REFERENCES

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2 Falkland A. (2006). Rakahanga, Cook Islands, Report on Water Investigations, September 2005 – June 2006. Ecowise Environmental report No EHYD 2006/47, prepared for GHD Pty Ltd, AusAID and Cook Islands Government, June 2006.

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6 GHD, (2004): Upgrading of Mangaia Water Supply – Project Design Document: Prepared for AusAID. G:\70\10357\WP\Design Document\Final PDD\72028

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9 WHO (2004) Guidelines for drinking-water quality. 3rd Ed. including addenda in 2006 and 2008. World Health Organization, Geneva, Switzerland

ANNEX A: SPECIALIST PDD TERMS OF REFERENCE

Project Design Document (PDD) Specialist (Original)

Contract to write the project design document for the ''Northern Water Harvesting and drought proofing'' (NWater)

Beneficiary Country
Pukapuka, Nassau & Penrhyn. Northern Group, Cook Islands.

Contracting Authority
NZAID (designer). Ministry of Infrastructure and Planning (MOIP) (Building contractors).

Stakeholders
Northern group communities and local government/Department of Internal Affairs /Public Health Division/National Council of Women/National Environment Service/MOIP/Aid Management Division/Ministry of Education/NZAID (Rarotonga)

Background

- This project is an element of Cyclone Recovery and Reconstruction Plan (CRRP). The 2004-05 cyclone seasons for the Cook Islands were particularly bad with 5 reported tropical cyclones occurring between February and March. Damage to varying extents was sustained to the Southern Islands of Rarotonga, Mangaia, Mauke, Aitutaki, Atiu and Mitiaro. The three (3) low lying northern atolls Pukapuka, Nassau and Palmerston were also affected with damages relatively greater. The Cyclone Recovery and Reconstruction Plan were developed in response to these events.
- NWater was approved after a series of studies including the ''Water Investigations'' of Pukapuka and Penrhyn undertaken by Tony Falkland in 2005 & 2006. These studies sought to establish the sustainability of rainwater and ground water resources available to the remote islands.
- Since this time the water situation in the northern group has changed due to private initiative and a series of government (CIGov) projects. These include the construction of micro shelters in Manihiki and improvements in storage capacity on most islands. It is assumed that increasing capacity for rainwater storage and collection is the most suitable solution and that the most urgent needs are in Pukapuka and Penrhyn. It is intended to address these islands first and then assess priority for use of remaining funds.
- The period 2006-2009 was marked by several changes to the way CRRP program was coordinated and managed. The ''Infrastructure Committee'' (IC) now prioritises and coordinates infrastructure projects at a national level. The National Strategic Development Plan acts as an overarching guide in this work.
- To support the CRRP program NZAID funds an Infrastructure TA position in MOIP responsible for the day to day management of the CRRP program. Due to NZAID infrastructure program growth, public sector capacity constraints and significant pressure to deliver projects within the next 12 to 18 months the strategy is to scale up project delivery by accessing private sector resources and manage multiple infrastructure project delivery
- Infrastructure committee (IC) has endorsed a Project Management Committee (PMC) to oversee completion of this project. The PMC includes a representative of Disaster Management, MOIP, AMD, NZAID, northern group representative.

Goal
The overall objective is to build up the Cook Islands and in particular the northern group islands resilience to natural disasters (including drought) and to strengthen disaster management capacities.

Objectives
The PDD specialist will develop project design document including the islands of Pukapuka, Nassau and Penrhyn that meet NZAID/CIGov standards and contribute to the CRRP goals. The design should incorporate relevant risk management strategies to mitigate contamination of drinking water. The design should maximise benefit of scoping work already done by using and checking existing bills of materials and budgets. The construction design should aim for minimum maintenance and provide employment for northern Island communities where ever possible. A supply and construct model is favoured by the PMC to firmly place the ordering, delivery and security of supplies with the contractor. In general design should strive for value for money, timely completion and deliver the project using relevant CIGov systems. The project must use and build local knowledge and reinforce community management of water resources in a sustainable manner. All existing projects and works on these islands mapped and opportunities to benefit from synergies investigated.

Methodology
The PDD specialist will work in a participatory and adaptive manner to actively involve the PMC and stakeholders in the design of the project. Consultation with northern communities is only expected via phone call/emails. No travel is required. All report and relevant information will be assembled and made available to the PDD specialist by MOIP/AMD/NZAID. The formal reporting channel for the PDD specialist is through the PMC. Day to day communications can be directed to the Infrastructure Technical assistant at MOIP (Ngateina Rani).

References

CRRP Development Partnership Agreement
CRRP NWater scoping document (MFEM December 2006)
Pukapuka & Penrhyn Water Investigations (T Falkland)
NZAID Activity Design Guideline
Draft PDD (D Rairi MOIP)
MFEM Financial Policy and Procedures Manual
NZAID Activity Design Guideline

Other relevant documents

Tasks

1 Agree a work plan with the PMC
2 Desk study of documents and relevant information. Consultations with stakeholders to complete analysis of current context by Island, relevant standards, identify relevant initiatives in progress/planned and opportunities.
3 Produce a PDD including bill of quantities, procurement models, work-plan, and final budget estimate to the satisfaction of the PMC.

Outputs
1. Draft PDD
2. PMC endorsed PDD

ANNEX B: STAKEHOLDER ANALYSIS

NORTHERN WATER HARVESTING & DROUGHT PROOFING PDD FOR PUKAPUKA, NASSAU AND PENRHYN

1.0 INTRODUCTION

1.1 Consultation Verification Process (CVP)

The CVP data was obtained by meeting with and interviewing key stakeholders from Penrhyn, and for Pukapuka and Nassau, by extracting the findings of previous work carried out by the Climate Change Country Teams held on the two islands in July 2009.

Meetings and consultations dates with Pukapuka and Nassau communities are provided in the table below.

MEETINGS AND CONSULTATIONS WITH:	DAY AND DATE:	DOCUMENTATION:
Pukapuka Public Meeting and Workshop Ngake Village Meeting Roto Village Meeting Yato Village Meeting Community Based Solutions Workshop	 Friday 03/07/09 Monday 06/07/09 Tuesday 07/07/09 Monday 13/07/09	Stakeholder Analysis Summarized in **Table 1.0**
Nassau Public Meeting and Workshop Nassau Meeting and Workshop	 Wednesday 1/07/09	Stakeholder Analysis Summarized in **Table 1.0**

The CVP for the island of Penrhyn was obtained from a meeting with and interview of island representatives and while they were on Rarotonga at the time of preparing the PDD.

Meetings and Consultations with Penrhyn stakeholders held on Rarotonga, October 2009 are provided in the table below.

MEETING AND CONSULTATIONS WITH:	DAY AND DATE:	DOCUMENTATION:
Aid Management Division, Penrhyn Representatives and Critical Path Consulting Teams	Monday 19 October 2009	Summary of Meeting Minute provided as Attachment **B1**
Mr. Willie John (Liaison person for Penrhyn people on Rarotonga), Mr. Tahaki Paula (Mayor for the Island of Penrhyn) and Takake Akatapuria (Government Representative for the Island of Penrhyn), Ms. Manuela Matala (Youth and Women's Group Representative)	Tuesday 20 October 2009	Stakeholder Analysis Summarized in **Table 1.0**
Mrs. Tikura Taime (Primary School Teacher), Mita Soatini (Police Sargeant and Deacon of the CICC Church), and Mr. Pa Taime (Agriculture Officer for the Island of Penrhyn)	Wednesday 21 October 2009	Stakeholder Analysis Summarized in **Table 1.0**

Meetings and Consultations with Co-operating Crown Agency and relevant NGO Representatives, held on Rarotonga, November 2009

MEETING AND CONSULTATIONS WITH:	DAY AND DATE:	DOCUMENTATION:
Ministry of Internal Affairs personnel: Bredina Drollet (Secretary for Ministry of Internal Affairs); Ruta Pokura (Director, Gender Development Division); John Henry (Director, Welfare Division); Vania Kenning (Director, Youth and Sports Division); and Nooroa Numanga (Director, Disability Division)	Consultation period – November 2009	Stakeholder Holder Analysis summarized in **Table 2.0**, Document provided by the Teams is provided as Attachment **B2**
Meeting with the Department of Public Health of the Ministry of Health: Mr. Tata Vaeau (Chief Health Protection Officer); Ms. Tae Nootutai (Health Protection Officer); Ms. Tereapii Nimerota (Health Protection Officer); and Mr. Oirua Joseph (Health Protection Officer – Penrhyn)	Consultation period – November 2009	Stakeholder Analysis summarized in **Table 2.0** Document provided by the Teams is provided as Attachment **B3**
Ms. Rongo File, Coordinator for the National Council of Women; and Mrs. Vereara Maeva-Taripo, President for the Cook Islands Association for Non-Governmental Organizations (CIANGO)	Consultation period – November 2009	Stakeholder Analysis summarized in **Table 2.0** Document provided by the Teams is provided as Attachment **B4**

1.2 The Aim of the Stakeholder Analysis

The primary aims of the stakeholder analysis are:

- To verify the need for the water harvesting proposal;
- To identify any issues and solutions to those issues;
- How the project can move forward;
- How local resources can be best utilized; and
- Who is going to do what, when and how?

2.0 METHODOLOGY

The stakeholder analysis is based on data collected from interviews of group representatives, and in the case of Pukapuka and Nassau, the analysis, used data collected from a workshop situation held on those two islands in July 2009.
The stakeholders are categorized into the following areas:

Leaders of the Communities, i.e. Island Councillor, Village Committees, Traditional Leader, Church Leader (Deacon or Pastor), Politician
Government workers involved, i.e. Managers, clerks, field workers, labours
Non-Government workers, i.e. private businesses, NGOs, CBOs
Teachers, i.e. people who teach children at the school level
Health Worker, i.e. medical doctors, nurses, public health inspectors
Fisherman, i.e. people who fishes for subsistence or commercial fishing
Farmers, i.e. people who plant for subsistence or commercial
Home Duty, i.e. people that carry out home duties

For the islands of Pukapuka and Nassau, for each cell of the stakeholder analysis matrix, the information is the outcome of working groups in a workshop situation.
For the island of Penrhyn, for each cell of the stakeholder analysis and for each group representative, the information is the outcome of an interview on Rarotonga with the group representatives.
The data used are answers to the following questions:

How important are the stakeholders to the success of the project?
What are their main issues?
How do we get stakeholder support and reduce opposition?
When do we involve them?
Who are the contact persons?

The answers are recorded in a matrix form for each island and summarized in Table 1.0 for people that live on the islands under "Island Community" in Section 3.0. Also, the same analysis was done for relevant sectors based on Rarotonga, and the answers are recorded and summarized in Table 2.0.

3.0 SUMMARY OF FINDINGS

In summary, the analysis shows that:

- The stakeholders clearly support the increase in water storage capacity that the project is aiming to put in place;
- There are a number of on island long term management and regulatory regimes that needs to be put in place to regulate water usage and costs, especially for fair and equal disbursement of water from community water supplies during long periods of no rain.
- These long term management regimes can be developed during the design and implementation of the project with the assistance of MOIP.
- There is also expressed the low quality of the water currently available and the need to install devises to remove rubbish, etc from entering the water tanks. Stakeholders accept that these issues can be addressed by the Project.
- It is also highlighted that the project will enable training and awareness activities to address the water quantity and quality of water supplied in the following areas:
    - Water conservation;
    - Public Health Issues (risk assessment, water quality testing, environmental monitoring)
    - Basic Plumbing Practices
- A set of selection criteria are provided in the analysis for deciding who should receive household water tank and assistance from this project (See Table 2.0)
- The need to seriously consult the main user of the water in the household, women, during the design phase of the project.

Specific findings of key areas and stakeholders are summarized and provided in Tables 1.0 and 2.0 below:

4.0 RECOMMENDATIONS

It is recommended that in preparing the design document, the issues raised in Tables 1.0 and 2.0 are taken into account.

