Environmental Assessment Document

October 2021

Second Palau Submarine Cable (PC2)

Initial Environmental Examination

This initial environmental examination (IEE) is a document of the borrower.

Project information, including the draft and final IEE, will be made available for public review and comment on the BSCC website. The IEE, or a summary of it, will be uploaded to BSCC website and available for download.

ABBREVIATIONS AND ACRONYMS

BMH	Beach Manhole
BMR	Bureau of Marine Resources - Palau
BU	Branching Unit
CA	Conservation Area
CBO	Community Based Organisation
CPP	Community Participation Plan
EA	Environmental Assessment
EIA	Environmental impact assessment (under Palau legislation)
EPA	Environmental Protection Agency
EQPB	Environment Quality Protection Board
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
Gbps	Gigabits per second
GDP	gross domestic product
IA	Implementing Agency
ICT	Information and Communications Technology
IPP	Indigenous Peoples Plan
IUCN	International Union for the Conservation of Nature
Km	Kilometres
Mbps	Megabits per second
MNRET	Ministry of Natural Resources, Environment and Tourism
MPA	Marine Protected Area
MoF	Ministry of Finance
NGO	Non-Government Organisation
PAN	Protected Area Network
para.	Abbreviation of paragraph as in para. 237
PIA	Project Influence Area
PNCC	Palau National Communications Corporation
PNG	Papua New Guinea
QMS	Quality Management System
RFP	Request for Proposal
RISLMA	Rock Island Southern Lagoon Management Area
RP	Resettlement Plan
SCS	Submarine Cable System
SPC	Secretariat of the Pacific Community

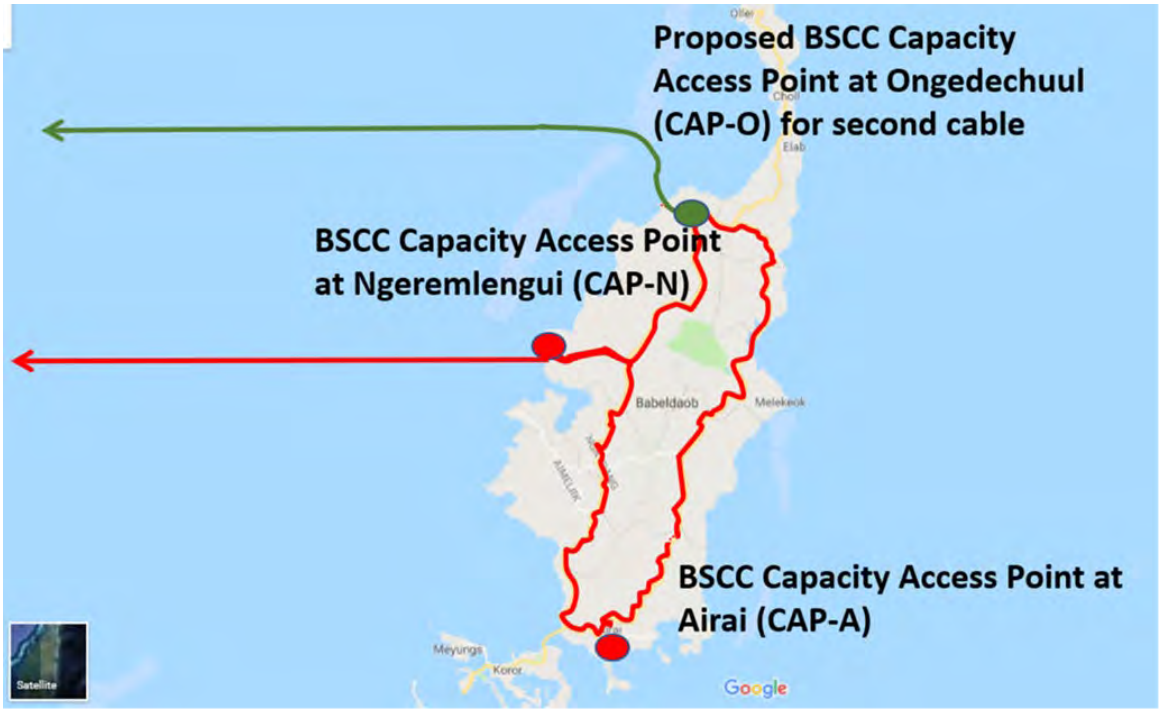
Contents

Environmental Assessment – Palau Second Submarine Cable (PC2)

EXECUTIVE SUMMARY

1. Palau is a western Pacific tropical country comprised of 16 states with a population of 17,661 people, with 4771 foreign residents included. Its main population center is Koror, where almost two-thirds of its population lives. It is a remote island-country dependent on the Belau Submarine Cable Corporation's (BSCC) international submarine fibre optic network (PC1) for global connectivity. The Palauan archipelago is at the westernmost portion of the Caroline Islands. Palau is 1,340 Km southwest of Guam, 3,174 Km southeast of Tokyo and 1,680 Km east of Manila.

2. Palau's first submarine fibre optic international network was connected by Belau Submarine Cable Corporation (BSCC) in 2017. The project was financed by $25M in loans from Asian Development Bank to the Republic of Palau government, which was on-lent to BSCC on a back-to-back basis. Capacity use on the network has rocketed from approximately 400 Mbps pre-BSCCnet to over 6 Gbps in four years. Current satellite legacy contracts can only back up 2.5% of the total current BSCC traffic. Satellite back-up is both ineffective and costly. Accordingly, the Republic of Palau is looking to BSCC to connect a second cable to promote national economic and social resilience.



3. BSCC has secured equity, grant and debt financing of $30 million to finance PC2 goods, works and services.

4. The cable will be placed along the seafloor, with deep sea sections resting on the seabed, and sections inside the 60m contour (approximation), laid directly on the seabed. The cable will be brought to shore at Ngardmau jetty, in the north-west of Babeldaob.

5. The project will impact a corridor about 0.3-0.5 m wide on the sea floor, and in some locations up to 0.75 m beneath the sediment. The cable, 3-7.5cm in diameter, will be sitting on the seafloor in deep waters or as it passes through the natural breaks in the barrier reef into Palau's nearshore zone.

6. As it enters the nearshore waters, the alignment will be laid in the middle of the shipping channel, which is essentially silt and sand and at a depth of 40-50m. The cable

will be landed on the Ngardmau dock. There is no other disturbance of the sea floor or the water column.

7. A detailed oceanographic survey of the alignment has been completed and any resulting environmental items added to the ESMP and included in the contract specifications. The Marine survey of the PC2 cable route was undertaken by EGS in May 2020 and December 2020. The survey has defined a route ensuring the distance of the cable from any potentially sensitive habitat such as corals and specific protected areas will be limited to no less than 100m, eliminating any chances that the work will negatively impact the marine environment.

8. PC2 landing site at Ngardmau will require construction of a new bulkhead and beach manhole (BMH), outfitted with a conduit running from the BMH into the Cable Landing Station (CLS) building; and ready to receive the fibre optic cable.

9. The environmental and social management plan (ESMP) defines work area boundaries and timing limits, which will be included in the construction contract specifications and which the contractor will have to comply with. Compliance will be monitored by the Project Coordinator and an ESMP monitor.

10. Given the small-scale nature of the work, and the fact that nearly all of it takes place on board a vessel at sea, with a specially trained crew, no negative social impacts are predicted during any stage of the project.

11. In order to effectively implement the mitigation and monitoring tasks defined in the ESMP, the National Project Management Unit (PMU) or BSCC will retain an independent environmental monitor. This will ensure that the ESMP is implemented; the monitoring is undertaken and reporting, as defined in the ESMP, is delivered.

12. The ESMP contains mitigative measures that are mostly specifications which need to be included in the bid documentation, such that they become legally binding tasks for the contractor to complete.

13. For the social sector, the new cable will add to the resilience of existing uses of bandwidth but will not introduce any new content.

14. To ensure that the environmental measures defined are fully implemented, performance indicators were identified and will be tracked by the PMU. With these actions being implemented and monitored, it is recommended that no additional environmental or social sector studies are needed, and that this project can move to detailed design and construction.

15. Palau is committed to applying the mitigative and monitoring measures defined in this IEE, and as such will be able to prevent or reduce to an acceptable level all the negative impacts listed in the ESMP.

16. Annexes 3 and 4 provide details of the Marine Route Survey and Land Based Facilities.

17. Social impacts of a second cable connection are minimal, as it merely ensures reliability of connectivity already established with the first cable. No involuntary resettlement is required.

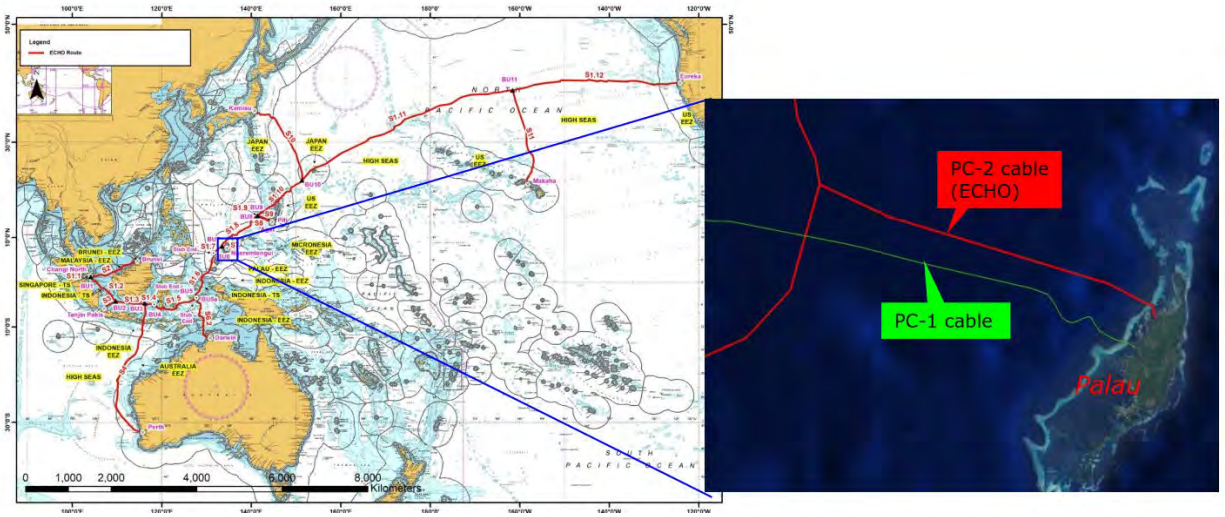
18. Given that the cable installation involves the placement of a 3-7.5 cm diameter solid cable (containing no liquids) in a narrow trench on the seabed and is carefully placed (via divers and/or a cable floated into place—if needed) in Palau's coastal waters, over a relatively short period of time, no cumulative effects are foreseen.

INTRODUCTION

A. The Proponent and Purpose of the IEE

Palau's development strategy, 2009–2014, focused on the: (i) facilitation of private sector development, and (ii) improvement of public sector services. Reliable, fast and competitively priced internet and telecommunication is essential for attracting business and satisfying tourism demand. The initial international submarine fiber optic cable built by BSCC has contributed significantly to achievement of those objectives. However, the corollary is rapidly growing capacity demand. Current backup in the event of a break on BSCCnet is provided by legacy satellite contracts held by the largest Palau RSP. That totals 150 Mbps, or about 2.5% of the current BSCC capacity in use. 15% is generally regarded in the industry as the minimum backup required for essential services.

1. The Echo cable system proposes a route close to Palau, from Singapore to Eureka Beach, California. BSCC has negotiated to insert a spur connecting Palau to Echo.



Map 1: Palau Second Cable Spur onto Echo Cable System

2. Palau's economy is highly reliant on tourism and services, with this sector accounting for more than 20% of the gross domestic product (GDP). Since FY2000, GDP per capita growth has averaged 1.1% pa. Despite recent downturns in visitor arrivals, from 168,767 in 2015 to 115,964 in 2018 and 90,000 in 2019, until the COVID impacts from 2020, as Palau pursued its high value tourism strategy, the economy continued to grow. The provision of continuous high- quality communication services such as high-speed internet connection is essential to support and sustain economic growth.

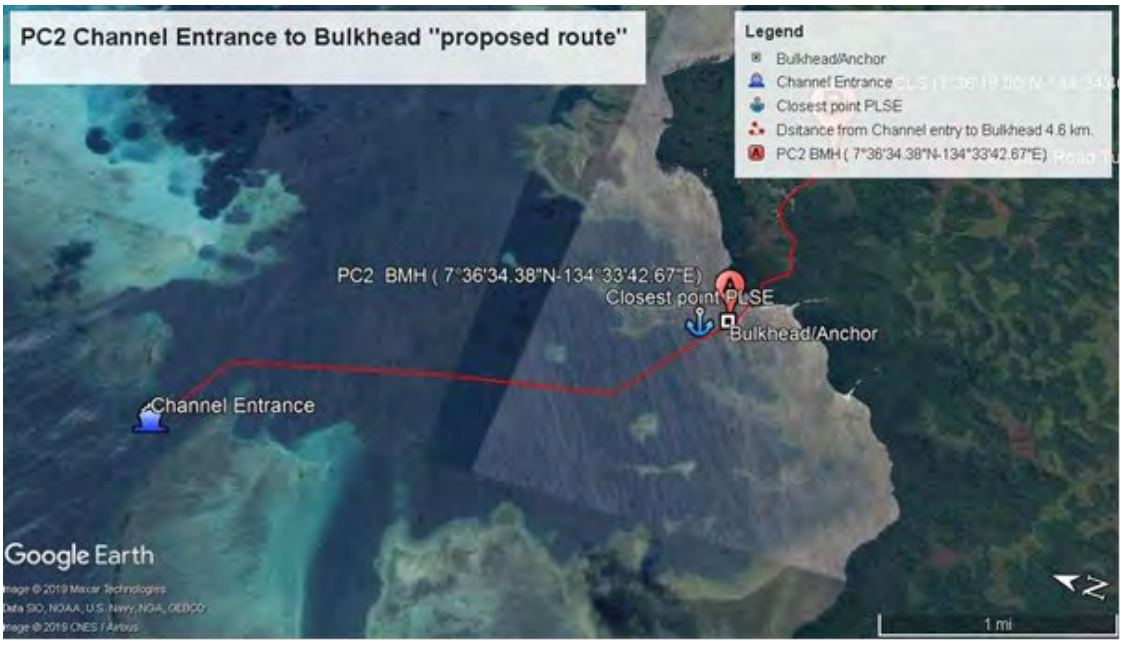
3. This IEE has been prepared to identify any negative environmental and social effects due to the project and to design ways to prevent them from occurring or define ways to minimize then, such that any impacts do not exceed national and international standards.

4. The project as a whole is being overseen by the BSCC Board.

5. The executing agency is the Ministry of Finance. BSCC is the Implementing Agency. A project management unit (PMU) will prepare bid documents, call for proposals, evaluate bids, select a contractor, and monitoring the construction.

B. Project Status and Documentation

6. This is the first update of the PC2 IEE. At the time when the initial IEE was prepared, a project feasibility study, as well as an economic and financial analysis of the proposed project had been completed. The original PC1 cable project was classified Category B, by ADB, signifying limited impacts from submarine cable network access and the requirement for an IEE.



7. Given that the focus of this IEE is on coastal zones and nearshore marine areas, various marine surveys were completed and are summarized in this IEE.

8. Social impacts of a second cable connection are minimal, as it merely ensures reliability of connectivity already established with the first cable. No involuntary resettlement is required.

C. Extent and Boundaries of the IEE

1. *The Project Influence Areas: Nearshore and Landing Sites*

9. The cable, which will be between 3 and 7.5cm (1.2-2.7") in diameter will be laid directly on the sea floor. Inshore the cable will be protected by articulated steel pipe pinned to the sea floor. Therefore, the project influence area (PIA) in the nearshore and coastal waters is no more than a 2-4m wide corridor allowing for all possible disturbances and lateral deviations.

10. All specially designated areas such as marine conservation areas and special habitats such as spawning aggregation areas and seagrass beds are being treated as sensitive habitats and the project's impact on these areas was identified.

11. The landing site and landside facilities to be provided will be similar to those deployed already at the Capacity Access Point at Ngeremlengui Cable Landing Station (CAP-N), namely:

- Beach bulkhead
- Buried conduit to Beach Manhole (BMH)
- BMH
- Cable Landing Station

Unlike CAP-N, there will be no need for a radio tower or for a satellite earth station. Onward connectivity will be through a connection to the proposed BSCCnet loop (Already partly in construction) around the Compact Road.

2. *Coastal and offshore corridors*

12. The PIA in the waters beyond the 60m depth contour will be determined as part of the detailed surveys once the oceanographic mapping of the alignment is completed (as part of the PC2 construction contract). Based on a review of the literature, no sensitive marine ecological areas such as deep-sea coral habitats and seamounts are known to occur along the 200 km trajectory of the cable to the main Echo trunk (Map 1).

3. *The IEE Methodology*

13. This IEE has been completed based on consultations with government officials to establish a landing site based mostly on minimizing coastal zone environmental impacts and minimizing land acquisition. This initial scoping easily revealed a preferred alignment (See Baseline Data) and landing site for which the IEE has been completed.

14. The work included a review of relevant secondary information sources, site visits, key respondent interviews, focus group discussion and public consultations to determine existing environment conditions in the PIA corridor and at the landing site.

15. This was followed by a marine ecological field survey and an analysis of the potential impacts that the construction and operation of the fibre optic cable could have on the corridor's natural and socio-cultural environment. The topics for which data were collected included:

- sensitive components of the environment within the PIAs, including Conservation Areas, Fish Attraction Devices (FADs) and special tourism sites, such as dive sites.
- marine ecology of the coastal zone and nearshore waters likely affected by the cable project, including bathymetry, benthic and coral conditions along the PIA corridor.
- land acquisition needs and any other potential impacts.
- cultural heritage and archeological sites within the PIA corridor.

16. The following is an outline of the activities undertaken to complete this IEE:

- discussions to establish preferred landfall for the cables and to define the work to be done.
- meeting with Palau's Ministry of Finance and other agencies that will manage this project.
- multiple site visits to collect primary data on the nearshore marine system as well as the landing sites and record social issues focusing on land acquisition and the need to relocate people or structures to make way for the cable.
- analyses and report preparation.

17. A rapid in-water visual field assessment and benthic profile of the marine environment and key indicator species associated with the proposed cable alignment locations was undertaken in August 2019 and December 2020 (refer Annex 3). The area assessed included the inshore marine environments located within an extended area of influence of the cable. This included the outer barrier reef and associated outer and inner channel, patch reefs, sub tidal and tidal lagoonal reef and island areas and the cables terminal location on the shoreline in Ngardmau. The assessment took a systematic approach, with the site-by site collection of biological and environmental information. Assessment site locations were selected for their proximity to the cable route, representation of different biological habitats and distance from conservation/protected areas.

