Initial Environmental Examination

Project No. 49450-021

Status: Final Draft

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Kiribati: South Tarawa Renewable Energy Project

Prepared by Public Utilities Board under the Ministry of Infrastructure and Sustainable Energy

Abbreviations

ADB	Asian Development Bank
AMSL	Above mean sea level
CBD	Convention on Biological Diversity
CCP	Communications and consultation plan (for the project)
CEMP	Construction environmental management plan (of the contractor)
cm	Centimeters
CO_2	Carbon dioxide
CSS	Country safeguards system
CSC	Construction supervision consultant
ECD	Environment and Conservation Division (within MELAD)
EHSG	Environmental, Health and Safety Guidelines (of the World Bank Group)
EIA	Environmental impact assessment
EMP	Environmental management plan
ENSO	El Niño-Southern Oscillation
GRM	Grievance redress mechanism
GWh	Gigawatt hour
ha	hectares
HIV/Aids	Human immunodeficiency virus / acquired immunodeficiency syndrome
HSP	Health and Safety Plan
IEE	Initial environmental examination
km / km^2	Kilometers / kilometers squared
kV	kilovolt
m / m^2	Meters / Meters squared
mm	Millimeters
MELAD	Ministry of Environment, Lands and Agricultural Development
MFED	Ministry of Finance and Economic Development
MISE	Ministry of Infrastructure and Sustainable Energy
MWac	Megawatt of alternating current
MW	Megawatt
MWh	Megawatt hour
MWp	Megawatt peak
PMU	Project management unit (within PUB)
PPE	Personal Protective Equipment
PUB	Public Utilities Board
PV	Photo voltaic
RCP	Representative concentration pathways
SPS	Safeguard Policy Statement 2009 (of ADB)
STREP	South Tarawa Renewable Energy Project
STWSP	South Tarawa Water and Sanitation Project
UXO	Unexploded ordinance

Executive Summary

Background to the Project. The Government of Kiribati (the government), through the Ministry of Finance and Economic Development (MFED), has requested support from Asian Development Bank (ADB) and other financiers to reduce dependence on fossil fuel imports by increasing the proportion of renewable energy electricity generation on South Tarawa, Kiribati.

In 2019 a project preparatory technical assistance was undertaken and the feasibility study of a solar photo voltaic (PV) power plant located at the Bonriki Water Reserve, North Tarawa, was completed under the South Tarawa Renewable Energy Project (STREP). The project proposes a 5 MWp / 13 MWh solar PV plant, along with storage batteries and controls to connect the scheme to the Tarawa grid, to increase the renewable energy penetration and grid stability.

The STREP solar project is expected to generate 6.845 gigawatt-hours (GWh) of electricity and avoid 4,928 tons of carbon dioxide equivalent greenhouse gas emissions per year by 2022. The PV Plant and associated facilities will require approximately 13 hectares and will be located at the Bonriki Water Reserve, at the eastern end of South Tarawa, Tarawa Atoll, Kiribati. Tarawa atoll is the capital of Kiribati and South Tarawa is the center of public sector and commercial activity. The Bonriki Water Reserve is government-leased land under the control of the PUB for the management of the Bonriki freshwater lens as one of the key sources of reticulated water supply for Tarawa. As a government-leased land, any land use that is inconsistent with the purpose of the water reserve is managed under the Squatters Recovery Act and the PUB Ordinance administered by the Ministers responsible for Lands and PUB respectively.

Implementation arrangements. The MFED is the executing agency. Implementation responsibility is shared by the Ministry of Infrastructure and Sustainable Energy (MISE), and the Public Utilities Board (PUB). MISE will implement the renewable energy enabling framework component and PUB--the state-owned power and water utility--will be the implementing agency for all other aspects of STREP and will house the project management unit (PMU).

Screening and categorization. The project will create site-specific impacts which can be readily avoided or managed/mitigated and has been classified as category B for environment following the ADB's Safeguard Policy Statement 2009 (SPS). A Category B project requires an environmental assessment commensurate with its level of impact, and this draft initial environmental examination (IEE) including a draft environmental management plan (EMP) has been prepared. The IEE also meets the requirements of an environmental assessment under Kiribati's Environment Act. The IEE will be updated based on the project detailed designs and will be (i) submitted to the Environment and Conservation Division (ECD) of the Ministry of Environment, Lands and Agricultural Development (MELAD) as part of the approvals process under the Environment Act; and (ii) integrated into the bid and contract documents, along with the environmental license (and conditions).

Potential impacts. The siting of the PV array, batteries and associated facilities will have a visual impact and an impact on current land uses at the Reserve. Many landowners and public use the land for informal gardens, harvesting of wild and semi-wild plants and materials (for medicine, fuel, fibre, food), and use it as open space. To mitigate visual amenity impacts, enrichment planting is proposed to maintain a 20m vegetative buffer between the public, residents and the solar array facility. Compensation for the loss of harvesting potential and other land uses is outlined in the STREP Resettlement Plan.

The benefits of the solar array at the reserve are to protect the quality and quantity of rainfall infiltrating into the freshwater lens, and to prevent incompatible land uses and encroachment onto the project site within the reserve. Design will take into account the capture and disposal of rainwater into the ground to maximize lens replenishment.

Most construction-related impacts will be minor and readily controlled. They include general nuisances such as noise and traffic, and some risks to erosion and sedimentation during high rainfall events. Dust may be an issue although the sandy soils do not generally create dust at nuisance levels. The workforce will be small, and the construction period will be approximately six months, which should not create significant risks to community health and safety. The North Village residents will be prioritized for employment as partial mitigation to the loss of land use, amenity and ecosystem services. There is one local source of licensed, sustainable aggregates and this will be used on the project rather than borrow pits and other ad hoc sources on South Tarawa which are likely to be unsustainable. The use of hazardous substances is a significant risk to the quality of the Bonriki lens and will be avoided where possible and otherwise will require rigorous management. Construction-related bulky wastes and packaging is likely to be limited. Any waste types that cannot be recycled or managed by the South Tarawa landfill will be removed for offshore processing or disposal.

An enrichment planting plan is proposed for a 20m wide buffer on the northern site boundary to mitigate some of the social impacts from vegetation clearance. There are unlikely to be any impacts on biodiversity or native ecosystems; however the EMP includes the need for an ecologist to survey and record the presence of any significant plants with ecological, medicinal or other values prior to land clearance, and a recovery plan prepared if necessary. There is potential to support local plant, reptile and crab species by providing suitable habitat under the PV arrays and site and within the 20m vegetative buffer. Roads and paths will be maintained where possible, and a new path has been recommended to mitigate the impacts on connectivity from installing the power plant.

Environmental management plan. Potential pre-construction, construction and operation impacts will be managed and likely reduced to acceptable levels through the implementation of the measures identified in the EMP. The IEE and EMP will be updated based on detailed design. The recommended environmental mitigation measures will be incorporated into the design. The IEE and EMP will be included in technical specifications and bidding documents. Prior to construction works commencing, the successful construction contractor will prepare a construction EMP (CEMP) based on their methodology and construction approach that will be reviewed and approved by the PMU (supported by a construction supervision consultant (CSC) which will include an environmental specialist).

Consultation, participation and disclosure. Stakeholders have been consulted during the preparation of the STREP project including government agencies, non-government organisations and landowners. Consultations will continue throughout project implementation as per the project's communication and consultation plan (CCP) which will be prepared by the CSC and implemented by MISE and the PUB's PMU. The CEMP will reflect the contractor's requirements of the CCP.

Grievance redress mechanism. At the start of project implementation, a grievance redress mechanism (GRM) will be established for the project and will be implemented through pre-construction, construction and operation. The community will participate in the design of the mechanism to ensure it is appropriate and incorporates traditional methods of/approaches to conflict resolution and will be informed of the GRM through the consultation programme and by

prominent display of the GRM process at the site and in PUB's office prior to the commencement of onsite works. There will be full and free access to the grievance focal point in PUB. The contractor will be responsible for implementing relevant elements of the GRM and this will be reflected in their CEMP.

Monitoring and reporting. Monitoring requirements are incorporated into the EMP. Monitoring will be carried out through all phases of the project development to ensure that the environmental mitigation measures are effective and that actual environmental impacts accord with predicted impacts and comply with environmental approval issued by ECD and ADB safeguard requirements. Additionally, PUB will contribute data to the national State of the Environment reporting on environmental indicators.

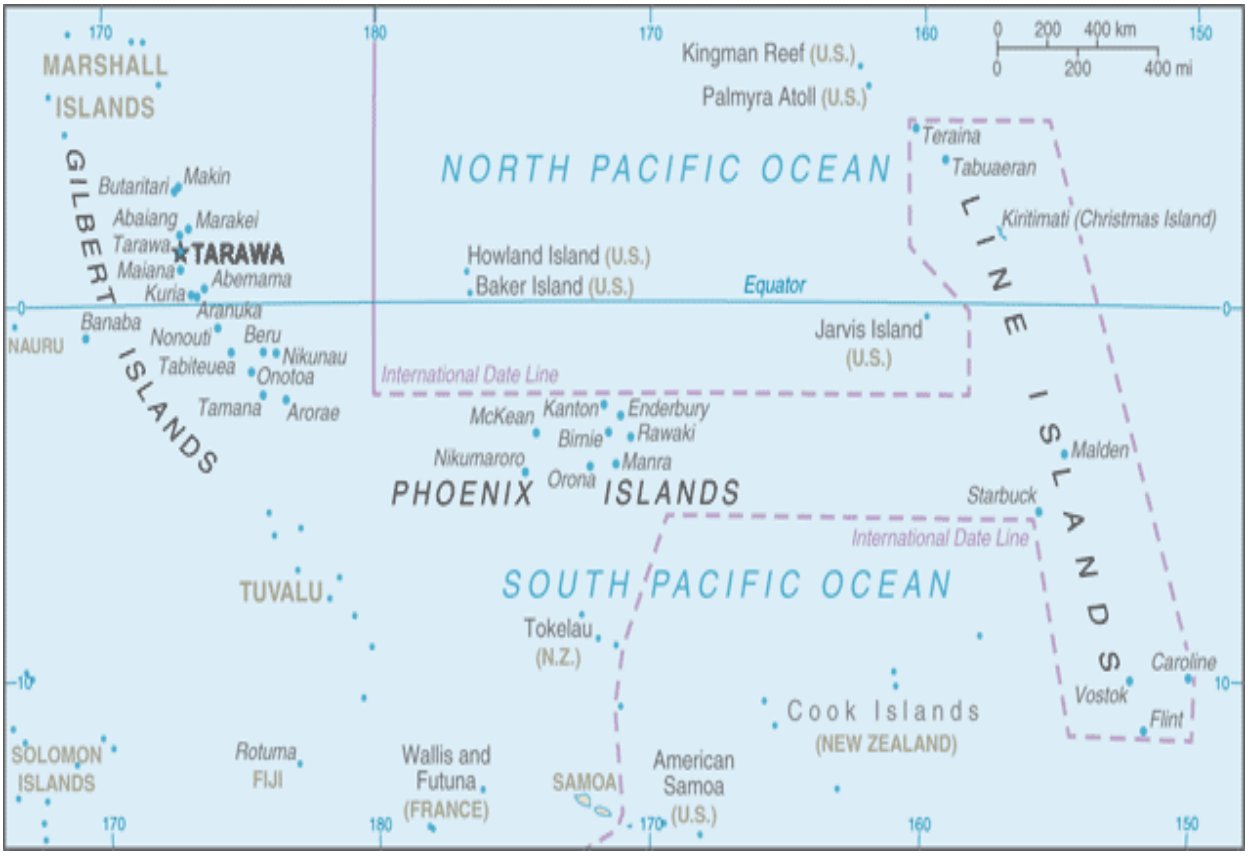
Safeguard implementation and compliance will be reported in contractor's monthly reports to PUB, quarterly progress reports prepared by PUB for MFED and ADB, and semi-annual safeguards monitoring reports prepared by PUB and submitted to the MFED and ADB. ADB will disclose the monitoring reports. Environmental safeguards monitoring reports will be shared with MELAD.

Conclusion. This IEE has identified potential environmental impacts associated with the 5 MWp / 13 MWh solar project for South Tarawa under the STREP project. Measures required to mitigate or minimize impacts have been summarized in an EMP. Provided the mitigation measures outlined in the IEE and EMP are appropriately implemented, the project is expected to have no significant environmental impacts.

1 Introduction

1. The Public Utilities Board (PUB) is responsible for generating and distributing electricity in South Tarawa, Kiribati (Figure 1.1). Tarawa atoll is the capital of Kiribati, located in the Gilbert Islands. South Tarawa is the center of public sector and commercial activity. The PUB operates a mix of diesel and solar electricity generation with a total installed capacity of 7.01 MW on the Tarawa grid network. The current power system in South Tarawa has installed or planned grid-connected PV capacity to meet part of the peak demand and offset expensive diesel electricity; but grid reliability will increasingly be put at risk as additional intermittent generation is added to the grid.

Figure 1.1: The islands of Kiribati – Gilbert Islands, Phoenix Islands and Line Islands



2. The Government of Kiribati (the government), through the Ministry of Finance and Economic Development (MFED), has requested support from Asian Development Bank (ADB) and other financiers to reduce dependence on fossil fuel imports by increasing the renewable energy percentage of electricity generation. This is to be implemented through three actions: a PV plus storage facility, a new energy act and enabling framework, and a capacity building programme in renewable energy. The PUB will be the implementing agency for the solar PV plant and the Ministry of Infrastructure and Sustainable Energy (MISE) will implement the renewable

energy enabling framework component. The PUB will establish a project management unit (PMU) and will be supported by a construction supervision consultant (CSC).

3. In 2019 a project preparatory technical assistance was undertaken and the feasibility study of a solar photo voltaic (PV) power plant located at the Bonriki Water Reserve, South Tarawa, was completed under the South Tarawa Renewable Energy Project (STREP). The reference design and bid documents for the detailed design and construction of a 5 MW[1] / 13 MWh solar PV plant and batteries for energy storage, along with the controls and connections to the scheme to the Tarawa grid, will be completed in 2020.

4. According to the feasibility study the STREP solar project is expected to generate 6.845 gigawatt-hours (GWh) of clean electricity from solar PV and avoid 4,928 tons of carbon dioxide equivalent greenhouse gas emissions per year by 2022. It will allow the South Tarawa grid to achieve 44.45 % renewable energy penetration, surpassing the Kiribati Integrated Energy Roadmap 2017-2025[2] target for South Tarawa, which is 23% renewable energy penetration by 2025.

5. The initial environmental examination provides the policy and legal framework, baseline environmental context, environmental assessment and proposed mitigation measures for the installation and operation of the solar PV panels, battery storage and ancillary facilities, and scopes the cumulative impacts of up to 10MW of ground-based solar energy generation at the Bonriki Water Reserve over the next 20+ years.

[1] 4.992 MWp (4.0 MWac)

[2] IRENA, SPC and PPA. 2017. Kiribati Integrated Energy Roadmap 2017-2025.

2 Legal and Institutional Framework

6. The implementation of the project will be governed by the laws and regulations of Kiribati and the safeguard requirements of the ADB.

2.1 Country Safeguards System

7. **Environmental protection.** The Ministry of Environment, Lands and Agricultural Development (MELAD), based in Bikenibeu, administers the Environment Act (No. 9 of 1999), 2007 amendments and the Environment (general) Regulations of 2009 which are the cornerstones of the country safeguards system (CSS) for environment. The Development Control Unit (DCU) of the Environment and Conservation Division (ECD) of MELAD oversees the day-to-day processing of environmental permit applications.

8. The Act provides the regulatory management of environmental impact assessment and management in Kiribati. All projects must comply with the legislation and regulations. Activities are 'scheduled' according to their environmental significance. Activities that are considered to create a significant environmental impact require application for environmental license. After screening, assessment and review of the application by the DCU and the MELAD Principal Environmental Officer who is also the Secretary of MELAD, some activities that may have significant impacts, may further require an environmental impact assessment (EIA) report and public consultations and disclosure. Activities with few or minor impacts will not require an EIA and the ECD will recommend to the Secretary of MELAD that a license is granted. Environmental licenses may prescribe conditions to be monitored and enforced by ECD.

9. The STREP solar PV plant and associated battery storage requires an environmental license in accordance with the regulations. The Principal Environmental Officer (PEO) will review the application and decide on the requirement for an EIA report and the detailed content of the report. Referring to MELAD's decision on the environmental license application for the solar PV project under the South Tarawa Water Supply Project, it is anticipated that MELAD will require an EIA for the STREP solar PV project.

10. Once the EIA report is received by MELAD, it will be reviewed against the national EIA requirements and for approval. Once the EIA report is approved by MELAD, the PEO will determine the appropriate form of its publication and disclosure to interested parties, and the deadline for receipt of comments. Comments received must be shown to the applicant and taken into consideration. Concurrently the report is also reviewed by the ECD, where regional and international expert views may be sought. In accordance with ADB policy, revisions should be made in response to comments.

11. On receipt of comments, the PEO decides whether to grant a license and if a license is to be granted with conditions. Conditions may include duration, location, prescribed methods, monitoring and reporting requirements, lodgment of bonds and payment of fees, and preparation of plans and specific mitigations. The ECD is responsible to monitor the activity's progress to ensure compliance with the license conditions.

12. **Land use planning and public utility.** Local government is provided for under the Local Government Act No. 2 of 1984 and the Local Government (Amendment) Act No. 6 of 2006. The Local Government Act establishes councils, their composition, management arrangements and

functions. Councils have the power to hold elections, pass by-laws, establish budgets and raise revenues including property rates or taxes.

13. A 'town council' means a council established in respect of an area described as a town in the warrant establishing the council – Betio is governed by a town council. An 'urban council' means a council established in respect of an area described as an urban area in the warrant establishing the council – the area of South Tarawa from Bairiki to Bonriki inclusive falls under the authority of the Teinainano Urban Council. Bonriki falls under the authority of a Teinainano Urban Council Local Planning Board in terms of development control, planning regulation, approval of land use, building permits, etc[9].

14. **Land Planning Ordinance 1972.** The objective of the ordinance, (amended 1973, 1974, 1977, 1979, 1980 (2), 2000), is to apply controls over land use and developments within designated areas. The area of South Tarawa has been designated as a planning area, with the establishment of a Local Planning Board by the Land Planning Ordinance 1977 and the subsequent LN 4/79.

15. The PUB is a state-owned enterprise reporting to MISE. PUB is responsible for the supply of water, sanitation and electricity services in South Tarawa and water and electricity in parts of North Tarawa. The protection and security of the water reserves is the responsibility of the PUB under the Public Utilities Ordinance, 1977, now administered under the Public Utilities Board (PUB) Act, 1978, for the purposes of protecting the freshwater lens. The Act prohibits settlement on water reserves and allows the control of land use by PUB.

16. **Biosecurity.** The purposes of the Biosecurity Act 2011 are to prevent the arrival of animal and plant pests and diseases into Kiribati and to control their establishment and spread, amongst other provisions.

17. International agreements**.** Relevant international conventions ratified by Kiribati include:

- Waigani Convention, 2001 – the Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement of Hazardous wastes within the South Pacific Region. The objective of the Convention is to reduce and eliminate transboundary movements of hazardous and radioactive waste, to minimize the production of hazardous and toxic wastes in the Pacific region and to ensure that disposal of wastes in the Convention area is completed in an environmentally sound manner.

- United Nations Framework Convention on Climate Change, 1994. The main objective of the Convention is to stabilize greenhouse gas concentrations at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system, within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner.

- Convention on Biological Diversity (CBD), 1993**.** The CBD has 3 main objectives:

    i. The conservation of biological diversity;

    ii. The sustainable use of the components of biological diversity; and

    iii. The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

- Basel Convention, 1989 – The Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes. Its scope of application covers a wide range of wastes defined as "hazardous wastes" based on their origin and/or composition and their characteristics, as well as two types of wastes defined as "other wastes" - household waste and incinerator ash.
- Minimum Age Convention, 1973 – setting the legal minimum working age at 15 years.
- World Heritage Convention, 1972 – protecting cultural and natural heritage.

18. **Occupational health and safety**. The Kiribati Occupational Health and Safety Act 2015 sets the country's comprehensive framework for occupational safety and health standards for the workplace. The Ministry of Labor and Human Resources is responsible for enforcing the standards. Employers are liable for the expenses of workers injured on the job. By law workers may remove themselves from situations that endanger their health or safety without threat to their employment. The Employment and Industrial Relations Code 2015 includes provisions supporting the Minimum Age Convention and other relevant conventions relating to working conditions for children, including the definition of a child meaning "a person under the age of 18 years".

2.2 Safeguard Policy Statement

19. The Safeguard Policy Statement 2009 (SPS) has the objectives to (i) avoid adverse impacts of projects on the environment and affected people; (ii) where possible; minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and (iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks. The environment safeguard requires due diligence which entails addressing environmental concerns, if any, of a proposed activity in the initial stages of project preparation.

20. The SPS categorizes potential projects or activities into categories of impact (A, B or C) to determine the level of environmental assessment required to address the potential impacts. The project is categorized as Category B for environment because potential adverse environmental impacts are site-specific, few if any of them are irreversible, and mitigation measures can be readily designed and implemented. Accordingly, this draft IEE has been prepared as the requisite level of assessment to address the potential impacts in line with the SPS.

21. ADB's SPS applies pollution prevention and control technologies and practices consistent with good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines (EHSG). The EHSG provide the context of international best practice and contribute to establishing targets for environmental performance. Standards incorporated into the EHSG will be used in parallel with Kiribati environmental standards (where they exist) throughout this document with the principles of due diligence and a precautionary approach adopted. Application of occupational and community health and safety measures, as laid out in the EHSG is required under the SPS.

22. ADB's safeguard due diligence emphasizes screening and scoping, planning, environmental and social impact assessments and safeguard documentation. Through such due diligence and review, ADB will confirm (i) that all key potential social and environmental impacts

and risks of a project are identified; (ii) that effective measures to avoid, minimize, mitigate, or compensate for the adverse impacts are incorporated into the safeguard plans and project design; (iii) that the borrower/client understands ADB's safeguard policy principles and requirements and has the necessary commitment and capacity to manage the risks adequately; (iv) that, as required, the role of third parties is appropriately defined in the safeguard plans; and (v) that consultations with affected people are conducted in accordance with ADB's requirements.

23. ADB will also assess the borrower's/client's capacity to manage environmental and social impacts and risks and to implement national laws and ADB's requirements. If gaps exist between ADB's requirements and the countries' laws, or where gaps in borrowers' capacity are apparent, the safeguard frameworks should include the details of the specific gap-filling requirements to ensure that policy principles and safeguard requirements are achieved.

3 Description of the Project

3.1 Background

24. As of March 2018, 22% of total installed electricity capacity on South Tarawa is ground and roof-mounted solar PV. The current power system in South Tarawa already has installed or planned grid connected PV capacity to meet some of the peak demand, but grid reliability will increasingly be put at risk as additional intermittent generation is added to the grid. Thus, to ensure system stability, battery storage needs to be deployed in the immediate future. Research conducted in the framework of the elaboration of the STREP investment plan also concluded that solar PV plus a battery storage system was the highest ranked and most appropriate technology option to meet Kiribati's energy sector challenges while mitigating the effects of climate change. This option was followed by solar micro grids and battery storage, wind and battery storage, and solar street lighting technologies.

25. According to the Kiribati 20-Year Vision (2016-2036), electricity generation continues to increase at an annual rate of 1.7% to try to meet the public demand.

3.2 Project Location

26. The ground-based 5 MWp / 13 MWh Solar PV Plant will be located at the Bonriki Water Reserve, at the eastern end of South Tarawa, Tarawa Atoll, Kiribati (Figure 3.1). Tarawa is the capital of Kiribati and South Tarawa is the center of public sector and commercial activity. Tarawa atoll is part of the Gilbert Islands group, the most western of three main island groups in Kiribati.

