 1.5 x Safe capacity of Pile)	Nos	1	15,00,000	0.15	Market rate
II	**Superstructure**					
2.1	**Concreting**					
2.1.1	Precast: Supply, Casting and placing of pre cast units of mix concrete grade M40 with approved admixtures including vibrating, mixing, curing etc complete (including bottom and side shuttering), transportation to the site placing in position to lines and level as per drawing, specification and as directed by Engineer-In-Charge.	cum	1307	31,271	4.09	Item No 7
2.1.2	In-Situ: Supply and placing in position to lines and levels cast in situ design mix cement concrete of grade M40 with approved admixtures for beams, slab etc compacting, curing of concrete complete (including bottom and side shuttering) including installation of inserts, bolts and other embedment with all labour and material as per drawing, specification and as directed by Engineer-In-Charge.	cum	1597	33,172	5.30	Item No 8
2.2	**Reinforcement**					
	Supply, cutting, bending and placing in position reinforcement including cleaning, wire brushing, straightening, welding with approved electrodes, binding wires etc with all labour and material complete including Laps, chairs, spacers, hooks etc. (Rebar shall be Fe500D of IS 1786-2008, stacking shall be done accordingly) all complete as per drawing, specification and as directed by Engineer-In-Charge.	MT	596	1,77,560	10.58	Item No 11
2.3	**Wearing Coat**					
	Supply and laying in position M30 grade concrete wearing coat with admixture as per approved mix design, approved casting sequence on deck to lines and level including forming slopes, finishing surface, curing etc complete as per drawing, specification and as directed by Engineer-In-Charge.	cum	79	12,283	0.10	Item No 9
III	**Retaining Structures**					
3.1	**Retaining Wall**					
3.1.1	Excavation upto founding level of the Foundation of the Retaining Wall	cum	68	941	0.01	DSR 2023 2.7.1
3.1.2	Supply and placing in position cast in situ design mix cement concrete of grade M40 with approved admixtures for Footing and wall of Retaining Structure compacting, curing of concrete complete (including side shuttering) transportation to the site placing in position to lines and level, with all labour and material as per drawing, specification and as directed by Engineer-In-Charge.	cum	29	33,172	0.10	Item No 8
3.2	**Approach Slab**					
	Supply and placing in position cast in situ design mix cement concrete of grade M40 with approved admixtures for Footing and wall of Retaining Structure compacting, curing of concrete complete (including side shuttering) transportation to the site placing in position to lines and level, with all labour and material as per drawing, specification and as directed by Engineer-In-Charge.	cum	30	33,172	0.10	Item No 8
IV	**Deck Fixtures and Miscellaneous**					
4.1	**Expansion Joint**					
	Supply and place in position, according to the drawings and specification, strip seal type expansion joint for max movement of 100 mm all complete as per drawing and as directed by Engineer-In-Charge.	RM	30	12,188	0.04	Morth - Kerala PWD - MR138
4.2	**Drainage Spouts**					
	Supply and Fixing in position drainage spout arrangements having 100mm dia PVC pipe fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	30	877	0.003	DSR 2023 - 7758
4.3	**Handrail**					
	Supply, Fabricating and fixing in position MS Hand rail posts and Hand railing, Utility trays including paint with surface prepration by copper slag blasting SA 2.5(50-70 micron) and one coat of inorganic zinc silicate primer with zinc content 80% to 90% (total DFT 50 to 75 microns) and one coat of high build MIO (DFT 100 micron) and one final coat of aliphatic acrylic PU1 (DFT 100 micron) of approved make and colour etc. and all fixtures as per drawing, specification and as directed by Engineer-In-Charge.	RM	675	4,595	0.31	Morth -Standard data book for analysis of rate -2019

SL.No.	Description of Work	Unit	Qty	Rate	Amount Rs in Cr	Reference to Annexure 10.3 - 102
4.4	**PVC Pipe for Conduits**					
	Supply and Fixing in position 150mm dia PVC pipe for utility purpose, fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	450	1,038	0.05	DSR 2023 - 7745
	Supply and Fixing in position 100mm dia PVC pipe for utility purpose, fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	450	877	0.04	DSR 2023 - 7758
V	**Architectural work for approach trestle**					
5.1	**Pergolas (2 Nos.)**					
5.1.1	Structural Glazing using toughened laminated DGU	Sqm	730	15000	1.10	Market rate
5.1.2	Structural steel framework using hollow tubular steel sections	Kg.	80300	367	2.95	DSR 2023 : 10.16.1
5.1.3	Polyurethane painting to steel work	Sqm	1205	1025	0.12	Market rate
5.2	**Viewing Deck (2 Nos.)**					
5.2.1	Glass Flooring using 35.52 mm thick laminated sandwiched glass	Sqm	60	42500	0.26	Market rate
5.2.2	Curved Stainless Steel ribs SS 316 Grade with laminated toughened glass in curved profile	Kg.	3180	1894.77	0.60	DSR 2023 : 10.28, Add 30% for higher grade
5.2.3	Structural steel framework using hollow tubular steel sections for glass floor	Kg.	6000	367	0.22	DSR 2023 : 10.16.1
5.2.4	Polyurethane painting to steel work	Sqm	90	1025	0.01	Market rate
5.3	**Kiosks (4 Nos.)**					
5.3.1	Glass Flooring using 35.52 mm thick laminated sandwiched glass	Sqm	38	48500	0.18	Market rate
5.3.2	Laminated toughened Glazed Wall in curved profile	Sqm	148	18500	0.27	Market rate
5.3.3	18 mm thick Cement Board for Canopy in Roofing	Sqm	160	3438	0.06	Market rate
5.3.4	PU paint over cement boards	Sqm	400	1025	0.04	Market rate
5.3.5	Glass Roof using 19.52 mm thick laminated sandwiched glass with SS supports	Sqm	56	32000	0.18	Market rate
5.3.6	Structural steel framework using hollow tubular steel sections for structure, floor and roof	Kg.	29180	367	1.07	DSR 2023 : 10.16.1
5.3.7	Polyurethane painting to steel work	Sqm	438	1025	0.04	Market rate
5.4	**Main Entrance Gate (1 NO.)**					
5.4.1	RCC M-40 Grade for Main Gate					
5.4.1.1	RCC Roof slab	Cum	12.0	19461	0.02	DSR 2023 : 5.33.2.4
5.4.1.2	RCC Columns	Cum	3.38	19461	0.01	DSR 2023 : 5.33.2.4
5.4.2.1	Soffits of roof slab	Sqm	60.00	1749.72	0.01	DSR 2023 : 5.9.3
5.4.2.2	Sides of columns	Sqm	30.00	1813.97	0.01	DSR 2023 : 5.9.6
5.4.3	Steel Reinforcement	Kg	2130.70	203.51	0.04	DSR 2023 : 5.22.6
5.4.4	MS Swing gates made out of hollow tubular sections	Kg	1181.25	366.83	0.04	DSR 2023 : 10.16.1
5.4.5	Membrane Waterproofing over roof slab	Kg	5550.00	2450.00	1.36	Market Rate
5.4.6	Polyurethane painting to steel work	Sqm	130.97	1025.00	0.01	Market Rate
5.5	**Deck Area**					
5.5.1	Pre-cast solid block masonry 200mm thick	Cum	80.44	12000	0.10	Market rate
5.5.2	Textured Paint for Block Work	sqm	545.00	2079	0.11	Market rate
5.5.3	Stainless Steel Railing SS 316 Grade	Kg	3808.00	1895	0.72	DSR 2023 : 10.28, Add 30% for higher grade
E	Total				42.55	
	Total after deducting 18% GST				**36.06**	

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
I	**PASSENGER BUILDING**							
				Floor Ht (in m)				
	Built-up Area	**1495.35**	**Sqm**					
	Ground Floor	500.00	Sqm	4.50				
	1st Floor	620.00	Sqm	4.50				
	2nd Floor	342.00	Sqm	4.50				
	Terrace Mumty	33.35	Sqm	2.80				
	Plot Area	**2616.86**	**Sqm**					
	Cost Index of Cochin over CPWD PAR 2023	**1.887**						
	Cost Index of Cochin over CPWD DSR 2023	**1.887**						
A	**CIVIL WORKS**							
I	**SHELL & CORE (SCHEDULED CIVIL WORK ITEMS)**							
1.0	**RCC FRAMED STRUCTURE (Upto Six Storeys)**							
1.1	RCC structure upto 6 storeys							
1.1.1	Floor Height 3.6 mt.	1495.35	Sqm.	30820.00	4,60,86,687		4,60,86,687	(Item no. 1.1.1 of PAR 2023)
	(Rate as per Annexure-I (e) of PAR 2023)							
1.2	**EXTRA FOR**							
1.2.2	Every 0.3 mt or part thereof, additional/ less height of floor above normal floor height of 3.6 meter/3.00 meter (on areas having additional/less Height)	1462.00	Sqm.	1263.00	18,46,506		18,46,506	(Item no. 1.3.2 of PAR 2023)
	((4.50-3.6)/0.30)x421=1263.00 (For GF, 1st & 2nd floors)							
	SUB TOTAL				**4,79,33,193**	**-**	**4,79,33,193**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (A) FOR CIVIL WORKS (RS.)				**9,04,49,935**	**-**	**9,04,49,935**	
B	**MEP WORKS**							
I	**HVAC & VENTILATION SYSTEMS**							
1.0	Supplying installation testing and commissioning of Energy Efficient Central AC Plants (For Public areas, offices & the like)	73.67	TR.	90380.00	66,58,382		66,58,382	(Item no. 6.5.1 of Specialized E & M Works PAR 2023)
2.0	Pressurized Mechanical Ventilation (with supply of exhaust blowers) (For toilets, service areas etc.)	153.35	Sqm.	1050.00	1,61,018		1,61,018	(Item no. 1.7 of PAR 2023)
	SUB TOTAL				**68,19,400**	**-**	**68,19,400**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		