18. This assessment provided an ecological description of the natural reef system and resources in the corridor associated with the cable alignment, helping to gauge potential environmental impacts associated with the deployment and operation of the cable within this reef ecosystem.

POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. Biophysical Environment

19. **Title 24 of the Palau National Code-Environmental Quality Protection (Division 3**) and its chapters provide the legal mandate for the Bureau of Marine Resources to manage the nation's resources. These fisheries Management initiative are associated with both the nation's inshore (reef associated resources and biomes) and offshore systems. This code also set out for the Environmental Quality Protection Board to define EIA, its content review compliance. The EQPB operates under the Environmental Quality Protection Act (EQPA) which sets out the specific roles and responsibilities for environmental protection and management.

20. **EIA Regulation-Chapter 2401-61 - Chapter 2401-61**. The Environmental Impact Assessment Regulations define when the EIA is need and provide the details for how EIA is conducted. The regulation requires that a project is compatible with land use plans and policies and compatibility with the terms, conditions, provisions and management plans for any national, state or traditional conservation area, preserve or other protected area as established by law. The activities for which EA is required is set out in Clause 3 of the Regulation and is listed as follows:

- use of national or state lands;
- use within any land which has been or maybe classified as a conservation are;
- use of national or state funds unless the funds are to be used for feasibility or planning studies for future programs or projects provided that environmental factors are specifically considered in the feasibility and planning studies;
- any use directly or indirectly impacting coastal waters and wetlands as defined in the Marine and Fresh Water Quality Regulations;
- any use with any historic site as designated by the Palau Preservation Office; and,
- any proposed action the EQPB determines may have a significant impact on the environment.

21. An ESMP is attached to this IEE to meet the requirements of the Environmental Quality Protection Board (EQPB).

22. The Bureau of Marine Resources applies the Marine Protection Act 1994, Executive Order number 116 and 203, the 1995 National Master Development Plan (NMDP), the Economic Development Plan, Palau National Congress 27 and a number of international agreements and treaties, all related to sustainable management of the nation's natural resources.

23. There are 15 specific laws that provide various levels of protection and management for coastal resources. Examples of these laws include the total protection on the collection of napoleon wrasse (*Cheilinus undulates*), humphead wrasse (*Bolbometopon muricatum*) and dugongs (Dugong dugon), closed fishing and hunting seasons for (e.g. groupers (*Epinephelus sp*. and *Plectropomus sp*.), turtles (green – (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and size restrictions (e.g. mangrove crab (*Scylla serrata*), lobsters (*Panulirus sp*.). In addition, specific gear restrictions (e.g. spearing with SCUBA, net mesh size), export requirements and complete banning of fish poisons and the use of explosives are employed (Palau Government, 2012).

24. Palau through its membership of a number of international and regional treaties, conventions and agreements (Annex 1: Table 1.1) and its membership to international and regional organizations associated with the marine sector (Annex 1: Table 1.2) manage the nation's environment, species and inshore and offshore foreign commercial fishing activities that are undertaken within the EEZ.

25. In 2003, the national government passed the Protected Areas Network Act (PAN) that creates a nationally sanctioned framework and system to support and coordinate the state government's efforts to develop conservation areas (CA) designed to protect and manage marine and coastal resources. State governments can register their CAs with the PAN permitting access financing assistance to ensure the long-term sustainability of CA and a number of capacity building and support programs. At the writing of this report 18 CAs have been registered under the PAN (see Annex 1: Table 1.3).

26. 2017 Telecommunications Law RPPL 10-17 provides a cable protection regime.

B. Socioeconomic Environment

27. Palau's traditional landownership system represented both a form of wealth and social network that binds people to land units within a village. People earn property ownership and land use rights by providing goods and services to those who control access to these resources.

28. Historically, land was categorized as public domain or clan land; lands belong to villages or group of villages. Any transactions associated with clan land required clan approval. The sale of land and ownership in fee simple is estimated to have started in the 1800s during Western occupations of Palau. The ones with the most significant and lasting impacts at present time were decrees ordered by the Germans and later by the Japanese.

29. In 1986, the Palau Registration Act was passed, creating the Land Claims Hearing Office. In March 1996, the Claims Reorganization Act was passed to respond to the shortcomings of the Land Claims Hearing Office. The intention of the Act was to complete land registration in the country. The Land Court in 1996 was formed to hasten the land determination process. This was later amended in 1999 to the Land Court, which increased the qualification requirements for judges and hiring of required Registration Officers to facilitate land determination. Land determination has become more important since Palau has started seeing foreign investment particularly through tourism and other related infrastructure such as communication.

30. Palau and Historical Preservation Act 1995 provides the regulatory framework to assure that historical sites and historical and cultural properties located in Palau are protected from destruction. The purpose of this Act include: (i) to preserve and foster historical and cultural heritage of the people of Palau for all (ii) facilitate preparation of a thorough and workable plan of historical and cultural preservation and education (iii) to have a strong regulatory framework to assure that historical sites and historical and cultural properties located in Palau are protected from destruction and (iv) to have a strong program of support for intangible cultural properties and activities to preserve Palauan culture and tradition in the face of inevitably increasing foreign contact and interaction.

31. The Act provides for formation of a Palau Historical and Cultural Advisory Board consisting of 16 members, appointed by the President, one member representing each state with a term of three years.

32. The Board is responsible for establishing: (i) policies and criteria to be used by the Board in recommending registration of historical sites, tangible and intangible cultural properties, and living national treasures; (ii) solicit nominations from government officials and agencies and private citizens for registration of historical sites, tangible and intangible cultural properties, and living national treasures; (iii) approve nominations solicited under subsection (b) and report its decisions to the Division for the Division's action; and (iv) serve as an adviser to the President, the Minister and the Chief of the Division of Cultural Affairs in matters relating to the maintenance and preservation of historical sites, tangible cultural properties, and living national treasures.

33. Underwater archaeological resources within the Republic of Palau cover a wide array of types from famous World War II wrecks to Yapese stone money disks which sank to the bottom of the sea during their transport, and to traditional sites - which includes but are not limited to semi-submerged docks/piers, fish traps, burials, and a sunken city mentioned in traditional folklore. These resources are protected under the Cultural and Historical Preservation Act (henceforth referred to as Title 19) mandated by the Palau Bureau of Arts & Culture (henceforth referred to as the Bureau). More specifically, Chapter 3 of Title 19 known as the "Palau Lagoon Monument" is exclusively reserved for all submerged and semi-submerged foreign vessels located within the Republic's territorial waters.

PROJECT DESCRIPTION

A. Project Need and Details

1. Need for the Project

34. Palau is increasingly reliant on high-speed connectivity provided through PC1; a submarine network declared Ready For Service (RFS) on December 11 2017. The only backup in the event of a service interruption on BSCCnet's submarine cable or the SEA- US trunk to which it is connected, is through legacy high-cost satellite contracts expiring in 2021 and 2022. To date, there has been one service outage of approximately 4 hours in May 2018.

35. With only 2.5% of current capacity usage available for backup via satellite, only minimum essential services can be supported.

36. As demonstrated in recently (during 2019) in Tonga and Saipan, an outage can last two weeks or more and is a major threat to Palau's economic and social development.

37. The proposed project is an investment in a submarine fibre optic cable network that would connect Palau directly with the USA west coast and Singapore, and onwards to the rest of the world.

38. From a telecommunications network engineering perspective, the high-level topology ceases to be a connection with an emergency backup and becomes a hub with three route

options. It will ensure resilience of improved public services (including online government services such as health, education and financial services), support the tourism sector, facilitate better trade and communication among north Pacific Island economies, and allow new, IT based industries to emerge.

2. Project Details

39. The project involves the placement of a submarine fibre optic cable from Palau to the proposed Echo Cable, much of it in deep ocean waters (Map 1). The environmental 'footprint' of the project will be that associated with a maximum 3-7.5 cm diameter inert cable (glass, steel and rubber), as shown in Figure 4.1, placed on or buried beneath the seafloor.[1]

Figure 4.1: Example of Fibre-optic Cable

Source: L.Carter

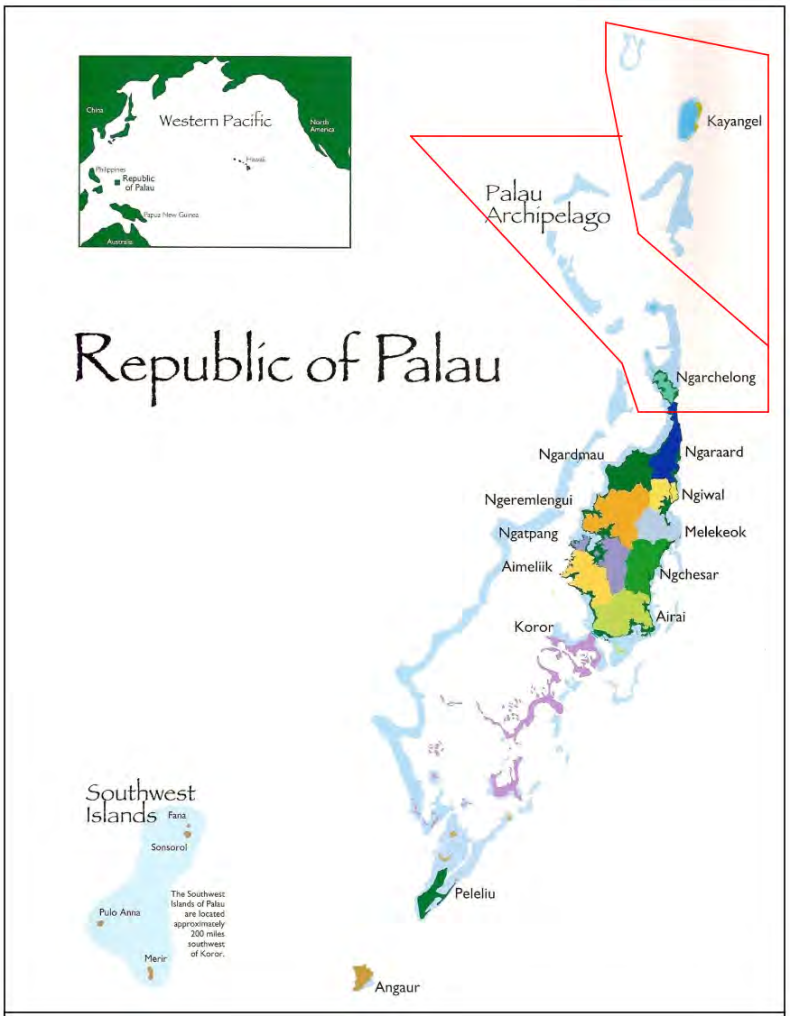
40. The cable will make landfall in Ngardmau hamlet on Babeldaob, a government owned landing site, provided with a conduit for placement of the cable leading directly to the government-owned Cable Landing Station site.

3. Components of the Work

41. The project consists of three main components: i) the Wet Segment including the oceanographic and nearshore bathymetric survey to establish a specific route for the cable from the Branching Unit (BU) on the Echo system to the proposed landing in Ngardmau, avoiding undersea mountains, seamounts, canyons and any terrain that could stress or over time damage the cable (refer Annex 3); ii) The Cable Installation - the placement of the cable from along the surveyed corridor using a special cable laying vessel; and iii) Land Based Facilities the preparation of the landing facility, which will be a building measuring about 60m^2 (refer Annex 4).

BASELINE DATA

42. Palau is located approximately 740 Km east of Mindanao in the southwest of the Philippines, 480 Km and 1,300km southwest of Yap State (FSM) and Guam, respectively. It shares ocean boundaries with FSM in the east, Guam in the northeast, the Philippines to the west, Indonesia to the southwest, and Papua New Guinea to the southeast. Map 2 shows the 16 states of Palau.



Map 2. The Republic of Palau and Its States

A. Physical Environment

1. Climate

43. Palau is located around 8.2 degrees north of the equator and is a fully tropical climate, with air temperatures generally ranging between 26 and 30°C. The nation has a wet and dry season, the wet season extending from May through September, with frequent storms and heavy rain and wind conditions. Other times of the year are predominantly sunny with occasional rain and wind, and daytime temperatures a steady 28°C.

2. Air Quality and Noise

44. The project will require the oceanographic survey of the cable route as well as the use of a large ocean-going vessel to place the cable. Both of these diesel-fueled ships emit large volumes of SO2, NOx, PM10 and PM2.5. The survey vessel will likely be in operation for a week, and the cable ship about 10 days covering the distance between the BU and Palau.

45. No doubt the operation of the large survey and cable laying vessels will generate noise but given that the work will be conducted at sea as well as near barrier reefs the background noise level of the waves breaking on the reefs, will negate vessel noise, making it a non-issue.

46. Given that there will be no need for extensive land-side excavation or use of heavy equipment, restricted to a trench for the connecting cable and ducts between the BMH and

the CLS, and construction of the (two-bedroom house sized) CLS itself, air quality and noise will be a temporary issue.

3. *Topography, Geology, Soils and Hydrology*

47. Palau is comprised of a set of 12 inhabited hilly, volcanic and raised limestone islands, often protruding abruptly out of the sea, and another 700 islets, mostly uninhabited. These are divided into 14 states (Map 4). The islands were formed by the accumulation of volcanic and limestone material and consists of high islands of basalt (e.g. majority of Babeldaob island, Arabesanh, part of Koror and some adjacent islands), high limestone islands, termed the "rock islands" (e.g. found from southern Babeldaob and Koror to Peleliu), low platform Islands made of limestone (e.g. Angaur and most of Peleliu) and coral atolls of Kayangel and Ngeruangel in the north and Helen reef in the south) (Colin, 2009).

48. A total of 1.7 m^3 million litres (450 billion gallons) of sustainable/renewable water is available in Palau (Gonzales, et.al. 2001). Lake Ngardok is the largest natural freshwater lake in Micronesia, with a storage capacity of 56,700 m^3 (15 million gallons) of water. Ngermeskang River, on the west side of Babeldaob, is the second largest and drains into the Ngaremeduu bay and is part of the largest watershed on the island.

49. In 2007, the Ngerikiil River in Airai supplied 11000 m^3 of water (3 million gallons) per day to the Koror/Airai Water Treatment Plant for use by 75% of the population of Palau. The same treatment plant extracts 1 million gallons (3700 cubic metres) a day from the Ngerimel Dam. The Ngerimel watershed (which is several times smaller than the adjacent Ngerikiil watershed) drains into the Ngerimel Dam, which has a holding capacity of 20 million gallons (75700 cubic metres).

50. The rest of the islands of Palau rely on groundwater sources and rainfall. Peleliu has the largest freshwater lens, which is in the south part of the islands. It has been estimated to be capable of yielding 1 million gallons (3,785 cubic metres) of fresh water per day (Barret 1986).

4. *Tides and Deep-Sea Bathymetry*

51. **Tides.** Palau tides are semi-diurnal and include a maximum tidal variation of just over 2 meters (meso-tidal variation). Small seasonal and daily tidal fluctuations have been recorded and are related to weather patterns existing at the time of the recording. Storms and typhoons do have a marked impact on the tidal height and can cause increased coastal erosion and flooding if they coincide with high water periods. These systems pass across the islands usually between late May and September.

52. **Deep Sea Bathymetry.** The deep-sea bathymetry associated with Palau includes deep ocean ridges, trench, and likely seamounts and thermal vents. The islands of Palau are part of an arc-trench system between the Philippine and Pacific continental plates. Palau is located towards the southern end of a generalised ridge system called the Palau-Kyushu ridge. This ridge runs north across the Philippines plate towards Japan in the north, whilst the trench, which is considerably deeper than the general ocean floor veers to the east of Palau away from the ridge. This trench, called the Yap Trench (Figure 2), continues in a north easterly direction passing to the south of the island of Yap.

53. The Palau/Yap trench has a maximum recorded depth of near 8000m with the majority of its length over 6000m deep. The surrounding water depth to the north and west of Palau averages between 4000 – 5000 metres (Colin, 2009). The cable alignment from is to the west of the trenches, avoiding having to cross these deep canyons.

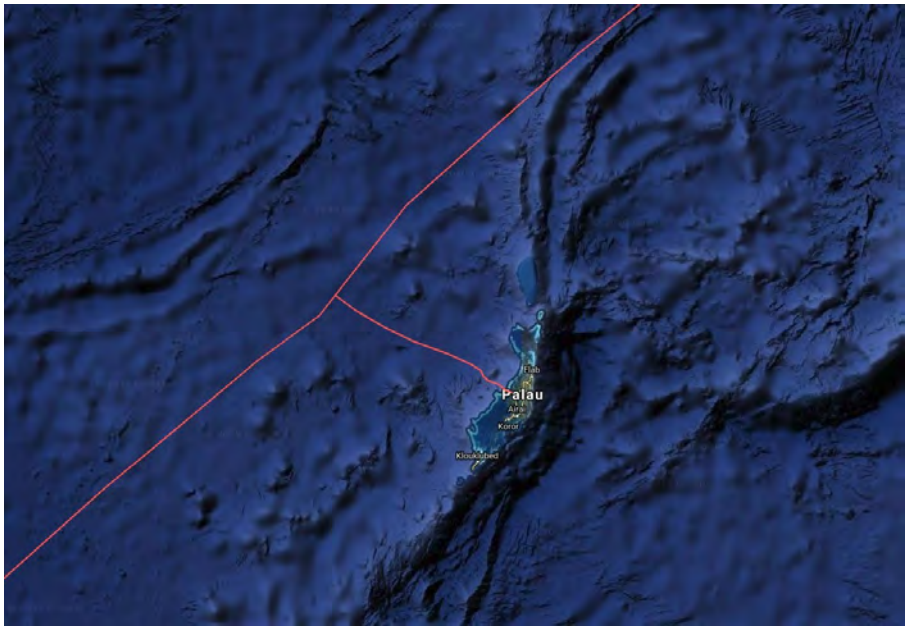


Figure 2

5. Hydrothermal Vents and Seamounts

54. **Hydrothermal Vents**. There are very few studies and information available detailing hydrothermal vents along the proposed (approximate) cable alignment corridor from the BU to Palau. Hydrothermal vents are present when volcanically heated water issues from cracks in the earth's crust. Typically, water issuing from these vents can exceed 300° C and is prevented from boiling only by the immense overlying hydrostatic pressure. However, within a few meters of the discharge, the water cools to around 2.5°C. The water is also extremely acidic, thus corrosive, and is capable of leaching out minerals from the surrounding rock.

