# 1.0 Country Profile

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## 1.1 Land Area

Tuvalu has a total land area of approximately 26 square kilometers and made up of nine coral atolls, located in the South West Pacific; west of the dateline and to the south of the equator. The islands are scattered of 1.3 million square kilometres of the Pacific Ocean.

## 1.2 Population

| | Actual in Year | | | Forecast for year | | |
|---|---|---|---|---|---|---|
| Islands | 1979 | 1985 | 1991 | 1995 | 2000 | 2001 |
| Nanumea | 844 | 879 | 818 | 897 | 986 | 1024 |
| Nanumaga | 605 | 733 | 644 | 707 | 777 | 807 |
| Niutao | 866 | 904 | 749 | 822 | 904 | 939 |
| Nui | 603 | 604 | 608 | 667 | 733 | 761 |
| Vaitupu | 1,273 | 1,231 | 1,205 | 1,322 | 1,453 | 1,509 |
| Nukufetau | 626 | 756 | 756 | 829 | 911 | 846 |
| Nukulaelae | 347 | 315 | 370 | 406 | 446 | 463 |
| Funafuti | 2,120 | 2,856 | 3, 836 | 4, 209 | 4, 626 | 4, 805 |
| **Total** | | | 8, 986 | | | |

**Table 1 Comparison of 1985 and 1991 Census**

**Table 1** clearly indicates the increase in population in Funafuti with a decrease on the outer islands. Hence provides a good guideline for management of water resources in Funafuti.

## 1.3 Climate

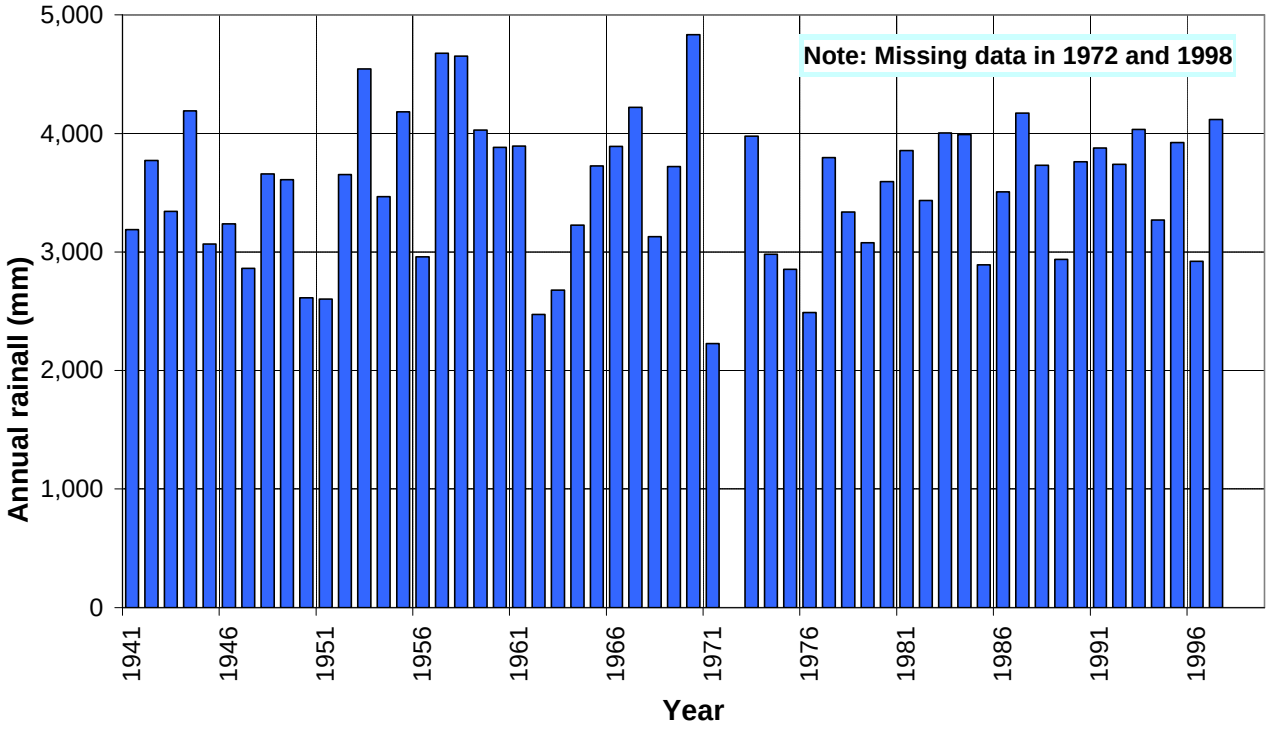
The climate is pleasantly tropical, if monotonous, they're being no marked wet or dry or hot and cold seasons could experience strong westerly winds during the period from October to March. The temperature is consistently uniform, high humidity and high rainfall. Average monthly and annual rainfall for the nine islands is given in Table 2 The mean annual rainfall as indicated in this table varies from a low 2737mm to a high of 3498 mm. The northern part of Tuvalu has the lowest rainfall.

