



Tonga

Water Supply System Description

Nuku'alofa/ Lomaiviti



Davendra Nath -Project Officer, Water Safety Plans Programme, (SOPAC), Fiji
Mitesh Mudaliar _Project Assistant –Water Safety Plans Programme (WHO), Fiji
Saimone Helu – Chairman, Tonga Water Board, Tonga

Water Safety Plan Programme
Kingdom Of Tonga
A Project Funded by AusAID

Table of Contents		Page
1	Introduction.....	3
	1.1 Background.....	4
	1.2 Climate and Geology.....	5
	1.3 Ground Water Resource.....	6
2	Water Supply System Description.....	9
	2.1 Nuku'alofa Urban Supply.....	9
	2.1.1 Catchment and Intake.....	9
	2.1.2 Storage and Treatment.....	10
	2.1.3 Distribution.....	10
	2.2 Lomaiviti Village Rural Supply.....	11
	2.2.1 Catchment and Intake.....	12
	2.2.2 Storage and Treatment.....	12
	2.2.3 Distribution.....	13
3	Water Resources Monitoring.....	14
4	Water Quality Monitoring.....	14
	4.1 Status of Tonga Water Board Laboratory.....	16
5.	Water Safety Planning.....	18
6.	Water Supply Improvement Needs.....	22
7.	Conclusion.....	24
8.	References.....	24

1. INTRODUCTION

The importance of safe drinking water for health and development in the Pacific Island Countries (PICs) has been reflected in many regional action plans and policies. Through the Regional Action Plan on Sustainable Water Management (Sigatoka, Fiji, 2002) Pacific Island Countries outlined actions that were needed to achieve sustainable water management through collaborative efforts by water sector authorities and inter-sectoral partners.

The WHO workshop on Drinking Water Quality Standards and Monitoring in Pacific Island Countries (Nadi, Fiji, 2005) developed a Framework for Action on Drinking Water Quality and Health in Pacific Island Countries, designed to support the implementation of drinking water quality actions envisioned in the Regional Action Plan.

The Pacific Island Countries embraced the Water Safety Plan concept during the workshop and this was reflected in the Regional Framework. It was recommended that PICs should use Water Safety Plans to better manage their water supplies to ensure safe quality drinking water for Pacific communities.

The Government of Tonga, through various government and non-government agencies including Tonga Water Board, Ministry of Health, Ministry of Lands and Survey, NGOs and Community Groups, are committed to establish Water Safety Plans for urban, rural and outer-island water supplies.

A Steering Committee for the Tonga Water Safety Plan Programme has been established and consists of relevant agencies, both government and non-government. The Tonga Water Board is the secretariat for the Steering Committee as well as the lead implementing agency. (Refer to Figure: 1 below)

Other agencies such as the Ministry of Health, Ministry of Lands, Survey and Natural Resources, Department of Environment, National Planning Office, Tonga Association of Non Governmental Organization, Tonga Community Development Trust, Ministry of Finance and Ministry of Fisheries and Forestry have committed to support the programme.

Since there are a number of agencies involved in water supply in different roles it is vital to include them in the functional structure. The use of authority in their specific areas and organizational networking is also important for the water safety programme at country level. It was noted that Tonga Water Board is the water supplier and owned the infrastructure whereas the role of Ministry of Health is seen as the regulator. The Department of Environment is monitoring the natural resource and educating the public on sustainable development. The other Non-governmental Organizations such as Tonga Trust is working very closely with the community in raising the public awareness in aspects of health and environment.

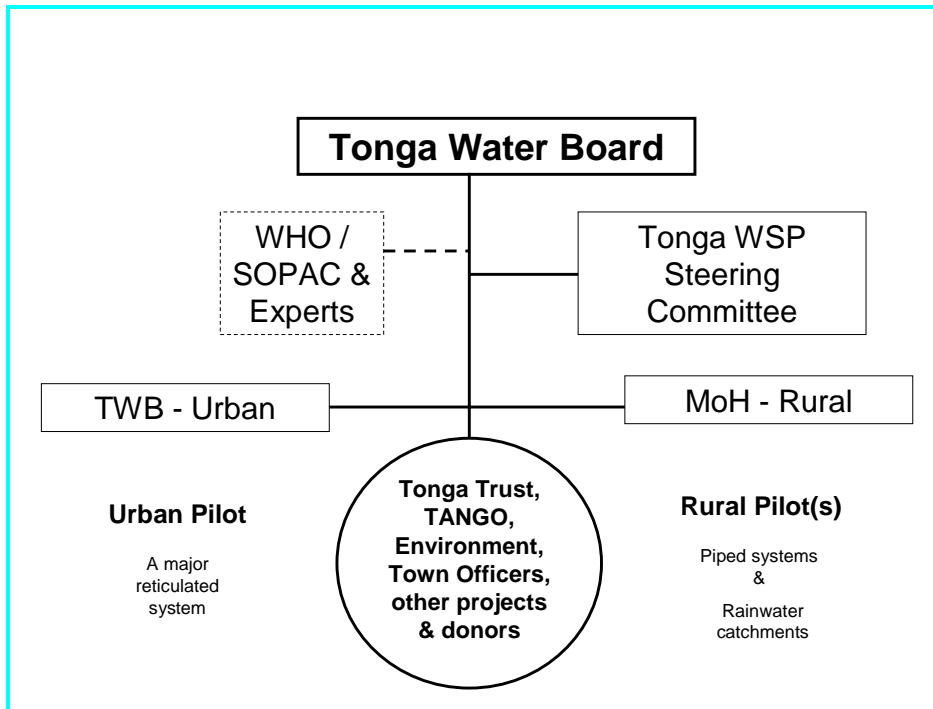
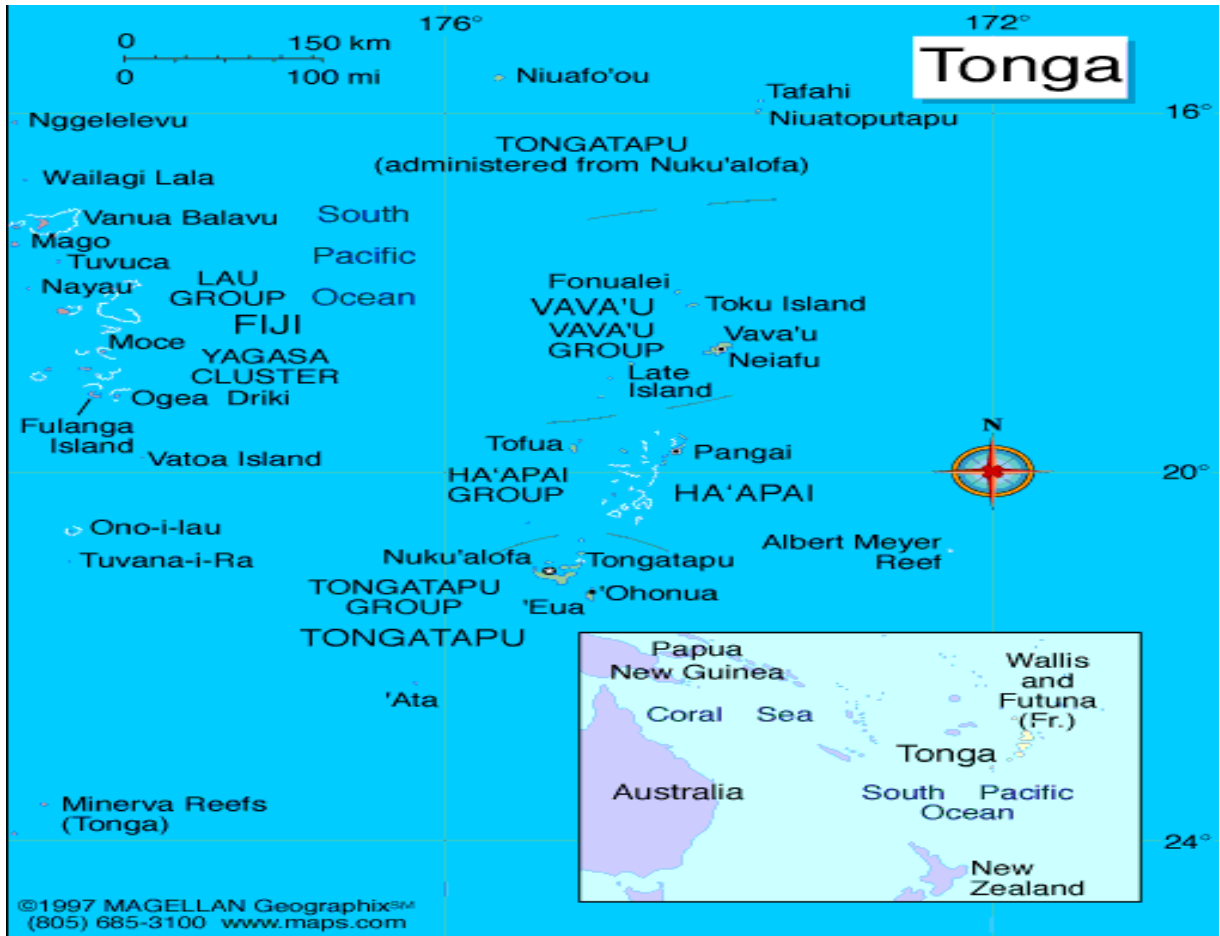