55. Individual vent structures are usually small, measuring only a few tens of metres across, and stand a similar height off the surrounding sea floor. Individual vents exist within vent fields. These fields, which measure in the order of a few kilometres across, are sites where hydrothermal activity is closest to the surface and within which vents form when heated water reaches the surface. Vents are also individually ephemeral and could occur at any site along the proposed cable alignment at any point in time, replacing sites that become dormant or are destroyed by volcanic activity.[2]

56. Deep Sea thermal vents support unique ecosystems consisting of densely populated organisms occurring within a few hundred square metres of the vent. The communities prey almost exclusively on microorganisms that reduce chemicals to provide energy to sustain a variety of associated, mainly invertebrate, organisms. In the western Pacific hydrothermal vents are dominated by bathymodiolid mussels, "hairy" gastropod, vesicomyid clams, and shrimp (Llodra & Billet 2006). Deep sea vents can be located in varying locations, but generally near volcanic activity, and can range from as shallow as 500m to the deep ocean.[3]

[2] The large-vessel bathymetric survey conducted prior to the final determination of the cable alignment should be able to detect any hydrothermal fields, and potentially establish a route around them.

[3] For more details see https://php.radford.edu/~swoodwar/biomes/?page_id=1027 and http://faculty.college-prep.org/~bernie/sciproject/project/HydroT/hydroint.html

57. **Seamounts.** Seamounts generally originate as volcanoes and are generally associated with intra-plate hotspots, mid ocean ridges or island arcs. They support unique ecosystems that have high biodiversity (endemism has been reported as being high) and act as important aggregations sites for pelagic and demersal fish resources, invertebrates and have been reported to act as important navigational "waypoints" for oceanic migratory species (Rodgers, 2012). Recent studies have shown that the pelagic biodiversity around seamounts is far greater than in areas of open ocean, and even in coastal reef areas. On average, 15% of benthic species found associated with seamounts in the Pacific are endemic either to that specific seamount or to a cluster of seamounts (Alder & Wood, 2004).

58. The main cause of this increased diversity is up-welling currents and oceanographic phenomena that drive primary productivity and create additional ecosystem niches that support more species associated with sea mounts.

59. Benthic areas not associated with hydrothermal vents, sea mounts and active spreading zones, such as the abyssal plains and ridges, also support a diverse albeit less dense populations composed mostly of nematodes, foraminifera, polychaete worms, small peracarid crustaceans, molluscs, nemerteans and a variety of marine worms (Llodra & Billet 2006).

60. Benthic organisms associated with the deep water of Palau have no current national economic importance and are not harvested commercially. The technology to access deep parts of the ocean floor for large scale collection or any potential commercial use is still not developed. The same limitations restrict the better understanding of the deep-sea area.

61. **Earthquakes**. Owing to the location of Palau within the Pacific Ocean, seismic activity resulting from tectonic plate movements, subsidence or uplift of the shore zone and/or adjacent terrestrial and marine areas and/or volcanoes is all but non-existent and therefore the proposed cable route does not appear to traverse near any extreme geologically active area.

62. **Tsunami**. Tsunamis are caused by vertical displacement of seabed fault lines during earthquakes, or by other processes such as a volcanic eruption, volcanic collapse or submarine landslide. Earthquakes that generate tsunamis tend to be shallow and of relatively large magnitude (i.e. greater than Richter Magnitude 7), hence the occurrence of a large, shallow earthquake located beneath the ocean will more often than not produce a tsunami, providing there is vertical offset of the sea floor. Currently, the Pacific Tsunami Warning Centre in Hawaii provides tsunami warning advice for the Pacific Island Countries, including Palau. There are no reports of tsunamis affecting the island of Palau. Since the area is a low earthquake zone—local tsunamis are very unlikely.

B. Ecological Environment

1. Mangroves

63. The nation has extensive mangrove forests associated with the coastal estuarine systems with Micronesia largest estuarine systems situated in Ngeremeduu Bay, which is adjacent to the nation's main shipping channel and south of the proposed cable route. There are also extensive mangroves in the Ngardmau area, but the proposed landing on the rock jetty avoids any disturbance to them. Mangrove forests are a significant coastal habitat that are associated with the coastal estuarine, foreshore and intertidal areas and play a significant role in coastal biological diversity, erosion control and are a natural barrier of protection for the islands. Cole (1999) estimated that the island of Babeldaob has 4025 hectares of mangrove forest which amounted to 9 percent of the islands land mass. There is no definitive list of mangrove species for Palau however many authors have reported their significance to the Palau coastal and reef ecosystems and the importance of managing them sustainably.

2. Marine Ecosystem

64. The nation's complex marine habitats stretch from Ngaruangel atoll (8o27'58.7N 134o37' 34.88E) in the north to Helen Reef (2o49'45.27N 131o47'16.46E) atoll in the south. The nation has an exclusive economic zone (EEZ) of 604,289 km^2, an estimated continental shelf area of 1,884 km^2 and an Inshore fishing area of 1,989 km^2 (SPC, 2013). The total land area of the nation is approximately 160km^2 with over 65% of the land on the island of Babeldaob.

65. Palau has an abundance of coral reef habitat types as well as complex marine habitats associated with coral reefs including mangroves, sea grass beds, deep algal beds, mud basins, current swept lagoons bottoms, rich tidal channels and marine lakes. The total estimated areas of coral reefs in Palau is 525 km^2 which consists of barrier reefs (264.7 km^2), fringing reef complexes (194.8 km^2), atoll habitats (65km^2) with 1457 patch reefs recorded that are scattered throughout the lagoons (Yukihira et. al, 2007).

66. The major marine habitats of Palau and their approximate sizes are:

- Mangroves – 45 km^2
- Inner reef – 187 km^2

- Outer reef – 265 km^2
- Lagoon – 1,034 km^2

67. For Palau no sensitive marine areas were identified during the inshore marine assessment of the project corridor. For the deep water, sensitive marine areas are unlikely but will only be confirmed during the oceanographic surveys during the design stage, with the project coordinator monitoring this output. Any finds triggering potential environmental effects will need to be assessed by a marine specialist retained by the project.

68. **Seagrass.** Palau possesses extensive seagrass meadows throughout the nation associated with the majority of shallow water reef systems (both intertidal and sub-tidal) with most located adjacent to the land in the intertidal areas. They are a significant coastal habitat and contain high biodiversity value for the nation through the provision of habitat, protection and feeding opportunities. Sea grass habitats support complex food webs by virtue of their physical structure and primary production and are well known for their role as breeding grounds and nurseries for crustacean, finfish and shellfish species. Sea grass ranks with coral reefs and mangroves as one of the world's most productive coastal habitats. Colin, (2009) reports that Palau has recorded 10 species of sea grasses belonging to 6 different genera. These include (Colin, 2009) *Enhalis acoroides, Thalassia Hemprichii, Halophila minor, Halophila ovalis, Halodule uninervis, Halodule pinifolia, Cymodocea serrulata, Cymodocea rotundata, Syringodium isoetifolium* and *Thalassodendron ciliatum*.

69. **Oceanic marine habitats and fauna.** The marine ecosystems of the deep waters surround the island of Palau are poorly understood. Information pertaining to movements of a number of commercial finfish such as tuna, and to a lesser degree the cetaceans (whales, dolphins) that use these waters for their annual feeding and reproductive migrations is poorly documented. Information on deep water benthic fauna and their habitats (e.g. sediments and bottom substrate) where these organisms reside is all but absent.

70. Information on the organisms and marine benthic habitats associated with the oceanic floor where the cable is to be placed is almost non-existent. However, within the proposed cable alignment route there are two distinct habitats, and whose biodiversity and ecosystems have been studied. These habitats include hydrothermal vents and seamounts, the latter actually known and mapped (see below).

71. **Marine Flora, Fauna, Rare and Endangered Species, and Species Richness.** Palau has a rich marine biota and diversity with the highest diversity of hard and soft coral recorded in Micronesia, which includes approximately 400 and 300 species of hard and soft corals respectively, over 1400 species of reef fishes, and a diverse invertebrate's flora and fauna, marine turtles and the regions only populations of dugong's and saltwater crocodiles. Detail descriptions of the coral reef habitats and species assemblages associated with the proposed cable alignment are described Annex 1. Terrestrial species include 1260 species of plants (including almost 200 endemics), 141 resident and migratory bird species (including 11 endemics), 5000 species of insects, and 40 species of freshwater fishes, including at least 4 endemics. Palau has the largest undisturbed forest and largest freshwater lake in Micronesia and has 70 unique marine lakes (Colin, 2009).

72. **Threatened and Protected Species.** As with other Pacific nations, data about threatened and protected species is restricted in general, to larger well known and studied icon species that are of regional and/or global concern. Information pertaining to other species is limited or non-existent. Palau continues to identify new marine and terrestrial species including species that are endemic to the nation's ecosystems. At present there is no definitive Palau or regional survey documenting all species that exist and/or are threatened in the country or the Pacific region. Data are often dispersed, taxonomic expertise is absent, and nomenclature and classification systems can be disputed for various species.

73. The International Union for Conservation of Nature & Natural Resources (IUCN) undertakes a global assessment (Red List) to classify species at varying risk of global extinction using three categories (critically endangered, endangered or vulnerable) and includes a fourth when data are not available to allocate a category. The most up to date list provides data on 1002 species of concern, of which there are currently 308 marine species, the majority of which are corals.

74. All five species of sea turtles known to live in the Palauan waters are on the IUCN red list. The hawksbill or ngasech (*Eretmochelys imbricata*) and the leatherback or bekuu (*Dermochelys coriacea*) turtles are critically endangered, the green or melob (*Chelonia mydas*) and loggerhead (*Caretta caretta*) are endangered, and the olive ridley or metau (*Lepidochelys olivacea*) turtle is vulnerable. Four species of sea turtles have been documented in Palau, although only two species, the hawksbill and green turtle, maintain resident and nesting populations (at least as of the 2007 SOPAC survey). The leatherback (*Dermochelys coriacea*) and olive Ridley turtles (Lepidochelys olivacea) occur in the islands but are much less common (SOPAC, 2007). Similarly, the Palauan dugong is endangered, and much concern has been raised over the past decade regarding its rapid decline.

75. Red listed species include 11 cetaceans (Annex 1 Table 1.4), a number of sharks of which two are considered endangered; the oceanic white tip (*Carcharhinus longimanus*), and the silky shark (*C. falciformis*). The shortfin mako (*Isurus oxyrinchus*) is vulnerable. In addition, the whale shark (*Rhincodon typus*) and big eye tuna (*Thunnus obesus*) are also red listed as vulnerable.

76. The EEZ of Palau has resident and transient or migratory populations of cetaceans (whales and dolphins). However, there is little information on their presence and population status despite cetaceans being commonly associated with Palau's open ocean environments such as oceanic islands, oceanic fronts and upwelling, seamounts, canyons, deep-sea trenches and are reported to be associated with the nation's lagoon systems. There is no known information on their seasonal migrations. Miller (2009) on behalf of the Whale and Dolphin Conservation Society, lists three species in total with a confirmed presence in Palau, however, acknowledges that the literature on cetaceans in Palau is dominated by anecdotal reports. He suggests that it is highly possible many more species at least pass through the Palauan waters, and has provided a list with an additional 12 unconfirmed cetaceans species (Annex 1, Table 1.4).

3. *Terrestrial Flora*

77. Forest habitats on Palau are extensive and consist of at least five types. Currently, forest cover is only 75% of its historic extent, due to extensive clearing which took place during the 20th Century. Non-forested land in Palau is comprised of savannah, marsh, secondary vegetation, cropland, strand (shoreline) vegetation, and urban development. Due to rugged conditions, tropical broadleaf forests do still cover much of the volcanic and all of the limestone islands.

78. The interior upland forests of Palau contain several endemic species of broadleaf trees found on flat or gently sloping sites as well as river and stream banks. There are six native palm species generally found in the understory or middle canopy layers of the forest. There are also swamp forests found in low-lying areas, often just inland of mangroves, where the soils are inundated with fresh or slightly brackish water and above tidal influence. Swamp forests are particularly vulnerable to siltation resulting from road building activities and clearing for taro patches, which causes coastal swamp forests, in particular, to degrade and become inundated with *Hibiscus tiliaceus* (hibiscus).

79. In the few areas of swamp forest remaining, including Peleliu, common tree species include *Barringtonia racemosa* (powder puff tree) and *Terminalia catappa* (tropical almond). *Derris trifoliate* (derris) is a common climbing vine found on trees in the swamp forest.

80. Atoll forests are found toward the interior of the larger, wetter uninhabited atolls and along coasts of the high islands. The introduced casuarina trees grow in these conditions, but more inside the strand belt, sometimes to heights of 35m (115'). Because their roots can produce nitrogen through nodules containing special nitrogen-fixing bacteria, casuarinas can grow on nutrient-poor soils and other marginal environments such as granite outcrops or sandy soils.

81. Limestone forests are found on Peleliu, Angaur, and the Rock Islands, which are limestone with little soil cover. Although the limestone forests of Palau were heavily disturbed during World War II, they are still fairly common in patches throughout the islands. The endemic Palauan palm, now found only in Chelbacheb, was once common in the limestone forest but was decimated once the cockatoos were introduced.

82. The cable landing station site is in a degraded area of State land, covered in brush, with no forest cover of any kind.

4. *Terrestrial Fauna*

83. Palau supports the highest level of terrestrial diversity in all of Micronesia and maintains a high level (25%) of species endemism among terrestrial biota. This endemism is a direct result of the isolation of the islands, both from one another and from the rest of the world. There are approximately 1,260 species of plants in Palau, of which 830 species are native and about 194 species are endemics (although endemic plants are typically found only in Babeldaob). Sadly, more than 428 invasive plant species have been documented (SOPAC, 2007).

84. Palau's terrestrial fauna include approximately 5,000 species of insects; 141 species of birds, of which 20 are endemic; at least 40 species of freshwater fishes, of which four are endemic; 46 species of terrestrial reptiles and amphibians; and three species of bat. Palau has 50 species of resident birds, many of which are protected by local laws. In total, 16 locally occurring bird species are found in Palau. Of these, the Micronesian scrub fowl (*Megapodius laperouse*) and the Japanese night-heron are both considered endangered and habitat loss continues to threaten their survival (SOPAC 2007).

85. Bats and a few dugongs are the only native mammal. The introduced species which have had a devastating impact on the native fauna are the bird-eating macaque, rats, mice, and the Asiatic musk shrew. Palau has eradication programs ongoing to rid the country of these pests (SOPAC, 2007).

86. Palau has 30 species of lizards, including at least nine endemics. The saltwater crocodile (*Crocodylus porosus*), at the edge of its northern range, is under threat from habitat destruction and hunting. There is also the mangrove monitor lizard, and seven species of non-venomous snakes and a number of sea snakes (sea krates), including the banded sea krait (*Laticauda colubrina*), which is highly venomous, and which must come ashore to lay eggs.

87. The landing site is on degraded State land.

5. *Marine Ecology of the Project Impact Area*

88. **Inside Barrier Reef**. The proposed site is an example of reef systems located along the channel within this area consisting of strong currents and deep drop off associated with the reef slope descending into the channel. The reef crest and flat are exposed during period of low water. The reef flat and crest are dominated by digitate, encrusting and massive corals interspersed with areas of sediment (sand). The upper and lower reef slopes have a high proportion of live coral coverage and deeper areas provide habitat and water circulation patterns conducive to fin fish spawning aggregations. Coral species diversity (see Plates in Annex 1) is high, dominated by massive, plate, encrusting and branching forms in the shallow areas whilst branching and more delicate structures dominate the deeper waters. A high proportion of live coral coverage is present.

89. **Critical Marine Habitats-** The BMR, which is a unit of the Ministry of Natural Resources Environment and Tourism is mandated to manage inshore and offshore marine resources in collaboration with other national agencies, state governments and communities.

90. Palau has implemented a ban on all commercial shark fishing and the possession and sale of any shark products associated with any fishing within its 250km EEZ. Similarly, discussions are ongoing to decide if commercial fishing activities within the nation's EEZ should be prohibited in the future (BMR personnel communications).

91. The management of the nation’s inshore coastal and marine waters are governed by both national (BMR) and state government legislation. State governments own and manage waters from high water on any point of land that extends 12 nautical miles directly offshore and therefore jointly manage the waters and resources within this zone with the national government. Directly adjoining this zone and extending another 12 nautical miles is the nation’s territorial sea that is managed by the national government which among other management interventions, prohibiting commercial fishing. The state waters and territorial sea are combined and termed the contiguous zone. Adjacent to the contiguous zone is the EEZ which extends out to 200 nautical miles (370 Km) which is managed by the national government. In addition to these three specific maritime boundaries, the nation of Palau has a commercial exclusion zone, principally developed to prohibit commercial fishing within a 50 nautical mile (92.6 Km) radius of the nation’s commercial harbour (Malakal harbour).

92. Palau has 43 designated Conservation Areas (CA) (Annex 1 Table 1.4). The designation of a CA is at the state level and is developed through a consultative process with the respective state’s communities, state government and is often assisted by national agencies, NGO’s and/or CBO’s. These CAs are managed by the respective states in conjunction with the communities based on national and state laws and regulations.

93. The designation of a CA is at the state level and is developed through a consultative process with the respective state’s communities, the state government and is often assisted by national agencies, NGO’s and/or Community-Based-Organization. These CA are

managed by the respective states in conjunction with the communities based on national and state laws and regulations. Each CA has been developed to manage and preserve specific marine, coastal or terrestrial environments, specific habitats and/or species (refer Annex 1) and are all currently at different levels of development. Most of the CAs have been initiated by the implementation of a traditional moratorium, or "bul" on an area. The "bul" prohibits all extractive uses for a set period of time (generally 2-3 years). During this period of time through a stakeholder consultative process CA management plans are developed. Established CA have site specific management plans including monitoring initiatives whilst newly developed CA are developing plans. Roughly 40 percent of all nearshore marine areas within Palau have some form of management while 15 percent of all terrestrial areas are managed. There are no CA's to date designated for marine areas outside of the 12 miles state boundaries.

94. **Reef systems.** The shallow reef systems located adjacent to the proposed cable alignment are healthy and are in good condition with substantial live coral coverage and associated healthy and diverse populations of marine plants, invertebrates (e.g. mollusc, echinoderms, crustaceans, polychaetes) and vertebrates (e.g. fin fish). Inshore patch reefs associated with Airai and Aimeliik States are dominated by the large, massive stony corals (e.g. Porities sp.,) interspersed with a fine substrate derived from both reef and teridgernous origin (See Annex 1). Similarly, the reefs associated with Ngerchebal Island Wildlife CA and adjacent patch reef show similar coral morphology however species diversity is higher, including healthy populations of Acropora sp. colonies. Live percent coverage and species diversity in general increases in a northerly direction along the proposed cable alignment for both hard and soft corals with highest coral diversity and morphology associated with western channel entrance and steep slopes. Invertebrate diversity mirrors this trend.