**Table 2**

**MEAN ANNUAL RAINFALL (mm)**

| Island | Period | Jan | Feb | Mar | Apr | May | June | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nanumea | 1947-84 | 386 | 271 | 298 | 253 | 215 | 202 | 214 | 223 | 166 | 170 | 181 | 306 | 2891 |
| Niutao | 1947-84 | 357 | 285 | 273 | 247 | 196 | 195 | 218 | 201 | 164 | 171 | 214 | 278 | 2799 |
| Nanumaga | 1955-84 | 309 | 250 | 296 | 232 | 168 | 173 | 180 | 209 | 167 | 193 | 218 | 342 | 2737 |
| Nui | 1941-84 | 402 | 347 | 347 | 221 | 206 | 196 | 218 | 231 | 201 | 220 | 281 | 375 | 3245 |
| Vaitupu | 1948-84 | 354 | 357 | 282 | 219 | 211 | 194 | 197 | 243 | 198 | 220 | 282 | 360 | 3117 |
| Nukufetau | 1955-84 | 337 | 300 | 269 | 205 | 178 | 189 | 192 | 204 | 189 | 189 | 255 | 324 | 2831 |
| Funafuti | 1941-84 | 402 | 356 | 314 | 246 | 240 | 230 | 260 | 270 | 210 | 266 | 291 | 413 | 3498 |
| Nukulaelae | 1953-84 | 382 | 333 | 354 | 221 | 219 | 223 | 248 | 240 | 211 | 253 | 266 | 341 | 3291 |
| Niulakita | 1945-84 | 380 | 351 | 362 | 249 | 239 | 226 | 239 | 237 | 225 | 301 | 316 | 353 | 3478 |

**Figure 2 Annual rainfall for Funafuti, 1941-1998**



## 2.0 INTRODUCTION

The common linkage between water resources management and water resources assessment is that they both determine the quantity, quality and availability of water on which is based an evaluation of the possibilities for their sustainable development, management and control.

Water resources management is predominantly the prerequisite for sustainable development. Where water is involved, it is vitally important for any country to have water assessment to assist the country in its development plan especially water projects and most importantly the adequate water supply system for the entire population.

In the case of Tuvalu the only reliable, cheap and potable water resource is rainwater. It is therefore of great importance to have water management polices. One of its key objectives stated in the Development Plan is the "expansion of water supply systems on Funafuti and the outer islands, which should ensure that, by the end of the plan, every person in the country will have access to a more adequate supply of water"

After Tuvalu gained independence in October 1978, there was an increase in the national priority to accord the provision of adequate supply of water, sanitation facilities and waste disposal. Tuvalu recognized the importance of being healthy and to live satisfactorily and happily on a small remote islands comprising Tuvalu, its population requires:

i. potable safe drinking water and suitable water for intended use whether for domestic use such as cooking, washing, or other uses-agriculture, commerce, industry, and

ii. to control methods of disposal for different form of wastes whether its solid or liquid. This would enable the minimization of water related disease and spread of disease resulting from direct or indirect contact with infected and polluted water.

