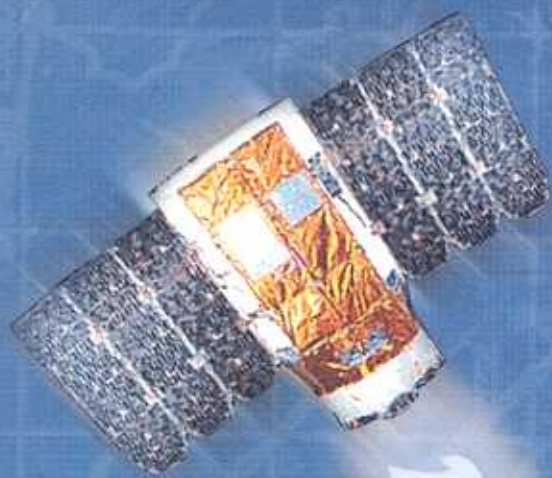


**SOPAC**  
Annual Report  
*Summary*



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I can say "It was a hell of a year, and I think just about everyone who lives or works in the Pacific will know what I'm talking about."

Those of us based in Suva, and our colleagues in Honiara could have well done without the civil and political unrest that marked most of 2000. If indeed there was an underlying "just cause," behind all the strife and unrest then it was lost in the hardship caused to people of both countries and the region.



The final and total cost is yet uncalculated. The physical and mental debt may never be paid. But even worse, the lessons may never be learnt and unfortunately events may be destined to repeat themselves. We had a problem many times larger than all of SOPAC's challenges, and needing a solution far greater than this Foreword can ever address.

During the height of the unrest in Suva, the Secretariat, when open, was operating with about four hours a day of supplied power. If the power was available in the evenings then that was when the staff came in to work. Some staff relocated to safer regions and some left permanently. I highlight these few issues, lest we forget the hardship faced by those who stayed. I would like to place on record my gratitude to all the staff that continued to work through those trying times.

So back to reality, SOPAC and the year that was.

I have said before that if this Annual Report Summary is the only SOPAC publication you read then it should give you an insight into what we're about and an overview of what we're doing. Every year we've changed the focus and the content in response to feedback from our members. This year is no exception.

I think you will find the reporting far more comprehensive and some might say we present too much for a summary report. A new innovation is the inclusion of personality stories. The stories are about real people in the Secretariat, and often focus on their personal opinion or a pet project.

SOPAC's work is all about making a difference to the lives of the people we are here to serve. Maybe next year this Report might incorporate some of your views and opinions. Why not? This organisation is yours, it works for you and needs to have your say in whether we are indeed addressing your needs.

Finally, if you see improvements in this Report then it's due to the hard work and vision of Kim Gravelle who dedicated many hours towards the production of this year's Annual Report Summary.

A handwritten signature in black ink, appearing to be "Alf Simpson".

Alf Simpson  
Director

April 2001





### **What is SOPAC?**

SOPAC is the South Pacific Applied Geoscience Commission. It is an inter-governmental, regional organisation dedicated to providing services to promote sustainable development in the countries it serves. SOPAC's work is carried out through its Secretariat, based in Suva. The work program is reviewed annually by the Governing Council assisted by: Secretariat representatives (SOPAC), a Technical Advisory Group (TAG), and a Science, Technology and Resources Network (STAR).

### **What does SOPAC do?**

SOPAC's work focuses on providing assistance to its member countries in three key areas: minerals, water and energy resource identification, promotion, and development; environmental geoscience issues; and human resource development in the geoscience field and disaster management. To effectively provide these services SOPAC maintains an information technology unit, provides publication and library services, and offers technical and field services for specific project work.

### **Who benefits from SOPAC?**

Member countries are Australia, Cook Islands, Federated States of Micronesia, Fiji Islands, Guam, Kiribati, Marshall Islands, Nauru, New Zealand, Niue, Papua New Guinea, Samoa, Solomon Islands, Kingdom of Tonga, Tuvalu, and Vanuatu. French Polynesia and New Caledonia are associate members. Any island member country can request assistance from SOPAC.

Benefits accrue to island member countries directly through the provision of basic geological knowledge. And indirectly, through improvements in land and ocean use, leading to improved health through water and sanitation provision, wealth generation through the development of mineral resources, hazard and disaster management and more sustainable development by taking into account the geo-environmental impacts of developments.

### **Who pays for SOPAC?**

SOPAC is funded by member-country contributions and supported by the following donors: Australia, Fiji Islands, Canada, France, Japan, Korea, New Zealand, People's Republic of China, Taiwan, the United Kingdom, the USAID/GII, the Commonwealth Secretariat, the European Union, and the UN family. Where donors have provided assistance for specific activities in the work program, either at the regional or country level, this is acknowledged in this Annual Report Summary.



# Resource Development Program

## Mineral Resources

**T**he Mineral Resources Unit (MRU) performs its role of promoting the sustainable development and management of terrestrial and marine mineral resources in the SOPAC member countries by providing technical and policy support to the national governments. MRU's interventions range from conducting resource assessments in the field to providing advisory support to develop national policies and legislation.

Many of the SOPAC member countries are richly endowed with mineral deposits on land and in their Exclusive Economic Zones (EEZs). Some of the world's largest copper deposits (Bougainville copper mine in Papua New Guinea [PNG] and Namosi Prospect in Fiji), gold (Lihir in PNG and Gold Ridge in Solomon Islands), nickel (Koniambo in New Caledonia and Isabel

Prospect in Solomon Islands) and manganese nodules (in EEZ of Cook Island). The revenue from mineral development contributes substantially to the Gross National Product of countries such as PNG, Solomon Islands and Fiji. Though the mineral sector occupies a key position in the economic fortunes of these countries; the limited skill base, poorly developed infrastructure, and high dependence on imported technology and capital constrain their ability to be self-reliant in this field. SOPAC strived to support the member countries through the focussed interventions of the MRU.

Given the fact that the 16 island member countries of SOPAC occupy 560,000 square kilometres



of land in an open space of 26 million square kilometres, marine mineral development has emerged as a fundamental area of focus.

SOPAC has developed marine mineral databases for manganese nodules, cobalt-rich crusts, metalliferous sediments and hydrothermal deposits and publishes regional summary maps regularly.

The Metal Mining Agency of Japan (MMAJ) donated a computer that has been installed in MRU to house the regional marine mineral database.

### THE MADANG GUIDELINES

In February 1999, at the request of the Government of Papua New Guinea (PNG), SOPAC organised an international offshore mineral policy workshop. It was held in conjunction with the Metal Mining Agency of Japan (MMAJ) and the Forum Secretariat and fielded a strong bench of international experts representing all facets of offshore mineral development. The outcomes are now known as the 'Madang Guidelines'. These guidelines on offshore mineral policy are set to become global in their application.

Jackson Lum, Head of SOPAC's Mineral Resources Unit says, "in fact, one of the frontier areas of SOPAC's work in recent years has been the development of offshore mining policies for member countries. This was triggered by these countries facing the onerous task of administering offshore development under the provisions of terrestrial mining legislation, which was proving to be hopelessly inadequate. SOPAC has maintained the view that member countries with offshore mineral resources should establish the legislative framework before opening up the sector for development by private investors. Interestingly, the Madang Workshop was a fallout of the request for an offshore exploration licence submitted to the Government of PNG by a mineral exploration company."

"The Madang Guidelines call for sustainability, proven baseline site information, clear environmental safeguards and adequate exploration funds. They also cover other aspects of offshore mineral development including stakeholder issues, benefit distribution mechanisms and dispute settlement procedures." Jack further notes, "another major issue in offshore mineral search being the occurrence of diverse biota living under toxic and high temperature conditions around the hydrothermal vents. Though little is known about these organisms, the Madang Guidelines recognises that the potential economic benefits arising out of pharmaceutical or biotechnological applications could even exceed the returns from mineral development. Therefore the Guidelines recommend clear regulations to protect this little-understood ecosystem."

The Policy Guidelines also attempt to safeguard the interests of pioneer explorers with recommendations for steps to acknowledge that offshore exploration is high risk, requires state-of-the-art

technology, and is capital intensive. The study calls for initial offshore developments to be viewed as 'pioneering efforts' with appropriate economic incentives granted to the developers.

The Guideline notes that though National Offshore Mineral Policy may vary from nation to nation, it must contain provisions to facilitate the discovery of new minerals and resources. However the most important purpose of National Policies should be to provide the rationale and focus of any eventual Offshore Mineral Legislation.

Among other aspects already noted, the Guidelines address problems which might arise for potential extensions of the continental shelf; sea lanes for navigation; and a call on coastal states to develop a comprehensive Offshore Mining Act which would be both country-specific and separate from existing on-land mining acts. Where appropriate, coastal states should consider declaring that non-living resources beyond the Provincial coastlines' three-mile limit, are a 'Common Heritage of the Nation.'

Marine mineral resources are non-renewable national assets that require responsible development to ensure the traditional values and environment of a nation are preserved. SOPAC has been promoting the Madang Guidelines to governments, academics, national policy makers, marine scientific researchers and mining companies. So far, it's all been thumbs up!



Jackson Lum





**Photo of the sea bottom shows an almost complete coverage by nodules.**

The complete data set from Japanese research cruises in the past is now available in ArcInfo. This database is expected to be converted to MapInfo (the Pacific standard) in the near future.

Development of mineral resources of the oceans is still a frontier area, with favourable metal demand-supply conditions combined with further advances in technology and legislation being required for commercial exploitation to commence.

Analysing international metal prices to assess the feasibility of the commercial development of manganese nodules in the waters of Cook Islands is an ongoing task. A proposal to develop a Master Plan for Environmental Impact Assessment of deep-sea hydrothermal deposit mining has been submitted to the Japanese Government for funding.

Following the Offshore Mineral Policy Workshop at Madang in Papua New Guinea in February 1999, SOPAC published two volumes of the 'Madang Guidelines' as the definitive guiding principles for developing National Offshore Mining Policies and Legislation in 2000.

The Madang Guidelines have already received critical acclaim as a comprehensive set of guidelines for Marine Mineral Policy Framework. SOPAC has provided on going guidance in the development of the Marine Mineral Policy for Fiji over the past two years. The draft version has undergone international peer review and the final draft is being prepared for tabling in the Fiji Parliament. A similar policy is also being developed for Solomon Islands and it is hoped that a common eclectic structure will be adopted for a regional marine mineral policy to promote consistency in legislative framework among the Pacific Island Countries.

Advisory support is provided as an ongoing task in this area. A synthesis of Phase III of the SOPAC-Japanese Deepsea Cooperative Minerals Programme was completed during 2000 with detailed reports of the research cruises in the waters of Fiji, Federated States of Micronesia, Marshall Islands and Tonga.

In recent years, the research vessel *Hakurei Maru No. 2* has collected bathymetric, subsurface and magnetic data, drilled into sulphide deposits and collected rock samples during surveys. Due to the tremendous appreciation of the benefits of this research, carried out over the past three phases, by member countries, the program was renewed in January 2000 for another three years with a possibility of extension for three more years.

Terrestrial fieldwork undertaken during the year included the drilling program to assess placer gold potential in the Nasivi River Delta near the Emperor Gold Mine in Fiji and the phosphate assessment drilling on Banaba in Kiribati.

The Banaba work is noteworthy as the assessment survey focussed on estimating the economic potential of the phosphate remaining under roads, buildings and other unmined areas on the island where commercial mining ended in 1979. Another project carried out aggregate testing of basaltic samples from Santo Island in Vanuatu to determine its suitability for construction purposes.

Over the years, SOPAC has provided assistance to the member countries in their dealings with private mining companies. Projects have varied from developing mineral promotional pamphlets for distribution among private investors to developing tender documents to assist in negotiations. An attractive, detailed promotional brochure to advertise the mineral wealth of Vanuatu is being prepared for publication. During the year MRU developed a draft tender document for the Isabel Nickel Prospect in Solomon Islands. Advisory support for mineral development at Gold Ridge Mine in Solomon Islands has been an ongoing task.

SOPAC maintains a Regional Petroleum Data Bank at AGSO in Canberra. The key outputs from this activity included the update of petroleum brochures for Solomon Islands and Tonga. Promotional data packages of the region were also updated for use amongst oil exploration companies. SOPAC mounted a booth at the Australian Petroleum Production Exploration Association (APPEA) conference at Brisbane in May 2000, aimed at generating greater interest in the petroleum potential of the Pacific region.





Marc Overmars

## WATER - OUR MOST PRECIOUS COMMODITY

He's young, Dutch, and you'd think he'd have something besides water on his mind. He doesn't seem to. Marc is a hydrogeologist, usually concerned with finding potable water just like a petroleum geologist wants to find oil. He is part of SOPAC's Water Resources Unit and on this particular day, his main concern is the outcome of World Water Day's water-and-health poster and essay competitions.

Health and sanitation are the by-products of having enough quality water around us, and education at the village level about our most precious commodity (ways to conserve it and ways in which diseases are related to it) is the special Day's task.

Celebrated worldwide since its UN conception in 1993, the day aims to increase awareness of water-related issues. Here in the Pacific, it means involving schools and communities in such things as poster competitions and children's essays on the importance of water. Water-borne diseases due to poor sanitation cause an estimated 3 million deaths per year (World Health Organisation) around the world, and in developing countries such as those in the mid-Pacific, a child dies from diarrhoea about every 15 seconds.

Water affects health, sometimes helping, sometimes hindering the transmission of communicable diseases such as diarrhoea, scabies and malaria.

"The minimum amount of water each person needs for cooking and hygiene," says Marc, "is about 20 litres per day, and in a lot of countries, this amount just isn't available. In the Pacific, only 62 per cent of the population have access to improved sanitation; a little over 50 per cent have access to an improved water supply."

Insists Marc: "Demand for water is quickly surpassing availability."

SOPAC, assisted by UNESCO and the British High Commission, prints and distributes thousands of brochures which highlight just how important water or the lack of it is to our general health. And it isn't just drinking water – we are talking about water for sanitation, health and hygiene, the financial burden of importing water or running a desalination plant, water used for agriculture.

"Last year, besides prizes for posters and stories based on water conservation, one kid," said Marc, "even sent us a valve he thought we'd like to see. I think he was one of the people in the region to win a prize."

Other useful tips from the hydrogeologist: storing water for just one day kills off about half of the bacteria in it; turn off taps (particularly in schools – no one else seems to bother) and check water meters at home for leakages. Compost on the garden can prevent up to 73% water evaporation ... and a dripping tap can waste about 1600 litres per month.

Interesting statistics, and he didn't even mention that our bodies are almost 91% water. If that fact doesn't convince people of the importance of water, then he has an even harder job than predicted, even before he begins locating sources of potable water in the region, which is the job he is trained for.



## Water Resources

The Water Resources Unit provides technical assistance, policy advice and information on the sustainable management of water resources, waste, health and sanitation to the member countries of SOPAC.

### Water Demand Management

#### Cook Islands

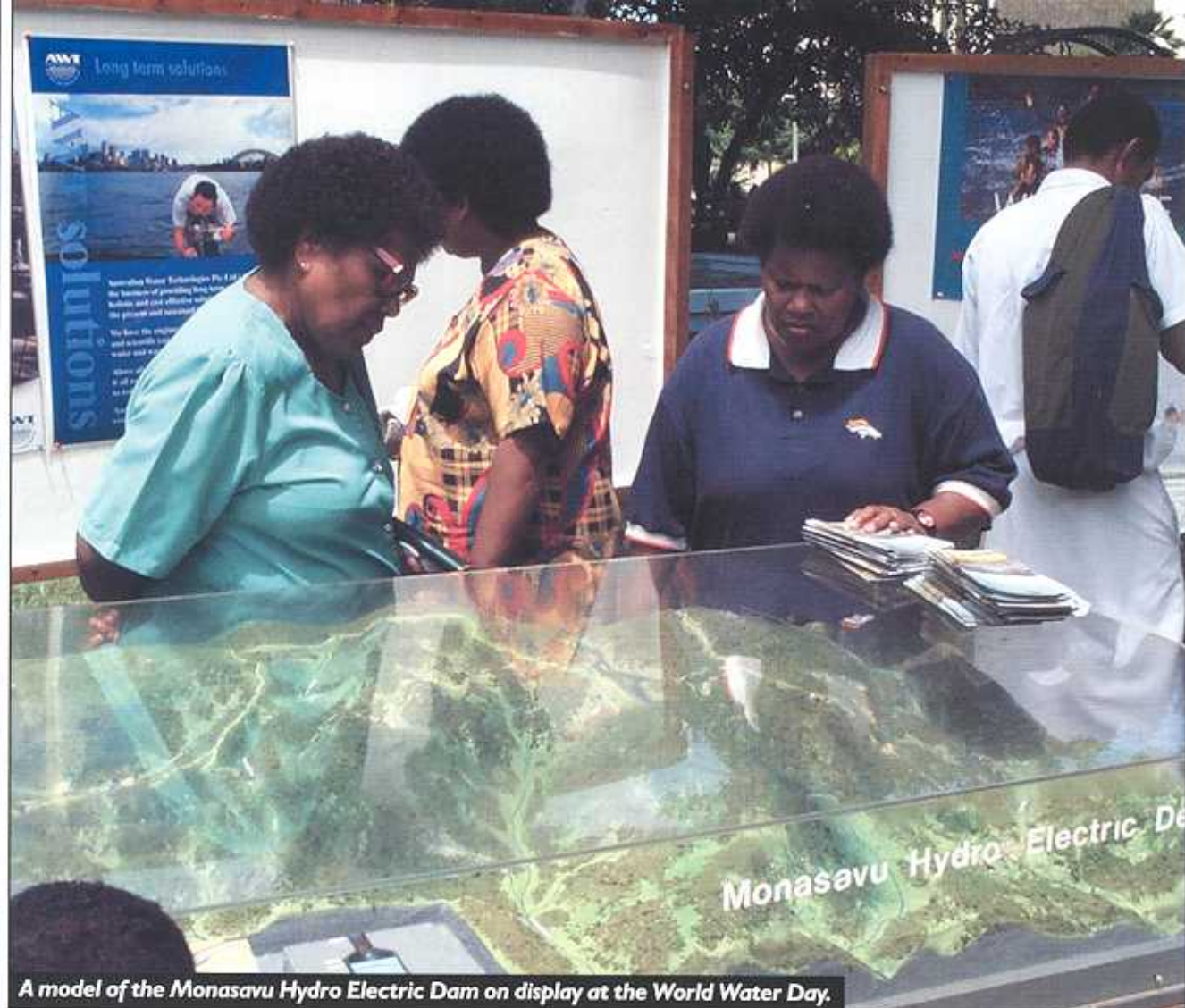
A hydraulic model of the Rarotonga water supply system was created and various baseline information concerning this system was collected. Currently over 50 % of the water entering the water supply system for distribution in Rarotonga never reaches the user. Following the water demand management project, in-country training in hydraulics and network modelling was provided to improve staff and system capabilities.