95. The reef systems bordering the proposed cable alignment in the shipping channel vary in size, however, are shallow and during periods of low water (spring tides) are exposed; with considerable exposure on the landward side of the channel (see Plates in Annex 1). Generally, the reefs are large and expansive on the landward side. The reef flats associated with the seaward side of the channel have good coral coverage, dominated by Porities sp. and Acropora sp., that increases as the water deepens down the reef slopes. Landward reef systems have good coral coverage associated with the reef edge, however as the elevation decreases the reef flats are dominated by sea grass beds and sediment, interspersed with Porities sp. coral heads. It is the reef slope areas on both sides of the channel and along its entirety that recorded the highest level of coral coverage, diversity and associated invertebrate flora and fauna. The reef slope in all areas associated with the main and inner channel have steep slopes, ranging between 10 - 40 meters wide before they descend directly to the sea floor. Similarly, the reef slopes of the patch reef located within Ngardmau State (closer to shore) possess steep slopes.

96. **Benthic profiles**. In all seven benthic profile transects completed across the proposed cable corridor, the sea floor follows a general pattern of a steep sided reef slope descending directly to the sea floor (between 35-55 meters deep) where the sea floor in all transects showed a homogenous and relatively flat seabed. Most of the transect data showed no evidence of irregular or sharp undulations on the sea floor that would result from the presence of hard substrates (rock). Transect 3 had evidence of a small sharp rise of 2-3 m height, indicating a hard structure on the sea floor. The unknown structure was located close to the reef slope (seaward side) and may be a coral head that has been dislodged from the reef slope/edge and tumbled down the slope to the seabed. Seabed depth did vary marginally on all transects; however, variations were less than 5m and showed a gentle slope.

97. The shallow water sea floor sediments are composed of both reef and terrigenous (principally basaltic rocks derived from Babeldaob) derived substrate. The landward (inshore) reefs close to coast are impacted by terrestrial run off from the land and a number of river and estuarine systems that discharge directly into the bays along the coast and eventually into the main channel. This is reflected in the higher proportion of terrestrial

derived finer sediment and expansive shallow water reef flats that are dominated by sea grass, marine invertebrates and mangroves close to shore (refer Plates 1 and 2, Annex 1). Substrates found in the main channel and to a certain extent the seaward side reef system associated with the channels has a higher proportion of coral reef substrate (white fine calcium carbonate sand). Reef sediments dominate the substrate located within theouter channel. It is expected that sediments located on the sea floor within the channel that are directly associated with the proposed cable alignment route would be derived from both reef and terrestrial sources.

98. **Flora and fauna**. Flora and fauna found in the marine sediments in close proximity to the proposed cable alignment has a low diversity and low population numbers. At depths where sunlight is present, the benthic substrate includes marine algae (green and blue green) and/or sea grass. Benthic coverage by these plants decreases as light penetration diminishes with water depth (e.g. 5-15 m) and will become absent in deeper water. Hard coral populations in general are light limiting and require a stable and solid substrate to attach and survive. In areas of constant sediment movements, especially were light is limited, hard corals are absent. This is demonstrated by the absence of hard corals in the deep channel areas and open lagoonal waters associated with the proposed cable alignment.

99. Soft corals show a similar trend, however there are a number of filter-feeding genera that inhabit soft sediments with good water flow. These animals (e.g. sea pens, anemones) may be present in areas associated with the cable alignment. Sponges and other invertebrates will also be expected in these areas. In addition, there will be a wide variety of detritus feeding invertebrate organisms that will live on or beneath (e.g. burrows) the substrate. These include holothurians (e.g. sea cucumbers, sea urchins), marine worms, and shrimps. Predator invertebrates (e.g. star fish, sea urchins, mantis shrimps) and finfish species will also be present. The physical presence of these species was not confirmed.

100. In summary, the benthic profiles within the areas surveyed are all very similar possessing a hard and coral covered steep reef slope and a relatively homogenously horizontally flat seabed that was almost devoid of hard benthic structures. The seabed sediment characteristics are a result of tidal currents and water movements within the lagoon. Benthic profiles, as described by navigational charts, clearly indicate conditions similar to the descriptions reported during the field surveys for the inner and outer channel.

C. Socio-Economic Environment

101. In 2017 Palau's GDP rose above US$ 17,000/year, and as such it has the highest standard of living in the region (except Guam). Palau receives substantial assistance from the United States through the Compact of Free Association. The renewed Compact grant agreement, which is pending United States Congressional approval, is set to end in FY2024 and real challenge for Palau is to achieve self-sufficiency when the renewed Compact grants expire. Palau's economy is highly reliant on tourism and services, with tourism accounting for more than 20% of gross domestic product (GDP) and services representing 77%. The International Monetary Fund has identified economic diversification and private sector development as the key elements required for Palau to increase growth and thus protect its economy from such shocks.[4] [5]

[4] International Monetary Fund. 2014. Staff Visit to the Republic of Palau: Concluding Statement of IMF Mission, Article IV. Washington.

[5] ADB. 2014 Concept Paper, North Pacific Regional Connectivity Investment Project, No. 46382-001

1. *Commercial Fisheries*

102. **Deep Sea Oceanic**. The EEZ waters of Palau support commercial purse seine and long line fisheries for various tuna species for many years. The commercial fishing fleet operates between the territorial waters and outer boundary of the nation's EEZ (approx. 250 Km).

103. This fishery currently operates within the EEZ and could be utilizing the waters directly above the cable alignment. The purse seine fishery involves the deployment of a circulate net that is moved around a school of pelagic fish, closed at the bottom and removed. There are no impacts on these fisheries from the deployment and operation of the telecommunication cable, however there are records of the gear snagging on cables and resulting in costly repairs and service disruption.

104. **Inshore**. There are no large-scale commercial inshore fishing operations in Palau. Small scale commercial game fishing charters such as catch (tag in some cases) and release fishing catering for local and tourist alike and small-scale reef fishing where customary ownership rights apply, are allowed. Much of the small-scale fishers capture fish principally for personal consumption and a source of family income.

105. Small scale fishing is undertaken in the waters and associated reef systems adjacent to the cable alignment, however fishing directly in the cables area of influence is not likely since the cable will be position in the middle of the main channel, away from reef system and fish habitats (especially for benthic associated species).

106. Similarly, small scale demonstration/research, artisanal and semi commercial aquaculture of marine and brackish water species are undertaken in Palau. None of these activities are associated with the cable's area of influence.

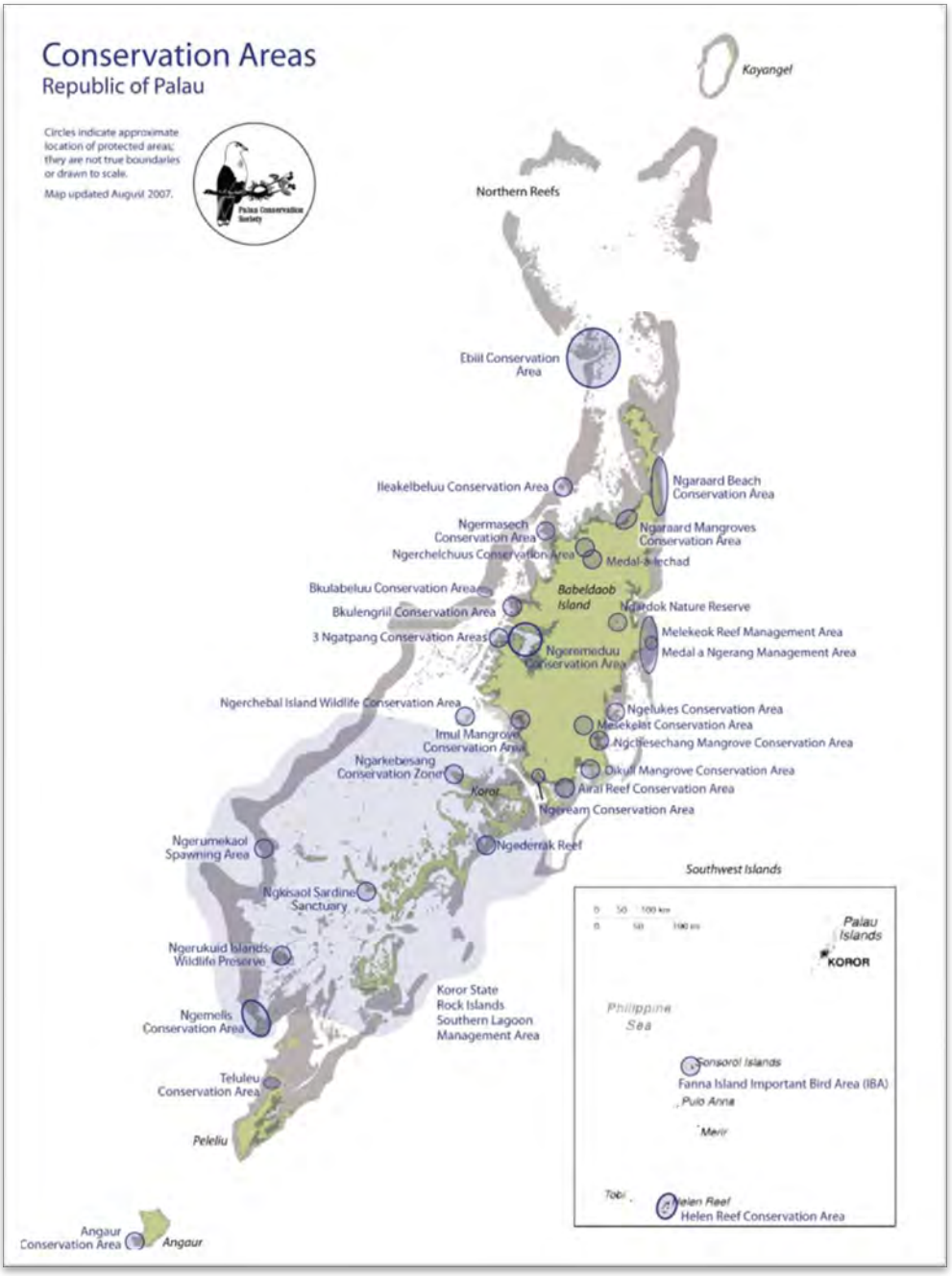
2. *Coastal Industries*

107. Palau's coastal industries are essentially tourism. These are resorts scattered along the coast of most of the larger islands and a few on the more remote islands. No tourism operations will be passed by or crossed over by the cable's general alignment as shown in Map 2.

Map 2. Proposed Project Influence zone

3. *Conservation Areas*

108. While the proposed cable will pass within several hundred meters of coastal conservation areas or pass through them, it will always be in the center of the existing channel.



4. *Transportation and Infrastructure*

109. Palau International Airport provides scheduled direct flights to Guam, Manila, Seoul Taipei and Tokyo-Narita. In addition, the Palauan states of Angaur and Peleliu have regular service to international destinations. Freight, military and cruise ships often call at Malakal Harbour, outside Koror Town. The country has 61 Km (38 miles) of highways, of which 36 Km (22 mi) are paved. Taxis are available in Koror. Only Koror offers bus services. Transportation between islands relies mostly on private boats, as there is no ferry or domestic air service.

5. *Tourism Industry*

110. Palau has a healthy tourism industry, focused entirely on the marine ecosystem and diving. In 2015 there were over 160,000 tourist visitors, however recent data suggest a steady decline in visitations, as Palau pursues a high-value tourism strategy.

111. The placement of the cable will be restricted to an alignment at least 500m from any dive sites. This has already been taken into account by identifying the shipping channel as the cable route inside the barrier reef—thus avoiding any active dive sites. Further, the placement if such a small diameter cable, requiring a very short period of disruption, will not interfere with sport fishing.

6. *Socioeconomic Profile*

112. **Demography.** Palau is a small northern Pacific country of 17,761 people. This population count reflects a decrease of about 10% from the 2005 census. Overseas migration in search of better economic opportunities, particularly in the US mainland and Guam, has contributed to this downward trend.

113. The distribution of population varies considerably between rural and urban areas. Koror, the capital, has 71% of the total country's population with 11,665 of 17,501 in 2012[6] with some states having six and 10 residents only. The population density varied widely as well with Koror having the highest at 648 people per km^2 and other states as low as two people (Sansorol State). In 2006, the average household size is 3.94 (urban) and 3.63 (rural).[7] Urban and rural household sizes are almost similar at 3.94 and 3.63 people respectively.

Table 1. State and National Demographic Information

Feature	Project Location	
	Palau	**Koror**
Land area (km^2)	444	18
Population	17,501	11,665
Male	9,217	
Female	8,284	
Population Density (km^2)	39	648
Household size	3.86 people	
Urban	3.94	
Rural	3.63	
Growth rate[8]	-12.1%	-8%
No. of Households	5,082	3,161

Source: Mini Census 2012, Government of Palau

114. Ngardmau Hamlet, the location for the cable landing and cable station sites, is one of the hamlets in Ngardmau State.

[6] Ibid

[7] The 2006 Household Income & Expenditure survey estimated the 2006 overall household size in Palau as being 3.86 compared with the 2005 Census figure of 3.86. Since the HIES report did not break this figure down any further, the 2005 Census data has been used as the source of household sizes across Palau. The Urban Household size should be used in conjunction with discussions about Koror and Kesebelau / Ked areas as both are highly urbanised communities.

[8] Percentage of change from 2000 to 2005 Census

115. During consultations with key government, private sector and non-government organizations, the importance of a second cable to ensure resilience of the growing applications dependent on fast internet was recognized widely. The risks inherent in a satellite backup strategy were well understood.

116. **Economic Development.** Population and key economic activities in Palau**,** particularly tourism**,** are concentrated in the coastal areas (Table 2).

117. Paid employment, in government and private sector, is the most common income source for Koror populations with a few engaged in informal trade such as selling prepared food packages and bulk food crops in the local markets and some engaging in fishing and agriculture. The median household income for Palau in 2006 was USD 15,699 (2006 HIES). In 2005, labour force participation (16 years old and above) in Palau was at 69.1% with male participation rate at 76.9% and 72.4% for females. In 2012, the reported employed population was 14,241 with 3,694 or 26% comprised of foreign workers working for tourist industry mainly from the Philippines, Indonesia and China.

Table 2. State and National Economic Activities (2005)

	Palau	Koror State	Meyuns Hamlet
Average Annual Income	USD 15,699		
Main Income Sector	Accommodation, wholesale, retail trade, real estate, farming & fishing	Accommodation, wholesale, retail trade & real estate	Accommodation, wholesale, retail trade
Population (2005)	19,907	2,712	1,153
(2012)	17,501		
Number of Households	4,704	2,993	
Employed Population	9,777	6,270	
Labor Force	10,023		
Participation			
Male (employed)	96.3%		
Female (employed)	95.1%		

Source: Mini Census, 2012, Government of Palau

118. **Public Health** - There are no potential public health issues associated with this project since nearly all work will take place in the high seas, and construction on land will involve a small 5 - 8-person, local construction crew. Therefore, no additional data on this topic were collected.

7. *Recreational Resources and Development*

119. Unfortunately, Palau has focused its recreational resources in providing better tourist facilities, at the expense of local amenities such as modern pools, gymnasiums and outdoor sporting grounds. The project will not impact or deter such development and may in fact stimulate improvement by providing better social media communication. No additional information was collected regarding this topic.

8. *Cultural Values and Physical Cultural Resources*

120. Palau is founded on a strong matrilineal culture, where a women's role symbolizes the nurturing land and a provider of food. Family inheritance is passed on by the women in the family. A person's position in the community is determined by his relationship to his

mother's family. The women choose the chiefs and have the power to demote them. Women also have significant role when it comes to setting conditions relating to cultural practices, and to educate the community of those conditions and practices. In 2002, the Palau Women's Organization began discussions on ways to preserve Palauan culture and traditions. This effort led to the establishment of the Ngarachamayong Cultural Centre on2006, where various women's groups, in collaboration with the Ministry of Community and Cultural Affairs conduct educational programs aimed at preserving and conserving the culture and traditions of the country.

121. Physical cultural resources are defined in the Historical and Cultural Preservation Act 1995 (see details in para. 31-34) and include historical sites and historical and cultural properties located in Palau that requires protection from damage.

122. No identified historical sites and cultural properties were identified within the cable landing site and the site for the cable landing station. This was also similar to the proposed underwater cable alignment where alignment selection included ensuring that there were no physical cultural properties that will be affected by the cable alignment.

123. Meetings were held with local people and government officials to establish if any archaeological or historically important sites could be impacted by the project. None of the proposed activities associated with this project will impact any of the national archaeological or historical sites/treasures located far from the cable route and landing site.

23. *Human Settlement in the Shore-Based Project Sites*

124. The proposed sites for the cable landing and cable station are unoccupied government land. There are also no residential structures on the proposed sites.

ANTICIPATED IMPACTS AND MITIGATIVE MEASURES

A. Preconstruction Period

125. Preventing negative impacts resulting from the completion of this project is all about early planning and provision of specifications that avoid future problems. During this IEE pre-construction period mitigative measures were identified, most related to including contract specifications in the bid documents that define the boundaries the survey and cable placement contractor will be required to work in. These actions are summarized in the ESMP (Annex 2) and discussed in greater detail in the following section.

126. The preconstruction actions require that environmental clauses which define the environmental limits of operations for both the oceanographic survey vessel(s) and the cable placement vessel(s) be added to the contract documents The key boundaries will be a) 2 Km distance from ocean seamounts, 1 Km distance from hydrothermal vents (at present none have been recorded in the project corridor) and a the minimum distance of 100 m from any coral formations defined on maps, provided the cable placement contractor (see Task No 1.8 of the ESMP).

127. The second level of boundaries is related to timing and duration of the work. Both the survey and the cable placement contractor will have to be aware of the timing of the migration of species at risk, namely the whales and careful planning of operations to avoid or minimize interference with cetacean migrations, generally taking place between November and March will need to be observed. Briefing of the contractors by specialists at the start of the cable survey and cable placement operations will therefore be essential.

1. *Physical Environment*

128. **Air Quality** Air pollutants released from all vessels involved in cable contract can be significant given that they burn low grade bunker and high sulphur diesel fuel, and measures to reduce emissions will be implemented. The contract specifications for the oceanographic survey and cable placement vessels include requirements for the provision of emission certification providing results concerning testing for PM, SO2 and NOx emissions from the diesel engines.

