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WATER USES AND THEIR SOCIO-ECONOMIC IMPACT IN THE KAT RIVER CATCHMENT: A REPORT BASED ON PRIMARY DATA

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WATER USES AND THEIR SOCIO-ECONOMIC IMPACT IN THE KAT RIVER CATHCMENT

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Terminology and Acronyms

AWARE	Action research and Watershed Analyses for Resource and Economic Sustainability
DWAF	Department of Water Affairs and Forestry
IWR	Institute for Water Research
IWRM	Integrated Water Resource Management
KATCO	The Kat River Citrus Co-operative
KRCF	Kat River Catchment Forum
KRWUA	Kat River Water User Association
WMA	Water Management Area
WRC	Water Research Commission

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1. INTRODUCTION

Through the Water Research Commission (WRC) project: "A stakeholder driven process to develop a Catchment Management Plan for the Kat River Valley", a process of participatory water resource management was initiated by the Institute for Water Research (IWR) and the Geography Department at Rhodes University (Burt, 2005). An integral part of the participatory process is the development of a negotiation-support tool, which will enable local water management institutions i.e. the Kat River Water User Association (KRWUA), to discuss future scenarios related to possible water allocations between the different sectors, in the catchment, and the consequences, of these scenarios, in terms of economic, social and environmental outcomes. This negotiation-support tool comes in the form of a simulation model called AWARE (Action research and Watershed Analyses for Resource and Economic Sustainability) (Farolfi, 2004); its construction is being undertaken within the outlines of Companion Modeling (Burt et al., 2005). The first version of AWARE was based on the Steelpoort Catchment in the Olifants Water Management Area (WMA), but a completely new version, re-named KatAWARE by the local research team, is now being developed to represent the water uses and availability in the Kat River Catchment (Farolfi-Rowntree, 2005).

Secondary and primary data collection and processing was a pre-requisite to the calibration of KatAWARE, of which the initial prototype has already provided local stakeholders with a relatively realistic representation of the present situation in their catchment.

This report synthesizes the results of the surveys conducted in the Kat River Catchment in 2004 and 2005, with the main aim of providing an accurate picture of the water use and consumption in the catchment. This data integrates and complements the information contained in Farolfi and Jacobs (2005), which focused on the relevant secondary data.

This document focuses on irrigation and domestic uses, the two sectors that according to the Department of Water Affairs and Forestry (DWAF) represent about 85% of the total water demand, excluding the Ecological Reserve, in the Kat River Catchment

(Farolfi and Jacobs, 2005). Afforestation, alien vegetation, livestock and game reserves make up the remaining water consuming sectors (about 15%) in the catchment.

The limited availability of time and resources, in this study, meant that only the agricultural and domestic sectors could be investigated. The same constraints forced researchers to limit their sample sizes to often statistically insignificant numbers. The difficulty of collecting information on water use and demand for sectors that do not have a formal accountancy system, such as smallholding agriculture or rural households, was also a hurdle. Most of the primary data contained in this document should be considered as additional local information to the secondary data available from the SA Census and from DWAF, but not as reliable, statistically sound numbers coming from formal surveys. The collected information is nevertheless useful in view of the fact that no formal data on water users and uses in the Kat River Catchment, existed prior to these surveys, and the secondary data did not provide enough insights on issues such as water consumption per sector's units or water prices/willingness to pay by the different users.

Direct interviews with key local users were utilized in obtaining this information. The interviewed stakeholders were encouraged to express their concerns and perspectives about water uses today and in the near future. These items were also captured in this report.

The report is organized into 5 sections: section 1 is the introduction to the report; section 2 presents irrigation users; section 3 is dedicated to domestic users; section 4 illustrates the main perspectives and preoccupations from local water users; section 5 synthesizes previous sections' findings and provides some conclusions.

2. AGRICULTURE IN THE KAT RIVER CATCHMENT

The complex and dynamic history of the catchment (Fox, 2005; Farolfi-Rowntree, 2005) has lead to a number of different types of farming groups, namely: small-scale, emerging and large-scale farmers. Most of the *small-scale farmers* are situated in the Upper Kat (Figure 2.1); they generally function within community irrigation schemes of approximately 30ha in which each farmer is allocated 1ha. The small-scale farmers of the catchment generally produce a variety of vegetables, although there are a few examples of community schemes growing cotton in conjunction with the local municipality. The *emerging farmers* produce citrus or are becoming citrus farmers and hold farms of 20-30 ha, situated mainly in the Middle& Upper Kat (figure 2.1). *Large-scale farmers* are predominantly white-commercial-citrus producers, situated mostly in the Lower Kat.

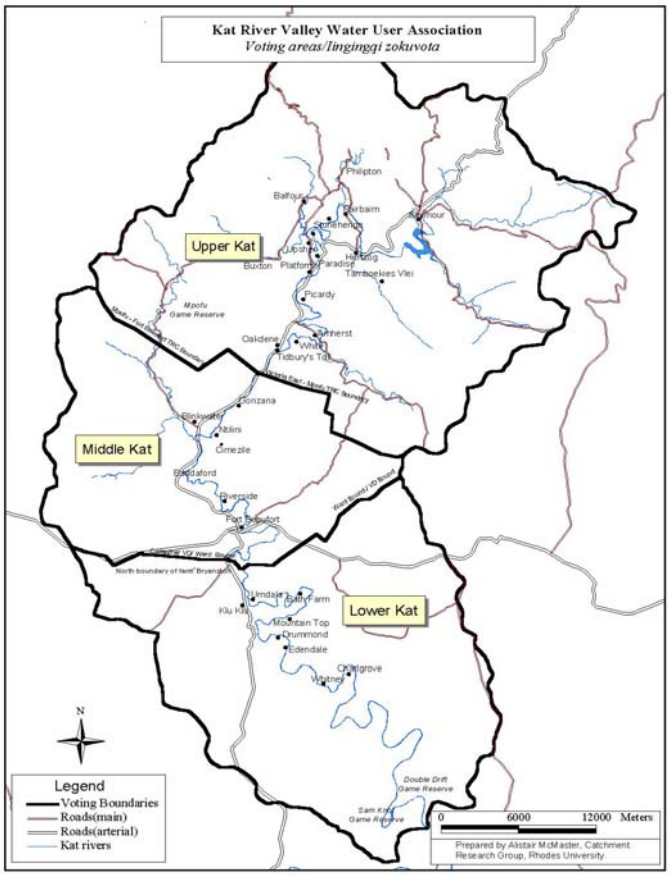

Figure 2.1 The Kat River Catchment and associated KRWUA voting areas: Upper, Middle and Lower Kat.

2.1 Small-scale farms

Small-scale farmers consists of community members who have organised themselves into collective irrigation schemes. An example is the Kat River Irrigation Scheme in Stonehenge, in the Upper Kat (figure 2.1), which is supported by the local Nkonkobe Municipality. It is here that Ms Ntando Mlilo, an honours student in the Rhodes Geography Department conducted most of her interviews (Mlilo, 2005).

