

Assessing low quality water use policy framework: Case study from Ghana



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ARTICLE INFO

Article history:

Received 30 August 2014

Received in revised form 22 January 2015

Accepted 26 January 2015

Available online 27 February 2015

Keywords:

Low quality water
Policy
Compatibility
Sustainability
Implementation

ABSTRACT

We sought to understand the factors that have undermined the effective implementation of the low quality water reuse provision in Ghana's Irrigation Policy. Two Strategic Environmental Assessment tools (i.e. compatibility matrix and sustainability test) were used for the policy analyses. The analyses identified neither conflicts nor sustainability issues which could undermine the effective implementation of the policy in Ghana. Rather, its effective implementation was found to be the result of the lack of supportive legislation, regulations and guidelines. Furthermore, most of the institutions, which have been identified as key stakeholders for the policy implementation, not only lack the commitment to implement the policy but also perceive low quality water reuse as a practice that can endanger public health. We conclude that effective implementation of the low quality water reuse policy requires an integration of the policy into the broader water resources management context supported with legislation and regulations which spell out clearly institutional responsibilities, and rewards and punishments for compliance or otherwise.

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1. Introduction

The World Water Assessment Programme's forecast indicates that by 2030, more than half of the countries in Africa will suffer from economic water scarcity¹ while a growing number of countries in the world will be water-stressed. As a coping strategy, urban agriculturists in the cities of most of the affected countries use low quality water for irrigation (Alfarra et al., 2011; Al-Kharouf et al., 2008; Kretschmer et al., 2010; Rojas-Valencia et al., 2011; Scott et al., 2004; Sinclair, 2010). Available estimates indicate that about 20 million hectares of land globally are irrigated with raw, treated or partially treated low quality water (Hamilton et al., 2007).

The unprecedented rate of urbanisation in developing countries resulting in high demand for land has also undermined urban agriculture. The phenomenon has led to significant appreciation of land

values. The poor urban farmers in most of these countries have been priced out of the urban land market (Drechsel et al., 2008; Owusu et al., 2012). For instance, a plot size averaging 5600 square feet (equivalent to 520 square metre) in the Kumasi Metropolis of Ghana was leased for amounts ranging from GH¢12,000 (equivalent to US\$7500)² in the periphery (such as Denkyemuso) to GH¢200,000 (equivalent to US\$125,000) at the city centre (such as Adum) in 2011 (Land Valuation Division, 2011 cited in Hammond, 2011). These prices are in excess of the average income of vegetable farmers in the cities in Ghana which ranges from U\$400–800 per annum (Drechsel and Keraita, 2014). The implication is that it would take an urban vegetable farmer not less than 18 years if he/she saves all the incomes accruing from the farming activity to acquire a plot at the periphery of the Kumasi Metropolis for farming. The poor urban vegetable farmers have therefore been priced out of the urban land market in Ghana.

In search of constant supply of water and land with secure tenure in the cities³ therefore, the urban vegetable farmers in

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¹ Economic water scarcity is understood to mean a situation where people do not have the necessary monetary means to utilise an adequate source of water. It is also used to refer to situations where investments in water is low.

² Using a 2011 exchange rate of US\$1.00 to GH¢1.60 Pesewas.

³ The farmers prefer to farm in the cities due to ready market for their produce. These farmers are unwilling to locate their farms outside the city where land is abundant and surface water quality is good for irrigation.

Table A.1
Number of people at risk of infection.

City	City dwellers eating dishes served with raw salad	Street food kitchens served with raw salad (usually a side dish)	Urban farmers producing exotic vegetables
Accra/Tema	160,000–300,000	1050–1750	800–1000
Kumasi	140,000–240,000	1100–1400	>330
Cape coast	15,000–35,000	110–170	ca. 30
Tamale	20,000–40,000	190–300	>400
Takoradi	15,000–35,000	120–200	80
Other cities	150,000	1000–2500	100–200
Total	500,000–800,000	3570–5320	1740–2040

Source: Drechsel et al. (2010).

