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Water Resources Development and Management in the Asian and Pacific Region: Issues and Opportunities  
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# **WATER RESOURCES DEVELOPMENT AND MANAGEMENT IN THE PACIFIC REGION**

## **ISSUES AND OPPORTUNITIES**

**DERRICK DEPLEDGE**  
HYDROGEOLOGIST  
Water and Sanitation Programme  
South Pacific Applied Geoscience Commission, (SOPAC)

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## 1 INTRODUCTION

The Pacific Ocean covers some 18 million km<sup>2</sup>, or 35.5%, of the Earth's surface. Between the coastline of the Americas and the landmasses of Australasia and the Far East Asian countries the ocean is scattered with over 30,000 small islands and a number of larger islands, (>2000 km<sup>2</sup>) which emerge from the sea floor. Of these about 1,000 are populated.

The Pacific island nations are mostly small in physical size and population. They are remote from each other and other larger developed nations. And they are widely dispersed throughout a vast expanse of ocean.

These unalterable facts of smallness and isolation have led to some neglect of the region by external support agencies, (ESAs), in favour of the more heavily populated, more accessible areas of the world. Indeed there is a distinct lack of reference to the Pacific in much of the literature outlining the health, education and other basic needs of developing countries. There are many publications relating to "Asia and the Pacific" which fail to mention the Pacific. It is as though a number of small voices cannot be heard above the louder voices of the larger global nations. So it is with some pleasure that this delegation from the Pacific is represented at this workshop to detail the particular issues in water resources development and management, (WRDM), in our region. For the Pacific region as a whole, and for individual countries represented by other delegates, we will attempt to give a snapshot of the problems confronting us in early 1996 in the water sector.

We would also like to suggest some possible opportunities, that is what can be done, to produce sustainable development in the water sector in the region. The opportunities fall neatly into four stages, setting goals, evaluating, consulting and coordinating, decision making and implementation. Opportunities are focused on the first two of these.

From these observations a number of areas of concern are identified and a number of opportunities outlined which may assist ESAs, and in particular the Asian Development Bank, (ADB), to formulate a policy for WRDM in the Pacific.

## 2 THE PACIFIC REGION

### 2.1 Geographical Location and Demography

The island nations of the Pacific are widely dispersed throughout this vast expanse of water. The national boundaries are largely historic ones reflecting general groupings of peoples, languages and the extent of colonial rule of the western nations who came to the Pacific.

The nations range in size from single island countries such as Niue and Nauru to large island nations such as Papua New Guinea, Solomon Islands, Vanuatu and Fiji, and to widely scattered groups of coral atolls such as Kiribati, Tuvalu, and the Marshall Islands.

Country populations also range from those with less than 20,000 inhabitants, such as Niue, Tuvalu and the Cook Islands to the high population of PNG with numbers now approaching 4 million. The majority still live in rural areas. Two-thirds of the population of W Samoa, for example, survive on subsistence farming or gardening in the rural villages. Almost 90% of the Solomon Islands population live in rural areas. But as elsewhere in the world there is a

trend towards rapid urban migration as access and transport become available and communication paints an alluring picture of life in town.

Physically the islands range from ancient continental islands of mixed sedimentary, igneous and metamorphic rocks, (New Caledonia, New Guinea), to more recent volcanic islands of andesite and basalt, (Fiji, Solomons, Pohnpei, Samoa), to submerged volcanoes capped by coral limestone, (Niue, various atolls).

The issues and opportunities discussed below therefore differ markedly between these nations, from the problems of small remote low-lying coral atolls with widths of a few hundred metres to the special needs of Papua New Guinea, where on the mainland alone 3 rivers drain about 200,000 km<sup>2</sup>, and 85% of the population live in rural areas, many of them remote.

## **2.2 Available Water Resources**

The subject of limited water resources in small island developing states, (SIDS), has been highlighted recently in a publication, (SOPAC/UNEP, 1996 in print), which outlines technologies available for augmenting water supplies. The advantages, disadvantages and relative costs of the various water supply options are covered in this book, which has recently been compiled, with funding from the United Nations Environmental Programme, (UNEP), by the United Nations Development Programme, (UNDP) funded Water and Sanitation Project in SOPAC, (the South Pacific Applied Geoscience Commission), based in Suva, Fiji,

### **Rain Water**

Mean annual rainfall varies from north to south and east to west over the wide expanse of the Pacific Ocean. The normal circulation of air masses driven by the differential pressure distribution over the large ocean area creates zones where rainfall is relatively abundant or relatively scarce. The annual average rainfall figures for different countries and different island groups within one country may also vary depending on the topography, latitude and extent of the country.

On a local scale seasonal differences in rainfall are common, with well identified "rainy" or "wet" seasons expected. Further secular variability is experienced in the Pacific over a longer time period with the repeated occurrence over a cycle of two to seven years of the phenomenon known as the El Niño Southern Oscillation, (ENSO). This reversal east-west of the pressure distribution changes the location of and the circulation pattern within the air masses, creating a change in the rainfall distribution. Some locations experience higher than average rainfall in ENSO events, e.g. Kiritimati Island in Kiribati, whereas other locations are distinctly drier, e.g. Vanuatu and Fiji.

For most of the Pacific the rainfall, on an annual basis, can be regarded as abundant.

### **Surface Water**

Surface water in the form of rivers and lakes occurs on the larger volcanic islands of the Pacific. Smaller islands and those with a predominantly limestone composition may have no surface drainage at all because of the high permeability of their surface materials.