Figure: 1- Functional Structure Water Safety Plans (WSP Mission Reports-SOPAC)

1.1 Background:

The Kingdom of Tonga is a Polynesian country located in the South west Pacific between Fiji Western Samoa and New Zealand. It is a Monarchical state with defined borders of longitudes 117degree West and latitude 15-30 degree south. The kingdom is comprised of 176 islands of which 35 are inhabited. These islands fall into the four major island groups namely Tongatapu, Haapai, Vavau and the Niuas. (Refer to Map 1)

In 1996 Tonga had an estimated population of 100,000 dispersed throughout the six island groups. Of the total population 98 % had access to water supply in urban areas and only 63% had access in rural areas. As noted in the WHO Guidelines for Drinking Water Quality Volume 3, access to water supply is of paramount importance. The capital and seat of government is Nuku'alofa where most of the population of about 50,000 resides. Access to water can be defined by factors such as the population served, the reliability of the supply, and the cost of the water to the consumer.



Map: 1- Main Islands of Tonga

1.2 Climate and Geology:

The climate is semi-tropical with moderate rainfall and high humidity during the wet seasons which extends from December to April. The mean temperature is 13.5 degree C and the mean humidity is 76.9. The mean annual rainfall is 1801 mm. in Nuku'alofa.

The Tonga ridge is a young volcanic island arc uplifted between the Tonga trench to the east and the Lau basin in the west. The ridge originated in the Tongatapu and is formed of mildly metamorphosed basic- intermediate lavanas, gabbros and tuffs. It is overlain by thick Eocene limestone, Miocene carbonates, slope breccias, volcanoclastics, and Pliocene to Holocene coralline limestone.

All the islands on the eastern side of the ridge are limestone covered. On the Tongatapu, oil drill holes penetrated through 137 m of reef limestone and alternating coarse and fine detritus sediments rich in volcanic lithoclastics to a total depth of 1685 m.

It is considered that a wide area of the Tonga platform is covered by thick sediments ranging from Lower Miocene to Lower Pliocene age and that these are at least 1500 m thick beneath Tongatapu. The area was probably dotted with intermittently active volcanoes, between which sediments are deposited in shallow to deep water environments. The sediments are mainly coarse to fine grained volcanoclastics, but reef, biostatic, and foraminifer's limestone are also present.



Photo: 1 Showing rocky coastal area of limestone in Tongatapu (Davendra Nath-SOPAC)

1.3 Ground Water Resource:

There are no large surface water supplies in Tonga and the source of domestic, agricultural and industrial water is either roof catchment or hand dug or drilled wells tapping a lens of fresh water floating on denser sea water.

Little is known about ground water on the volcanic island, but more than 50 dug or drilled wells from a few meters to 62.5 m deep are recorded in coral limestone in Tongatapu. The logs are all broadly similar and record hard and soft coral limestone beneath weathered superficial clay. The softer limestone, open textured and composed mainly of comminuted coral fragments, transmits water rapidly. It is estimated that between 25 to 30 % of the average rainfall penetrates to the water table, and that permeability may reach 1300 inches/day.

At the Mataki- Eua water reserve the surface of the fresh water lens is from 50 to 75 cm above sea level. The lens does not occur at the coasts and reaches a total thickness of about 20 m in the interior. Transmissivity is calculated at 1200 sq m/day. Draught from the fresh water lens on Tongatapu amounts to about 300m³ /day (1978)

The main drinking water source in urban areas of Tonga is groundwater and for rural areas rainwater, with some utilization of surface river water. Due to the hardness of the ground water Tongans supplement their drinking water supply with rainwater catchment system and purchase filtered ground water.



Photo: 2 Borehole overhead mechanical pumps (Davendra Nath-SOPAC)

On the majority of the islands, the ground water resource is located in the shallow and highly porous limestone aquifers. Conjunctive use of ground water and rainwater resources is a preoccupation throughout the islands due to the omnipresence of saline intrusion into groundwater resources. For instance in the main island of Tongatapu, groundwater was noted to be as little as 0.6 meters above sea level. Consequently, the town of Nuku'alofa water supply is supplied by ground water from 31 boreholes in a borehole field to the south west of the town.

The rain water catchment system is predominantly based on corrugated iron roof which collect water in Ferro- cement tanks. The majority of tanks is equipped with an inspection hatch and soaks away facility; however none were noted as having the first flush systems. The rainwater tanks provide the annual principal source of drinking water. However 10% of Tonga's population was recorded as living in thatched roof dwellings during the 1996 census. In these households rainwater catchment is not possible due to the low roof and the material used.

Responsibility for water supply, distribution operation and maintenance in urban areas and of village committee in rural areas is that of the Tonga Water Board. Monitoring of water quality is carried out by the board in urban areas and by the Ministry of Health in rural areas, though both monitoring and surveillance activities are generally poor. The urban area under Tonga Water Board includes Nuku'alofa the capital of Tongatapu, where ground water is the normal supply, together with the sale of rain water which is rarely inspected or monitored for quality. Consumption of water is high and a programme of installing water meters in urban areas is underway to help reduce abuse and monitor the water demand.

Figure: 2 Urban Water Supply System- (Illustrations by Davendra Nath-SOPAC)

