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Planning urban water – dependent livelihood opportunities for the poor in Accra, Ghana

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Abstract
Ghana's capital Accra, has a resident population of about 1.6 million and an annual growth rate of 3.4 %. With a 5% poverty index, there are 90000 people earning less than 1 USD per day. The increasing demand for and use of domestic water in the city, simultaneously translates into wastewater generation. What is little known in most developing cities, and Accra is no exception, is that both domestic water and wastewater (including storm water runoff and all polluted surface water sources like city waterways), are used for multiple purposes.

Per capita domestic water supply is said to vary between 60 and 120 liters per capita per day (in the well served areas only) and 25 to 60 liters per capita per day when poor households buy water from vendors.
These same households are involved in various income generating activities requiring water such as catering, small scale food processing, water vending, small industry, and various forms of urban and peri-urban agriculture. Notably, wastewater from cities which planners traditionally see as "useless", is a potential "water resource" popularly providing water (and nutrients) for irrigated urban agriculture. These users are estimated to provide up to 90 % of the most perishable vegetable needs of the city.

The poor entrepreneur buys water for these purposes at exorbitant rates even exceeding the official water utility commercial rates. The paper presents a framework for analyzing this type of use, records the different urban livelihood activities that utilize domestic water/wastewater and quantifies such use. Constraints faced by users and opportunities to improve access are discussed. It makes preliminary recommendations for including urban water dependent livelihoods into city planning and provides insights to policy makers, planners and researchers on the wide range of 'other uses' that domestic water supply is utilized for. The role of innovative approaches like the learning alliances emerges from this discussion.

Keywords: Urban water, livelihoods, multiple uses, wastewater use

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1 Understanding the 'unseen' resource potential

Coastal Accra is situated in the Odaw catchment, and has a population of 1.66 million (within its current administrative boundary covering 240 sq km) and a population growth rate of 3.4% annually with 1.2 to 1.6% of this accounting for rural-urban migration. Similar to many developing countries, the big city tends to attract people from rural areas in search of job opportunities and a better life. But the poverty index for Accra is 4.7% with a daily minimum wage of just under 2 USD per day (as of March 2006). In absolute numbers this amounts to almost 90,000 persons in absolute numbers.

60% of the population lives in what are known as low income settlements, and though sanitation coverage in the city is 88% with only 12% being un-served, given the poverty conditions, the predominant situation in these communities is public toilets. Only about 14% of the population in the original center of the city, is sewered and the rest is onsite sanitation (septic tanks/latrines). 22 sewage treatment plants serving institutions and hotels, but only a few are properly operated and maintained (Akuffo, 1998; EPA, 2001). These plants serve in total about 5-7% of Accra's population. The largest an up flow anaerobic sludge blanket (UASB) plant which was operating at 30% of its capacity is now broken so much of the collected sewage is discharged untreated. In the case of onsite sanitation many of these systems are poorly designed so overflows from them also commonly enter the city storm drainage canals. A small study carried out in Accra indicated that 53% of the population disposed of their grey-water directly into gutters and storm-drains, about 12% of the population throws it on the streets or outside, and 20% in their compounds (Obuobie et al., 2006). All this wastewater eventually empties into the stream and river network in and around the city, that serve as water sources for irrigated urban vegetable production. The annual volume of wastewater that is used in commercial (680 ha) and informal (60 ha) urban and peri-urban agriculture is estimated to be 4.0 and 0.4 MCM(Million Cubic Meters), respectively.

Water supply coverage to the city is said to be 80% but this does not imply a house connection. In reality only 45% of the population has a household or at best a yard connection, and this category includes the urban rich. The majority who live in the low income settlements depends on water vendors for their daily needs.

The rapid expansion of the city spatially and demographically has outpaced urban water infrastructure investments, and the water distribution network is inadequate both in terms of coverage and physical condition. The latter results in upto 30% of water being lost through leakage. The water supply company implicitly manages demand by supplying water intermittently, barring a few exceptions. Households respond by storing water for later use. Intermittent supply has also led to a thriving business of water vending, which, whilst it is a support to households without connections, also exploits the poor. These vendors 'source' their water in the urban pipe-borne network. Water vending is essentially of 2 types: large scale enterprises requiring a capital outlay for purchase of tankers that supply water in large volumes to richer households situated in water scarce neighborhoods, and small scale vendors who sell water in smaller volumes to individual households at the community level. What is interesting is that these small scale vendors mostly 'purchase' the water at domestic rates and resell it at a higher value to generate profits.

Monthly supplied water to Accra is estimated at 11.5 Million Cubic Meters (MCM) inclusive of losses in the system. Statistics on urban domestic water use give per capita water consumption that varies between 30 and 120 (source: Ghana Water Company Ltd, 2006) or 29 and 98 (source: London Economics) liters per capita per day, depending on whether it is purchased in small quantities from vendors (where use will be limited by price of water and accessibility) or obtained from an individual/household connection (when water use is more because of availability and convenience).

Under these prevailing conditions, migration into the city continues to occur exacerbating an already deficient situation. The city attracts people from rural areas because cities do offer better access to education, health care, and people believe they will have better job opportunities and a better life. However, the harsh reality is that new-comers end up with poor and insecure living standards; overcrowding, poor infrastructure, a polluted environment and a daily struggle to generate enough income. People are also inventive and flexible when seeking the means to sustain income generating activities. They seek livelihood opportunities that require a minimum capital outlay and many of these centers around servicing the material needs of people. These types of "businesses" or small scale commercial activities are not officially registered and are therefore difficult to keep a track of. Many of these are also water dependent, but what is of interest is that the water used is not paid for or recognized as commercial water. Rather it is one of the multiple uses to which urban domestic water is put. This paper is a very preliminary appraisal of the diversity, critical importance, and benefits of such use. It will also show that these types of livelihoods closely depend on small scale water vendors or purchase of water from neighborhood taps at tariffs higher than the official urban domestic water tariffs. It is suggested that constraints to and consequences of such use must therefore be recognized by city decision makes and incorporated into urban water management and planning. The need for a more comprehensive study will emerge from the analysis.

2 A framework for analysis

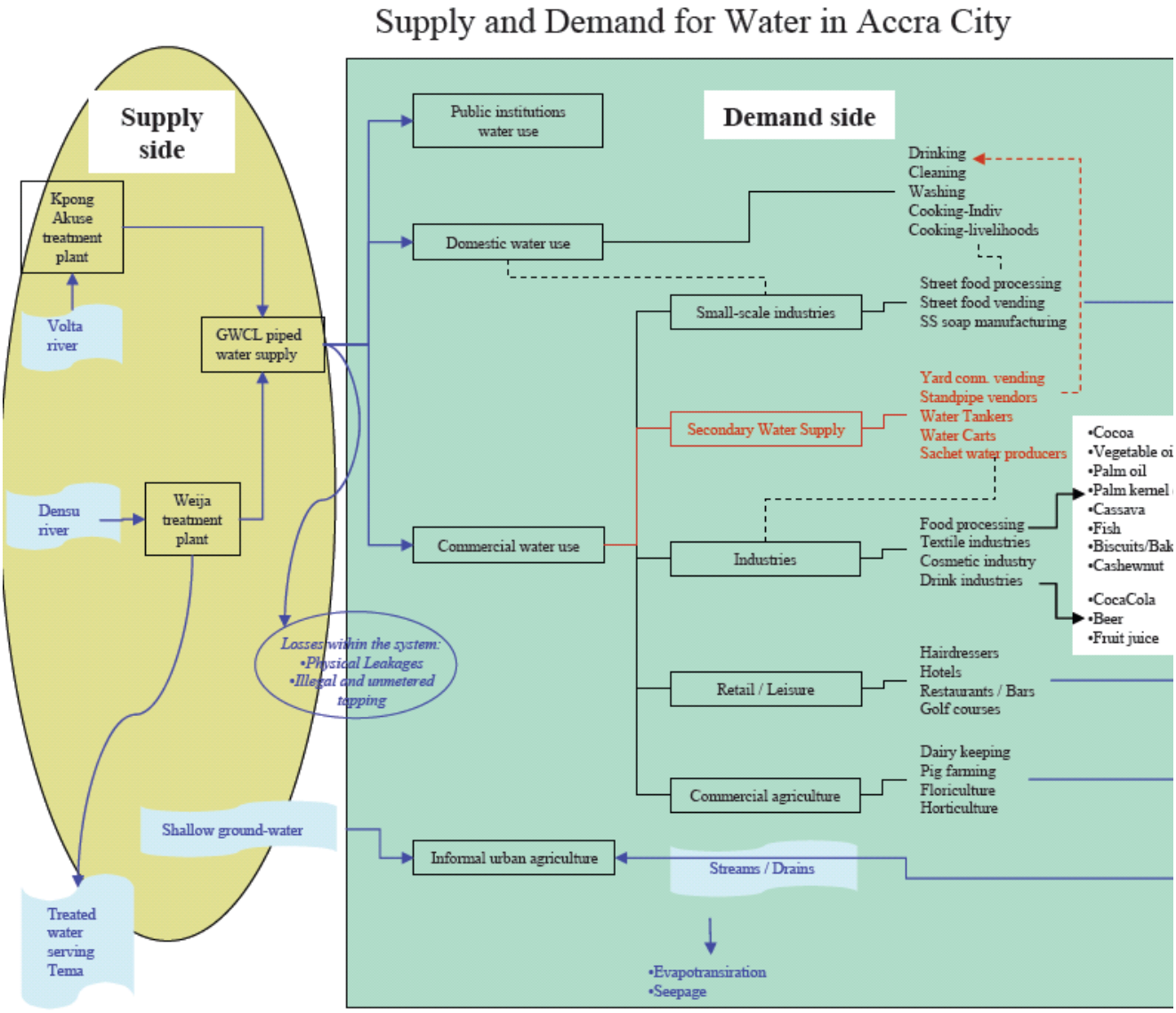

Figure 1: Supply and Demand for water in Accra city

In developing the framework for analysis it was first necessary to visualize the urban water use pathways to be able to identify the types of activities likely to utilize domestic water for livelihood purposes (Fig 1).

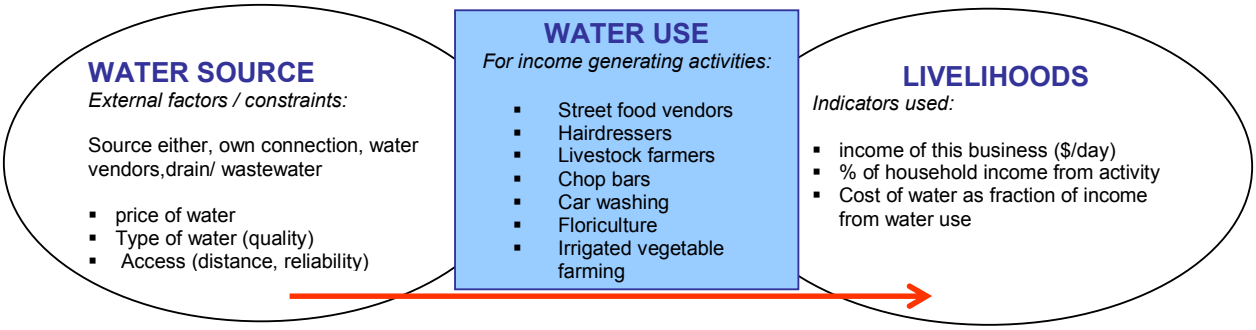

Fig. 2. Illustration of linkages between urban water and livelihoods through the various income generating activities.

Quantification of this water use through an identified set of indicators that show its economic significance, and identifying the constraints will be the first step towards improved decision support. A preliminary set of indicators are shown in the livelihoods box in figure 2. The profitability (income from the business) of the enterprise gives an indication of the overall economic demand for and sustainability of this enterprise. The part of household income that is generated by the water-use-activity gives an indication of the household dependency on this activity and consequent water requirement. The part of costs or household income that is spent on payment for the water gives an indication of the value of water and willingness to pay to sustain their activity.

The sources of water for these activities are essentially own piped connection (charged at domestic tariff rates by the Ghana Water Company Ltd), water vendors, and drain/wastewater. The external factors influencing or constraining water use are the price paid and therefore the amount used; the quality of the water (clean water is used for food preparation and cleaning related activities; and the distance to source and reliability of supply, which again influences how much water is collected and used.

Additionally information was collected on water use by households for domestic purposes (like cooking, bathing and drinking), in low income neighborhoods, where households mainly depend on water vendors to supply their needs. This also provided a rapid estimate of the willingness and ability of households to pay for domestic water use. This figure allowed us to surmise on the extent to which they would stretch if the water was also providing them with an income.

3 Methodology

Preliminary brainstorming and discussions with persons familiar with city developments patterns and income generating activities, and informed persons from the municipal and sub regional authorities, allowed us to develop figure 1 which shows the water supply and demand pathways for the city of Accra. This helped to isolate the different categories of informal sector, non-registered, income generating activities likely to utilize urban domestic water. All information was gathered through exploratory surveys which used rapid assessment interview methods supported by a checklist of questions. The objective was to quantify the indicators listed in figure 1, and identify the water related constraints that were faced by the users in the pursuit of their livelihoods.

As this was only exploratory, a very small sample of users was selected. The Accra Metropolitan Area comprises 6 sub-metropolitan districts, which are further divided into 13 constituencies. These constituencies are divided additionally to 68 electoral areas. Some of these informal income generating activities (like chop bars, food vendors, and hair salons) were known to be scattered randomly in all of the electoral areas. Six electoral areas were selected and a few persons were randomly picked for the interviews. On the other hand, some activities like urban and peri-urban farming (for irrigated vegetables, and livestock) were very location specific (2 electoral areas in all). Within these locations, a few persons were randomly selected and interviewed.

Data on per capita urban domestic water use was available from secondary literature which was dated, and more recent figures from Ghana Water Company Ltd which did not focus on the poor. So a rapid survey of a small sample of the poorer users from similar backgrounds to those involved in informal sector activities was conducted to update the existing information. Here too, open ended interview techniques were used.

Information presented on the urban irrigated vegetable farming is based on very comprehensive surveys and studies that were carried out previously (Obuobie et al 2006, Abraham et al., 2006a) In all ten different enterprise types categorized in five group were interviewed at nine locations in urban Accra (Table 1).

4 Results and Discussion

4.1 Enterprises using urban water and wastewater

Table 1 provides a brief description of the different enterprise categories highlighting the type of clientele, the gender representation and the quality of water used. As can be seen, many of these small scale informal livelihood activities are the mainstay of women, and difficulties and constraints faced in the provision of water will have impacts foremost on the earning capacity of women

For all the enterprises listed in Table 1, water is an indispensable and irreplaceable, ingredient. In the small scale food business as can be expected, a large portion of the water used is for washing the dishes and containers used for cooking. Potable water quality is essential. In the beauty business most of the water used is for washing of hair and the bacteriological quality is not so important. Hardness of the water is much more of a concern. In the livestock business, the water is used for feeding the animals so even though piped water supply is used the quality is not such an issue. Car washing, floriculture and irrigated vegetable farming do not need water of potable quality. The water users are aware of this to a large degree because they use non-potable water in many of the cases.

Table 1. Enterprise categories and locations and number interviewed.