	SUB TOTAL (I) FOR HVAC & VENTILATION SYSTEMS (RS.)				**1,28,68,207**	**-**	**1,28,68,207**	
II	**ELECTRICAL SYSTEMS**							
1.0	Internal Electrical Installations (12.5% of Building Civil Cost)	4,79,33,193.00	Ls.	12.50%	59,91,649		59,91,649	(Item no. 2.3 of PAR 2023)
2.0	Power wiring and plugs (4% of Building Civil Cost)	4,79,33,193.00	Ls.	4.00%	19,17,328		19,17,328	(Item no. 2.4.1 of PAR 2023)
3.0	Electrical External Service Connections (3.75% of Building Civil Cost)	4,79,33,193.00	Ls.	3.75%	17,97,495		17,97,495	(Item no. 2.2.1 of PAR 2023)
4.0	Lightning conductors (0.25% of Building cost)	4,79,33,193.00	Ls.	0.25%	1,19,833		1,19,833	(Item no. 2.4.2 of PAR 2023)
5.0	Telephone conduits (0.25% of Building cost)	4,79,33,193.00	Ls.	0.25%	1,19,833		1,19,833	(Item no. 2.4.3 of PAR 2023)
6.0	SUBSTATION EQUIPMENTS							
6.1	Supplying, installation, testing and commissioning of 33kV/0.433kV or 11kV/0.433 kV substation equipments	500.00	per KVA	9,000.00	45,00,000		45,00,000	(Item no. 6.2.1 of Specialized E & M Works PAR 2023)
7.0	DIESEL GENERATOR SETS							
7.1	Supplying, installation, testing and commissioning of Silent Type DG Sets, AMF Panel, Bus Ducting/ Cables..... (100% backup)	500.00	per KVA	11,560.00	57,80,000		57,80,000	(Item no. 6.3.1 of Specialized E & M Works PAR 2023)
8.0	UPS SYSTEM							
8.1	Supplying, installation, testing and commissioning of online 3 phase UPS System with 30 minutes back up including batteries, interconnecting cables, battery racks etc. (20% backup)	100.00	per KVA	21,290.00	21,29,000		21,29,000	(Item no. 6.4.1 of Specialized E & M Works PAR 2023)
9.0	Supply of Aluminium HT Cables, Conductor Screen With Extruded Semi Conducting Compound, XLPE Insulated, Insulation Screening with extruded Semi Conducting Compound in combination with Copper Tape (0.2kA for 1 sec/Core),, innersheath of PVC tape,galvanised flat steel strip armoured and overall PVC Sheathed Cable conforming to IS 7098 / (PART-II) 1985 with latest amendments.	2,200.00	per Mtr	4,265.00	93,83,000		93,83,000	MR
9.1	Laying of one number PVC insulated and PVC sheathed / XLPE power cable of !!KV grade direct in ground including excavaion, sand cushioning, protective covering and refiling the trench etc as requird	2,200.00	per Mtr	415.00	9,13,000		9,13,000	(Item no. 8.2.2 of DSR 2022 - E&M)
	SUB TOTAL				**3,26,51,138**	**-**	**2,23,55,138**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (II) FOR ELECTRICAL SYSTEMS (RS.)				**6,16,12,697**	**-**	**6,16,12,697**	
III	**PLUMBING & DRAINAGE SYSTEMS**							
1.0	Internal Water Supply & Installations (4% of Building Civil Cost)	4,79,33,193.00	Ls.	4.00%	19,17,328		19,17,328	(Item no. 2.1 of PAR 2023)
2.0	Civil External Service Connections (1.25% of Building Civil Cost)	4,79,33,193.00	Ls.	1.25%	5,99,165		5,99,165	(Item no. 2.2.2 of PAR 2023)
3.0	Hydropneumatic water supply system	300.00	LPM	1,640.00	4,92,000		4,92,000	(Item no. 6.13.1 of Specialized E & M Works PAR 2023)
4.0	Overhead tank without independent staging	10,500.00	Litre	23.00	2,41,500		2,41,500	(Item no. 4.1 of PAR 2023)
	SUB TOTAL				**32,49,993**	**-**	**32,49,993**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		

	SUB TOTAL (III) FOR PLUMBING & DRAINAGE SYSTEMS (RS.)				**61,32,736**	**-**	**61,32,736**	
IV	**FIRE FIGHTING WORKS**							
1.0	With wet riser & sprinkler system	1,495.35	Sqm	1,200.00	17,94,420		17,94,420	(Item no. 1.5.3 of PAR 2023)
	SUB TOTAL				**17,94,420**	**-**	**17,94,420**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**33,86,071**	**-**	**33,86,071**	
V	**FIRE ALARM & FIRE DETECTION SYSTEM**							
1.0	Automatic Fire Alarm System	1,495.35	Sqm	600.00	8,97,210		8,97,210	(Item no. 1.6.2 of PAR 2023)
	SUB TOTAL				**8,97,210**	**-**	**8,97,210**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**16,93,035**	**-**	**16,93,035**	
	SUB TOTAL (B) MEP WORKS				**8,56,92,746**	**-**	**8,56,92,746**	
C	**MISCELLANEOUS ITEMS**							
1.0	IBMS System upto area of 10000 Sqm	1495.35	Sqm	430.00	6,43,001		6,43,001	(Item no.6.12.1 of PAR 2023)
2.0	Access Control System	1495.35	Sqm	220.00	3,28,977		3,28,977	(Item no. 6.11.1 of PAR 2023)
3.0	IP based EPABX System (Excluding common areas)	1196.28	Sqm	580.00	6,93,842		6,93,842	(Item no. 6.17.1 of PAR 2023)
4.0	AV System (For Arrival, Departure & Waiting areas on GF)	350.00	Sqm	11,890.00	41,61,500		41,61,500	(Item no. 6.18 of PAR 2023)
5.0	IP based CCTV System (for indoors)	1495.35	Sqm	210.00	3,14,024		3,14,024	(Item no. 6.10.1 of PAR 2023)
6.0	IP based CCTV System (for external surveillance)	1495.35	Sqm	210.00	3,14,024		3,14,024	(Item no. 6.10.2of PAR 2023)
7.0	LAN system (20% of area considered)	299.00	Sqm	560.00	1,67,440		1,67,440	(Item no. 6.16.1 of PAR 2023)
8.0	Illuminated Signages	1495.35	Sqm	250.00		3,73,838	3,73,838	Market Rate
	SUB TOTAL				**66,22,807**	**3,73,838**	**69,96,644**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (C) MISCELLANEOUS ITEMS				**1,24,97,237**	**3,73,838**	**1,28,71,074**	
D	**ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS**							
1.0	Engineered Hardwood flooring	180.71	Sqm	8500.00		15,36,035	15,36,035	Market Rate
2.0	Double charged Vitrified Tiles of tile size greater than 600 x 600 mm for flooring	707.06	Sqm	3497.00		24,72,589	24,72,589	Market Rate
3.0	Deduct for Vitrified Tiles Flooring as per CPWD norms	-887.77	Sqm	1,553.45	(13,79,106)		(13,79,106)	(Item no. 11.41.2 of DSR 2023)
4.0	Aluminium (wood finish) coffered ceiling	194.25	Sqm	10000.00		19,42,500	19,42,500	Market Rate
5.0	Aluminium (wood finish) baffle ceiling	180.71	Sqm	14500.00		26,20,295	26,20,295	Market Rate
6.0	Wooden ceiling with cove	229.88	Sqm	8500.00		19,53,980	19,53,980	Market Rate
7.0	Deduct for Gypsum board false ceiling as per CPWD norms	-604.84	Sqm	1,355.80	(8,20,042)		(8,20,042)	(Item no. 12.45.1 of DSR 2023)

8.0	Decorative Wallpaper	238.60	Sqm	900.00		2,14,740	2,14,740	Market Rate
9.0	UPVC Fluted Paneling with wooden finish	682.99	Sqm	5500.00		37,56,445	37,56,445	Market Rate
10.0	Brick finish tile cladding	320.47	Sqm	3000.00		9,61,410	9,61,410	Market Rate
11.0	Interior Grade Textured Paint	2206.34	Sqm	2079.00		45,86,981	45,86,981	Market Rate
12.0	Acoustic panel cladding	214.08	Sqm	8750.00		18,73,200	18,73,200	Market Rate
13.0	Anti-bacterial Vitrified Tiles of tile size greater than 600 x 600 mm for cladding	172.24	Sqm	3686.00		6,34,877	6,34,877	Market Rate
14.0	Deduct for Acrylic emulsion paint as per CPWD norms	-3662.48	Sqm	216.75	(7,93,843)		(7,93,843)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
15.0	Deduct for Vitrified Tiles dado as per CPWD norms	-172.24	Sqm	1623.05	(2,79,554)		(2,79,554)	(Item no. 11.46.2 of DSR 2023)
16.0	Aluminium Composite Panels -Wooden Finish in Exterior ceiling	1150.53	Sqm	5,015.05		57,69,965	57,69,965	(Item no. 8.32 of DSR 2023)
17.0	Stainless Steel Vertical Fins in exterior façade	866.05	Rmt	11700.00		1,01,32,785	1,01,32,785	Market Rate
18.0	Extra for double glazed/ laminated glass in exterior façade	1280.93	Sqm	3500.00		44,83,255	44,83,255	Market Rate
19.0	Deduct for 230 mm thick brick masonry as per PAR norms	-294.61	Cum	9105.95	(26,82,739)		(26,82,739)	(Item no. 6.4.2 of DSR 2023)
20.0	Deduct for 12mm thick internal plaster as per PAR norms	-1280.93	Sqm	347.05	(4,44,547)		(4,44,547)	(Item no. 13.1.1 of DSR 2023)
21.0	Deduct for 18 mm thick external plaster as per PAR norms	-1280.93	Sqm	537.45	(6,88,436)		(6,88,436)	(Item no. 13.12 of DSR 2023)
22.0	Deduct for internal acrylic emulsion paint as per PAR norms	-1280.93	Sqm	216.75	(2,77,642)		(2,77,642)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
23.0	Deduct for exterior acrylic emulsion paint as per PAR norms	-2431.46	Sqm	181.25	(4,40,702)		(4,40,702)	(Item no. 13.48A.1 of DSR 2023)
24.0	Structural Steel purlins & supports for ceiling panels -Hot Rolled Sections	11505.30	Kg	133.70	15,38,259		15,38,259	(Item no. 10.2 of DSR 2023)
25.0	Epoxy paint to structural steel work	172.58	Sqm	241.75	41,721		41,721	(Item no. 13.52.1 of DSR 2023)
26.0	Extra for adding corrosion inhibiting admixtures in concrete	1.00	Ls	1850500.00		18,50,500	18,50,500	Provisional Sum
27.0	Fixed cabinetry (Casework only)	1.00	Job	1600000.00		16,00,000	16,00,000	Provisional Sum
	SUB TOTAL				**(62,26,631)**	**4,63,89,557**	**4,01,62,926**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (D) ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS				**(1,17,49,653)**	**4,63,89,557**	**3,46,39,904**	
	TOTAL AMOUNT) (RS.)				**17,68,90,265**	**4,67,63,394**	**22,36,53,659**	
	Total after deducting 18% GST						**18,95,36,999**	
	Total in Rs Crs						**18.95**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.		DATE
		RP031 BQ104	Rev A	28-Mar-25
C1221104	Bill of Quantities for Boat landing facility at Kalpeni	DESIGNED	CHECKED	PAGE
		SWATHY AKILESH	IAN	