TABLE 1.0 STAKEHOLDER ANALYSIS SUMMARY – ISLAND COMMUNITIES						
STAKEHOLDERS	**IMPORTANCE TO THE PROJECT**		**WHAT ARE THEIR MAIN ISSUES?**	**HOW DO WE GET THEIR SUPPORT AND REDUCTION TO OPPOSITION?**	**WHEN DO WE INVOLVE THEM?**	**WHO ARE THE CONTACT PERSONS?**
	DIRECT	**IN-DIRECT**				
Leaders of the Communities	A	A	Adequate storage capacity to cater for long periods of no rain	Get the project going, and carefully: § Size the tanks according to demand value and existing roof catchments for each entitled household and community water catchments.	In the beginning of the project and the start and end of the implementation stage	Mayor, Island Secretary, Chairperson of Village Committees[10] and Heads of households
	A	A	Tanks to be compatible to harsh high temperature conditions and salt air	The Project to provide the following: § Information on the options and how they were arrived at	Design Stage	Mayor and Island Council, and Water Engineer on Rarotonga
	C	A	Fair distribution of water to households during drought conditions	Through the Project, MOIP to assist the IA to get the following done: § Leaders to regulate according to each island's situation and household need levels	ASAP	MOIP HoMs, Mayor, members of the Island Council and Aronga Mana
	C	A	Charge rates for community water supply[11]	Through the Project, MOIP to assist the IA to sought the following: § Government cost and support	ASAP	MOIP HoMs, Mayor and Island Secretary
	A	A	Confirmation of old arrangements with	Through the Project, MOIP to assist the IA to secure the following:	Prior to completion of	MOIP HoMs, Mayor, Island

[10] For Pukapuka and Nassau
[11] For Penryhn only

TABLE 1.0 STAKEHOLDER ANALYSIS SUMMARY – ISLAND COMMUNITIES						
STAKEHOLDERS	**IMPORTANCE TO THE PROJECT**		**WHAT ARE THEIR MAIN ISSUES?**	**HOW DO WE GET THEIR SUPPORT AND REDUCTION TO OPPOSITION?**	**WHEN DO WE INVOLVE THEM?**	**WHO ARE THE CONTACT PERSONS?**
	DIRECT	**IN-DIRECT**				
			community water supplies on private lands[12]	§ Document arrangement between Island Council and Landowners	project	Council and the Aronga Mana
Government Workers on the islands	B	A	Insufficient ongoing maintenance budget from the Central Government	Through the Project, MOIP to assist the IA to: § Secure support from the Central Government Budget Committee § MP to Lobby the Central Government Budget Committee § Project outcome to be utilized in the Central Budget Committee bidding process	Prior to the Budget being approved	MOIP HoMs, MP and Island Secretary
NGOs	A	A	Unfair distribution of water during drought conditions	Through the Project, MOIP to assist the IA to get the following done: § Leaders to regulate according to each island's situation and household need levels	ASAP	MOIP HoMs, Mayor, Island Council and the Aronga Mana
	A	A	Community water supply are not clean	Through the Project, MOIP to assist the IA to get the following done: § Health Workers to do their job § Include dirt and rubbish removing devices in the project	ASAP, Design and Implementation stage	MOIP HoMs, Island Secretary and the Public Health Department, and Contractors
	A	A	No rubbish and dirt cleaning devices to prevent	Through the Project the following to be considered:	As for above	Contractors

[12] For Penryhn only

TABLE 1.0 STAKEHOLDER ANALYSIS SUMMARY – ISLAND COMMUNITIES						
STAKEHOLDERS	**IMPORTANCE TO THE PROJECT**		**WHAT ARE THEIR MAIN ISSUES?**	**HOW DO WE GET THEIR SUPPORT AND REDUCTION TO OPPOSITION?**	**WHEN DO WE INVOLVE THEM?**	**WHO ARE THE CONTACT PERSONS?**
	DIRECT	**IN-DIRECT**				
			dirt and rubbish getting into the water supply	§ Include dirt and rubbish removing devices in the project		
	A	A	A situation of forced climate change	Through the Project the following to be considered: § A regular Aid package to be decided to sustain the benefits of the project	Planning and Design Stage	Government and the AID Donor
Teachers	C	A	Water supply from school building catchments to remain for school use only[13]	Through the Project and with the assistance of the MOIP, the following to be carried out: § Leaders to regulate according to each island's situation and in consultation with the Ministry of Education § Water Conservation programme	ASAP Ongoing	MOIP and the Island Council
Health Workers	A	A	Inadequate supply of water	Through the Project carry out the following in the schools and the community: § Water Conservation programme	Design and Implementation stage Ongoing	IA and Public Health Officer
Fisherman	A	C	Not enough storage capacity for when there is lots of rain	§ As above	Design and Implementation Ongoing	Project Manager and Contractors
Farmers	A	A	Not enough storage capacity for when there is lots of rain; Dry spells getting longer; and Health Standards to drain all waste water into one hole, i.e. septic tank	Through the Project the following to be carried out: § Water Conservation programme § Health Inspectors to design a system that will enable farmers to use waste water.	Design and Implementation stage	PM and Contractors

[13] Does not apply to Nassau

TABLE 1.0 STAKEHOLDER ANALYSIS SUMMARY – ISLAND COMMUNITIES						
STAKEHOLDERS	**IMPORTANCE TO THE PROJECT**		**WHAT ARE THEIR MAIN ISSUES?**	**HOW DO WE GET THEIR SUPPORT AND REDUCTION TO OPPOSITION?**	**WHEN DO WE INVOLVE THEM?**	**WHO ARE THE CONTACT PERSONS?**
	DIRECT	**IN-DIRECT**				
Home Duty	A	A	Not enough storage capacity for when there is lots of rain; and. Dry spells getting longer	Get the project going and do the following: § Water Conservation programme	Planning and Design Stage Ongoing	Heads of Households

Important Values: ***A= Extremely Important; B= Fairly Important; C= Not Important***

Direct and Indirect important values mean: ***Direct= Stakeholders have a direct role to play in the implementation of the project; Indirect= Stakeholders role is more in the long term, e.g. capacity building through monitoring, education training and awareness, law enforcement and compliance and physically maintaining the water tanks.***

TABLE 2.0: STAKEHOLDER ANALYSIS SUMMARY – RELEVANT SECTORS						
STAKEHOLDERS	**IMPORTANCE TO THE PROJECT**		**WHAT ARE THEIR MAIN ISSUES?**	**HOW DO WE GET THEIR SUPPORT AND REDUCTION TO OPPOSITION?**	**WHEN DO WE INVOLVE THEM?**	**WHO ARE THE CONTACT PERSONS?**
	DIRECT	**INDIRECT**				
Ministry of Internal Affairs	A	A	Selection Criteria for Households	By establishing a selection criteria that carefully assess the following: § The most vulnerable in the community (severely disabled, very elderly, destitute and women with young children); § Roofing capable of collecting water; § Households with no water tank or tank capacity of less than 6,000L; § Where a household has roofing not capable	Design, and implementation stage	Bredina Drollet and the IA for each Island

TABLE 2.0: STAKEHOLDER ANALYSIS SUMMARY – RELEVANT SECTORS						
STAKEHOLDERS	**IMPORTANCE TO THE PROJECT**		**WHAT ARE THEIR MAIN ISSUES?**	**HOW DO WE GET THEIR SUPPORT AND REDUCTION TO OPPOSITION?**	**WHEN DO WE INVOLVE THEM?**	**WHO ARE THE CONTACT PERSONS?**
	DIRECT	**INDIRECT**				
				of collecting be allocated a 3,000L tank to improve storage capacity and to reduce hardship; § Any household with roofing capable of collecting rainwater whether occupied or not to be given a water tank; and § Included in the assistance accessories to improve the capacity of the roof to collect water, reduce and eliminate contamination of water, and to reduce hardship and improve access to water.		
	A	A	Community Water Tanks	By carefully assessing the capacity and needs of existing community water catchments with the following intentions: § Upgrade all existing community water catchments under the management of the Island Council; § Upgrade catchments of buildings under the management of the Ministry of Education and increase their water storage capacity; § Upgrade catchments and water storage capacity increased where necessary; and § Upgrade and increase the storage capacity of Church Buildings.	Design and Implementation stage	Water Engineer on Rarotonga
	A	A	Traditional Ground Water Harvest	By recognising the fact that communities has existed on traditional sources of water provided by the natural environment in terms of coconuts and traditional shallow ground water supply, carefully develop the following: § Access to shallow ground water supply;	Design and implementation phase	Mayor, members of the Island Council; Aronga Mana; Landowners;

TABLE 2.0: STAKEHOLDER ANALYSIS SUMMARY – RELEVANT SECTORS						
STAKEHOLDERS	**IMPORTANCE TO THE PROJECT**		**WHAT ARE THEIR MAIN ISSUES?**	**HOW DO WE GET THEIR SUPPORT AND REDUCTION TO OPPOSITION?**	**WHEN DO WE INVOLVE THEM?**	**WHO ARE THE CONTACT PERSONS?**
	DIRECT	**INDIRECT**				
				§ Revive customary management practices of that supply; and § Work with the Public Health to ensure those water supplies are not contaminated by household waste water treatment systems		and water engineer
Department of Public Health	B	A	Assessment of Risks	Provide for, in the project, support to the local Officers in terms of up-skill training on the following: § Check on quick assessment of surrounding environment of water tanks; § Check for foreign matters in the water tank; § Check for leakages; § Check for signs of mosquito breeding areas; and § Other checks that may be necessary to carry out a quick risk assessment to the water supply	Design and Implementation Stage	Department of Public Health on Rarotonga (and Ministry of Health), IA (Island Secretary)
	B	A	Surveillance and Monitoring	Provide for in the project support to local officers by way of up-skill training on the following: § Continuous Risk Assessment (as above); § Check for algae growth in the water tanks; § Check for mosquito breeding in the water tanks; § Investigate any gastro enteritis cases; and § Other types of surveillance and monitoring that may be needed to protect the water supply and source.	Design and Implementation Stage	Department of Public Health on Rarotonga (and Ministry of Health), IA (Island Secretary)
	B	A	Water Testing	Provide for in the project support to local officers by way of up-skill training on the following: § Water sampling when requested or when	Design and Implementation Stage	Department of Public Health on Rarotonga

TABLE 2.0: STAKEHOLDER ANALYSIS SUMMARY – RELEVANT SECTORS						
STAKEHOLDERS	**IMPORTANCE TO THE PROJECT**		**WHAT ARE THEIR MAIN ISSUES?**	**HOW DO WE GET THEIR SUPPORT AND REDUCTION TO OPPOSITION?**	**WHEN DO WE INVOLVE THEM?**	**WHO ARE THE CONTACT PERSONS?**
	DIRECT	**INDIRECT**				
				necessary		(and Ministry of Health), IA (Island Secretary)
	B	A	Awareness and Education	§ Provide for in the project support to local officers by way of improving and diversifying their methods of communicating the water safety awareness programme to the schools and the community.	Design and Implementation Stage	Department of Public Health on Rarotonga (and Ministry of Health), IA (Island Secretary)
NGO – National Council of Women	A	A	To be seriously consolidated	§ As the women are the ones responsible for cooking, cleaning in the homes, provide for in the project the opportunity for women groups to offer their views on siting of water tanks and ways to improve access to water.	Design and Implementation Stage	Gender Development Officer on each island, and Island Secretary
	B	A	Know how to fix basic plumbing in the kitchen	§ Provide for in the project the opportunity for basic plumbing practice training for women in the homes.	Design and Implementation Stage	Gender Development Officer on each island and Island Secretary

Important Values: ***A= Extremely Important; B= Fairly Important; C= Not Important***
Direct and Indirect important values mean: ***Direct= Stakeholders have a direct role to play in the implementation of the project; Indirect= Stakeholders role is more in the long term, e.g. capacity building through monitoring, education training and awareness, law enforcement and compliance and physically maintaining the water supply.***

ATTACHMENT B1 – SUMMARY OF MEETING MINUTE WITH PENRHYN ISLAND REPRESENTATIVES

Venue: Aid Management Division (Manager's Office)
Date: 19/10/2009
Time: 10.00 am
Present: Steve Barrett (AMD Staff), Chris Manu (CPC Consultant), Teariki Rongo (CRC Consultant), Mr. Willie John (Liaison person for Penrhyn people on Rarotonga), Mr. Tahaki Paula (Mayor for the Island of Penrhyn) and Takake Akatapuria (Government Representative for the Island of Penrhyn)

Critical Path Consulting Ltd Teams Leader, Mr. Chris Manu, outlined the project, its desired output and the project implementation timing to the leaders from the Penrhyn Island community. Mr. Manu also presented to the representatives a copy of the household inventory Survey following the current selection criteria for the project which was all houses with a power connection.

Penrhyn Island Spokes person Mr. Willie John and Mayor both expressed their support of the project as it is very important for the livelihood of their people. They also advised the meeting that the list may have to be revised as some of the households listed have been renovated.

Steve Barrett of AMD advised the meeting that the project will be implemented by the end of this financial year. He further advised that his preference would be to implement the project in the same manner that the cyclone recovery programme for Pukapuka was carried after the 2005 cyclones. The process was the contractor goes up and gets the work done employing local people where possible. People can contribute what they can in terms of labour and natural resources. The contractor will provide the materials.

ATTACHMENT B2 – SUMMARY OF INPUT FROM MINISTRY OF INTERNAL AFFAIRS – ELIGIBILITY CRITERIA

The main objective of the project is water security by ensuring that water is available when required and is hygienic and safe. The proposed project focuses on increasing rainwater storage capacity at the household level by providing individual water tanks but will also include community level assistance through community storage tanks.

Household

- Priority will be given to most vulnerable households in the communities (severely disabled, very elderly, destitute and women with young children) in times of drought, and with roofing capable of collecting rainwater;
- All occupied homes of usual residence with roofing capable of collecting rainwater;
- Where a household has no water tank or tank capacity is less than 6,000L, and roofing is capable of collecting rainwater;
- Where a household has tank capacity of less than 6,000L, and roofing is capable of collecting rainwater, storage capacity should be increased to 6,000L;

- Where a household has roofing not capable of collecting rainwater, e.g. rau or kikau roof, a 3,000L water tank will be given for the purpose of improving their storage capacity and reducing hardship;
- Any household with roofing capable of collecting rainwater whether occupied or not; and
- Household assistance will include accessories to improve the capacity of the roof to collect water, reduce and eliminate contamination of water, and to reduce hardship and improve access to water.