Enterprise category	Description
Food vendors	
Tea and beverage	These vendors prepare tea and beverage with hot water and sell in the morning and in the evenings. The tea or beverage is sold together with bread and fried eggs. The water use includes preparation of tea and washing of cups. Customer base ranges from high to low income earners. Gender representation: Men and women Water quality : Clean piped water supply
Porridge	This kind of watery porridge is known as "Hawsa KoKo" in the local Ghanaian parlance and is consumed essentially in the mornings but sometimes also in the evenings. It is prepared from sorghum. A lot of water is used in its preparation. The water is used in the preparation of the porridge and the washing of utensils. The customer base ranges from the high income to low-income earners Gender representation: Women Water quality : Clean piped water supply
Fast food joint	These vendors have become very important in the lives of the city dwellers who have little time for food preparation. They are also a cheap source of food. They are seen in many suburbs of both high and low-income neighbourhoods. They sell mainly fried rice and 'wakye' also known as colored rice; and occasionally local food like yam, and fufu. A lot of water is used right from the preparation to the washing of the plates during sale of food. Gender representation: Men and women Water quality : Clean piped water supply
Chop bar	These mainly sell traditional/local foods such as fufu, banku, rice etc. accompanied by local soups and stews. Employees are mostly women. Chop bars serve as a major street food source for all categories of people. Gender representation: Women Water quality : Clean piped water supply
Restaurant	There are several classes of restaurants. The class determines the cost of food sold in it. Restaurants also sell all kinds of dishes ranging from traditional to continental. Water is an important resource in this business and used in the food preparation, washing of plates, glasses, cooking utensils and cleaning. The customer base range from medium to high-income groups. Gender representation: Men and women Water quality : Clean piped water supply
Hair and beauty salons	
Beauty salon	Such salons offer all sorts of beauty treatments like facials, manicures, pedicures and other skin treatments, for women mainly. They are very popular in all neighborhoods irrespective of income class. Some beauty clinics may also do hair dressing. Relatively less water is used as compared to hair dressing salons. Water is used for washing the face, feet, towels etc. Gender representation: Women Water quality : Clean piped water supply
Hair salon	Salons are places for women to wash and reattach their hair. This is a popular practice among African women. They are found in almost every locality. Water use is for washing the hair, towels, cleaning hair equipment etc. Gender representation: Women Water quality : Clean piped water supply

Livestock	These farmers are found at specific locations within the city. Those who keep animals usually live in low-income communities. The livestock keeping serves as a sort of relief during hardships when the animals are sold for an additional source of income. Water use is for the animals to drink mainly. Customer base varies, but mainly by butchers, individuals during local festivals. Gender representation: Men Water quality : Clean piped water supply
Car washing	Car washing enterprises use significant amounts of water. There are two types of car washing bays. Formal ones that are connected to GWCL water pipes and pay commercial rates. There are also informal car washing bays where water from drains is used or water is purchased from tanker operators. Customer base is varied from taxi drivers who have their cars cleaned and middle and high income car owner. Gender representation: Men Water quality : Clean piped water supply and Wastewater
Floriculture	Floriculture is a business venture that is also located along streets to ensure unhindered visibility. There are several selling points within the city. Floriculturists use different sources of water. The water could be pipe water, stream, or dugout. Significant amount of water is used in the nursery and plant stages. Customer base are the middle and high income groups who can afford to buy plants and flowers. Gender representation: Men and women Water quality : Clean piped water supply, Groundwater and Wastewater
Irrigated urban vegetable farming	Please see detailed section below Gender Representation: Men Water quality: Wastewater

4.2 Livelihood importance of urban water use and constraints

Table 2 gives water use data for the cases interviewed and the related livelihood information

Table 2: Water and Livelihood data for the cases interviewed

Enterprise + no. persons interviewed	Water data				Livelihood data		
	Source[quality]	Price of water cedi/liter	Constrained by [when]	Expenditure on water (cedis/day)	Income (cedi/day) [no customers per day]	Relative water costs (% of income)	HH income contribution (%)
Tea and beverage (2)	Public standpipe [good]	26.54-44.2	Absence water seller / [intermittently]	500-2,500	60,000 [20]	1-4	100
Porridge (1)	Neighbors tap [good]	18.5	Distance [daily]	5,000	450,000 [1500]	1	100

Fast food joint (3)	Private or neighbors tap [good]	4-5.5 (GWCL domestic rate)	No problem	na.	30,000 – 3 Million [20-300]]	na	-
Chop bar (4)	Private or neighbor tap/public institution [good]	23.5	Low water flows [intermittent]	na	100,000 – 6 million [20-1500]	na	100 (2) second income (2)
Restaurant (2)	Private tap (commercial or domestic connection) [poor when intermittent]	6.9 (GWCL commercial rate)	Low water flows [intermittent]	5000	Upto 1,200,000 [250]	0.6	100
Beauty salon (1)	Neighbor's tap [good]	na	[intermittent]	na	na [1-10]	-	100
Hairdressing salon (5)	Neighbor's private tap (2), own private (2), public institute [good]	17.7-23.5	In some cases access difficult/ unreliable/ [intermittent]	1,000 – 3,300	50,000 – 100,000 [5-10]	1 - 7	Depending on position in enterprise
Livestock (5)	Neighbor's tap [good]	29.4-58.8	Access difficult [daily]	4,000 – 10,000	15,000 – 200,000 [# livestock]	5-20	Only source (3)
Car washing (3)	Stream (wastewater), own private or commercial connection [poor for wastewater. Piped water good]	Free(stream/ Wastewater) na (piped water)	Unreliable [intermittent] (then turn to water tankers)	0 – 60,000	100,000 – 300,000 [10-30]	0-30	100
Floriculture (3)	Private commercial, stream/ dugout	Free (stream) na(	Unreliable [intermittent]	Free	16,666 -33,333 [25-30]	na	100

Note: na – not available

Table 3 : Per capita water use differentiated by means of water supply

Means of supply	% of households	Per cap water use (l/cap/day)
Own private connection or yard tap	60	98 (house connection) 65 (yard connection)
Neighbor's private connection or yard	25	34 (neighbours)
Commercial water seller	14	31 (other)
Standpipe	1	29
Borehole and well	0	31 (other)
Total / average	100	55

Source : London Economic (1999)

Table 4 : Per capita water use related to household size, cost of water and cost to household in old Fadama, a low income settlement

Sample	Household size			Cost/liter cedis*	Consumption liters/capita/day	Total water use liters/day
	Adults	Children	Total			
Case 1	6	4	10	15.69	59.4	9314.3
Case 2	1	4	5	11.76	30.8	1814.3
Case3	5	7	12	14.71	30.8	5428.6
Case 4	2	3	5	41.18	25.3	5200.0
Case5	5	3	8	23.53	28.8	5428.6
Case 6	5	5	10	23.53	30.8	7257.1
Case 7	2	2	4	11.76	35.8	1685.7
Case 8	2	3	5	41.18	49.5	10200.0

* 1USD is approx 9000 cedis Source: study data from a sample of 8 interviews

In Accra city the poor source water from a large and thriving informal sector water trade conducted by informal vendors who ply their trade in the local neighbourhoods to which they belong. These vendors serve a very useful purpose providing water in small quantities to the poor who can afford neither large storage nor large sums of money for one off purchases of water. Results in Tables 2, show that to earn their livelihoods, people are willing to go to great lengths to access water, often paying between 18 and 59 cedi / liter of water which is 3.6 to 12 times higher than the water utility domestic rate (4-5.5 cedi/liter), and 2.6 to 9 times higher even than the water utility direct commercial rate (6.9 cedi/liter) for water. Many of the informal enterprises visited used substantial amounts of water in relation to the activity with expenditure on the water being upto 30% of the income generated by such water use. The high percentage is due to the very high prices in certain neighbourhoods which receive intermittent water services. The informal enterprise may even be a neighbour who has a household or yard connection and is willing to share the water s(he) pays for, at a price. Tables 3 and 4 show the data from a very small sample of households who buy the water for domestic use only. Here too users pay upto 8 times the domestic rate which figure is in excess of even the commercial rate. These prices are a function of the availability of water at the specific location. The water utility is aware of this aberration, but as they 'improve the coverage of potable water' in the city without the intervention of the water utility, it is in their interest to encourage the service.

The quality of water from these vendors, is perceived as good in the majority of the cases, since the origin of the water is the treated city water supply. On the other hand, wastewater when used for cultivation (see section 4.3 for more details), is perceived as being of acceptable quality for the use. Farmers do not necessarily avoid contact with the water either

In terms of livelihoods significance, for many the income from these informal enterprises, represents 100 % of their earnings. They exist because there is a demand for such services, and in addition they provide employment and support a chain of beneficiaries.

4.3 Irrigated urban agriculture systems: - significance and livelihood potential.

It is estimated that about 100000 m^3 per day of wastewater is generated, though this is based on an average per capita daily consumption of 76 liters (MoWRWH, 1998), and a wastewater return flow of 80%. A portion of this reaches the stream and drainage network of the city which serves as the main source of water for irrigated urban agriculture. In Accra about 680ha are under maize, 47 ha under vegetables and 251 ha under mixed cereal-vegetable systems. In addition about 50-70 ha are distributed over 60% of Accra's households (80,000 tiny backyards). Plot sizes under cultivation in the city range from 0.01-0.02 ha per farmer, and increase up to 2.0 ha in peri-urban areas. In Accra practically any open space is used for farming vegetables and other crops because of the high demand from the city Land is continuously lost to estate developers hence the shrinking size of farmlands. (Obuobie et al., 2006).

Depending on the source of water, collection and application can vary. In the case of streams, the water is fetched and applied to crops with buckets or watering cans. Some farmers dig shallow wells close to the streams where the water table is high, or channel the drain water into shallow ponds and fetch it with watering cans. Where piped water is used it is applied with a hose or collected in shallow ponds and fetched with watering cans or buckets.

In total there are about 100ha under vegetable irrigation in the dry season.As the rainfall in Accra is low (730 mm/year), vegetable farming which has high water requirements, is mainly dependent on irrigation. It is therefore mainly practiced on valley bottoms along streams, which are now practically wastewater conduits. Farmers do not pay for this water and they perceive the nutrients in the wastewater and its year round availability as advantages.

In addition AMA has provided standpipes for farmers at some sites to serve as alternative sources of safe water (e.g. Dzorwulu, North Dzorwulu and La). The volume and availability of water depends on the supply and distribution of potable water by the Ghana Water Company Limited (GWCL). Farmers could either pay a flat rate irrespective of the volume of water used or pay by volume of water used. Farmers using piped water are in groups and share the bill according to the number of beds each farmer crops.

There are about 800-1000 vegetable farmers in Accra .Open space crop cultivation brings in very good earnings in spite of the challenge of crop loss. A study (Obosu-Mensah,1999) in Accra revealed that out of 200 urban farmers interviewed 60% had no intention of stopping farming even if they were offered a regular salaried employment. Furthermore, out of 138 farmers interviewed, about 60% totally rely on irrigated vegetable production as their only source of income while 33% do it as supplementary source of income. Monthly net income from irrigated mixed vegetable farming in Accra (US$ per actual farm size) is estimated at 40-57.

The practice is predominantly male dominated. On the average only less than 10% of all open space farmers were women. However, women dominate vegetable marketing.

In Accra, the contribution of urban agriculture and therefore wastewater, in terms of certain types of vegetables in the urban diet, may be substantial and therefore beneficial. Data show that 35% of lettuce sold in Accra originated from wastewater irrigation. No data is available on the contribution of other vegetables. Whilst positive health benefits are expected from consuming vegetables, this also has significance in terms of exposure of urban dwellers to pathogens conveyed through consuming raw

vegetables like lettuce. A survey in Accra has shown that daily, around 280000 persons consume food from street-food vendors, canteens and other public eating houses, containing 12 g of lettuce (Obuobie et al, 2006) with corresponding positive and negative health impacts.

The situation described above is specific to cities and the implications for urban authorities are complex. On the one hand urban agriculture serves a very useful purpose providing livelihoods to farmers and sourcing food to the city. On the other the urban water source used for irrigation is suspect. Ironically it is the city itself which has endangered its own food source, by the pollution it creates. The solution to the problem is not straightforward as a variety of stakeholders, are involved in this food production and consumption chain, that need to be consulted. Multi-stakeholder platforms that use innovative mechanisms for exchange of ideas are a necessity. Learning alliances are a potential tool for this purpose.

5 Conclusions and Recommendations

'Hidden' contribution of urban water and wastewater to livelihoods
According to the results of the preliminary survey, this 'hidden' commercial water use appears to be significant if valued in terms of numbers of direct and indirect beneficiaries, the contribution to their household income and the services they provide to the city population. This is particularly evident with irrigated vegetable farming.

Optimizing wastewater use in the urban water catchment
From an urban water management perspective in a catchment or watershed under water short conditions (as is the case with Accra), using wastewater for irrigation or for washing vehicles, is an innovative means of recycling a waste product. In cities where providing safe access to water supply for all is difficult, wastewater recycling for certain types of water use within the city that do not require potable quality eg car washing, floriculture/ horticultural activities, livestock watering, irrigated urban vegetable farming should be encouraged. However optimizing such use and rendering it safe would require that sanitary wastewater (also known as black-water from toilets/latrine facilities), and toxic industrial wastewater, is separated from grey-water (kitchen, washing, bathing wastewater) when it is directed to the open drainage networks in the city. This will reduce both the pathogen contamination and the toxic contaminants in the wastewater. This should be accompanied by researching and disseminating, small scale simple treatment methods for use under such conditions.

Institutional adjustment
Such solutions may require institutional adjustments. For instance in the case illustrated above, national and city level institutions that deal with water quality regulation, industry regulation, urban planning, sanitation, health and hygiene, and private sector design and construction engineers would all need to work together to make the recommendation practicable.

Creating the right learning environment
Above all the degree of comprehension and coordination necessary between institutions and individuals requires a paradigm shift. Such a shift can occur only when the right learning climate is established. Multi-stakeholder learning platforms with horizontal and vertical learning structures will raise issues hitherto unidentified and suggest innovative solutions. Comprehensive decision support tools can only be developed when the different needs of each stakeholder groups are correctly identified in unison and not in isolation. The Accra Learning Alliance is one such platform being established through the SWITCH project

Eliminating 'water barriers' and supporting women

The popularity of informal enterprises within the city is an indication of the service they provide, simultaneously providing employment to others as well, as the enterprise grows. Removing water barriers will assist them in their growth. Enhancing the access of poor communities to water will benefit their water dependent livelihood activities. Given the importance of such activity, this could be an effective way of decreasing poverty in such communities. The water utility together with the Accra Metropolitan Authority should encourage dialogue with users to identify constraints and discuss solutions. Many small enterprises are either owned by or employ women and this makes it imperative to mainstream them in the discussions pertaining to water needs, provision and demand management.

Is price regulation possible?

The preliminary studies show that the price of water paid by the poor seems inordinately high, compared to the water utility prices both for domestic and commercial connections. This affects their immediate household water use, but also limits their economic gains. From the perspective of the water utility also, the lost revenue from this consumption, may be considerable. In fact data shows that even if the poor paid commercial rates they would still be better off, and the amounts they pay currently are an indication of their willingness and ability to pay. Improving the water infrastructure would create a win-win situation for the water user, and the water utility, both of whom will have increased income/revenue from the water.

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D 5.2.5 /6.3.1

Baseline study Report on Dzorwulu-Roman Ridge Demonstration site, Accra, Ghana

Seth Agbottah, Luke Abatania, Adrienne Martin, Olufunke Cofie

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Acknowledgement

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1. Introduction

1.1 Background

In Accra, Ghana, SWITCH partners within work package 5.2, have formed a city Urban Agriculture working group. This group held two workshops (in May and November 2007) for programme development and planning. SWITCH work in Accra under 5.2 aims to come up with interventions to effect significant improvements in agricultural production, processing and marketing and other livelihoods activities using freshwater, storm and waste water.

Urban agriculture (UA) is a means of livelihood for many urban dwellers; usually low income households. It may be the only means of livelihood or a supplement to other livelihood activities. In view of limited land holdings and water requirements, UA is mostly restricted to high value vegetable crops. Concern over the poor quality of water used in urban agriculture sites and the need to improve upon UA, led to the planning of interventions to address these problems. One of the outputs of the November working group meeting were plans for a participatory action research and demonstration project on on-farm, low cost water treatment technology for urban agriculture in Accra.

In Accra, UA activities are found in the Dzorwulu area (stretching from the area near Plant Pool across the Olusengu Obasanjo way at the Electricity Company of Ghana (ECG) Achimota station, to the area around Roman Ridge). This area has been a focus for research and demonstration activities for the International Water Management Institute (IWMI) and other research institutions. Urban agriculture can also be observed in other parts of Accra such as 1) Marine drive at the Independence Square, 2) La, 3) Korle-bu, 4) Airport Residential Area around the CSIR and IWMI, and 5) close to the Ghana Broadcasting Company (GBC).

Criteria for the selection of the demonstration site were identified and field visits were made to potential sites to assess their suitability. Among the criteria were - the visibility and accessibility of the site, the numbers of farmers and their willingness to participate, security of land tenure, a wide range of crops, a secure water source, long term involvement in UA, existence of organised and registered farmers' groups, existing innovation and potential for further technology development, and good relations with surrounding communities. The sites visited during the demonstration site selection were the Dzorwulu and Roman Ridge areas, Korlebu and La.

The Dzorwulu and Roman Ridge sites were chosen as the best match for the criteria. The working group further agreed to consolidate and make available, existing information and reports on the Dzorwulu and Roman Ridge sites. It was also agreed that a baseline study was necessary to provide detailed information on the current situation and help decide on what interventions are required. The baseline would also be the basis for measuring any impact of the potential interventions.

The emphasis placed on social inclusion within SWITCH activities has encouraged the integration of social, economic and institutional considerations within the activities of work package 5.2. Hence the baseline study was conducted in collaboration with, and partly funded by work package 6.3, Social Inclusion.

1.2 Objectives of the survey

This survey is a follow up to an overview on Dzorwulu as a SWITCH demonstration site in Accra. The main objective of the survey is to provide an understanding of the situation of urban agricultural activities in the selected site with a view to developing and testing on-farm technologies that allow for treatment of waste water and safe handling of vegetables, and that are appropriate for farmers' social and economic situation. The Roman Ridge site was added in the survey as a site without an organised farmer group for comparison with the Dzorwulu site where there is a vegetable farmers' cooperative society. The following specific objectives were set in pursuance of the main objective:

1. to provide an understanding of farmers' current water management and irrigation practices
2. to analyse farmers' and market traders' perceptions and practices in relation to water use and contamination of vegetable produce
3. to identify the livelihood importance of urban agriculture for practitioners, the conditions of access and degree of inclusivity.
4. to understand the characteristics of UA groups, their dynamics and their management and representational capacity.

1.3 Methodology

The Dzorwulu area was selected as a demo/baseline site because of its large number of farmers, secure land for cultivation, huge range of market crops, secure water source and large range of water sources, the existence of a normed group i.e. formally registered with Department of Cooperatives (DOC), and adoption of improved technology (Egyir and Adjeifah, 2008). In addition, there has been long–term occupation of farmers (the theoretical risk in the environment i.e. the proximity of the land to high tension poles has provided some protection against the land being developed for other purposes).