Basic hydraulic training was provided for one of the water works staff, in keeping with the main objective to provide technical staff engaged in operating and designing water supply systems with relevant background on hydraulics and appropriate software.

In 1997 the Ministry of Water, Energy, and Physical Planning (MOWEPP) purchased a Global Positioning System (GPS) supported field asset management system, to facilitate water catchment delineation by the Lands and Survey Department of the Ministry.







**A model of the Monasavu Hydro Electric Dam on display at the World Water Day.**

SOPAC's assistance was in testing and upgrading GPS equipment, setting up of a base station in the Ministry and getting the staff familiar with field asset management techniques using GPS.

## **Tonga**

SOPAC provided the Tonga Water Board (TWB) with in-country training in hydraulic network modelling of the Nuku'alofa Water Distribution System.

Since the Nuku'alofa Water Supply Masterplan is already 7 years old, TWB was concerned that the information on which it was based was still valid and wanted to propose a second upgrading plan. TWB requested SOPAC assistance with the assessment of the Nuku'alofa water distribution system and its upgrading plans. A review of the Nuku'alofa water distribution system was performed as part of a field visit that included training of TWB staff in the use of hydraulic network models.

Presently the TWB has very few reliable maps to indicate the course of water supply pipes and no system is in use for on-site location of pipes. If maintenance

work is required pipes are usually approximately traced with the help of visible parts such as hydrants, valves, service boxes etc. The exact location is determined by search trenches. This approach is time consuming and costly, mainly because of the heavy-duty equipment required for excavation.

A task was completed aimed at identifying available technologies for exact pipe location considering the special circumstances and difficulties in Tonga, namely the detection of underground PVC pipes partly saturated with seawater. The task also demonstrated the use, and assessed the advantages and disadvantages of using PVC pipe-detection technology in Tonga.

Training was provided on hydraulics to the TWB Planning Engineer, Mr Malaki Vakasiola, and a calibrated numerical model of the Nuku'alofa water distribution system was produced.

## **Samoa**

Two field trips were undertaken to Samoa in which software, advice and recommendations were provided on steps to take to boost the capacity at the

Hydrology Section before staff can be in a position to effectively address priority needs. Assistance with proposal development and design was also given.

## **Marshall Islands**

Over the last few years EPA has collected valuable water quality data. The data comprises information on freshwater sources, the lagoon, on the water supply system and on the wastewater ocean outfall. Currently the data is being stored using MS Excel, which allows very limited access to it. A change in software would allow increased capability for the Marshall Islands Environmental Protection Authority to manage environmental data.

Following Abraham Hicking's training attachment in September of 1999, a database on water quality was developed based on previous information provided to SOPAC by the Marshall Islands. An in-country visit to the Marshall Islands took place in October 2000 to provide training to the EPA staff.



## Niue

Work performed included pipe detection surveys and the creation of a water utility GIS for better water supply network management and planning.

## Water Resources Assessment

### Fiji

#### *Springwater Development in Rural Areas of High Island Member Countries*

The main objective of this project is to provide rural populations in high island member countries with emergency water supply. During the last drought that struck the region, many member countries experienced severe water supply problems, with many ordinary surface water intakes running dry.

In the majority of the rural areas on high islands local people know of the existence of all year yielding springs. The appropriate development of springs as fall-back alternatives for rural areas could have secured a basic water supply and avoided expensive emergency measures. A village visit was made to Kadavu as part of the project, following a request put forward by the village community where a review was made of the water supply system.

### Kiribati

Detailed assessment of Banaba's groundwater resources was called for,

following recent droughts and in response to the growing interest in the possibility of rehabilitation and resettlement of the island. Fresh water resources are limited and pose a constraint to any form of development. A mission to Banaba was undertaken in August 2000 to map surface geological units and undertake an electrical resistivity survey of selected sites to identify possible fresh 'water lenses.

A social survey was also conducted to investigate water consumption issues plus other social water-related issues: alternative potable water sources and possible use of cave systems and roof catchments. The mission resulted in recommendations for further study and a test drilling program.

### Tonga

Little is known about the water resources of many of the outer islands of Tonga. The assessment of potential water resources in outer islands was completed during an in-country visit.

### Samoa

In 1998 JICA requested SOPAC to develop a three-week groundwater assessment project for Savai'i in order to provide the background information for a water supply feasibility study. Outcomes of this assessment resulted in detailed analysis of groundwater availability in the specified region (ca. 10 km<sup>2</sup>) with recommendations

for drilling and sustainable yields. On-the-job training for Samoa nationals was also carried out.

## Water Supply, Sanitation & Hygiene Surveys for Sanitation Park Project

### Fiji

Sanitation issues in the region are attributed little importance. Consequently, there is an absence of appropriate sanitation systems in the rural and peri-urban areas, Fiji is no exception. This has resulted in large numbers of sanitation related diseases, and subsequently poor health in the community. The inadequate disposal of wastewater has resulted in widespread pollution of the sub-soil, coastal marine environment and freshwater resources.

The main objective of the Sanitation Park project is improved health in communities through the introduction of appropriate excreta disposal technologies. Prior to carrying out the project, a pre-feasibility study is required. This has included a checklist sent out to District Offices with a set of questions regarding the present sanitation situation in communities in their district.



A young i-Kiribati girl washing clothes.





**Sunset over the cantilevers carrying the conveyor belts used for loading phosphate ore onto cargo boats moored outside the narrow fringing reef in Nauru.**

Each Office has completed the checklist and identified three 'problem' community types consisting of rural interior, rural coastal and settlements.

The survey will determine the extent of sanitation problems that communities are experiencing. It will target 13 communities and will last for a period of approximately 4 weeks. Results from the survey will be compared with data from a 'control' village and analysed accordingly, allowing the project team to identify groups that will serve as appropriate 'target' communities for the project.

## **World Water Day 2000 -Water for the 21<sup>st</sup> Century**

World Water Day is an annual event to help focus on water; its development and conservation and the implementation of the recommendations of Agenda 21.

SOPAC has the regional mandate to disseminate water and sanitation related information to its member countries as the regional focal point for water and sanitation issues. World Water Day is seen as an excellent opportunity to make all stakeholders focus on water and sanitation problems in the region. This year member countries were provided with posters, fliers, and articles for newspapers and magazines (Press Packs) to run their campaign.

## **Guidelines for Disaster Preparedness of Water and Sanitation Systems in Pacific Small Island Developing States**

The project produced user friendly guidelines to allow individual Pacific small island developing states to develop contingency plans to deal with potential natural and human-induced disasters to water and sanitation facilities.

While surveying existing facilities for potential effects by disasters, weaknesses in facilities may be discovered and modified before a disaster strikes. Resulting contingency plans will enable small island developing states to provide water and sanitation services, even if at limited capacity. A report was prepared and presented to the 5th Global Forum of the Water Supply and Sanitation Collaborative Council (WSSCC) in November 2000.



**World Water Day Poster competition drew a big response from children all over the Pacific region.**





Delegates to the 2000 Regional Energy Meeting.

## Energy

### Cook Islands

SOPAC assisted the Cook Islands in the development of their national energy policy statement, which will help in guiding their government and the outer island Councils in the planning and management of their energy sectors.

### Papua New Guinea & Vanuatu

Assistance was provided to Papua New Guinea with the editing and refining of their Rural Electrification Policy. Similar assistance was also provided to Vanuatu with their rural energy policy statement and preparation of guidelines for the implementation of policy statements. This activity was carried out in conjunction with an energy mission during which other aspects of the energy sector were discussed and assistance provided with their general energy sector activities and planning.

### Regional Energy Supply and Demand Database

Building on the success of work carried out in 1999 on the energy supply and demand database, specific emphasis was given to continuing to provide very focused in-country support to the Cook Islands, Fiji, Vanuatu, Kiribati and Papua New Guinea. This was done primarily through the installation of the modified and considerably more user-friendly energy supply and demand-side database. Generally it has been found that in a number of countries (the approach was first trialed in Kiribati), all relevant sectors who are likely to have an input and likely to want to use the database can be invited to participate in a 2-3 day training workshop. This approach has engendered a greater level of understanding of the reasons behind maintaining and contributing to the database.

Follow-up work in PNG and Kiribati has assisted them in preparing energy data books which they hope to publish shortly.

In addition, it has allowed a better understanding of the energy sector and provided a tool for improved planning.

It is important to note that there is a significant amount of preparatory work required in updating and modifying the individual country databases and the preparation of revised database management guidelines and training manuals. In particular, it is essential to ensure that all the linkages are correct, conversions are accurate and that the energy balance makes sense.

### Regional Energy Technology/Information Database

Access to energy information on technologies, projects and research and development is spread out across member countries and regional organisations. Therefore in an attempt to address this problem and to assist in consolidating a complete record of this information and experience, so as to avoid the longer-term loss to the region, an Energy Technology/Information Database has been prepared.

The initial concept was developed within the Energy Unit with assistance from a Canadian internship and finally trialed and manuals prepared through the cooperative effort of two graduates from the University of the South Pacific (Fijian/I-Kiribati) into a workable database. In this, information can be entered for member countries and relevant regional organisations and then

collated into a regional master database in SOPAC and regularly distributed to members. A longer-term objective is to have the database accessible through the web.

The potential benefits of having such a database are immense. However, to realise these, the users or beneficiaries are going to have to be the ones that contribute to the database now and put in place a mechanism within their own structures to ensure that input to the regional database continue. This provides access to a wealth of information on technologies in the region, which in the longer-term would also be accessible to international users.

### SPF Invitational Programmes

During 2000 and as a result of the PALM2000 (Pacific Island Leaders Meeting) held in Miazaki in Japan, two "invitational programmes" were convened in Japan. Participation was from the Pacific Forum 'island member' countries with representation from the energy planning sectors and the power utility sectors. SOPAC provided the coordination role for these two invitational programmes. The Energy Planners meeting focused on renewable energy technologies with visits to demonstration wind power installations, geothermal, solar photovoltaic, battery storage technology, energy research, fuel cell technology, energy efficiency/saving opportunities, design issues, energy education parks and discussions on these technologies and their appropriateness to the region. The diesel training workshop focussed on better operation and maintenance of diesel engines. This involved the disassembly/assembly of a diesel engine, testing and calibration of the various components of a diesel engine, injectors, pumps etc. In addition time was dedicated to troubleshooting, fault finding and diagnostics of diesel generating systems.

In addition to the benefits gained from the scheduled training activities there was also a significant amount of information and experience exchanged between the participants of the two workshops. This related to their personal experiences within their countries that was considered valuable and opened up opportunities to further exchange ideas once they returned to their respective countries.



## WIND AS A SOURCE OF ENERGY

Improving the economies of small island developing states (SIDS) through the reduction of their costly and continuing reliance on fossil fuels was one of many outcomes of the UN global conference on SIDS in Barbados, 1994.

One of the answers – and a proven technology – was generating electricity with wind turbines, those airplane-like propellers on tall towers which could, singularly, supply up to 15 per cent of a small island country's electricity demand especially where a proven wind resource existed.

The Danes stepped in with a three-phase plan, with financial support from their government, directed at the Pacific, coordinated and monitored in the region by SOPAC's Energy Unit. A number of regional organisations such as the University of the South Pacific also supported the plan agreeing to function as repositories of know-how on the utilisation of wind energy and to develop wind power as a potential complement for diesel generation in island power grids. That's the first phase, to study the amount of wind energy actually available in this part of the world and, through the University of the South Pacific, develop a curriculum which would enable the university to offer a post-graduate degree in wind energy. In that degree course, participants would study integrated energy planning, wind energy efficiency and performance, analyse wind data, create digital wind monitoring models, determine key parameters for the selection of wind turbines; in other words, a total wind education program.

The initial wind energy resource monitoring program for the region commenced with the installation of monitoring stations in five member countries: Fiji Islands, Vanuatu, Cook Islands, Niue and Tonga. Following the initial two-year monitoring period a regional workshop was held followed by a number of smaller national workshops that have focused on the use of special wind-related software and computer analysis of wind data from individual sites with wind potential.

"In the long term," said Anare Matakeviti, Energy Adviser; "we're working on integrating wind power into existing power grids. We already have just that at Nabouwalu on Vanua Levu in Fiji. It's called a 'hybrid system' because the eight kW wind turbines are integrated with both solar and diesel power, the only mini-grid of its type to power a government station anywhere in the Pacific. If there's no wind and no sun, nothing to contribute to a bank of batteries, the diesel generator kicks in, but if and when necessary."

Size of the wind generators is one of the considerations. In larger countries such as Australia and New Zealand (and even in New Caledonia), 'wind farms' are using rows of 200 kW to 300 kW turbines (or bigger) where the choice of equipment is wide and opportunities for suppliers worthwhile financially. Not so in most Pacific



Anare Matakeviti

Island countries, where local power demands are small and annual peak demands may be in the range of 1 to 5 MW. The market for wind technology suppliers in the region is currently small when compared to world standards, in particular in the northern hemisphere.

That's why the Nabouwalu system is interesting – where, as it would be in most Pacific Island countries, the potential for wind turbine installations is relatively small. For example, 100 kW hybrid power systems are perfect for outer islands and small rural communities.





## Regional Energy Meeting (REM) 2000

The convening of the REM2000 – a joint SOPAC/SPC regional energy meeting prior to the 29th SOPAC Annual Session in Kiribati – provided a perfect venue for the exchange of energy information and new ideas.

The focus of the REM2000 was to finalise a regional energy position paper for submission to the Secretariat for the UN Commission on Sustainable Development (CSD) for their ninth meeting to be held in April 2001 and to review the priorities of the energy sector based on the earlier joint energy program design in 1998.

Although the Energy Unit provided a significant amount of information to member countries throughout the year, the REM2000 provided a very successful discussion forum.

In addition to the REM2000, the opportunity was taken for a number of technical papers to be presented at the SOPAC STAR Session (Science, Technology and Resources Network). This was the first time that there had been a significant number of energy papers presented in the technical session by national counterparts. The papers generated significant discussion and were well accepted by the academic community who participated in the STAR. Papers presented included: Efficiency of solar hot water systems in the Pacific; Energy Audit of the SOPAC Secretariat; and Nabouwalu hybrid rural power system (wind/solar/diesel).

**Technical publications** completed during the year included: Solar Hot Water Systems.

The **Pacific Energy Newsletter (PEN)** was published and distributed in October 1999, January 2000, May 2000, and August 2000. A mailing list of about 180 readers is maintained. Requests continue to be received from individuals and institutions both within and outside the SOPAC membership to receive PEN. Major contributors to PEN include the Energy Unit of the Secretariat of the Pacific Communities (SPC) and the Forum Secretariat's Petroleum Adviser.

### Technical Assistance on Renewable Energy Programs and Projects, and to Solar Cooperatives

Assistance was provided to the Cook Islands - Rakahaga Island with the evaluation of a design submitted by consultants for a Photovoltaic/Diesel Hybrid System.

Under the Development of Sustainable Rural Energy Programs task, support was provided for the evaluation of the Nabouwalu Hybrid



Power System. This system was selected for evaluation as part of a post-graduate course project.

The implementation of the study (aside from meeting the project/thesis requirement of a staff member of Fiji's Energy Department, provided a totally unbiased evaluation of what is currently the only truly hybrid power supply system in the region. The system is being used for the supply of energy to a provincial/rural-located government centre. The evaluation will be invaluable to other Pacific island countries who are contemplating the introduction of similar hybrid power systems.

### Regional Wind Energy Education Program

The commencement of activities associated with the **Pacific Danish Environmental Education Program** followed the preparation and signing of a terms of reference among RISO/UNEP, SOPAC and the University of the South Pacific (USP) in May 2000.

This formally commenced the development of an education programme and demonstration wind turbine with USP that will be available in 2001 to assist energy planners and engineers in member countries with their wind power development programs through capacity building.



Energy training for SOPAC member country personnel.



The demonstration wind turbine will be used for design considerations, monitoring and efficiency testing as part of the education programme with the energy being fed into the urban grid. Progress with the project is encouraging with the designed curriculum being adopted by USP.

Project activities focused on the identification of a suitable site for the location of the wind turbine in Suva and the technical specifications, while work commenced on the preparation of an energy planning course module.

### Regional Biomass Resource Assessment

Funding for the training component of the Regional Biomass Resource Assessment was confirmed during 2000 which will enable the commencement of the biomass resource assessment in member countries. Currently the following countries have indicated an interest in the project (Cook Islands, Fiji, FSM, Kiribati, Samoa, Tonga and Tuvalu) but it is expected that once the programme formally commences other countries will realise the benefit of being able to accurately determine their biomass resources. This project will help ensure that member countries are able to better assess and manage their relatively scarce biomass resources. The programme in the longer-term will assist in the preparation of a management plan for the future effective use and management of individual country and the region's biomass resource.

### Energy Resources

In the energy sector there are many ongoing technological developments in the utilization of ocean-based energy resources, wind, biomass and land-based energy resources (Ocean Thermal Energy Conversion & geothermal) for power generation. It is essential that potential investors and donors visit the region to identify opportunities in the supply of energy using indigenous

energy resources. The development of these potential new initiatives is constrained by the unavailability of monitored/assessed data from the potential project sites. SOPAC has been engaged in the monitoring of ocean-based energy resources and member countries have expressed interest in participating in an extension of this exercise. SOPAC continues to pursue the opportunities for reviewing and updating earlier ocean/wave energy assessment.

