# Darwin Initiative for the Survival of Species

## *Coral Reef Conservation/Wai Bulabula Project – Fiji*

***Project 162-8-89***

***Just World Partners (formerly UKFSP) and***
***the Foundation for the Peoples of the South Pacific (FSP Fiji)***

# Final Report

# 1999-2002

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# *Final Report*

## 1. Darwin Project Information

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|---|---|
| Project title: | *Coral Reef Conservation / Wai Bulabula Project* |
| Country: | *Fiji* |
| Contractor: | *FSP Fiji* |
| Project Reference No. | *162-8-89* |
| Grant Value | *£77,560* |
| Starting/Finishing dates | *July 1999 - March 2002* |

## 2. Project Background/Rationale

**Introduction**
The Darwin Initiative for Survival of Species funded the Coral Reef Conservation / Wai Bulabula project. This project was implemented by FSP Fiji, in collaboration with Just World Partners, UK. The Wai Bulabula project aimed to conserve coral reefs and their associated biodiversity by managing land based sources of pollution, particularly wastes containing nutrient loadings, through participatory community approaches.

**Background**
Coral reefs throughout Fiji have come under increasing environmental pressure. The main contributing factors to this increasing pressure includes the use of fertilisers in sugarcane farms, over-harvesting of forests and human population pressure producing improperly produced solid and liquid waste materials. Industries are located along coastal areas and rivers dump polluted wastewater into rivers and sea without adequate treatment. Liquid wastes are a concern because they contain nutrients such as nitrates and phosphates. In sufficient concentrations nutrients have the ability to hinder reproduction in certain fish species, coral growth and stimulate eutrophication thereby upsetting the coral reef ecosystem and its biodiversity. While recent initiatives by government departments, non-governmental organisations, communities and other stakeholders have focussed on directly conserving coral reefs there have been fewer attempts to manage wastewaters that enter the marine environment.

The Wai Bulabula project was carried out in Cuvu district which is situated south west of Viti Levu. Cuvu is a coastal community consisting of 8 villages namely Cuvu, Tore, Sila, Navuevu Yadua,Rukurukulevu, Hanahana and Voua. Divided into two major components, the Wai Bulabula focused on community activities and simultaneously worked with the Shangri La Fijian Resort, located on Yanuca Island. Yanuca Island is about 0.5 square kilometres and is connected to the main land by a causeway, about 70 meters in length. Cuvu district traditionally owns Yanuca.

The need for this project was identified by local communities and by FSP (Fiji) in partnership with Just World Partners. The district of Cuvu was specifically chosen for

the implementation of this project as a result of the enthusiasm of local communities, the extent of local marine pollution, and the presence of financial and logistical support form the Shangri La Fijian Resort. Major stakeholders include the communities, FSP (Fiji), the Sigatoka Provincial Office and the Shangri La Fijian Resort

## 3. Project Summary

**Project purpose:** To reduce the pollution of coral reefs in Cuvu District by reducing land based sources of pollution.

**Specific objectives:**

- To raise awareness amongst communities of the importance of coral reefs and the implications of water and waste management on the marine environment and encourage community initiated simple waste management innovations,
- To identify and develop ecological waste management technologies for one hotel and one community,
- To train local counterparts in the design, construction and maintenance of appropriate technologies
- To collaborate with the Department of Environment in the production of specific strategies that could be incorporated under Fiji's National Biodiversity Strategy and Action plan

The Wai Bulabula project has achieved a great deal despite initial difficulties due to a political coup and the problems suffered due to the unsuccessful contracting of consultants both from the Living Waters UK group and the HEAL Australian group. A great deal of the work initially planned for these consultants was finally carried out by FSP (Fiji) staff. This caused some delays as FSP personnel had to learn new techniques but has ultimately resulted in the project outcomes being highly sustainable as project staff now have the knowledge to be able to carry out similar projects without the expense of contracting consultants.

The project addresses the following *Articles* from the *Convention on Biological Diversity*:

***Article Number:***

7. Identification and monitoring,
8. In-situ conservation
10. Sustainable use of components of biological diversity,
11. Incentive measures,
12. Research and training,
13. Public education and awareness,
16. Access to and transfer of technology, and
17. Exchange of information.

- The project was very successful in raising awareness amongst communities about the importance of coral reefs and implications of land based sources of pollution in terms of marine conservation. This was largely due to (a) the participatory approach adopted by the project (b) the intergrated approach that took into account the land based activities and relationship with the marine environment. Evidence of this success includes a significant reduction in the amount of wastes formerly deposited into Rukurukulevu channel, cleaning up of Cuvu beach which

was an informal rubbish dump and replanting of mangroves. Several men and women were recently interviewed in a recent documentary by the Fiji TV. They explained clearly the linkage between land-based sources of pollution and conservation of the marine environment. Secondly, a local youth group was trained and is promoting environmental awareness through dramas.

- In terms of design, construction and maintenance of appropriate ecological waste technologies the project was successful in constructing an artificial wetlands treatment system for the resort. However, given the circumstances experienced it was not possible to construct one at a community. This was because of the unsuccessful contracting of 2 technical assistants. A local contractor was selected and together with FSP successfully completed the wetlands. However so much time and effort was devoted to completing the wetlands systems on their own without the support and assistance of a technical expert. It was just not possible to make time to build one at village level.

- The local contractor (Kantas construction), FSP and 5 men from Cuvu district while working on site expanded their knowledge about the construction, maintenance and design of wetlands. It was not possible to train other local counter parts including a student and an environmental engineer. The reasons being (a) firstly, the technical consultants were not on site - it was inappropriate to have trainees (b) the FSP and Kantas construction struggled to complete the wetlands (c) it was not possible to locate an environmental engineer that was willing to be trained in the wetlands system without receiving some form of compensation (d) the construction coincided with the later period of semester i.e. students were preoccupied with completion of assignments and preparing for final exams.

- The project collaborated quite actively with the Department of Environment. It was an example of a community based project empowering locasl to conserve their reefs directly supporting the National Biodiversity Strategy Action Plan (NBSAP). During NBSAP workshops the Wai Bulabula project was considered and discussed and lessons learnt incoporated into the NBSAP.