Small-scale farmers in the Kat River Catchment produce exclusively annual crops, mainly cabbages, butternut, potatoes and recently, through a municipal initiative, cotton.

Despite the recent liberal trends of the national SA policy, irrigation schemes often benefit from the financial and technical support provided by local and/or national development projects, which provide capital, machinery, inputs and training.

Several surveys were conducted amongst the Upper Kat irrigation schemes; these aimed at obtaining the necessary information on the economic aspects of annual productions and water use amongst this sector. Nevertheless, because of the lack of records, farmers were not able to produce reliable information. Table 2.1 shows a summary of the information that could be obtained, concerning local economic outputs from small-scale irrigation schemes, the table shows the annual costs and income of a small-scale cabbage-irrigation scheme of 30 hectares in the Kat River Catchment.

The data in table 2.1 comes from a PhD thesis realized in the area by Simphiwe Ngqangweni in 2000. More recently the data has been updated by Dr Farolfi, using information collected in the Kat River Catchment in 2005.

Table 2.1 Costs, income and profit in a 30ha community irrigation scheme producing cabbage, in the Upper Kat (Adapted from Ngqangweni, 2000).

Budget for 30 ha Community Irrigation Scheme.		
Size of Scheme (hectares ha)	30	
Costs	**R/ha**	**Total**
Labour	670	20100
General variable costs	7320	219600
Total Costs		***239700***
Income	**R/ha**	**Total**
Cabbage	10050	301500
Total Income		***301500***
Total Profit		**61800**

Direct surveys on labour, enabled the estimation of the seasonal labour needs for the same 30 ha irrigation scheme - excluding the local farmers managing a plot included in the scheme (table 2.2).

Table 2.2 Labour needs in a 30ha community irrigation scheme producing cabbage (Direct surveys, 2005).

Labour for 30ha community irrigation scheme				
Type of labour	**Hours/ha**	**area**	**h/employee**	**Number of employees**
Seasonal	536	30	420	38.29

Table 2.3 shows a breakdown of the costs and income for 1 ha of cultivated cabbage. From this table it can be seen that capital costs and machinery costs do not appear in the budget, this is because they are usually covered by sponsoring projects and not directly by the farmers.

Table 2.3 Costs and Income for 1ha of cabbage production in the Upper Kat (Adapted from Ngqangweni, 2000).

Budget for 1 ha				
	Units	**Quantity**	**R/unit**	**R/year**
Costs				
Seasonal employees	h	536	1.25	670
Total Labour Costs				***670***
Herbicide	L	2	361.3	722.6
Seedlings	units	25000	0.05	1250
Fertiliser 2.3.4	ton	0.5	1360	680
Fertiliser LAN	ton	0.5	1040	520
Pesticide (solid)	ton	0.02	31330	626.6
Pesticide (liquid)	L	6	258.72	1552.32
Pockets	units	1675	0.85	1423.75
Land	L of fuel	30	6.5	195

Preparation				
Transport	ha	1	200	200
Water, repair and maintenance	ha	1	150	150
Total Variable Costs				***7320***
Income	**Units**	**Quantity**	**Market price**	**Total**
Production	bags	1675	6	10050
Total Income				***10050***

2.2 Citrus Production in the Kat River Catchment

Citrus has become the chief agricultural export in the Kat River Catchment over the last decade. Currently 874ha, in the catchment, are under large-scale commercial citrus production, of which 418ha are situated north of Fort Beaufort (6 farms, all scheduled[1]), and 456 south of Fort Beaufort (5 farms, only 30ha scheduled). In addition to this, about 400ha are held by emerging farmers (+/-22 farms) mainly located in the Middle and Upper Kat (figure 1). According to local producers, about 700 additional hectares can be irrigated in the catchment under the present water allocation scheme. The large-scale farms situated north of Fort Beaufort produce 12 500 tons per year, corresponding to an average of 30 tons per hectare, the majority of these farms are marketed through the Riverside packing shed. Riverside is a large private corporation which not only packs and ships much of the citrus produced in the catchment, but also actively assists numerous of the emerging-citrus farmers in growing and selling their crops. The rest of the large-scale and emerging farmers, predominantly in the Lower Kat, south of Fort Beaufort, are members of the Kat River Citrus Co-operative (KATCO). This cooperative of citrus producers, packs and markets the remaining citrus produced in the catchment.

Citrus production needs a combination of factors in order to succeed (Mlilo, N., 2005), these include: farm business skills; financial and labour management;

[1] While all farms in the middle and lower Kat rely on the Kat River for irrigation water, two systems of access to water are in place. The first is that of scheduled use. Annual allocation fees are paid according to the area of a farm that has been scheduled for irrigation. All farms in the middle Kat, above the town of Fort Beaufort, are part of the scheduled area. Below Fort Beaufort, the lower Kat farmers opted out of the scheduled scheme and therefore do not pay an annual sum for their water. They rely on storing the excess water flowing past the upstream farmers in large instream weirs. We can see from the above overview that there are four groups of irrigators in the Kat River Catchment: small-scale black farmers, often forming cooperatives, large-scale 'emerging' black farmers, white commercial farmers with scheduled water rights, white commercial farmers without scheduled water rights (Farolfi & Rowntree, 2005).

accountancy skills; knowledge about climate; type of soil; water quantity and quality; information concerning the various markets and their requirements for each cultivar. Also good equipment and safe sheds are crucial for citrus production. These factors are often lacking in emerging and especially in small-scale agriculture, hampering the development of citrus production in the Kat River Catchment.

The following section presents Ms Ntando Mlilo's 2005 findings. Her research focused on citrus production amongst emerging farms. She interviewed 16 farmers (4 small, 8 emerging and 2 large-scale) and key members of the local Nkonkobe Municipality. The interviews were more qualitative then quantitative.

2.2.1 Emerging farms

Table 2.4 shows the annual costs (fixed, variable and commercialisation costs) and the annual income from an emerging citrus farm (18 ha of which 15.75 are producing and 2.25 are new plantations not yet producing); from these the annual profit is calculated. Labour costs (7005 R/year in this farm) and costs for water (depending on the water tariff (about 0.05 R/cubic meter today) do not appear in the table (Direct interviews to large-scale farmers by Farolfi, 2005).

Table 2.4 Costs and income for an emerging Citrus farm (18ha) (Direct surveys, 2005).