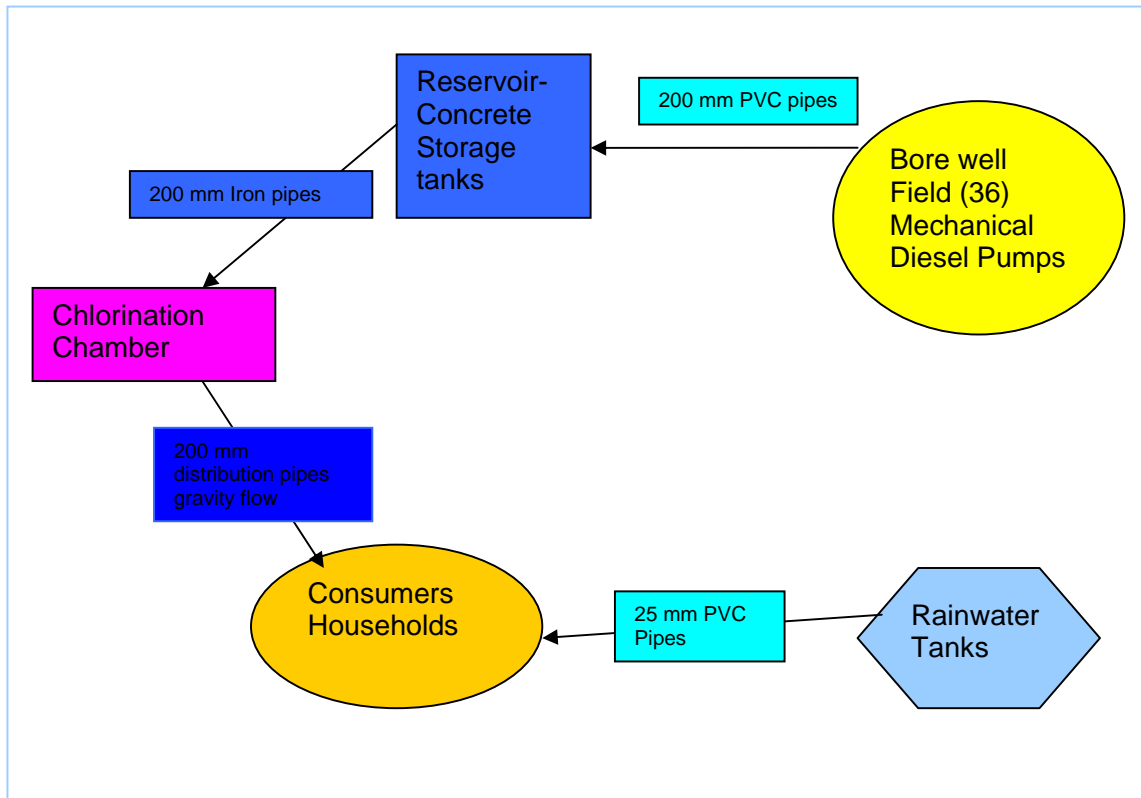
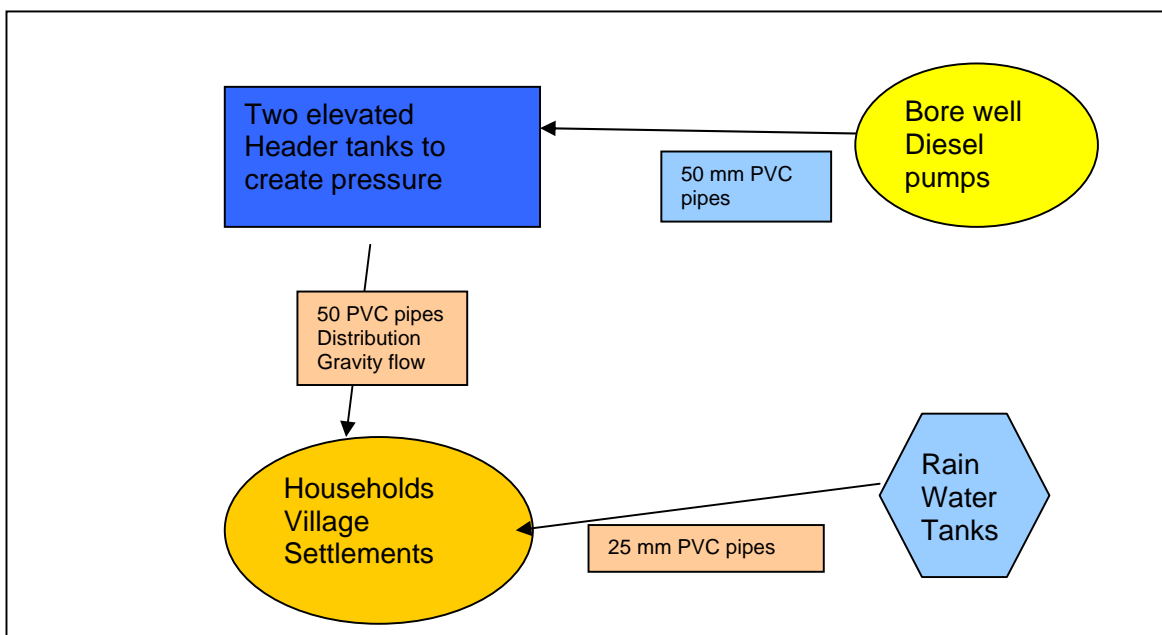
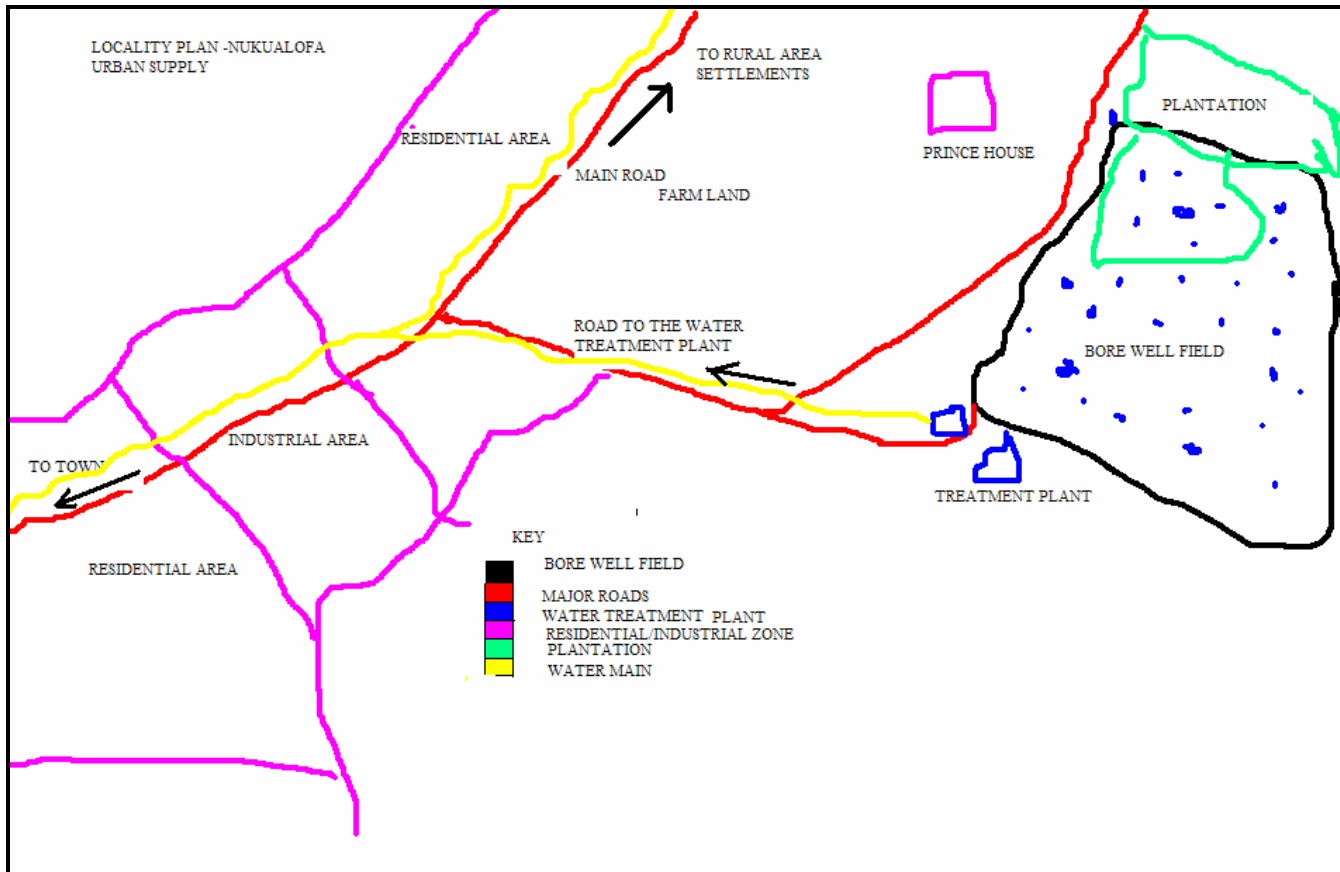


