

Rehabilitation Project of Carabela Port, Timor-Leste

Simplified Environmental Impact Statement

February 2026

PACIFIC CONSULTANTS CO., LTD.

Ides Inc.

ENVIPRO QUINOFAR

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Appendix-1 Participants of Stakeholder Consultation

List of Abbreviations

Abbreviations	Official Name
ADB	Asian Development Bank
ANM	National Minerals Authority
APC	Civil Protection Authority
APORTIL	Administrative dos Portos de Timor Leste
BTL	Bee Timor-Leste/ Timor Leste Water Corporation
CI	Conservation International
DNMG	National Directorate of Meteorology and Geophysics
DNRAS	Direção Nacional para a Regulação de Água e Saneamento
DNTM	National Directory of Maritime Transportation
DWT	Deadweight Tonnage
EDTL	Electricidade de Timor-Leste
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
FS	Feasibility Study
GDP	Gross Domestic Product
IBAT	Integrated Biodiversity Assessment Tool
ICUN	International Union for Conservation of Nature and Natural Resources
IEE	Initial Environmental Examination
IGTL	Geosciences Institute of Timor-Leste
IMO	International Maritime Organization
IPG	Institute of Petroleum and Geology
ISPS	International Ship and Port Facility Security Code
JCC	Joint Coordination Committee
JICA	Japan International Corporation Agency
KBA	Key Biodiversity Area
MAF	Ministry of Agriculture and Fisheries
MCI	Ministry of Commerce and Industry
MTC	Ministry of Transports and Communication

Abbreviations	Official Name
MOAF	Ministry of Agriculture and Fishery
MoD	Ministry of Defense
MOF	Ministry of Finance
MOJ	Ministry of Justice
MoT	Ministry of Tourism, Trade and Industry
MPS	Major Projects Secretariat
MPSI	Ministry of Planning and Strategic Investment
MPW	Ministry of Public Works
MPM	Ministry of Petroleum and Mineral
MPSI	Ministry of Planning and Strategic Investment
MTCI	Ministry of Tourism, Commerce and Industry
NBSAP	The National Biodiversity Strategy and Action Plan
NAEL	National Agency for Environmental License
NDLP	National Directory of Land & Property
NOAA	National Oceanic and Atmospheric Administration
ODA	Official Development Assistance
PAM	Pollution Assessment and Management
PDM	Project Design Matrix
PMOT	Municipal Land Management Plans
PMU	Project Management Unit
PO	Plan of Operation
PPP	Public-Private Partnership
SEA	Strategic Environmental Assessment
SEA	Secretary State of Environment
SDP	Strategic Development Plan
SOLAS	International Convention for the Safety of Life at Sea
SSB	Suai Supply Base
TIMOR-GAP	TIMOR-GAP E.P.
TOR	Terms of Reference
UNDP	United Nations Development Programme
UNCTAD	United Nations Conference on Trade and Development

Abbreviations	Official Name
UNTL	Universidade Nacional Timor-Leste
USAID	US Agency for International Development
WB	World Bank
ZEEDOA	Special Zone Economic Development Oecussi Ambeno
ZEESM (ZEEDOA)	Special Zones for Social Market Economy

1. Executive summary

Environmental survey around existing Carabela Port to renovate the facility for enhancing maritime logistics leading to economic growth was conducted.

Available information was collected and organized and scoping study was conducted to understand insufficient information to be collected. Based on the study, environmental field survey was conducted.

Using those data, impact assessment study was carried out. And Environmental Management Plan to minimize the impact caused by the project was prepared and Monitoring Plan to understand the effectiveness of the environmental management was also prepared.

Followings are summary of this document.

1-1. Description of the project

1-1-1 Identification of the project

This project aims to rehabilitate the existing facilities to establish maritime network for contribution to the promotion of economic activities in the country by ensuring the safe and efficient operation of passenger and cargo transportation at the Port of Carabela in the Baucau region.

1-1-2 Category of the project

Requirements concerning environmental categories associated with development are stipulated in Decree-Law No. 5/2011. For port-related projects, the development of port facilities capable of mooring vessels exceeding 500 gross tons is designated as Category A.

However, this project is a rehabilitation of existing facility in the existing area with a national initiative requiring urgency. And no new land acquisition is necessary.

Also based on the results of the environmental site survey, the environmental impact was deemed minor.

It is considered that the project will not cause significant adverse environmental impacts and does not involve characteristics prone to causing impacts or vulnerable areas.

Furthermore, no derivative or secondary impacts, cumulative impacts, or inseparable integrated projects are planned.

Therefore, this project is classified as Environmental and Social Considerations Category B.

1-2. Brief explanation of nature, size and size of the project

1-2-1 Location map

(1) Location



Source :

(Left) MOFA of Japan、(Right) Earthstar

Project Site Location

1-3. Policy, legal and institutional framework

1-3-1 Policy

(1) Strategic Development Plan

In the government program, the development of regional ports was positioned to enable the sea transport of domestic passengers and cargo. Since there are many mountainous areas in Timor-Leste and the road network is under development, sea transport can be an indispensable infrastructure for public transport. The Strategic National Port Development Master Plan consists of the following three core plans.

Strategic National Port Development Master Plan	Target Year
National ports development plan	2040
Development plan for high priority ports	2030 or 2035 depending on individual port development
Action plan for improvement of port operation and maintenance by APORTIL, I.P	2040

As one of development plan for high priority ports, Carabela Port is listed.

(2) APORTIL, I.P 5-year Strategic Plan

The plan shows rehabilitation plans for Com, Ataúro and Carabela.

(3) Program of eighth constitutional cabinet

Construction of a port facility at Carabela, Vemasse District, Baucau Municipality, to facilitate access to maritime transport and support the tourism sector.

1-3-2 Laws and regulations

The role of MTC (Ministry of Transport and Communications) was redefined by Decree-law No.75/2023. According to this Decree, MTC's role in port development and operation is as follows.

Two institutions were indicated as leading this sector, DNTM and APORTIL, I.P: DNTM is the organization primarily responsible for the legal and regulatory framework in accordance with "Decree-Law No. 20/2016", whereas, APORTIL, I.P. is the organization responsible for the ports and anchorages of Oecusse, Tibar, Dili, Dili Pertamina, Hera, Ataúro, Carabela (Baucau), Com (Los Palos), Betano, Beaço, and Suai, and it is responsible for all infrastructure, operations, and services under the authority and supervision of the Minister, in accordance with "Decree-Law No. 3/2003".

1-3-3 Institutional aspects

(1) Land Ownership

Land owned and managed by communities follows social and cultural norms and customary law, and most of the land used by rural households falls into this category. The primary methods of land acquisition in Timor-Leste are customary law and inheritance (including transfers within families) (Henriques, Narciso, & Branco, 2011).

The population of the Vemmase district, where the Carabela project site is located, is 11,206 people (5,725 males, 5,479 females) (MoF, 2022). Approximately 20-30 households reside in the vicinity of the project site. Most residents earn their livelihood through fishing and operating eateries that grill and serve fish. The employment rate is approximately 50% for men and 40% for women (according to the interview to Vemmase Municipal Office).

(2) Social Infrastructure Around the Port Area

Most government facilities and offices are in the Vemasse administrative district. Carabela has one elementary school for grades 1 through 6. Additionally, Vemasse has three more elementary schools, a pre-secondary school (grades 7-9), and a secondary school (grades 10-12).

(3) Social Capital

In Timor-Leste, there are approximately 30 dialects, which serve as markers of ethnicity. The Vemmase district where the project site is located has two dialects (Galolen and Uaimoa). While Uaimoa is predominantly spoken, Galolen is also used in the project site vicinity (Vemmase Tasi). This dialect is primarily spoken in the northwestern part of the Vemmase district. Furthermore, interviews with residents

of Vemmase Tasi revealed that there is no particular discrimination despite the different dialects, and the residents coexist harmoniously. And there are no indigenous peoples or ethnic minority groups in the region.

(4) Decision-making Bodies Around the Port

At the local government level, the 12 municipalities (excluding Oecusse, which belongs to the Special Administrative Region) are administered by the Municipal Authority President (Presidente Autoridade do Municipio: PAM). Next, and Administrative Chief is placed under the PAM. Subordinate to the Administrative Chief are the Suco and Aldeia levels, led by the Chief of the Suco and its organization and the Aldeia Chief. Regarding Beaço, the decision-making bodies for matters related to cultural elements are the Aldeia Chief, Youth Leaders, and traditional elders. To some extent, the Suco Chief and its organization are involved in the decision-making process.

1-4. Description of the environment

1-4-1 Physical component

(1) Climate

The climate of Timor-Leste is classified as tropical savanna (Köppen climate classification 'Aw'). It experiences two seasons annually due to seasonal influences from the West Pacific monsoon.

(2) Topography and Geology

The topography of Timor-Leste is dominated by mountainous terrain reaching elevations of approximately 3,000 meters, divided by deep valleys. In the north, the mountains extend from the central region to the coast, while in the south, the mountainous terrain narrows into a flat coastal zone (BSRP, 2016).

(3) Air

In some areas near Dili, such as Tibar landfill, excessive air pollution occurs due to uncontrolled waste burning (World Bank, 2019). Furthermore, the annual average concentration of PM_{2.5} is 18 µg/m³, and it significantly exceeds the WHO guideline value of 5 µg/m³ (WHO 2016).

(4) Surface water

Surface water of Timor-Leste includes spring water, rivers and lakes. Timor-Leste has approximately 100 rivers, with 10 of its 27 watersheds being significant and designated as priority watersheds (Alongi, Da Silva, Wasson, & Wirasantosa, 2013).

(5) Ground water

Groundwater in Timor-Leste is typically replenished by rainfall during the rainy season, which generally occurs from December to May. Water quality in coastal areas of Timor-Leste is generally good.

However, these coastal waters are significantly affected by fluctuations in salinity and excessive inputs of sediment and nutrients, resulting in increased turbidity (Do Carmo Da Silva, 2016).

(6) Coastal water/Marine water

Water quality in marine areas of Timor-Leste is generally good for dissolved oxygen and heavy metals. However, they face problems and challenges such as insufficient wastewater treatment facilities, rapid urbanization, and deforestation.

1-4-2 Ecological components

(1) Wetlands

74 wetlands have been identified in Timor-Leste (Trainor C. R., 2011). These ecosystems are not present in the vicinity of the planned project site, and no impact is anticipated.

(2) Mangroves

19 mangrove species and 13 mangrove-associated species inhabit Timor-Lest (Alongi, D. M., 2014). Additionally, several mangrove trees exist adjacent to the planned project site. However, local interviews indicate these are considered sacred, and entry into the area or any construction-related alterations or impacts are not anticipated.

(3) Corals

Timor-Leste is located within the Coral Triangle, comprising six countries: Indonesia, Malaysia, Papua New Guinea, the Philippines, the Solomon Islands, and Timor-Leste (Wever, 2008; Lauretta Burke, 2012). Since coral also exists in the vicinity of the project site, we investigated the distribution status of these corals and summarized the findings in later section.

(4) Fisheries

Timor-Lest possesses abundant fish resources, particularly coastal species. Offshore, commercially viable demersal fish resources exist. Existing data shows that fish from Scombridae family are the main species sold.

(5) Protected areas and National Parks

① Protected areas

Timor-Leste has established 46 protected areas, comprising 44 terrestrial protected areas and two marine protected areas (Batu Gede Island and Atauro Island). Regarding the planned project sites for port development, the project area in Carabela is not located within designated protected areas.

② National Parks

Nino Konis Santana National Park (NKSNP), located in the easternmost municipality of Lautem, is currently only national park in Timor-Leste. It comprises three national parks: Jacopo Island Marine National Park, Lake Iralir National Park, and the area surrounding Komu village (RD TL, 2011).

(6) Endemic and threatened species

In 2017, the Government of Timor-Leste (GoTL), through the Ministry of Agriculture and Fisheries and the Ministry of Industry, Commerce, and Environment, established a list of protected aquatic species via a Joint Cabinet Decision (18/MAP/MCIA/II2017). This list includes 23 marine species and 7 marine families (see Table 11) considered fundamental to conserving biodiversity in national waters.

22 marine species classified as threatened based on data collected from the International Union for Conservation of Nature (IUCN) Red List (ADB, 2014) are also extracted.

(7) Habitat of Sea Turtles, Dugongs, and Whales

In Timor-Leste, sea turtle nesting sites have been confirmed at Tutuala Beach, located at the easternmost point, and on Jacco Island offshore.

Seagrass beds in Timor-Leste serve as critical habitat and a food source for dugongs (*Dugong dugon*) (Seagrass Watch, 2023).

The population and distribution of dugong remain largely unconfirmed. Sightings and a 2008 marine megafauna survey indicate dugongs have been observed north of the capital Dili, along the northern coast of Atauro Island. Insufficient survey coverage and the remoteness of Timor-Leste's southern coast complicate understanding of dugong distribution within the country (Dugong & Seagrass Hub, n.d.). During the 2019 Marine Megafauna Survey conducted in Timor-Leste, the majority of large whales and whale sharks were observed in waters off the northwest coast, beyond the municipalities of Dili and Liquica.

(8) Seagrass bed

The seagrass bed area in Timor-Leste is 19km² (Sudo, et al., 2021). It forms extensive areas along the coastline between mangroves and beaches and the boundary with coral reefs.

Since seagrass also exists in the vicinity of the project site, we investigated the distribution status of these seagrasses and summarized the findings in later section.

(9) Key biodiversity area

Timor-Leste has a total of 33 Key Biodiversity Areas (KBAs) (UNDP, 2021). Currently, the proposed project areas is not designated as KBAs.

1-4-3 Economic components

(1) Ferry transport

As of March 2023, domestic ferry services are provided for two routes, Dili - Ataúro and Dili - Oecusse, as shown in Figure 8. These two routes are served by APORTIL, I.P. and two private companies, Versado

Shipping Lda. and Irmao Timor. APORTIL, I.P. owns two vessels, BERLIN NAKROMA and BERLIN

RAMELAU. BERLIN NAKROMA was in dock for repairs until October 2022, but it is currently in operation.

(2) Road network

Road standards are classified into seven types, from Expressway to Rural (non-core), and the total length of roads, including sections under construction, is 7,505 km. A 30 km section of the Expressway has already been constructed at east of Suai.

The road density in the country is about 0.42 km/km², which is reported to be higher than in other developing countries (Indonesia 0.19 km/km², Thailand 0.11 km/km², Kenya 0.11 km/km²).

There are three bus terminals in Dili city, connecting each city in the country. There is also a bus service to Kupang in Indonesia, but the bus starts and ends in front of the bus operating company, not the bus terminal.

1-7-4 Social component

(1) District and villages

The population of the Vemmase district, where the Carabela project site is located, is 11,206 people (5,725 males, 5,479 females) (MoF, 2022). Approximately 20-30 households reside in the vicinity of the project site. Most residents earn their livelihood through fishing and operating eateries that grill and serve fish. The employment rate is approximately 50% for men and 40% for women (according to the interview to Vemmase Municipal Office).

The Vemmase district where the project site is located has two dialects (Galolen and Uaimoa). While Uaimoa is predominantly spoken, Galolen is also used in the project site vicinity (Vemmase Tasi). This dialect is primarily spoken in the northwestern part of the Vemmase district. Furthermore, interviews with residents of Vemmase Tasi revealed that there is no particular discrimination despite the different dialects, and the residents coexist harmoniously. And there are no indigenous peoples or ethnic minority groups in the region.

(2) Legal ownership of the project site

Carabela Port is an existing port since the Indonesian time. It is owned by Ministry of Transportation and Communication. And any surrounded community land will not be acquired.

(3) Other components

Other components such as institutions, land ownership, social infrastructure around the port area, social capital and decision-making bodies are described in Section 2-3.

1-5. Alternatives

The feasibility of these alternative plans was examined and summarized, including without project option.

Since the area is already owned the project proponent, alternatives were discussed within the area.

1-6. Impact assessment and mitigation measures

1-6-1 Scoping

Existing data was compiled, and the potential environmental impacts were studied and arranged in a scoping matrix.

In total 20 environmental items, including both natural environment and social environment, were studied.

1-6-2 TOR for Environmental and Social Consideration Survey

Terms of Reference (TOR) for Environmental and Social Consideration Survey (Baseline Survey) regarding the impact items narrowed down through scoping study and are summarized in a table.

In total 9 items for the work were listed.

1-6-3 Results of Environmental and Social Consideration Survey

The results of environmental and social consideration survey were arranged. Standard values used in Timor-Leste were also compared to know the result levels.

1-6-4 Results on Ecosystem Survey

The results of ecosystem survey were especially discussed in this section.

The observed corals were categorized according to the IUCN (International Union for Conservation of Nature) Red List categories and summarized.

Although VU (Vulnerable) species exist in the survey area, it was found that NT (Near Threatened) species are also abundant. However, considering the primary geographic ranges, there are species distributed almost worldwide and not unique to this area. Furthermore, they are not found in colonies but are scattered, attached to boulders. Therefore, the impact from the construction work is considered to be minor.

1-6-5 Additional survey

Although coral is scattered, with the understanding that detailed knowledge of its distribution and location can further mitigate construction impacts, an additional survey was conducted to identify coral distribution.

Results revealed: 1) Many species listed as Vulnerable (VU) or higher on the IUCN Red List were observed, though distant from existing structures; 2) Their distribution consisted of solitary corals attached to boulders, not forming colonies; 3) Few boulders suitable as coral attachment substrates were present around existing structures scheduled for removal, likely due to the impact of the original construction, resulting in limited coral distribution.

Therefore, it is possible to minimize the impact on coral by carefully considering these distributions during construction. The presence or absence of impact can be confirmed through monitoring, thereby ensuring sustainability.

1-6-6 Impact assessment

The results of the impact assessment targeting 20 items which were listed during scoping study. 11 items out of 20 were not considered to cause impact to environmental.

1-7. Summary of Environmental Management Plan

Based on the results of impact assessment, Environmental Management Plan (EMP) was prepared targeting all items rated B- in the impact assessment. Since these management plan and mitigation measures do not require special equipment or techniques, the associated costs shall be included in the construction costs and in the operating costs after commissioning.

Monitoring will be conducted to verify the impact of the project and the effectiveness of mitigation measures for the items where mitigation measures were implemented as described above. In the monitoring plan, the monitoring items, methods, frequency, and other details are specified. As stated in the mitigation measures, the costs associated with monitoring will be included in the construction costs.

1-8. Public consultation and information disclosure

In total two consultations were held as shown in the table below.

Num-ber	Date	Objective	Venue
1	October 28, 2024	To share project overview and survey details.	Carabela
2	January 6, 2026	To share survey results and mitigation measures.	Vemmase

1-8-1 First consultation

Ahead of the field survey, the first stakeholder meeting was held on October 28, 2024, in the Vemmase Town Hall conference room to share the project overview and survey details. Participants included local government representatives, local residents, customary chief, local elders, youth leaders, farmers, fishermen, women representatives, and others, totaling 84 individuals (75 men, 9 women). Initially, the project overview and the implementation of the field surveys (geological, topographical, environmental surveys, etc.) for detailed planning were explained, and agreement was obtained.

Participants suggested performing traditional ceremonies to pray for safety before commencing work, including offshore operations. They also requested that local laborers, including women, be considered when manpower is needed and that appropriate mitigation measures be implemented if adverse impacts on the marine environment are anticipated during actual construction.

Indeed, local residents' boats were chartered for use as work vessels, and local residents were employed as workers during the field surveys.

1-8-2 Second consultation

The second stakeholder consultation was held on January 6, 2026 to present environmental survey results to the relevant stakeholders at Vemassee district hall in Baucau municipality.

A total of 63 participants (58 men, 5 women) attended the meeting, representing communities, government agencies, and partners.

Key points raised during the meeting included:

- Early and ongoing information disclosure, including advance notice of construction activities
- Local employment and procurement opportunities, with prioritization of Carabela residents for non-specialized jobs during project development
- Land and asset management clarity to avoid future compensation disputes, including engagement of relevant land authorities to explain applicable laws and existing land status.
- Environmental protection of coastal and marine ecosystems (especially coral), and requests for baseline information on fish and aquatic species relevant to fisheries.
- Livelihood considerations, particularly for fishing households and women vendors operating near the port, including avoidance and minimization of impacts and fair compensation where impacts are unavoidable.
- Technical risks (flooding/erosion) that should be considered in rehabilitation design and during construction management.
- Women vendors highlighted the potential risk of disruption to trading activities if construction encroaches on current vending areas. They requested (i) advance notice to enable relocation and continuity of income, and (ii) fair compensation if their businesses are affected. Regarding concerns about sales pressure from a woman, MTC explained to residents that the planned project site is outside the community and that no impact from the project is anticipated.

1-9. Difficulties encountered

Not applicable

1-10. Conclusion and recommendation

1-10-1 Conclusion

Requirements concerning environmental categories associated with development are stipulated in Decree-Law No. 5/2011. For port-related projects, the development of port facilities capable of mooring vessels exceeding 500 gross tons is designated as Category A.

However, this project is a rehabilitation of existing facility in the existing area with a national initiative requiring urgency.

No new land acquisition is necessary.

Also based on the results of the environmental field survey, the environmental impact was deemed minor.

It is considered that the project will not cause significant adverse environmental impacts and does not involve characteristics prone to causing impacts or vulnerable areas.

Furthermore, no derivative or secondary impacts, cumulative impacts, or inseparable integrated projects are planned.