## 4. Scientific, Training, and Technical Assessment

### 4.1 Artificial Wetlands Treatment System

The Wai Bulabula project team together with a local contractor (Kanta Construction, Sigatoka) successfully took on the challenge of completing the wetlands treatment systems. Apart from the delays caused by the initial consultants the wetlands construction process was prolonged as a digger with a rock breaker had to be used to lower the base of the last two wetlands which had an unusually rock hard limestone base. A total of 5 men from Cuvu district, the Wai Bulabula team (2) and 11 labourers from Kanta Construction worked on the wetlands.

***Wetlands construction***

Three wetlands were constructed, each 60m x 8m in dimension. Constructed along a slope, they allow wastewaters to flow from one wetland to the other. A layer consisting of black polythene (200 microns thickness), chicken mesh wire and 5 inches of concrete seals the wetlands thereby preventing seepage. The average depth of the water column is 30cm. At the base of the wetlands is a 10cm layer of gravel used to anchor roots and keep plants upright. The wetlands are connected by an outlet or lip which ensures that while depth is maintained at 30cm excess water flows into the next wetland naturally.

The quality of water in the wetlands treatment system is monitored on a monthly basis. The project is being assisted by Dr Luke Mosley of the University of the South Pacific. Water samples were analysed from the first and final lake. The most recent analysis as listed below indicates a 75% reduction in nitrates and 10% reduction in phosphates. The huge reduction in nitrates is a major break through as the purpose of these wetlands is to improve the quality of wastewaters by consuming nutrients (i.e. nitrates and phosphates). However the phosphates loading to the ponds is very high relative to nitrate levels. A study on what types of detergents and washing powders are used at the resort and whether phosphate free types could be used if they are not already is recommended. When released into the marine environment excess nitrogen can stimulate eutrophication and hinder the growth of coral reefs. Previously, wastewaters on Yanuca were sprayed onto golf courses at night. Taking into account the porous nature of limestone (the resort is on an uplifted calcareous limestone outcrop) a high percentage of these wastewaters make their way into the sea directly or indirectly through the water table.

***Completed wetland planted with a variety of species***

**Report of Sample Analysis dated 28th February, 2002**

| | Pond Input | Pond Output | Change |
|---|---|---|---|
| Nitrate (micrograms/litre) | 806 | 208 | - 75% |
| Phosphate (micrograms/litre) | 2256 | 2040 | -10% |

The Wai Bulabula artificial wetlands treatment system developed under this Darwin funded project is recognized as one of the few of it's kind in Fiji and Pacific. There is a huge potential for treatment of wastewaters through artificial wetlands.
The delays, which were caused by the political coup and the problems with the contracted consultants, resulted in the Wai Bulabula team devoting a higher percentage of their time to wetlands construction than previously planned. This has resulted in the further delay of the wetlands systems for villages. It is hoped that this aspect of the project will be developed as a follow on project from the Darwin project. With the skills and knowledge gained, the Wai Bulabula staff and the five men from Cuvu district (who worked as labourers to construct the wetlands) are now confident in constructing similar systems at village level.

To date there have been no reported problems such as leaks. The only problem encountered was that the wetlands were infested with mosquito larvae. To solve this potentially serious health risk about 400 adult talipa (fish) were added to the lakes. These fish feed on the larvae and have solved the problem.

Following an environmental appraisal of the Fijian Resort and surrounding watersheds the resort took several initiatives to improve waste management. Outlets from the laundry and several restaurants were blocked to prevent waste from entering Cuvu bay or the Rukurukulevu channel. These were also concerns raised by locals during community workshops. The Fijian Resort contracted an expatriate engineering firm to upgrade the present sewage treatment plant with the aim of reducing nutrient levels.

**4.2 Media promotion of the Wai Bulabula project**

The local media have been very interested in the project and it has received various mentions in the media. In addition, the Shangri La Fijian Resort received a special environmental award at the 2001 Fiji Excellence in Tourism annual event. It was honoured for the initiative taken to restore the coastal environment surrounding the resort and Cuvu district in conjunction with FSP (Fiji). Articles about FSP and in particular the Wai Bulabula Project have appeared in the Fiji Times and Fiji Sun newspapers. Fiji TV is also making arrangements to film a documentary of the Wai Bulabula project.

**4.3 Mangrove Replanting**

The OISCA, a Japanese non-governmental organization, over the past two years has assisted FSP (Fiji) and the Yadua community with replanting of mangrove seedlings, mainly *Rhizophora. Spp*, along the foreshore especially in deforested areas. To date over 400 seedlings have been planted, some now reaching up to over a metre tall. A nursery was set up in the same area in order to supply sufficient seedlings to other villages that have requested replanting of mangrove. Yadua villagers have observed crabs and fish species such as mullets now frequenting the new mangrove areas. This has generated more interest in replanting mangroves in neighbouring districts. A second village, Navuevu, has declared their existing mangrove swamps a protected area.

A villager next to replanted mangroves

***A villager next to replanted mangroves, Yadua***

Additionally, hybrid dwarf coconuts were obtained from the Agricultural Coconut Research Station, Taveuni. These seedlings mature faster than normal coconuts bearing fruits at about three years. All villages received at least 100 seedlings and planted them to strengthen and protect their coastlines.

**4.4 Establishment of Marine Protected Areas**

During the PLA workshops carried out as part of the project all communities indicated a reduction in fish and shellfish in recent years and unanimously requested the establishment of marine protected areas (MPA). Following its endorsement at the district council meeting, 3 MPA sites were demarcated for all communities in June 2001. Facilitated by the Department of Fisheries, a one-day introductory fish warden's workshop was conducted at Cuvu village, for the 14 traditionally appointed fish wardens. Each village has it's own wardens who are issued with identification cards