For purposes of sampling, the area was divided into two; the Dzorwulu site where farmers are organised in a formal group and the Roman Ridge site where the farmers operate on an individual basis.

Data for the study was collected through focus group discussions as well as individual interviews with vegetable producers. Five focus group discussions were held as follows:

1. discussion with farmers on waste water management and irrigation practices
2. discussion with farmers on post-harvest handling of vegetables, perceptions of levels and sources of contamination on vegetable produce and marketing issues
3. discussion with market traders on post-harvest handling of vegetables, perceptions of levels and sources of contamination on vegetable produce and marketing issues
4. discussion with group members on inclusion and access to UA opportunities
5. discussion with executives of groups and some group members on organisational and capacity building needs of UA groups

For each focus group discussion, a minimum of six people was considered adequate for the discussion.

Individual interviews were conducted to explore the issues of improving water quality and inclusion and access to UA opportunities.. In the Dzorwulu site 15 farmers were selected out of a total of 31 (26 of whom belong to the organised group) for the individual interviews. This represents approximately 50% of the total number of farmers. In the Roman Ridge site 10 farmers out of 20 were selected for the individual interview.

The data collected was analysed using the stata computer software. Descriptive statistics were used to summarise the data. Where applicable, statistical tests (t-tests) were performed to establish if differences existed between the two survey sites (Dzorwulu and Roman Ridge) for certain variables (age of respondents, number of household members working on vegetable farm, proportion of household vegetable consumption that comes from own farm etc).

In addition, physical measurements were also carried out which included:

- differential GPS mapping of the sites to determine the topography, the position of water sources, the location of ponds and the size or area of the sites,
- determination of number of ponds and measurement of pond capacity,
- measurement of plot and bed sizes, and
- determination of waste water flow

2 Biophysical characteristics of both survey sites

2.1 Topography and location of ponds

The Dzorwulu site is bounded by the Electricity Company of Ghana (ECG) Achimota sub-station and railway line to the north, by a stream to the south (except for a few farmers who have plots across the stream), by a waste water drain to the west and by vegetable farms of the Roman Ridge site to the east. The Roman Ridge site is bounded by the railway line to the north (except for a few farm beds across the railway line), by the stream to the south (with a few farmers who have plots across the stream), by vegetable farms of the Dzorwulu site to the west and by a waste water drain to the east (Figure 1). The total area of the survey sites is 82,756 m^2 (8.28 ha), with Dzorwulu covering an area of 38,713 m^2 (3.87 ha) and Roman Ridge an area of 44,043 m^2 (4.40 ha). The topography is gently undulating. The maximum and minimum heights were registered for the railway line and the stream respectively. The measured height ranges from 40.217 m - 49.988 m with an average of 44.316 m at mean sea level. The average slope of the stream at Roman Ridge and Dzorwulu sites were 0.178 % and 0.019 % respectively. However, the overall slope of the stream stretching from Roman Ridge to Dzorwulu was 0.334 %. There are many shallow ponds scattered at both sites. The total number of ponds was 128 of which 51 were at Dzorwulu and 77 at Roman Ridge. The sites have clay soils and are prone to flooding during heavy rains.

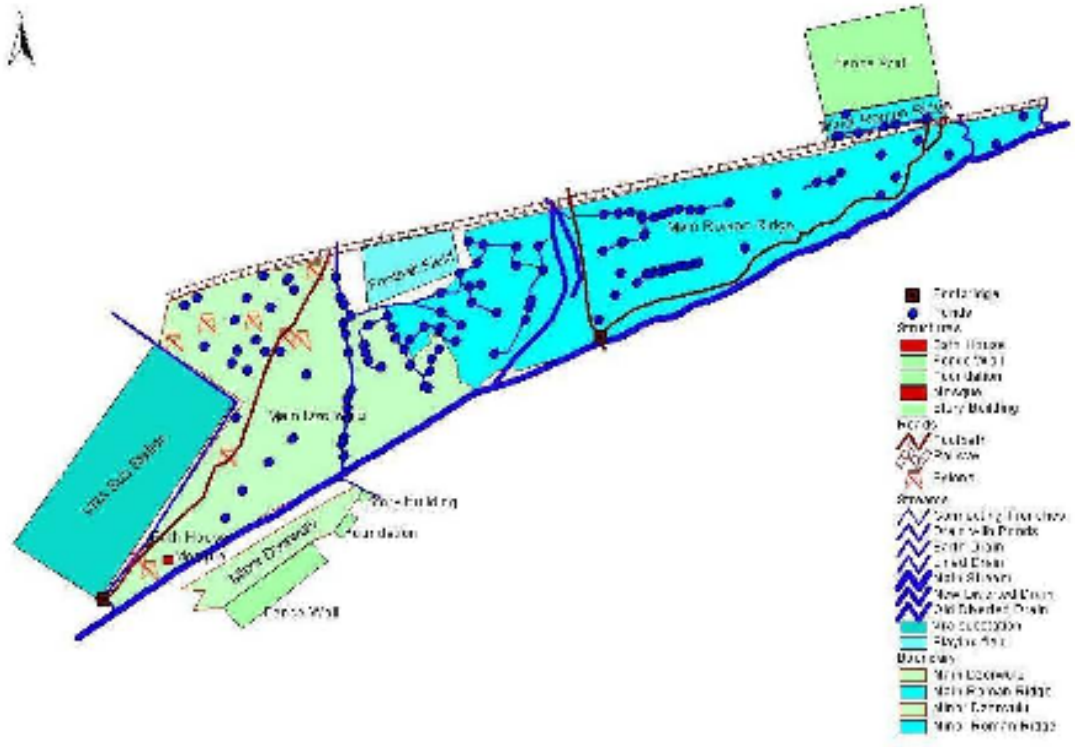

Figure 2.1. Map of the survey sites showing water resources

2.2 Climate and rainfall patterns

The Dzorwulu and Roman Ridge are suburbs of Accra, the capital city of Ghana. Accra lies within the coastal-savannah zone with low annual rainfall averaging 810 mm distributed over less than 80 days. The rainfall pattern of the city is bimodal with the major season falling between March and June, and a minor rainy season around October. Mean temperatures vary from 24 ^{o}C in August to 28 ^{o}C in March (Obuobie et al., 2006).

3 Water management, irrigation and farming practices

3.1 Farm size, vegetables cultivated and fertiliser/manure application

Most farmers at both sites have more than one plot at different locations within the farmland. The number of farm plots ranges from 1 to 5 per farmer with a varying number of beds per plot. The number of beds contained in one plot varied greatly from about 8 to 48 beds at Dzorwulu and from about 8 to 51 beds at Roman Ridge. The plot sizes under cultivation varied between 0.02 - 0.14 ha with a mean size of 0.07 ha. The bed sizes varied between 0.001-0.003 ha with a mean size of 0.002 ha. The Dzorwulu farm size is about 3.87 ha and that of Roman Ridge is 4.40 ha.

The various farming activities carried out by the farmers include land preparation, fertiliser/manure application, preparing seed beds and planting, weeding, spraying of chemicals and watering. The farmers at both sites apply the same type of fertiliser/manure to their crops. The commonly used fertilisers/manure were NPK 15-15-15, ammonium sulphate, poultry manure and NPK 19-19-19 which is a foliar type of fertiliser (Table 3.1). All respondents use at least one of the above mentioned plant nutrients except one farmer at Dzorwulu who uses only carpet grass[1] to fertilise his crops. According to him, the grass serves as a plant nutrient as well as mulch. He applies the grass only once per crop. However, this farmer is faced with the challenge of inadequate availability of the grass.

Table 3.1: Types of plant nutrients used by the farmers

	Respondents*			
	Dzorwulu		Roman Ridge	
Fertiliser/manure	Number	%	Number	%
NPK (15-15-15)	15	93.8	8	80
Ammonium sulphate	3	18.8	2	20
Poultry manure	15	93.8	10	100
NPK (19-19-19)	2	12.5	5	50
Carpet grass	1	6.2	-	-

* Farmers gave multiple answers

The majority of the farmers interviewed apply fertiliser/manure only once per crop. At Dzorwulu, 62.5% of the respondents apply chemical fertiliser (NPK 15-15-15 or ammonium sulphate) only once per crop while 31.3% apply it twice per crop. In Roman Ridge, 40% of the respondents apply it once, 40% twice and 20% thrice per

[1] Axonopus affinis

crop. In the case of poultry manure, 87.5% of respondents from Dzorwulu and 60% from Roman Ridge apply the manure only once per crop, 6.3% from Dzorwulu and 20% from Roman Ridge apply it twice per crop and 20% from Roman Ridge apply it three times per crop. For foliar fertiliser NPK 19-19-19, the frequency of spraying is between 7-10 days for about 3-4 times per crop.

The application rate of chemical fertilisers (NPK 15-15-15 and ammonium sulphate) was in the range of 0.006 – 0.05 kg/m^2 with a mean rate of 0.026 kg/m^2 at Dzorwulu, whereas in Roman Ridge it was 0.013 – 0.033 kg/m^2 with a mean of 0.022 kg/m^2. The mean application rate for foliar fertiliser NPK 19-19-19 was 0.004 kg/m^2. For poultry manure, it was 0.4 – 3.0 kg/m^2 with a mean of 1.4 kg/m^2 at Dzorwulu and 0.5 – 1.5 kg/m^2 with a mean of 1.0 kg/m^2 at Roman Ridge. All farmers interviewed were of the view that the type of irrigation water used (be it fresh or waste water) does not make any difference to the amount of fertiliser/manure used. They said that the amount of fertiliser/manure used per crop and the frequency of application is based on the individual farmer's own judgement.

The farmers' responses regarding the use of human waste as fertiliser in agriculture were positive. All farmers expressed willingness to use urine or excreta-based fertiliser. Some pointed out that they would like to experiment with it first and if the results were good then they would use it.

Most farmers at both sites have been hiring labour for their farming activities when the need arises. However, 25% of the respondents at Dzorwulu and 10% at Roman Ridge never hire labour. The hired workers are found in and around the farm gate, since people always come to the farm seeking for work. The tasks for which labour is usually hired include land preparation, planting, weeding and harvesting of sweet pepper. Only two respondents (one from each site) stated that they occasionally hire labour for watering. Depending on the size of a bed, the farmers pay for hired labour in the range of GH¢ 0.50 – 2 per bed for land preparation, GH¢ 0.50 - 1 per bed for planting and GH¢ 0.20 – 1 per bed for weeding. For harvesting of sweet pepper, the farmers normally pay GH¢ 1.5 for every sack of pepper harvested. Moreover, the farmers who hire labour for watering pay GH¢ 2 for about 16 beds watered. Furthermore, 56.3 % of the respondents at Dzorwulu and 50 % at Roman Ridge stated that their family members (brothers and sons) help them occasionally in the farm. The male children work on the farm during school holidays; no female child works on the farm. In addition, the farmers help each other occasionally to carry out farming activities.

The same types of vegetables are grown at both farming sites (Dzorwulu and Roman Ridge). More than 13 types of vegetables are cultivated at both sites. The major vegetables grown are listed in Table 3.2. Every respondent grows many of these vegetables. These vegetables are grown at any time of the year. They are not grown according to season but rather according to market demand. However, sweet pepper is grown once in a year during the dry season. The farmers have been cultivating these vegetables for many years ranging between 9 and 51 years with an average of 21.7 years at Dzorwulu, and between 3 and 30 years with an average of 17 years at Roman Ridge.

Table 3.2: Types of vegetables cultivated

Vegetable	Respondents (Dzorwulu) [1]		Respondents (Roman Ridge)[2]	
	Number	%	Number	%
Lettuce	16	100	8	80
Cabbage	14	87.5	7	70
Carrot	5	31.3	7	70
Cucumber	9	56.3	6	60
Spring onion	13	81.3	8	80
Cauliflower	7	43.8	3	30
Sweet pepper	7	43.8	1	10
Radish	3	18.8	5	50
Beetroot	2	12.5	3	30
Coriander	1	6.3	7	70
Spinach	2	12.5	3	30
Parsley	1	6.3	5	50
Chinese cabbage	3	18.8	-	-

3.2 Sources of irrigation water

The farmers at Dzorwulu have three sources of water for irrigation; polluted stream, domestic waste water and pipe-borne water. The stream and the domestic waste water could be classified together as wastewater. There are about 14 farmers at Dzorwulu using pipe-borne water and 19 using wastewater for irrigation (some using multiple sources). On the other hand, all farmers at Roman Ridge use wastewater for irrigation. They have only two water sources; polluted stream and domestic waste water (Figure 3.1).

Figure 3.1. Wastewater sources: Stream drain at Dzorwulu (top left); stream drain at Roman Ridge (top right); unlined waste water drain (bottom left) and lined waste water drain (bottom right)

[2] Each farmer grows multiple crops


Some farmers at both sites use more than one water source. A small portion of the stream drain was lined at Dzorwulu site but unlined at the Roman Ridge end. There are five domestic waste water drains; three of them were used by Dzorwulu farmers and one by Roman Ridge farmers. Two of these drains at the Roman Ridge site were virtually unused for irrigation purposes. Only one of the waste water drains was lined; it is at the Dzorwulu site and close to the electricity sub-station. The effluents of all the waste water drains were discharged into the stream.

Table 3.3 shows the percentage of respondents using a particular water source. The main reason given by Roman Ridge farmers for using waste water is the lack of access to other sources of water. However, the Dzorwulu farmers stated the unreliability of the pipe-borne water supply as the reason for using the waste water, because the waste water is abundant and available throughout the year. In addition, one farmer mentioned a financial constraint as his reason for using the waste water because he cannot afford to pay the monthly water bills. With regard to what determines the choice of using the stream or the domestic waste water, the farmers mentioned the nearness of the particular water source to their farm plots as the determining factor.

Table 3.3: Percentage (%) of respondents using available water source

Respondents	Stream only	Domestic waste water only	Piped water only	Stream & domestic waste water	Domestic waste water & piped water
Dzorwulu (%)	18.75	18.75	37.5	12.5	12.5
Roman Ridge (%)	80	-	-	20	-

3.3 Seasonal variation in appearance and availability of water

The flow of the wastewater (stream and domestic waste water) is all year round but the quantity is reduced during the dry season. However, whatever the season, the flow of the wastewater is always adequate for farming activities. The waste water flow through the drain close to the electricity sub-station was estimated to be 0.0025 – 0.0028 m^3/s. The stream is mainly polluted by the domestic waste water from the surrounding households. The farmers gave conflicting responses with regard to how they perceive the quality of the stream in terms of physical appearance during different seasons. Dzorwulu farmers were of the view that the stream appears cleaner

in the rainy season than the dry season because when it rains, debris is washed away by the stormwater. On the other hand Roman Ridge farmers were of the view that the stream is cleaner in the dry season than the rainy season. Their reason was that the surrounding households used to dump their rubbish into the stream in the rainy season thus making the stream dirty and turbid.

3.4 Water storage and irrigation methods used

Different types of techniques are used by the farmers to make water accessible to them for their irrigation activities. Shallow ponds are extensively used to store water for irrigation purposes. The following are some of the advantages of ponds as enumerated by the farmers: 1) storage of water, 2) improvement in the water quality (physical appearance) and 3) easy accessibility of water since the ponds are made close to the farm plots thus making watering less tedious. However, some of the respondents do not see any difference in water quality (i.e. physical appearance) from the ponds compared with the raw wastewater. They stated that the quality remained the same.

The capacity of these ponds varies over time as a result of siltation, especially in the rainy season. These ponds are not protected and when it rains, some of them cave in and also debris (e.g. mud) is washed into the ponds due to the surface runoff, thus reducing the capacity (volume) of the ponds. According to the farmers, desilting of the ponds is carried out regularly, at least once a month. The surface areas of these ponds are of irregular shapes thus making estimation of capacity very cumbersome. There are about 51 ponds scattered all over the Dzorwulu site of which 21 are for piped water storage and 30 for domestic waste water. The waste water ponds were either dug along the unlined waste water drain or were connected by trenches linking the waste water drains. At the time of measurement, the surface areas of the Dzorwulu ponds varied between 2.57 - 14.72 m^2 with volumes varying between 0.91 - 7.68 m^3. At Roman Ridge, there are about 77 of such ponds for storing wastewater; 44 of them are for domestic waste water and 33 for stream water. The waste water ponds were connected by trenches. The surface areas of the Roman Ridge ponds varied between 0.95 - 21.65 m^2 with volumes varying between 0.48 - 11.74 m^3. The following different water management scenarios were practised by the farmers:

Shallow ponds for pipe-borne water: These are shallow ponds dug close to farm plots and scattered all over the Dzorwulu site (Figure 3.2). There are 21 of such ponds used by about 14 farmers. Pipe-borne water users at Dzorwulu fill these ponds with piped water by using hose pipes connected to water taps. The ponds are used to store water especially against pipe closure. The farmers then use watering cans to fetch water from the ponds during watering of crops. Some of these ponds have water lettuce or duckweed (which appeared naturally) floating on the water surface. Pipe-borne water is only used at Dzorwulu. The users of the piped water pay monthly water bills (the farmers are given flat rates). The farmers organised themselves to use the piped water and the water bill is shared among them. The amount paid varies with the individuals depending on the farm size per farmer, with some farmers paying in the range of GH¢ 2-6, some paying in the range of GH¢ 6-10 and others paying in the range of GH¢ 10-15 or GH¢ 15-25 per month.