Note: To address the issue of possible excessive costs in ensuring that a household roof has the capacity to collect water, there is a need for a detail on the ground assessment of households prior to project design and implementation. This could be a possible role for the Ministry of Internal Affairs Staff, or an employee of the contractor.

Community Water Tanks

- All existing community water catchments under the management of the Island Council to be upgraded;
- All existing water catchments under the management of the Ministry of Education to be upgraded, and storage capacity increased where necessary;
- All existing Government Buildings with capable roof catchments to be upgraded, and storage capacity increased where necessary; and
- All Church buildings capable of collecting rainwater, with the capacity to increase its storage capacity, will be upgraded.

Ministry of Internal Affairs Work Plan and Involvement

The Ministry of Internal Affairs' welfare officers on each of these islands, in consultation with the IAs and Island Councils, could support the project by:

- Identifying which houses meet the eligibility criteria;
- Provide ongoing training and awareness for the maintenance of the tanks and benefits of efficient and safe water use;
- Identify and refer disputes, complaints and appeals to the project management Teams.

Environmental Sustainability – Ground Water Harvesting

The sustainability of the environment supporting the biodiversity of each island is as important as water is to the people of the islands. Without coconut trees, a basic lifeline for our people on the atolls since they arrived there, and part of the intricate life cycle of the biodiversity that maintains those islands, to live through times of long drought conditions will not be possible. For Pukapuka and Nassau, and Penrhyn (to an extent), ground water is vital to the surrounding biodiversity that supports their stable (taro and pulaka), and the survival of other accessible food sources such as coconut crabs, tupa and birds.

Although, numbers show there is a need to tap into ground water resource, one has to consider extraction of ground water in a wider context, and that is its impacts on the environment that supports our people.

Traditional practice, i.e. the harvesting of ground water from shallow water wells, is the extent upon which ground water resources should be exploited. This has been the practice of our ancestors.

Cost associated with Contribution

Not exceeding **NZD$15,000** (does not include airfares) for 2 Officers from Rarotonga (meals, accommodation for a 7 day stay on each island, training materials, survey materials, higher duty allowance to monitor and prepare dispute cases and an allowance for contingencies)

Staff consulted within the Ministry of Internal Affairs:

Bredina Drollet - Secretary for the Ministry
Ruta Pokura - Director, Gender Development Division
John Henry - Director, Welfare Division
Vania Kenning - Director, Youth and Sports Division
Nooroa Numanga - Director, Disability Division

SUMMARY OF INPUT FROM DEPARTMENT OF PUBLIC HEALTH - PUBLIC HEALTH WATER SAFETY WORK PLAN: - SEE ANNEX E

Water is essential for Life, and a safe, adequate supply must be available to all. Contamination of drinking water is a significant concern to Public Health and monitoring microbiological quality is of principle importance of the acute risk to health posed by bacteria and viruses in the drinking water. Drinking water must be clear, colourless and free from objectionable taste and odour. The presence of pathogen in drinking water is usually due to animal and human waste entering the water sources.

Public Health's main function is to prevent and protect the health and wellbeing of the people and minimize harm from water-borne diseases (Gastroenteritis illnesses etc.). Public Health also promotes and ensures that "Water is Safe for people to drink", through ongoing and continuous risk assessments, surveillance and monitoring, and continuous community awareness program. (See Annex E)

Staff Consulted Within the Public Health Division

Mr. Tata Vaeau – Chief Health Protection Officer
Ms. Tae Nootutai – Health Protection Officer
Ms. Tereapii Nimerota – Health Protection Officer
Mr. Oirua Joseph – Health Protection Officer (Penrhyn

ATTACHMENT B4 – SUMMARY OF INPUT FROM NCW AND CIANGO PRESIDENT - THE ROLE OF WOMEN IN THE PROJECT

Like the other sectors, the National Council of Women (NCW) expressed the importance of water to the home, and especially to the women who are, in most homes in the outer islands, responsible for cleaning, washing and ensuring availability of clean water for drinking and cooking in the homes. The NCW representative who has quite recently visited the islands of Pukapuka, Nassau and Penrhyn expressed that there is, quite naturally, a strong dependence by women on male members of the family whether spouse, partner or young men to collect water or fix any leakages and to undertake any plumbing needs to their respective systems.

The NCW is very supportive of the project and considers its implementation as a progressive development to assist the role of women on those islands.

Consideration:

The representative raised two issues that are important considerations, and they are:

1. Women to be consulted during the design phase regarding the positioning of water systems around the house; and
2. Training on basic plumbing practices to fix basic plumbing needs

Positioning of Water Systems

Quite often, water systems are installed to comply with infrastructure arrangements in the village, which usually ensures that the service lines from the source are as direct as possible to ensure installation and maintenance work load is minimal, and that costs are below the available budget. Also, water systems, in the case of water tanks are positioned based on what is best for the way the catchment was built and no budget is available to ensure the outlets, e.g. taps, are in a position that is convenient to the users especially the women. This, according to the NCW representative, usually, is a contributing factor to the hardship experienced by women in the homes. In addition, in some cases, the water tank is located in a position that is some distance from the kitchen and access during times of harsh whether and heavy rain are at most times inconvenient.

Recommendation: 1. Women, especially the women of the house to be consulted during the design and implementation phase, to reduce hardship issues for women in accessing water; and **2.** The leaders of the communities must show support to women during the on the ground consultation process.

Basic Plumbing Practices Training for Women

This is an area that is normally a man's job. However, in reality, for the isolated islands of the outer islands, such as the northern Group, at most times, the supply of water available to the women in the homes are affected by poor plumbing causing leaky taps, etc. Although, men of the house would normally see to it that the problems are addressed, usually, because of the men's work schedules, these problems may take a while to be fixed. This may result in lost of water through leakage, and hardship in the

homes, of having to cart water from community water tanks, which could be a distance away.

Recommendation: The implementation of a tool kit training programme for men and women in the household on basic plumbing practices aimed at fixing common plumbing problems in the kitchen and household area.

Cost associated with Contribution

No cost was provided, however, a qualified plumber trainer may be involved in the project whose sole responsibility is to provide the training in basic plumbing practices.

People Consulted

Rongo File – Coordinator for National Council of Women (NCW)
Mrs. Vereara Maeva-Taripo – President for Cook Islands Association for Non-Governmental Organizations (CIANGO)

ANNEX C: PROPOSED WATER SUPPLY DESIGN GUIDELINES

Water Supply Design Guidelines

The following water supply design guidelines were adopted for this report. These suggested guidelines are similar in most regards to those outlined for other northern Cook Islands.

These guidelines should be considered as interim only. They require confirmation from the CIGOV (in particular, MOIP and the Ministry of Health) and the selected Island communities.

General

§ Types of water supply systems:
Rainwater collection systems should be used to supply minimum potable water requirements (estimated at 10 L/p/day) at all times. These systems can also supply non-potable needs when rainfall is plentiful.

Groundwater pumping systems to provide supplementary water to the population when rainwater is inadequate to supply more than potable water needs. Groundwater should be supplied from infiltration galleries fitted with solar pumps.

§ Water quantity (demand):
Domestic use: Sufficient to meet the potable and non-potable needs of the design population. The per capita supply for all needs should be **100 L/p/day of freshwater with a minimum potable (drinking water) supply of 10 L/p/day**.

The allowance of 100 L/p/d is larger than the current water demand estimate of 50-75 L/p/d but allows for some expansion in per capita demand (e.g. increased use of appliances such as washing machines).

Non-domestic use (school, clinic, hospital and other): allow 5% of total residential use.
Leakage (for piped systems to standpipes only): allow 10% of total domestic and non-domestic demand supplied from groundwater sources.

§ Water quality (potable water):
Should meet WHO guidelines for drinking water (WHO, 2004).
Specific requirements are as follows:

Salinity (EC): less than 1,500 µS/cm on all occasions.

Bacteriology: meet WHO (2004) guidelines in most cases. Maximum limit of 10 faecal coliforms acceptable on infrequent occasions.

Water chemistry (heavy metals, herbicides, pesticides or other organic chemicals): meet WHO (2004) guidelines.

§ Water quality (non-potable water):
Salinity (EC): less than 2,500 µS/cm on all occasions except during periods of extended droughts.

Bacteriology: low faecal coliforms. Maximum limit of 100 faecal coliforms acceptable on infrequent occasions.

Water chemistry (heavy metals, herbicides, pesticides or other organic chemicals): meet WHO (2004) guidelines.

§ Supply points:
Rainwater: from tanks adjacent to houses, community buildings or purpose-built roof collection systems.

Groundwater: supplied by pumps to elevated tanks and then by gravity pipeline to standpipes near houses and community buildings.

§ Standpipes:
Standpipes should be located no further than 100 m from houses. This means the maximum spacing between standpipes in housing areas should be 200 m.

Standpipes should be fitted with appropriate taps to prevent leakage and minimize wastage. These could be lever-action ball valves or spring-loaded taps.

§ Service: Continuous (i.e. 24 hours/day)
Water supply should therefore be sustainable throughout droughts.

- **Storage capacity**:

Rainwater: sufficient community storage to enable the design population to access 10 L/p/d at all times.
Groundwater: sufficient to supply water at the average water demand for at least one day. For solar pumping systems, it would be advisable to have sufficient storage for a longer period (preferably two days) to allow for intervals of low solar radiation.

- **Minimum pressure:**

Rainwater: based on available pressure from residential house or community rainwater systems. Groundwater at standpipes: preferably 5m with a minimum of 2 m.

§ Technology:
The technology must be simple and capable of being operated and maintained at village level after some training.

§ Standard Designs:
Wherever possible, adopt standard designs to minimise requirements for different types of equipment and materials.

§ Non-corroding Materials:
Wherever possible, non-corroding materials should be used. This may mean that installation costs will be higher, but savings will be made on later maintenance and replacement costs.

§ Pipelines:
All main pipelines should be laid using medium density polyethylene (MDPE) pipe, rather than other alternatives such as PVC pipe. MDPE pipe is supplied in long coils and can be joined with compression fittings rather than solvent cement (glued) joints. MDPE

pipelines tend to have fewer joints than PVC pipelines and the joints can easily be tightened to prevent leaks. Many PVC pipelines in the Cook Islands have developed leaks owing to poor solvent weld joints. MDPE pipes are also more robust than PVC pipes and do not become brittle after long exposure to direct sunlight.

Pipelines should be laid in trenches. It is particularly important to lay pipelines properly within villages to avoid damage. Depths of trenches and type of backfill should be in accordance with normal water supply practice. The minimum depths of cover for pipelines are as follows:

Open areas: 300 mm
In areas other than roads where vehicles can drive: 450 mm
Under sealed roads: 600 mm
Under unsealed roads: 750 mm.
Automatic air-valves should be installed at any high points on pipelines. These should be fitted with suitable protective boxes.

§ Storage water-tanks:

The tank must be manufactured from Food Grade Polyethylene Chip UV Stabilised with a thickness of 8 mm in the base and 6 mm in the walls. The draft specification for supply and delivery of the tanks provided in Attachment C1 specifies provision of the type of tank required.

PE tanks should be robust.

In general, the minimum capacity of PE tanks should be 6 kL.

Regarding domestic rainwater tanks and associated fittings and materials, refer to the specification in Attachment C1, this provides for tank specification, installation and tender notes.

§ Tank stands:
Tank stands should be equipped with ladder and safety cage, steel mesh deck and safety rails.

They should be designed to withstand loading from full water tanks and from relevant wind and seismic loads.

They should be made from heavily galvanised steel members, which should also be protected with two coats of epoxy-based paint.

§ Groundwater Supply
Groundwater Infiltration galleries, and pumps must be disinfected immediately after construction, repair, or installation of equipment, as they normally become contaminated during the improvement work. In addition, the Infiltration Galleries must also be protected from pollution.
Open wells are especially vulnerable to contamination caused by surface water inflow and unsanitary ropes and buckets. Infiltration galleries should be protected by establishing a groundwater protection zone around the gallery. (An example of this is being done on the Mauke Project).

The gallery pump station should have a solar pump installed for extracting water from the gallery. (Hand pump is not recommended at a gallery area as it will then require people to be right over the gallery zone potential contaminating the area with ground surface disturbances. Infiltration galleries should be constructed so that surface area around the gallery zone is flat to prevent ponding and flooding of the area. Gallery pump station should be located above and at least 30 to 50 meters away from any sanitation facilities and their discharges.

Note: Even 30m – 50m separation from sanitation facilities may not guarantee that the pollution through the groundwater does not occur. A lot depends on where the well & sanitation facilities are located relative to the ocean/lagoon. Awareness of safe sanitation and hygiene practices need to be incorporate in the education programs and in designs of future sanitation systems.

A suitable solar pump should be installed at the pump station connecting towards the groundwater tank or tanks.

Install 2 X 6000L tank at locations of galleries for the distribution of ground water to surface.
The infiltration galleries below ground level require protection from infiltration by surface water and other contaminants and are completely reliant on pumps for supply to the storage tanks. Tank locations are reliant on the source of the groundwater. Further discussion is required for optimal use of tanks, header tank/s and pumps which require minimum maintenance.

