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Network on Water Technology in Asia and Pacific

South Tarawa Water Supply Project, Kiribati

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Summary

The South Tarawa Water Supply Project funded by Asian Development Bank (leader), Green Climate Fund, World Bank and the Government of Kiribati is a USD 58 million project that aims to improve the water supply services by the construction of a desalination plant supported by solar photovoltaic cells connected to the grid that can generate the energy required for the operation of the plant. The project also includes awareness programs for the public an stakeholders in addition to technical and financial capacity building of Public Utilities Board and the relevant authorities of the Government of Kiribati, to ensure a sustainable system of high quality water supply to the entire population of South Tarawa at adequate amounts. After the completion of the preliminary works, the 6-year long project is to be officially initiated in the year 2019, and completed by the end of the year 2024. The implementing agency of the project is the Ministry of Infrastructure and Sustainable Energy (MISE). Various components of the project are already being completed. The most recent work that was initiated is the Project Design Advance of USD 2 million, the outcome of which will be the detailed design of the project and its bidding documents.

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Acronyms and Abbreviations

ADB	Asian Development Bank
EA	Executing Agency
GoK	Government of Kiribati
FGD	Focus Group Discussions
HH	Households
IA	Implementing Agency
LAR	Land Acquisition and Resettlement
MELAD	Ministry of Environment, Land and Agricultural Development
MFED	Ministry of Finance and Economic Development
MISE	Ministry of Infrastructure and Sustainable Energy
PUB	Public Utilities Board
RF	Resettlement Framework
RP	Resettlement Plant
SES	Socio Economic Survey
SPS	Safeguard Policy Statement
STWSP	South Tarawa Water Supply Project
TA	Technical Assistance

1 Introduction

South Tarawa is the capital of Republic of Kiribati situated on the Pacific Ocean at the equator. Majority of the islands of South Tarawa are less than 3 meters above the mean sea level. It represents the southern end of an atoll comprising of a string of islands with the Tarawa Lagoon to the north and the Pacific Ocean to the south as depicted in Figure 1. The individual islands of South Tarawa have now been joined into a single stretch by building causeways. The average width of the islands is about 450m. South Tarawa is governed by two local administrative subdivisions, mainly: the Betio Town Council on Betio islands in the west, and the Teinainano Urban Council governs Bairiki islands (north eastern end) to Tanaea (south western end).

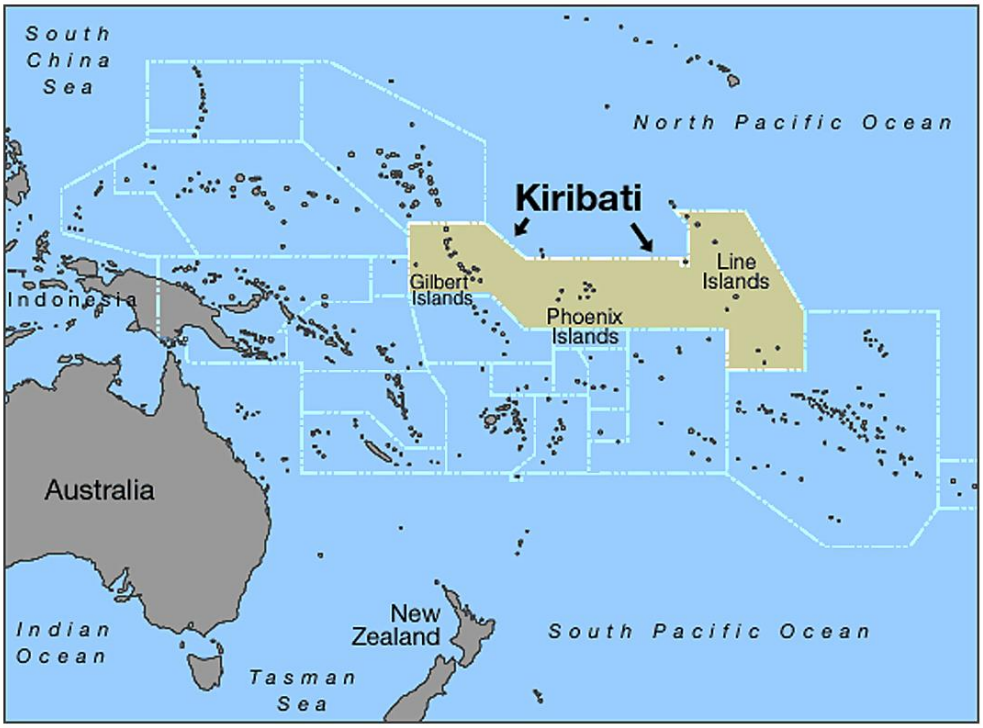


Figure 1: Location of Kiribati in the Pacific Region

Ever since achieving independence in 1979, South Tarawa has experienced rapid urbanization and population growth, with tripling rates. According to the 2010 census, the population of South Tarawa is 50,182 people, accounting for about 48% of the entire country's population. Population projections reveal that the estimated population of the South Tarawa area by the year 2020 will be around 60,936 with a growth rate of 3.87% per annum, out of which 2.26% is estimated to be caused by natural birth and death rates and 1.19% from in-migration. There is a high rate of in-migration from less developed areas of Kiribati to South Tarawa mainly due to the fact that the capital is the central hub of the country with the majority of economical, medical commercial and educational institutions and opportunities, in addition to government offices. The map of north and south Tarawa and islands is presented in Figure 2. Although the land area of South Tarawa has been recorded as 15.76 km^2, the area available for development is 12.02 km^2, and the land available for residential use is even smaller at 8.79 km^2. (Government of Kiribati and ADB, 2011).

Figure 2: Map of North and South Tarawa and Islands

Being equatorial, South Tarawa experiences warm and humid weather through-out the year, and experiences relatively high levels of rain. The rainfall is highly unpredictable due to the increase in frequency of extreme weather events in the region where South Tarawa is situated, with droughts that can go on for many months at a time. According to UNDP Human Development Report of 2014, Republic of Kiribati's Human Development Index (HDI) considering healthy life, access to knowledge and standard of living is 0.590, positioning it at 137 out of a total 187 countries. Additionally, the nominal gross domestic product (GDP) in Republic of Kiribati was US Dollar 1,599 per capita in the year 2019. Figure 3 presents the population trend in Kiribati and South Tarawa since 1947.

