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Water use survey report, Barakau Village, Central Province, PNG

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Acronyms

CWST	Community Water Supply Tank
HH	Household
IWP PNG	International Waters Project Papua New Guinea
LPMC	Local Project Management Committee
PCU	Project Coordination Unit
PGK	Papua New Guinea Kina
WHO	World Health Organisation

Units of Measure

km	kilometre
l	litre

1 Introduction

The International Waters Project (IWP) aims to strengthen the management and conservation of marine, coastal and freshwater resources in the Pacific Islands region. It is financed through the International Waters Programme of the Global Environment Facility, implemented by the United Nations Development Programme, and executed by the Secretariat of the Pacific Regional Environment Programme (SPREP), in conjunction with the governments of the 14 participating independent Pacific Island countries.

IWP has two main components. The oceanic component focuses on the management and conservation of tuna stocks in the western central Pacific. The coastal component's focus is on integrated coastal watershed management. It involves the implementation of 14 pilot projects that address sustainable resource management and conservation issues in the coastal zone. The vision for the whole programme is sustainable managed and effectively conserved coastal and marine resources and habitats in the Pacific Islands region.

The primary objective of the coastal component is to address root causes of the degradation of international waters in coastal regions through a programme focused on improved integrated coastal and watershed management. It requires action at the community level to address priority environmental concerns relating to marine protected areas, sustainable coastal fisheries projects, protection of freshwater resources and community-based waste reduction.

Located within the Department of Environment and Conservation, IWP Papua New Guinea (PNG) is concerned with the implementation of the oceanic component. At the conclusion of the assessment of PNG's priority environmental concerns, the IWP focal areas were ranked in terms of severity as follows: waste management, protection of freshwater quality and sustainable coastal fisheries. Due to funding constraints it was decided that the pilot project would be located in the Central Province. When expressions of interest to host the pilot project were solicited, the public in the Central Province was advised that those intending to apply should ensure the environmental issues in their respective villages were relevant to the focal areas, and preferably in the same order of importance. Barakau was among the sixty villages that responded. In the final selection it was chosen as the host site for a number of reasons. These were: (i) relatively easy accessibility from Port Moresby, (ii) manageable population size, (iii) environmental issues relevant to IWP focal areas and (iv) degree of understanding of these environmental concerns by the people and their apparent preparedness to address them.

Barakau is a coastal Motuan village situated about 40 kilometres (km) southeast of Port Moresby (travel time by road about 30 minutes). It has a population of 1500 people. As is typical of Motuan villages, 40% of the houses are built over the sea.