## 3.0 Background Information

*Water Resources Development*

There are three main sources of water supply in the outer islands and Funafuti, namely well water, desalination and rainwater. The wells are found in all the islands of Tuvalu except Niulakita in the southern group and Nanumaga in the Northern group.

## 3.1 Wells

Most wells are open topped with communal wells are tapered traditionally from 600 mm to 900 mm across water levels. Some could be 3.6 meters across ground level. The sides are pitched with stones. The depth of the wells is 600mm below water level. All wells are vulnerable to pollution by surface debris, frequently rotting vegetation and animal wastes.

The water from the well is collected through a smaller bailer bucket with a long pole tied to the bailer by a rope. The bailer is dipped into the well and the pole is raised where the bailer is tipped into a bucket. Washing or bathing close to the wells is strictly prohibited. The water from these wells is classified as brackish and suitable to be used as second-class water. But sometime could be used for drinking if the supply of rainwater is very low. The Government has also procured solar operating pumps to some of the outer islands to pump water from these wells up to overhead tanks and distributed by a tractor and trailer to the village.

Groundwater water lens on each respective island is yet to be explored, however, the extent of underground water area had been explored using the Schlumberger techniques as stated in the Internal Report TUV/26.

| Island | Islet | Location and Area | |
|---|---|---|---|
| Nanumea | | Main Village | 0.10 $km^3$ |
| | | Matagi | 0.63 $km^3$ |
| | Lakena | Majority | 0.53 $km^3$ |
| Nanumaga | | Majority | 0.90 $km^3$ |
| Niutao | | Eastern Half | 0.81 $km^3$ |
| Nui | Fenua Tapu | limited | 0.08 $km^3$ |
| | Meang | Central | 0.15 $km^3$ |
| Vaitupu | | Northern | 0.94 $km^3$ |
| | | Motufoua | 0.34 $km^3$ |
| Nukufeatu | | Fale | 0.21 $km^3$ |
| | | Savave | no test |
| Funafuti | | Fongafale | no test |
| Nukulaelae | | Fagaua | 0.03 $km^3$ |
| | Fenualago | Central | 0.02 $km^3$ |
| | Tefakai | Northern | 0.02 $km^3$ |
| Niulakita | | Western half | 0.15 $km^3$ |

Most islands ground water is available under the main village settlement thus making it contaminated because of the extensive use of pit latrines, septic tanks and animal wastes. To utilize this limited resources there could be an option to use it for toilet flushing or other means of second-class water.

### 3.2 Rainwater

Most houses in the Tuvalu have corrugated galvanized iron and Aluminum roofing. The rainwater is collected from these roofs, which have PVC gutters that run water through to down pipes into Ferro-cement, fibreglass, block work or reinforced concrete, and plastic tanks. There are large public buildings in all the islands of Tuvalu that are centrally located so that their Roof catchments are basically used for collecting rainwater and runs into large public water cisterns ranging from 100 $m^3$ to 400 $m^3$. The water is distributed

to the community by buckets. The use of diaphragm pumps to distribute water into buckets is now been used in some of the water cisterns in some of the outer islands.

A $10m^3$ water truck at a subsidy rate of $15/5,000 litres to public and AUD $44/5,000 litres carries out the distribution of water in Funafuti from Government cisterns to business and vessels. The use of hand pump to fill overhead tanks and supply water into the house by the use of gravitational pressure is still quite common both in the outer island and Funafuti. Government Civil servant houses in Funafuti have electric water pumps that reticulate the water through the house whilst some private dwelling still preferred a container under the outlet of the tank. Tuvalu still prefers and would continue to use rainwater because of the consistent and high annual rainfall in the country.

