Water & Sanitation in the Outer Islands of the Republic of Kiribati (KIRIWATSAN) Phase 1

WATER RESOURCES ASSESSMENT
FINAL REPORT
May 2012 – June 2015

EUROPEAN UNION

SPC Secretariat of the Pacific Community

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A UNICEF project in partnership with the European Union and SPC for Kiribati


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SPC Technical Report SPC00027

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Abbreviations and symbols

CLTS	Community led total sanitation (UNICEF)
CV	Coefficient of Variation
ENSO	El Niño – Southern Oscillation Index
FACE	Funding Authorization and Certificate of Expenditure
GEF	Global Environmental Fund
GoK	Government of Kiribati
GSD	Geoscience Division (of SPC)
KIRIWATSAN I	Kiribati Water and Sanitation Phase 1 for outer islands
KAP	Kiribati Adaptation Program (Phases I, II & III)
MDGs	Millennium Development Goals
MELAD	Ministry of Environment, Land, and Agricultural Development
MIA	Ministry of Internal Affairs (formerly known as the Ministry of Internal & Social Affairs)
MPWU	Ministry of Public Works and Utilities
OIC	Officer In Charge
OIWT	Outer Island Water Technician
PCA	Programmed Contribution Agreement
PDA	Personal Digital Assistant
PE	Polyethylene
PMU	Programme/Project Management Unit
PUB	Public Utilities Board (within MPWU)
ROM	Results Orientated Monitoring
RWH	Rainwater harvesting
SOPAC	Pacific Islands Applied Geoscience Commission (now known as the Geoscience Division of SPC)
SPC	Secretariat of the Pacific Community
UNICEF	United Nations Children's Fund
WASH	Water, sanitation and hygiene
WEU	Water Engineering Unit (within MPWU)
WHO	World Health Organization
WQ	Water Quality
WRA	Water Resources Assessment

WATER RESOURCES ASSESSMENT PROGRESS REPORT – FINAL

Project Title:	**Water and Sanitation in the Outer islands of the Republic of Kiribati (KIRIWATSAN) Phase 1**
Reporting Partner:	**Secretariat of the Pacific Community**
Country:	**Kiribati**
No. and title:	**KIRIWATSAN Water Resources Assessment: FINAL Report May 2015**
Reporting period:	**May 2012 – May 2015**

I. PURPOSE

The purpose of KIRIWATSAN Phase I is to increase access to improved and sustainable water and sanitation and reduce the prevalence of water, sanitation and hygiene (WASH)–related diseases.

It has three project components:

1. hydrogeological assessment and design;
2. rainwater harvesting (RWH); and
3. community mobilisation and capacity building.

Phase II of the project will focus on the implementation of improved water supply and sanitation infrastructure.

The overall objective of KIRIWATSAN is to improve social and economic development and reduce poverty in the outer islands in Kiribati. It will contribute to closing the wide disparity between the socio-economic conditions in the capital, South Tarawa, and outer islands.

Through the provision of safe water and adequate sanitation, risk and frequency of associated water-borne diseases will be reduced and thus contribute to improving human health (MDG 3 and 4), protecting the environment and reducing inequalities in access to improved and reliable water and sanitation (MDG 7). In some cases access to improved water and sanitation, may enhance income-generating activities, which may reduce human migration to South Tarawa in search of better social services and contribute to poverty reduction (MDG 1).

In June 2011, UNICEF Pacific signed a Contribution Agreement with the European Commission for the joint implementation of Phase 1 of the Water and Sanitation in the Outer islands of the Republic of Kiribati Project (KIRIWATSAN I) together with the Government of Kiribati (GoK).

In collaboration with the Ministry of Public Works and Utilities (MPWU) of GoK, KIRIWATSAN I is being implemented in 70 villages on 16 islands of the Gilbert Islands Group between June 2011 and April 2014. The project is expected to increase access to safe and sustainable water and sanitation, improve hygiene practices and reduce the prevalence of water, sanitation and hygiene (WASH-related) diseases.

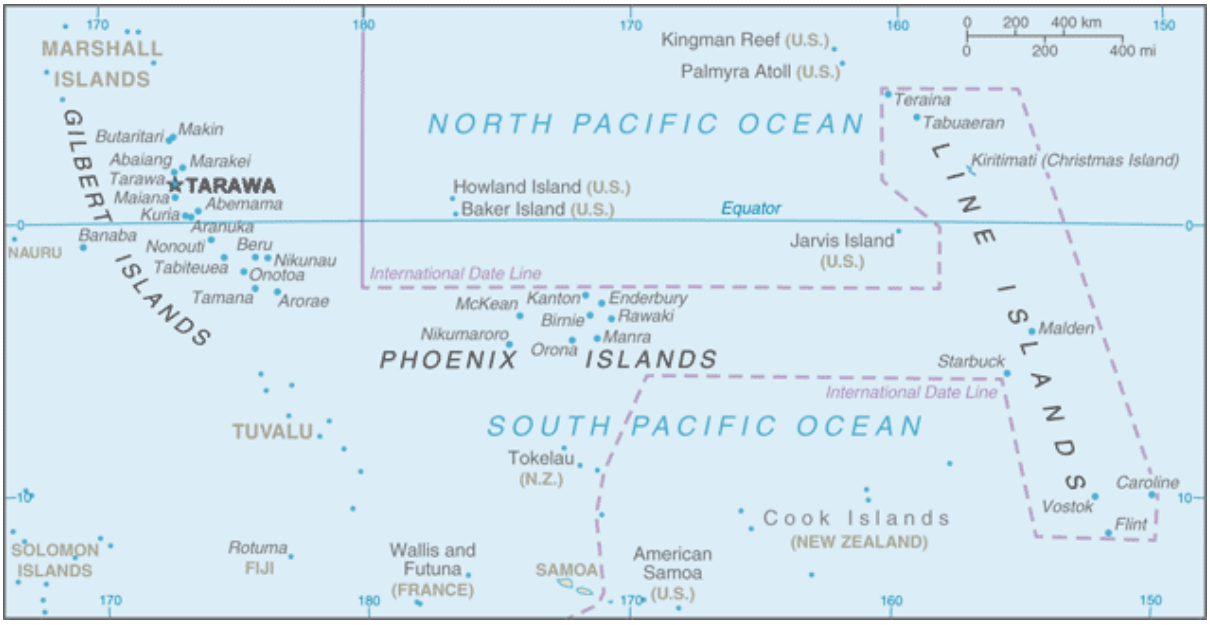

Figure 1. Map of the Gilbert islands, Kiribati: Makin, Butaritari, Marakei, Abaiang, Maiana, Nikunau, Nonouti, Beru are the targeted islands for water resource assessment.