Therefore, this project is classified as Environmental and Social Considerations Category B.

1-10-2 Recommendation

During construction, it is recommended to monitor the situation of environmental status following the Monitoring Plan. If any change of environmental status is realized, intensive study shall be conducted to know its causes. And if it is caused by the project, cease of construction activities must be planned until countermeasures is secured and the causes are resolved.

Since important marine ecosystem, such as coral and seagrass exist in the area, consecutive occurring of turbid water causes negative impact to the ecosystems. And, therefore, continuous monitoring is fundamental.

2. Details of the project proponent

Name: Ministry of Transport and Communication

Address:

Contact Person:

Phone number:

E-mail Address:

3. Details of the EIA consultants

This study was conducted by a joint team as follows:

- JICA Survey Team: PACIFIC CONSULTANTS CO., LTD., Ides Inc.
- Local consultant: EnviPro Quinofar

PACIFIC CONSULTANTS has been deeply involved in the development of social infrastructure both in Japan and abroad for over 70 years as a leading construction consulting company since its foundation in 1951. With a total of over 1,300 high skilled civil engineers, it is expanding globally to solve social issues. PACIFIC CONSULTANTS CO., LTD. is a lead company of the JICA Survey Team on the JICA project on Preparatory Survey on the Project for Development of Carabela Port in Timor-Leste.

Address: 3-22 Kanda Nishikicho, Chiyoda-ku, Tokyo 101-8462, Japan

Website: <https://en.pacific.co.jp/>

Ides Inc. has been actively involved in various international cooperation projects, providing comprehensive consultation services for numerous port/transport infrastructure projects. Its services range from policy development, master plan and feasibility studies, advice for operation and management improvement, to capacity building of human resources. The company also put strong emphasis on sustainable development by taking into consideration the environmental/social impacts and by consulting wide range of stakeholders.

Ides Inc. supervised the environmental and social study this time.

Address: Matsuki Bldg. 3F, 1-3-8 Shibakoen, Minato-ku, Tokyo, 105-0011, JAPAN

Phone: +81 3 3434 0038

Email: info@ides-inc.co.jp

Website: <https://ides-inc.co.jp/>

EnviPro Quinofar (EnviPro) is a local Timorese firm that operates in environmental consultancy and management services for individuals and organizations seeking professional guidance in meeting environment-related requirements for environmental protection and safeguarding human health.

EnviPro offers services such as conducting environmental impact assessments (EIA) as required by national regulations in Timor-Leste, conducting environmental baseline study to investigate the original

state of the environment in the area before beginning project development work, and performing environmental monitoring to examine the quality of the environment based on specific parameters to fully quantify the impact of an activity or project on the environment.

Address: Beco Maloa Kraik I, Rio de Janeiro, Bairro-Pite, Dom Aleixo, Díli, Timor-Leste

Phone: +670 7714 9760 /+670 7459 4303

Email: enviproconsultancy@gmail.com

Website: <https://enviproquinofar.business.site/>

4. Description of the project

4-1. Identification of the project

This project aims to rehabilitate the existing facilities to establish maritime network for contribution to the promotion of economic activities in the country by ensuring the safe and efficient operation of passenger and cargo transportation at the Port of Carabela in the Baucau region.

4-2. Category of the project

Requirements concerning environmental categories associated with development are stipulated in Decree-Law No. 5/2011. For port-related projects, the development of port facilities capable of mooring vessels exceeding 500 gross tons is designated as Category A.

However, this project is a rehabilitation of existing facility in the existing area with a national initiative requiring urgency.

No new land acquisition is necessary.

Also based on the results of the environmental site survey, the environmental impact was deemed minor.

It is considered that the project will not cause significant adverse environmental impacts and does not involve characteristics prone to causing impacts or vulnerable areas.

Furthermore, no derivative or secondary impacts, cumulative impacts, or inseparable integrated projects are planned.

Therefore, this project is classified as Environmental and Social Considerations Category B.

4-3. Brief explanation of nature, size and size of the project

4-3-1 Location

Figure 1 shows the location of the project site.

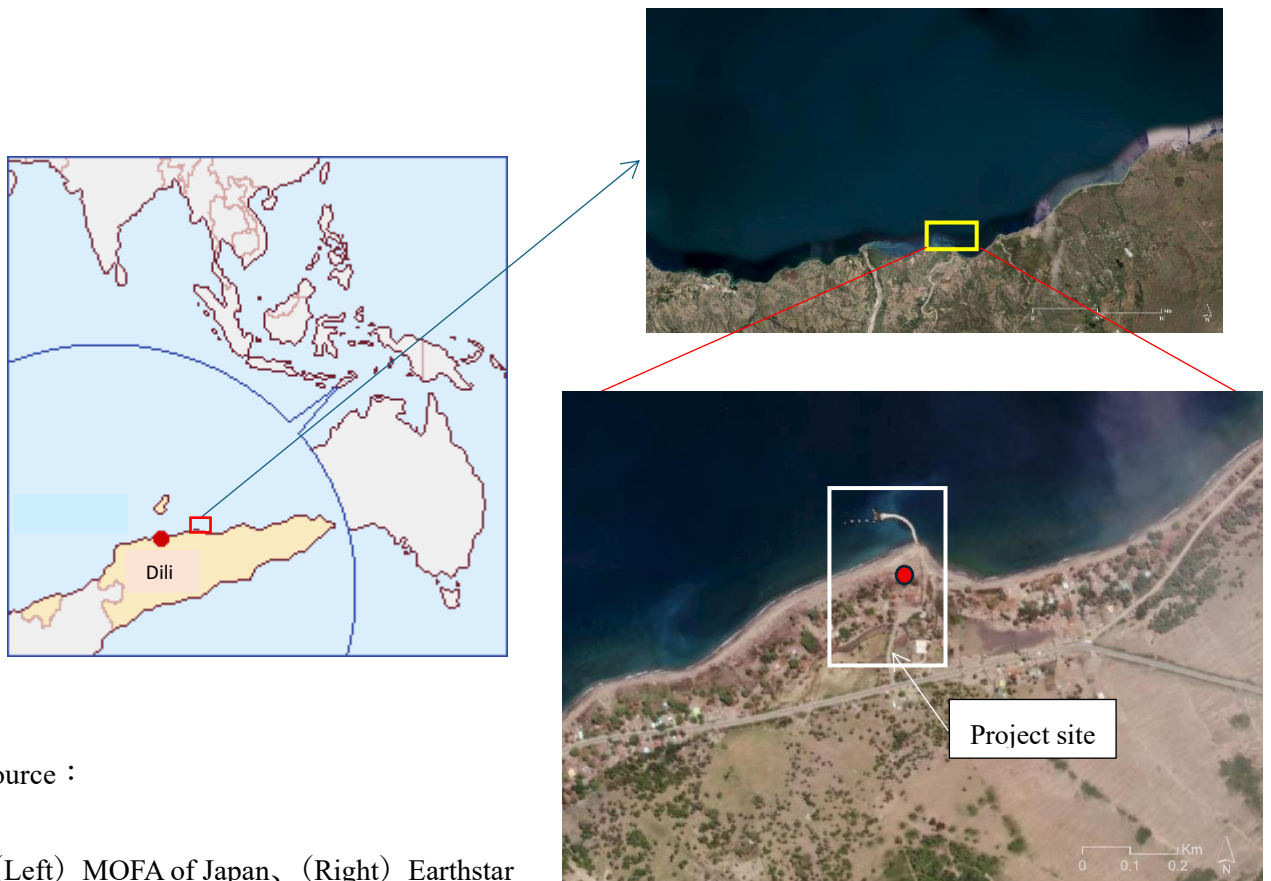


Figure 1 Project Site Location

4-3-2 GPS coordinate

126°16'30.59"E, 8°28'54.60"S (Location of the red dot shown in Figure 1)

4-3-3 Existing features

(1) Watercourse and water bodies

Refer to Figure 2.



Figure 2 Water course and water bodies

(2) Facilities and Equipment

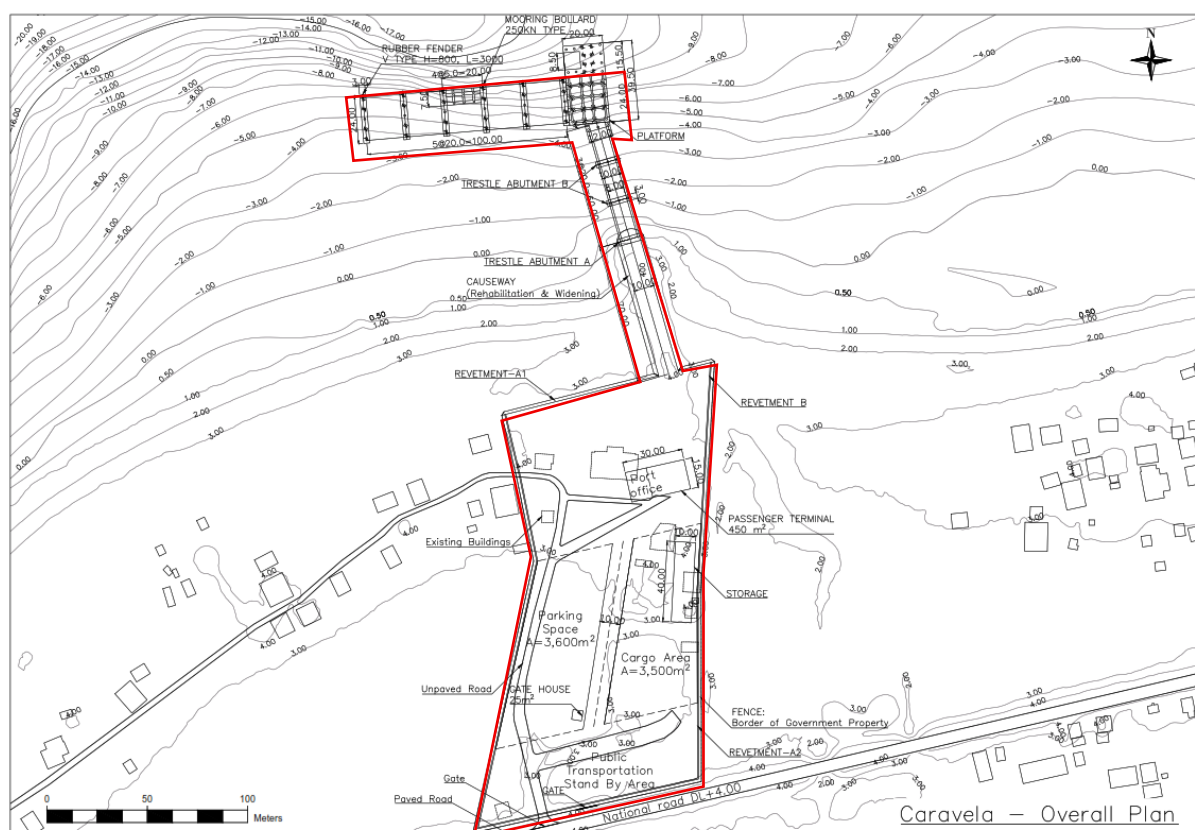
- A mooring pier capable of accommodating ferries and cargo ships
- Boarding/Alighting platform
- Connecting bridges and walkways
- Buildings (terminal building and warehouse (planned))
- Embankments, ICB/concrete pavement, revetments/retaining walls
- Civil engineering facilities ancillary to the above facilities, including lighting, water supply, power supply, and firefighting systems
- Drainage channels surrounding the port area

Table 1 shows the overview of the project.

Table 1 Project overview and scale

Facility Name	Plan details	Specification
Preparatory work	Removal of existing facilities	Existing Jetty, Dolphin Existing buildings
Ferry Jetty	1) Jetty Style (1) Ceiling Height: D. L+3.5m (2) Planned water depth: D.L-6.0m 2) Ancillary Facilities (1) Fender (2) Ship post. (3) Ladder (4) Anti-corrosion (5) Car stop (6) Corner Protector (7) Beacon Light (8) Lighting equipment	Jetty part: L=66m (2 spans) PC bridge section: L=17m, dolphin section: L=17m V600H: 4 bases, V400H: 7 bases 250kN: 5 bases, 150kN: 5 groups 1 base Coated anti-corrosion, anti-corrosion 1 on the Jetty, 2 azimuth markers (at sea). 2 Base
Platform	1) Jetty style (1) The height of the top end of the quay wall: D. L+3.5m (2) Planned water depth of the quay wall: D.L-6.0m 2) Ancillary Facilities (1) Ship post (2) Ladder (3) Corrosion prevention (4) Car stop (5) Corner Protector (6) Beacon Light (7) Lighting equipment	Jetty: L=35m (2 spans) 250kN: 1 base 1 base Coated anti-corrosion, anti-corrosion 1 on the platform 1 base
Connecting Bridge	1) PC Hollow Bridge 2) Ancillary Facilities (1) Corrosion prevention (2) Guard Pipe (3) Handrails (4) Lighting equipment	L=43m 2 Piers (steel pipe pile type) and 1 abutment (gravity type). Coated anti-corrosion, anti-corrosion 4 Base
Land Development	1) Causeway 2) Embankment and grading (ground height: DL+3.5m) 3) Revetments and retaining walls 4) Drainage 5) Pavement	L=71m, concrete pavement V=8,320m ³ Gravity revetment (R1): L=82m Gravity retaining wall (R2): L=445m Sheet pile revetment (R3): L=82m Box Culvert: L=93m ICB Paving: A=10,150m ²
Passenger terminal	RC building one-story building	Building area 64m ² / Total floor area 697m ² Building height 6.1m
Warehouse building	RC building one-story building	Building area 468m ² / Total floor area 458m ² Building height 6.925m
Guard House	RC building one-story building	Building area 3.4m ² / Total floor area 3.4m ² Building height 4.1m

Source: JICA Survey team



Source : JICA Survey team

Figure 11 Horizontal layout of the port after rehabilitation (red line)

4-4. Justification and need for the project

4-4-1 Beneficial Effects

The project is highly feasible, as it is expected to contribute not only to the residents of the northern coastal region served by existing routes and planned new routes, but also to the economic development of the “Democratic Republic of Timor-Leste,” thereby extending beneficial effects to the entire population.

4-4-2 Consistency with Long-Term Development Plans

In the SDP, the long-term development plan for Timor-Leste, port infrastructure development is positioned as a key policy to ensure the country's economic growth, making this project highly consistent with the SDP. Furthermore, with the transfer of cargo functions to Tibau Port, Dili Port is expected to serve as a maritime and land transportation hub, including an international passenger terminal and ferry terminal. The development of Calabela Port will enhance connectivity and expand these functions, making this project highly appropriate.

4-4-3 Securing alternative transport routes

Landslides, floods, and other severe disasters associated with climate change are occurring frequently

in Timor-Leste. The damage from the cyclone in April 2021 was particularly devastating, causing numerous casualties and damaging much infrastructure, including urban flooding and road disruptions. This project will secure maritime transport routes for emergency supplies during such disasters.

4-4-4 Consistency with Major Foreign Policies

Timor-Leste” is located in a strategically important region along the sea lanes connecting the Indian Ocean and the Pacific Ocean. This initiative also contributes to “multi-layered connectivity,” one of the pillars of the Free and Open Indo-Pacific (FOIP) initiative.

4-5. Proponent’s endorsement of the SEIS

As a proponent of this project, Ministry of Transport and Communication endorses the SEIS.

4-6. Features of existing or past land use

4-6-1 Current land use

Land use in Carabela is mostly comprised of settlement areas, agricultural land, livestock husbandry, and vegetation cover. Within the project area, there is an abandoned building formerly used for a cement factory (see Figure 3), with the remaining land covered with vegetation such as palms, coconut trees, and bushes. There are rice fields south of the project area that are only cultivated during rainy seasons. There are also some small businesses, such as local grilled fish restaurants and markets, available along the main road. The west part of Carabela is Vemassee town, where most of the settlement areas are located. These settlement areas are mostly used for community houses, government offices, health clinics, schools, small-scale fisheries, markets, and larger rice paddy fields with irrigation systems and water supply along the main road (also see Figure 4).



Figure 3 A photograph of the abandoned cement factory within the proposed project area in Carabela

4-6-2 Community lands and nearby communities

Carabela Port is an existing port since the Indonesian time. The facilities built for the port are within the Port fence. Currently, no community encroached within the port area. Some communities settle just outside the port fence. The community settled within the east and west side of the port area are between 20-30 households in each side within 300 m radius. Community houses range from traditional housing using palm leaves and trunk (uma bebak or uma tali) to semi concrete and fully concrete housing. It is expected that the rehabilitation of the existing Carabela port will not acquire any community land.

Figure 3 shows the port area.



Note: Within the yellow line is the port area

Figure 4 Port area and community area

5. Policy, legal and institutional framework

5-1. Policies and legislation relevant to the project

5-1-1 Strategic Development Plan

The Government of the Democratic Republic of Timor-Leste recognized infrastructure development in the port sector as one of its priority issues in the Strategic Development Plan 2011-2030 (SDP). In the government program, the development of regional ports was positioned to enable the sea transport of domestic passengers and cargo. Since there are many mountainous areas in Timor-Leste and the road network is under development, sea transport can be an indispensable infrastructure for public transport. Ferry services to rural areas are currently operated between Dili, Oecusse and Ataúro, however, maritime traffic to other regions is not open. While no specific development plan for regional ports has been made due to restrictions on the government budget, it is required to formulate a development plan for the regional ports including consideration of future maritime transport networks for economic development and improvement of living standards of local residents, especially in rural areas. Tibar Bay Port started its official operation from November 2022. The redevelopment plan for Dili Port after the transfer of

cargo handling being completed, has been suspended and alternate plan is expected. However, the reorganization plan of APORTIL, I.P., which operated Dili Port, has not yet been considered. In light of this situation and the need to formulate a strategic port development master plan, the Government of Timor-Leste requested Japan to implement a technical cooperation development plan project and R/D (Record of Discussion) with contents of the investigation was signed in May 2022.

The Strategic National Port Development Master Plan consists of the following three core plans.

Strategic National Port Development Master Plan	Target Year
National ports development plan	2040
Development plan for high priority ports	2030 or 2035 depending on individual port development
Action plan for improvement of port operation and maintenance by APORTIL, I.P	2040

As one of development plan for high priority ports, Carabela Port is listed.

5-1-2 APORTIL, I.P 5-year Strategic Plan

The plan shows rehabilitation plans for Com, Ataúro and Carabela.

5-1-3 Program of eighth constitutional cabinet

The development of maritime transport is also listed as one of the important measures in Program of eighth constitutional cabinet. The development of port infrastructures is essential to enable Timor-Leste to import essential goods and equipment, with a view to strengthening and diversifying the national economy.” Therefore, it will continue to invest in port systems nationwide following Tibar Bay Port, and will carry out the following projects.

- Construction of a port facility at Carabela, Vemasse District, Baucau Municipality, to facilitate access to maritime transport and support the tourism sector.

5-2. Laws and regulations

The role of MTC (Ministry of Transport and Communications) was redefined by Decree-law No.75/2023. According to this Decree, MTC’s role in port development and operation is as follows.

MTC is the government department responsible for national transport and communications policy and legislation in Timor-Leste. The Directorate-General for Transport and Communications (DGTC), the lead agency within the MTC, is responsible for coordinating all the services of the Ministry in the areas of land transport, sea, air, meteorological services and geophysics, postal services, and communications. In addition, DGTC shall collaborate with public service agencies, namely APORTIL, I.P. (port), ANATL (civil aviation), and TIC Timor (communications) to promote intermodal transport. The specific responsibilities of DGTC in terms of ports development are as follows:

Two institutions were indicated as leading this sector, DNTM and APORTIL, I.P: DNTM is the organization primarily responsible for the legal and regulatory framework in accordance with "Decree-Law No. 20/2016", whereas, APORTIL, I.P. is the organization responsible for the ports and anchorages of Oecusse, Tibar, Dili, Dili Pertamina, Hera, Ataúro, Carabela (Baucau), Com (Los Palos), Betano, Beaço, and Suai, and it is responsible for all infrastructure, operations, and services under the authority and supervision of the Minister, in accordance with "Decree-Law No. 3/2003".

5-3. Institutional aspects

5-3-1 Land Ownership

Land owned and managed by communities follows social and cultural norms and customary law, and most of the land used by rural households falls into this category. The primary methods of land acquisition in Timor-Leste are customary law and inheritance (including transfers within families) (Henriques, Narciso, & Branco, 2011). Ignoring customary law has led to land disputes in many municipalities. Ultimately, the President of Timor-Lest signed Decree-Law No. 13/2017 in June 2017, establishing the country's fundamental land legal framework (Yoder & Joreiman, 2019).

The population of the Vemmase district, where the Carabela project site is located, is 11,206 people (5,725 males, 5,479 females) (MoF, 2022). Approximately 20-30 households reside in the vicinity of the project site. Most residents earn their livelihood through fishing and operating eateries that grill and serve fish. The employment rate is approximately 50% for men and 40% for women (according to the interview to Vemmase Municipal Office).

5-3-2 Social Infrastructure Around the Port Area

Most government facilities and offices are in the Vemassee administrative district. Carabela has one elementary school for grades 1 through 6. Additionally, Vemassee has three more elementary schools, a pre-secondary school (grades 7-9), and a secondary school (grades 10-12). Regarding healthcare and facilities, Carabela has no health center or clinic. Health centers and clinics are in Vemassee, staffed by doctors and nurses with basic medical equipment. The referral hospital is in Baucau, equipped with more comprehensive medical facilities.