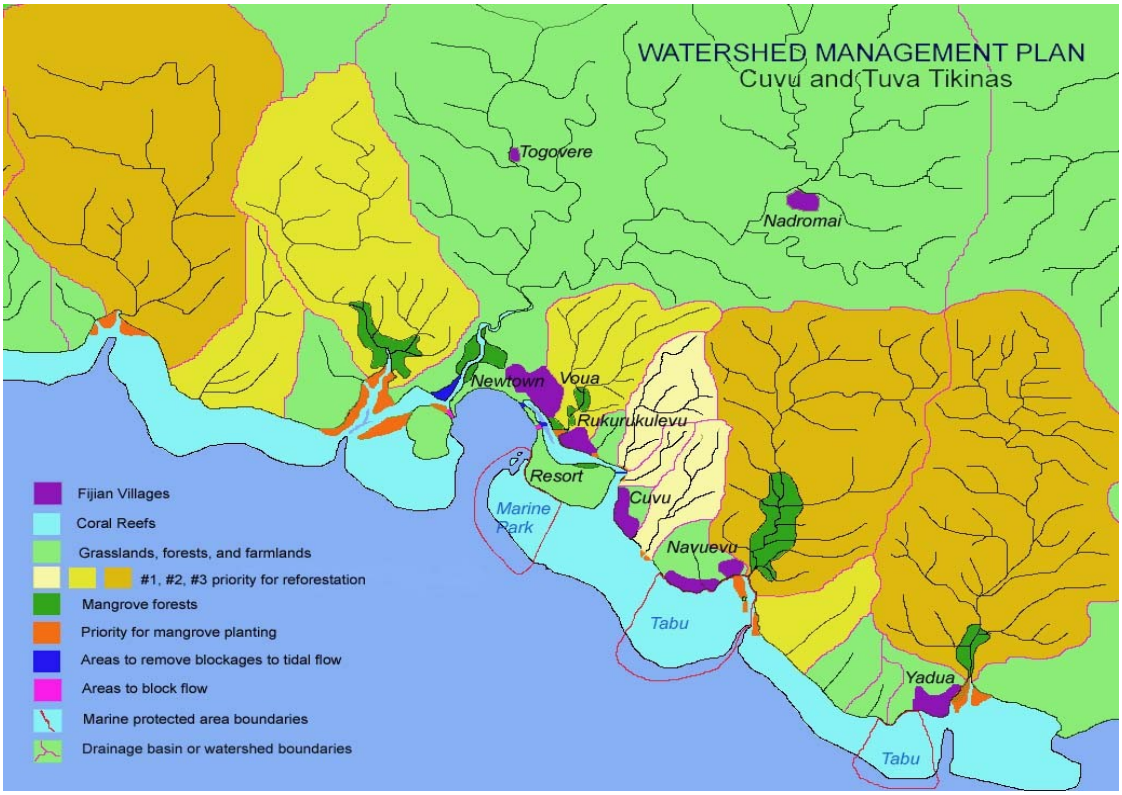
by the Department of Fisheries. Nearby villages such as Navuevu, Tore and Sila share a common MPA site.

### 4.5 Watershed Management

Based upon a preliminary environmental assessment of waste and water management at the Fijian Resort and adjacent watersheds it was found that the main watershed impacts on reefs appear to be related to occasional massive fresh water and silt influxes during heavy rain and cyclones. This is made worse by the steep hills and erodable soils. All together there are about 7 main watersheds. Three watersheds have been identified as priority because they lack mangroves; deposit sediments directly onto the reef flats and owing to their sizes are manageable. Two are located just above and below the course way while the third is situated between Cuvu and Tore (see Map 1 below).

A difficulty experienced with watershed management was the uncertainty of renewal of lease agreements. The majority of occupants in the reaches of the watersheds are cane farmers leasing land from local communities. With the uncertainty of renewal of lease agreements most farmers lacked interest in improving land management practices. As a result of this, a soil conservation site was established. In conjunction with the Department of Agriculture and landowners, Vertiver grass (*Veriveria zizanoides*) was planted in contours along a steep slope in an area of about 3 acres at Yadua. Vertiver forms a dense root network and thick hedges thereby reducing soil erosion and allowing more water to filter through the soil. Commercial crops such as pineapple and sugarcane are planted in between the hedges. This is intended to serve as a demonstration site for other farmers and villagers in the watershed area.


***Map1 The Watershed Management Areas***




***Map 2 The Cuvu and Tikina Watershed Management Plan***

### 4.6 Project Staff

Two full time local staff were employed by the Wai Bulabula project. One person was hired at the beginning of the project and the other one was hired towards the last months of the first year. The two British consultants were integral to the project and visited Fiji in order to help establish the technical details for the wetlands. Hugh Govan visited the project three times and established the community component of the project. He trained local NGO officials in Participatory Learning and Action tools and techniques and he also assisted with the monitoring and evaluation of the project. The Living Water project consultant, Jane Shields, was not able to continue her consultancy because of the political crisis of 2000 and was then unable to travel because of her pregnancy. FSP Fiji acknowledges that without their input this project would not have been possible.

### 4.7 Volunteers and Students

Four undergraduate volunteer students from the UK were attached under the Wai Bulabula project. They had special interest in waste management, which was part of their science degree programme. Each stayed on for an average of 7 months. Over the 2 years of the project there were about 40 – 50 students from the University of the South Pacific visiting the project either on field visit or for practical exercise such as water quality analysis.

### 4.8 Contractors

It became necessary to hire a full time local qualified contractor with experience in construction of artificial pools or ponds after the Living Waters consultant was unable to provide on site technical input. The contractor unfortunately did not have the technical expertise of the Living Waters consultant but together with the FSP Fiji team the contractors were able to complete the required work.

The earthworks began when FSP Fiji hired an Australian consultant from the HEAL Group of Companies as a replacement for Living Waters. At that time they were

working at the Fijian Resort upgrading their sewerage treatment plant. They were interested in assisting in the construction of the wetlands as they had experience doing this in other tropical countries. The HEAL Group did assist with digging of the wetland ponds but returned to Australia without completing the job. This situation left FSP Fiji with no option but to hire a local contractor to complete the project. After much consultation it was agreed that Kantas Construction be hired to complete this project as they had expertise in setting levels with regards to earthworks and their costs were reasonable.

**4.9 Selection of Plants for the Artificial Wetlands Treatment System**

This project commenced with the identification and consultation of relevant stakeholders. Meetings were held with Departments of Forestry, the Environment, Agriculture and non-governmental organisations including the World Wide Fund for Nature and the SPACHEE. The purpose of these meetings was to determine if these organisations had implemented similar projects and / or had knowledge and experience of artificial wetland designs. It was found that although much literature was available on wetland species there had been no trials carried out using local Fijian species in artificial wetland treatment systems.

Before the project was implemented in Cuvu, a piggery site was identified to pilot the compost, vermiculture and wetlands techniques. The owner had two simple wetland ponds and allowed the project to conduct vermiculture, compost and wetland trials. The Living Waters consultant set up the trials with the purpose of determining the best practices of waste management and treatment in the local situation. The lessons learned during the pilot were then used in the implementation of the wetlands on a larger scale in
the Cuvu district with the neighbouring resort the Fijian Shangri La Resort

The trials included consisted of the following systems:

(a) 5 compost bunkers. They were 1 cubic metre and each had different number holes of the side of walls.