[Refer relevant sections in both the Falkland (2005) for Pukapuka and Falkland (2006) for Penrhyn reports.]

§ Pipe work at storage tanks (and for groundwater supply):
Each storage tank should be fitted with one inlet pipe and one outlet pipe. Two or more inlet or outlet pipes are unnecessary as tees can be used either upstream or downstream from the tank if necessary.

Each tank should also be fitted with an overflow pipe and scour pipe. The overflow pipe should be fitted near the top of the tank to direct any overflows away from the tank. The scour pipe should be connected near the base of the tank to enable periodic draining and cleaning of the tank. A suitable scour (gate) valve should be fitted to this pipe close to the tank. The overflow and scour pipes should be laid in a trench away from the base of the tank(s) and terminated in a place where scour flows and overflows will not cause erosion or nuisance flooding.

§ Flow-meters
For monitoring purposes include flow-meters. Refer to Pukapuka (2005) and Penrhyn (2006) on type, installation method and monitoring schedules.

Attachment: C1

TECHNICAL SPECIFICATION SUPPLY OF DOMESTIC WATER TANKS FOR NORTHERN GROUP WATER PROJECT, COOK ISLANDS

1. Introduction

This specification is for the supply of materials and assistance with installation of domestic water tanks for the Northern Water Project in the Cook Islands. The tanks will be used to store freshwater from rainwater sources for domestic use.

2. Scope of Works

The scope of works is as follows:

(a) Supply domestic water tanks (as per list proved for each island) (nominal capacity 6000 L (Note: 2X3000L tanks are envisaged therefore confirm from schedule), associated fittings and materials and deliver on a cost insurance freight (CIF) basis to the selected islands.

(b) A works supervisors will be engaged by the project in the proper installation and maintenance of the selected tanks on the selection islands;

(c) Provide a detailed installation manual and conduct training workshop for recipients;

(d) Provide a completion report;

3. Site

The tanks will be stored at a site nominated by the IA. The contractor shall be responsible to delivery of the tanks to the nominated storage area. The IA will assist the contractor for delivery of the tanks to each site. IA vehicle hireage anticipated.

4. Tank Requirements

The domestic tanks shall be Nalco 6000 L tanks or equivalent and shall have an effective tank capacity of at least 6,000 L (or 2X3000L tanks). The tanks shall be manufactured from food grade virgin polyethylene chip, UV stabilised. The effective capacity is the volume in storage that is available for use. It can be computed by multiplying the floor area of the tank by the height between the bottom water level (controlled by level of tank outlet pipe) and the top water level. Design drawings for the proposed tank and a description of its materials shall be submitted with the tender.
The tank shall have a warranty against material defect for at least 10 years.

5. Fittings and Materials

Each tank shall be equipped with the following minimum fittings and materials:

Marley “Storm Cloud” spouting or equivalent.	10	M
Marley “Storm Cloud” mounting bracket or equivalent.	20	No.
Marley “Storm Cloud” rain head or equivalent.	1	No.
Marley “Storm Cloud” end LH or equivalent.	1	No.
Marley “Storm Cloud” end RH or equivalent.	1	No.

Marly down pipe 3 m length or equivalent.	2	No.
Marley 90 deg bend or equivalent.	2	No.
Marley downpipe bracket or equivalent.	2	No.
25 kg cement	3	No.
Ball cock float valve 15mm	1	No.
M/F ball valve 15mm	1	No.
One way check valve 15mm	1	No.
Quest pipe 15mm	4	M
Brass Tee 15mm	1	No.
Brass elbow 15mm	1	No.

6. Installation of Tanks

The tank foundation will be prepared by the community (or home recipient) under the supervision and assistance of the IA. The tanks will be recessed into the ground, at least 150mm below ground surface. Foundation material (below recessed area) will be compacted sand and aggregate and should not be within 5 meters of any sanitation facility. Scour and outlet pipe shall be protected and directed away from tank foundation (say min 0.8 metres). The contractor will install the tank (at approved locations) and provide remedial work on the houses so that the tank is fully operational in accordance with the detailed installation manual. The contractor will train the IA supervisors and the community during the installation of the initial tanks over a two week period.

7. Inspection and Test Plan

An inspection of the tanks will be conducted by the works supervisor during their installation. The tank supplier will be required to provide an Inspection and Test Plan (ITP) and to demonstrate how their quality assurance system ensures that the tanks are fit for purpose. MOIP will review and approve the ITP for use during manufacture, delivery and final installation of the tanks to the selected islands.

8. Reporting

A brief report (or pro-forma sheet) shall be prepared by the contractor at the completion of each installation works outlining the work program, results of the testing, operation and maintenance requirements and any additional relevant comments.
The report shall be submitted and approved for payment by the work supervisor <<***to be nominated***>>> within one week of the completion of the works.

9. Shipping

The contractor will be responsible for shipping of all tanks, fittings and materials required for the project including coverage on insurance of the said materials to the selected islands and for unloading of the tanks at the selected islands onto the local transportation barge. The contractor with the assistance of the IA will be responsible for transporting the tanks from the barge to the storage area, and for customs clearance. Delivery of the tanks, fitting and materials to the selected site will be the responsibility of the contractor with assistance and direction from the IAN secretary.

10. Tender Submission Information.

Tenders shall include the following:

- Design drawings of proposed tank and fittings (3 sets).
- Tank installation instructions (3 sets).
- Calculated effective storage volume.
- Certificate from a qualified structural engineer re suitability of the tank design.
- Note regarding availability of a 10 year warranty for the tank liner.
- Prices for components of the proposed work as follows:
  - Tanks, fittings and materials.
  - Spare parts
  - Packing, shipping.
  - Training of local supervisors
  - Other (air fares, accommodation, reporting, etc).

ANNEX D: MOIP SURVEY OF HOUSES FROM PUKAPUKA AND PENRHYN

NGAKE VILLAGE Pukapuka		Occupants			Roof Con		Tanks Rqd		
Hse No.	Name	Adults	Children	Total	Pass	Fail	6000L	3000L	Comments
1	Maru Marukore	4	2	6			1		Back and one side of hse spouting has been installed
1	Kautaki Katoa	4	4	8	✓		1		Spouting required only
	Public water tank			0					All completed
	Public water tank			0					9m of the 21m side not roofed
1	Tinga Tapuni	2	4	6	✓		1		Fascia to one side only, spouting required to both sides
	CICC Church (motu Ko)			0					Fascia required to one side only, spouting required to both sides
	SDA Chruch (Motu Ko)			0					Fascia and spouting required
	Koa Marurai (Motu Ko)			0					Fascia required to one side only, spouting required to both sides
	Tarai Noroto (Motu Ko)			0					Fascia and spouting required
	Vata Vailoa (Motu Ko)			0					Fascia required to front side only, spouting required to both sides
	Catholic Church (Motu Ko)			0					Fascia and spouting required
1	Kirirau Tepa	2	6	8	✓		1		Fascia and spouting required
1	Matatia Taikakara	3	2	5	✓			2	Fascia and spouting required
1	Poila Arie	2	3	5				2	Fascia and spouting required
1	Penese Polia	4	2	6				2	Fascia and spouting required
1	Casey Poila			0				2	Fascia and spouting required
1	Rima Ben Pani	3	4	7	✓		1		Spouting installed to back of hse only
1	Noroto Teapa	2	6	8		✓		2	Fascia and spouting required
1	Rupena Simona	2	4	6		✓	1		Fascia and spouting required
1	Timati Amosa	2	2	4	✓			2	Spouting installed to one side only
1	Amosa Puluata	2	4	6	✓		1		New fascia and spouting
1	Nukuaro Marukore			0	✓			2	Spouting required only
1	Inapa Auwia	2	4	6	✓		1		Fascia and spouting required
1	Areta Vailoa	2	2	4	✓			2	Fascia and spouting to one side only
1	Yipori Kirirua	2	4	6	✓		1		Fascia and spouting to both sides
1	Makuare Tepa	2	4	6	✓		1		Completed both sides
1	Pareura Katoa			0	✓		1		Fascia and spouting installed to one side only
1	Andrew Pita	2	4	6	✓		1		Fascia and spouting installed to one side only
1	Chief Walemaki	5		5	✓			2	Fascia and spouting to both sides
1	Tekia Tauia	2	1	3	✓			2	Fascia and spouting to both sides
1	Karito Tauia	2	2	4	✓		1		Spouting installed to one side only

1	Puapii Raverua	2	5	7	✓		1		Spouting installed to one side only
1	Ketura Vila	2	3	5	✓		1		Spouting installed to both sides
	Catholic Church			0	✓				Spouting installed to both sides
1	Charlie Frisbie	3	3	6	✓			2	Spouting installed to one side only
1	Auwia Tapuni	5	3	8	✓		1		Fascia and spouting to one side only
1	Rubena Ruarau	3	5	8	✓		1		Fascia and spouting required
1	Katangaia Maro	3	3	6	✓		1		Fascia and spouting required
1	Peta Akaruru	3	6	9	✓			2	Flat Top Fascia and spouting required
1	Akima Taikakara	2	6	8	✓		1		Spouting required only
1	Toni Pira	2	3	5			1		Spouting installed to one side only
1	Vigo Nemiti	2	4	6	✓			2	Fascia and spouting required
1	Pereo Nemeti	2	2	4	✓			2	Spouting required only
1	Tengere William	3	3	6	✓		1		Fascia and spouting installed to one side only
1	Pira Pira	2	4	6	✓				Fascia and spouting required
1	Meeting House			0	✓		1		Spouting required only
1	Tinima Teingoa	3	3	6	✓			2	Spouting required only
1	Iotama Raverua	3	6	9	✓		1		New spouting, Fascia front side of house needed
1	Jack Jack	1	4	5	✓		1		Spouting required only
1	Ngarima Noorota	2	4	6	✓			2	Fascia and spouting required
	Catholic Hall			0	✓				New spouting for both sides and fascia
1	Terepai Topetai	4	6	10	✓			2	Fascia and spouting required
1	Pone Apiuta	2	4	6	✓		1		New spouting for one side only
1	Tearo Tinomana	2	1	3			1		New spouting for both sides
1	Wale Teingoa	2	4	6				2	New spouting for both sides required
1	Vairoa Vairoa	4	6	10		✓		2	Fascia and spouting required for one side only
1	Casio Opo	2	4	6	✓		1		New spouting for both sides
1	Kore Tinga	2	3	5	✓		1		Fascia and spouting required for one side only
1	Lewi Walewaoa	3	2	5	✓			2	New spouting for both sides
	TOTALS	**79**	**112**	**191**			**28**	**40**	**NGAKE VILLAGE**

ROTO VILLAGE Pukapuka		Occupants			Roof Con		Tanks Rqd		
No.	Name	Adults	Children	Total	Pass	Fail	6000 L	3000 L	Comments
1	Mangere Maro	3	5	8			1		12m of fascia and spouting required to complete hse, Hse is also supply community tanks
1	Mose Manutai	3	2	5	✓			2	Fascia and spouting required
1	Paulo Pakitonga	3	6	9	✓			2	Fascia and spouting required
1	Rakera Aumatangi	2	3	5	✓		1		Spouting installed to one side of hse only
1	Tinirau Kavana	4	4	8	✓			2	Spouting installed to one side of hse only
1	Marurai Marurai	2	4	6	✓		1		Spouting installed to one side of hse only
1	Manea Opo	3	2	5	✓		1		Spouting installed to one side of hse only
1	William William	2	5	7	✓			2	Spouting installed to one side of hse only
1	Tere William	2	5	7	✓			2	New spouting installed to both sides of hse
1	Ngatokorua Purotu			0		✓	1		Fascia and spouting required
1	Dawn Obeda	2	1	3		✓		2	Spouting installed to one side of hse only
1	Tavero Robati	2	4	6	✓			2	Fascia and spouting required
1	Vao Tiare			0		✓		2	Fascia and spouting required
1	Vavia Mataora	3	5	8	✓			2	Fascia and spouting required
1	Titonga Henry	2	4	6	✓		1		Spouting required for both sides
1	Eraiti Teinaki	2	1	3				2	Flat top, Fascia and spouting required
1	Aruia Romani	2	5	7	✓		1		Spouting to both sides of hse
1	Ieremia Poiri	3	2	5	✓		1		Fascia and spouting required to one side only
1	John Hagai	5	3	8	✓		1		Spouting installed to one side of hse only
1	Tai Ravarua	3	6	9		✓	1		Fascia and spouting required to one side only
1	Aporo Mataora	2	5	7	✓		1		Fascia and spouting required
1	Arona Tariau	2		2	✓		1		Fascia and spouting required for front of hse only
1	Ngarui Taunga	2	2	4	✓			2	Fascia and spouting required
1	Maningi Tiro	4	1	5	✓			2	Spouting installed to one side of hse only
1	Teopenga Nio	2	2	4	✓			2	New spouting installed to both sides of hse
1	Wuatai Wuatai	5	4	9	✓			2	Fascia and spouting required
1	Peua Taingauru	2	3	5	✓			2	Spouting installed to one side of hse only
1	Vai Peua	2	3	5	✓			2	Fascia and spouting required to one side only
1	Ata Akaruru	2	4	6			1		Spouting required only
1	Issac Elisa			0	✓			2	Spouting installed to one side of hse only

