FIJI ISLANDS

I. INTRODUCTION

The Fiji Islands comprise of over 300 islands, 109 of which are permanently inhabited. The majority of these islands lie between longitudes 176° 50'E and 178° W and latitudes 16^0 S and 20^0 S. The two main islands, Viti Levu and Vanua Levu support the majority of the total population of 775,077[3] with a sizeable percentage being in the urban centers of Suva (167, 975), Lautoka (43,274), Labasa (24,095) and Nadi (30,884). These islands are predominantly of volcanic origin and rise to an elevation of around 1000m with rivers and streams supporting tropical rainforest on the windward side and extensively cultivated sugarcane farms on the leeward side. All major economic activities, including tourism are based on these two islands. In contrast outer islands vary considerably in both geology and topography from smaller coralline or limestone islands to larger volcanic edifices. They support significant but smaller populations. The total land area of 18 272 km^2 is dispersed in territorial waters of around 141 800 km2. The proportion of land to water is only 13% and is even smaller when compared to the even larger Exclusive Economic Zone.

The climate in Fiji is dominated by the Southeast trade winds and this together with topography controls the distribution of rainfall on the islands. Average annual precipitation over the Fiji Group ranges from 1500mm on the smaller islands to over 4000 mm on the larger islands. Topographic effects mean however that much of this falls within the windward side of the islands. The principal influences on this seasonal rainfall pattern are tropical disturbances and cyclones and the El-Nino Southern Oscillation effects intensify these effects.

The wet season from November to April is also the tropical cyclone season. Up to 80% of the annual total rainfall falls during this period. Tropical disturbances, cyclones and high intensity rainfall are frequent causing floods ranging in magnitude from moderate to very severe. The problems associated with floods and droughts are discussed later in this report.

As little as 20% of the annual rainfall falls during the dry season (May to October) and is non-homogeneously distributed over time and space. Drought conditions are exacerbated during El-Nino episodes, which lead to considerable difficulties for all sectors of the economy. Decline in agricultural production threatens food security, and poses severe health problems, whilst errant rainfall patterns disrupt hydroelectric power generation on Viti Levu. These are some of the more visible impacts of water shortage over these periods.

All urban centers within Fiji have reticulated water supply systems that are metered and many have wastewater treatment facilities. Over 70% of the population has access to treated, metered reticulated water supply although continuity of supply is perhaps not ideal and maybe in question, particularly in the drier months. This high percentage is achieved because of the concentration of the population in the urban settlements and with urban corridors such as between Lautoka-Nadi and Nausori-Suva. The situation in the rural areas and settlements is different with options of having their own supplies through subsidized small rural surface or borehole schemes. The smaller islands support significant but much smaller populations and have variable water resources relying on conjunctive use of roof catchments, minor streams and boreholes for supply.

Rapid urbanization (from 37% in 1976 to 47% in 1996) together with increases in requirements for industry and the tourism sector has led to demand often outstripping supply. This in turn has led to frequent interruptions in supply or in many places long periods with no supply. Just over 90% of the urban population[4] is reputed to have access to clean piped water supply, in terms of reliable supply the much less. Government's immediate to medium term strategy is to improve infrastructure such that it does not become a major impediment to economic growth in the future and adversely affect health.

There has been a concerted effort at the development of Master Plans to address key areas needing additional resources but implementation is capital intensive and requires significant levels of funding. Whilst these plans are being considered for loan funding one major constraint not significantly being addressed is the question of cost recovery, the cost to consumer for water being low compared to the region[5]. Government's commitment to deliver water for all and to maintain current cost structure means therefore the developing of better efficiencies and reducing wastage.

[3] Population figures imputed from 1996 census figures

[4] 1996 Census

[5] add comparative data for water costs in a table (if available)

Development of water resources management strategies within Government are thwarted by a lack of clear comprehensive legislation encompassing water compounded by the number of agencies that deal with water related matters at one level or another. These comprise the Ministry the Works, the Ministry of Lands & Mineral Resources, Health, Regional Development, Department Land Use and Planning, Agriculture and Irrigation not including various NGO's.