(b) 5 artificial wetlands constructed next to the compost bunkers (each 1m by 0.5m by 3m). They were filled with gravel and planted with a variety of grasses, sedges and rhizomes. Piggery effluent was added to the beds at least twice weekly.

(c) 1 vermiculture bed (3m by 1m). In simpler terms adding worms to composts to enhance the break down of wastes. Five vermiculture beds (each 2m x 5m) were prepared under an old shed. Piggery waste was composted in alternate layers of sawdust and over 200 earthworms were put into the beds. Hessian bags covered the top of these beds. These bags were kept always kept moist as it is a common ground for reproduction of worms. Earthworms were obtained from another piggery owner who had set his own vermiculture trials.

Plants in the wetlands adapted at the piggery thrived until the arrival of the dry season when they died because there was not enough water coming off the piggery.. The vermiculture bed was a successful because the material decayed quicker than the normal compost beds and the worm population multiplied.

A number of useful lessons were learned from these trials and are listed as below:

(a) lower compost beds have greater aeration and this enhances the breakdown process,

(b) it is crucial to maintain the moisture content of compost and vermiculture beds at all times. The worms are very sensitive to changes in moisture,

(c) layers of composting material must be turned over regularly,

(d) the addition of earth worms speeds up the decomposition process, and

(e) for the wetlands to be successful a continuous supply of effluent is required.

Another important factor identified was that a large commercial piggery such as Vuda uses antibiotics in the feed to protect pigs from intestinal worms. This seriously affected the earthworms as the residual antibiotic in the waste killed many of them. Village piggeries without imported feed may be better able to use vermiculture. In addition, the Wai Bulabula project was more confident in the construction of an artificial wetland system for the Fijian Resort after testing one on a smaller scale.

Two British students spent a year each assisting the project team to collect and identify species for the wetland systems. The plants eventually used in the wetland system come from a variety of environments in Fiji including swamps, creeks, lakes and wetland areas. Many trips were made on the two main islands of Fiji to gather as wide a variety of species as possible. These species were collected, planted onto 50 rafts and placed on the artificial lakes at the Fijian resort. Over 12 months they were planted onto the rafts and tested in the lakes containing untreated nutrient rich waters. All plants except for about 3 grew well on the rafts.

The Living Waters consultant supplied initial designs for the wetlands however they were modified to suit the local situation. Firstly, a raft was made of bamboo and put into a lake. It was shown to float well. About 3 more rafts were made from bamboo, planted with kuta (*Eleocharis. Spp*) and put onto the lake at the resort. Two rafts made from PVC pipes (one from 2 inch pipes and one from 4 inch) were tested in the lakes. Both had floated well but the 4 inch PVC raft was best as it had the ability to support a greater weight and was ideal since plants become heavier as they grow. The remaining rafts were made from 4 inch PVC pipes.

The plants selected for the rafts included plants of economic value which provide basic material for handicraft production such as 3 varities of kuta grass (*Eleocharis dulcis, Eleocharis. spp),* 7 species of dalo (*Calocassia .spp*) and 2 varieties of sedges. Other species included 2 varieties of via (*Alocassis .spp*), 3 varieties of voivoi (*Pandanus. spp*), 5 varieties of impatiens (*Impatiens. sultani*), 4 varieties of ferns, balabala (*Cyanthea. decurrens*), watercress (*Rorippa nasturium. aquaticum and Rorippa. sarmentosa),* water hyacinth (*Eichhorina crassipes*), 6 varieties of heliconia (*Heliconia. Spp*), 10 varieties of ginger ( *Zinger. spp*) , 3 varieties of reeds (*Mischanthus. spp, Mischanthus. spp and Arundo. spp*), about 30 different ornamental species, papyrus, Egyptian sedge, 5 varieties of danidani, banabana (*Musa nana*), 4 varieties of orchids and also bamboo (*Bambusa spp.*). About 15 other species were collected but their scientific names have not yet been identified.

It was noticed that different species adapted at different rates. Some species such as kuta (*Eleocharis. spp)* appeared *to* wither but after several weeks new shoots grew. The most successful of all plants in the wetlands included via (*Alocassis .spp*), water

hyacinth, papyrus (*Eichhorina crassipes* ) and kuta (*Eleocharis. spp).* Many species could not adapt to the wetlands as the water column was too deep for them. Therefore they were planted on heaps of gravel in the wetlands (i.e. shallow areas) e.g. *Zinger .spp.*

The quality of water in the wetlands treatment system is monitored on a monthly basis. Samples are analysed from the first and third wetlands for nutrient content.

**4.10 Baseline Study**

The two project consultants coordinated a Preliminary Assessment of Waste and Water Management at the Fijian Resort and Adjacent Watersheds from the 30th August to 3rd September 1999. The purpose of this report was twofold:

(a) to investigate how the Fijian Resort can improve the quality of discharges into the sea,

(b) to set up models of best practise in water and waste management and treatment that could be transferred to communities in the watershed.

The report was based upon field observations, interviews with resort staff, and locals. Water samples were analysed from the resort and waters surrounding the resort. This found that discharges sampled from the resort were at levels that cause eutrophication of the marine environment, thus affecting coral reefs. The Living Waters consultant presented a summary of the report findings to the Resort management.

**Results of Water Analysis at the Fijian Resort**

| | Nitrogen (milligrams/L) | Phosphorus (milligrams/L) |
|---|---|---|
| Post filter irrigation | 7.0 | 2.57 |
| Laundry over flow and storm water drain | 20 | Low |
| Garbage room and storm drain | 54.3 | 9.98 |
| Takali Restaurant and storm water | Less than 0.012 | 0.978 |

The report also identified priority watersheds for the project to focus on.

**4.11 Research by the University of the South Pacific**

The University of the South Pacific conducted a research project entitled "Investigation of Current Flow, Sedimentation and Health of Marine Ecosystem in Yanuca Channel, Shangri La Fijian Resort, Cuvu, Sigatoka". This project determined causes for the degradation of Yanuca channel which was a major concern to nearby villages of Rukurukulevu and Cuvu. Apart from the impacts of natural disasters prevention developments such as the construction of a causeway (connecting Yanuca Island to the main land) and construction of sea walls were an additional factor contributing to the sedimentation of the channel resulting from increased soil erosion. The increased soil erosion was attributed to coastal deforestation, destruction of mangroves and the clearing of natural forests for farmlands.