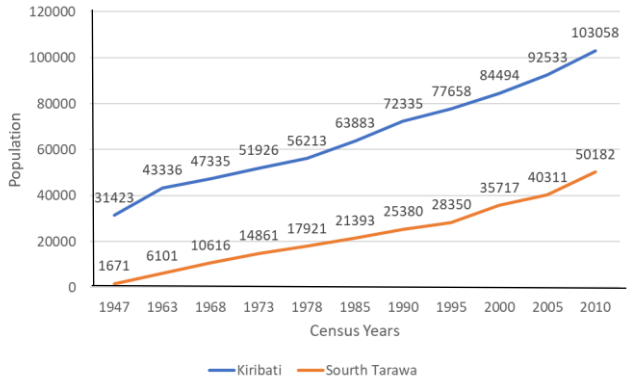


Figure 3: Population trend of Kiribati and South Tarawa from census data of 1947 to 2010

The livelihood of the people of South Tarawa is highly dependent on the health of its natural environment, mainly the marine ecosystems. The land area can be considered a fragmented coastal area with limited resources. Over the years, beach mining and other shoreline activities and the release of anthropogenic waste into the environment has led to the decline of the natural defenses that offer protection. The increasing effects of climate change has made the adaptation and mitigation measures more problematic and daunting.

The rise of sea levels and loss of land due to erosion and increase occurrence of storm surges in relation to that rise, and salt water intrusion of freshwater reserves are few of many impacts expected to hit the islands of Republic of Kiribati including South Tarawa (Figure 4). Severe storms could incur irreparable damage to housing and infrastructure as well as the natural coastal defenses that protect the vulnerable islands from wave impacts. It is estimated that the carrying capacity of the islands will decrease with some areas becoming inhabitable for humans. Climate change, sea level rise and extreme weather patterns are well known and acknowledged in the country. However, little work is done to factor the issues in during public and private investment decisions.

Figure 4: Sea water intrusion in Kiribati

Due to the uneven distribution of the population in the country, with about half the population residing in South Tarawa, public health services are not accessible to all. With an increase in the access to safe water and sanitation, the infant mortality rate was found to have decreased significantly between the years 1995 and 2005. However, tests conducted on the fresh water sources in South Tarawa has revealed that the water all the sources are contaminated and unfit for drinking. Due to this, a large percentage of households boil their water before consumption. Even so, due to the presence of pathogens that are resistant to the boiling temperature and duration, it is not sufficient enough to eradicate the occurrence of water-borne diseases.

According to health clinic statistics in 2010, one out of four people are affected by diarrhea or dysentery. Assuming that people who visit clinics will be less than the actual number of people infected (as most people will try home remedies before resorting to medical facilities), the actual incidence number will be significantly higher than the statistics imply. In November 2010 the Ministry of Health and Medical Services (MHMS) confirmed an outbreak of fever and vomiting (which was later identified as a typhoid fever outbreak by WHO), particularly among children living in Betio and South Tarawa. Infants are high risk segment of the population, and about 4 infants or children die from diarrhea in South Tarawa every month. Statistically, this is the highest infant mortality rate in the entire pacific region. Other than diarrhea and dysentery, some commonly occurring diseases include conjunctivitis, tinea corpis, and ringworm, including tinea versicolor. The origins and characteristics of the diseases and the poor health conditions of the people of South Tarawa put an emphasis on the dire need for an improved water and sanitation system in the populated areas. In

the absence of such an initiative, the number of incidences of water-borne diseases could potentially rise to devastating levels, and the potentiality of an outbreak of cholera will be imminent.

The electrical capacity of South Tarawa as of the year 2010 is 5.45 megawatts, which is generated from diesel driven power stations at Betio and Bekenibeu. There has been a rising trend among households to pay a premium amount for the installation of solar energy generators to produce upto 1.45 MW to improve energy security. Additionally, six solar photovoltaic sites at the Bikenibeu Power Station with a capacity of 400 kW and at the Bonriki Pump Station with a capacity of 500kW were installed in the year 2015. The power is distributed at 11 kV using underground cables. Even though there have been multiple investments to improve the power supply, the people of South Tarawa experience power cuts very frequently for long periods. Due to the low charge for power supply services, the utility works at a loss with no availability of funds for expansion or improvements without external funding sources.

There are three main sources of water in South Tarawa, that is Public Utilities Board water supply, rainwater and well water. The statistics of the census conducted in the year 2005 revealed that at least 80% of the population of the Republic of Kiribati is dependent on open wells as a source of water for consumption. As South Tarawa consists of coral sand and limestone islands, even though the water table is very high, the fresh water level very shallow and floats on top of the sea water in the aquifers. Due to the thin layer of fresh water available, the fresh water lenses of South Tarawa are deemed to be highly vulnerable sources, with a tendency of occurrence of high salinity due to salt water intrusion. As the ground water table is replenished by rainwater recharge, due to the high variance in the levels of precipitation and its unpredictability, they are highly fragile. The recommended use of the main fresh water lens of South Tarawa which is the Bonriki reserve is 1,660 m^3/day. However, due to the increasing rates of fresh water extraction from the reserve (as much as 20% higher than the recommended rates) the rate of salt water intrusion has increased.

The fresh water lenses that are utilized for secondary uses (other than potable uses) are also found to suffer from rapid degradation due to a large amount of water being extracted for flushing toilets, as well as for other uses like bathing and washing. Additionally, the freshwater lenses are also vulnerable to the impacts of extreme weather events. Even though the main source of water for secondary uses at Betio can withstand long-term droughts, the reserves at Biriku and Bikenibeu tend to lose their fresh water lenses even with a short-term drought. The mapping of the water lenses for the South Tarawa Water and Sanitation Roadmap 2011 to 2030 has also found increased levels of pollution in all fresh water lenses, even finding traces of fuel and oil in some cases. Furthermore, the levels of water in the aquifers found in South Tarawa have been reported as insufficient in quantity in order to provide enough water for both potable and secondary uses.

Therefore, due to their inconsistencies and vulnerability to impacts, it has been concluded that fresh water lenses are unreliable and cannot be depended on as the main source of water for human use in the long run. Many fresh water lenses have also been reported as unsuitable for use in human consumption. The pollution levels along the coast of South Tarawa is presented in Figure 5.