5-3-3 Social Capital

In traditional Timorese society, interpersonal relationships are considered to require the most careful handling. These relationships not only provide security to the individuals and families that comprise them, making them indispensable, but are also multidimensional (Trindade, 2015). The sacred house, ritual house, or cult house known as Uma Lulik is central to the customs of local people because it embodies the collective beliefs and values shared by the community. The vast majority of East Timorese are members of an UmaLulik (Boldoni, 2020).

In Timor-Leste, there are approximately 30 dialects, which serve as markers of ethnicity. The Vemmase

district where the project site is located has two dialects (Galolen and Uaimoa). While Uaimoa is predominantly spoken, Galolen is also used in the project site vicinity (Vemmase Tasi). This dialect is primarily spoken in the northwestern part of the Vemmase district. Furthermore, interviews with residents of Vemmase Tasi revealed that there is no particular discrimination despite the different dialects, and the residents coexist harmoniously. And there are no indigenous peoples or ethnic minority groups in the region.

5-3-4 Decision-making Bodies Around the Port

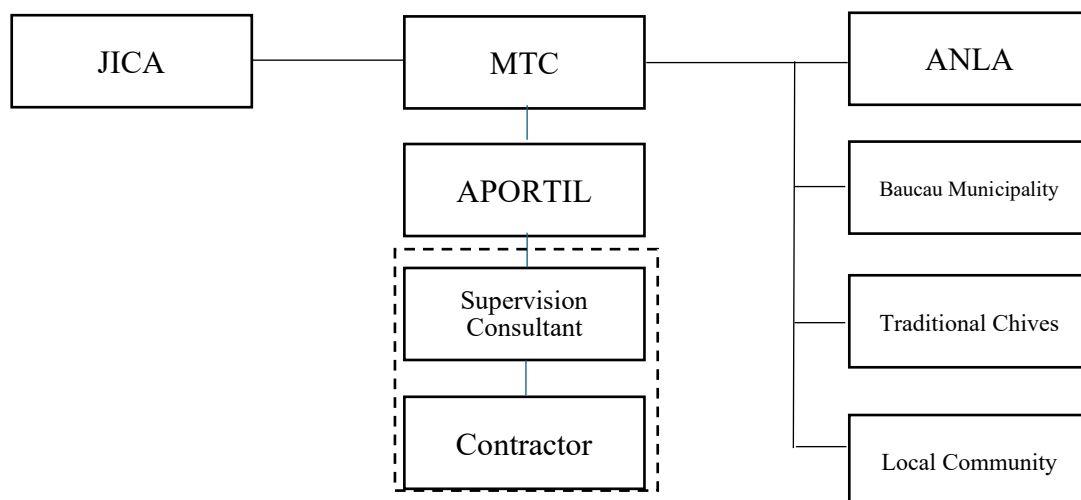
At the local government level, the 12 municipalities (excluding Oecusse, which belongs to the Special Administrative Region) are administered by the Municipal Authority President (Presidente Autoridade do Municipio: PAM). Next, and Administrative Chief is placed under the PAM. Subordinate to the Administrative Chief are the Suco and Aldeia levels, led by the Chief of the Suco and its organization and the Aldeia Chief. Regarding Beaçó, the decision-making bodies for matters related to cultural elements are the Aldeia Chief, Youth Leaders, and traditional elders. To some extent, the Suco Chief and its organization are involved in the decision-making process.

5-4. Possible institutional constraints

Implementation structure is shown in Figure 5.

The core organizations for the implementation of the project are MTC and APORTIL.

Since APORTIL belongs to MTC, no possible institutional constraints is considered.



Note: Dashed lines indicate construction in progress only.

Source: JICA Survey team

Figure 5 Implementation Structure¹

6. Description of the environment

6-1. Baseline information of physical components

6-1-1 Climate

The climate of Timor-Leste is classified as tropical savanna (Köppen climate classification 'Aw'). It experiences two seasons annually due to seasonal influences from the West Pacific monsoon. The dry season typically runs from June to November, while the rainy season lasts from December to May, though regional variations exist.

6-1-2 Topography and Geology

The topography of Timor-Leste is dominated by mountainous terrain reaching elevations of approximately 3,000 meters, divided by deep valleys. In the north, the mountains extend from the central region to the coast, while in the south, the mountainous terrain narrows into a flat coastal zone (BSRP, 2016).

6-1-3 Air

The World Bank's 2009 Country Environmental Assessment classified outdoor air quality in Timor-Leste as generally good (JICA, 2016). Concerns on outdoor air pollution are limited to Dili and other major urban areas, primarily caused by gaseous pollutants emitted from road transport and open-air waste burning (World Bank, 2019). In some areas near Dili, such as Tibar landfill, excessive air pollution occurs due to uncontrolled waste burning (World Bank, 2019). Furthermore, the annual average concentration of PM_{2.5} is 18 µg/m³, and it significantly exceeds the WHO guideline value of 5 µg/m³ (WHO 2016).

6-1-4 Surface water

Surface water of Timor-Leste includes spring water, rivers and lakes. Timor-Leste has approximately 100 rivers, with 10 of its 27 watersheds being significant and designated as priority watersheds (Alongi, Da Silva, Wasson, & Wirasantosa, 2013).

6-1-5 Ground water

Groundwater in Timor-Leste is typically replenished by rainfall during the rainy season, which generally occurs from December to May. Water quality in coastal areas of Timor-Leste is generally good. However, these coastal waters are significantly affected by fluctuations in salinity and excessive inputs of sediment and nutrients, resulting in increased turbidity (Do Carmo Da Silva, 2016).

6-1-6 Coastal water/Marine water

Water quality in marine areas of Timor-Leste is generally good for dissolved oxygen and heavy metals. However, they face problems and challenges such as insufficient wastewater treatment facilities, rapid

urbanization, and deforestation. These issues can result in wastewater pollution and high sedimentation, potentially impacting marine water quality and ecosystems (PEMSEA and Ministry of Agriculture and Fisheries, 2019).

6-2. Baseline information on Ecological components

6-2-1 Wetlands

74 wetlands have been identified in Timor-Leste (Trainor C. R., 2011). Wetland complexes such as Lake Ilalarro and Lake Modo Mahuto are considered globally significant (Trainor, et al., 2008). These wetland areas encompass diverse natural environments including exposed coral reefs, intertidal sandy beaches and mudflats, sandy and rocky shores, freshwater lakes, salt lakes, rivers, marshes and swamps, wet grasslands, and estuaries (Trainor et al., 2008).

Furthermore, these ecosystems are not present in the vicinity of the planned project site, and no impact is anticipated.

6-2-2 Mangroves

As shown in Table 13, 19 mangrove species and 13 mangrove-associated species inhabit Timor-Lest (Alongi, D. M., 2014). Among these species, *Avicennia marina*, *Sonneratia alba*, *Rhizophora stylosa*, *Ceriops tagal*, *Lumnitzera racemosa* are the most common species found throughout East Timor. Most trees are stunted (less than 6-8 m tall), except for *Sonneratia alba*, which grow to over 40m. Additionally, several mangrove trees exist adjacent to the planned project site. However, local interviews indicate these are considered sacred, and entry into the area or any construction-related alterations or impacts are not anticipated.

Table 13 Recorded true mangroves and mangrove-associated species

19 species of true mangroves		13 species of mangrove-associated species	
<i>Acanthus ilicifolius</i>	<i>Heritiera littoralis</i>	<i>Barrintonia asiatica</i>	<i>Suriana maritima</i>
<i>Acrostichum aureum</i>	<i>Lumnitzera racemosa</i>	<i>Callophyllum inophyllum</i>	<i>Terminalia catappa</i>
<i>Aegiceras corniculatum</i>	<i>Rhizophora apiculata</i>	<i>Cerbera manghas</i>	<i>Ryssopterys timoriensis</i>
<i>Avicennia marina</i>	<i>Rhizophora mucronata</i>	<i>Derris scandens</i>	
<i>Bruguiera cylindrica</i>	<i>Rhizophora stylosa</i>	<i>Derris trifoliata</i>	
<i>Bruguiera gymnorhiza</i>	<i>Sonneratia alba</i>	<i>Hibiscus tiliaceus</i>	
<i>Bruguiera parviflora</i>	<i>Sonneratia caseolaris</i>	<i>Ipomoea pes-caprae</i>	
<i>Ceriops australis</i>	<i>Sonneratia urama</i>	<i>Pemphis acidula</i>	
<i>Ceriops tagal</i>	<i>Xylocarpus granatum</i>	<i>Premna serratifolia</i>	
<i>Excoecaria agallocha</i>		<i>Scaevola taccada</i>	

Source : Alongi, D. M. (2014)

6-2-3 Corals

Timor-Leste is located within the Coral Triangle, comprising six countries: Indonesia, Malaysia, Papua

Furthermore, since coral also exists in the vicinity of the project site, we investigated the distribution status of these corals and summarized the findings in later section.

Timor-Lest possesses abundant fish resources, particularly coastal species. Offshore, commercially viable demersal fish resources exist. These resources are primarily shared with Australia and Indonesia (RDTL, 2011). While no data exists on catch volumes by municipality, literature indicates the types of fish primarily sold in Baucau (Table 1). This table shows that fish from Scombridae family are the main species sold.

TOP FISH FAMILIES SOLD based on family groupings		Average score (from fisher ranking) 0						
Region I: Baucau, Manatuto, Lautem, Viqueque	Family	Region I	Region II	Region III	Atauro	RAEOA	Timor-Leste	
Region II: Manufahi, Ainaro, Covalima								
Region III: Dili (mainland), Liquica, Bobonaro								
Atauro: Atauro Island								
RAEOA: Special Administrative Region of Oecusse Ambeno								
		Scombridae*	112	120	60	67	113	97
		Clupeidae	52	60	60	0	60	52
		Lutjanidae	60	13	40	47	33	40
		Zerchopteridae	32	40	20	0	7	26
		Carangidae	32	7	20	47	33	24
		Serranidae	32	0	33	53	0	23
	Exocoetidae	12	0	60	0	13	20	
	Laxar (unknown)	0	27	0	0	0	7	
	Belonidae	16	0	0	13	0	6	
	Caesionidae	16	0	0	0	0	5	
	Trichiuridae	0	20	0	0	0	5	

(1) Protected areas

26

(2) National Parks

Nino Konis Santana National Park (NKSNP), located in the easternmost municipality of Lautem, is currently only national park in Timor-Leste. It comprises three national parks: Jacopo Island Marine National Park, Lake Iralir National Park, and the area surrounding Komu village (RDTL, 2011).

6-2-6 Endemic and threatened species

In 2017, the Government of Timor-Leste (GoTL), through the Ministry of Agriculture and Fisheries and the Ministry of Industry, Commerce, and Environment, established a list of protected aquatic species via a Joint Cabinet Decision (18/MAP/MCIA/II/2017). This list includes 23 marine species and 7 marine families (see Table 11) considered fundamental to conserving biodiversity in national waters. The capture of these species is always prohibited unless for scientific research, recreation, or aquaculture purposes.

Table 11 List of protected aquatic species under a Joint Cabinet Decision (18/MAP/MCIA/II/2017)

No.	Classification Name	Generic Name	Status	Findings
1	<i>Cheilinus Undulatus</i>	Maori wrasse	Threatened	
2	<i>Delphinidae*</i>	Dolphin	Threatened	-All species -Excluding recreational activities
3	<i>Balaenidae*</i>	Whale	Threatened	All species
4	<i>Chelonioidea*</i>	Sea turtle	Threatened	All species
5	<i>Anthozoa*</i>	Coral	Threatened	All species
6	<i>Dugong dugon*</i>	Dugong	Threatened	All species
7	<i>Pinctada maxima</i>	Pearl oyster	Threatened	Except for pearl oysters from officially licensed commercial aquaculture facilities
8	<i>Tridacna gigas</i>	Giant Clam	Threatened	
9	<i>Tridacna maxima</i>	Small Giant Clam	Threatened	
10	<i>Hippopus hippopus</i>	Horse hof	Threatened	
11	<i>Tridacna squamosa</i>	Scaly Clam	Threatened	
12	<i>Tridacna derasa</i>	Southern Giant Clam	Threatened	
13	<i>Tridacna crocea</i>	Saffron-Colored Giant Clam	Threatened	
14	<i>Pristis Microdon</i>	Sawfish	Endangered	
15	<i>Lamna nasus</i>	Porbeagle Shark	Threatened	
16	<i>Carcharodon Carcharias</i>	Great White Shark	Threatened	
17	<i>Carcharinus Longimanus</i>	Oceanic White tip Shark	Threatened	
18	<i>Sphyrna Lewini</i>	Scalloped Hammerhead Shark	Threatened	
19	<i>Sphyrna Mokarran</i>	Great Hammerhead Shark	Threatened	
20	<i>Sphyrna Zygaena</i>	Smooth Hammerhead Shark	Threatened	
21	<i>Rhincodon typus</i>	Whale shark	Threatened	
22	<i>Cetorhinus Maximus</i>	Breaking Shark	Threatened	
23	<i>Alopias pelagicus</i>	Pelagic Thresher Shark	Threatened	
24	<i>Alopias superciliosus</i>	Bigeye Thresher	Threatened	
25	<i>Alopias vulpinus</i>	Common Thresher	Threatened	
26	<i>Manta birostris</i>	Giant Manta Ray	Threatened	
27	<i>Manta alfredi</i>	Manta Ray (Alfredi)	Threatened	

28	<i>Aetobatus narinari</i>	Spotted Eagle Ray	Threatened	
29	<i>Nautilidae</i> *	Nautilus	Threatened	All species
30	<i>Crocodylidae</i> *	Crocodile	Threatened	-All species -Except for crocodiles from officially licensed commercial farms
*Family/superfamily taxonomy				

Source : 18/MAP/MCIA/II/2017

Table 12 also shows 22 marine species classified as threatened based on data collected from the International Union for Conservation of Nature (IUCN) Red List (ADB, 2014).

Table 12 List of Threatened Marine Species in Timor-Leste Based on IUCN Red List Categories

No.	Scientific Name	Generic Name	IUCN Status ²
1	<i>Chelonia mydas</i>	Green turtle	EN, CITES
2	<i>Chelodina mccordi</i>	Roti snake-necked turtle	CR
3	<i>Eretmochelys imbricata</i>	Hawksbill turtle	CR
4	<i>Dermochelys coriacea</i>	Leatherback turtle	CR
5	<i>Caretta caretta</i>	Loggerhead turtle	EN
6	<i>Lepidochelys olivacea</i>	Olive ridley turtle	EN, CITES
7	<i>Dugong dugon</i>	Dugong	VU
8	<i>Physeter catodon</i>	Sperm whale	VU
9	<i>Orcinus orca</i>	Killer whale	LR/ed, CITES
10	<i>Stenella longirostris</i>	Spinner dolphin	LR/ed, CITES
11	<i>Tursiops truncatus</i>	Bottlenose dolphin	DD
12	<i>Rhincodon typus</i>	Basking shark	VU
13	<i>Apogonichthoides timorensis</i>	Timor Cardinalfish	LC
14	<i>Epinephelus timorensis</i>	Yellowspotted Grouper	LC
15	<i>Yirrkala lumbricoides</i>	Earthworm Snake-eel	DD
16	<i>Tridacna derasa</i>	Southern giant clam	VU
17	<i>Tridacna gigas</i>	Giant clam	VU
18	<i>Tridacna maxima</i>	Small giant clam	LR/ed
19	<i>Tridacna squamosa</i>	Fluted giant clam	LR/ed
20	<i>Hippopus hippopus</i>	Bear paw clam	LR/ed
21	<i>Hippopus porcellanus</i>	China clam	LR/ed
22	<i>Birgula latro</i>	Giant coconut crab	LR/ed

Source : ADB, 2014

¹CITES=Convention on International Trade in Endangered Species of Wild Fauna and Flora, CR=Critically Endangered, DD=Data Deficient, EN=Endangered, IUCN=International Union for Conservation of Nature, LR=Lower Risk (nt=near threatened, ed=conservation dependent), VU=Vulnerable

6-2-7 Habitat of Sea Turtles, Dugongs, and Whales

In Timor-Leste, sea turtle nesting sites have been confirmed at Tutuala Beach, located at the easternmost point, and on Jacco Island offshore. It is said that a small number of green sea turtles nest at Ulmera and Tibar Bay, west of Dili. Conservation International (CI) may possess additional information regarding

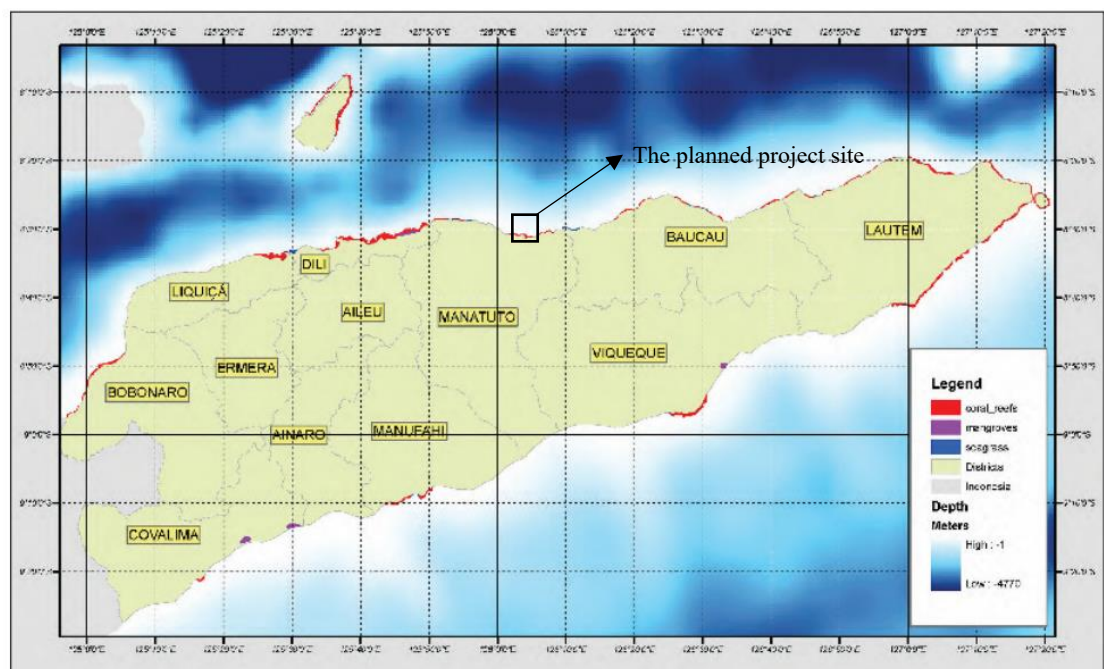
² CITES = Convention on International Trade in Endangered Species of Wild Fauna and Flora; CR = critically endangered; DD = data deficient; EN = endangered; IUCN = International Union for the Conservation of Nature; LR = lower risk (nt = near threatened, ed = conservation dependent); VU = vulnerable.

sea turtle nesting sites in Timor-Leste, though details remain unpublished (Pilcher, 2021). Furthermore, seagrass beds in Timor-Leste serve as critical habitat and a food source for dugongs (*Dugong dugon*) (Seagrass Watch, 2023). However, the population and distribution of dugong remain largely unconfirmed. Sightings and a 2008 marine megafauna survey indicate dugongs have been observed north of the capital Dili, along the northern coast of Atauro Island. Insufficient survey coverage and the remoteness of Timor-Leste's southern coast complicate understanding of dugong distribution within the country (Dugong & Seagrass Hub, n.d.). During the 2019 Marine Megafauna Survey conducted in Timor-Leste, the majority of large whales and whale sharks were observed in waters off the northwest coast, beyond the municipalities of Dili and Liqueica. In September, two adult blue whales (*Balaenoptera musculus*) were sighted, and in November, a pod consisting of two adults and one calf was observed. The final November survey report for the Environmental Survey for the Timor-Leste National Strategic Port Development Master Plan Project 14 noted one Bryde's whale (*Balaenoptera borealis*) observed in the northeast, identified as a mother and calf pair (Dethmers, et al., 2009).

6-2-8 Seagrass bed

The seagrass bed area in Timor-Leste is 19km² (Sudo, et al., 2021). It forms extensive areas along the coastline between mangroves and beaches and the boundary with coral reefs. The distribution of seagrass can be seen in Figure 7 below. A very small proportion of seagrass has been identified along both the northern and southern coasts of Timor-Leste. Extensive seagrass beds are found along the northern coast (ADB, 2014).

Furthermore, since seagrass also exists in the vicinity of the project site, we investigated the distribution status of these seagrasses and summarized the findings in Section 9-4.



Source: RDTL (2021)

Figure 6 Mangrove (purple) and Seagrass (blue) in Timor-Leste

6-2-9 Key biodiversity area

Timor-Leste has a total of 33 Key Biodiversity Areas (KBAs) (UNDP, 2021). As depicted in Figure 3, 79% of KBAs are covered by protected areas (PA), which does not complicate the country's transition towards biodiversity conservation (RDTL, 2019). Currently, the proposed project areas is not designated as KBAs (see Figure 5).



Figure 7 KBAs protection in Timor-Leste

6-3. Baseline information on economic components

6-3-1 Ferry transport

As of March 2023, domestic ferry services are provided for two routes, Dili - Ataúro and Dili - Oecusse, as shown in Figure 8. These two routes are served by APORTIL, I.P. and two private companies, Versado Shipping Lda. and Irmao Timor. APORTIL, I.P. owns two vessels, BERLIN NAKROMA and BERLIN RAMELAU. BERLIN NAKROMA was in dock for repairs until October 2022, but it is currently in operation.