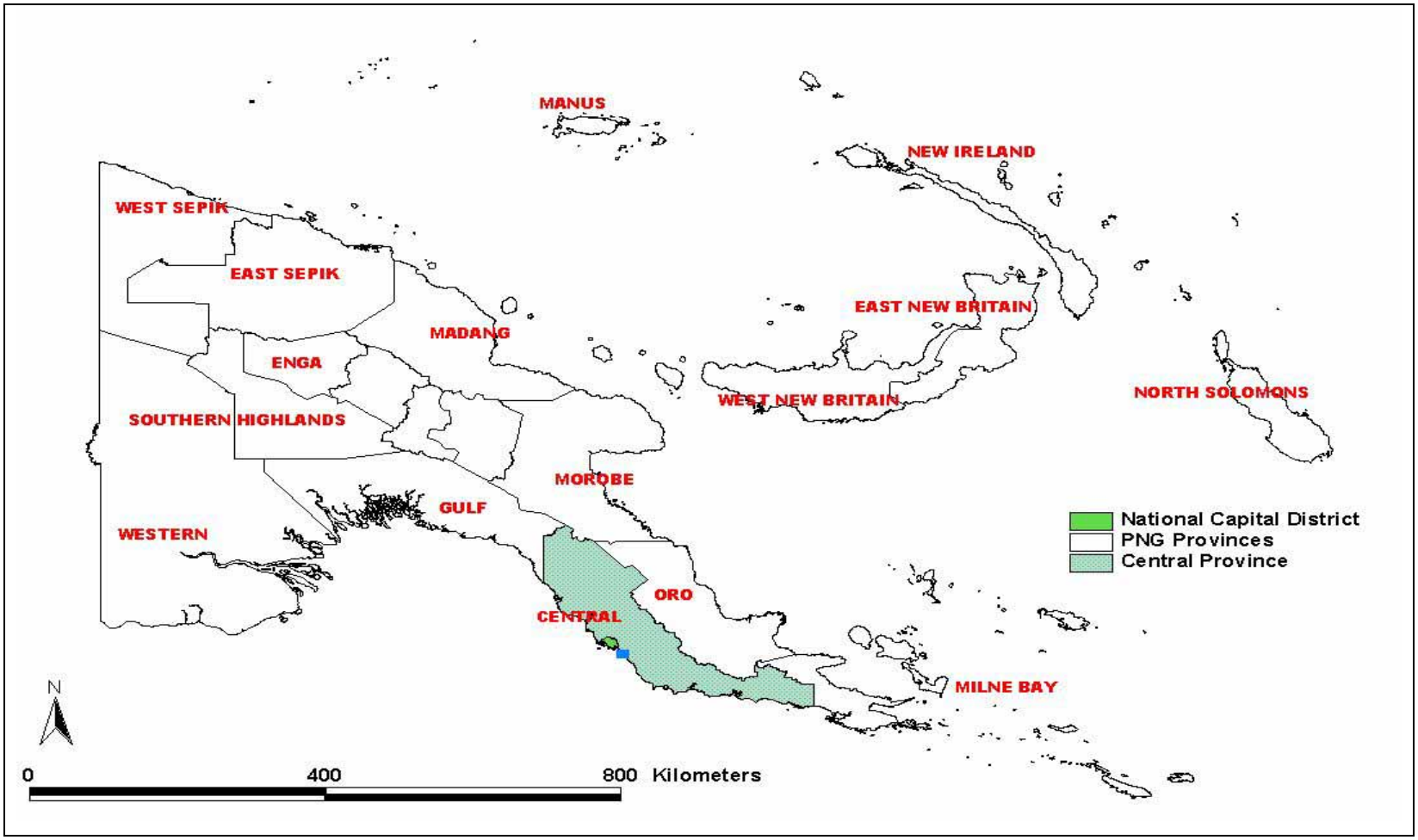

Figure 1: Map of Papua New Guinea

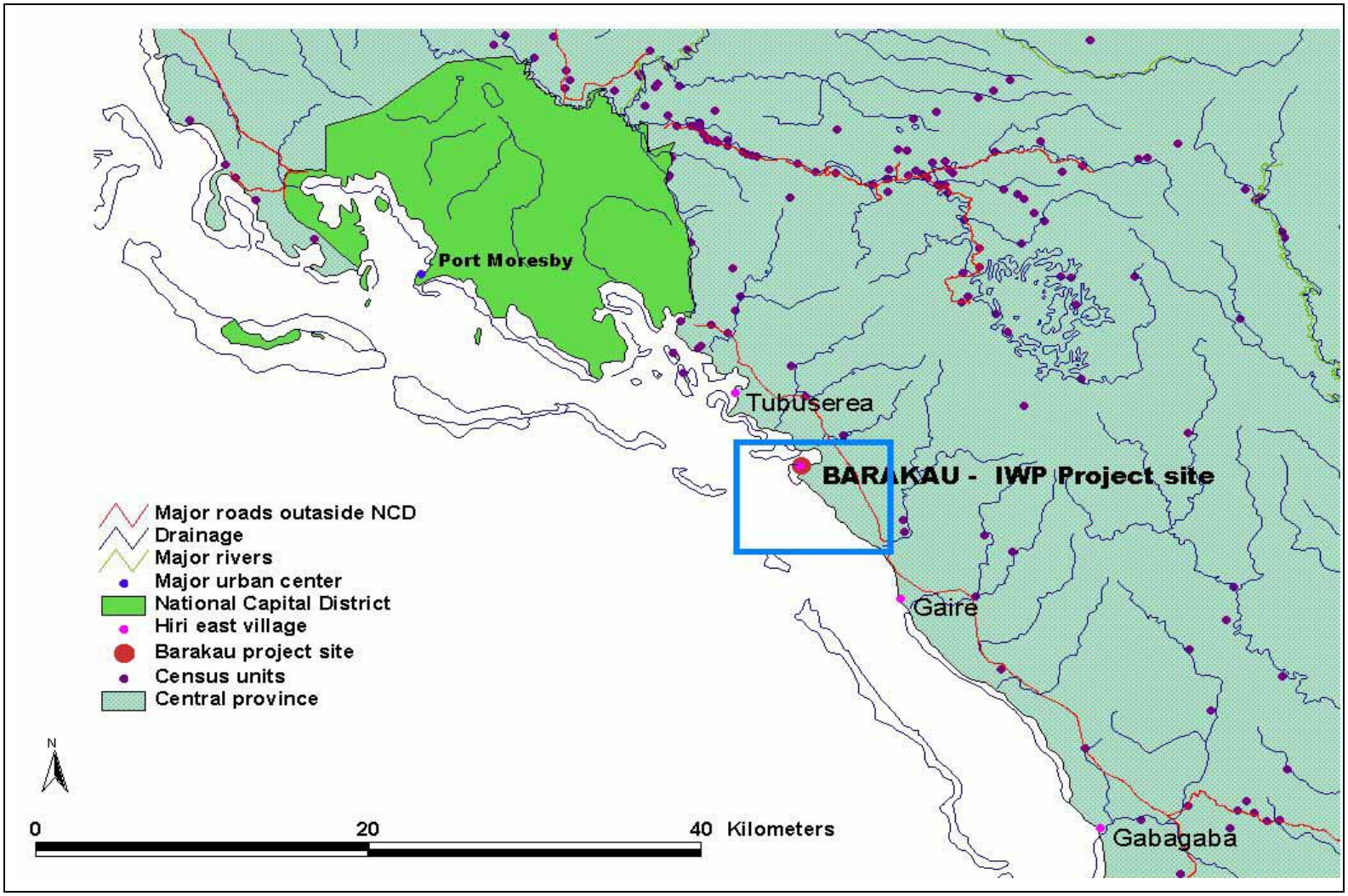

Figure 2: Location of Barakau Village relative to the National Capital District

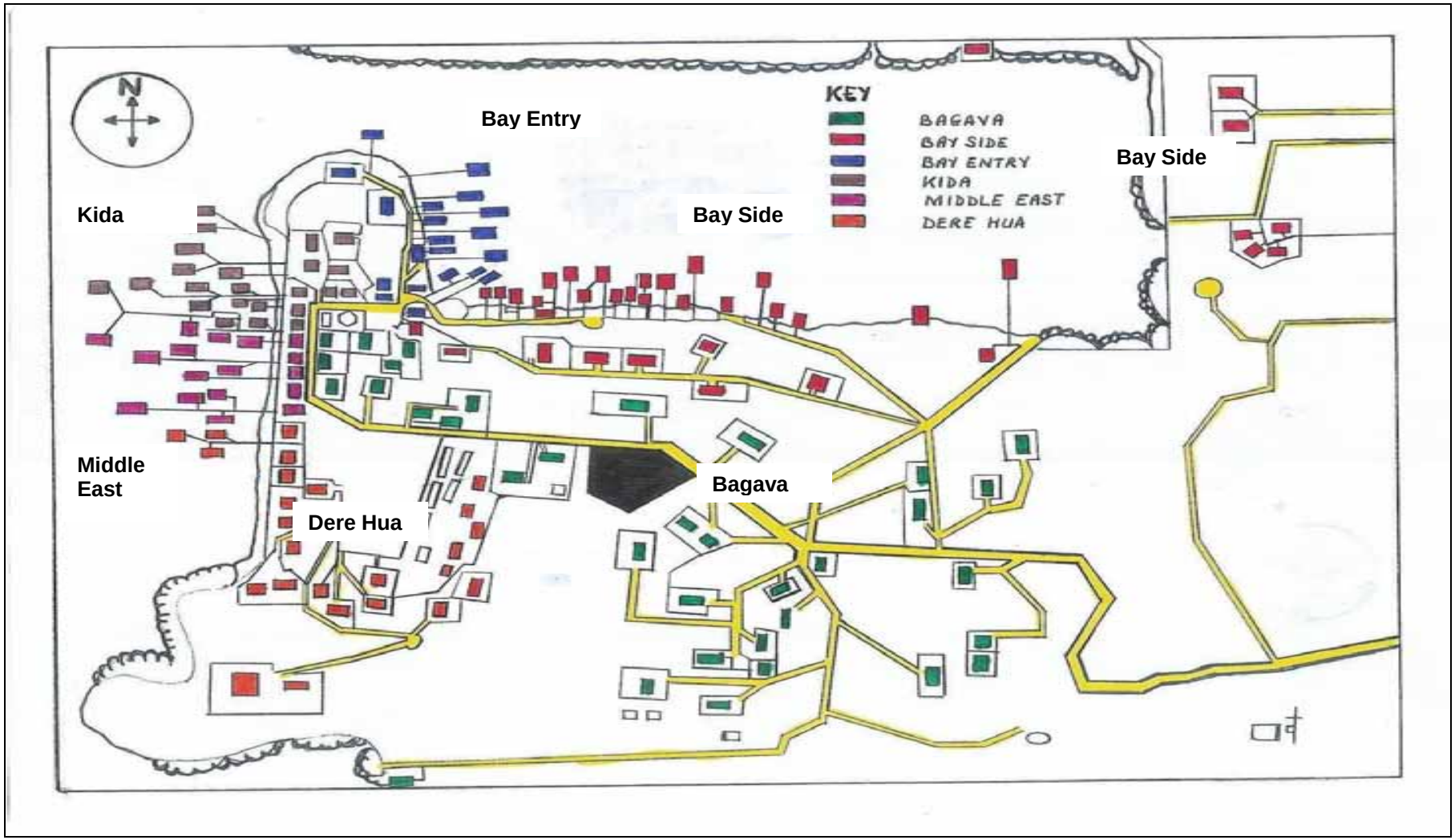

Figure 3: Sketch map highlighting the six sections of Barakau Village

One of the main issues that the people stressed repeatedly in the preliminary consultation meetings was the difficulty in accessing clean and safe water, especially in the long dry season that is normally experienced. The people were advised that although IWP is not a water supply project, the team will assist by locating interested donors to install a reliable long-term water supply for the village.

In order to assist the project team prepare donor support requests, it was decided that as part of the baseline data collection, a water use survey should be undertaken to establish where the people get their water, the reliability of these sources, how much water is involved and how much time and money is expended. This report outlines how the survey was carried out, discusses the results and recommends ways in which villagers can be assisted.

2 History of communal water supply systems in Barakau Village

The availability of clean and safe water from a reliable source is essential for the health and prosperity of human beings. The latest World Health Organization (WHO) Western Pacific Region Health Databank, (2004) indicates that 60% of PNG's population lacks access to clean and safe drinking water. Although Barakau is located just 40km from the capital, it still does not have such a water supply system. Responsibility does not lie solely with the government: several previous schemes funded by the government in collaboration with donors were vandalized by community members; as is the case in similar scenarios, it is the law abiding majority that suffers the consequences.