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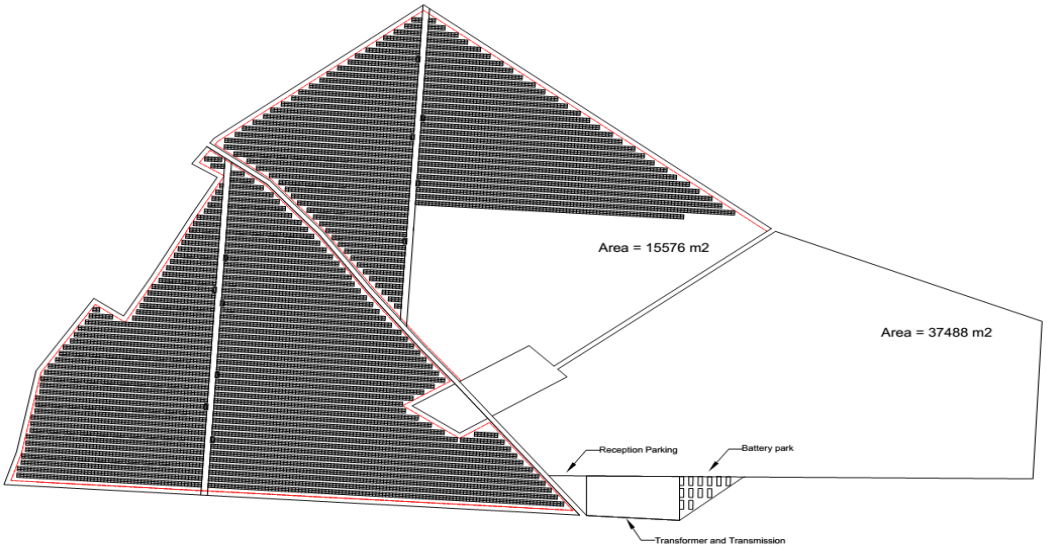
27. The Bonriki Water Reserve is government-leased land under the control of the PUB for the management of the Bonriki freshwater lens as one of the key sources of reticulated water supply for Tarawa. To provide for the immediate outputs of STREP and projected future needs, the feasibility study proposes setting aside an area of approximately 13 ha within the Bonriki Water Reserve (Figure 3.2).

Figure 2.2: Proposed delineation of 13 ha area (white boundary) for current and future solar PV developments

Note: Area excludes an area in the middle containing dwellings and cemetery, and proposed layout of PV Solar Array under STREP (blue)

28. The Feasibility Study estimates that about 6 hectares of land is required for 5 MWp of ground-based PV solar array and accompanying capacity battery storage facility to be funded by STREP. The Feasibility Study considered additional land requirement for solar PV to provide for future energy needs. According to the government investment plan, PUB intends to develop up to 10 MW of solar PV in future within the Bonriki Water Reserve that would require a total site of 13 hectares, as shown in Note: .2. Also, to meet Kiribati's Nationally Determined Contributions targets, a total of 24 MW of renewable energy power generation is required by 2030 which would equate to a total site area of approximately 36 hectares at the water reserve, assuming only ground-based solar PV.

Figure 3.3: Indicative layout of proposed PV panels, battery storage plant and future expansion



3.3 Design Components – STREP 5 MWp / 13 MWh Solar PV and Battery Storage

29. The Feasibility Study proposes a 5 MWp / 13MWh, capacity plant with output of 6.845 GWh per year. The study proposes the following components:

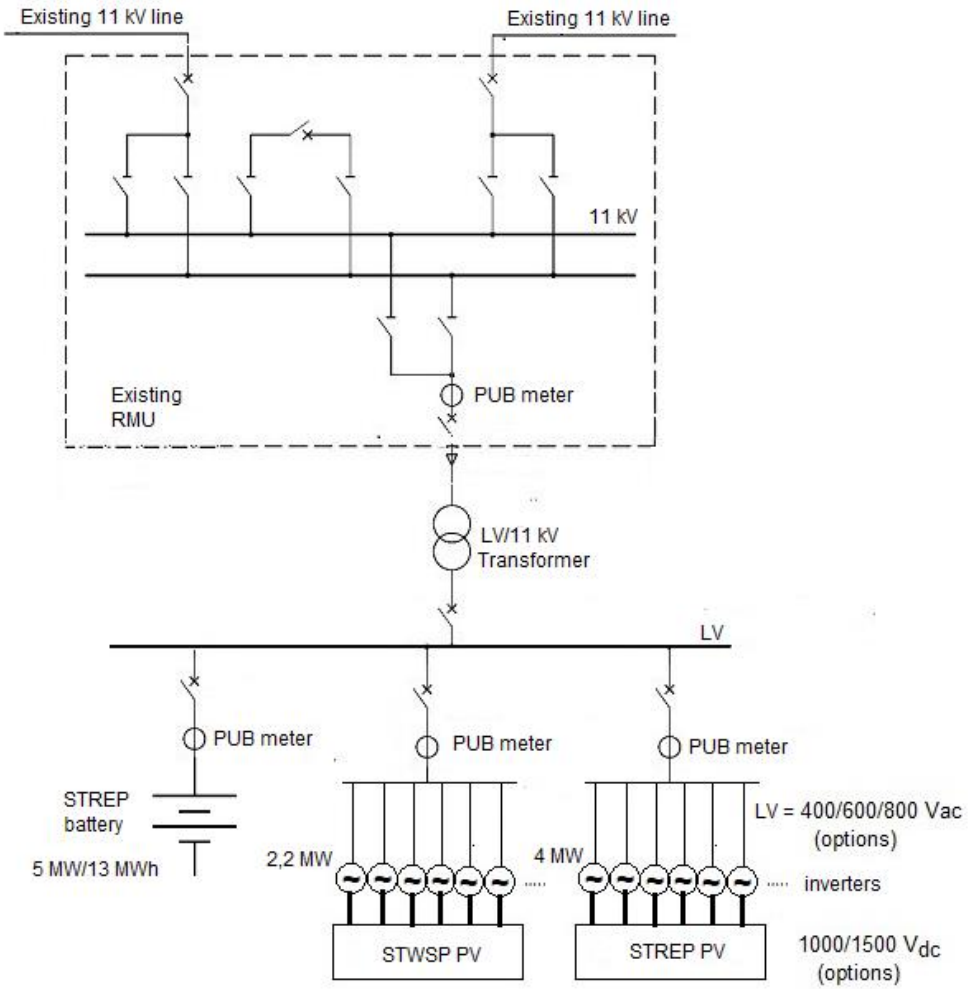
- Silicon panels – approximately 15,000 panels. These will be 'solid-state', with no liquid chemicals, gases or heavy metals that can leak. The panels will be 80% glass and 20% aluminum (frame).
- Panels will be fixed to the ground at a set angle to maximize the exposure to the sun (they won't move through the day or through the seasons).
- inverters located at the access road sides.
- Lithium-ion batteries, stored in a series of purpose-built containers on site. These will be designed to prevent damage to the batteries and contain all spills and have air conditioning and venting to ensure the batteries don't get too hot.
- Transformer and transmission equipment.
- Existing North-South road upgraded (aggregate) to 4m wide.
- A partially new path on the east side of the site fence.
- Reception and parking areas, 295 m^2.
- Perimeter security fencing.

30. Associated facilities such as laydown areas and temporary offices or workshops, can be set up within the perimeter of the project area. Workers will be accommodated within existing guest houses or rental properties within commuting distance of the site.

31. The power evacuation will be done through the existing 11 kV lines. One line passes at around 200 m from the site and the PV project connection to the grid is at 700 m from the site following the existing roads.

32. A schematic is shown in Figure below illustrating the connection of the PV panels to the batteries and to the distribution network via transformers.

Figure 3.4: Schematic of the PV Panels



3.4 Construction Activities – 5 MWp Solar PV

33. The duration of the construction period is expected to be no more than six months. Construction will occur during normal working hours – 7am – 5pm Monday to Friday, and possibly 7am-5pm on Saturdays. No work will be carried out on Sundays. Workers will be a mix of foreign specialists and local labor. Installation of the Solar PV panels and associated equipment (inverters, battery containers, transmission etc.) will involve small-scale construction activities consisting of light machinery and manual labor under the supervision of trained personnel. No specialized equipment will be necessary.

34. The entire 13ha site will be permanently fenced and the public will be excluded from site access. The project will attempt to keep the roads that are commonly used open and unobstructed throughout the construction period, including the main unsealed road used (north-south), which

runs north-west to south-east through the STREP site. The existing path from the northern ring road through the Reserve will be shifted to the east of the STREP site and will join the existing path leading to the airport boundary to maintain pre-project access for Bonriki residents to the south via the airport runway.

35. Site preparation will include removing all vegetation from the 13ha site. No earthworks or land contouring will be necessary unless the contractor finds old pits that require filling. If this happens then clean sand and / or aggregates will be used to reduce the risk of groundwater contamination. Ground compaction is not necessary. Panels will be installed on 6ha of the site. They will be installed on poles or ballast-mounted structures using block foundations that sit above ground, rather than large underground foundations. This will limit the scale of earthworks and the demand for aggregates and will assist with site drainage by avoiding the penetration of the ground and the creation of hardstand or compacted areas.

Figure 3.5: 'Solid state' silicon solar panels with ballast foundations

36. Minor works may be required to create preferential drainage paths and any other drainage features such as soak pits. There is unlikely to be any excess soil to manage but any small volumes of leftover soil will be used on site where possible and otherwise stored or disposed as clean fill at a designated site on South Tarawa to be agreed with PUB and the local council. If additional fill is required, or sand is required for concrete mixing, then this will be from other construction projects on the island or from dredged sand from licensed sources. There will be no use of borrow pits (existing or new) from the water reserve area or elsewhere on South Tarawa.

37. If poles, rather than concrete ballasts are selected for the PV panel frames, these may be installed using pole-drivers; the latter create a steady banging noise during operation which can be loud and will be a major source of noise on site. Other sources of noise emissions will be vehicle noise. Ballast-mounted anchor blocks will be manufactured offshore and imported to Kiribati.

38. Dust emissions may be possible during vegetation clearance in dry and windy periods until such time as vegetation has re-established. Emissions are likely to be low, due to the lack of ground disturbance and the lack of significant winds for most of the time in South Tarawa.

39. The site is easily accessible by existing roads. Traffic will predominantly be staff travelling to and from the site. Light machinery will be mobilized to the site and removed at the end of the construction period. Transportation of construction material and equipment will be on flat bed or high-sided medium-sized trucks. Excess vegetation and / or aggregates will be transported to a designated storage or disposal areas. The overall traffic movements for this project on a daily

basis will be low and readily absorbed into the main road traffic but will be noticeable to people using the roads into and through the water reserve area. Roads within the water reserve may be closed or use restricted at times to allow for road improvements.

40. Prior to and during the construction period an enrichment planting programme will be implemented by MELAD and the local community. More detail on this is provided in Section 5.

41. At the end of the construction period temporary equipment and machinery will be removed, and work areas will be restored, all waste removed and the vegetation under panels established. Storm water systems to capture, treat and store or discharge storm water to ground will be operational. All public roads will be open. The site will be permanently fenced, security systems installed and personnel will be employed.

3.5 Operation and Maintenance

42. The solar PV plant will boost renewable energy generation. The existing and upgraded control systems and batteries will ensure grid stability by controlling the source of electricity into the grid as the solar PV systems fluctuate and load changes. The Plant and batteries will reduce diesel consumption while ensuring reliability of customer electricity supply.

43. The generation of electricity from solar PV plants does not have any emissions to air, water or ground. The panels require routine washing with water but without chemicals. Rainfall runoff and wash water runoff from the structures will be concentrated along the downgradient edge and some may be retained for further use or discharged to ground to infiltrate into the freshwater lens. Even if panels were to crack or break, there are no liquid chemicals or gases or heavy metals that could pollute the soil or water. The panels are ‘solid state’, mostly glass. The frames may be galvanized steel, and if so, they may leach zinc over a period of time, depending on the maintenance regime.

44. Traffic movements will only be intermittent PUB staff trips, travelling to site for inspections and maintenance purposes.

45. The risk of batteries leaking or discharging heavy metals and other contaminants into the environment is low if they are well-maintained, retained securely within the purpose-built containers and any leaks or spills in the containers are quickly identified and cleaned up.

46. Panels may be replaced or repaired during their working lifetime. End-of-life panels and batteries will be sent off-shore for recycling and disposal. Panels or batteries that may still have some life, but are no longer suitable for the PUB solar plant, will be repurposed and donated or sold for local reuse.

3.6 Deconstruction / Decommissioning

47. There are no immediate plans for deconstruction or decommissioning of the site and renewable electricity generation will be in demand for the foreseeable future on South Tarawa. The equipment can feasibly be deconstructed and removed from site and the site rehabilitated to its current state or to natural habitat, and / or redeveloped for some other development purpose. Working panels that are no longer required by PUB can be donated or sold for local reuse or be sent off-shore for recycling and / or disposal. Any temporary buildings or structures will be

deconstructed at the end of the construction period and removed off site for reuse by the contractor or in the community where possible.

4 Description of Existing Environment (Baseline Conditions)

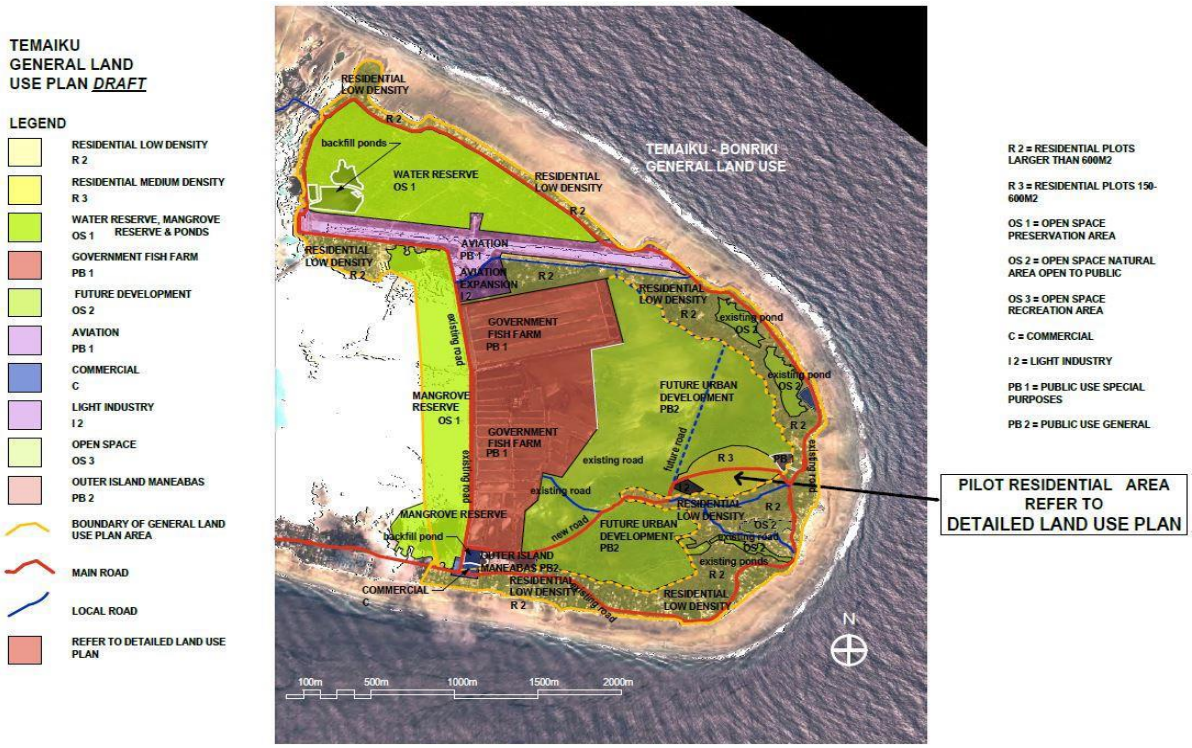
4.1 Site Description and Land Use

49. The solar PV plant will be located at the Bonriki Water Reserve, South Tarawa. The Bonriki Water Reserve is legally designated a Water Reserve under the Public Utilities Ordinance, 1977, now administered under the Public Utilities Board Ordinance, 1978, for the purposes of protecting the freshwater lens (Figure 4.1). The legislation prohibits settlement on water reserves and allows the control of land use by PUB including the eviction of dwellers and land uses not consistent with the purpose of the Ordinance[3]. As a government-leased land, the land is at the disposal of Government and any use inconsistent with the purpose of the water reserve can be dealt with under the Squatters Recovery Act and the PUB Ordinance administered by the Ministers responsible for Lands and PUB respectively.

50. In the wider area the Bonriki International Airport runway and terminal is located adjacent to the southern end of the Water Reserve. The main road wraps around the eastern side of the Reserve connecting South Tarawa and the airport to Buota in the north-west. The Bonriki Reserve is at the east end of an agglomeration of several villages connected by a single long sealed road. The main South Tarawa road stretches across the island to Betio in the west, which is the location of the only shipping port and will be the entry point for any equipment for the project. Human settlement is concentrated along the northern ocean-side boundary and eastern boundary of the reserve. Brackish ponds and marshlands are located at its south western edge.

[3] For further analysis on the history of land acquisition for the purposes of a water reserve refer to the STREP Land Due Diligence Report.

Figure 4.1: Temaiku general land use plan showing the Bonriki Water Reserve



Source: MELAD (2017)

51. Compared to elsewhere on South Tarawa the Reserve area is notably absent of urban development, and predominantly grassland, trees, open space. The landscape character is semi-rural and semi-wild when compared to the urbanization that has occurred elsewhere on the island, even though it is a heavily modified environment. Therefore, it has relatively high value visual amenity.

52. The area is used as a public space and commons, with seasonal and long-term crops and productive trees planting, and harvesting of biomass for food, building materials, firewood and craft. There is a large active cemetery and an open field the size of two football-sized fields which is used for sports and other recreational activities. However much of the development is informal and potentially illegal. Encroachment of residential properties and associated land uses is most visible and intensive on the eastern end; this includes dwellings, gardens, pig pens, burial sites, aggregate mining and home-based businesses. These activities have the potential to reduce infiltration and groundwater recharge and are a source of pollutants affecting groundwater quality (notably hazardous materials and fecal contamination). Aggregate mining pits increase the risk of exposure of groundwater to contamination from surface activities.

53. Roads and footpaths crisscross the area, used by adjacent villages and the informal settlers in the Reserve to access resources and recreation areas within the Reserve and public services and community facilities (churches, school, shops) outside of the Reserve.

54. Land uses and vegetative land cover have changed a lot since at least the 1940s. The United States Navy was responsible for excavating areas on Bonriki and nearby Temaiku to create two runways at Bonriki for military purposes in the 1940's. This created a large amount of bare land. Significant vegetation re-establishment occurred after the Second World War, eventually

reclaiming the secondary runway by the mid-1960s.[4] Gradual encroachment of housing and other land uses, and the development of land reclamation, the sealing of the runway and construction of the causeway and road network around the area have occurred since the early 1980's. These changes have all influenced the quality and hydrology of the Bonriki water reservoir by changing the rate and quality of recharge and future land uses will continue to do so.

55. The delineated 13 ha site for the proposed STREP-funded solar PV plant and future solar investments has specifically avoided dwellings and an inactive cemetery. Site selection was carried out by the feasibility study team and MELAD in late 2019 with the objective to avoid high risk areas and minimize resettlement. The site is covered in grasslands, productive trees (mainly pandanus, coconuts and breadfruits; some wild, others planted) and unsealed roads and footpaths. The trees comprise a 'commons' resource that squatting households and others outside the Reserve occasionally harvest for food, toddy, craft or wood for construction and fuel. This is becoming an important source of herbal medicinal plants collection area for the rest of the people living on south Tarawa, especially those living in crowded areas: Betio – Bikenibeu. Several bwabwai (swamp taro pits) are present. Two PUB infiltration galleries, pump stations, borehole monitoring stations and piping network are located in parts of the site, as well as two privately-dug wells.

4.2 Geology and Soils

56. Tarawa atoll exhibits typical geological features of an atoll; its structure is the remains of a sinking volcanic mountain. Coral reef formations at the rim of the submerged volcano have created a thin layer of dense, hard limestone. The atoll soils consist of loose to dense limestone sand and rubble.

57. The three main lithologies are: (i) unconsolidated silt and sand towards the lagoon; (ii) poorly cemented sand and coral gravels inland; and (iii) consolidated sand and coral at depth and towards the ocean side.[5] The soil is alkaline, porous and lacks essential elements and significant organic matter. Topsoil, where present, is thin and predominantly organic matter.

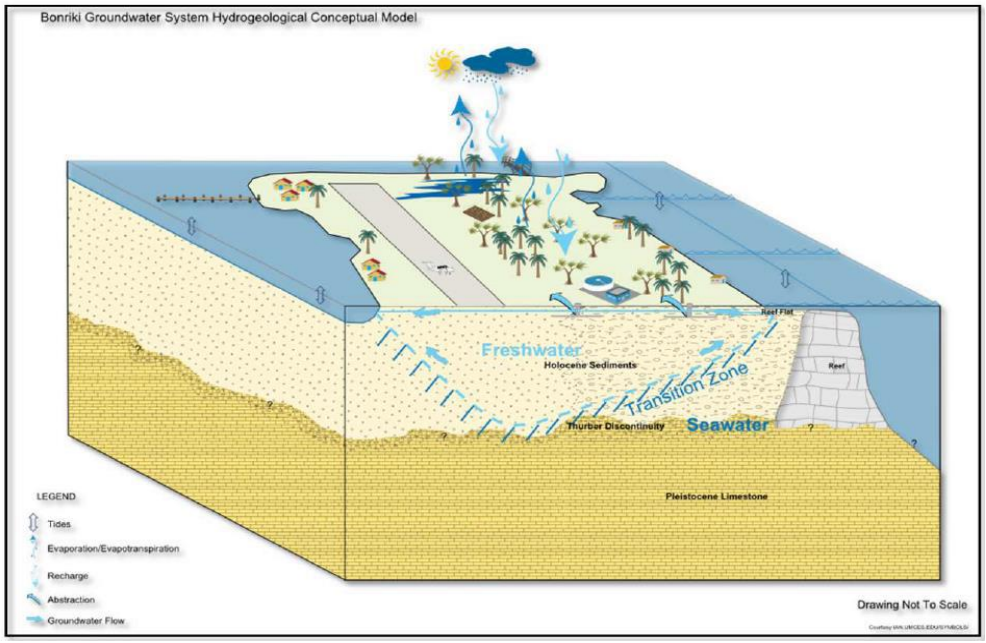
4.3 Topography and Hydrology

58. A topographic survey referenced in the Feasibility Report shows that the Water Reserve area has generally flat topography and less than 5m above sea level. The freshwater lens is 3 – 6 m below ground level. The freshwater lens sits on top of seawater connected to the ocean. Water levels fluctuate on a daily basis responding to the incoming and outgoing tides. The water table sits above mean sea level (AMSL) up to a maximum elevation of 1.5 m AMSL. The maximum freshwater lens thickness was estimated at approximately 15m measured at the center of the island.

[4] Raj, A., Damaliam, H., and Kruger, J. 2015. Bonriki Inundation Vulnerability Assessment. Land Use Mapping. Suva, SPC.

[5] Mack, P. 2015. Bonriki Inundation Vulnerability Assessment. Summary Report. Fiji, SPC.

Figure 4.2: Conceptual diagram of the Bonriki water reservoir



Source: SPC - Assessment of Sea-Level Rise and Inundation Effects on Bonriki Freshwater Lens, Tarawa Kiribati - Groundwater Modelling report – Groundwater Modelling Report (SPC Technical Report SPC00010 2015)

59. Extraction of groundwater from the Bonriki Water Reserve is the cheapest source of water for South Tarawa, compared to large-scale rainwater harvesting or desalination. Therefore, the protection of the water resource to sustain the 53,000 people on Tarawa is of critical importance. The freshwater lens is vulnerable to a number of risks: (i) surface land uses (as described above); (ii) changing climatic conditions, in particular the increasing frequency and intensity of droughts; (iii) over-abstraction for the reticulated water supply in Tarawa; and (iv) overtopping from storm surges or a typhoon event. Notably, the freshwater lens does not appear to be at risk from sea level rise (except as it influences the frequency and intensity of inundation)**Error! Bookmark not defined.**. F urther detail on the water infrastructure is provided in Section **Error! Reference source not found.**.