Area of productive citrus (ha)				15.75
Area of non-productive citrus (ha)				2.25
Costs				
	Unit price R/ha	**Quantity R/ha**	**Life span**	**Total cost R/year**
Fixed Costs				
Installation costs	31500	1.00	32	17718.8
Land rental	2000			36000.0
	Quantity	**Unit price**	**Life span**	**Total cost R/year**
Tractor	1	100000	15	6666.7
Boom sprayer	1	100000	15	6666.7
Variable costs				
Other machines (O&M)	700	1		12600
Total Variable costs/ha	17920	1		322560
Commercialisation costs	**R/ton**	**Ton/ha**		

International	1250	31.5		620156.3
Local	446	13.5		94830.8
Total costs R/year				***1 117 199.1***
Income				
	Total quantity (tons)	**Market prices R/tons**		
Citrus	708.75	R/T		
International	496.125	2500		1240312.5
National	212.625	833		177116.6
Total income R/year				***1 417 429.13***
Total profit R/year				**300 230.04**

Most emerging farmers have the basic equipment, which consists of one or more tractors, a boom sprayer, herbicides and pesticides, fertilizers and an installation for irrigation. In terms of water requirements, in the summer citrus needs more irrigation (8-12h per day) than in the winter (4h per day). Diesel, herbicides, pesticides and fertilizers are very important intermediate costs for the farmers (Mlilo, 2005).

The main problems emerging citrus farmers have to face are the lack of clarity in their land tenure status and the consequent difficulties in obtaining loans to cover their costs. Since farmers do not often own their farms, they are unable to obtain bank loans. One form of ownership is a lease contract, but often when the contract expires, the titles aren't made available. The 1994 moratorium from N. Mandela tried to arrange the ownership issues, but there is still a lot of confusion around this issue (Mlilo, 2005). On the other hand, farmers can get support from other agencies, for instance: the government, the department of agriculture, the development bank, Riverside or KATCO, the municipality and private volunteers and organisations (Mlilo, 2005).

Beside citrus, emerging farmers produce annual crops such as butternuts, cabbage, potatoes, maize and other vegetables. Cotton is also being produced in the Upper Kat at present. Many farmers are also involved in livestock production, and many areas still possess uncultivated lands (Mlilo, 2005).

2.2.2 Large-scale farms

The following section outlines the findings of Mr Anel Mujkanovic and Mr Johan Edgren, two Swedish honour students working under the supervision of Prof. Kate Rowntree (Rhodes University Geography Department) and Dr. Stefano Farolfi (Ceepa, University of Pretoria). Mr Mujkanovic investigated labour-related issues on three large-scale citrus farms in the Middle and Lower Kat; these farms will be indicated in this report as: C, K and R. The surveyed farms create important job opportunities and the farms' employees are completely dependent on the income they earn on the farms. Primary information was collected through six interviews, three with the owners, and three with an employee of each farm. Mr Edgren also worked on the same three farms (C, K and R), but focused on critical production factors related to citrus production. Mr Edgren also utilised interview techniques and observations to obtain his information.

In general the larger commercial citrus farms are owned by families who have been in the catchment since the 1820s, and the first European settlement in the catchment. Their farms are therefore well established and quite extensive. Farm C and K have been producing citrus for more then 80 years and R has been running even longer that that, however, it has only been producing citrus since the 1990s (Mujkanovic, 2005).
The recognised definition of a large-scale citrus farm, in the Kat River Catchment, corresponds to those farms which cultivate more than 25 hectares of citrus. The three surveyed farms have a citrus surface corresponding to: 37 ha for C, 70 ha for K and 280ha for R (Mujkanovic, 2005).

Annual citrus production of C is around 1320 tons, for K it is 2500 tons, and for R 12000 tons. About 70% of the production is exported; the remaining goes to the domestic market. Those farmers interviewed would prefer to export their whole crop to international markets, however, the high quality standards set by international markets prevent many from doing so (Mujkanovic, 2005; Edgren, 2005).

The citrus cultivars produced varied slightly between the three investigated farms, likewise does the amount of water used per hectare and the type of soil (table 2.5) (Edgren, J., 2005).

Table 2.5 Citrus production and use of water in three large-scale farms in the Kat River Catchment (Edgren, 2005).

Farms	C	K	R
Area under citrus (ha)	37	70	280
Production (tons)	1320	2500	12000
Water use per hectare (m^3)	6500	6000	7000
Citrus cultivars	- Navels, - Lemons, - Clementines, - Mandarins, - Satsumas (planted but not in production)	- Oranges, - Lemons, - Navels, - Satsumas	- Lemons, - Navels, - Mandarins
Soil characteristics	Sandy loam	Sandy loam and decomposed dolerite	Sandy loam

2.2.3 Export and packaging

Citrus from the Kat River Catchment is mostly exported internationally. For most of the farmers the exported quantity corresponds to far more that 50% of their production, and about 70% of the catchment's total citrus production. The citrus is exported abroad, mainly to the Middle East, Europe, Russia and the Far East. Exported citrus is graded, if the fruits score 1 or 2 they are suitable for foreign markets, if they score 3 they are sent to the local market. Grading according to fruit size and quality is done at the KATCO and Riverside packing sheds. Both institutions have packing and processing facilities, at which they collect, select, wash, pack and transport the fruit for export (Mlilo, N., 2005).

KATCO presently has 21 producing members. 5 members are located in the Upper Kat and produce 10% of total produce for KATCO. As a packing shed, KATCO has a capacity of 58 000 bins/year. The total citrus surface cultivated by KATCO members is 800 hectares. 50% of the production is graded class 1, 15-20% is class 2, and the remaining 30-35% is class 3. At the moment one of the largest obstacles holding back KATCO's production capacity, are old labour intensive machines, which reduce their effectiveness and increase the cost per unit. Replacing the machines would also create an opportunity for additional human capacity. Presently KATCO employs 800 people seasonally and 20 on a permanent basis.

Farmers (associates) pay annual fees to be part of KATCO. Each 500 bins commercialised, the farmers have to pay KATCO the corresponding income of selling 40 – 50 bins (about 10% of their income). The board is composed of 7 elected members and 1 chairman. A nominated manager, who is not a farmer, refers back to the board.

In addition to supporting its members, KATCO provides technical assistance and training to associate emerging and small-scale farmers. KATCO has a training facility where basic literacy, numeracy, health and safety issues, home economics and prevention of aids are taught. As mentioned above, KATCO grades the fruit from its members and provides training to graders (Mlilo, N., 2005).

2.2.4 Labour in citrus farms

Workers on the citrus farms can be divided into three categories: permanent, seasonal and casual workers (table 2.6). Each group has a different work schedule: permanent workers work the whole year, seasonal workers only during the picking season - from May until July - and casual workers are hired occasionally, when required. For instance, at the farm R casual workers are the people working at the packing sheds. Permanent workers usually get the highest wages. R850 is considered to be the minimum wage (Mujkanovic, 2005).

Table 2.6 Labour force and wages in the three large-scale citrus farm surveyed (Mujkanovic, 2005).