Badira and Wiliams (2003) provide an account of the water supply systems established for Barakau village since the 1970s. A windmill and water pump were set up at Konedobu in the early 1970s and water was piped to the village over a distance of 4 km. Unfortunately, the windmill was severely damaged during a storm in the mid-1980s. In the late 1980s and early 1990s, Williams acquired an electric pump and together with the Village Councillor, PNG Power and the provincial government, managed to revive the system. Misfortune struck again, this time at the hands of vandals, who caused serious damage to the system. Another attempt was made by Williams to restore the system with the involvement of a prominent villager, Dr Sibona Kopi. The restoration was successfully completed but some time later a fire destroyed the tanks and the pump was stolen. In 2003, the present Village Councillor[1] was able to secure provincial government funding and engage a local contractor to locate a bore water source and install a pump and a transformer. The source is located beside the feeder road about 1.5 km from the village. A further PGK 70,000 is required to complete the system (including a new reservoir, piping from the pump to the reservoir, further piping from the reservoir to the village, and seven stand taps at strategic locations throughout the village).

3 Data collection and compilation

A survey questionnaire was formulated covering issues such as the volume of water used, source of water and resources used in obtaining water (the survey questionnaire is included as Annex 1. To increase community involvement, it was decided that the village youth would be trained to carry out the survey. Two training sessions were conducted, and the carried out over a week, with guidance and support provided by the Project Facilitators. A list of the interviewers is attached as Annex 2. The youth learned how to conduct an interview-based survey, and gained a better appreciation of the water supply situation in the village, and the need for concerted community action. Following the survey, the information was compiled and summarised into several tables (discussed below).

[1] Mr. Kala Madu.

4 Discussion of Data

The results of the survey are discussed in terms of the source, reliability, quality and cost. Table 1 shows that 40% of households (and 37% of the population) have direct access to tank water. The main supplier of water for the tanks is Leahys Water Deliveries, located in East Boroko. Table 2 shows that 60% of households (in which 63% of the population resides) do not have direct access to tank water. Most of these people purchase water from households with tanks, while others obtain water from rivers, creeks and wells or relatives in Port Moresby.

Table 3 shows that Bagava has the highest number of households with tanks (19), while Middle East only has two. The rate of water use seems to be the same, because all refills take place monthly at a cost of PGK 150. This means that Leahy's Water Deliveries makes approximately PGK 9,150 gross monthly from household tank refills in Barakau village. This represents an annual gross income for the company of PGK 109,800, although sales do decline during the rainy season, when rainwater is collected from roof tops.

Table 4 indicates the water sources used by households without tanks, and the time taken to deliver the water to the houses. Note that this is time taken to walk to and from these sources. The distances between respective houses and these water sources vary and this is indicated by the total delivery time.

Table 1: Households with tanks

Section	Total population	Total no. households	Households with tanks		Population with tanks		Source of refill
			No.	% of households	No.	%	
Bagava	409	38	19	50%	188	46%	Leahys Water
Bay Side	364	39	13	33%	121	30%	Leahys Water
Bay Entry	212	21	11	52%	95	45%	Leahys Water
Middle East	171	16	2	13%	42	25%	Leahys Water
Derehua	188	19	10	53%	82	44%	Leahys Water
Kida	190	18	6	33%	46	24%	Leahys Water
TOTAL	**1534**	**151**	**61**	**40%**	**574**	**37%**	

Note: 1. 40% of households have water tanks.

2. 37% of the population has direct access to tank water.

Table 2: Households without tanks

Section	Total Population	Total HH	HH w/o tanks		Population w/o tanks		Supplier/Sources		
			No.	%	No.	Population	Tank Owners	River	Town Supply
Bagava	409	38	19	50%	221	54%	70%	28%	2%
Bay Side	364	39	26	67%	243	67%	96%	4%	
Bay Entry	212	21	10	48%	117	55%		100%	
Middle East	171	16	14	88%	129	75%	64%	29%	7%
Derehua	188	19	9	47%	106	56%	56%	44%	
Kida	190	18	12	67%	144	76%	59%	41%	
TOTAL	1534	151	90	60%	960	63%			

Note: HH = households. 1) 60% of households do not have water tanks. 2) 63% of the population obtains water from other sources.

Table 3: Water transported from Port Moresby for households with tanks

Section	No. of Tank Owners	Volume	Supplier	Frequency	Cost PGK
1. Middle East	2	3500L	Leahy's Water	Monthly	150.00
2. Derehua	10	4200L	Leahy's Water	Monthly	150.00
3. Kida	6	1300L	Leahy's Water	Monthly	150.00
4. Bagava	19	87500L	Leahy's Water	Monthly	150.00
5. Bay Side	13	28500L	Leahy's Water	Monthly	150.00
6. Bay Entry	11	16500L	Leahy's Water	Monthly	150.00