4.4 Climate and Climate Change

60. Detailed analysis of the historic, current and predicted future climatic conditions for Tarawa have been documented in the Climate Vulnerability Assessment for the Project. Relevant to the environmental assessment is the current and future rainfall and evaporation patterns. Tarawa experiences two seasons; the dry and the wet season. The driest six-month period begins in June, with the lowest mean rainfall happening in October. The wet season usually starts in December and lasts until April.

61. Rainfall patterns are very susceptible to the El Niño-Southern Oscillation (ENSO), where ocean water temperature and currents influence the amount and location of rainfall across the equatorial Pacific. The rainiest years in the historic records are generally related to El Niño cycles, while the driest years are generally related to La Niña events. In years where La Niña events occur the total annual precipitation can be as low as 630 mm (producing severe droughts, with

several consecutive months with hardly any rain), but in years associated to El Niño events, precipitation can be above 3,000 mm leading to flood events.

62. The climate risk and vulnerability assessment (CRVA) assesses that the number of extreme precipitation days is increasing over time (over 65mm per day) and the frequency and intensity of dry spells (which lead to droughts) is increasing. Generally, climate changes are expected in the form of (i) increases in mean temperature; (ii) increases in rainfall and less drought, (iii) rises in mean sea level [about 33cm under worst case predictions compounded by high tides and storm surges]; (iv) increased sea temperature by several degrees and possible coral bleaching; and (v) acidification of seawater bringing damage to coral reefs through dissolution. Due to location, cyclones are not expected to affect Kiribati more frequently and inundation threats are more likely to arise from high tides and storm surges. The projection years of 2050 and 2080 were chosen for the CRVA analysis, consistent with the expected design life of the deliverable project infrastructure.

63. **Surface air temperature and sea-surface temperature**. Annual mean temperatures and extremely high daily temperatures will continue to rise, and warming will be large compared to natural variability. Temperatures in Kiribati have warmed and will continue to warm with more very hot days in future. The annual average air temperature and sea-surface temperature will also increase. By 2030 this increase may be as high as 1.6°C by 2050 and 3.0°C by 2090 under the worst cases. The annual mean temperature could increase from 28.12^{o}C to 30.44^{o}C by 2080. Extreme maximum temperatures are also projected to increase.

64. **Annual and seasonal mean rainfall**. Most models predict increased average annual and seasonal rainfall in the 21st century. In Kiribati extreme rainfall events are projected to increase, and drought to decrease. Droughts, usually associated with La Niña years, can be severe in Kiribati.

65. Average rainfall is predicted to increase and there is moderate confidence that the number of droughts will decrease. Forecasts for Kiribati also suggest both increased average monthly rainfall in 2080 and show more frequent extreme rainfall days with greater intensity. However, none of these increases are significantly different from zero (no change in precipitation), suggesting uncertainty over whether any change in average precipitation levels will occur.

66. **Mean sea-level rise.** Sea level near Kiribati has risen and will continue to rise throughout this century. By 2030, under the worst-case sea-level rise in the range of 7–17cm is forecast. By the end of the century sea levels around the Pacific are projected to rise by at least 26-55 cm

67. The sea-level rise near Kiribati measured by satellite altimeters since 1993 ranges from 1–4 mm per year, compared with the global average of 3.2 ± 0.4 mm per year. The change is partly linked to a pattern related to climate variability from year to year and decade to decade. The sea-level rise combined with natural year-to-year changes will accentuate the impact of storm surges and coastal flooding, especially for the low-lying atolls of Kiribati, which are on average only 2m above sea level. Table 4.1 provides a summary of sea-level rise projections for the Gilbert Islands for four scenarios, illustrating the expected sea-level rise through to 2090.

68. Even moderate sea-level rise can result in extreme sea level events associated with high tides and storm surges that will occur more frequently. In Kiribati the perception is that king tides have become more frequent. This would be due to a combination of increased frequency of La Niña which forces sea levels to increase; further exacerbated by sea-level rise.

69. For example, the average time period that sea levels exceeded a level of 2.8m above SEAFRAME datum in the 1970s was more than five hours per year. This exceedance has subsequently increased (e.g. > 28 hours between 2000 and 2008). Long-term sea-level rise will continue to push sea levels higher resulting in high tide levels exceeding current king-tide levels more frequently. By convention ("rule of thumb") occurrence of flooding events trebles for every 0.1m of sea-level rise. Therefore, transport infrastructure designed for a 1-in-100-year flooding event (a common design criterion), could experience the same flood every few months after the sea level had risen 0.5 m.

Table 4.1 – Sea-level rise projections for the Gilbert Islands

Emissions scenario	Year (cm)			
	2030	2050	2070	2090
Very low	7-17	13-29	18-44	23-59
Low	7-16	13-30	20-47	27-66
Medium	7-16	13-29	19-46	28-67
Very high	7-17	16-33	26-56	38-87

Source: Australian Bureau of Meteorology and CSIRO (2014)

70. The mean sea level naturally fluctuates from year to year due to the ENSO. Episodic increases in sea level are driven by shoreward wind-driven water circulation and atmospheric pressure. However, the literature shows the mean sea level has increased in Bonriki area at an estimated average rate of approximately 2.7-3.8 mm per year during 1980-2014, in line with the global average (2.8-3.6 mm per year).[6]

71. The most recent assessment of projected climate change in Kiribati within the context of the Pacific-Australia Climate Change Science Adaptation Planning project, 2015 indicates that sea level will rise between 7-17 cm by 2030, 13-29 cm by 2050 and 23-59 cm by 2090 under the lowest emission scenario (RCP 2.6), and between 7-17 cm by 2030, 13-33 cm by 2050 and 38-87 cm by 2090 under the highest emission scenario (RCP8.5).[6] The CRVA notes that there is additional uncertainty as to the sea level changes due to the annual variability in sea level which is driven by ENSO. El Niño events cause higher sea levels in Kiribati and westerly storms, which can drive waves into the lagoons and intensify flooding. Furthermore, there is uncertainty associated with projections of the Antarctic ice sheet contribution.

72. The risks of sea level rise are increased coastal erosion, flooding and inundation.

73. **Extreme storms, storm surges and cyclones.** Kiribati lies just outside the main tropical cyclone belt in Southwest Pacific. Tropical cyclones hit about once per year, and rarely pass within 400km of Kiribati. Three cyclones passed within 400 km of both Arorae Island (west) and Caroline Island (east) between 1969/70 and 2009/10. Whilst all of the project islands are located outside the major cyclone path and of low to moderate cyclone risk, the Gilbert Islands are considered to be vulnerable to other important extremes including extreme sea levels and storm surges

[6] STREP Climate Risk and Vulnerability Report.

associated with an increase in the incidence of cyclones and extreme storm events. There is a greater increase in losses projected for more extreme events.

74. However, it should also be noted that there is considerable variation in cyclone and storm hazard patterns across the archipelago and even between islands in the same atoll, due to local variation in geophysical and climatic factors. Coastal inundation is a constant concern on low-lying islands in Kiribati. Because Kiribati is close to the equator (latitude 1°north), it is not threatened by cyclone-generated inundation. Rather, inundation is expected to be triggered by high storm tide levels or swells, or the occurrence of extreme storm and tropical cyclone activity, together. For example, the northern atolls face a greater risk of cyclonic winds and storm surges than the southern atolls, where the risk is much lower because of proximity to the equator.

75. **Increasing sea surface temperatures.** Sea surface temperatures locally have risen gradually since the 1970s by approximately 0.15°C per decade and there is high confidence that sea surface temperature will increase by 0.4-1.0^{o}C by 2030 and 2-4^{o}C by 2090.

76. **Ocean acidification.** Based on information from the Pacific Climate Change Science Program, ocean acidification due to dissolution of carbon dioxide has been slowly increasing (reducing the pH) in Kiribati's waters for two centuries and will continue to increase, threatening coral reef ecosystems.

77. **Effects of changing climate**. The effects of sea level rise, storm surge, coastal erosion and saltwater intrusion increase Kiribati's vulnerability given that most of its atolls are only 1.8 meters above sea level. Sea-level rise also threatens saltwater intrusion and the loss of the freshwater lenses under the islands. Forecasts from recent scientific studies show that climate change is also likely to have substantial impacts on Kiribati coastal and oceanic fisheries, their habitats and reefs. Climate change is projected to alter ocean temperatures and currents, with resulting impacts on oceanic marine ecosystems.

78. **Decline in coral reefs and coastal fisheries**. Rising sea surface temperatures and more acidic oceans will likely impact on the growth of hard corals (and their complex fish habitats). Degraded coral reefs are likely to support different types of fish and perhaps lower yields. This may be a significant concern for Kiribati as it is likely to result in reduced catches of reef fish, with significant ramifications for food security and fisheries development.

79. **Damage to infrastructure**. More powerful storms are predicted, with increased risks of damage to wharfs and essential infrastructure. This may also create higher financial risks for operations in coastal areas due to more frequent damage to structures and equipment.

4.5 Ecology and Biodiversity

80. Kiribati marine ecosystems are part of the Polynesia-Micronesia Biodiversity Hotspot, one of 34 regions of the world where extraordinary levels of biodiversity and endemism (species unique to a known and defined area) are coupled with extremely high levels of threat.[7] The main threats associated with this degradation include climate change, pollution (water and land), overfishing,

[7] ECD, MELAD. 2013. Key Biodiversity Area Report

invasive species, overpopulation, and infrastructure developments. The main driver for the identified threats is rapid urbanization particularly on South Tarawa.

81. The Nooto-North Tarawa Conservation Area was officially established in 1996 as a Ramsar site.[8] It is complex system of relatively pristine and healthy representative coastal wetland ecosystems which are significant for the bio-ecoregion including a wide range of coastal habitats such as lagoons, coral reefs, intertidal mudflats, and mangroves that support a high biodiversity and are resource rich, with a wide variety of finfish, turtles, crustaceans, seaweed and other plants. It is one of the few areas where mangroves are found in the whole of Kiribati, with stands of mangrove dominated by a single species, *Rhizophora stylosa*. The site is an important breeding area for marine species of conservation value, such as the globally endangered green turtle (*Chelonia mydas*) which nests and forages at the site, the vulnerable giant clam (*Tridacna gigas*), and the near threatened bonefish (*Albula vulpes*).

82. The North Tarawa lagoon was also proposed as a key biodiversity area due to its habitat for endangered species; Green Turtles (*Chelonia mydas*), Big Eye Tuna (*Thunnus obesus*), Humphead Wrasse (*Cheilinus undulates*) and Giant clam (*Tridacna gigas*).

83. Terrestrial biodiversity in Kiribati, by comparison to the marine ecosystem, is not particularly rich or endemic and what exists is threatened by human development and expansion activities across a limited land area. Furthermore, there is insufficient data to accurately assess the vulnerability of native species.

84. Coconut trees (*Cocus nudifera*), pandanus or screw pine (*Pandanus tectorius*), two breadfruit species (*Artocarpus altilis* and *A.marianensi*) and giant swamp taro, or te babai (Cryptosperma chamissonis) are all considered indigenous, but most likely brought by i-Kiribati to the islands.[8]

85. Mangrove, coral, and sea-grass ecosystems, which occur around South Tarawa, are of conservation significance and are under threat from urbanization.

86. The most significant invasive alien species currently existing in Tarawa include: Pacific or Polynesian rat *Rattus exulans*; Ship rat – *Rattus rattus*; House mouse – *Mus musculus*; all detrimental to sea bird populations and sea turtle eggs; and wedelia – *Wedelia Trilobata*, a creeping mat-forming herb and *Cassytha filiformis* which both displace native vegetation.

87. No site surveys of biodiversity have been carried out on the Bonriki Water Reserve area for STREP and none have been found in the literature. Plant species noted during the November 2019 site visit included coconut palms, pandanus, swamp taro and breadfruit. It is possible that there are communities of native plants, such as herbs, grasses, groundcovers and shrubs that exist despite the highly modified area. A botanical and fauna survey to identify any specific values at the site that may be affected by the development, and the invasive species to manage, will be undertaken during the detailed design stage.

[8] Ministry of Foreign Affairs and Trade. Jacobs. 2018. Temaiku Land and Urban Development Project Feasibility Investigations - Environmental and Social Impact Assessment. ESIA Volume 2: Environmental Impact Assessment (Terrestrial).

4.6 Summary of Ecosystem Services

88. Ecosystem services are mentioned in the above sub-sections and summarized as follows:

- Provisioning services – people gather food, drink, medicine, firewood, building materials and craft materials from the site and use the site for cultivation.
- Regulating services – the site is part of the Bonriki Water Reserve and is the recharge zone for the Bonriki freshwater lens.
- Cultural services – even though there are legal restrictions the site is used as open space where people can recreate or gain aesthetic enjoyment, which is rare on South Tarawa. Furthermore, materials are gathered from pandanus plants and other plants for craft and food relating to cultural practices.

4.7 Socio-economic Context

89. Typical of urban areas in small island states in the Pacific, South Tarawa is experiencing in-migration from other islands as it is the center for economic and public sector activity and provides health and educational opportunities not available in the outer islands. Currently in-migration into South Tarawa accounts for about one third of the overall population growth rate.[9]

90. South Tarawa has a total population of approximately 53,000 with 96% of the population identifying as i-Kiribati. The population density is approximately 2,700 people per square kilometer (km^2).[10] Within the urban areas, such as Betio, it reaches approximately 10,400 people/km^2 which is the highest density in the Pacific except for the Marshall Islands.[11,12] The population of South Tarawa is expected to double by 2030.[13]

91. Infrastructure development and land use planning has not kept pace with a rapidly growing population. Only 77% of households are provided water by PUB (either by reticulated pipe network or water truck).[13] The remainder of households rely on rainwater, wells or a combination. Piped water supplies are available for only two out of every 48 hours and it is common for PUB customers to also use other sources of water. Only 40% of households in South Tarawa have access to improved sanitation facilities, such as flush toilets connected to the PUB sewerage system, flush toilets connected to septic tanks, or compost toilets. Of this, a little over half have access to centralized sewerage systems, with access unevenly distributed within and across villages.[13] Systems are poorly maintained, and overflows are common. The existing PUB system discharges screened sewerage, without treatment, to the ocean, in close proximity to shore. There

[9] MELAD. 2014. Kiribati Adaptation Program Phase III (KAP III). Governance and Land Management Advisor to the Government of Kiribati Buota and Bonriki Water Reserves Task Force. Final Baseline Situation Assessment Report.

[10] This is the type of density comparable to major cities such as Sydney (2,000 people/km^2) or Paris (3,900 people/km^2). Data retrieved from www.ourworldindata.org; February 2020.

[11] And is comparable to Chennai (9,700 people/km^2) or Delhi (11,600 people/km^2). Data retrieved from www.ourworldindata.org; February 2020.

[12] Population densities in some of the urban settlements in Marshall Islands exceed 28,000 people/km^2 (United Nations Population Fund. 2014. Population and Development Profiles; Pacific Island Countries.).

[13] ADB. 2014. Economic Costs of Inadequate Water and Sanitation, South Tarawa, Kiribati.

is still a high rate of open defecation on the beaches, even within households with access to improved sanitation facilities.

92. Overcrowding and inadequate infrastructure affect public health and the environment and put pressure on natural resources. Wells are contaminated by sewerage seepage and overflows. The nearshore coastal environment has suffered from overharvesting and from pollution from untreated sewage resulting in bioaccumulation of bacteria on important food source like fish and shellfish. Food and water contamination affect health, mortality and economic productivity. As an example, over the period 2010–2012, there were 35,000 reported cases of illnesses per year related to water, sanitation, and hygiene, including diarrhea, dysentery, conjunctivitis, and fungal infections including ringworm. This rate is very high for a population of 53,000. However, many more cases are estimated to go unreported.

93. The incidence of poverty is greater in South Tarawa than elsewhere in Kiribati. According to the national basic needs poverty line the incidence of poverty was 21.8% nationally and 24.2% in South Tarawa in 2006 (the most recent data set). As in many Pacific islands, poverty is concentrated in households where the household head has a lower level of formal education.[14]

94. Near the project site, the population of Bonriki is approximately 2,800, one of the smaller South Tarawa villages. The STREP Land Due Diligence Report outlines the history and legacy of the Government's land acquisition process for the Water Reserve, indicating several decades of grievances from both the process and the resulting constraints on land use in the Reserve. This includes several attempts to evict illegal squatters.

95. The community consultation on 23 November 2019 discussed STREP and its land needs.[15] The records show no negative comments regarding the government's control and use of the reserve land and unanimous support for the proposed STREP solar PV plant at the proposed site. Comments received were more about the unreliable supply and high cost of electricity, support for harnessing solar energy to replace diesel to reduce dependence on imported fuel, and the hope that STREP will produce a reliable supply and more affordable electricity.

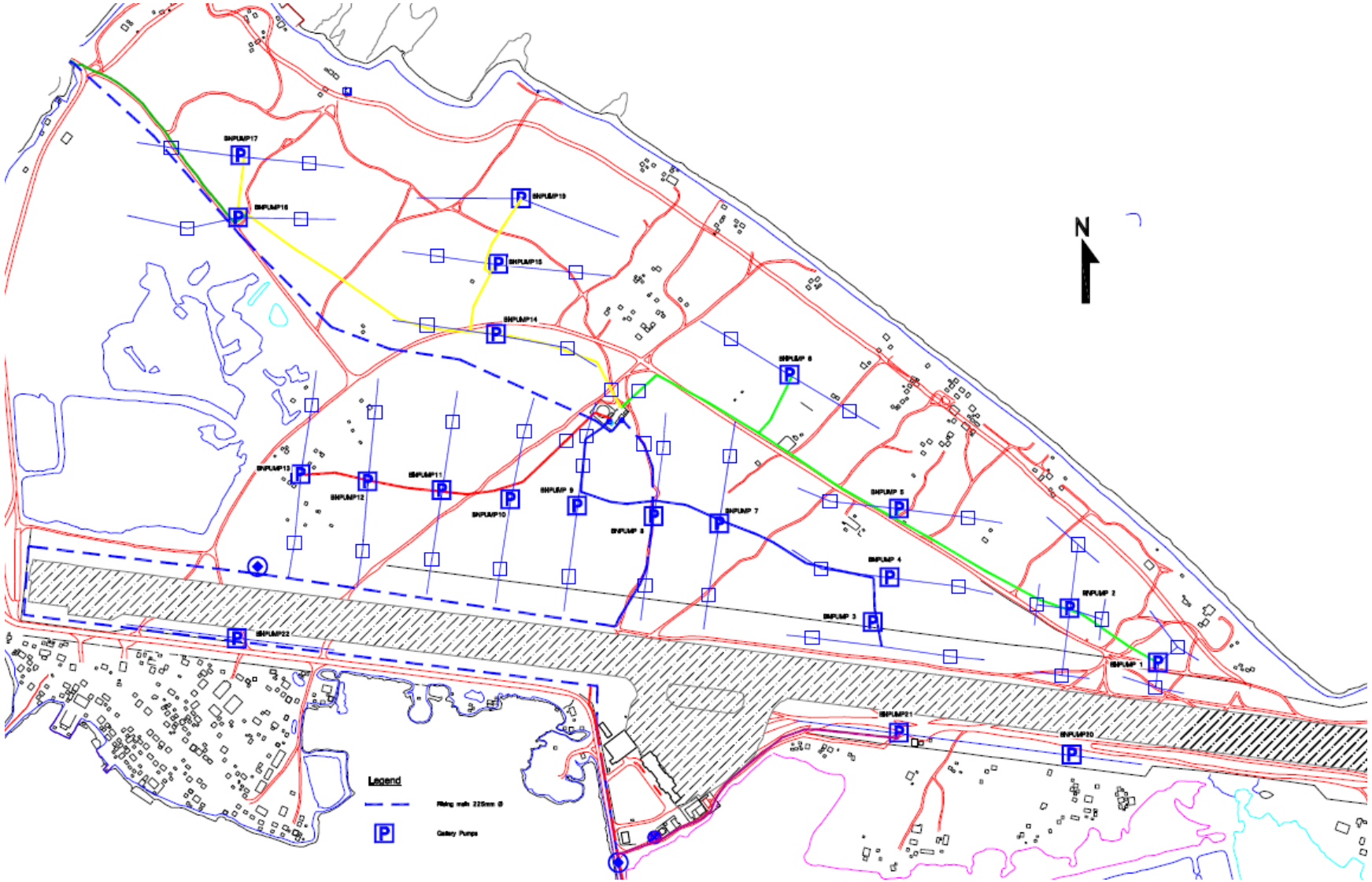
4.8 Critical Infrastructure and Relevant Concurrent and Future Developments

96. The PUB have a series of infiltration galleries to supply the South Tarawa water supply scheme. Figure 4.3 shows the location of the galleries and pumps. This is critical infrastructure that must be protected.

[14] World Bank. 2018. Poverty and Equity Brief. Kiribati. http://documents.worldbank.org/curated/en/767551528203422506/pdf/Kiribati-PEB-Spring-2018.pdf

[15] ADB – STREP. 2020. Social Safeguards Due Diligence Report and Resettlement Plan

Figure 4.3: Bonriki gallery pumps locality plan (P= gallery pumps)



97. Also relevant to the STREP solar PV project is the current and proposed solar plants on Bonriki Water Reserve. The PUB has an existing 500kW plant on the Reserve (red in Figure 4.4). The STWSP-funded 2.5MW Solar PV Plant is proposed to be located on a 3-ha site adjacent to the STREP site on the Reserve (black in Figure 4.4). The future solar plant development area identified by the Feasibility Study is shown in yellow on Figure 4.4.

Figure 4.4: Approximate locations of current and proposed solar PV plants on Bonriki Reserve

Note: Red = existing PUB plant; black = proposed STWSP-funded plant; blue = STREP-funded plant and yellow future plant areas

98. On the south side of the runway is the Temaiku area; a mix of unproductive coconut plantations, shrub, milk fishponds and swamps, fringed with urban development. Land was created by filling in an area of lagoon, but it is low lying, prone to inundation and experiences high salinity in the soils and groundwater lens. This is the other remaining green space area in South Tarawa, with similar informal land uses, harvesting, recreation and gardens.

4.9 Summary of Sensitive Receptors

99. Bonriki freshwater lens is sensitive to changes in land use that increase risks of pollution, increase salinity and reduce the volume of freshwater. This leads to the vulnerability of Tarawa residents to reduced access to fresh water, particularly in times of drought, as a result of changes to the quality and availability of freshwater from Bonriki.

100. Households adjacent to the site, including the house in the middle of the site will be sensitive to the loss of visual amenity and to construction-related nuisances (noise, dust, traffic disruptions). They will be sensitive to any increased flooding risks. Households and communities with connections to the cemetery are sensitive to temporary loss of access to burial sites and any risk of damage, desecration or disturbance to sites.

101. Communities that derive benefit from the use of open space, trees and land in the Bonriki Water Reserve are sensitive to any loss of benefit, particularly those that depend on the resources for subsistence or livelihoods. Communities are vulnerable to reducing access and connectivity across the site to schools, friends and family, work, markets and the main road network.

102. Landowners are sensitive to the ongoing control of land use by PUB.

103. The unique biodiversity of Kiribati is vulnerable to loss of habitat, mammalian pests and invasive weed species.

4.10 Unexploded Ordinance

104. Based on the consultations during Project preparations, UXO are not considered to be a risk. The reason is that during World War II, the Americans and Japanese fought a battle in Betio, which is 40 km away from Bonriki at the other end of South Tarawa and was not connected to it by a land bridge at that time. In previously conducted work in Bonriki for both the ADB and World Bank, including water pipeline projects and retaining walls, UXO surveys were not undertaken as they were not considered to be a risk.

5 Environmental Impacts and Mitigation Measures

5.1 Overview

105. This IEE provides an analysis of the anticipated environmental impacts associated with the Project as recommended by the feasibility assessment. Environmental safeguard measures will be incorporated into the Project as described below.