https://www.cia.gov/library/publications/the-world-factbook/geos/kr.html

To support the delivery of this project, UNICEF engaged the Water and Sanitation Programme (WSP) of the Geoscience Division (GSD), formerly known as SOPAC, of the Secretariat of the Pacific Community (SPC) to specifically implement Component 1, which includes hydrogeological assessments to ascertain the availability and adequacy of groundwater, RWH and sanitation systems; the preliminary design of appropriate water and sanitation systems for a minimum of 35 villages in the outer islands of the Gilbert Islands Group; the production of a monitoring guideline for use by in-country water technicians; and capacity building of key local partners and counterparts.

The expected results to be achieved under this cooperation are:

- Groundwater and RWH assessments in a minimum of 35 villages of the outer islands of the Gilbert Group documented.
- Sustainable, socially acceptable, age and gender appropriate, and cost-effective preliminary designs for abstracting and capturing water for household and/or public use that optimizes the availability of improved drinking water for consumption year-round for each village.
- Sustainable, socially acceptable, age and gender appropriate and cost-effective preliminary designs for basic sanitation facilities for each village that minimise groundwater contamination, and is appropriate in the outer island hydrogeological and water resources context.
- Guidelines for groundwater monitoring to be used by water technicians (locally assigned MPWU staff) produced.
- On-the-job technical guidance and targeted training and capacity building to the assigned MPWU staff, including all water technicians on key elements of water resources assessment (WRA), analysis and reporting undertaken.
- Visual materials of preliminary water and sanitation design options developed, and publication of assessment results and stakeholder discussions appropriate for use in related KIRIWATSAN I community mobilisation interventions completed.

This progress report summarises achievements for the SPC-GSD related activities for Component 1 for the period May 2012 to May 2015 which include the following:

- Development of the Programmed Contribution Agreement (PCA).
- Development of a methodology for water resource assessments in outer islands.
- Recruitment of a dedicated Senior Hydrogeologist and two i-Kiribati national staff (1 male,1 female) and establishment of a Kiribati WRA team.
- Completion of WRA in thirty six (36) villages across eight 8 islands from September 2012 to November 2013.
- Training of eight (8) outer island water technicians and 12 MPWU staff (including OICs) in various water resources assessment techniques.
- Presentation of preliminary findings and results to village communities, GoK and UNICEF staff.
- Development of an internet-based water resources database for the project and the Government of Kiribati.
- Development of RWH and Well Improvement Fact Sheets for distribution during surveys to households in both English and Gilbertese.
- Participation in KIRIWATSAN Project steering committee meeting, and the EU Results Orientated Monitoring (ROM) reviews.
- Development of detailed designs and technical notes for groundwater abstraction systems suitable for use in outer islands.
- Development of detailed designs and technical notes for RWH systems suitable for use in outer islands.
- Development of detailed designs and technical notes for composting toilet systems suitable for use in outer islands.
- Eight technical reports covering selected villages in Makin, Butaritari, Abaiang, Marakei, Maiana, Nonouti, Beru and Nikunau.
- A guideline for water resources monitoring in the outer islands.

The water resources assessment (WRA) required significant resources that included the following:

- Twenty (20) staff from the Ministry of Public Works, 3 staff from SPC, and over 200 village casual labour engaged, over a 12-month period, to assist with the assessment work.
- Purchasing of equipment on behalf of the Government of Kiribati for use in water resource assessment, including field computers, water sampling equipment, Trimble “Juno” GPS data surveying units, field cameras, Conductivity Temperature Depth (CTD) divers, E.coli compact-dry plate materials, repair of EM34 machine and other field equipment totalling over USD $38,000.
- Travel, per diem, and miscellaneous field expenses totalling more than USD $81,000.

Issues and challenges encountered associated with undertaking water resource assessments in outer islands included:

- A general lack of preparedness by island communities to assist and resource the survey team despite preparations by the WRA team with the island council prior to the survey team arrival.
- Communication of project objectives within target villages.
- Frequently changing flight schedules.
- High cost of air-freight charges by domestic airline.
- Limited communications.
- Limited access to reliable power, clean water and transport.
- Expectation by villages to provide day labour resulting in work delays due to the need to conduct training and familiarisation of survey methods and equipment to new labour on a daily basis.
- Frequent policy changes at the Ministry of Public Works and Utilities over staff secondment procedures resulting in difficulties to establish continuity in training, and generate confidence in the application of various WRA field techniques.

A flexible approach, preparedness and planning for all eventualities, and self-sufficiency is required to counter the above challenges. Considerable effort to communicate project components and manage village and island council expectations is required.

The project also encountered difficulties in the recruitment of the national project staff. Engagement of Kiribati nationals for the project proved problematic requiring a number of iterations of contractual arrangements with Government to ensure staff could receive agreed remuneration. This issue was overcome by the use of SPC Suva-based staff.

The project also encountered cases of equipment failure and theft. The water resources component employed local villager labour to assist with the assessment and, while this approach has benefits in regard to ownership and local knowledge, additional effort and time is required for training, which resulted in greater wear and tear on the equipment being experienced. For example, treatment of the EM34 by many different labourers necessitated in repairs to be carried by the supplier in Canada. The project also experienced the theft of an expensive down hole logger. Costs for repair and replacing damaged or stolen equipment was an unexpected burden on the WRA budget.

While the agreed timeframe was tight, the WRA field work was completed on time. The work demands during the field missions were considerable and these took their toll on staff, particularly the lack of access to good quality food and water, and the very long hours required. At times national staffs were not available to assist with the field assessments due to work, health and family commitments.

II. RESOURCES

This section outlines the various human, equipment and financial resources drawn upon to undertake the assessments.

- **Human Resources**

The WRA team is composed of SPC staff and Kiribati nationals, and has engaged the human resources outlined in Table 1. In addition, more than 200 casual labourers were used from participating villages, to undertake the survey and assessment work.