Figure 3.2. Shallow ponds for pipe-borne water storage at Dzorwulu

Shallow ponds for stream water. These are ponds dug close to farm plots and scattered all over the Roman Ridge (Figure 3.3). There are about 33 of these ponds. The farmers using the stream use pumps to lift the water into the ponds, from which they fetch water during watering using watering cans. Some of these ponds were connected by trenches so that water can flow from one into the other. The Dzorwulu farmers using the stream do not make use of ponds for water storage. Regarding why the stream water users at Dzorwulu do not use ponds for stream water storage, the farmers mentioned 1) the nearness of the stream to their farm plots and 2) limited land space, as the ponds would occupy some land space resulting in reduced land space for farming. Moreover, some farmers mentioned financial constraint as they cannot afford to buy pumps to lift water into the ponds.

Figure 3.3. Shallow ponds for stream water storage at Roman Ridge

Shallow ponds connected by trenches: Trenches were dug by some of the farmers at both sites (Dzorwulu and Roman Ridge) to divert a portion of the domestic waste water flow to their farm plots. These trenches were made to connect a series of ponds which serve as water storage and fetching points (Figure 3.4). The farmers then use watering cans to fetch water from the ponds to water their crops. There are about 16 of these ponds at Dzorwulu and 44 at Roman Ridge. Most of these ponds have duckweeds or water lettuce (which appeared naturally) floating on the water surface which helps in improving the water quality.

Figure 3.4. Shallow ponds connected by trenches for waste water storage

Shallow ponds along waste water drain: This practice is carried out only by some Dzorwulu farmers. These are series of 14 shallow ponds dug along one of the unlined waste water drains by the farmers. Water is fetched from these ponds using watering cans during watering of the crops.

Figure 3.5. A shallow pond dug along a waste water drain at Dzorwulu

Fetching water directly from stream: This practice is carried out by some farmers at both farming sites. During watering the farmers go into the stream to fetch water using watering cans.

Blocking of waste water flow by sand bags: Some farmers at Dzorwulu have placed sand bags in the waste water drain close to the electricity sub-station to block the waste water flow. The water then accumulates behind the sand bags and is fetched with watering cans during watering of crops.

Figure 3.6. Sand bags blocking waste water flow in a drain at Dzorwulu

The above water management techniques were either the farmers' own initiatives or according to others they learnt them from their colleague farmers. The irrigation methods being practised by the farmers are: 1) the use of watering cans and 2) hosepipes. The use of watering cans is the most widely used irrigation method by the farmers. Every respondent from both sites use watering cans; some of them also use hosepipes. The watering cans are used to fetch water from the ponds or directly from the stream. 50% of the respondents from Dzorwulu and 20% from Roman Ridge sometimes use a hosepipe for watering. Some of the farmers use the watering can at the early stages of the crop (in order to protect the young crop) and change to the hosepipe at the later stages. The piped water users usually use watering cans to fetch water from the ponds but occasionally some of them do the watering with hosepipes by connecting to the tap. For domestic waste water users, only watering cans are used. However, three different scenarios were identified for users of the stream as listed below:

1. Fetching with watering cans directly from the stream. This is practised by about 10 Roman Ridge farmers and 9 Dzorwulu farmers.
2. The use of hosepipes connected to pumps to pump stream water for watering. This is mainly practised by three Dzorwulu farmers.
3. The use of pumps to pump water from the stream first into shallow ponds for storage and then using watering cans to fetch water from the ponds during

watering of crops. This practice is only identified with Roman Ridge farmers. In the dry season when watering is done almost every day, these ponds are filled with water at least every 2-3 days.

It was observed that 18.8% of the respondents from Dzorwulu and 60% from Roman Ridge use pumps in their irrigation activities. All the respondents using pumps in Dzorwulu and 66.7% of the users from Roman Ridge owned pumps. The remaining users have to borrow the pumps from their friends (colleague farmers) when needed. The farmers from Dzorwulu and Roman Ridge spend in the range of GH¢ 4-10 and GH¢ 4-15 per farmer per week respectively on fuel for the pumps. This could then be estimated for two months cropping season to amount to GH¢ 32-80 and GH¢ 32-120 per farmer respectively since most of the vegetables mature within two months except for example carrot, cabbage and sweet pepper.

3.5 Volume of water used during watering

Watering of crops is done by the farmers in the mornings and/or afternoons after 3:00 pm. All respondents from Dzorwulu carried out their watering activities in the morning. Moreover, 62.5% of them also do the watering in the afternoon during instances where they were not able to do it in the morning or were not able to finish the watering in the morning. At Roman Ridge, all the respondents do the watering in both morning and afternoon. At both sites, most farmers carried out watering once a day per crop (either in the morning or afternoon), but some farmers do it twice a day per crop during the dry season. The farmers use more water in the dry season than the rainy season. In the rainy season the farmers do not water their crops regularly. During heavy rains the farmers cease to do watering for many days since the land becomes waterlogged.

The volume of water used during watering was estimated from the number of watering cans used per bed. The volume of a watering can is about 15 litres. The volume of water used per bed largely depends on the size of bed and the season. The volume of water used during watering at Dzorwulu and Roman Ridge were between 90-480 litres per bed per watering and 90-300 litres per bed per watering respectively. Moreover, the most probable volume of water used in the dry season is about 180 litres per bed per watering. The farmers use an average watering times of 7.8 min per bed at Dzorwulu and 6.7 min per bed at Roman Ridge.

3.6 Health and hygiene related issues

All the farmers interviewed consume their own farm produce and say they do not experience any health problem. According to the farmers, vegetables are well washed with piped water before eaten raw or cooked. 93.8% of the farmers interviewed at Dzorwulu and 70% of those from Roman Ridge do not employ any measures of protection during farming activities. However, all farmers wash hands and feet after field work. Those who protect themselves wear wellington boots when working on the field, and use a nose mask, polythene bag or shirt to cover their nose during spraying of chemicals (e.g. pesticides). Some farmers at Dzorwulu said that during spraying, they consider wind direction to avoid inhaling drift material. Moreover, 68.8% of the respondents from Dzorwulu and 60% from Roman Ridge do not have any awareness or information about health risks associated with wastewater use. All wastewater users were of the view that they do not experience a health problem which is related

to wastewater usage except one farmer at Roman Ridge who complained of a foot infection which he associated with the wastewater usage. According to him, he always enters the wastewater without protecting his feet, which has resulted in a chronic foot infection.

3.7 Potential for improvement

The Roman Ridge farmers argued that they do not face any constraints with their current water management practices because they pump stream water into ponds which were dug close to farm plots, and also diverted waste water through trenches to plots. On the other hand, Dzorwulu farmers listed some constraints and gave possible suggestions for improvement (Table 3.4).

Table 3.4: Current water management constraints at Dzorwulu

Constraints	Possibility for improvement
Very tedious to fetch water from stream with watering cans and carry to field	1. Digging of ponds close to plots, and pumping water into them for storage. 2. Digging of more waste water trenches and ponds thus bringing water close to farm plots.
Water pipes are sometimes closed thus causing water shortage	Digging of more ponds and filling them with piped water against pipe closure
High water bills	-

The farmers from both sites are concerned about the current trend of pollution of the stream. They pointed out that the stream used to be clean in the past, but now it is polluted as a result of human settlement along the stream. Moreover, farmers are in favour of on-farm water treatment and are willing to accept any suitable water treatment intervention. The Dzorwulu farmers would prefer the system of trenches and ponds with aquatic plants to purify the water. The Roman Ridge farmers, though they will accept any intervention, are more inclined to acquire a pipe system.

Other possible areas of intervention that are of interest to Dzorwulu Farmers which they would be pleased to have an external assistance in building their capacity, include the following:

- Proper maintenance of fertility of soil,
- Ways to reduce soil salinity, and
- Simpler irrigation methods

4 Marketing and post-harvest handling practices

4.1 Post-harvest practices

The vegetables are harvested mostly by the traders (who are mainly women) at their own convenient time after they have bargained and agreed with the farmers on an acceptable price. However, the traders (market women) are assisted in many cases by the farmers to harvest the crops. Moreover, it is labour-intensive to harvest certain types of vegetables e.g. sweet pepper, so labour is usually hired to help in the harvesting and paid for. Normally GH¢ 1.5 is paid for every sack of pepper harvested. Each vegetable has a specific way it is harvested as shown in Table 4.1.

Table 4.1: Methods used in vegetable harvesting

Vegetable	Harvesting method
Cabbage	Cutting with knife
Lettuce	Uprooting with hand (without a tool)
Carrot	Using hoe or fork to dig/uproot
Cucumber	Plucking with hand
Green pepper	Plucking with hand
Cauliflower	Cutting with knife
Spring onion	Uprooting with hand
Radish	Uprooting with hand
Beetroot	Uprooting with hand
Coriander	Cutting with knife
Spinach	Cutting with knife
Parsley	Cutting with knife
Chinese cabbage	Twisting and breaking with hand

During harvesting sorting is done by separating the bad crops from the good ones. According to the farmers, no washing or cleaning of the harvested vegetables is done on the farm. This is being done by the market women in the market place with piped water, according to the traders. After the vegetables are harvested, they are then put into sacks, baskets, nets or polythene bags which were brought by the market women and transported to the market. The market women make their own arrangement for transporting the vegetables to the market. They carry the produce to the roadside or hire labour to do it for them, and then hire a taxi to the market. The farmers sometimes help to get people to carry the harvested vegetables to the roadside for the traders but the cost is being paid by the traders. The cost of carrying the vegetables to the roadside is usually One Ghana Cedi per trip (GH¢ 1 per trip).

4.2 Marketing arrangements

All vegetables are sold on the farm; no farmer sells his/her vegetable in the market. The vegetables are sold to wholesalers (i.e. market women) and individuals who buy for household consumption. The traders (market women) go to the farm themselves looking for vegetables to purchase. However, some of the farmers have regular customers that they inform when their vegetable is ready for harvesting.

The marketing and selling of the vegetables is done on individual basis; there are no group deals. Although there is a vegetable traders association, the individual traders negotiate contracts with individual farmers. Some traders buy the whole plot; others buy only a portion of the plot. The individual farmer bargains with his/her customer based on the quantity of the vegetable that the trader needs. The farmers price the vegetables based on the number of beds a trader wants to buy. The price is then bargained upon by the two parties until an acceptable price is reached. The trader is then supposed to pay cash at that time. However, based on trust and the relationship between trader and farmer, an agreement may be reached for the trader to make payment after sales. After that, the harvesting becomes the responsibility of the trader; she decides when the harvesting should be done. In most cases, the traders do the harvesting themselves (even in the absence of the farmers), but the farmers do assist sometimes if they are on the farm at the time the traders are doing the harvesting. However, for crops that rejuvenate after harvesting (e.g. parsley, spinach), farmers may want to harvest them for the traders as care needs to be taken in harvesting them so as to guarantee their survival.

The discussions revealed that traders come from various markets to buy vegetable produce at the survey sites. Markets listed by the traders include: Agbogbloshie, Malla Atta, Kaneshie and Madina.

The vegetable traders finance their activities from their own cash and any extra cash they can mobilise from 'susu' (saving). On average one can get into the vegetable marketing business with a start up capital of fifty Ghana cedis (GH¢ 50).

4.3 Factors influencing markets, prices and incomes

The pricing of the vegetables is mostly based on quality of crop, size of bed/plot and size of crop (e.g. cabbage, carrot, cauliflower). Moreover, the pricing of the same vegetable differs depending on the season.

The price is not affected by whether or not the harvesting is done by the farmer or the trader. Whoever does the harvesting, the price remains the same. In addition, there is no price differential between vegetables irrigated with wastewater or clean water.

One of the main factors influencing the prices of the vegetables is the season or availability (i.e. scarcity or abundance) of the vegetable in the market. During the period of scarcity, the price goes high and vice versa during the period of abundance. The traders observed that an important reason for seasonal fluctuation in vegetable prices is the influx of produce from neighbouring countries particularly Togo and Burkina Faso. There is also an influx of vegetables into the Accra markets from other parts of the country (e.g. cabbage from Brong Ahafo).

According to Dzorwulu farmers, the price is good (high) from January – May; it is bad from June – August (i.e. too low) and from September – December, the price fluctuates between good and bad.

According to Roman Ridge farmers, the price is bad from January to February and from June-September; from March-May the price is better than in the months stated earlier, and from November-December the price is good. It is obvious that the price is not stable but keeps fluctuating throughout the year. Table 4.2 shows the range of proceeds the farmers were able to realise from vegetable sales per plot. It should be

noted that plot sizes differ; the sizes range from 0.02 ha to 0.14 ha with a mean size of 0.07 ha.

Table 4.2: Amount of money (gross) made from vegetable sales per plot

Vegetable	Amount per plot (GH¢)
Lettuce	100-300
Cabbage	200-400
Sweet (Green) pepper	200-600
Cucumber	100-300
Cauliflower	150-400
Spring onion	150-500

The factors which affect the farmers' proceeds from vegetable production are as listed below:

- Farm inputs (e.g. fertiliser, poultry manure, pesticides, seeds, petrol and engine oil for pumping machine)
- House rent
- House keeping money (e.g. feeding money, light bill, water bill)
- Buying of personal and family belongings
- Children school fees
- Hospital bills
- Transportation

The main constraints facing the farmers in their vegetable production are financial problems such as a weak financial base and unavailability of financial assistance from external sources (e.g. from the banks). Their only source of assistance usually comes from their customers (i.e. traders) and friends. The farmers sometimes receive financial assistance from their customers in the form of a loan. These loans are then deducted from the monies the traders are supposed to pay the farmers. In other cases, a farmer takes a loan from a colleague farmer or a friend and then pays back later. However, in many cases the farmers do not get the loan they asked for. According to the farmers, they never seek a loan from the banks because they would not get it even if they try.

4.4 Perceptions of levels and sources of contamination of vegetable produce

The traders are not concerned about the type of irrigation water used by the farmers, but some individual buyers for household consumption do ask about the type of water used. The traders have a perception that there are other sources of contamination of vegetable produce that are more serious than contamination from usage of waste water. They mentioned contamination from use of pesticides. They also observed that the use of chemicals in vegetable production affects the shelf life of vegetables. According to the farmers, their vegetables are clean, good, attractive and free from contamination; the quality is good, hence the traders do not complain. However, they were of the view that the vegetables should be washed to remove dirt before eating/cooking. They argued that they follow good farm practices including handling and harvesting of vegetables. The harvested vegetables are not washed in the farm; it is the responsibility of the traders, which they do in the market place. When asked about what can cause vegetables to be unclean, the farmers cited among other things the use of unauthorised pesticides, immature manure and poor water quality as some

of the factors[3]. The Dzorwulu farmers mentioned some institutions which were of immense help in advising them on good farm practices (Table 4.3).

Table 4.3: Sources and types of information and advice given to vegetable farmers

Source of information	Type of information
Extension officers from MOFA	• Good farm practices • Methods to combat crop diseases
Agrochemical dealers	• Suitable chemical for a particular crop • Information on new products (chemicals) in the market suitable for a particular crop
NGOs/Research Institutions e.g. IWMI	• Outline the risk involve in UA • Awareness creation on water quality and manure and risks involved

[3] This knowledge is likely due to the fact that sensitisation work has been carried out with these farmers

5 Inclusion and access to urban agriculture opportunities

The issue of social inclusion is a cross cutting theme within SWITCH city activities[4]. The baseline study therefore explored the characteristics of the UA groups working at Dzorwulu and Roman Ridge sites; access to membership and the relevance of gender, ethnicity, financial ability and social linkages. It also considered their degree of security/vulnerability; their relationships with city authorities, tenure arrangements and processes of representation and communication.

5.1 Socio-economic characteristics of vegetable farming households

The survey respondents were invariably the heads of their respective households. Out of the total of 25 individuals interviewed only three of them were female, while the remaining 22 were male. The age distribution of the respondents in the Dzorwulu site ranged from 22 to 70 years with a mean of 44.7 and standard deviation of 11.7. The corresponding figures for the Roman Ridge site are 20 to 69 years with a mean of 44.3 and standard deviation of 17.3. Statistical tests (using t-test) indicate that there is no significant difference between the mean ages of respondents in the two sites. The age distribution of the survey respondents is given in Table 5.1 below. From the table, the majority (67%) of the respondents in the Dzorwulu site are aged between 40 and 59 years. Age of respondents in the Roman Ridge site is normally distributed.