Figure 8 Ferry service operated APORTIL, I.P. and private companies

6-3-2 Road network

Figure 9 shows the road network of Timor-Leste. Road standards are classified into seven types, from Expressway to Rural (non-core), and the total length of roads, including sections under construction, is 7,505 km. A 30 km section of the Expressway has already been constructed at east of Suai.

The road density in the country is about 0.42 km/km², which is reported to be higher than in other developing countries (Indonesia 0.19 km/km², Thailand 0.11 km/km², Kenya 0.11 km/km²).

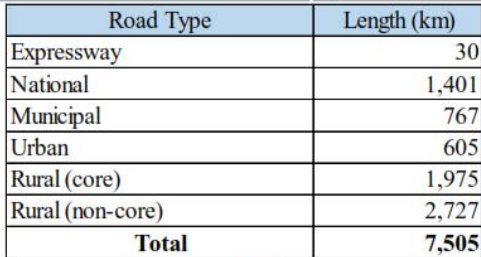


Figure 9 Extent of the road network in Timor-Leste

32

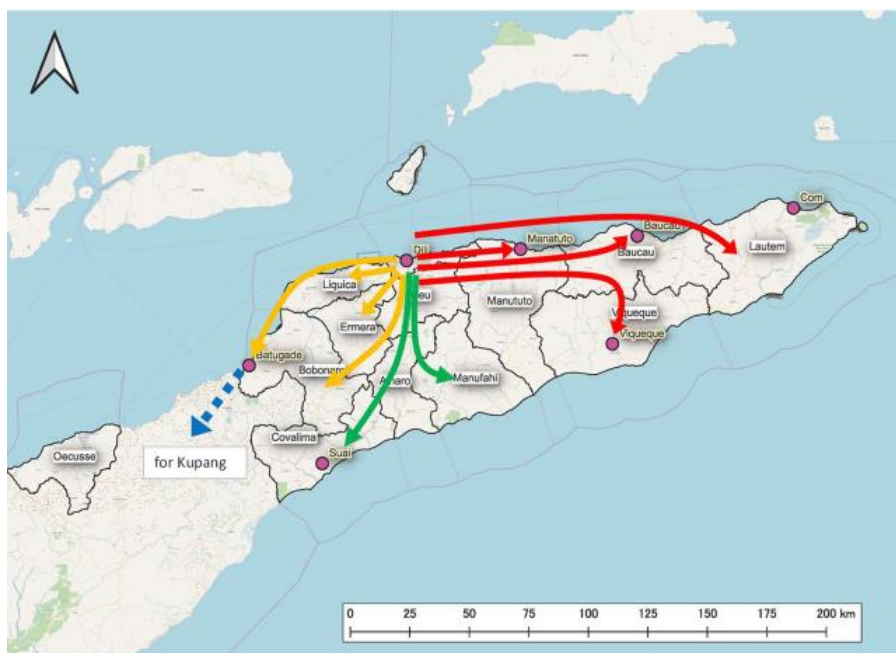


Figure 10 Bus route currently in service

6-4. Baseline information on social components

6-4-1 District and villages

Land owned and managed by communities follows social and cultural norms and customary law, and most of the land used by rural households falls into this category. The primary methods of land acquisition in Timor-Leste are customary law and inheritance (including transfers within families) (Henriques, Narciso, & Branco, 2011). Ignoring customary law has led to land disputes in many municipalities. Ultimately, the President of Timor-Lest signed Decree-Law No. 13/2017 in June 2017, establishing the country's fundamental land legal framework (Yoder & Joreiman, 2019).

The population of the Vemmasse district, where the Carabela project site is located, is 11,206 people (5,725 males, 5,479 females) (MoF, 2022). Approximately 20-30 households reside in the vicinity of the project site. Most residents earn their livelihood through fishing and operating eateries that grill and serve fish. The employment rate is approximately 50% for men and 40% for women (according to the interview to Vemmasse Municipal Office).

Most government facilities and offices are in the Vemmasse administrative district. Carabela has one elementary school for grades 1 through 6. Additionally, Vemmasse has three more elementary schools, a pre-secondary school (grades 7-9), and a secondary school (grades 10-12). Regarding healthcare and facilities, Carabela has no health center or clinic. Health centers and clinics are in Vemmasse, staffed by doctors and nurses with basic medical equipment. The referral hospital is in Baucau, equipped with more comprehensive medical facilities.

In traditional Timorese society, interpersonal relationships are considered to require the most careful handling. These relationships not only provide security to the individuals and families that comprise them, making them indispensable, but are also multidimensional (Trindade, 2015). The sacred house, ritual house, or cult house known as Uma Lulik is central to the customs of local people because it

embodies the collective beliefs and values shared by the community. The vast majority of East Timorese are members of an UmaLulik (Boldoni, 2020).

In Timor-Leste, there are approximately 30 dialects, which serve as markers of ethnicity. The Vemmase district where the project site is located has two dialects (Galolen and Uaimoa). While Uaimoa is predominantly spoken, Galolen is also used in the project site vicinity (Vemmase Tasi). This dialect is primarily spoken in the northwestern part of the Vemmase district. Furthermore, interviews with residents of Vemmase Tasi revealed that there is no particular discrimination despite the different dialects, and the residents coexist harmoniously. And there are no indigenous peoples or ethnic minority groups in the region.

6-4-2 Legal ownership of the project site

Carabela Port is an existing port since the Indonesian time. It is owned by Ministry of Transportation and Communication. And any surrounded community land will not be acquired.

6-4-3 Other components

Other components such as institutions, land ownership, social infrastructure around the port area, social capital and decision-making bodies are described in Section 2-3.

6-5. Baseline information on cultural component

6-5-1 Cultural heritage

There are no cultural heritage sites (tangible or intangible) within the project site or its surrounding areas. While there is a community hall used by residents, it will not be affected.

6-5-2 Traditional use area

There is no land in the project area which is used for traditional purpose.

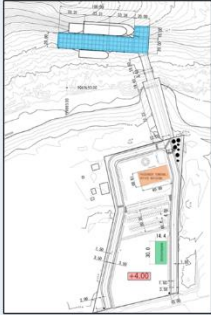
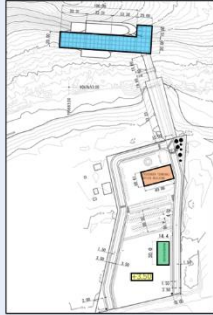
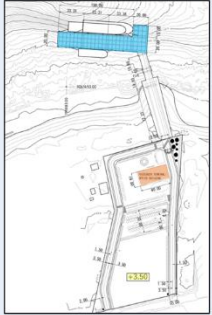
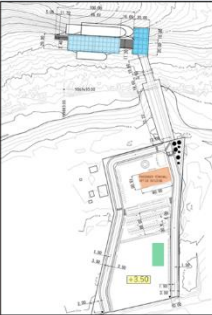
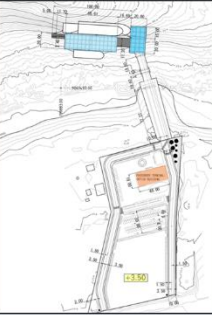
6-5-3 Historic, archeological, sacred sites

There is mangrove are at east side of the project area, which is considered as a sacred site by the local community. Therefore, the area is not modified and touched by the project.

7. Alternatives

Figure 7 shows the alternative plans for the development plan. The feasibility of these alternative plans was also examined and summarized, including without project option.

Since the area is already owned the project proponent, alternatives were discussed within the area.

Plan A Full Specification	Plan B Ground Elevation was modified from Plan A	Plan C Warehouse was omitted from Plan B	Plan D Configuration of jetty was changed from Plan B	Plan E Warehouse was omitted from Plan D
Ferry Terminal Jetty (+3.5m) Warehouse Ground Elevation (+4.0m)	Ferry Terminal Jetty (+3.5m) Warehouse Ground Elevation (+3.5m)	Ferry Terminal Jetty (+3.5m) Ground Elevation (+3.5m)	Ferry Terminal (Dolphin + Connecting Bridge) Jetty (+3.5m) Warehouse Ground Elevation (+3.5m)	Ferry Terminal (Dolphin + Connecting Bridge) Jetty (+3.5m) Ground Elevation (+3.5m)
43.09 (44.80)	41.59 (43.30)	39.35 (40.89)	38.59 (40.41)	36.35 (38.00)
				

Note:

Unit of blue letters (Construction cost): hundred million Yen

As of 24 September 2025.

Cost estimation rate: upper: 144.50 Yen/USD (September 2025 Cabinet Meeting Rate), Lower: 153.36 Yen/USD (Averaged Quantification Rate (Oct. - Dec. 2024))

Source: Cost by JACA, Other by JICA Survey team

Figure 8 Comparison Analysis of Alternative Plans

Table 9 Comparison of Alternative Plans

Evaluation Criteria	Option A	Option B	Option C	Option D	Option E	Without project option
Construction costs (Highest to Lowest)	1	2	3	4	5	6
Presence of warehouses (Versatility of cargo storage)	Available 2	Available 2	None 1	Available 2	None 1	N/A 1
Environmental impact (in descending order of impact)	The water surface coverage is extensive, and its impact on water environment is a concern. 1	Same as left 1	Same as left 1	The water surface coverage rate is smaller compared to option A, B, and C. 2	Same as left 2	Maintain the status quo -
Facility convenience	Maximum convenience	Same as left	The lack of storage space	There is a warehouse, and the	The lack of storage space	N/A

Evaluation Criteria	Option A	Option B	Option C	Option D	Option E	Without project option
			reduces convenience.	convenience is moderate.	reduces convenience.	
	4	4	2	3	2	1
Social impact	Transportation convenience will improve, but no differences will arise between the options. The acquisition of adjacent land is not planned.					-
	2	2	2	2	2	2
Impact on local economy	Increased logistics and improved accessibility to the metropolitan area will have a positive impact on the economy.					Maintaining the status quo offers no prospect for economic development.
	2	2	2	2	2	2
Evaluation and reasoning	The facility offers high convenience, but construction costs are significant.	The facility offers high convenience, but construction costs are significant.	Slightly less convenient and high construction costs.	While it is slightly less convenient, it has a smaller environmental impact and lower construction costs.	While less convenient than option D, it has a smaller environmental impact and lower construction costs.	Economic development is not expected.
	12	13	11	15	14	13
				Recommended option (The reason is that it offers a certain level of convenience, has minimal impact on tourism, and could have a positive effect on the economy)		

Source: JICA Survey team

8. Climate change

Not considered in the structure plan, since the variation of sea water level is within the length of the structures.

9. Impact assessment and mitigation measures

9-1. Scoping

Existing data was compiled, and the potential environmental impacts are summarized in Table 14.

Table 14 Scoping Matrix

Item	Evaluation		Evaluation
	Before construction/Under Construction	During operation	
Air pollution	✓	✓	Under construction: Impacts from exhaust gases and dust emitted by port construction machinery are possible. During operation: Impacts due to increased port users are possible.
Water pollution	✓	✓	Under construction: Water pollution from port construction and oil contamination from construction machinery are possible concerns. During operation: Oil contamination and wastewater pollution from operating vessels are possible concerns.
Waste	✓	-	Under construction: Construction waste and harmful substances may be generated. During operation: No impact is expected
Soil contamination	-	-	There is no soil will be discharged from the construction area, so soil contamination is not anticipated.
Noise and vibration	✓	✓	Under construction: Noise and vibration may be generated from port construction machinery. During operation: For noise, impacts may occur due to an increase in port users. For vibration, no impact is anticipated given that it is a coral-derived geological formation and vibrations are unlikely to propagate far.
Ground subsidence	-	-	There is no significant groundwater pumping, so no impact is expected.
Odor	-	-	Waste is generated, but it is typically managed appropriately, so no impact is expected.
Sediment contamination	✓	✓	Under construction: Sediment contamination from port construction machinery is possible. During operation: Impact from operating vessels is possible.
Protected areas	✓	✓	There are no protected areas nearby, but this will be confirmed through literature research.
Ecosystems	✓	-	Under construction: Construction may impact seaweed, seagrass, coral, mangroves, etc. During operation: No impact is expected.
Hydrology and water resources	✓	-	No impact on hydrology or hydromechanics is anticipated, but this will be confirmed through literature research.

Item	Evaluation		Evaluation
	Before construction/Under Construction	During operation	
Topography and geology	-	-	No impact on topography and geology is anticipated.
Land acquisition and resident relocation	-	-	This involves modifications to existing port facilities, with no land acquisition or resident relocation required.
Livelihoods	✓	-	Under construction: Fishing vessel navigation is expected to be obstructed. During operation: No negative impact on daily life or livelihoods is anticipated.
Socially vulnerable groups	-	-	Activities that could adversely affect socially vulnerable individuals are not anticipated.
Cultural heritage	-	-	There are no cultural heritage sites (tangible or intangible) within the project site or its surrounding areas. While there is a community hall used by residents, it will not be affected.
landscape	-	-	No impact on the landscape is anticipated due to the renovation of existing facilities.
Minority groups and indigenous people	-	-	Activities that adversely affect ethnic minorities and indigenous people are not anticipated.
Working environment (including occupational safety)	✓	-	Under construction: In accordance with relevant laws and regulations, it is necessary to ensure a safe construction work environment. During operation: As the facility is managed, there will be no impact.
Community health, safety, and security	✓	-	The influx of construction workers may lead to the spread of infectious diseases. The use of main roads by construction-related vehicles may increase traffic accidents.

Source: JICA Survey team

9-2. TOR for Environmental and Social Consideration Survey

The terms of reference (TOR) for Environmental and Social Consideration Survey (Baseline Survey) regarding the impact items narrowed down through scoping are summarized in Table 15.

Table 15 Survey Items and Methods for Environmental and Social Consideration Survey

Item	Survey Item	Period
Air pollution	- Field survey - Carbon monoxide, NO₂, SO₂, ozone, PM_{2.5}, PM₁₀	September 19 – September 20, 2023
Water pollution	- Field survey (5 locations, 1 time) - Water depth, watercolor, odor - On-site measurement (5 locations, 2 layers, 1 time) - Water temperature, salinity, pH, turbidity, dissolved oxygen - Lab analysis (5 locations, 2 layers, 1 time) - Suspended solids, chemical oxygen demand, coliform bacteria, etc.	11 November 2023
Waste	Interview on waste disposal	September 19 – September 20, 2023
Noise	- Field survey (1 location, 1 time, 24 hours) - LAeq 1h, LAeq 24h, Ld, Ln, Ldn	September 19 – September 20, 2023
Sediment contamination	- Field survey - Sediment temperature - Lab analysis - Specific gravity, moisture content, particle size distribution, total organic carbon, etc.	11 November 2023
Protected areas	- Literature review - Existence of protected areas around the port	4 – 22 September 2023
Ecosystems	- Field survey - Species composition of aquatic flora and fauna, presence of endangered species, etc.	11 November 2023, 29-30 October 2024
Hydrology and water resources	Literature review	4 – 22 September 2023
Social factors (Land use, Livelihood, Vulnerable groups, Cultural heritage, Landscape, Minority and indigenous people, Working condition, Community health, safety, and security)	- The following will be confirmed as a precaution: - Field survey - Interview	4 – 22 September 2023

Source: JICA Survey team

9-3. Results of Environmental and Social Consideration Survey

Table 16 shows the results of environmental and social consideration survey.

Table 16 Results of Environmental and Social Consideration Survey

Item	Survey Results Summary
Air pollution	Timor-Leste has no environmental standards for air quality indices. Therefore, the World Health Organization (WHO) 2021 Global Air Quality Guidelines are used as guidelines. For SO₂, the 24-hour average ambient concentration was 90µg/m³. This is more than twice the WHO AQG 2021 limit value of 40µg/m³. Similar trends were observed in measurements taken at other locations (Oecussi, Bairso), suggesting this may be due

	to an anomaly in the measuring equipment. Other indicators were below the standards. Note that for items other than PM2.5 and PM 10, including SO₂, the monitoring items were limited to PM 2.5 and PM10 only, as the heavy machinery used is also limited and the impact on the atmosphere during construction is not considered significant. The current levels are sufficiently low compared to the standards, and it is considered that even with an increase in vehicles by facility users, there will be no impact during operation. The summary of results (24-hour measurement averages) is as follows. <table><tr><td>Item</td><td>Measureme nt value</td><td colspan="2">Standard value</td></tr><tr><td>PM_{2.5}</td><td>9 mg/m³</td><td>15 mg/m³</td><td rowspan="6">WHO AQG2021</td></tr><tr><td>PM₁₀</td><td>22mg/m³</td><td>45 mg/m³</td></tr><tr><td>SO₂</td><td>90mg/m³</td><td>40 mg/m³</td></tr><tr><td>CO</td><td>100mg/m³</td><td>35,000 mg/m³</td></tr><tr><td>NO₂</td><td>0 mg/m³</td><td>200 mg/m³</td></tr><tr><td>O₃</td><td>41mg/m³</td><td>100 mg/m³</td></tr></table>	Item	Measureme nt value	Standard value		PM _{2.5}	9 mg/m ³	15 mg/m ³	WHO AQG2021	PM ₁₀	22mg/m ³	45 mg/m ³	SO ₂	90mg/m ³	40 mg/m ³	CO	100mg/m ³	35,000 mg/m ³	NO ₂	0 mg/m ³	200 mg/m ³	O ₃	41mg/m ³	100 mg/m ³																																																																																																	
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Water pollution	Timor-Leste has no water quality standards. Therefore, the analysis results were compared to Indonesian standards. No parameters exceeded the standards. The results are as follows. <table><tr><td>Item</td><td>1-U</td><td>1-B</td><td>2-U</td><td>2-B</td><td>3-U</td><td>3-B</td><td>4-U</td><td>4-B</td><td>5-U</td><td>5-B</td><td>Sta nda rd</td></tr><tr><td>Water temperat ure (oC)</td><td>31.6</td><td>31.0</td><td>30.3</td><td>31.5</td><td>31.9</td><td>31.7</td><td>32.9</td><td>34.3</td><td>32.7</td><td>33.4</td><td>-</td></tr><tr><td>Conducti vity(μs/c m)</td><td>43.6</td><td>43.9</td><td>43.9</td><td>43.7</td><td>43.3</td><td>43.6</td><td>43.3</td><td>42.6</td><td>43.4</td><td>42.9</td><td>-</td></tr><tr><td>pH</td><td>8.3</td><td>8.2</td><td>8.2</td><td>8.2</td><td>8.3</td><td>8.1</td><td>8.2</td><td>8.2</td><td>8.3</td><td>8.3</td><td>7- 8.5</td></tr><tr><td>Turbidit y (NTU)</td><td>0.5</td><td>0.7</td><td>0.6</td><td>0.5</td><td>0.5</td><td>0.5</td><td>0.5</td><td>0.3</td><td>0.4</td><td>0.4</td><td>5</td></tr><tr><td>SS (mg/L)</td><td><5</td><td><5</td><td><5</td><td><5</td><td><5</td><td><5</td><td><5</td><td><5</td><td><5</td><td><5</td><td>20</td></tr><tr><td>T-N (mg/L)</td><td>0.1</td><td>0.1</td><td>0.2</td><td>0.4</td><td>0.4</td><td>0.2</td><td>0.2</td><td>0.2</td><td>0.2</td><td>0.3</td><td>10</td></tr><tr><td>T-P (mg/L)</td><td>0.03</td><td>0.01</td><td>0.04</td><td>0.04</td><td>0.06</td><td>0.12</td><td>0.05</td><td>0.04</td><td>0.33</td><td>0.04</td><td>2</td></tr><tr><td>Oil (mg/L)</td><td><5</td><td><5</td><td><5</td><td><5</td><td><5</td><td><5</td><td><5</td><td><5</td><td><5</td><td><5</td><td>10</td></tr><tr><td>DO (mg/L)</td><td>8.7</td><td>9.0</td><td>9.0</td><td>8.9</td><td>9.0</td><td>9.0</td><td>9.2</td><td>9.1</td><td>9.4</td><td>9.4</td><td>>5</td></tr></table>	Item	1-U	1-B	2-U	2-B	3-U	3-B	4-U	4-B	5-U	5-B	Sta nda rd	Water temperat ure (oC)	31.6	31.0	30.3	31.5	31.9	31.7	32.9	34.3	32.7	33.4	-	Conducti vity(μs/c m)	43.6	43.9	43.9	43.7	43.3	43.6	43.3	42.6	43.4	42.9	-	pH	8.3	8.2	8.2	8.2	8.3	8.1	8.2	8.2	8.3	8.3	7- 8.5	Turbidit y (NTU)	0.5	0.7	0.6	0.5	0.5	0.5	0.5	0.3	0.4	0.4	5	SS (mg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	20	T-N (mg/L)	0.1	0.1	0.2	0.4	0.4	0.2	0.2	0.2	0.2	0.3	10	T-P (mg/L)	0.03	0.01	0.04	0.04	0.06	0.12	0.05	0.04	0.33	0.04	2	Oil (mg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	10	DO (mg/L)	8.7	9.0	9.0	8.9	9.0	9.0	9.2	9.1	9.4	9.4	>5
Item	1-U	1-B	2-U	2-B	3-U	3-B	4-U	4-B	5-U	5-B	Sta nda rd																																																																																																														
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T-P (mg/L)	0.03	0.01	0.04	0.04	0.06	0.12	0.05	0.04	0.33	0.04	2																																																																																																														
Oil (mg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	10																																																																																																														
DO (mg/L)	8.7	9.0	9.0	8.9	9.0	9.0	9.2	9.1	9.4	9.4	>5																																																																																																														