Figure: 3 Rural Water Supply Systems (Illustrations by Davendra Nath-SOPAC)



2. WATER SUPPLY SYSTEM DESCRIPTION

2.1 NUKUALOFA- Urban Supply. Mataki-Eua



Map: 2 Locality plan of Nuku'alofa Urban supply. (Davendra Nath-SOPAC)

2.1.1 Catchment and Intake

The intake for the Nuku'alofa supply is from the bore well field of under ground freshwater lens. There is a network of 36 hand-dug or tube driven well within 140 acres of flat land. The underground is of limestone with little soil cover. There are 33 diesel and 3 electrically operated pumps with covered well heads. The pumps are located on top of the well head and the diesel tanks were also located within meters. There were pump sheds at each well but were not secure enough to exclude animals and man. The diesel fuel tanks were filled every second day and there was visible oil spillage which also can enter the boreholes during heavy rains. There were cultivation within the well field and since there was no perimeter fencing it was difficult to exclude humans and animals as can be seen in photos 2 and 3.

The aquifer is liable to contamination from the surface activities such as farming, household waste water and sewage within the recharge zone. There are no control measures and in addition to that the porous nature of the ground offers little protection against contamination. The extent of the ground water lens is currently unknown. The diesel spills and leaks could seep into the wells through cracks in the casing and well heads as it appears to be old and worn out.



Photo: 3 Showing pump sheds in Nuku'alofa Bore well field.(Davendra Nath- SOPAC)

During the power failures the electrical pumps will stop but the diesel pumps will be functioning. The other long term option would be to install wind pumps or solar panels which will not require fuel or electricity. There is greater chance of vandalism and sabotage due to insufficient security as the wells are scattered in a large area.

2.1.2 Storage and Treatment

It was seen that the system had some storage and treatment of water prior to the distribution for consumption. This was insufficient and a lot of improvement is needed in this area.

Each of the 36 wells pumped water into one of the six concrete storage tanks located within a kilometre of the wells. Only treatment done is chlorination with dosing of Calcium Hypochlorite granules. Chlorine mixing is done at the chlorination chamber and injected in the main line at the reservoir prior to distribution. It was seen that the mechanical dosing machine usually malfunctions and manual chlorination is done especially in case of power failures. Secondly it is likely that there is insufficient chlorine on site and also the deterioration of the quality of the chlorine due to the lack of proper storage. When this happens then untreated water is distributed to the consumers. Also it was revealed that only few staff knew the manual chlorine formulation. Monitoring of residual chlorine was done on monthly bases and there were no set procedures. It was also noted that the pH level is too high for effective disinfection with chlorine. The pH level monitoring at intake and storage needs to be improved as well. There is no

treatment or barrier for protozoa, so it could be assumed that they are present in water. The picture below shows the chlorine being injected into the distribution mains at the treatment plant.



Photo 4 - Chlorine injecting chamber (above),
Photo 5 -Concrete reservoirs holding water pumped from the boreholes at Mataki Eua.
(Davendra Nath-SOPAC)

2.1.3 Distribution:

Distribution is by gravity feed through 200 mm diameter mains (PVC/Galvanised) to the city and its surroundings. The supply rate is about 6-7 ML per day. Every household is encouraged to connect to the reticulated system but many households have the options of supplementing the reticulated supply with rainwater catchment and have a rainwater tank as well. There is insufficient contact time with chlorine before the water reaches the first consumer as they are within 200 metres from the plant. It was informed that there are illegal connections and this may lead to cross contamination. As there is no relevant

laws, policies to restrict or control household rainwater systems there fore it is necessary to monitor the rain water system regularly. Low pressure in the system is common and so the consumers are deprived of water. To improve the system booster pumps are required for the distribution system. Leakages are common due to old pipes in the system and thus cross contamination is liable. The Tonga Water Board has mobilized a leak detection programme in order to curtail the problem. Free chlorine in the distribution system could not be determined precisely due to lack of proper monitoring procedures in place.

2.2 LOMAIVITI VILLAGE –RURAL SUPPLY

In rural areas, groundwater from dug wells and collected rainwater provide the normal water supply with some areas also utilizing the river water. Most household have their own rainwater collection system, although in some villages common collectors, water storage tanks, and piping systems are used. The construction, operation and maintenance, and collection of fees are the responsibility of the village water committee, with the Ministry Of Health providing technical assistance in design and construction and some funding.

Although the National Plan 2000-2004 indicates that 100% of the population has access to safe drinking water, and no serious outbreak of water borne diseases ,the water supply and quality monitoring system are generally not well developed and remain a subject of concern, particularly in rural areas. There is established water committee in each rural supply and the appointed water managers are responsible for the operation of the pumps. The Ministry of Health acts as the advisors and provides training on plumbing and maintenance to the water managers in the rural areas.

2.2.1 Catchment and Intake

The source of water supply in the rural areas is mainly of underground freshwater lens. There is usually one dug well with a diesel operated pump capable of supplying water to a small community of about 500 people or less. The pump is operated for about ten hours a day (from 5-10 am and 5 to 10 pm). The well sites have very little soil cover with porous (limestone) ground underneath. The well –head was covered and there was no oil spillage seen at the Lomaiviti rural supply. A pump shed was provided and was securely locked. Diesel is filled when needed and was not stored at the shed. There were cultivation and farming activities within 100 m of the bore well. Due to the well being located in the vicinity of the residential area contamination from the waste water was likely.

2.2.2 Storage and Treatment

The water is pumped into the two elevated header storage tanks (refer Photo 6 below) to create head pressure in the distribution system. Since Tonga has a flat land this measure is necessary to assist the reticulation. There is no treatment of water prior to the supply, and only in emergencies the Ministry of Health advises on treatment by manual chlorination. There is always danger of elevated tanks falling during hurricane thus disrupting the water supply to the households. The rural community also has Ferro-cement storage tanks for rain water as can be seen in the photo 7 below.



Photo: 6 Elevated header tanks, borehole well shed for Rural Supply system (Davendra Nath-SOPAC)

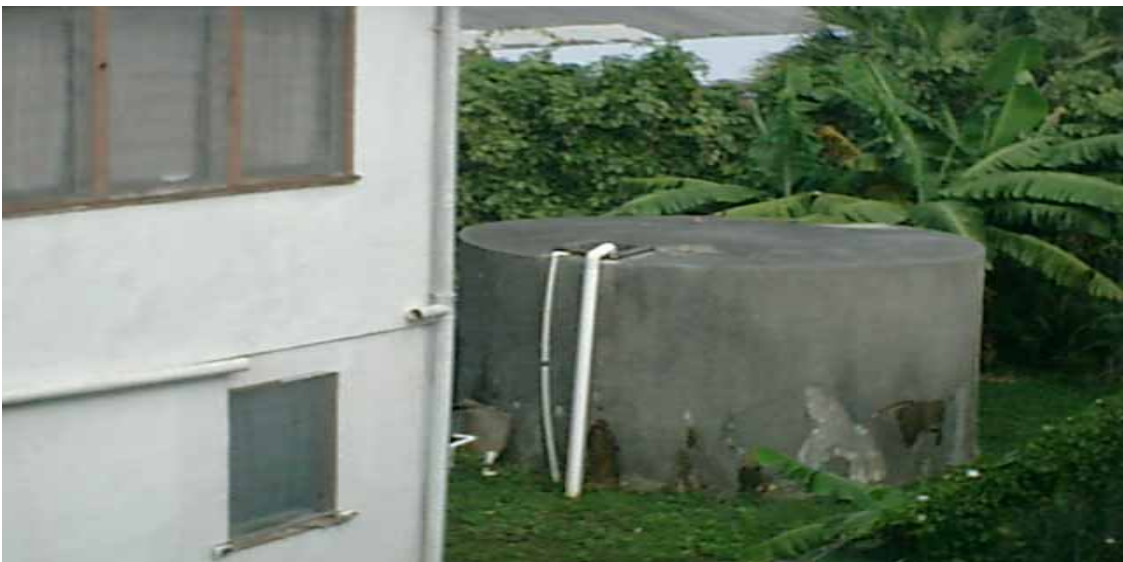


Photo: 7 Shows households use rain water as well. (Davendra Nath-SOPAC)

2.2.3 Distribution

Distribution is by gravity feed from the elevated tanks to the community. Households also supplement the reticulated supply with rainwater catchment and most have a Ferro cement water tank. It was noted that tanks were not cleaned and maintained well to eliminate the risk of contamination. Consumers do not get the water when the pressure is low in the reticulation; secondly running pumps all day is expensive as price of fuel is high in Tonga.