Farm	**C**		**K**		**R**	
	R/Month	No.	R/Month	No.	R/Month	No.
Permanent workers	1 000	4	1000	8	1 000 - 2 500	80
Seasonal workers	850	80	850	50	700 - 1 600	200
Casual workers	320	10	850	50	850	200
Total		94		108		480

The labour force at all three farms, C, K and R, comes predominantly from the Kat River area, where unemployment reaches 80% (Farolfi-Jacobs, 2005). The areas around Fort Beaufort are the main zones from which employees are recruited. People working at the surveyed farms are mostly men older than 30 years. Not many young people or women are employed in citrus farms because the job is very physically

demanding (Mujkanovic, A., 2005). Although presently, labour supply is not a concern because of the high unemployment, there are worries about the availability of labour in the future. The area is heavily affected by HIV/AIDS and therefore, there is a concern that within a few years there might be a shortage of labour, pushing local employers to hire workers from outside the Kat River Catchment (Mujkanovic, A., 2005). Mujkanovic (2005) interviewed three employees from farms C, K and R, all of them indicated that for them the job at the farm is the only source of income for him/herself and his/her family; they indicated that the average amount earned is about R850 per month for seasonal and causal workers. Worth mentioning is that the interviewed employees do not get any other benefits on top of their salary. They do not get money towards food, transportation, housing, or any pension funds (Mujkanovic, 2005).

2.2.5 Water and citrus

The three surveyed large-scale farms experience the same climate and rainfall: the slight difference in production and water use can be explained by the different irrigation techniques used, the different citrus cultivars grown, the area of land under citrus, and by the different nature of the soil on the three farms. The data shows a positive relationship between water use per hectare and citrus production per hectare. The more water used, the higher the production (table 2.7). Nevertheless, citrus productivity per cubic meter of water does not show the same linearly positive correlation (Edgren, 2005).

Table 2.7 Water and citrus production on three large-scale citrus farms in the Kat River Catchment (Edgren, 2005).

Farm	Production (kg) per hectare	Water use m^3 per hectare	Production (kg) per m^3 of water
C	37000	6500	5,6
K	36000	6000	6
R	43000	7500	5,7

In fact, the amount of water alone does not explain everything. Many other factors influence the observed differences in citrus production. Water quality, fertilizers and pesticides type and quality of soil, varieties of crops, irrigation techniques and climate are all equally important. The characteristics of some of these factors in the Kat River Catchment are discussed below (Edgren, 2005).

Table 2.8 General environmental factors affecting citrus production in the Kat River Catchment, at farms C, K and R (Edgren, 2005).

Water Quality Water in the Kat River becomes stagnant during the winter months and therefore the quality deteriorates. But when the river flows again the quality improves. Local farmers point out that there has been a deterioration of the water quality since the dam was built, and the growth of Fort Beaufort has negatively affected the water quality in the lower Kat River. One of the farmers pointed out that the difference in production output between a good and a bad year can be up to 30 %.
Soil The soil in the lower Kat River Catchment is homogeneous, all three surveyed farms have a sandy loam with an increasing proportion of clay when leaving the river. Farmers would prefer a deep sandy soil, which is best for citrus production, but they still find the soil in the Kat River Catchment is good for citrus production. Local farmers point out that the soil makes a massive difference for the production both in quantity and quality. The Kat River Catchment is known for it good quality citrus produce. In the Lower Kat water use increases in September because of the dolerite soils. In the Upper Kat water use increase starts in August, because of the sandy soils (Burt et al., 2005).
Climate Interviewed farmers identify climate as a very important factor in citrus production. If the climate is too dry, too windy or too cold the production will be negatively affected. Looking at the climate conditions in the Kat River Catchment, local farmers are very satisfied and one of the farmers put it in the following way: “There are places closer to the coast, which are far more suited for citrus production but there they have problems with the wind. Up north they have problems with frost and here nothing is too bad”. One can argue that the Kat River Catchment is an optimal spot for citrus production because local farmers can cultivate a wide range of varieties so they can extend their season and therefore stay longer on the market.

3. DOMESTIC USERS

In order to obtain information on domestic water use, particularly in rural areas of the Kat River Catchment, a Master Student supervised by Prof. Kate Rowntree (Merle Naidoo) interviewed, in 2004, 101 households in the following villages and farms (table 3.1 and figure 3.1):

Table 3.1 Villages and Farms surveyed by M.Naidoo (2005).

Village/Farm	Number of Households	Location in Catchment
Sheshegu	11	Lower Kat
Charlgrove Farm	2	Lower Kat
KluKlu mouth Farm	6	Lower Kat
Cimezile	12	Middle Kat
Gonzana	10	Middle Kat
Blinkwater	8	Middle Kat
Ntilini	2	Middle Kat
Oakdene	6	Upper Kat
Tidbury's Toll	5	Upper Kat
Fairbairn	10	Upper Kat
Hertzog	13	Upper Kat
Ekuphumleni	10	Upper Kat
Platform	1	Upper Kat
Stonehenge	1	Upper Kat
Philipton	2	Upper Kat
Balfour	1	Upper Kat

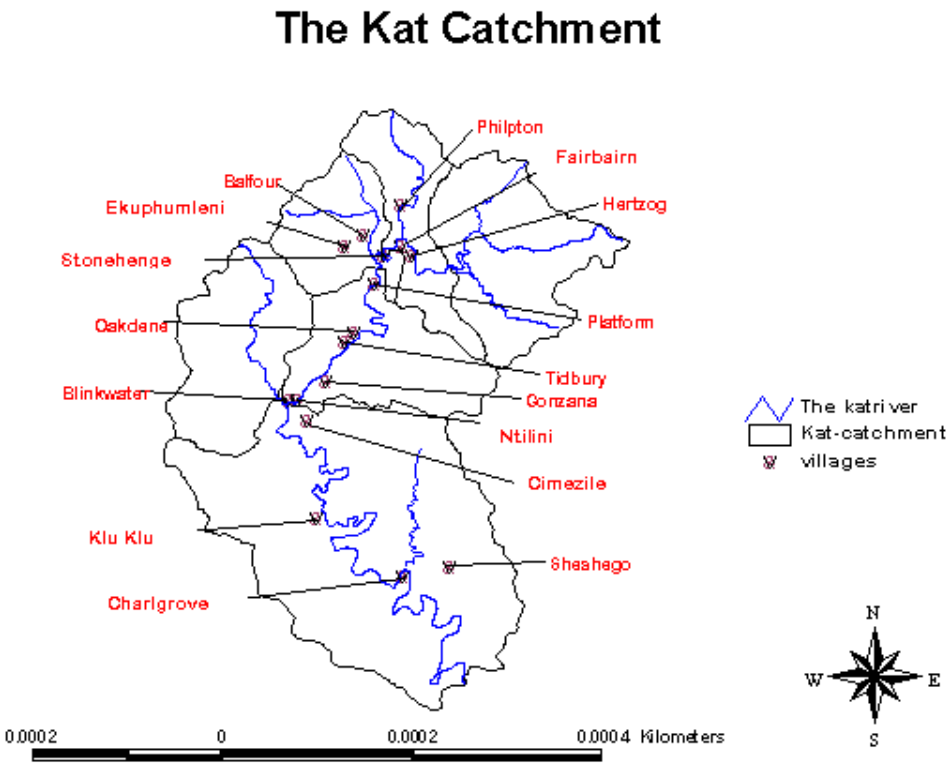

Figure 3.1 Villages in the Kat River Catchment surveyed by M.Naidoo (2005).