1	Tukia Mataora	2	3	5	√			2	New spouting installed to both sides of hse
1	Mataau Matangi	2	4	6	√		1		Spouting installed to one side of hse only
	SDA Church			0					Spouting installed to one side of hse only
1	Tuiva Karowia	2	4	6	√		1		Hse completed
1	Vakaula Opo	2	2	4	√			2	Fascia and spouting required
1	Manurere Opo	2	3	5	√			2	Spouting required only
1	Atiau Tutai			0	√			2	Fascia and spouting required for front of hse only
1	James Auwola	2	3	5	√		1		Spouting required only
1	Beniamina Tengere	2	4	6	√		1		Spouting required only
1	Ataera Ataera	3	2	5	√			2	Spouting required only
1	Tinirau Kavana	2	2	4	√			2	Fascia and spouting required
1	Temahana Kiki	5	6	11	√			2	Fascia and spouting required
1	Pitai Teinaki	4	3	7	√			2	Spouting required only
1	Ravarua Tutai	2	5	7	√		1		New spouting installed to one side of hse
1	Tiaki Wuatai Marukore	2	4	6	√		1		Fascia and spouting installed to back of hse only
1	Ngereteina Opo	2	2	4	√		1		Spouting installed to back of hse only
1	Maia Rangi	2	3	5	√		1		Fascia and spouting required
1	Potokotai Kairua	3	5	8	√		1		New spouting installed to one side of hse Back
1	Ta Nio	2	2	4	√			2	Spouting installed to back of hse only
	Roto Meeting Hse			0					Everything completed
	Roto Motu Tawa Ngake			0					Nun
	Roto CICC Church			0					Completed
	Totals	**84**	**107**	**191**			**22**	**52**	**ROTO VILLAGE**

YATO VILLAGE Pukapuka		Occupants			Roof Con		Tanks Rqd		
Hse No.	Name	Adults	Children	Total	Pass	Fail	6000L	3000L	Comments
	Public Water Tank								Everything Complete
1	Manila Matenga	2	3	5				2	Spouting only is required for this hse
1	Mairaro Merota			0	✓		1		Spouting installed to one side only
1	Auki Paniani	6	7	13	✓			2	Spouting installed to one side only
1	Veuku	6	8	14				2	Fascia and spouting required for front and side only
	Community Hall (Motu Kotawa)			0					Fascia and spouting required
	Varia Maru (Motu Kotawa)			0					Fascia and spouting required
	Taote Tinokura (Motu Kotawa)			0					Fascia and spouting required
	Norma Matenga (Motu Kotawa)			0					Fascia and spouting required
1	Tamangaro	5	7	12				2	Fascia and spouting required
1	Patuki Tengere	2	4	6	✓		1		Spouting installed to one side only, need spouting and fasica for back only
1	Rautana Robati	2	6	8		✓		2	Fascia and spouting required
1	Tapa Mataora	3	2	5				2	Needs spouting for both side and fascia for front side only
1	Ngatokorua Purotu	2	4	6	✓		1		Fascia and spouting required
1	Tutu Nikoro			0	✓			2	Flat top, Fascia and spouting required
1	Aretio Pira	2	6	8				2	Fascia and spouting required
1	Apitai Teinaki	2	4	6	✓		1		Needs spouting only
1	Rutonga Maru	6	6	12				2	Fascia and spouting required
1	Rukuaro Marukore	4	6	10	✓		1		Fascia and spouting required
1	Ngarupe Mataito			0	✓		1		Flat top, Spouting installed to one side only
1	Mare Daniel	2	8	10	✓		1		Spouting required for front and back
1	Rito Tinokura	4	4	8	✓			2	Spouting installed to one side only, Fascia and spouting required for front
1	Ngutu Ngutu	2	3	5	✓			2	Fascia and spouting required
1	Teau Panakiliuvi	2	4	6	✓			2	Fascia and spouting required
1	Yingonge Purotu	3	2	5				2	Fascia and spouting required
1	Yitiri Yitiri	6	7	13				2	Fascia and spouting required
1	Tarapu Wiiliam	2		2	✓			2	Spouting installed to one side only, Fascia and spouting required for front
1	Meeting House			0			1		Spouting installed to one side only, Fascia completed

1	Katia Utarenga	4	6	10				2	Fascia and spouting required
1	Utarenga Taumaina	3	2	5				2	Fascia and spouting required for front only
1	Tekere Pereti	2	4	6			1		Fascia and spouting required
1	Toru Taunga			0				2	Fascia and spouting required for one side only
1	Boaza Boaza	3	3	6	✓			2	Fascia and spouting required
1	Ruarau Iakopo			0			1		Fascia and spouting required for front only
1	Joseph Timoti			0				2	Fascia and spouting required
1	Punga Punga			0			1		Spouting required for front and side only
1	CICC Mission Hse (Atirai Atirai)	3	5	8	✓		1		Both sides completed
1	Rotoika Tengere	5	3	8	✓		1		Spouting installed to 2 sides of hse, new spouting required for other 2 sides of hse
1	Makonia Boaza	1	1	2	✓			2	Spouting required for one side only
1	Ritawa Akaroa	2	2	4		✓	1		Fascia and spouting required
1	Kupa Marera	2	2	4	✓			2	Completed bothe sides
1	Tupea Mataora	2	2	4	✓			2	Fascia and spouting required
1	Yetu Katia	1	1	2		✓		2	Fascia and spouting required for front only
1	Tutau Punga	2	3	5			1		New spouting been installed both sides of hse
1	Woetai Okotai	3	2	5	✓			2	Existing spouting installed on back side only, needs spouting for right hand and front only
1	Niua School Principal's hse	2	4	6	✓		1		Spouting required for one side only
1	Manila Maika Akariri	4	3	7	✓		1		Spouting required only
1	Tinokura Utarenga	5	8	13			1		Fascia and spouting required for one side only
1	Rangiuira Walemaki	2	4	6	✓			2	Fascia and spouting required for one side only
	Totals	**109**	**146**	**255**			**18**	**52**	**YATO VILLAGE**

OMOKA VILLAGE Penrhyn		Occupants			Roof Con		Tanks Rqd		Tap	
No.	Name	Adults	Child	Total	Pass	Fail	6000L	3000L	Fitting	Remarks
1	Ben Samuela	3	3	6	✓			2	2	Need to replace fascia boards & install new guttering system, no tanks on site
2	Tuariki Mariri			0	✓		1		1	Fascia OK, guttering to half of hse only, existing 5000L PE tank leaking
3	Tahaki Paulo	0		0	✓			1	1	Needs fascia boards installed, guttering not whole length of hse & to one side only, Existing 3000L PE tank on site
4	Marorua Tangaroa (derelict)	0		0		✓		2	2	Whole hse needs re-roofing
5	Doreen Heria (derelict)	0		0		✓		2	2	Whole hse needs renovations
6	Tongareva Community Carft Centre	0		0	✓		1		1	Guttering Ok, needs brackets for 1 side of guttering, Requested for extra tank as community uses the water during shortage
7	Tekaikura Marsters			0	✓					Needs guttering & down pipe. 2x5000L PE tanks on site
8	Tekaikura Marsters	0		0	✓			2	2	Needs guttering, down pipes
9	Fana Ivirangi (derelict)	0		0		✓		2	2	Whole hse needs renovations
10	Moiho Tetuputou	0		0	✓		1		1	New hse with no fascia, guttering & down pipes
11	Rara Rasmussen	0		0	✓			1	1	Fascia & guttering on both sides of hse Ok, needs brackets for back guttering only.
12	Arue Nikore	0		0	✓		1		1	Fascia boards ok, needs guttering system installed
13	Pautapu Soatini	0		0	✓			2	2	Needs new fascia, guttering & down pipes. Existing tanks no use
14	Sinapu Faireka	0		0	✓		1		1	Needs new fascia, guttering , down pipes, existing tank leaking
15	William Tekena	2		2	✓			1	1	Fascia, guttering system on 1 side only
16	William Tekena			0	✓		1		1	Guttering at back of hse only, needs new fascia boards, not whole hse with spouting
17	Taruia Matara (derelict)	0		0		✓		2	2	Needs complete re-roofing with guttering system, Existing tank leaking
18	Mita Soa	3	3	6	✓					Guttering system to hse ok, needs support for down pipes. 2x5000l tanks on site
19	Tinanui Tata	0		0		✓		2	2	Roof rusted, needs fascia etc
20	Naave Williams	0		0	✓			2	2	Fascia needs replacing along with guttering, down pipes, Existing Conc. Tank leaking
21	Teaurere Mahela			0	✓			1	1	Guttering to main hse fine need support for down pipes, no guttering to front extension. 5000L PE tank on site
22	Boma William			0		✓	1		1	Roof rusted, needs fascia etc, no guttering & down pipes. Conc. Tank some leak

23	William Kekena	0		0		✓		1	1	guttering in front of hse only, need to replace fascia. 3000L PE tank on site
24	Peter Rasmussen			0	✓			2	2	Needs new fascia & guttery, down pipes
25	Peter Rasmussen			0	✓		1		1	Needs new guttering (existing iron). Existing conc. tank leaking
26	Puna Maretu			0	✓		1		1	Fascia ok, guttering at back needs replacing
27	Puna Maretu	0		0	✓			1	1	Fascia ok, guttering at back needs down pipe
28	Mona Viniki			0	✓			2	2	Needs fascia, guttering & down pipes. Old guttering at back only. Conc. Tank leaking
29	Sonny Teaurere	0		0		✓		2	2	Need to replace fascia, no guttering. Conc. Tank leaking
30	Wilky Rasmussen	0		0	✓			1	1	Guttering on back roof only. Need to replace down pipe
31	Joe Rasmussen	0		0	✓			2	2	Guttering on back roof only
32	David Teaurere			0	✓			1	1	Guttering, fascia and down pipe ok. Existing Conc. Tank some leak
33	Banaba Matara			0	✓					All ok on this hse
34	Manata Akapuria	3	2	5	✓			1	1	Supports needed for down pipes, fascia & guttering ok. Conc. Tank some leak
35	Kirikava Moerangi	1		1	✓			2	2	Guttering on one side only, no tank on site, no down pipe
36	Maru Manata			0		✓		2	2	Roof rusted, Need one length spouting, replace fascia
37	Turua Taime	0		0		✓	1		1	Roof rusted, Need fascia, guttering & down pipes. Existing conc. Tank leaking
38	Andrew Vaeau	1		1	✓			1	1	Existing guttering (tin) in front of building ok,back not whole length. PE tank at back of hse
39	Rausei Meremere	6	3	9		✓		2	2	Roof rusted, Existing guttering, down pipe, facia ok. Needs support for pipes. Conc. Tanks some leaking
40	Okiroa Mita (derelict)	0		0		✓		2	2	Roof rusted, Needs new fascia & guttery, down pipes.
41	Ussiah Taruia	0		0	✓		1		1	Fascia required for front of hse. Guttering & down pipe ok, Tank leaking
42	Riu Isaia	0		0	✓		1		1	Need new fascia, guttering, down pipes. Hse feeding community tank & own tank
43	Pa Nanua (derelict)	0		0		✓		2	2	Main hse roof rusted, Needs new fascia, guttering & down pipe
44	Takiika Tetuputou (derelict)	0		0		✓		2	2	Roof rusted, Requires new fascia, guttering & down pipe
45	Serah Marsters	0		0	✓		1		1	Needs new fascia, guttering & down pipe, conc. Tank leaking
46	Dick Marsters (derelict)			0		✓		2	2	Roof rusting, Needs new fascia, guttering & down pipe, back tank used only but leaking
47	Naporoaki Tai	0		0	✓					Needs new fascia, guttering & down pipe, conc.tanks at back of hse, over grown by shrub
48	Maumau Mita	0		0	✓			2	2	Needs new fascia, guttering & down pipe, existing tank at back of hse
49	Mere Soa (derelict)	0		0		✓		2	2	Not all roofing iron replaced. Needs fascia, guttering & down pipes. Need fiitings to existing tank