The need to investigate geothermal potential through the drilling of deep investigatory wells at locations that have been identified has great potential.

Wind energy data continues to be collected and new locations for monitoring are being identified and plans are proposed for the re-establishment of an earlier wind resource assessment program.

Details for a solar radiation-monitoring project have been discussed and a preliminary proposal prepared.

### Pacific Regional Energy Assessment (PREA 2000) —

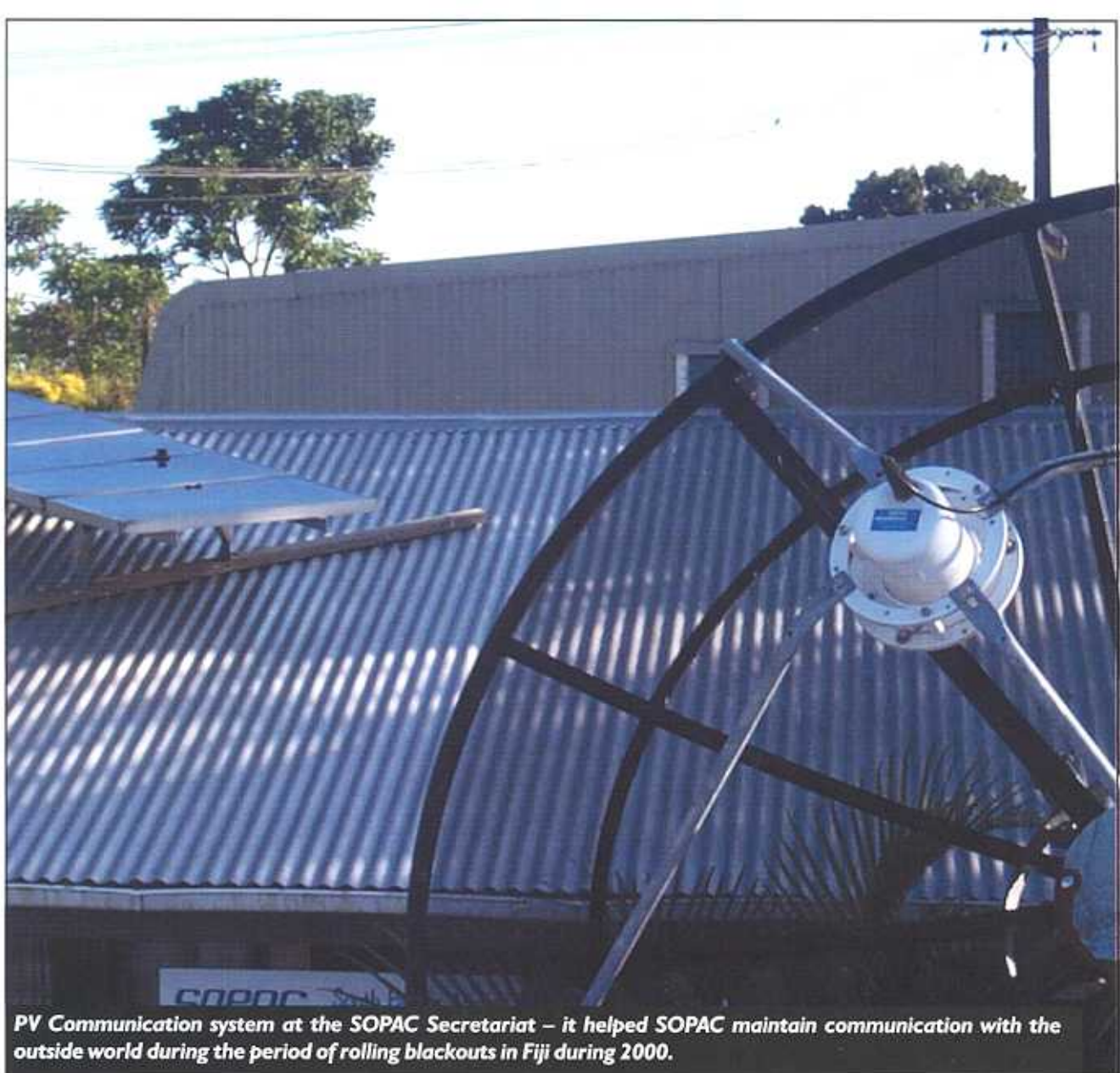
Quantification and qualification of each country's energy situation has been completed as a regional initiative and was previously supported by the UN, ADB and the World Bank on a relatively regular 10-yearly cycle. The continuation of this assessment is seen as beneficial for the region as a whole and countries individually. A detailed terms of reference for a PREA2000 is being prepared.

**Cooperation on Renewable Energy** in the region continues between SOPAC and UNESCO based on an earlier concept of establishing a Centre or Centres for Education and Training in Renewable Energy for the Pacific Region. The SOPAC Energy Unit continues to pursue this initiative and the establishment of a likely funding arrangement.



One of the generators at the Nabouwalu Hybrid Power Station.





**PV Communication system at the SOPAC Secretariat – it helped SOPAC maintain communication with the outside world during the period of rolling blackouts in Fiji during 2000.**

#### Energy Meetings and Conferences

Participation at selected regional and international energy meetings and conferences provided a significant amount of relevant energy information; in particular to new and developing technologies along with the opportunity to establish and develop a number of potential funding opportunities for energy projects and programs in the future.

#### Training Workshops and Evaluation of the Institutional Woodstoves Project

With the first phase of the Regional Institutional Woodstoves Training Workshops Project completed in Kiribati, Tonga and Tuvalu, it was agreed to evaluate the programme before commencing the second phase.

The evaluation of this project commenced during this period and once this is completed in 2001 and the findings are taken into account, it is proposed that the second phase will commence in Kosrae in FSM, Papua New Guinea and Vanuatu.

#### Training attachments and activities carried out during the period:

- A representative from the Fiji Department of Energy participated in the APEC Appliance Labelling and Efficiency Conference convened

in Wellington, New Zealand.

- A representative from the Fiji Department of Energy participated in a hydropower training programme in India.
- A representative from the Cook Islands Energy Unit was on training attachment in Fiji.
- A representative from the Tonga Energy Planning Unit was on training attachment in Fiji and participated in the evaluation of Naro Solar PV installation with the Fiji Department of Energy and received training with the Naro (FJ) Prepayment Meter PV Project.
- A representative from the Fiji Department of Energy doing studies in Australia helped evaluate the Nabouwalu hybrid power system as part of their masters degree.

#### Small Energy Projects Program (SEPP)

A PV System for Telecommunications and Security Lighting at the SOPAC Secretariat demonstrated that a solar back-up system can be used to provide power for communication and security night lighting when mains power was interrupted. It has proven to be successful during the first year of operation and continues to be monitored and evaluated.



## DETERMINING VULNERABILITY

What began as a special project, is now a million dollar project, supported by all of the SOPAC member countries; something highlighting Pacific involvement but with a global reach.

It's called EVI, the Environmental Vulnerability Index, and it is the special project being coordinated by Craig Pratt. It differs from other SOPAC programs because it is dealing with the impacts on the natural environment rather than those directly on humans.

"The project specific objectives are different than, say, the Hazards Unit," says Craig, "because our goal is to produce a specific tool, along with the in-country education to use it, to pool and store on a database - a resource library of vulnerability issues relating to countries."

"Because SOPAC is a clearing house for regional data, whether it is marine research data or shoreline assessments, the EVI builds upon this important regional database of information bringing together more environmental vulnerability data into a useful and simple database."

The EVI special project has been tagged onto the Environmental Science Program as its role integrates with and complements several of these key SOPAC focal areas. In the past year, its principal progress has been to generate support data that will identify key vulnerability issues and examine those issues, building a common basis so that stakeholders can share common information and make comparisons."

"The interesting thing here is not only that 19 Pacific nations are keyed into it, but also a number of small island developing states outside the region such as Barbados, Jamaica, Maldives, Malta, St. Lucia, Mauritius, Trinidad and Tobago are also involved, all receiving a guiding hand through the financial support of New Zealand, Ireland, Italy and Norway."

The project is expected to have a duration of two years, giving it a limited SOPAC shelf-life. And what then?

"Well, by then, the global environmental vulnerability index should provide at a glance, a quick and inexpensive way of characterising the vulnerability of natural systems of a country. It may seem like a mouthful, but for Pacific islands the index will take into account the interplay of geographical remoteness and an island nation's limited natural resource endowment. ... 47 indicators in all. Data for these indicators will be held at regional stations and will provide data ranging from meteorological events, to population, to exploitation of resources and pollution."

"And after that, yes, I'll be out of a job ... but there still is plenty to do."



Craig Pratt

## Environmental Science Program Environmental Vulnerability Index

The EVI Study was first initiated in SOPAC in 1998 with the task of formulating methodology for determining the environmental vulnerability of countries. Since then the study has undergone two phases of development. Phase I focused on developing a workable framework for measuring environmental vulnerability of states. In Phase II this model was exposed to a critical expert peer review and the preliminary testing of the EVI carried out on Fiji, Tuvalu, Samoa and Vanuatu.

Generous support from New Zealand, Ireland, Italy and Norway has enabled the project to undertake Phase III, which is aimed at extensively testing the EVI both mathematically and with real country data. At the EVI Think Tank Meeting in Fiji, 1999, it was recommended that at least 15 countries that characterise the possible global extremes for environmental systems should be represented. This will require the support of several countries outside the region in the provision of environmental vulnerability data for use in the testing and refinement of the EVI to ensure its global applicability, workability and robustness.

The compilation of environmental vulnerability profiles for SOPAC member countries has been the focus of efforts to date, as these information profiles will provide the basis for testing and refinement of the EVI model. To facilitate this work, each country has been visited by the SOPAC EVI team to establish and strengthen links with government agencies; build capacity to identify, collect and collate environmental vulnerability data; and most importantly, use the EVI tool.

Several Pacific country environmental vulnerability profiles have been completed including Fiji, Cook Islands, Palau, Tuvalu, Marshall Islands and Samoa. Countries whose profiles have been initiated and require follow up efforts to complete include Federated States of Micronesia, Nauru, Tonga, Niue, Papua New Guinea, Kiribati and Vanuatu. The compilation of an environmental vulnerability profile for the Solomon Islands is planned for the near future.

International support for the work being undertaken by SOPAC on developing an EVI has continued to grow. Expressions of interest from Small Island Developing States (SIDS) wishing to participate in the project continue to be received. Missions to Barbados, Jamaica, St Lucia and





Trinidad were undertaken with the successful completion of an environmental vulnerability profile for Trinidad. Follow up work is required for other countries including Maldives, Malta, Mauritius and Seychelles.

The international initiative to involve more countries beyond SIDS in the project continues to evolve and greater cooperation with the United Nations Environment Programme in this exercise is expected with the organisation of a global meeting on the EVI planned for mid-2001.



## TONGA'S SUPPORT FOR THE ENVIRONMENTAL VULNERABILITY INDEX

Tonga at the UN Millennium Summit in New York called upon the UN to recognise SOPAC's work on the environmental vulnerability index as highlighted in the following PACNEWS Bulletin item, 08 September 2000:

"Tonga has spoken of its satisfaction with the United Nations (UN) decision to promote the inclusion of economic vulnerability as a factor for determining the criteria of Least Developed Countries (LDC). But Tonga's Prime Minister, HRH Prince Ulukalala Lavaka Ata suggested the UN and other international agencies ought to do more.

He proposed the adoption of an environmental vulnerability index being worked out by the Fiji-based South Pacific Applied Geoscience Commission (SOPAC).

'I welcome the inclusion of economic vulnerability as a factor for determining the LDC criteria but also recognize that small island developing States are vulnerable to environmental changes,' Prince Ulukalala told the UN-sponsored Millennium Summit in New York.

'I, therefore, commend to you the work on the environmental vulnerability index currently being carried out by the South Pacific Applied Geoscience Commission and register my appreciation to those member States who have made available the resources for the completion of this study,' the Prince added."



## MULTIBEAM MAPPING – THE NEWEST TOOL FOR THE COASTAL UNIT

"Just three years ago, we only had an echo sounder," said the Coastal Unit's head, Robert Smith. He drew an inverted cone on his scratch pad ... "and it sent down a vertical signal from the boat like an inverted cone. That helped define the shape of the seabed immediately under the boat."



Robert Smith

"Now, we have 101 echosounders all working at once, sending out a focused beam which is called multibeam mapping. Working in, say, 100 metres water depth, that gives us a 'swath' which covers an area extending 300 metres each side of the boat, and the density of the soundings gives us a very accurate image of the seabed and everything that is on it. We might, from a single swath mapping survey, be printing out one million data points on an A-1 size sheet of paper, all of it data permanently stored and retrievable. That sheet of paper could represent an area of 2 kilometres by 4 kilometres of real space on the ocean bed with a depth measurement for every 2 square metres."

"Of course, to map the seafloor accurately, we also need to have a motion sensor which works like a guided missile system, monitoring the boat's heave (the sea swell), roll and pitch. Otherwise, our map wouldn't mean anything. We also have to have a gyro compass to measure accurate heading. The multibeam readings provide us with a bathymetric model of the seafloor we're looking at, provide insight into its geology, whether it is rocky, sandy, has lots of reef patches, or if faulting has occurred."

"This kind of mapping is essential before over-the-water construction or pipeline laying can begin. It's so accurate, one can map the scouring effects around bridge and wharf foundations, or large mooring blocks. For ports and harbours or environmental surveys, multibeam mapping is a pretty useful technique. The side-scan can pick up and image an old fridge dumped in the harbour ... it's giving us a 3-D image of any structure on the seabed."

"So," his interviewer said, "it's like towing a submersible camera ...."

"No, we're not towing anything. All of the equipment is mounted on the boat; about a half-million Fiji dollars worth."

"As an example, we might be studying seabed channels to understand just where tailings from a Namosi copper mine would flow and ultimately end up. SOPAC has done a similar study in New Caledonia, looking for a disposal route for a nickel mine tailings and the result is that we know precisely what's down there, better than if we were using a submersible camera, because cameras need light and the multibeam doesn't."

"One spin-off to this sophistication is that it can provide information very useful for the fishing industry. I'm a keen pakapaka fisherman and I know just where they're likely to be if I head outside Suva Harbour ... but I'm not about to tell you where."



A blow hole in Tonga.

## Coastal Management

**M**anagement of coastal areas is clearly of considerable concern for the region, yet development of coastal structures and modification of the coastal environment, without proper knowledge of how these alterations will affect the area, still occur. The end result is erosion and general degradation of the coastline.

Marine pollution is hardly a new issue but it is a growing issue with many of our ports and lagoons under duress. To sustain and protect the environment, island administrations and communities require some scientific understanding of the dynamic processes that build and sustain their islands, ports, harbours and lagoons. Investment in training and education is assisting in these goals but in many instances resources (both human and equipment) are not sufficient or available to allow for this information to be freely available and used in the planning process, thus alleviating many of the problems. The size of the problem and the size of the Coastal Unit are of course disproportionate but fundamentally the coastal program activities address these needs.

Not a new initiative but nevertheless an important issue, the availability of technical documentation on how to monitor beaches and shorelines of small islands, in particular, is being developed. The project will fill a regional data gap in available technical information (at the country level) on criteria for monitoring and evaluation of beach erosion and development of management strategies in all member countries. The information will be published as a book by SOPAC. This document will assist in technology transfer and capacity building at the local, national and regional level. In addition, material will be extracted from this document to prepare public awareness brochures for community awareness (using the publications and training departments of the SOPAC Secretariat).





**Global warming likely to affect coastal atolls in the Pacific.**

The project is to serve as a vehicle for involving women in coastal monitoring as a contribution to addressing the gender imbalance in the geosciences.

During the course of the year, there was coastal representation and participation at international meetings and advisory groups: the International Geological Congress, Rio de Janeiro, Brazil; the Oceans 2000 conference in Brighton United Kingdom; and Pacific Coastal Global Ocean Observing Systems meeting in Apia Samoa, enabling the unit to keep abreast with technology and development issues. SOPAC also continues to enjoy collaborative projects with various regional and international universities.

Monitoring of ocean and lagoon physical and chemical parameters is an important key to promoting successful mariculture enterprises in the lagoons of atoll countries to improve their balance of trade. SOPAC continues to use numerical circulation modelling techniques for circulation studies of whole lagoons coupled with an interactive database to support data collection, reduction, display, analysis and archiving of conductivity, temperature and depth (CTD) data and the deployment of long-term temperature loggers. The value of baseline data in evaluating changes in the health of lagoons and harbours cannot be overstated.

Equipment upgrades continue to support the field work and data acquisition with the addition of a second CTD probe complete with dissolved oxygen and turbidity sensors. For improved marine real time DGPS a Trimble DMS 12 RS and DMS 12M were acquired to upgrade navigation control for multibeam surveying.

The importance of the maintenance workshop and its role



**Where the fresh water meets the sea water in Samoa.**

## A WORKSHOP MEASURED IN KILOMETRES

Simon Young is head of the SOPAC workshop and it is true the workshop was renovated during the year, with noticeable improvements in equipment and the amount of working space for Simon and his three assistants.



**Simon Young**

But Simon's workshop actually extends for thousands of square kilometres. He sometimes spends weeks 'in the field', often helping Robert Smith with the boats, electronics and other equipment. Maybe he's helping out in Tuvalu; maybe he's in Tonga... wherever, it's one heck of a working space.

"I spend a lot of time with Robert: we need to thoroughly test all equipment to make sure it works before it's sent off to a member country. Once there, it all has to be installed and checked again, and we're talking about equipment that weighs up to half a tonne (gross weight). We get frantically busy at the start of a new survey and busy again when it is finished. In the middle, if all the equipment is working well, we just might get to relax a bit."