The villages were selected because of their representativity (in the Upper and Middle Kat) or randomly (in the Lower Kat). To conduct the survey a questionnaire, designed in collaboration with Dr. Stefano Farolfi (Ceepa/University of Pretoria), was adopted. The questionnaire is composed of two sections: In section one, general information on the socio-economic characteristics of the household was collected; in section two, more specific info about the water use, water prices and willingness to pay for an improved water availability or for a better quality of water was collected. A copy of the questionnaire is available in the appendix. Selected results from this survey (Naidoo, 2005) are shown in this section.

In terms of type of dwelling, 41.6% of the surveyed households were living in mud and tin houses without electricity; 13.9% in brick structures without electricity; 17.8% in mud and tin houses with electricity and 26.7% in brick houses with electricity. The data indicated that the households in the Lower Kat, on the richer large-scale farms all

had electricity. The average distance between the villages and the Kat River is 2.5 km, but a high variance exists from village to village (figure 3.1).

The average age of the household head was 58 years, 51 of them were male, 47 female, and 3 unknown. The mean educational level of the household head on a scale from 0 (no education) to 12 (last year of high school) was around 6, varying between 3 and 9 (table 3.2).

The average household size is 5.5, varying between 4 and 6. Most of the time, only one person per household is employed, often nobody is working. This is consistent with the high level of unemployment in the area. The average income per head of household was about R800 per month. It was lower if the head was a pensioner or unemployed, it was higher if the head worked in the service-providing sector (teacher, nurse, etc.). Government grants (200 R/month as an average) are very common in the form of child grants, pensions and disability grants. Only a little minority of the households owned their own land. The land is mainly owned by the state, the farm chief or the community (Naidoo, 2005).

Table 3.2 Domestic water users in the Kat River Catchment rural areas: socio-economic data referring to the surveyed villages (Naidoo, 2005).

Village/Farm	Distance to River (m)	No. of household members	No. of household members earning an income	Income of head*	Total income of household **
Sheshegu	11000	5.8	1	5.6	5.6
Charlgrove Farm	200	3	1	6	4.5
KluKlu mouth Farm	0	2.7	0.8	3.7	3.3
Cimezile	1508.3	5.3	1.2	3.4	4.7
Gonzana	435	5.3	1	2.7	3.1
Blinkwater	1466.3	5.1	2	4.3	5
Ntilini	85	3.5	1	2.5	2
Oakdene	1500	4.7	1.2	2.8	3
Tidbury's Toll	300	5.4	0.6	2.3	1.5
Fairbairn	324.1	5.1	1.4	4.1	4.5
Hertzog	903.5	5.5	0.8	3.9	4.2
Ekuphumleni	3250	6	1.2	3.9	4
Platform	500	2	0	/	/
Stonehenge	100	7	1	5	6
Philipton	3000	5.5	1.5	3.5	2
Balfour	1000	4	2	/	/

* and ** : The values in the table correspond to the average answer for each village according to the following scales:

*: < R200: **1**, R200-R500: **2**, R500-800: **3**, R800-R1200: **4**, R1200 –R1500: **5**, R1500-R2000: **6**, R2000-R2500: **7**, R2500-R3000: **8**, >R3000: **9**

: < R500: **1, R500-R700: **2**, R700-R1000: **3**, R1000-R1300: **4**, R1300-R1700: **5**, R1700-R2000: **6**, R2000-R2500: **7**, R2500-R3000: **8**, 3000-R3500: **9**, R3500-R4000: **10**, >R4000: **11**

Rural domestic users in the Kat River Catchment get water for drinking, washing, cooking, gardening and livestock. In the interviewed villages, 70.3% of the households mainly used water from the river. The least river water was used in villages like Cimezile, Sheshegu and Klu Klu Mouth Farm, most of them being situated further from the river (figure 3.1). A large majority of the households collected rainwater in a drum or a tank (77.2%). Very few households (5%) used water from a dam. In Cimezile, Ekuphumleni, Sheshegu, Klu Klu Mouth Farm, Charlgrove and Blinkwater, households get water from either private or community taps.

For the whole sample the main water source is the river (52.5%) followed by community tap (42%). Very few households have a pipe connection to their house. In general people in the Kat River Catchment have to walk to get their water, and sometimes they bring a wheelbarrow or a donkey. On average people collect water 10 to 15 times per week. Mostly women and children do the collecting. Everyone in the household generally makes the decisions about the water used, if not it is the head that decides.

The amount of water usually collected during one week is about 500 litres (table 3.3). This amount corresponds to an average of 13 l/capita/day for an average household of 5.5 members, well below the indicated minimum requirement of 25 l/capita/day prescribed by DWAF.

Table 3.3 Domestic water use characteristics in selected villages and farms in the Kat River Catchment rural areas (Naidoo, 2005).

Village/Farm	Distance from main water source (m)	Number of trips per week to fetch water.	Litres collected per week.
Sheshegu	26.5	20.1	567.8
Charlgrove Farm	150	0	/
KluKlu mouth Farm	76.7	14	392
Cimezile	175.4	12.9	585.9
Gonzana	700	13.3	577
Blinkwater	212.5	12.3	437.5
Ntilini	/	/	/
Oakdene	1500	12.2	437.5
Tidbury's Toll	300	28	840
Fairbairn	400.1	10.8	586.9
Hertzog	883.1	15.3	498.8
Ekuphumleni	138.6	4.9	395
Platform	0	7	420
Stonehenge	100	14	700
Philipton	55	7	560
Balfour	1	3	300

The average distance to the main water source is just above 0.4 km (table 3.3). The distance to the tap is shorter than the distance to the river.

Households pay for tap water on Charlgrove Farm (R110/month) and Cimezile (R20/month). Table 3.4 shows the monthly payments for community tap water as referred by interviewed households.

Table 3.4 Rural households interviewed that pay for water (Naidoo, 2005).

Household	Village	Amount paid per month
1	Cimezile	R20
2	Cimezile	R10
3	Cimezile	R15
4	Cimezile	R20
5	Cimezile	R15
6	Cimezile	R30
7	Cimezile	R20
8	Cimezile	R20
9	Cimezile	R20
10	Cimezile	R20
11	Cimezile	R20 - R30

12	Cimezile	R10
1	Charlgrove	R70
2	Charlgrove	R150

In terms of assurance of water supply, drums and tanks depend on variable rainfall, taps are not always available for several reasons: either the pump or the pipeline is damaged, or the engine is too weak to get evenly distribute water to all households, etc. 13.8% of the interviewees didn't have a water storage system, all the others (86.1%) did. 22.8% had tanks and 63.3% had drums. The average lifespan of storage facilities was 7 years. Some households got the drum/tank for free (11.9%), some didn't know (9%), the majority had to buy it (79.1%) (Naidoo, 2005).