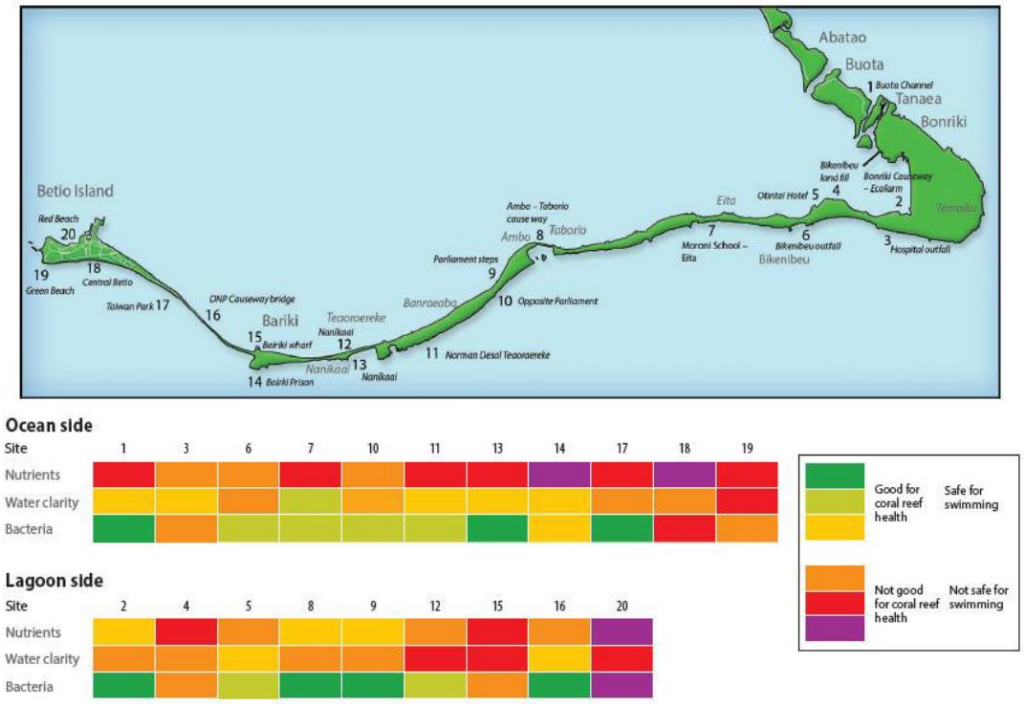


Figure 5: Pollution levels along the coast of South Tarawa (Source: GCF Funding Proposal)

The provision of water has been difficult due to the distribution of 21 inhabited islands over 3 million km^2 of ocean. Due to their geographic characteristics, most islands do not have any surface water sources and are entirely dependent on the ground water or fresh water lenses (which can be unreliable sources of water as described above). Even though there are piped water supply networks installed, it does not cover all of the households and the number of connections are declining due to the low quality of services. Due to the presence of high levels of leakages it is estimated that at least one-fourth of the supplied water is wasted. With little to no means to monitor the leaks, or flow meters for the pipes, improvement of the supply network will require in-depth planning, commitment and a continued effort. Furthermore, due to the insufficient capacity of the water supply network, the supply is rationed to a measly 2 hours of water over 48 hours at very low pressure. Frequently, water does not reach the households or destination, and the people are forced to rely of formal or informal points of water collection. It is also to note that most schools and public institutions are not included in the water supply network. Due to the low quantity of water provided, there has been an increase in the use of ground water for potable use, which is often polluted (chemically and microbiologically) and causes the break out of multiple diseases within the population.

After the initiation of the National Water Resources Policy and the National Water Resources Implementation Plan, the Government of Kiribati has proved its readiness to enhance the climate change resilience of water supply infrastructure, services and projects. Principle that relate to decreasing vulnerability to the impacts of climate change has been incorporated in the Tarawa Water Master Plan 2010 to 2030 and the Tarawa Water and Sanitation Roadmap 2010 to 2030 prepared by the Government of Kiribati in collaboration with international funding agencies.

Public Utilities Board (PUB) which was established in 1977 is the state owned enterprise that has been assigned the management and supply of power, water and sewage disposal services in the urban

area of South Tarawa. The operation and maintenance of all the infrastructure, equipment and other assets under these sectors is to be borne by the PUB. The water is supplied to the public through underground pipeline networks, including treatment and storage facilities and pumps for distribution.

Due to rapid urbanization and the projection of population increase due to expected rates of in-migration, the demand for water supply is expected to rise to 6,000 to as much as 14,000 cubic meters of water every day by 2041. However, after high losses through non-revenue water and distribution of low quantity of water, each customer ultimately receives less than 20 L every day. Due to lack of financial and technical capacity for monitoring and even maintenance, there is a high occurrence of tampering and illegal connections and tapping into the network, which contributes to the loss of water.

Even though the customers were charged a monthly rate of USD 10, the decline of quality of services and the inability for the system to keep pace with the increase in population and demand has also led to most households refusing to pay for the supplied water. The existing household connections are not metered, and the only steady income is generated by the supply of water to the commercial and industrial customers. Customers can also order for tanker trucks that charge for every cubic meter of water in addition to the delivery distance. Considering all of this, the income generated by the services provided is only USD 0.83 million over a year, whereas the cost of the water supply network has been estimated at USD 1.06 million. The high operational cost and low revenue generation has caused the PUB to suffer from significant financial difficulties. This has led to a domino effect, with the irrecoverable dent on the financial capacity of the service providers leading to further degradation of services quality and maintenance works, which can potentially lead to the ultimate collapse of the entire system.

2 Technical and Technological Brief

The South Tarawa Water Supply Project aims to rehabilitate the existing water supply network by increasing their efficiency and improving their infrastructures, and also to construct and operate a desalination plant to provide sufficient water to all residents of South Tarawa, with supporting renewable energy source to counter the added energy demand of the plant.

The Asian Development Bank, Green Climate Fund and World Bank have agreed to offer financial and technical support to the Government of Kiribati, covering the financial gap required for the works to be done. The implementing agency has been declared as the Ministry of Infrastructure and Sustainable Energy (MISE) and the Public Utilities Board (PUB).

Due to the multiple sources of donations, and the limitations of the implementing agency to adhere to multiple procurement and financial policies, procedures and requirements, the donor partners have declared ADB as the leading parallel financier during the implementation of the project.

The Asian Development Bank has already completed the preliminary works of the project including an inception report in 2016, detailed environmental impact assessment with poverty and social analysis in 2017, and other works under Project Preparatory Technical Assistance (PPTA). The project was aimed to (ii) assess technical suitability, economic, financial and social viability, capacity and institutional issues, climate change resilience and address environmental and social safeguards of the project, and (iii) identify measures to strengthen project implementation capacity of implementing agencies. Upon completion of the PPTA, ADB is now funding the Project Design Advance of USD 2 million which in included in the total project amount of USD 58 million.