	Note: East Timor has no water quality standards, so the results were compared to the reference values typically used for evaluation. T-N, T-P, Oil: IFC Guideline (discharge values of treated water to marine area) Other parameters: Environmental Water Quality in Indonesia (Coral Area)																																																																					
Waste	The JICA Survey team’s visual inspection found no noticeable waste around the port area. Regarding waste disposal, they confirmed the presence of a landfill site nearby. Hazardous materials are reportedly processed at a managed final disposal facility in a town a short distance away.																																																																					
Noise	• The daytime noise level at Carabela is within the IFC standard of 55 dBA. • The nighttime level (22:00-07:00) is 46.5 dBA, slightly exceeding the 45 dBA standard. The primary component of nighttime environmental noise of Carabela is waves breaking at the water surface and along the shoreline. • The summary of results (24-hour measurement averages) is as follows. <table><tr><th>Measureme nt time period</th><th>Measuremen t value LAeq (dBA)</th><th colspan="2">Standard LAeq (dBA)</th></tr><tr><td>7:00-21:00</td><td>53.6</td><td>55.0</td><td rowspan="3">• IFC 200 7 (Re side ntia l Are a)</td></tr><tr><td>21:00-7:00</td><td>46.5</td><td>45.0</td></tr><tr><td>All day</td><td>52.0</td><td>55.0</td></tr></table>	Measureme nt time period	Measuremen t value LAeq (dBA)	Standard LAeq (dBA)		7:00-21:00	53.6	55.0	• IFC 200 7 (Re side ntia l Are a)	21:00-7:00	46.5	45.0	All day	52.0	55.0																																																							
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All day	52.0	55.0																																																																				
Sediment contamination	Timor-Leste has no sediment standards. Therefore, the analysis results were compared to Indonesian standards. • Metals were detected in the sediment samples, but their concentrations did not exceed the standards. • The sediment samples showed significant pesticide contamination. <table><tr><th rowspan="2">PARAMETE R</th><th rowspan="2">UNIT</th><th rowspan="2">LOR (ALS)</th><th colspan="5">RESULT</th></tr><tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr><tr><td>Moisture Content</td><td>%</td><td>1.0</td><td>23.7</td><td>24.1</td><td>8.8</td><td>12.0</td><td>20.9</td></tr><tr><td>Arsenic</td><td>mg/kg</td><td>5</td><td>6</td><td><5</td><td><5</td><td><5</td><td>6</td></tr><tr><td>Cadmium</td><td>mg/kg</td><td>1</td><td><1</td><td><1</td><td><1</td><td><1</td><td><1</td></tr><tr><td>Chromium</td><td>mg/kg</td><td>2</td><td>228</td><td>30</td><td>182</td><td>147</td><td>202</td></tr><tr><td>Copper</td><td>mg/kg</td><td>5</td><td>14</td><td>37</td><td>12</td><td>16</td><td>12</td></tr><tr><td>Lead</td><td>mg/kg</td><td>5</td><td>5</td><td>7</td><td><5</td><td><5</td><td><5</td></tr><tr><td>Nickel</td><td>mg/kg</td><td>2</td><td>418</td><td>10</td><td>389</td><td>365</td><td>337</td></tr></table>	PARAMETE R	UNIT	LOR (ALS)	RESULT					1	2	3	4	5	Moisture Content	%	1.0	23.7	24.1	8.8	12.0	20.9	Arsenic	mg/kg	5	6	<5	<5	<5	6	Cadmium	mg/kg	1	<1	<1	<1	<1	<1	Chromium	mg/kg	2	228	30	182	147	202	Copper	mg/kg	5	14	37	12	16	12	Lead	mg/kg	5	5	7	<5	<5	<5	Nickel	mg/kg	2	418	10	389	365	337
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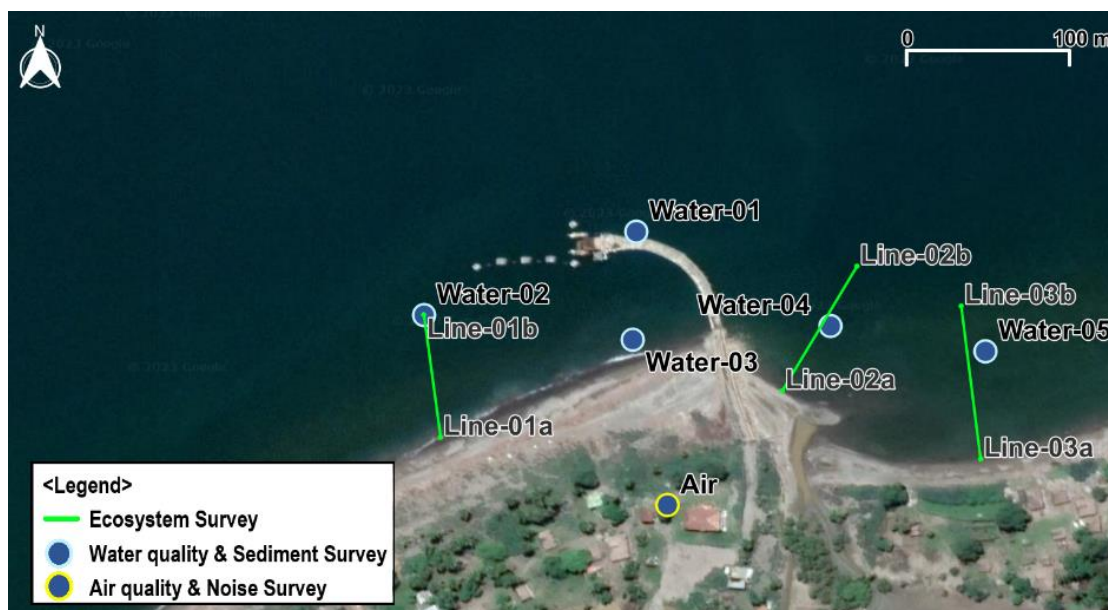
	Zinc	mg/kg	5	26	65	18	21	14
	Mercury	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	PCB	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	^ Sum of Aldrin + Dieldrin	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	^ Sum of DDD + DDE + DDT	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	^ C10 - C36 Fraction (sum)	mg/kg	50	<50	<50	<50	<50	<50
	Tributyltin	µgSn/kg	0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	PCB Surrogate							
	Decachlorobiphenyl	%	0.1	114	99.7	108	118	106
	Organochlorine Pesticide Surrogate							
	Dibromo-DDE	%	0.05	129	84.0	67.1	83.9	113
	Organophosphorus Pesticide Surrogate							
	DEF	%	0.05	126	79.9	138	83.6	107
	TPH(V)/BTEX Surrogates							
	1,2-Dichloroethane-D4	%	0.2	67.5	79.2	79.7	84.4	108
	Toluene-D8	%	0.2	68.6	84.3	75.6	89.8	117
	4-Bromofluorobenzene	%	0.2	71.1	82.0	76.2	86.9	119
Protected areas	There are no protected areas adjacent to the port.							
Ecosystems	• A total of 31 species, including seaweed, seagrass, coral, and fish, were confirmed in the vicinity of the survey area. • Species classified as Vulnerable (VU) and Near Threatened (NT) on the IUCN Red List were identified. • Additional surveys also confirmed species classified as Endangered (EN), and their locations were also identified. • Details are provided in the margin. • Coral distribution is limited around existing facilities where actual construction will occur. • Identifying coral locations enables avoidance of direct impacts from anchoring and construction work, and monitoring allows impacts to be minimized.							

Hydrology and water resources	No impact on hydrology or hydrography is anticipated from port construction. Groundwater surveys conducted as part of the natural conditions assessment confirmed that water supply is secured during both the rainy and dry seasons.
Social factors	At the stakeholder meeting, concerns regarding potential social issues such as pressure on sales at individually operated shops were raised. However, it was explained to residents that the project site is located outside the community and that no impact from the project is anticipated.

Source: JICA Survey team

9-4. Results of Ecosystem Survey

Regarding ecosystem survey, the distribution of mangroves was confirmed on land. Approximately 10 mangrove individuals are distributed on the eastern side of the planned public notice area. However, they are located outside the planned construction area. Furthermore, according to interviews with residents, this area is considered sacred, so no entry or alterations due to construction will occur. Meanwhile, in the marine area, as shown in Figure 8, three observation lines (100m per survey line) were established within the survey area. Surveyors slowly moved along these lines via scuba diving, observing and photographing the presence, types, and coverage of corals, seagrasses, and seaweeds at regular intervals.



The survey transects for marine portion of the ecosystem are Line01 to Line03

Source: JICA Survey team/Google Earth

Figure 12 Environmental Survey Locations and Side Lines

Table 17 summarizes the observation results.

Table 17 Overview of the Ecological Survey

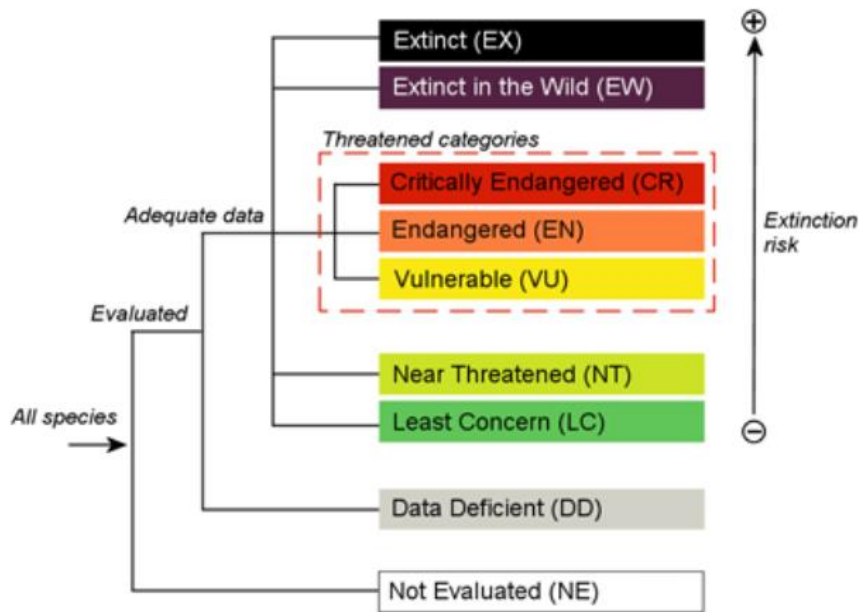
Line	Summary of Results	Pictures of Coral
1	Coral and seaweed are abundant.	
2	The seabed consists mainly of rocks and pebbles up to 45 meters from the shoreline, with no coral present.	
3	Many dead corals are present. According to local interviews, this is due to blast fishing.	

Source: JICA Survey team

The observed corals were categorized according to the IUCN (International Union for Conservation of Nature) Red List categories (see Table 13) and summarized in Table 18.

Although VU (Vulnerable) species exist in the survey area, it was found that NT (Near Threatened) species are also abundant. However, considering the primary geographic ranges in Table 19, there are species distributed almost worldwide and not unique to this area. Furthermore, as evident from photographs, they are not found in colonies but are scattered, attached to boulders. Therefore, the impact from the construction work is considered to be minor

Table 18 IUCN Red List Categories



Source: IUCN

Table 19 List of IUCN Red List Species Found in the Ecosystem Survey

				Total		VU		NT									
				VU	NT	<i>Turbinaria reniformis</i>	<i>Acropora muricata</i>	<i>Diploastrea heliophora</i>	<i>Favia stelligera</i>	<i>Favites Abdita</i>	<i>Favites flexuosa</i>	<i>Favites halicora</i>	<i>Platygyra lamellina</i>	<i>Pocillopora grandis</i>	<i>Stylophora pistillata</i>		
Primary geographic scope				Africa Middle East India East Asia Southeast Asia Australia Pacific Islands		Africa Middle East India East Asia Southeast Asia Australia Pacific Islands		Africa Middle East India East Asia Southeast Asia Australia Pacific Islands		Africa Middle East India East Asia Southeast Asia Australia Pacific Islands		Africa Middle East India East Asia Southeast Asia Australia Pacific Islands		Africa Middle East India East Asia Southeast Asia Australia Pacific Islands Central America		Africa Middle East India East Asia Southeast Asia Australia Pacific Islands	
Line-01	100m		2					o				o					
	95m		1					o									
	90m		1													o	
	80m		1					o									
	75m		2					o				o					
	70m		3					o				o				o	
	65m		4		o			o	o	o							
	60m		1													o	
	55m		1													o	
	50m		1													o	
	45m		1													o	
	30m		1									o					
Line-02	25m		1								o						
	20m		1								o						
	90m		1					o									
	85m	1		o													
	80m		1					o									
	75m		1					o									
	70m		2							o						o	
	60m		2					o								o	
Line-03	55m		2										o			o	
	50m		1													o	
	100m		1													o	
	95m	1		o													
	90m		2					o	o								

85m	1			○							
80m	1				○						
75m	1						○				
70m	1								○		
65m	1		○								
60m	1		○								
55m	1		○								

Source: JICA Survey team

9-5. Additional Survey

Although coral is scattered, with the understanding that detailed knowledge of its distribution and location can further mitigate construction impacts, an additional survey was conducted in October 2024 to identify coral distribution.

The survey employed the Manta Method, assessing underwater conditions through visual observation and photography. Coral locations were identified by overlaying the time stamp recorded on photographs with the time recorded by a continuously operating GPS device on the vessel.

Results revealed: 1) Many species listed as Vulnerable (VU) or higher on the IUCN Red List were observed, though distant from existing structures; 2) Their distribution consisted of solitary corals attached to boulders, not forming colonies; 3) Few boulders suitable as coral attachment substrates were present around existing structures scheduled for removal, likely due to the impact of the original construction, resulting in limited coral distribution.

Therefore, it is possible to minimize the impact on coral by carefully considering these distributions during construction. The presence or absence of impact can be confirmed through monitoring, thereby ensuring sustainability.

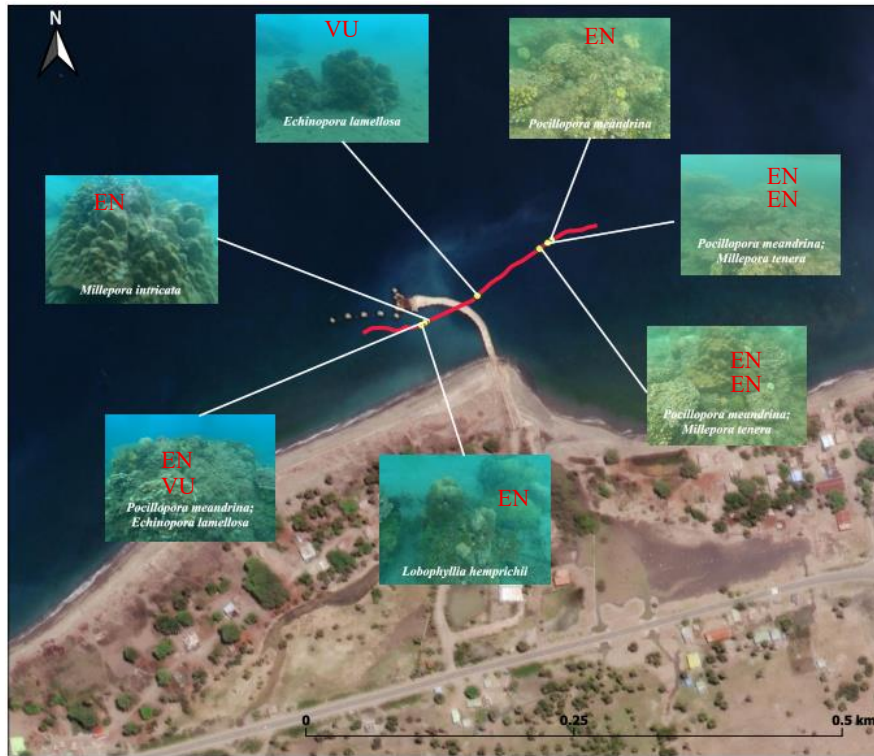
Table 19 shows the distribution of corals listed as Vulnerable (VU) or higher on the Red List.



Line 4



Line 3



Line 6



Line 2

Note: Red List status is indicated in red text on each coral photograph. The yellow line on Line 3 indicates a location estimated due to GPS failure preventing accurate position recording.

Base map source: Earthstar Geographics, Esri, Maxar, and the GIS User Community

Figure 13 Distribution of Red List VU or Higher Coral Species

9-6. Impact assessment

The results of the impact assessment are summarized in Table 20.

Table 20 Impact Assessment Results

Item	Impact assessment during scoping period		Impact assessment based on survey results		Evaluation
	Before construction/Under construction	During operation	Before construction/Under construction	During operation	
Air pollution	✓	✓	B-	D	Under construction: Impact from port construction machinery is possible. During operation: Impact is not expected.
Water pollution	✓	✓	B-	B-	Under construction: Water pollution from port construction and oil contamination from construction machinery are possible concerns. During operation: Oil contamination and wastewater pollution from operating vessels are possible concerns.
Waste	✓	-	B-	D	Under construction: Impacts such as construction waste and hazardous material emissions may occur. During operation: Impacts are not expected as the facility will be managed by port authorities.
Soil contamination	-	-	D	D	Since no soil is discharged outside the system, soil contamination is not anticipated.
Noise and vibration	✓	✓	B-	B-	Under construction: Noise may be generated from port construction machinery. During operation: Impacts may occur due to an increase in port users. For vibration, no impact is anticipated since the geology is of coral origin and vibration is not expected to propagate far.
Ground subsidence	-	-	D	D	There is no significant groundwater pumping, and no impact is expected.
Odor	-	-	D	D	Waste is generated, but no impact is expected since it is typically managed appropriately.
Sediment pollution	✓	✓	B-	B-	Under construction: Sediment contamination from harbor construction machinery is possible. During operation: Impact from navigating vessels is possible.
Protected areas	-	-	D	D	There are no protected areas in the vicinity.
Ecosystems	✓	-	B-	D	Under construction: Construction may impact coral. During operation: No impact is expected.

Item	Impact assessment during scoping period		Impact assessment based on survey results		Evaluation
	Before construction/Under construction	During operation	Before construction/Under construction	During operation	
Hydraulics and Hydrology	-	-	D	D	No impact on hydrology or hydromechanics is anticipated.
Topography and geology	-	-	D	D	No impact on topography and geology is anticipated.
Land acquisition, Resident relocation	-	-	D	D	This involves modifications to existing port facilities, with no land acquisition or resident relocation required.
Livelihood	✓	-	B-	D	Under construction: Fishing vessel navigation may be interfered. Employment promotion is necessary to improve the livelihoods of local residents. During operation: No negative impact on daily life or livelihood is anticipated.
Socially vulnerable individuals	-	-	D	D	Activities that could adversely affect socially vulnerable individuals are not anticipated.
Cultural heritage	-	-	D	D	There are no cultural heritage sites (tangible or intangible) within the project site or its surrounding areas. While there is a community hall used by residents, it will not be affected.
Landscape	-	-	D	D	No impact on the landscape is anticipated due to the renovation of existing facilities.
Minority people, indigenous people	-	-	D	D	Activities that adversely affect ethnic minorities and indigenous people are not anticipated.
Working environment	✓	-	B-	D	Under construction: Construction labor conditions must be ensured in accordance with relevant laws and regulations. During operation: No impact, as the facility is managed.
Health, Safety and Security of Local Communities	✓	-	B-	D	Under construction: The influx of construction workers may lead to the spread of infectious diseases. The use of main roads by construction vehicles may increase the risk of traffic accidents. During operation: Since it is managed by the facility, no impact is considered.

Note:

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

C: Extent of impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)

D: No impact is expected.

N/A : Impact assessment is not conducted because the item was categorized as no effect in scoping phase.

Source: JICA Survey team

9-7. Mitigation measures

Table 2 summarizes mitigation measures for all items rated B- in the above impact assessment. The table includes the implementation agency and responsible agency for super vision. Since these mitigation measures do not require special equipment or techniques, the associated costs shall be included in the construction costs and in the operating costs after commissioning.