Table 5.1 Age distribution of survey respondents

	Dzorwulu site		Roman Ridge site	
Age range	Frequency	Percentage	Frequency	Percentage
20 – 29	2	13	2	20
30 – 39	2	13	2	20
40 - 49	6	40	2	20
50 - 59	4	27	2	20
60 and above	1	7	2	20
Total	15	100	10	100

The survey revealed that vegetable growing households live in 11 suburbs of Accra. The majority of the households live in suburbs within 2-3 km of the vegetable production sites. These relatively nearby suburbs are Mamobi, Pig farm and Kotobabi. As many as 11 out of 15 households from the Dzorwulu site live in these three suburbs while 6 out of 10 households in the Roman Ridge site live in the same suburbs. The remaining 8 households in the survey sample live in suburbs that are more than 10 km away from the vegetable production sites. These suburbs include Alajo, La, Lapaz, Mdina, Awoshi and Kasoa. In general, those who live far away from the production sites are households that own the houses in which they live. Table

[4] **Learning Alliances Briefing Note 10: An Introduction to Social Inclusion**, Prepared by Valerie Nelson, Adrienne Martin (Natural Resources Institute, University of Greenwich, UK) and Deirdre Casella (IRC International Water and Sanitation Centre, Delft, Netherlands) http://www.switchurbanwater.eu/outputs/pdfs/WP6-2_BRN_10_Introduction_to_social_inclusion_draft.pdf

5.2 gives a frequency distribution of where vegetable farming households at the Dzorwulu and Roman Ridge sites live.

Table 5.2 Place of residence of vegetable farming households

Place of residence	Frequency (Number of households)	
	Dzorwulu site	**Roman Ridge site**
Mamobi	5	4
Pig farm	3	1
Kotobabi	3	1
La	1	-
Alajo	1	-
Tantra Hill	1	-
Lapaz	1	-
Kanda	-	1
Awoshi	-	1
Madina	-	1
Kasoa	-	1
Total	15	10

The survey revealed that vegetable farmers at both sites are mainly migrants from Northern Ghana and Burkina Faso. Only one respondent out of the twenty-five respondents interviewed (individual interviews) comes from Accra. Four of the respondents come from Burkina Faso, two from Aflao in the Volta region while one comes from Ajumako in the Central region. The remaining seventeen farmers come from Northern Ghana (one from Tamale in the Northern Region and the remaining sixteen from Bawku and Pusiga in the Upper east region). Table 5.3 gives the distribution of vegetable farmers at the Dzorwulu and Roman Ridge sites by place of origin.

Table 5.3: Distribution of vegetable farmers by place of origin

Place of origin	Frequency (number of respondents)	
	Dzorwulu site	**Roman Ridge site**
Bawku (Upper East region)	8	7
Burkina Faso	2	2
Aflao (Volta region)	1	1
Ajumaku (Central region)	1	-
Pusiga (Upper east region)	1	-
La (Accra)	1	-
Tamale (Northern region)	1	-
Total	15	10

Vegetable farming households have spent a considerable number of years in Accra. From the survey results, farmers in the Dzorwulu site have stayed in Accra for an average of 38.1 years with a range of 7 – 54 years. The average number of years of stay in Accra by households in the Roman Ridge site is 32.5 with a range of 20 – 45 years. The distribution of the length of stay in Accra by vegetable farming households is left skewed in the Dzorwulu site. This suggests that most of the households have

stayed in Accra for a shorter period of time than the average number of years. The distribution of length of stay in Accra is nearly normal in the Roman Ridge site. Table 5.4 illustrates the frequency distribution of the length of stay in Accra by vegetable farming households. Over 60% of households in the Dzorwulu site have been in Accra for 40 years or more while in the Roman Ridge site only 20% of the households have been in Accra for this length of time.

Table 5.4: Length of stay in Accra by vegetable farming households

Length of stay in Accra (years)	Dzorwulu site		Roman Ridge site	
	Frequency	Percentage	Frequency	Percentage
Less than 20	1	7	0	0
20 – 29	3	20	3	30
30 -39	1	7	5	50
40 - 49	8	53	2	20
50 and above	2	13	0	0
Total	15	100	10	100

The length of cultivation (in years) by vegetable farming households in the Dzorwulu site ranges from 2 to 45 years with a mean of 21.1. The corresponding figures for the Roman Ridge site are 5, 36 and 18.6 in that order. The frequency distribution of the number of years of cultivating vegetables by households in both survey sites suggest that 10 – 19 years is the most frequent length of cultivation (40% of respondents in each site). The distribution of the length of cultivation is illustrated in Table 5.5

Table 5.5: Distribution of length of vegetable cultivation in survey sites

Length of cultivation (years)	Dzorwulu site		Roman Ridge site	
	Frequency	Percentage	Frequency	Percentage
Less than 10	2	13	2	20
10 – 19	6	40	4	40
20 - 29	2	13	2	20
30 - 39	4	27	2	20
40 and above	1	7	0	0
Total	15	100	10	100

The average household size in the two sites is about the same, although there is a difference in the range of household size. Household size in the Dzorwulu site ranges from 1 to 15 while in the Roman Ridge site it ranges from 3 to 10. The average household size is 6.8 and 7.1 for Dzorwulu and Roman Ridge respectively. The difference in average household size for the two sites is not statistically significant.

Household size can give some indication of available farm labour from household sources other things being equal. There is a positive relationship between household size and family labour (in terms of number of household members available to work on the household farm) considered in the light of alternative opportunities open to household members. This relationship was observed for the Dzorwulu site, but not in the case of the Roman Ridge site. Approximately 25% of household members work

on the household farm in the Dzorwulu site. Household members who work on the farm are males. No household (both sites) reported any females working on the farm, except the 3 women who own plots at the Dzorwulu site. The number of household members who work on the vegetable farm is given in table 5.6.

Table 5.6: Number of household members who work on vegetable farm

Number of household members who work on vegetable farm	Frequency (number of households)	
	Dzorwulu site	**Roman Ridge site**
1	10	4
2	4	4
3	-	2
4	-	-
5	1	-
Total	15	10

The number of household members available to work on the farm is not enough to meet the labour requirements in vegetable farming. As a result households frequently hire labour for certain activities in the plots. Households hire labour for various activities, but land preparation is the activity for which labour is most frequently hired. Three households in the Dzorwulu site and one in the Roman Ridge site reported that they do not hire labour for their vegetable farming activities. One of these households in the Dzorwulu site has 5 household members working on the farm. This may provide enough labour for their activities. For the remaining households that do not hire labour, the number of household members that work on the farm is between 1 and 3. Some respondents reported that constraints such as lack of cash to hire labour were the reason they were not using hired labour. Table 5.7 gives the activities for which labour is hired.

Table 5.7 Vegetable production activities for which labour is hired

Activity for which labour is hired	Frequency (no. of households hiring labour for activity)	
	Dzorwulu site	**Roman Ridge site**
Not applicable (hires no labour)	3	1
Land preparation	11	6
Weeding	6	7
Watering	1	7

5.2 Patterns of gender related involvement in urban agriculture

Urban agriculture is a male dominated venture in so far as vegetable production is concerned. Apart from three women who are operators in the Dzorwulu site there are no women involved in vegetable production in the two sites (Dzorwulu and Roman Ridge) under study. There is a history to the involvement of these three women in vegetable production. They are former employees of the Ministry of Food and Agriculture, who worked at the same site on an irrigation project. They were laid off during the structural adjustment programme of the Government of Ghana. As they had

gained some experience in vegetable production, they chose to remain at the site to embark on their own production activities. Women generally have smaller plots than their male counterparts due to the laborious nature of field activities. In the focus group discussions the women reported that field activities are laborious, especially land preparation.

The survey also revealed that there are no female household members involved in vegetable production. The only female involvement reported by the interviewees was harvesting of the vegetable crops at the time of marketing. During harvesting market women (vegetable traders) come to buy the vegetables in the field and harvest them by themselves. These women are not necessarily related to the farmers. In the case of one farmer, his wife is a vegetable trader; this is the instance in which the involvement of female members of household in Urban Agricultural activities was observed. There is also very little child (under the age of 15) involvement in vegetable production activities.

5.3 Plot acquisition, land tenure and access arrangements

Plots may be acquired in one of three ways in the Roman Ridge site. Existing farmers reported that they acquired their plots through relatives or friends. Others indicated that they were the first to clear and cultivate the plots, thus gaining ownership over them. One survey respondent explained that in the past, there were relatively few farmers in the survey sites and would be farmers could take as much land for themselves. As at the time of this survey, land in the area could be said to be fully occupied. Out of the ten respondents in the Roman Ridge site, one acquired his plot through a friend; six others acquired their plots through relatives while the remaining three said they acquired the plots in their own right (they were the first to clear and cultivate the plots). In the Dzorwulu site two additional modes of plot acquisition were mentioned. One respondent in this site reported that he acquired his plot from a former employer. He worked for his employer for wages until the employer left the site permanently. The plot was then handed over to him by his employer. The three women farming at the site stated that they acquired their plots from MOFA. They actually appropriated the plots to themselves when they were laid off while MOFA was leaving the site at the same time. This is to say they decided to continue cultivation without having the land allocated to them by any person. Table 5.8 shows how plots were acquired in the survey area.

Table 5.8: Mode of plot acquisition

How plot was acquired	Dzorwulu site		Roman Ridge site	
	Number of respondents	Percentage	Number of respondents	Percentage
Through a relative	4	27	6	60
From a friend	5	33	1	10
From MOFA	3	20	-	-
Self appropriated	2	13	3	30
From former employer	1	7	-	-
Total	15	100	10	100

No costs were incurred in acquiring the plots and no rent is paid for their use. The farmers explained that some people considering themselves as the traditional owners of the land have attempted to sell the land for residential purposes, but their efforts were negated by government intervention. As a matter of fact the cultivable area is sandwiched between the railway line and the stream on the north and south respectively. There are also high tension power lines at the Dzorwulu site. By legislation, residential apartments must be a certain minimum distance away from railway lines and high tension power lines. This may further explain why the development of residential accommodation in the area has not been possible to date. Evidence of an attempt to put up residential accommodation in the area could be seen at the time of the interviews in the form of partially demolished buildings. The farmers reported that a section of the traditional land owners have made attempts to sell the land to individuals for the development of residential accommodation. Traditionally (customarily) all lands in Accra and its environs are owned by the Ga except those acquired by the government (from traditional authorities).

Farmers in the two sites do not hold any title to the land they cultivate. There are no tenure arrangements between the farmers and any recognised individual or organisation. Egyir and Adeifah (2008) have stated that, a mutual agreement has been formalized with VRA for farming in the area as a way of maintaining it and to prevent any non-agricultural encroachment. The same authors state that job insecurity is a big constraint as farmers' hope for brighter future seems bleak. This is because VRA can ask farmers to move any time. During the focus group discussions, farmers noted that there are no arrangements for use of the land and that they do not have any written documents with regards to access to and use of the land. As the case stands, there is no security of tenure and the farmers could be asked to leave the site at any moment if an alternative use for the area comes up in future. In a follow up discussion the farmers noted that a potential alternative use of the land that poses a threat to their activities is the development of residential accommodation. However the area experiences seasonal flooding and the government is opposed to its use for residential accommodation, the farmers added. They also noted that the area could easily develop into a slum if farmers were to fallow the land. In terms of access to plots, the area can be said to be fully occupied. No plot sharing or subletting was recorded by this survey. New entrants can only get plots from fragmentation of existing plots or in the event that an exiting occupant is leaving his/her plot for good. There is no waiting list and no formal procedure for acquiring plots. In general, a person who wants to acquire a plot must get affiliated to a farmer who owns a plot in the area. Based on their relationship, the plot owner may sub divide his plot to give part to a friend or relative. These are permanent arrangements. There is however no time frame for the process of acquiring a plot at the moment.

5.4 Analysis of household livelihood assets

The survey sought to establish the ownership/access to certain assets by the respondent households. The analysis is done on the basis of physical assets, natural, social, human, and financial assets. The analysis also considered household livelihood activities and related these to water use. Finally, household general well being as well as any plans to improve upon household agricultural activities were discussed.

Table 5.9 Ownership of physical assets by households and access to utilities

Asset/facility	Dzorwulu site				Roman Ridge site			
	No. with asset	No. without asset	Minimun/ household	Mximum/ household	No. with asset	No. without asset	Minimun/ household	Mximum/ household
House	**9**	6	1	1	4	6	1	1
Pipe water	10	5	-	-	5	5	-	-
Flush toilet	3	12	2	3	2	8	1	1
Electricity	14	1	-	-	10	0	-	-
Car	0	15	-	-	0	10	-	-
Bicycle	6	9	1	1	7	3	1	3
Motor-cycle	0	15	-	-	3	7	1	2
Generator	1	14	1	1	0	10	-	-
Water pump	5	10	1	2	7	3	1	2
Sprayer	6	9	1	3	8	2	1	2
Wrist Watch	11	4	1	9	10	0	1	8
Clock	15	0	1	3	7	3	1	3
Sewing machine	9	6	1	2	4	6	1	2
Electric iron	12	3	1	4	7	3	1	3
Refrigerator	10	5	1	3	5	5	1	3
Television set	14	1	1	4	9	1	1	4
Radio/tape recorder	12	3	1	4	9	1	1	3
Radio	10	5	1	5	7	3	1	3
Video deck	6	9	1	3	6	4	1	2
DVD player	10	5	1	2	5	5	1	3
Mobile phone	12	3	1	6	9	1	1	7

Physical Assets
In general physical asset ownership patterns are similar in the two survey sites. Assets and facilities owned include houses, means of transport (bicycle, motor-cycle, and car) and electrical appliances among other things. One difference between the two sites in terms of asset ownership is that no survey respondent owned a motor-cycle in the Dzorwulu site while three households own them in the Roman Ridge site. There is also more ownership of water pumps in the Roman Ridge site for urban agricultural activities as 7 out of 10 households own water pumps compared to 5 out of 15 in the Dzorwulu site. This may be explained by the availability of piped water for urban agricultural activities in some parts of the Dzorwulu site and none in the Roman Ridge site. More information on household ownership of physical assets and access to facilities is given in Table 5.9.

Natural Assets
In terms of natural assets, average plot size at the Dzorwulu and Roman Ridge sites was .07 hectare (as discussed in section 3.1). The survey respondents were asked to indicate if they cultivated plots elsewhere. Only 3 respondents (2 in the Dzorwulu site and 1 in the Roman Ridge site) reported that they cultivate plots elsewhere. One of the respondents in the Dzorwulu site indicated he also cultivates a plot of 25 beds at the Plant Pool area[5]. The other respondent at the Dzorwulu site cultivates a plot 0.6 ha at Kwabenya (a suburb of Accra). The respondent in the Roman Ridge site who cultivates another plot elsewhere reported that he has 1.8 ha of land under onions at Lashibi. Except one case in the Dzorwulu site, none of the households in the survey sample owns a home garden.

Ownership of animals among the survey households is not a common practice. A number of respondents explained that they live in rented accommodation and that the environment does not allow them to keep animals. This was confirmed by examining the number of animal owning households who live in their own houses and those in rented accommodation. Animals owned by households from the survey data include chickens, guinea-fowls, cats, dogs, goats, sheep, cattle and rabbits. Table 5.10 provides information on the number of households that own each type of animal, the mean number of animals owned and the proportion of animal owning household who live in their own houses.

Table 5.10: Ownership of animals by vegetable farming households

Type of animal	No. of households owning animal	Mean No. owned	% of households in their own house
Dzorwulu site (n = 15)			
Chickens	6	27	67
Guinea-fowl	1	15	100
Rabbit	1	2	100
Cat	1	2	100
Dog	-	-	-
Goat	2	7	100
Sheep	1	5	100
Cattle	2	7	100

[5] The Plant Pool area is a stretch of land to the west of the Dzorwulu site and separated from the latter by the Olusengu Obasanjo way

Type of animal	No. of households owning animal	Mean No. owned	% of households in their own house
Roman Ridge site (n = 10)			
Chickens	4	14	75
Guinea-fowl	-	-	-
Rabbit	-	-	-
Cat	1	11	0
Dog	1	1	0
Goat	1	1	100
Sheep	-	-	-
Cattle	-	-	-

Social Assets

Membership of community organisations/groups and relationships among farmers constitute social assets. In the Dzorwulu site, 14 out of 15 respondents reported that they or members of their households belong to community organisations/groups. The corresponding figures for the Roman Ridge site are 4 out of 10. Information on membership of community organisations/groups for the survey respondents is presented in Table 5.11.

Table 5.11: Membership of community organisations/groups

Community organisation/group	Frequency (number of respondents)	
	Dzorwulu site	**Roman Ridge site**
Not applicable (does not belong to any group)	1	7
Dzorwulu Vegetable Farmers Association	12	-
La Farmers Association	1	-
Tarizona Welfare Association	1	-
Busanga Association	2	2
Agupa Welfare Association	1	-
Kanda Young men Association	-	1

Three of the respondents in the Dzorwulu site reported that their wives belong to organised groups. One of them indicated his wife belongs to the Busanga Association, while the other two said they did not know the names of the groups to which their wives belonged. In the roman Ridge site another three respondents said their wives belong to the following organised groups: Busanga Association (1), Moslem Women's Association (1) and Tomato traders Association (1).

A number of the survey respondents in the Dzorwulu site hold positions in organised groups compared to the Roman ridge site where only one respondent indicated that he is the treasurer of the group he belongs to. Another respondent from the Roman Ridge site indicated that his wife is the publicity secretary of the Moslem Women's Association to which she belongs. Six respondents in the Dzorwulu site hold positions in the groups they belong to (3 of them hold positions in the Dzorwulu vegetable farmers Association).