106. **Design and pre-construction phase**. This IEE and EMP will be updated as the solar PV project is further defined during the detailed design phase. This IEE and EMP will be included in the bid documents for the design-build-operate contract. The contract will be subject to compliance with any updates to the IEE and EMP. Environmental mitigation measures, including feedback from stakeholders, will be incorporated into project design. Baseline surveys for ecology and noise will be conducted during the detailed design, this will confirm if any flora or fauna at the site requires any specific protection measures and will assist in further defining habitat enhancement opportunities and invasive species control measures and management requirements. The noise baseline will provide ambient measurements at specific sites and closest sensitive receptors to provide additional information for the contractor to address in their CEMP. The updated IEE and EMP will be submitted as part of the approval process under the CSS. The design-build-operate contractor may mobilize to site but not commence works (including site clearing) until a notice to proceed is issued. The contractor shall prepare a site-specific construction EMP (CEMP), including sub-plans as specified in this IEE and EMP, which will be reviewed and approved by the PUB (supported by the CSC which will include an environmental specialist). No physical works (including site clearance) will be undertaken before the CEMP is approved.

107. **Construction phase**. The period from the time that the 'notice to proceed' is issued to the contractor to when the 'certificate of completion' is issued. The contractor will complete the project as per the design and technical specifications and implement the measures included in the approved CEMP. This process will be monitored and documented by PUB's Supervising Engineer.

108. **Operation and maintenance phase**. The period starting when the 'certificate of completion' has been issued until the end of the agreed lifetime of the project. The PUB will be responsible for implementing the measures identified in the operation phase of the EMP to mitigate impacts from operating and maintaining the plant.

5.2 Design and Pre-Construction Impacts

109. Most impacts for this project will be managed through good design and effective stakeholder engagement. Therefore, engaging land owners and the community early and meaningfully, and making good design decisions during this phase are important to determining the overall risks and impacts of the project.

110. **Site selection, resettlement and loss of access to assets and land uses.** Locating the Solar PV Plant on the Bonriki Reserve has significant benefits – it contributes to protecting the critical freshwater lens while minimizing resettlement, and it will improve North South access across the reserve. The impacts of using the site relate primarily to the loss of access to gardens, open space and natural resources on the reserve by land owners and community members.

111. The current layout has avoided the resettlement of people, assets and graves, which is a significant benefit for South Tarawa given the high population density and urbanization elsewhere on the island. Some footpaths will be removed and connectivity may be affected as a result.

112. There are few locations left on South Tarawa that could host a 5 MWp / 13 MWh solar plant. The Reserve status already gives PUB the ability to control land uses. The Resettlement Plan contains conclusions on those who may be affected by the change in land use and would be eligible for assistance under the Project as follows – (i) landowners who will continue to receive lease payments for land occupied; (ii) owners of trees that will be removed from the site; (iii) 3 households who draw water from two water wells in the Project site. Furthermore, enrichment planting in the 20m buffer will compensate for the loss of plants from the Project site.

113. The solar PV plant is compatible with the management of the Bonriki Reserve freshwater lens because it will increase the infiltration of rainwater to the freshwater lens compared to the vegetated land use by reducing evapotranspiration.[16] By occupying the site, the solar PV Plant will avoid the potential for further informal and unplanned encroachment onto the water reserve which will avoid the associated risks of water pollution from non-compatible land uses. This is a critical measure which will have long term benefits for the Bonriki freshwater lens and the South Tarawa community that rely on it for potable water supply. The proposal is consistent with the work completed by the Buota and Bonriki Water Reserves Task Force under the Kiribati Adaptation Program for sustainable management of the Bonriki water reserve [17] which recommended more control of high risk land uses, reduced number of coconut trees (phreatophytes which draw water directly from the lens), reduced polluting land uses and enabling low impact or beneficial land uses such as solar PV plants.

114. Some existing land uses will be protected by the solar PV plant development, which is also a positive outcome of the feasibility stage design. The cemetery will not be disturbed and a residential property will remain; the panels will be installed around these two areas and access will be maintained or improved by the proposed upgrades to the north-south road. The Project will not disturb the operation of the PUB infiltration galleries and pump stations. The development will improve the existing north-south road, increasing the ease of access between the villages to the North and the main road to the south.

115. Some existing land uses will no longer be possible at the site – this includes the informal gardening, harvesting, recreation and use of footpaths. The Resettlement Plan has concluded the compensation arrangements for the loss of trees and crops, including who receives payment and the value of payment. The loss of access to natural resources (both wild and planted) may affect people from providing food or income to supplement their own gardens or formal income, or affect their ability to contribute to social or cultural occasions or to meet their community obligations. This can affect social capital in a community. Private gardens are diminishing in South Tarawa due to the demand for land for dwellings and other purposes, and many families with urban lifestyles don't have the time for gardening. The Resettlement Plan is proposing enrichment planting to offset the loss of plants within the project site. The scale of impact needs to be determined through further consultation with affected communities.

[16] Further information on hydrological impacts below.

[17] MELAD. 2014. KIRIBATI ADAPTATION PROGRAM PHASE III Buota and Bonriki Water Reserves Task Force Draft Scope of a Sustainable Management Plan for Buota and Bonriki Water Reserves.

116. The loss of ecosystem services will be exacerbated in future by the cumulative impacts of adjacent solar PV plant developments on the Bonriki Reserve. Losing food-producing areas may put further pressure on the long term food security of the atoll.

117. The households that will lose the access to the privately-dug wells will be compensated with the provision of water tanks.

118. The loss of footpath access for locals is expected to be minor, since there are alternative routes available, but further consultation will confirm whether additional roads or footpaths should be included in the project layout if significant connectivity issues are possible.

119. **Stormwater management and infiltration into the Bonriki freshwater lens.** The CRVA predicts more intensive rainfall periods which may bring higher daily rainfall events leading to surface ponding or flooding on the site or down gradient of the site. In addition, the **s**olar PV plant will contribute a larger quantity of rainfall into the freshwater lens compared to the existing ground cover of trees and grass land (discussed in more detail under the operational phase impacts in Section 5.6). Solar panels concentrate rainfall into drip lines and this can create rill or scour erosion gradually over time, or during significant rainfall events. Design of effective storm water management is the primary mitigation measure to: (i) avoid ponding and flooding; (ii) minimizing erosion; and, (iii) maximizing infiltration of clean fresh water into the lens. The design phase mitigation measures include:

- Ballast mounting of ground mounted solar arrays to reduce the need to contour and compact the ground;
- Design stormwater collection around natural contours, and including minor site contouring in site works design where necessary to assist with the optimal distribution and flow of storm water and facilitate infiltration to ground;
- Consider the alignment and tilt angle of panels and arrays to reduce flooding and erosion risks in peak events (where this does not impact on generation capacity).
- Design land cover (grasses, ground cover plants) that will assist in trapping sediments and assist with ground infiltration;
- Design soak pits and other devices and structures at key locations to assist with infiltration and reduce the risk of ground ponding of rain water;
- The site should not contribute any additional risk of surface ponding or flooding outside of the project boundary;
- Design rainwater collection from the PV array and direct to ground to maximize infiltration and avoid flooding potential;
- Consider the future adjacent Solar PV Projects in the design of stormwater facilities, so as not to compromise the ability of future project to effectively manage flooding, ponding and ground infiltration.

120. **Landscape and visual impacts.** The solar PV plant will permanently change the landscape character in the area, replacing open space and green space with an industrial character - orderly lines of panels repeated over 6 hectares. It will contribute to the gradual development of the Reserve from other structures (including other solar projects) and dwellings (both formal and informal). Green space, with a semi-rural or semi-wild outlook, is now rare on

South Tarawa; and the Bonriki Reserve and the Temaiku area nearby are the remaining spaces, although they are both highly modified.

121. The site has been a mix of trees and grasslands for many decades, and changing the landscape reduces the visual amenity and changes people's sense of place and connection to the area.

122. The people most sensitive to the change in landscape character are those who live or work nearby and currently experience the most benefit from the green space. The residents along the eastern and northern site boundaries will be most affected, along with the household that will remain in the middle of the site. Others who use the Reserve for walking / connectivity, recreation, harvesting and other purposes will also be affected by the reduction in the open space / green scape character. The view from the main road will also change in the same manner.

123. The addition of further solar PV installations will have a cumulative impact on the loss of green space and open space on Bonriki Reserve, and in the medium term the development of Temaiku will further add to the urbanization of the wider area. The intensive reclamation and redevelopment of Temaiku will remove all vegetation, ponds and swamp areas and replace with a mixed-use urban landscape.

124. The loss of open space cannot be mitigated without providing offsets elsewhere, but the landscape character of the area may be retained or at least mitigated somewhat by maintaining and enhancing a vegetated buffer between the residential properties, the main road and other major viewpoints. MELAD's enrichment planting plan (Annex 5) within the 20m buffer at the northern (ocean side) site boundaries, which will provide some mitigation to loss of open space. This buffer is also proposed in the Resettlement Plan to compensate for loss of biomass and food / fibre / medicine. The site boundary is currently set back from the roads and residential areas which also allows for a natural buffer if vegetation is maintained. During detailed design the layout can be optimized to ensure this buffer will be maintained and enhanced as part of the Project.

125. **Ecological impacts.** No ecological or biodiversity values have been identified in the literature and due to the highly modified environment it is anticipated that there will be no significant ecological impacts from the Project. However, a botanical survey during detailed design phase is recommended to identify the presence of any plants or communities of plants that may have ecological value and / or value for ecosystem services, and provide any other relevant mitigation measures. As part of this process, the enrichment planting plan can be reviewed and, if necessary, enhanced to provide specific habitat needs.

126. Kiribati is vulnerable to the introduction of new pathogens and invasive species which may be transported to South Tarawa on, or in, materials, equipment and workers. Furthermore, vehicles and earth moving equipment can transport existing invasive plant species or insects around the site and assist in their spread. The potential is highest where the contractor imports used vehicles, equipment or imported aggregates, plant material and soils, but risks are also inherent in the shipping process.

127. Mitigation measures are well-understood, and if implemented correctly should reduce the risk of an incursion or enable an incursion to be managed in time. Mitigation measures to prevent the introduction or spread of invasive species and pathogens will include:

- The tendering documents will specify that the contractor must obtain all required biosecurity and phyto-sanitary clearances (e.g. permits) for any material or equipment imported into Kiribati.

- The contractor will comply with all measures stipulated in the Biosecurity Act 2011 and obtain all permits and clearances for import of any materials and equipment to be used for the project as required by ECD.
- Materials will be inspected and any equipment imported for project purposes will be steam-cleaned and certified under biosecurity and phyto-sanitary procedures prior to use.
- Immediately following clearing and construction, the site will be planted with low growing ground cover to help stabilize the site and minimize the establishment of weeds. The species of ground cover will be selected in consultation with ECD.
- Weed hygiene measures will be implemented to prevent introduction or spread of invasive species, including cleaning machinery before it enters and leaves the site.

128. **Local employment opportunities.** The opportunity for employment of locals should be maximized to ensure direct economic benefits and an opportunity to develop skills. Men are typically employed for unskilled and semi-skilled labor work and for work in the energy sector more broadly. To enhance employment benefits for i-Kiribati and to support gender equality and equal opportunity in employment, the Project will require these outcomes in the tender documentation and monitor efforts by the contractor to comply throughout the period of contract. The North Village community will be prioritised to mitigate the adverse effects of the project. Child labor and trafficked labor is not considered high risk for solar panel installation, but the minimum age for the workforce will be included in tender documentation.

5.3 Construction Impacts on the Physical Environment

129. **Erosion and sedimentation control**. The sandy soils present on site are generally highly erodible when disturbed, however, due to the generally flat location and lack of earthworks in the construction process, erosion potential is slight and readily managed by good housekeeping. Measures to minimise and mitigate erosion at the site will be the responsibility of the contractor, and they will be required to include the following in their work methods:

- Erosion control works and measures will be installed to control surface water runoff and prevent the export of sediments from the site by ensuring: 1) discharge of storm water is to stable preferably vegetated land or to settlement ponds; and 2) erosion control measures closely follow existing land contours to reduce runoff velocity from exposed soils.
- All vegetation clearances will be confined to the minimum practicable working area to ensure that the minimum area of land is exposed to erosion for the shortest possible time;
- Existing drainage lines will be protected and diversion of drainage lines avoided;
- Sediment traps (e.g. silt fences) will be constructed across all drainage lines and erosion controls from site that are likely to receive runoff from exposed or disturbed soils;
- If settlement ponds are used, they will be designed to decant clean water to ground infiltration at a rate not exceeding the natural ground infiltration rate;

- Sediment and erosion control measures will be monitored and maintained regularly to ensure their continued correct functioning;
- Any spoil or aggregates will be stored away from drainage paths and will be covered by tarpaulins or similar where possible to avoid sediment run off.
- A shade tolerant low groundcover (e.g. grass) will be established as soon as practicable after site clearance. The species of groundcover will be selected in consultation with the ECD and local species will be prioritised. The species selected will not shade the PV panels.

130. **Water resources and quality**. Water will be required for small batches of concrete, potable drinking water and ablutions for staff and other incidental uses. Large concrete batching is not anticipated because the panels will be on poles or imported concrete ballast mounds rather than block foundations. Small amounts of batching will be required for the foundation pads for the battery energy storage system and small buildings. Water use is not expected to be significant.

131. The freshwater lens may be negatively impacted through pollution (e.g. accidental spill of hazardous materials (refer Hazardous materials). Storm water design features may alter surface water flow across the project site leading to ponding, flooding or sedimentation of adjacent environments, or run off of accidental spills of hazardous materials. Design features for storm water and construction phase controls for storm water should avoid any off-site discharges. Ongoing monitoring and maintenance is required by the contractor to ensure that all design and construction-related features are achieving this objective.

132. Furthermore, the freshwater lens can be affected in the long term by compaction of soils during construction (for example on the access road and laydown areas). This should be avoided by minimising the hardstand or compacted areas and identifying alternative methods of transportation.

133. Mitigation measures to manage water resources and quality include:

- PUB will determine whether the reticulated supply should be used for construction water supply or whether the project should be self-sufficient, depending on the daily volumes required;
- Following the design outputs, construction techniques will avoid the need to alter the topography unless required to effectively manage storm water and prevent off –site issues;
- Minimise the areas of hardstand, including compaction of access roads, and direct storm water run off from compacted areas to ground;
- Implementation of hazardous material mitigation measures (Refer Hazardous materials); and
- Provision of adequate sanitation facilities for construction workers (Refer Health and Safety)

134. **Use of local materials.** The construction of the project may involve the use of materials such as aggregate for concrete (sand or coralline) and water (refer above). Small amounts of fill or aggregate should be recycled from other infrastructure projects or sourced from the licensed dredging operation on South Tarawa.

135. No existing or new borrow pits will be used from the water reserve area. If suitable local materials are not available, then materials will be imported and will undergo biosecurity treatment and checks as described in Section 5.2.

136. **Hazardous materials**. Hazardous materials (e.g. fuels, oils, chemicals) will be required for construction. The inappropriate transport, storage and use of hazardous materials has the potential to negatively impact the Bonriki freshwater lens or the nearby marine, aquatic, and terrestrial environments.

137. Additionally, in the event of an accidental spill, failure to adequately contain and clean up the spill has the potential to negatively impact the lens and surrounding environment. Mitigation measures will be the responsibility of the contractor, and they will be required to include the following in their work methods:

- As part of the CEMP, the contractor will prepare a hazardous materials management plan that shall, at a minimum, include all requirements of this EMP and the EHSG and include: (i) the type and quantity of hazardous materials that will be present on site; (ii) safety data sheets for all hazardous materials; (iii) a spill response plan, including training, for staff in the use of spill kits; and, (iv) details of planned transport, storage and disposal of hazardous materials (including compliance with commitments contained within this IEE);
- The transport of hazardous materials will be undertaken by an appropriately qualified, experienced and equipped contractor;
- Hazardous materials storage areas will be located at least 50 m from any marine environment;
- Hazardous materials will be stored in appropriate containers that are in good condition with adequate labelling;
- Hazardous materials (including fuel and oils) storage will be appropriately bunded (e.g. self-bunded containers or a bund with a minimum of 110% capacity of the largest container);
- Refuelling will take place in a designated area and drip trays or containment devices will be used when refuelling equipment and machinery;
- Limit the amount of any marine paint to be used on the solar array pylons to no more than two litres at any one time contained within a larger volume drip tray;
- Spill kits and containment devices appropriate for the type and volume of hazardous materials on site will be located at the storage area(s), on site and on vehicles carrying hazardous materials; and
- All personnel involved in the handling of hazardous materials will be trained in the handling, emergency procedures and storage requirements for the materials they are handling.

138. **Waste management**. The project is not anticipated to produce a significant volume of waste. Wastes will predominantly include small volumes of packaging materials and general waste. There are expected to be few hazardous wastes generated during construction however, there are no facilities for the disposal of hazardous wastes.

139. The inappropriate management of waste during construction of the project has the potential to pollute surrounding water, freshwater lens and land. Waste management during construction will seek to reduce, reuse and recycle waste as far as possible and dispose of waste in an appropriate way. Mitigation measures will be the responsibility of the contractor, and they will be required to include the following in their work methods:

- The contractor will prepare a waste management plan as part of the CEMP in accordance with the mitigation measures in this EMP and the EHSG;
- All solid and inorganic waste will be removed from Kiribati to a licensed facility recycling and / or disposal, to reduce the burden on South Tarawa's landfill.
- Hazardous waste (if generated) will be stored appropriately based on the health and environmental risks and removed from Kiribati to a licenced facility for treatment, recycling and / or disposal.
- The contractor will consult with the ECD to identify opportunities to avoid and reduce the generation of waste and to recycle or re-use waste generated. Vegetation may be composted or made available for firewood or other purposes by the community.
- If excess spoil is generated during site preparation it will be stored at an existing stockpile site for re-use.
- Labelled bins for recycling and general rubbish will be provided at the project site and materials laydown area for the disposal of construction wastes and will be removed off site regularly and before the handover of the site to PUB.

5.4 Construction Impacts on the Biological Environment

140. **Removal of vegetation**. The construction of the solar arrays and installation of battery storage will require the removal of approximately 13ha of existing vegetation. This is a moderate size of vegetation to be cleared compared to the overall reserve area; the visual impacts on green space and open space are discussed in Section 5.2.

141. Most of the mitigation measures will be the responsibility of the contractor, and they will be required to include the following in their work methods:

- Vegetation will be made available to landowners and the community prior to clearance, in order to maximise the salvage of crops, fruit, firewood, fibre and other useful resources;
- The project site boundary will be clearly marked on a plan and approved by the Engineer and CSC prior to the commencement of clearing. Trees and vegetation to be removed according to the plan will be physically marked with paint or tape. Only vegetation identified on the plan will be removed;
- Ensure vegetation clearance is restricted to within the project site boundary and is the minimum practically required for the proposed works.

- Cleared vegetation will be removed disposed of at a location approved by PUB and ECD (noting cleared vegetation may include weeds and weed seeds). Vegetation will not be stockpiled on site or pushed into existing vegetation adjacent to the site;
- Machinery storage and materials lay down areas will be established within the site boundaries or in previously disturbed areas to avoid increasing the footprint of the project site.

142. An enrichment planting plan has been prepared MELAD to offset the loss of plants across the 13ha. The plan is appended in Annex 5. This has been prepared as a result of the social impacts identified in the Resettlement Plan, primarily the loss of ecosystem services such as food, fibre, firewood and medicine. The planting will occur within the 20m buffer zone along the northern and western ring-road. In the short term, the ETPP will also provide employment opportunities for over 100 men and women from the directly affected households in Bonriki. The planting will provide habitat to mitigate ecosystem and fauna impacts (below) and will also provide a visual buffer to the solar plant from the viewpoints of the ocean-side villages.

143. **Ecosystems and fauna.** The project is not expected to impact any threatened and protected species or habitats, critical habitat as defined by the SPS or any protected areas. Skinks and geckos and insects may be disturbed during construction. The enrichment planting plan will replace some habitat that it lost across the 13ha site.

144. To reduce mortality of skinks and geckos the contractor can employ the following methods, with support from ECD and / or an independent ecologist:

- Minimise the amount of land that is cleared at any one time;
- Enhance lizard habitat in the vegetative buffer zone or on land adjacent to the site at least three months prior to the site disturbance (including lizard ‘hotels’ out of rock and wood);
- Manually disturbing sites prior to earthworks machinery to allow the chance for lizards to move out of the site. Translocation of individuals can also occur at this time;
- Prioritise the use of native plant species as ground cover between and under panels if they provide the required functionality such as preventing erosion and dust and providing groundcover to outcompete invasive plant species. The use of native species can assist with providing habitat for crabs, lizards and insects, which in turn provide food for birds.

5.5 Construction Impacts on the Socio-economic Environment

145. **Noise and vibration**. The construction of the solar PV plant and associated facilities will generate noise through the operation of machinery and movement of vehicles and machinery transporting equipment and materials. The sensitive receptors are the nearby residential properties at the eastern and northern boundaries, and the one dwelling that will remain within the project site area. Construction noise impacts will be temporary and sporadic and are expected to have a minor impact on community wellbeing and no health impacts. Mitigation measures will be the responsibility of the contractor, and they will be required to include the following in their work methods:

- Prepare a noise management plan as part of the CEMP, referring to the mitigation measures in this EMP and the EHSG. The noise management plan will clearly identify the nearest sensitive receptors and noise levels at those sites/locations;
- Working hours will be between 7am and 5pm Monday to Friday, and possibly Saturdays if agreed between the contractor, PUB, the town council and the nearby community. Where, for safety or technical reasons, work is required to be completed outside of these hours, noise levels will be kept to a minimum and the town council and nearby residents will be informed;
- Significant noise-generating activities will be carried out in the least sensitive time periods as determined in consultation with the town council and neighbours;
- Equipment and plant will be maintained in good order. Noise reduction components (e.g. mufflers) will be inspected prior to the commencement of works to ensure they are fully functional. Noise emissions from construction equipment will not exceed 75 dBA.

146. **Air quality and dust**. The construction of the project has the potential to generate dust through earth moving associated with site clearance and contouring (if required), by the movement of vehicles and machinery and by exposed soil on cleared sites or in soil stockpiles. Exhaust emissions will also be generated from machinery and vehicles. Sensitive receptors are the people living in the house that will remain within the site, and the neighbouring dwellings to the north and east of the site. Mitigation measures will be the responsibility of the contractor, and they will be required to include the following in their work methods:

- Vehicles and machinery will be maintained in good order;
- Vehicles will not be left idling when not in use;
- Vehicles carrying soil, sand, crushed aggregate or other fine materials to or from the site will be covered;
- The sites, and access roads, including those from the wharf and material stockpile areas, will be wetted or stabilized by other means if weather conditions dictate dust may be generated to the extent that neighboring properties or road users will be impacted (dry and windy periods). Water use will be strictly controlled (Refer water resources). Small amounts of dust that do not affect staff and do not migrate off site will be tolerated;
- Material stockpiles will be covered with tarpaulins or similar to avoid dust generation.

147. **Loss of access to resources and assets.** The project will remove gardens, coconut trees, pandanus trees, recreational areas and other private and communal resources and assets. The enrichment planting plan (Annex 5) has been proposed to offset the loss of access to plants.

148. **Loss of connectivity.** The project will attempt to keep the roads that are commonly used open and unobstructed, however smaller walking paths will be impacted by the project, since the perimeter fence will create permanent barriers.

149. To somewhat mitigate the connectivity impacts, a path running through the reserve (between the STREP and STWSP sites) connecting the northern ring-road to the airport runway

boundary to the south will be established in response to community requests during the June 2020 consultation in Bonriki. Streetlights may be installed along the eastern side of the STREP fence (by PUB), which will illuminate this path to ensure public safety.

Figure 5.3: Access path from north ring-road through reserve to the boundary with airport runway (in blue)

150. **Influx of labour – impacts of foreigners and non-local workers.** The Project is likely to require a small number of foreign contractors and technical specialists for the duration of construction. It is anticipated that, dependent on the number of local workers employed, between approximately five and ten foreign workers would be required for the duration of construction which is expected to be approximately six months. There is potential for conflict between foreign workers and local communities and risks that workers create demand for sex, transmit diseases (including, but not be limited to, Covid-19, STI including HIV/AIDS) to local populations or create harm in the form of physical violence and / or sexual harassment and assault. The risks are low because of the very small number of workers however the consequence of harm can be significant, especially if vulnerable people are targeted. Therefore, even the small residual risk needs to be addressed through a communicable diseases awareness and prevention campaign.