Ghana have cultivated the buffers created along surface water bodies and wetlands in the cities. The urban farmers' decision to cultivate vegetables in the wetlands is therefore informed by the following factors: (1) the wetlands provide secure land tenure (*in defacto terms*) due to its marginal nature, and (2) the wetlands offer farmers reliable supply of water for all-year-round farming. Water from the wetlands are however highly polluted by the discharge of untreated or partially treated wastewater into them (Danquah et al., 2011; Keraita et al., 2010; Owusu et al., 2012; Qu et al., 2012; Scheierling et al., 2010). Scientists have found excess amounts of pathogens in the surface water bodies and shallow wells used for irrigation by urban farmers in Ghanaian cities (Amoah et al., 2005; Hamilton et al., 2007; Keraita et al., 2008a; Rooijen et al., 2010). The vegetables produced with the polluted water have therefore been found to have been contaminated (Amoah et al., 2007, 2005; Drechsel et al., 2014; Owusu et al., 2012). For instance, the faecal coliform levels found on the vegetables produced with low quality water in Kumasi was found to be 10^{6-7} counts per 100 g weight at the farm gate (Amoah et al., 2007, 2005; Scheierling et al., 2010). This raises a lot of public health concerns and this is the case in almost all countries where untreated low quality water is used for irrigation in unrestricted in agriculture. For instance, a rise in gastro-intestinal diseases and acute respiratory infections in Mexico was attributed to the use of untreated low quality water in vegetable farming (Rojas-Valencia et al., 2011). Hussain et al. (2002 cited in Owusu et al., 2012) and Feenstra et al. (2000) also identified an association between low quality water use and diarrhoeal and intestinal diseases among farmers. Endemic typhoid which had persisted for decades in Santiago until 1991 was linked to the indirect use of wastewater for irrigation of vegetables (Scheierling et al., 2010). Drechsel and Seidu (2011) found that about 12,000 disability-adjusted life years (DALYs) are lost every year in Ghana's major cities. These result from the consumption of salad prepared from low quality water irrigated lettuce. Available data further suggest that between 500,000 and 800,000 people in the cities in Ghana are at risk of infections (Table A.1).

What is clear from the foregoing is that low quality water use especially in unrestricted agriculture, has adverse implications for the health of the stakeholders along the contamination pathway (i.e. from farm to fork). Despite the health risks, urban irrigated agriculture plays critical roles in urban poverty reduction agenda by supporting the livelihoods of farmers and many off-farm entrepreneurs (Busari et al., 2012; Danso et al., 2014; Drechsel et al., 2006; Drechsel et al., 2014). Given these factors, there was the need to intervene to mitigate the health risks linked to low quality water use in agriculture and at the same time sustain the livelihoods.

Several city authorities have however successfully treated low quality water for productive purpose. For example, in places like Israel, Jordan (Alfarra et al., 2011), North Africa (Bakir, 2001) and India (Mekala et al., 2008), low quality water is used for irrigation purpose. These cases highlight physical water scarcity as a driver for low quality water treatment and reuse in arid and semi-arid regions in the world. The poor urban vegetable farmers in the developing

countries cannot, however, afford treated water for irrigational purpose or tap water from the aquifer. The land tenure problems further undermine their willingness to invest in boreholes or protected dugouts or treat water for irrigation.

The World Health Organisation's (WHO, 2006) multiple barrier approach is regarded as the way forward in protecting livelihoods and safeguarding public health. The multi-barrier approach in the 2006 guidelines follows the Hazard Analysis and Critical Control Points (HACCP) concept (Keraita et al., 2010). This implies that the health risks associated with low quality water use in agriculture can be safely managed if the stakeholders along the contamination pathway comply with the multiple-barrier approach. Underpinned by these strengths of the guidelines and coupled with the growing economic water scarcity in cities in Ghana, the Ministry of Food and Agriculture (MOFA) in Ghana, has introduced low quality water use policy provisions in the National Irrigation Policy, Strategies and Regulatory (hereinafter referred to as the National Irrigation Policy). The term "low quality water" is used to describe surface water or underground water which is polluted by storm water, greywater and black water or a combination of them. The National Irrigation Policy was approved by the Cabinet of the Government of Ghana in June, 2010. It supports best practices for the safe use of low quality water in accordance with the World Health Organisation (WHO) 2006 guidelines (Ministry of Food and Agriculture, 2011: 13). In most cities in Ghana, like several other countries below the sanitation ladder, differentiating between wastewater and greywater used for irrigation is difficult. This is because greywater gets contaminated with faecal matter on its way through drains/gutters, canals and streams before being used for irrigation in urban vegetable farms. In this context, low quality water covers diluted wastewater and polluted stream water used for irrigation (Keraita et al., 2014: 1).