**Table 2 Funafuti Rainfalls – Summary Statistics**

| Parameter (mm) | Period of record | |
|---|---|---|
| | July 1927-July 1999 | Jan 1941-July 1999 |
| Average annual rainfall | 3,596 | 3,545 |
| Maximum annual rainfall | 6,733 (in 1940) | 4,833 (in 1970) |
| Minimum annual rainfall | 2,226 (in 1971) | 2,226 (in 1971) |
| Coefficient of variation of annual rainfall | 0.21 | 0.17 |
| Maximum monthly rainfall | 1,293 (May 1939) | 1,141 (Jan 1955) |
| Minimum monthly rainfall | 40.9 (Aug 1950) | 40.9 (Aug 1950) |
| Minimum 2 month rainfall | 87.9 (Aug-Sep 1950) | 87.9 (Aug-Sep 1950) |
| Minimum 3 month rainfall | 147.8 (Aug-Oct 1950) | 147.8 (Aug-Oct 1950) |
| Minimum 4 month rainfall | 292.1 (Aug-Nov 1950) | 292.1 (Aug-Nov 1950) |

Table 2 provides a summary statistics for the two sets of data, which are reasonably consistent with each other.

The Health Unit on various public tanks, shops and other discipline, carries out water quality control and monitoring programs. The Unit however, does not implement water quality testing prior to the distribution of water to the public. It is an area where stakeholders should discuss and focus during the National Consultation process.

### 3.3 Desalination Water

Most recently desalination plants were installed on Funafuti, Vaitupu and Nanumaga after Tuvalu experienced drought in 1999 and the demolition of approximately 300 $m^3$ of water storage in Funafuti. Desalination Plant that produced 65 $m^3$/day was installed on Funafuti, whilst the 2 units 30$m^3$/day were installed on Vaitupu, because of the secondary school and a single unit on Nanumaga. Desalination water is very reliable sources of water but operational and maintenance costs is far too expensive for a developing country like Tuvalu. It is recommended by Falkland that it is an option for emergency use. This recommendation is very supportive from PWD staff as the plant currently operating on a very high maintenance and operational cost although electricity charges had been subsidizes by Government.

## 4.0 National Consultation Process

The National Consultation Process was the calling of stakeholders from the various disciplines to address the needs for water development and to strongly identify areas where they can participate and contribute towards the sustainable development of the water sector in Funafuti and outer islands.

The consultation process usually initiated within the Government institutions, for instance PWD due to the availability of technical assistance and the fact that the department is responsible for water development in Tuvalu.

The Public Works Departments would consult the relevant ministries who are directly involve or have some involvement in the water sector to discuss areas of upgrading and improvising the water system in all islands of Tuvalu. The need for this is due mainly to the fact that current water system is still inefficient and strongly suggested in the consultation process to review the water supply system.

There were areas identified in the process that require the participation of stakeholders especially the community participation and contribution towards water development projects. There is still a need to improve and assist the people on the outer islands and Funafuti the many basic requirements to manage water efficiently and effectively. For the outer island consultation process, a Taskforce (consist of appropriate Govt instution) should be identified to travel to the outer islands to consult and discuss with the various community groups and other organization through the Kaupule (Government representative) the islands needs and areas of great importance to them that require an upgrade or training.

There is also a need for stakeholders to clearly identify their responsibilities to put in place a more coherent system where they should recognizes their roles to ensure the entire population received quality and safe water.