"While I'm often attached to the Coastal Unit, the workshop naturally works with all other SOPAC sections. Sometimes we're out with Mineral Resources on one of their drilling rigs.

"Actually, there are two workshops; one for electronics and another, a mechanical workshop which ensures small engines, such as water pumps, generators, winches and boats are all in order.

"Problems? Just ring Simon. If you can find him.

at the Secretariat in maintaining the field support equipment is evident with the preparation and assistance in over a dozen field surveys in the Cook Islands, Fiji, Kiribati, Federated States of Micronesia, Vanuatu, New Caledonia, Samoa, Solomons and Tonga.

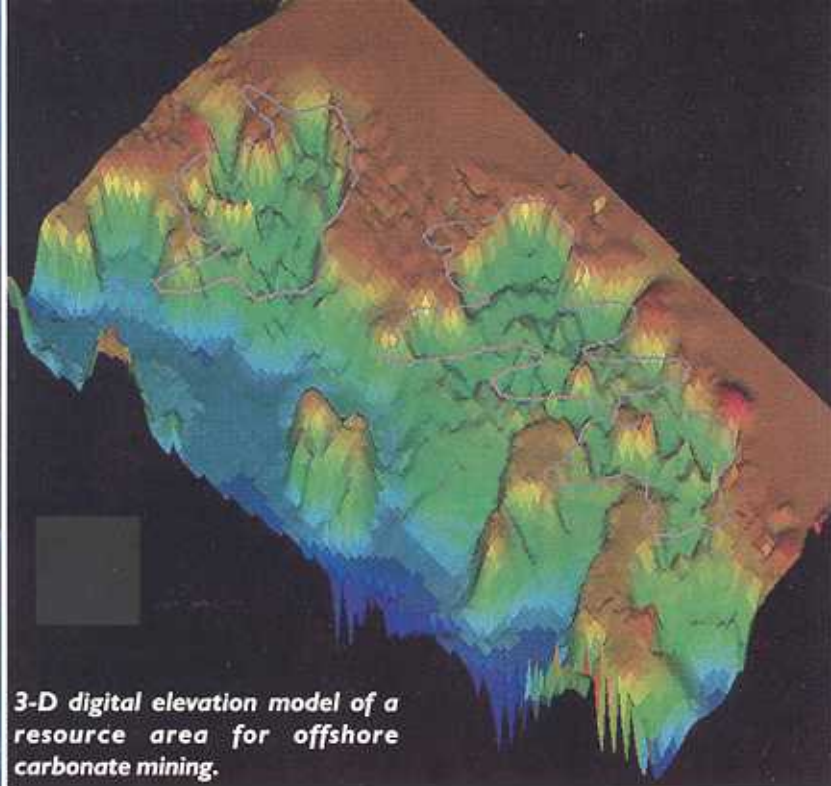
## Federated States of Micronesia

An assessment of coastal erosion problems in the outer atoll islands of Chuuk, Yap and Pohnpei States that SOPAC undertook, recognised that the lack of technically trained personnel to monitor and evaluate shoreline changes, erosion and the effects of construction activities on the various islands prevented sound decisions from being made. This lack of appropriately trained personnel in the FSM did not facilitate a rational approach to coastal management further hindering timely decisions on day-to-day development activities.

Training of technical personnel to be better equipped with the necessary skills to provide timely and appropriate advice from various government departments in erosion assessment and shoreline management strategies was carried out.

The geotechnical evaluation of onshore aggregate in Pohnpei and their suitability for various construction and coastal engineering activities was completed. To date, much of the aggregate supplied for construction in Pohnpei has been mined from reef sites, causing much environmental degradation and coastal erosion problems. Superior quality construction material (which may cause minimal environmental damage) can be identified. Previously, complete geotechnical evaluation of the rock types and aggregate of Pohnpei





**3-D digital elevation model of a resource area for offshore carbonate mining.**

had not been done. Therefore, this study was timely, as it provided the specific application and suitability of the various rock types on land, as an alternative to reef aggregate mining, for the construction engineering industry. Reflecting the variability in SOPAC's program work, the local environmental protection agency sought advice for the preparation of a scope of works for an environmental impact assessment for a power plant in Pohnpei.

## **Fiji Islands**

Based on a three-year initiative, multibeam mapping in various parts of Fiji to accommodate the work programs of both the Department of Mineral Resources and the Ports and Maritime Authority of Fiji were completed in Lautoka, Vuda and Nadi. The data from these surveys is fundamental to understanding coastal processes; the impacts of new port development, and understanding and tracing marine pollution through the use of hydrodynamic modelling.

As an example of "good practice" for small island development SOPAC completed the detailed multibeam mapping and sand resource evaluation of two offshore islands closely associated with tourism.

An island resort development project commissioned the evaluation of an existing marine water pipe location, highlighting the problems of not having suitable base maps for planning the construction of structures that extend offshore. Also completed was a sand resource survey to identify suitable resources for beach nourishment for the present and future demands of the tourism industry.

## **Kiribati**

Vulnerability to accelerated sea-level rise for islands like Kiribati still remains a growing concern for many Pacific island nations. SOPAC completed the field work for vulnerability studies of Bairiki,

Bikenibeu and Bonriki in August 1999 following up the vulnerability study of Betio in 1997.

The assessment of corals, an important habitat for marine life, for sustainable use of the resource is important. Kiribati, like the rest of the other small island countries, is made up of corals but there is limited knowledge on the species found, abundances and distribution.

It is important that this information is obtained for proper management purposes, especially for countries where resources are being seriously degraded due to human interference.

A resource management plan on coral species and abundance distribution for Abaiang and Tarawa atolls was completed.

Water quality modelling studies in Abaiang and Kiritimati for management and defining sanctuary areas were initiated. Outputs for Abaiang lagoon include a hydrodynamic model and bathymetric data now in GIS format. For Kiritimati, included the acquisition of field data sets on currents, CTD measurements and bathymetry to provide background baseline data and model calibration.

A first for SOPAC was the interpretation of the bathymetry of Kiritimati from Landsat image data. Kiritimati lagoon is not only extensive but also very shallow with numerous reef patches and shoals difficult for traditional mapping methods.

## **Marshall Islands**

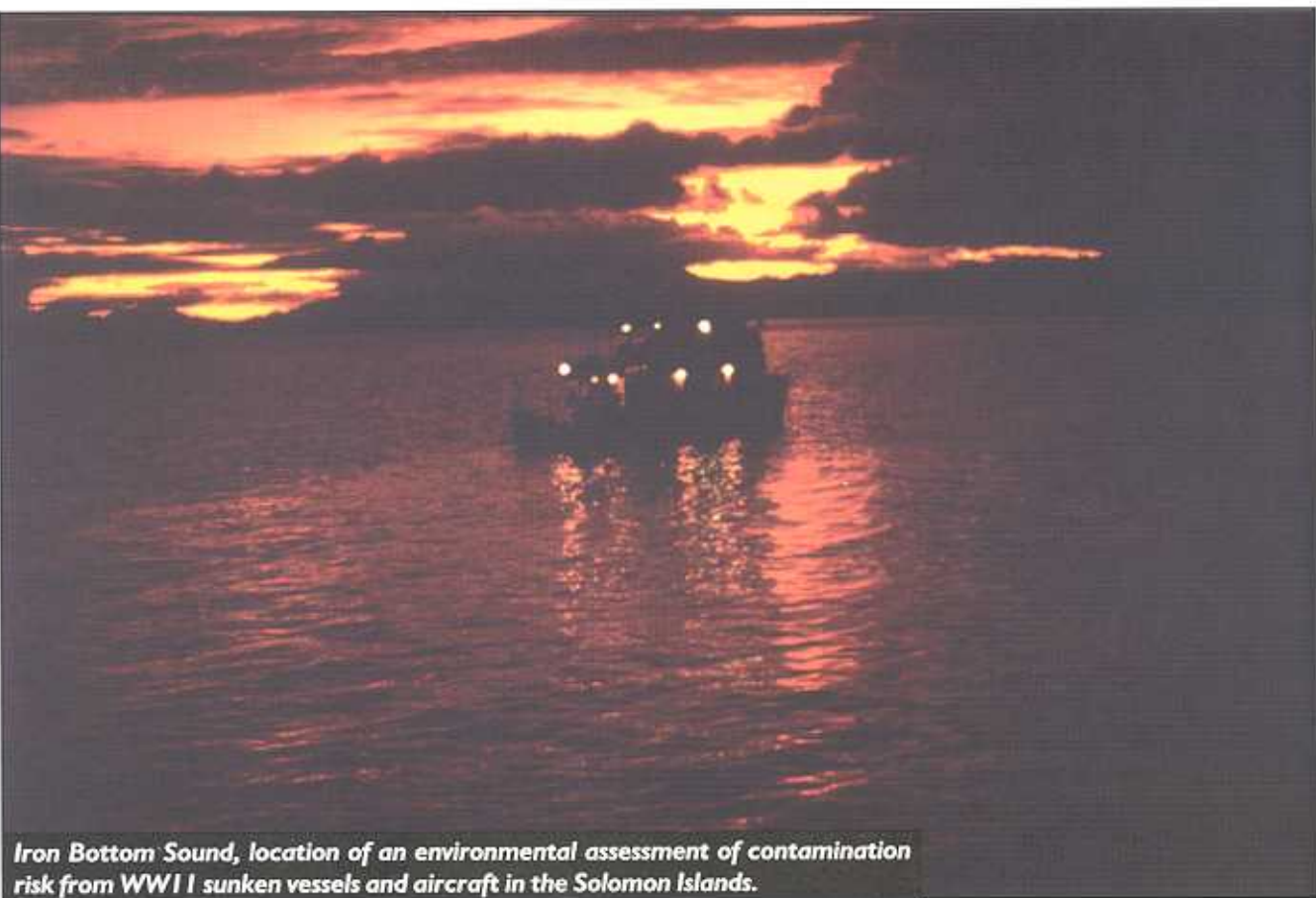
The environmental and economic assessment for the recovery of offshore sands remains a priority. Alternate sand resources have been identified for Majuro lagoon. Selection and utilisation of these prospects required an environmental and economic assessment to know what specific technologies can be used for recovery of aggregates, the transporting of them and merits and disadvantages of each prospect, including applicable technology for the economic recovery of offshore sands.

Merits and disadvantages of each prospect with impacts to the natural and human resources need to be studied. However the lack of funding to have this task completed independently has seen this project deferred.

The feasibility study for foreshore protection and development in Majuro Atoll is a difficult task. However with the completion of GIS layers of coastal geology for thematic mapping for planners and decision makers,







**Iron Bottom Sound, location of an environmental assessment of contamination risk from WWII sunken vessels and aircraft in the Solomon Islands.**

combined with bathymetry for the lagoon and with GIS mapping of infrastructure, land use zoning, help towards a shoreline protection feasibility study can be implemented.

#### Nauru

For the island of Nauru, the lack of maps showing the island's geomorphology and bathymetry nearshore is a hindrance in assisting with development projects like the placement of Fish Aggregate Devices (FADS) to aid the local fishermen. With the recent multibeam survey by the NOM vessel *RV Ron Brown* and the acquisition of multibeam data set reprocessing and database archiving, both digital GIS and hard copy maps can be generated for local use. Coastal erosion on Nauru is not new but the provision of monitoring and advice on response strategies through SOPAC is. During the course of the year, studies identified areas where infrastructure may be under threat; the collection of information on countermeasures currently taken or proposed at government level were completed and advice on effective and sustainable response strategies formulated. Also completed was beach profiling and training. Much of the reporting was incorporated into a GIS for ongoing monitoring programs.

The monitoring and assessment of the Anibare small boat harbour which was nearing completion was done. Here the evaluation of coastal processes of the adjacent shorelines in the harbour area to identify impacts, both positive and negative, of harbour construction on the shoreline stability and proposed management and engineering plans/options for the coastal area were completed.

#### Papua New Guinea

**Sissano Tsunami, Inshore and Lagoon Mapping Investigations, Papua New Guinea.**

Although there was no progress on funding for the multibeam survey the analysis of the sediment cores for decay profiles of excess lead and thorium isotopes was initiated.

From this work sedimentation rates and age estimates of the included turbidites can be obtained. Also sampled were seven of the "push cores" from *Shinkai 2000* dives 1155 to 1161. These were subsampled downcore primarily for lead isotope decay profiles. This work is being carried out for SOPAC at the University of Hawaii by Dr Gary McMurtry.

#### Tonga

Difficulties in identifying suitable marine aggregate resources in Vava'u necessitated the expanding of the survey area further south in the southeast quadrant of Vava'u. Preliminary results from the September survey indicate that the sands found are not suitable for use in the construction industry.



**Core drilling.**





**Bridge washout in Mele area near Port Vila, Vanuatu during the floods associated with Tropical Cyclone Dani, 1999.**

## Hazard Assessment

### General Regional Report

In 2000, tasks associated with the Pacific Cities concept continued to form the major part of the workload of the Hazard Assessment Unit, concentrated as it was in five cities: Suva, Apia, Honiara, Nuku'alofa and Port Vila.

Early next year, 2001 will see major reporting on the progress of Pacific Cities with the production of the first version of up-to-date data CDs on all five cities. The data will be in GIS format and will represent an accumulation of all the work carried out in the cities. This first version will form the platform for the further addition of data layers and later versions of the data CD.

From 2001, the various tasks associated with Pacific Cities will be reported on together under the risk analysis and presentation task for each city as the concept moves into a new phase of using the accumulated data to analyse risks and reduce vulnerability in each city. During 2000, major advances were made in bringing all facets of the information available for the cities up to publication standard. In particular, digital elevation models and orthophotos were produced for the cities for which that data was available; Suva and Port Vila. Census and building occupation data was obtained and incorporated into the GIS database for the same cities.

This year also saw the completion of the French-funded earthquake and tsunami modelling project for Suva, and a major reporting effort by way of a presentation held in Suva, at which contributions were made by the Fiji Government, SOPAC and representatives of the French organisations involved on the project, A2ER LDG, and BRGM.

### PROJECT: PACIFIC CITIES

To illustrate his point, Graham Shorten has got a stack of maps rolled under his arm. Four Pacific cities, eight 'layers' for each city; all the city maps overlaying each other so that geographical coordinates line up exactly.



**Graham Shorten**

The maps are the backbones of the Pacific Cities concept, some of the more visual aids of the Hazard Assessment Unit and scenarios of just what would likely happen if an earthquake, and the resulting tsunamis, or tidal surges and flooding would hit Port Vila or Suva or Nuku'alofa or Honiara. What buildings would likely collapse; how many people, depending on time of day, would likely be buried in the rubble.

Several of the member countries have been a little slow to adopt the concept: they've got their own, more imminent political tidal waves at their doorsteps. And then came along Samoa. Samoa wanted in on the action; it helped find the seed-funding: a quiet on-looker that realised the potential advantages if Apia's city planners not only knew the risks it faces from nature but could deal with those risks before disaster strikes.

"To most people, this looks like a nicely scenic aerial photograph, a section of Port Vila called Malapoa Reserve," said Dr Shorten. "It's actually an orthophotograph that defines height above sea level. Locked in place, SOPAC can put it together with other maps and studies to create a digital terrain model. The key result is a means of managing hazards and providing information to city planners whether they're from the water and sewerage section or wherever."

"Have a look at the Suva map. Seven layers - eight if you count the 300 boreholes drilled in Suva Harbour and the business section - all the information consolidated, beginning with the bedrock level (which is quite different from harbour levels and mud contours), the, bathymetry of the harbour, up through the orthophotograph and related low-lying earthquake hazard zone, to Suva's buildings and roads." The consolidated information allows us to draw up a scenario....four earthquake response zones, four areas which would 'shake' at a different resonance, and which buildings in those zones, depending on their height, might collapse and people working inside those buildings might be killed."

"Currently, we've got three more Pacific cities on our planning list-Lae, Luganville, and, Nadi. For a good study, we need to know characteristics of buildings, how and what they're built of, and the population distribution. The countries benefit by having this information (in fact, we would like to make it available to anybody who is interested and needs to know) and SOPAC keeps adding to the databases as new information comes in. The interaction of the maps assists developers in understanding where river flooding and storm surges are likely to be a threat."

"What's frightening, besides any obvious figures, is the lack of questions, the apparent lack of interest among city officials in knowing the risks. SOPAC can answer the questions, but so few people ask."

That's what makes Samoa's enthusiasm so heartening. It's a win-win situation."



Field work was carried out in Apia principally for a building asset survey. Aerial photography was carried out for the project on a speculative basis, and Samoa has given a further commitment to find the funding for the production of digital elevation models and orthophotos next year.

Some of the fundamental tasks needed to carry Pacific Cities through to the risk analysis stage were unable to be completed due to a lack of donor funding or country support. In particular these were in the areas of the production of orthophotos of the cities, digital elevation models for the harbour areas of the cities and the tasks relying on digital elevation models, namely the numerical modelling of wind, storm surge and tsunami effects.

New work planned for Honiara during the year was postponed because of the civil unrest there, although some work was carried out to bring existing data to publication stage.

An initiative by the Hazards Assessment and the Disaster Management Units on Strengthening Community Resilience through Applied Community Risk and Vulnerability Analysis commenced this year in two pilot areas in Vanuatu.

Preliminary discussions were held with officials associated with the proposal by the World Bank to institute a pilot project for Catastrophe Insurance in the Pacific, similar to the scheme currently being developed in the Caribbean.

Discussions were held with a large number of regional and international organisations in an attempt to ensure world-class,

leading-edge performance in our current hazard and risk assessment and disaster mitigation strategies, as well as to publicise SOPAC's considerable efforts in these fields and establish links for future collaborative projects.

## Physical Database Assembly, Pacific Cities

During 2000, digital cadastral data were incorporated into the comprehensive GIS database of geographic and physical surface information for each city.

Surveying was carried out in all cities except Lae using the survey GPS equipment to accurately locate the local survey system into the WGS 84 global system.