3. WATER RESOURCE MONITORING.

There is no defined water quality monitoring and surveillance programme in Tonga, which results in unsupervised system characterized by limited water analysis, intermittent sanitary inspection, and a lack of review and evaluation. Information exchange is limited, as is co-operation and collaboration between the main agencies. There are no national standards for drinking water quality in Tonga, and therefore no comparative parameters to be monitored. The sampling and analysis is ad-hoc as there is no critical points identified for bacterial or chemical in the system.

In order to improve the situation a closer collaboration between the Ministry of Health and the Tonga water Board is required so that the results of water analyses and complaints about water quality can be reviewed from the different perspective. This would assist in identifying the source of contamination, remedial actions that can be taken, and the establishment of an effective quality assured monitoring scheme.

The Tonga Water Board has the technical capacity to take the responsibility as the service provider whereas the quality control is the responsibility of the Ministry of Health. This might take the form of an independent legislative body created to monitor quality of service provision from Tonga Water Board and Ministry of Health, and assist in capacity building of water committees to monitor the water in the rural areas.

The minimum number of parameters to be monitored should be defined based on an evaluation of potential contaminants of the water supply system. These parameters can form the basis of national drinking water standards that are capable of being enforced. The results of the chemical analysis undertaken overseas should be reviewed to help evaluate the parameters that need to be measured. The location and number of sampling points and sampling frequencies should be reviewed, and monitoring procedures established which includes the duties of both major agencies, and promoting methods of information dissemination.

4. Water Quality Surveillance and Monitoring

It was revealed that there is no national drinking water quality standards in Tonga and regulations are governed by the Law of Tonga –Water Supply Regulations of 1963 which lays down the general rules and regulations for utilization of water sources and formation of village committees, and the act to deal with Public Health Services in Tonga. – Water Supply Control 1992. This second Act provides general rules for the examination of water sources by the authorized officers of the Ministry of Health to carry out routine water quality sampling, issue portable water certificates, advice on the prevention of

contamination and the operational aspects of the village water committee. A third Act to Reconstitute and Empower the Tonga Water Board and for related purpose –Water Supply 2001 states the formation, functions and powers of the Tonga Water Board but defines no responsibilities for the board to maintain or monitor the quality of the water supply.

In urban Nuku'alofa, the Tonga Water Board conducts monthly water quality analysis from fixed sampling points at wells, water tanks and in the distribution system, and analyses samples from other areas. All samples from the mains supply are tested for salinity, total and faecal coli form, and residual chlorine.

The Tonga Water Board has a single laboratory in Nuku'alofa for the analysis of all water samples from its system by the two lab technicians. The laboratory is poorly equipped and maintained though some equipment is provided by Institute Pasteur from Noumea. Total and faecal coliform, residual chlorine, and salinity are measured, but the bacteriological analyses is performed by a non-standard method according to WHO guidelines. Residual chlorine is measured on-site and there is currently no capacity for the measurement of pH, turbidity, and other physical –chemical parameters.

The environmental Health Unit of the Ministry of Health (MoH) performs sanitary inspections weekly at a single point. Sanitary inspections are purely observational and include monitoring potential saline intrusion, engine leakage into bore hole and drop off flow rates due to leakages.

From the total samples taken only 50 % are analyzed because of limited laboratory capacity in the hospital labs. Often only one bacteriological analysis for total and faecal coliform is performed, and in the case of positive results, the Tonga water board is alerted for remedial actions. Residual chlorine is not measured and as the sampling point used by the agencies differs there is no opportunity for crosschecking or comparison of results.

Despite the Director of Health of MoH being a member of the Board of Directors at the Tonga Water Board, there is lack of information exchange, reporting, or collaboration between the agencies and there is no overall evaluation and supervision of water quality monitoring.

In rural areas the Environmental Health Unit of MoH is responsible for water quality monitoring, advising on remedial actions, and for disinfection where necessary. Monitoring is performed on a quarterly basis, with samples collected from villages once every three months and transferred to the Ministry of Health Laboratory for bacteriological analysis. However, the MoH laboratory currently has the capacity to test up to six samples per week. This is very low and is not enough samples to have a representational overview of water quality in a given area. Rural water samples from Tonga tapu are sent annually to Australia for chemical analyses to determine possible contamination from agricultural activities. Analysis is normally for nitrogen compounds, ammonia, phosphate, and organochlorine and organ phosphorous pesticides. To date there is no significant contamination by these chemicals.

The Ministry of Health laboratory is located at Vaiola Hospital on Tongatapu and is responsible for all clinical, food, and water analysis, resulting in excessive workload on the limited number of staff. Water quality analysis has a lower priority, which restricts the

number of samples analyzed. Another limitation is a lack of testing equipments for bacteriological analysis, and like the Tonga Water Board laboratory, there is no capacity for measuring pH, turbidity, and physical-chemical parameters, the portable kits provided by WHO for on-site testing by Health Inspectors are no longer functioning.



Photo: 8 Coastal areas near Nuku'alofa. Intrusion of sea water is common in the well fields giving unpleasant taste to the water. People prefer using rainwater instead. (Davendra Nath-SOPAC)

4.1 Status of Tonga Water Board Laboratory

Staffing

The TWB lab employs two full-time staff. They are Timote Fakatava (Head Chemist) and Timote Kaufusi (Lab Assistant).

Sample Testing

Currently, the water quality tests performed by the TWB include faecal coli form, free chlorine (FC) and electrical conductivity. These tests are performed once a month on samples from the 4 island groups of Nuku'alofa, Vava'u, Ha'apai and 'Eua. The analysis of Free Chlorine is performed in the lab while the others tests are done on site. Timote Fakatava and Timote Kaufusi are responsible for the sampling around Nuku'alofa. For the outer island groups, the TWB staff based there sends over the FC samples to the TWB lab and performs the rest of the analysis on site. Table 1 below summarizes the number of samples taken for testing from the 4 island groups mentioned. It should be noted that: for a particular parameter all the sampling locations are visited on the same day for each island. For example, all FC testing in Nuku'alofa is done on the same day. The dates vary for the different island groups. Residual chlorine and EC are tested from the same location and on the same day. However, some additional sites are tested for EC. FC is analyzed on a separate day to EC and residual chlorine.

Table 1: Number of samples tested for each island group per month

Test performed -parameters	Number of sample for each island group			
	Nuku'alofa	Vava'u	Ha'apai	'Eua

Faecal coli form	18	6	7	6
Electrical conductivity	6 tanks 16 distribution 20 wells	3 tanks 9 distribution 9 wells	3 tanks 11 distribution 3 wells 5 galleries 3 private wells	-
Free chlorine	18	10	11	6

The population served by the TWB in Nuku'alofa is around 30,000. According to the *Municipal Drinking Water Guidelines (EPB 202, edition 2) 2004*, the minimum number of samples taken for bacteriological testing of groundwater drinking source for a population range of 15,000 – 50,000 should be 1 per 8,000 population/week which is the case of Nuku'alofa should be **3 - 4 samples per week**.