151. Mitigation measures are the responsibility of the PUB, supported by the CSC, and the contractor. Each party must be vigilant to potential risks and to avoid all harm, and will include:

- Before construction commences the contractor will engage an approved service provider to deliver communicable diseases (including STI, HIV/Aids and Covid-19) awareness and prevention training for all workers and adjacent community;
- The Health and Safety Plan (HSP) will identify measures that are aligned with the any relevant government regulations and guidelines on COVID-19 prevention and control, or in the absence of these, aligned with international good practice guidelines as updated in the future such as those prepared by the U.S. Department

of Labor Occupational Safety and Health Administration *Guidance on Preparing Workplaces for COVID-19*;[18]

- A code of conduct will be agreed between the PUB and all project workers, including engineers and the contractor, which will govern the conduct of all workers for the period they are working at site. The protocols will govern workers' conduct while at work and in communities, behaviour around women and children, restrictions on alcohol consumption, prohibitions (with sanctions for non-compliance) on workers hunting or fishing, implementation of awareness programs, implementation of the GRM and handling of complaints, hiring of local labour, and implementation of the HSP.

- All non-local workers will receive an induction that outlines the social and cultural expectations when working in Kiribati and the code of conduct they must adhere to. Any worker not complying with the code of conduct will be expelled from Kiribati and repatriated at the employer's expense.

- A grievance redress mechanism (GRM) has been established for the project (refer Section 7.5) and will be communicated through the engagement programme and by prominent display of the GRM process at the project site prior to the commencement of onsite works.

152. **Local employment opportunities.** The opportunity for employment of locals will be maximized during construction and will be monitored by PUB. The bid documents will specify the contactor to prioritise North Village residents for any employment opportunities. The opportunity for women to be employed in the Project will also be prioritized, encouraged and monitored by PUB through the Gender Action Plan.

153. **Health and safety – workers**. The construction of the project will involve health and safety risks to contractors, PUB staff and official visitors to the site (ECD, ADB staff, town council staff etc.). Except by agreement with the PUB, the contractor will be responsible for access to the project sites during construction. The contractor shall be required to prepare a HSP, as part of the CEMP, which complies with the World Bank Group's EHSG that describes the safety measures that will be implemented to protect staff, contractors and official visitors during construction as well as the community as described in this section. The HSP, as part of the CEMP, will at a minimum:

- Include measures and equipment required to protect workers and link to the emergency response plan and other plans as necessary.

- Identify responsibilities and authorities within the contractor's staff for adhering to occupational health and safety requirements.

- Identify and provide required personal protection equipment (PPE) for staff, sub-contractors and official visitors (before they start work) and keep this maintained throughout the contract. Ensure equipment is of suitable size and fits correctly for each individual, including specific needs for women.

[18] Available at https://www.osha.gov/Publications/OSHA3990.pdf

- Be aligned with any relevant government regulations and guidelines on COVID-19 prevention and control, or in the absence of these, aligned with international good practice guidelines as updated in the future[19].
- Install fencing on all areas of excavation greater than 1 m deep whether temporary or permanent.
- Define appropriate emergency and medical process including evacuation procedures.
- Prepare appropriate work method statements for each construction activity.
- Provide daily hazard identification checklists and risk assessments.
- Identify mandatory meeting requirements including toolbox sessions, to ensure all personnel understand the task before commencing work for the day.
- Set procedures for safe handling of toxic materials and other hazardous substances.
- Provide for installation of lights and cautionary signs in hazardous areas.
- Ensure operators of vehicles and equipment are properly licensed and trained.
- Ensure safety and inspection procedures are implemented, setting schedules for regular checking.
- Ensure movements of heavy vehicles is managed so as to minimise impacts to existing traffic and the wider community.
- Provide for the provision of adequate accommodation, sanitation and potable water for staff and contractors for the duration of construction works, including separate accommodation and toilet facilities for men and women.
- Provide adequate rest days / periods for staff, particularly foreign workers, and provide sick leave, holiday leave, maternity leave and other entitlements as per the law.
- Children under 15 years of age are not permitted to work on site and children between the age of 15 and 18 years must not be permitted to work in a manner that may compromise their health and wellbeing or their access to education.

[19] For examples, see World Health Organization. 2020. *Considerations for Public Health and Social Measures in the Workplace in the Context of COVID-19.* https://www.who.int/publications-detail/considerations-for-public-health-and-social-measures-in-the-workplace-in-the-context-of-covid-19; Government of the United Kingdom. 2020. *Working Safely During COVID-19 in Construction and Other Outdoor Work: Guidance for Employers, Employees and the Self-Employed.* https://assets.publishing.service.gov.uk/media/5eb961bfe90e070834b6675f/working-safely-during-covid-19-construction-outdoors-110520.pdf; Canadian Construction Association. 2020. *COVID-19 Standard Protocols.* https://www.cca-acc.com/wp-content/uploads/2020/04/CCA-COVID-19-Standardized-Protocols-for-All-Canadian-Construction-Sites-04-16-20.pdf.

- The HSP will be reviewed by the engineer and environmental specialists of the supervision consultant and/or project management unit (PMU). The review may be undertaken in consultation, as required, with relevant public health authorities. The recommendation of the review (i.e., approval of the plan or additional strengthening required, etc.) will be forwarded to the project implementing agency for clearance. The implementing agency will then advise the Ministry of Finance and Economic Development and ADB.

154. **Health and safety – community.** The construction of the project will also involve health and safety risks to the local community. In addition to the health measures discussed above in the HSP the contractor's HSP will also include measures to protect the community at a minimum including:

- Deliver training on environmental safety, environmental hygiene and the workers code of conduct;
- Child and/or trafficked labour will be strictly prohibited for any activities associated with the project;
- Children will be prohibited from entering the site (including worker's accommodation, works area/construction zone) and prohibited from playing on any equipment or machinery;
- Consultation with the community will be ongoing and will follow the CCP and focus on informing community members about current and upcoming risks and mitigation measures. Announce high risk activities to the community in advance (such as material/equipment haulage, significantly noisy or dusty work);
- Access will be controlled to and through the Project site for the duration of construction to prevent public access e.g. through the use of security fencing and providing suitable alternative pathways or roads where necessary to reduce the impacts on community connectivity;
- Advisory signage warning of the dangers of unauthorised access will be placed where clearly visible on security fencing;
- All advisory and warning signage will be clear, secured on fences, gates and signboards and be posted in Kiribati, the language of the main nationality of foreign workers and repeated in English.

155. **Cultural heritage.** The cemetery has been avoided in design, however additional measures are required during construction to ensure that the site is protected and not desecrated or damaged by accident. No other sites have been identified through consultation. Artefacts may be discovered during site clearances. Mitigation measures will be the responsibility of the contractor, and they will be required to include the following in their work methods:

- Fence the cemetery prior to earthworks and train all staff in the procedures to avoid the disturbance or use of cemetery land for any purpose for the duration of the construction period.
- Allow full and safe access to the cemetery by the public at all times. If there is a safety risk to the public at any time (such as during road works), the public will be forewarned, and alternative measures put in place.

- If an artefact is discovered during site clearance that may be of cultural heritage significance work will cease immediately and the ECD contacted to determine significance of the find. The PUB will also be notified immediately. A chance finds protocol is included in the EMP and will be elaborated in the CEMP.

156. **Unanticipated environmental impacts**. If unanticipated environmental impacts occur during construction phase, in consultation and agreement with the PUB, the contractor will act to avoid or minimise the risks and respond to incidents immediately and update the CEMP as required. The environmental protection measures will be designed to address the impacts.

5.6 Operational Impacts

157. Many of the impacts that will occur during operation have been identified and analyzed in the Design and Pre-Construction Impacts phase (Section 5.2). These include the changes in land uses and access to plant resources and open space by land owners and the community, the change in landscape character and the changes in hydrology. They won't be repeated here, but it is important to note that those impacts are for the duration of the life of the Solar PV Plant.

158. **Waste and hazardous materials**. The operation of the project will generate waste, including hazardous waste (e.g. inverters and batteries may require replacement during the life of the project), which must be appropriately managed to prevent contamination. Mitigation measures will include:

- A Waste Management Plan will form part of operational procedures.
- Where possible batteries and inverters that are replaced during the operating lifetime of the power station will be recycled. If recycling is not possible, they will be transported to an appropriately licenced landfill facility outside of Kiribati;
- Waste will be sent for disposal at regular intervals and not allowed to accumulate at the power station.
- Washing of solar PV panels will only be undertaken on an 'as needs' basis and no chemicals or detergents will be used, minimising the volume and contaminant load of wash water that will be discharged to ground on site. Contaminants will only be particulate matter and will be filtered by plant material and topsoil as part of the storm water treatment and disposal systems before reaching the freshwater lens.
- All infrastructure containing hazardous materials (e.g. batteries) will be inspected regularly to ensure they function correctly and no hazardous materials are being discharged.
- Galvanised steel framing may leach zinc over time due to corrosion. This may enter the freshwater lens, depending on the rate of discharge and adsorption of zinc in the soil. The bid documents will specify that if galvanized steel will be used for framing, the supplier will develop a suitable monitoring regime to detect the leaching of zinc, including trigger values for implementing an action plan to avoid or mitigate leaching, any required training and any specific equipment. MISE will collect zinc data as part of the ongoing water quality monitoring programme for the Bonriki lens.

159. **Water resources.** Water will be required for washing solar PV modules during operation. Rainwater will be harvested by PUB to use for washing. Washing of solar PV panels will only be undertaken on an 'as needs' basis to avoid water use.

160. All storm water run-off from the system, including panels, battery containers, roads and other infrastructure, will be directed to ground for infiltration into the freshwater lens. As discussed in the baseline assessment the freshwater lens is a critical ecosystem service to the South Tarawa population and is at threat from over-abstraction, salinity and land-based pollution. Referring to modelling by Post et. al (2019) [20], the Solar PV Plant will contribute more rainfall into the freshwater lens compared to the existing land cover of trees and grass land, leading to a net benefit for the lens and for the South Tarawa community that relies on the resource for potable supply. The additional annual volume has not been calculated. Run off from panels will not contain chemical or heavy metal contaminants but may contain dust and faecal matter from birds or lizards.

161. These types of contaminants will be treated naturally through the grass/vegetation and ground and are not anticipated to impact on groundwater quality compared to the existing land cover.

162. Cook et. al (2013)[21] modelled run off from solar panels and showed that while the solar panels themselves did not have a significant effect on the runoff volumes, peaks, or times to peak if the ground cover under the panels is gravel or bare ground, the peak discharge may increase significantly with storm-water management needed. In addition, the kinetic energy of the flow that drains from the panels was found to be greater than that of the rainfall, which could cause erosion at the base of the panels. Storm water controls will be integrated into site design as discussed in Section 5.2. During operation, the standard operating procedures will include checking the effectiveness of storm water controls and maintaining and upgrading treatment and disposal features, including maintaining the grass / vegetation beneath the panels and along the drip lines. These controls will also control panel wash water runoff.

163. In the medium term these impacts will be cumulative with the addition of future Solar PV Plants on the Reserve. Cumulative additional infiltration to the freshwater lens is a significant benefit to the South Tarawa community. Storm water management should be integrated across the various sites to ensure that one development does not compromise the ability of the next development to effectively manage water on their site.

164. One other impact on the freshwater lens recharge rates may arise from the enrichment planting along the northern border. Plant transpiration can decrease infiltration and recharge compared to bare land or grassland. Based on feedback from MISE and PUB, the planting has been concentrated along the northern border to minimise adverse impacts on recharge rates while still meeting the social and ecological objectives of the planting. To date, no modelling of the cumulative recharge impacts has been undertaken and is recommended that this completed during the detailed design process and any further mitigation measures be integrated into the final site layout and planting design.

[20] Post, V., Galvis, S., Sinclair, P., and Werner, A. 2019. *Evaluation of Management Scenarios for Potable Water Supply Using Script-based Numerical Groundwater Models of a Freshwater Lens.* Journal of Hydrology 571 (2019) pp 843 – 855.

[21] Cook, Lauren & McCuen, Richard. (2013). *Hydrologic Response of Solar Farms.* Journal of Hydrologic Engineering. 18. 536-541.

165. **Erosion control.** Erosion is unlikely to be a significant issue to control due to the generally flat nature of the site and the porous nature of the soils that assist with fast infiltration. However, rain intensity is predicted to increase, and the area is prone to periods of intense rainfall and localised flooding. The site will be vegetated, and engineered drainage solutions will be installed to avoid erosion, as discussed in Section 5.2. If localized erosion is detected during operation additional mitigation measures will be installed such as:

- Application of mulch;
- Covering with open weave jute matting and reseeding with ground cover;
- Protection with geotextile fabric;
- Localized flow dispersal and diversion structures.

166. **Ecology**. The sites will be grassed or vegetated with suitable, low maintenance, species to prevent erosion and dust. Native species may be prioritised in the design and construction of the plant, but there is a risk that the industrial nature of the site will favour invasive plant species over time, because of a lack of regular ground disturbance and lack of competition from other plants. The collision risk of birds and solar panels (e.g. through glare) in generally considered to be low. Overall the impacts on ecology are considered low, but there may be ecological benefits in the selection of ground cover vegetation and managing the site to be friendly to lizards, crabs and insects. Mitigation measures in the operating procedures include the following:

- Maintaining the enrichment planting along the northern boundaries.
- Maintaining grass and ground cover species within the compound (preferably native species);
- Manual weed management to avoid the encroachment of invasive weed species in the compound and enrichment planting area;
- Pest control for rats in the compound and enrichment planting area;
- Facilitating lizard, crab, bird and insect habitat by providing suitable plant food species and undisturbed areas to nest, hide and feed in the compound and enrichment planting area.

167. **Employment**. It is expected that existing employees will be retained to operate the new solar power systems. Training will be provided for PUB employees in the operation and maintenance of the new infrastructure. Health and safety management procedures will be part of standard operating procedures and personal protective equipment will be provided. Opportunities to increase the participation of women in the energy sector workforce are described in the Gender Action Plan.

168. **Emergency response**. PUB will prepare an operational emergency response plan to respond to events that may be risky to staff, bystanders or the Plant and equipment, such as fire, flooding or inundation. Emergency responses should not adversely affect other properties or land uses beyond the site boundary (such as managing flood water on the site should not exacerbate flooding on an adjacent site). The plan will be included in the training provided to employees and be implemented during the operation of the power plant.

5.7 Decommissioning Impacts

169. **Decommissioning of solar PV array and batteries**. The solar PV modules are expected to have an economic life of at least 25 years. At this time it is expected that they will be replaced by new solar PV modules. Panels that are still in good working order will be offered to residents or small businesses for reuse. The removal of end-of-life solar PV modules will be contracted to a specialist supplier for recycling off-shore at a licensed facility.

170. The batteries installed are expected to have an economic life of between 10 and 20 years depending on the battery type selected and its usage. All equipment will be removed from the project site (e.g. PV modules, batteries, inverters) and will be reused or recycled where possible. Equipment that cannot be reused or recycled will be disposed of at an appropriately licenced facility outside of Kiribati. No waste will be left on Kiribati.

171. **Site restoration**. If the site is not reused for Solar PV Plant or some other infrastructure purpose it will be allowed to revegetate with species appropriate to the protection of the Bonriki freshwater lens and designed in consultation with landowners and stakeholders.

5.8 Environmental Benefits Compared to Alternative Energy Sources

172. Compared to the most likely alternative energy source for South Tarawa, diesel generation, the solar PV plant will avoid environmental and health exposure to contaminants from exhaust emissions (heavy metals, particulates, oxides of nitrogen, sulfates, etc.) and will reduce the net emissions of greenhouse gases. Comparing the without-project and with-project scenarios, the project is expected to displace an average of 1.6 million liters of diesel fuel consumption and avoid 4,774 tons of carbon dioxide equivalent (tCO_2e) greenhouse gas (GHG) emissions per year for 25 years by generating an annual average of 6.68 GWh of clean electricity from solar photovoltaic. It is estimated that combustion of diesel fuel results in emission of 2.68 kg of CO_2 per liter into the atmosphere[22]. It also avoids the exposure to noise from diesel generation and reduces the risks of hydrocarbon pollution from the transport, storage and use of fuel and oil and the disposal of waste oil.

[22] South Tarawa Renewable Energy Project Economic Analysis August 2020.

6 Consultation and Information Disclosure

6.1 Consultation

173. Following general good practice and the requirements of the SPS and Public Communications Policy 2011, public consultations were undertaken during the feasibility study and specifically for development of the IEE to determine community attitudes to the project and elicit information relevant to establishing baseline conditions and understanding potential environmental and social effects (Table 6.1).

Table 6.1: Consultations undertaken during feasibility study

Meeting	Date	Location	Participants
Stakeholder Meeting, Inception Phase	02-Oct-19	Kiribati United Church Maneaba	Representatives from: BTC, KANGO, MISE, PUB, OB, RAK, MFAT, LMD-MELAD, ECD-MELAD, MFED,
Community Meeting Inception Phase	21-Nov-19	AMAK Conference Room, Bikenibeu, South Tarawa	Representatives from: Youth Peer, Tamou Community, Church of God, Rotin Tetanguira Community, AMAK (women's NGO Umbrella Organisation), Assemblies of God, KUC, MWYSSA, SDA (DORCAS Womens Organisation)
Bonriki Community Meeting Inception Phase	23-Nov-19	Community maneaba, Northern Bonriki.	61 community members (35 female, 17 male, 9 gender not recorded)
Community Meeting Inception Phase	29-Nov-19	MWYSSA Conference Room, Bairiki, South Tarawa	Representatives from: St Teresa, St Kabiriera, KPC RAM Coordinator, Teitoningaina, Catholic Women's League, Teaoraeke, Nanikaai, Kiribati Irekenraw World Women Organisation
Bonriki Community Meetings (2) IEE and Resettlement Plan	26-Jun-20	'Te Kawai ae Boou' – new road, and Bonriki Village Catholic Maneaba	15 people from ocean side and over 60 people from the lagoon side.

174. All community meetings were conducted in I-Kiribati and involved the use of power point presentations. Further details are provided in the Resettlement Plan. From meetings held during the inception visit, the overwhelming feedback was positive**Error! Bookmark not defined.**. C omments received were more about the unreliable supply and high cost of electricity, support for harnessing solar energy to replace diesel to reduce dependence on imported fuel, and the hope that STREP will produce a reliable supply and more affordable electricity.

57. A communications and consultation plan (CCP) has been drafted for the project within the Due Diligence Report for Land Access, Social and Gender Assessment. Project information bulletins were prepared to disseminate information about the solar plant (refer Annex 4). . The two Bonriki community meetings on the 29 June 2020, led by MELAD and PUB, discussed the draft Resettlement Plan, with specific emphasis on the proposed enrichment planting activity. The community expressed support for the tree planting activity. The community also requested extending road access from the north ring-road and the airport runway boundary to the south as well as measures to ensure the safety of pedestrians.

175. During implementation, PUB will ensure that meaningful public consultations, particularly with project affected persons, if any, continue to be undertaken throughout the design, construction and operational phases. A Stakeholder Communications Strategy and Plan will be prepared by the PMU and future consultations will be carried out by the PMU and MELAD. At each consultation activity, the grievance redress process will be explained. The plan must focus on the locals around the area and those who often visited these sites to collect medicinal plants, fuel, fibre and food, and ensure they are well versed and able to participate fully by providing their comments/inputs, etc.

176. The contractor will include relevant elements of the Stakeholder Communications Strategy and Plan and GRM in the CEMP so that any concerns raised during construction can be addressed.

6.2 Information Disclosure

177. As per ADB's Access to information Policy 2018, all safeguard documents are subject to public disclosure, and therefore will be made available to the public. Following clearance of the IEE by ADB the document will be posted on government and ADB websites as per the Public Communications Policy. Provided it does not contain any commercially sensitive information, the approved CEMP will also be disclosed.

178. This version of the IEE will be submitted to PUB, MISE and ADB for review and once cleared it will be available for public review. The preliminary consultations with landowners, affected people and the local communities have expressed support for the project, however additional and ongoing consultations will be required to discuss the outcomes of the feasibility study and the IEE, social assessment and other due diligence processes. Ongoing discussions and grievance management will inform the final design and construction methodologies and the implementation timing of activities. The updated IEE (including EMP), which will be based on the detailed design, will also be subject to disclosure.

179. Information regarding the approved STREP project, the proposed solar PV plant design, the proposed environmental management measures and the GRM will be posted on websites and at suitable locations at and near the site so that the public can be informed.

7 Environmental Management Plan

7.1 Introduction

180. This EMP is intended to cover all phases of the STREP implementation including design, construction, commissioning, operation and decommissioning. The EMP complies with the SPS and includes the following information:

- Implementation arrangements including institutional roles and responsibilities for the EMP implementation throughout all phases of the project.
- Environmental management matrices including:
    i. Potential environmental impacts at each stage of the project.
    ii. Proposed mitigation measures to address each potential impact.
    iii. Institutional responsibility for implementing proposed mitigation measures.
    iv. Schedule of implementation of mitigation measures.
- Environmental monitoring plan including:
    i. Aspects to be monitored to ensure mitigation measures have been implemented effectively.
    ii. Schedule and frequency of monitoring.
    iii. Costs associated with monitoring.
    iv. Responsibility for implementing and supervising monitoring.

7.2 Implementation Arrangements and Responsibilities

181. The MFED will be the executing agency for the project and the PUB will be the implementing agency of the physical works as a state-owned enterprise under MISE. The MFED will have overall responsibility for the project whilst the PUB, through its PMU supported by a CSC, will be responsible for day to day implementation and management of the project including the project's compliance with environmental safeguard requirements. PUB will be responsible for implementing all environmental safeguards as per the SPS and country safeguard system.

182. Organisational responsibilities for environmental management during the project are summarised in Table 7.1.

Table 7.1: Organisational environmental responsibilities

Project implementation organizations	Environmental management roles and Responsibilities
Executing agency - Ministry for Finance and Economic Development	• General project oversight • Ensure overall compliance with the project grant agreement and covenants .Overall delivery of the project and reporting to Government. • Ensure compliance with grant agreement covenants. • Ensure the compilation and presentation of all reporting requirements under the project.
Implementing Agency - Public Utilities Board (PUB)	• Submission of environmental documentation to ECD-MELAD as required under the Environment Act (No. 9 of 1999), 2007 amendments and the Environment (general) Regulations of 2009. • Responsible for the overall implementation of the project • Ensure compliance with the provisions of the Grant and Project Agreements and government policies and guidelines • Responsible for procurement and services for the project. • Issue contract change orders as appropriate. • Establish and implement the project monitoring and evaluation framework.
Project Steering Committee (or similar, TBC)	• Responsible for providing Government oversight of project and reporting to Office of the President.
Project Management Unit (PMU) and their specialist consultants (including environmental and social consultants within the CSC)	• Responsible for oversight of the implementation of the project, under the direction of PUB, to ensure compliance of contractors with contracts, specifications and management plans. • Update the IEE including its EMP as required and assist the PUB prepare and submit the applications to ECD-MELAD. • Incorporation of updated IEE mitigation measures and EMP and any conditions on the development approval into bidding documents and technical specifications. • Provide inputs to the bid evaluation in respect of contractor's response to the EMP requirements. • Prepare reports and supporting information for the EA, PUB and Project Steering Committee as required. • •Submission of quarterly progress reports and semi-annual monitoring reports. • Ensure readiness of the project site for contractor including surveyed and staked out sites, any required permits in place and secured lease agreements. • Recruit and retain CSC . • Depending on the experience of the contractor, provide support in preparation of contractor's CEMP. • Review and approve selected contractor(s) project specific CEMP and other plans as required by the EMP. • •Revising the EMP and ensuring its integration along with other safeguards provisions into the bid and contract documents. • Prepare semi-annual safeguards monitoring reports to be submitted to EA and ADB. All safeguards monitoring reports to be disclosed as per ADB policies.