Lakes often occupy old craters on volcanic islands or shallow mud lined depressions. The water is not generally used because of its quality, either acid or saline or because access is difficult as in W Samoa.

Rivers and streams, however, are widely used in the Pacific countries for water supply. The use ranges from small gravity fed systems for individual villages to major storage, treatment and distribution for large urban areas such as for Suva in Fiji or Apia in W Samoa. Rarotonga in the Cook Islands has a reticulated supply from filter intakes in the upper reaches of the island's radial streams.

## **Ground Water**

A major source of fresh water in Pacific Islands comes from the ground. Again the range is large between thin and fragile lenses on small atolls and high volume limestone, volcanic or alluvial aquifers on the larger islands. Quality is generally good in its natural condition, but anthropogenic effects on the resource may limit its use locally, especially on the smaller and more densely inhabited islands. Both Honiara, the capital of the Solomon Islands and Port Vila, the capital of Vanuatu derive their water from ground water and springs.

### **2.3 Water Use**

The use of water for irrigation is small within the Pacific. Some nations have developed markets for agricultural products such as squash pumpkins and sugar cane and it is possible in the future that irrigation will be a major water requirement in such places as Tonga, Vanuatu and Fiji. At present about 6 million m<sup>3</sup> are stored in irrigation dams in Fiji and ground water is being developed for irrigation purposes.

Industrial use of water is also limited in the Pacific. Beer making, soft drink manufacture, fish processing and sugar refining are some of the larger users of water.

Water is also used for hydro electric power in some countries such as Fiji, W Samoa, PNG and Vanuatu, but this is not, in general, a competing or consumptive use. Larger dams can leave stretches of river bed dry.

For the purposes of this workshop I will be concentrating on domestic water supplies for drinking, cooking, washing and toilet flushing in the urban and rural areas of the Pacific.

### **Small Atoll Islands**

The choice for small atoll islands is limited largely to rain water harvesting and to development of any available ground water resources.

Rain water catchments, generally a galvanised iron or tiled roof, or sometimes a ground catchment, such as the runway which is used in Majuro, Marshall Islands, are linked to some form of storage, usually a tank or reservoir. Tanks are made of ferro cement, fibreglass or polyethylene, or any container available.

Ground water use on small islands ranges from dug wells with water retrieved via a container on a rope to sealed wells with diesel, wind or solar powered pumps. Hand pumps of many varieties are used in the Pacific region.

## Larger Volcanic or Mixed Geology Islands.

Larger islands include in addition the use of surface water and in particular rivers, streams and spring sources.

## Alternative Technologies.

On some islands water is derived from desalination plants. The island nation of Nauru has installed a plant to supply the country's needs. On Ebeye in the Marshall Islands there is a multiple effect distillation, (MED), plant capable of providing up to 1,100 m<sup>3</sup>/day. A smaller reverse osmosis (RO), plant exists in Tuvalu, specifically for emergency hospital supply.

Technologies used in the Pacific are displayed on a poster at this meeting.

## 3 ISSUES

The issues described below have been compiled from observation, consultation and documentation from individual countries. There are a number of themes which have been incorporated in groups, of which the first is the major concern - inadequate water for everyone. The remaining four groups are all issues which contribute to the major issue.

There are clearly two sets of issues relating to the more heavily populated urban areas and to the more widely dispersed rural areas. Both need a reliable water supply but the means of achieving this are markedly different, which is reflected in the differing issues. It should be noted that there is a definite need to consider the non-urban areas which are often neglected, particularly in the larger island nations.

### 3.1 PROVISION OF ADEQUATE QUANTITY AND QUALITY OF WATER TO EVERYONE

#### Inadequate Quantities of Water

There are shortages of supply in many of the Pacific countries despite water on a global scale being readily available. The problem is more one of economics, health and hygiene than of alleviation of thirst. In particular there is a **need to drought proof** many regions which are prone to **seasonal and secular shortages** of supply. Various methods of overcoming periodic lack of water are practiced in the Pacific, ranging from using coconuts as an alternative, bringing water by canoe from neighbouring islands to barging and tankering water in bulk to water short areas, which is a regular practice in Fiji in dry years. There is an obvious need to provide a secure continuous supply.

#### Inadequate Quality

More importantly in the Pacific there are many areas which have adequate quantities of water but of poor quality leading to health problems. Chronic diseases such as diarrhoea, and occasional outbreaks of more serious infections such as cholera and typhoid occur. During dry periods people, particularly in rural areas and on small islands, are forced to use **unsafe sources of water** when their primary source fails.

Other areas have limited fresh water and are forced to use partially saline water for drinking and cooking.

This paper intentionally links water with sanitation, health and hygiene. Any initiative in the water sector must consider this link very carefully.

### High Project Failure Rates

Many developments in water supply, in both the urban and rural areas, have had a poor impact on the community being served, for a variety of reasons. Often the **technology** has been **inappropriate**. In Fiji there are examples of complex early model solar pumping systems which have been beyond the ability of villages to maintain. Throughout the Pacific there are abandoned hand pumps of various designs and materials, such as the Rocket and Fuji in PNG, which have been provided by aid without the necessary access to spares or training in maintenance. Some hand pumps have proved **culturally unsuitable**. In PNG for example one of the designated handpumps, the Blair, cannot be used by women because they have to stand directly over the water source, which is not allowed.