SL.No.	Description of Work	Unit	Qty	Rate in Rs as per DSR 2023	Cost indexed rate	Amount Rs in Cr	Remarks
A	**PREAMBLE**				1.887		
	1. This BOQ comprises of quantities for Proposed boat landing facility of 75m						
	2. The design has been done as per the latest IS-4651 Part IV 2014.						
B	**EXCLUSIONS**						
	1 Any specialsed requirements are not included and are to be provided by user.						
C	**BILL OF QUANTITIES**						
1	Earthwork excavation in coral sand (exceeding 30cm in depth, 1.5m in width as well as 10sqm on plan), getting out and disposal of excavated earth lead upto 50m and lift upto 1.5m , dressing the bottom and sides of the trench complete as per specifications, as directed by Engineer in Charge	cum	225	498.90	941.42	0.02	DSR 2023 2.7.1
2	Supplying granite stone upto 10 kg with specific gravity of not less than 2.65 including cost and conveyance from quarry to site, loading and unloading charges and spreading in uniform layers at an average thickness of 30 cm in sea in all tides and weather conditions for forming the filter layer as per the approved drawing including hire and operational charges of crane, floating crafts, tools and plants, drivers etc., complete as per the direction of Engineer-in-charge of the work.	cum	225	7404	-	0.17	Refer Annexure 10.3 - 104 - Rate Analysis for Beach landing and associated facilities Item No 1
3	Profiling of beach slope from existing ground level upto (-)1.5m CD including cutting and filling to from a slope of 1 in 10 including cost of all machineries and tools and labour with lead upto 50m complete as per specifications.	cum	2244	498.90	941.42	0.21	DSR 2023 2.7.1
4	Levelling the prepared base with granite / trap broken metal 100mm. and down size, with approved sand including hand packing, ramming, watering, including cost of all materials and labour with lead upto 50m. and lift of 1.5 m. complete as per specifications.	cum	3519	9479		3.34	Refer Annexure 10.3 - 104 - Rate Analysis for Beach landing and associated facilities Item No 2
5	Supplying granite stone upto 10 kg with specific gravity of not less than 2.65 including cost and conveyance from quarry to site, loading and unloading charges and spreading in uniform layers at an average thickness of 30 cm for forming the slope protection as per the approved drawing including hire and operational charges of crane, floating crafts, tools and plants, drivers etc., complete as per the direction of Engineer-in-charge of the work.	cum	52	7404	-	0.04	Refer Annexure 10.3 - 104 - Rate Analysis for Beach landing and associated facilities Item No 1
6	Supply and laying in position M30 grade concrete PCC with admixture as per approved mix design, approved casting sequence over the EGL to lines and level including finishing surface, curing etc complete as per drawing, specification and as directed by Engineer-In-Charge.	cum	2706	12257		3.32	Refer Annexure 10.3-101-Rate analysis for Western Jetty Item no 9
D	**TOTAL**					**7.09**	
	Total after deducting 18% GST					**6.01**	

SL.No.	Description of Work	Unit	Qty	Rate	Amount Rs in Cr	Reference to Annexure 10.3 - 102
A	**PREAMBLE**					
	2. The design has been done as per the latest IS-4651 Part IV 2014.					
	3. Liner thickness of 8 mm is considered for all BCI piles up to Liner Termination level.					
	4. Considering the nature of coral rocks, Pile socket length is considered as 4.5x Pile diameter from rock level					
	5. Average bed level is assumed as (-) 3.1m CD					
	6. Maximum lifting weight of precast unit is 20 Tonnes.					
	7. Refer Drawing for Jetty Dimensions					
	8. Refer Annexure 10.3 - 102 for rate analysis of various components					
B	**EXCLUSIONS**					
	1. Electrical, Mechanical and other service fixtures are not considered in this BoQ.					
	2. Service pipelines quantity is not considered in this BoQ.					
C	**BILL OF QUANTITIES**					
1	**Substructure**					
	Construction of cast in situ RCC bored piles with M.S. liner including driving liner up to required depth, boring in all types of soil strata, removal of excavated material, stabilizing unlined soil using bentonite or any other approved method, providing reinforcement as per design / drawing, providing and placing M40 grade of concrete by means of tremie method, providing all necessary labour, materials, plant, tools and machinery working platform etc complete to the lines and levels as per the drawings and specifications and as directed by Engineer-In-Charge.					
1.1	**Positioning and Setting up**					
	Positioning and setting up of piling equipment at each pile location for 900mm dia pile	Nos	10	99,479	0.10	Item No 1
	a) 900mm pile					
1.2	**Liners**					
	Supply and Fabricating Liners from MS plates of thickness 8 mm for 900mm piles, including additional bottom shoe of 1m high, including transportation, alignment, welding (welding electrodes & welding procedure shall be approved by Engineer-In-Charge before commencement of work) and placing in position, all complete as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia pile	MT	9.16	1,93,443	0.18	Item No 2
1.3	**Lowering and Pitching**	MT	9.16	27,673	0.03	Item No 3
	Lowering and Pitching of fabricated cylindrical steel liners at each pile location for 900mm dia pile					
1.4	**Driving**					
	Driving of Liners to any depth as required all complete as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia pile					
1.5	**Boring of Piles**					
1.5.1	Boring from level formed after dredging to founding level through all types of fresh and slightly weathered rock (including Quartzite/Schist and Mica schist/ Slate/ Phylite) all complete as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia pile	m	125	27,131	0.34	Item No 4
1.5.2	Rock boring for 900mm dia pile	m	41	29,450	0.12	Item No 4
1.6	**Dressing of Pile head**					
	Cutting and Dressing Pile head up to to cutoff level (COL) to satisfaction of Engineer-In-Charge as per specification and as as directed by Engineer-In-Charge for 900mm dia pile . Rate to include for cutting of steel liners and chipping of concrete above pile cutoff level and cleaning of projected reinforcement. If sound concrete is not met at COL then chipping should be continued till good concrete is met.	Nos	10	19,190	0.02	Item No 6
1.7	**Concreting**					

SL.No.	Description of Work	Unit	Qty	Rate	Amount Rs in Cr	Reference to Annexure 10.3 - 102
	BCI Piles: Supply and Placing in position of design mix concrete grade M40 with approved admixtures, in pile shaft by means of tremie and by approved method upto a level indicated in Specifications above pile cutoff level underneath the Bentonite slurry including all testing and recording by approved method, including cost of all labour and material complete and will be measured from COL to Founding Level as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia pile	cum	131	30,759	0.40	Item No 5
1.8	**Reinforcement**					
	BCI Piles: Supply, cutting, bending and placing in position reinforcement including cleaning, wire brushing, straightening, welding with approved electrodes, binding wires etc with all labour and material complete including Laps, chairs, spacers, hooks etc. (Rebar shall be Fe500D of IS 1786-2008, stacking shall be done accordingly) all complete as per drawing, specification and as directed by Engineer-In-Charge for 900mm dia pile	MT	29	1,77,000	0.51	Item No 10
1.9	**Pile Load Test**					
1.9.1	Pile Integrity Test					
	Conducting non destructive integrity test on working piles to be conducted using low strain sonic diagnostic system as per specifications and as directed by Engineer-In-Charge for 900mm dia pile	Nos	1	2,176	0.0002	DSR 2023 - 20.9
	a) 900mm pile					Item No 8
1.9.2	Routine Pile Load Test					
	Conducting Routine Pile load test as per approved methodology, and IS:2911 (Part-IV). as per specification and as directed by Engineer-In-Charge. The price shall be inclusive of all installation as may be required for testing. (Test Load - 1.5 x Safe capacity of Pile)	Nos	1	15,00,000	0.15	Market Rate
II	**Superstructure**					
2.1	**Concreting**					
2.1.1	Precast: Supply, Casting and placing of pre cast units of mix concrete grade M40 with approved admixtures including vibrating, mixing, curing etc complete (including bottom and side shuttering), transportation to the site placing in position to lines and level as per drawing, specification and as directed by Engineer-In-Charge.	cum	297	31,271	0.93	Item No 7
2.1.2	In-Situ: Supply and placing in position to lines and levels cast in situ design mix cement concrete of grade M40 with approved admixtures for beams, slab etc compacting, curing of concrete complete (including bottom and side shuttering) including installation of inserts, bolts and other embedment with all labour and material as per drawing, specification and as directed by Engineer-In-Charge.	cum	363	33,172	1.20	Item No 8
2.2	**Reinforcement**					
	Supply, cutting, bending and placing in position reinforcement including cleaning, wire brushing, straightening, welding with approved electrodes, binding wires etc with all labour and material complete including Laps, chairs, spacers, hooks etc. (Rebar shall be Fe500D of IS 1786-2008, stacking shall be done accordingly) all complete as per drawing, specification and as directed by Engineer-In-Charge.	MT	136	1,77,560	2.41	Item No 11
2.3	**Wearing Coat**					
	Supply and laying in position M30 grade concrete wearing coat with admixture as per approved mix design, approved casting sequence on deck to lines and level including forming slopes, finishing surface, curing etc complete as per drawing, specification and as directed by Engineer-In-Charge.	cum	22	12,283	0.03	Item No 9
III	**Retaining Structures**					
3.1	**Retaining Wall**					
	Excavation from level formed after dredging to founding levelof the Foundation of the Retaining Wall	cum	69	941	0.01	DSR 2023 2.7.1
	Supply and placing in position cast in situ design mix cement concrete of grade M40 with approved admixtures for Footing and wall of Retaining Structure compacting, curing of concrete complete (including side shuttering) transportation to the site placing in position to lines and level, with all labour and material as per drawing, specification and as directed by Engineer-In-Charge.	Cum	31	33,172	0.10	Item No 8