Surveillance of treated water for chlorine residual for all communities, regardless of population size, is necessary to properly regulate the chlorination process. Both free and total chlorine monitoring is necessary to get a complete picture. The minimum basic monitoring for residual chlorine according to the *Municipal Drinking Water Guidelines* is:

- **Once per day** from treated water at the treatment site, and
- **Two per week** from the distribution system, which can be the same locations used for bacteriological sampling.

As such the stated number and frequency of analysis is far short of the guidelines.

It is also short of the WHO (2004) guideline which states that the minimum number of samples that should be taken for drinking water testing for a population over 10,000 is 7 samples +1 extra sample per 5,000 populations - at works outlet, 1 at storage tank and rest in the network. One set of monitoring samples for every 5,000 people should be taken each month. Therefore, in the case of Nuku'alofa 6 sets of monitoring samples should be taken per month.

Other details:

The lab staffs do not have a proper logbook to record the results at the time of analysis. They record the results on paper and transfer it to an excel spreadsheet on a computer outside the lab building. Whilst out in the field in Nuku'alofa, the results are recorded in diary and later transfers to the excel spreadsheet. It was mentioned that some of the data was unavailable due to loss of a flash drive containing the results and the diary seems to be the only hard copy of the result data. Some results sheets containing analysis data for outer islands were seen but it was not properly organized and filed.

Photo Gallery: Tonga Water Board Laboratory



The spectrophotometer provided by Institute Pasture is used by TWB lab – that lacks the manual & consumables, not a very clean space to work. Also seen is the membrane filtration system for bacteriological analysis.



The sterilizer provided by Institute Pasture-Noumea – The water purification system – currently not in working condition.

5. WATER SAFETY PLANNING

Water Safety Plans (WSP) is the nameplate for WHO's new risk-assessment / risk-management approach to ensuring safe drinking water. This approach was introduced to Pacific island countries (PICs) in a February 2005 workshop in Nadi, Fiji. That gathering

of 18 countries and territories also completed a 'Framework for Action on Drinking Water Quality and Health in Pacific Island Countries' to guide future activities and gather donor support. The meeting of Pacific Islands Health Ministers in Apia, Samoa, endorsed this 'Framework' two months later with a statement in the 'Samoa Commitment'. Three Pacific-wide water quality programmes have since been proposed and funded.

The 'Pacific Water Safety Plans Programme' began in late 2005 under AusAID funding to SOPAC and WHO. This two-year joint programme will pilot Water Safety Plans in at least four PICs. Tonga is among the four PICs selected according to the programme's selection criteria and is one of the two Polynesian countries selected.

The WHO/SOPAC country scoping mission was conducted to determine the scope and interest and secure the commitment of key government counterparts including the Tonga Water Board, the Ministry of Health (MoH), Department of Environment and other potential partners including NGO's. The Tonga Water Board applied to WHO/SOPAC for support under the Pacific WSP Programme and requested the scoping mission.