In some cases the **resource** has been **inadequately investigated** and is unreliable. Too often a supply source is developed on the observations of flow or ground water level in the rainy season. Springs and upper catchment stream sources dry up and wells have to be deepened if supply is to continue. On the island of Tanna in Vanuatu for example several gravity schemes failed to deliver water soon after completion because of the secular drying up of the sources due to a prolonged ENSO event, (1992-1994).

In other cases there has been little consultation with the local community regarding the **suitability of the location of the supply source** or the means of delivering the water. In particular gravity schemes, of necessity, often have to be located on land remote from the consumers and have to cross land under the control of other landowners. Lack of consultation in these circumstances can lead disputes which may result in diversion of the supply, vandalism and at best long delays while compensation is negotiated.

Consultation is also required regarding the **acceptability of the resource**. There may be resistance to wells located at some distance, requiring long walks to obtain water. These may be abandoned because of the location. Some consumers may want and be willing to pay for water to be delivered to the individual household. In Fiji there are examples of families opting out of a larger scheme to provide their own supply.

In addition many projects fail because there has been **no provision for** the funding or responsibility for **operation and maintenance** of any scheme. The current UN funded outer island water project in Kiribati has provided water supplies to many villages on outer islands so far, but already problems are occurring because of inadequate provision for procuring simple spare parts such as nuts and bolts and rubber diaphragms for handpumps and a responsibility which requires lengthy communication through three levels back to central government to order spares.

The Pacific in fact is a graveyard of many technologies tried and failed. Windmill pumps, solar pumps, handpumps, desalination plants can be found abandoned and in disrepair throughout the region. Many rain water tanks remain empty because of missing or unrepaired guttering and down pipes.

In the urban context technologies used are often inappropriate or beyond the technical or financial capabilities of the agency operating the scheme. The state of disrepair of the distribution line and storage tanks, and the lack of standby pumps for the water supply for South Tarawa in Kiribati is an example of poor planning for and utilisation of a scarce resource.

Similarly financial constraints can lead to poor maintenance, **lack of standby facilities** and health risks due to **lack of disinfection**. A recent failure of a major source for Honiara in the Solomon Islands highlighted the lack of alternative sources of supply. Many urban sources have periods without chlorination because of non supply of the chlorine.

### 3.2 LACK OF DATA, EQUIPMENT AND TECHNICAL EXPERTISE

#### Lack of Data

Data requirements in the field of WRDM covers a vast range. The needs are for adequate climatological, hydrological, hydrogeological and water quality information, water related health statistics and details of water supply installations and abstraction rates to allow informed decisions to be made in the choice of the most suitable water supply installation.

The **security of data**, using some form of backup system, is essential. Almost all of the hydrological records for W Samoa were lost following a cyclone which passed over Apia, causing much damage in the Observatory where records were kept.

In the Pacific there is a reasonable amount of climatological data which is ongoing largely because of the interest of other nations who need data from the Pacific for regional and global weather and climate predictions and because of the need to identify potentially disastrous events such as cyclone development and movement.

The more water supply oriented measurements of evaporation, sunshine hours and solar radiation data are less well covered than rainfall, pressure and wind observations.

Hydrological data is collected systematically in many countries but suffers from a shortage of adequately trained personnel and a **variety of complex data management packages**.

**Ground water data** is generally **inadequate** in terms of volume and completeness. This is largely a result of the only recent emphasis on ground water as a source. Data is usually stored on hard copy with only some nations, such as PNG, Fiji and Vanuatu, attempting to create hydrogeological databases.

Water quality has a very low profile in most countries. Testing is done intermittently and is often triggered by an outbreak of some possible water borne disease such as cholera or typhoid. Health statistics are partially available in the area of water related disease. NGOs are sometimes responsible for in depth investigations of health and hygiene topics such as diarrhoeal incidence.

Water utilities vary in their recording of abstraction rates from virtually no records to full metering of all abstraction points and storage facilities. The rural water supply **installations** within a country are mostly **poorly recorded** both in terms of initial engineering details and in subsequent operation and maintenance.

#### Lack of, Inappropriate, or Underused Equipment

Equipment is often **inappropriate, badly maintained and rarely calibrated**. Pressure transducers and dataloggers provided by the EU in the late 1980s to the water resources section of the Department of Geology, Mines and Water Resources in the Solomon Islands for river water level recording turned out to be prototypes with several defects, which limited the life and operation of the equipment.

The provision of equipment is often tied to suppliers in the donor countries or areas. Donor agencies vary considerably from country to country. Thus we have W Samoa currently

using English consultants, introducing English equipment and software and Tonga using Australian consultants with the obvious use of the Australian equivalents. This leads to a **proliferation of many types** of equipment making regional training in such equipment and software particularly difficult.

Much of the **water quality equipment**, such as the Delagua bacteria testing kits provided by WHO, may be located in the wrong organisation and suffer from **under-use**. I have seen many of these kits carefully stored behind doors and on shelves in organisations throughout the Pacific with no sign of use or interest in the contents.

Geophysics equipment used for ground water investigations often requires an enthusiast to operate because of its daunting array of wires, clips and recording boxes.

#### Lack of Technical Expertise

The education systems in most Pacific Island countries tend to produce **few students who** go on to **study sciences and engineering** at tertiary level. The resulting human resource skills shortage affects many of the Pacific countries in the area of water resources.