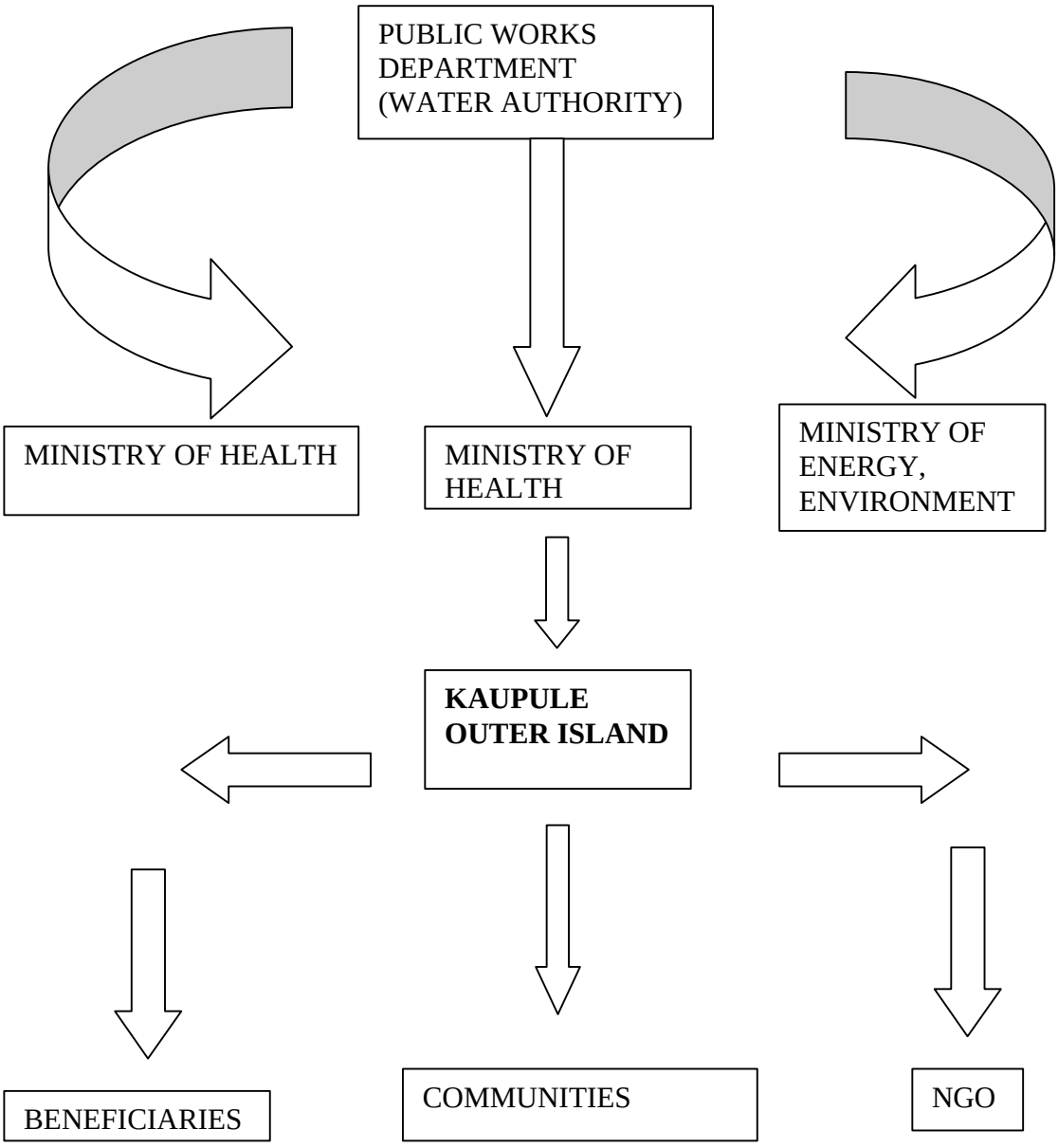
As part of the consultation process, the emphasis was strongly directed towards capacity building to ensure users or beneficiaries are fully aware of their individual responsibilities.

If we consider the case of Tuvalu, for instance, the entire population depend solely or mostly on rainwater. The average annual rainfall in Tuvalu is approximately 3000mm as clearly indicated in **Table 2.** What requires from the community or users in this point time is the effective management of rainwater.

The process should focus to incorporate in their programs the fundamental and basic requirement of effective management of rainwater by providing emphasis to individual households, that they should ensure a reasonable size water storage is available and in good condition to accommodate the families during dry spell prior to buying water from Government supplies. Guttering should be clean and properly installed. For a family of six members the size of the tank should at least be $12m^3$ based on the conservative design consumption rate of 50litres/person /day

The consultation process should also emphasize to Kaupule or government representatives on the outer islands the importance of carrying out the water survey of available water storage on their respective islands. There are other issues, of island type of management, which should be considered by the Kaupule to assist in the development of the water sector in the outer islands.