50	Soa Tini	0		0		✓		2	2	Roof rusted, Needs new fascia, guttering at back ok, front needs brackets & support for down pipe
51	Kirikava Moerangi			0	✓			2	2	Back-Needs new fascia, down pipe. Guttering ok, Conc. Square tank leaking
52	Kirikava Moerangi			0	✓			2	2	Fascia, guttering & down pipe on front & back ok
53	Tama Tavake	0		0	✓			2	2	Needs new fascia, guttering for back of hse only
54	Taote Rakau	0		0		✓		2	2	Roof rusted, Needs new fascia, guttering & down pipe and supports
55	Taote Rakau (derelict)	0		0		✓				Roof rusted, Needs new fascia, guttering & supports for down pipe
56	Maru Morau			0	✓			2	2	Fascia, guttering ok, needs down pipe & connection to guttering. Conc. Tank leaking
57	Oioi Tangimetua	0		0	✓			2	2	Existing fascia & guttering at back ok but no tank, front- needs guttering & down pipes, conc. Tank some leak
58	Tini Ford			0	✓					Existing fascia, guttering & down pipes ok, needs support for down pipes to main hse. Extension of hse needs new guttering.
59	Maki Ford	0		0	✓			2	2	Existing fascia ok, needs new guttering to front & back, no cover to tank, evidence of leakage
60	Tere's Bakery (commercial)			0	✓					Existing fascia, guttering Ok. Needs down pipe to front guttering
61	Alex Maretapu			0	✓		1		1	Front-fascia, guttering & down pipe ok. Back- fascia ok, needs new guttering & down pipe
62	Davida Maretapu			0		✓	1		1	Rusted roofing, Needs new fascia, guttering and down pipes.
63	Tom Peau			0	✓			2	2	Fascia, guttering & down pipe ok, conc. Tank leaking
64	Fred Ford (derelict)	0		0		✓	1		1	Rusted roof, Needs new roof, fascia, guttering & down pipes
65	Jemima Peau	0		0	✓					Fascia, guttering & down pipes ok, needs connection for down pipe & supports
66	Terepai Tutai			0	✓			2	2	Needs new fascia, guttering, down pipes & tap fittings for tank, tank leaking
67	Teinaki William	0		0	✓			2	2	Needs new fascia, guttering for back of hse only, tap connections ok, tank leaking
68	Taime Store (Commercial)	0		0	✓					Existing fascia, guttering & down pipes ok.
69	Tapiua Taime	0		0	✓			2	2	Existing fascia, guttering ok, Guttering to 2 sides only, square tank leaking
70	Tangi Taime	0		0	✓		1		1	New hse with no fascia, guttering & down pipes fitted
71	Joel Taime	0		0	✓		1		1	Back-Existing fascia, guttering ok, needs down pipe. Front-All ok, conc, tanks leaking
72	Serah Woonton (derelict)	0		0		✓		2	2	Whole building needs renovation
73	Rakoroa Tai (Derelict)	0		0		✓				Whole building needs renovation
74	Tonitara Taitai (derelict)	0		0		✓		2	2	Need to replace roof, no existing fascia
75	Rupe Meremere			0	✓			2	2	Existing Fascia, guttering Ok needs connection & down pipe. Conc. Tank leaking
76	Ngariau Tuaine			0	✓			2	2	Needs new fascia, guttering & down pipe

77	Tini Joseph	2	1	3	✓			2	2	Roof rusted, Need to replace fascia boards, guttering ok but not whole width of hse
78	Tera Tonitara			0	✓			2	2	Existing fascia, guttering & down pipes ok, tanks ok.
79	Tera Ford	0		0	✓			2	2	Existing fascia ok, need new guttering for front & back. 1 PE tank leaking
80	Peter Rasmussen	0		0	✓			2	2	Front-fascia ok, needs guttering, support for down pipe. Back-Needs new fascia & down pipe.
81	Mama Tai (Agrculture Shed)	0			✓		1		1	Needs fascia & guttering system. Land taken back by landowner from Agriculture
82	Tutu William			0	✓		1		1	Fascia boards ok, needs guttering system installed
83	Matetoru Tautu	0		0	✓			2	2	Needs new fascia & guttering system, hse also needs renovations
84	Tangaroa Tai			0	✓		1		1	Everything on this house ok, owner still completing hse. (2 story building)
85	Bill Marsters	1		1	✓			2	2	Guttering system to hse ok, needs connection to down pipes
86	Kaukau John	0		0	✓		1		1	Hse still undergoing renovations, needs fascia & guttering system, existing round tanks no good, square tank leaking
87	Maoro John	0		0	✓			2	2	Front-fascia ok, needs guttering & down pipe, Back-Needs fascia boards, 1 length of guttering only, down pipe required
88	Turua Taime			0	✓			1	1	Fascia boards ok, guttering system on back of hse only, and no guttering in front of hse. 1x5000l PE tank on site
89	Takake Akatapuria			0	✓			2	2	Fascia boards ok, needs new guttering system at back of hse, no guttering in front of hse existing tank leaking
90	Arake Tonitara	2	1	3	✓			1	1	Guttering system on this hse ok, Conc. Square tank leaking. 1x5000l PE tank on site
91	Arake Tonitara			0	✓					Existing guttering needs repair, tank behind hse. 1x3000l tank at back of house
92	Sope Carnahan			0	✓			2	2	Existing guttering system on main hse only, all good. Back extension no guttering. Existing square tank leaking
93	Tata Tonitara			0	✓			1	1	Existing system ok, need support for down pipe. 1x5000l PE tank ok, conc. Tank leaking
94	Don George			0	✓			2	2	Needs new fascia board, spouting system, existing square tank leaking
95	Rangi Rass			0	✓			1	1	Existing system installed on 1 side only in good condition, existing tank PE 6000l
96	Tira Nikau	0		0	✓			2	2	Existing system installed on 1 side only in good condition. Existing square tank leaking
97	Abela William	4	3	7	✓			1	1	Guttering system installed on both ends of hse in good condition, 1x5000l tank on site
98	Rangitava Taia			0	✓					Guttering system installed on both ends of hse in good condition. Needs proper support for down pipes. 4xPe tanks on site
99	Pahu Toka	2	3	5	✓					Guttering system in good condition, installed on both ends of hse, needs support for down pipes. Existing square take leaking. 1x6000l,1x3000l PE tanks on site.

100	Kiripapa Teio	0		0	✓			2	2	New hse with no fascia, guttering & down pipes fitted
101	Paroa Niukore			0	✓					Guttering system ok needs connection for down pipe. 2xPE tanks in use, 5000l & 3000l
102	Moana Viniki			0	✓			1	1	Guttering not install the length of hse, 2xPE tanks on site, 3000l & smaller
103	Musani Wooton	0		0	✓		1		1	Hse still under going construction, not yet complete. No tank on site. Guttering system partly completed
104	Tarura Sangapu	0		0	✓			2	2	Hse fitted with guttering system to both ends, no tanks on site, tank base 850mm ht
105	Tehio Maireriki			0	✓			1	1	Guttering system in good condition, installed on both ends of hse, needs support for down pipes. Existing square take leaking. 2xPE tanks in use
106	Jubilee Turama			0	✓			1	1	Guttering system in good condition, installed on both ends of hse.
107	Nikoia Faireka			0	✓		1		1	Guttering system in good condition, installed on both ends of hse but not whole front with spouting. Needs down pipe for front & tank
108	Vaimea Pange	0		0	✓			1	1	Guttering system in good condition, installed on both ends of hse. One side with no down pipe
109	Taui Nikoro			0	✓			1	1	Guttering system in front of hse ok, corner connection required. Back-spouting ok but not all water goes to tank. 2xPE tanks in use 3000l & smaller
110	Tutavake Andrew			0	✓			1	1	Guttering in front OK, Back of hse not whole length of hse with spouting. 2xPE tanks in use, 3000l & smaller
111	Bob Sonny	0		0	✓			2	2	Gutting system Ok, existing square tank leaking, installed on 1 side only
112	One Brother Joseph	4	6	10	✓			1	1	Guttering system Ok installed at 1 end only. 1x5000l PE tank in use
113	Pohatu Paulo	0		0	✓			2	2	Fascia ok, needs guttering & down pipe. No tank on site. Conc. Base 400mm ht
114	Tane Tautu (derelict)	0		0		✓		2	2	Existing roof unsound, needs to be renovated
115	Reisura Samatua			0	✓					Guttering system installed on 1 side only, in good condition. 2x6k or5kltr tanks in use
116	William Ford			0	✓			1	1	Guttering system installed to 1 side only in good condition
117	Teva Meremere			0	✓			1	1	Guttering installed to 1 side only, Ok. 1x5Kltr tank in use
118	Aru William			0	✓			1	1	Guttering installed to 1 side only, Ok. 1x5Kltr tank in use or smaller
119	Ru Taime			0	✓			1	1	Guttering system & hse condition good. 1x6K ltr PE tank in use
120	Pa Taime			0	✓			1	1	Fascia boards ok, no guttering fitted to hse, existing PE tank 6 or 5K ltr needs proper base
121	Torama Pearl Ltd	0		0	✓					Guttering system Ok
122	Toru Samuel			0	✓					Guttering system Ok
123	Tongareva Sunrise			0	✓			1	1	Guttering system Ok
124	Warwrick Lathem	2		2	✓					Guttering system Ok, needs support for down pipes

125	Roland Long	0		0	✓					Guttering system Ok
126	Roland Long	0		0	✓			1	1	Guttering system Ok, no tank
	TOTALS	**36**	**25**	**61**			**24**	**137**	**161**	
							4	**28**	**32**	
		36	**25**	**61**			**28**	**165**	**193**	**OMOKA VILLAGE**

TETAUTUA VILLAGE Penrhyn		**Occupants**			**Roof Con**		**Tanks Rqd**		**Tap**	
No.	**Name**	**Adults**	**Child**	**Total**	**Pass**	**Fail**	**6000L**	**3000L**	**Fitting**	**Comments**
1	Koiatu Raki	2		2	✓			2	2	Fascia Ok, Hse not fitted with guttering system. No tanks on site
2	Tome Nikau	2	2	4	✓			2	2	Fascia board needs replacing, existing guttering system installed halfway only. Existing tank round no lid
3	Hospital			0	✓					Guttering system in good condition.
4	Rongo Taia	2	2	4	✓		1		1	Fascia board, guttering system in good condition
5	Tinikata Joseph	2	1	3	✓			2	2	Roof condition good. Needs fascia, guttering system for front of hse as this hse is feeding 2 community tanks. Back- facia, guttering system ok.
6	Kaitangi Mamia	0		0	✓		1		1	Fascia board ok, needs guttering system
7	Tekotia Joe	2	3	5	✓			2	2	Fascia boards ok, needs new guttering system. Existing guttering (tin) on 1 side only
8	Ben William	2	2	4						No Hse, will be rebuilding soon
9	Tini Ford	2		2	✓					New hse with no fascia boards & guttering systems installed. Existing 6000l tank on site
10	Silinga Solo			0	✓					Fascia ok Needs guttering system & down pipe. Existing 6000l tank on site
11	Silinga Solo			0	✓			1	1	Guttering system in good condition. Existing tank ok
12	Marama Tautu	2	2	4	✓			2	2	Fascia ok needs 2m to reach overhang, Needs new guttering system & down pipe
13	Pepe Tutavake (main hse)	0		0	✓			1	1	Needs fascia, spouting & down pipe replaced to back of hse
14	Pepe Tutavake (kitchen)			0	✓			1	1	Fascia ok on kitchen, guttering needs replacing. Existing tank ok
15	Napa Tutavake	4	4	8	✓					Fascia & guttering system on 1 side only & all in good condition
16	Tipani Taia			0	✓			1	1	Needs new fascia, guttering & down pipe. Existing 6000l tank on site
17	Saitu Marsters	2	3	5		✓		2	2	Needs new fascia, guttering & down pipe

18	Joe Marsters	2	3	5	√			2	2	Fascia Ok, Guttering not installed whole length & width of hse
19	Rite Tapaitau	2	2	4	√			1	1	Fascia board, guttering system in good condition, down pipe required
20	Taia Tau	2	3	5	√		1		1	Fascia, guttering system on 1 side only in good condition. Existing tank showing some leak
21	Tapita Tinirau	2	2	4	√			2	2	Needs new fascia, guttering & down pipe
22	Mamia Tapaitau	1		1		√		2	2	Needs new roofing with fascia, guttering & down pipe
23	Pange Poreva	2	2	4	√			1	1	Guttering system installed on back only & in good condition
24	Puremana Teika			0	√		1		1	Guttering system on this hse all in good condition
25	Solomona Tapu	2	3	5	√			2	2	Needs new fascia, guttering & down pipe
26	Banaba Tapu			0	√					All guttering system in good condition installed on both side of hse
27	Teumere Joseph	2	1	3	√					All guttering system in good condition installed on both side of hse
28	Tepe Tai	2	1	3	√			2	2	Last hse at end of village, needs new fascia, guttering system, no existing tanks on site
	TOTALS	**39**	**36**	**75**			**4**	**28**	**32**	**TETAUTUA VILLAGE**

ANNEX E: PUBLIC HEALTH – WATER SAFETY WORK PLAN

Water Safety Work plan – Public Health Department. (MoH) – February 2010.

Introduction:

Water is essential for Life, and a safe, adequate supply must be available to all. Contamination of drinking water is a significant concern to Public Health throughout the world and monitoring microbiological quality is of principle importance of the acute risk to health posed by bacteria, viruses in the drinking water. Drinking water must be clear, colourless and free from objectionable taste and odour. The presence of pathogen in drinking water is usually due to animal and human waste entering the water sources.

Public Health's main function is to prevent and protect the health and wellbeing of the people and minimize harm from water-borne diseases. Public Health also promotes and ensures that "Water is Safe for people to drink", through ongoing and continuous risk assessments, surveillance and monitoring, and continuous community awareness program.

Objective:

The objective of a water safety plan is to ensure safe drinking water through good water supply practice, that is:

• To prevent contamination of the source;

• To advise the community on water safety issues;

• To prevent re-contamination during storage, distribution and handling of drinking water.