Table 1: Overview of the South Tarawa Water Supply Project, Kiribati

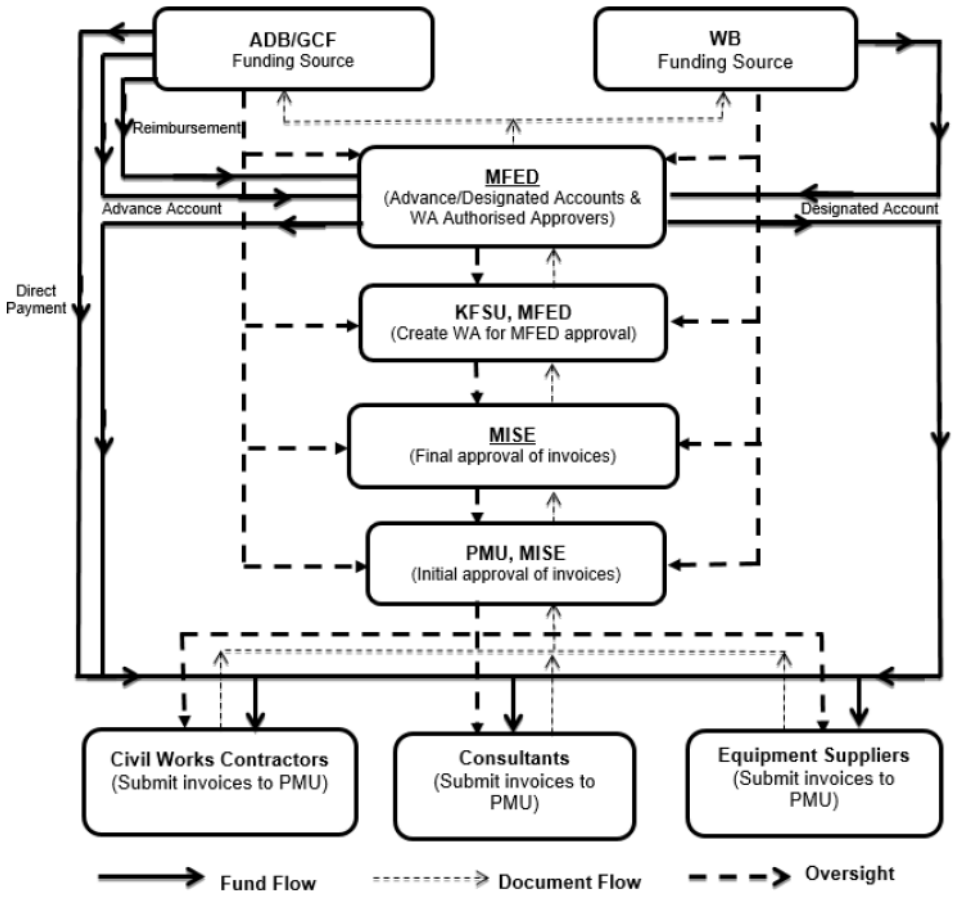
Project Name	South Tarawa Water Supply Project
Project Location	South Tarawa, Kiribati
Lead Financier	Asian Development Bank
Parallel Financiers	World Bank International Development Association (IDA) Green Climate Fund Government of Kiribati
Implementation Start Date	1st January 2019
Implementation End Date	31st December 2024
Estimated Duration of Project	6 years
Environmental Category	Environment (B) Involuntary Resettlement (B) Indigenous Peoples (C) (to be updated upon completion of detailed designs)
Borrower	Ministry of Finance and Economic Development
Implementing Agency	Ministry of Infrastructure and Sustainable Energy, Betio, Tarawa
Total Project Cost	USD 58 Million
Sectors	Water and other urban infrastructure and services / Urban water supply
Targets	Increased access of South Tarawa's population to safe water supplies

3 Financial Brief

The project is to be co-financed by four main sources: Asian Development Bank, Green Climate Fund, World Bank and the Government of Kiribati. The amount of contribution by each funding agency and the component they will contribute to are yet to be confirmed by appraisal. The details of the sources of funding and their amounts are given in Table 2 below. The summary of flow of funds is presented in Figure 6.

Table 2: Sources of Funding and their amounts

Source of Funding	**Amount (Million USD)**	**Funding Type**
International Development Association (IDA) Grant	15.00	Grant
The Government of Kiribati	1.49	Guarantee
Green Climate Fund (GCF)	28.63	Grant
Asian Development Bank	15.00	Grant
Total Project Cost	**58.00**	



ADB = Asian Development Bank; KFSU = Kiribati Fiduciary Services Unit; MFED = Ministry of Finance and Economic Development; MISE = Ministry of Infrastructure and Sustainable Energy; PMU = Project Management Unit; WA = Withdrawal Application; WB = World Bank.

Figure 6: Diagram for the flow of funds (Source: GCF Project Proposal)

4 Project Features

4.1 Technical and technological features

a Project Implementation

The main implementation body of the project will be situated at the Ministry of Infrastructure and Sustainable Energy (MISE), and will actively support the national policies and strategies of the Government of Kiribati. The timetable for project implementation is summarized in Figure 7. The Project Management Unit (PMU) will be situated at and overseen by MISE, and they will be carrying out the project activities, coordinating between stakeholders and development partners, in addition to the management of contractual works. The PMU will report to the MISE and the steering committee of the project, which is the National Infrastructure Development Steering Committee (NIDSC). Private consultants will be hired for the PMU under the project budget, and the PMU will be further supported by the technical assistance of the Project Design Advance (PDA) consultancy firm. The main tasks of the PDA firm include the preparation of the design of the water supply network, in

addition to the bidding and safeguard documents. Public participation programs will also be conducted by the PDA firm prior to the finalization of the design, with the assistance of the PMU. The National Designated Authority (NDA) will aid in the monitoring of the project progress, and Kiribati's National Water and Sanitation Coordination Committee (NWSCC) will assist in the stakeholder analysis and communication.

Components	Activities	2018				2019				2020				2021				2022				2023				2024			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Project Processing Milestones																													
Stregthening climate resilient low carbon water infrastructure	Construct desalination plant																												
	Upgrade and expand water supply network																												
	Construction solar PV plant and system																												
Institutional Strengthening for water supply management	Undertake operations and maintenance of desalination plants																												
	Implement institutional strengthening																												
	Project implementation and safeguards																												
	Undertake detailed project design																												
Outreach and awareness raising	Implement water conservation and WASH awareness programs																												
	Construct climate change and water resources visitor education center																												
Project Management	Project Management Unit																												

Figure 7: Timetable for project implementation

b Project Components

Component 1: Improvement of Water Supply Services (USD 41 million)
The target of the first component of the project is to decrease the vulnerability of the water supply services to the impacts of climate change and to increase the coverage of water supply services in South Tarawa. The works includes the development and operation of a desalination plant of capacity 4000 cubic meters under 5 year long a design, build and operate agreement, with the support of a solar photovoltaic energy system to generate the energy required for the operation of the plant and other needs. It also involves the technical assistance from the contractor required for monitoring and maintenance.
The component also includes the improvement of the efficiency of the existing water supply networks and their expansion, with the installation of meters at house connections and designated areas of the network. The parts of the existing networks that are unusable will be completely overhauled and reconstructed. Under this component, the activities will be carried out with the Public Utility Board and by utilizing the labor force within the local community.