SL.No.	Description of Work	Unit	Qty	Rate	Amount Rs in Cr	Reference to Annexure 10.3 - 102
3.2	**Approach Slab**					
	Supply and placing in position cast in situ design mix cement concrete of grade M40 with approved admixtures for Footing and wall of Retaining Structure compacting, curing of concrete complete (including side shuttering) transportation to the site placing in position to lines and level, with all labour and material as per drawing, specification and as directed by Engineer-In-Charge.	cum	31	33,172	0.10	Item No 8
IV	**Deck Fixtures and Miscellaneous**					
4.1	**Marine Fenders**					
	Supply and Fixing of Tyre fenders complete with other fixtures, complete as per drawing, specification and as directed by Engineer-In-Charge.	**Nos**	25	60,920	0.15	From Jetty BOQ
4.2	**Bollards**					
	Supply, fabricate and Placing of Inserts for Pipe Bollards of 2T capacity made of MS Steel including fixtures in position as per Drawings and as directed by the Engineer-in-charge.	**Nos**	13	10,976	0.01	From Jetty BOQ
4.3	**Expansion Joint**					
	Supply and place in position, according to the drawings and specification, strip seal type expansion joint for max movement of 100 mm all complete as per drawing and as directed by Engineer-In-Charge.	RM	9	12,188	0.01	Morth - Kerala PWD - MR138
4.4	**Drainage Spouts**					
	Supply and Fixing in position drainage spout arrangements having 100mm dia PVC pipe fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	12	877	0.001	DSR 2023 - 7758
4.5	**PVC Pipe for Conduits**					
	Supply and Fixing in position 100mm dia PVC pipe for utility purpose, fixed as per drawings, specifications and as instructed by Engineer-In-Charge.	RM	100	877	0.009	DSR 2023 - 7758
D	**TOTAL**				**6.81**	
	Total after deducting 18% GST				**5.77**	

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
II	**BOAT REPAIR SHED**							
				Floor Ht (in m)				
	Built-up Area	**150.00**	**Sqm**					
	Ground Floor	150.00	Sqm	9.95				
	Plot Area	**150.00**	**Sqm**					
	Cost Index of Cochin over CPWD PAR 2023	**1.887**						
	Cost Index of Cochin over CPWD DSR 2023	**1.887**						
A	**CIVIL WORKS**							
I	**SHELL & CORE (SCHEDULED CIVIL WORK ITEMS)**							
1.0	**RCC FRAMED STRUCTURE (Upto Six Storeys)**							
1.1	Composite structure upto 6 storeys							
1.1.1	Floor Height 3.6 mt.	150.00	Sqm.	30820.00	46,23,000		46,23,000	(Item no. 1.1.1 of PAR 2023)
	(Rate as per Annexure-I (e) of PAR 2023)							
1.2	**EXTRA FOR**							
1.2.2	Every 0.3 mt or part thereof, additional/ less height of floor above normal floor height of 3.6 meter/3.00 meter (on areas having additional/less Height)	150.00	Sqm.	6174.67	9,26,200		9,26,200	(Item no. 1.3.2 of PAR 2023)
	((8-3.6)/0.30)x421=6174.67 (For GF & 1st floors)							
	SUB TOTAL				**55,49,200**	**-**	**55,49,200**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (A) FOR CIVIL WORKS (RS.)				**1,04,71,340**	**-**	**1,04,71,340**	
B	**MEP WORKS**							
I	**HVAC & VENTILATION SYSTEMS**							
1.0	Pressurized Mechanical Ventilation (with supply of exhaust blowers)	150.00	Sqm.	1050.00	1,57,500		1,57,500	(Item no. 1.7 of PAR 2023)
	SUB TOTAL				**1,57,500**	**-**	**1,57,500**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (I) FOR HVAC & VENTILATION SYSTEMS (RS.)				**2,97,203**	**-**	**2,97,203**	
II	**ELECTRICAL SYSTEMS**							

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
1.0	Internal Electrical Installations (12.5% of Building Civil Cost)	55,49,200.00	Ls.	12.50%	6,93,650		6,93,650	(Item no. 2.3 of PAR 2023)
2.0	Electrical External Service Connections (3.75% of Building Civil Cost)	55,49,200.00	Ls.	3.75%	2,08,095		2,08,095	(Item no. 2.2.1 of PAR 2023)
3.0	Lightning conductors (0.25% of Building cost)	55,49,200.00	Ls.	0.25%	13,873		13,873	(Item no. 2.4.2 of PAR 2023)
4.0	SUBSTATION EQUIPMENTS							
4.1	Supplying, installation, testing and commissioning of 33kV/0.433kV or 11kV/0.433 kV substation equipments	10.00	per KVA	9,000.00	90,000		90,000	(Item no. 6.2.1 of Specialized E & M Works PAR 2023)
	SUB TOTAL				**10,05,618**	**-**	**10,05,618**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (II) FOR ELECTRICAL SYSTEMS (RS.)				**18,97,601**	**-**	**18,97,601**	
III	**PLUMBING & DRAINAGE SYSTEMS**							
1.0	Internal Water Supply & Installations (4% of Building Civil Cost)	55,49,200.00	Ls.	4.00%	2,21,968		2,21,968	(Item no. 2.1 of PAR 2023)
2.0	Civil External Service Connections (1.25% of Building Civil Cost)	55,49,200.00	Ls.	1.25%	69,365		69,365	(Item no. 2.2.2 of PAR 2023)
	SUB TOTAL				**2,91,333**	**-**	**2,91,333**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (III) FOR PLUMBING & DRAINAGE SYSTEMS (RS.)				**5,49,745**	**-**	**5,49,745**	
IV	**FIRE FIGHTING WORKS**							
1.0	With wet riser & sprinkler system	150.00	Sqm	1,200.00	1,80,000		1,80,000	(Item no. 1.5.3 of PAR 2023)
	SUB TOTAL				**1,80,000**	**-**	**1,80,000**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**3,39,660**	**-**	**3,39,660**	
V	**FIRE ALARM & FIRE DETECTION SYSTEM**							
1.0	Automatic Fire Alarm System	150.00	Sqm	600.00	90,000		90,000	(Item no. 1.6.2 of PAR 2023)
	SUB TOTAL				**90,000**	**-**	**90,000**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**1,69,830**	**-**	**1,69,830**	
	SUB TOTAL (B) MEP WORKS				**32,54,039**	**-**	**32,54,039**	
C	**MISCELLANEOUS ITEMS**							
1.0	IP based CCTV System (for indoors)	150.00	Sqm	210.00	31,500		31,500	(Item no. 6.10.1 of PAR 2023)
2.0	IP based CCTV System (for external surveillance)	150.00	Sqm	210.00	31,500		31,500	(Item no. 6.10.2 of PAR 2023)
	SUB TOTAL				**63,000**	**-**	**63,000**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
	SUB TOTAL (C) MISCELLANEOUS ITEMS				**1,18,881**	**-**	**1,18,881**	
D	**ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS**							
1.0	Structural Steel Work (in lieu of RCC roof)							
1.1	Riveted, Bolted or welded in built up Hot Rolled sections	5400.00	Kg	133.70	7,21,980		7,21,980	(Item no. 10.2 of DSR 2023)
1.2	Hollow tubular sections- welded type	8100.00	Kg	194.40	15,74,640		15,74,640	(Item no. 10.16.1 of DSR 2023)
2.0	Aluminium Standing seam roofing (double skinned insulated)	219.82	Sqm	12000.00		26,37,888	26,37,888	Market Rate
3.0	Flashings in Roofing	60.00	Rmt	1500.00		90,000	90,000	Market Rate
4.0	Gutters in Roofing	40.00	Rmt	18000.00		7,20,000	7,20,000	Market Rate
5.0	Fall Arrest System	60.00	Rmt	9500.00		5,70,000	5,70,000	Market Rate
6.0	Deductions for RCC roof							
6.1	RCC work	-46.50	Cum	10011.35	(4,65,528)		(4,65,528)	(Item no. 5.33.2.2 of DSR 2023)
6.2	Shuttering work	-395.25	Sqm	843.07	(3,33,223)		(3,33,223)	(Weighted avg. rate of 5.9.3, 5.9.5 & 5.9.6 of DSR 2023)
6.3	Steel reinforcement	-8137.50	Kg	107.85	(8,77,629)		(8,77,629)	(Item no. 5.22.6 of DSR 2023)
6.4	Terrace Waterproofing	-219.82	Sqm	1684.60	(3,70,316)		(3,70,316)	(Item no. 22.7.1 of DSR 2023)
7.0	Zincalume sandwiched Insulated Wall & column Panels clading from inside	533.68	Sqm	9900.00		52,83,432	52,83,432	Market Rate
8.0	Exterior Aluminium composite panel cladding	403.12	Sqm	5015.05	(20,21,667)		(20,21,667)	(Item no. 8.32 of DSR 2023)
9.0	Structural Steel purlins & supports for wall panels	22710.00	Kg	194.40	44,14,824		44,14,824	(Item no. 10.16.1 of DSR 2023)
10.0	Deduct for 230 mm thick brick masonry as per PAR norms	-122.75	Cum	9105.95	(11,17,723)		(11,17,723)	(Item no. 6.4.2 of DSR 2023)
11.0	Deduct for 12mm thick internal plaster as per PAR norms	-533.68	Sqm	347.05	(1,85,214)		(1,85,214)	(Item no. 13.1.1 of DSR 2023)
12.0	Deduct for 18 mm thick external plaster as per PAR norms	-533.68	Sqm	537.45	(2,86,826)		(2,86,826)	(Item no. 13.12 of DSR 2023)
13.0	Deduct for internal acrylic emulsion paint as per PAR norms	-533.68	Sqm	216.75	(1,15,675)		(1,15,675)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
14.0	Deduct for exterior acrylic emulsion paint as per PAR norms	-533.68	Sqm	181.25	(96,730)		(96,730)	(Item no. 13.48A.1 of DSR 2023)
15.0	Anti-microbial Epoxy flooring including concrete screed sub-base	115.00	Sqm	3300.00		3,79,500	3,79,500	Market Rate
16.0	Deduct for Vitrified Tiles Flooring as per CPWD norms	-115.00	Sqm	1553.45	(1,78,647)		(1,78,647)	(Item no. 11.41.2 of PAR 2023)
17.0	Anti-bacterial Vitrified Tiles of tile size greater than 600 x 600 mm for	21.42	Sqm	3686.00		78,954	78,954	Market Rate
18.0	Deduct for Acrylic emulsion paint as per CPWD norms	-21.42	Sqm	216.75	(4,643)		(4,643)	(Item no. 13.83.2 + 13.85.3 of
19.0	Interior Grade Textured Paint for ceiling of office	19.90	Sqm	2079.00		41,368	41,368	Market Rate
20.0	Deduct for Gypsum board false ceiling as per CPWD norms	-19.90	Sqm	1355.80	(26,978)		(26,978)	(Item no. 12.45.1 of PAR 2023)
21.0	Extra for adding corrosion inhibiting admixtures in concrete	1.00	Ls	104000.00		1,04,000	1,04,000	Provisional Sum
22.0	Fixed cabinetry (Casework only)	1.00	Job	600000.00		6,00,000	6,00,000	Provisional Sum
	SUB TOTAL				**6,30,647**	**1,05,05,142**	**1,11,35,789**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (D) ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS				**11,90,030**	**1,05,05,142**	**1,16,95,172**	
	TOTAL AMOUNT) (RS.)				**1,50,34,291**	**1,05,05,142**	**2,55,39,433**	
	Total after deducting 18% GST						**2,16,43,587**	
	Total in Rs Crs						**2.16**	