Several good attempts have been made in the past to develop coordination between agencies and consider development of appropriate legislation. These have often bogged down in beaurocracy. The new vision for sustainable development of this valuable natural resource depends on the development of strong political will which is related to highly sensitive land issues.

II. THE NATIONAL CONSULTATION PROCESS

The development of this paper and the process towards this consultative meeting exemplifies clearly the basic problems with coordination of various agencies related to water management in Fiji. The Directorate of Water and Sewerage (DWS) of Public Works Department plays a major role in water and wastewater services. Hence a first draft of the country briefing paper was prepared and circulated with a formal invitation to Mineral Resources Department, Drainage and Irrigation of the Ministry of Agriculture, National Planning and Ministry of Health for input in a consultative meeting. The meeting took place in with seven participants. Amendments, additional inputs and editing of the original draft were requested with final text being finalized as a joint effort. The representatives agreed that this group in future would constitute a core committee to look at development of future strategies with regard to water resource management in Fiji.

Fiji has embarked on a major exercise to develop a new strategic development plan (SDP) for the medium term and to be adopted at a planned economic summit later in 2002. Whilst water is represented, it is not so as an independent sector in itself but through the various agencies that deal with it in one way or another, i.e. Infrastructure (water supplies), Groundwater (with Mineral Resources) etc. The development of the SDP has however been through a wider consultative progress involving both the private sector and others with broader interests.

Similar difficulties have been raised during earlier attempts to arrange coordinated meetings and this "initial step or hurdle" needs to be overcome for real progress to be made. The present Government is attempting to address these issues but within the general funding and staffing constraints and this is an area that could be assisted through aid inputs as this is seen as a general area of concern for other countries besides Fiji.

III VISION, ISSUES AND CONSTRAINTS

Government's vision is 'to provide safe, adequate and affordable water and wastewater services for the total population of Fiji while equitably meeting the needs of all other users (food production, environment maintenance, energy generation) in a sustainable manner'.

Although Fiji is blessed with plentiful supply of fresh water with high annual rainfall, the spatial and temporal distribution causes frequent shortage and excesses (droughts and floods). The collection, treatment and reticulation of potable water during these events can be, and has been a financial burden. For example during droughts cartage of emergency water supplies to remote locations and outlying small islands is a necessary burden. During the last two decades the four ENSO related droughts (1982/83, 1986/87, 1992/93, 1997/98) the cost of emergency water supply was in the order of a million dollars or more per event. Significant costs are also incurred annually in the cartage of water due to inadequate infrastructure and during the more normal May to October dry season.

Fiji is also a collection of islands of various geological types, size and topography, each of these factors influencing the availability of water resources. In fact one could assume and quite correctly so that water is perhaps a major constraint to sustained habitation of the outlying islands and the reason why only a 100 or so out of the 300 islands have permanent populations.

Extreme rainfall deficiency during the dry season is invariably linked to El-Nino Southern Oscillation climate phenomena. Droughts are slow onset and their severity is difficult to predict. Public participation in putting in place preparedness and adaptation measure is difficult, as there is a large degree of uncertainty. One rainstorm may alleviate all the water shortage in a matter of a day or even hours. Past experience, particularly with the 1997/98 drought, demonstrate the need for early decisive action at the earliest onset of

drought to minimize the losses and maximize the use of available water resources. This requires the development of public education and information dissemination mechanisms.

Whilst government's vision and action plans with regard to water relate principally to the provision of adequate, reliable and safe supply, it falls short of addressing water and water use in a holistic and integrated fashion considering the multitude of water use from agriculture, commercial irrigation, bottled or "mineral water", energy and environmental considerations and the differing sources. Assessment of water resource be it ground or surface water often has far less and actually annually decreasing budgets, the bulk going to the development of infrastructure and supply.