Thus there is a **need** in the water sector **to provide training**, particularly at the **technician level** in the disciplines associated with water supply. One particular need with the increasing use of ground water is the **need to provide driller training** at all levels from supervisor to drilling assistant.

### **3.3 LACK OF POLITICAL WILL, LEGISLATION AND POLICIES IN WRDM**

**Political will**, a crucial factor in achieving the major goals in water supply, which would normally manifest itself in a series of policy statements and plans relating to the water sector, backed by an appropriate legal framework, is **not clearly visible** in many Pacific nations.

Draft legislation exists in some countries such as the Solomon Islands and Vanuatu, in others colonial legislation from pre-independence days is utilised. Papua New Guinea has a series of acts, including a Water Resources Act, (1982), which cover some aspects of the water sector, but in general the **will to control** such a vital natural **resource is lacking**.

The Marshall Islands have various regulations relating to water and sanitation but no one to enforce them.

In particular there is a lack of clear legal rights relating to the **ownership of water**, (Goodwin,1996). Some countries, such as PNG have put the control of water in the hands of the government, but in general there is no reference to ownership.

Landowners throughout the Pacific usually have **custom rights** to carry out whatever activity they choose **on their own land**, regardless of the consequences to the water resources which flow over or under that land. The will to alter this right of the individual in preference to a national need is not a step readily taken.

### 3.4 LACK OF CATCHMENT MANAGEMENT AND ENVIRONMENTAL PROTECTION

In the northern Pacific the nations with a compact of free association with the USA, such as Guam and Marshall Islands have benefited by having Environmental Protection Agencies established in country together with appropriate legislation. In other nations there is a

distinct **lack of** catchment control and environmental **protection from** such activities as mining, forestry and agricultural **development**.

The impact on water resources in the region is gradually being realised as water ways are polluted and further downstream the reef ecosystems are being threatened. The Melanesian countries are perhaps most at risk from these activities in catchment. Twenty-five logging companies are presently operating in the Solomon Islands, for example, with just a handful of timber control officers attempting to enforce a draft code of practice for logging. Rarotonga in the Cook Islands, which derives much of its water from filter intakes in the upper catchments of the many radial streams on the island, has major erosion problems in catchment mainly from poorly kept roading and ad hoc land development. This erosion contributes to the poor quality of the water supply in terms of sediment load.

Where water sources are derived from a catchment there is often no legislation protecting the area from polluting activities. In Port Vila ground **water protection zones** have been defined for the water supply area but as yet **no legal framework** has been established to enforce this zoning.

### 3.5 LACK OF URGENCY IN THE WATER SECTOR

Despite the push given for the "provision of water and sanitation for all" in the International Drinking Water and Sanitation Decade in the 1980s, there are still **large numbers** in the Pacific, as elsewhere, **without** what could be described as a **safe and adequate water supply**. The UNICEF goal of Health for All by the year 2000 includes goals to provide safe drinking water in the developing countries. Chapter 18 of the Agenda 21, the United Nations Programme of Action suggested that all states could set a target by the year 2000.

To have designed and initiated ..... national action programmes, and to have put in place appropriate institutional structures and legal instruments.

But in the Pacific, as elsewhere, **water** seems to have **lost its interest as an urgent need** both from within country and from ESAs. Other areas of concern such as the trade, the economy, and the environment in general have jumped the queue, disregarding the basic requirements of the water sector. At a recent Logical Framework Workshop on Regional Programming of the 8th EDF Resources, held in Fiji, Water and Sanitation was placed second to last of the many topics requiring funding by the Pacific country delegates attending.

The humanitarian UN goals for Health and Water and Sanitation seem to be forgotten and hidden in the shadow of national economic objectives and more popular environmental considerations.

World Water Day comes and goes in the Pacific almost without mention.

## 4 OPPORTUNITIES

### 4.1 SETTING GOALS

There appears to be no easy way of persuading political leaders to take unpopular actions, such as regulating the use of water on a national scale. **General education of the public** regarding the importance of the resource to the country as a whole and awareness of the importance of having some control over its use may be the only method of rectifying this. This **may take some time**.

There are opportunities, however, in continuing the **promotion of plans and policies** in the water sector. Whilst some plans are little more than coathangers to impress donor agencies and to justify project proposals, those plans and policies which clearly identify priorities and immediate concerns and set out means to achieve the goals in the water sector should be used as examples for those countries without such planning.

Many organisations within the Pacific Island nations have taken a **bottom up approach** and promoted plans, (Master Plans, Sector Strategy and Action Plans), and Policies relating to water, some of which they have persuaded their political leadership to support. These plans and policies are often incomplete but serve as guidelines in which individual project proposals can be formulated.

The need to restore the place of water and sanitation in the priority list for funding can be helped by **drawing the attention** of politicians and other decision makers **to the consequences of poor water supply and sanitation**. The major linkage of water and sanitation with health and economics needs to be highlighted. The effects of poor health in a country on the educational performance and labour productivity of its people needs to be clearly broadcast. We must promote **water and sanitation** as **foundations to the economic growth and social development** that nations seek.

Water related health problems are found in the more remote areas and in the more densely populated areas where hygiene is little practiced or understood and the water is often inadvertently polluted by the community itself. A recent study of diarrhoeal diseases in Kiribati, (Saito,1995), pointed to the inadequate supplies of clean water and poor sanitation as the main contributing factor in the country's very high infant mortality rate. **Attention** should be **refocused on providing water** and sanitation **to the poorer** and larger percentage **sections** of ADB's developing member countries', (DMC), populations.