Table 1. Human resources from SPC and WEU of MPWU engaged in the WRA & survey.

Position	WRA Human Resources
SPC WSP Water Resources Monitoring and Assessment Coordinator	Peter Sinclair (Suva based)
SPC WSP Water Resources Monitoring and Assessment Technical Assistant	Amit Singh (Suva based)
KIRIWATSAN Senior Hydrogeologist/ Team Leader	Aminisitai Loco
KIRIWATSAN Project Officers	Martin Mataio Mwaketa Iotebwa
Water Engineering Unit Officers	Tateti Bwatio, Moiua Aroito
KIRIWATSAN PMU	Laava Juliano
Contracted Draughtsmen	Mr Stephen Tiante (Tarawa) Mr Eremasi Nawaqaliva (Suva)
Contracted Report Editors	Mr Peter Rodda Ms Lala Bukarau
Outer Island Water Technicians	
Makin	Mr Matauea Rakobu
Butaritari	Mr Motiree Fialua
Marakei	Mr Aritiona Atanikakia
Abaiang	Mr Matanterawa Tebaai
Tarawa (N)	Mr Bwentaarawa
Maiana	Mr Tabirine Banian
Abemama	Mr Tabua Taoba
Kuria	Mr Betero Korere
Aranuka	Mr Benna Raoiroi
Nonouti	Mr Mwaia Tautebea
Tabiteuea (S)	Mr Kanenei Nakuau
Beru	Mr Bakoauea Mitiraim
Nikunau	Mr Nintabeiti Tekitea
Onotoa	Mr Teueanna Rabaere
Tamana	Mr Tebibita Tabaki
Arorae	Mr Tekabwara Tearoua

Two (2) local project officers were recruited over the course of the project. The staffs were selected through an open and transparent recruitment process. Staffs from MPWU were invited to apply on the understanding with the GoK that they would be able to be seconded to the project without losing their substantive position in MPWU. Mr Martin Mataio and Mrs Mwaketa Iotebwa were

selected by the competitive selection process and approved by the Government of Kiribati to assist the WRA work under KIRIWATSAN. However after lengthy negotiations, only Martin was made available by MPWU for the period August - December 2013. Mrs Mwaketa Iotebwa, despite agreement by GoK to be seconded to KIRIWATSAN full time for this period, was subsequently attached to the USAID-GIZ Project in Abaiang Island. This demonstrates the difficulty of developing and retaining staff long term for specialised tasks over the life of the project. It was fortunate that Laavaneta Juliaono, the MPWU Project focal point, and Mouia Arioto, a contractor with MPWU, were able to assist with some of the island assessments, in Makin, Butaritari and Beru. A permanent replacement for Mwaketa was not made available, which further reduced the Project's capacity to progress key tasks within this component.

The continuation of the secondment of Martin Mataio to the KIRWATSAN Project was planned for the period January – August 2014. This secondment was restricted to a period of only 6 weeks, due to changes in MPWU's secondment policy and changes to the WEU OIC position. Approval was finally granted for Martin's secondment for a period from July 16th to August 31st, 2014, creating significant disruption and severely restricting the progress of the project and the associated capacity building with WEU staff.

The development of the construction designs for proposed water supply systems and sanitation designs for outer islands used a contracted draughtsmen, Mr Stephen Tiante in Tarawa and Eremasi Nawaqaliva in Fiji, who were able to transfer conceptual designs into construction detailed drawings into AUTOCAD files. The detailed drawings and design notes were reviewed by a number of stakeholders in Tarawa in December 2014 resulting in amendments to the designs.

External editors, Ms Lala Bukarau and Mr Peter Rodda were used to review the final reports and reformat into the agreed standard for UNICEF and SPC.

- **Equipment Resources**

There has been significant investment in equipment for the KIRIWATSAN Project to date (Table 2), totalling more than $38,000 USD. This equipment included the following items:

Table 2. A summary of main equipment required for WRA.

Computers	2 x Dell laptop computers, 1 x Panasonic Toughbook, 1 x Dell Desktop, External Hard drives
Survey equipment	2 x Trimble Handheld Juno PDAs and software 2 x Diver downhole water quality loggers 1 x Diver baro Additional cables for EM34
Water quality equipment	Consumable laboratory equipment IDEXX Reagents EC Compact dry WQ plates
Miscellaneous and consumables	Pelican cases for equipment Iridium Satellite phone Large-scale laminated maps of survey areas Rechargeable batteries for EM34

The equipment is held with the KIRIWATSAN Phase I WRA team located at the Ministry of Public Works and Utilities in Tarawa, Kiribati. All items will remain with the broader KIRIWATSAN Project until its completion, at which point they will be transferred to the Water Engineering Unit.

- **Financial resources**

The expenditure for the KIRIWATSAN Phase I covers the period from May 2012 until end June 2015. It details expenditure against:

- Tranche 1 estimates and identifies SPC in kind contribution in regard to staff resources and administrative costs, totalling $72,666 USD.
- Tranche 2 estimates and identifies SPC in kind contribution, staff contribution and administrative costs, totalling $28,535 USD.

Tranche 3 estimates and identifies SPC in-kind contribution, staff contribution and administrative costs, totalling $79,842 USD. This expenditure is outlined in the following Table 3. The signed SPC Project Financial Report is attached at Annex 1.

Table 3. Approved budget of financial resources available to the WRA component.