Component 2: PUB capacity building and performance improvement (USD 7 million)
In order to ensure the sustainability of the investments made under the project, the component aims to improve the technical and financial capacity of the Public Utility Board.

Sub-component 2.1: Institutional support to PUB (USD 6.8 million)
The Public Utility Board will be aided by a Private Contractor hired under an operation and maintenance contract based on performance over a 5 year period. The contractor will be assigned to provide operation and maintenance services to the pumping stations and network and monitor the construction works. The target of the Private Contractor will be to achieve lower levels of water wastage and higher efficiency in energy and resource consumption. Additionally, the Private Contractors will provide technical assistance to the Public Utility Board through management and training programs, in order to properly pass down information on plant, business and asset management and maintenance to the Public Utility Board.

Sub-component 2.2: Groundwater management (USD 0.2 million)
Under this sub-component the Government of Kiribati will be assisted in the conservation and preservation of the main water reserves on South Tarawa Buota and Bonriki, to prevent them from being contaminated and depleted by over extraction.

Component 3: Hygiene promotion and sanitation pilot (USD 3.2 million)
The effectiveness of an improved water supply services in improvement of the human health and well-being depends on the behavior of the community as well. This component aims to improve and bring behavioral changes to the members of the local community by encouraging WASH practices through in depth awareness programs. The component will also aim to come up with a sustainable sanitation model that is economically feasible for application in the South Tarawa area, before investing in their establishment. Technical advice and training will also be provided for key community members to improve their capacity to organize.

Component 4: Project management and institutional strengthening (USD 6.8 million)
Assistance will also be provided to the Ministry of Infrastructure and Sustainable Energy for the monitoring of the contractual works commenced under the project. Technical assistance will be provided for the evaluation of the existing laws and regulations in the water and sewerage sector, identifying gaps and offering alternatives and solutions. Funding will be provided for the establishment and operation of a Project Management Unit including technical assistants, supervision and design consultants.

c Main Infrastructure Works

The estimated structures that will be constructed under this project includes the following:

- Installation of solar panels mounted on concrete footings, connected to the grid using underground cables and a transformer. The environmental issues that arise from this work is manageable. However, the social aspect of land acquirement with the required proximity to the desalination plant or water reserve could post an issue.
- Installation of the water supply networks pipelines will include excavation, placement of pipes, pump stations and other plumbing requirements, followed by backfilling. This work may involve temporary relocation of structures and facilities and the related compensations to be provided to the resident, and potential removal of vegetation or crops.
- Installation of the desalination plant will be done on a government owned land at Betio, and will contain a storage facility for chemical, a plant control centre, desalination units, supply water storage units and filter concentrate discharge through the existing sewer outfall.

Desalination Technology

The process of seawater desalination was considered to be the most economically feasible and sustainable method of water treatment for supply according to multiple studies done and reports generated from the preliminary works of the project. The low vulnerability of the system to climate change impacts, and its diverse applications in various types of source water has made the method even more attractive for implementation at South Tarawa. Figure 8 shows the proposed location of the desalination plant. For islands with small land area, desalination process is deemed to be the least land resource consumptive method of water treatment. As an added support to the enhancement of the water supply services by the construction of a new plant, the project includes the rehabilitation

of existing systems, and awareness components for the strengthening of WASH behavior amongst the community.

Figure 8: Proposed location of the desalination plant in South Tarawa

Solar Photovoltaic Technology

Desalination has a high demand for energy due to the requirement of pressures that enable reverse osmosis. To offset the energy requirement, the RO Desalination Plant is to be powered by Solar PV which has been deemed the best renewable energy technology option for South Tarawa in a study conducted by the International Renewable Energy Agency. A detailed option study revealed that the most effective location for the Solar PV will be near the Bonriki pumping station. It also stated that the system should consist of 2,500 kW of ground mounted PVs with a 2000 kW Solar Smoothing Energy Storage (SSES) system to provide adequate operation flexibility. The recommendations will be reviewed and finalized in the Project Design Advance phase, which is currently being carried out.

4.2 Economic and Financial Features

The costs of the project and its components are outlined in Table 3 below. The division of the costs between the various funding agencies is to be done during the Appraisal and will be confirmed then.

Table 3: Estimated distribution of finances to the components and subcomponents of the project

Component	Activity	Amount (Million USD)
Strengthening climate resilient, low carbon water	Construct a desalination plant	16.20

infrastructure (capital expenditures only)	Upgrade and expand water supply network	14.55
	Construct a solar PV plant and system	9.63
Institutional strengthening for water supply management	Undertake O&M of desalination plant (5 years)	1.57
	Implement institutional strengthening	7.00
	Implement project and safeguards	2.60
	Undertake detailed project design	2.00
	Treat water (additional treatment needs due to climate change for 5 years)	0.16
Outreach and awareness raising	Implement water conservation and WASH awareness program	2.17
	Construct climate change and water resources visitor education center	0.06
Project management	Manage project (PMU)	2.15
	Total	**58.08**

The total project cost in Table 3 involves funding that is to be spent on the evaluation of the existing sanitation network and the establishment of a WASH awareness program. These aspects have been included in the South Tarawa Water Supply Project due to their inseparability from the objective of the project.

a Economic Analysis

The estimated Economic Internal Rate of Return (EIRR) of the project is 13%, with a threshold rate of 9%. Considering the lower threshold rate of 9% for discounts, the Expected Net Present Value (ENPV) will be an estimated amount of USD 11.8 Million. Even with the increase in operation and maintenance costs to 20% of the expected value, the ENPV is still profitable. If there is a decrease in revenue generation along with the increase in operation costs, the ENPV becomes a negative value. The effect of changes in fuel cost to the effectiveness of the project is negligible as the project is dependent on a renewable source of energy. Additionally, the increase in water quality and quantity will lead to a decrease in the occurrence of water-borne diseases, creating economic benefits in the curbing of the cost for medical treatment. The inclusion of the benefits from an in-depth study on the willingness to pay of the consumers, the estimated ENPV could potentially rise with the increase in readiness to pay for improved water supply services that can increase the revenue generated.

b Financial Analysis

Due to the ineffectiveness of the existing water supply tariff structure, an entirely new structure is required for the proper implementation of an improved water supply system. The tariff system will need to be determined through sufficient public and stakeholder consultation meetings, and an evaluation of the willingness of the customers to pay for the services. The rate of water consumption will also need to be determined for decision making. The tariff determined will provide a more reliable projection of the revenue that will be generated through the water supply service provision, and will allow the prediction of the potential requirement for subsidies.