**4.12 Community Training Workshops and the Community Process**

The community process began with an initial consultation with the provincial office, chiefs and community leaders. After their acceptance and endorsement of the project at the district council meeting a series of meetings and workshops was conducted for the eigth communities in the Cuvu district. Whilst it was obvious to some extent that wastewater management and marine degradation was a principal issue for these communities the project did not pre-empt the communities but preferred to learn from the sources themselves. This was achieved by using the Participatory Learning and Action (PLA) methodology. The process was written by the community specialist consultant from the U.K with inputs from local practioners of the PLA process.

It was decided by the district heads of the eight communities that an environmental committee be formed to oversee the project and be the liaison group between FSP Fiji and the community. The selection was done by the district head and the committee was managed by landowners that included district Department of Fisheries, Lands, Agriculture, Environment, Forestry, the provincial office, the Fijian Resort and non-governmental organizations including FSP Fiji and OISCA.

A total of 10 community workshops were conducted. The first set was of seven Participatory Learning and Action (PLA) workshops. These initial workshops allowed for communities to discuss environmental problems, identify the causes of these problems, recommend solutions and set the basis for long term management planning. Community training also consisted of Environmental Awareness Raising and Community Based Monitoring.

The PLA workshops consisted of various exercises that sought to gather information. To encourage greater and wider participation, exercises were conducted in peer groups (e.g. men, women, youths etc.). At the end of each exercise each group reported to others the outcome of their discussions. This approach generated enthusiasm and helped participants to:

- identify future stakeholders
- realise that the purpose of the project was to empower them to better manage their resources i.e. ownership of project belonged to the communities.

SPACHEE and an experienced facilitator from the Social Welfare Department, Sigatoka, assisted FSP Fiji in conducting these workshops. A total of 250 persons attended the PLA workshops in all villages. Listed below is a schedule of the workshops that were conducted. Each workshop lasted a day.

The PLA community workshops were conducted in the 7 villages of the Cuvu tikina and a near by village of Voua (belonging to a separate district but located within the physical boundaries of Cuvu district). The workshop consisted of exercises that enabled the participants to share knowledge on their social and natural surrounding, problems cause identification, recommended solutions and action planning based on the existing situation.

## A Table Listing PLA Workshops for Cuvu District

| Location | Date | Facilitators/Resource Persons | Key Findings | Number of participants |
|---|---|---|---|---|
| Yadua | 18/10/99 & 25/10/99 | FSP, Social Welfare Department Sigatoka ,SPACHEE and Fijian Affairs Board | • Decreasing marine resources due to over harvesting<br>• Increasing usage of modern and effective fishing methods | 37 |
| Rukurukulevu | 19/10/99 | FSP, Social Welfare Department Sigatoka, SPACHEE and Fijian Affairs Board | • Significant reduction in marine resources along channel<br>• Channel is more shallow<br>• Concern being the release of Resort waste waters into the channel and it's impact on marine life | 37 |
| Sila | 20/10/99 | FSP, Social Welfare Department Sigatoka, SPACHEE and Fijian Affairs Board | • Decreased marine resources due to over harvesting<br>• Concerns are that waste disposal along coast and deforestation | 35 |
| Navuevu | 21/10/99 | FSP, Social Welfare Department Sigatoka, SPACHEE and Fijian Affairs Board | • Decreased marine resources due to over harvesting<br>• Deforestation along coastal and interior<br>• Rubbish disposal along coast and usage of duva a concern<br>• | 44 |
| Cuvu | 25/10/99 | FSP,SPACHEE and Social Welfare department | • Decreased marine resources due to over harvesting<br>• Concerns include deforestation, rubbish disposal, use of duva, lack of mangroves and waste outflows from resort into the channel impacting marine life | 28 |
| Voua | 19/11/99 | FSP | • Decreased marine resources due to over harvesting<br>• Concerns include use of duva, waste disposal along cuvu beach and deforestation<br>• Major concern being | 28 |

| | | | | |
|---|---|---|---|---|
| | | | resort outflows into the channel | |
| **2000: Project activities hindered because of political instability** | | | | |
| Hanahana | 04/09/00 | FSP | • Decreased marine resources due to over harvesting<br>• Concerns being the use of duva and waste waters from resort released into the channel and impacting biological diversity | 34 |
| Yadua | 13/03/02 - 15/03/02 | FSP, Fisheries dept, Land use section, Agriculture, Rural local authority, OISCA | • Unanimous agreement to implement marine protected area (MPA)<br>• Specific training requested e.g. fish warden, women in Fisheries workshop e.t.c.<br>• The linkage between land and sea in conservation | 45 |
| Cuvu | 20/02/01 - 22/02/01 | FSP, Fisheries dept, Land use section, Agriculture, Rural local authority, OISCA | • Unanimous agreement to implement marine protected area (MPA)<br>• Specific training requested e.g fish warden<br>• The linkage between land and sea in conservation | 39 |
| Navuevu, Tore, Sila | 06/03/01 - 08/03/01 | FSP, Fisheries dept, Land use section, Agriculture, Rural local authority, OISCA | • Unanimous agreement to implement marine protected area (MPA)<br>• Specific training requested e.g. fish warden, women in Fisheries workshop etc.<br>• The linkage between land and sea in conservation | 40 |
| Rukurukulevu, Voua, Hanahana | 21/03/2001 - 22/03/2001 | FSP, Fisheries dept, Land use section, Agriculture, Rural local authority, OISCA | • Unanimous agreement to implement marine protected area (MPA)<br>• Specific training requested e.g. fish warden, women in Fisheries workshop<br>• The linkage between land and sea in conservation | 44 |

A women's group discussing an exercise during a community workshop

***A woman's group discussion during a community workshop.***

The PLA report found that (a) the majority of pollutants entering the marine environment are land based, (b) the vast reduction in shellfish and fish in the last 40 years is most probably a result of over exploitation, destructive fishing methods and pollution, (c) a major concern of most villagers was the release of waste waters from the Fijian resort into Rukurukulevu channel. They claimed that it was responsible for biological degradation (i.e decrease in fish and shellfish) in the channel, (d) deforestation of mangroves and (e) accelerated soil erosion.