Project implementation organizations	Environmental management roles and responsibilities
	• Ensure contractors are aware of any development application or other permit conditions and the implications for the implementation of the project. • Supervise, monitor and report on contractor's implementation of approved CEMP and all other contractual obligations. • Enforce contractual requirements. • Audit construction phase through environmental inspections and review monitoring reports and data.
ECD-MELAD	• Review ESIA and EMP and process application as required under the Environment Act (No. 9 of 1999), 2007 amendments and the Environment (general) Regulations of 2009. • Monitor and enforce permit conditions as required under the Environment Act (No. 9 of 1999), 2007 amendments and the Environment (general) Regulations of 2009. • Prepare any amendments to the enrichment planting plan.
Solar installation contractor (design-build-operate)	• Design project in accordance with the mitigation measures in the EMP. • Preparation of the project CEMP and other plans as required prior to the commencement of any on site works. • Submit CEMP to PMU or their representative for review and approval (revising as necessary if required) • Prepare, in consultation with the Town Council, the Code of Conduct to be implemented and complied with by all workers. • Compliance with the EMP. • Compliance with the environment licence condition issued by ECD-MELAD. • Identify materials and equipment sources and arrange necessary permits, consents and compliance certificates. • Provide inductions prior to commencement of construction. • Provide ongoing training, awareness and "tool box" sessions for workers. • Implement CEMP. • Implement relevant aspects of GRM and CCP. • Include sections and updates on CEMP, CCP and GRM implementation in the monthly reports. • •Implementation of corrective actions as requested by the PMU or their representative. • Compliance with the operational phase aspects of the EMP. • Identify materials and equipment sources and arrange necessary permits, consents and compliance certificates. • Provide inductions as required to all staff, contractors and visitors to site. • Provide ongoing training and awareness raising of EMP requirements to staff, contractors and visitors to site. • Implement relevant aspects of GRM and CCP.
ADB	• Review all feasibility study documentation (incl. IEE) • Prepare documents package for Board review • Board approval of project • Undertake regular review missions • Review monitoring reports • Disclose project information as required

7.3 Mitigation Measures

183. Environmental mitigation measures have been designed to avoid potential impacts where possible and to mitigate impacts that cannot be avoided. Implementation of this EMP and mitigation measures will ensure compliance with obligations under the Kiribati legislation. The EMP will also ensure ADB safeguard standards are met.

184. To ensure mitigation measures contained in the EMP are successfully implemented:

- The EMP will be included in the design-build-operate contract bid documents and design will be based on the EMP mitigation measures.
- The EMP will be updated based on detailed design and along with any conditions of the project approval issued by the ECD-MELAD.
- The contractor shall prepare a CEMP describing the project and measures that will be implemented to comply with the EMP. It is expected that the contractor's CEMP will address specific environmental issues associated with the construction methods they propose.
- The contractor will submit its CEMP to the PUB PMU and to ECD-MELAD for approval prior to the commencement of any construction (including site preparation, clearing and grubbing activities).
- PUB will ensure there are sufficient resources to oversee the implementation of the approved CEMP.
- The updated IEE including EMP, CCP and GRM will be disclosed to the public in accordance with the Access to Information Policy 2018.

185. An EMP describing the potential impacts and proposed mitigation measures and responsible agency has been prepared in a matrix form and presented in Table 7.2, 7.3 and 7.4. The matrices provide an operational reference and a tool for environmental management during construction activities. It describes in general terms how the contractor will meet the specified contractual, regulatory and statutory requirements. The contractor will provide the detail in its response (the CEMP) which will set out method statements and site-specific plans as required. It also details how impacts will be managed in the operational phase by PUB and their contractors and consultants.

186. This project will be subject to the SPS and requirements of Kiribati's CSS. The project is classified as category B for environment.

7.4 Monitoring and reporting

187. **Monitoring**: Environmental monitoring will be carried out through all phases of the project to ensure that the environmental mitigation measures are effective and that actual environmental impacts accord with predicted impacts and are in compliance with Kiribati legislation and ADB safeguards. An environmental monitoring plan is presented in Table 7.2, 7.3 and 7.4 and outlines the parameters, frequency and responsibility for monitoring.

188. PUB PMU will ensure appropriate monitoring is undertaken during construction in accordance with project progress. Complaints received will be monitored and resolved in accordance with GRM. If required, addition monitoring inspections will be undertaken.

189. PUB will work with MELAD to identify the relevant environmental indicators and reporting criteria from this project that will contribute to the national State of the Environment monitoring and reporting, to assist with reaching the targets for indicators such as number of renewable energy projects and reduction in greenhouse gas emissions.

190. **Reporting**: In consultation with EA and ADB, the PUB PMU will establish a system for preparing quarterly reports on safeguards performance monitoring, issues resolution, and corrective action plans. The quarterly report will include a summary of the contractor's monthly reports. The EA will submit environmental monitoring reports on EMP implementation for ADB's review.

191. Contractors will prepare monthly reports which will describe the implementation of the CEMP including any non-compliances and corrective actions. The report will be submitted, reviewed and approved by the IA.

192. Throughout implementation of the project, ADB will monitor the implementation progress and impacts of the Project. Overall, the EMP will be implemented by the PUB PMU through project implementation. In consultation with the executing agency and ADB, the implementing agency will establish a system for preparing quarterly reports on safeguards performance monitoring, issues resolution, and corrective action plans.

193. The EMP will be part of the overall project monitoring and supervision and will be implemented by the project management unit with oversight from the implementing agency. Progress on the preparation and implementation of an EMP will be included in the periodic project progress reports. Specific monitoring activities defined in the IEE and EMP will be carried out by the contractor and supervised and monitored by the PUB PMU. The PUB PMU will prepare and submit semi-annual environmental monitoring reports for MFED and ADB review and disclosure.

194. In general, the overall extent of monitoring activities, including their scope and periodicity, should be commensurate with the project's risks and impacts. The PUB PMU is required to implement safeguard measures and relevant safeguard plans.

Table 7.2: Environmental mitigation and monitoring plan – design and pre-construction phase

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
Tender document preparation	Lack of control of contractor behaviour leading to environmental, health and safety incidents creating harm, and non-compliance of the EMP.	• Include all relevant EMP controls in the contract tender documents. This includes: the requirement to prepare and implement a CEMP, biosecurity controls, labour and employment requirements, vegetation clearance, erosion and sediment control, hazardous materials management, waste management, water management, source of aggregates, protection of cultural heritage, community engagement, health and safety, monitoring regime for zinc (discharged from galvanised steel frames), including training and monitoring equipment, etc. • Include provisions for enforcement of EMP controls, incentives for compliance or consequences for non-compliance. • Include requirements for adequate EHS resources on site for the duration of the project.	CSC, on instruction from PUB	Tender documents include the requirements of the updated IEE and EMP as well as environmental license (and conditions)	Ongoing supervision of design and clearance at final approval of tender documents	PUB and ADB.

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
Road upgrade design	Increased road safety risks to users from improved road surface / wider road. Lost opportunity to include community benefits in road design (such as footpaths). Compacted road area affecting groundwater infiltration. Loss of access and connectivity.	• Include road safety features in design. • Include stakeholder engagement in design process and address community needs where possible. • Ensure compaction / sealing is minimised, and storm water is directed to ground • Include extension of road to the airport in design. • Identify other connectivity mitigation measures in design.	Contractor, on instruction from PUB	Road safety features and community needs incorporated into design. Storm water and groundwater infiltration features integrated into design. Airport road extension included in design.	Ongoing supervision of design and clearance at final approval of design.	PUB and ADB.
Storm water design	Poor design leading to flooding, ponding and erosion onsite or off site during construction and / or operation phases. Storm water run-off contaminates groundwater	• Design storm water treatment and disposal features to protect the quality of the freshwater lens, improve infiltration rates to freshwater lens. • Avoid land contouring. • Incorporate the use of vegetation, preferably native grasses and ground cover, in the storm water design.	Contractor, on instruction from PUB	Storm water design and site earthworks design meets the objectives of the IEE.	Ongoing supervision of design and clearance at final approval of design.	PUB and ADB.
Site layout design.	Conversion of landscape character from semi-rural / semi-wild to industrial infrastructure with solar panel arrays over 6 ha	• Include the enrichment planting plan in the 20m site buffer on the ocean side in the site layout design.	Contractor to incorporate planting into site layout.	Site layout design incorporates the enrichment planting plan to meet the	Ongoing supervision of design and clearance at final approval of design.	PUB and ADB.

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
	initially to 13ha eventually.	• Maintain vegetation at other border locations around the site particularly residential properties and the main road, on the site layout design. • Maintain existing vegetation and incorporate additional planting where necessary to screen the Solar PV Plant.		objectives of the IEE. .		
	Change in recharge rates due to conversion of land to solar arrays and the vegetative buffer.	• Model recharge rates to compare current scenario with future scenario(s) with the STREP project and cumulative with the STWSP and future solar plants. • Updates of environmental impacts in the IEE.	CSC on behalf of PUB	Modelling of recharge rates.	During detailed design. Modelling results checked.	PUB and environmental specialist.
Site flora and fauna values	Habitat affected and site ecological values damaged	• Undertake flora and fauna surveys of site and update baseline included in the IEE; • Updated IEE to identify site specific measures for protection of flora and fauna as required; • Identification of existing invasive species and potential pathways for new invasive species and pests and specify mitigation and management controls; • Consultations with MELAD and PUB to confirm layout	Specialist engaged by PUB PMU.	As per survey baseline report.	During detailed design and prior to construction commencing; Baseline report recommendations integrated into updated IEE/EMP and CEMP.	PUB PMU, MELAD, ADB

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
		and site and enrichment planting plan and provide input to maximise ecological outcomes.				
Site clearance planning	Unintended clearance of rare, unique, valued plants from the site.	• Botanical survey prior to the final site clearance plan. • IEE and EMP updated with any new risks and mitigation measures relating to protecting Kiribati's ecological values.	Specialist engaged by PUB PMU. CSC to update IEE and EMP/	Botanical report reviewed and cleared. Updated IEE and EMP reviewed and cleared.	Once to clear the final reports.	PUB and ADB.
Notice to Proceed	Works begin without suitable controls in place and prior to compensation paid, leading to complaints, grievances and unmitigated environmental and social incidents.	• CEMP to be cleared by PUB and ADB.	PUB	CEMP reviewed and cleared.	Once before notice to proceed issued.	PUB and ADB
		• All compensation payments made and resettlement complete.	PUB	All compensation payments made and resettlement complete	Ongoing supervision checks during compensation period and one final audit prior to notice to proceed issued.	Independent auditor and ADB
Biosecurity controls	Accidental introduction of invasive species	• Exclusion of invasive species or potentially invasive species in planting plans. Take a precautionary approach to plant selection and avoid introducing new plants unless considered low risk and high priority. • Prioritise local species for land rehabilitation, stabilisation etc.	Contractor, on instruction from PUB	Plant recommendations do not increase the risk of introducing invasive species and include the requirements of the EMP.	Ongoing supervision of design and clearance at final approval of design. Phyto-sanitary certificates and permits for imported equipment and material	PUB and ADB

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
		• Contractor to comply with the Biosecurity Act requirements				

Table 7.3: Environmental mitigation and monitoring plan – construction phase

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
Erosion and sedimentation control	Erosion of soils and sedimentation of surrounding environment.	• Erosion control works and measures will be installed to control surface water runoff and prevent the export of sediments from the site by ensuring discharge of storm water is to stable preferably vegetated land. • Erosion control measures closely follow land contours to reduce runoff velocity from exposed soils. • All land disturbances will be confined to the minimum practicable working area to ensure that the minimum area of land is exposed to erosion	Contractor	Erosion on site and sedimentation of adjacent land or water bodies. Site drainage, erosion and runoff controls in place and functioning correctly. Inspection records.	Daily, visual inspection during construction. Monthly, visual inspection of sites for 6 months post construction. Monthly inspection of records during construction	CSC on behalf of PUB

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
		for the shortest possible time. • Existing drainage lines will be protected and diversion of drainage lines avoided. • Settlement ponds designed to discharge treated water to ground not exceeding the natural ground infiltration rate. • Sediment traps (e.g. silt fences) will be constructed across all drainage lines and erosion controls from site that are likely to receive runoff from exposed or disturbed soils. • A shade tolerant low groundcover (e.g. grass) will be established as soon as practicable after site clearance. The species of groundcover will be selected in accordance with the ecologists recommendations and in consultation with ECD. Local species will be prioritised.				

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
The use of water for potable supply, dust suppression, concrete mixing and other purposes, and the discharge of contaminated storm water and wastewater.	Unsustainable use of water that restricts South Tarawa residents from accessing freshwater.	• PUB to determine the appropriate source of water (reticulated or rainwater harvesting). • Avoid contouring to minimise storm water run off.	PUB Contractor	Ongoing supervision to ensure agreed water supply is being used without affecting the rights of other users.	Weekly and Monthly site audits.	CSC on behalf of PUB
Demand for construction aggregates	Unsustainable sources of local aggregates causes coastal erosion or damages coastal ecosystems.	• All aggregates to be sourced from the licensed dredging facility in South Tarawa, recycled from other projects or imported from off shore. • No use of existing or new borrow pits on the water reserve.	Contractor	Verification checks and clearances prior to ordering aggregates. Spot checks throughout the construction period.	As required.	CSC on behalf of PUB
Transportation, storage, use and disposal of hazardous materials.	Leak, spill or other incident leading to discharge of contaminants to groundwater, land or marine area.	• The contractor(s) will prepare and implement a hazardous materials management plan that shall, include all requirements of the EMP.	Contractor	Hazardous materials management plan in place and implemented.	Once, visual inspection of hazardous materials plan, as required visual inspection of controls and mitigations during construction.	CSC on behalf of PUB
Waste management	Inappropriate storage, transport or disposal of waste resulting in contamination of surrounding water, groundwater and land. Waste going to South Tarawa landfill and taking up valuable space, or	• Waste will be avoided and reduced, such as vegetation waste and fill. • All solid and inorganic waste will be shipped offshore for recycling and / or disposal. • Excess spoil will be stockpiled for reuse.	Contractor	All hazardous waste appropriately managed. All waste removed prior to site hand over to PUB.	Daily visual check of waste disposal bins during construction, monthly check of waste disposal documentation. Final inspection at the end of the Construction Phase.	CSC on behalf of PUB

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
	creating a contamination issue at the landfill.	• Hazardous waste (if generated) will be stored in spill-proof containment before being shipped offshore to an appropriately licenced facility.				
Vegetation clearance.	Unintended loss of ecological values, ecosystem services, visual buffers and private assets.	• Vegetation will be made available to landowners and community prior to clearance. • Project boundaries will be defined and marked prior to works starting to avoid clearances beyond the boundary. • Cleared vegetation will be disposed at approved location. Vegetation will not be stockpiled or pushed into adjacent areas. • Machinery storage and equipment laydown will be within disturbed areas of the site. • Enhance lizard habitat prepared in the enrichment planting plan and / or in adjacent areas prior to vegetation clearance. • Other biodiversity protection measures to be implemented as per the	Contractor	All activities implemented by the contractor in compliance with the EMP and CEMP. All activities in the enrichment planting	Daily and Weekly visual check of vegetation clearances and disposal areas. Final inspection at the end of the Construction Phase.	CSC on behalf of PUB

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
		ecologists recommendations. • Manually disturb sites prior to earthworks machinery, to allow lizards to move. Translocate individuals that are discovered during the disturbance activities. • MELAD and community to implement the enrichment planting plan in a way that minimises the impacts on people who rely on the resources.	MELAD	plan to be implemented as per the plan. All activities recommended by the ecologist to be implemented as per the plan. Number and type of community complaints.	Monthly progress checks.	
Cultural heritage protection.	Damage to, or desecration of, the cemetery. Restriction of access to the cemetery. Unexpected discovery of artefact(s) of cultural heritage significance	• Fence the cemetery to avoid damage from earthworks activities. • Allow full and safe access to the cemetery by the public. If there is a safety risk to the public, provide forewarning and provide alternative access. • If an artefact is discovered during site clearance that is suspected of being of cultural heritage significance work will cease immediately and the ECD contacted to determine significance of the find. The PUB will also be notified immediately.	Contractor	All activities implemented by the contractor in compliance with the EMP and CEMP.	Daily and Weekly visual check of cultural heritage protections. Follow up after a chance find incident. Final inspection at the end of the construction phase.	CSC on behalf of PUB

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
		• The CEMP will include an unexpected discovery protocol.				
Noise and vibration	Noise and vibration impacts on local communities	• Working hours will be between 7am and 5pm Monday to Friday, and Saturdays if agreed between the contractor, PUB, town council and the nearby community. Where safety or technical reasons require work to be completed outside of these hours, noise levels will be kept to a minimum and town council with nearby residents will be informed. • Significant noise generating activities will be carried out in the least sensitive time periods to be determined in consultation with the town council and neighbours. • • Equipment and plant will be maintained in good order. Noise reduction components (e.g. mufflers) will be inspected prior to the commencement of works to ensure they are fully functional. Noise	Contractor	Work carried out between agreed times, equipment in good order with appropriate noise reduction components and all other noise and vibration actions implemented by the contractor in compliance with the EMP and CEMP	As required, daily visual inspection of all equipment	CSC on behalf of PUB

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
		emissions from construction equipment will not exceed 75 dBA.				
Air quality and dust	Creation of dust and air emissions by vehicles and machinery.	• • Vehicles and machinery will be maintained in good order. • • Vehicles will not be left idling when not in use. • Vehicles carrying soil, sand, crushed aggregate or other fine materials to or from site will be covered.	Contractor	Dust generated, complaints received via GRM.	Daily visual inspection during construction	CSC on behalf of PUB
	Excessive dust from project sites, stockpiles and access roads	• Site and access roads, including those from the wharf and material stockpile areas, will be wetted or stabilised by other means if weather conditions dictate dust may be generated to the extent that neighbouring properties or road users will be impacted (dry and windy periods). Water use will be strictly controlled. Low levels of dust will be tolerated. • Materials stockpiles will be covered with tarpaulins or similar to avoid dust generation.	Contractor	Dust generated, application mitigation measures, inspection records, complaints received via GRM	Daily visual inspection of site during construction	CSC on behalf of PUB

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
Influx of labour – impacts of foreigners and non-local workers	Presence of foreign workers caused conflict, social disruption and/or diseases in community	• Employment of North Village residents as per the requirement in the bid documents. • The contractor will implement a communicable diseases (incl. STI, HIV and Covid-19) awareness and prevention program; • A code of conduct will be agreed between the PUB and all project workers, including engineers and the contractor, which will govern the conduct of all workers for the period they are working at site. The protocols will govern workers' conduct while at work and in communities, behaviour around women and children, restrictions on alcohol consumption, prohibitions (with sanctions for non-compliance) on workers hunting or fishing, implementation of awareness programs, implementation of the GRM and handling of complaints, hiring of local labour, and implementation of the	PUB, contractor, approved service provider	Communicable diseases prevention and awareness; Code of conduct agreed, inductions carried out, GRM in place	As required, visual inspection of agreement and GRM as well as records of induction.	CSC on behalf of PUB

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
		health and safety plan (HSP). • All non-local workers will receive an induction that outlines the social and cultural expectations when working in Kiribati and the code of conduct they must adhere to. Any worker not complying with the code of conduct will be expelled from Kiribati and repatriated at the employer's expense. • The GRM will be communicated through the engagement programme and by prominent display of the GRM process at the project site prior to the commencement of onsite works.				
Health and safety – workers and community	Health and safety of workers and communities inadequate managed leading to injury of fatality.	• The contractor will prepare and implement a Health and Safety Plan that will at a minimum: include all requirements of the EMP.	Contractor	Health and Safety Plan in place, training completed. Plan is implemented and updated.	As required, visual inspection of Health and Safety Plan, health and safety controls, records of training and induction. Daily checks of health and safety management as part of site management.	CSC on behalf of PUB

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
Unanticipated environmental impacts	Unanticipated environmental impacts during construction	• If unanticipated environmental impacts occur during construction phase, in consultation and agreement with the PUB, the contractor will act to avoid or minimise the risks and respond to incidents immediately and update the CEMP as required.	Contractor	Update of IEE / EMP and CEMP as required	As required, respond to incident or risk management as necessary and review and clearance of updated IEE / EMP and CEMP.	CSC on behalf of PUB

Table 7.4: Environmental mitigation and monitoring plan – operations and maintenance phase

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
Replacement of broken or end-of-life panels, batteries and other electrical equipment.	Solid waste disposal on South Tarawa which would take up valuable and scarce landfill space. Leaking batteries or broken panels discharge heavy metals and other contaminants into the ground, coast and marine area from unlined / unsanitary landfill. Pollution affects ecosystem health and potentially affects the food chain.	• A waste management plan to be prepared prior to commissioning. This will include protocols for avoiding, reducing, recycling and disposing of waste, specific procedures for hazardous waste and the permitting and licensing processes for off-shore export of hazardous waste. • All PV, electrical and battery and hardware equipment will be	Contractor for 1-2 years, then PUB	Waste management plan approved.	Once prior to commissioning.	MISE with support from MELAD.
				Inventory of waste removed from site.	Annual audits for the duration of the operation phase.	PUB via an Independent environmental auditor
				Waste export documentation.	Annual audits for the duration of the operation phase.	PUB via an Independent environmental auditor

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
		removed from site in-tact and will be reused where possible. • Equipment that cannot be reused will be exported for recycling or safe disposal in a sanitary landfill facility. • All waste export will be in accordance with the Waigani Convention and Basel Convention.				
Storage of batteries.	Leaks, spills, flooding or breakages leading to discharges of chemicals to ground and potentially the freshwater lens.	• Batteries to only be stored in the purpose-built containers with suitable spill containment. • Containers to be locked and secure when unattended. • Visual checks for leaks, spills and damage as part of regular, routine inspections. • Immediate clean-up of spills, leaks or damaged equipment. All materials and waste that is non-hazardous will be disposed to landfill on South Tarawa. All materials and waste that is considered	Contractor for 1-2 years, then PUB	Inventory of waste removed from site.	Annual audits for the duration of the operation phase.	PUB via an Independent environmental auditor
				Waste export documentation.	Annual audits for the duration of the operation phase.	PUB via an Independent environmental auditor

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
		hazardous shall be stored safely (fully-contained, out of the weather) prior to export for recycling or disposal in a sanitary facility. • Waste to be clearly labelled, stored according to waste type and regularly removed from site.				
Panel washing	Using scarce fresh water, particularly in times of drought.	• Panel-washing on an as needed basis. • Manual dusting to remove dust where possible to avoid the use of water. • Use on-site rainwater harvesting for the supply of wash water. Harvesting to occur during periods of heavy rain, to mitigate flooding and avoid loss of water to the freshwater lens.	Contractor for 1-2 years, then PUB	Water use records (total volume of water used, source of water (PUB supply, rainwater harvesting), date used, purpose of use).	Annual audits for the duration of the operation phase.	PUB via an Independent environmental auditor
	Panel wash water transporting contaminants into freshwater lens.	• Operational procedures to plan for panel-washing on an as needed basis, rather than routine basis. • No detergents or chemicals to be used	Contractor for 1-2 years, then PUB	Maintenance records.	Annual audits for the duration of the operation phase.	PUB via an Independent environmental auditor

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
		in cleaning (water only). • Manual 'dusting' to be prioritised to avoid producing wastewater. • Stormwater run off protection measures will also mitigate run off issues from wash water (refer above/below).				
Corrosion of panel frames	Discharge of zinc to ground and freshwater lens, contaminating drinking water supply.	• Maintenance programme to avoid corrosion. • Monitoring of ground and / or freshwater lens to identify early signs of elevated zinc. • Action plan to increase or change maintenance as a response to elevated zinc beyond trigger level.	Contractor for 1-2 years, then PUB responsible for maintenance regime. MISE will include zinc monitoring in their routine lens sampling programme.	Zinc concentration mg/l– trigger values to be determined.	Water quality sampling as per existing MISE monitoring routine. Results to be shared with PUB.	PUB will monitor and verify sampling has taken place and will implement action plan when trigger values are exceeded.
Stormwater run-off.	Rill and scour erosion of sandy soils. Surface ponding / flooding during intensive rain events. Solar panels increases rainwater availability.	• Sediment treatment implemented as per the specifications and design	Contractor for 1-2 years, then PUB	Maintenance records.	Annual audits for the duration of the operation phase.	PUB via an Independent environmental auditor
Employment of staff.	Gender bias towards male employment (typical in the energy sector).	• Ongoing training to be provided for PUB employees on the	Contractor for 1-2 years, then PUB	Training records and employment records.	Annual audits for the duration of the operation phase.	PUB via an Independent