III.1 Water Resources Management

The Director of Water and Sewerage (DWS) in the Public Works Department has the overall responsibility for Fiji's Water supply and Sewerage services. He is responsible for the design and planning of water supplies and sewerage. The hydrology section under the guidance of the DWS provides hydrological information related to surface water for Fiji. The Mineral Resources Department (Ministry for Lands & Mineral Resources) assists in the planning, assessment and development of ground water resources. Other Ministries involved in the water sector include the Ministries of Fijian Affairs and Regional Development, Ministry of Health and the Ministry of Primary Industries. In many ways these pieces of legislation impact through either ownership of rivers, riverbanks, land, or dams. This wide involvement sometimes leads to lack of co-ordination of development projects.

Legislation relating to water resources in Fiji are outdated, but has served well to date largely because of the non-competitive environment and generally plentiful supply. The Water Supply Act, Rivers and Streams Act, Native Lands Act, Crown Acquisition of Lands Act, The Electricity Act and the Agricultural Landlord and Tenants Act are some of the laws in question. Groundwater is however presently not covered under any specific legislation. Commercial use of water and competition for resources, conflicting use of rivers and other sources, impacts of upstream industries, catchments areas and landowner demands are however on the increase and it is readily becoming apparent that current legislative instruments are in urgent need of revision.

A case in point is the commercial use of water for sale as bottled "mineral water", where industry has sought a protection zone for the protection of an aquifer and objected to similar or other industries upstream. For such an industry protection of "source" is a critical factor to long-term sustainability. Another recent case involves approvals or conditional approvals by one authority of poultry breeder farms adjacent to boreholes used for public supply. Pressures on available land as populations grow or shift will bring into focus other similar constraints that require a well thought management strategy backed by complementing legislation.

The Public Works Department operates and maintains 13 regional, city or town water supply systems which have full treatment with water quality is generally equal to or better than those prescribed by WHO Guidelines. A total of around 170 000 cubic meters per day is produced serving approximately 610 000 people. An additional 19 smaller metered schemes produce 15 000 cubic meters per day and serve 49,000 people. A large proportion of water is drawn from surface water sources whereas a small fraction of Fiji's reticulated supply comes from ground water. However, the situation is changing rapidly as knowledge of groundwater resources grows and ground water is beginning to be regarded, when appropriate, as a viable option. The advantage of gravity flow system is the economics. Costs of electricity or fuel for pumping groundwater can be substantial. However increased agricultural and other use has meant that leases for catchments areas attract premium rates and main rivers are often polluted and the trend over recent years has been for settlements, villages and communities to consider groundwater in conjunction with roof catchments as a viable alternative.

In rural locations, particularly on small islands, ground water is used conjunctively with roof catchments and surface or stream sources. A majority of these supplies are managed and maintained by the local community and on larger islands this is often with assistance from the Public Works Department (Rotuma, Vanua Balavu, Ovalau). Since 1965 Government has helped in providing basic water supplies in rural and island areas through subsidized self-help schemes under which government meets two-thirds of the cost of projects. Similar schemes termed the borehole subsidy schemes assist in the drilling of boreholes in rural areas. Tests on water from some of these systems indicate contamination of drinking water from human and animal activities or from over pumping. Measures such as fencing off the area around the well, covering sources, replacing open water holes with properly constructed and lined wells, installing hand and solar pumps instead of using unclean buckets and relocation of latrines and animal pens from near sources will help reduce contamination.

Significant educational and awareness programs are needed particularly in smaller rural, village and semi urban communities to develop a conservation attitude with regard to water. The fact that water is a diminishable and pollutable resource needs to be stressed together with the need to develop low cost solutions. Wells on many small islands have been found to be contaminated with feacal colliform[6] and due principally to a lack of sanitation, habits and awareness. There is an "aid recipient" mentality on the part of some where high-tech solutions such as boreholes are sought for where simpler solutions such as conjunctive use of water from a number of sources needs to be readvocated, with simpler, more sustainable solutions.