**Consultation Process**



## 5.0 VISION, ISSUES and CONSTRAINTS

Tuvalu has a 10-year water master plan that needs to be legally adopted by Government. The plan clearly stated that to be healthy and live a satisfactorily lives its population requires to have Adequate and Safe Potable Water and suitable methods for sanitation and waste disposal.
"This vision does link or coincides with World vision theme because of its focus to ensure that water resources is adequate and sustainable for future generation."

Every country in the world has some sort of vision which could be inter-related because freshwater is a unitary resource. Although Tuvalu may have a different approach to the management of its water resources but issues of water quantity cannot be separated from water quality. One may think that a country with high rainfall and a small population of 10, 500 people will encounter less water related issues. That could have worked very effectively for Tuvalu if every objectives of the 10 Year Plan was carried out and fulfilled accordingly. The people on the other hand should have been more responsible and self-reliance rather than Government dependent.

It is anticipated that Government should provide a more holistic management approach for this unitary resource. That is the Government should support any project development from various institution or stakeholder in all areas of the water sector.
It is quite encouraging for Tuvalu to receive such great assistance from the non-governmental organization and communities in each island in the group to actively involve in some of the water projects development in the past.

One of the key factors for a high water demand is the population increase. In Funafuti the high demand for water is an issue to serious consider. The influx of people to the capital Funafuti and insufficient water storage capacity is a major set back and dilemma to Government. It would mean that Government has to resort to either increase its water storage capacity or look at other alternative sources of water supply to ease the increasing

demand. One area to exploit is the use of ground water as second-class water for washing and flushing of toilets.

The current situation in Funafuti is that the demand for water starts directly after a week of no rain. This is a clear reflection of the lack of proper water management skills at the grass root level. During the water storage survey of households particularly in Funafuti it was noted that most of the households are dependent mostly on government water. Most families buy their water requirement from Government despite heavy rain during that period. They don't have proper water storage, with gutters are not properly installed.

It was also discovered that rainwater storage throughout the islands with the exception of Funafuti is unknown. This unknown data for water storage in the outer islands make it very difficult for PWD to accurately monitor water situation during a dry spell.
Having insufficient Government water storage couple with limited fresh groundwater and difficulties of achieving the 100% desalination water output has prompt and alert PWD to explore and consider a well structured strategic plan where water policy and legislation should be legally adopted. The legislation should at least provide a yardstick for any prevailing circumstances that might affect the water supply in the country.

What has been lacking the Government to recognize the insufficient and inefficient of the water supply is the commitment and ability to accept the fact that Tuvalu has a major problem with the water supply and especially in Funafuti where the majority of the population segregate. The Government in his own right and capacity should provide the full support for any vision in the water sector not only in principle but every way it could to improvise the standard and development of the water sector initiatives.

However, there are constraints beyond the capacity of Government to achieve some of the goals identified under the plan. The common constrain to Tuvalu and probably most Pacific islands is **FINANCIAL RESOURCES and GOVERNMENT PRIORITIES**

There are also constrain exist within the different level of the Government Institutional structure where there is lack of planning, policy making, legislation, insufficient human resources capacity and fragmentation in the water sector. The current structure of the water authority is required strengthening and restructuring.

## 6.0 PLAN OF ACTION

### *6.1 Advocacy*

It is envisage that the Government strongly advocates the Ten-Year Master Plan by legally adopting it. The Government should also provide any assistance and support to any water development projects proposed from various stakeholders. Without the support of Government the tendency to implement certain objectives of the water plan would be very difficult. There still quite a number of issues that are yet to be implemented or resolved.