Since adoption, the low quality water reuse provision has not been effectively implemented in Ghana. No known studies have identified the factors that have undermined its effective implementation. The study which came close to identifying the policy issues was undertaken by the Kwame Nkrumah University of Science and Technology in collaboration with the International Water Management Institute and the Food and Agriculture Organisation. It identified that the policies for the use of low quality water in irrigated agriculture were scattered in several documents with institutional responsibilities fragmented among different Ministries (Drechsel et al., 2014). We argue however that the fragmentation cannot be a factor which undermines the policy's effective implementation provided all the responsible institutions discharge their responsibilities as required. Furthermore, the scattered nature of the policies on low quality water reuse cannot undermine its effective implementation if there are no contradictions among them. What was not clear in the study referred to in this paper was whether the low quality water policy framework did not conflict with any other sectoral policies. Another gap in the study was its silence on the adequacy/completeness of the policy framework. We sought to address these knowledge gaps

by assessing the low quality water reuse policy framework with the aim of identifying any issues which may have undermined its effective implementation.

We address the knowledge gaps by analysing the issues that address the following specific research questions:

1. What are the conflicts that exist between the national irrigation policy and other sectoral policies in Ghana?
2. What are the legislation and regulations that mandate state institutions in Ghana to support low quality water use in irrigated agriculture?
3. What institutional provisions have been put in place to implement the low quality water use policy provision in the National Irrigation Policy?

2. Materials and methods

2.1. Research design and sources of data

The research design was primarily qualitative which involved a desk review of national policy documents, legislation, regulations and institutional manuals and guidelines. Primary data were obtained through direct interviews with the heads of the institutions which have been identified in the National Irrigation Policy as stakeholders for its implementation (refer to pages 21 and 23). The institutions were the: Ghana Irrigation Development Authority, Extension Services Directorate and Agriculture Engineering Directorate all under the Ministry of Food and Agriculture. The others were Water Resources Commission, Environmental Protection Agency and Ministry of Health.

Ghana's decentralisation programme mandates District Assemblies (including de-concentrated institutions) to implement national policies at their areas of administration. In this regard, we interviewed the heads of the departments and institutions in the Kumasi Metropolis which were relevant for the implementation of the low quality water policy. The interviews were intended to assess their awareness of the low quality water reuse provision and how they were contributing to its implementation. The devolved departments were the: Metropolitan Agricultural Development Unit, Environmental Health Directorate and Waste Management Department. The de-concentrated institutions were the: Environmental Protection Agency, Food and Drugs Authority, Ghana Standards Authority and Metropolitan Health Directorate.

2.2. Analytical methods

Two Strategic Environmental Assessment (SEA) tools, namely the 'Sustainability Test' and 'Compatibility Matrix', were used to assess the National Irrigation Policy. We applied the tools with the aim of identifying policy conflicts and issues which may have accounted for the ineffective implementation of the low quality water use policy in Ghana.

2.2.1. Compatibility test

The compatibility matrix allows analysts and policy makers to compare various policies to identify and eliminate areas of conflicts (Hirji and Davis, 2008; Ministry of Water Resources Works and Housing et al., 2006). It also helps to identify mutually reinforcing policies which could be implemented to achieve maximum synergy (Ministry of Water Resources Works and Housing et al., 2006). We therefore used the compatibility matrix to identify any possible conflicts between the low quality water reuse policy and other sectoral policies in Ghana. The conflicts are potential factors that can undermine the effective implementation of the low quality water reuse policy provision in the National Irrigation Policy.

Table B.1

Likert scale for the compatibility analysis.

Scale	Description
1	Compatible: the two policies are consistent. That is, the achievement of one affects the other in a positive manner.
0	Neutral: there is no linkage/relationship between the two policies. That is, the achievement of one goal does not affect the other.
–1	Incompatible: the two policies are inconsistent. That is, the achievement of one goal impedes the achievement of the other.

The national policies covered in the paper were the: Food and Agriculture Sector Development Policy II, National Environmental Sanitation Strategy and Action Plan, National Drug Policy, National Urban Policy and National Health Policy. The others were the: National Water Policy, National Land Policy, National Youth Policy and National Employment Policy (see Table D.1). A three-interval likert scale was used to determine the level of compatibility between the Irrigation Policy and other sectoral policies (see Table B.1). We then used a record sheet to explain the identified positive, negative or neutral relationships (Appendix A.2). A negative scale/score indicates a conflict which has the potential of undermining the effective implementation of the low quality water reuse policy provision.