Four Community Resource Management workshops were conducted for the whole district, each lasting two days. These workshops were solely coordinated and facilitated by FSP Fiji as the staff capacity had increased from the PLA workshops. Venues for these workshops included Yadua, Navuevu (for Navuevu, Tore, Sila), Cuvu and Rukurukulevu (combined with Voua and Hanahana). A total of 308 participants attended. The purpose of these second series of workshops was for communities to confirm and reflect on the findings of the PLA workshops (reports were also translated into Fijian).

In addition, a range of government departments including health, agriculture, fisheries, native land and fisheries commission and provincial office participated by informing communities of specific training and technical advice that they could offer to assist locals manage their concerns. All communities were grateful as this the first time for most including the elderly to see several government department representatives all at their villages. An outcome was the request for specific training including environmental awareness raising workshops.

The awareness raising workshops had a positive impact on the communities. For example, it was found that there was a significant reduction in the amount of solid wastes that was previously dumped into Rukurukulevu channel and Cuvu beach, which was used by some as a rubbish dump, was recently cleaned and is now well kept. Villagers now realise the linkage between the conservation of the marine environment and the controlling of land based sources of pollution. The community resource management workshops generated much enthusiasm amongst communities to proceed with the implementation of marine protected areas and specific training

workshops. Some activities that the community proceeded with include the replanting of mangrove seedlings, the planting of coconut hybrids to stabilise the foreshore, the establishment of a soil conservation site, the demarcation of three marine protected areas and the demarcation of a mangrove protected area.

A further three day workshop was held in November 2001 by Hugh Govan as a follow on from previous workshops. This was entitled 'Participatory Processes for Locally Managed marine Areas in Fiji: a practitioners working retreat'.

**A Table of Training Workshops for Cuvu District**

| Date | Venue | Purpose of the workshop | Facilitators | Number of participants |
|---|---|---|---|---|
| 12/03/02 - 13/03/02 | Cuvu District School | To improve the knowledge and skills of teachers in delivering environmental education that will encourage students to participate in improving their local environment and own attitude towards community development | Department of environment, Live and Learn, health centre and FSP | 23 |
| 14/06/01 | Cuvu village | Introductory training for traditionally appointed fish wardens covering basic legislation, roles and rights of fish wardens | Department of Fisheries and FSP | 30 |
| 14/05/01 - 16/05/01 | Tore village | Raise environmental awareness of youths especially those in the local drama group | Department of environment, FSP and Wan Small Bag theatre group | 25 |

**4.13 Reef Check**

Two annual reef checks were conducted in conjunction with the Reef Check International representative, Ed Lovell, FSP Marine Biologist, Austin Bowden Kerby, and the Fijian Resort Dive Centre staff. Staff at the dive centre including locals from Cuvu district were trained in the reef check methodology.

The reef check method is appropriate for areas of at least 3 meters deep whereas the reefs of Cuvu are shallow and low lying. Therefore together with the University of the South Pacific a new transect method for reef monitoring was developed by the project and 5 further students were trained. This system will now be adopted for Cuvu with the aim of training locals in reef monitoring.

**4.14 Coral Replanting Trials**

Several attempts to replant coral (Stag horn ) were conducted. Pieces of live coral were planted on concrete trays. However they were severely affected by the recent coral bleaching which spread across the whole of Fiji and were not successful,

# 5.0 Project Impacts

**Summary**

| Objective | Achievement |
|---|---|
| Raise awareness amongst communities of the importance of coral reefs, implications of water and waste management on the marine environment and encourage community initiated simple waste management innovations | Conducted PLA and training workshops that have raised the awareness of local communities. Evidence of impacts includes almost all villages organising their own rubbish collection system. Cuvu beach that was an informal rubbish dump was recently cleaned and landowners have sought the help of local authorities to prosecute those dumping wastes on the beach. After witnessing the benefits of MPA's sites for at least 10 months communities have decided to extend the MPA life for at least 3 months. A local act group consisting of youths from the 7 villages has performed at least 3 dramas raising environmental awareness. |
| To prepare a watershed management plan and strategy for the region identified | A watershed management plan for the district was prepared. The report was based largely upon a watershed management report coordinated by the 2 project consultants, community workshops and informal discussions with villagers. |
| To train local counter parts in the design, construction and maintenance of appropriate technologies | During the construction of the artificial wetlands 5 men from the Cuvu district were selected and trained in the stages of construction. A hotel staff was also attached to the construction and planting of wetlands. |
| To collaborate with Doe in the reproduction of specific strategies that could be incorporated under Fiji's National Biodiversity Strategy Action Plan. | The Wai Bulabula project supports the National Biodiversity Strategy Action Plan (NBSAP) by implementing community based conservation that empowers locals to better manage their resources. The project was used as case studies in the NBSAP and other workshops. The NBSAP is a component towards the Convention of Biological Diversity |
| To identify and develop ecological waste management technologies for one hotel and one small community | The Artificial wetlands system at the resort was built and planted with local species with the aim of reducing nutrient content. The latest analysis indicates a 75% reduction in nitrates.<br>With the difficulties experienced so much time and effort was directed towards completing the wetlands that it was impossible to construct a simple system at village level. However 5 men from Cuvu district received training while working on the construction of the artificial wetlands project. |

The Coral Reef Conservation / Wai Bulabula project made significant achievements both technically and in the community.

The artificial wetlands treatment system has reduced nitrate content by 75% in the Fijian resort and the lessons and skills learned by FSP Fiji have resulted in capable personnel to continue with these principal in developing smaller community wetlands.

Following community workshops most villages have taken the initiative to implement field activities such as the demarcation of marine protected areas, and the replanting of mangroves and coconut hybrids along their coast. Locals recently cleaned up Cuvu beach, which used to be an informal rubbish dump. In addition, communities no longer dump solid wastes into Rukurukulevu channel. Most villages have now organised their own rubbish collection system.

The main beneficiaries of the project have been the communities themselves. Many villagers have observed more fish species swimming closer to shore or by the marine protected areas. This has generated much enthusiasm in the project. Several villages

from nearby districts have also implemented their own marine protected areas including marine and mangrove areas

The Wai Bulabula project is a member of a Locally Managed Marine Protected Area (LMMA) working group. This consists of several non-governmental organisations, the Department of Fisheries and stakeholders currently involved in marine community based conservation projects. Through numerous workshops Wai Bulabula staff have contributed to the National Biodiversity Strategy Action Plan.