Depending on the political will to fulfill certain obligations of the plan the participation of community in any water projects or any other development project is very encouraging and positive. It is aimed that environmental understanding and gender balance be moved a step further so that these issues are well addressed to the grass roots level. That is by having Government to recognize the importance of these issues and to provide awareness programs for communities where gender balance and equity is involved.

### *6.2 Action already Undertaken*

The water authority has carried a water survey to all storage capacity in Funafuti and envisages having water survey to all the islands of Tuvalu. The survey will provide data for better monitoring and management of the distribution of the available water during dry spell. The data will also develop a database to accurately monitor and predicts the existing and new storage requirement. Tuvalu currently is not quite equipped to use the new technology GIS system of water monitoring due to lack of appropriate technical staff. The Water Authority (PWD) will acquire the assistance of Government to continue its support to provide the financial resources in the annual budget for the outstanding

tasks of the water storage survey to all the islands. So far the community response to this objective is satisfactorily acceptable.

### *6.3 Future Actions Needed*

The Government to resolve outstanding issues that had been prioritizes and identified by the stakeholders for the development of the water sector. Appended is the list of unresolved issue which required future action;

?? review, update as necessary and approve the Draft Tuvalu Water and Sanitation Plan. One aspect of this is the need to review design criteria for water supply in the light of present and future circumstances. In particular, the amount of water that should be available to the population needs to be considered. At present the "standard" is 50 litres/person/day. (Some questions, which need to be answered, are: Is this adequate? Can less be used in a low rainfall period?),

?? review, update as necessary and approve the Draft Water Resources and Sanitation Management Bill (refer Kageega o Tuvalu, 1995-1998, p70),

?? implement regulations to require minimum storage sizes for all new buildings and extensions to existing buildings,

?? implement regulations to ensure that households maintain their rainwater collection and storage systems in good order,

?? implement regulations to ensure that water saving devices are used in houses,

?? develop and implement plumbing standards, and

?? use the proposed water Management Committee to undertake reviews suggested above.

These future actions is also required the support at the Regional level and International Cooperation where they could provide assistance in many areas where Tuvalu is lacking the ability to fulfill some of the outstanding issues.

### *6.4 Implementation and Responsibilities*

The Public Works Department to implement certain objectives of the action plan and forward to the Development Coordinating Committee for endorsement and support before it is recommended for cabinet to make any formal decision. Cabinet will decide and responsible for approval. The responsibility to advocates the implementation of the action plan whether it will bear by Government or seek support at the Regional or Bi-lateral level.

## 7.0 CONCLUSION

It has been confirmed by previous reports and recently tests carried out by Falkland that in Funafuti there is limited fresh ground water.

Since Funafuti is the most densely populated island in the group and the island with very low public reserve storage it is vitally important that proper measure, control and management of the water system should be well established. Some of the options identified by Falkland that could improve the water situation in Funafuti is appended;

### *7.1 Possible Options*

There are a number of possible options to improve the water supply situation on Funafuti in the short and longer terms. The main options for increasing the supply of freshwater are:

?? Rainwater collection system improvements,

?? Surface water collection from runway,

?? Desalination, and

?? Importation.

Other options, which are aimed at decreasing the use of the limited freshwater resources, are:

?? Use of groundwater (for some water uses),

?? Alternative sanitation methods, and

?? Demand management and water conservation measures.

Finally, there are a number of measures that can be adopted to improve the overall planning and management of water resources and water supplies. These measures include:

?? Improved water distribution system,

?? Improved co-ordination and institutional arrangements,

?? Policy and legislation,

?? Plumber training, and

?? Improved water monitoring and information systems.

More than one option could be implemented depending on the applicability to the social and physical environment of Funafuti and the costs of implementation and future operation and maintenance.

Each of these options is considered below together with conclusions about the most appropriate strategy in both the immediate future and the longer term.

Some of these options could also be applicable for the outer islands water system.

The rainwater systems can be improved for both households and communal buildings. This improvement is the increase of water storage of households and communal. The use of the airstrip as a catchments and use the water as second-class is an option, which is under Water Authority's consideration.