Table 4: Household water usage from rivers, creeks and wells

Water Source	No. of Households	Time Taken (hrs)	%
1. Kohua	25	2	18
2. Rabia	25	1	18
3. Konebada	20	1.5	14.5
4. Tauduba	20	1	14.5
5. Vairara	18	1	13
6. Karaikou	11	2	8
7. Boubada	6	1	4
8. Kaita	4	1	3
9. Tapa	3	2	2
10. Marago	2	1	1.5
11. Seme	2	.5	1.5
12. Vedi and Kogo	1	2	0.7
TOTAL	**137**	**1.33 (average)**	

With sources such as rivers, creeks and wells, quantity and quality are critical. Quantity is usually determined by season and quality is influenced by upstream as well as nearby land

uses. Compared to river and creek water, the quality of well water is relatively good but because the wells are not covered, contamination is always possible. A number of these wells are linked to seemingly reliable groundwater aquifers and are able to yield water well into the dry season. These sites are worth further investigation to confirm dependability of supply and feasibility of installation sealed wells with hand pumps, which will substantially reduce the risk of contamination.

Recognising the difficulties faced by the majority of the people in terms of obtaining water directly from natural water sources (including the time and effort, and cost associated with purchasing water from other households), IWP PNG requested that the IWP Projct Coordination Unit prepare an estimate of the costs associated with installation of a large user-pays community water supply tank (CWST). The submission is attached as Annex 3.

The questionnaire included two questions relating to a community tank. One addressed the preferred location of the tank, taking into account access and vandalism, and the other the preferred cost for a standard 20 litre (l) container of water. The Councillor's house was preferred over other locations for the tank (Tables 5(a) and 5(b)); the preferred price was PGK 1 per 20 l. The PCU endorsed the CWST request and the facility commenced operation on 1 August, 2004. A status report (as of December 2004) on the operation of the tank is attached as Appendix 4.

Table 5(a): Preferred location of the CWST by sections of the village

Section	Preference	No. of Households
1. Middle East	Middle of Village (Ariara)	5
	Pastor's House	3
	Middle East (Ariara)	2
2. Derehua	Derehua	10
	Middle East	8
	Kida	7
	Pastor's House	4
3. Kida	Bayside	11
	Kida	7
	Derehua	6
	Bagava	4
4. Bagava	Middle of Village (Ariara)	10
	Middle East/Kohua Junction	6
	Bayside/Society/Councillor	7
5. Bayside	Councillor's House	16
	Lohia Badu's House	9
	Bayside	6
6. Bay Entry	Councillor's House	14
	Lohia Badu's House	6
	Pastor's House	4

The amount of clean and safe water available to people will generally determine the rate and variety of usage and level of hygiene. For example, with limited water, people will have to bathe less often and wash clothes and bedding less frequently. It can also lead to poor toilet hygiene. All these can contribute to sub-standard personal and household health for residents. A healthy population is more likely to be productive and responsible. People facing chrinic water shortages tend to be more preoccupied with meeting their daily water needs than making rational decisions about responsible behaviour relating to community waste management and sustainable resource use. It is assumed that the project's assistance with the people's water

supply needs will in turn lead to improved responsibility over the environment for the immediate and future wellbeing of the community.

Table 5(b): Preferred sites for installation of the CWST

Location	No. of Households	%
1. Councillors House	36	25
2. Middle East/Kohua	17	12
3. Bayside	17	12
4. Derehua	16	11
5. Middle of Village	15	10
6. Lohia Badu's House	15	10
7. Kida	14	9
8. Pastor's House	11	8
9. Bagava	4	3

Table 6: Preferred user pays price for CWST water

Section	Yes/No	Cost/Hire	Comments
1. Middle East	Yes	5t – 10 t	
2. Derehua	Yes	PGK 1.00/container	20 L container
3. Kida	Yes	PGK 1.00/container	20 L container
4. Bagava	Yes	50t – K1.00/container	20 L container
5. Bayside	Yes	5 t – 50 t/L	
6. Bay Entry	Yes	2 t – 5 t/L	

t = toea; 100 t = 1 kina (PGK)

Apart from the CWST, the project team will attempt to secure external donors who can contribute towards funding the completion of the bore water-based water supply scheme. A total PGK 70,000.00 is required and the community has been strongly urged to make a contribution. If the people are required to pay even a small part of the installation costs, they will be more likely to look after the facilities.

It appears that most households with tanks have sufficient income to arrange monthly tank refills. Some of the money is derived from water sales to those without tanks. The reliability of supply is as good as one's ability to pay, and quality is not an issue. In certain situations some households may restrict water sales to ensure their own uses are adequately covered.

Although the community is living with and experiencing the full impact of the water supply problem, there does not seem to be any planned collective effort to address it. This may be attributable to several factors, but a crucial issue appears to be the absence of an effective ward development system (as outlined in the Barakau Ward 8 Development Plan; see Hiri District Administration 2003). What is needed is an institutional approach that holistically addresses the social, economic and biophysical factors making up and relevant to the community, and is designed to ensure maximum participation by citizens in all aspects of community development and welfare. Such a system needs to be established in the Barakau Ward, in order to revive, upgrade and maintain the provision of basic and essential services, including water supply for the people.