The report on the Economic Costs of Inadequate Water and Sanitation report included the results of a willingness to pay study, and it concluded that majority of households are willing to pay an average

amount of AUD 13 per month for improved water supply and sanitation services. As the study involved both sanitation and water sectors, it is not directly applicable for the water supply project, but can be used as an indicator. Some customers already pay amounts greater than AUD 10 per month for water tanker deliveries and buckets of rainwater, as discussed in the stakeholder meetings in 2017. South Tarawa Desalination Economic and Social Feasibility Study (2017) revealed that most households are willing to pay 1 to 2 cents for every liter of water, and most households already spend USD 0.5 to 2 everyday for their water needs. According to the study, more than 80% of the population were willing to pay for improved services.

Tarif generation with a local context can be achieved with the application of the results of 24/7 water supply pilot projects that are currently ongoing in 3 communities of South Tarawa. The results of the project will enable the determination of consumption of water and the best applicable tariff systems which are research gaps in the region.

c Cost of Operations and Maintenance

It is estimated that the Government of Kiribati will have to subsidise the long-term operation and maintenance of the new water supply network, to ensure sustainability of the project. The cabinet of the Government of Kiribati has already agreed to meet the financial requirements (if any arises) for the implementation of the new system following the completion of the project. The Government of Kiribati is adamant to develop a sustainable water supply sector with adequate reforms in the tariff structure and has created a Kiribati Economic Reform Plan (KERP) which passes the mandate of publishing a Community Service Obligation Policy to the Ministry of Finance and Economic Development and oversee the improvement of the PUB and its services through the Cabinet.

4.3 Social and Environmental Features

The project has already completed an Environmental and Social Impact Assessment which includes a grievance redress mechanism, an environmental and social management plan in addition to a monitoring plan. With proper implementation of the mitigation measures stated in the ESIA, the project will not have any long-lasting environmental impacts, and most of the impacts will be short term and limited to the construction period.

The ESIA also stated that the project will not affect any vulnerable ecosystems or historically significant locations as the project scope is within an already developed urban area. Additionally, as the water extraction will be done well below the fresh water lens of the area, it will not alter the fresh water lenses that are being utilized by the community. As the desalination plant is to be constructed in a government owned land, it is not estimated that the project will require any displacement of people, other than the short-term relocation for the installation of pipelines. The excavation required for project implementation is considered minimal due to the relatively shallow depth. In order to mitigate the disturbances to the community during the construction phase, the works will be carried out during pre-specified hours, with proper measures to control dust. The pipeline network will be equipped with secure manholes, adequate protection for pumps and other equipment, including warning signs to mark areas that are not to be accessed for safety reasons. The desalination plant will be fitted with necessary noise cancellation measures, to minimize the disturbance caused by the high-pressure pump.

Risk of accidents will be minimized by the provision of effective protective and safety gear, in addition to the conduction of awareness programs on diseases and their prevention. The requirement for sand for backfilling will be managed with the reuse of construction waste instead of procurement of sand, after receiving the required permits. The contractor for construction works will be required to submit a construction Environmental and Social Management Plan that aligns with the project ESIA before the start of any physical works. The filter concentrate from the RO plant will be conveyed through pipes to the existing outfall pipeline of the neighboring pump station at Betio to combine with sewage and pumped to the ocean. The outfall pipe has been selected so that immediate dilution and mixing of the effluent stream is achieved, with the diffuser at 30 meters below the surface and 47 meters away from the nearest coral ecosystem. Figure 9 presents the route of filter concentrate from the RO plant to the outfall pipe.

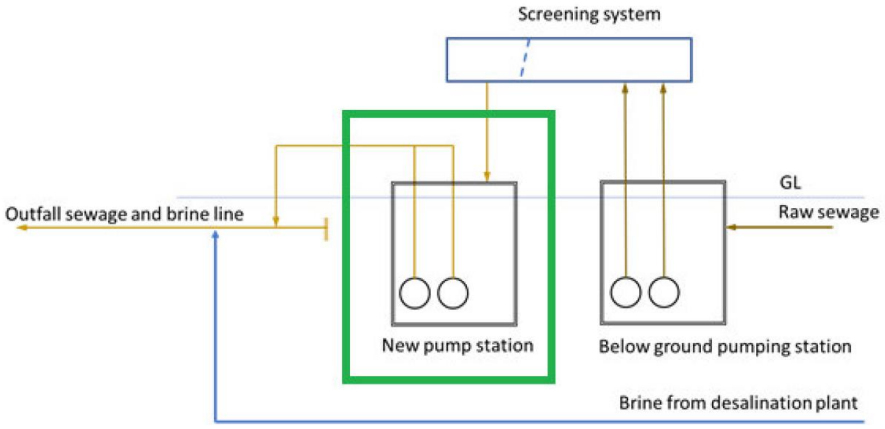


Figure 9: Route of filter concentrate from the RO plant to the outfall pipe

The supply water will be regularly monitored for salinity and pathogens in order to adhere to the WHO guidelines and local regulations, and any breakouts will be corrected, and the required precautionary measures informed to the public. In addition to the environmental and technical aspects of the project, the ESIA also covered the impacts on the social aspects as well. The project is to be conducted with the participation of relevant stakeholders and the public community in all aspects of the project: from the design to its final implementation and ultimate operation and monitoring. Reach out programs will be carried out through stakeholder consultation meetings, in order to determine the issues in the existing systems and the needs of the public (including men, women and children at equitable level) before the finalization of the design. Surveys will be done prior to, during and post construction and operation to determine the quality level of the services and get feedback from the public regarding any complains through a grievance redress mechanism. Among the activities of component 2 that involves the increase in capacity of the Public Utility Board, actions have been included to improve the customer relationship through better communication routes and provision of a mechanism to lodge complaints and address them in the planning of operations. The aim of increased participation of the public in project outcome is to achieve higher numbers of household connections and enable the accountability of service providers by the community themselves.