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
	Reduced performance of the plant due to untrained staff. Increased likelihood of environmental incident due to untrained staff. Very low to no risk of child labour.	operation and maintenance of PV and the Environmental Management procedures. • Gender awareness training for PUB and policies and procedures to encourage women to apply for jobs. • Comply with laws relating to child labour.				environmental auditor
Staff working with electrical equipment, working outside (exposure to heat and UV), working with batteries and other sources of hazardous materials.	Injury, loss of life or increased risk of damage to infrastructure.	• Health and safety operational procedures to be prepared prior to commissioning and updated regularly (at least annually). • Health and safety training provided, including refreshers as necessary. • PPE and other equipment to be purchased and stored in a convenient location.	Contractor for 1-2 years, then PUB	Health and Safety Plan approved and audited. Health and Safety Plan implemented, training occurs and PPE available.	Once prior to commissioning and annually. Annual audits.	MISE with support from Labour Department.
Emergency procedures in response to flooding,	Injury, loss of life or increased risk of damage to infrastructure.	• Operational emergency response plan prepared prior to commissioning and	Contractor for 1-2 years, then PUB	Operational emergency response plan prepared and audited.	Once prior to commissioning. Annual audits for the duration of the operation	MISE with support from Labour Department

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
inundation event, fire or other emergency.		updated at least two yearly or after an emergency event. • Staff training in emergency response plan. • PPE and other equipment to be purchased and stored in a convenient location.			phase and after an emergency event.	
				Training completed and equipment in place.	Annual audits for the duration of the operation phase.	MISE with support from Labour Department

Table 7.5: Environmental mitigation and monitoring plan – decommissioning phase

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
Decommissioning of solar PV array, batteries and other electrical equipment.	Waste disposal on South Tarawa taking up valuable and scarce landfill space. Leaking batteries or broken panels discharging heavy metals and other contaminants into the ground, coast and marine area from unlined landfill. Affecting ecosystem health and potentially affecting the food chain.	• A waste management plan to be prepared prior to decommissioning. • All PV, electrical and battery and hardware equipment will be removed from site in-tact and will be reused where possible. • Equipment that cannot be reused will be exported for recycling or safe disposal in a sanitary landfill facility. • All waste export will be in accordance with the Waigani Convention and Basel Convention.	PUB	Waste management plan approved.	Once prior to decommissioning.	MISE with support from MELAD.
				Inventory of waste removed from site.	Once during decommissioning.	PUB via an Independent environmental auditor
				Waste export documentation.	Once following export of waste.	PUB via an Independent environmental auditor
Removal of foundations and other non-hazardous materials and disposal.	Waste disposal at South Tarawa landfill taking up valuable and scarce space. Unplanned waste disposal on private property or government property creating a hazard or eyesore, or affecting vegetation or the ability for the site to be used for productive purposes.	• A waste management plan to be prepared prior to decommissioning starting. • All waste to be reused or recycled where possible on Tarawa. • Clean fill to be reused on site as part of the site restoration or sold/given away for reuse.	PUB	Waste management plan approved.	Once prior to decommissioning.	MISE with support from MELAD.
				Inventory of waste removed from site.	Once during decommissioning.	PUB via an Independent environmental auditor

Project Activity	Potential Impact	Management and Mitigation		Monitoring		
		Proposed Mitigation Measures	Responsibility	Parameters	Frequency and verification	Responsibility
Site restoration	Site is not restored to the satisfaction of the land owner. Decommissioning leaves the freshwater lens exposed to contamination.	Site restoration plan to be prepared in consultation with the land owner. If the site is not reused it will be revegetated with species appropriate to protect the freshwater lens.	PUB	Site restoration plan approved.	Once prior to decommissioning.	MISE with support from MELAD.
				Site restoration plan implemented.	Monthly during restoration and at completion.	PUB via an Independent environmental auditor

7.5 Grievance Redress Mechanism

195. The project will establish a GRM for any matters related to project design, construction and operation. From a safeguards perspective, members of the public may perceive risks to themselves or their property or have concerns about the environmental performance of the project. These issues may relate to construction and operation and therefore they will have rights to file complaints for the contractor, PUB PMU and the MISE to address promptly and sensitively, and for complaints to be made without retribution. During the design phase, the GRM will be raised with stakeholders during consultation so that the people who are most likely to be affected by (or benefit from) the project are aware that there is a feedback mechanism and the rights around making a complaint.

196. **Construction phase.** During construction, the contractor will be required to comply with the Project EMP and the approved CEMP, including any issues relating to noise, dust nuisance, accidental damage to property, worker behavior, waste management etc. The contractor will appoint one staff member as a liaison officer to receive complaints and initiate corrective action as appropriate. This staff member's name will be made available to the Project Implementation Consultant. Further, the name and contact details of the contact person will be presented on a notice board at work site and PUB office. The notice board will also state (i) that members of the public with a grievance or concern have the right to register complaints (verbally or in written form) and for appropriate and reasonable action to be taken to address any valid complaint and (ii) that complaints can be made to the individuals concerned either verbally, in person, or in written form and that (iii) a written response will be provided within 48 hours.

197. The contractor will maintain a complaints book on site, containing complaint forms that are filled out in duplicate, with one copy provided to the complainant. The forms will record date, time and nature of the complaint and information on the rights of the complainant and process to be followed for assessing and acting on the complaint. The forms will allow space for anonymous complaints to be registered. Registering and resolving a complaint will be at no cost to the complainant. The contractor will then address the complaint and take corrective action agreed to with the complainant.

198. For minor complaints, such as noise or dust nuisance, or disregard of safety procedures, immediate corrective action will be taken. For more serious issues requiring guidance or further discussions, the contractor will raise the issue with the Supervising Engineer. A written response will be prepared, stating either (i) the nature and duration of action that has been taken, (ii) where an issue is not readily addressed by direct action on site, the steps that have been taken for resolution or (iii) complaint is considered invalid, an explanation as to why. In each case, the complainant will be informed as to their rights for the next step. The response will be handed to the complainant or made available for them to collect, within 48 hours of the complaint being received.

199. Should the complainant remain dissatisfied with the action taken or the explanation received, the matter/complaint file will be forwarded to the Supervising Engineer. The Supervising Engineer will have assigned a member of staff with the role of community liaison. The name of this individual will be provided on the complaints registration form, with contact details and notice that this individual can be approached for follow up in respect of the complaint and that this may be done in person, by phone or in written form. The Supervising Engineer will consult with PUB and on their behalf review the complaint and the response of the contractor, then make a decision to be referred to the complainant within a maximum of two weeks. If the grievance remains

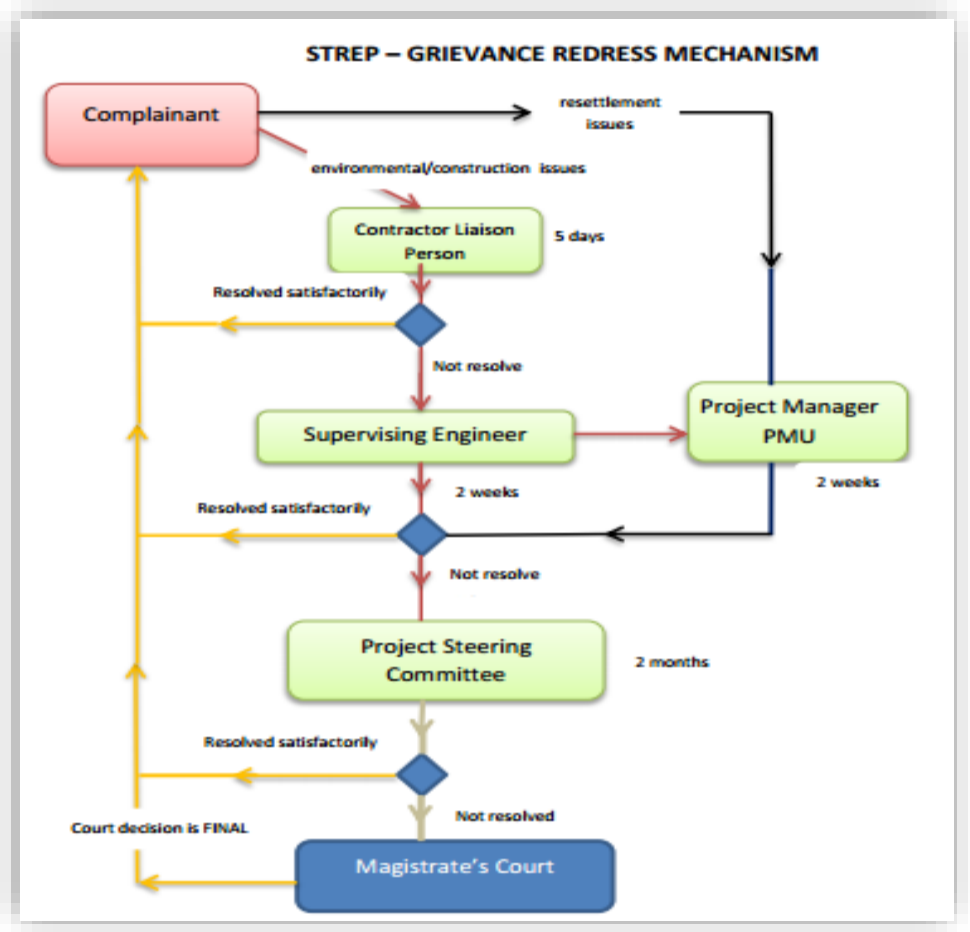
unresolved, the Project Steering Committee will be advised, and they will consult with the complainant and determine the next course of action.

200. The expected period of time for this process is two months. If the complainant remains dissatisfied with the Project Steering Committee's actions or decisions, the grievance may be filed with the Magistrate's Court, which under normal conditions involves a registration fee. The Magistrate's ruling will be binding on all parties.

201. At the completion of the works, and when the contractor's defects liability period has passed, the infrastructure is handed over to PUB. The PUB, is responsible for infrastructure service delivery, will be required to receive and act on complaints relating to the operation and maintenance of the solar PV system. A complaints register will be maintained.

202. The contractor will maintain a register of all complaints and grievances received either on site or at the office. The register will include: date of the complaint, the name of the complainant (and their contact details), name/title of person receiving the complaint, nature of complaint, any actions taken to immediately resolve the complaint and any future actions required, and close-out date when the complaint was satisfactorily resolved. The register will be subject to inspections during audits and monitoring.

Figure 7.4: STREP grievance redress mechanism



203. **Awareness of the GRM.** The procedures for filing grievances, including details of contact persons, will be discussed and explained during Project Disclosure and subsequent consultations. During construction, the name and contact details of the liaison contact person will be presented on a notice board at work site and PUB office. The notice board will also state (i) that members of the public with a grievance or concern have the right to register complaints (verbally or in written form) and for appropriate and reasonable action to be taken to address any valid complaint and (ii) that complaints can be made to the individuals concerned either verbally, in person, or in written form and that (iii) a written response will be provided within 48 hours.

204. **Confidentiality and Anonymity.** The project will aim to protect a person's confidentiality when requested and will guarantee anonymity in semi-annual reporting. Individuals will be asked permission to disclose their identity and grievances may be submitted anonymously with an option for a third party to liaise with the project if desired. Investigations will be undertaken in a manner that is respectful of the complainant and the principle of confidentiality. The complainant will need to recognize that there may be situations when disclosure of identity is required, and the project will identify these situations to see whether the complainant wishes to continue with the investigation and resolution activities.

205. **Implementation and budget.** PUB, specifically the Project Management Unit, will be responsible for implementing the GRM. A plan to implement the GRM, including record keeping documents and information brochures, will be prepared by the PMU during the pre-construction phase. The associated costs to implement the GRM will be borne by PUB.

206. **Land related disputes.** These are described in detail in the Resettlement Plan.

207. **Accountability Mechanism.** People who are, or may in the future be, adversely affected by the project may submit complaints to ADB's Accountability Mechanism. The Accountability Mechanism provides an independent forum and process whereby people adversely affected by ADB-assisted projects can voice, and seek a resolution of their problems, as well as report alleged violations of ADB's operational policies and procedures. Before submitting a complaint to the Accountability Mechanism, affected people should make an effort in good faith to solve their problems by working with the concerned ADB operations department. Only after doing that, and if they are still dissatisfied, should they approach the Accountability Mechanism.

8 Findings and Conclusions

208. The Bonriki Reserve is a highly modified environment but one of two remaining open space and green space areas on South Tarawa, Kiribati. While there is low natural character, there are visual amenity values due to the lack of development and presence of trees, and there are various ecosystem services such as the provision of food, fiber and recreational space. The Reserve is a legal land status that protects the underlying Bonriki freshwater lens, the primary source of fresh water for South Tarawa residents. The lens is vulnerable and at risk from pollution, saline intrusion and over-abstraction. Solar panels for electricity generation have been identified as a low impact, beneficial land use on the Reserve to protect and enhance the freshwater lens while providing a socio-economic benefit for the people of South Tarawa.

209. The project will have a number of environmental benefits: a reduction in the emissions to air, noise and hazardous materials management compared to the most likely alternative: diesel electricity generation. The net greenhouse gas emissions will be significantly reduced. The enhanced protection of the Bonriki freshwater lens is a significant benefit compared to the current baseline land use.

210. Ecological impacts are anticipated to be minor, due to the highly modified nature of the site and wider area. A botanical and fauna survey is recommended to identify any potential natural habitat values on the site, which would include the potential to document plants and animals with ecosystem services values. There is the potential to provide micro-habitat for plants, lizards, insects, crabs and birds on the site by prioritizing native ground cover and grass species and other habitat features.

211. The landscape character will change with the eventual installation of approximately 13 ha of solar panels, from green space and open space to industrial infrastructure. Incremental change to the wider landscape will occur over the medium term from the cumulative impacts of solar developments on the Reserve and the urban developments proposed for Temaiku. Mitigation of impacts on visual amenity is possible through vegetation screening. An enrichment planting plan is proposed along the northern boundaries to mitigate this impact and the social impacts of vegetation clearance across the site. These offsets are to enable people to continue to harvest and gather resources to support low income households and to allow people to continue to contribute to their cultural and social responsibilities. The cumulative impacts of reducing the common areas for food and fiber production on South Tarawa may contribute to reduced food security in the medium to longer term.

212. The primary mitigation measures will be developed in the design phase, including: minimizing earthworks, designing stormwater systems to maximize infiltration and avoid ponding and flooding, maintaining vegetative buffers to protect visual amenity, avoiding harm to the cemetery and private assets and enhancing the North-South road through the site.

213. Construction-related impacts are relatively moderate to minor because earthworks are not required, the duration of works is approximately six months, the required work force is small, the working hours will be restricted to Monday to Friday (and possibly Saturday if agreed with PUB, the town council and communities) and the work will not create large emissions to air, water or continuously high levels of noise.

214. Standard mitigation measures will be put in place for environmental protection and health and safety management, under the contractor's CEMP, including: site clearance and earthworks controls, fencing the site to protect the community, invasive species management, chance find

procedures, hazardous waste management, health and safety measures, employment and staff management protocols and site rehabilitation requirements.

215. Operational impacts relate to the potential benefits of enhanced lens recharge and protection of the lens from encroachment and pollution, and the management of weeds and pests. Hazardous materials management will be required to prevent discharges of pollutants into the environment on site. All waste will be recycled, reused or exported offshore to avoid unsanitary disposal and the occupation of rare space at the South Tarawa landfill.

216. A CCP and GRM will be prepared to ensure that there is continuous stakeholder engagement and feedback is incorporated into solar PV plant design and operation and that complaints and grievances are quickly followed up and satisfactorily addressed.

ANNEX 1 REPORT OF STAKEHOLDER CONSULTATIONS, 3 OCTOBER 2019

Minutes of Stakeholder / Public Consultation for South Tarawa Renewable Energy Project (STREP)	
Venue : Kiribati United Church Maneaba,	**Date/Time:** 3 October 2019 10:00am - 12:30 noon
Participants	Refer to Annex 6 – Participants' Sign-Up Sheet.
Representatives of ADB	None
Representatives of TA s	Antoine Bittar (Team Leader; AB); Sam Sesega (Social Safeguards/Land Resettlement Specialist; SS); Tiaon Aukitino (National Consultant/Project Engineer; TA)
Representative of PUB	Teitibwebwe, Manager Customer Services
Name/Time/Matter/	**Comments/Presentation**

Opening

Tiaon Aukitino (TA) facilitated the opening, calling the workshop to order before inviting one of the participants to give an opening prayer as per local tradition.

TA then invited Acting Secretary for MISE, for his remarks and to officially open the workshop.

The A/Secretary welcomed participants on behalf of GOK, speaking briefly about the STREP and its importance to Kiribati in terms of its economy, as well as part of GOK strategy for adapting to climate change, and to strengthening its CC resilience. He then officially opened the workshop.

Presentation 1 - Project Overview

TA Team Leader Antoine Bittar (AB) took the floor; thanked PUB for organizing the workshop, and participants for making time to attend. AB then presented in power-point presentation, an overview of the STREP, including the objectives, project activities, intended beneficiaries. He emphasized that STREP is a GOK project and the TA is simply assisting in preparing the documentations required for ADB funding. He called on all participants and their various agencies to assist the TA by responding to requests for information.

Presentation 2 - Social Assessment and Land Access

Sam Sesega (SS), Social Safeguards and Land Resettlement Specialist for the TA, introduced himself, before commencing on his power-point presentation. SS noted that ADB Policy on Involuntary Resettlement is triggered, likewise also GOK's Environment Act 1999 which, among its requirements, is a Development License Application supported by an Environmental Assessment report. SS discussed the methodology used and the central role of inclusive stakeholder consultations in the Project preparation process.

SS also discussed efforts during the week to identify and assess a suitable site for STREP within the Bonriki Water Reserve. He noted the challenge in avoiding resettlement impacts due to the extent of illegal habitation of the Reserve, which is GOK leased land. He also noted the objective of ADB's safeguards policy of avoiding all adverse impacts on local people and communities or where avoidance is not possible, reducing adverse impacts to an acceptable level. Aerial photos showed the area within the Bonriki Water Reserve that is of interest and where illegal occupiers are located. Using maps and aerial images including some provided by MELAD, SS pointed out unoccupied areas that would pose the least adverse social impacts.
Following the presentations, participants were encouraged and invited to ask questions and comments. The following constitute all the comments/questions made/asked.
Comments/Views expressed
1. There is high expectation that STREP will not only result in accessible and affordable electricity for the whole population of South Tarawa, but that the problem of frequent power outages and availability will be eliminated. He noted power rationing and frequent outages as a major issue for businesses and families. Can this Project make sure these results are delivered?
2. Can you define energy efficiency? (NZ HC (MFAT) representative).
3. ECD representative asked what mechanism and arrangements are in place to ensure full compliance of contractors to the Project ESMP. He noted that contractors simply do their own thing and ignore the requirements of the ESMP. (ECD Representative
4. Can you give some timelines for project implementation and completion?
5. Are outer islands included in the scope of this ADB funded projects? (Woman representative)
6. Do we need more electricity storage capacity than PV arrays?
7. Is there another option for project site other than the Bonriki Water Reserve?
8. Regarding the project's capacity building objective, there is some capacity within the PUB especially in PV installation. (This participant recalled their involvement in installing the existing PUC 500kW PV facility and the level of experience within the agency but noted that STREP's proposed capacity building activities is most needed and should built on this existing albeit limited capacity.
9. Will the GOK agencies have access to the project design documents being prepared by the TA? ECD Representative
10. In the presentation, women involvement in the project is mentioned several times. What is the level of women involvement required? (Woman representative)

Closure:

The workshop was concluded after no further questions and or comments were asked/made. The TA Local Engineer (TA) spoke on behalf of the TA team thanking all participants for their interest and attendance. The TA Team Leader (AB) also expressed gratitude to all participants for their interest and making time for this workshop. He noted that further consultation with all stakeholders will be held in the near future as the TA's work progresses.

Following the closure, lunch was served. Other participants used to the opportunity to informally discuss the project further with members of the TA. Workshop ended at around 12:30pm.

End.

Minutes compiled by Sam Sesega

ENTURA –Social Development/Safeguards Specialist

Participants Sign-Up Sheet for Stakeholder Consultation

eco STA

STREP workshop

South Tarawa, 2 October 2019

Attendance list

Name	Organisation	email	Tel #	Gender
Kaiea	BTC	[illegible]	73005672	M
Aleina	Hogo ingering	[illegible]	73031628 / 73054055	F
Baobai	PUB	acsm@pub[illegible]	73024112	F
Tarita	KSEC	[illegible]	73099735	M
Tabauia	RAK	[illegible]	[illegible]	F
Iaeta I.	OB	iaeta@ob.gov.ki	73061452	F
Tanua	KANGO	tetairuatoa@gmail.com	73037096	M
Ross	MFAT	[illegible]@mfat.govt.nz		M
Ngaina	MFAT	[illegible]@mfat.govt.nz		F
Temoa	LMD-MELAD	[illegible]	7306757[illegible]	M
Puta Tofinga	ECD-MELAD	[illegible]@environment.gov.ki		M
Taati	CFD-MFED	[illegible]@finance.gov.ki	75022755	F
Teren	[illegible]	[illegible]@gmail.com		M
Teitibwebwe	PUB	csmanager@pub.com.ki	73060725	M
Toki T.	MISE	[illegible]	[illegible]	M
Sam Seeseja	TA	[illegible]@gmail.com		M
KANGO:				
Catholic Women group				

NGO
NGO

Aming Uriam
aminauriam@gmail.com

ANNEX 2 REPORT OF CONSULTATION WITH THE BONRIKI COMMUNITY, 23 NOVEMBER 2019

Minutes of Meeting/Consultations with the Bonriki Community to discuss South Tarawa Renewable Energy Project (STREP)		
Venue	Community maneaba, Northern Bonriki.	**Date/Time** 23 November 2019 4pm – 6pm.
Participants Refer to Annex 6 – Participants' Sign-Up Sheet.		
Representatives of ADB - None		
Representatives of TA Sam Sesega (Social Safeguards/Land Resettlement Specialist; SS); Tiaon Aukitino (National Consultant / Project Engineer; TA)		
Bonriki Local Council Representative:		
Opening The local Council Representative called the meeting to order, expressed thanks to the participants for their attendance. He introduced the TA consultants then invited the consultants to make their presentation. He also asked the participants to sign the attendance sheets being circulated. (The community meeting was conducted in I-Kiribati language with Tiaon Aukitino (TA) providing partial translation for the benefit of the Safeguards Specialist).		
Powerpoint Presentation of Project Overview A powerpoint presentation tailored for the local community was prepared and presented by Tiaon Aukitino. A leaflet in local language explaining the project was also distributed prior to the start of the powerpoint presentation. The presentation presented the objectives of STREP, the activities and the expected outputs and outcomes. TA also commented on the boundary survey being initiated and informed the community that the counting of crops, trees and other assets for compensation purposes will be carried out the next day, 24th November. Following the presentation, the community was invited to ask questions or make comments.		
Comments/Views expressed		
1. The speaker (male) expressed support for the project and referring to the area presented as being earmarked for STREP, endorsed it noting that only one household lives in the area.		