**Low cost sustainable technology** should be **promoted** to help reach the main goals we have for the water sector in the region within the required time. These technologies can service more people for less and increase dramatically the access to safe water for the rural sector of these countries.

### 4.2 COORDINATION, EVALUATION AND CONSULTATION

"The water and sanitation effort must not be a lonely sectoral undertaking isolated from overall social and economic policy" - James Grant, UNICEF Executive Director.

#### Evaluation and Coordination in the Urban Context

An economic evaluation alone will often demonstrate the **need to provide** a more **efficient** and **cost effective means of supplying water** in bulk. Most Pacific nations have made this evaluation and have considered ways to implement their decision. In basic terms there is a need to strengthen those existing institutions which provide water as a service.

**Privatisation** is one of the options which has been tried and may be extended in the region. The French model of private/public partnership used successfully in the French territories of the South Pacific in New Caledonia and French Polynesia has been adopted by the Vanuatu government. The Port Vila water supply has been running successfully for two years in the hands of the private company, UNELCO.

An alternative is to direct aid towards **strengthening of institutions** such as water or public utility boards, which generally requires some form of **corporatisation** or at least autonomy and economic independence to achieve the same goals as privatisation. Governments may act as a shareholder to whom the organisations are responsible.

Strengthening in both the above cases also involves **coordination with other organisations** involved in the water sector. Water resource investigation in particular should be addressed as a necessary preliminary to water supply and the organisations responsible should be included in the strengthening process. Similarly there is a need to incorporate some control on the quality of the water required. This requires control of the source and of the distributed water. The need therefore is an integrated approach to institutional strengthening, perhaps including strengthening of sections of other Departments, to ensure coordination of all activities involved in the water sector.

AusAID is currently funding the Tonga Water Board Institutional Development Project and the Western Samoa Water Authority is in a similar process with the assistance of the EU, (WSWA National Water Resources Master Plan Study, Stage 1, 1995). Both projects include strengthening of other government Departments related to water supply, and recommendations on source protection and supply monitoring.

The Bureau of Water Resources, (BWR), in PNG has suffered from attachment to four ministries over the last five years with the inevitable loss of resources and identity. An AusAID review of the PNG Department of Environment and Conservation will include BWR.

**Twinning** of a utility with an organisation in a developed country is another alternative. This brings technical expertise to a Pacific island and the opportunity to train in a fully developed and operational water utility overseas. The Solomon Island Water Authority has adopted this method of upgrading its service to Honiara and other urban areas.

One area not easily covered by such an option is the problem of peri-urban settlements, squatter-type groups of housing, which though within reach of the urban distribution system perhaps cannot afford or be supplied by the existing supply.

#### Technical Evaluation of Water Demand

Any rationalisation of water supply will inevitably evaluate the **water demand**. At a technical level opportunities exist to **reduce** the generally high percentage of **“unaccounted for” water** in water supply distribution systems. Leakage control techniques should be promoted to reduce losses. In Guam 44% of the water supplied from 100 wells is lost from the system. 44 wells are producing water which brings no return and ends up with the water returning rapidly back to the hydrological cycle. On Nuku'alofa in Tonga the losses have been reduced to 45%, and in Port Vila to about 30%.

Robert Goodwin, Chief Technical Adviser for the UN programme based in Pohnpei reports that losses in FSM are typically 40-60% and suggests that water utilities in the region should aim at reducing the level to 15%, (Goodwin, 1996).

There are also many techniques available in the area of **demand management**. Perhaps the most effective is **metering and billing** of all consumers in urban areas. There is nearly

always a reduction in water use following the emplacement of an effective billing system. Reductions in the order of 25% in municipal areas have been recorded, (Grisham A and Flemming W,1989). **Pricing policies** based on efficient use with low cost for the low water users and higher costs for those who use much water can also reduce overall consumption by up to 10%. Substantial reductions in use have been recorded in Port Vila where an effective metering, billing and tariff system have been introduced.

**Education of the public** regarding the economic value of water, the need to conserve and the basic necessities such as turning off taps has less effect but should be pursued.

**Water conservation devices** such as dual flush cisterns and self closing taps may also be encouraged where the financial situation allows.

In the **rural situation** demand will be much lower than in the urban areas. Nevertheless a **realistic estimate** of requirements, particularly for potable water should be made. Supply options should be based on these figures.

### Evaluation of the Water Supply

With the information obtained from such consultations and evaluation the **simplest solutions** to water supply should be tried **first**, (Falkland,1993). Such options as conjunctive use of rain water and ground water may be what is required in the atoll situation. The major requirements are for a **financially viable and effective** mechanism for providing water on a sustainable basis.

In the choice of technology water quality should always be a prime concern. The use of **infiltration galleries** on low islands **where the freshwater lens is thin**, for example would be an appropriate technology to ensure that saline intrusion does not occur. Infiltration galleries have been used successfully in places such as the island of Kwajalein in the Marshall Islands and in Bonriki in Tarawa, Kiribati.

Similarly the **location of** a ground water **well away from sources of pollution**, such as septic tanks, latrines or landfill sites is preferred to an option to utilise polluted water and provide disinfection. The UN outer island project in Kiribati locates its hand pumped wells up to 750 metres from a village to avoid contamination. To avoid the long walk to fetch water diaphragm pumps are used which can be located in the village.