129. **Substrate** The use of foreign (allochthonous) materials when backfilling cable trenches could lead to unknown local area contamination. To avoid that cable-laying contractor's specification should indicate that:

- all backfill will have to be only original material; and,
- only inert/stable materials will be used in cable laying and anchoring.

130. **Unexploded Ordnance** During all preparation stages of cable deployment, due diligence and careful surveys will need to be undertaken to eliminate the risk of the presence of unexploded WWII munitions in the substrate, where trenching will take place. Particular emphasis and care need to be exercised in areas associated with the deep waters of the main shipping channel. The Palauan government is also working to locate and remove all unexploded ammunition in its coastal zone and EEZ. Details of areas 'cleaned" in relation to the cable alignment need to be discussed before cable deployment commences.

131. **Hydrothermal Vents** Although none are presently known to exist in the general alignment of the cable, the oceanographic survey may turn up such a site. Physical damage to vents by the cable laying process is possible, as is damage to the cable from the 300^{o}C+ temperatures of the venting water. Therefore, in contract documents there will be a specification requiring the oceanographic survey team to identify a cable route that maintains a minimum clearance of 1 Km from active hydrothermal vents, and specify this route in the design specification.

132. **Sea Mounts** Placing a cable across a seamount, which is an important fishing ground and fish gathering area, can lead to habitat damage and conflict with fisher people. To avoid this, contract documentation will include the requirement for the survey team to identify a cable route that maintains a minimum clearance of 2 Km from the base of seamounts and specify this route in the design specification.

2. *Ecological Environment*

133. **Conservation Areas** These areas managed by local communities for sustainable marine resource use and consumption need to be protected from any encroachment by the cable laying activity. To that end, Palau will define a cable route that provides ≥ 100 m distance from CA boundaries and requires all survey and cable laying vessels to maintain this distance at all times (limited by the proximity of CAs to the shipping channel), in contract specifications and via GPS and ground-survey markers.

134. **Coastal and Deep-Sea Habitats** Vessel operations in the deep ocean and especially in the waters inside the barrier reef, could result in accidental spills and leaks of hazardous materials or in coastal area vessel grounding, leading to habitat destruction. To minimize this risk Palau will require contractors to:

1) provide specifications of the fuel and lubricant management equipment and storage on vessels used during the survey and cable laying operations, and certify that the installations in in compliance with national regulations and-or MARPOL specifications for fuel management.
2) Maintain a contingency plan to address spills and groundings due to storm events.

135. **Coral Communities** The cable laying operations will avoid infringing on any live coral reefs or areas where coral is recovering from past degradation. To that end the oceanographic survey team will receive instructions to align the cable around living reefs

(*based on the 2014 surveys to date no such interaction is anticipated, so long the cable is placed in the channel*). This instruction will be provided in the contract document.

136. The alignment and landing site will reduce the amount of cable to be laid within the barrier reef and lagoon area, to approximately 7 kilometers. This will result in a significant reduction in impacts to sensitive habitats, such as corals and seagrass, from the laying of the cable through these areas, and possible damage from vessels working to lay the cable in shallow lagoon habitats.

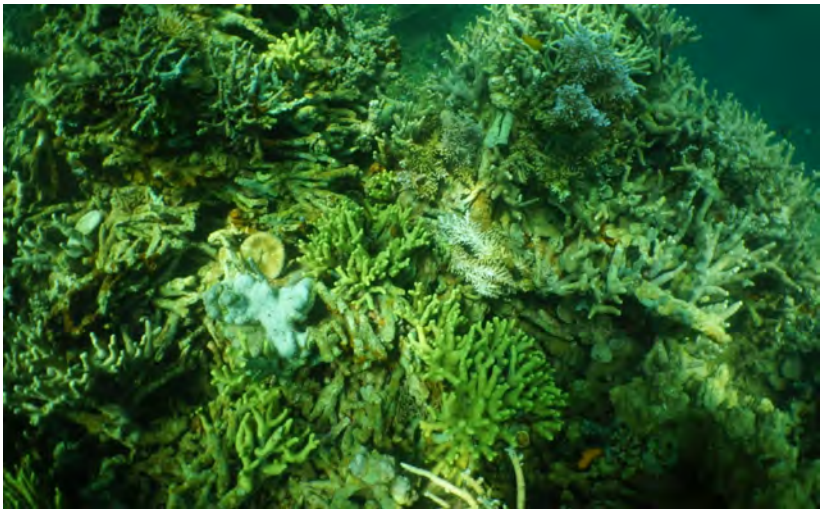
137. The cable will be placed along the seafloor, at the bottom of the Ngardmau channel, which traverses from the old bauxite port at Ngardmau through the western barrier reef to open ocean waters. The channel also traverses through the Ngardmau State Conservation Area (see Figure 1 below).

Figure 1: Cable route alignment

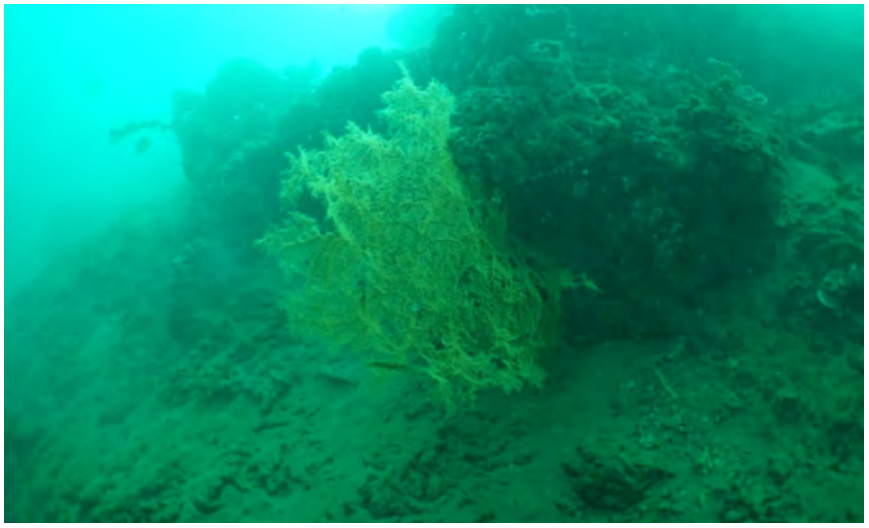
138. Habitat through the channel bottom is characterized by sediment, and, since it is at depths of over 12m, is beyond that suitable for significant coral habitat. Armored submarine cable will sink into this sediment very rapidly. A depth finder survey found no evidence of any deep reefs or other structures in the channel.

139. Once inside the channel a route has been surveyed for the cable to avoid impacts to shallow water coral habitat, with minor impacts anticipated to seagrass habitat from the 7.5 cm (3 inch) diameter cable.

140. Dense thickets of Porites and Acropora line the rim of the channel at 5m – 7m depth but will be avoided by the cable route through the channel. The area to the north-east of the yellow line in Figure 1 contains many soft corals and should be avoided.



141. There are a variety of mixed soft and hard corals in the area. These corals are growing on highly sediment laden benthos. This means they are more easily damaged and are less resilient to strong current or waves. Species such as the gorgonian coral shown below are highly sensitive to sediment loading. It is important to note their location to minimize impact of cable laying.



142. Where necessary, soft corals growing in highly sedimented areas can be relocated easily.

143. In several locations there are breaks and gaps in the reef that will allow ingress of a submarine cable without damage.

144. Annex 3 provides more detail of the marine survey undertaken to determine optimum route alignment for the cable landing.

145. **Seagrass** If not placed with care and in the channel the cable could impact local seagrass meadows; albeit minimally, given that the cable is 3-7.5 cm in diameter. To avoid this, the cable`s placement will be confined to a narrow path (less than 0.4m (15") wide and these specifications will be included in contract documents and avoiding seagrass meadows wherever possible. Seagrass meadow locations were identified, but none found to be in the preferred cable-placement corridor.

146. **Species at Risk Whales** are known to migrate through the waters the cable alignment survey and cable laying activities will take place in. The work could have two impacts: 1) acoustic effect of ocean sonar survey on marine mammals, and 2) entanglement in cable by deep diving cetaceans such as the sperm whale. To reduce the risk of this occurring vessel and survey operators will be instructed, in contract documents to:

- Use best practices for operating vessels in proximity to marine mammals to be incorporated in contract specification;
- undertake seafloor survey outside whale presence/migration season, namely between May and October;
- post a watch for whales and suspend activities when whales are within 1 Km of vessel;
- use multi-beam and/or side-scan sonar only – No Air Guns; and.
- identify a route to avoid suspended segments of cable by routing along terrain that does not have sharp changes in relief, and specify this route in the cable-laying specification.

3. *Socio-Economic Environment*

147. These measures will be implemented once the Project Coordinator, working with a contract specialist, a marine ecologist, and using the ESMP as a guide, prepares specific clauses that will become a part of the legal contract between Palau and the contractor.

148. **Coastal Resource Users** Damage to local fishing grounds through a poorly thought-out cable alignment can lead to damage to or the loss of subsistence and artisanal fisheries. To prevent this contract specifications will be prepared laying out the alignment limits and protection through articulated pipe in shallow waters.

149. **Monitoring** Neither the coordinator or the PMU have technical capacity in ESMP implementation. This gap will be filled with the hiring of the environmental monitor/technical with experience in ESMP implementation. That person will begin work during the preconstruction period and carry on to the end of the construction period.

150. **Community Information** The communities where the project will take place will be informed on project timing and impacts in sessions during the preconstruction period.

151. **Community Grievances** Grievances and complaints concerning a project can surface at any time, even before construction begins. BSCC already has a grievance process supported on its website.

B. Construction Period

152. The mitigative and monitoring tasks defined for the construction period reflect (listed in the ESMP) the time during the work when nearly all potential negative impacts could occur, nearly all being environmental as opposed to social. The details are described in the ESMP section of this IEE.

1. Physical Environment

153. **Air Quality and Greenhouse Gases** The contractor will be required to provide written evidence that vessels have up-to-date emission controls and that emissions have been tested and meet manufacturers' specifications. This action will be followed up by the Project Coordinator and the PMU.

154. **Substrate** The use of only autochthonous materials for any backfilling will be a defined in specification for the contractor to adhere to and will be enforced by the Project Coordinator and the PMU.

156. **Hydrothermal Vents** If hydrothermal vents exist anywhere along the alignment with will be detected during the oceanographic survey. Any such features will be mapped by the survey vessel and avoidance as specified in the ESMP will be adhered to.

157. **Sea Mounts** The ocean corridor in which the cable is to be placed has not been mapped and therefore seamounts have not been identified. Discussions with officials in Palau suggest that there are no seamounts within Palau's 250 Km EEZ. This, however, will be confirmed during the survey and if seamounts are detected, boundaries as defined in the ESMP will be adhered to.

2. Ecological Environment

158. **Marine Coastal Conservation Areas** The specific cable routes have not been defined as the oceanographic survey has yet to take place. However, protection of Cas will be achieved since all vessel operations and cable placement will adhere to the minimum 100 m safe-distance from active CA sites.

159. **Coastal and Deep-Sea Habitat** The contractor will be required to 1) meet contract specifications and national laws, storing all fuel, lubricants and transmission fluids in double walled tanks on vessels and if in drums, store below deck; and 2) maintain a contingency plan to address spills and storm events.

160. Cable Laying operations inside the barrier reef (i.e. once in the channel), needs to be done quickly and with the least amount of degradation of the benthic substrate as cable placement operations approaches the shore. The general instruction to the contractor will be to stay in the middle of the channel, making sure that consultation with the national marine navigation agency responsible for channel maintenance. Given that the cable from the landing site out to deep water will need to be precisely placed, it will either require careful placement, with the cable floated out and guided to the bottom by divers. Cable placement can be controlled with very precise limits.

161. In the deep ocean the cable placement will need to avoid rapid changes in elevations, i.e. undersea mountains or canyons, hydrothermal vent areas as well as

seamounts which are fish congregating and fishing areas. These will be identified by the project proponent as well as during the oceanographic survey.

162. **Coral Communities** The marine survey identified coral communities within several hundred meters of approximate the cable alignment, but with placement in the shipping channel all damage was avoided and no degradation of a reef is anticipated. Once the oceanographic survey is completed, especially the route inside the barrier reef, the contractor will be given a specific map with an exact alignment that will indicate no-go areas, including and coral areas.

163. **Seagrass** As with corals, the proposed nearshore alignment for the cable will avoid all seagrass beds, however if during the detailed surveys sites are identified the protocol as defined in the ESMP item 1.9.

164. **Whales** Contractors installing the cables will need to control cable tension so that the placed cable conforms to contours of seabed as per cable laying specification and-or provide anchors if needed. IN this way the cable will be as unobtrusive as possible and eliminate the risk of cable-whale interaction.

3. *Socio-Economic Environment*

165. **Coastal Resource Users (subsistence and artisanal fishers)** Any damage to coastal, artisanal fisheries will be avoided by contractors adhering to the specifications and confining the cable alignment to a narrow corridor and consulting with Fisheries Department to assign the best dates for cable placement inside the barrier reef and to define any other avoidance measures. The Project Coordinator and contractor will discuss placement of temporary markers along the corridor where water depth is < 10m.

166. **Coastal Resource Users (Game fishers)** Once a new cable is placed the international agreement requires the owner to notify the International Cable Protection Committee, who then place the new cable on a map. In addition, all navigation maps used by vessels need to be updated to indicate the location of the new cable. This information will be passed on the licensed fisheries vessels operating inside the 200 nautical miles (370 Km) exclusive fishing zone of Palau.

167. **Coastal Shipping** Commercial shipping and ports-the placement of the cables will mean potential short-term danger to ship traffic in the seas. Therefore, the contract will be required to:

- ensure a shipping notice is issued warning of cable-laying, dates, and safe clearance for other activities;
- to request port authorities to advise local shipping of laying activities and avoidance measures; and
- ensure that marine navigation lights and other national maritime measures are closely followed by the project vessels at all times.

168. **Land Use and Access** Given that there are no landside acquisition or access issues, the only impact possible could arise if contractors stray from the proposed alignment and encroach into communal resource harvesting areas. The cable route boundaries have been defined in the IEE and this ESMP and as such the contractor will be required to adhere these conditions and be able to deviate only after consultation with the Project Coordinator.

169. **Completion Reporting** It is essential that as the construction period comes to a close the Project Coordinator, instruct the contractor to prepare the environmental completion report as defined in this ESMP and the contract specifications. That summary report will define the mitigation & monitoring actions completed & what needs to be continued during the operating period.

170. **Contractor Awareness** It is possible that the contractor will not be aware of the environmental effects associated with vessel movement in the ocean or the urgency to avoid corals and plan the work to interfere minimally with other sensitive marine life such as whales. If required to address this gap the Project Coordinator and the senior

safeguards technician hired by the government will deliver a ½ day workshop on ESMP compliance and linkages between the cable project and marine systems effects.

C. Operating Period

171. Environmental mitigative and monitoring measures during this period are identical to those deployed for PC1, these are minimal and focus on making sure that the mitigative and monitoring action defined for the construction period are in fact implemented.

1. Physical and Ecological Environment

172. **Completion Report** BSCC will ensure that a construction period completion report is filed with appropriate project stakeholders and the national government.

173. **Hydrothermal Vents** The environmental completion report prepared by the contractor will provide the details on the placement of the cable and proximity to sensitive areas such as hydrothermal vents and seamounts—if these features are identified a periodic check if there are any changes in the location of vents should be undertaken, particularly after any significant seismic events.

174. **Perceived Pollution when installed** Once the cable is in place it will be an inert, small diameter, glass, metal and plastic conduit (3-7.5cm in diameter), buried about 0.75m (2.5ft) below the seafloor. In the deep ocean it will be a smaller diameter cable likely resting in the seafloor, which over time will become submerged in the deep-sea sediment. If required, the cable may also be anchored to the seafloor with special anchoring devices. It will be a passive structure, similar to a rock formation and are often quickly colonized by deep sea invertebrates (Photo 2).

Photo 1. Deep sea cable, shortly after placement on seafloor and start of natural burial by mobile bottom sediment (left panel) and growth of anemones and sea-pens (> 140m depth) on the hard substrate of the cable – taken by a Remote Operated Vehicle.

Source: ICPC/UNDP 2009. Submarine Cables and the Oceans: Connecting the World

28. *Socio-Economic Environment*

175. **General Impacts** No concerns have been expressed.

176. **Fishing** Project-generated negative impacts to the communities along the marine protected areas. Due to the small size of the fibre optic cable (3-7 cm in diameter) and the non-polluting materials of the fibre optic cable e.g. glass, steel and plastic, and the fact it will be buried and does not emit any noise or vibration the project does not pose any threat to the livelihoods (food supply) of the communities near the cable alignment sites. The route suggested by the executing agency brings the cable across an exposed tidal mud flat, with no coral or seagrass, ideal for the placement/burial of the cable.

177. In addition, ownership and/or decisions regarding access to the seabed where the cable will pass are vested by law with the state governments (governor and state legislature). Consultations with the two state governors through which the cable will likely be laid, confirmed overall support for the project and raised no objection to the cable crossing through all Conservation Areas.

178. **Poverty.** The government recognizes that greatly improving internet connectivity will contribute to improving economic opportunities, particularly job creation and access to basic social services such as distance education and remote medical diagnosis, for both the urban and remote rural states of Palau. Resilience of those services is a critical issue.

179. Palauans enjoy a relatively high standard of health, education and other public service, provided mostly free or heavily subsidized by the Government. Palauans have constitutionally guaranteed access to 12 years of public education and free or subsidized healthcare.[9] However, secondary level graduations have been declining in recent years. Of the 94% of school age children who attended school in 2005, 97% finished elementary school and only 78% completed high school.[10] Only 30% of students went on to get a university level education.[11] The majority of students go to the US on a scholarship and only a small proportion of graduates reportedly return to Palau.

180. Based on the analysis of the 2006 Palau Household Income and Expenditure Survey (HIES), a high level of unemployment is recorded for those young people who stay in Palau. This is because the economy employs a large number of guest workers at all levels of skill and experience, who are prepared to work at significantly lower wages than Palauans.

181. In terms of income, tourism is the largest driver, accounting for almost half of the country's GDP. Tourist arrivals already exceed 80,000 per year since 2007, or four times the national population and are projected to grow by an average of 4.4% per annum over the next 10 years. In 2012, tourist arrivals reached a high of 124,286, and then dipped to 114,287 in 2013. Among other factors, poor internet connection was identified as a possible cause for this decline. From surveys conducted by the Visitors Bureau, improvement in the slow internet service was one of the main recommendations made by tourists/visitors and viewed as a stimulus to bring tourism numbers up again.