In general, relationships among farmers are good. Thirteen farmers out of fifteen in the Dzorwulu site described their relationship with other farmers in the site as cordial. The other two farmers in the survey sample said they had good relationships with the

other farmers. The situation is however different in the Roman ridge site. Six out of ten farmers reported they have cordial relationships with other farmers in the site. One respondent noted that there is a lot of envy among the farmers while another said there are selfish attitudes among them. The remaining two respondents in this site reported that relationships are not too bad, hereby signalling that all may not be well.

In terms of trust and sharing of information, two respondents in the Dzorwulu site reported that there is trust among farmers but that information is not shared freely. The remaining thirteen respondents said there is trust and willingness to share information among the farmers. This would have a positive effect on capacity development of farmers in the site. In the Roman Ridge site, six out of ten respondents said there is trust and willingness to share information. The other four respondents had varying opinions on the situation. One respondent was emphatic that there is no trust among farmers and people do not share information freely with others. Another respondent indicated that there is not much trust among farmers while two others said information is not shared freely or people share information only with their close friends. The situation of trust and willingness to share information would have a negative effect on any capacity development efforts in the Roman Ridge site.

Human Assets

Health, education and skills training are important aspects of human capital assets. On this basis, the survey established household access to health services, family health status and participation of survey respondents in skills training in the past. Households are using the National Health Insurance (NHI) scheme to access health services for their members. Responses from the individual interviews revealed that one third of households in the Dzorwulu site have NHI for all members of the household. Another one third have insurance for some members of the household (19 – 75% of members of households in this category have NHI). The remaining one third of households in this site does not have NHI for any member of household.

In the Roman Ridge site only one household has NHI for all members of the household. Another three households have NHI for some members of the household (12.5 – 75% of members). The remaining 6 households in the in this site do not have NHI for any member of the household. On the average 48% of household members have NHI in the Dzorwulu site compared to 24% in the Roman Ridge site. Respondents cited cash constraints as the main reason they either do not have NHI for some members of the household or for any member. Currently it costs GH¢20 per household member aged 18 years and above and GH¢2 per member less than 18 years old.

The family health status of the survey respondents is generally good. The majority of the respondents indicated that they have quite a healthy family. Other responses about family health status were: good health, not too bad, quite okay. Family health status is similar in both survey sites. The family health status of the survey sample is summarized in Table 5.12

Table 5.12: Family health status of survey households

Family health status	Frequency (number of respondents)	
	Dzorwulu site	**Roman Ridge site**
Quite a healthy family	9	4
Child/son falls ill occasionally	2	-
Good health	3	3
Not too bad	-	2
Quite okay	1	1
Total	15	10

The educational status of the survey respondents and their children have implications for socio-economic opportunities open to the household in the present as well as opportunities in the future. The survey revealed that most vegetable farmers have some form of education. In general farmers in the Dzorwulu site have higher levels of education compared to the Roman Ridge site. Although some of the survey respondents indicated that they are illiterate, others have received formal or non-formal education such as Koranic education. The highest level of education attained by any respondent and confirmed in the focus group discussion is secondary level. The relatively low level of education of the survey respondents limits the range of opportunities that may be open to them. The educational level of the survey respondents is given in Table 5.13.

There is a conscious effort by vegetable farmers to send their children to school. However, in two instances in each site a child of school going age was out of school. In one of the cases in the Dzorwulu site, the survey respondent explained that his son had to stay out of school after completing the Junior Secondary School for lack of cash to let him continue. He added that every effort was being made to put the boy back in school. There are also equal opportunities for both male and female children of school going age. Households that had both male and female children reported that both were attending school.

Table 5.13: Educational level of vegetable farmers in Dzorwulu and Roman Ridge

Educational level	**Dzorwulu site, n = 15**		**Roman Ridge site, n = 10**	
	Number of respondents	Percentage	Number of respondents	Percentage
Koranic/Islamic	1	7	3	30
Primary only	5	33	0	0
Junior Secondary	2	13	2	20
Middle school	3	20	1	10
Secondary/SSS	1	7	0	0
Illiterate	3	20	4	40

As far as skills training is concerned, a good number of the survey respondents have participated in skills training during the last 10 years. Thirteen respondents out of fifteen in the Dzorwulu site and six out of ten in the Roman Ridge sites recalled that they participated in at least one skills training activity in the last ten years. All the

respondents who participated in skills training cited an Integrated Pest Management (IPM) that was conducted for them in the form of a Farmer Field School (FFS).

Financial Assets

Financial assets of the survey households are influenced by any savings they can mobilise as well as their indebtedness. Over 70% of the households in the Dzorwulu site reported that they have savings (10 out of 15 respondents). Seven of the ten households with savings said they have no debts while the other three indicated they have debts as well as the savings. The other five respondents in the sample stated that they neither have savings nor debts. A similar situation of savings and debts was observed for the Roman Ridge site. In this site 6 out of 10 households have savings and no debts whiles 2 out of 10 households have savings as well as debts. The remaining 2 households reported they had no savings and no debts. The financial situation of households regarding savings and debts is summarized in Table 5.14.

Table 5.14: Financial situation of survey households

Financial situation of households	Frequency (number of households)	
	Dzorwulu site	**Roman Ridge site**
Has no savings and no debts	5	2
Has savings and no debts	7	6
Has savings and debts	3	2
Total	15	10

Other sources of financial assets include pensions and remittances. Three household in each site indicated they receive remittances or pensions (2 receive remittances and 1 receives a pension in Dzorwulu site while 2 receive pension and 1 receives remittances in the Roman Ridge site). All the remittances come from relatives abroad.

5.5 Economic contribution of urban agriculture to household livelihoods

An analysis of livelihood activities of vegetable farming households suggests vegetable farming is the most important economic activity among the survey households. Six respondents (5 in the Dzorwulu site and 1 in the Roman Ridge site) indicated that vegetable farming is the sole economic activity of their respective households. The remaining respondents all have vegetable farming featuring among the three most important economic activities of the household. 14 out of 15 (93.3%) respondents reported that vegetable production is their main occupation. The focus group discussions confirmed this pattern. There are other occupations that combine with vegetable production. These other economic activities considered important for the survey households include salary work, trading and sale of cooked food. Details of the three most important economic activities of households are given in Table 5.15.

Among the livelihood activities in the survey sites (in addition to vegetable farming), that make use of water are the sale of cooked food and sale of pipe-born water. Sources of water for vegetable farming have been discussed in section 3.2.

Table 5.15: Most import economic activities of survey households

Most important economic activities	Frequency (number of households)	
	Dzorwulu site	**Roman Ridge site**
Vegetable farming	5	1
Vegetable farming, salary work****	2	3
Vegetable farming, sale of cooked food	1	1
Vegetable farming, trading	1	1
Vegetable farming, sale of pipe water	-	1
Vegetable farming, sales agent	-	1
Vegetable farming, sale of fertiliser	1	-
Vegetable farming, Vegetable trading	1	-
Vegetable farming, hiring out PA system	1	-
Vegetable farming, rearing cattle	1	-
Vegetable farming, dress making, trading	1	-
Vegetable farming, salary work, running corn mill	1	-
Vegetable farming, building contract works, trading	-	1
Vegetable farming, salary work, trading	-	1
Total	15	10

The importance of vegetable farming among the economic activities of the households was emphasised by the proportion of household income that comes from vegetable production. Even those respondents who could not give an exact figure for the proportion of household income that comes from vegetable farming, noted that a greater proportion of the income comes from vegetable farming.

On average, 81.8% of household income comes from vegetable farming in the Dzorwulu site. The corresponding figure for the Roman Ridge site was 68%. Table 5.16 gives the distribution of the proportion of household income that comes from vegetable production in the survey sites.

Table 5.16: Proportion of household income from vegetable production

Proportion of household income from vegetables	**Dzorwulu site**		**Roman Ridge site**	
	Frequency	Percentage	Frequency	Percentage
Less than 40%	0	0	1	10
40 – 59%	3	20	0	0
60 – 79%	1	7	3	30
80 – 100%	10	66	2	20
Greater than other sources	1	7	4	40
Total	15	100	10	100

Income from vegetable farming may be put to several uses. Farmers in individual interviews identified eight main uses, listed as follows:

1. School fees
2. Staple food stuff
3. Medical expenses
4. Electricity bills
5. Water bills
6. Rent for residential accommodation

7. Clothing
8. Savings

The survey respondents were unanimous that it is the head of household who makes the decisions on how income from urban agricultural activities should be used. Some respondents acknowledged that in certain cases other members of the household are consulted on the use of urban agricultural income.

5.6 Perceived livelihood benefits from urban agriculture

Farmers perceive certain benefits from urban agriculture (vegetable production). Apart from cash benefits, the focus group discussion mentioned social benefits, source of employment and better nutrition as the other benefits derived from vegetable production. Social benefits include support received during bereavement, 'outdooring' (naming ceremony for a newborn baby) and wedding ceremonies among other social activities. It is important to note that social benefits are enjoyed only by members of the Dzorwulu cooperative vegetable farmers' Society. However, one has to be involved in urban agriculture in order to qualify to be a member of the Society. It is in this sense that the social benefits are seen by the farmers as coming from urban agriculture. As a source of employment, the group members noted that vegetable production is more remunerative than any job any of its members could get given their backgrounds.

Involvement in UA seems to provide a level of food security for the participating households. From the individual interviews, a significant proportion of household vegetable consumption comes from the farmers' own plots. The proportion of household vegetable consumption from own plots in the Dzorwulu site ranges from 80 to 100% with a mean of 95.3%. In the Roman Ridge site the range is 75 to 100% with a mean of 95%. The farmers also swap vegetable products and this enhances their vegetable consumption. When asked whether there were times when they had difficulty securing food for their family only one respondent out of 25 individuals interviewed said this was a frequent occurrence. Table 5.17 gives the responses to this question showing that the majority answered 'rarely' or 'never' to this question.

Table 5.17: Household Food security:

Are there times when you have difficulty securing food for your family?	**Dzorwulu site**	**Roman Ridge Site**	**Total**
Frequently	1	0	1
Occasionally	4	2	6
Rarely	7	4	11
Never	3	4	7
	15	**10**	**25**

A perception of the group about the wealth status of its members is that they are not doing badly compared to non-vegetable farmers in their environment. The group also noted that others may be financially better than its members, but they and their families are healthier because of better nutrition from consumption of vegetables. The farmers mentioned this healthier status from vegetable consumption without being prompted to do so.

Individual respondents ranked their level of wealth and poverty in relation to other households in their neighbourhood. Table 5.18 shows that only 2 placed themselves below average, while 7 out of 25 considered they were better off than average.

Table 5.18 Comparative self ranking in terms of wealth or poverty

How would you rank yourself in relation to other households in your neighbourhood?	Dzorwulu site	Roman Ridge Site	Total
Better off than average	4	3	7
Slightly above average	2	1	3
Average	8	5	13
Slightly below average	1	1	2
Worse off than average	0		0
	15	**10**	**25**

Perceptions of changes in household economic situation over the last 10 years were very variable. More people at Dzorwulu saw improvements in comparison to those at the Roman Ridge site as shown in table 5.19. Positive aspects mentioned were an increase in farm income from improved vegetable prices and demand, better living conditions, improved health and food security, while negative aspects included the high fertiliser prices and reduced demand and income and the high cost of living resulting in a lower standard of living.

Table 5.19 Changes in household economic situation over last 10 years

	Dzorwulu site	Roman Ridge Site	Total
A big improvement	4		4
Slightly improved	3	2	5
About the same	2	5	7
Slightly worse	4	1	5
Much worse	2	2	4
	15	**10**	**25**

The UA group members are convinced that urban agriculture can be a pathway out of poverty but were quick to add that larger areas of land would be required to earn an income that is substantial enough to take people out of poverty. Land is a limiting factor for poverty reduction through urban agriculture. In a follow up discussion, the farmers indicated that a minimum of 0.4 ha of land for urban agriculture would be required per household to get them out of poverty.

A majority of farmers would like to improve their agricultural activities in future. The individual interview results indicate that 87% of the survey respondents in the Dzorwulu site have plans to improve their activities. The corresponding figure in the Roman Ridge site is 60%. Planned improvements are mainly in terms of expansion of cultivated land area. The intended improvements are improvement in quality of produce, intensification of land use (more use of purchased inputs) and diversification of activities to include livestock rearing or staple food crops production. Table 5.20 gives the frequency distribution of planned improvements in agricultural activities of the survey households.

Table 5.20: Planned improvements in agricultural activities of households

Planned improvement	Frequency (number of respondents)	
	Dzorwulu site	**Roman Ridge site**
No response	2	4
Area expansion	10	4
Quality vegetable produce	1	-
Intensification (use more purchased inputs)	1	1
Diversify into livestock	1	-
Diversify into staple crops	-	1
Use mechanised irrigation methods	1	-

There are however certain constraints to planned improvements in agricultural activities as indicated by the farmers. There is insufficient land for expansion of the cultivated area. Besides the farmers explained that they do not have adequate cash to purchase inputs/equipments and hire labour for the increased area to be cultivated.

5.7 Inclusiveness in the Dzorwulu Vegetable Farmers' Cooperative Society

Formation of the Dzorwulu Vegetable Farmers Society was motivated by the need for mutual support (social and financial). Financial support here is limited to provision of relief to a member of the Society in time of difficulty such as bereavement and does not include support for vegetable production. This support is mobilised from contributions from individual members of the Society. There are no written down membership criteria and eligibility considered in admitting members to the group. However, willingness to join and commitment to group activities are necessary criteria. In general any person farming in the site qualifies to join the group.

Current membership of the group stands at 26 (comprising 3 women and 23 men). In total there are 31 people farming in the site. The age range for members of the group was given as 22 – 70 years from information obtained during the focus group discussion and individual interviews. One respondent in the individual interviews, who is not a member of the Society, stated that he was a member until when he opted out because of old age (he was aged 70 years). Another respondent used to offer a helping hand to one of the members of the Society until recently when he was give a portion of land to cultivate for himself. This may explain why he is not a member of the Society. As stated in section 6.1, membership of the society is voluntary. However the reasons for the non-membership of the remaining 3 farmers were not probed during the interviews.

There are 5 ethnic groups represented in the Society, viz. Busanga, Ewe, Ga, Fanti and Krobo. As many as 22 members are Busanga while the other ethnicities have one member each. In the survey sample 17 out of 25 respondents were Busanga (8 out of 15 in the Dzorwulu site and 9 out of 10 in the Roman Ridge site). The Busanga originally come from the Bawku area in the Upper East region of Ghana, the Ewe from the Volta region while the Fante and Krobo originally come from the Central and Eastern regions respectively. Ga is the only local ethnic group found in the Association. There are language differences among these ethnic groups. Each ethnic

group speaks a completely different language. Observations during the field work revealed that Hausa and Twi languages are commonly used for communication among the ethnic groups. In terms of religion, the 22 Busanga members are all Moslem while the other 4 members are Christian. Though there are many Moslems in the group, only few attended the Koranic School (1 out of 8 in the survey sample). Others went to regular school (4 out of 8 in the survey sample).

5.8 Interaction of farmer groups with surrounding community/city authorities

From the focus group discussions it was established that members of the Dzorwulu farmers group are also members of identifiable groups in the respective communities in which they live. The groups are mainly social, religious and sporting groups. Although there is no organised farmers group in the Roman Ridge site it was established that farmers in this site belong to identifiable groups in the communities in which they live. It could not be established if the group is represented in social gatherings in the community. However the group is represented in official gatherings. The group noted that it sends representatives to meetings at the Accra Metropolitan Assembly (AMA) (when issues of interest to them are being discussed), Ministry of food and Agriculture (MOFA) and the International Water management Institute (IWMI).Arrangements for representation of the group at these meetings are informal.. Personal observations during the data collection revealed that people from the local community sometimes come to buy vegetables from the farmers in the field. This suggests that the group is known for its vegetable production activities by the local community, especially that these activities are visible.

The group reported that it sometimes meets with city authorities and other organisations to discuss their vegetable production activities. They stated that the relevant organisation would normally invite the group to a meeting when issues to be discussed affect the group and its contribution is useful in addressing the issues. In such cases the group then sends representatives to the meeting. There has been no instance in which the group initiated any meeting between it and any organisation to discuss their vegetable production activities. It was recalled that in 2005 there was a concern for the quality of water used for vegetable production in the area. The press made so many negative comments about the quality of water in the area that an official from AMA and staff of MOFA visited the area to ascertain things for themselves. Vegetable production activities were not interrupted following this visit, the group intimated.

In terms of consultations between city authorities and the farmers on policy about urban agriculture the group reported that there have been some consultations and that AMA was currently formulating a policy to be made known to farmers later. There have been instances in which the group was represented in planning meetings with city authorities. It was recalled that two years ago a forum was organised by AMA to discuss the implications of widening the stream. The vegetable farmers group was represented at that meeting. The group is normally represented members of the executive committee at such meetings. The representatives have the right to reply or make contributions to discussions on behalf of the group. People who own houses along the stream were also represented at the meeting. The main issues discussed included farmers whose plots would be affected by the widening of the stream and how they would be compensated; compensation for owners of houses that would be affected by the proposed widening of the stream.