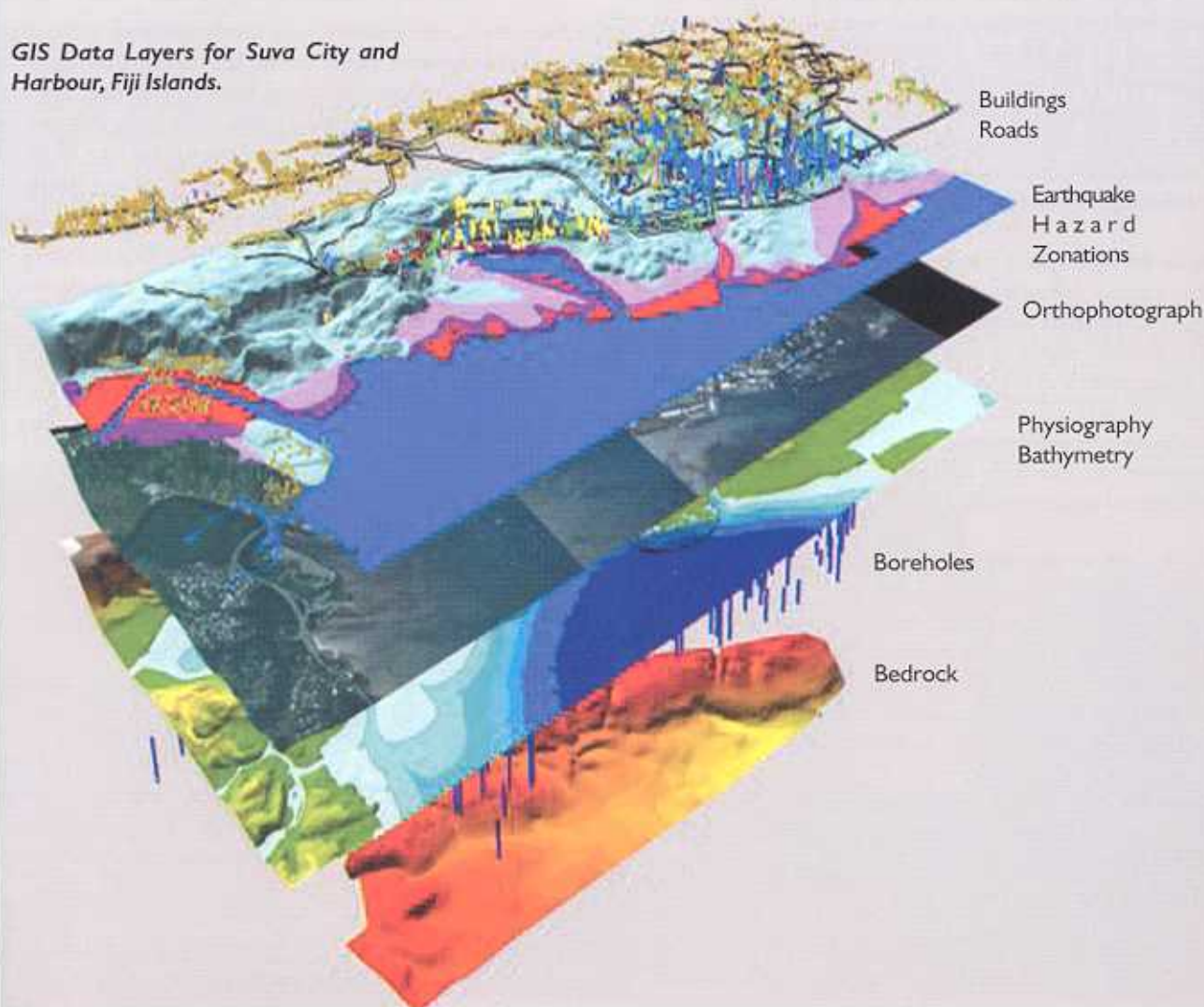
**Suva and Port Vila:** The work enabled the cadastral and roadway information to be linked to the orthophoto and digital elevation model and a surface contour model and accurate height information to be generated for the city.

## Hazards Assessment, Pacific Cities

The ongoing task of recording all existing hazards information available, and incorporating this into the GIS database continued this year in all five cities.

Much of the information needs to be obtained from more obscure sources through research. In the future, this research will be linked closely to an initiative by the Asian Disaster Reduction Center in Kobe to accumulate all known disaster information into a single world-wide database.

*GIS Data Layers for Suva City and Harbour, Fiji Islands.*





## Subsurface Database, Pacific Cities

All readily available borehole records for the cities have been summarised and entered into the GIS database. There is still a need in all cases for in-country counterparts to continue to search out records. Modern interpretative software, Borehole Mapper, which was installed this year now enables the easy production of subsurface cross-sections on demand.

**Suva:** While all existing borehole information in the public domain was incorporated and modified in the Suva GIS database, a significant body (mostly post-1986) of more recent borehole data is currently held with private consultants and government organisations. This requires an initiative to obtain the relevant data and update this information source next year.

**Apia:** Following fieldwork in Apia, a small number of borehole records were obtained, but further work is necessary in country.

**Nuku'alofa and Port Vila:** Requests were made to the country counterpart to seek further detailed information on geotechnical boreholes known to have been drilled in the urban areas.

## Earthquake Microzoning Study, Pacific Cities

The GII-USAID microzoning study of Suva, Honiara, Port Vila and Nuku'alofa to investigate the modification of earthquake effects by local ground conditions was completed and a preliminary report was published and peer-reviewed during the year. Modifications to the final report suggested by the review are still in progress and expected to be completed for final publication in early 2001. The major thrust of the work was presented at the Australian Disaster Conference in Canberra in late 1999 and is contained in the proceedings of that conference.

**Apia:** An earthquake microzonation was carried out for Apia closely following the precepts of the GII-USAID microzoning study designed to investigate the modification of earthquake effects by local ground conditions. A report is in preparation and is expected to be published early next year. Important and innovative modifications and improvements were carried out to the original GII-USAID equipment on loan from Vanuatu in order to increase the reliability of data acquisition and facilitate the task at hand.

## Survey of Community Assets, Pacific Cities

One of the cornerstones of Pacific Cities has been the survey of building assets for each city which seeks to individually assess each building for a series of characteristics related to its potential performance under earthquake, cyclone, flooding or poor foundation conditions.

**Suva:** The basic survey of buildings in the Suva city area is now completed. The survey was successfully utilised in early 2000 to carry out a rapid damage assessment of building damage during civil unrest in Suva.

**Apia:** A survey of all Apia city buildings was undertaken concurrently with the fieldwork for the microzonation



survey using a team of local graduates and government employees.

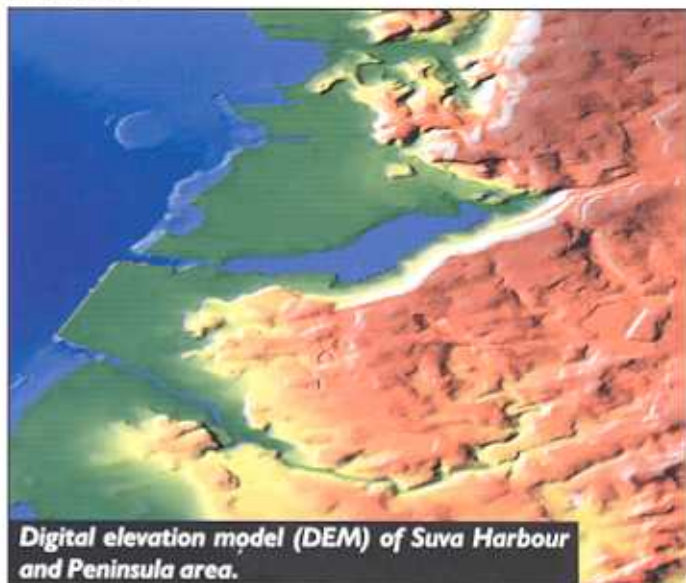
**Nuku'alofa:** A funding commitment was received from the British High Commission Tonga to finalise the survey of Nuku'alofa next year.

**Port Vila:** The survey of all city buildings was finalised during field work carried out in Port Vila in early 2000.

## Photobase and DEM, Pacific Cities

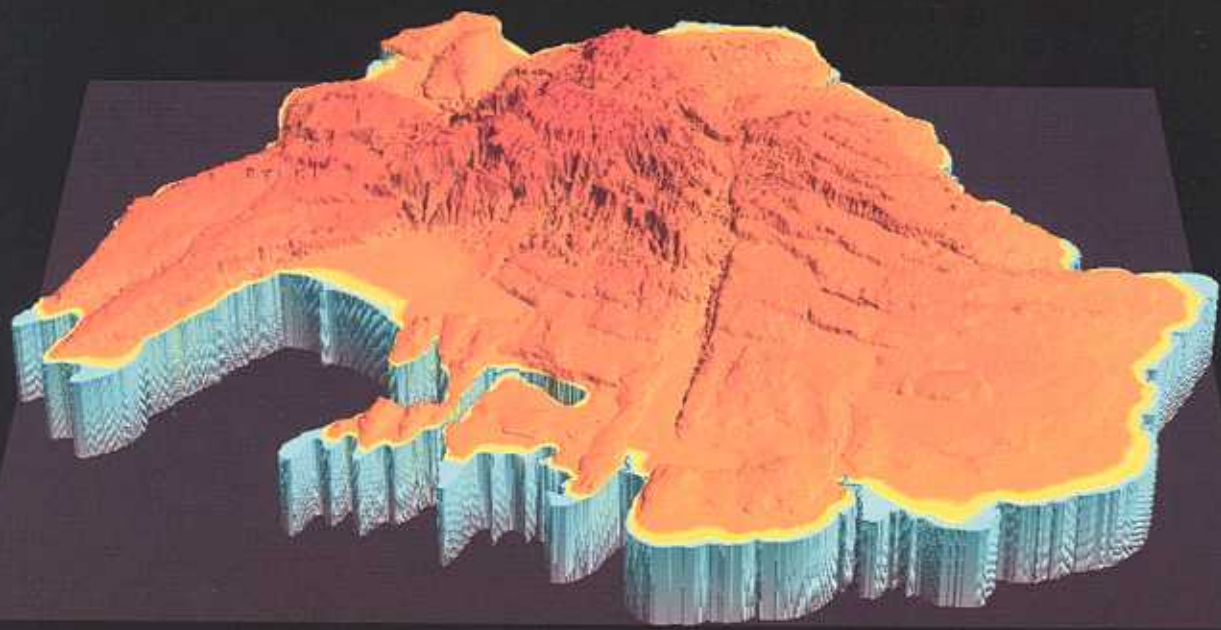
In the short term, the greatest need is to acquire an orthophoto base and digital elevation model for the GIS database for each city. The underlay of an orthophoto base as backdrop has the advantage of opening the GIS database to many more users, giving it far greater application. As well as enabling a display of the city in three-dimensions, the digital elevation model is essential as a numerical base for modelling and analysing the effects of tsunami, storm surge, sea-level rise and cyclonic winds.

**Suva:** The acquisition of aerial photos, the digital elevation model and orthophoto for western Suva is now completed. The purchase of aerial photography for eastern Suva is completed as a result of French funding and further funding is being sought to develop the digital elevation model and orthophoto for the remaining part of Suva in 2001.



Digital elevation model (DEM) of Suva Harbour and Peninsula area.





**Digital elevation model of Efate, Vanuatu.**

**Apia:** A commitment has been obtained from Samoa to provide funding for the production of an orthophoto and digital elevation model for Apia. This will be carried out next year.

**Port Vila:** The acquisition of aerial photos, the digital elevation model and orthophoto for Port Vila is now completed.

## Other Hazard Modelling Pacific Cities

Modelling of pollution, surge, seiche, wave and tsunami hazards is planned for the Pacific Cities using MIKE 21 hydrodynamic modelling software provided, together with specialist training, as part of an aid project from the Danish Government. Although the Danish developer of the software has undertaken to follow up by providing expertise in modelling to date no funding source has been identified to cover the costs of the required consultancy.

**Suva:** Notwithstanding specific models of tsunami behaviour in Suva Harbour were developed and presented this year by SOPAC's French partners LDG and A2EP in the second project shown above, together with an assessment of earthquake resonance based on ground conditions in Suva by French Bureau de Recherche Geologiques. In the process, the digital elevation model of the harbour seafloor was finalised and a subsurface model of harbour and city foreshore completed.

**Port Vila:** A model of tsunami behaviour has been developed for Mele Bay adjoining Port Vila harbour through French support to the Coastal Unit.

## Demographic Database Links, Pacific Cities

It is essential to the ultimate risk analysis of each city for Pacific Cities to eventually reach the stage of incorporating census and population data in the GIS database and integrating it with building and community information.

**Suva:** Census data for Suva was purchased this year from the Fiji Government and incorporated into the Suva database, and a survey of working-hours and after-hours occupancy of commercial central city buildings on a floor-by-floor basis was also completed.

**Port Vila:** Vanuatu has supplied information which has been incorporated into the database and has committed to providing the results of last year's census as soon as possible.

## Risk Analysis and Presentation, Pacific Cities

The ultimate aim for Pacific Cities is the quantification of risk using the GIS database built up from all the preceding inputs, before it is then utilised by the Disaster Management Unit, amongst others, in reducing vulnerability and in raising awareness in both government organisations and the public about the risks facing their communities from natural and man-made hazards.

This process is a continuous one, and the risk analysis task is ongoing and forms the overriding co-ordination on all hazard projects carried out under Pacific Cities.

**Suva:** Preliminary risk/damage models were developed this year with regard to flood, earthquake and riot damage. However these relatively unsophisticated models require further input and development in the coming year.



## Ocean Management

The Secretariat recruited a full-time professional Marine Affairs Advisor in May 2000, to manage work program activities for the Ocean Unit. Enabling funds for activities on national, regional and international ocean issues have been provided by Taiwan (ROC) and New Zealand.

A short-term consultant was recruited in late 2000 to assist in the collation of relevant existing data and information, relevant to individual SOPAC island member state's submissions to claim an extended continental shelf. This activity serves as a precursor to more detailed technical reviews to establish what further requirements are necessary for coastal States to prepare a robust and acceptable submission to the United Nations Commission on the Limits of the Continental Shelf.

Key activities and decisions related to the Ocean Unit work program during 2000, included:

- Ongoing regional coordination of provisions of the Law of the Sea relevant to the SOPAC mandate, through the provision of technical and policy advice on the implementation of provisions such as marine scientific research, maritime boundary and continental shelf delimitation, and offshore mineral exploration and mining in the area.
- Coordinating regional marine scientific research activities being carried out in areas under national jurisdiction, included assistance in the assessment of applications to undertake research, ensuring cruise (and post-cruise) participation and, the collection and management of resulting data and information, on behalf of SOPAC island member states.
- Continuing to promote SOPAC's preferred data formats through its established GIS and Data Policy and protocol, to international research organisations. Increased compliance by international research organisations will enable SOPAC to become more effective in the management, assessment and utilisation of data.
- Endorsement by the Forum Fisheries Committee and the SOPAC Governing Council at their meetings held in May and September 2000, respectively, to transfer the FFA-based Maritime Boundaries Delimitation Project to SOPAC, will result in the expansion of the Ocean Unit's work program brief. The SOPAC Governing Council agreed that a new project be designed and that funding be sought to implement a program to complete boundary delimitation, as well as to assist those Pacific coastal States able to claim an extended continental shelf toward preparing their submissions.

### PacificGOOS – BEGINNING TO FLY

GOOS is the acronym for Global Ocean Observing System and world-wide, it's flying high in V-formation. It is a decade old and is dealing with climate, coastal seas, living marine resources, the health of the ocean (read pollution) and marine meteorological and oceanographic services.

Regionally, though, the PacificGOOS is only just off the ground, and last May came under the wing of Cristelle Pratt in the Ocean Management Unit. It began, and was immediately sheltered by the SOPAC umbrella, in 1998.



Cristelle Pratt

The overall concept is that anyone in the world could have access to the system, providing information on mariculture developments, coral reef health, coastal water quality, and monitoring the seas in ways they've never been looked at before. GOOS provides "end-user value" to the many countries which depend on marine resources and services to contribute to their Gross National Product. Some countries, many of them in the Pacific, depend almost entirely upon marine fisheries and aquaculture for not only GNP but for food protein.

Direct beneficiaries include the managers and coordinators of tourism resorts, ports and harbours, coastal defences, fishing, shellfish and fish farming, shipping, cable and pipe-laying enterprises. Basically, where managing the marine environment and forecasting global climate changes were concerned, and that includes safety at sea and mitigation of disasters such as coastal floods, GOOS is a long-sought answer.

So back to Cristelle. She says she's a resource person and admits to being "realistic" in terms of getting PacificGOOS off the ground. Its benefits can be easily demonstrated, with practical applications such as monitoring coastal water quality in the Cook Island's Manihiki Lagoon ensuring the effective management and protection of their black pearl farms, and in Kiribati. PacificGOOS could be used as a vehicle to monitor and manage their seaweed and proposed pearl farm developments.

- Attending the International Seabed Authority's Workshop on Mineral Resources of the International Seabed in Kingston, Jamaica, and presenting a paper on "The Role of SOPAC in Promoting the Exploration of Marine Mineral Resources in the Pacific Region."
- Sitting on the Legal and Technical Commission, for the development of draft guidelines for the assessment of the possible environmental impacts arising from exploration for polymetallic nodules in the Area. The Director sits in his own right as an independently elected member to the Commission.
- Providing technical assistance and policy advice on the sustainable development and management of non-living marine resources such as to Permanent Heads of Pacific Missions at the United Nations in New York at the Oceans UN/15-UNICPOLOS I Meeting from 30th May to 2nd June.





**Deployed from an ocean research vessel, the Dolphin 3K, is a remotely operated submersible capable of working in water depths up to 3000metres, and carries cameras and sampling devices for studying the deep ocean, the seabed and associated resources.**

- Coordinating and collaborating at the national, regional and international levels on ocean observing systems activities being carried out in the Pacific, such as the Triangle Trans-Ocean Buoy Network [Triton], the International Argo Float Program and the regional Global Ocean Observing System [GOOS] initiative PacificGOOS.