The project has special emphasis on the equal representation of both genders through activities that minimize the gender gaps that were highlighted in the Preparation Technical Assistance project conducted by ADB. It is commonplace that the woman is usually the person in the household that plays a major part in the chores involving the use of supplied water, washing and cleaning. Additionally, it has been found that water collection and delivery is usually done by the men in the

household. Therefore, an effective public participation requires that women are represented as much as men in the decision-making process.

A social and poverty assessment done by ADB revealed that the community of South Tarawa is in dire need to an in-depth long-term awareness programs need to be conducted regarding the interrelationship between the quality of supply water and sanitation services and the occurrence of diseases. In order to enable the implementation of a tariff system that is beneficial for the sustainability of operations of the new water supply system, the public needs to be made aware of the advantages of improve water quality in the prevention of water-borne diseases, and water quantity for prevention of water-washed diseases. Additionally, awareness programs will also cover the risks involved in the illegal tapping in to the supply system to the persons health, and the community's well-being. The project will also ensure that the poor are not unfairly charged a higher fee for their higher need for water quantity, due to lack of facilities for rainwater harvesting.

Even though it is not predicted that the project will require land acquisition private parties that may lead to resettlement, ADB has already formed a Resettlement Framework and Plan which includes the due procedures to follow in case the need for land attainment arises. During the preparation of the project overview, due consideration was given to the methods that will lead to a low requirement of land (low footprint) for the components of the project. Additionally, steps will be taken to enable the installation of new equipment or tanks for the rehabilitation of the existing systems within the currently used land plot itself, with minimum modifications to the design and layout.

Furthermore, as the project is going to be conducted in an already developed area of South Tarawa, it is predicted that it will not have any impact on indigenous communities present in the area, other than the potential clearance of certain plants or crops for the installation of the pipeline network. The proximity of burial sites to the locations of project implementation will be determined through the ESMP, and awareness programs will be conducted to prevent further burial rituals at the sites as well.

Additionally, the project aims to provide assistance to the Government of Kiribati to manage the informal settlements and their populations which are situated over the two main water reserves of South Tarawa (Buota and Bonriki) to ensure sustainability of the fresh water reserves. The project team will aid the Government of Kiribati to determine the best way to approach the 100 or so squatter households in the area, taking into consideration the past experiences the government has had in dealing with them. The current approach that has been recommended includes the conduction of awareness programs for the community to improve the sanitation and WASH behaviors of the squatters, to inform them of the dangers of water contamination and to prevent further expansion of the settlement. The comprehensive social engagement process as described above will ensure proper information dissemination between the parties and prevent the rise of conflicts. In case the Government of Kiribati decides to relocate the squatters during the lifetime of the project, it will be done in accordance with the Resettlement Framework and Plan that has been prepared.

5 Project Benefits

The project has been actively designed to be environmentally and socially beneficial in all aspects. The introduction of desalination plants in the South Tarawa atoll will decrease the dependency of the population on the unsafe and unreliable fresh water lenses (mainly Bonriki and Buota) as a source of potable water. Due to the deterioration of the quality of water in the fresh water lenses caused by climate and anthropogenic activities, the availability of a more reliable source of drinking water will

greatly increase the water security of the area. It will also increase the quantity of water available for everyday use, improving the health and well-being of the people of South Tarawa.

The most significant positive impact from the project will be the health benefits, and the expected reduction of infant mortality rates that are attributed to diarrhea occurrence. The cost of treatment upon disease occurrence ill also be greatly reduced, in addition to the losses due to the reduction of productivity of the infected people. Furthermore, the overall improvement of the health of the residents will also reduce the losses of income or benefits incurred by the absences to work and school. Through the equal involvement of women in the public consultations held during project development and implementation process will enable an even share for women in the benefits of the project, and the special needs of women can also be met. With the provision of the minimum amount of 50 litres per person per day, there will be a significant decrease in occurrence of water-borne diseases and water-washed diseases which are preventable by higher quality and quantities of water.

The benefits of such water supply projects extend beyond the enhancement of health and well-being. Such projects can also have indirect positive impacts on the residents by enabling higher income levels through improved productivity and time management, better child care and the overall enhancement of the quality of life. An adequate supply of water will also improve psychological aspects of the residents' life by lower stress levels, higher self-esteem and the enrichment of communication, interactions and relationships between individuals and groups. It will also enable the observation of religious rites and customs with little to no limitations.

The components of the project will also be designed to incorporate adaptive and mitigation actions against the impacts of climate change. The decrease in availability of fresh water due to the increase in temperatures and increase in frequency of occurrence and duration of droughts will be curbed by the use of a steady source of water from the ocean. The time taken for the collection and carriage of water from formal or informal sources to the household will be practically eliminated, allowing the time saved for recreational purposes, and increasing the overall livelihood of the people of South Tarawa.

The installation of solar photovoltaic cells will enable the provision of a steady level of water supply to the customers and the network can be established as a reliable trustworthy source of potable water. The utilization of solar energy will also reduce the level of greenhouse gas emissions by the use of renewable energy sources instead of burning fossil fuels for the generation of energy. Indirect reduction of greenhouse gases will also be achieved through the provision of good quality water that is not contaminated, which will ultimately reduce the amount of fossil fuels burned for generation of energy for boiling of the water to make it fit for consumption. The rehabilitation of the existing water supply network will reduce the level of non-revenue water, increase efficiency of the pumping systems. This has the indirect positive effect of decreasing the energy required to produce and supply water to all customers. It has been estimated that a total reduction of 154,000 tons can be achieved over the operation of the facility in its 20-year lifetime. Therefore, the social, economic and environmental co-benefits of the project are significant, and overall, the provision of a safe and sufficient water supply has the potential to be a truly transformative event in the lives of all people in South Tarawa.

6 Implementation and Status of the Project

With the development of the Kiribati Adaptation Program, the implementing agency MISE has enabled the management of safeguards risks. It has also been reviewed by a former World Bank staff,

to confirm the compliance with social safeguard policies of World Bank. Due to the limitations in technical capacity within the Government of Kiribati to manage safeguards, and the vulnerability of South Tarawa geographical status and the existence of informal settlements in the project area, the environmental and social risks are considered a key element in the project implementation. It has been concluded that technical assistance will be provided to the Project Management Unit specifically for the management of environmental and social safeguard matters.

Public consultation meetings have been held with the participation of relevant stakeholders including MISE, PUB, the Presidents Office, Ministry of Environment, Lands and Agricultural Development (MELAD), Ministry of Education, Ministry of Women, Youth and Social Affairs (MWYSA), Ministry of Health and Medical Services (MHMS), Ministry of Internal Affairs (MIA), airport improvement consultants, international and national NGOs, KAPIII staff and specialists, Australian Department of Foreign Affairs and Trade, New Zealand Ministry of Foreign Affairs and Trade and UNICEF.