With an increase in population, urbanization and industrial growth there are increased demands for adequate quantity and quality of water. Current sources will have to be developed further or new ones established to cater for the growing demand and regional master plans have been developed for all populated centers. Much hydrological, hydro-geological and meteorological data will be needed and utilized for these larger capital-intensive regional schemes.

Whilst still in its infancy, water for use in agriculture could play an important role in the drier parts of the main islands and lead to better and year round crop yields. Groundwater as well as surplus surface water could be used with significant improvements in crop yield.

III. 2 Island Vulnerability

Fiji's geographic location, its geological and physiographic characteristics together with the size of the islands and its oceanic environment results in various hydrological regimes. High annual, inter-annual and seasonal variation of rainfall makes Fiji particularly vulnerable to floods and droughts. Cyclonic storms produce damaging winds and extremely high rainfall. Up to 1000mm of rainfall has been recorded over 24 hours in cyclonic storms. Disruption to support infrastructure such as communication and electricity is common.

The three most recent droughts (1982/83, 1986/87 and 1992/3) associated with the ocean-atmosphere coupled climate phenomena were of increasing intensity. Intensity of floods displays a similar trend.

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Climate change will have the most adverse impact in the small island states especially the poor within the developing countries are the most vulnerable with the least ability to cope. The third Assessment report of IPCC indicates that anthropogenic influences will change the earth's climate system and:

The earth has warmed 0.6 +/- 0.2^{o}C with the last two decades being the warmest of the last century. Precipitation patterns have changed with some areas becoming wetter and others drier accompanied by heavy precipitation in some regions The magnitude, frequency and persistence of ENSO phenomena appears to have increased in the last few decades Sea level has risen 10 to 20 cm since 1900 (polar glaciers are retreating and arctic ice thickness has decreased Bird migration patterns have changed, birds are laying their eggs earlier, growing season in Europe has lengthened by 11 days during the last 30 – 40 years and there is pole ward migration of plants and insects. Economic losses due to extreme weather events have increased substantially in recent decades.

These are authoritative estimates. Social and economic systems must be robust to withstand meteorological and hydrological extremes and be resilient for not only rapid recovery following disasters but rapid adaptation in the event of climate change induced impacts. Shortage of water for hydropower generation and crop production during the recent droughts is an indication of Fiji's vulnerability.

Fiji National Disaster Management Council has disaster management and contingency plans in place to combat against such events. Strategies are in place for preparedness and mitigation measures. It is likely that with climate change the intensity, if not the frequency, of disaster events will increase.

[6] Islands off northern Vanua Levu, data available on request from Mineral Resources Department

The recent strengthening of the office of the NDMO and its elevation to a full departmental status within the Ministry of Regional Development augurs well for a more systematic approach to disasters and disaster risk management.

III.3 Awareness & Consulations

Government's policy on water resources management reflects its commitment to sustainable development and a growing awareness to the increasing population and its consequent demands for a better lifestyle, health and environment. This has been the basis for the development of master plans for water resources development. These plans have been developed to meet the medium and long-term needs with both the community and the environment in mind. Where possible satisfactory arrangements with stakeholders are negotiated viz. land, easements, catchment areas, and location of storage facilities.

Development of irrigation schemes and hydropower generation systems follow similar procedures – where consultation with all stakeholders takes place well before any works are carried out. By legislation an environment impact assessment (EIA) has to be carried out. The EIA report highlights any deficiencies and or weakness, which are addressed before the project is approved. In this process all stakeholders become involved well before the project is undertaken. It is a prerequisite for project development and governed by legislation.

Although changes are emerging, social and cultural sensitivities discourage females from taking up engineering and related professions in the Pacific Islands and Fiji is not an exception. However during the development consultation process and EIA all concerned stakeholders are consulted.