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
IV	**ICE PLANT**							
				Floor Ht (m)				
	Built-up Area	**150.00**	**Sqm**					
	Ground Floor	150.00	Sqm	9.95				
	Plot Area	**150.00**	**Sqm**					
	Cost Index of Cochin over CPWD PAR 2023	**1.887**						
	Cost Index of Cochin over CPWD DSR 2023	**1.887**						
A	**CIVIL WORKS**							
I	**SHELL & CORE (SCHEDULED CIVIL WORK ITEMS)**							
1.0	**RCC FRAMED STRUCTURE (Upto Six Storeys)**							
1.1	Composite structure upto 6 storeys							
1.1.1	Floor Height 3.6 mt.	150.00	Sqm.	30820.00	46,23,000		46,23,000	(Item no. 1.1.1 of PAR 2023)
	(Rate as per Annexure-I (e) of PAR 2023)							
1.2	**EXTRA FOR**							
1.2.2	Every 0.3 mt or part thereof, additional/ less height of floor above normal floor height of 3.6 meter/3.00 meter (on areas having additional/less Height)	150.00	Sqm.	8911.17	13,36,675		13,36,675	(Item no. 1.3.2 of PAR 2023)
	((9.95-3.6)/0.30)x421=8911.17(For GF & 1st floors)							
	SUB TOTAL				**59,59,675**	**-**	**59,59,675**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (A) FOR CIVIL WORKS (RS.)				**1,12,45,907**	**-**	**1,12,45,907**	
B	**MEP WORKS**							
I	**HVAC & VENTILATION SYSTEMS**							
1.0	Pressurized Mechanical Ventilation (with supply of exhaust blowers)	150.00	Sqm.	1050.00	1,57,500		1,57,500	(Item no. 1.7 of PAR 2023)
	SUB TOTAL				**1,57,500**	**-**	**1,57,500**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (I) FOR HVAC & VENTILATION SYSTEMS (RS.)				**2,97,203**	**-**	**2,97,203**	

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
II	**ELECTRICAL SYSTEMS**							
1.0	Internal Electrical Installations (12.5% of Building Civil Cost)	59,59,675.00	Ls.	12.50%	7,44,959		7,44,959	(Item no. 2.3 of PAR 2023)
2.0	Electrical External Service Connections (3.75% of Building Civil Cost)	59,59,675.00	Ls.	3.75%	2,23,488		2,23,488	(Item no. 2.2.1 of PAR 2023)
3.0	Lightning conductors (0.25% of Building cost)	59,59,675.00	Ls.	0.25%	14,899		14,899	(Item no. 2.4.2 of PAR 2023)
4.0	SUBSTATION EQUIPMENTS							
4.1	Supplying, installation, testing and commissioning of 33kV/0.433kV or 11kV/0.433 kV substation equipments	10.00	per KVA	9,000.00	90,000		90,000	(Item no. 6.2.1 of Specialized E & M Works PAR 2023)
	SUB TOTAL				**10,73,346**	**-**	**10,73,346**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (II) FOR ELECTRICAL SYSTEMS (RS.)				**20,25,405**	**-**	**20,25,405**	
III	**PLUMBING & DRAINAGE SYSTEMS**							
1.0	Internal Water Supply & Installations (4% of Building Civil Cost)	59,59,675.00	Ls.	4.00%	2,38,387		2,38,387	(Item no. 2.1 of PAR 2023)
2.0	Civil External Service Connections (1.25% of Building Civil Cost)	59,59,675.00	Ls.	1.25%	74,496		74,496	(Item no. 2.2.2 of PAR 2023)
	SUB TOTAL				**3,12,883**	**-**	**3,12,883**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (III) FOR PLUMBING & DRAINAGE SYSTEMS (RS.)				**5,90,410**	**-**	**5,90,410**	
IV	**FIRE FIGHTING WORKS**							
1.0	With wet riser & sprinkler system	150.00	Sqm	1,200.00	1,80,000		1,80,000	(Item no. 1.5.3 of PAR 2023)
	SUB TOTAL				**1,80,000**	**-**	**1,80,000**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**3,39,660**	**-**	**3,39,660**	
V	**FIRE ALARM & FIRE DETECTION SYSTEM**							
1.0	Automatic Fire Alarm System	150.00	Sqm	600.00	90,000		90,000	(Item no. 1.6.2 of PAR 2023)
	SUB TOTAL				**90,000**	**-**	**90,000**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**1,69,830**	**-**	**1,69,830**	
	SUB TOTAL (B) MEP WORKS				**34,22,507**	**-**	**34,22,507**	

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
C	**MISCELLANEOUS ITEMS**							
1.0	IP based CCTV System (for indoors)	150.00	Sqm	210.00	31,500		31,500	(Item no. 6.10.1 of PAR 2023)
2.0	IP based CCTV System (for external surveillance)	150.00	Sqm	210.00	31,500		31,500	(Item no. 6.10.2 of PAR 2023)
	SUB TOTAL				**63,000**	**-**	**63,000**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (C) MISCELLANEOUS ITEMS				**1,18,881**	**-**	**1,18,881**	
D	**ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS**							
1.0	Structural Steel Work (in lieu of RCC roof)							
1.1	Riveted, Bolted or welded in built up Hot Rolled sections	5400.00	Kg	133.70	7,21,980		7,21,980	(Item no. 10.2 of DSR 2023)
1.2	Hollow tubular sections- welded type	8100.00	Kg	194.40	15,74,640		15,74,640	(Item no. 10.16.1 of DSR 2023)
1.3	Epoxy paint to structural steel work	202.50	Sqm	241.75	48,954		48,954	(Item no. 13.52.1 of DSR 2023)
2.0	Aluminium Standing seam roofing (double skinned insulated)	165.00	Sqm	12000.00		19,80,000	19,80,000	Market Rate
3.0	Flashings in Roofing	50.00	Rmt	1500.00		75,000	75,000	Market Rate
4.0	Gutters in Roofing	30.00	Rmt	18000.00		5,40,000	5,40,000	Market Rate
5.0	Fall Arrest System	50.00	Rmt	9500.00		4,75,000	4,75,000	Market Rate
6.0	Deductions for RCC roof							
6.1	RCC work	-51.15	Cum	10011.35	(5,12,081)		(5,12,081)	(Item no. 5.33.2.2 of DSR 2023)
6.2	Shuttering work	-434.78	Sqm	843.07	(3,66,546)		(3,66,546)	(Weighted avg. rate of 5.9.3, 5.9.5 & 5.9.6 of DSR 2023)
6.3	Steel reinforcement	-8951.25	Kg	107.85	(9,65,392)		(9,65,392)	(Item no. 5.22.6 of DSR 2023)
6.4	Terrace Waterproofing	-165.00	Sqm	1684.60	(2,77,959)		(2,77,959)	(Item no. 22.7.1 of DSR 2023)
7.0	Aluminium sandwiched Insulated Wall & column Panels	502.70	Sqm	11200.00		56,30,240	56,30,240	Market Rate
8.0	Structural Steel purlins & supports for wall panels	17594.50	Kg	194.40	34,20,371		34,20,371	(Item no. 10.16.1 of DSR 2023)
9.0	Deduct for 230 mm thick brick masonry as per PAR norms	-115.62	Cum	9105.95	(10,52,839)		(10,52,839)	(Item no. 6.4.2 of DSR 2023)
10.0	Deduct for 12mm thick internal plaster as per PAR norms	-515.78	Sqm	347.05	(1,79,001)		(1,79,001)	(Item no. 13.1.1 of DSR 2023)
11.0	Deduct for 18 mm thick external plaster as per PAR norms	-502.70	Sqm	537.45	(2,70,176)		(2,70,176)	(Item no. 13.12 of DSR 2023)
12.0	Deduct for internal acrylic emulsion paint as per PAR norms	-515.78	Sqm	216.75	(1,11,795)		(1,11,795)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
13.0	Deduct for exterior acrylic emulsion paint as per PAR norms	-502.70	Sqm	181.25	(91,114)		(91,114)	(Item no. 13.48A.1 of DSR 2023)
14.0	Anti-microbial Epoxy flooring including concrete screed sub-base	122.96	Sqm	3300.00		4,05,768	4,05,768	Market Rate
15.0	Double charged Vitrified Tiles of tile size greater than 600 x 600 mm for flooring	23.47	Sqm	3497.00		82,075	82,075	Market Rate
16.0	Deduct for Vitrified Tiles Flooring as per CPWD norms	-146.43	Sqm	1553.45	(2,27,472)		(2,27,472)	(Item no. 11.41.2 of PAR 2023)
17.0	Interior Grade Textured Paint for ceiling of office	23.47	Sqm	2079.00		48,794	48,794	Market Rate
18.0	Deduct for Gypsum board false ceiling as per CPWD norms	-23.47	Sqm	1355.80	(31,821)		(31,821)	(Item no. 12.45.1 of PAR 2023)
19.0	Extra for double glazed/ laminated glass in exterior façade	50.40	Sqm	3500.00		1,76,400	1,76,400	Market Rate
20.0	Anti-bacterial Vitrified Tiles of tile size greater than 600 x 600 mm for cladding	13.08	Sqm	3686.00		48,213	48,213	Market Rate