Table 2 Mitigation Measures and Their Costs

[Before construction/Under construction]					
Item	Expected impact	Mitigation measures	Implementing agency	Responsible agency	Cost
Air pollution	Exhaust gases from port construction machinery and transport vehicles	Enclose the perimeter of the construction site with fencing or similar barriers.	Contractor	MTC/APORTIL	Include in the construction costs.
		Choose a car with low emissions.	Contractor	MTC/APORTIL	
		Implementation of regular air quality monitoring	Contractor	MTC/APORTIL	
	Dust from transport vehicles	Watering the field	Contractor	MTC/APORTIL	
Water pollution	Water turbidity caused by port construction	If turbidity is detected, suspend construction, identify the cause, and implement countermeasures. Proper operation and maintenance of sedimentation basins.	Contractor	MTC/APORTIL	
	Discharge of port construction machinery and facilities	Proper operation and maintenance of wastewater treatment facilities	Contractor	MTC/APORTIL	
		Properly check for any oil, fuel, waste, hazardous substances, etc., that may have leaked or been	Contractor	MTC/APORTIL	

[Before construction/Under construction]					
Item	Expected impact	Mitigation measures	Implementing agency	Responsible agency	Cost
		discharged into surrounding wasters and clean up immediately.			
Waste	Generation and increase of illegally dumped waste	Compliance with waste management procedures and the regulations of the relevant country	Contractor	MTC/APORTIL	
Noise and vibration	Noise and vibration from port construction machinery	Select equipment with low noise and vibration levels.	Contractor	MTC/APORTIL	
		Store facilities away from susceptible receptors.	Contractor	MTC/APORTIL	
	Noise from transport vehicles	Select vehicles with low noise levels.	Contractor	MTC/APORTIL	
Sediment pollution	Soil contamination caused by port construction machinery	Use appropriate construction machinery to reduce pollution	Contractor	MTC/APORTIL	
Ecosystems	Impact on the valuable ecosystems around the port	Refrain from driving stakes or anchoring near identified important coral species.	Contractor	MTC/APORTIL	
		If any changes are observed in the coral or its habitat, construction shall be suspended and countermeasures implemented.	Contractor	MTC/APORTIL	
Livelihood	Interfere with fishing vessels navigation	Take measures such as establishing navigation routes to ensure fishing vessels can navigate safely.	Contractor	MTC/APORTIL	
Working environment	Deterioration of workers' labor environment	Distribution of appropriate protective gear and heat countermeasures, regular safety briefings	Contractor	MTC/APORTIL	

[Before construction/Under construction]					
Item	Expected impact	Mitigation measures	Implementing agency	Responsible agency	Cost
		Prohibition and monitoring of child labor and forced labor			
[During operation]					
Item	Expected impact	Mitigation measures	Implementing agency	Responsible agency	Cost
Water pollution	Water pollution caused by vessel navigation and port terminal operations	Implementation of regular vessel inspections	Contractor	APORTIL	Include in the construction costs.
		Proper management of wastewater treatment systems	Contractor	APORTIL	
Noise and vibration	Noise from vehicles using the facility	Speed limit management	Contractor	APORTIL	

Source: JICA Survey team

10. Summary of Environmental Management Plan

Based on the results of impact assessment, Environmental Management Plan (EMP) was prepared targeting all items rated B- in the impact assessment. Since these management plan and mitigation measures do not require special equipment or techniques, the associated costs shall be included in the construction costs and in the operating costs after commissioning.

Monitoring will be conducted to verify the impact of the project and the effectiveness of mitigation measures for the items where mitigation measures were implemented as described above. In the monitoring plan, the monitoring items, methods, frequency, and other details are specified. As stated in the mitigation measures, the costs associated with monitoring will be included in the construction costs.

11. Public consultation and information disclosure

11-1. Stakeholder analysis

Table 21 summarizes stakeholders related to the project.

Table 21 Stakeholder analysis

No.	Organization/Group Name, etc.	Role	Reason for selection
1	Ministry of Finance	Budget management for national projects	It is important to understand securing project budgets at an early stage.
2	Ministry of State Administration	Management and coordination of the national administrative structure	Nationwide projects require coordination with numerous government agencies.
3	Ministry of Planning & Strategic Investment	National development plan and strategic investment	This project is part of the national development plan and requires strategic investment.
4	Ministry of Public Works	Construction and maintenance of public infrastructure	Ports are part of public infrastructure, and their construction and maintenance require direct involvement.
5	Ministry of Transport & Communications	Policy formulation and management of transportation and communications infrastructure	Ports are a vital part of transportation infrastructure and require communication systems.
6	Ministry of Tourism, Trade & Industry	Promotion and management of tourism, trade, and industry	Port development directly impacts tourism and trade and contributes to the development of local industries.
7	Ministry of Agriculture & Fisheries	Formulation and management of agricultural and fisheries policies	the impact on fisheries due to port development is anticipated.
8	Ministry of Petroleum & Minerals	Formulation and management of petroleum and mineral resources policy	The port under development has the potential to play a significant role in the import and export of petroleum and mineral resources.
9	UPM (Unidade Polísia Marítima)	Securing and maintaining maritime police forces	Port safety and legal compliance are required.
10	Municipality Authority	Local government	Coordination with local governments, port authorities, and local stakeholders is necessary.
11	APORTIL I.P. (Port Administration of Timor-Leste)	Port authority of Timor-Leste	APORTIL I.P. is the project proponent and the implementing body for environmental and social considerations.
12	DNTM (National Direction of Maritime Transportation)	Supervision and management of maritime transportation	Port development is highly likely to impact maritime transportation.
13	DNTT (Direção Nacional de Transportes Terrestres)	Command and management of land transportation	Port development is highly likely to impact land transportation.
14	ANLA (Agencia Nacional de Licenciamento Ambiental)	Issuance and management of environmental permits	Port development requires obtaining environmental permits.
15	DNMG (Direção Nacional Meteorologia e Geofísica)	National-level surveys and forecasts concerning weather and other issues	Port development and operation are affected by weather conditions.
16	EDTL,E.P (Electricidade de Timor-Leste Empresa Pública)	Management and maintenance of nationwide power supply	Due to port development, it is necessary to improve the power supply network.
17	TIMOR GAP	Resource development and management as a state-owned oil company	TIMOR GAP is the managing and operation entity for the Tasi-Mane Project, and coordination is required.
18	CI (Conservation International)	International Environmental NGO	Coordination is required in connection with the establishment of protected areas in Timor-Leste.

No.	Organization/Group Name, etc.	Role	Reason for selection
19	USAID (United States Agency for International Development)	International development and humanitarian assistance	Coordination is required in connection with the establishment of protected areas in Timor-Leste.
20	ADB (Asian Development Bank)	Promoting economic growth and cooperation in the Asia-Pacific region	Coordination is required in connection with the development of Timor-Leste.
21	WB (World Bank)	Poverty reduction and promotion of sustainable development	Coordination is required because this is related to the development of Timor-Leste.
22	IFC (International Finance Corporation)	Promotion of development by the private sector	Coordination is required because this is related to the development of Timor-Leste.
23	MPS (Major Projects Secretariat)	Management and coordination of major projects	Given the scale of this project, cooperation and coordination with MPS is necessary.
24	ANPM (Autoridade Nacional do Petróleo e Minerais)	State management of petroleum and mineral resources	The port to be developed could play a significant role in the import and export of petroleum and mineral resources.
25	SUCCESS (ferry)	Ferry service management	Port development may affect ferry operations.
26	Crossland Shipping Service, Lda	Provision of transportation services	Port development may impact shipping services.
27	Pacific Agency Unipessoal Lda Office	Provision of port-related services	Port development may impact port-related services.
28	Biqueli Ocean Agency	Marine services	Port development may impact on marine services.
29	Bethoven Line Agencias	Provision of maritime transportation services	Port development may impact shipping services.
30	Meratus Line	Provision of maritime transportation services	Port development may impact shipping services.
31	Trans Aslamea Shipping Lda	Provision of maritime transportation services	Port development may impact shipping services.
32	Versado Shipping, Lda.	Provision of maritime transportation services	Port development may impact shipping services.
33	Ariana Oceano Agency Lda	Marine services	Port development may impact on marine services.
34	Crossland Shipping Services, Lda	Provision of maritime transportation services	Port development may impact shipping services.
35	Pertamina International Timor, SA	Supply and sale of petroleum products	The port to be developed could play a significant role in the import and export of petroleum and mineral resources.
36	Timor Port	Port operation and management	Knowledge of existing port operations and coordination regarding the operation of newly developed ports are necessary.
37	Bollere Logistics	Provision of maritime transportation and logistics services	Port development may impact maritime transportation and logistics services.
38	Local government to which the target port belongs	Management of public services and regulations in development areas	-The development requires cooperation and approval from the local government. -The local government will be involved in the post-development port operations and regulations.
39	Local community to which the target port belongs	Statement of opinion as a local community	Port development impacts local communities, and their opinions and

No.	Organization/Group Name, etc.	Role	Reason for selection
			cooperation are crucial to the success of project.
40	Local residents around target port site	Opinion as local residents	Port development impacts local communities, and their opinions and cooperation are crucial to the success of project.
41	Local fisherman around target port site	Representative of local fishermen	Port development affects local fishermen, and their opinions and cooperation are crucial to the success of project.
42	Local fishery cooperative around target port site	Representative of the local fishery community	Port development impacts local fishing cooperatives, and their opinion and cooperation are crucial to the success of project.
43	Local marine products processor around target port site	Representative of local seafood processors	Port development affects local seafood processors, so their opinion and cooperation are crucial to the success of project.
44	Local tourist agent around target port site	Statement on behalf of the local tourism industry	Port development affects local tourism businesses, so their opinions and cooperation are crucial to the success of project.
45	Local construction company around target port site	Statement on behalf of local construction companies	Port development impacts local construction companies, and their opinions and cooperation are crucial to the success of project.
46	Local shipping company around target port site	Representative of the local shipping industry	Port development impacts local shipping companies, and their opinions and cooperation are crucial to the success of project.

11-2. Names of stakeholders previously consulted

Out of stakeholder listed in Table 21, most likely affected persons such as local community were mainly consulted.

The lists of participants are attached as Appendix 1.

11-3. Date of consultation

Table 22 Summary of consultations

Number	Date	Objective	Venue
1	October 28, 2024	To share project overview and survey details.	Carabela
2	January 6, 2026	To share survey results and mitigation measures.	Vemmase

11-4. Means of consultation

All consultation were held face-to-face.

11-5. Over view of key comments

11-5-1 First consultation

Ahead of the field survey, the first stakeholder meeting was held on October 28, 2024, in the Vemmase Town Hall conference room to share the project overview and survey details. Relevant parties were notified one week before the meeting through the Vemmase Town Hall.

Participants included local government representatives, local residents, customary chief, local elders, youth leaders, farmers, fishermen, women representatives, and others, totaling 84 individuals (75 men, 9 women).

Initially, the project overview and the implementation of the field surveys (geological, topographical, environmental surveys, etc.) for detailed planning were explained, and agreement was obtained.

Participants suggested performing traditional ceremonies to pray for safety before commencing work, including offshore operations. They also requested that local laborers, including women, be considered when manpower is needed and that appropriate mitigation measures be implemented if adverse impacts on the marine environment are anticipated during actual construction.

Indeed, local residents' boats were chartered for use as work vessels, and local residents were employed as workers during the field surveys.



Source: JICA Survey team

Figure 12 Stakeholder Meeting

11-5-2 Second Stakeholder Meeting

The second stakeholder consultation was held on January 6, 2026 to present environmental survey results to the relevant stakeholders at Vemassee district hall in Baucau municipality. The meeting was convened approximately one week prior, with written notice sent to each organization via Vemassee Administration.

A total of 63 participants (58 men, 5 women) attended the meeting, representing communities, government agencies, and partners.

Description by group:

- Community representatives:
Chiefs of villages from 7 Sucos and their structures (Caicua, Loilubo, Ossouala, Ostico, Uaegae, Uato-Lari, Vemassee), Carabela community representatives, Church representative, youth representatives, and youth leaders.
- Government representatives:
APORTIL, ANLA, Administrator, PNTL, Ministry of Transportation and Communications, MAPP/Department of Fisheries.
- Others
NGOs / partners

Key points raised during the meeting included:

- There was no significant opposition from participants regarding the implementation of the project.
- Early and ongoing information disclosure, including advance notice of construction activities
- Local employment and procurement opportunities, with prioritization of Carabela residents for non-specialized jobs during project development
- Land and asset management clarity to avoid future compensation disputes, including engagement of relevant land authorities to explain applicable laws and existing land status.
- Environmental protection of coastal and marine ecosystems (especially coral), and requests for baseline information on fish and aquatic species relevant to fisheries.
- Livelihood considerations, particularly for fishing households and women vendors operating near the port, including avoidance and minimization of impacts and fair compensation where impacts are unavoidable.
- Technical risks (flooding/erosion) that should be considered in rehabilitation design and during construction management.
- Women vendors highlighted the potential risk of disruption to trading activities if construction encroaches on current vending areas. They requested (i) advance notice to enable relocation and continuity of income, and (ii) fair compensation if their businesses are affected.
Regarding concerns about sales pressure from a woman, MTC explained to residents that the planned project site is outside the community and that no impact from the project is anticipated.

12. Difficulties encountered

Not applicable.

13. Conclusion and recommendation

13-1. Conclusion

Environmental survey around existing Carabela Port to renovate the facility for enhancing maritime logistics leading to economic growth.

Available information was collected and organized and scoping study was conducted to understand insufficient information to be collected. Based on the study, environmental field survey was conducted. Using those data, impact assessment study was carried out. And Environmental Management Plan to minimize the impact caused by the project was prepared and Monitoring Plan to understand the effectiveness of the environmental management was also prepared.

Requirements concerning environmental categories associated with development are stipulated in Decree-Law No. 5/2011. For port-related projects, the development of port facilities capable of mooring vessels exceeding 500 gross tons is designated as Category A.

However, this project is a rehabilitation of existing facility in the existing area with a national initiative requiring urgency.

No new land acquisition is necessary.

Also based on the results of the environmental field survey, the environmental impact was deemed minor. It is considered that the project will not cause significant adverse environmental impacts and does not involve characteristics prone to causing impacts or vulnerable areas.

Furthermore, no derivative or secondary impacts, cumulative impacts, or inseparable integrated projects are planned.

Therefore, this project is classified as Environmental and Social Considerations Category B.

13-2. Recommendation

During construction, it is recommended to monitor the situation of environmental status following the Monitoring Plan. If any change of environmental status is realized, intensive study shall be conducted to know its causes. And if it is caused by the project, cease of construction activities must be planned until countermeasures is secured and the causes are resolved.

Since important marine ecosystem, such as coral and seagrass exist in the area, consecutive occurring of turbid water causes negative impact to the ecosystems. And, therefore, continuous monitoring is fundamental.

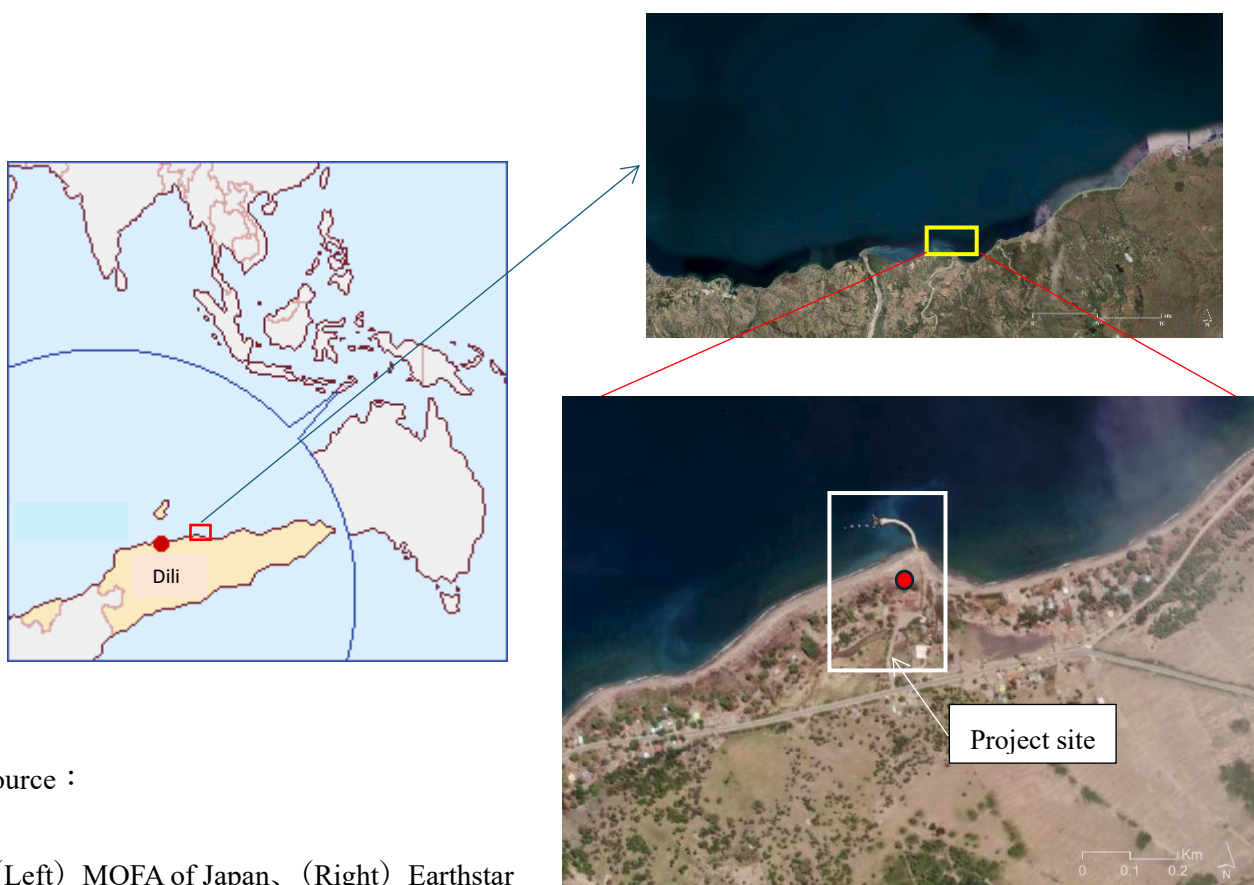
14. Non-technical summary

Environmental survey around existing Carabela Port to renovate the facility for enhancing maritime logistics leading to economic growth.

Available information was collected and organized and scoping study was conducted to understand insufficient information to be collected. Based on the study, environmental field survey was conducted. Using those data, impact assessment study was carried out. And Environmental Management Plan to minimize the impact caused by the project was prepared and Monitoring Plan to understand the effectiveness of the environmental management was also prepared.

Followings are summary of this document.

14-1. Project Location



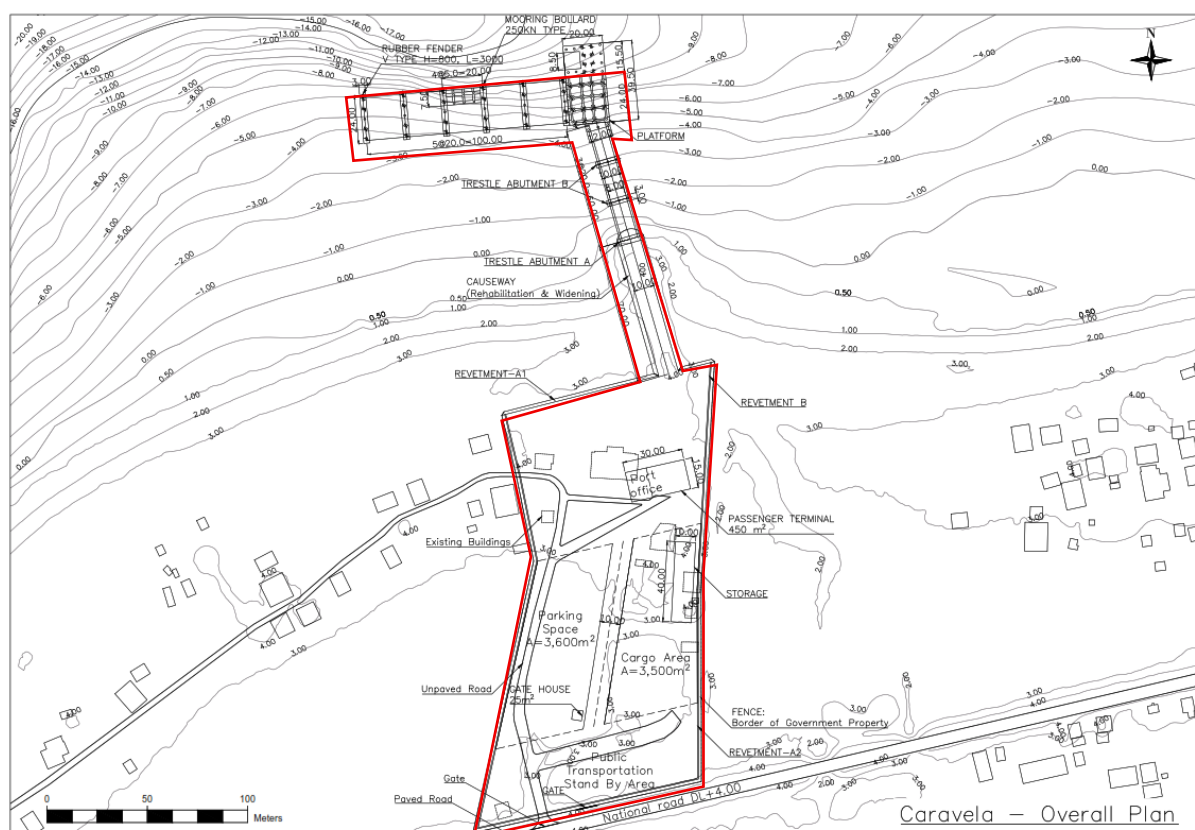
Source :

(Left) MOFA of Japan、(Right) Earthstar

Project Site Location

14-2. Horizontal layout

Horizontal layout of the port after rehabilitation (planned) is shown below in red line.



Source : JICA Survey team

14-3. Summary of environmental impact

There is important ecosystem, such as coral seagrass bed exists around the project area.

As for seagrass, it distributes close to the coast, which is not touched by the project.

Important coral species were found in the survey. However, considering the primary geographic ranges, there are species distributed almost worldwide and not unique to this area. Furthermore, they are not found in colonies but are scattered, attached to boulders. Therefore, the impact from the construction work is considered to be minor.