Virtually all of Tuvalu is covered with adequate water supplies by the use of rain water tanks for individual houses. Rainwater stored from roof catchments on government buildings is used in cases of emergency and as a backup supply in the capital, Funafuti. The relatively high annual rainfall throughout the country, the willing local labour and materials, in the form of sand and gravel, and good communication at the local level, including the provision of booklets on tank construction and maintenance in the local language, have all contributed to the success of this UN project.

### Consultation and Evaluation in the Rural Context

The requirements of any rural water supply project are that water is supplied at the highest service level a community is willing to pay for, in cash or in kind, that they will benefit from and for which they have the capacity to sustain. To achieve this a high degree of **consultation** at grass roots level is **needed** to ascertain what this service should be. The **essential requirement** is **feedback** from the stakeholders. This feedback should be thorough, realistic and be based on informed choices of the cost and efficiency of any design.

In addition there needs to be an **analytical framework** in which any project is discussed in order to make a proper evaluation of all the options available to any community. Thus the

process must include a **combined consultation and evaluation process** as an essential first step. For this procedures should include using local agents, often local non governmental organisations, (NGOs), able to discourse in the local language, to discuss any project with local leaders, such as chiefs, teachers and church leaders. The proposers of any project also require **full knowledge of the options** available, for example the available technologies for small islands defined in the UNEP/SOPAC book on the subject. Time may be needed for this phase of a project but the long term benefits will outweigh any losses caused by delays in the decision making process.

#### Coordination of all Water-Related Activities

In most Pacific countries there are a number of organisations involved in and responsible for the various aspects of the water sector. Water resources data collection, health aspects, service delivery, environmental constraints and other activities are generally delegated to different government agencies. Up to six or more departments can be involved in the water sector activities of a country, many of whom rarely consult each other.

An immediate means of coordination of all the related activities is to **form a mechanism for meeting regularly**, such as a committee, either by statute or by mutual agreement. These exist in many countries but are not always active, and indeed sometimes only meet when an urgent water related subject needs to be discussed. These committees take various forms such as the statutory Water and Sanitation Committee, (WASCOM), in PNG to the Water Policy Development Committee in Western Samoa.

The universal establishment of such committees, perhaps with statutory obligations to coordinate all water sector activities in country would assist greatly in developing multiple approach projects and would establish the important links between water, sanitation, health and economic and environmental planning.

On a regional scale there is a need, which was voiced clearly at the regional workshop on Pacific Water Sector Planning, Research and Training which was held in Honiara in 1994 for a **regional water and sanitation programme**. This has been established in SOPAC in Suva, Fiji since October, 1994 with funding from the United Nations Development Programme, (UNDP).

This also contributes to the goal of “water for all” within the region, in a variety of ways.

#### Evaluation of Equipment Needs

Many of the organisations responsible for the investigation of the water resources in their country need some backup from outside suppliers or organisations in **maintenance of equipment**. If suppliers are unable to include this in their service it may be possible to use existing hydrological servicing organisations in New Zealand or Australia to provide this service. Quality control is just as important in the Pacific as elsewhere.

To maintain quality control there should be **regular calibration of instruments**, perhaps using the same regional facilities.

Where possible countries should **standardise** their **equipment** to simplify cooperation between the countries of the Pacific. Regional organisations can assist in this standardisation process and can benefit by being able to create training opportunities using such standard equipment.

#### Evaluation of Training Requirements

An attempt has been made to create a **Pacific Drilling Association** with the aim to provide training and accreditation in the region. So far no donor has been found to establish such an organisation. The proposal will be to set up a series of courses annually, perhaps run by the Australian Drilling Industry Training Committee, (ADITC) with the intention of upgrading the drilling capability in the Pacific and accrediting competency by certification.

SOPAC in Fiji has been running an **Earth Science** course for technicians in the Pacific for about 18 years. The course runs for three months each year for three years. From last year, when the Water and Sanitation Programme was attached to SOPAC, a “water” component has been added to this University of the South Pacific, (USP), **certificate course**. This component consists of a two week introductory water course in the first year, an optional 7 week course on Hydrology in the second year and an optional 7 week course in hydrogeology in the third year.

Additionally those students with science backgrounds, recruited into the water organisations in the Pacific often require further training in water related subjects. In general these are not available within the region and they have to go to New Zealand, Australia or further afield to achieve some qualification in their chosen career. SOPAC has provided or arranged for several **scholarships** to pursue graduate or post-graduate studies at various universities for those making a career in the water sector. Many of those who have benefited from the training assistance within SOPAC now hold senior positions within Pacific Island governments.

#### Coordination of Regional and Local Data Collection and Storage

There is a clear **need to record all data** collected relating to water in the Pacific. There is also a need to ensure that the data is stored **safely** and able to be retrieved easily. Depending on the volume of data available this may be done on hard copy or by using simple or complex data management systems on computer.

The essential elements are **security and ease of retrieval**. For this there needs to be a reliable computer programme or recording system and backup facilities. These are relatively simple to establish but require a clear set of procedures to maintain and backup the data. Climatological data is backed up by transfer to other meteorological offices in New Zealand and Australia. Some hydrological data is also transferred to New Zealand, where it may only be retrieved at a cost. There is an opportunity to **establish a regional database** centre in the SOPAC Water and Sanitation Programme. SOPAC has already begun establishing mineral resource database systems for Vanuatu based on Microsoft Access and Mapinfo. This GIS system can easily be adapted to hydrogeological data. Hydrological data, water quality information and water supply and sanitation information can all be stored locally with backup in a regional office for security.