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.	
		RP 031 BQ107	Rev A
C1221104	Bill of Quantities for Development of Ice Plant	DESIGNED	CHECKED
		SWATHY AKILESH	IAN

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
21.0	Interior Grade Textured Paint for walls	53.55	Sqm	2079.00		1,11,330	1,11,330	Market Rate
22.0	Deduct for exterior acrylic emulsion paint as per PAR norms	-53.55	Sqm	181.25	(9,706)		(9,706)	(Item no. 13.48A.1 of DSR 2023)
23.0	Extra for adding corrosion inhibiting admixtures in concrete	1.00	Ls	104000.00		1,04,000	1,04,000	Provisional Sum
24.0	Fixed cabinetry (Casework only)	1.00	Job	700000.00		7,00,000	7,00,000	Provisional Sum
	SUB TOTAL				**16,70,043**	**1,03,76,820**	**1,20,46,863**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (D) ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS				**31,51,371**	**1,03,76,820**	**1,35,28,191**	
	TOTAL AMOUNT) (RS.)				**1,79,38,666**	**1,03,76,820**	**2,83,15,486**	
	Total after deducting 18% GST						**2,39,96,175**	
	Total in Rs Crs						**2.40**	

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
III	**FUEL STATION**							
				Floor Ht (in m)				
	Built-up Area	**76.70**	**Sqm**					
	Ground Floor	76.70	Sqm	3.00				
	Plot Area	**76.70**	**Sqm**					
	Cost Index of Cochin over CPWD PAR 2023	**1.887**						
	Cost Index of Cochin over CPWD DSR 2023	**1.887**						
A	**CIVIL WORKS**							
I	**SHELL & CORE (SCHEDULED CIVIL WORK ITEMS)**							
1.0	**RCC FRAMED STRUCTURE (Upto Six Storeys)**							
1.1	RCC structure upto 6 storeys							
1.1.1	Floor Height 3.0 mt.	76.70	Sqm.	30820.00	23,63,894		23,63,894	(Item no. 1.1.1 of PAR 2023)
	(Rate as per Annexure-I (e) of PAR 2023)							
	SUB TOTAL				**23,63,894**	**-**	**23,63,894**	
	COST INDEX OVER PAR 2023				**1.89**	**1.00**		
	SUB TOTAL (A) FOR CIVIL WORKS (RS.)				**44,60,668**	**-**	**44,60,668**	
B	**MEP WORKS**							
I	**HVAC & VENTILATION SYSTEMS**							
1.0	Pressurized Mechanical Ventilation (with supply of exhaust blowers)	76.70	Sqm.	1050.00	80,535		80,535	(Item no. 1.7 of PAR 2023)
	SUB TOTAL				**80,535**	**-**	**80,535**	
	COST INDEX OVER PAR 2023				**1.89**	**1.00**		
	SUB TOTAL (I) FOR HVAC & VENTILATION SYSTEMS (RS.)				**1,51,970**	**-**	**1,51,970**	
II	**ELECTRICAL SYSTEMS**							
1.0	Internal Electrical Installations (12.5% of Building Civil Cost)	23,63,894.00	Ls.	12.50%	2,95,487		2,95,487	(Item no. 2.3 of PAR 2023)
2.0	Electrical External Service Connections (3.75% of Building Civil Cost)	23,63,894.00	Ls.	3.75%	88,646		88,646	(Item no. 2.2.1 of PAR 2023)
3.0	Lightning conductors (0.25% of Building cost)	23,63,894.00	Ls.	0.25%	5,910		5,910	(Item no. 2.4.2 of PAR 2023)
4.0	SUBSTATION EQUIPMENTS							

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
4.1	Supplying, installation, testing and commissioning of 33kV/0.433kV or 11kV/0.433 kV substation equipments	10.00	per KVA	9,000.00	90,000		90,000	(Item no. 6.2.1 of Specialized E & M Works PAR 2023)
7.0	DIESEL GENERATOR SETS							
7.1	Supplying, installation, testing and commissioning of Silent Type DG Sets, AMF Panel, Bus Ducting/ Cables (100% backup)	10.00	per KVA	11,560.00	1,15,600		1,15,600	(Item no. 6.3.1 of Specialized E & M Works PAR 2023)
8.0	UPS SYSTEM							
8.1	Supplying, installation, testing and commissioning of online 3 phase UPS System with 30 minutes back up including batteries, interconnecting cables, battery racks etc. (20% backup)	2.00	per KVA	21,290.00	42,580		42,580	(Item no. 6.4.1 of Specialized E & M Works PAR 2023)
	SUB TOTAL				**6,38,223**	**-**	**6,38,223**	
	COST INDEX OVER PAR 2023				**1.89**	**1.00**		
	SUB TOTAL (II) FOR ELECTRICAL SYSTEMS (RS.)				**12,04,326**	**-**	**12,04,326**	
III	**PLUMBING & DRAINAGE SYSTEMS**							
1.0	Internal Water Supply & Installations (4% of Building Civil Cost)	23,63,894.00	Ls.	4.00%	94,556		94,556	(Item no. 2.1 of PAR 2023)
2.0	Civil External Service Connections (1.25% of Building Civil Cost)	23,63,894.00	Ls.	1.25%	29,549		29,549	(Item no. 2.2.2 of PAR 2023)
3.0	Hydropneumatic water supply system	150	LPM	1,640.00	2,46,000		2,46,000	(Item no. 6.13.1 of Specialized E & M Works PAR 2023)
4.0	Overhead tank without independent staging	1,000	Litre	23.00	23,000		23,000	(Item no. 4.1 of PAR 2023)
	SUB TOTAL				**3,93,104**	**-**	**3,93,104**	
	COST INDEX OVER PAR 2023				**1.89**	**1.00**		
	SUB TOTAL (III) FOR PLUMBING & DRAINAGE SYSTEMS (RS.)				**7,41,788**	**-**	**7,41,788**	
IV	**FIRE FIGHTING WORKS**							
1.0	With wet riser & sprinkler system	76.70	Sqm	1,200.00	92,040		92,040	(Item no. 1.5.3 of PAR 2023)
	SUB TOTAL				**92,040**	**-**	**92,040**	
	COST INDEX OVER PAR 2023				**1.89**	**1.00**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**1,73,679**	**-**	**1,73,679**	
V	**FIRE ALARM & FIRE DETECTION SYSTEM**							
1.0	Automatic Fire Alarm System	76.70	Sqm	600.00	46,020		46,020	(Item no. 1.6.2 of PAR 2023)
	SUB TOTAL				**46,020**	**-**	**46,020**	
	COST INDEX OVER PAR 2023				**1.89**	**1.00**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**86,840**	**-**	**86,840**	
	SUB TOTAL (B) MEP WORKS				**23,58,603**	**-**	**23,58,603**	
C	**MISCELLANEOUS ITEMS**							
1.0	IP based CCTV System (for indoors)	76.70	Sqm	210.00	16,107		16,107	(Item no. 6.10.1 of PAR 2023)

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
2.0	IP based CCTV System (for external surveillance)	76.70	Sqm	210.00	16,107		16,107	(Item no. 6.10.2of PAR 2023)
	SUB TOTAL				**32,214**	**-**	**32,214**	
	COST INDEX OVER PAR 2023				**1.89**	**1.00**		
	SUB TOTAL (C) MISCELLANEOUS ITEMS				**60,788**	**-**	**60,788**	
D	**ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS**							
1.0	Aluminium Composite Panels for exterior façade	125.34	Sqm	5,015.05		6,28,586	6,28,586	(Item no. 8.32 of DSR 2023)
2.0	Structural Steel purlins & supports for wall panels	1253.40	Kg	194.40	2,43,661		2,43,661	(Item no. 10.16.1 of DSR 2023)
3.0	Epoxy paint to structural steel work	18.80	Sqm	241.75	4,545		4,545	(Item no. 13.52.1 of DSR 2023)
4.0	Anti-microbial Epoxy flooring including concrete screed sub-base	50.32	Sqm	3300.00		1,66,056	1,66,056	Market Rate
5.0	Deduct for Vitrified Tiles Flooring as per CPWD norms	-50.32	Sqm	1553.45	(78,170)		(78,170)	(Item no. 11.41.2 of PAR 2023)
6.0	Interior Grade Textured Paint for ceiling of office	59.51	Sqm	2079.00		1,23,721	1,23,721	Market Rate
7.0	Deduct for Gypsum board false ceiling as per CPWD norms	-59.51	Sqm	1355.80	(80,684)		(80,684)	(Item no. 12.45.1 of PAR 2023)
8.0	Interior Grade Textured Paint for walls	148.28	Sqm	2079.00		3,08,274	3,08,274	Market Rate
9.0	Extra for double glazed/ laminated glass in exterior façade	58.21	Sqm	3500.00		2,03,733	2,03,733	
10.0	Deduct for 230 mm thick brick masonry as per PAR norms	-13.39	Cum	9105.95	(1,21,912)		(1,21,912)	(Item no. 6.4.2 of DSR 2023)
11.0	Deduct for 12mm thick internal plaster as per PAR norms	-58.21	Sqm	347.05	(20,202)		(20,202)	(Item no. 13.1.1 of DSR 2023)
12.0	Deduct for 18 mm thick external plaster as per PAR norms	-58.21	Sqm	537.45	(31,285)		(31,285)	(Item no. 13.12 of DSR 2023)
13.0	Deduct for internal acrylic emulsion paint as per PAR norms	-58.21	Sqm	216.75	(12,617)		(12,617)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
14.0	Deduct for exterior acrylic emulsion paint as per PAR norms	-58.21	Sqm	181.25	(10,550)		(10,550)	(Item no. 13.48A.1 of DSR 2023)
15.0	Anti-bacterial Vitrified Tiles of tile size greater than 600 x 600 mm for cladding	10.00	Sqm	3686.00		36,860	36,860	Market Rate
16.0	Deduct for internal acrylic emulsion paint as per PAR norms	-10.00	Sqm	216.75	(2,168)		(2,168)	(Item no. 13.83.2 + 13.85.3 of DSR 2023)
17.0	Extra for adding corrosion inhibiting admixtures in concrete	1.00	Ls	75900.00		75,900	75,900	Provisional Sum
18.0	Fixed cabinetry (Casework only)	1.00	Job	500000.00		5,00,000	5,00,000	Provisional Sum
	SUB TOTAL				**(1,09,380)**	**20,43,131**	**19,33,751**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (D) ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS				**(2,06,401)**	**20,43,131**	**18,36,730**	
	TOTAL AMOUNT) (RS.)				**66,73,658**	**20,43,131**	**87,16,789**	
	Total after deducting 18% GST						**73,87,109**	
	Total in Rs Crs						**0.74**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.	
		RP 031 BQ109	Rev A
C1221104	Bill of Quantities for Development of Pump house	DESIGNED	CHECKED
		SWATHY AKILESH	IAN