182. **Gender.** The ADB 2009 Palau Gender Assessment Report, identified the following seven national issues: (i) less tertiary education and qualifications for women than men, therefore gender gaps and fewer opportunities; (ii) increasing risky sexual behavior among the youth (iii) low representation of women in political decision making (iv) violence against women and girls (vi) limited access to infrastructure e.g. water and sanitation services, communication and (vii) low government's capacity on gender analysis. The project could, contribute to addressing issue (i), by requiring that women be trained to provide fibre optics system management and maintenance services. BSCC's Operations Support Officer, recruited for PC1 in 2017, is a Palauan woman.

183. While women in Palau have decision-making powers rooted in their matrilineal heritage and play a key role in household and clan decision-making, they are severely under-represented in the political arena. Only 3 of 16 state governors are women, and there are no female Members of Congress, with men outnumbering women 3:1.[12]

184. Women's participation in the labour force is concentrated in the technical and administrative sectors. Although women have the right to work, and pay equity legislation is in place, less than 50% are engaged in the formal labour force.

185. During consultations, women reported that the mobile (cell) phones helped them with multi-tasking at home and at work. It also improved women's' access (young and elderly) to family members within Palau and overseas. Moreover, it has also helped improve time management between home and work (rural women) and home and the taro patch (rural areas). Access to faster and cheaper internet is expected to further improve women's opportunities to communicate with family members particularly those overseas and increase economic opportunities such as distance learning and e-marketing from home.

[9] Palau Gender Assessment, Country Partnership Strategy (2009-2013), ADB, May 2009

[10] *Country Reports on Human Rights Practices*. U.S. Bureau of Democracy, Human Rights, and Labor, March 2007.

[11] ADB. Palau Economic Report

[12] ADB 2007. ibid.

186. The key gender issues and benefits of the project will be resilience of (i) improved (faster) access to social services such as health and education; (ii) employment opportunities for women in both project management and maintenance including creation of spin-off employment or business opportunities from fibre optic cable; (iii) capacity within Ministry of Public Infrastructure, Industries and Commerce (MPIIC) and/or the future fibre optics service provider, to mainstream gender in communications; and (v) internet security and safety among girls and women, including pornography and human trafficking.

187. **Land acquisition and resettlement**. The project site will be located on vacant Ngardmau State land thus will not require land acquisition. The project CLS site is in a vacant lot. The sites are free from residential and business structures. No crops, food plantations or productive trees will be affected and there will be no physical displacement of people. Finally, since the proposed cable corridor, once inside the barrier reef is in the main channel and the landing is on an existing rock jetty, livelihoods will not be affected.

D. Cumulative Impacts and Mitigation Measures

1. Environmental

188. Given that the cable installation involves the placement of a 3-7.5 cm diameter solid cable (containing no liquids, and not needing transmission of electrical power[13]) in a narrow trench on the seabed and is carefully placed (via divers and/or a cable floated into place—if needed) in Palau's coastal waters, over a relatively short period of time, no cumulative effects are foreseen. There are no other known activities occurring at the same time that the cable is to be placed on the seafloor. There may be other construction activities on land, but since the Palau landing will only require the construction of a room to house the cable unit, no cumulative effect will be triggered.

2. Socioeconomic

189. There are no expected irreversible and irretrievable cumulative social impacts resulting from the fibre optic cable project. Due to its small footprint, and even though it will cross the degraded sections of existing marine protected areas i.e. the shipping channel, it is not expected to cause permanent loss of communal fishing grounds and local people's livelihoods.

190. **Other impacts**. Given the very small disturbance to the environment from the cable installation and landside building (30-50 m^2-or 325-540 ft^2) construction, there will be no irreversible or irretrievable impacts due to the project. Implementation of the mitigation measures defined in the ESMP will ensure that no irreversible or irretrievable impacts occur.

E. Environmental and Social Enhancements/Benefits

191. Fibre optic cable connectivity has improved people's access to income and social services and enhanced social networks, particularly family relationships between Palauans living in Palau and those who live abroad. Faster internet has facilitated regular and affordable connections among local and overseas-based groups, particularly women's organizations who rely on internet to be in-touch. Cloud based applications are being accessed widely by business and government organizations. The nation is more and more dependent on its broadband connections, and the cost of weeks of service interruption is an increasingly serious threat to economic and social activities.

[13] If Palau decides to recover an existing cable, placed some years ago, it is likely that this cable will have a copper transmitter and will require constant power to the repeaters.

GRIEVANCE REDRESS MECHANISM

192. A Grievance management process is already in place (implemented for the PC1 and succeeding projects) on the BSCC web site.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

193. The ESMP is organized into a single cross-referenced table and is provided in Annex 1. It lists in detail the mitigative measures and monitoring actions that the IA has committed to implement, from the planning through the operating period of the project.

194. This approach makes for an ESMP that is practical and can easily be used during bid document preparation as well as during project implementation. This type of ESMP is short, information rich, and with minimal text to wade through.

REFERENCES

Alder, J. & Wood, L., 2004. Managing and protecting seamount ecosystems. In: Morato T, Pauly D eds Seamounts: biodiversity and fisheries. Fisheries Centre Research Report 12(5). Pp. 67– 73.

Berzina, A and Saksina, T., 2013. Piloting responsible marine seismic surveys in Sakhalin: New Approaches help minimise risk to marine mammals in environmentally sensitive areas. In. Marine News – Industry in the Environment.

Carter, L., Burnett, D., Drew, S., Marle, G., Hagadom, L., Bartlett-McNeil, D., and N. Irvine., 2009. Submarine cables and the oceans – Connecting the World. UNEP-WCMW Biodiversity Series No. 31 – ICPC/UNEP-WCMC.

Cole, T. G., Ewel, K. C., and Devoe, N. N. 1999. Structure of mangroves trees and forests of Micronesia. Forest Ecology and Management 117: 95-109.

Colin, P. 1990. Marine Environments of Palau. Coral Reef Research Foundation publication, pp 413. Conservation Society Of Palau. 2001. Sea Turtles, their Management and Policy in the Republic of Palau. An assessment of Stakeholder Perception.

Davis, P. Z., 2003. Dugong and Seagrass in Malakal Harbour, Koror, Republic of Palau. Current status and management recommendations. C3 Technical report Series No. 3. Community Centred Conservation.

Department of the Environment, Heritage and Local Government, Government of Ireland 2007. Code of practice for the protection of marine mammals during acoustic seafloor surveys in Irish Waters. Dublin, Republic of Ireland.

English, S., Wilkinson, C. & Baker, V., (Ed). 1997. Survey manual for Tropical Marine Resources, 2nd Edition. Australian Institute of Marine Science publication. 390pp.

Heezen B 1953. Whales entangled in deep sea cables, Deep Sea Research 4(1957– 1958): 105–114.

Llodra R, Billett D 2006. Deep-sea ecosystems: pristine biodiversity reservoir and technological challenges. In: Duarte CM ed. The exploration of marine biodiversity: scientific and technological challenges. Bilbao, Spain, Fundacion BBVA. Pp 63–92.

Marino, s., Bauman, A., Miles, J., Kitalong. A., Bukurou, A., Mersai, C., Verheij, E., Olkerill, I., Basilius, K., Colin, P., Patris, S., Victor, S., Miles, J., and Golbuu, Y. 2008. The state of Coral Reef Ecosystems of the Republic of Palau. In IUCN 2008 World Coral Reef Status Report. pp 511-539.

Miller, C., (2009). Current State of knowledge of Cetacean Threat, Diversity and Habitats in the Pacific Islands region, 2009 Revision. WDCS International. 77p.

Palau Government. 2012. Palau Domestic Fishing Laws. SPC publication of Fisheries, Aquaculture and Marine Ecosystems. Pp 48.

Nowacek D, Thorne L, Johnston D, Tyack, P., 2007. Responses of cetaceans to anthropogenic noise. Mammal Review 37 (2): 81–115.

Rodgers, A., (2012). An Ecosystem Approach to Management of Seamounts in Southern Indian Ocean. Volume 1. Overview of Sea mount Ecosystems and Biodiversity. IUCN Global Marine and Polar Programme.

Scientific Committee on Antarctic Research (SCAR) 2006. Report on marine acoustics and the Southern Ocean, produced for Antarctic Treaty Consultative meeting. Scott Polar Research Institute, Cambridge, United Kingdom.

SPC, 2013. Pacific Islands Fisheries Address Book. SPC publication of Fisheries, Aquaculture and Marine Ecosystems. Pp 76.

Whale and Dolphin Conservation Society 2009. Current state of knowledge of cetacean threats, diversity and habitats in the Pacific Islands region: 2009 revision for second meeting of the signatories to Convention on Migratory Species Memorandum of Understanding for the Conservation of Cetaceans and their Habitats in the Pacific Islands Region, Auckland, New Zealand, 28–29 July 2009.

Wolanski, E., and K. Furukawa, 2997. The oceanography of Palau: 59-72 in H. Kayanne, M. Omuri, K. Fabricius, E. Verherji, P. Colin, Y. Golbuu and H. Yukihira (eds). Coral Reefs of Palau. Palau International Coral reef Center, Koror, Palau, 238pp.

Wood M, Carter L 2008. Whale entanglements with submarine telecommunication cables. IEEE Journal of Oceanic Engineering 33(4): 445 - 450.

Yakihira, H. K., Shimoike, Y. Golbuu, T. Kimura, S. Victor, and H. Ohba, 2007. Coral Reef Communities and Other Marine Biotopes in Palau, pp10-29. In: H. Kayanne, M. Omuri, K. Fabricius, E. Verherji, P. Colin, Y. Golbuu and H. Yukihira (eds). Coral Reefs of Palau. Palau International Coral reef Center, Koror, Palau, 238pp.

ANNEXES

ANNEX 1: Tables

Table 1.1: List of Relevant Conventions and Treaties

Ratified	Convention and/or Treaty
1996	To ratify the United Nations convention on the Law of the Sea ("UNCLOS").
1999	To accede to the "Convention on Biological Diversity," the objectives of which are to conserve biological diversity, to promote the sustainable use of biological components, and to provide for the fair and equitable sharing of the benefits of genetic resources and technology, including biotechnology.
1999	Kyoto Protocol to the United Nations Framework Convention on Climate Change
1999	To ratify the Agreement on Regional Cooperation in Matters Affecting International Commercial Shipping in Micronesia.
1999	To ratify the Articles of Agreement establishing the Arrangement for the Management of the Western Pacific Purse Seine Fishery, otherwise known as "The Palau Arrangement".
1999	Ratifying the convention for the prohibition of fishing with the long driftnets in the South Pacific, otherwise more popularly known as "The Wellington Convention"
1999	Ratifying the Niue Treaty on Cooperation in Fisheries Surveillance and Law Enforcement in the South Pacific Region
2000	To ratify the amendment to the treaty on fisheries between the Governments of certain Pacific Island States and the Government of the United States of America, the Aim of said amendments is to allow U.S. long line vessels access to high seas within the treaty area.
2001	Cartagena Protocol on Biosafety to the Convention on Biological Diversity
2002	Convention concerning the Protection of the World Cultural and Natural Heritage (11 Sept 2002)
2003	Protocol to Amend the Convention on Wetlands of International Importance Especially as Waterfowl Habitat
2004	Convention on International Trade in Endangered Species of Wild Fauna and Flora
2005	Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
2006	To ratify the accession of the Republic of Palau to the Convention for the Conservation of Migratory Species of Wild Animals.
2008	Agreement for the Implementation of the Provisions of the UN Convention on the Law of the Sea of 10 Dec 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks
2010	To ratify the Third Arrangement Implementing the Nauru Agreement Setting Forth Additional Terms and Conditions of Access to the Fisheries Zones of the Pacific.
2010	To ratify a number of agreed upon amendments to the Palau Arrangement for the Management of the Western Pacific Purse Seine Fishery.
2010	To ratify the amendments to the Federated States of Micronesia Arrangement for Regional Fisheries Access (The FSM Arrangements)
2011	To provide for the acceptance, approval and ratification by the Republic of Palau of UNESCO's Convention for the safeguarding of the Intangible Cultural Heritage.
2011	To approve and otherwise ratify certain international agreements, conventions and treaties, including protocols or amendments thereto, within the respective purviews of the International Maritime Organization (IMO); the World Health Organization (WHO), and the International Telecommunications Union (ITU) in order to ensure efficient and orderly implementation of the Open Ship Registry Act of the Republic of Palau
2011	Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal
2011	International Convention for the Prevention of Marine Pollution from Ships, 1973 (MARPOL) adopted in London on 2 Nov 1973 and its Protocol of 1978, adopted in London on 2 Nov 1973 and its Protocols of 1978, adopted in London on 17 Feb 1978(MARPL 73/78), including following subsidiaries:

Table 1.2: Membership to International & Regional Organizations

International Organisation Membership
➢ United Nations (UN)
➢ United Nations Development Program (UNDP)
➢ Secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
➢ Food and Agriculture Organization of the United Nations (FAO)
➢ International Seabed Authority (ISA)
➢ International Watershed Project (IWP)
➢ International Whaling Commission (IWC)
➢ International Tribunal for Law of the Sea (ITLOS)
➢ International Maritime Organization (IMO)
➢ Bureau (Secretariat) of the Convention on Wetlands (RAMSAR)
➢ Secretariat of the United Nation Convention to Combat Desertification (UNCCD)
➢ Secretariat of the United Nations Convention on Biological Diversity (UNCBD)
➢ United Nations Educational, Scientific and Cultural Organization (UNESCO)
➢ Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC)
➢ Asian Development Bank
➢ World Bank Group
Regional Organisations Membership
➢ Western and Central Pacific Fisheries Commission (WCPFC)
➢ Secretariat of the Pacific Community (SPC)
➢ Forum Fisheries Agency (FFA)
➢ Secretariat of the Pacific Islands Forum (PIF)
➢ Secretariat of the Pacific Regional Environment Programme (SPREP)
➢ Applied Geoscience and Technology Division (SOPAC) of the Secretariat of the Pacific (SPC)

Table 1.3: List of Conservation Areas in Palau

Number	Name	State	Year Established	Type	Ecosystem/Species Protected	Size Km^2	PAN
1	Ngeruangel Marine Reserve	Kayangel	1996	Marine and Terrestrial	Atoll island, reefs and lagoons	34.9	
Northern Area	Reefs Managemnet	Ngarchelong	Under Development	Marine & terrestrial	Atoll island, reefs and lagoons		
2	Ebiil Conservation Area	Ngarchelong	1999	Marine	Grouper Spawning Aggregations	19.0	2008
3	Ngaraard Mangrove Conservation Area	Ngaraard	1994	Marine and Terrestrial	Mangrove	1.48	2011
4	Ungellel Conservation Area	Ngaraard	2007	Marine	Seagrass bed and reef flat	0.39	2011
5	Ngerkall Lake Conservation Area	Ngaraard	2008	Terrestrial freshwater	Forest, pond, watershed	2.23	2011
6	Diong Era Ngerchokl	Ngaraard	2008	Terrestrial, freshwater	Forest, stream, water shed	0.91	2011
7	Ongiil Mangrove	Ngaraard	2010	Marine coastal	Mangrove and reef	2.0	2011
8	Ngermasech Conservation Area	Ngardmau	1998	Marine coastal	Mangrove, reef flat, sea grass beds.	2.93	2010
9	Lleakelbelu	Ngardmau	2005	Marine	Patch reef	0.62	2010
10	Ngerchelchuus	Ngardmau	2005	Terrestrial	Forest, Mountain vista	0.30	2010
11	Ngardmau Waterfall	Ngardmau	2005	Terrestrial	Waterfall, flora & fauna	6.12	2010
12	Ngermeskang Nature Reserve	Ngarmelengui	2008	Terrestrial	Forest, river water shed	8.86	
13	Ngermeskang Bird Sanctuary	Ngarmelengui	2008	Terrestrial	Swamp forest	1.50	
14	Ngaremeduu Bay Conservation Area	Ngarmelengui, Aimeliik, Ngatpang,	1999	Marine & Terrestrial	Fish, corals and mangroves	98.0	
Special Areas within the Ngaremeduu Bay Conservation Area							
15	Bkulengriil Conservation Area	Ngarmelengui	2006	Marine & coastal	Mangrove and sea grass	0.71	
16	Bkulabeluu Conservation Area	Ngaremelngui	2006	Marine	Northern channel, reef and fish spawning aggregation sites.	0.30	
17	Mokiad Recreation Zone	Ngaremelngui	2009	Marine	Reef habitats		
19	Ngatpang Clam Conservation Area	Ngatpang	2003	Marine	Reef, Fish and Clams	0.15	
18	Ngatpang Crab Conservation Area	Ngatpang	2003	Marine	Reef and Crabs	0.15	
19	Ngatpang Fish Conservation Area	Ngatpang	2003	Marine & coastal	Reef and fish	0.15	
20	Imul Mangrove Conservation Area	Aimeliik	2002	Marine & coastal	Mangrove forest	0.43	
21	Ngerchebal Island Conservation Area	Aimeliik	2006	Marine & Terrestrial	Island and reef flat	0.3	
22	Ngerderrar Watershed Conservation Area	Aimeliik	2008	Terrestrial	Forest , watershed, flora & fauna	3.80	2010
23	Ngemai Conservation Area	Ngiwal	1997	Marine	Reef flat	1.0	2008
24	Olsolkesol water fall/ Ngerbekuu River Nature Reserve	Ngiwal	2009	Terrestrial	River system	1.05	2008