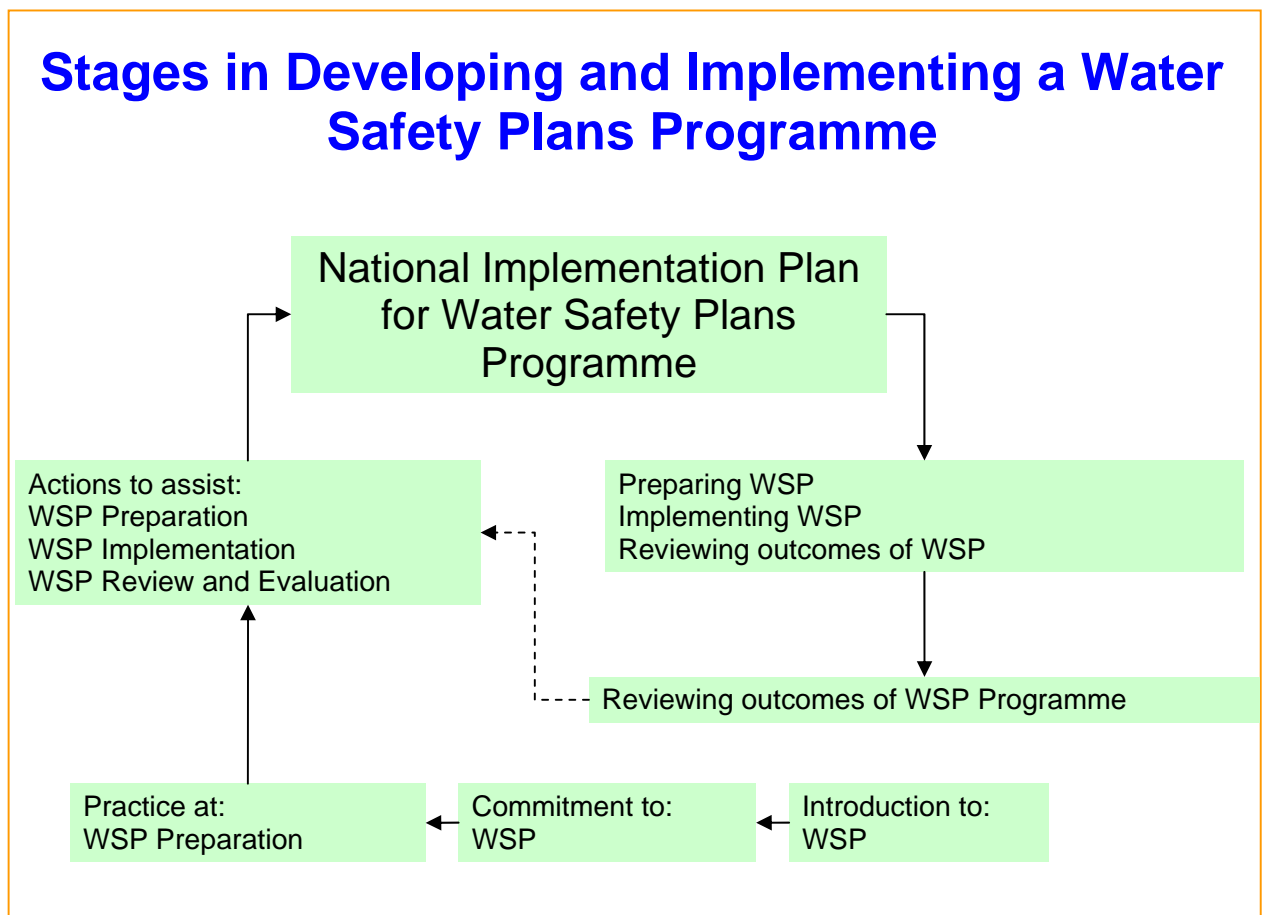


Fig: 4 Jan Gregor et.al 2005

Tonga National Implementation Plan

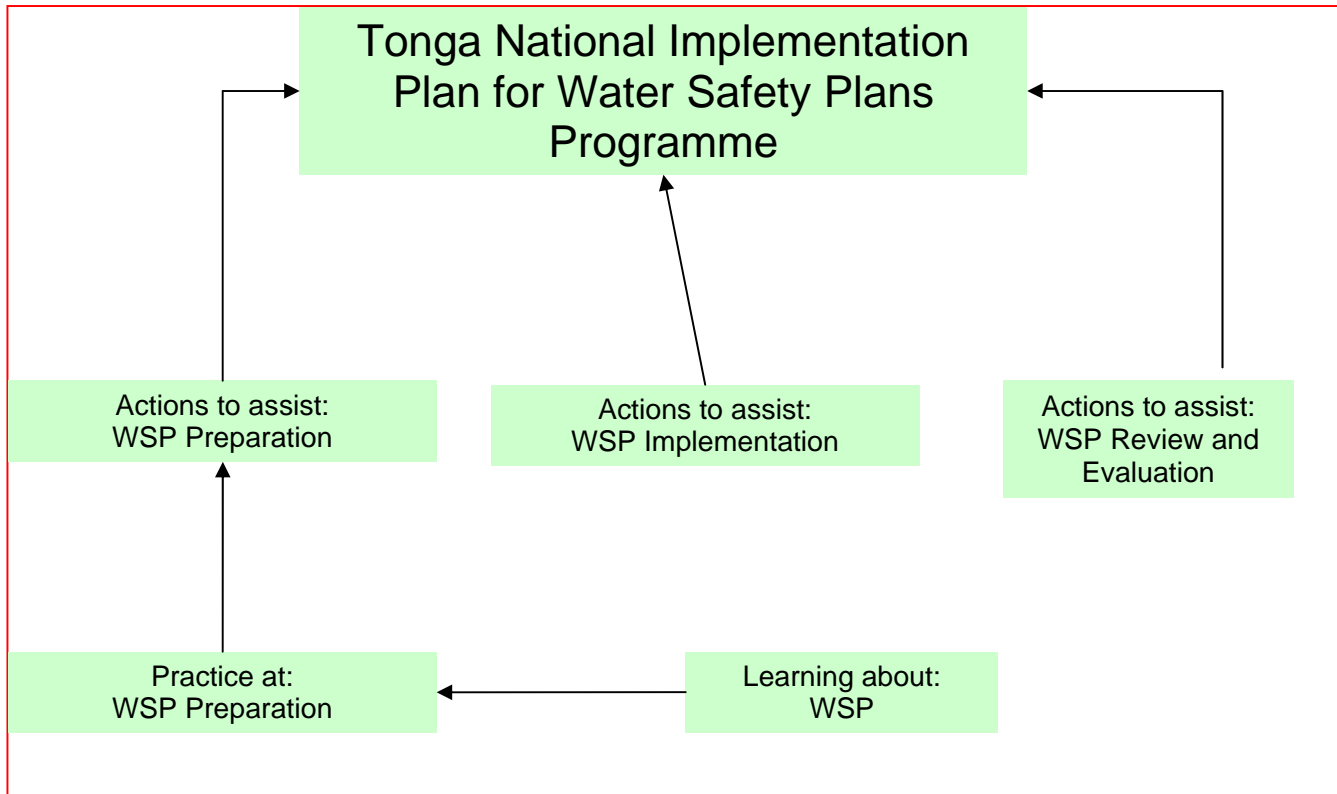


Fig: 5 Jan Gregor et.al 2005

OUTCOMES

Draft Water Safety Plan for Nuku'alofa Urban Water supply System
Draft Water Safety Plan for Rural Lomaiviti village water supply system
Draft National Implementation plan