#### Coordination of Research Activities in the Pacific

To address the lack of data in some areas of the water sector several **research projects** were proposed at the Honiara meeting in 1994 on “Pacific Water Sector Planning, Research and Training”. Some of these have been promoted by UNESCO in a pilot project, “Sustainable Small-Island Development Through Integrated Management of Freshwater Resources”. The main aims are to determine the rate of groundwater recharge and contaminant transfer, to record community behaviour in water management and involve communities in project implementation and outcome. In this the SOPAC Water and Sanitation Programme is taking an active part. The first stages are currently underway, with

SOPAC arranging funding for Pacific island participants to use the research projects for training.

Other research activities proposed include optimum roof catchment and storage tank design and prediction of drought periods and other effects in the Pacific using the Southern Oscillation Index during El Nino Southern Oscillation events.

#### Technical Cooperation

Despite the dearth of technically trained personnel in many countries in the Pacific, there are a number of adequately staffed organisations in the region, especially those in the northern Pacific benefiting from their compact of free association with USA, and the French territories in the south Pacific. However cooperation within the region has been minimal in the past and experience has not been shared.

During the last two years there has been a concerted effort by the water utilities to **establish a Pacific Water and Wastewater Association, (PWA)**. A meeting was held last year in Apia, facilitated by the Water and Sanitation Programme in SOPAC of water utility managers to establish such an organisation. A series of resolutions and the establishment of a steering committee has led to a course of action which should see the establishment of the organisation this year and its inaugural annual general meeting in Apia in August subject to sufficient funding. One of the aims of such an organisation is the **sharing of technical expertise** within and from outside the region. The stronger public utilities from the US and French territories and some utilities in Australia have shown an interest in joining. SOPAC's Water and Sanitation Programme also contributes to the sharing of expertise by running a series of **workshops** on selected topics of interest to the region. Last year there were workshops on the New Zealand hydrological software, TIDEDA, and on the UN groundwater software, Ground Water for Windows. This year, as well as a workshop associated with the UNEP book on augmenting freshwater and a meeting of the UNESCO/IHP working group, there will be a workshop in Kiribati in August on "Appropriate and Affordable Sanitation for Small Islands" and also one in Fiji on "Solar Pumping". The programme also distributes **written information** on particular subjects such as a recent report on "Handpumps in the South Pacific".

#### Integration of Environmental Aspects into a Project

It is possible to **incorporate** some form of **environmental assessment** or examination into any water related project. As well as being economically sustainable each project needs to be environmentally sustainable. The ADB is leading the way in this respect with their policy requiring that environmental considerations are integrated into each stage of any project.

As part of its assistance to Kiribati ADB has recently funded Technical Assistance, (TA), to strengthen the Environment Unit in Tarawa.

**Protection of catchments**, especially where they are used for drinking water supply should be **by regulation**. The Watershed Protection and Management Regulations, (1992), of W Samoa could be used by other countries as a guideline. It should be noted that the protection of ecosystems and catchments, often related to in-catchment activities is an end in itself, not always connected with the protection of water as a resource for drinking.

**Zoning regulations** can be included in any Water Law that is proposed. These would follow an Act which requires designated water supply catchments to be protected. The problem of custom land rights might however still be a conflicting problem if not resolved.

### 4.3 DECISION MAKING AND IMPLEMENTATION

These two stages are perhaps the least difficult in the process of achieving the goals set. As an aside, it is surprising that decision making is such a highly paid profession in the modern world, whereas the time consuming and demanding data gathering and analysis process rates much lower in the list for financial rewards.

Implementation of any water project requires competence on the part of those supervising the work. It should be compulsory for any project implementation to **include a training component**, particularly **in** the areas of **operation and maintenance** of the system. It has been an unwritten policy in the Pacific to use opportunities in one country where construction is involved as a means of providing training for participants from other countries. In this way driller training has been promoted, with workshops held in one country attended by participants from other countries, with the permission of the host country. As another example a technician from an NGO in Fiji was funded to go to Tonga to observe how ferrocement tanks were being constructed. The skills learnt are now being used to provide storage in water short outer islands of Fiji.

## 5 INTEGRATION OF ADB'S POLICIES WITH THE OPPORTUNITIES

To summarise the opportunities noted above there is a need to concentrate on establishing clear goals for the water sector. A second necessary process involves initial consultation with stakeholders and coordination of all related organisations with interests related to the water sector, such as health and the environment, and then evaluation of the options.

It is my opinion that these stages need to be carried out in as thorough a manner as possible if the final stages of any water supply project, the decision making and implementation, are going to produce sustainable development.

### The Staged Approach

With regard to **ADB's activities** in the water sector it clearly has advantages in being able to be **involved in all** four of the **stages** of any development in initiation, evaluation, decision making and implementation. The Bank can support the formation of plans, policies and legislation in country. It can use Technical Assistance programmes to consult, evaluate and coordinate in the design of a water project. If the first two stages have been carried out thoroughly, in-country training has been provided and procedures put in place to deal with operation and maintenance costs, ADB can provide the necessary loans to implement any scheme proposed. Thus donor and stakeholder should be satisfied that a process has been followed to ensure sustainability.