- Organising a joint SOPAC/IOC Regional Workshop for the development of Coastal GOOS pilot projects under the umbrella of PacificGOOS in August 2000 in Apia, Samoa, with wide and active participation from international, regional and national agencies. Three potential Coastal-GOOS pilot project concepts in the areas of mariculture development, coral reef health [as it relates to coastal tourism] and coastal water quality, were developed during the workshop.

It is envisaged more detailed project documents will be designed and funding sought to implement and establish these as Coastal-GOOS pilot projects in the region.

These research initiatives result in the long-term, continuous acquisition of oceanographic data, which will advance our understanding of the role of the ocean in climate. Further it will improve ENSO-based atmospheric forecasts and enhance our understanding of sea-level rise associated with inter-annual climate variability and global warming. The results of these international programs also provide a broad-scale oceanographic data context for addressing coastal issues such as the health of coral reefs, inshore fisheries, and mariculture developments.



**A hydrothermal active submarine vent.**





## National Capacity Development Program Information Technology

**T**he year 2000 was a most challenging period with the disastrous events in Fiji severely disrupting operations within the Secretariat where the worst was power outages both scheduled and unexpected.

This placed a heavy burden on the Unit as the Secretariat requires 24-hours/7-days-a-week (24/7) operations of its networked information system as well as 24/7 operations of its Internet link, where the latter is a service shared by other major development organisations in Suva.

The power disruptions lasted some four months and usually only a maximum of four hours was available during the day when it was necessary to operate four standby generators strategically located throughout the Secretariat to maintain operations.

Despite the inconvenience of maintaining 24/7 operations together with continual repair of hardware caused by unexpected loss of power, low voltage and inconsistent frequencies the overall operations of the Secretariat were maintained.

The key tasks in the 2000 Work Program were initially grouped into three task development areas. During 2000 the fields of Information Systems and Communications converged and in keeping with the goal of ease of reporting the task development areas have been rationalised into two main components:

- Information and Communication Technologies
- GIS and Remote Sensing

### INFORMATION OVERLOAD: SEEING THE WOOD FROM THE TREES

Les is in charge of SOPAC's Information and Technology Unit and is a keen spokesman on one of the Unit's most pressing tasks – assuring Fiji's forest certification and 'Chain of Custody' process is on track. Which it apparently is. This project is the latest example of where SOPAC's expertise in information use and management is extending into national areas as well as beyond its traditional areas of impact.

Les claims Fiji's Department of Forestry (a part of the country's Ministry of Agriculture, Fisheries and Forests) has "some of the best accountability in the world for a developing country" and takes pride in the fact that the island nation does not export whole logs.

This is important in a country where more than 50% of Fiji's landmass is still covered by forests, with 90% under natural forest and the remainder hardwood and pine plantations. Assisted by the International Tropical Timber Organisation (ITTO) and SOPAC, the Department of Forestry works with landowners to prevent anything other than selective logging, sustaining the indigenous forest and preventing over exploitation by foreign companies. The result: the country has been self-sufficient in timber products for the past 25 years; achieved one fifth of its total export earnings from sawn logs and pine-plantation wood chips; all without extensively damaging the natural forest.

The Department of Forestry is intensely involved in every aspect of natural forest management, from logging, sawmilling and export. Where SOPAC comes in, (and ITTO) is with assistance in 'value adding' in Fiji's export markets.

"Products of high quality need to be identified by the customer as coming from a sustainably-managed forest," says Les, "and the best way to do this is with a certified chain of custody; with a timber-flow



Les Allinson

monitoring system which identifies the flow of sawn timber from the point of origin – the stump in the forest – to the point of export." ITTO provides the funding for this project. SOPAC assists the Forestry Department.

The timber-flow monitoring system links computers located at divisional offices throughout Fiji. Connected to a central database, each log is tracked, not only at the gate of one of the country's 22 registered sawmills, but again at the sawmill's log yard.

This data, coupled with the landowner's removal license and the application for an export license, enables the Forestry headquarters to keep accurate information on each log – right back to its point of origin, is an important step towards green labelling. Training and assistance is also required at the village and community level.

"We do this," noted Les, "primarily by putting landowners on video so they can see themselves at the village level, sort of discuss their output over the grog bowl. We work with them in the forest as part of the education process".

"At the village level, global positioning with GIS systems and stump bar-codes are being introduced to assist with information needed by export markets, which in turn assists in the value-adding process," says Les.

"It's important to realise that we're talking about natural forest, not plantation forests such as pine or mahogany, and there are certainly ways to get around rules, but the activities being undertaken on behalf of Fiji's indigenous forests are certainly a step in the right direction."



Information and Communication Technologies (ICT) includes information system deployment, database development and maintenance and more broadly, data warehousing. The Regional Data Centre holdings are included as well as organisation of offshore data. The dividing line between Information Technology and Communication Technologies has blurred where the latter includes wide and local area networking, employing Internet as the predominant transport mechanism. Internet and Intranets are included in ICT as well as Internet Service Provider (ISP) operations.

GIS & Remote Sensing is fundamental to the operations of SOPAC and this task development area is often the final layer of the knowledge management system that is built upon the foundations of Information Systems with data warehouses and communications infrastructure.

It is also important to note that ICT and GIS and Remote Sensing are the fundamental tools of Island Systems Management.

Each task development area has been divided into two sections; member-country support and Secretariat support where both may include training or technology transfer. Task profiles, however may address one section in one area or several sections in several areas and will vary according to the requirements of individual member countries.

## **Information and Communication Technologies**

### ***Support to Member Countries***

SOPAC is dedicated to the support of all Member Countries in the development installation and maintenance of appropriate ICT systems. These systems are essential for improving the effectiveness of the relevant government department by providing access to timely and accurate information. These systems are the building blocks of knowledge management systems.

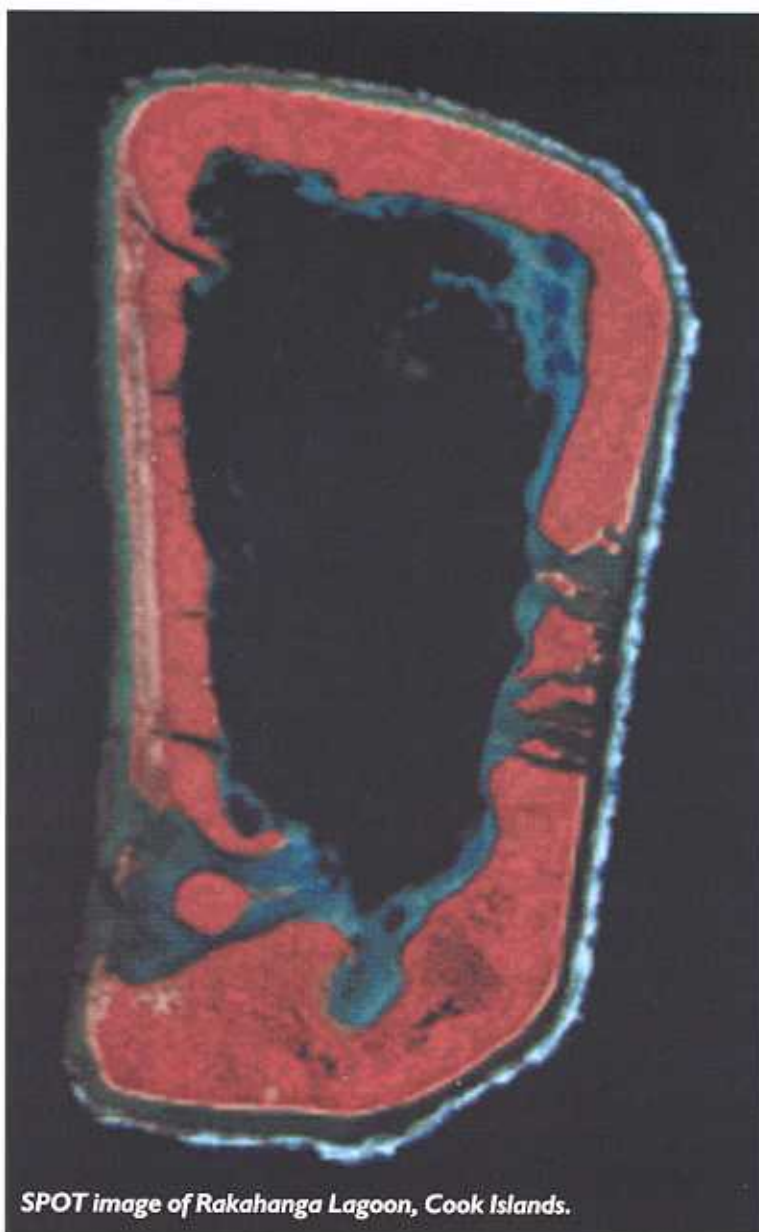
The objective is the provision of relevant and effective ICT systems to assist member countries in discharging their obligations under resource management objectives.

Training and technology transfer is essential to maintain skill levels of member country technical staff responsible for deployment and development of in-country information systems.

The objective is to provide adequately trained staff in member countries to ensure that information systems are developed and maintained.

### ***Regional***

A major initiative has been the establishment and development of the Fiji Internet Group that provides a shared access to the International Internet for a group of development organisations located in Fiji. They include



***SPOT image of Rakahanga Lagoon, Cook Islands.***

the European Union Delegates Office, Fiji Institute of Technology, Fiji National Training College, Fiji School of Medicine, Fiji Trade and Investment Board, Forum Secretariat, French Embassy, Mineral Resources Department as well as missions such as the Federated States of Micronesia and Marshall Islands. This initiative directly and indirectly benefits all member countries.

A review was conducted of the ICT status of the International Seabed Authority in Jamaica where this organisation assists all states party to the UN Convention on the Law of the Sea (UNCLOS) through its regulatory work in offshore mining in international waters.

Representation was made at the annual Regional IT Strategies Meeting (IT-PACNET 2000) that was hosted by Tuvalu. This is the first time a member country has hosted this meeting where previous meetings since 1995 have been hosted by members of the Committee of Regional Organisations of the Pacific (CROP). Representation was made at the Internet Conference 2000 (INET) held in Japan with the objective of promoting Internet development in all member countries.

Procurement and delivery of power conditioning equipment was carried out for Meteorology Department offices in Kiribati, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu through the support of the European Union funded Tropical Cyclone Warning Upgrade Project.



## Country Specific

A component of the Fiji Landowner Awareness Project for Forestry Department was undertaken where this consisted of multimedia production targeted at landowners. The project is funded by the International Tropical Timber Organisation.

A LAN/WAN was established within the Ministry of Natural Resources Development in Kiribati. It links the Headquarters, Fisheries Department

the Meteorology Division in Samoa through the support of the European Union funded Tropical Cyclone Warning Upgrade Project where this included a three-week training attachment for a staff member from the observatory as well as provision of a server.

A national ISP was established in Tuvalu through UNDP support. Extensive computer equipment was procured, set-up and shipped to Tuvalu for the National Fisheries Corporation, Ministry of Lands and Survey, Office of the Prime Minister and Department of Customs. In addition, on-going support was provided to the Tuvalu High Commission in

needs basis. The objective is to provide ease of access to information through organised datasets using a common interface.

There was ongoing development of the Task Profiles Database with linkage to SOPAC Financials, a SunSystems based accounting package provided through the support of Australia. This linkage provides excellent control for financial management and donor reporting.

The total networked information system named SOPACNet is continually evolving where key activities include introduction of more cost effective Linux-based server solutions especially for the communications, external web and firewall server.

A migration from 10 to 100 Mbps local area network infrastructure is progressing.

Other activities include migration of Microsoft Access databases into Microsoft SQL Server for more robust operations within a corporate environment as well as enabling linkage of some datasets with the SQL Server based SunSystems Financials.

The implementation of a Virtual Library system for the Publications and Library Unit to enable the scanning of paper documents into a digital database was also carried out. This was possible through the support of New Zealand.

## GIS and Remote Sensing Development

### Support to Member Countries

SOPAC is dedicated to supporting member countries in the use of GIS and Remote Sensing technology; and supporting in-country technical staff involved in the development of GIS-related work.

The objective is the applied use of this technology to provide improved management of the resources in a sustainable manner through the development of knowledge management systems.

SOPAC has initiated the development of in-country computer mapping experience and has shown that the sustainability of these projects can be achieved if proper training is supplied in-country or through attachments at the Secretariat.



and Agriculture Department together and to the Internet via a gateway at the Headquarters. A significant portion of the equipment as well as a three-week training attachment for the MINRD IT specialist was provided through the support of Taiwan ROC.

A proposal for implementing an ICT system for the Nauru Rehabilitation Corporation was provided that would allow identification of risks and establishment of an appropriate rehabilitation program.

A desktop computer was supplied to the Niue Police Department to enable them to access meteorological and other environmental data that is continually down linked from a satellite system.

A LAN/WAN was established within

Suva for establishing and developing their networked information system with connection to the Internet.

### Support to the Secretariat in ICT Development

The information system is a foundation for all activities within the Secretariat and provides all staff with access to organisational information via a server-based system where the servers include file and resource sharing, Internet web services, Intranet web services and security.

SOPAC is a web-centric organisation and continually migrates and reorganises datasets to be accessible through the common interface of web browsers.

Training is provided for Secretariat staff responsible for maintenance of the corporate information system as well as other staff on a



The objectives include the training of users from the various government departments and show the benefit of the use of GIS for high-level decision-making.

### Regional

A fundamental component of the Pacific Marine Pollution Prevention Program (PACPOL) is a GIS database to assist in evaluating risks through a spatial data interface where such risks include high vessel traffic areas, navigational hazards such as reefs and prior incidents. SPREP is managing the program and selected SOPAC as the GIS developer for this component where the funding support is from Australia and Canada. The duration of this component is some 6 months.

The GIS Policy Paper has been continually updated as it is a living document and was produced to assist all member countries, other CROP organisations and the Secretariat with guidelines for selecting compatible tools and ownership of data. Again it should be stressed that MapInfo products are the recommended regional standard and are endorsed by the CROP Information Technology Working Group.

An annual SOPAC Data CD has been produced since 1995 for distribution to all member countries at the Annual Session. The majority of the data is in MapInfo format and is accessible via a web browser. 3D bathymetry and satellite image coverage are amongst new features this year and the CD was distributed during the annual session in Kiribati.

SOPAC promotes technology transfer through the use of various publication systems and methods that include mailing lists such as GIS-PACNET, FIG-NET and ICT PACNET: the SOPAC Web, publications such as the Pacific GIS & Remote Sensing Newsletter (a joint SOPAC/USP publication), user support in Remote Sensing Data Acquisition, Pacific Secretariat for the Permanent Committee on GIS and Infrastructure for Asia and the Pacific (PCGIAP), and regional member of the International Society for Photogrammetry and Remote Sensing.

In addition we provide a help desk for GIS and Remote Sensing issues as well as assisting USP through specialist lectures for graduate and post-graduate students and support for post-graduate students in new techniques for image analysis.

SOPAC is aware that technology transfer should not only be made available to



**Stump barcode tagging.**

SOPAC member country geological departments but to all Pacific regional stakeholders where the method envisaged is through active participation in on-line and off-line forums.

Development of a Metadata System is ongoing through support by France where this task will support in-country technicians and departments in all member countries involved in development of GIS/RS related work. Development of a Metadata System for geographical data sets is required for proper cataloguing and access to accurate and current datasets.

### Country Specific

A GIS was established in Kosrae State, Federated States of Micronesia, for land use planning, coastal monitoring and land cover change during a two-week visit where funding support was provided by Australia.

A component of the Fiji Landowner Awareness Project for Forestry Department was the development of a GIS-based pre-harvest inventory with funding support from the International Tropical Timber Organisation.

Assistance was provided to the Mineral Resources Department, Fiji through institutional strengthening in the selection of GIS staff as well as conducting a two-week MapBasic GIS workshop.

A landowner boundary rapid mapping project for the Native Lands Trust Board, Fiji using GPS and GIS tools has been approved for funding by ADB but final

transfer of funds have been delayed due to the events of May 2000.

A shallow-water lagoon mapping project in Kiritimati Island, Kiribati was supported through extensive image analysis of Landsat data.

A four-week, French-funded training attachment was provided for a student from Vanuatu studying at the University of New Caledonia.

There was on-going support for the GIS for Power Utilities project located at the Tonga Electric Power Board where the project was originally funded by the European Union.

### Support to Secretariat

SOPAC as the recognised lead organisation in GIS and Remote Sensing uses these technologies within the broad range of technical programs and units. The Information Technology Unit has been tasked with coordinating these activities within the Secretariat. The objective is co-ordinated development of scalable and transferable systems that assist all SOPAC programs in effectively carrying out their tasks.

A project, named FMaps was initiated to develop a GIS under an open source license with cooperation of the international programming community to operate under the Linux operating system. It is anticipated that this will eventually provide a free or very low cost alternative to MapInfo and other GIS or desktop mapping products.



# Disaster Management

## New DMU Established

**T**he establishment of a regional Disaster Management Unit (DMU), at the SOPAC Secretariat became a reality during 2000 with the appointment of Alan Mearns as the new Disaster Management Coordinator in May. Alan, who has extensive experience as a disaster management consultant, is now leading a new team to implement the SOPAC Disaster Management Project, which has been approved by the SOPAC Council.

This project, which is funded by Australia, New Zealand and the United Kingdom, has as its goal the strengthening of national disaster management programming capacities and the integration of risk management practices within government economic strategies of member-country governments.

Specifically the project will address the following:

- The establishment of an effective regional coordination center for disaster management activities in the Pacific
- The professional skilling of key officials in order to establish a sustainable capacity to design, implement, manage and evaluate national programs
- The development of national comprehensive disaster/risk management programs
- The development of a regional advocacy strategy to promote the benefits of risk management amongst politicians, policy makers and non-traditional donors

In order to ensure a seamless transition between the South Pacific Disaster Reduction Program (SPDRP) and the new SOPAC DMU, the Disaster Management Coordinator worked very closely with Joe Chung and the other members of the SPDRP team. A key member of the SPDRP team Atu Kaloumaira has stayed on, as the Program Support Adviser to the DMU and this will provide a high level of ongoing continuity.