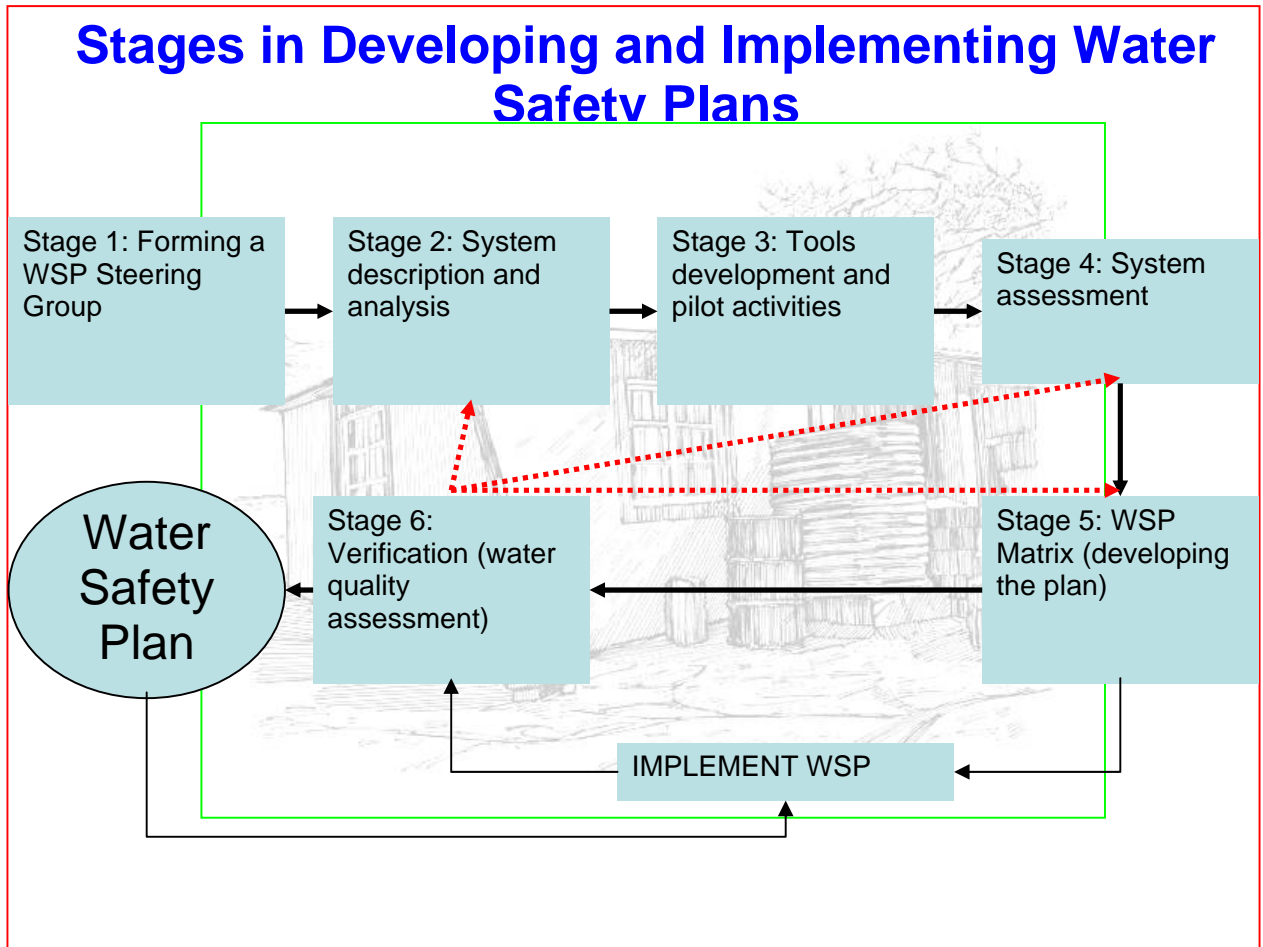


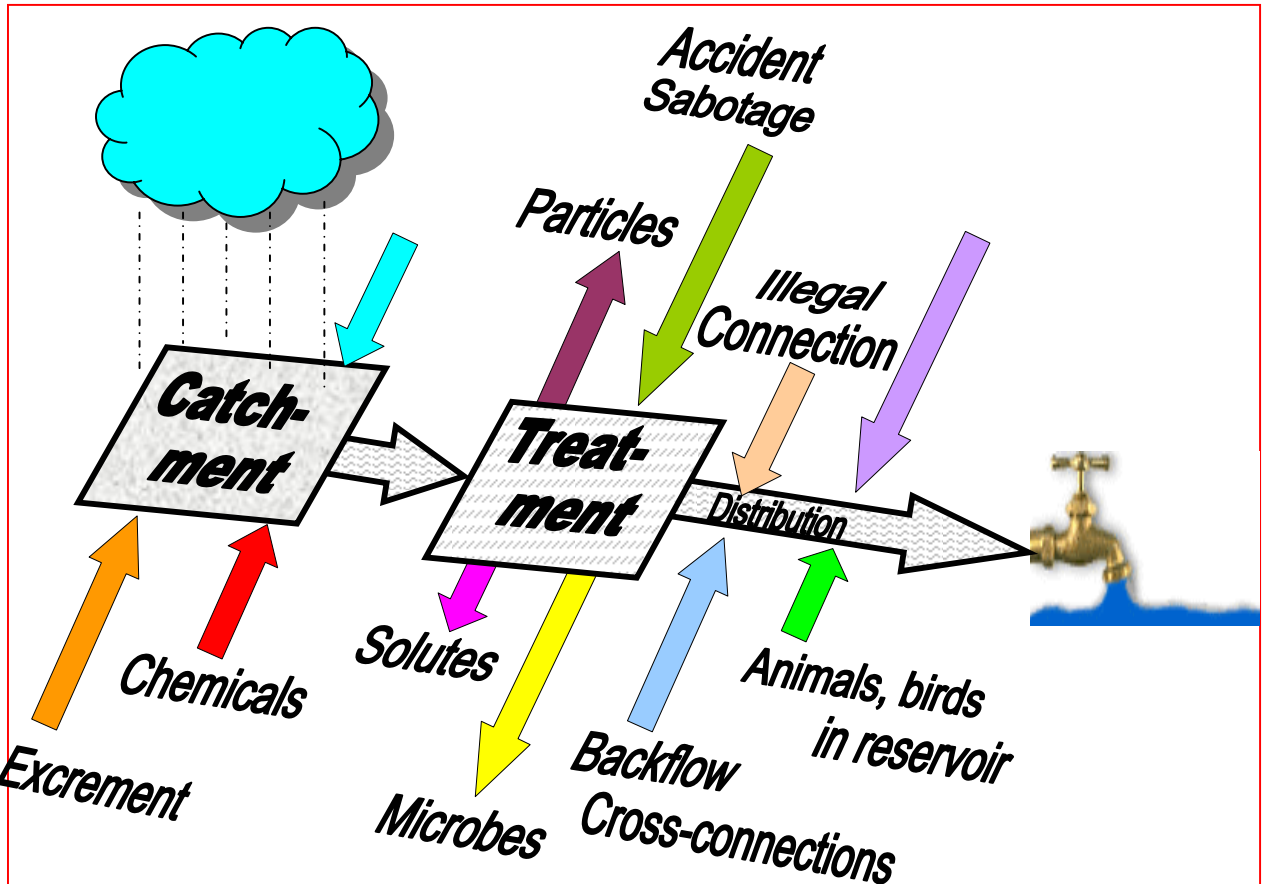
Fig: 6 WEDC Publications 2005

WHO NEEDS TO BE INVOLVED?

The following agencies have a key role to play in the further development of the WSP programmes in Tonga:

- Tonga Water Board
- Ministry of Health
- Department of Environment
- TANGO, Tonga Trust & other NGOs
- Village Water Committees
- Lands and Survey, MAFF, Min. of Agriculture
- Emergency and Disaster Office
- Finance, Legal and National Planning Office.

Figure:7 Risks in the Water Supply System



Water Safety Plans (WSP) ,as promoted by WHO in the Guidelines for Drinking Water Quality (3rd edition) ,are tools that allow for proactive approaches to ensuring safety of a drinking water supply using risk assessment and management approaches to identify risks of contamination of water supply and allow for efficient mechanisms to manage these risks.

The primary objective of a Water Safety Plan is to minimise contamination of water sources, prevent or remove contamination during storage, treatment and distribution as reference to Figure 7 above.

6. Water Supply Improvement Needs

The minimum number of parameters to be monitored should be identified based on an evaluation of potential contaminants of the water supply system. These parameters can form the basis of national drinking water standards that are capable of being enforced.

The location and number of sampling points and sampling frequencies should be reviewed, and a monitoring scheme established which includes the duties of major agencies, exchange of information, and common reporting methods.

Where chlorination is used for disinfection, equipment should be maintained, with adequate dosing to ensure efficient disinfection with sufficient residual chlorine content. To estimate the appropriate dosages of chlorine, pH and turbidity are essential parameters to test

Currently, water quality sampling is focusing on groundwater supplies even though a large percentage of the population uses rainwater as their principal water source. The inclusion of rain water in Water Quality Surveillance programme is essential. Sampling should not be done only at source/outlet but also at household level.

The sample collection system should also be reviewed to ensure that the points used are indicative of the most vulnerable points of the system, and are analyzed regularly. There should be a sampling point immediately after the chlorination unit. Analysis of duplicate samples by both agencies should be conducted to ensure the measurements are comparable.

Laboratories that are currently poorly equipped and maintained should be improved to enable standards methods of bacteriological analysis, simple physical –chemical methods such as pH, turbidity and any parameters identified by a risk management evaluation to be performed.

There should be a sufficient number of suitably trained personnel available to analyze for these critical parameters with sufficient equipment and reagents.

Field test kits should be maintained to enable simple on site analysis to be made. This would minimize transportation cost, and reduce workloads for the two testing laboratories in Nuku'alofa. It will also encourage community participation in sampling and testing their water supply on site particularly if supported by technical assistance by the surveillance agency. It will build capacity in the village water committee and allow them to measure the deterioration or improvement of their water supply and participate in hygiene promotion programs and H₂S tests, particularly in schools.

Computer and data analysis facilities should be available for the storage and evaluation of monitoring results and analysis.

In order to understand rain water and ground water usage in Tonga, it is important to undertake an inventory of ground water and rain water sources for drinking water. The information will provide direction in planning the location and frequency of sampling of future water quality surveillance.

A major improvement needs to be taken for the urban water infrastructure, for the well field shed and pumps, to the storage reservoir and chlorination and distribution system.

The rainwater system also needs major improvements to eliminate contamination. The rain water tank design and maintenance is vital through public awareness and commitment of other stakeholders

7. Conclusion

The country scoping mission and the workshops has revealed the many problems within both the urban and rural water supply which could be improved through implementation of Water Safety Plans programme. The water supplier, Tonga Water Board has financial constrains and as such has not been considering any major improvement to the water supply system. The steering committee formed during the mission can assist in the programme activities by networking with other stakeholders. There is a good functional establishment which focuses in the area of water supply in Tonga but improvement progress is slow due to many constraints and human behavior. Tonga has a slow economic growth and compounded by lack of proper water supply may affect tourism and health in the country. It is envisaged that with the continued commitment from all the stakeholders the water problem could be resolved in the Kingdom of Tonga.

Reference

1. Development of Drinking Water Quality Monitoring and Surveillance in Tonga, Hulya Aras, April 2002.
2. Needs assessment of Drinking Water Quality Surveillance and Control In Tonga, Sam Godfrey, Water Engineering and Development Centre (WEDC).
3. Country report for Tonga : Dr Litilli' Ofanoa, Mr. Lelea Tuitopou. Workshop on Water Quality Control , Suva Fiji ,29 Oct 2001'
4. SOPAC/ADB ,2002 .Pacific Regional Consultation on Water in Small Island Countries, Pacific Preparatory for the 3rd World Water Forum , Sigatoka ,Fiji.
5. SOPAC/WHO Country Scoping Mission report 2006, Water Safety Plans Programme.
6. SOPAC/WHO Country Workshop Report, 2006, Water Safety Plans Programme.
7. Water Safety Plans- planning Water Safety Management for urban water supplies in developing countries; Godfrey.S; Howard, G; 2005.
8. Water Safety Planning in Practice-Whose plan is it; Paper presented during the Water Safety Plans Workshop, Suva Fiji .Gregor, J et al 2005 Suva Fiji.
9. WHO Guidelines for Drinking Quality, 2004 Vol 1 ,Third Edition Small Drinking- Water Supplies, Preparing a Public Health risk Management Plan, Ministry of Health, 2005, Wellington, New Zealand.