Although coral is scattered, with the understanding that detailed knowledge of its distribution and location can further mitigate construction impacts, an additional survey was conducted to identify coral distribution.

Results revealed: 1) Many species listed as Vulnerable (VU) or higher on the IUCN Red List were observed, though distant from existing structures; 2) Their distribution consisted of solitary corals attached to boulders, not forming colonies; 3) Few boulders suitable as coral attachment substrates were present around existing structures scheduled for removal, likely due to the impact of the original construction, resulting in limited coral distribution.

Therefore, it is possible to minimize the impact on coral by carefully considering these distributions during construction. The presence or absence of impact can be confirmed through monitoring, thereby ensuring sustainability.

Also based on the results of the environmental field survey, the environmental impact was deemed minor. It is considered that the project will not cause significant adverse environmental impacts and does not involve characteristics prone to causing impacts or vulnerable areas.

Furthermore, no derivative or secondary impacts, cumulative impacts, or inseparable integrated projects are planned.

However, Environmental Management Plan and Monitoring Plan have been prepared and continuous environmental management will be carried out continuously during the project. Also, continuous monitoring will be conducted to know if the environmental management properly works.

When negative environmental impact is realized, mitigation measures will be taken.

Therefore, this project can be considered sustainable.

Reference

- ADB. (2004). *Water Availability and Water Demand Hydrology and Hydrogeology of Timor-Leste*. Asian Development Bank TA: TIM 3986.
- ADB. (2011). *Initial Environmental Examination TIM: District Capitals Water Supply Project the Expansion, Rehabilitation, Operation and Maintenance of Pante Macassar Water Supply Systems*. Asian Development Bank.
- ADB. (2014). *The State of Coral Triangle: Timor-Leste*. ADB. Manila: ADB. Retrieved 10 08, 2023, from <https://www.adb.org/sites/default/files/publication/42394/state-coral-triangle-timor-leste.pdf>
- ADB. (2014). *Timor-Leste Country Gender Assessment*. Mandaluyong.
- ADB. (2016). *Initial Environmental Examination for Second District Capitals Water Supply Project Final Report Volume 3- Appendix O*. Asian Development Bank TA 8064 TIM.
- ADB. (2016). *Initial Environmental Examination for Second District Capitals Water Supply Project Final Report Volume 3- Appendix O*. Asian Development Bank .
- ADB. (2016). *Volume 3 - Appendix O - Initial Environmental Examination for Second District Capitals Water Supply Project (46160-001) TA-8064 TIM*.
- Alongi, D. M. (2014). Mangrove forests of Timor-Leste: ecology, degradation and vulnerability to climate change. Mangrove ecosystems of Asia: status, challenges and management strategies.
- Alongi, D. M., Da Silva, M., Wasson, R. J., & Wirasantosa, S. (2013). Sediment discharge and export of fluvial carbon and nutrients into the Arafura and Timor Seas: A regional synthesis. *Marine Geology*, 343, 146-158.
- Alongi, D., Amaral, A., de Carvalho, N., McWilliam, A., Rouwenhorst, J., Tirendi, F., . . . Wasson, R. (2012). *River catchments and marine productivity in Timor-Leste: Caraulun and Lacro Catchments; South and North Coasts Final Report*. Retrieved from https://ris.cdu.edu.au/ws/portalfiles/portal/84520107/Alongi_D_et_al_2012_River_Catchments_and_marine_productivity_in_Timor_Leste.pdf
- Alves, G. (2007). *Thematic Assessment Report: The United Nations Convention on Biological Diversity (UNCBD)*. Dili: UNDP.
- Audley-Charles, M. (2004). Ocean trench blocked and obliterated by Banda forearc collision with Australian proximal continental slope. *Tectonophysics*.
- Ayling, A. L., Edyvane, K. S., Penny, S., Carvalho, N. d., Fernandes, A., & Amaral, A. L. (2009). *Preliminary biological resource survey of fringing reefs in the proposed Nino Konis Santana Marine Park, Timor-Leste*. Northern Territory Department of Natural Resources, Environment & the Arts.
- Barnes, S., Hägerdal, H., & Palmer, L. (2017). An East Timorese Domain: Luca from Central and Peripheral Perspectives. *Journal of the Humanities and Social Sciences of Southeast Asia*, 325-355.
- Boggs, G., K., E., N., d. C., J., M., P., P., R., M., . . . L., F. (2009). *Marine and Coastal Habitat Mapping in Timor Leste (North Coast) – Final Report*. Ministry of Agriculture & Fisheries, Government of Timor Leste.
- Boldoni, C. (2020, June 30). Uma Lulik as Heritage: Authorised Heritage Discourse in Timor-Leste. doi:<https://doi.org/10.4000/eces.5298>
- Brackhane, S., Webb, G., Xavier, F. M., Gusmao, M., & Pechacek, P. (2018). When conservation becomes dangerous: Human-Crocodile conflict in Timor-Leste. *Wildlife Management*.
- Bria, M. M. (2018). Promoting Timor Leste's Tais Cloth Using Mobile Augmented Reality Application. *Procedia Computer Science*.
- BSRP. (2016). *Timor-Leste*. Retrieved from Building Safety & Resilience in the Pacific : <https://bsrp.gsd.spc.int/index.php/timor-leste/>
- Burke, L., Reyntar, K., Spalding, M., & Perry, A. (2012). Reefs at Risk Revisited in the Coral Triangle. *The World Resource Institute*.
- Casquilho, J. P., & Martins, X. (2021). On the influence of Customary Law "Tara Bandu" in Community Based Forest Management at the Mountains of Timor-Leste. Retrieved from https://www.researchgate.net/profile/Jose-Casquilho/publication/355788735_On_the_influence_of_Customary_Law_Tara_Bandu_in_Community_Based_Forest_Management_at_the_Mountains_of_Timor-Leste/
- Casquilho, J. P., & Martins, X. (2022, November 17). *Tara Bandu: On the Hybridization of a Sign*.
- Castro, A. F. (2012). A Religião em Timor-Leste a partir de uma Perspectiva Histórico-Antropológica.
- Cho, W., & Lim, C.-H. (2023). Simplified and High Accessibility Approach for the Rapid Assessment of Deforestation in Developing Countries: A Case of Timor-Leste. *Remote Sensing*.
- CI. (2017). *GEF Project Document*.
- da Costa, D. (2023, November). Social interview. (Quirmado, Interviewer)
- De Lucca, D. (2020). Ficções históricas de Timor-Leste: tempo, violência e gênero na produção filmica pós-independência. *Afro-Asia*, 270-320.
- Dethmers, K., Chatto, R., Meekan, M., Amaral, A., Cunha, C. d., Carvalho, N. d., & Edyvane, K. (2009). *Marine megafauna surveys in Timor Leste: identifying opportunities for potential ecotourism - Final Report*. Government of Timor-Leste.
- Do Carmo Da Silva, J. L. (2016). An objective approach to evaluate environmental management in the offshore oil industry in Timor Sea, East Timor. *Heriot-Watt University*.
- Dugong & Seagrass Hub. (n.d.). *Where We Work - Timor-Leste*. Retrieved November 30, 2023, from Dugong & Seagrass Hub: <https://www.dugongseagrass.org/where-we-work/timor-leste/>
- Durand, F. (2002). East Timor: A country at the crossroads of Asia and the Pacific: A Geo-Historical Atlas. In *Silkworm Books* (Vol. 13, pp. 39-40). Bangkok.
- Eisemberg, C. C., Costa, B. G., Guterres, E. C., Reynolds, S. J., & Christian, K. A. (2016). Notes on Chelodina mccordi timorensis Biology, Harvest, Current Threats, and Community Perceptions in the Lake Iralalaro Region, Timor-Leste. *Chelonian Conservation and Biology*.
- Eni Timor-Leste. (2007). *3D Seismic Survey Environmental Management Plan*.
- Erdmann, M., Allen, G., Turak, E., Devantier, L., & Mohan, C. (2013). *A Rapid Marine Biological Assessment of Timor-Leste*. RAP 66 Bulletin of Biological Assessment, Conservation International, Jakarta.
- Fabrizius, K. E. (2004). Effects of terrestrial runoff on the ecology of corals and coral reefs: Review and synthesis. *Marine Pollution Bulletin*, 125-146. doi:doi:10.1016/j.marpolbul.2004.11.028
- Farram, S. (2014). Two journeys in Indonesian-occupied Timor-Leste, 1991 and 1997.

- Fox, M., Hidayat, T., Knuckey, I., Greenberg, N., Koopman, M., & Ribeiro, L. (2021). *Scaling up RBM in the ATS: Taking a rights-based approach to the management of small-scale red snapper fisheries in the ATS region*. Arafura and Timor Seas Ecosystem Action Phase 2. Bali: ATSEA-2.
- GoTL. (2016, September 29). *Government of Timor-Leste website*. Retrieved from timorlestegov.tl: <http://timor-leste.gov.tl/?p=16325&lang=en>
- Hawkins, S., O'Connor, S., Maloney, T. R., Litster, M., Kealy, S., Fenner, J. N., & Louys, J. (2017). Oldest human occupation of Wallacea at Laili Cave, Timor-Leste, shows broad-spectrum foraging responses to late Pleistocene environments. *Quaternary Science Reviews*.
- Henriques, P. D., & Narciso, V. (2010). The Role of Traditional Land Use Systems in the Well-being of Rural Timor-Leste. (L. L. Tolentino, L. D. Landicho, S. Wun'Gaeo, & K. Ikegami, Eds.) *The College of Agriculture* (ISBN 978-971-8778-87-6), 77-91.
- Henriques, P. D., Narciso, V., & Branco, M. (2011). The role of traditional land use systems in the well-being of rural Timor-Leste.
- Hutomo, M., & Azkab, M. H. (2003). The Status of Knowledge and Management Policy of Dugong in Indonesia. Jakarta: Research Centre for Oceanography, Indonesian Institute of Science.
- IFC. (2007, April 30). *General Environmental, Health, and Safety (EHS) Guidelines*. Retrieved from International Finance Corporation: <https://www.ifc.org/content/dam/ifc/doc/2023/ifc-general-ehs-guidelines.pdf>
- Ilman, M. (2017). *Assessment Report of the Biophysical, Ecological and Socio-Economic Conditions of Mangroves Ecosystem of Timor-Leste*. UNDP and National Directorate of Forestry, Coffee and Industrial Plants, MAF, Timor Leste.
- JICA. (2016). *Simplified Environmental Impact Statement/Initial Environmental Examination - Timor-Leste: National Road No. 1 Upgrading - Dili - Baucau*.
- Knowema. (2020). *Timor-Leste-Volume of groundwater produced internally*. Retrieved 2023, from <https://knoema.com/atlas/Timor-Leste/Volume-of-groundwater-produced#:~:text=Volume%20of%20groundwater%20produced%20internally&text=Between%201971%20and%202020%2C%20Timor,by%20our%20digital%20data%20assistant>
- Langley, M. C., O'Connor, S., & Piotto, E. (2016). 42,000-year-old worked and pigment-stained Nautilus shell from Jerimalai (Timor-Leste): Evidence for an early coastal adaptation in ISEA. *Journal of Human Evolution*.
- Lauretta Burke, K. R. (2012, January). *Reefs at Risk Revisited in the Coral Triangle*. Washington: World Resources Institute.
- Leach, M. (2015). *Heritage and Memory of War: Responses from Small Islands*. New York: Routledge. doi:<https://doi.org/10.4324/9781315736433>
- López-Angarita, J., Hunnam, K., Pereira, M., Mills, D., Pant, J., Teoh, S., . . . Tilley, A. (2019). *Fisheries and aquaculture of Timor-Leste in 2019: Current knowledge and opportunities*. Penang: WorldFish.
- Lundahl, M. & (2009). Population growth and job creation in Timor-Leste. *Asia Pacific Economy*.
- Martins, N., & Travena, L. (2014). Implementing what works: a case study of integrated primary health care revitalisation in Timor-Leste. *Asia Pacific Family Medicine*.
- MDF. (2017, June). *Timor-Leste's Transition to a Post-Conflict, Post-Oil Economy*.
- Metzner, J. K. (1977). *Man and his environment in Eastern Timor*. Canberra: ANU.
- Metzner, J. K. (2017). *Man and Environment in Eastern Timor*. In *Man and Environment in Eastern Timor*. Canberra, ACT: Development Studies Centre The Australian National University.
- Metzner, J. K. (2017). *Man and Environment in Eastern Timor*. Canberra, ACT: Development Studies Centre The Australian National University.
- Milliman, J. D., Farnsworth, K. L., & Albertin, C. S. (1999). Flux and fate of fluvial sediments leaving large islands in the East Indies. *Journal of Sea Research*, 41(1-2), 97-107.
- Ministry of Public Works. (2020). *Project Document for Environmental Licensing - Viqueque Municipal Capital*. Dili: Ministry of Public works.
- MoF. (2022). *Timor-Leste Population and Housing Census - Data Sheet*.
- MoF. (2022). *Timor-Leste Population and Housing Census - Main Report*.
- Neef, A. (2019, February). *Tourism, Land Grabs and Displacement*. Auckland.
- Niner, S., & Nguyen, T. T. (2022). *Timor-leste: substantive representation of women parliamentarians and gender equality. Substantive representation of women in Asian parliaments*. Routledge.
- O'Connor, S., Pannell, S., & Brockwell, S. (2011). Whose culture and heritage for whom? The limits of National Public Good Protected Area Models in Timor Leste. *Rethinking Cultural Resource Management in Southeast Asia: Preservation, Development, and Neglect*.
- Ono, R., Pawlik, A., & Fuentes, R. (2020). Island migration, resource use, and lithic technology by anatomically modern humans in Wallacea. *Pleistocene archaeology-migration, technology, and adaptation*.
- Osaka, H. (2012). *Human Rights Education in Asia-Pacific—Volume Three*. Osaka: Asia-Pacific Human Rights Information Center.
- Palmer, L. (2021). *Island Encounters: Timor-Leste from the outside in*. ANU Press.
- Palmer, L., Niner, S., & Kent, L. (2007). Exploring the Tensions of Nation Building in Timor-Leste. *Proceedings of a forum held at The University of Melbourne, The University of Melbourne, Victoria 3010 AUSTRALIA*. The School of Social and Environmental Enquiry, .
- Palmer, Niner, & Kent . (2007). Exploring the tensions of nation building in Timor-Leste.
- PEMSEA and Ministry of Agriculture and Fisheries. (2019). *National State of Oceans and Coasts 2018: Blue Economy Growth of Timor-Leste*. Quezon City, Philippines: Partnerships in Environmental Management for the Seas of East Asia (PEMSEA).
- Pereira, M. (2023, October). Social interview. (Quirmado, Interviewer)
- PIFSC. (2017). *Interdisciplinary baseline ecosystem assessment surveys to inform ecosystem-based management planning in Timor-Leste: Final Report*. NOAA Pacific Islands Fisheries Science Center. PIFSC Special Publication.
- Pilcher, N. J. (2021). *Status of Sea Turtles in the Arafura and Timor Seas - A Literature Review*. Marine Research Foundation for The Arafura and Timor Seas Ecosystem Action Phase 2 (ATSEA-2) Project.
- RDTL. (2005). *Natural Resources and Environment Priorities and Proposed Sector Investment Program*. Retrieved from https://www.laohamutuk.org/OilWeb/Finances/Donor5-05/NATURAL%20RESOURCES%20&%20ENVIRONMENT_Eng.pdf
- RDTL. (2011). *The National Biodiversity Strategy and Action Plan of Timor-Leste*.
- RDTL. (2012). *Analyses of the Current Situation and Potential for Aquaculture Development in Timor-Leste*. Ministry of Agriculture and Fisheries, Timor-Leste, National Directorate of Fisheries and Aquaculture, Dili.

- RDTL. (2012). *The Tasi Mane Project – Betano Petroleum Refinery and Beaco LNG Plant Strategic Environmental Impact Assessment Final Report*. Timor Gap E.P. . WorleyParsons .
- RDTL. (2017). *Assessment Report of the Biophysical, Ecological and Socio-Economic Conditions of Mangroves Ecosystem of Timor-Leste*.
- RDTL. (2019). *Timor-Leste's Sixth National Report to the Convention on Biological Diversity*.
- Red Cross, I. F. (2021, April). *Climate Health Impacts On Health And Livelihoods: Timor-Leste Assessment*. Retrieved from Red Cross Red Crescent Climate Centre: https://www.climatecentre.org/wp-content/uploads/RCRC_IFRC-Country-assessments-Timor-Leste-V4.pdf
- Rede ba Rai. (2019). *Land Registration in Timor-Leste: Impact Analysis of the National Cadastral System (SNC)*.
- Rofi, A., & Saragih, S. (2019). Protect the water sources through community participation on the micro-watershed management in the Region of Oecusse Timor-Leste. *IOP Conference series: Earth and Environmental Science*, 256, 012006.
- Sandlund, O., Bryceson, I., de Carvalho, D., Rio, N., da Silva, J., & Silva, M. (2001). *Assessing Environmental Needs and Priorities in East Timor. Final Report*. Trondheim: Foundation for Nature Research and Cultural Heritage Research.
- Seagrass-Watch. (2023). *Seagrass-Watch*. Retrieved from Sea: <https://www.seagrasswatch.org/timor-leste/#:~:text=The%20coral%20reefs%2C%20seagrass%20meadows,including%20dugongs%20and%20marine%20turtles.>
- Secretary of State for Environment. (2020, November). *Timor Leste's Second National Communication - The United Nations Framework Convention On Climate Change*. Retrieved from UNFCCC: <https://unfccc.int/sites/default/files/resource/Second%20National%20Communication%2C%20Timor-Leste.pdf>
- SPREP, S. o. (2020). *Assessment of Legislative Frameworks Governing Waste management in Timor-Leste*. SPREP. Retrieved from <https://library.sprep.org/sites/default/files/2021-03/waste-legislation-Timor-Leste.pdf>
- Standish, C. D., García-Diez, M., O'Connor, S., & Oliveira, N. V. (2020). Hand stencil discoveries at Lene Hara Cave hint at Pleistocene age for the earliest painted art in Timor-Leste. *Archaeological Research in Asia*.
- Standish, C. D., García-Diez, M., O'Connor, S., & Oliveira, N. V. (2020). Hand stencil discoveries at Lene Hara Cave hint at Pleistocene age for the earliest painted art in Timor-Leste. *Archaeological Research in Asia*.
- Stead, V. (2015). Homeland, territory, property: Contesting land, state, and nation in urban Timor-Leste. *Political Geography*.
- Steenhagen, E., Fuller, S., Farelly, T., Borrelle, S., & Rengal-Goncalves, A. (2023). *Plastic Pollution Prevention in Timor-Leste: Gap Analysis of Current Legislation, Policies and Plans*. Apia, Samoa: SPREP.
- Stockwell, A. (2001). Introduction to Co-Management or Community-Based Management of Coastal Resources. Dili: World Bank.
- Sudo, K., Quiros, T. E., Prathep, A., Luong, C. V., Lin, H.-J., Bujang, J. S., . . . Nakaoka, M. (2021). Distribution, Temporal Change, and Conservation Status of Tropical Seagrass Beds in Southeast Asia: 2000-2020. *Frontiers in Marine Science*.
- Suwartiningsih, S., Purnomo, D., & Lahade, J. R. (2020). The Role of Social Capital on International Trade Transactions at Wini Market, In Realizing Social Harmonization of Indonesia-Timor Leste Border Community. *International Journal of Criminology and Sociology*.
- Tatoli. (2017, June 5). Presidente Republika Promulga Lei ba Rai. Dili, Timor-Leste.
- The Nature Conservancy. (2009). *The Lesser Sunda Ecoregion: Designing a resilient network of MPAs - linking coastal and deep sea ecosystems*. Bali: The Nature Conservancy Indonesia Marine Program. Retrieved 10 09, 2023, from https://www.reefresilience.org/wp-content/uploads/Lesser_Sunda_factsheet.pdf
- Thompson, S. J. (2011). *Geology and Soils in Timor-Leste*. Seeds of Life Program Report. Retrieved from <http://seedsoflifetimor.org/wp-content/uploads/2012/12/Geology-and-Soils-in-Timor-LesteA4.pdf>
- Timor Resources. (2021). *Preliminary Assessment of Impacts Arising from Drilling Activity in PSC TL-OT-17-09*.
- Trainor, C. R. (2011). The waterbirds and coastal seabirds of Timor-Leste: new site records clarifying residence status, distribution and taxonomy. *Forktail*, 63-72.
- Trainor, C. R., & Hidayat, O. (2014). Kupang Bay: an internationally significant wetland in West Timor, Indonesia. *Birding Asia*, 45-50.
- Trainor, C. R., Santana, F., Pinto, P., Xavier, A. F., Safford, R., & Grimmett, R. (2008). Birds, birding and conservation in Timor-Leste. *BirdingASIA*.
- Trindade, J. (2015). Relational Dimensions within Timor-Leste Customary Society. *Timor-Leste: The Local, the Regional and the Global: A TLSA Research Conference* . Dili.
- UNDP. (2021). Aichi Biodiversity Target 11 Country Dossier: TIMOR-LESTE.
- UNWater. (2021). Retrieved 2023, from UN Water: https://www.laohamutuk.org/OilWeb/Finances/Donor5-05/NATURAL%20RESOURCES%20&%20ENVIRONMENT_Eng.pdf
- Veron, J., Devantier, L., Turak, E., Green, A., Kininmonth, S., Stafford-Smith, M., & Peterson, N. (2009). Delineating the Coral Triangle. *Galaxea, Journal of Coral Reef Studies*.
- Wallace, L., Sundaran, B., Brodie, R. S., Marshall, S. K., Dawson, S., Jaycock, J., . . . Furness, L. J. (2012). *Vulnerability Assessment of Climate Change Impacts on Groundwater Resources in Timor-Leste*. Geoscience Australia. Retrieved from <https://www.dccew.gov.au/sites/default/files/documents/groundwater-timor-leste-report.pdf>
- WBG & ADB, W. B. (2021). *Climate Risk Country Profile: Timor-Leste*. Retrieved from Climate Knowledge Portal - World Bank: https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15971-WB_Timor-Leste%20Country%20Profile-WEB.pdf
- Wever, L. (2008). *Assessing Management Challenges and Options in the Coastal Zone of Timor-Leste*. Southport, Queensland, Australia: In Griffith Centre for Coastal Management Research Report.
- WHO. (2005, August 12). *AQGs Global Update 2005*. Retrieved October 10, 2023, from World Health Organization: <https://www.who.int/publications/i/item/WHO-SDE-PHE-OEH-06.02>
- WHO. (2021, September 22). *Global Air Quality Guidelines 2021*. Retrieved September 2023, from World Health Organization: <https://www.who.int/publications/i/item/9789240034228>
- Wilkinson, C. (2008). Status of coral reefs of the world: 2008. *Global Coral Reef Monitoring Network and Reef and Rainforest*.
- World Bank . (2016). *Timor-Leste-Oecusse Economic and Trade Potential: Overview of Oecusse Today and Long-term Potential*. World Bank Group. doi:<https://doi.org/10.1596/24726>
- World Bank. (2016). *Timor-Leste-Oecusse Economic and Trade Potential: Overview of Oecusse Today adn Longterm Potential*.