In the six months since his arrival the new DMU Head visited a number of countries in the region including Tonga, Samoa, Vanuatu, Niue, and Kiribati. At the annual regional disaster management meeting, which was held in Niue in September, he was introduced to the broader disaster management community of the South Pacific.



**Joe Chung the SPDRP Chief Technical Advisor welcomes the new SOPAC Disaster Management Coordinator, Alan Mearns to the DMU.**

## KEYWORD IS CHARM

How do you "manage" a disaster? Alan Mearns smiled at the suggestion of the Disaster Management Unit being perceived as responsible for the management of regional disasters. Then, as head of SOPAC's newest unit, he began to explain what disaster or risk management was all about.

In terms of the Pacific region he summed it up in one word: CHARM. This acronym stands for Comprehensive Hazard and Risk Management and it represents a major transition from the former South Pacific Disaster Reduction Program (SPDRP), which was successfully implemented during the past 7 years under the guidance and leadership of Joe Chung. CHARM is about developing partnerships and networks that enhance community resilience and sustainability to all hazards through the integration of risk management practices and information management tools and technologies. It will ensure that a "whole of government" approach is adopted to strengthen national development planning. The DMU strategy for CHARM has been developed through in-country stakeholder workshops conducted in Kiribati and Tonga where country priorities for hazard reduction have been identified and perceived gaps clarified. CHARM takes into account the resource and economic benefits associated with this broader approach to managing risks.

"We've got something like 40 million square kilometres out there and 15 stakeholder countries, so it is important that we develop an effective network of national focal points who can then act as a link to other key stakeholders" says Alan. "We try to enhance our capacity building and networking both regionally and internationally by conducting an annual disaster management meeting where we bring together a range of disaster and risk management practitioners to discuss issues of importance to the Pacific region. This year our primary focus has been on the establishment of the new regional center at SOPAC and the design and development of the CHARM framework for national capacity building. We will need to support this framework with an advocacy strategy that encourages a commitment to a whole of country approach."

Alan went on to say "There has been a dramatic shift in a global sense from the traditional response and recovery modes of disaster management to a more proactive preparedness approach that aims to strengthen community resilience through risk management practices. We are looking very closely at our vulnerable communities in the Pacific and working with them to clearly identify and prioritise those risks that have the most potential to set back economic development and sustainable national development planning initiatives. It's kind of like wearing your seat belt in the car... you know there's other traffic out there that represents risks to you but you are prepared to accept the level of risk by taking appropriate action. CHARM is our regional seat belt."



**Alan Mearns**





**Waimanu Road bearing the scars of the May 19 crisis in Suva.**

Links with a number of regional and international organisations are being established in order to facilitate future partnering arrangements.

The DMU Head has also replaced the SOPAC Program Manager as the regional representative on the International Strategy for Disaster Reduction (ISDR) Taskforce and attended the second meeting of this group, which was held in Geneva in October 2000.

In August 2000 the first meeting of the Global Disaster Information Network (GDIN) Asia Pacific Working Group was held in Australia and the DMU played and will continue to play an active role in supporting this important initiative. In November the Unit Head was invited to deliver a presentation on the South Pacific to participants of the Disaster Management Course, which was conducted at the Asian Disaster Preparedness Center in Thailand. Discussions are now underway to develop MOU's between SOPAC and ADPC, Bangkok and EMA, Australia.

## **South Pacific Disaster Reduction Program (SPDRP)**

The SPDRP was the initiative of the United Nations Development Programme and the UN Department of Humanitarian Affairs (UNDHA) in the early 1990s. It became the main disaster management program for the Pacific islands region. A considerable number of donors provided financial and technical assistance to the program.

The development objective of the SPDRP was to strengthen institutional capacities and develop human resources in Pacific island countries, enabling them to mitigate the impact of natural disasters and to improve post-disaster recovery management.

The achievements of SPDRP have been significant given that most Pacific island countries did not have disaster management activities or direct links to a comprehensive regional programme that provided ongoing support and direct assistance before the implementation of SPDRP. Only some countries had national disaster plans, some did not have a full or part-time national disaster management office (NDMO) or focal point, very few training opportunities existed and generally no ongoing disaster mitigation activities. These and more are mostly in place now.

Most Pacific island countries now have functional national disaster management offices (NDMO). All but two countries now have National Disaster Plans and some have support plans for specific hazards. The training component has facilitated the short-term training of numerous people, disaster managers and others, at national, regional and international courses, in governments and NGOs. The Introduction to Disaster Management (IDM) and Training for Instructors (TFI) were the main courses provided and adapted for the region. In collaboration with a number of technical agencies, the SPDRP implemented several pilot projects for specific hazards in selected countries.

It also produced a significant number of technical publications to assist disaster managers and policy-makers in the Pacific, which will be adapted as training and promotional material where applicable. In all aspects of its work, SPDRP has given high priority to fostering cooperation and collaboration with all organisations involved in the multi-disciplinary field of disaster management, from community action NGOs to technical specialists in the natural science fields. It has worked closely with regional and international agencies and donor governments. SDPRP developed its role as the Pacific islands regional focal point through extensive linkages, sharing of information and co-ordinating activities among the Pacific island countries.

It has provided a forum for disaster managers, donors, regional organisations, and NGOs to discuss important disaster management issues and other related matters. It is envisaged that the DMU will continue to build on the achievements of SPDRP and to add on new activities as needed.

It will be too lengthy to acknowledge everyone who contributed to the SPDRP. The following have been the main partners for the last 10 years: United Nations Development Programme (UNDP), UN Office for the Coordination of Humanitarian Affairs (OCHA), Australian Agency for International Development (AusAID), New Zealand Government (NZODA), UK Department for International Development (DFID), the US Office of Foreign Disaster Assistance (OFDA) and the Asia Foundation, the French Government and Emergency Management Australia.



## Human Resources

**Y**ear two of the current three-year cycle of the Earth Science & Marine Geology (ESMG) course started in March 2000. Sixteen students from Cook Islands, Fiji Islands, Kiribati, Papua New Guinea, Samoa, Solomon Islands and Tonga attended the advanced courses. The ESGM course was suspended because of the civil unrest in Fiji in May 2000 when access to USP facilities became difficult and the students requested to return home for security reasons.

Computer-aided teaching methods together with distance education resources continued to be introduced where relevant and two students completed year one (introductory) studies in Samoa by distance methods, to enable them to join the rest of the ESGM group in March 2000. The future status of the ESGM course within the USP structure has been confirmed and actions relating to student registration and fuller use of the USP facilities were taken. In 2001 the students will enrol and receive full USP student status.

A number of regional workshops, seminars or short training courses were organised in-country or at the Secretariat during the reporting period. These are fully reported on by the Work Program unit principally concerned.

Six SOPAC Fellowships were awarded in 2000. The attachment periods ranged from four days to a month, and the following countries benefited: Kiribati, Marshall Islands, Samoa, Solomon Islands, Tuvalu and Vanuatu.

Assistance with course design and development was provided through advice, visits and materials to secondary and tertiary institutions from throughout the region and especially to USP with the teaching of courses SC301 Applied Geology and SC302 Principles of Integrated Coastal Management. Staff also provide input into USP's Ocean Resource Management courses.

Distance education programs in the geosciences continued to be evaluated. The introduction of computer-aided learning packages and experimental teaching of the Earth Science & Marine Geology course by extension and on-the-job training continued. Major constraints such as limited coverage for data transmission by e-mail and Internet availability remained, but these continue to improve.

At the end of June 2000 the whole staff complement of the Human Resources Development Unit disappeared with the departure of the Training Coordinator at the end of his contract. The Assistant Training Coordinator's contract expired earlier on in the same month. Options are being explored to at least temporarily fill the Training Coordinator position so the current cycle of the ESGM Course can be completed in 2001.



ESMG student examining minerals.

## Publications & Library

**A** total of 74 internally-produced reports (see Appendix 2) passed through the SOPAC publishing system, 66 of which were direct output of Work Program tasks. Particularly noteworthy was the "Madang Guidelines" the special publication that was the result of a regional workshop on offshore mineral policy, hosted in Madang, Papua New Guinea, with regional partners (SOPAC Miscellaneous Report 362).

Proceedings volumes of the 29th SOPAC Session; the 8th South Pacific Disaster Management Meeting; and the Regional Offshore Minerals Policy Workshop were published and distributed.

Technical summaries and promotional material published included the 1999 Annual Report Summary, one issue of SOPAC News, two issues of SOPAC Projects, and the major achievement for the Secretariat in 2000, was the publishing of the SOPAC Country Profiles. The latter was a truly collaborative project that spanned two years of research involving regional students at USP, most staff at the Secretariat, and in-country counterparts.

Library assistance and transfer of skills to member countries were carried out for our Solomon Islands and Samoan counterparts. The Samoan work involved more basic training for the Apia officer along with the physical reorganisation of their collection. The Solomon Island officer visited the Secretariat once the furore of civil unrest in both countries abated enough to allow her to catch a plane out of Honiara. Her training was in basic library management.

The library assistance/transfer of skills aspect of PLU activities is highlighting a problem faced by most of SOPAC's regional counterparts. While acknowledging the need for a basic well-managed reference and bibliographic collection with an information system that logs for posterity completed departmental projects, most member country small libraries find themselves with budgets that don't match the expectations placed on them. We have found through our experience that our counterpart departments firstly have difficulty retaining staff in the library services. Secondly, because of budgetary priorities,



## PUBLISH OR PERISH

Politely phrased, the Publications and Library Unit, with its staff of three, publishes the proceedings of annual meetings; designs and publishes the huge amount of SOPAC project reports; prints a quarterly SOPAC gazette along with various and frequent newsletters and related promotional material; all the while, with a smile, providing access to the shelves and shelves of geoscientific information.



Less politely, and in the words of the Unit's Publications Coordinator, Lala Bukarau, it's "data, data, data up to your ears – talk to anyone here and it's about collecting data, and most of it is destined to be put in a report. We have a lot to do ... too much to do ... and it was interesting when a key publications person from one of the other regional agencies looked at our work load and said 'you people do all this? This is amazing. In fact, it's embarrassing.'"

"But I guess our success story for 2000," she added, "would have to be in publishing the SOPAC country profiles, a task that was done for all 15 member countries and took two years." The profiles, A-4 size, nicely designed and full of photos and artwork, give the reader at a glimpse all the necessary information about each place: population and land area; geography, geology, rainfall, economy, natural hazards, minerals potential, SOPAC's on-island projects. They're now available as a set, a reference guide for SOPAC personnel and others before beginning an in-country task ... an easy and visually exciting opportunity to know about the country before arriving.

library services is usually a dual task to be performed by secretarial or administration staff with the library services being the task of lesser priority.

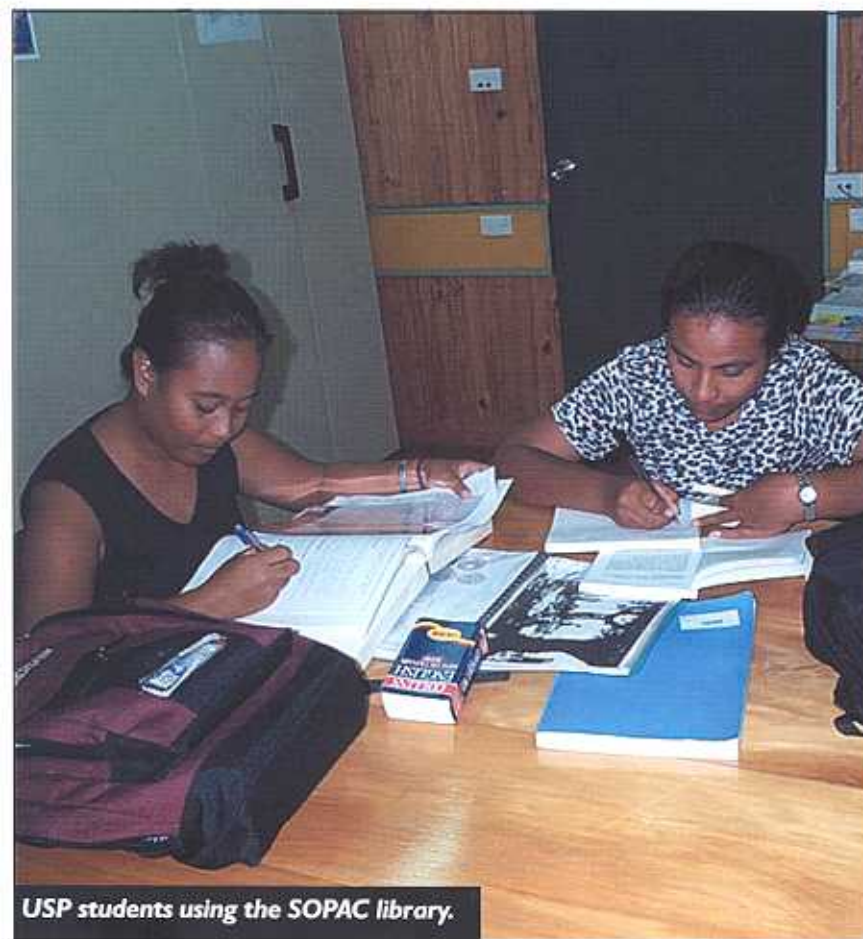
For these reasons, library assistance is likely to be an ongoing activity of this unit for as long as SOPAC exists unless this fundamental flaw in allocation of national departmental resources is addressed from source, and these in-country department small libraries can reach and stabilise at a steady state of information flow and take their proper place in contributing to the larger framework of national development.

The Secretariat continued to provide assistance and advice to the ECOWOMAN network with database development. Work with the network, Pacific Woman & Her Environment: A Better Life for Communities through Science and Technology (ECOWOMAN), continued with attendance at bi-monthly meetings of the Steering Committee and quarterly meetings of the whole ECOWOMAN Collective. An end-of-funding cycle retreat was attended for debriefing, proposal writing and planning. In the interest of taking our proper place in the regional dissemination of information process, the Librarian attended the 2nd Pacific Environmental Information Network (PEIN) and Clearinghouse Sub-Regional Workshop in Apia.

The SOPAC Library is also a node and participant/contributor to the Pacific Islands Marine Resources Information System (PIMRIS) network managed out of the USP Library.

### Statistics 2000

- 525 reports and publications recorded as sent out between Jan-Jun 2000 in response to user requests.
- 299 users recorded as being requesters of the above material (Jan-Jun).
- 265 hits were recorded for bibliographic reference queries only and not removing and taking material from the Library (Jan-Jun).
- 22 staff requests for new publications/books for order (Jan-Jun).
- 623 new items received into the Library during Jan-Jun for cataloguing and classifying to be accessible to Library users.



USP students using the SOPAC library.



# Corporate Service Program

## Finance & Administration

The work of the Finance and Administration Unit throughout the year focused on ensuring the following services were provided:

- Professional financial services
- Advice to management on financial matters
- Timely management, donor, financial and audit reports
- Assistance in the preparation of Work Program and Budget
- Professional personnel services which included job sizing and the implementation of the CROP Remuneration System
- Administration, office and property support services which included relocation and refurbishing of Units
- Design, implement and maintain operational systems and databases
- Design and Implementation of Finance package funded by Australia (Sun Business Account, Fixed Asset Register & Purchase Order module)

Timely preparation and reporting to donors and support agencies was completed together with financial statements for new and ad-hoc donor funding provided during the year.





# Appendix I: Summary of 2000 Donor Funding by programs (RXB and XB combined)

ANTICIPATED SOURCE OF FUNDS	GRAND TOTAL	RESOURCE DEVELOPMENT PROGRAM	ENVIRONMENTAL SCIENCE PROGRAM	NATIONAL CAPACITY DEVELOPMENT PROGRAM	CORPORATE SERVICES PROGRAM	WORK PROGRAM MANAGEMENT
AUSTRALIA: Annual Grant Special Grant	562,300 746,311	154,300 115,000	388,000	20,000 631,311		
CANADA	60,000	60,000				
CFTC	278,440		127,550	150,890		
CHINA	145,800		145,800			
DENMARK/UNEP	36,516	36,516				
Fiji	81,342	22,392	58,950			
FRANCE	141,000			141,000		
IRELAND	104,167					104,167
JAPAN	150,121	150,121				
KOREA	20,000	20,000				
NEW ZEALAND: Annual Grant NZ Special Grant	453,743 515,498	363,993	13,750 48,963	175,767		76,000 290,768
TAIWAN/ROC	329,530	131,000	198,530			
UNITED KINGDOM: DFID ODI	688,705 115,000	379,538 115,000	89,667	219,500		
UNITED NATION (UN)	542,896	115,000		427,896		
UNDMP	49,100			49,100		
UN/PEREZ GUERRERO of	75,000	75,000				
VARIOUS	115,737		115,737			
<b>Total Budget</b>	<b>5,211,206</b>	<b>1,737,860</b>	<b>1,186,947</b>	<b>1,815,464</b>	<b>0</b>	<b>470,935</b>

## Work Program Management



Russell Howarth

This work program is ongoing and specific reports under each unit of the SOPAC Work Program is reported under that unit.

Events that significantly affected the operation of the Secretariat and subsequently the implementation of the SOPAC Work Program during the year 2000, were the aftermath of the civil unrests that afflicted both the Solomon Islands and Fiji, which hosts the SOPAC Secretariat.

While the continuing situation in Solomon Islands caused the suspension of most of its 2000 Work Program components, the aftermath of the events of May 19th in Fiji had a resounding impact on the Secretariat's ability to operate normally.

The Secretariat's preliminary evaluation of the losses incurred to the Secretariat was FJ \$1.4 million.

The events exposed weaknesses in the Secretariat's ability to effectively respond to these significant events. Immediately identifiable was the lack of an effective risk management strategy, and the need for a demonstrable and proactive approach to assist the SOPAC senior management team.