Cost		UNICEF Total budget all years		Direct Programme support costs (USD)		Tranche 3 (USD)	September 2014 to June 2015			Available resource (USD)
		Total budget (FJD)	Total budget (USD)	May 2012 - October 2013	November 2013 - August 2014		Actual expenditure (USD)	UNICEF expenditure (USD)	SPC in-kind contribution on (USD)	
1	Human resource	502,215	276,625	200,386	74,927	1,312	76,696	1,312	75,384	-
2	Travel	148,008	81,524	49,775	9,796	21,953	14,546	21,953	-	-
3	Equipment and supplies	69,818	38,433	36,000	- 1,700	4,133	- 858	4,133	-	-
4	Local office	12,000	6,606	4,800	- 1,402	3,208	1,247	3,208	-	-
5	Other costs, services, consultancies	78,951	43,279	17,309	9,109	16,861	15,893	16,861	-	-
6	Other	-	-	-	-	-	-	-	-	-
7	**Direct eligible costs of the Action (1 - 6)**	**810,992**	**446,467**	**308,000**	**91,000**	**47,467**	**107,524**	**47,467**	**75,384**	**-**
8	Provision for contingency reserve *	40,500	22,323	-	-	22,323	22,323	22,323	-	-
9	**Total direct eligible costs of the Action (7+8)**	**851,492**	**468,790**	**308,000**	**91,000**	**69,790**	**129,847**	**69,790**	**75,384**	**-**
10	Administrative costs *	59,604	32,815	23,000	5,000	4,815	9,273	4,815	4,458	-
11	**Total eligible costs (9 +10 + 11)**	**911,096**	**501,605**	**331,000**	**96,000**	**74,605**	**139,120**	**74,605**	**79,842**	**-**

*Provision for contingency reserve is a maximum of 5% of the direct eligible costs of the Action (item 7)

** Administrative costs are a maximum of 7% of the total direct eligible costs of the Action (item 9)

III. RESULTS

The implementation of the Programmed Contribution Agreement (PCA) for Component 1 was delayed six months due to difficulties in reaching agreement on the required budget for the proposed scope of works, delaying the subsequent release of funds from UNICEF to SPC. In addition, difficulties recruiting the Tarawa-based team were experienced during the Project. Efforts to reduce the impact of these delays on the Project, in agreement with UNICEF and GoK, included using Suva-based SPC personnel to undertake the WRA work to ensure activities progressed. Summaries of the key activities are outlined below:

- **Water Resources Assessments**

Field visits to eight outer islands were conducted from September 2012 to November 2013. The schedules of visit and the target villages are presented in Table 4 below:

Table 4. Schedule of outer islands visit and list of surveyed villages.

Island	Surveyed Villages	Assessment Period
Marakei	Tekarakan	2nd - 7th September, 2012
	Tekuanga	
Makin	Kiebu	25th - 28th October, 2012
Butaritari	Bikaati	28th October - 4th November, 2012
	Tanimaiaki	
	Antekana	
Abaiang	Ribono	8th - 22nd February, 2013
	Tebunginako	
	Aonobuaka	
	Ewena	
	Tuarabu	
	Taniau	
Nonouti	Taboiaki	22nd May - 5th June, 2013
	Matang	
	Matabou	
	Benuaroa	
	Abamakoro	
Nikunau	Nikumanu	5th - 19th August, 2013
	Rungata	
	Tabutoa	
	Murubenua	
Maiana	Tebikerai	2nd - 14th September, 2013
	Tematantongo	
	Tekaranga	
	Aobike	
	Tebwanga	
	Temwangaua	

Island	Surveyed Villages	Assessment Period
	Toora	
	Tebiauea	
	Raweai	
	Bubutei	
Beru	Autukia	18th November - 2nd December, 2013
	Tabiang	
	Aoniman	
	Nuka	
	Teteirio	
	Taubukinberu	

The survey as per the agreed methodology for this component included:

- a survey of existing and permanently roofed buildings to assess the existing and potential RWH systems;
- a survey of all groundwater wells to determine their condition, construction type, and risk to water safety; and
- a electromagnetic (EM34) geophysical survey to estimate the thickness of freshwater lens beneath the target village surrounds.

Consultation meetings were conducted in all of the target villages with the presentation of the preliminary survey results, including freshwater lens mapping and groundwater bacteriological findings. Discussions were held in each target village on developing village-specific governance and management mechanisms for water supply systems by the village and documented in Village Action Plans.

Key WRA outcomes in all the villages included the following:

- Delineation of the freshwater lens, preliminary estimates of sustainable yield, and identification of optimal areas for communal groundwater supply sources.

- Establishment of the groundwater and RWH infrastructural status and identification of appropriate technological improvements.

- Establishment of bacteriological contamination status of existing water supply systems.

- Identification of potential RWH infrastructure for communal water supply options considering the variability in rainfall CV and effects of ENSO processes.

- Assessment of sanitation systems and recommendation of appropriate sanitation options with consideration to the hydrogeological, environmental and social requirements.

- Preliminary design for appropriate groundwater and RWH technological options for water supply as per the WRA findings and community preferences.

Designs of water supply and sanitation systems

During this reporting period the designs for water and sanitation systems were finalised. Background notes on the selection of these water and sanitation systems is provided in the report Sinclair et al. (2015)[1]. (Annex 2)

Engineering construction drawings were completed with the assistance of engineering draftsmen in both Tarawa and Fiji. The construction drawings will assist with costings, construction, and future ongoing developments and modifications.

RWH systems

- Designs for low roofed buildings < 1.5 m height
- Designs for buildings with roofs > 1.5 m height
- First flush devices for roofs > 1.5 m height

Groundwater abstraction systems

- Standard well – individual households
- Communal wells
- Village well
- Infiltration gallery

The water supply systems have been designed for use with readily available materials to simplify construction and logistics. Village-specific modifications may be required and should be able to be accommodated on site in accordance with landowner consultation, on-site conditions and environmental permits. Detailed designs for water supply systems are provided in the report Sinclair et al. (2015).

Similarly the sanitation system proposed as most suitable for use in atoll environments from a technical viewpoint, is a composting toilet. The benefits of this type of toilet and sanitation system for atoll environments are well established, as they do not require additional water, they have minimal impact on the underlying groundwater, and provide a valuable soil conditioner for poor atoll soils. Difficulties over behaviour change for their use, set-up costs and ongoing maintenance are often cited as reasons against their introduction and this requires consideration before utilising it in all situations. The compost toilet designs provided are based on composting toilets which have been successfully trialled in Tuvalu, Republic of the Marshall Islands, Nauru and Tonga under the GEF IWRM Demonstration Project. Further adaptation to the environment and conditions in Kiribati with regard to family size, construction materials and recognising on-site construction considerations, are required to ensure optimal performance.

These preliminary designs for rainwater harvesting, groundwater abstraction, and sanitation were reviewed by stakeholders' representatives, namely MPWU, UNICEF, NZ Aid engineers, USAID and KAP III. This review resulted in some amendments from the original designs which were included in the final designs provided.