In the area of water conservation, sanitation in matters related to safe use, storage and disposal of wastewater significantly more can be done by Government in raising the level of awareness within the general public, and particularly villages and settlements, both on the mainland and small islands. A general cursory look at many villages shows lack of use of much of the available roof space for water catchment, and facilities are in poor state of repair. This awareness and education would require coordination of efforts between the Ministries of Health, the Department of water & sewerage and NGO's.

III.4 Technology

Reticulated water supply in Fiji has full treatment with pH correction, flocculation, sedimentation, filtration and chlorine is added for disinfecting. Where possible and economically viable gravity supply system as opposed to pumping is preferred. Water from all urban water supply systems is routinely analyzed for quality (pH, residual chlorine, and colliform) every month.

Wastewater and sewerage (urban) is treated before being discharged. Low energy waste treatment lagoons are preferred to high-energy mechanically driven aeration treatment where possible. Availability of economically suitable land for this type of waste treatment facilities in urban centers is restrictive. Treated waste discharge is routinely analyzed for quality by the national water quality laboratory to monitor satisfactory standards in accordance with accepted international guidelines.

Although Fiji has advanced access to technology they are not necessarily applicable, as supplies and support is invariably from abroad and in many cases it can be economically restrictive.

Simple technology that balance modernity, economy, robustness and suitability for Pacific Island environment is needed, to this end home grown as opposed to imported high tech equipment is desirable.

For irrigation and hydropower runoff the river systems are preferred however because of seasonal deficiencies in many cases capital-intensive storage reservoirs are the only option.

III.5 Institutional Arrangements

Responsibility for water resources development and management is vested in a number of government ministries and statutory authorities, each with specific interest. There are procedures for areas of common interest but these are at the project implementation and not at policy level. The need of a comprehensive national policy or strategy for better management of water resources crops up time and again.

The Director of Water and Sewerage of the Public Works Department (PWD) has over all responsibility for Fiji's water supply and sewerage services. The Land and Water Resources Management Division of the Ministry of Agriculture has responsibility for river engineering, irrigation and drainage works. Their operation includes the protection of coastal agricultural land from saline intrusion and river engineering for flood protection. Flood forecasting has been the traditional responsibility of the hydrology section of PWD. The Fiji Electricity Authority a government corporate body operates commercial hydroelectricity generation schemes, while development of small rural hydropower schemes are undertaken by the Department of Energy. The Mineral Resources Department carries out groundwater assessment and development. It has a policy mandate for work in this area and posses physical capability but has no legislative backup to develop formal regulations and policies with regard to resource development, management and environmental control.

The need for an apex water authority to evaluate priorities, solve conflicts or issue licenses is gradually emerging. The need for some workable institutional arrangements endowed with resources and an appropriate legislative instrument is required to address these new issues.

The last major attempt to draw up comprehensive water legislation was under the auspices of FAO with an initial report concluded in 1975 and a substantial discussion paper in 1987. An attempt to put in place legislation drawn by Prof. Clarke failed to get the required the approval of the Great Council of Chiefs. Little has been done since to improve legislation or coordination mechanisms. As of 2001 there is Cabinet approval to set up a committee to draw up a Strategic Water Resource Management Plan, which would involve the setting up of an authoritative regulatory body to take care of licensing and related matters. However there are a number of contentious and conflicting social, cultural and economic issues e.g. royalty payments, land issues. This committee has however only met once and realised immediately that the problem of water management. Attempts are being made to urgently revive the process and even with external assistance.

Another critical area of concern within both water development and assessment areas is the lack of skilled professional staff, be they engineers, hydrologists or hydrogeologists. In many cases donor assistance has been required to get expert help to design and implement works. Whilst this has helped considerably, this assistance without a balanced institutional capacity development in government will not lead to sustainable capabilities.