2.2.2. Sustainability test

The 'Sustainability Test' is a tool used to assess policies in line with the three main components of sustainability, namely, (1) natural resources sustainability, (2) socio-cultural sustainability, and (3) economic sustainability. The tool helps policy makers and analysts to refine policies for effective implementation. It offers a simple quantitative and visual measure of policies, plans and programmes (PPPs). The tool can be applied to identify the sustainability issues that may have undermined the effective implementation of the policies. This is necessary given that there is no evidence of the application of the tool during the policy formulation stage. In this regard, the sustainability issues may have been glossed over by the policy formulators.

A number of socio-cultural, economic and natural resource factors were identified and used for the sustainability analysis (Table E.1). Equal weights were assigned to the socio-cultural, economic and natural resource issues to measure the extent to which the low quality water policy provision minimises environmental degradation, reduces poverty, enhances quality of life, improves social and cultural assets, creates better economic conditions and promotes good institutional governance. Three basic steps were followed in the application of the sustainability tool. They were:

- i. description of the policy by providing enough information to allow an informed judgement to be made about its likely effects on each of the sustainability criteria identified (see Appendix A.2);
- ii. assessment of the performance of the policy in relation to each criterion; and
- iii. scoring the performance.

For each criterion, an interval scale of 0–5 (in Table C.1) was used to indicate the extent to which the policy action supports, is neutral to, or works against the sustainability aim. Zero (0) indicates that the policy is not relevant to the sustainability component being considered and therefore has no relations or bearing. One (1) implies that the policy works strongly against the aim; which means that the policy will have extreme negative effects on either natural resources, socio-economic conditions or the economy. When a value of two (2) is assigned, it means it will have

Table C.1
An interval scale for the sustainability test.

0	1	2	3	4	5
Not relevant	Works strongly against the aim	Works against the aim	Has neutral effects on the aim	Supports the aim	Strongly supports the aim
No colour	Red	Red	Yellow	Green	Green

Source: Adopted from National Development Planning Commission (2014).

negative effects on sustainability component being considered in the analysis. Where a value of three (3) is used, then the policy has neutral effects (neither positive nor negative). Values of four (4) indicate that the policy supports the aim while five (5) indicates that the policy strongly supports the aim. When a policy supports an aim, it means the purpose for which the activity was designed is met. When the policy strongly supports the aim, it means the policy meets the purpose for which it was designed in addition to other minor benefits. A record sheet was prepared to provide reasons for the scores assigned during the analysis.

2.2.3. Review of supportive legislation and guidelines

Several legislation and regulations were reviewed with the intention of identifying any legal barriers that restrain or support the use of low quality water in agriculture. The legislation and regulations covered in this paper have been indicated in [Appendices B.1 and B.2](#).

2.2.4. Institutional awareness and implementation of the low quality water policy

We assessed institutional awareness of the low quality water use policy by asking a dichotomous question: are you aware of any policies in Ghana that support the use of untreated low quality water in agriculture? A 'yes' response to the question implies that the institution was aware of low quality water reuse policies in Ghana. The weakness of this approach is that a respondent can influence the research outcome by saying 'yes' which may not be an accurate response. To address this inherent weakness, we reviewed the institutional programmes of action to know if they were implementing low quality water reuse activities. The review was guided by a checklist which was designed to identify low quality water reuse promotional activities in the institutions' programmes of action and annual plans. Three likely outcomes were expected: (1) yes (i.e. aware of the low quality water reuse policy) and has low quality water reuse promotional activities in its programmes of action, (2) yes (i.e. aware of the low quality water reuse policy) but does not have low quality water reuse promotional activities in the programmes of action, (3) no (i.e. unaware of the low quality water reuse policy) and does not have low quality water reuse promotional activities in the programmes of action.

3. Analyses and discussions

3.1. The low quality water reuse policies in Ghana

The policies that support low quality water reuse in Ghana are scattered in several policy documents ([Drechsel et al., 2014](#)). These policies are contained in the entire national development policy framework implemented in Ghana from 2003 to 2014. The development frameworks are: the Ghana Poverty Reduction Strategy (2003–2005), Growth and Poverty Reduction Strategy (2006–2009), and the Ghana Shared Growth and Development Agenda 1 (2010–2014). These frameworks recognised the urgent need to manage the growing economic water scarcity in Ghana. A key strategy to doing this is to recycle, recover, re-use and reduce all types of waste (including wastewater) generated in Ghana.