The project initiation was marked with a workshop held on 18th July 2017. During the workshop, comments and recommendations were received from the stakeholders, for consideration at the initial stage of the project, and inclusion in the project inception report. Additionally, land owners have also been consulted regarding the selection of locations for installation of water storage tanks and additional pumping stations.

Furthermore, Civil Society Organisation (CSO) training programs have also been conducted, as the awareness programs are to be implemented by the establishment of partnerships with NGOs and local CSOs. The capacity of the existing CSOs for their potential involvement in the project awareness sections were done during the meeting held with 8 representatives from the 2 identified national, community based, water supply and sanitation sector relevant CSOs active in South Tarawa. A training for the CSOs was conducted on 25th to 26th July 2017, and a community consultation team was established. The selected 2 CSOs also participated in a regional meeting on the improvement of CSOs that was held in Samoa in September 2017 by the ADB Pacific Department and NGO and Civil Society Centre.

Since the initiation of the first phase of the project, about 20 community-based workshops were held in 13 villages from 31st July to 5th August 2017, with 426 participants in total. The participants were selected with an average age of 42 years, with adequate representation of low- and no-income households, and it was ensured that at least 50% of the participants were women. The purpose of the workshops was to share information with the community regarding the project, the need for the project, the issues being faced, the stakeholders that are involved and the part they will play in the project implementation, and the solutions being considered for the issues. The community was allowed to share any dissent and voice concerns and ask questions and discuss various ideas and opinions.

A Resettlement Framework and Resettlement Plan has already been prepared by ADB on December 2017, followed by the Environmental and Social Impact Assessment Report prepared in February 2018. A survey was also done on the practices of water boiling and fossil fuel consumption within households in South Tarawa during January 2018 as a preliminary activity of the project. Information regarding the objections of the project and the results of the Project Preparatory Technical Assistance (PPTA) conducted by ADB was shared with the stakeholders through presentations on 13th February 2018.

The works of Project Design Advance was initiated in January 2018 and was to be completed by March 2019. Even though the consulting firm was hired and 87% of the contracts have been awarded, the disbursement of the project is only at 9% according to ADB. The design of the project has not

been finalized as of yet, and the documents have not yet been made public. The design and safeguard documents required under component 1 are to be completed by the date of project appraisal, and the capacity building and performance improvement bidding documents are also expected to be completed by then.

References

Asian Development Bank (2017). Project Preparatory Technical Assistance, Retreived on 4 th May 2019 from https://www.adb.org/sites/default/files/project-document/225581/49453-001-pptar.pdf

Asian Development Bank (2017). Republic of Kiribati: South Tarawa Water Supply Project - Project Design Advance, Retreived on 4th May 2019 from https://www.adb.org/sites/default/files/project-documents/49453/49453-003-pda-en.pdf

Asian Development Bank (2018). Environmental and Social Safeguards: South Tarawa Water Supply Project, Retreived on 4th May 2019 from https://www.greenclimate.fund/documents/20182/425199/ESS_report_-_FP091_-_ADB_-_Kiribati.pdf/9e5b1c0d-c47b-7aaf-19c6-5ddfd8a1326e

Asian Development Bank (2019). Gender Action Plan: South Tarawa Water Supply Project, Retreived on 4th May 2019 from https://www.greenclimate.fund/documents/20182/737049/Gender_action_plan_-_FP091_-_ADB_-_Kiribati.pdf/722329ec-1ca4-c574-f581-4326806df3cb

Asian Development Bank (2008). Kiribati Social and Economic Report 2008: Managing Development Risk, Retreived on 4th May 2019 from https://www.adb.org/sites/default/files/publication/29733/kiribati-economic-report-2008.pdf

Asian Development Bank (2017). Grant Agreement: Project Design Advance for South Tarawa Water Supply Project, Retreived on 4th May 2019 from https://www.adb.org/sites/default/files/project-documents/49453/49453-003-grj-en.pdf

Asian Development Bank (2018). Funding Proposal 091 : South Tarawa Water Supply Project, Retreived on 4th May 2019 from https://www.greenclimate.fund/documents/20182/574760/Funding_Proposal_-_FP091_-_ADB_-_Kiribati.pdf/9320f17b-f4a0-e0bc-8408-9d5655eda908

Asian Development Bank (2019). Gender Assessment: South Tarawa Water Supply Project, Retreived on 4th May 2019 from https://www.greenclimate.fund/documents/20182/737046/Gender_assessment_-_FP091_-_ADB_-_Kiribati.pdf/b0a8390d-e071-0b83-d6e8-4c8081d68b1d

The World Bank (2018). Project Information Document / Integrated Safeguards Data Sheet (PID / ISDS), Retreived on 4th May 2019 from http://documents.worldbank.org/curated/en/396751536746086581/pdf/Concept-Project-Information-Document-Integrated-Safeguards-Data-Sheet-South-Tarawa-Water-Supply-Project-P162938.pdf

Government of Kiribati and ADB (2011). South Tarawa Water and Sanitation Road Map 2011 – 2030 Volume 1, Retreived on 4th May 2019 from https://www.theprif.org/file/6641/download?token=74KZdvWF

Ministry of Infrastructure and Sustainable Energy (2017). Resettlement Framework KIR : South Tarawa Water Supply Project, Retreived on 4th May 2019 from https://www.adb.org/sites/default/files/project-documents/49453/49453-001-rf-en.pdf

Ministry of Infrastructure and Sustainable Energy (2017). Resettlement Plan KIR : South Tarawa Water Supply Project, Retreived on 4th May 2019 from https://www.adb.org/sites/default/files/project-documents/49453/49453-001-rp-en.pdf

Ministry of Infrastructure and Sustainable Energy (2018). Draft Environmental Impact Assessment Report : South Tarawa Water Supply Project, Retreived on 4th May 2019 from https://www.adb.org/sites/default/files/project-documents/49453/49453-001-eia-en.pdf

PARD/PAUS (2017). Initial poverty and social analysis: South Tarawa Water Supply Project, Retreived on 4th May 2019 from https://www.adb.org/sites/default/files/project-documents/49453/49453-001-ipsa-en.pdf

The World Bank (2013). Acting on Climate Change & Disaster Risk for the Pacific, Retreived on 4th May 2019 from http://www.worldbank.org/content/dam/Worldbank/document/EAP/Pacific%20Islands/climate-change-pacific.pdf