Number	Name	State	Year Established	Type	Ecosystem/Species Protected	Size Km^2	PAN
25	Ngardok Nature reserve	Melekeok	1999	Terrestrial	Wetlands, forest, water shed.	5.0	2008
26	Ngermedellim Marine Sanctuary	Melekeok	2010	Marine	Reef habitats	0.3	
27	Ngelukes Conservation Area	Ngchesar	2002	Marine	Patch reef habitat	0.50	2011
28	Mesekelat Conservation Area	Ngchesar	2002	Terrestrial	Forest, water shed.	0.50	2008
29	Ngchesechang Mangrove Conservation Area	Airai	1994	Marine, coastal	Mangrove forest	0.97	
30	Oikull Mangrove Conservation Area	Airai	2002	Marine, coastal	Mangrove forest	0.78	
31	Ngeream Conservation Area	Airai	1997	Marine, coastal	Coastal and Mangrove forest	1.64	
32	Medal Ngediull Reef Conservation Area	Airai	2006	Marine, Coastal	Coral reef, sea grass	0.30	2011
33	Rock Island Southern Lagoon (RISL) Managemnet Area	Koror	1997	Marine, Coastal	Rock Island, lagoons, barrier reef.	621.0	
Special Areas within the RISL							
34	Ngerukuid Islands Wildlife Preserve	Koror	1956	Marine & terrestrial	Island, reef lagoon habitats and resources	11.02	
35	Ngerumekaol Spawning Area	Koror	1976	Marine	Grouper spawning aggregation	2.08	
36	Ngkisaol Sardines Sanctuary	Koror	1999	Marine	Sardine spawning aggregation.	0.05	
37	Ngederrak Reef	Koror	2001	Marine	Seagrass bed, reef flat	5.98	
38	Ngerkebesang Conservation Zone	Koror	2002	Marine	Reef flat	0.04	
39	Ngemelis Island Complex	Koror	1995	Marine & Terrestrial	Island, reefs and dive sites	40.26	
40	Teluleu Conservation Area	Peleliu	2001	Marine	Seagrass beds reef flat	0.83	
41	Angaur Conservation Zone	Angaur	2006	Marine	Sea grass, reef flat	0.39	
42	Fanna Island Important Bird Area	Sonsorol Islands	Traditional decree	Terrestrial	Island	0.40	
43	Helen Reef Reserve	Hatohobei	2001	Marine & terrestrial	Atoll Island, reefs, lagoon	163.0	2009

PAN=Date added to Palau Protected Area Network

Table 1.4: Cetaceans Confirmed and Likely in Palauan Waters and IUCN Redlist Category

Species	Common Name	Status	IUCN Category
Balaenoptera sp.	Bryde's-like whale	Confirmed	-
Orcinus orca	Orca	Confirmed	Dd
Stenella coeruleoalba	Striped dolphin	Confirmed	Dd
Balaenoptera sp	Minke whale	Unconfirmed	-
Feresa attenuate	Pygmy killer whale	Unconfirmed	Dd
Globicephala electra	Short-finned pilot whale	Unconfirmed	Dd
Physeter macrocephalus	Sperm whale	Unconfirmed	Vu
Psuedorca crassidens	False killer whale	Unconfirmed	Dd
Ziphius cavirostris	Cuviers beaked whale	Unconfirmed	Lc
Tursiops sp	Bottlenose dolphin	Unconfirmed	Lc
Stenella longirostris	Spinner dolphin	Unconfirmed	Dd
Stenella attenuate	Pantropical spotted dolphin	Unconfirmed	Lc
Lagenodlphis hosei	Fraser's dolphin	Unconfirmed	Lc
Grampus griseus	Risso's dolphin	Unconfirmed	Lc

Key: Dd=data deficient Vu=vulnerable, Lc=Limited Coverage

Plate 1: Hard Coral Associated with Landward reef sites

Plate 2: Bottom substrate and organisms associated with the intertidal reef flat

Plate 3: Hard Coral Associated with Seaward reef site

ANNEX 2: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Super-vises
1. PRE-CONSTRUCTION PERIOD							
Physical Environment							
1.1 Air Pollution	Air pollutants released from all vessels involved in cable contract	In contract specs, require all ships used, to submit emission certification re PM, SO2 and NOx. The results will need to meet emission standards for such vessels, based on the USEPA standards (http://www.epa.gov/otaq/marine.htm CFR-40 set of codes). A smoke density test will also be performed by the technical monitor, using the Canadian Department of Transport Smoke Chart set out in the schedule of the regulations (https://www.dieselnet.com/standards/ca/marine.php). For vessels with diesel engines a stack smoke density less than No. 1 is normally required with the exception that a smoke density of No. 2 for an aggregate of not more than 4 minutes in any 30-minute period is allowed.	Confirm contract specification and compliance certification	During preconstruction period	Written and signed DD inspection note-to file	BSCC	PMU
1.2 Substrate	Use of foreign materials for filling cable trench, causing unknown pollution.	Specify in cable-laying contractor's specification that 1. All backfill will have to be only locally sourced or seabed material. 2. Only inert/stable materials are to be used in cable laying and anchoring. 3. Be aware of unexploded WWII munitions.	Confirm contract specification and bidder response	During preconstruction period	Written and signed DD inspection note-to file	Project Coordinator	PMU

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Super-vises
1.3 UXO	Failure to complete an unexploded ordinance sweep of the cable route as it enters the coastal waters could lead to explosions and loss of life	Conduct a UXO survey of the cable alignment as it passes the barrier reef cut and all the way to the landing site	Obtain record of UXU sweep completed	During preconstruction period	Written and signed DD inspection note-to file	Project Coordinator	PMU
1.4 Hydrothermal Vents	1. Physical damage to vents by cable or cable- laying equipment. 2. Smothering by disturbing area sediments. 3. Physical damage to cable, given 300ºC of vent water.	1. In construction contract specifications (prepared by Project Coordinator) require survey team to identify a cable route that maintains a minimum clearance of 1 Km from active hydrothermal vents (if known), and specify this route in the cable-laying specification.	Confirm that appropriate specification contained bid documentation	During preconstruction period	Written and signed DD inspection note-to file	Project Coordinator	PMU
1.5 Sea mounts.	Physical damage to habitat and possible fishery usage.	During preparation of contract specifications, Project Coordinator will include a minimum clearance of 2 Km from the base of seamounts, for any cable alignment and that this specification will be rigorously adhered to by the contractor (both the oceanographic survey and cable -laying operators)	Confirm adequate presentation in bid documentation	When b id documents are being prepared	DD note to file	Project Coordinator	PMU
Ecological Environment							
1.6 Conservation Areas (MPA)	Disturbance of marine organisms and habitats in CA.	1. Define in contract specifications, via GPS and survey markers, a cable route that provides ≥ 75m distance from CA boundaries, and requires all survey and cable laying vessels to maintain this distance at all times (limited by the proximity of CAs to the shipping channel).	Confirm contract specification in place as indicated in ESMP	During preconstruction period	Written and signed DD inspection note-to file	Project Coordinator	PMU

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Super-vises
1.7 Coastal and deep ocean habitats	Accidental discharge of pollutants from vessel and from vessel grounding.	1. Require bidders to provide specifications of the fuel and lubricant management equipment and storage on survey and cable laying vessels used and certify that the installations in in compliance with national regulations and-or MARPOL specifications for fuel management 2. Maintain a contingency plan to address spills and storm events and due to grounding. .	Confirm that appropriate specification contained bid documentation	During preconstruction period	Written and signed DD inspection note-to file	Project Coordinator	PMU
1.8 Coral Communities	Failure to plan route around coral communities	Via contract specifications instruct cable survey team to survey cable alignment around all coral reefs, avoiding all coral outcrops, and following the defined shipping channel.	Confirm that appropriate specification contained bid documentation	During preconstruction period	Written and signed DD inspection note-to file	Project Coordinator	PMU
1.9 Sea grass	Damage to sea grass communities due to cable placement.	Define in contract specifications that the cable`s placement must be confined narrow a path (less than 0.4m wide an 0.75m deep), keeping in mind that the cable will be between 3 and 6cm in diameter.	Confirm that appropriate specification contained bid documentation	During preconstruction period	Written and signed DD inspection note-to file	Project Coordinator	PMU
1.10 Species potentially at risk	1. Ocean sonar survey affecting cetaceans. 2. Entanglement in cable by deep diving cetaceans such as the sperm whale.	Contract specifications to include reference to best practices for operating vessels in proximity to marine mammals as included in Env. Code of good Practice document, prepared as part of this assignment. These instructions include: 1. Survey timing outside whale presence/migration season, namely between May and October. 2. Post a watch for whales and suspend activities when whales are within 1 Km of vessel. 1. 3. Multi-beam and/or side-scan sonar only – No Air Guns.	Confirm inclusion in contract specifications	When specifications are being written	Record to file	Project Coordinator	PMU

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Super-vises
Socio-Economic Environment							
1.11 Coastal Resource Users– subsistence and artisanal fisheries	Damage to ecosystem integrity and fishery productivity through loss or damage to local fishing grounds.	Using the data on design limits found in the IEE, prepare contract specs. defining trenching/cable laying activities to be limited to a narrow corridor and trenching to be followed by immediate burial.	Confirm that contract specification is properly written and includes specs.	When specifications are being written	Record to file	Project Coordinator	PMU
1.12 ESMP implementation monitor	Lack of an experienced technician will likely lead to delayed or failed implementation of ESMP items, e.g. no clauses in the bid docs.	Local ESMP technician resources identified for PC2	Confirm that the technician is available	At start of the detailed design stage	Note to file	Project Coordinator	PMU
1.13 Community Information	Community resistance and resentment	Early consultation	Confirm meetings held and documented	Pre-construction	Note to file	Project Coordinator	PMU
1.14 Community Grievances	Minor concerns/issues developing community resentments due to unaddressed project related concerns.	Process already established on BSCC web site	Ensure process is maintained	Throughout	Note to file	Project Coordinator	PMU

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Super-vises
2. CONSTRUCTION PERIOD							
Physical Environment							
2.1 Community Consultation	Concerns/issues developing in the community due to construction project related concerns.	Consult and inform Affected Persons and the wider community of the project and their rights including Grievance Redress Mechanism and ensure project documents are available to local communities.	At least one community consultation prior to commencement of civil works, during construction and after project completion to address any concerns about construction impacts.	At start of construction.	Note to file	Civils Contractor	PMU
2.2 Soil Management and Sediment Pollution	Soil erosion and sediment pollution- low risk	Minimize area of vegetation clearing and land disturbance, keep trench excavation to the minimum practical width.	Regular checks by Environmental Support, weekly photo reports by Contractor and PMU	Throughout	Regular Reports	Civils Contractor	PMU
2.3 Soil and groundwater contamination due to spills of fuels and oils during construction	Damage to ecosystem due to soil and groundwater contamination.	Fuel and oil and chemicals to be stored in a bunded tray or container to catch any spills; fuel and oil transfers to be carried out over a drip tray and any spills cleaned up immediately. Contaminated material to be disposed of to a licensed waste facility in consultation with ECD. The island has a landfill for hazardous materials, and this should be used subject to the relevant permits and consent of the operator.	Regular checks by Environmental Support, weekly photo reports by Contractor and PMU	Throughout	Regular Reports	Civils Contractor	PMU

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Super-vises
2.4 Construction waste impacts.	Damage to ecosystem	Contractor to include Waste Plan, in Contractor's Site Specific Construction Environment Management Plan. Site to be maintained in a clean and orderly condition. No uncontrolled dumping and / or burning of waste. Waste to be managed according to the waste management hierarchy of reduce waste generated, reuse waste materials where possible, recycle materials and safe disposal of residual waste material. Waste materials such as cleared vegetation, wood and clean metal offcuts that require disposal shall be made available to the local community if safe. Recyclable materials to be removed for recycling where safe and practicable. Non-hazardous non-toxic waste that is not recycled shall be disposed of at an appropriate licensed facility after approval from the local authority.	Regular checks by Environmental Support, weekly photo reports by Contractor and PMU	Throughout	Regular Reports	Civils Contractor	PMU
2.4.1 Waste - oil	Damage to ecosystem	Waste oil shall not be disposed of to land or waters. Small quantities of waste oil may be made available for local reuse. Larger quantities to be removed to a recycling facility. Oil and fuel spill kits to be on site during construction and operation.	Regular checks by Environmental Support, weekly photo reports by Contractor and PMU	Throughout	Regular Reports	Civils Contractor	PMU
2.4.2 Waste – failed equipment rejected during installation	Damage to ecosystem	Any batteries and electrical equipment that are rejected during installation and commissioning shall be removed from the site and disposed of in line with local regulations.	Regular checks by Environmental Support, weekly photo reports by Contractor and PMU	Throughout	Regular Reports	Civils Contractor	PMU

Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Super-vises
2.4.3 Waste - Sanitation	Damage to ecosystem	Human waste will be disposed of via appropriate toilet and wastewater facilities to protect public health and prevent water pollution. During construction toilet and washing facilities will be provided for workers. Toilets will be fitted with lids to exclude insects.	Regular checks by Environmental Support, weekly photo reports by Contractor and PMU	Throughout	Regular Reports	Civils Contractor	PMU
2.4.4 Waste – General Solid	Damage to ecosystem	General solid waste will be disposed of at a facility approved by the local government (not including, batteries and electrical equipment). Food waste will be disposed of so as to prevent access by vermin. There shall be no burning of waste on the site	Regular checks by Environmental Support, weekly photo reports by Contractor and PMU	Throughout	Regular Reports	Civils Contractor	PMU
2.5 Terrestrial flora and fauna.	Protect environment.	Minimize clearing and land disturbance.	Regular checks by Environmental Support, weekly photo reports by Contractor and PMU	Throughout	Regular Reports	Civils Contractor	PMU
2.6 Traffic Management	Accidents arising as a result of contractor working at CLS ste or on fronthaul duct route.	Prepare Traffic Management Plan (TMP)	Regular checks by Environmental Support, weekly photo reports by Contractor and PMU	Throughout construction	Regular Reports	Civils Contractor	PMU

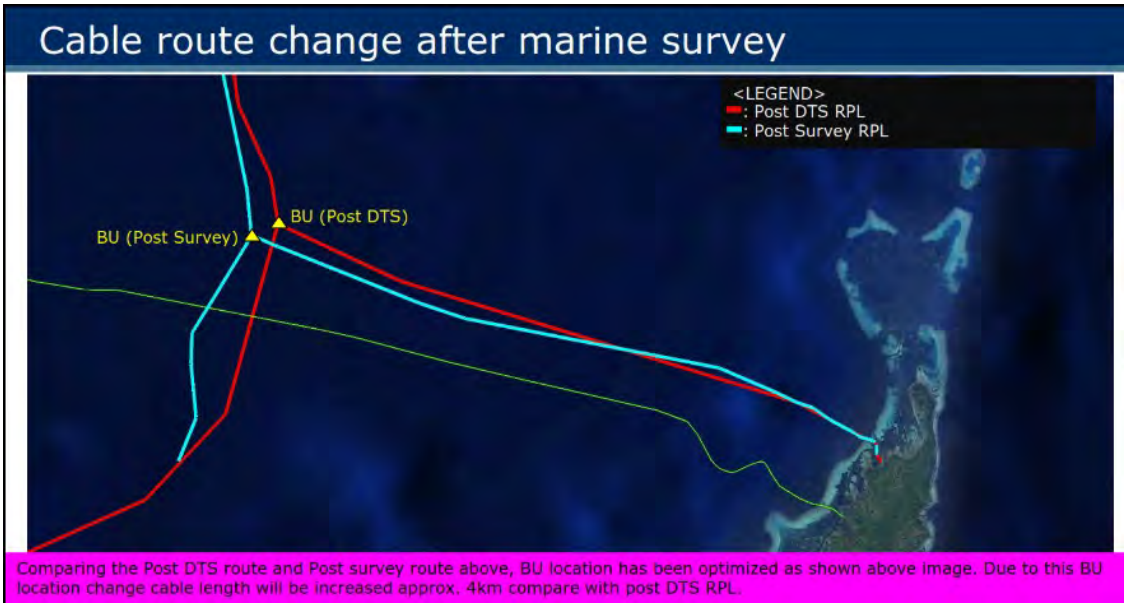
Project Period and Environmental Parameters	Project Impact	Mitigation Measures	Details of Monitoring Action to be Undertaken	When/ Frequency/ Duration	Output to be Provided	Who Implements	Who Super-vises
Socioeconomic							
2.6 Local Community Relations	Community Concerns/Complaints	Workers shall not enter local residents' land or use land even temporarily outside of designated area without permission.	Regular checks by Environmental Support, weekly photo reports by Contractor and PMU	Throughout	Regular Reports	Civils Contractor	PMU
2.7 Occupational Health and Safety OHS	Productivity loss	Safety training, site briefing, personal protective equipment, safety inspections, incident records. Contractors to provide a first aid post and safety equipment for workers.	Daily Toolbox Meetings, regular checks by PMU	Throughout	Regular Reports	Civils Contractor	PMU
2.8 Air quality – smoke and dust	Health and Safety risk	Minimize dust generation. Change work method or timing if dust blowing into residences. Maintain equipment to prevent excessive emissions. No burning of waste. Consult residences in case of risk of dust generation.	Regular checks by PMU	Throughout	Regular Reports	Civils Contractor	PMU
2.9 Noise nuisance at residences during construction.	Health and safety risk	Workers induction to include noise sensitivity and antisocial behavior; Consult and inform residents. Respond to complaints. Modify methods to reduce impact. Work only in scheduled daytime hours.	Regular checks by PMU	Throughout	Regular Reports	Civils Contractor	PMU
2.10 Noise – diesel generators installation and operation.	Health and Safety Risk	Confirm that diesel generators deployed and installed have adequate acoustic enclosure and shielding in place.	Regular checks by PMU, reports by Contractor	Throughout	Regular Reports	Civils Contractor	PMU

ANNEX 3: Marine Facilities

Main purpose of the submarine cable route survey is to select the most suitable cable laying route. The cable route survey uses the route created during the desktop study phase and carries out a dedicated marine hydrographic survey along a route corridor.

EGS was contracted to supply topographic, hydrographic, geophysical and geotechnical survey services to provide data to enable NEC to carry out engineering, construction and subsequent maintenance of PC-2 cable system. All EGS offices and vessels are regularly audited by independent accredited certification bodies and world leading Oil & Gas, Telecoms and Utilities companies. This helps ensure that EGS always meet or exceed all client's high expectations in the areas of Health, Safety, Environment and Quality (HSEQ).

Cable system: PC-2 Submarine Cable System	**Segment:** 7
Connection: BMH Ngardmau, Palau to BU7	**Total cable length:** 128.308km
Client: NEC Corporation (NEC)	**Surveyed by:** EGS (Asia) Ltd
Landfall/Inshore survey date: 2 – 19 Dec 2020	**Inshore Vessel:** *MV Kemedukl*
Offshore survey date: 1 - 3 May 2020	**Offshore Vessel:** *RV Bold Explorer*
Cable crossing: 0 IS, 0 OOS, 0 P	**Pipeline crossing:** 0 IS, 0 OOS, 0 P
Burial: None	**RPL:** Issue-3.2(PSR03)_05MAR2021



EGS performed the PC-2 marine route survey as follows:

- RV Bold Explorer was used as the primary survey vessel for the ECHO offshore survey. After completion of ECHO Segment 1.7 and BU7 box survey, the RV Bold Explorer started and completed the deep-water survey of PC-2 on 1st May 2020. Then the vessel was standby for the daylight. On 2nd May 2020, the RV Bold Explorer started a scouting towards coastline. A drone survey was undertaken while the vessel approached to the edge of the outer reefs. After the drone survey, the shallow water geophysical survey was commenced. RV Bold Explorer completed the shallow water survey of PC-2 on 3rd May 2020, including two CPTs and one gravity coring.