III. 6 Finance

Current government is committed to improving the efficiency of water and wastewater services and the option of introducing a commercial oriented entity has not been ruled out.

The Fiji Public Works Department supplies potable water to over 80% of the population in Fiji. This high percentage is achieved only because of the high proportion of the population in the urban settlements. As indicated earlier rural and small island settlers have options of having their own supplies through subsidized small rural, surface or borehole schemes.

For the period 1991 – 2001, Government spent $11.2m to subsidize 741 rural self-help schemes and around $2.8m on 2535 bore hole subsidy schemes with no returns to Government. Since the inception of the scheme in 1965 some 2200 such self–help schemes and around 2600 bore hole schemes have been completed in an effort to meet the water demands.

The last four years has seen significant increases in capital investment by Government in water supply and wastewater management ($F 12 million in 1996, $22M in 1999 and $22 Million in 2000), whilst revenue has been around $F10 million per annum. This shows significant income/revenue discrepancies.

With the current global trend of reducing Government expenditure and users pay for services rendered there is a need to consider the charging of economic prices for water if only to enable a sustainable maintenance and operational capacity.

The argument that water is available free from nature does not hold when it has to be processed or treated and transported to the users. The cost for operation and maintenance of these facilities must be met and ideally the system of user pays makes economic and logical sense.

Water and Sewerage charges are levied in Fiji at the following rates: -

Domestic Water Supply	
0 – 50 units	$0.153 per unit
50 – 100units	$0.439 per unit
Over 100units	$0.838 per unit
Commercial	$0.529 per unit
Special Reading	$9.88 each
Reconnection fees	$10.00 each
Meter Testing Fees	$12.74 each
New Connection Fees	
Domestic	$21.95 each
Commercial	$100.98
Sewerage	
Domestic	$0.200 per unit
Commercial	Assessed Individually

It is worthy to note that the last increase in water rates with the exception of the introduction of VAT in 1992 was in 1984. With two changes in government VAT was removed and replaced. Had the charges for water rates kept up with the rate of annual inflation the current price of water would be much higher. Charges for government's use would also be necessary, currently government institutions do not have to pay for water use. To recover operation and maintenance costs and costs for future commitments water charges would have to be doubled.

It follows logically that if operation and maintenance (O&M) costs are not met research and development (R&D) cannot be undertaken as desirable or even required. The very basis of R&D is for improvement in the services and development of new and efficient techniques.

Substantial government investment in infrastructure for irrigation and crop production has been made. There are over 3,000 ha of rice land with irrigation facilities to improve rice production. Three reservoirs with storage capacities ranging from one to three million cubic metres, and several run off the river systems are used for double cropping of rice. Rice production remains low and well below half of the national demands. There are potential to expand the systems for increased production. Cost recovery for water use are levied at $20 to $40 per ha and this does not meet even the maintenance and operation costs let alone the capital investments.

In addition 1000 ha of land is under various types of irrigation for the production of crops, other than rice for local and export markets. Most of these are pumped sprinkler systems using surface and unconfined ground water sources. No charges for water are levied. The infrastructure in the form of pumps and piping installed by government, once commissioned and operational is taken over by farmers. Operation and maintenance of the system is the responsibility of the users.

IV PLAN OF ACTION

Government has initiated various activities including the hiring of consultants and bilateral aid sources to provide assistance with issues related to water supply for a number of decades. These include areas related to: - legislation, flood forecasting dredging, irrigation and watershed management, groundwater assessment, water supply master plans and so forth. Each of these arose out of necessity after for example floods and droughts. However follow up mechanisms have in most cases been weak and many of these have failed to meet the recommendations.