Goal: Water is clean, safe and fit for human consumption.

Objective 1.1: Prevent and minimize water-borne illnesses. (Gastroenteritis illnesses etc)

ACTIVITY	1ST QUARTER				2ND QUARTER				3RD QUARTER				4TH QUARTER			
	January - March				April - June				July - September				October - December			
	Wk1	Wk 2	Wk 3	Wk 4	Wk 1	Wk 2	Wk 3	Wk 4	Wk 1	Wk 2	Wk 3	Wk 4	Wk 1	Wk 2	Wk 3	Wk 4
Risk assessment																
Surveillance and monitoring																
School awareness																
Community awareness																
Sampling (when requested)																

A list of activities have been provided below by health officials in the implementing their workplan.

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Public Health Officials Involved in this consultation: Tata Vaeau, Tae Tutai, Jacqui Evans and Apii Nimerota

Activities

Rainwater/Groundwater (Wells)

Risk Assesment:

- Inspection and assess outside surrounding of water tank
- Check for foreign matters in the water tank. (e.g. mosquito larvae and other objects)
- Check for leakages
- Check for dents or concaves on tank for any signs of mosquito breeding.
- Ensure that groundwater sources (wells) are well away from septic tanks and other human activities including animal and agricultural farming.
- Elevate and slope the area around the well to drain surface runoff
- Install a well cap or sanitary seal to prevent unauthorized use, or entry into, the well.
- Keep accurate record of any maintenance of the well.

Surveillance and Monitoring:

- Continuous inspection as identified above in risk assessment.
- Check for algae growth in the tank.
- Periodically inspect exposed parts of the wells for problems such as: cracked, corroded or damaged well casing; broken or missing well cap and settling or cracking of surface seals.

Awareness Program

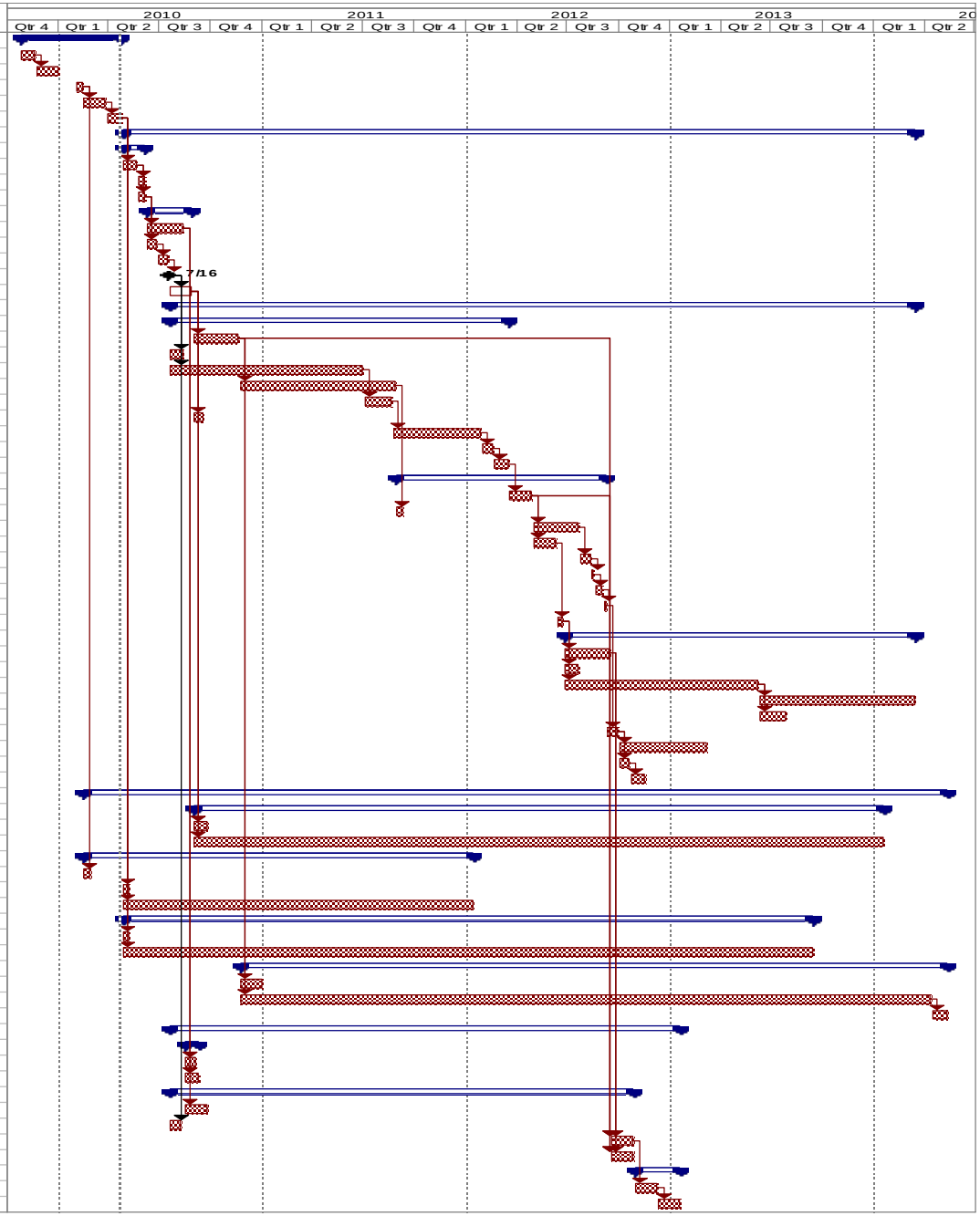
- Public Health Inspectors will conduct water safety awareness program in the school and community according to the workplan (refer to item #3 & #4 for the period).

Water Sampling

- Have a random testing of 10 or 20 water tanks once a year for bacteriological testing.
- Have the wells tested once a year for coliform bacteria, nitrates and other constituents of concern.
- When requested or if necessary (1. Any individual or home owner that will request his water tanks or well to be tested. 2. In case of food and water borne illness or outbreak on the island)

ANNEX F: IMPLEMENTATION SCHEDULE

ID	Task Name
1	**Preparation of PDD for Puk, Nass & Pen**
2	Facilitate discussions with NZAID, CIGOV & PMC
3	Consultation with key stakeholders
4	Evaluated design Considerations & Recommendations
5	Submit final PDD to PMC for Approval
6	Engage & mobilise Project Team
7	**Component 1 - Water Supply Infrastructure Upgrade**
8	**1.1 Prepare preliminarysurvey of upgrading Works**
9	Review existing survey information
10	Confirm and approve Survey information
11	Confirm Groundwater sources for upgrade
12	**1.2 Prepare details design & documentation**
13	Prepare final design report
14	Prepare cost estimates
15	Prepare Implementation Plan
16	Approval of Design Report and Implementation Plan
17	Tender and Engage Contractor for Implementation
18	**1.3 Procurement and Implementation of Upgrading Works**
19	**Pukapuka Water Project**
20	Mobilise Contractor to procure project materials
21	Procure materials for the Groundwater upgrade works
22	Provide supervision for Water Project
23	Implement House Catchment Upgrade- 212 houses
24	**Community Catchment Improvements**
25	Mobilise, Set up Specialist Team for Groundwater Improvements
26	**Groundwater Intallation Program**
27	Water Monitoring
28	Demobilise Project
29	**Nassau Water Project**
30	Mobilise Contractor to procure project materials
31	Procure materials for the Groundwater upgrade works
32	Provide supervision for Water Project
33	Implement House Catchment Upgrade- 10 houses and 5 Community Facilities
34	**Community Catchment Improvements**
35	Mobilise, Set up Specialist Team for Groundwater Improvements
36	**Groundwater Installation Program**
37	Water Monitoring
38	Demobilise Project
39	**Penrhyn Water Project**
40	Mobilise Contractor to procure project materials
41	Procure materials for the Groundwater upgrade works
42	Provide supervision for Water Project
43	Implement House Catchment Upgrade - 193 houses
44	**Community Catchment Improvements**
45	Mobilise, Set up Specialist Team for Groundwater Improvements
46	**Groundwater Intallation Program**
47	Water Monitoring
48	Demobilise Project
49	**Component 2 - Project Management Supervision & Monitoring**
50	**2.1 Project Management and Administration**
51	Establish site offices and project personnel on selected Islands
52	Establish communincation lines with MOIP IA, PMC,
53	**2.2 Establish and maintain in country Project Support Team**
54	Determine requirements for in-country support
55	Establish Project Support Team
56	Engage Project Support Team in project activities
57	**2.3 Provide effective stakeholder communications**
58	Prepare a Communications Plan
59	Provide regular communication and liaison with IA and PMC
60	**2.4 Monitor and report on project progress**
61	Conduct regular review of project activities
62	Monitor financial and technical progress of the projects
63	Prepare quarterly progress reports, plans and final report
64	**Component 3 - Awareness, Education and Training of Public Health use**
65	**3.1 Implement awareness education & training programs**
66	Review awareness and training activities,
67	Prepare and develop awareness and training activities,
68	**3.2 Provide in-country specialist for awareness, education & training**
69	Engage specilaist for awareness and training activities
70	Develop awareness and training programs,
71	Implement awareness and training programs,
72	Implement community consultation and education programs
73	**3.3 Report on Progress of Awareness and Training programs**
74	Monitor progress of awareness and training programs
75	Prepare final review and report of awareness and training programs



ANNEX G: COST SCHEDULE

Note: ** Detailed costs are derived from (Falkland 2005 and Falkland 2006) under Preliminary cost schedule section 12 of those Reports.

PUKAPUKA ISLAND					
Total No. House Surveyed	141				
Population Impacted	791				
PHASE 1		**Unit**	**Quantity**	**Cost**	**Total**
1. Capital Cost					
Housing Catchment					
PE Tanks	6000Ltr	no.	68	$ 1,870	$127,160
	3000Ltr	no.	144	$ 1,275	$183,600
Spouting		mtr	2407		
	5m Length	no.	454	$ 78	$35,412
	3m Length	no.	74	$ 47	$3,478
External Brackets	3 per mtr	no.	7220	$ 5	$36,100
LH Stopend	Approx 2per Hse	no.	282	$ 5	$1,269
RH Stopend	Approx 2per Hse	no.	282	$ 5	$1,269
Spouting Joiner	Approx 4per Hse	no.	564	$ 4	$1,974
External Corner	Approx 4per Hse	no.	564	$ 15	$8,460
Dropper Outlet	Approx 2per Hse	no.	282	$ 20	$5,640
Down Pipes 80mm	3m Length (approx 6 p	no.	846	$ 35	$29,610
Down Pipe Brackets	3 per mtr	no.	2538	$ 3	$6,345
Hose Tap 15mm Male	1 per tank	no.	212	$ 13	$2,756
Quest Female Adaptor	1 per tank	no.	212	$ 5	$954
Fascia Boards	6x1	lengths	1615	$ 14	$22,610
Screws 25mm	Approx 2 per Bracket (	no.	98	$ 10	$980
Nails 3'	25kg Backets	no.	2	$ 160	$320
Sundaries					$6,000
				Sub Total	**$ 473,937**
Community Tank Improvements	**Provisional Sum**				**$ 30,000**
2. Freight - Phase 1		LS			**$ 71,091**
3. Contractor builders/plumbers/etc		LS			**$ 94,787**
Contingencies (10%)		LS			**$ 9,479**
4. MOIP Working Capital		LS			**$ 47,394**
PHASE 2					
5. Groundwater Installation		LS			$688,600
6. Water Monitoring		LS			$12,520
7. Water Sanitation & Hygiene Program		LS			$12,520
8. Consultant Input		LS			$62,600
9. MOIP Working Capital		LS			$23,000
10. Freight Phase 2		LS			$50,000
				Sub Total	**$849,240**
Continugency (10%)					**$ 157,594**
GRAND TOTAL ESTIMATE $NZ					**$1,733,521**

NASSAU ISLAND					
Total No. House Surveyed	45	Ratio	0.32		
Population Impacted	138		0.17		
PHASE 1		**Unit**	**Quantity**	**Cost**	**Total**
1. Capital Cost					
Community Tank Improvements	Provisional Sum	LS			**$25,532**
House Catchment					
PE Tanks	6000Ltr	no.	10	$ 1,870	$18,700
	3000Ltr (X2)	no.	3	$ 1,275	$3,825
Both Community/Residential					
Spouting		mtr	768		
	5m Length	no.	145	$ 78	$11,296
	3m Length	no.	24	$ 47	$1,109
External Brackets	3 per mtr	no.	2303	$ 5	$11,516
LH Stopend	Approx 2per Hse	no.	90	$ 5	$405
RH Stopend	Approx 2per Hse	no.	90	$ 5	$405
Spouting Joiner	Approx 4per Hse	no.	180	$ 4	$630
External Corner	Approx 4per Hse	no.	180	$ 15	$2,699
Dropper Outlet	Approx 2per Hse	no.	90	$ 20	$1,799
Down Pipes 80mm	3m Length (approx 6 p	no.	270	$ 35	$9,446
Down Pipe Brackets	3 per mtr	no.	810	$ 3	$2,024
Hose Tap 15mm Male	1 per tank	no.	68	$ 13	$879
Quest Female Adaptor	1 per tank	no.	68	$ 5	$304
Fascia Boards	6x1	lengths	515	$ 14	$7,213
Screws 25mm	Approx 2 per Bracket (	no.	31	$ 10	$313
Nails 3'	25kg Backets	no.	1	$ 160	$102
Sundaries					$2,000
				Sub Total	**$ 74,664**
2. Sea freight		LS			**$ 15,000**
3. Contractor builders/plumbers/etc (20%)		LS			**$ 14,933**
Contingencies (10%)		LS			1,493
4. Island Admin working capital (10%)		LS			**$ 15,000**
PHASE 2**					
5. Groundwater Installation		LS			$40,000
6. Water Monitoring		LS			$2,520
7. Water Sanitation & Hygiene Program		LS			$2,520
8. Consultant Input		LS			$6,600
9. MOIP Working Capital		LS			$13,000
10. Freight Phase 2		LS			$10,000
				Sub Total	**$ 74,640**
Continugency (10%)					**$ 22,125**
GRAND TOTAL ESTIMATE $NZ					**$ 243,388**