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
II	**PUMP HOUSE**							
				Floor Ht (m)				
	Built-up Area	**107**	**Sqm**					
	Ground Floor	107	Sqm	3.60				
	Plot Area	**107**	**Sqm**					
	Cost Index of Cochin over CPWD PAR 2023	**1.887**						
	Cost Index of Cochin over CPWD DSR 2023	**1.887**						
A	**CIVIL WORKS**							
I	**SHELL & CORE (SCHEDULED CIVIL WORK ITEMS)**							
1.0	**RCC FRAMED STRUCTURE (Upto Six Storeys)**							
1.1	Composite structure upto 6 storeys							
1.1.1	Floor Height 3.6 mt.	106.50	Sqm.	30820.00	32,82,330		32,82,330	(Item no. 1.1.1 of PAR 2023)
	(Rate as per Annexure-I (e) of PAR 2023)							
	SUB TOTAL				**32,82,330**	**-**	**32,82,330**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (A) FOR CIVIL WORKS (RS.)				**61,93,757**	**-**	**61,93,757**	
B	**MEP WORKS**							
I	**HVAC & VENTILATION SYSTEMS**							
1.0	Pressurized Mechanical Ventilation (with supply of exhaust blowers)	106.50	Sqm.	1050.00	1,11,825		1,11,825	(Item no. 1.7 of PAR 2023)
	SUB TOTAL				**1,11,825**	**-**	**1,11,825**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (I) FOR HVAC & VENTILATION SYSTEMS (RS.)				**2,11,014**	**-**	**2,11,014**	
II	**ELECTRICAL SYSTEMS**							
1.0	Internal Electrical Installations (12.5% of Building Civil Cost)	32,82,330.00	Ls.	12.50%	4,10,291		4,10,291	(Item no. 2.3 of PAR 2023)
2.0	Electrical External Service Connections (3.75% of Building Civil Cost)	32,82,330.00	Ls.	3.75%	1,23,087		1,23,087	(Item no. 2.2.1 of PAR 2023)
3.0	Lightning conductors (0.25% of Building cost)	32,82,330.00	Ls.	0.25%	8,206		8,206	(Item no. 2.4.2 of PAR 2023)
4.0	SUBSTATION EQUIPMENTS							
4.1	Supplying, installation, testing and commissioning of 33kV/0.433kV or 11kV/0.433 kV substation equipments	10.00	per KVA	9,000.00	90,000		90,000	(Item no. 6.2.1 of Specialized E & M Works PAR 2023)
	SUB TOTAL				**6,31,584**	**-**	**6,31,584**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (II) FOR ELECTRICAL SYSTEMS (RS.)				**11,91,800**	**-**	**11,91,800**	
III	**PLUMBING & DRAINAGE SYSTEMS**							
1.0	Internal Water Supply & Installations (4% of Building Civil Cost)	32,82,330.00	Ls.	4.00%	1,31,293		1,31,293	(Item no. 2.1 of PAR 2023)
2.0	Civil External Service Connections (1.25% of Building Civil Cost)	32,82,330.00	Ls.	1.25%	41,029		41,029	(Item no. 2.2.2 of PAR 2023)
	SUB TOTAL				**1,72,322**	**-**	**1,72,322**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (III) FOR PLUMBING & DRAINAGE SYSTEMS (RS.)				**3,25,172**	**-**	**3,25,172**	
IV	**FIRE FIGHTING WORKS**							
1.0	With wet riser & sprinkler system	106.50	Sqm	1,200.00	1,27,800		1,27,800	(Item no. 1.5.3 of PAR 2023)
	SUB TOTAL				**1,27,800**	**-**	**1,27,800**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**2,41,159**	**-**	**2,41,159**	
V	**FIRE ALARM & FIRE DETECTION SYSTEM**							
1.0	Automatic Fire Alarm System	106.50	Sqm	600.00	63,900		63,900	(Item no. 1.6.2 of PAR 2023)
	SUB TOTAL				**63,900**	**-**	**63,900**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (IV) FOR FIRE FIGHTING WORKS (RS.)				**1,20,579**	**-**	**1,20,579**	
	SUB TOTAL (B) MEP WORKS				**20,89,724**	**-**	**20,89,724**	
C	**MISCELLANEOUS ITEMS**							
1.0	IP based CCTV System (for indoors)	106.50	Sqm	210.00	22,365		22,365	(Item no. 6.10.1 of PAR 2023)
2.0	IP based CCTV System (for external surveillance)	106.50	Sqm	210.00	22,365		22,365	(Item no. 6.10.2 of PAR 2023)
	SUB TOTAL				**44,730**	**-**	**44,730**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (C) MISCELLANEOUS ITEMS				**84,406**	**-**	**84,406**	
D	**UNDERGROUND SUMP**							
	Underground sump	250000.00	litre	23.00	57,50,000		57,50,000	(Item no. 4.5 of PAR 2023)
	SUB TOTAL				**57,50,000**	**-**	**57,50,000**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (D)				**1,08,50,250**	**-**	**1,08,50,250**	
	TOTAL AMOUNT) (RS.)				**1,92,18,136**	**-**	**1,92,18,136**	
	Total after deducting 18% GST						**1,62,86,556**	
	Total in Rs Crs						**1.63**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.	
		RP 031 BQ110	Rev A
C1221104	Bill of Quantities for Development of Fish Collection Yard	DESIGNED	CHECKED
		SWATHY AKILESH	IAN

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
II	**Fish Collection Yard**							
				Floor Ht (in m)				
	Built-up Area	**135**	**Sqm**					
	Ground Floor	135	Sqm	3.60				
	Plot Area	**135**	**Sqm**					
	Cost Index of Cochin over CPWD PAR 2023	**1.887**						
	Cost Index of Cochin over CPWD DSR 2023	**1.887**						
A	**CIVIL WORKS**							
I	**SHELL & CORE (SCHEDULED CIVIL WORK ITEMS)**							
1.0	**COMPOSITE (PARTIALLY LOAD BEARING AND PARTIALLY RCC FRAMED) STRUCTURES**							
1.1	Composite structure upto 6 storeys							
1.1.1	Floor Height 3.6 mt.	135.00	Sqm.	21260.00	28,70,100		28,70,100	(Item no. 1.2.1 of PAR 2023)
	(Rate as per Annexure-I (e) of PAR 2023)							
	SUB TOTAL				**28,70,100**	**-**	**28,70,100**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (A) FOR CIVIL WORKS (RS.)				**54,15,879**	**-**	**54,15,879**	
B	**MEP WORKS**							
II	**ELECTRICAL SYSTEMS**							
1.0	Internal Electrical Installations (12.5% of Building Civil Cost)	28,70,100.00	Ls.	12.50%	3,58,763		3,58,763	(Item no. 2.3 of PAR 2023)
2.0	Electrical External Service Connections (3.75% of Building Civil Cost)	28,70,100.00	Ls.	3.75%	1,07,629		1,07,629	(Item no. 2.2.1 of PAR 2023)
3.0	Lightning conductors (0.25% of Building cost)	28,70,100.00	Ls.	0.25%	7,175		7,175	(Item no. 2.4.2 of PAR 2023)
	SUB TOTAL				**4,73,567**	**-**	**4,73,567**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (II) FOR ELECTRICAL SYSTEMS (RS.)				**8,93,620**	**-**	**8,93,620**	
III	**PLUMBING & DRAINAGE SYSTEMS**							
1.0	Internal Water Supply & Installations (4% of Building Civil Cost)	28,70,100.00	Ls.	4.00%	1,14,804		1,14,804	(Item no. 2.1 of PAR 2023)

Sr. No.	Description of Item	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
2.0	Civil External Service Connections (1.25% of Building Civil Cost)	28,70,100.00	Ls.	1.25%	35,876		35,876	(Item no. 2.2.2 of PAR 2023)
	SUB TOTAL				**1,50,680**	**-**	**1,50,680**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL (III) FOR PLUMBING & DRAINAGE SYSTEMS (RS.)				**2,84,334**	**-**	**2,84,334**	
D	**ADDITIONAL ITEMS NOT COVERED UNDER CPWD PAR NORMS**							
	Deduct for 230 mm thick brick masonry as per PAR norms	-27.51	Cum	9105.95	(2,50,486)		(2,50,486)	(Item no. 6.4.2 of DSR 2023)
	SUB TOTAL				**(2,50,486)**	**-**	**(2,50,486)**	
	COST INDEX OVER PAR 2023				**1.887**	**1.000**		
	SUB TOTAL				**(4,72,668)**	**-**	**(4,72,668)**	
	TOTAL AMOUNT) (RS.)				**61,21,164**	**-**	**61,21,164**	
	Total after deducting 18% GST						**51,87,427**	
	Total in Rs Crs						**0.52**	