While many projects have focussed directly on managing marine areas the Wai Bulabula project sought to also work in controlling land based sources of pollution. The project has enjoyed the support of numerous government departments including agriculture, health and fisheries. Two years ago a parliamentary select committee visited the projected site and recommended it as a model for indigenous Fijian communities. The Wai Bulabula project complements government policy for promoting community development.

The International Waters project of the South Pacific Regional Environmental Programme (SPREP) has had a number of consultants look at the Wai Bulabula Project. They are very impressed as it is the only project of it's kind in the Pacific which involves wetlands technology and local communities. SPREP is encouraging this project as a model beyond Fiji to be developed in other Pacific nations.

## 6.0 Project Outputs

An open day promotional workshop of the artificial wetlands is planned for June, 2002. Various stakeholders including other hotels, resorts, government department, non-governmental organisations and other interested individuals will be invited. In the mean time relevant stakeholders are regularly updated about the progress of the wetlands. Two articles appeared in 2 locals newspapers about the artificial wetlands and Wai Bulabula project in general. An FSP booklet is prepared annually and there is a section describing briefly all FSP projects. The Wai Bulabula staff have made project presentations at several workshops.

## 7.0 Project Expenditure

**Total Project Expenditure**

| *Item* | *Budget* | | | *Total* | *Expenditure* | | | *Total* |
|---|---|---|---|---|---|---|---|---|
| | *Year 1* | *Year 2* | *Year 3* | | *Year 1* | *Year 2* | *Year 3* | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| ***Total*** | **24353** | **39540** | **13667** | **77560** | **24353** | **15127** | **38080** | **77560** |

## 8.0 Project Operation and Partnerships

The Wai Bulabula project was very successful in networking amongst various stakeholders. These included government departments such as the Fisheries and Agriculture Departments, the native land and fisheries commission, the provincial office, mineral resources, health and environment. A non-governmental organisation, OISCA, and the Fijian Resort also participated. The Cuvu District Environmental Committee coordinated project activities in conjunction with the above stakeholders. All these stakeholders participated in community workshops, training workshops and other field activities. Two villagers from Verata village also made presentations in these workshops describing to the people of Cuvu their experiences of the Verata community based projects.

FSP joined a further networking group, which includes the University of the South Pacific, and other non-governmental organisations that are implementing conservation projects. The Wai Bulabula project had strong connections with the Department of Environment keeping them regularly updated of progress throughout the project life.

## 9.0 Monitoring and Evaluation, Lesson learning

The termination of Living Waters (UK) was a major draw back to the project and therefore the project was not able implement a specific monitoring strategy. However, the community consultant made annual visits to Fiji to monitor and evaluate project progress. Community process and activities were modified wherever necessary to adapt to local circumstances. Progress was also regularly discussed at district environmental committee meetings. The artificial wetlands treatment system is currently monitored every month and water samples are analysed.

A number of lessons have been learnt during the course of the Wai Bulabula project. They are as listed below:

- The requirement for a ‘comprehension period’: it takes at least a year before communities begin to actively commit themselves to a project.

- The importance of networking: firstly the project would not have been successful without government support. Objectives of any project are best met when there is widest possible collaboration amongst stakeholders.
- The importance of linking project activities to existing practices. The project should not be seen as a totally new concept but build on past activities.
- Wetlands have a great potential in Fiji. However several factors require further investigation including, the durability of liners such as clay, geo textile liners and the strengths of concrete mix.
- The importance of networking: by communicating and coordinating widely with other national institutions it was possible to build on existing experience in the implementation of the project and strengthen the national capacity in this field by sharing expertise. This networking effort comes at a cost but is felt to be very worthwhile. (cf. shared training workshops and multi-institutional PLA teams). Regular joint meetings enabled learning from the experience and constructive criticism and learning from both successes and failures.

## 10.0 Darwin Identity:

The funding for this project has been the first that FSP Fiji has received from the Darwin Initiative for Survival of Species. Few organisations in Fiji are familiar with the Darwin Initiative. The Darwin Initiative for Survival of Species has been acknowledged in all Wai Bulabula presentations, community workshops and publications. The project was recognised by Government and stakeholders as a distinct project with a clear identity.

## 11.0 Leverage

The Shangri La Fijian Resort supported the project logistically as well as financially. It funded additional grants of GB£30,000 over a two year period.

Just World Partners (JWP) continues to work with FSP Fiji in developing projects to secure further funds for similar work. JWP staff work continually with FSP staff to build fundraising capacity. A proposal was recently submitted to the New Zealand government by FSP Fiji to secure further funding in order to continue the Wai Bulabula project.

## 12.0 Sustainability and Legacy

The artificial wetlands treatment system has already generated a lot of interest amongst government departments and the private sector. Being a pilot system it is very likely that the wetlands will be replicated in other parts of Fiji. Activities under the Wai Bulabula project will now be covered by another FSP environmental project also operating in the district of Cuvu, the Coral Gardens Project. Communities are now confident and interested enough to continue activities such as the replanting of mangroves and to continue the monitoring f their marine protected areas by fish wardens without project financial support.

## 13.0 Value for money

The only major financial concern was funding for the completion of the artificial wetlands system. The wetland budget went beyond what was allocated for construction purposes. Completion of the wetlands was also supported by the Network Foundation and Shangri La Fijian Resort. Otherwise funding for community activities was sufficient.

**Author(s) / Date**

Floyd Robinson, April 2002

## Appendix I: Project Contribution to Articles under the Convention on Biological Diversity (CBD)

| Project Contribution to Articles under the Convention on Biological Diversity | | |
|---|---|---|
| **Article No./Title** | **Project %** | **Article Description** |
| **6. General Measures for Conservation & Sustainable Use** | 3 | Develop national strategies which integrate conservation and sustainable use. |
| **7. Identification and Monitoring** | 10 | Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities which have adverse effects; maintain and organise relevant data. |
| **8. In-situ Conservation** | 30 | Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources. |
| **9. Ex-situ Conservation** | | Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources. |
| **10. Sustainable Use of Components of Biological Diversity** | 5 | Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector. |
| **11. Incentive Measures** | 5 | Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity. |
| **12. Research and Training** | 20 | Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations). |
| **13. Public Education and Awareness** | 17 | Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes. |
| **14. Impact Assessment and Minimizing Adverse Impacts** | 5 | Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international |

| | | |
|---|---|---|
| | | damage. |
| **15. Access to Genetic Resources** | | Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits. |
| **16. Access to and Transfer of Technology** | 2 | Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such assess and joint development of technologies. |
| **17. Exchange of Information** | 3 | Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge |
| **19. Bio-safety Protocol** | | Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research. |
| **Total %** | **100%** | **Check % = total 100** |