PENRYN ISLAND					
Total No. House Surveyed	154				
Population Impacted	166				
		Unit	**Quantity**	**Cost**	**Total**
PHASE 1					
Housing Catchment					
PE Tanks	6000 Ltr	no.	28	$ 1,870	$52,360
	3000 Ltr	no.	165	$ 1,275	$210,375
Spouting			2108		
	5m lengths	no.	317	$ 78	$24,726
	3m lengths	no.	172	$ 47	$8,084
External Brackets	3 per mtr	no.	6324	$ 5	$31,620
LH Stopend	Approx 2 per Hse	no.	308	$ 5	$1,386
RH Stopend	Approx 2 per Hse	no.	308	$ 5	$1,386
Spouting Joiner	Approx 4per Hse	no.	616	$ 4	$2,156
External Corner	Approx 4per Hse	no.	616	$ 15	$9,240
Dropper Outlet	Approx 2per Hse	no.	308	$ 20	$6,160
Down Pipes 80mm	3m lengths	no.	372	$ 35	$13,008
Down Pipe Brackets	3 per mtr	no.	3345	$ 3	$8,363
Hose Tap 15mm Male	1 per tank	no.	193	$ 13	$2,509
Quest Female Adaptor	1 per tank	no.	193	$ 5	$869
Fascia Boards	6x1	lengths	1468	$ 14	$20,552
Screws 25mm	Approx 2 per Bracket (200per Ja	no.	97	$ 10	$970
Nails 3"	25kg Backets	no.	2	$ 160	$320
Sundaries					$6,000
				Sub Total	**$ 400,083**
Community Tank Improvements*	**Provisional Sum**				**$ 80,000**
2. Freight - Phase 1		LS			**$ 60,013**
3. Contractor builders/plumbers/etc		LS			**$ 80,017**
Contingencies (10%)		LS			**$ 8,002**
4. MOIP Working Capital		LS			**$ 50,000**
PHASE 2**					
5. Groundwater Installation		LS			$687,380
6. Water Monitoring		LS			10,000
7. Water Sanitation & Hygiene Program		LS			10,000
8. Consultant Input		LS			$65,730
9. MOIP Working Capital		LS			$23,000
10. Freight Phase 2		LS			$20,000
				Sub Total	**$ 816,110**
Continugency (10%)					$149,423
GRAND TOTAL ESTIMATE $NZ					**$ 1,643,647**

ANNEX H: RISK MANAGEMENT PLAN

RISK MANAGEMENT PLAN

RISK	PROBABILITY	IMPACT	MANAGER	MITIGATION APPROACH
Poor coordination of project by number of stakeholders	High	Project activities detract from, rather than support, achievement of the goals Creates tension/jealousy within and between communities	PMC PM	The Project Management Committee (PMC) the MOIP PM and IA to regularly liaise with stakeholders to identify opportunities for cooperation and to avoid duplication. PMC to keep stakeholders informed of donor plans. PMC and Donor to regularly liaise and share information on donor/agency plans.
Project activities overload the local absorptive capacity of communities	Medium	Project support leads to chronic inefficiencies, and exhausting existing resources	PMC IA	Assessments of activity proposals to include evaluation of absorptive local capacity. Project activities to include capacity building and recruitment of specialist personnel not on the Island.
Quality of installation and construction work is poor	Medium	Danger of destruction in the event of another cyclone Political fallout Media criticism	IA PM Contractors	Emphasis on site supervision by PM and works supervisor. Additional monitoring of QA systems and construction quality by PM as required. Training of supervisors and community groups by Contractors.
Public Health Risks from poor Water Use Practices	High	Unsustainable use of water resources. Prone to contamination and transmittal of water borne deceases.	MoH IA	Training workshops by Health Officials on safe use and practices in water use and storage. Sanitation and water hygiene training and awareness programs.
Contamination of Groundwater from unhygienic	High	Unsustainable use of water resources. Prone to contamination and	MoH IA	Training workshops by Health Officials on safe use and practices in water use and storage. Sanitation and water hygiene training and

RISK	PROBABILITY	IMPACT	MANAGER	MITIGATION APPROACH
and sanitation practices.		transmittal of water borne deceases.		awareness programs.
Cost overruns	High	Fewer activities are funded	PM PMC	Ensure participation of key stakeholders in activity planning and proposal assessments so they have a realistic picture of costs. Keep the PMC and Donor, informed of activity costs against budget on a regular basis. (Quarterly reports).
Quality of supervision is poor	Medium	Unskilled labour forces and lack of supervision. Political fallout/ community dissatisfaction Media criticism	PM PMC IA	Provide additional training for construction supervisors of local personal hired on the project. Additional monitoring of QA systems and construction quality by PM and works supervisor as required.
Theft of project materials	Medium	Delays in the implementation works program.	PM IA	PM, Works Supervisor and IA to address security issue as a part of the activity planning process.
Availability of skilled labour	Medium	Delays in completion of the implementation works program. Possible cost overruns	PM PMC	Early identification and contracting of skilled labour. Identify skilled labour from within the communities.
Poor linkages between IA activities and plans for the implementation works program.	Medium	Failure to achieve objective of the implementation plan, failure of receiving support from Island council for the project.	PM PMC IA	Regular monitoring to ensure a match between Island Council activities and plans. Regular attendance at Island Council meetings.
Lack of stakeholder	Medium	Inappropriate works Confusion of priorities	PM IA	Use of Island Facilitators. Use existing Island Council structure. Use of culturally appropriate

RISK	PROBABILITY	IMPACT	MANAGER	MITIGATION APPROACH
engagement		Delays in works		methods of organizing support from stakeholders. Encouragement through employment of paid work.
Failure of PMC	Low	Project direction is not focused; Project does not meet its goal.	Donor PMC	Regular reporting by PMC to the Donor. External monitoring by the PMC by Donor. Interim replacement of PMC by Gov.
Failure of PM	Low	Project does not meet its goal.	Donor PMC MOIP	Regular reporting by PM to the PMC and Donor. Monitoring of reports by PM to the PMC. External monitoring by PMC or Donor, if required. Interim replacement of PM by the PMC. Recruitment of a replacement PM.
Local agencies are ambivalent about working with Project	Low	Poor participation in, or support for, Project activities, leading to a loss of support from local communities	PMC IA	Each member of Project Teams allocated task of building good working relations at all levels. Workshops to introduce Project and its processes.
Projects maintain a male focus and wrongly assume 'traditional', domestic roles for women	High	Reaffirms women's domestic roles where they in fact have not existed	PM IA PMC	Shortfalls of community awareness and knowledge of women's roles by the by project remedied through in-house training Always insure a gendered perspective; women's, children's and marginal peoples' participation from planning stages;
Lack of inclusion of women's input into project design, planning and implementation	High	Increase in Gender-Based Violence; inappropriate designs;	PM IA PMC	Always consult the full range of community members; assure women's voices, needs, safety, efficiency as their perspectives may vary widely from males.
Inappropriate /	Medium	Resistance or	PM	Always ensure cultural sensitivity through

RISK	PROBABILITY	IMPACT	MANAGER	MITIGATION APPROACH
un- culturally sensitive approach in setting and implementing Projects.		reluctance from community to participate in the Project	IA PMC	community workshops/input activities/ community-based monitoring when developing strategy and implementing Project / activities
Communities (don't agree with Project strategy / approach.	Low	Low participation from communities	PM IA PMC	PM and PMC update information, review strategy and approach in a transparent manner. Responsiveness to accept recommendations for amended strategy or approach
Lack of accountability, transparency and involvement of community for monitoring and evaluation.	Medium	Corruption by community leaders or individuals	PM IA PMC	Ensure that information about the Project is understood by various parts of communities. Ensure communities take ownership of activities such that they will monitor the outcomes. PM monitors risk and report incidents. Create a 'suggestion box' which any member of the community provide input anonymously.
Contamination of groundwater from seawater intrusion (from pumping too much)	Medium	Over-pumping of groundwater resources. Pump burn-out	IA	IA to monitor the use of groundwater resources and only resort to these resources as backup. Regular routine maintenance checks to be carried out to ensure pump still functioning properly.

ANNEX I: TREATMENT OPTIONS FOR CONTAMINATED WATER

Treatment Options[14]

1. Rainwater

Although rainwater flowing into a tank may seem to be a pure source of drinking water, it may contain chemicals and organisms that could pose a risk to health.

Contamination may occur from microorganisms that could cause gastroenteritis and other diseases. Therefore it is essential that tanks are disinfected and roof guttering monitored and cleaned regularly. Similarly, dust and chemicals deposited on the roof may also contaminate rainwater.

In addition to protecting water at its source, there are two basic methods that can be used for water treatment in the northern Islands: storage and boiling. These methods can be used singly or in combination.

a. Storage

Leaving water undisturbed in containers, tanks, or reservoirs improves its quality over time. Storage allows pathogens to die off and suspended particles to settle through sedimentation. If water supplies are unsafe and cannot be easily treated, immediate action must be taken to provide maximum water storage capacity. Storage of untreated surface water for 12 to 24 hours will considerably improve its quality; the longer the period of storage and the higher the temperature, the greater the improvement. A two-tank system is often used, with the first tank used as a settling tank and the second used to store the clarified water.

Great care should be taken to prevent the pollution of stored water. This task can be done by covering storage tanks and screening all inlets into them. In addition, the area where storage tanks are located should be fenced off and guarded to prevent children from playing or swimming in the tanks.

b. Boiling

Boiling is the surest and perhaps simplest method of water sterilization. Bringing water to a boil will essentially destroy most pathogens transmitted by drinking water. To improve taste, allow the water to cool, and then pour the water from one clean container to another several times.

Prolonged vigorous boiling is often recommended but not necessary to destroy faecal-oral transmitted pathogens. Prolonged boiling is not only unnecessary, but it also wastes fuel. The availability of domestic fuel supplies may be the determining factor, as boiling requires about 1 kg of wood per litre of water.

[14] 2005; Field Operations Guide: -For Disaster Assessment and Response U.S. Agency for International Development Bureau for Democracy, Conflict, and Humanitarian Assistance Office of U.S. Foreign Disaster Assistance Version 4.0

2. Groundwater Protection and Treatment Options[15]

Sanitation systems with on-site disposal to unconfined aquifers which are used as drinking water supplies are notorious for their impacts on public health, primarily through pollution by pathogens. These problems are particularly severe on low lying tropical islands, where water tables are shallow, soils and aquifers are highly permeable, well depths are limited by underlying saline groundwater, and options for locations of water supply infiltration galleries and septic systems may be constrained.

The report found that septic systems are preferable to latrines for groundwater quality protection, especially where water tables are shallow.

The thickness of the unsaturated zone through which septage leaches was found to be the most significant determinant of groundwater contamination. Groundwater contamination by pathogens has been recorded more than 1 km from sanitation systems. Generally guidelines of 30 metres separation between domestic septic tanks and water supply Infiltration Galleries have been applied and found to give inadequate protection from pathogens, especially in permeable aquifers. A fifty day residence time in the subsurface is needed to provide effective pathogen removal for drinking water. Nitrate concentrations may be a concern, and can dictate the threshold population density beyond which common effluent schemes are needed.

Investigation and monitoring methods and their effectiveness in meeting various monitoring objectives were evaluated. It was found that wastewater residues such as nitrate and sodium can be effective determinants of the extent of groundwater contamination by sanitation systems. Degradable organics, and organic dyes are poor tracers of pollution by sewage, but bromide has been used effectively to measure travel times. Monitoring programs based on pathogens and surrogate variables are the best indicators of the current and potential incidence of water supply well contamination.

A series of control measures spanning from sanitation planning; well-head protection; design, maintenance and monitoring of on-site sanitation; treatment of sewage and water supplies, and public education were discussed. These provide a range of measures which can be adapted by local communities to meet their needs for safe water supplies, and assurance of this, within reasonable costs.

[15] Direct Reference: Peter Dillon (1997) Groundwater pollution by sanitation on tropical Islands CSIRO Division of Water Resources Adelaide, Australia IHP-V Project 6-1 UNESCO, Paris.