5 Recommendations

Based on the results of the water use survey, discussions with the village people and general observations on water availability and use within Barakau Village, the following actions are recommended:

(a) a water supply and sanitation committee should be established to oversee and monitor the provision of water supply and related services in the village;

(b) all members of the community should work to ensure that the CWST continues to function as planned;

(c) the community's contribution towards the completion of the bore water supply system should be given priority;

(d) establishment of sealed wells with hand pumps should be investigated.

6 Conclusion

More than 60% of the people of Barakau do not have direct access to clean and safe water from reliable source. These people either have to buy water from households with tanks or the CWST. If funds are unavailable, they have to walk or drive some distance to nearby rivers, creeks or wells to obtain water. The availability of clean and safe water affects the health of the people in general, and most women and children spend a great deal of time ensuring there is sufficient water in the house for cooking, washing, bathing and laundry. While IWP PNG is targeting waste management and sustainable coastal fisheries, it cannot overlook water supply problems, if the ultimate aim is to promote the wellbeing of the people of Barakau. The project team will continue to work with the people to ensure that the current water supply situation is satisfactory addressed.

7 References

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Annex 1 Interviewers involved in the household water use survey

	Name	Sex	Age
1	Sibo Asi	F	31
2	Kebe Tai	F	29
3	Kwalimu Rarua	F	21
4	Raka Allan	F	23
5	Maria Lohia	F	21
6	Jency tau	F	22
7	Hereva Nanadai	M	22
8	Peter Valahu	M	32
9	Joe Tai	M	32
10	Gima Valahu	F	31
11	Harry Itana	M	35
12	Hetahu Gou	M	62
13	Manau Vagi	M	25
14	Sibona Vicky	M	20
15	Patrick Bodi	M	18
16	Timo Podi	M	19
17	Lucy Henao	F	21
18	Dickson Nua	M	33
19	Mera Willie	M	26
20	Mary Rea	M	33
21	Marava Willie	M	22
22	Korema Sam	F	19
23	Sibona Vegudi	F	30
24	Terence Tau	M	36
25	Nelson Sesero	M	34
26	Baroa Vagudi	M	26
27	Malofi Rea	M	22
28	Willie Seura	M	17
29	Terry Boga	M	23
30	Sibona Gou	M	40
31	Adam Nanadai	M	32
32	Tony Koipiri	M	29
33	Alesana Gabi	F	23
34	Donsi Maino	M	26
35	George Tai	M	20
36	Jimmy Mareva	M	26
37	Bai Vegudi	F	22
38	Maimu Iubu	F	30
39	Nou Kala	M	19
40	Zealous Nanai	M	35
41	Boga Koko	F	29
42	Gou Seri	M	27
43	John Rigana	M	38
44	Maimu Vagi	F	24
45	Sam Aisi	M	42
46	Heni Aisi	F	36
47	Lucas Madu	M	45
48	Winnie Sam	F	22
49	Walter Henao	M	30
50	Rita Marava	F	18
51	Lois Nanai	F	35

Annex 2 Household Water Use Survey Questionnaire

1.0 Name of Head of household:

1.0 Number of occupants:

(a) Adults

(b) Children

2.0 Water source

(a) Tank Water

(i) Number of Tanks

(ii) Volume

(b) Well Water

(i) Location

(ii) Time spent collecting water

(c) Other sources

(i) Supplier

(ii) Frequency

(iii) Volume

(iv) Cost

3.0 If water is carted from elsewhere:

(i) Supplier

(ii) Frequency

(iii) Volume

(iv) Cost

4.0 Do you agree with a User pay Community Water Supply Tank System to supplement the groundwater based water supply system?

5.0 If Yes, how much do you think should be charged per litre?

6.0 Other related comments

Annex 3 Feasibility evaluation of Barakau Village user-pays community water supply tank (CWST)

Background

In June 2004, IWP PNG approached the PCU to see if it could fund a water tank for the host village, Barakau, which experienced water shortages each year. The tank would need to be self-financing in order to remain operative following the IWP. The PCU conducted a crude assessment of the viability of the concept to inform its consideration. This annex describes that assessment. The assessment was based on the demand for water by households with no access to a water tank of their own.

Cost recovery can be approached in one of two ways: IWP could provide the infrastructure (tank etc.) free of charge, with the village covering only water and other variable costs (*recovery of variable costs only*), or the village could cover all costs, including that of the tank (*full cost recovery).*

Demand for water

The IWP PNG team has conducted a survey of water use in the village. A summary of water survey results so far (as of May 2004) are given in Table A3–1.

Table A3-1: Total water consumption (demand) from non-tank owners

Section of Village	Water Source	No. HHs	Average litres consumed per day	Total consumption per day (l)	Travel cost incurred accessing water source	HH Population	Total Population
Bagava	River	5	40	200	3	62	69
	Tank owners	13	55	715	4	155	
	Town	4	20	80	4	4	
Bay Side	Tank owners	15	20	300	2	128	364
	River	11	20	220	0	115	
Bay Entry	Well	10	110	1100	4	117	212
Dere Hua	Tank	9	50	450	5	106	188
Kida	Tank owners	10	20	200	2	122	190
	Well	2	80	160	3	22	
Middle East	Tank owners	10	55	550	4	73	171
	Town	3	50	150	0	7	
	River	7	65	455	4	49	
TOTAL		99	585	4580		960	1534
Average			5.9				

HH = households

Average water consumption per day by households is 5.9 l per household, with total estimated daily demand for households with no water tank of their own at around 585 l/day. This gives a total estimated demand for water by households with no tanks of around 4095 l/week.