The group feels it lacks the social recognition to make its views or situation known to the relevant organisations. One speaker had this to say during the focus group discussion, "People want to see you well dressed and sporting a big car before they listen to you or take you seriously. Unfortunately we do not have these attributes". The group would however do everything within its capacity to oppose any activity that threatens its activities in the area. It was recalled that at one time (around 1995) AMA asked the farmers to stop producing vegetables using the stream. The then Chairman of the group (Alhaji Iddrisu Sandau) faced up to the task in telling AMA they could not stop as many people depended on the stream for vegetable production as their main source of livelihood. The statement added that the Chairman argued that the solution lay in AMA taking steps to stop the pollution activities of people living along the stream. This at least brought the eviction attempt to a rest.

In terms of networking, the Dzorwulu farmers' group does not have linkages with other farmer organisations. However the group interacts with Universities (i.e. University of Ghana and KNUST), research organisations such as IWMI and governmental institutions, such as MOFA and AMA. Valuable information on agriculture practices and policies is made known to the group by mainly MOFA and to some extent by IWMI. MOFA, through its Extension Officers provides information to the farmers on water quality issues and pest control. The input dealers such as DEZINGOF and AGRIMAT also provide information on the proper use of agricultural inputs.

6 Organisational capacity strengthening of groups

6.1 Structural and organisational analysis of groups

In 1985, a Greater Accra Vegetable Farmers Association was formed as one big entity with members comprising vegetable farmers at different catchment areas in Accra. However, with time it became difficult to effectively organize meetings and carry out group activities; so on the initiative of the extension officer from Ministry of Food and Agriculture (MOFA) the groups were decentralised (i.e. the larger group was split into smaller groups). Thus in 2001, the Dzorwulu and Roman Ridge farmers groups were formed. The following two institutions, Village Infrastructure Project and Department of Co-operatives were then mandated by MOFA to provide training and build capacity of the farmers in group formation and leadership roles. Later, the group also had training in the area of strengthening the existing group which was provided by the Farmer Based Organisation under MOFA.

Unfortunately, the Roman Ridge group has collapsed completely, became non-functional about one and half years after its formation due to misunderstanding among the members as a result of refusal of some members to pay dues. They are, however, now making some efforts to form the group again, and membership will not be compulsory, but only open to those who want to be a member.

The Dzorwulu farmers group however is still functional. The name of the group is Dzorwulu Cooperative Vegetable Farmers Society. The total number of members is 26 including 3 women. This number has remained the same since the formation of the group; however some of the old members who were no longer farming in the area have been replaced by new members who are now farming on their plots. It should be noted that not all the farmers at Dzorwulu are members of the group because membership is done at individual's free will. There are 31 farmers altogether at the site out of which 5 are not members of the group. The constitution of the group was prepared by the members and was modified and approved by the Department of Co-operatives. The vision and objective of the group is to work as a united and strong body in order to share ideas, solve problems together and help one another to improve the farming activities and livelihood of members. To be a member of the group, one has to be farming within the catchment area and has to pay a registration (or an entrance) fee of Two Ghana Cedis (GH¢ 2).

There are five executive positions which are Chairman, Vice Chairman, Secretary, Treasurer and Organiser. The executives of the Dzorwulu Cooperative Vegetable Farmers Society are elected by voting every two years. An executive member can only serve a maximum of two terms after which he/she is no longer eligible to contest for a position.

The chairman is responsible for organisation and supervision of activities of the other executives and making sure that everything is going on well. He organises meetings and gives out assignments to members of the group, listen to members' grievances and find solutions to them in collaboration with other executives. The vice chairman takes control of the chairman's role in his absence.

The secretary is responsible for taking minutes at meetings, keeping records on groups' activities and meetings, and representing the group at meetings and functions to which the group was invited.

The organiser is responsible for calling members for meetings after taking an instruction from the chairman. He makes sure information reaches all members, and also does other assignments such as representing the group at meetings elsewhere.

Group meetings are organised and attended once in a month; however the executives meet every fortnight. Activities to be undertaken are planned during meetings. Some of the activities undertaken by the group include:

- Solving land disputes among members
- Contribution by members financially or in kind to support a colleague member during wedding, child naming ceremony, bereavement, etc
- Communal activities within the farming area. Some such activities undertaken were clearing of footpaths, building of bathing, resting and worship places for members, and construction of a wooden bridge over a drain to allow passage of people in the surrounding area

6.2 Management and decision making

There is a problem in regards to payment of monthly due by members. Every member of the group is obligated by the constitution to pay a monthly due of GH¢ 1. However many members are in arrears and this situation is not helping the group. The inadequate contribution by members is denying the group the ability to support members financially in the form of loans to help in their farming activities. It should be noted that contribution by members towards development projects (e.g. construction of bathroom and place of worship), and towards wedding, child naming ceremony, funeral, etc is very good and recommendable. The problem only arises when it comes to payment of monthly membership dues.

The group has a bank account into which dues paid by members is deposited. Some of the members who do not have their own bank accounts also bring their money to be deposited in the group's bank account for safe keeping. The group's money is used to buy farming inputs. For example, the group has purchased a number of sprayers which are used by all members. There is a committee which is responsible for purchasing, maintenance and safe keeping of common assets. The only common asset own by the group so far is the sprayers kept in the storeroom and can be used by any eligible member. Any other equipment (e.g. pumps, watering cans) are owned by the individual farmers. The decision on how the group's finances and common assets can be used is not the prerogative of the executives. Any member can raise the issue at meetings and it would be deliberated upon and a decision taken. It should be noted that since there is no operational farmers group at Roman Ridge, the farmers do not have common assets. They have individual farming equipment but they lend them to one another when the need arises.

The farmers share ideas as members of one group but production decisions, water management issues and marketing of farm produce are done on individual basis. Each member is responsible for his/her own decision and farming practices. However, some members of the group organised themselves in using piped water to irrigate their

crops and the water bill is shared among them. Furthermore, with the constraint of inadequate land space at Dzorwulu, the farmers group has taken a decision at one point in time to acquire an additional farming land at Dawhenya for irrigated farming and to expand their farming activities, but unfortunately the land was not given to them by the powers that be.

Conflict management and resolution is one of the things being carried out by the group. There are times conflicts over land use and water do arise. Any time such conflicts arise, there is a four member committee which sits on the case, makes recommendations and the case is solved. However, when understanding fails to prevail among the parties then the Extension Officer is called upon to help resolve the issue. Roman Ridge farmers were of the view that they do not have conflicts which need resolution. According to them, though there is no functioning farmers' group, they live peacefully and help each other such as lending of farming equipments to those who need them.

6.3 Economic status

The financial status of the group is weak due to the inability of some members to pay their monthly dues of GH¢ 1. According to the executives, deterrent measures were instituted as punishment for defaulters (e.g. preventing a defaulter to use common assets of the group) but such penalties are not applied. The reason being that if it should be carried out those members can decide to leave the group which is not in the interest of the group. Their aim is to maintain one strong group and implementation of such penalties will disintegrate the group. They stated that apart from the financial handicap of the group, the group is stable and will remain so for many years to come.

On the individual basis, it can be said that urban agriculture is a profitable venture. According to the farmers, they usually make a profit in the range of GH¢ 600 – 1,500 per farmer per year with a mean profit of about GH¢ 1,000 per farmer per year. Notwithstanding the instability of the market and other adverse factors such as destruction of crops due to flooding, the performance of the UA over the past 5 years is good. There is an improvement in the performance of the farming activities and profit has increased in the last 5 years. Apart from financial gains, UA is providing sustainable employment and food security to the farmers and their households. Though there is no land tenure security between the farmers and the Government which owns the land, it is believed that the land is secured and will be used for farming for many years to come. Some constraints enumerated by the farmers as militating against their farming performance are as follows:

- Inadequate land
- No access to quality water
- Pest and diseases
- Instability of the market
- No access to loan (i.e. no outside help)
- Flooding (not all rainy seasons) resulting in destruction of crops and financial loss

6.4 Capacity building needs of farmers groups

The executives of the Dzorwulu farmers group stated that the training and knowledge acquired have equipped them and they are in a position to effectively articulate and present the group's needs at any appropriate forum. Moreover, the group pointed out that additional training and capacity building are necessary to enable them improve upon their farming activities. The following capacity building needs or priorities were listed by the farmers in order of decreasing ranking:

- Refresher group training programmes to strengthen the group (Dzorwulu). Group formation training programme (Roman Ridge)
- Training regarding new and appropriate agricultural practices (e.g. appropriate pest and disease control methods)
- Training in irrigation methods and water quality management
- Training in alternative farming e.g. grasscutter and snail rearing

7 Conclusions

The farmers at both farming sites (Dzorwulu and Roman Ridge) are using wastewater extensively for irrigation. It is therefore necessary to employ low-cost on-farm water treatment options to remove pathogens while conserving nutrients for agriculture. There are three water sources in the Dzorwulu site (the stream, domestic waste water and pipe) and two in the Roman Ridge site (the stream and domestic waste water). Farmers have various strategies in managing the use of these sources of water. Shallow ponds are extensively used by the farmers to store water. The use of watering cans is the mostly used irrigation method by the farmers and to a lesser extent the use of hosepipes. In the Dzorwulu site where piped water is used for irrigation, farmers store water in the ponds for use as and when necessary. This strategy is adopted against the background that pipes are not opened all the time. Farmers who use the stream either fetch directly from the stream using watering cans (for plots close to the stream) or use pumping machines to lift the water into shallow ponds for use (for plots that are distant from the stream). The use of watering cans to fetch water from the stream is practised at both sites but pumping of water into shallow ponds is only practised at Roman Ridge site. Farmers using pumping machines at the Dzorwulu site, irrigate directly using water hoses. Farmers that use waste water either have waste water drains close to their farm plots or dug trenches to bring the water close to their plots. Waste water users are found in both sites. These farmers dig shallow ponds to impound water for irrigation where the waste water drains were not lined. Where the waste water drain was lined, the farmers used sand bags to impound the water in the drain for use.

The use of ponds as practised by the farmers creates the potential for on-farm water treatment. Modifications could be introduced to have a preliminary settling/sedimentation ponds in series with the shallow ponds to allow settling of particles. Two different scenarios are possible as illustrated below. The question is what would be the capacity of the settling ponds to achieve the desired water quality.

- **Waste water:** The already dug shallow ponds by the farmers which were connected by trenches should be used (and if necessary more added) but well protected to minimise siltation. Aquatic plants (e.g. water lettuce, duckweed) should be introduced into all ponds to enhance water purification. Larger preliminary settling ponds should be dug possibly along the unlined waste water

drains to allow particles in water to settle before the water flows through the trenches into the shallow ponds.

- **Stream:** Preliminary settling/sedimentation ponds should be dug to connect shallow ponds by trenches. At Roman Ridge, the already dug shallow ponds for storing stream water should be used and connected to the settling ponds by trenches. However, at Dzorwulu new shallow ponds should be dug. The difficulty envisaged in this scenario is that pumps will be used to lift water to fill the ponds with its attendance fuel cost. This is because the stream depth is far below the farm level. Furthermore, there is no land space for the settling ponds as almost every space is used for farming unless some farmers were willing to give out some of their land space.

Vegetables are harvested mostly by the market traders who buy the crops on the plots. Vegetables are generally not washed on the farm before sent to the market. In a few cases however, cucumber was observed (during the survey) being washed by farmers before sale (in the Roman Ridge site). The washing water could have come from the stream or waste water with implications for contamination of the produce. Traders noted that they wash vegetables at the market place using clean water. Vegetables are transported from the farm to the market in polythene bags, baskets or sacks. The traders normally transport the produce in taxis. Farmers and traders alike have the perception that the irrigation water for vegetable production is clean enough and leads to no contamination of vegetable produce. However, the domestic waste water is likely to be a source of contamination of vegetable produce. The fact that domestic wastewater is discharged into the stream implies that the stream can also be a source of contamination.

Urban agriculture is the main occupation of majority of those involved in it (over 80% of practitioners depend on it as their main source of livelihood). There is an indication that UA could be a pathway out of poverty for many city dwellers without requisite skills to compete for other jobs. However, scarcity of land is a limiting factor to the realisation of this potential. A minimum 0.4 ha would be required per household to them out of poverty through UA. Other livelihood activities of households include paid employment (unskilled labour), trading sale of cooked food. In general, income earned by the head of household is what supports the needs of the households. Income earned by other members of the household is seen as private income (especially that earned by spouses).

There is no organised farmers group at the Roman Ridge site due to the collapse of the group owing to financial impropriety and mistrust between group executives and group members. In contrast there is a functional farmers group at the Dzorwulu site. The group has a legal status by being registered with the Department of Cooperatives. Membership of the group is open to all farmers farming at the site who are willing to join and live by the norms of the group. Formation of the group was motivated by certain benefits such as conflict resolution. The group is often represented at fora discussing issues of concern to it, usually at the invitation of institutions organising such fora. This gives the group the opportunity to be heard and to contribute to discussion of issues affecting the welfare of its members. However, the group is yet to initiate any discussion with stakeholders or institutions on issues that affect its members. We recommend here that skills of the group be developed in advocacy, lobbying and negotiations.

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ANNEX 1: Checklists used for Baseline Studies at Dzorwulu area.

Module 1: On-farm water treatment options developed and implemented

The first research activity is the participatory design of on-farm water treatment options and action research to test them, together with appropriate crop management and irrigation techniques. The anticipated outputs are that the features of appropriate treatment options are identified and agreed upon and options are evaluated technically for microbial pollution reduction and nutrient recovery, and through participatory action research, for improvement in irrigation water quality and volume and for their social and economic implications. The anticipated outcomes are that contamination on vegetables is reduced. Farmers and extension workers awareness of water quality issues is increased and their technical and organisational skills in water and crop management are improved.

A. Focus group discussion with farmers

1. **Wastewater management & Irrigation practices**
   - Which water sources are used for irrigation?
   - What determines farmers' choice of water source and water use? Do farmers mix water from different sources?
   - The nature of wastewater flow (volume) throughout the year. Are there seasonal variations? Is the wastewater flow adequate all year round?
   - The physical appearance of the wastewater at different seasons of the year?
   - What type of treatment measures do farmers employ to improve the quality of the water before use.
   - What are the functions of the ponds and how are they managed?.
   - Which irrigation methods are used? Are pumps used extensively for irrigation or is it mainly by gravity flow? How much does it cost to fuel the pump during one cropping season?
   - What is the volume of water used during watering?

2. **Farm size and manure application**
   - Number of farmers in the area
   - Number of plots cultivated
   - Type of fertiliser/manure use? How often is the manure applied per crop?
   - Rate of application of fertiliser/manure
   - Would they consider using urine or excreta based fertiliser?

3. **Health and hygiene related issues**
   - Types of protection measures adopted
   - Are there any health problems YOU THINK are related to wastewater usage? What are they?
   - Do you wash produce before sale? What are the reasons for washing?
   - What is the source of water used for washing?
   - Are pesticides used? What precautions are taken?

4. Potential for improvement

- Constraints of current water management and possibilities for improvement
- What importance/ranking is given by farmers to water quality issues and to waste water treatment? Why?
- Discussion on possible water treatment options and location. Farmers' perception and willingness to accept water treatment interventions.
- Discussion of other possible interventions

B. Physical Measurements

- **Topography of the site**

The slope will be measured using the line level. This requires a spirit level with small hooks at either end, two poles (about 1.5 m each), and a string (about 2 mm in diameter) and precisely 8 metres in length.

- **Climate and Rainfall patterns**

The rainfall and temperature data will be obtained from the Accra Meteorological Department (or from available literature)

- **Capacity of existing ponds**

The capacity will be estimated by taking the ponds dimensions (length x width x depth). The total number of ponds at the site will be recorded.

- **Water pollution level & nutrient content**

Wastewater samples will be taken at various locations (i.e. from the existing ponds) and analysed in the laboratory for microbial pollution (e.g. helminth, E-coli), heavy metals (e.g. Hg, Cr, Pb, Cu), and nutrient (e.g. N, P, K).

- **Estimation of wastewater flow**

The wastewater flow (quantity) could be estimated by determining the cross-sectional area (A) and the velocity (V) of the wastewater. The velocity can be measured by placing a floating object, such as a stick or tennis ball, in the channel and recording the time it takes to travel a measured distance. The quantity is calculated as $Q = A \times V$

- **Identification of location for intended treatment plant**

Determination of most convenient sites for the intended treatment plant and its auxiliary ponds and channels through site observation and survey.

Tools and materials

- Spirit level for slope determination
- Measuring tape for taking ponds dimensions
- Sampling bottles for taking water samples
- Stop watch for recording flow time

MODULE 1: On-farm water treatment options developed and implemented

Questions for Individual Farmers

Name of farmer (with permission only): …….
Date and location of interview: ……/……/08 at ……
Interviewer: ……..