Most households consider the quality of river water bad for several reasons:
a) They have to share it with livestock;
b) People do their washing in it;
c) Septic tanks leek into the river after the rain and
d) Wastewater is not treated.

Drums and tanks are seen to provide the best quality water, because they contain clean rainwater, although they sometimes rust through. The quality of water from taps is often considered bad, as people say that the water tastes funny and they are not sure the water is properly purified.

Out of the 101 households interviewed, 58.4% used/collected water for food production or any business/small-scale economic use and 41.6% did not. Most collected water is used for: food production, for subsistence or for small-scale trade. For this purpose mostly river (56%) or tap water (27%) is used, more rarely rainwater and water from the dam. The biggest cost here isn't the water, but the electricity (estimated at around R70 per household / month).

68.3% of the interviewed households were willing to pay for both a flush toilet and a private tap; 9.9% of the households only wanted to pay for a private tap, none wanted to pay only for the flush toilet – 2 didn't know and 2 didn't answer. 17.8% of the households didn't want to pay for either. 26.7% of the households wanted to pay for better quality of the water, 66.3% did not, 6 didn't know and 2 didn't answer.

Reasons for desiring a private tap were: “we won't have to worry about safety of water; we won't have to travel long distances; we would no longer have to worry about diseases; taps will make our lives better; we will know that the water we are drinking is clean; this will ensure that we always get water; we also need clean and fresh water like everybody else”. The main reason for not wanting a private tap was lack of funds to pay for the service.

The most mentioned reason for desiring a flush toilet was that pit latrines are not at all hygienic and not good for health. Also digging a new hole or destroying the old one takes time. Here also money was the critical problem: the households who didn’t want to pay for better water quality were too poor to afford this commodity (Naidoo, 2005).

4. STAKEHOLDERS' FUTURE PERSPECTIVES

As part of the development of the KatAWARE model, with the local stakeholders, the Project's 'social team' and Dr Farolfi and his team organised a first workshop in Fort Beaufort, June 2005. An objective of the workshop was: "*making the model our model, giving the stakeholders the opportunity to contribute to the development of the model by discussing water use under current practices and proposed future practices"*. Methods to obtain these objectives included:

- *Visual representation of identity as a representative of particular water users on a map of the catchment;*
- *Facilitated group discussions;*
- *Mixed stakeholders discussions and activities;*
- *Use of a 3-D model (wooden blocks and wooden panel representing water use over a year);*
- *Group discussions presented back to everyone with the opportunity for all participants to ask questions* (Burt et al., 2005).

Table 4.1 illustrates all the different sector representatives, which participated in the workshop. Where possible they mentioned: if they paid for water; their water use; their access to water; and their water use for irrigation.

Table 4.1 Participants to the first workshop for the construction of the AWARE model (Burt et al., 2005).

	Identify yourself	Location in Kat	Do you pay for water	Water use	Source of water	Irrigation
1	domestic user		no	25 l/d	river	no
2	domestic user		no	30 l/d	tap	garden
3	domestic user	middle	no	25 l/d	river	no
4	small-scale	middle	no		pump	cabbage
5	domestic user, WUA		some areas (Seymour)	100 l/d	tap/river/borehole	garden
6	resarcher SS					
7	small-scale (Coop 147)	upper	not anymore	2,5 l/d	river	butternut/cabbage/ potatoes
8	municipality, water sanitation		yes, to DWAF	7,5 million l/d		
9	researcher AWARE					
10	researcher AWARE					
11	researcher AWARE					
12	small-scale	lower	yes		river	crops/ vegetables

13	large-scale			560 million l/d	pump	citrus
14	researcher representativity					
15	large-scale			5000 m^3/ha	buy water	citrus
16	large-scale	lower		6500 m^3/ha		citrus
17	researcher social team					
18	researcher social team					

The workshop also provided a good opportunity to collect information about present and future issues relating to water use and availability from the different water users. The information presented here is a summary of the data provided by participants to the workshop and is included in Burt et al. (2005), where further information and more details on the mentioned workshop can be found.

4.1 Emerging and Large-scale Farmers

Emerging and large-scale farmers mainly use water for the irrigation of their citrus and vegetable fields. The amount of water used in the summer (8 hours/day twice per week) is much larger than in the winter (3 to 4 hours once a month), because of the heat and the evaporation. Their future plans mainly involve expanding the size of their farms. Large-scale irrigators would like to see them expanding by 150 hectares in the Upper Kat and between 30-40 hectares in the Lower Kat. Emerging farmers see land tenure as the key to success, especially farmers in the Upper Kat who do not own their plots. They also need:

- Access to capital;
- Water availability (in the Upper Kat they were not allowed to build weirs, and they would need storage capacity in this area);
- Labour and machinery: “we are using old tractors at the moment”.

In the lower Kat there are $^{+}$/-25 weirs which are on average 3.5m high and 20m wide, their back-up pools stretch for about 1km upstream. This corresponds to a storage capacity of about 850 000 m^3.

Expansion will lead to economies of scale “more citrus means more money, more profit and more job creation, more export and more foreign currency, a better

concurrence position". Water use in 5 to 10 years is likely to change proportionally with this expansion (Burt et al., 2005).

When asked how the emerging and large-scale farmers think their present and future use of water would impact other water users and how other water users would impact them, they said the creation of employment through their expansion would be a positive effect. More water use could potentially have a negative impact on the availability of water for others. While more land will be used, farmers pointed out that citrus need less water then other crops. Non-scheduled farmers from the Lower Kat could be disadvantaged if farmers from the Upper and Middle Kat use more water. Farmers from the Lower Kat are also more vulnerable for water quality and salinity, with highest salinities occurring during spring. The Fort Beaufort town barrage needs water every 10 days due to the silting up of barrage. Before the silting, water in the barrage lasted up to 4 months (Burt et al., 2005).

Emerging farmers will have to deal with several problems:

1. *Land title* is the biggest issue.
2. *Access to capital*: because of land tenure issues farmers cannot get bank loans: "The only way you can get money for investments is from profits".
3. *Water assurance of supply*: it might not be enough in the future. In the past farmers in the Upper Kat have been prevented from building weirs because of concerns that these upper farmers would limit or stop the water flowing to the Lower Kat.
4. *Labour*: people might migrate out of the catchment and then there will be an insufficient workforce; HIV/AIDS is also a crucial concern in this sense.
5. *Machinery*: it is often very old and it "breaks all the time".
6. *Water supply*. No water rights (no licences), means no water security. When you are a scheduled user you do have water rights. There is generally scarcity once every twenty years, then the farmers have to use ground water. This groundwater is however, very brackish and bad for the trees if used for an extended period of time (Bur et al, 2005).