Financial Analysis

Revenue

The current price of water is PGK 2 per 20 l container. It is assumed that the charge for water from the village tank would be the same. A supply of 3000 litres of water would meet most of the demand for water per week and would enable up to 150 sales (of 20 l tanks). This is worth PGK300 per delivery (150 × PGK 2).

Supply of water

The tank may need to be fenced to ensure no theft of water out of hours. The cost of fencing is not known.

To meet a weekly demand for water of 4095 litres per week, a 3000 litre tank could be purchased for PGK1800. An operator would be needed to man the tank and provide water on demand. Consultation with IWP PNG suggests that a low skill employee such as a domestic servant in Port Moresby earns around PGK 2 per hour. If we assume this price for providing water and that the tank is available 4 hours a day, 6 days a week, the cost of labour would be PGK48 per week (PGK 2/hourr × 24 hours).

Water can be purchased in bulk and delivered to the village by a local supplier. At the time of estimation, no quote was available for the purchase of 3000 litres of water to meet the capacity of the tank, so the price of 5000 litre delivery — which was already known — was used as an upper bound estimate. Obviously this will overestimate the time required for repayment of the tank. 5000 litres of water currently costs PGK 175, delivered to the village.

Costs and breakeven assessment

Table A3-2: Cost of water supply and tank

Component	PGK
3000 litre tank	1800
Fencing	?
Labour per week	48
Water cost per 5000 litres	175
TOTAL COSTS	**2023**

If the tank is supplied free of charge by IWP, the only known costs to recoup are variable cost of labour and water (costs = 175 + 48 = 223 PGK/week). In this case, revenue from one tank of water (PGK300) would cover all variable costs (PGK223) each week. The water sales would thus be self-financing immediately.

If the water was subject to full cost recovery, the price of the tank would also need to be considered. Ignoring fencing (for which costs are unknown), total costs would be PGK 2023 in week 1, with an addition of another PGK 223 or so each subsequent week to cover replenishment of water in the tank, and labour. Costs and revenues are given in Table A3. In this case, the tank should be able to recover all costs in less than 6 months.

Table A3–3: Reimbursement total costs (including tank)

Component	PGK
Tank (one time cost)	1800
Labour (48 PGK × 24 weeks)	1152
5000 litres water (175 PGK × 24 weeks)	4200
Total costs	**7152**
Cumulative revenues (150 × PGK 2 × 24 weeks)	7200

The tank would possibly be paid for earlier since demand for water is higher than 3000 l per week; also the cost of water would be less than PGK 175, as only 3000 l would be purchased at a time, not 5000.

Risk analysis

Demand for water

Would people buy all water at the price given? Intuitively, most people would be expected to want to buy water from a central village tank since, even at the same price, villagers would be spared the time and transport costs of traveling to and from the water source (bus, car or legwork).

It is possible that some households might not want to participate in the scheme. Note that 12 households currently get their water for free (11 in Bayside, 1 in Middle East). These households walk to their water sources (thereby avoiding transport costs) and do not pay for the water once there. If water was sold at the central tank cheaply enough, they might be interested in participating in the scheme if it saved them a lot of legwork. However, for conservative estimates, we can temporarily consider that these households might not participate.

Table A3-4: Total water consumption (demand) revised

Total daily water demand (from households without tanks, not including free water users	515
Total weekly water demand (515 × 7)	3605

In this case, weekly demand for water would still exceed a full tank per week. The tank should therefore still pay for itself within one week (variable costs only) or within six months (full cost recovery).

Other issues

The management of the tank will be important. A transparent system must be established for the ownership of the facility and access to it through the village. A system of payment and receipts should be introduced to ensure that water is fairly and honestly managed and to ensure that water and costs are fully accounted for. Consideration will need to be given to a number of issues including:

- who will manage the tank;
- where it will be located (somewhere with easy access); and
- who will own and manage the tank after the IWP finishes (including coverage of labour costs).

Recommendations

The provision of a water tank can be trialled at current water retail prices. The village may buy the tank on an interest free loan or IWP PNG, if it considers it appropriate, can provide the tank and appropriate infrastructure for free as an act of goodwill to ensure continued interest in the project.

Annex 4 Status report on the operation of the community water supply tank

Background

During the pre-pilot project site selection meetings held in Barakau village, the people highlighted the difficulties encountered with obtaining clean water for domestic consumption and inquired if the project could provide some assistance. It was made very clear that IWP was not a water supply project but it would assist in whatever way possible.

In order to gain a better appreciation of the situation the project team decided to carry out a water use survey to determine the extent of the water supply problem and identify possible avenues through which it may be able to assist.

The survey revealed that 60% of the people did not have access to water tanks and either bought water from households with tanks or obtained water from nearby rivers, creeks and wells. The latter was time consuming and physically stressful, especially if people had to walk to and from the water sources. These people also have to minimise their water use on a daily basis, which often means that personal hygiene is not given the required attention and health complications are likely to emerge.