Preliminary material costings for water supply systems are provided in Annex 3. Recently efforts are underway to consider options to reduce the cost of materials for the composting toilet, investigating different moulding options and materials for pedestals and designs which reduce construction costs.

[1] Sinclair, P., Loco, A., Mataio, M. (2015). KIRIWATSAN Technical Notes on Water Supply Design Principles (Unpublished)

Administrative activities

Administrative activities undertaken during this reporting period include:

- completion of progress reports 1 (Annex 4) and 2 (Annex 5);
- acquittal of tranche 1 and submission of 2nd FACE form;
- sought no-cost Project extension approval to 28 February 2015;
- presentation of activities at the KIRIWATSAN Phase 1 Project Steering Committee meeting; and
- presentation of lessons learned and challenges to the KIRIWATSAN Phase 2 Project Steering Committee.

- **Relocation of staff**

The Project hydrogeologist based in Tarawa from March 2013 to August 2014 has been relocated to SPC's Suva office. Originally it was anticipated that the project hydrogeologist would be based in Tarawa for a period of 12 months; however, it was recognised in order to satisfactorily complete the fieldwork and consolidate some of the water resources assessment training of i-Kiribati staff, his length of time stationed in Tarawa should be extended to 18 months. The decision to relocate the Project hydrogeologist to Suva was taken for the following reasons:

- fieldwork activities completed;
- training of WEU staff was becoming more problematic due to changes in staffing and secondment procedures;
- access to additional services required for completion of the reporting including printing, editing and publishing, IT, and technical drafting services were not readily available;
- access to additional technical, administrative, and financial support necessary for project completion was not available; and
- contractual issues with the Project hydrogeologist remaining in Tarawa.

Subsequently, the relocation assisted with the completion of the remaining technical reporting commitments of the Project, with increased access to additional support from Suva-based SPC staff.

- **Training and capacity building**

Extensive training on various water resources assessment aspects was undertaken over the course of Phase I of the Project. I-Kiribati nationals included 12 WEU staff, 8 outer island water technicians, and more than 200 casual labourers from the surveyed villages (Annex 6) were trained in:

1. the use of EM34 geophysics equipment;
2. conducting detailed household well surveys;
3. conducting detailed RWH assessments;
4. data entry and data analysis techniques;
5. the use and application of GPS equipment for conducting well survey and EM34 transect survey lines;
6. E.coli sampling procedures using both IDEXX Collilert 18 and compact-dry plate filtration membrane methods;
7. the maintenance and basic repair of survey equipment;

8. the design of water supply systems;
9. project management and administration skills; and
10. conducting village consultation meetings and design of village action plans.

Changes in personnel at MPWU resulted in the continuity of staff and activities being reduced, with significant time spent on additional training and administration activities in an attempt to resolve issues with staff secondment and staff engagement.

Martin Mataio received the most comprehensive training during this Project. Other WEU staff was allocated to the Project for short periods on an ad hoc basis depending on their availability and other work commitments. While grateful for these additional resources, the training and progression of work commitments were hampered.

While there is a preference to train and provide training opportunities for employees attached to the MPWU and other government departments; it may be worth reconsidering the best approach or model for engagement of national staff until the issue of secondment and retention of seconded staff can be resolved.

It is recommended that the GoK and implementing agencies identify the demands of projects on GoK staff from the outset and agree on a coordinated approach for training and capacity building. This will be important to ensure that both parties' expectations, objectives and needs are met with minimal or negligible adverse impacts on either parties' planned schedules or activities.

- **Database**

All island water resources assessment data has been downloaded and formatted into a web-based database (see Annex 7). Improvements in data editing and data access have continued during this period.

Martin Mataio received training in the application of the database and it is expected that he will be able to further extend the application of this database to others in the WEU.

- **Water resources assessment reporting**

All the water resource assessments have been completed for the eight islands, covering 35 villages. Originally it was planned that certain aspects of the reporting could be undertaken by seconded WEU staff to the Project, including rainfall analysis and data collation, and associated reporting. Difficulties with securing continuity of staff to support this function and limited reporting and data analysis skills has considerably reduced the anticipated support available to the Project.

The delay in reporting contributed to the need to request a no-cost extension until February 2015, approved in August 2014.

Annex 8 contains all final water resources assessment reports for the 8 islands under study - Abaiang, Beru, Butaritari, Maiana, Makin, Marakei, Nikunau and Nonouti.

- **Monitoring guidelines**

Ongoing monitoring of the water resources in the outer islands will benefit the resource users and government in the long term. Monitoring of the resource for key indicators including salinity, water levels, and rainfall collected over time allows for base information on the status of the resource. Furthermore, its development impacts under different climatic situations may be better understood; thereby improving access, sustainability and quality of the water resource long term.

Island water technicians already undertake some monitoring of water resources indicators including salinity of certain wells and rainfall measurements. The monitoring guidelines will be used to help support them in this role.

The guidelines will also provide a useful resource for identifying future support to island water technicians.

Annex 10 contains the Groundwater and Rainwater Monitoring Guidelines for Kiribati outer islands (Loco et al., 2015)[2].

Table 5 provides a status report summary of the progress against the project objectives.

A status report of the capacity building and water resources assessment activities in the Phase I period, September 2012 – May 2015 is contained in Annex 6.

[2] Loco, A., Singh, A., Chand, A., Mataio, M. 2015. KIRIWATSAN Groundwater and Rainwater Monitoring Guideline for Outer Islands (Draft)

Table 5. Status of outputs identified in the PCA.