4.2 Small-scale Farmers

Small-scale farmers mainly use water for the irrigation of their vegetables. In summer they use more water than in winter, because of the heat and evaporation. Water use increases in October/November when growing butternut and cabbage. In December they are harvesting and use less water. In January/February use increases because new crops are planted. February is the month during which the highest water consumption is observed. In March/April water use drops again. May and August are similarly low.

Small-scale users would like to be able, in the future, to expand their land from the current 1ha to 5ha and become emerging farmers. They would like to have equipment, e.g. tractors and irrigation pipes to accompany their expansion. Small-scale users would like to expand the number of crops grown and expand their market. Small-scale users are at the moment negotiating with the municipality for vacant land. "More land means more crops and more widespread market".

Water use in the future will follow this expansion. A better access to equipment and technique of irrigation (e.g. from furrow to pipe) would diminish the amount of water used through a reduced evaporation and would make the maintenance cheaper (Burt et al., 2005).

When asked how the small-scale farmers think their present and future use of water would impact other water users and how other water users would impact them, they said that they would not affect other stakeholders, but cooperation shall be required. A potential problem will be that some people pay and some do not, some people use more water than others, and some people have better access than others.

There is a continual concern amongst downstream users, that upstream users will take the water, especially in summer (Burt et al., 2005).

4.3 Domestic Users

Domestic users use water for household use and for watering their gardens. In the summer more water is used because relatives living elsewhere come home for the festive season, additionally more water is needed for the gardens. In the future they would like to have the opportunity to irrigate for commercial agriculture. Rural domestic users want land because they believe that without land there is nothing they can do. Flush toilets should be realized in five years, private indoor taps in ten years (Burt et al., 2005).

According to a domestic user, the government is giving seeds to promote subsistence gardening. The Kat River Catchment Forum (KRCF) representative on the KRWUA presented the following list with the needs and future plans for water uses of the villages represented on the KRCF (table 4.2).

Table 4.2 Kat River Catchment Forum (KRCF) Villages' plans for future infrastructure.

Village	Future infrastructure wanted.
Seymour	A pump for irrigation
Balfour	To improve street taps
Gonzana	Street taps
Oakdene	Taps in the individual households
Stonehenge	Street taps
Ntilini	A water engine
Ekuphumleni	Improvement of taps
Philipton	Taps on street
Cathcatvale	Taps, and cotton project
Lower Blinkwater	Pump for irrigation
Tamboekiesvlei	Taps on streets
Hertzog	Cotton project
Cimezile	Households taps
Teba	Households taps

When asked how the domestic users think their present and future use of water would impact other water users and how other water users would impact them, they said they

would have no impact on others but they indicated that there must be negotiations. They consider that water taken from the river might influence the farmers, whereas water taken from the tap would not (Burt et al., 2005).

In the future, downstream users will be concerned that upstream users will take the water, especially in summer. Their main problem is access to water. Nobody takes care of taps because they are public property. Taps are often far away. One must engage stakeholders to inform them on the institutions they can approach to address their problems and ideas, e.g. Department of Land Affairs, DWAF, Municipality and Department of Agriculture. These departments are supposed to help with land ownership issues, financial and equipment assistance i.e. provide tractors, pipes and pumps. They said they need an advisor to help them determine what channels to take in order to achieve their future plans. They don't know the steps that would need to be taken. Representatives of domestic users also pointed out that funding could be a problem. The biggest problem they identified is land ownership.

The future plans for the local Municipality were illustrated in this way: "We want to enlarge the treatment plants, because the quality of the water collected from rivers decreases during winter. We also are installing water meters in houses for payment purposes. There will be an increase in water demand caused by development (housing)" (Burt et al., 2005).

5. CONCLUSION

Primary data on water users and uses were collected in the Kat River Catchment to complement the secondary information contained in Farolfi-Jacobs (2005). Both secondary and primary data are currently being used to calibrate the KatAWARE simulation model (Farolfi-Rowntreee, 2005) that will be adopted within a Companion Modelling Approach with the KRWUA to implement a strategy for participatory water management in the Kat River Catchment.

Despite the mentioned difficulties in obtaining reliable data from field surveys, this report contains valuable information on the socio-economic aspects of water use by the main groups of water users in the catchment, namely irrigators (large scale, emerging, and small scale) and domestic users.

The section on local stakeholders' perspectives and preoccupations about future water use and availability is a precious complement of information to simulate water users' behaviours and defining scenarios to be tested through the KatAWARE model and discussed with the KRWUA members during the next workshop (set to occur in September 2005).

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APPENDIX

Questionnaire for domestic water use survey

Schedule no.: ----------
Time started: ----------

Rhodes University
Department of Geography

Kat River Valley Interview Schedule 2004

The purpose of this interview schedule is to collect information for a Masters research study. Confidentiality is guaranteed as only the researcher will have access to these schedules.

The researcher intends to determine the level of demand for water and the quality of the resources and services presently available. This interview schedule is also aimed at looking at the level of involvement of residents in the **Kat River Valley Catchment Forum** (KRVCF) and **Water User Association** (WUA), their perceptions of these organizations and the **National Water Act**.

****

SECTION 1
Household socio-economic characteristics

1.1 Name of village. ----------

1.2 Name of respondent (if willing to provide). ----------

1.3 Contact details (if willing to provide). ----------

1.4 Please specify type of dwelling you live in e.g. brick structure with electricity, mud and/or tin structure with no electricity, etc. ----------

1.5 How close is your household to the Kat River (metres/kms)? ----------

1.6 Age of the head of the household. ----------

1.7 Gender of the head of the household. ----------

1.8 Age of the respondent. ----------

1.9 Gender of the respondent. ----------

1.10 Highest level of education of the head of the household. ----------

1.11 Number of household members. ----------

1.12 Number of household members earning an income (over the last 12 months). -

1.13 Occupation of the head of the household. ----------

1.14 Occupation of the other members of the household earning an income over the last 12 months. **Please indicate whether full-time or seasonal**. ----------

1.15 Do you mind providing information about your household income?

YES	
NO	

1.15.1 If **no**, please select monthly income bracket of head of household.

< R200 ----- R200-R500 ----- R500-800 ----- R800-R1200 ----- R1200 –R1500 -----

R1500-R2000 ----- R2000-R2500 ----- R2500-R3000 ----- >R3000 -----

1.15.2 Does any member of the household receive a government grant?

YES	
NO	

1.15.2.1 If **yes**, please specify what kind of grant/s (e.g. pension, disability, child, or other) and how many are received. ----------