As a first step to ensuring that the Secretariat management is able to respond to any significant event in the future, the Secretariat will develop a business continuity plan for presentation to the SOPAC Council in the new year.





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- Taylor, P., Talia, L. 1999. Volcanic hazards assessment of Savai'i, Samoa. SOPAC Technical Report 295.
- Schölzel, H., Dawe, P. 1999. Numerical model for the water supply system, Rarotonga, Cook Islands. SOPAC Technical Report 296.
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- Cronin, S. 1999. Volcanic hazard and risk assessment for Taveuni, Fiji. SOPAC Technical Report 298.
- Kaly, U. & others. 1999. Report on the environmental vulnerability index (EVI) Think Tank, 7-10 September 1999, Pacific Harbour, Fiji Islands. SOPAC Technical Report 299.
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- Maharaj, R. 1999. Engineering, geological assessment on onshore aggregate potential, Pohnpei Island, Federated States of Micronesia. SOPAC Technical Report 301.
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- Varea, S. 2000. Managing the implementation of the Fiji Study on "Reducing the Impacts of Environmental Emergencies through early warning and preparedness, the case of the El Niño South Oscillation (ENSO)". SOPAC Technical Report 307.
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- Smith, R. 1999. Bathymetry and hydrodynamic model for mariculture projects, Abaiang Atoll, Kiribati. SOPAC Preliminary Report 112.
- Schmall, S., Biukoto, L. 1999. The Asset Building Survey building a community assets database for Suva, Honiara, Port Vila and Nukua'lofa. SOPAC Preliminary Report 115.
- Kojima, K. 1999. Preliminary report on the results of the Japan/SOPAC deepsea mineral resources survey in the Republic of the Fiji Island waters. SOPAC Preliminary Report 117.
- Sharma, S. 1999. Conductivity-Temperature-Depth profiles – Fiji a database compilation of surveys, 1997-1999, Fiji Islands. SOPAC Preliminary Report 118.
- McLeod, H. 2000. Draft Solomon Islands Mineral Policy. SOPAC Preliminary Report 119.
- Mario, R. 2000. Efficiency monitoring of solar hot water systems in Fiji and Tonga. SOPAC Preliminary Report 120.
- Smith, R. 2000. Multibeam and seismic mapping, Lautoka Port, Viti Levu, Fiji Islands. SOPAC Preliminary Report 122.

**Miscellaneous Reports**

- SOPAC Secretariat, 2000. ENSO Impact on Water Resources in the Pacific Region Workshop, Tanoa International Hotel, Nadi, Fiji Islands, 19-23 October 1999. SOPAC Miscellaneous Report 336.
- McLeod, H. 1999. Report on the Intergovernmental Panel on Climate Change (IPCC) Expert Meeting on Small Island States, Valletta, Malta, 19-22 July 1999. SOPAC Miscellaneous Report 348.
- Seraphim, F. 1999. Development of a metadata solution for geographic data of the South Pacific. SOPAC Miscellaneous Report 349.
- Schölzel, H. 1999. Development of a numerical network model for Nukua'lofa, Kingdom of Tonga – TWB Planning Engineer attachment at the Secretariat. SOPAC Miscellaneous Report 350.



- Schölzel, H. 1999. Water demand management work with Department of Rural Water Supply in Vanuatu. SOPAC Miscellaneous Report 351.
- Schölzel, H. 1999. Developing a regional GIS for water utilities. SOPAC Miscellaneous Report 352.
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- Schölzel, H. 1999. A regional manual for Wenner Offset resistivity tests. SOPAC Miscellaneous Report 354.
- Crook, K.A.W.; Rodda, P. (eds) 1999. Abstracts of papers presented at the STAR Session. SOPAC Miscellaneous Report 355.
- Burke, E. 1999. Recommendations for disaster preparedness of water and sanitation systems in Pacific small island developing states. SOPAC Miscellaneous Report 356.
- Fifita, S. 1999. Evaluation of the photovoltaic power system for the Christian Institute for Community Development, Abemama Island, Republic of Kiribati. SOPAC Miscellaneous Report 357.
- SOPAC Secretariat, 2000. Reports of the STAR Working Groups at the STAR Meeting during the 28<sup>th</sup> Annual Session of SOPAC. SOPAC Miscellaneous Report 358.
- Bower, R. 2000. Report on water & sanitation section of environmental module coordinated by SPREP for the Pacific Community. SOPAC Miscellaneous Report 360.
- Schölzel, H. 2000. Installation of a global positioning system (GPS)-assisted field asset management (FAM) system for the department of water works in Rarotonga, Cook Islands. SOPAC Miscellaneous Report 361.
- [SOPAC Secretariat], 2000. The Madang Guidelines. Principles for the Development of National Offshore Mineral Policies. SOPAC Miscellaneous Report 362 (appended by SOPAC Miscellaneous Report 323: Offshore Minerals Policy Workshop, 22-26 February 1999, Madang, Papua New Guinea – Workshop Report).
- McLeod, H. 2000. Final Report, for the Resource Economist (October 1997-December 1999). SOPAC Miscellaneous Report 364.
- McLeod, H. 2000. Assistance in amending Vanuatu Quarrying Act. SOPAC Miscellaneous Report 365.
- Allinson, L. 1999. MNRD LAN-WAN-based Information System (MNRDIS) Report and Recommendations. SOPAC Miscellaneous Report 366. (Restricted)
- Allinson, L. 1999. MNRD LAN-WAN-based Information System (MNRDIS) User's Guide. SOPAC Miscellaneous Report 367. (Restricted)
- Allinson, L. 1999. MNRD LAN-WAN-based Information System (MNRDIS) Administrator's Manual. SOPAC Miscellaneous Report 368. (Restricted)
- Allinson, L. 1999. The role of Telecom Services Kiribati Ltd as an Internet Services Provider – a briefing paper. SOPAC Miscellaneous Report 369. (Restricted)
- Koshy, R. (compiler) 2000. [Poverty alleviation – SOPAC's philosophy and approach]. SOPAC Miscellaneous Report 370.
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- Cronin, S.; Kaloumaira, A. 2000. Taveuni volcanic hazards workshops, National Level – Suva, 21-23 June 1999; Island Level – Waiyevo, Taveuni, 13-14 December 1999. SOPAC Miscellaneous Report 372.
- Cronin, S.; Petterson, M.; Taylor, P.; Biliki, R.; Planitz, A. 2000. Workshop on the volcanic hazards, operational support plan and awareness programs for Sava volcano, Solomon Islands, 1-6 November 1999. SOPAC Miscellaneous Report 373.
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- Allinson, L. 2000. Information Technology Evaluation of the International Seabed Authority, Kingston, Jamaica; 16 March 2000. SOPAC Miscellaneous Report 376.
- Shorten, G. 2000. Report of visit to Japan, Geological Survey of Japan, Asian Disaster Reduction Center on 11-20 February 2000. SOPAC Miscellaneous Report 379.
- Martin, F. 2000. Information Systems Development Review Commission, Kosrae, Federated States of Micronesia. SOPAC Miscellaneous Report 380.
- Mario, R. 2000. The National Energy Demand/Supply Database Manual [Vanuatu]. SOPAC Miscellaneous Report 381.
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- Schmall, S. 2000. The End-Users of Pacific Cities II Hazard, Vulnerability and Risk Assessment Information. SOPAC Miscellaneous Report 384.

## Training Reports

- Sanchez, S. 1999. Hydrodynamic impact assessment of Natadola Beach, Fiji. SOPAC Training Report 83.
- Maharaj, R.J. 2000. Guidelines for monitoring and evaluating beach erosion and shoreline dynamics. Report of a Training Workshop, Tarawa, Kiribati, 14-16 March 2000. SOPAC Training Report 84.







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### **Trip Reports**

McLeod, H. 2000. Tuvalu Environmental Vulnerability Index Data Gathering Report. SOPAC Trip Report 264.

McLeod, H.; Koshy, R. 2000. Isabel Nickel Tender, 13-20 November 1999. SOPAC Trip Report 265.

Fairbairn, P. 2000. Energy Division Mission to Papua New Guinea, 8-12 February 2000. SOPAC Trip Report 266.

Biukoto, L.; Teakle, G. 2000. [Hazards Assessment Unit] visit to Port Vila, 26 February-11 March 2000. SOPAC Trip Report 267.

Koshy, R. 2000. The Vanuatu Mineral Sector Promotional Pamphlet – data collection trip to Port Vila, 4-11 March 2000. SOPAC Trip Report 268.

Prasad, S. 2000. [Publication & Library Unit] visit to Samoa, 26 June-7 July 2000. SOPAC Trip Report 269.

### **Joint Contribution Reports**

White, I., Falkland, A., Crennan, L., Jones, P. (et al.) 1999. Groundwater recharge in low coral islands Bonriki, South Tarawa, Republic of Kiribati: issues, traditions and conflicts in groundwater use and management. UNESCO, Paris. IHP-V Technical Documents in Hydrology 25: 37 p.; 5 figs.; 2 tables (SOPAC Joint Contribution 127)

White, I., Falkland, T., Scott, D. 1999. Droughts in small coral islands: case study, South Tarawa, Kiribati. UNESCO, Paris. IHP Technical Documents in Hydrology 26: 55 p.; (SOPAC Joint Contribution 128)

South Pacific Applied Geoscience Commission (SOPAC), Vanuatu Department of Geology, Mines and Water Resources (DGMWR). 2000. Hydrological baseline studies project November 1999 field trip report. 8 p.; 3 app.

Japan International Cooperation Agency (JICA), Metal Mining Agency of Japan (MMAJ). 2000. Report on the Cooperative Study Project on the Deepsea Mineral Resources in Selected Offshore Areas of the SOPAC Region (Volume 5) Sea Area of the Republic of Fiji Islands. (SOPAC Joint Contribution 130) 135 p.; figures, tables.

2000. Boosting the Net Economy 2000: results of an online think tank about the impact of the Net Economy. (SOPAC Joint Contribution 131).

Japan International Cooperation Agency (JICA), Metal Mining Agency of Japan (MMAJ). 2000. Report on the Cooperative Study Project on the Deep Sea Mineral Resources in Selected Offshore Areas of the SOPAC Region: Data Analysis and Digitalization between 1985 and 2000.

Japan International Cooperation Agency (JICA), Metal Mining Agency of Japan (MMAJ). 2000. The Cooperative Study Project on the Deep Sea Mineral Resources in Selected Offshore Areas of the SOPAC Region: Data Analysis and Digitalization between 1985 and 2000: Geographic Information System (GIS) user's guide. (SOPAC Joint Contribution 132). 97p; 5 CD-ROMs

Japan International Cooperation Agency (JICA), Metal Mining Agency of Japan (MMAJ). 2000. Report on the Cooperative Study Project on the Deep Sea Mineral Resources in Selected Offshore Areas of the SOPAC Region: Data Analysis and Digitalization between 1985 and 2000: appendices

### **Routine Publishing Projects**

Annual Report Summary 1999

1 issue of SOPAC News

1 issue of Pacific GIS & Remote Sensing Newsletter

SOPAC Introductory leaflet (in response to public demand)

SOPAC Country Profiles (14 countries)

2 Issues of SOPAC Projects

# 13, Tsunami! Offshore Surveys after the Papua New Guinea Event of July 1998 (December 1999)

# 14, World Water Day 2000, 23 March 2000 (August 2000)

### **External Publishing Projects**

Paradise or Comic Opera? 50 years in the Tropical Pacific by the late Stuart G. Kingan (subject to approval of Kingan family)

Transferred publications from the UNDHA Office to the Disaster Management Unit, SOPAC

8<sup>th</sup> South Pacific Regional IDNDR Disaster Management Meeting, Apia, Samoa, 6-10 September 1999,

Disasters and Agriculture in the Pacific Islands/Andrew & Ian McGregor for the SPDRP, UNDHA Office.

Natural Disaster Reduction in Pacific Island Countries/Jack Rynn. Final Report for the International Decade for Natural Disaster Reduction (IDNDR) 1990-2000.



Appendix 3: SOPAC-paid employees are listed with the date they joined SOPAC, and the start and finish date of their current contract. In-kind staff provided by donors and support organisations are listed with the date they joined SOPAC in *italics*.

SECTIONS	NAME	COUNTRY OF ORIGIN	DATE JOINED	CONTRACT START	CONTRACT END
<b>RESOURCE DEVELOPMENT PROGRAM</b>					
1 Program Assistant	Laisa Baravilala-Baoa	Fiji	Jul 1987	Permanent	
<b>Mineral Resources Unit</b>					
2 Marine Geologist	Jackson Lum	Fiji	Nov 1992	Nov 1998	Nov 2001
3 Offshore Geologist	Kazuhiro Kojima	Japan	Sep 1998		Feb 2000
4 Resource Economist	Robin Koshy	India	Oct 1999	Oct 1999	Oct 2001
5 Senior Geology Technician	Sekove Motuiwaca	Fiji	April 1980	Permanent	
<b>Water Resources Unit</b>					
6 Environmental Engineer	vacant				
7 Hydrogeologist	Marc Overmars	Netherlands	April 2000		
8 Hydraulic Engineer	vacant				
9 Workshop Assistant	Setareki Ratu	Fiji	Oct 1986	Permanent	
<b>Energy Unit</b>					
10 Energy Coordinator	Paul Fairbairn	New Zealand	Jan 1998	Jan 1998	Jan 2003
11 Energy Advisor	Anare Matakaviti	Fiji	Feb 2000	Feb 2000	Feb 2003
<b>ENVIRONMENTAL SCIENCE PROGRAM</b>					
12 Program Assistant	Sisilia Gravelle	Fiji	Sep 1998	Permanent	
<b>Coastal Unit</b>					
13 Marine Geophysicist	Robert Smith	Australia	Oct 1998	Jul 1998	Jun 2001
14 Coastal Geologist	Russell Maharaj	Trinidad & Tobago	Jun 1998		Jun 2001
15 Coastal Geologist	Chao Xiong He	China	Jul 1998		Jul 2001
16 Senior Electronics Technician	Simon Young	Fiji	Jan 1993	Jan 1999	Jan 2002
17 Electronics Technician	Peni Musunamasi	Fiji	Jun 1989	Permanent	
<b>Hazard Assessment Unit</b>					
18 Coastal Engineering Geologist	Graham Shorten	Australia	Oct 1995	Jan 1999	Jan 2002
19 Technical Support Assistant	Graeme Frost	Fiji	Mar 1992	Permanent	
<b>Ocean Unit</b>					
20 Marine Affairs Advisor	Cristelle Pratt	New Zealand	May 2000	May 2000	May 2002
<b>NATIONAL CAPACITY DEVELOPMENT PROGRAM</b>					
21 Program Assistant	Vive Vuruya	Fiji	Sep 1998	Permanent	
<b>Human Resource Development Unit</b>					
22 Training Coordinator	vacant				
<b>Disaster Management Unit</b>					
23 Disaster Management Coordinator	Alan Mearns	Australia	June 2000	Jun 2000	Jun 2003
24 Disaster Management & Program Support Officer	Atu Kaloumaira	Fiji	Dec 2000	Dec 2000	Dec 2003
25 Professional Development Officer	vacant				





SECTIONS	NAME	COUNTRY OF ORIGIN	DATE JOINED	CONTRACT START	CONTRACT END
<b>NATIONAL CAPACITY DEVELOPMENT PROGRAM</b>					
26 Disaster Management Training Advisor	Lesu Waqaniburotu	Fiji	Oct 2000	Oct 2000	Oct 2003
27 Unit Assistant	Vive Vuruya	Fiji	Sep 1998	Permanent	
<b>Information technology Unit</b>					
28 Information Technology Manager	Les Allinson	Australia	Nov 1992	Nov 1992	Oct 2001
29 Database Development Officer	Frank Martin	France	Sep 1993	Apr 1999	Apr 2003
30 Computer Geologist	Myriam Gallois	France	Aug 2000		
31 Computer Operator	vacant				
<b>Publications and Library Unit</b>					
32 Publications Coordinator	Lala Bukarau	Fiji	Nov 1985	Sep 2000	Sep 2003
33 Library / Program Assistant	Sunita Prasad	Fiji	May 1989	Permanent	
<b>CORPORATE SERVICE PROGRAM</b>					
34 Program Assistant	Annette Warbrooke	Fiji	Oct 1990	Permanent	
35 Executive Assistant	Litia Waradi	Fiji	Apr 1989	Permanent	
<b>Management Unit</b>					
36 Director	Alfred Simpson	Fiji	Feb 1995	Feb 2001	Feb 2004
37 Deputy Director	vacant				
38 Program Manager	Russell Howorth	New Zealand	Nov 1986	Mar 2001	Mar 2002
39 Finance & Administration Controller	Mohinish Kumar	Fiji	Mar 1995	Mar 2001	Mar 2004
<b>Finance Unit</b>					
40 Accountant	Makereta Kaurasi	Fiji	Apr 1998	Apr 2001	Apr 2004
41 Assistant Accountant	James Ram	Fiji	May 2000	Permanent	
<b>Administration Unit</b>					
42 Administrative Assistant	Nazmeen Whippy	Fiji	July 1986	Permanent	
43 Receptionist / Clerk	Unaisi Bainiloga	Fiji	Feb 1987	Permanent	
44 Driver / Clerk	Enele Gaunavou	Fiji	July 1998	Permanent	
45 Office Assistant Cleaner	Nlu Daurewa	Fiji	Sep 1987	Permanent	



**Appendix 4: 2000 Revised Budget and 2001 Approved Budget Summary of Anticipated Income (including in-kind support contribution) and Expenditure by Programs**

	2000 Revised Budget F\$	2001 Approved Budget F\$
PROGRAM HEADS		
Resource Development Program	1,906,647	3,137,249
Environmental Science Program	1,407,011	2,463,137
National Capacity Development Program	2,398,464	1,960,000
Corporate Services Program	994,825	1,078,500
Work Program Management Program	711,935	699,583
<b>TOTAL</b>	<b>7,418,882</b>	<b>9,338,469</b>