Result	Output	Indicators	Status
RESULT 1: Groundwater and RWH assessments in a minimum of 35 villages on selected Outer islands of the Gilbert Group documented.	1.1 Inception report detailing all steps necessary to complete the groundwater and rainwater assessment, including work plan, scope and approach for the assessment at each site, building on information from previous studies and assessments in Kiribati. 1.2 Geographical prioritization of assessments agreed with MPWU staff in coordination with PMU, at Island level with Island Councils and landowners. 1.3 Formal consent of applicable village leaders and landowners obtained, building on the initial visit, prior to commencing assessment work. 1.4 Reconnaissance survey results determining locations of the WRA. 1.5 Detailed technical reports per Island.	• Island level technical assessment reports	Status October 2013 1.1 Draft inception report submitted. Comments received Dec 2013. 1.2 Completed 1.3 Consent obtained via the UNICEF visits prior to WRA assessment undertaken. 1.4 Reconnaissance survey results provided to each village at completion of survey, and to WEU and UNICEF on return from island assessment. (36 villages completed to date) 1.5 Status May 2015 Water resources assessment reports completed for Abaiang, Nonouti, Beru, Maiana, Nikunau, Butaritari, Marakei, Makin (see Annex 8)
RESULT 2-3: Sustainable, socially acceptable, age and gender appropriate and cost-effective Preliminary Design for each village of: i) abstracting and capturing water for household and/or public use that optimize the availability of improved drinking water for consumption year-round developed, and; ii) basic sanitation facility that minimize ground water contamination, appropriate for the Outer Island hydrogeological and water resources context developed.	2.1. Preliminary design options per target village documented and costs estimated.	• Documented design options and cost estimates.	Status May 2015 2.1 Completed detailed designs for water and sanitation – completed (see Annex 2). Conducted stakeholders review in Tarawa in December 2014 on proposed water supply and sanitation design. Completed technical notes on KIRIWATSAN Water Supply Design Cost estimates for water supply systems – completed (Annex 3)
RESULT 4-5: Guidelines for groundwater monitoring to be used	3.1. On the job training provided to all Water Technicians	• Number of trained staff of MPWU, water technicians.	Status May 2015 3.1 All eight water technicians have been involved in the water

Result	Output	Indicators	Status
by water technicians. Training and capacity building of Outer Island Water Technicians and national MPWU staff on key elements of WRA and monitoring.	3.2. Guidelines for monitoring for use by island water technicians.	One per island, 8 in total.	resource assessment surveys for their islands. All available WEU staff have been involved in some aspects of the water resource assessments. 3.2 Draft Water Resources Monitoring Guideline document- draft completed, awaiting editing
RESULT 6: Relevant reports and communication materials developed, consulted and disseminated.	4.1. Visual materials of preliminary water and sanitation design options per village, appropriate to be used for the community mobilization interventions developed. 4.2. Official publication of key assessment results.	• Number of villages (35) in which visual materials on design options were prepared for.	Status May 2015 4.1 Completed 4.2 KIRIWATSAN water resources database developed with data collected on the wells and the buildings uploaded and functionality and access improved (Annex 7) 4.3 All WRA reports completed (Annex 8) 4.4 KIRIWATSAN technical notes on water supply designs completed (Annex 2) 4.5 Guideline for water resources monitoring for outer islands drafted.

Implementation constraints and lessons learnt for the water resources assessment work and consideration to future implementation activities are numerous and vary from field trip to field trip. Work in the outer islands of Kiribati presents many challenges and some of these are outlined in Table 6.

Table 6. Summary of constraints and lessons learnt throughout the implementation of this component.

Implementation constraints	Lessons learnt
• **Water quality testing difficult in outer island where facilities, including access to power and clean water, is limited.** **Presence/absence testing for E.coli is insufficient to achieve relevant information.**	Preparation for this component is critical and it is necessary to carry all essential equipment and be able to operate independently. Investigation of alternatives from presence and absence testing resulted in adopting the use of EC Compact Dry methodology, a quantifiable E.Coli test suitable for use in the outer islands in field bacteriological sampling.
• **Logistics to undertake travel to outer islands with limited flights and transport on islands is proving challenging. Cargo costs for outer islands travel is very high.**	Use of reliable and safe boats for islands close to Tarawa within a few hours is recommended to reduce costs and improve reliability of service. Negotiations with Air Kiribati for reduced air-freight costs were unsuccessful.
• **Limited access to power on outer islands is restrictive with regard to charging of field equipment and undertaking tests.**	Ongoing issue requiring negotiation with island clerk, and others to ensure a generator and sufficient fuel is available on the island was problematic. Use of own generator maybe appropriate in some cases however air freight cargo costs would be prohibitive, reliant on boat travel only.
• **Use of large scale high quality imagery data as base maps has proven to be successful tools for working with island communities.**	Large scale maps for discussions and explanation is valuable for consultations and planning of field activities. Recommend that a vertiplan map storage cabinet be purchased so that these valuable resources are not lost or damaged. The Request made to UNICEF for the purchase of this as per PCA agreement is outstanding.
• **Training of staff and labour at each village to assist with undertaking water resource assessments is time consuming, damage to equipment can occur, and quality of survey is compromised.** • **Protocol demands in the islands** ○ **By-laws relevant for governance of infrastructures** ○ **Can inhibit or delay project progress**	This is problematic, as village protocol expects that the village labour is used. Recommend that in the future consideration be given to using the same labour across the island for assessment work and use village-based staff as guides only. There is a need to have some flexibility and understanding between communities and implementing agencies to allow timely progress of project activities.
• **Cooperation and motivation of island administration and village communities is mixed, some are highly motivated to support the survey and receive the results, whilst others are politically motivated and appear indifferent to the survey or the results. In many villages there appears to be limited knowledge of the proposed survey work and limited preparation before the survey team arrives.**	Improved communication in this area is required including preparation by community mobilisation team and from the island administration prior to the arrival of the WRA team.