Obviously ADB cannot be the only ESA active in the water sector in the Pacific. Coordination of all activities needs dialogue with other donors. The **staged process**, however, should be a **prerequisite** for ADB if it is to be involved in any water development at any stage. In a recent example, a US\$8m Water Supply Project includes major implementation work on upgrading the water supply and wastewater system for a water short high population density area in the Pacific. There appears to be no leak detection or rehabilitation work, or inclusion of bulk metering to monitor the system included in the contract, but evaluation of a ground water lens will be investigated at the same time. This would seem to be an example of decision making before full evaluation. In this instance there is also an example of lack of consultation. An incomplete Sector Strategy and Action Plan for the country involved exists. The final stage "Action Plan" may be completed this year with funding from SOPAC's Water and Sanitation Programme if the government requests this. In addition the water supply for outer islands, where about 40% of the people

live, seems to have been forgotten. This may also serve as an example of the need for coordination in regional activities and to consider the poorer sections of any community.

### Regional Support

If there is any area on the globe which needs support at a regional level it must be the Pacific. The unique setting of small nations with limited economies, small widely dispersed islands within nations and remoteness from each other and the rest of the world has led the nations making up the Pacific to create their own regional organisations, the South Pacific Forum, Forum Fisheries Association, The University of the South Pacific, etc., which can unite their voices and efforts in various areas of interest.

There is a need for **support** for **regional activities** in the water sector. In particular any initiatives to provide regional training, transfer of expertise and other areas such as the establishment of a regional database relating to water, could be encouraged by the Bank. Perhaps the Regional Technical Assistance Programme, (RETA), could be extended for the Pacific to assist with these activities. The Bank's Medium Term Strategic Framework, (1995-1998) has a section on regional cooperation in which it suggests that it can support "specific and prioritised regional cooperation objectives", including capacity building areas.

There is the opportunity in the Pacific to support a regional programme and regional centre in the water sector. The strengths and capacity of such an organisation include :-

Efficiencies in addressing the same issues in several conditions.

Cost effectiveness as a data centre.

Cost effectiveness in providing a capacity which the countries only need to call on occasionally.

Ability to analyse, compare practices, developments.

In aquatic terms it is like having a reservoir to serve many communities rather than each community having its own reservoir complete with quality and maintenance problems. There is an economy of scale.

### Priority Areas

The basic requirement of a safe water supply should be given more prominence in the Pacific region. There is a need to follow the "some for all rather than more for some" approach if the basic right to a safe water supply is going to be achieved. The **priority** therefore should be for governments and donors to focus on the largely forgotten **rural and peri-urban** poor communities in any water resource development programme.

In summary, there are opportunities to make WRDM projects in the Pacific region **equitable, efficient and sustainable**. Some ways of achieving these goals have been outlined in this paper. Projects must be derived from a **community participatory basis** and must be based on **financially and environmentally sustainable** policies. In this way the plans to provide water to the Pacific communities will be achievable. They will not only be completed but will be sustainable.

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Water is a key driver of economic and social development while it also has a basic function in maintaining the integrity of the natural environment. However water is only one of a number of vital natural resources and it is imperative that water issues are not considered in isolation. Enhancing the application of Integrated Water Resources Management in the ESCWA region [ - 646.45 KB] United Nations Economic and Social Commission for Western Asia (UNESCWA). 2004 This overview report introduces the process of Integrated Water Resources Management (IWRM) to senior policy and decision makers with the aim of mobilizing political and decision support to implement IWRM at the basin, national and regional levels. Economic and Social Commission for Asia and the Pacific Ministerial Conference on Environment and Development in Asia and the Pacific. Sixth session. Astana, 27 September-2 October 2010 Item 4 of the provisional agenda In-depth review of critical environment and development challenges and response strategies in Asia and the Pacific. Emerging challenges and trends in water resources management. Note by the secretariat. Summary. The present document reviews the current status of water resources management in the region and identifies the challenges associated with it. The review leads to the ide Since 1967, K-water has been developing and managing the Republic of Korea's water resources, as well as conducting international training programs. With 50 years of experience in water resources development and management, it has become a model water organization in the Asia-Pacific region. The K-water model offers knowledge solutions and best practices that may be adopted by other countries to address their water challenges. This case study is based on the learning materials from the Asian Development Bank's exposure and study visit, Sharing Successful Implementation and Best Practices of Sm Trends in water resource management Irrigation development trends and challenges. v vi xiv. 1 1 3 3 4 6. Assistant Director-General and Regional Representative for Asia and Pacific. FAO. It argues that future investments in agricultural water management should complement other interventions to support rural transformation and poverty reduction programmes. The region is confronted with a double transitional challenge of maintaining rapid economic growth and man-aging natural resources sustainably. Although water scarcity and constraints are threatening a number of livelihood systems in the sub-region, the potential for water development can still benefit a large number of people (about 60 percent of total demand) through irrigation expansion or intensification. Asian Development Bank Asian Water Development Outlook 2013: Measuring water security in Asia and the Pacific. Mandaluyong City, Philippines: Asian Development Bank, 2013. 1. Water security index. Bindu N. Lohani Vice-President for Knowledge Management and Sustainable Development Asian Development Bank. Foreword by the Asia-Pacific Water Forum. Water security in Asia and the Pacific is under threat from many sources: population growth, urbanization, increasing water pollution, the over-abstraction of groundwater, water-related disas-ters, and climate change. Competing demands on water resources for these different uses make integrated water resources management essential to enable provision of secure water services.