1.15.3 Please select **total household monthly income** bracket (average over the last 12 months).

< R500 ----- R500-R700 ----- R700-R1000 ----- R1000-R1300 ------

R1300-R1700 ----- R1700-R2000 ----- R2000-R2500 ----- R2500-R3000 -----

R3000-R3500 ----- R3500-R4000 ----- >R4000 -----

1.16 Do you own the land you are now occupying?

YES	
NO	

1.16.1 If **no**, who does own the land? ----------

1.16.2 What is your **security of tenure** i.e. legally, do you have a right to be here e.g. title deed? ----------

1.16.3 Have any land claims been made on the land you live on?

YES	
NO	

1.16.3.1 If **yes**, by whom (you or an outside party)? ----------

1.16.3.2 When was the claim made? ----------

1.16.3.3 What have been the results so far? ----------

1.16.4 Who controls what you can do on the land? ----------

1.16.5 What restrictions regarding the use of **land** and **water** are there?

1.16.6 Are decisions regarding the use of land and other natural resources made by individuals or the community? Please explain. ----------

1.17 Does the household have any property rights/access to land **for agricultural use**?

YES	
NO	

1.17.1 If yes, please list whether private or communal property rights. ----------
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SECTION 2
Water sources and water uses

2.1 From what source/s do you get your water supply for household use (**not irrigation/business**) e.g. drinking, cooking, washing, etc? Please list the different sources and next to them the different uses for each source. **(* very important: drinking water source)**.

Source **Use/s**
---------- ----------
---------- -- ----------

2.2 Do you pay for any of the above water sources?

YES	
NO	

2.2.1 If **yes**, please list source/s and approximate amount paid per month.
Source ---------- R ----------
---------- ----------

Is water always available from all your sources?

YES	
NO	

2.3.1 If **no**, please state source(s) and reason/s why.

2.3.2 How would you rate the **quality of water** from each of the sources you utilize (**good, very good, satisfactory, bad or very bad**)? Please provide a reason for your answer?

Source	**Rating**	**Reason/s**
----------	----------	----------

2.5 What is your main source of water for household use (select one from answer to 1.1)? ----------

2.6 How far is this main water supply from your home **(round trip)**? Km ---- m ----

2.7 What means of transport do you use to collect water? ----------

2.8 How often do you collect water from this supply (if daily, please specify no. of trips per day)? ---------- ----------

2.9 Who usually collects the water in your household? ----------

2.10 Who decides how this water is used? ----------

2.11 How much water do you collect per day/week (container/s size in litres x no. of trips)? ----------

2.12 Do you use/collect water for **food production** or any **business/small-scale economic use**?

YES	
NO	

If no for 2.12 please proceed to question 2.14.

2.12.1 If **yes**, please specify for what purpose e.g. subsistence or small-scale agriculture, small-scale economic use e.g. spaza shop, hairdressing business, etc. Please specify if other (e.g. citrus farming). ----------

2.12.2 What is your source of water for this use? ----------

2.12.3 Do you pay for this water?

YES	
NO	

2.12.3.1 If **yes**, please provide approximate amount paid per month. R ----------

2.12.4 Is the water supply always available from this source?

YES	
NO	

2.12.4.1 If **no**, please provide reason/s why. ----------

2.12.5 How far is this water source from your irrigation plot/business **(round trip)**? Km ---- m ----

2.12.6 How do you transport water to your plot/business location? ----------

2.12.7 How often is this done? ----------

2.12.8 Who in your household undertakes this task? ----------

2.12.9 Approximately how much water do you use for irrigating/your business each **day/week** (in litres)? ----------

2.13 Do you sell any of the crops you grow?

YES	
NO	
N/A	

2.13.1 If **yes**, how important is this income source to you i.e. is it the **only source of income**, the **most important source** or is it a **supplement**? ----------

2.13.2 Do you eat any of the crops grown?

YES	
NO	

2.13.2.1 If **yes**, how does this contribute to your overall food consumption? ----
---

2.13.3 Do you belong to an irrigation group e.g. **HACOP**? If **yes**, please provide details.

****

Answer only if answer to 2.12 is no. If answer to 2.12 is yes, please proceed to 2.15.

2.14.1 If **no**, please state reasons why. ----------

2.14.1 Would you like to do so in the future?

YES	
NO	

2.14.1.1 Please provide a reason/s for the above answer? ----------
---

****

2.14.2 What are the main challenges you face with respect to water supply? ----------
---

2.14.3 How can these challenges be addressed? ----------

2.14.4 What does "**better access**" to water mean to you? ----------
---

2.14.5 If you and your household were given "better access" to **water resources** how would this benefit you? ----------
---

2.14.6 If you and your household were given "better access" to **water services** (i.e. household taps & flush toilets) how would this benefit you? ----------
---

2.20. Can you think of any way your household monthly income or quality of life could be increased/improved if the above were to happen **(2.18 and 2.19)**? ---
---

2.21 Who in your household would benefit the most from this (women, children or men)? Please provide reasons for your answer. ----------
---

2.22 What benefits to the **water resources** in your area **(e.g. Kat River, nearby streams)** would there be if you were given "better access" to **water services**?

2.23 How would you rate the quality of water from the nearby streams and river in your area (**good, very good, satisfactory, bad or very bad**)? Please provide a reason for your answer. ----------
---

2.24 Does your household boil the water used for drinking?

YES	
NO	

2.24.1 Please provide a reason for your answer.

2.25 Are **water-borne diseases** prevalent in your area? (E.g. cholera)

YES	
NO	

2.26 Is **diarrhoea** a problem in your area?

YES	
NO	

2.26.1 If **yes**, please state known or assumed causes. ----------
---

2.27 Does your household have a **water storage system/facility** (e.g. rainwater storage tank)?

YES	
NO	

If no, please proceed to question 2.28.

2.27.1 If **yes**, please specify type of storage system/facility. ----------

2.27.2 Period of use of system. ----------

2.27.3 Cost of system. ----------

2.27.4 What is this water used for? ----------

2.27.5 Is water always available from this source?

YES	
NO	

2.27.5.1 If **no**, please state maximum duration of water availability from this source. ----------

****

2.28.1 Are there any other sources of water you utilize that we have not talked about? If **yes**, please list them.

2.29 Please list all **water uses** of your household that are not mentioned above, together with their sources (e.g. water for livestock from river).

2.30 Are you willing to pay to have a tap and flush toilet system installed in your house?

YES	
NO	
Tap only	
Flush toilet only	

2.30.1 Please provide reasons for your answer. ----------

2.30.2 If yes, please state how much you would be willing to pay per month for **each** service.

2.30.2.1 Flush toilet system R ---------- per month
2.30.2.2 Household tap R ---------- per month

2.31 Would you be willing to pay for better **water quality** from your **present water source/s**?

YES	
NO	

2.31.1 Please provide reasons for the above answer. ----------
---

2.32 Would you consider leaving the KRV for good if you were offered accommodation with formal water services elsewhere (i.e. household tap and flush toilet system)? Please provide reasons for your answer.

Time of completion of questionnaire: ----------
Date of completion: ----------
Does the respondent mind being quoted in the researcher's master thesis? ----------

Thank you for your time and effort in completing this questionnaire!!!