Implementation constraints	Lessons learnt
• **Large demands on WEU staff time for different projects, can result in limited support from WEU for WRA work.**	Problematic, this was not anticipated, however WEU have been supportive to assist in the assessment work where possible. Additional support from SPC was required to ensure sufficient skills and resources were available for scheduled field surveys.
• **Awareness of groundwater vulnerability and risk from existing and introduced threats at the village and household level is low.**	Visual materials explaining a concept of groundwater and impacts from sanitation and other contamination sources has been important. Fact sheets have proved valuable to communicate groundwater risk and vulnerability. These fact sheets can be improved upon.
• **Limited logistic support. Difficulties and delays engaging casual labourers, hiring of generator for data downloads and equipment charging, accommodation and hiring of transport has proved difficult and at times has delayed progress.**	To carry all necessary supplies including first aid, satellite communication, water, food, and bedding have been required by the team, and is a necessary consideration for travel to outer islands for the WRA.
• **Additional demands on limited island resources were experienced during the recent combined trip (with CLTS) to Maiana.**	With larger teams even greater consideration to logistics is required. In general accommodating more than 6 people at a time at the government guest house is difficult. Larger teams stretch the islands' limited resources including food supplies, drinking water, sanitation facilities and wash rooms, transportation and fuel. It is suggested that consideration to these basic logistics be included in the planning for larger groups in the future.
• **The EM34 has seen extensive use in the last few years with a number of different operators and has been transported to many different locations by plane, boat and truck. It has shown a considerable amount of wear and tear, but overall performed well. A number of the cables were sent for repair and one cable has been replaced. Similarly the coils required repairs with connectors requiring replacement and recalibration of the machine.**	SPC were able to provide a compatible machine to use so the survey could be completed. Lessons include spare cables, regular checks on the connectors and coils, and where possible the same operators be used and made responsible for the equipment. Calibration is required about once every 5 years but is a function of use.
• **Recognised short life of survey equipment because of severe tropical conditions – there is a need to budget for significant replacement**	The costs for the transport and repair of equipment were significant and were not budgeted for. This will be a consideration for future project work.
• **Communication with Island Council offices prior to arrival for the WRA, regarding target villages and proposed WRA methods and schedules, is difficult. Responses and interest in the WRA varied from village to village, from indifference to great interest.**	Whilst island staff were informed prior to the WRA team arrival additional time was required on arrival to accommodate the general lack of preparation from the island administration and at the village level before arrival of the WRA team.
• **Most village communities are surprised by the arrival of WRA team and the purpose of the activities, requiring more effort by the WRA team to re-introduce and clarify the project scope to the target communities.**	The use of WEU staff to assist with communication has been invaluable, as they have been familiar with many of the outer island water technicians and island administration personnel and protocols.

Implementation constraints	Lessons learnt
• **Communication access via telephone and internet proved very difficult in outer islands, and should not be relied upon or assumed.**	
• **Engagement with the youth and women at the village level and penetration of messaging back into the community has proven difficult.**	Additional support or focus during the community mobilisation would assist in preparing women and youths to be part of the WRA engagement and consultation. Improved awareness and understanding is likely to assist in avoiding future conflicts and vandalism. It is recognised that women have the dominant role in family welfare, which includes ensuring adequate supplies for drinking and domestic water needs. ADB TA 6031 2004 documents the roles and responsibilities of men and women and gender issues, with women doing the majority of work for water supply and who have a better understanding of the problems associated with household water supply. Women's role in water management especially during dry times is underutilised. Identifying this during the community mobilisation process and developing a mechanism or process, which allows more active ongoing engagement of woman into decisions about water would benefit water resources management and the project in general. This activity is beyond the scope of the Water Resources Assessment component and should be considered under Phase II during the community mobilisation component.
• **Strong church denominational segregation in some villages.** • **It was observed in a few target villages that access to water, particularly communal rainwater tanks, is solely based on church membership.**	In areas where the church building provides the best RWH option, agreements/consents will need to be established (prior to the implementation stage) to ensure the accessibility of water supply for all members of the community.
• **Most Outer Island Water Technicians (OIWT) have a demonstrated understanding of water resources issues on the islands and possess useful skills to assist in monitoring existing water systems and conduct solar pump and hand pump repairs. However, as the project progresses towards proposing community-led improved water supply and water governance, it would be appropriate to reassess, better define, and strengthen the roles and responsibilities of OIWT.**	OIWT are employed by the National Government and are assigned to assist with the repair of water supplies. This approach reinforces the notion within communities that government is responsible for water supplies and not the community. However the support to OIWT from government to maintain water supply systems is limited. The success and sustainability of communal systems includes empowering the community to take the responsibility for the management and maintenance of the water supply system. The current structure of OIWT's being responsible for all maintenance does not support the concept of village responsibility. It is suggested that the role of the OIWT and community responsibilities be better defined and promoted at the island and village level. Village Action Plans will be a useful approach to support the clarification of roles (see Annex 9 for a draft action plan).
• **A review of the White report (2009) which details issues and concerns with regards to the implementation of a water and sanitation for**	White (2009) identifies public perception to be that water should be free, requiring change over an extended time through information and education campaigns. A Cabinet decision in 2004

Implementation constraints	Lessons learnt
outer islands, identifies some specific issues for sustainability and include: **1. Apparent lack of statutory basis for the lead water agency and for charging fees for OI water supply** **2. Lack of legal protection of OI water source areas or reserves** **3. Lack of local ownership and engagement** **4. Capacity of OI villagers to pay for water services** **5. Willingness of OI villages to pay for water services** **6. RWH in OI villages** **7. The problem of appropriate sanitation in OIs** **8. Behavioural change**	states that outer island water supply systems should be sustainable. This suggests a cost recovery scheme; however costs for maintenance and operation are currently not covered by water charges to consumers. White 2009 suggests that "all current draft and existing legislation concerned with the control, protection and management of water resources and the supply of water services be reviewed and revised and that the statutory basis be established for a Water Authority (or lead Ministry) to enable it to legally control and manage water resources and supply water services.
• **Constant change in government at all levels** ○ **Inconsistency in policies, support and approaches** ○ **In 3 years, there had been 4 permanent secretaries and 7 WEU-OIC**	Policy changes for secondment of government staff to projects left affected staff uncertain about their tenure and contribution to the project, creating significant difficulties to the detriment of project progress. Some staff seconded to the KIRIWATSAN Project were transferred to other projects. A policy of short-term appointment of junior staff to secondment positions was applied resulting in the project being short staffed with inexperienced personnel restricting opportunities to develop increased capacity and training with staff who were assigned to the position rather than selecting the best person for the position. These changes to secondment policy has resulted in significant delays and created misunderstanding on the engagement of local staff. Clear policy and guidance is required to develop long-term capacity building opportunities to benefit both seconded staff and the project. Alternative project staffing and appropriate mechanisms for capacity building of government staff needs to be considered to provide the longer term assurances required for project progress and sustained capacity building.
• **Lack of technical capacity to conduct on-going proper water resources .assessment and monitoring work**	Regular training & annual review needed and to be linked with water resources monitoring for both OIWT and MPWU, even including nominated community representatives ○ Recommended rainfall and groundwater practice ▪ EM34 ▪ Database ▪ Equipment, use and maintenance ▪ Well survey ○ Water quality ○ Salinity ○ Rainfall monitoring ○ Plumbing works & well designs

Implementation constraints	Lessons learnt
• **Current GoK and Institutional arrangement does not allow sustainable management of water supply infrastructure.**	Acknowledge self-sufficiency demanded by the physical location of outer islands and policies and current GoK policies and institutional arrangements need to recognise and reflect this o Communities show willingness and commitment to manage and govern W&S system, with appropriate training and support needed.
• **Recent sand-extraction restriction imposed by MELAD on KAP III and KIRIWATSAN I can cause significant construction delays in the outer island and may significantly increase shipment costs of materials from Tarawa.**	GoK authorities, MPWU and MELAD, should be aware of the project scope and needs, and must be supportive and proactive in designing sound solutions to avoid and minimise potential project delays.