## Appendix II Outputs

Please quantify and briefly describe all project outputs using the coding and format of the Darwin Initiative Standard Output Measures.

| Code | Total to date (reduce box) | Detail (←expand box) |
|---|---|---|
| **Training Outputs** | | |
| 4a | Number of undergraduate students receiving training | 2 |
| 4b | Number of training weeks provided to undergraduate students | |
| 4c | Number of postgraduate students receiving training (not 1-3 above) | It was not possible to train an environmental engineer in the design and construction of wetlands because of the following difficulties experienced. The duration of construction was delayed for a period of three months and after the inability of 2 consultants to complete them a local contractor was obtained. There are not many environmental engineers in Fiji. It was not possible to train a student because the construction of wetlands coincided with last months of semester when students were focussed on compiling reports, assignments and preparing for exams. |
| 6a | Number of people receiving other forms of **short-term** education/training (i.e not categories 1-5 above) | The Reef Check method of reef monitoring was discovered inappropriate to the shallow waters of Cuvu. Therefore a simpler method of monitoring was tested and found appropriate. Many villagers were trained in its use.<br><br>Five men from Cuvu district were directly involved in the construction of the wetlands. They received training through the various stages of construction. Two resort workers were also attached to the project. |
| 6b | Number of training weeks not leading to formal qualification | A total of 14 weeks. |
| 7 | Number of types of training materials produced for use by host country(s) | 1. A manual produced for waste management.<br>2. A watershed management plan produced for the area.<br>3. A manual also produced for the artificial wetlands treatment system.<br>4. The manual for participatory public awareness in conjunction with the University of the South Pacific (USP) has not been produced as the project team decided to collaborate further with the USP to instead produce a book entitled "***Locally-managed marine protected areas toolkit: a guidebook for coastal resource managers and conservation practitioners"***. This book is currently in press and a copy will be forwarded to Darwin when it is published. |

| | | |
|---|---|---|
| **Research Outputs** | | |
| 8 | Number of weeks spent by UK project staff on project work in host country(s) | Living Waters consultant spent 8 weeks while the community consultant spent 12 weeks.<br>4 British volunteers were attached to the project. The first two spent 10 months each in Fiji while the second two spent approximately 4 months each. |
| 11a | Number of papers published or accepted for publication in peer reviewed journals | 1 by Hugh Govan |
| **Dissemination Outputs** | | |
| 14a | Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work | 1 workshop has been organised for June to present findings of the project. This will be held at the Fijian Resort. |
| 14b | Numbers of conferences/seminars/workshops attended at which finding from Darwin project work have been presented/disseminated | 5 (3 local and 2 regional ) |
| 15a | Number of national press releases or publicity articles in host country(s) | There have been a total of 3 press releases: one national press article. |
| 15b | Number of local press releases or publicity articles in host country(s) | Two local press releases. |
| 18a | Number of national TV programmes/features in host country(s) | One in production. |
| **Physical Outputs** | | |
| 22 | Number of permanent field plots established | 1 soil conservation site |

## Appendix III: Publications

Provide full details of all publications and material that can be publicly accessed, e.g. title, name of publisher, contact details, cost. Details will be recorded on the Darwin Monitoring Website Publications database which is currently being compiled.

Mark (*) all publications and other material that you have included with this report

| **Type *** (e.g. journals, manual, CDs) | **Detail** (title, author, year) | **Publishers** (name, city) | **Available from** (e.g. contact address, website) | **Cost £** |
|---|---|---|---|---|
| Newsletter | *Govan, Hugh (2000)* Building on cultural resources in the Pacific. In CM News, Newsletter of the IUCN Collaborative Management Working Group*, No. 4.* | *IUCN* | *Hgovan@compuserve.com* | *free* |
| Report * | *Govan, Hugh (1999)* Empowering local communities to reverse the decline of coral reef ecosystems in Fiji. | FSP Working Document | *Hgovan@compuserve.com* | *free* |
| University Lecture Outline * | *Govan, Hugh (1999)* Community based coastal management, Fiji. | Hugh Govan | *Hgovan@compuserve.com* | *free* |
| Manual * | *Floyd Robinson (2002)* Manual of Waste Management Techniques in Fiji. | FSP Fiji | *admin@pcdf.org.fj* | *free* |
| Plan * | *Floyd Robinson (2002)* A watershed management plan for Cuvu District, Nadroga, Fiji. | FSP Fiji | *admin@pcdf.org.fj* | *free* |
| Manual * | *Floyd Robinson (2002)* WetlandsTreatment Systems, Fiji. | FSP Fiji | *admin@pcdf.org.fj* | *free* |
| Book (awaiting publication)<br><br>(draft section attached *) | *Govan, Hugh (ed.)(in press)* Locally-managed marine protected areas toolkit: a guidebook for coastal resource managers and conservation practitioners. | USP | *University of the South Pacific, Fij.* | *not known yet* |

## Appendix IV: Darwin Contacts

To assist us with future evaluation work and feedback on your report , please provide contact details below.

| | |
|---|---|
| **Project Title** | Coral Reef Conservation |
| **Ref. No.** | **162-8-89** |
| **UK Leader Details** | |
| Name | Just World Partners |
| Role within Darwin Project | Project management and monitoring. |
| Address | 4a Newmills Road, Dalkeith, Midlothian, EH22 1DU |
| Phone | |
| Fax | |
| Email | |
| **Other UK Contact (if relevant)** | |
| Name | Hugh Govan |
| Role within Darwin Project | Project consultant. |
| Address | Fundación TUVA, Apartado 54, Puerto Jiménez,<br>Costa Rica, Central America |
| Phone | |
| Fax | |
| Email | |
| | |
| **Partner 1** | |
| Name | Floyd Robinson |
| Organisation | Foundation for the Peoples of the South Pacific, Fiji (FSP Fiji) |
| Role within Darwin Project | Project implementation. |
| Address | 12 Cakau Street, PO Box 451, Lautoka, Fiji |
| Fax | |
| Email | |
| **Partner 2 (if relevant)** | |
| Name | |
| Organisation | |
| Role within Darwin Project | |
| Address | |
| Fax | |
| Email | |

## Appendix V: Various Project Related Publications