- World Bank. (2016). *Timor-Leste-Oecusse Economic and Trade Potential: Overview of Oecusse Today and Longterm Potential*.
- World Bank. (2018). *Timor-Leste Water Sector Assessment and Roadmap*. Retrieved from <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/433121521173685667/timor-leste-water-sector-assessment-and-roadmap>
- World Bank. (2019). *Simplified Environmental and Social Impact Statement (SEIS)/Environmental and Social Impact Assessment (ESIA) - Branch Road Section of Dili – Ainaro Road (Aituto – Hatubuilico – Letefoho – Gleno)*.
- WorleyParsons. (2012). *Tasi Mane Project - Betano Petroleum Refinery & Beaco LNG Plant - Strategic Environmental Impact Statement - Final Report*.
- WorleyParsons. (2012). *Tasi Mane Project - Betano Petroleum Refinery and Beaco LNG Plant Strategic Environmental Impact Assessment Final Report*.
- WorleyParsons. (2012). *Tasi Mane Project - Betano Petroleum Refinery and Beaco LNG Plant Strategic Environmental Impact Assessment Final Report (Volume 2)*.
- WorleyParsons. (2017). *Baucau Cement Project - EIA - Cement Plant, Jetty, Conveyor Belt and Associated Infrastructure*.
- WorleyParsons. (2017). *Baucau Cement Project - Environmental Impact Statement Limestone Mine - Volume 1*.
- WorleyParsons. (2017). *Baucau Cement Project: Environmental Impact Statement - Cement Plant, Jetty, Conveyor Belt and Associated Infrastructure. Vol. 2*.
- Wyatt, A. S. (2004). Preliminary survey of the nearshore coastal marine environment of the south coast of East Timor: a baseline for assessing the impacts of a developing nation. University of Western Australia.
- Yoder, L. S. (2015). The development eraser: Fantastical schemes, aspirational distractions and high modern mega-events in the Oecusse enclave, Timor-Leste. *Journal of Political Ecology*.
- Yoder, L. S., & Joreiman, S. F. (2019). Possession and Precedence: Juxtaposing Customary and Legal Events to Establish Land Authority . *Land Restitution: Processes and Outcomes in Different Political and Socio-Cultural Contexts*.
- ZEESM-TL. (2013). *Special Economic Zones of Social Market Economy, First steps towards new Oecusse*. Retrieved from <https://www.laohamutuk.org/econ/Oecussi/ZEESMSituationAnalysisMar14en.pdf>
- Hawkins, S., O'Connor, S., Maloney, T. R., Litster, M., Kealy, S., Fenner, J. N., & Louys, J. (2017). Oldest human occupation of Wallacea at Laili Cave, Timor-Leste, shows broad-spectrum foraging responses to late Pleistocene environments. *Quaternary Science Reviews*.
- Henriques, P. D., & Narciso, V. (2010). The Role of Traditional Land Use Systems in the Well-being of Rural Timor-Leste. (L. L. Tolentino, L. D. Landicho, S. Wun'Gaeo, & K. Ikegami, Eds.) *The College of Agriculture*(ISBN 978-971-8778-87-6), 77-91.
- Henriques, P. D., Narciso, V., & Branco, M. (2011). The role of traditional land use systems in the well-being of rural Timor-Leste .
- Hutomo, M., & Azkab, M. H. (2003). he Status of Knowledge and Management Policy of Dugong in Indonesia. Jakarta: Research Centre for Oceanography, Indonesian Institute of Science.
- IFC. (2007, April 30). *General Environmental, Health, and Safety (EHS) Guidelines*. Retrieved from International Finance Corporation: <https://www.ifc.org/content/dam/ifc/doc/2023/ifc-general-ehs-guidelines.pdf>
- Ilman, M. (2017). *Assessment Report of the Biophysical, Ecological and Socio-Economic Conditions of Mangroves Ecosystem of Timor-Leste*. UNDP and National Directorate of Forestry, Coffee and Industrial Plants, MAF, Timor Leste.
- JICA. (2016). *Simplified Environmental Impact Statement/Initial Enviornmental Examination - Timor-Leste: National Road No. 1 Upgrading – Dili – Baucau*.
- Knowema. (2020). *Timor-Leste-Volume of groundwater produced internally*. Retrieved 2023, from <https://knoema.com/atlas/Timor-Leste/Volume-of-groundwater-produced#:~:text=Volume%20of%20groundwater%20produced%20internally&text=Between%201971%20and%202020%2C%20Timor,by%20our%20digital%20data%20assistant>
- Langley, M. C., O'Connor, S., & Piotto, E. (2016). 42,000-year-old worked and pigment-stained Nautilus shell from Jerimalai (Timor-Leste): Evidence for an early coastal adaptation in ISEA. *Journal of Human Evolution*.
- Lauretta Burke, K. R. (2012, January). Reefs at Risk Revisited in the Coral Triangle. Washington: World Resources Institute.
- Leach, M. (2015). *Heritage and Memory of War: Responses from Small Islands*. New York: Routledge. doi:<https://doi.org/10.4324/9781315736433>
- López-Angarita, J., Hunnam, K., Pereira, M., Mills, D., Pant, J., Teoh, S., . . . Tilley, A. (2019). *Fisheries and aquaculture of Timor-Leste in 2019: Current knowledge and opportunities*. Penang: WorldFish.
- Lundahl, M. &. (2009). Population growth and job creation in Timor-Leste. *Asia Pacific Economy*.
- Martins, N., & Travena, L. (2014). Implementing what works: a case study of integrated primary health care revitalisation in Timor-Leste. *Asia Pacific Family Medicine*.
- MDF. (2017, June). Timor-Leste's Transition to a Post-Conflict, Post-Oil Economy.
- Metzner, J. K. (1977). Man and his environment in Eastern Timor. Canberra: ANU.
- Metzner, J. K. (2017). Man and Environment in Eastern Timor. In *Man and Environment in Eastern Timor*. Canberra,, ACT: Development Studies Centre The Australian National University.
- Metzner, J. K. (2017). Man and Environment in Eastern Timor. Canberra, ACT: Development Studies Centre The Australian National University.
- Milliman, J. D., Farnsworth, K. L., & Albertin, C. S. (1999). Flux and fate of fluvial sediments leaving large islands in the East Indies. *Journal of Sea Research*, 41(1-2), 97-107.
- Ministry of Public Works. (2020). *Project Document for Environmental Licensing - Viqueque Municipal Capital*. Dili: Ministry of Public works.
- MoF. (2022). *Timor-Leste Population and Housing Census - Data Sheet*.
- MoF. (2022). *Timor-Leste Population and Housing Census - Main Report*.
- Neef, A. (2019, February). Tourism, Land Grabs and Displacement. Auckland.
- Niner, S., & Nguyen, T. T. (2022). Timor-leste: substantive representation of women parliamentarians and gender equality. *Substantive representation of women in Asian parliaments*. Routledge.
- O'Connor, S., Pannell, S., & Brockwell, S. (2011). Whose culture and heritage for whom? The limits of National Public Good Protected Area Models in Timor Leste. *Rethinking Cultural Resource Management in Southeast Asia: Preservation, Development, and Neglect*.
- Ono, R., Pawlik, A., & Fuentes, R. (2020). Island migration, resource use, and lithic technology by anatomically modern humans in Wallacea. *Pleistocene archaeology-migration, technology, and adaptation*.

- Osaka, H. (2012). *Human Rights Education in Asia-Pacific—Volume Three*. Osaka: Asia-Pacific Human Rights Information Center.
- Palmer, L. (2021). *Island Encounters: Timor-Leste from the outside in*. ANU Press.
- Palmer, L., Niner, S., & Kent, L. (2007). Exploring the Tensions of Nation Building in Timor-Leste. *Proceedings of a forum held at The University of Melbourne, The University of Melbourne, Victoria 3010 AUSTRALIA*. The School of Social and Environmental Enquiry.
- Palmer, Niner, & Kent. (2007). Exploring the tensions of nation building in Timor-Leste. PEMSEA and Ministry of Agriculture and Fisheries. (2019). *National State of Oceans and Coasts 2018: Blue Economy Growth of Timor-Leste*. Quezon City, Philippines: Partnerships in Environmental Management for the Seas of East Asia (PEMSEA).
- Pereira, M. (2023, October). Social interview. (Quirmado, Interviewer)
- PIFSC. (2017). *Interdisciplinary baseline ecosystem assessment surveys to inform ecosystem-based management planning in Timor-Leste: Final Report*. NOAA Pacific Islands Fisheries Science Center. PIFSC Special Publication.
- Pilcher, N. J. (2021). *Status of Sea Turtles in the Arafura and Timor Seas - A Literature Review*. Marine Research Foundation for The Arafura and Timor Seas Ecosystem Action Phase 2 (ATSEA-2) Project.
- RDTL. (2005). *Natural Resources and Environment Priorities and Proposed Sector Investment Program*. Retrieved from https://www.laohamutuk.org/OilWeb/Finances/Donor5-05/NATURAL%20RESOURCES%20&%20ENVIRONMENT_Eng.pdf
- RDTL. (2011). *The National Biodiversity Strategy and Action Plan of Timor-Leste*.
- RDTL. (2012). *Analyses of the Current Situation and Potential for Aquaculture Development in Timor-Leste*. Ministry of Agriculture and Fisheries, Timor-Leste, National Directorate of Fisheries and Aquaculture, Dili.
- RDTL. (2012). *The Tasi Mane Project – Betano Petroleum Refinery and Beaco LNG Plant Strategic Environmental Impact Assessment Final Report*. Timor Gap E.P. . WorleyParsons .
- RDTL. (2017). *Assessment Report of the Biophysical, Ecological and Socio-Economic Conditions of Mangroves Ecosystem of Timor-Leste*.
- RDTL. (2019). *Timor-Leste's Sixth National Report to the Convention on Biological Diversity*.
- Red Cross, I. F. (2021, April). *Climate Health Impacts On Health And Livelihoods: Timor-Leste Assessment*. Retrieved from Red Cross Red Crescent Climate Centre: https://www.climatecentre.org/wp-content/uploads/RCRC_IFRC-Country-assessments-Timor-Leste-V4.pdf
- Rede ba Rai. (2019). *Land Registration in Timor-Leste: Impact Analysis of the National Cadastral System (SNC)*.
- Rofi, A., & Saragih, S. (2019). Protect the water sources through community participation on the micro-watershed management in the Region of Oecusse Timor-Leste. *IOP Conference series: Earth and Environmental Science*, 256, 012006.
- Sandlund, O., Bryceson, I., de Carvalho, D., Rio, N., da Silva, J., & Silva, M. (2001). *Assessing Environmental Needs and Priorities in East Timor. Final Report*. Trondheim: Foundation for Nature Research and Cultural Heritage Research.
- Seagrass-Watch. (2023). *Seagrass-Watch*. Retrieved from Sea: <https://www.seagrasswatch.org/timor-leste/#:~:text=The%20coral%20reefs%2C%20seagrass%20meadows,including%20dugongs%20and%20marine%20turtles>
- Secretary of State for Environment. (2020, November). *Timor Leste's Second National Communication - The United Nations Framework Convention On Climate Change*. Retrieved from UNFCCC: <https://unfccc.int/sites/default/files/resource/Second%20National%20Communication%2C%20Timor-Leste.pdf>
- SPREP, S. o. (2020). *Assessment of Legislative Frameworks Governing Waste management in Timor-Leste*. SPREP. Retrieved from <https://library.sprep.org/sites/default/files/2021-03/waste-legislation-Timor-Leste.pdf>
- Standish, C. D., García-Diez, M., O'Connor, S., & Oliveira, N. V. (2020). Hand stencil discoveries at Lene Hara Cave hint at Pleistocene age for the earliest painted art in Timor-Leste. *Archaeological Research in Asia*.
- Standish, C. D., García-Diez, M., O'Connor, S., & Oliveira, N. V. (2020). Hand stencil discoveries at Lene Hara Cave hint at Pleistocene age for the earliest painted art in Timor-Leste. *Archaeological Research in Asia*.
- Stead, V. (2015). Homeland, territory, property: Contesting land, state, and nation in urban Timor-Leste. *Political Geography*.
- Steenhagen, E., Fuller, S., Farelly, T., Borrelle, S., & Rengal-Goncalves, A. (2023). *Plastic Pollution Prevention in Timor-Leste: Gap Analysis of Current Legislation, Policies and Plans*. Apia, Samoa: SPREP.
- Stockwell, A. (2001). *Introduction to Co-Management or Community-Based Management of Coastal Resources*. Dili: World Bank.
- Sudo, K., Quiros, T. E., Prathep, A., Luong, C. V., Lin, H.-J., Bujang, J. S., . . . Nakaoka, M. (2021). Distribution, Temporal Change, and Conservation Status of Tropical Seagrass Beds in Southeast Asia: 2000-2020. *Frontiers in Marine Science*.
- Suwartiningsih, S., Purnomo, D., & Lahade, J. R. (2020). The Role of Social Capital on International Trade Transactions at Wini Market, In Realizing Social Harmonization of Indonesia-Timor Leste Border Community. *International Journal of Criminology and Sociology*.
- Tatoli. (2017, June 5). Presidente Republika Promulga Lei ba Rai. Dili, Timor-Leste.
- The Nature Conservancy. (2009). *The Lesser Sunda Ecoregion: Designing a resilient network of MPAs - linking coastal and deep sea ecosystems*. Bali: The Nature Conservancy Indonesia Marine Program. Retrieved 10 09, 2023, from https://www.reefresilience.org/wp-content/uploads/Lesser_Sunda_factsheet.pdf
- Thompson, S. J. (2011). *Geology and Soils in Timor-Leste*. Seeds of Life Program Report. Retrieved from <http://seedsoflifetimor.org/wp-content/uploads/2012/12/Geology-and-Soils-in-Timor-LesteA4.pdf>
- Timor Resources. (2021). *Preliminary Assessment of Impacts Arising from Drilling Activity in PSC TL-OT-17-09*.
- Trainor, C. R. (2011). The waterbirds and coastal seabirds of Timor-Leste: new site records clarifying residence status, distribution and taxonomy. *Forktail*, 63-72.
- Trainor, C. R., & Hidayat, O. (2014). Kupang Bay: an internationally significant wetland in West Timor, Indonesia. *Birding Asia*, 45-50.
- Trainor, C. R., Santana, F., Pinto, P., Xavier, A. F., Safford, R., & Grimmett, R. (2008). Birds, birding and conservation in Timor-Leste. *BirdingASIA*.
- Trindade, J. (2015). Relational Dimensions within Timor-Leste Customary Society. *Timor-Leste: The Local, the Regional and the Global: A TLSA Research Conference*. Dili.
- UNDP. (2021). Aichi Biodiversity Target 11 Country Dossier: TIMOR-LESTE.

- UNWater. (2021). Retrieved 2023, from UN Water: https://www.laohamutuk.org/OilWeb/Finances/Donor5-05/NATURAL%20RESOURCES%20&%20ENVIRONMENT_Eng.pdf
- Veron, J., Devantier, L., Turak, E., Green, A., Kininmonth, S., Stafford-Smith, M., & Peterson, N. (2009). Delineating the Coral Triangle. *Galaxea, Journal of Coral Reef Studies*.
- Wallace, L., Sundaran, B., Brodie, R. S., Marshall, S. K., Dawson, S., Jaycock, J., . . . Furness, L. J. (2012). *Vulnerability Assessment of Climate Change Impacts on Groundwater Resources in Timor-Leste*. Geoscience Australia. Retrieved from <https://www.dccew.gov.au/sites/default/files/documents/groundwater-timor-leste-report.pdf>
- WBG & ADB, W. B. (2021). *Climate Risk Country Profile: Timor-Leste*. Retrieved from Climate Knowledge Portal - World Bank: https://climateknowledgeportal.worldbank.org/sites/default/files/country-profiles/15971-WB_Timor-Leste%20Country%20Profile-WEB.pdf
- Wever, L. (2008). *Assessing Management Challenges and Options in the Coastal Zone of Timor-Leste*. Southport, Queensland, Australia: In Griffith Centre for Coastal Management Research Report.
- WHO. (2005, August 12). *AQGs Global Update 2005*. Retrieved October 10, 2023, from World Health Organization: <https://www.who.int/publications/i/item/WHO-SDE-PHE-OEH-06.02>
- WHO. (2021, September 22). *Global Air Quality Guidelines 2021*. Retrieved September 2023, from World Health Organization: <https://www.who.int/publications/i/item/9789240034228>
- Wilkinson, C. (2008). Status of coral reefs of the world: 2008. *Global Coral Reef Monitoring Network and Reef and Rainforest*.
- WHO. (2016). Air pollution: concentrations of fine particulate matter (PM_{2.5}), SDG 11.6.2, from World Health Organization: [https://www.who.int/data/gho/data/indicators/indicator-details/GHO/concentrations-of-fine-particulate-matter-\(pm2-5\)](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/concentrations-of-fine-particulate-matter-(pm2-5))
- World Bank . (2016). *Timor-Leste-Oecusse Economic and Trade Potential: Overview of Oecusse Today and Long-term Potential*. World Bank Group. doi:<https://doi.org/10.1596/24726>
- World Bank. (2016). *Timor-Leste-Oecusse Economic and Trade Potential: Overview of Oecusse Today and Longterm Potential*.
- World Bank. (2016). *Timor-Leste-Oecusse Economic and Trade Potential: Overview of Oecusse Today and Longterm Potential*.
- World Bank. (2018). *Timor-Leste Water Sector Assessment and Roadmap*. Retrieved from <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/433121521173685667/timor-leste-water-sector-assessment-and-roadmap>
- World Bank. (2019). *Simplified Environmental and Social Impact Statement (SEIS)/Environmental and Social Impact Assessment (ESIA) - Branch Road Section of Dili – Ainaro Road (Aituto – Hatubuilico – Letefoho – Gleno)*.
- WorleyParsons. (2012). *Tasi Mane Project - Betano Petroleum Refinery & Beaco LNG Plant - Strategic Environmental Impact Statement - Final Report*.
- WorleyParsons. (2012). *Tasi Mane Project - Betano Petroleum Refinery and Beaco LNG Plant Strategic Environmental Impact Assessment Final Report*.
- WorleyParsons. (2012). *Tasi Mane Project - Betano Petroleum Refinery and Beaco LNG Plant Strategic Environmental Impact Assessment Final Report (Volume 2)*.
- WorleyParsons. (2017). *Baucau Cement Project - EIA - Cement Plant, Jetty, Conveyor Belt and Associated Infrastructure*.
- WorleyParsons. (2017). *Baucau Cement Project - Environmental Impact Statement Limestone Mine - Volume 1*.
- WorleyParsons. (2017). *Baucau Cement Project: Environmental Impact Statement - Cement Plant, Jetty, Conveyor Belt and Associated Infrastructure. Vol. 2*.
- Wyatt, A. S. (2004). Preliminary survey of the nearshore coastal marine environment of the south coast of East Timor: a baseline for assessing the impacts of a developing nation. University of Western Australia.
- Yoder, L. S. (2015). The development eraser: Fantastical schemes, aspirational distractions and high modern mega-events in the Oecusse enclave, Timor-Leste. *Journal of Political Ecology*.
- Yoder, L. S., & Joreiman, S. F. (2019). Possession and Precedence: Juxtaposing Customary and Legal Events to Establish Land Authority . *Land Restitution: Processes and Outcomes in Different Political and Socio-Cultural Contexts*.
- ZEESM-TL. (2013). *Special Economic Zones of Social Market Economy, First steps towards new Oecusse*. Retrieved from <https://www.laohamutuk.org/econ/Oecussi/ZEESMSituationAnalysisMar14en.pdf>