2. This community representative asked about crops and trees that will be affected, whether there will be any compensation. He also expressed support for the project.
3. This representative expressed relief that only 1 household lives in the area of interest; he expressed support for the project noting that the benefits far outweigh the negative impacts.
4. There was a request to maintain existing access through the reserve from the north through to the airport runway side.
5. Expressed support for the project, noting that the project will improve power supply, referring to frequent power outages.
6. Questions were asked about possible employment during construction and operational phases.
7. The project is timely, to improve the power supply situation which is presently not reliable with too frequent power outages.
8. The water reserve is an important source of firewood for most families. Many families will have to look for firewood elsewhere, or otherwise use more kerosene for cooking.
9. This participant noted many crops are grown inside the reserve. Suggested that the boundary on the northern side be moved inside by 50m or so to avoid loss of crops and fruit trees.
10. Three households depend on wells dug inside the reserve for water and were concerned about losing access to their wells. (This was conveyed to TA after the workshop).

Closure:

The Local Council Representative expressed gratitude to the TA Consultants for the useful presentation and information about the STREP. The Consultants were invited to a cup of tea and biscuits as per tradition, and the Consultants presented a small monetary donation for the use of the maneaba and the refreshments.

Workshop ended at around 6:00pm.

End.

Minutes compiled by Sam Sesega

ENTURA –Social Development/Safeguards Specialist

****

(1) Bonriki Community Mtg, 23 Nov, 2019

#. Name	Female/Male	Age (yrs)
1 Teboutara. Obwaia	F	48 ~~Bwaranika Marlin~~
2. Bineta Teteki	F	61
3. Betiata. Taareta	F	23
4. Taakenteiti. Nikutabu	F	21
5. Bwangkangke. Teroron	F	44
6. Kantarawa Taakatu	F	30
7. Butiata Timon	F	40
8. Anatatia. Eketi	F	27
9. Beretekine. Atata	F	52
10. Taarela Mukana	M	59
11. Ribatii. Areke	M	49
12 Maria Tekarie	F	67
13. Tinang. Tauki	F	65
14. Rerei. Rabangaki	F	62
15. Tebwebwe Rabangaki	M	51
16. Kabetite Mwetaka	M	67
17. Meere Metara	F	54.
18. ~~Japeta~~, Fawoanea	F.	57.
19. Kekeia. Timau	F.	38.
20 Aboro Manuao	F	39
21 Raitini Toakibu	F	52
22 Jaruru Teue	F	47
23 Tebanu Kaioro	F	54
24 Bwaranika. Marlin	F	36
25 Eren	F	58

(2) Bonriki Community Meeting, 23 Nov 2019

Name	Female (F) / Male (M)	Age (yrs)
26. Tebota	F	39
27. Tiimon	F	44
28. Mereria	F	24
29. Kimwe	F	49
30. Moanmarti Tatera	F	64
31. Tari Arebonto	F	40
32 Mareta Letawa	F	52
33 Nimaaki Teremia	M	24
34 Anerina Taaraeta	M	25
35. Teaborua-Rauneke	- M	60
36 Waibona Tekima	- M	91
37 Mariano Karoro	M	58
38 Naatan Taakibu	M	61
39 Arawi Kawanaka	M	60
40 Baia Baiaveu Ieloo	F	26
41 Kiteita Timatan	F	21
42 Tebwebwe Timatan	M	32
43 Emma Timatan	F	20
44. Marco Kaufinoke	M	52
45 Taamoa Bokaraoa	M	58
46 Tiaon Ioatia	M	38
47. Buateriki Teeraron	M	48
48. Karaabaa Tamwuaki	M	22

(3) Bonriki Community Meeting, 23 Nov 2019

Name	Female/Male	Age (Yrs)
49. Talerui James	F	60 yrs.
50. Iotobina Raeke	F	48
51. Kaate Ueanta	F	54
52. Tanta Uriam	F	52
53 Teuta Tawaba		22
54 Tawaba Mitiana		47
55 Biauro Teroton		50
56 Bwebweninnatang		22
57 Tiataren Tokarake		54
58 Tebwaki Tebwan		49
59 Johnas Waibenua		33
60 Rutian Boe		42
61 Nikutabu Ano		44

ANNEX 3 MINUTES OF CONSULTATION WITH BONRIKI RESIDENTS, 29 JUNE 2020

Team members:

Timon Uatioa	- Team Leader (Deputy Secretary, MELAD)
Kinaai Kairo	- Director, ALD
Teaaro Otiuea	- Deputy Director, ALD
Kabuati Teuriaria	- Senior Agricultural Officer (SAO), ALD
Tekataake Oromita	- Ag. SAO, ALD
Karoti Toto	- Agricultural Officer (AO)
Tiaon Aukitino	- Ministry of Infrastructure and Sustainable Energy (MISE)
LMD Team	
PUB Team	

1. The first 'maneaba' at the new road or 'Te Kawai ae Boou' was visited at 0930hrs on Monday morning 29th June 2020. The consultation commenced with welcome remarks from the Chairperson of the Mother Community followed by additional introductory remarks from Councilor Martin Pine. Finally, the team was given the floor to proceed with their presentation
2. MELAD Team Leader gave a brief introduction on the purpose of the visit which is to introduce the planting component plan of the solar panel project and the outcome expected from the consultation to be raised from Bonriki residents especially those to be affected by the project. There were around 15 people attending the consultation meeting at the ocean side of Bonriki
3. ALD Director, presented the replanting plan highlighting the 20m buffer zone outside the fence to be erected when the project starts, as the area to be planted. In addition, she elaborated that there would be different varieties of crops to be planted ranging from fruit trees, root crops, medicinal plants and other low maintenance local crops. The main idea behind this is to ensure that Bonriki residents will be able to harvest food and get local medicines later on from crops within the 20m zone once the project site is completely fenced off. Furthermore, she stressed that there would be no watchman to look after the zone and the residents are kindly requested to do this job on a voluntary basis as a way forward to ensure ownership by those residents who will be executing the activities at the end of the day
4. SAO Kabuati presented specifically on the 5 nurseries to be established on the site at different locations as well as the crops to be planted. He briefly informed that a total of 2,000 crops will be planted and these will include coconut trees (specifically the dwarf variety), pandanus (as many varieties as can be provided), wild fig (te bero), breadfruit trees (different varieties), pawpaw, banana, cassava, sweet potato, medicinal plants like, te ren, te ukin, te uri, etc. There would be 5 nurseries to be established as well inside the fenced area at different locations around so that each can provide planting materials during implementation of activities that is anticipated to start in July
5. After the presentation from MELAD team, the team leader gave some time for residents to ask questions or make comments. The following questions, comments and concerns were raised:
    i) The Councilor asked if the team could advise on the boundary surrounding the project site and also if different varieties per crop could be planted

ii) One of the audiences raised a concern to the team that he has 2 water wells inside the designated area so he would like to know what will happen to those when the project commenced given that they depend on the wells for their daily needs for water
iii) One of them proposed that maybe it is better to contract one member from each household (landowner) to implement the planting activity
iv) One old man raised a concern on the proposed fenced project site to reconsider closure of the area or allow access road to cross from the ocean to lagoon side. The reason is that the area has been serving as an access road for ages to go to visit their relatives on the lagoon side of Bonriki.

6. The second consultation was convened at the Bonriki Village Catholic Maneaba on the lagoon side of Bonriki Village where more than 60 people attended. The same procedure was done and again MELAD team presented the plan following the same procedure as the first maneaba. There were a lot of concerns raised from residents and these include the following:
    i. The 20m buffer zone to be planted is insufficient to cater for the whole Bonriki residents increasing population in terms of local food, shelter and firewood. If this is done, there is an assumption that this will create more problems to those who are not land owners within the buffer zone to fight over the crops against landowners based on the advice that the cops to be planted are for everyone
    ii. The watchman should be recruited to ensure that crops to be planted are not destroyed
    iii. The project should consider giving some space for access road in order to be able to cross from the lagoon to the ocean side
7. Tiaon Aukitino from MISE provided responses to those concerns raised that were related to the solar panel project saying that these will be further considered in the process before the project commenced
8. Consultation in the third maneaba was not possible due to absence of Bonriki residents at the appointed venue. The team decided to call it a day at that point and agreed to find another time for the last consultation later.

ANNEX 4 PUBLIC INFORMATION BULLETIN

South Tarawa Renewable Energy Project

Bonriki Solar Farm

The PUB is planning to create a solar farm on the Bonriki Water Reserve. This is part of the South Tarawa Renewable Energy Project (also known as 'STREP'). It will be connected to the electricity grid to provide more reliable and 'home grown' energy for the South Tarawa community. The solar farm will have the capacity to generate up to 5 megawatts of electricity at any one time, and PUB are planning that it will generate 6.8 gigawatt hours of electricity each year (that's enough to supply around one quarter of South Tarawa's annual electricity needs[23]).

What is a Solar Farm?

Long rows of solar panels will be installed on the ground. Each panel will capture sunlight during the day and turn it into electricity. The electricity will be sent directly to the electricity network and into the homes and businesses in South Tarawa. Batteries will be used to store electricity not needed straight away. There is already one solar farm on the Bonriki Water Reserve and many buildings and homes in South Tarawa now have solar panels to generate electricity from sunlight.

Why is PUB building a Solar Farm?

Kiribati has a target to increase the amount of electricity generated by sunlight to reduce the amount of diesel required. This means Kiribati generates more of its own electricity and reduces the reliance on imported diesel. It also means Kiribati will reduce its overall greenhouse gas emissions. Solar farms are low maintenance compared to diesel.

Some key facts:

217. The solar farm will:

- Occupy 5.3 hectares of land on the Bonriki Water Reserve
- Include about 15,000 panels
- Generate a maximum of 5 megawatts of electricity at one time and around 6.845 gigawatt hours a year of clean electricity (no exhaust fumes, no noise)
- Offset 1.83 million litres of diesel fuel a year
- Avoid 4,928 tons of carbon dioxide equivalent emissions per year for 25 years

Where is the Project located and how much land is required?

[23] The Kiribati Integrated Energy Roadmap 2017-2025 says that the total generation on South Tarawa in 2014 was 23.7 gigawatt hours.

The Project will be located on the north western side of the Bonriki Water Reserve; the exact area to be finalized in consultation with MELAD. The project will occupy 5.3 hectares of land for the solar panels, batteries, office and reception areas (shown in red in the photo below). An additional 7 ha has been earmarked for future PV solar development. The land is a Government lease. The total area is shown in white in the photo below.

STREP Bonriki Solar Farm Project Area (boundary of 12.3ha in white)

The Bonriki Water Reserve is an ideal location for solar panels:

- There is a large area of flat land.
- Solar panels will not contaminate the freshwater lens; there are no pollutants that can escape from panels (even from broken panels). Batteries will be stored in containers so if there were any spills the ground will be protected from pollution.
- Panels are likely to increase the amount of rainwater that will drain into the freshwater lens.
- PUB already lease the land for the purposes of the Bonriki Water Reserve.

What does a solar farm look like?

Long lines of panels mounted on the ground. An example of what they can look like is this:

There will be some changes to the Reserve:

- Trees will need to be cleared – first from the area in 'red' in the photo, and eventually the entire area marked in white. This will change the look and feel of the Reserve at the northwestern side – changing from greenspace to solar arrays. People directly affected by the loss of trees will receive assistance by the Project. A 20 metre deep buffer of trees will be kept around the edge of the solar farm so that the panels are screened. More trees will be planted to help with screening and to compensate for trees lost during site clearance. This buffer zone will help to keep the look and feel of the green space area from the houses and roads around the reserve.
- A wire fence will be built around the site and along the roads to restrict access and protect the panels. People will still be able to use the road going through the middle of the site. But the fence will stop people from walking across the site.
- The road crossing the site will be improved so it can handle the traffic required to deliver and install the panels and other equipment.

How will the freshwater lens and neighbours be protected during construction?

Construction will not require large machinery and care will be taken to avoid dust or noise. It will take about 6 months to install the panels, batteries and office. Construction will occur during normal working hours – 7am – 5pm Monday to Friday, and possibly 7am-5pm on Saturdays. No work will be carried out on Sundays. There are standards prepared in the Environmental Management Plan that the contractor will need to follow. Importantly:

- No earthworks allowed that might affect the freshwater lens.
- No use of borrow pits within the reserve and no use of beach sand.
- Rainfall runoff to be directly to the freshwater lens and filtered if necessary.
- No local water supplies to be affected.
- Specific rules for managing rubbish and hazardous goods.
- Training of foreign staff on local culture, avoiding transmission of diseases, and a code of compliance for good behaviour and avoiding harassment and abuse of locals.

- Community safety will be protected in the way that traffic is managed and work areas are fenced off from the public. Consultation with the community and site signage will be used to inform people of the risks and to keep away from site works.

Who are the people who are directly affected by the Project?

Once operational, the Project will provide a more reliable supply of electricity that will benefit all consumers of electricity in South Tarawa, including private homes, businesses and government users. During the construction phase, the Project will affect landowners of the 14 land plots that will be repurposed for the Project, owners of trees within the site that will be removed; three households who draw water from two wells inside the Project site, and the surrounding households who will no longer be able to collect leaves, wood, firewood, and food from the project area.

Who is eligible for assistance?

(i) landowners will continue to receive lease payments;
(ii) owners of trees that will be removed from the site will be compensated;
(iii) households who draw water from two water wells in the Project site will receive a replacement water tank;
(iv) households that will no longer be able to collect leaves, wood, firewood and food from the project are will be given priority to project-related employment, where possible.

The details for eligible assistance are provided in the Resettlement Plan.

Will there be jobs available?

There may be some jobs available during the construction phase. PUB will encourage the contractor to hire households living nearby, particularly vulnerable households, locals and a target to employ at least 30% women. PUB will also ensure equal pay for equal work and all workers will be employed under international and national labor standards. Under other parts of the STREP project there is funding available for skills training in the renewable energy sector.

Will this mean cheaper electricity for our home and business?

The Project will result in more reliable electricity and less outages, and funds previously spent on diesel fuel will be used for equipment upgrades and maintenance. Electricity users will not be able to tell the difference between solar and diesel-generated power.

Has PUB considered climate change impacts?

Yes. A climate change report has been prepared. The solar farm will not be affected by sea level rise over the next 25 years, but the design will factor in the increased drought and flood risks and ensure that flood waters do not affect the panels or neighbour's properties.

Where can I find out more about the Project?

Everyone is welcome to get in touch at any time. All inquiries about the Project are to be directed to – Tiaon Aukitino, Project Management Unit – STREP, MISE. Mobile phone – 73016012; email – aukitino@gmail.com

The PUB and the contractor will get in touch with neighbors, land owners and other groups to keep them informed.

Anyone who feels affected by the project talk to The Project Management Unit, MISE, PUB, Supervising Engineer or the contractor to make a complaint or lodge a grievance, suggestion or request for information. Complaints, grievances, suggestions and requests can be made anonymously. Complaints will be directed to the responsible person/team to resolve. The complaint/grievance will be escalated to the Project Steering Committee if a suitable resolution cannot be found.

Details about the grievance mechanism, environmental impacts and benefits are provided in Initial Environmental Examination. Details about the land access process and assistance to land owners and land users, and the grievance process, are provided in the Resettlement Plan. These documents can accessed at the PUB and MISE office.

South Tarawa Renewable Energy Project Facts

The 'STREP' is an ADB, MFAT (NZ) and Kiribati Government funded project to harness solar energy for the production of electricity in South Tarawa. It follows Kiribati's priority to increase the use of renewable energy and reduce greenhouse gas emissions. STREP has three outputs: (1) Solar photovoltaic and battery storage system installed; (2) enabling framework for renewable energy adopted; and, (3) institutional capacity in renewable energy project development, management and supervision enhanced.

STREP will produce three outputs. **Output 1. Solar photovoltaic and battery energy storage system (BESS) installed.** Installation of climate-resilient, ground-mounted solar photovoltaic and BESS on the Bonriki water reserve. The output includes 5 MWp/4MWac solar photovoltaic capacity and 5 MW/13 MWh BESS, network strengthening, including associated modern control systems. The project is expected to generate 6.845 GWh of clean electricity, offset 1.83 million litres of diesel fuel a year, and avoid 4,928 tons of carbon dioxide equivalent emissions per year from 2023, for 25 years. **Output 2. Enabling framework for renewable energy adopted.** The project will assist in the creation of enabling frameworks for renewable energy development, including the development of the Energy Act for submission to Parliament, along with corresponding implementing regulations, as well as development of model transaction documents for private sector investments in renewable energy. **Output 3. Institutional capacity in renewable energy project development, management and supervision enhanced.** The output will include support for consulting services for project management and project implementation including construction supervision as well as a comprehensive and inclusive institutional capacity development program covering technical (PV and BESS design, construction, testing, commissioning, operation and maintenance), financial and economic analyses, financial management, environmental and social safeguards, gender, procurement,

tariff and governance and will use various methods and modalities such as workshops, lectures, hands-on training and certified training and degrees.

Who will be implementing the Project?

MFED is the executing agency. MISE is the implementing agency (IA) for the regulatory framework component while PUB is the IA for all other project components (Outputs 1 and 3). A project steering committee and a tender evaluation committee will be established for the project. The TA consultant will also support PUB for pre-implementation works, including procurement. The Project Management Unit (PMU) will be housed in PUB and will be supported by a Project Implementation Committee (PIC) in construction supervision and capacity building.

What are the Environmental and Social Instruments that will be used to protect people and the environment?

The Initial Environmental Examination includes an assessment of environmental risks and an Environmental Management Plan to provide standards to protect the environment.

The Resettlement Plan includes an assessment of the land requirements, the assistance to land owners and land users and the eligibility criteria. The Resettlement Plan ensures no one is worse off from this project.

Closer to the time of construction PUB will apply for an environmental permit from MELAD.

ANNEX 5 ENRICHMENT PLANTING PLAN

Rationale/Background of Program

The Tree Planting Program (TPP) is geared to recuperate unnecessary transitional costs that may arise by the affected communities once the Resettlement Plan (RP) is underway. The planting site will include the buffer zone shaded in blue which covers a land area of 4.25 acreages (Fig.1). The TPP targeted long term fruit tree species and medicinal plants which are resilient species and which require minimal maintenance. In total, there will be 650 plants to be planted by the program. The planting schedule of these crops is scheduled to commence in 2020 as to ensure plants are well established prior the Resettlement Plan commencement. As these plants require minimal maintenance, a period of three months will be catered for the establishments of the plants. Five more months for ensuring the plants are well established. Hence, a recommendation that the TPP will operate for eight months maximum duration.

Figure 1: Proposed planting area (in blue)

Prior the commencement of the TPP, the need for consulting the affected community is crucial, hence the consultation was held on June 29, 2020. Two communities were consulted. The community from the northern side of STREP (*Te Kawai ae Boou*) and the community located on the southern side of STREP - the Bonriki village community. The aim of the consultation is to inform the affected community of the TPP plan to get their views and especially, to give them the ownership feeling of the program.

The outcome of the consultation was that the community welcomed the program; however, there were two issues raised by the two communities. The first issue was on the need for the rate of compensation on food crops to be raised and the second issue was for a safer access road from northern side to southern side. The two issues had been shared previously also with STREP. TPP has nothing to do with the issues hence the program will commence as proposed if approved.

Objectives:

There are five major objectives of the program. These include:

(i) Planting available space of the TPP's site with 4 food crops and 4 medicinal plants;
(ii) Providing employment opportunity to a maximum of 125 people from the affected community for eight months;

(iii) Capacity building in Crop husbandry and Nursery management to the people employed by the program;
(iv) The planting site will be a provider to the affected community's needs in terms of food, medicine and firewood and other social and economic benefits;
(v) The program is expected to continue to provide the benefits as stated in (iv) provided the community sustained it.

Program Duration:

The program duration is eight months commencing from August, 2020 and to end in March, 2021.

Outcomes:

The outcomes of the program comprise:

(i) The 4.25 acreages of land area is enriched with the planting of four fruit tree species and four medicinal plants totaling to 638 plants. Food crops comprise of 60 dwarf coconut varieties (*Cocos nucifera*), 60 breadfruit (*Artocapus altilis*), 84 pandanus (*Pandanus amaryllifolius*), and 84 native fig (*Ficus carica*) totalling to 288. Medicinal plants on the other hand has a total of 350 which include 70 beach heliotrope (*Messerschuidia argentea*), 70 beach almond (*Terminalia litoralis*), 47 beach salt bush (*Scaevola sericea*), 46 beach mulberry (*Morinda citrifolia*) and 46 guettarda (*Guettarda speciose*).

Consideration to the solar panels that they are not shaded by the plant's canopies, the plants are to be planted away from the fence of the STREP. The food crops are tall trees when they are fully mature hence will be planted at the edge of the 20 meters buffer zone or in other words near to the road. The breadfruit and dwarf coconut trees will be planted alternatively in one row at a distance of four (4) meters away from the road. The pandanus and fig tree will be planted behind them as the second row at a distance of eight (8) meters away from the first row. In between the first and second rows, the small shrubby medicinal plants, beach mulberry (noni), and beach salt bush, will be planted. A space of eight meters will be used for food crops.

Further behind the row of pandanus and fig trees, at a distance of three (3) meters are the taller medicinal plants, the heliotrope and beach almond which will be planted in the fourth row. A space of five (5) meters away from the fence of STREP to the last fourth row will contain nothing.

All trees will be planted in existing spaces within the buffer zone and will not require the clearance and removal of existing trees.

(ii) Five Nurserymen (NM) and 120 Nurserymen Assistants (NA) are recruited from the affected community and are trained on crop husbandry and nursery management. The five NM are to be contracted on an eight months period as they are to be the leading hand of the program. As for the NA position, 15 at a time will be recruited on a one-

month duration. The aim for this short period of contract is to ensure the financial benefits are more equally distributed among more people of the affected community (Attachment 1 - Salary.docx). Gender balance will be given the priority with consideration of the heavy duty to be involved such as the digging and getting of planting materials where climbing may and will involve.

(iii) Training of the 120 recruited people will be provided by MELAD-ALD. The training will be conducted in two different modules. The first module targets the NM who are responsible to provide trainings and mentoring to the new NA as they are recruited. The second module will be for both NM and NA. The training will be divided into five different topics as to align to the phases of activities namely (a) compost making, (b) mass producing of planting materials & nursery management, (c) preparation of planting holes, (d) backfilling them with compost and, (e) planting and care of plants in their early stages after transplant phase.

Workplan and Budget of the activities to be undertaken

Activities of the program are summarized in the Work Plan/Budget table below.

No.	Activities	Outputs	Cost Description	Amount (AUD)	2020							2021		
					Q 2	Q3			Q4			Q1		
					J	*J*	*A*	*S*	*O*	*N*	*D*	*J*	*F*	*M*
1	Survey buffer zone for (i)Baseline data on food crops already established	Baseline data	Cost of survey											
	(ii)identifying the types and number of food crops and medicinal plants to be planted	Species and number of food crops are identified for planting												
2	Consultation for (i)sharing the tree planting program (TPP) with the affected community (ii)identify the 105 labours to be employed in the scheme	Affected community are informed of the program	Refreshment for 3 consultation											
		Assist in identifying of the 125 labours for the program												
		Sought community's inputs to the TOR of the labours												

3	Recruitment of 5 NM and 120 NA	5 NM & 120 NA recruited	Recruitment cost	400										
4	Training of NM & NA	NM & NA are trained of their roles according to the 4 phases of the program as scheduled	Training cost of Trainer	300										
5	Salaries for TPP employees	Salary of 5 NM (L18-1) & 15 NA (L19-1)	TPP's employees' salary	78,312										
6	Compost making by the NM & NA	Compost is made to be ready after 8 weeks	Fuel cost for shredding & transport hire	1,612										
			Cost of compost batching	6,110										
7	Procurement of planting materials	13 fruit trees, 1 creeping specie, 3 medicinal plants are procured	Cost of 2,000 planting materials & transport cost	1,600										
8	Mass production of planting materials in nursery	Planting materials are well cared in nurseries	Cost of nursery tools & equipment	4,830										
9	Planting holes preparation and backfilling with compost	2,000 plantings holes are to be made ready	Cost of shovel, spade, pick, bush knife, wheelbarrow											
10	Transplanting of food crops & medicinal plants	Targeted crops are all planted												
11	Monitoring and replacement of dying crops	All planted crops are well established												
			SUB TOTAL	**93,614**										
	Miscellaneous		**10%**	**9,361.4**										
			TOTAL	**102,975.40**										