- Two local survey contractors, namely Coral Reef Research Foundation (CRRF) and Mapping and Planning Solutions (MAPS), were hired to conduct the marine MBES and drop camera surveys and the land topographic survey respectively in December 2020.
- CRRF mobilized the MV Kemedukl to conduct MBES (Multi Beam Echo Sounder) bathymetry survey and drop camera survey from the outer slope of the barrier reef off Ngardmau to the shore adjacent to the pier. CRRF initiated work on 30th Nov 2020 with the vessel alongside and local checks of equipment. MBES calibration and wet tests were carried out on 1st December 2020 prior to the commencement of survey operations. The MBES data collection began on 2nd December 2020 and continued on 4th and 8th December 2020. The drop camera survey was conducted on 7th and 9th December 2020. Demobilization was performed on 10th December 2020.
- MAPS mobilized a survey team to commence the land topographic survey using Real-Time Kinematic (RTK) land survey technique and Unmanned Aerial Vehicle (UAV) survey. Drone survey planning and setting up of control stations were carried out on 14th and 15th December 2020. The drone survey and collection of ground control points took place on 18th and 19th December 2020. As reported, the Marine Survey is compliant by mapping a confined narrow path for the cable placement (to minimize any damage to sea grass), with route designed to ensure cable alignment around all coral reefs and avoiding all coral outcrops.

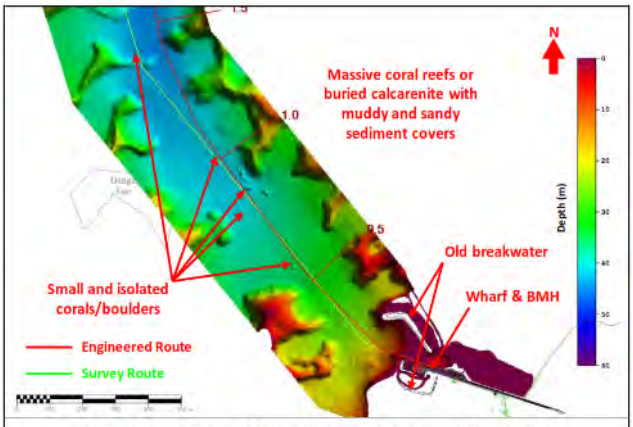


Figure 12: Sun illuminated bathy data example between KP0 and KP1.5

NB: 0.5km between KP flags, vertical exaggeration x3

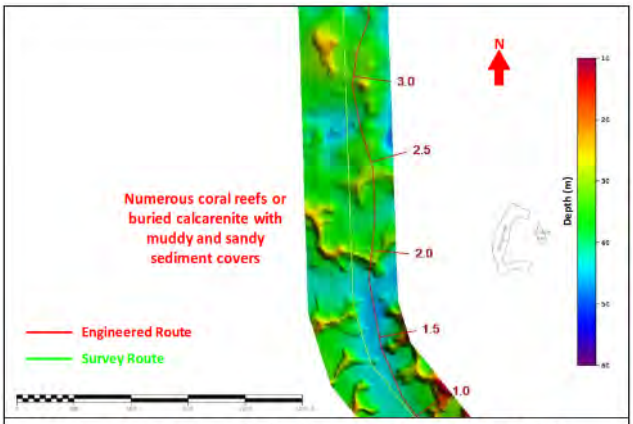


Figure 13: Sun illuminated bathy data example between KP1.0 and KP3.5

NB: 0.5km between KP flags, vertical exaggeration x3

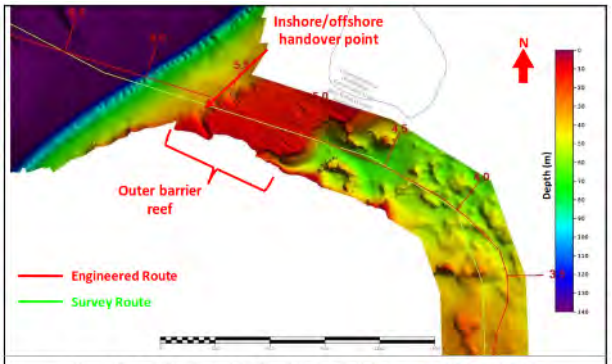


Figure 14: Sun illuminated bathy data example between KP3.5 and KP6.0

NB: 0.5km between KP flags, vertical exaggeration x3

Figure 16: Picture showing the survey vessel standby outside the coral reefs near KP5

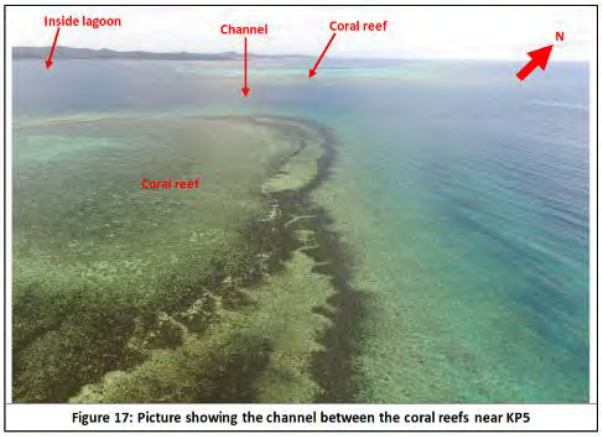


Figure 17: Picture showing the channel between the coral reefs near KP5

The following table summarizes the hazards and issues encountered during the survey of PC-2:

Hazards/Issues	Yes	No	Comments	Recommendations
Presence of CORAL reef	✓		Sighted by the drop camera survey over the outer reef zone Start of SSS survey at KP5.4 – KP5.6	Consult environmental authority; careful manoeuver vessel when working in this area
Presence of seagrass			NA	NA
Presence of ROCK on proposed route	✓		KP5.6 – KP5.7 KP5.8 – KP6.1 KP7.1 – KP8.0 KP8.2 – KP8.3 KP8.5 – KP8.8 KP10.9 – KP12.1	Proper cable armour is expected
Presence of ROCK within target burial zone	✓		KP6.1 – KP7.1	No burial for this segment
Presence of HARDGROUND on proposed route	✓		KP9.7 – KP10.0 KP10.6 – KP10.7 KP13.5 – KP13.7 KP14.4 – KP14.6	Proper cable armour is expected.
Presence of HARDGROUND within target burial zone	✓		KP8.0 – KP8.2 KP8.3 – KP8.5 KP8.8 – KP9.7 KP10.0 – KP10.6 KP10.7 – KP10.9	No burial for this segment
Presence of pockmarks and gas seepage		✓	None	None
Presence of very soft sediments with low bearing capacity		✓	None	None
Presence of sonar contacts within the survey corridor	✓		6 sonar contacts attributed to debris and unknown object	Route engineering/ clearance if applicable
Presence of megaripples and sandwaves		✓	None	None
Indication of slumping		✓	None	None
Presence of in-service cables crossing		✓	None	None
Presence of in-service pipelines crossing		✓	None	None
Presence of out-of-service cables/pipelines crossing		✓	None	None

Hazards/Issues	Yes	No	Comments	Recommendations
Indication of fishing activities (Trawl scars, FADs, etc...)	✓		Fishing activities were low in the offshore deep water area, and increased in the shallow water area. No commercial fishing was observed, but small speed boats for the recreation fishing. The route crosses several Fishing Zones.	Liaison with locally authorities is expected before cable installation
High level of shipping activity		✓	Low levels of shipping activity was observed	None
The route traverses traffic separations schemes (TSS)		✓	None	None
Presence of anchorage areas along the route		✓	None	None
Presence of wrecks along the route		✓	None	None
Presence of dumping areas along the route		✓	None	None
The route traverses military exercise areas		✓	None	None
The route traverses hydrocarbon concessions		✓	None	None
The route traverses mineral/sand extraction/dredging		✓	None	None
Risk of piracy		✓	None	None
Presence of adverse currents		✓	None	None
Occurrence of adverse weather (monsoon, typhoon, hurricane, etc...)		✓	The weather was fine during survey	Avoid monsoon season for cable installation if possible

The Route Position List for the PC2 cable is as follows:

Route Position List
WGS84 Spheroid Datum

ECHO
Segment S7
Palau - BU7

Pos No.	Event	Latitude	Longitude	Bearing °T	Distance (km)		Slack %	Cable Distance (km)		Cable Type	Cable Totals By Type (km)	Approx Depth (m)	Target Burial (m)	Additional Route Features
					Between Positions	Cumulative Total		Between Positions	Cumulative Total					
1	BMH Ngardmau	7 ° 36.5678 ' N	134 ° 33.7112 ' E			0			0.02			0		BMH Ngardmau
				290.28 °	0.098		0.5	0.099		DAS				
2	POL	7 ° 36.5863 ' N	134 ° 33.6611 ' E			0.098			0.119			0		Exit Coral Reef
				290.22 °	0.141		0.5	0.142		DAS				
3	AC	7 ° 36.6128 ' N	134 ° 33.5890 ' E			0.24			0.261			9		
				321.11 °	0.533		0.5	0.536		DAS				
4	POL	7 ° 36.8379 ' N	134 ° 33.4070 ' E			0.773			0.796			20		
				321.11 °	0.629		0.5	0.632		DAS				
5	AC	7 ° 37.1036 ' N	134 ° 33.1922 ' E			1.402			1.429			38		
				343.21 °	0.339		0.5	0.34		DAS				
6	AC	7 ° 37.2795 ' N	134 ° 33.1390 ' E			1.74			1.769			38		
				358.03 °	1.003		0.5	**1.174**		DAS				
7	Shore End Inteface point	7 ° 37.8236 ' N	134 ° 33.1202 ' E			2.744			2.943			25		
				358.02 °	0.739		0.5	0.743		DAS				
8	AC	7 ° 38.2244 ' N	134 ° 33.1063 ' E			3.483			3.686			40		
				340.14 °	0.465		0.5	0.467		DAS				
9	AC	7 ° 38.4617 ' N	134 ° 33.0204 ' E			3.948			4.153			60		
				301.50 °	0.58		0.5	0.583		DAS				
10	AC	7 ° 38.6262 ' N	134 ° 32.7513 ' E			4.529			4.736			40		
				287.63 °	0.209		0.5	0.21		DAS				
11	POL	7 ° 38.6606 ' N	134 ° 32.6428 ' E			4.738			4.947			20		20m WD (fr Chart)
				287.67 °	0.157		0.5	0.157		DAS				<20m WD
12	POL	7 ° 38.6864 ' N	134 ° 32.5616 ' E			4.895			5.104			18		Enter Coral Reef (fr WCMC)
				287.63 °	0.414		0.5	0.417		DAS				
13	POL	7 ° 38.7545 ' N	134 ° 32.3468 ' E			5.309			5.521			20		20m WD (fr Chart)
				287.64 °	0.281		0.5	0.282		DAS				
14	POL	7 ° 38.8007 ' N	134 ° 32.2012 ' E			5.59			5.803			20		Exit Coral Reef (fr WCMC)
				287.64 °	0.18		0.5	0.181		DAS				
15	POL	7 ° 38.8303 ' N	134 ° 32.1079 ' E			5.77			5.984		5.984	200		200m WD (fr Chart)
				287.65 °	0.408		1	0.412		SA				
16	AC	7 ° 38.8974 ' N	134 ° 31.8965 ' E			6.178			6.396			252		
				297.60 °	2.389		1	2.413		SA				
17	Tr DAS/SA	7 ° 39.4978 ' N	134 ° 30.7452 ' E			8.567			8.809			400		
				297.59 °	1.478		1	1.493		SA				
18	POL	7 ° 39.8692 ' N	134 ° 30.0329 ' E			10.045			10.302			500		
				297.60 °	2.609		1	2.635		SA				
19	POL (RPL)	7 ° 40.5249 ' N	134 ° 28.7754 ' E			12.654			12.937			1050		
				297.61 °	0.306		1	0.309		SA				
20	POL	7 ° 40.6019 ' N	134 ° 28.6278 ' E			12.96			13.246			1088		Exit Coastal State Waters; Enter Northern Reef Fisheries Management Project / Northern Reef Co-Managed Commercial Fisheries Zo
				297.60 °	5.211		1	5.263		SA				
21	Tr SA/LWS	7 ° 41.9114 ' N	134 ° 26.1164 ' E			18.171			18.509		12.525	1500		1500
				297.59 °	1.134		2	1.157		LWS				
22	AC	7 ° 42.1964 ' N	134 ° 25.5697 ' E			19.305			19.666			1564		
				286.77 °	4.767		2	4.862		LWS				
23	POL	7 ° 42.9427 ' N	134 ° 23.0874 ' E			24.072			24.528			1896		Exit Northern Reef Fisheries Management Project / Northern Reef Co-Managed Commercial Fisheries Zone; Enter Coastal State Wat
				286.79 °	0.393		2	0.4		LWS				
24	POL	7 ° 43.0042 ' N	134 ° 22.8830 ' E			24.465			24.928			2088		Exit Coastal State Waters; Enter Domestic Fishing Zone
				286.77 °	5.721		3	5.893		LWS				
25	MB	7 ° 43.8998 ' N	134 ° 19.9037 ' E			30.186			30.821			2873		Exit Palau TW
				286.77 °	0.749		3	0.772		LWS				
26	POL	7 ° 44.0171 ' N	134 ° 19.5135 ' E			30.935			31.593			3107		
				286.77 °	10.335		4	10.748		LWS				
27	Tr LWS/LW	7 ° 45.6350 ' N	134 ° 14.1312 ' E			41.27			42.341		23.832	4000		4000m WD
				286.77 °	16.828		4	17.501		LW				
28	MB	7 ° 48.2695 ' N	134 ° 05.3667 ' E			58.098			59.842			4350		Enter Palau EEZ
				286.77 °	33.385		4	34.721		LW				
29	AC	7 ° 53.4960 ' N	133 ° 47.9760 ' E			91.483			94.563			4690		
				294.77 °	8.491		4	8.831		LW				
30	POL	7 ° 55.4258 ' N	133 ° 43.7807 ' E			99.975			103.394			4805		Exit Domestic Fishing Zone; Enter Palau National Marine Sanctuary
				294.77 °	0.766		4	**5.796**		LW				
31	Final Splice	7 ° 55.5998 ' N	133 ° 43.4024 ' E			100.74			109.19		66.849	4834		
				294.77 °	9.615		4	**15**		LWS				
32	**BU7**	7 ° 57.7853 ' N	133 ° 38.6515 ' E			110.355			124.19		15	4872		

ANNEX 4: Land Based Facilities

Belau Submarine Cable Company (BSCC) is constructing a new cable station and ductline in Ngardmau for the landing of an international submarine cable for Palau (PC2).

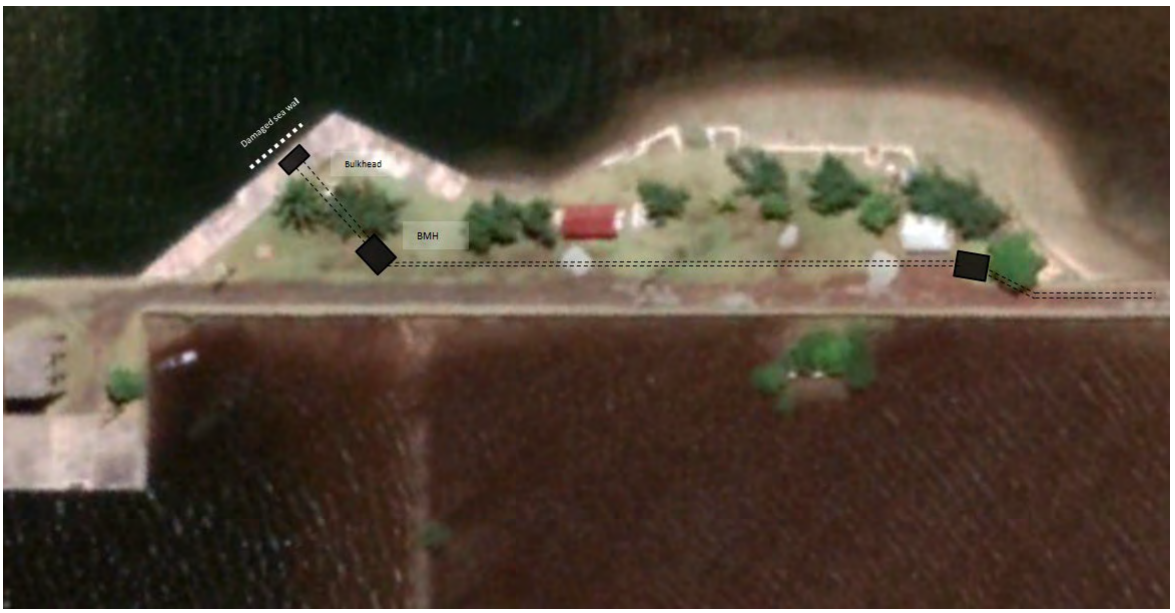
A site has been leased for the Submarine Cable Landing Station (CLS) and a landing location has been determined and agreed with the relevant authorities. The proposed Ngardmau landing station site lies on the western coast of Babeldaob Island, some 60km from Koror.

Initial access to Ngardmau from Koror is via the Compact Road, a two-lane asphalt road, wide and well maintained. Some 50 minutes' drive from Koror, and leaving the Compact Road, the road changes to concrete and asphalt to both the landing site and CLS.

The proposed CLS location is a plot of unmade land located approximately 1.3 miles (2.1km) from the Landing Point. Physical Address for CLS is: Chemutii, Ngardmau state, Republic of Palau 96940

The construction location and overview is shown in the following diagrams

The bulkhead and BMH are to be placed as shown below on the site plan. The ductline is then to be buried at 1m depth along the jetty, 1.5m from the Northern Edge



The ductline is to be in as straight a line as possible and as much as possible, directional changes are to be made in the pulling and turning manholes placed along the roadway. At the crossroad intersection to the Ngardmau dock, and township, the ductline should be on the Southern side of the road to the jetty and thus be laid under the side road to the dock.

The ductline will remain on the southern side of the road until reaching the Cable Landing Station Cable Vault. Two 110mm ID ducts are to be buried a minimum of 1.0m deep from a bulkhead and Beach Manhole (BMH) on the Ngardmau jetty, to the CLS - approximately 2,200m. Ten manholes are to be constructed along the duct route to the CLS.

For the CLS, the BSCC will install a modular cable building with 35sq meters of technical space, separate generator space and separate WC/toilet. Power Systems will include Diesel Generators and specific switch gear – installed with noise suppression under a separate outdoor enclosure. The facility is designed for unmanned operation with building alarms extended to a central BSCCNet site in Airai.