1. How long have you been farming at this site?
2. Which water source(s) do you use for irrigation? □ fresh water □ storm water □ wastewater
3. If you are using waste water what are the reasons?
   □ No access to other water
   □ Have access to other water but prefer wastewater because it is abundant and available throughout the year
   □ Have access to other water but prefer wastewater for its nutrients
   □ Other (Please describe)
4. What measures do you employ to manage water before you use it for irrigation? Explain why. □ settling ponds □ ditches/trenches □ filtration (sand bags) □ use of aquatic weeds □ other (explain)
5. Where did you get the idea to implement this on-farm water management technique?
6. How long is water left in the ponds before you use it for irrigation?
7. Have you observed any differences in the water quality from the ponds compared with the raw water from the stream?
8. Do you have any awareness or information about health risks associated with wastewater use?
9. Do you use any measures to protect yourself? □ Wear foot protection □ Protect hands □ Wash hands and feet after field work □ Other: Explain
10. Are there any health problems you experience, that YOU THINK are related to wastewater usage?
11. How many plots do you have? How many beds?
12. What are the crop types grown? What crops do you grow (seasons?)
13. What is the volume of water used during watering?
14. At which times of the day do you water your crops?
15. How long does it take to water your crops?
16. Do you pay for irrigation water? (this question applies to farmers using pipe borne water) □ Yes □ No
17. What is the basis for payment? If yes, how much
□ Per irrigation □ Per hectare irrigated □ Fixed fee
□ Monthly □ Once per season.
18. What are the irrigation methods used? E.g. hosepipe, watering can, other.
19. Do you use a pump for irrigation water? Is it owned or borrowed?
20. How much do you pay for fuel for the pump during one cropping season?
21. What type of fertiliser/manure do you use?
22. How often do you apply the fertiliser/manure per crop?

23. What is the application rate of fertiliser/manure? (we have to estimate this from the quantity of manure used per plot)
24. Does the source/type of water used make any difference to the amount of fertiliser required?
25. Do you consume your own produce? □ Yes □ No
    If yes, are there any health or other problems related to this? Explain
26. What are the sources of labour on your plots.
27. Do family members work on the plot? Specify whether men , women, children
28. For what tasks do you usually hire labour? What are the wage rates?
    - □ land preparation
    - □ planting
    - □ weeding
    - □ watering
    - □ Other Explain
29. How do you find hired workers to help on your plot (e.g. from your own community, friends, etc.)
30. What arrangements do you make for harvesting and marketing your crops?

Module 2: Improved strategies for safe vegetable handling

The second research activity is the analysis of farmers and market traders' perceptions and practices in relation to water sources, water use and contamination, to develop a better strategy and procedures for vegetable handling at the farm level which guarantees safety for the consumers (e.g. minimum water quality, processing and washing on farm, packaging, quality control etc.) Based on this, field schools will be held for farmers and market women.

The intended outputs are realistic and cost effective methods for reducing pollution at the farm site and farmers and market women trained in their use. Information materials on these methods will be produced for farmers, market traders and consumers. The outcome is safer handling of marketed produce through farmers' and market traders' use of improved practices in management of water and produce. Farmers' and market traders' awareness of safe vegetable handling is improved and their skills and organisation enhanced.

A. Focus group discussions with farmers

Marketing arrangements

1. To whom do you sell the vegetables – to wholesalers, retailers at farm gate, taken to market and sold to wholesalers or retailers, taken to market and sold retail, to customers directly, - other?
2. If you sell vegetables at the market, where is it and how far is this market from the farm?
3. What kind of arrangements do you make with traders to purchase vegetables? (e.g. agreeing to sell the crop from a specific plot; with or without harvesting etc.). Is there any variation by crop?
4. Do individual farmers or farmers' groups deal with individual traders or traders groups?
5. How do you make these linkages / identify particular markets and traders who want to buy your produce?

Current post-harvest practices

1. Who picks/harvests vegetables?
2. How are vegetables harvested, including any equipment/tools used
3. Describe what is done to the vegetables after harvesting before they are sold. [*Facilitators, note what happens to different types of vegetables*]
4. Do you do anything to add value – cleaning, grading, sorting, packaging – what influences opportunities for these?
5. Means of transport from farm to where vegetables are sold.
   [*Facilitators, probe for constraints faced in 1-5 above]*
6. Do you pay for labour for post harvest activities - much does it cost for each activity. [*Facilitators, list activities (picking, washing, packaging etc.) in turn and have farmers estimate labour cost*]

Markets, prices and incomes and what influences these

7. What is the basis for pricing your vegetables at *farm level* (weight, size, quality, area of crop etc.). How does the price vary if the trader does the harvesting?
8. What influences the negotiations with market traders over vegetable prices?
9. How stable are vegetable prices in different seasons?
10. What are the constraints you face in financing your vegetable production and how do you overcome them?
11. How much money are you able to make from your vegetable sales? *[Facilitators, let a number of farmers estimate the income they get for each vegetable they grow on per plot basis or per acre basis if they can relate plot size to an acre.*]
12. Let farmers list the factors affecting their income from vegetables production

Current perceptions of levels and sources of contamination on vegetable produce and reasons for current handling practices

13. What do you think about the cleanliness of vegetables harvested from your farm?
14. Do you think there is a problem associated with eating/cooking these vegetables without washing?[*Facilitators find out if traders consider the problem i) not very serious, ii) serious or iii) very serious*]
15. What are the causes of vegetables being unclean?
16. Do you take steps to ensure the cleanliness of vegetables in the way you handle them at or after harvest? How? [*e.g. washing/water source*] and why?
17. Do customers buying vegetables ask about the source of irrigation water used for their produce? Would they pay more for clean produce?
18. Is there a price differential between produce irrigated with waste water and produce irrigated with clean water for the same crop type? Give examples.
19. Current sources and types of farmers' information and advice on vegetable contamination and on regulations concerning vegetable marketing.

Participants: **Date** **Location** **Interviewer**

B. Focus group discussions with market traders

Marketing arrangements

1. What kind of arrangements do you make with farmers to purchase vegetables? (e.g. agreeing to purchase the crop from a specific plot; with or without harvesting etc.). Is there any variation by crop?
2. Do individual traders or traders groups deal with individual farmers or farmers groups?
3. How do you make these linkages / identify particular locations and farmers with produce to sell?
4. Where do you sell the vegetables and how far is this market from the farm?
5. To whom do you sell the vegetables – to retailers, to customers directly, - other?

Current post-harvest practices

6. How are vegetables harvested, including any equipment/tools used?
7. Describe what is done to the vegetables after harvesting before they are sold. [*Facilitators, note what happens to different types of vegetables*]
8. Do you do anything to add value – cleaning, grading, sorting, packaging – what influences opportunities for these?
9. Means of transport from farm to where vegetables are sold. *[Facilitators, probe for constraints faced in 1-4 above]*

Markets, prices and incomes and what influences these

10. What is the basis for pricing vegetables at *farm level* (weight, size, quality, area of crop etc.). How is the cost of labour factored in if you do the harvesting?
11. What influences your pricing of the vegetables at the *market*?
12. How stable are vegetable market prices in different seasons?
13. What are the constraints you face in financing your vegetable trade and how do you overcome them?
14. How much money are you able to make from your vegetable sales? *[Facilitators, ask traders to estimate the income they get for each vegetable they harvest and sell on per plot basis or per sack or other container*]
15. What are the factors affecting your income from vegetables marketing?

Current perceptions of contamination on vegetable produce and reasons for current handling practices

16. What do you think about the cleanliness of vegetables harvested from this farm?
17. Do you think there is a problem associated with eating/cooking these vegetables without washing?[*Facilitators find out if traders consider the problem i) not very serious, ii) serious or iii) very serious*]
18. What are the causes of vegetables being unclean?
19. Do you take steps to ensure the cleanliness of vegetables in the way you handle them after harvest? How? [*e.g. washing/water source*] and why?
20. Do customers buying vegetables ask about the source of irrigation water used for their produce? Would they pay more for clean produce?
21. Is there any current price differential between wastewater produce and clean water produce for the same crop type? Give examples.
22. From where do you get information and advice on vegetable contamination and on regulations concerning vegetable marketing.

Participants: Date Location Interviewer

Module 3: Inclusion and access to urban agriculture opportunities

This activity area considers two levels – access to membership of UA groups, and access and entitlement of the UA groups to land and their degree of security/vulnerability; rules and eligibility of membership of UA groups - gender, ethnicity, financial ability and social linkages; relationships of UA groups with city authorities, tenure arrangements and processes of representation and communication.

The output will be practical integration of inclusivity and eligibility principles in membership of UA groups, greater awareness of land rights. The outcomes will be strategies to widen access to UA opportunities including access to water and improved water treatement, and for facilitating contact between farmers groups and institutional bodies linked to legislation.

A. Focus Group Discussion with Group Members

1) Social inclusion *(Membership information needed for Roman Ridge 2, updating for Dzorwulu Farmers' Association.*

1. What made you come together as a vegetable producers group?
2. What are the membership criteria and eligibility considered in admitting members to the group?
3. What is the current composition of UA groups - age, gender, ethnic background, religion, other differences. Who is not included? Who would find it difficult to be a member?
4. What is the range of educational levels of members

2) Perceived livelihoods benefits from UA (including non monetary benefits)

5. What do you gain from vegetable production? [*Facilitators, probe for benefits other than cash (e.g. improved nutrition from own consumption]*
6. What do you use the money you get from vegetable production for?
7. What proportion of the group have another occupation in addition to vegetable production.
8. In terms of wealth or poverty – how would you rank yourselves as urban farmers in relation to other households in your neighbourhood? Can urban agriculture be a pathway out of poverty?

3) Patterns of gender related involvement in UA and perceived reasons

9. Gender disaggregated data on plot ownership
10. Gender relations in UA activities. [*Facilitators, list activities and ask who takes part in each activity in terms of gender*]
11. Reason for observed pattern of gender involvement outlined above. *(already covered for DFA)*

4) Plot acquisition, waiting lists and subletting processes

12. Describe the process a member has to go through in order to acquire a plot for vegetable cultivation. (e.g. allocated by the committee, allocated by another member, inherited etc).
13. What fees/costs are involved in plot acquisition?
14. How long does it take for a member to get a plot after the initial request is made?
15. Number of people currently on waiting list (by gender)
16. What are the rules governing the use of a plot acquired. Under what circumstances can land that has been acquired be taken away
17. For what period is the member entitled to use the plot?
18. Are there informal or formal subletting processes? What are the arrangements, including time frame, costs
19. Can plots be inherited or purchased or sold? Do members pay rent for their plot – either formally or informally?

5) Past and current land tenure and access arrangements

20. Who has authority to allocate land in this area? Who owns the land?
21. What do you have to do/pay to guarantee use rights over the land each year?

22. Have these practices changed over time? (e.g. over the last 20 years)
23. What arrangement does the group have with the landowner. What agreements and written documentation exist? Is there tenure security? What could change this?

6) Interaction between group and surrounding communities

24. Are members of this group also members of other identifiable groups in the community? Specify other groups
25. Is this group represented at social gatherings in the community?
26. How is the group and UA activities perceived by the local community?

7) Interaction of farmers' organisations with city authorities and planners. Degree of representation and inclusion in city planning processes

27. Do you meet city authorities to discuss issues related to your vegetable activities?
28. Who initiates such meetings
29. Have city authorities visited the site? Who and how often?
30. Has there been any consultation with the group on policy about UA.
31. Describe any instances where the group has been represented in e.g. policy related meetings, planning workshops or other fora with city stakeholders etc.
32. Views on this experience and ability to make their voices heard? What are the constraints? What could improve this?

Tools and materials

Flip charts and markers
Note books

Module 3: Inclusion and access to urban agriculture opportunities
Individual household questions

Profile of UA participants and their households.

1. Name of household head: ……..
2. Age: …….. 3. Sex: ……..
4. Educational level: …….. 5. Main occupation: …….
6. Ethnicity:…… …….
7. Number of household members; Total: …….
8. Members who work on vegetable farm: male:…….. female:……..
9. Number of children: In school male:…female: ..Out of school: male….female:…..
10. Where do you live? ……
11. How many years have you been in Accra: ……..……...
12. Place of origin: ……
13. .How many years have you been cultivating at Dzorwulu …….

Access to assets

Natural

14. How did you acquire plot(s) for vegetable cultivation. (e.g. through a relative/friend, allocated by the committee, allocated by another member, inherited etc).
15. What fees/costs were involved?
16. Do you pay rent for the plot – either formally or informally?
17. Do you share the plot(s)?
18. Do you hire labour on the plot (s).
19. Do you cultivate other land elsewhere – give details.
20. Does your household have a home garden
21. Does your household have any animals. Specify.
22. What proportion of your household vegetable consumption is from your own plot?

Social

23. Do you or any family member, belong to a community organisation or any group? E.g. farmers' group, savings group, social, religious, cultural, sports, extended family kin group etc.
24. Do you hold any positions of responsibility, e.g. committee member in any group?
25. How would you describe your relationship with your fellow farmers?
26. Do people trust each other and are they willing to share ideas and information.

Physical

27. Does the household/ any member of your household own the following

Physical Assets	**No.**
House	
Piped water to the house	
Flush toilet	
Mains electricity	
Car	
Bicycle	
Motor bike	
Generator	
Water Pump	
Sprayer	

Watch/clock	
Sewing machine	
Electric iron	
Refrigerator	
Television	
Radio/tape recorder	
Radio	
Video deck	
DVD player	
Mobile phone	
Others (specify)	

Human

28. Do you have health insurance for every member of your household? yes no
29. Have you received any skills training in the last 10 years – formal or informal
30. What is your family's health status?

Financial

31. Do you have any savings, any debts?
32. What is your main source of finance for your agricultural activities
33. Do you receive a pension or remittances from family members elsewhere?

FILL IN LIVELIHOOD ACTIVITIES SHEET

34. What are the three most important economic activities in the table for supporting the household:
35. What % of your total household income comes from agriculture?
36. What is the money you get from vegetable production used for?
37. Who makes the decisions within the household on how to use this money.

Water use

38. Which of the livelihood activities in the table above makes use of water?
39. What is the source of water of livelihood activities of your household?
40. Amount paid per month for water for livelihood activities:
41. Amount paid per month for water for household domestic use…

General well being

42. Are there times when you have difficulty securing food for your family?
    Frequently/ Occasionally/Rarely/Never. What are the reasons?
43. In terms of wealth or poverty – how would you rank yourselves in relation to other households in your neighbourhood? Better off than average/slightly above average/ average/ slightly below average/worse off than average
44. How has your household economic situation changed over the last 10 years;
    A big improvement/Slightly improved/About the same/Slightly worse/Much worse
45. In what ways has it changed and what are the reasons?
46. Do you have plans to improve your agricultural activities in future? In what ways? What are the main current constraints?

Date and location of interview ……
Interviewer ……..

Livelihood activities of household

List all members of your household and what they do*

Member ID	Relationship to household head	Age	Sex	Main occupation	Average Income/mnth	Other occupations	Average Income/mnth
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Enumerator, probe in order to, list all economic activities of each household member

Module 4: Organisational capacity strengthening

This activity will explore the current structure and capacity of farmers' organisations and will support and facilitate their capacity strengthening including their management capacity of the water treatment interventions.

The output will be an understanding of the organisational practices and values of farmers' groups, and strategies agreed to enhance solidarity, leadership, management and joint decision making and the practical and financial management of water treatment innovations. The outcome will be more effective UA group organisation and management and. capacity of the group to represent itself in policy fora.

Focus group discussions with a) executive committee/group leaders b) a sample of members.

1) **Structural and organisational analysis of UA groups*** *(NB This is needed for Roman Ridge II, not the Dzorwulu Farmers Association, unless briefly to update).*

- Origin and history of the group, growth and stability of membership
- Group vision, objectives, organisational status - formal status/registration
- Describe the leadership roles, group constitution and group management. How are leaders chosen?
- Functioning - regularity of meetings, planning processes, group activities, support to members and mutual help.
- Group record keeping

2) **Management and decision making**

- Financial management – members' financial contributions; membership shares.
- Group savings and arrangements for accessing; sources of finance and credit – group or individual.
- Examples of joint action - inputs purchase, production decisions, marketing, etc. Examples of joint investments and pooling. Any previous investment in irrigation infrastructure or other site improvements?
- How are common assets –managed and shared? e.g. land, equipment (pumps, sprayers, watering cans etc.)
- Who makes the decisions on the use of group finances and use of common assets
- Water management, water costs and payment arrangements?
- Conflicts and conflict resolution. Any conflicts over land or water use? How resolved?
- how would the group organise and manage new technologies for improving water quality

3) Economic status

- Group's current financial status
- Views on the profitability of urban agriculture; average and range of net margins of members per year. Performance over the last 5 years
- Views on the stability and economic sustainability of the group?

4) Networks

- Linkages with other farmer organisations.
- Interaction with service and research organisations.
- Sources of information on agriculture, technologies, finance, markets and related policies.

5) Capacity building needs of UA groups

- Past initiatives to build skills and management capacity of group members Training received and sources.
- Capacity for articulation and presentation of group needs. Constraints.
- Priority capacity building needs.

Tools and materials

- **Focus group discussion** using checklist as a guide. Points recorded on flip chart and as detailed verbatim notes taken as possible.
- A participatory **time line** can be used to trace the history and growth of the second group (already done for DFA)
- Explore the possibility of seeing any **group documentation**.
- **Venn diagram** for institutional linkages (partly covered in DFA but to be updated)
- **Ranking** of constraints and priorities for capacity building.