Resource Management

The more pressing and politically sensitive of the issues, the provision of adequate water supplies has advanced perhaps the most in recent years. Shortage of water supply is bad political news and has to be addressed. In the recent past almost all political parties have had the "provision of adequate water for all" in the election manifesto's, and this a welcome sign as it shows a growing awareness in the community for the

need for adequate supply as a minimum. Master Plans have been developed for improvement and expansion of water supply systems in all urban centers in Fiji. This expansion will also provide an opportunity for inclusion of rural dwellers to reliable regional, city or town supply systems.

These master plans take into account projections of population increases, industrial development and other demands that are likely to arise. Vigilant monitoring of wastage is already in place, more so in urban areas and needs to be extended countrywide. It is envisaged that the current high losses from reticulation systems can and will be reduced to acceptable levels in the foreseeable future. The situation is however more critical in the drier side of the islands and on the smaller islands where groundwater is utilized. Aquifer protection systems and concepts are new or non-existent.

The major constraint for implementation of many of these master plans is adequate capital; capital costs in the sector as we all know are high. Much of the current problems with reticulation are the result of failures to monitor and maintain systems, the principal constraint being perhaps again the lack of adequate funding coupled with need for better planning. The availability of skilled professionals perhaps comes a close second followed by development and implementation of policies and regulations to conserve water, protect sources and aquifers, and develop the concept of water as a vital and fragile resource.

It is clear that there are multiple agencies involved in the water sector and co-ordination amongst these agencies is necessary although difficult. The recent setting up of a committee to draw a Strategic Water Resources Management Plan (SWMP) for Fiji is a step in the right direction. It is envisaged that the SWMP will address current issues, and provide guidelines relating to sustainable water resources planning and management. Although there is a nucleus of interested people it requires empowerment and much guidance.

Much can be learnt from lessons in other countries and regional and international cooperation in these areas, including sourcing of funding for implementation, policy development, training and just plain sharing ideas would be welcome.

Vulnerability

Significant regional partnerships to consider the vulnerability of islands to aspects of climate change already exist and coordinated by agencies such as SPREP, SOPAC amongst others. Considering the significant differences in island type and size, the scale of the problem itself also differs. The most vulnerable are the rural and small island communities.

There are major changes in the organization of the central Disaster Management agency and these will bring significant improved levels of coordination in the near future. The adoption of the Comprehensive Hazard and Risk Management strategy (or CHARM) promoted by SOPAC and especially the concept of Risk Management when applied fully can have significant impacts on early assessing and identifying of risks.

Coordinated input rather then complicated research is needed once again between the various agencies first to identify situations like drought or ENSO events and provide both comfort as well early warning to communities and nationally develop mitigation measures.

Awareness

As stated throughout the paper for much of Fiji there is at most times an ample supply of water. The supply rates are also relatively cheap. Screams of water shortage bring on somewhat of a response from Government, the development of supplies or carted water. Hence there is somewhat of a complacency come aspects such as good water management, conservation and in borehole schemes concepts such as over pumping, and salination.

Events such as World Water Day, high-level advocacy, churches and involvement of NGO's working in areas of health and sanitation are effective means of bringing conservation and environmental concepts to the public. They can also serve as means to foster appropriate technology, conjunctive use of roof catchments, wells and boreholes and prevention of aquifer pollution.

Institutional arrangements

There is need for a national policy with regard to water in due recognition of its place as a basic necessity for all people. Water management is presently fractured with various institutions looking after specific uses of water from irrigation, water supply, energy etc. The need for one overarching legislation to do with all aspects in a coordinated fashion has been known for some time. Legislation for the abstraction and management of groundwater does not exist.

There have been recent new initiatives to develop a coordinated approach. This second renewed attempt needs much guidance and technical input to first initiate discussions on a national level with regard to water, develop guidelines and consider the development of a National Policy on Water as a basis towards moving into the formulation of legislation. This will take much effort and political will.

There is need to develop sustainable local capacity and capability within many of the water related institutions, and this lack has been a major constraint to orderly and sustained levels of development in the water sector. This is an area where many developments agencies and aid donors to the country could consider as part and parcel of project aid – an inbuilt capacity building component with the assistance of organizations like SOPAC or the USP.