After evaluating the results of the survey, the project decided to assist in two ways:

(i) install a user-pays Community Water Supply Tank (CWST) and

(ii) identify donors to complete the bore water supply system for the village.

Installation of the community water supply tank

Sixty per cent of the people have been buying water (primarily for drinking and washing) from households with tanks, at prices ranging from PGK 1.50 to PGK 2.50 for a 20 l container. The project decided to install a CWST and charge PGK 1 for 20 l, which was the preferred price according to the survey. The project team developed the proposal with the assistance of Ms. Paula Holland, the PCU Resource Economist, and submitted it to the PCU for endorsement. Approval was given for the purchase of a 3,000 gallon or 13,500 litre tank. With this volume, and the price of PGK 1.00/20 litres, PGK 675.00 could be generated per tank fill; given a refill cost of 510 PGK, this generates a surplus of PGK 165, which would be used to recoup installation costs, as well as cater for maintenance expenses and other project related activities.

4.0 Operation of the CWST

The tank was bought on 28/06/04 and installed on 20/07/04. The first fill was made on 01/08/04 and members of the Councillor's household performed the first round of fee collection. The revenue from the first sale was K530.00, which was enough to cover the K510.00 cost of refill. The next lot of sales fetched a total K450.00 so the project provided the balance for the refill. The third collection was K30.00 short of the cost of refill and the project paid the balance. In the fourth batch of sales, K600.00 was collected and in the fifth lot of sales K532.00 was raised. Sales of the sixth refill are now in progress. The Councillor's household members continued to collect fees for the second tank fill. It was then decided that members of the LPMC take turns in conducting sales so the last three rounds were handled accordingly. Table A4–1 shows the record of tank fills and the revenue collected.

Table A4-1: Record of Tank Fills and Revenue Collected

No.	Date of Tank fill	Name of Monitor	Revenue PGK	Cost of Tank fill PGK	Deficit PGK	Surplus PGK
1	01/08/04	K. Madu	530	510		20
2	27/09/04	K. Madu	450	510	60	
3	15/10/04	T. Badira	480	510	30	
4	11/11/04	R. Vali	600	510		90
5	23/11/04	A. Gau	532	510		22
6	13/12/04	S. Aisi				
		Total PGK	**2592**	**2550**	**90**	**132**

The main reasons for the revenue shortfalls were: (i) inconsistent volume of water delivered by the supplier, Leahy's Water Deliveries, (ii) inconsistent volume of sales as a large proportion of consumers were bringing containers bigger than 20 l, (iii) some credit sales in the first and second batches of sales. After the third refill, the LPMC decided to ban all credit sales, strictly enforce the use of 20 l containers, and check with the supplier to ensure the correct amount of water that is paid for is delivered. In order to minimize losses and ensure 20 l sales, a local company, K.K Kingston PNG Ltd, will be engaged to assemble a 20 litre dispensing container.

Table A4–2 shows progress with installation cost recovery. It is obvious that the system is a long way from recouping the initial establishment expenses. Assuming that PGK100.00 surplus is acquired per tank fill and there are about four tank fills per month, it will take about ten months before the total installation funding is recouped. It is important that sales stabilize at the expected revenue mark (i.e., K675.00) in order to expedite cost recovery and provide excess funds for other planned expenditures.

Table 2.0: Progressive Installation Cost Recovery

Component	All costs in PGK
Cost of Tank	3019.28
Cost of First Fill	510
Cost of Stand	600
Total System Installation Cost (TSIC)	4129.28
Total Deficit (TD)	90
Total Surplus (TS)	132
Progressive Percentage Recovery (PPR)	PPR = (TS – TD) / TSIC = [(132 – 90) / 4129.28] x 100 = 1%
Estimated TSIC Recovery Period (ETSICRP)	ETSICRP – TSIC/TS per fill/fills per month = 4129.28/100/4 = 10.3 months

Most of the consumers are happy with the CWST and agree that PGK1.00 is a reasonable price for 20 litres. They appreciate the concept and are willing to ensure it commences as soon as possible to generate additional revenue. Some people have indicated that if properly managed, it could even be possible down the track to purchase two more tanks to serve the western and eastern ends of the village.[2]

[2] Editor's note: the actual tank size and cost, and the cost of tank refills (per litre), were significantly different from the figures used in the original cost recovery estimate (in Annex 3).

Recommendations

Having examined the performance of the CWST to date, the following actions are recommended to improve the operations of the facility and ensure the expected revenue is generated.

(a) The Project Team should ensure that a 20 l dispenser is purchased and commissioned without delay.

(b) The Project Team is to immediately meet with the water supplier and check on the water delivery procedures.

(c) The Project Team and LPMC are to appoint and train full-time, paid monitors to oversee water sales.

(d) The Project Team and LPMC are to evaluate performance of the CWST over the next twelve months and make appropriate operational and price changes.

Conclusion

Given time, the project team is confident that the user-pay concept will succeed. This will demonstrate the feasibility of the approach to the people and hopefully encourage them to apply it in similar situations whereby collective communal benefit can be achieved.