- **Key partnerships and interagency collaboration**

Some difficulties have been experienced in coordinating activities between the different components and resources from the Government of Kiribati Water Engineering Unit, due to demands placed on the teams to deliver on their components and the timing of field activities competing with other demands. To overcome any shortfall in availability of personnel for field missions, SPC staff and (when available) the UNICEF project management unit staff were used to provide support for these missions.

The joint Community Led Total Sanitation (CLTS) team and the Water Resources Assessment (WRA) team missions to Maiana and Beru demonstrated the benefits of joint missions between the CLTS and WRA team. Whilst the WRA and CLTS teams acted independently, the joint missions allowed relevant information to be shared in a timely manner; however, as indicated facilities and logistics to accommodate larger teams for joint missions are problematic and require additional preparation and supplies.

The review of preliminary water supply and sanitation designs by numerous stakeholders, together with the sharing of the draft Abaiang and Nonouti island reports with UNICEF, provided the necessary inclusiveness for different parties and enabled continued support and awareness for the relevant organisations in terms of their expectation of the proposed designs and report structure. These allowed the exchange/sharing and adoption of useful ideas and provided guidance towards the improvement of the component's deliverables component as per the PCA.

Table 7. Summary of expenditure May 2012 to June 2015.

Cost		UNICEF	Expenditure Period			Total	SPC Contribution	UNICEF Contribution	Remaining
		Total budget all years	May 2012 - Oct 2013	Nov 2013 - Aug 2014	Aug 2014 - June 2015	Project cost	May 2012 to June 2015	May 2012 to June 2015	Budgeted balance
		A	B	C	D	E=B+C+D	F	G = E-F	H=A-G
1	Human resource	276,625	269,189	99,767	76,696	445,652	93,643	352,009	-
2	Travel	81,524	49,775	17,203	14,546	81,524	-	81,524	-
3	Equipment and supplies	38,433	40,991	- 1,700	- 858	38,433	-	38,433	-
4	Local office	6,606	6,761	- 1,402	1,247	6,606	-	6,606	-
5	Other costs, services, consultancies	43,279	17,039	10,347	15,893	43,279	-	43,279	-
6	Other	-	-	-	-	-	-	-	-
7	**Direct eligible costs of the Action (1 - 6)**	**446,467**	**383,755**	**124,215**	**107,524**	**615,494**	**93,643**	**521,851**	**-**
8	Provision for contingency reserve *	22,323	-	-	22,323	22,323	-	22,323	-
9	**Total direct eligible costs of the Action (7+8)**	**468,790**	**383,755**	**124,215**	**129,847**	**637,817**	**93,643**	**544,174**	**-**
10	Administrative costs **	32,815	26,863	8,695	9,273	44,831	12,016	32,815	-
11	Programme support costs carried forward from Aug 2014	-	-	-	-	-	-	-	-
12	**Total eligible costs (9 +10 + 11)**	**501,605**	**410,618**	**132,910**	**139,120**	**682,648**	**105,659**	**576,989**	**-**

*Provision for contingency reserve is a maximum of 5% of the direct eligible costs of the Action (item 7)

** Administrative costs are a maximum of 7% of the total direct eligible costs of the Action (item 9)

Note: Contingency funds have been assigned to Human Resources component as per UNICEF letter 19/12/2013, with other variances in accordance with paragraph 27 of PCA.

IV. FINANCIAL IMPLEMENTATION

The Programmed Contribution Agreement (PCA) between UNICEF and SPC was signed 11 July 2012 with the first amendment to this PCA on 11 February 2013.

The water resources assessment project has an available budget of USD $501,608, with three separate Tranches identified in the PCA.

"SPC will send UNICEF a written request for Cash Transfer instalment of USD$331,000 on signing of the contract and acquit within 3-6 months, but not later than 9 months. SPC will send UNICEF a written request for a second amount of USD$96,000 after three months and the last amount $USD74,600 after six months of signing of the contract."

Table 3 in this report's section on Financial Resources, contains a breakdown of the actual expenditure versus the budgeted expenditure for the period May 2012 – May 2015. The table identifies some variances in expenditure due to a modified work plan in response to changes from the expected delivery. The most notable variance is the Suva-based salary costs. The increased costs reflect the use of Suva-based SPC staff to develop the proposal and PCA, and undertake the field assessment work on more occasions than originally planned and budgeted. This was due to WEU staff being unavailable at times and unforeseen delays in establishing a contract with the Project's field officers. The use of Suva-based staff for this assessment work has allowed the Project to progress the field work without delays. This was identified at the time with the UNICEF PMU and it was agreed that this approach would be used to prevent delays in implementation.

- **Financial implementation status**

The human resources required to complete the activities to date have been significant. To accommodate the additional demand on human resources and allow activities to progress as planned, SPC has agreed to provide for some of the human resources costs as in-kind contribution, as indicated in Table 3.

Additional time was required from Suva-based staff to assist in the completion of the reporting. The contingency funds allocated as part of Tranche 3, in combination with some additional SPC in-kind contribution, were used to meet these human resources costs.

It is also noted that there is an under-spend in regard to some travel and other costs. The original budget considered higher estimates for these costs with some costs being deferred to later in the Project. The underutilised funds in these areas have been utilised to accommodate over-spends in other budget inputs in accordance with the PCA paragraph 27.

WATER RESOURCES ASSESSMENT FINAL REPORT

ANNEXES

EUROPEAN UNION

SPC Secretariat of the Pacific Community

unicef

A UNICEF project in partnership with the European Union and SPC for Kiribati