Sr. No.	Description of Work	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
VII	**EXTERNAL SERVICES**							
1.0	**EXTERNAL LIGHTING**							
1.1	Supply and fixing of 70W LED Aesthetically designed IP 66 LED post Top Made up of Pressure Die Cast aluminium body and opal PC cover. IP 66 and IK 07 rating ensures it stands tall amid varied , input voltage AC 220 - 260 Volts with PF>0.9, Surge protection: 2KV,THD<10%, with inbuilt driver and cover CCT: 3000K.etc., complete.	51.00	Nos	47500.00		24,22,500	24,22,500	HAVELLS TYCOONPT70WLED730PSYMTOPC
1.2	Supply and fixing of decorative hot dipped galvanised mild steel step pole with grey powder finish. Compatible for all post top range. Window - Plasma cut & duly chamfered opening window of 300x110 mm for terminal connections & mounting accessories. Window cover is fitted with allen screws to the pole..etc., complete.	51.00	Nos	7750.00		3,95,250	3,95,250	Havells-2023 3.5M POLE ,HSNE-7308
1.3	Supply and Erection of Highmast with 12 Nos. 400W LED Fitting directed by the field engineers during execution with all accessories and labour charges complete.	4.00	Nos	11,41,200.00		45,64,800	45,64,800	Market Rate
	FEEDER PILLAR							
2.1	Supply and fixing of suitable out door type street light and landscape lighting feeder pillar box made with 14 SWG CRCA sheet after 7 tank process including S & F 40-63A FP MCB, 6 Nos SP MCB's, din chanel, bus bars, 6 Sqmm 3 core copper cable for internal wiring, contactor, connectors and provision for energy meter etc., complete for finished item of work. [Makes : Legrand / Schnieder / L&T]							
2.2	Mini pillar box	1.00	Nos	23,377.00	23,377		23,377	(Item no. 1521 of DSR 2022 E&M
2.3	Timer switch	1.00	Nos	10,597.00	10,597		10,597	(Item no. 15.4.3 of DSR 2022 E&M
2.4	3P 6A MCCB	50.40	Nos	1,007.00	50,753		50,753	(Item no. 2.10.4 of DSR 2022 E&M
2.5	3P 10A MCCB	6.00	Nos	1,007.00	6,042		6,042	(Item no. 2.10.4 of DSR 2022 E&M
3	**CABLING**							
3.1	Supply of Aluminium HT Cables, Conductor Screen With Extruded Semi Conducting Compound, XLPE Insulated, Insulation Screening with extruded Semi Conducting Compound in combination with Copper Tape (0.2kA for 1 sec/Core),, innersheath of PVC tape,galvanised flat steel strip armoured and overall PVC Sheathed Cable conforming to IS 7098 / (PART-II) 1985 with latest amendments.	2,350.00	Mtr	4,265.00		1,00,22,750	1,00,22,750	Market Rate
3.2	Laying of one number PVC insulated and PVC sheathed / XLPE power cable of !!KV grade of following size direct in ground including excavaion, sand cushioning, protective covering and refiling the trench etc as requird	2,350.00	Mtr	415.00	9,75,250		9,75,250	(Item no. 8.2.2 of DSR 2022 E&M
4.0	**Earthing**							

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep	Document No.	
		RP 030 BQ112	Rev A
C1221104	Bill of Quantities for Development of Utilites and Services	DESIGNED	CHECKED
		SWATHY AKILESH	IAN

Sr. No.	Description of Work	Quantity	Unit	Rate (Rs.)	AMOUNT (RS.)			Rate Reference
					PAR /DSR Items Amount (Rs.)	Market Rate Items Amount (Rs.)	Total Amount (Rs.)	
4.1	Providing independent earthing with copper earth plate 600X600X3 by excavating a pit to a depth of 2.1 m with 0.3 m dia in soil using 40 mm dia 'B' class GI pipe of 2.5 m length having staggered holes, filling up the surrounding space around the pipe with Bentonite powder up to 1.8 m from the bottom and remaining space of the pit with loose earth and fixing hume pipe ring (3 mm Thick) with necessary accessories and proper connections including cost, conveyance of all materials, and labour charges etc., complete.	10.00	Nos	13,838.00	1,38,380		1,38,380	(Item no. 5.6 of DSR 2022 E&M
4.2	Providing independent earthing by excavating a pit to a depth of 2.1 m with 0.3 m dia in soil using 40 mm dia 'B' class GI pipe of 2.5 m length having staggered holes, filling up the surrounding space around the pipe with Bentonite powder up to 1.8 m from the bottom and remaining space of the pit with loose earth and fixing hume pipe ring (3 mm Thick) with necessary accessories and proper connections including cost, conveyance of all materials, and labour charges etc., complete.	10.00	Nos	6,855.00	68,550		68,550	(Item no. 5.2 of DSR 2022 E&M
2.0	**EXTERNAL WATER SUPPLY & DRAINAGE**							
2.1	External Sewerage	1.00	Ls	10,00,000.00		10,00,000	10,00,000	Market Rate
2.2	Filtered water supply distribution lines	1.00	Ls	15,00,000.00		15,00,000	15,00,000	Market Rate
2.3	Unfiltered water supply distribution lines	1.00	Ls	5,00,000.00		5,00,000	5,00,000	Market Rate
3.0	**EXTERNAL FIREFIGHTING**							
3.1	External hydrants, pumps, piping work & appurtenances, pump house etc	1.00	Ls	30,00,000.00		30,00,000	30,00,000	Market Rate
4.0	IT, communication, External CCTV	1.00	LS	30,00,000.00		30,00,000	30,00,000	
5.0	Navigational Aids	2.00	nos	2,82,718.00		5,65,436	5,65,436	Ref Annexure 10.3-103-Rate Analysis Utilities
7.0	Compund wall	435	m	9,160.00	39,80,020		39,80,020	(Item no. 5.8.2 of PAR 2023)
8.0	Cement concrete pavment with 60mm thick paver blocks	849	sqm	2,960.00	25,13,040			Item No 5.2.4 of PAR 2023
	SUB TOTAL				**77,66,009**	**2,69,70,736**	**3,22,23,705**	
	COST INDEX OVER PAR 2023				1.887	1.00		
	TOTAL AMOUNT (RS.)				**1,46,54,459**	**2,69,70,736**	**4,16,25,195**	
	Total after deducting 18% GST						**3.53**	

ASSYSTEM INDIA LIMITED

PROJECT No.	Consultancy services for providing port led development works and allied facilities in six islands of Lakshadweep		Document No.		DATE	
			RP 031 BQ111	Rev 0	22-Mar-25	
C1221104	Bill of Quantities for Development of Connecting Roads				PAGE	

SL No	Description of work	Unit	Total Quantity	Rate	Amount	Remarks
1	Cement Concrete Pavement (Construction of un-reinforced, dowel jointed, plain cement concrete pavement over a prepared sub base with 43 grade cement @ 400 kg per cum, coarse and fine aggregate conforming to IS 383, maximum size of coarse aggregate not exceeding 25 mm, mixed in a batching and mixing plant as per approved mix design, transported to site, laid with a fixed form or slip form paver, spread, compacted and finished in a continuous operation including provision of contraction, expansion, construction and longitudinal joints, joint filler, separation membrane, sealant primer, joint sealant, debonding strip, dowel bar, tie rod, admixtures as approved, curing compound, finishing to lines and grades as per drawing)	Cum	143.10	6575.32	9,40,928.29	Refer Item 6.2 of 10.3-104-Rate Analysis Roads
2	Seperation Membrane	sqm	477.00	already included in PQC Cost		
3	Dry Lean Cement Concrete Sub- base (Construction of dry lean cement concrete Sub- base over a prepared sub-grade with coarse and fine aggregate conforming to IS: 383, the size of coarse aggregate not exceeding 25 mm, aggregate cement ratio not to exceed 15:1, aggregate gradation after blending to be as per table 600-1, cement content not to be less than 150 kg/ cum, optimum moisture content to be determined during trial length construction, concrete strength not to be less than 10 Mpa at 7 days, mixed in a batching plant, transported to site, laid with a paver with electronic sensor, compacting with 8-10 tonnes vibratory roller, finishing and curing.)	Cum	71.55	3715.21	2,65,823.28	Refer Item 6.1 of 10.3-104-Rate Analysis Roads
4	Granular Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method (Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401) for grading-III Material	Cum	71.55	2,638.08	1,88,754.62	Refer Item 4.1A of 10.3-104-Rate Analysis Roads
5	Construction of Subgrade (Construction of subgrade with approved material obtained from borrow pits with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2)	Cum	238.50	335.3	79,969.05	Refer Item 3.18 of 10.3-104-Rate Analysis Roads
6	Excavation in Soil using Hydraulic Excavator and Tippers with disposal upto 1000 metres. (Excavation for roadwork in soil with hydraulic excavator including cutting and loading in tippers, trimming bottom and side slopes, in accordance with requirements of lines, grades and cross sections, and transporting to the embankment location within all lifts and lead upto 1000m)	Cum	182.67	50.2	9,169.93	Refer Item 3.6 of 10.3-104-Rate Analysis Roads
7	Embankment Construction with Material Obtained from Borrow Pits (Construction of embankment with approved material obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement of table 300-2)	Cum	156.99	332.3	52,166.48	Refer Item 3.16 of 10.3-104-Rate Analysis Roads
8	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	Sqm	38.35	605	23,201.75	Refer Item 8.13 of 10.3-104-Rate Analysis Roads
9	Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of high intensity grade sheeting vide clause 801.3, 2mm thick aluminium sheeting, 3mm/4mm thick Aluminum composite material sheet depending on the size of the sign fixed over back support frame of min 25x25x3mm Angle mounted on a mild steel circular pipe 65 NB ,3.2 mm thicknness firmly fixed to the ground by means of properly designed foundation with M25 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing.					
i	600mm Triangle	Nos	2.00	3137	6,274.00	Refer Item 8.4 of 10.3-104-Rate Analysis Roads
ii	600mm Circular	Nos	2.00	3227	6,454.00	
iii	600x450mm Rectangle	Nos	8.00	3206	25,648.00	
	Total Cost as per CPWD 2023				15,98,389.40	
	Applying island factor @ 1.887				30,16,160.80	
	Total after deducting 18% GST				**25,56,068.47**	
	Total Cost in Rs Crs				**0.26**	