Finance

Water rates are comparatively low in Fiji and the low capital returns from reticulated supply mean that funding of water supply is one way. An adequate cost recovery component, however unpalatable needs to be established both to adequately self-finance aspects such as maintenance and expansion of systems and the concept of conservation. Such proposals are not new and have been mooted several times in the recent 3 years.

Adequate finance, or sufficient and consistent annual level of funding has been stated as one requirement to ensure that master plans do get implemented and reviewed and that there is sufficient for operational maintenance.

Aid agencies, financing agencies, donors and regional consultative forums such a Forum Secretariat, SPREP, SOPAC, SPC could act as coordinating groups and assist in practical ways to develop more sustainable schemes.

Theme	**Action Needed**
Water Resource Management	Advocacy to place water as a No 1 development priority – translate political rhetoric into action. Develop equal emphasis on resource assessment and supply. Adopt monitoring and follow up on all capital project implementation and place equal emphasis on maintenance and capital work.
Vulnerability	Address vulnerability to risk through use of CHARM concepts Strengthen NDMO and linkages Advocate information access to people that is understandable by all and so allows preparation to mitigate against climatic variability at all levels (farmers to citizens)
Awareness Technology	Need for education, public awareness with regard to conservation of resource – water is a finite resource Advocate conjunctive use of water, catchment protection and environmental safeguards – water is everyone's business Advocate and implement appropriate and cost-effective solutions Consider active training of staff and community people involved in the water sector, especially the technical support

Institutional Arrangements	Need to develop holistic, National Water Policies as a lead up to legislation Advocate at regional forums for development of a regional freshwater policy as a lead up to develop National ones Develop active coordinating mechanisms and force active involvement of central agencies.
Finance	Advocate Capacity building in all major capital projects and a percentage of funds for maintenance. Prioritise master plans and actively seek funding for capital development and maintenance

V. CONCLUSION

Fiji's water resources require orderly and planned development for which adequate good quality data is required for the intended purposes (water supply, irrigation, hydropower development, wastewater and waste disposal). The infrastructure currently in place needs upgrading and improvement to meet the expanding demands. Sustainable use of the limited water resources will inevitably be linked and required due to the impact of climate. Every effort will have to be made to mitigate against the negative impact and take advantage where possible. Adaptation strategies need to be developed where mitigation is not possible.

Some of the answers to Fiji's water, wastewater and hydrological are:

- Develop sufficient levels of funding for the required development and levels of services. Additional funding including aid needs to be sought with urgency.
- Increased attention is required in the operation and maintenance of water supply and sewerage systems for increased reliability and efficiency
- Vigilant hydrological and geo hydrological monitoring with an active national water resources assessment policy for planning and management. Water resources data for all purposes viz. water supply, irrigation, and drainage, flood control, river engineering, and waste disposal.
- Standardize rural water supply design and construction, centralize it's administration and train local villagers to operate and maintain their own schemes.
- Ensure environmental issues are adequately investigated and suitably resolved.
- Establish a workable catchment protection policy based on sound watershed management practice with effective policing and monitoring.
- Ensure activities in catchments such as logging and cultivation are organized, planned and carried out with best practices.
- Draw up and enact appropriate and practical legislation in consultation with relevant stakeholders.
- Cooperate with regional and international organizations to take advantage of relevant information such as the impact of climate and severe weather events. Shift of attitude from a society that learns from mistakes to one that learns not to make mistakes.
- Above all and foremost set programmes for intensive training for engineers, hydrologists, hydrogeologists, technicians and community stakeholders to build endogenous capacity and self-reliance.

Demand management for water resources be it for irrigation, water supply or hydropower may have to be given higher priority particularly in view of the climate change impact assessed by the authoritative IPCC.

An intensive programme on accurate monitoring of all the activities is vital for guidance and further action.