We also found policies that relate to low quality water reuse in several sectoral policies. They include the: Food and Agricultural Sector Development Policy II and National Irrigation Policy. Low quality water reuse is clearly expressed in the National Irrigation Policy as follows: "support best practices for the safe use of marginal quality water in accordance with World Health Organisation (WHO) Guidelines for the Safe Use of Wastewater, Excreta and Grey-water in agriculture" ([Ministry of Food and Agriculture, 2011: 13](#)). The National Irrigation Policy further supports low quality water by encouraging "research on safe irrigation practices for irrigated urban and peri-urban agriculture and disseminate these in collaboration with other institutions" ([Ministry of Food and Agriculture, 2011: 16](#)). The Ministry of Food and Agriculture has therefore adopted the WHO 2006 edition of the guidelines for the safe use of wastewater, excreta and greywater in agriculture. Adopting the 2006 edition of the WHO guideline implies that low quality water can be used after carefully applying the multiple-barrier approach. This makes Ghana the only country in sub Sahara Africa to have adopted the WHO guidelines to safeguard public health and sustain livelihoods. It is also a confirmation of the claim in literature that policy frameworks in support of low quality water reuse are emerging in lower middle income countries ([Scheierling et al., 2010](#)).

Though low quality water reuse is widespread in low income countries worldwide, there are hardly any policy frameworks to guide its use ([Scheierling et al., 2010](#)). Where policy frameworks exist, they are hardly enforced. For instance, Nigeria and Tanzania's environmental policies emphasise wastewater treatment before disposal. The Tanzanian Environmental Management Act (2004) and Public Health Act (2009) forbid the use of untreated low quality. The perception of the governments in these countries is that treatment is the ultimate and most reliable means of eliminating the health risks associated with low quality water reuse ([Drechsel et al., 2014](#)). They have subsequently instituted strict quality standards to guide effluent discharge and possibly reuse; which are hardly enforced especially in the informal sector ([Taljaard et al., 2006; Weckenbrock et al., 2011](#)). Tunisia's wastewater treatment policy based on the 1989 edition of the WHO guidelines provides evidence of direct support for low quality water reuse in Africa. However, the emphasis on drinking water quality standards ([Scheierling et al., 2010](#)) automatically prices out several small-holder farmers. Ghana's adoption of the WHO guidelines is a good case for the rest of the countries at the same level of the sanitation ladder to replicate.

3.2. What conflicts exist between the national irrigation policy and national sectoral policies?

3.2.1. Compatibility analyses

We identified no areas of incompatibility between the low quality water use policy and the other sectoral policies in Ghana ([Table D.1](#)). The record sheet in [Appendix A.1](#) shows that urban agriculture features directly or indirectly in all the policies we have reviewed in this paper. The most plausible explanation is that urban agriculture is a major source of livelihood despite the farmers' limited access to secure land and quality water for irrigation

Table D.1
Policies' compatibility analysis.

	Other sectoral policies								
	FASDEP 2	NESSAP	NDP	NUP	NHP	NWP	NLP	NYP	NEP
NIP	1	1	0	1	–1	1	1	1	1

Source: Authors' Construct (2014).

Key to the acronyms in Table D.1:

NIP = National Irrigation Policy – NDP = National Drug Policy

NUP = National Urban Policy – NHP = National Health Policy

NWP = National Water Policy – NLP = National Land Policy

NYP = National Youth Policy – NEP = National Employment Policy

FASDEP 2, food and agricultural sector development policy 2; NESSAP, National Environmental Sanitation and Action Plan.

(Drechsel et al., 2008; Ministry of Food and Agriculture, 2011). The Food and Agricultural Sector Development Policy 2 National Urban Policy and National Land Policy aim to address the land tenure insecurity issues through appropriate land use planning while the National Water Policy, National Urban Policy and National Environmental Sanitation and Action Plan set out to provide reliable supplies of good quality water for all-year-round irrigation.

It is important to stress that the reliability of low quality water supply is not in contention (Al-Jayyousi, 2003; Adewumi et al., 2010; Almasri and McNeill, 2009). In this vein, the low quality water use policy complements the other sectoral policies which aim to improve and sustain urban agricultural practice in Ghana (Table D.1 and Appendix A.1). The implication therefore is that low quality water reuse in agriculture is a vital conduit to achieving the National Water Policy, National Urban Policy and National Environmental Sanitation Policy's objectives of providing reliable supplies of good quality water for all-year-round irrigation. The adoption of the WHO guidelines suggests that, where the irrigated water is contaminated by wastewater water, compliance with the multiple-barrier approach can help to mitigate the health risks.

The National Environmental Sanitation and Action Plan further recommends the use of Waste Stabilisation Ponds (WSP) for the treatment of large volumes of night soil and septage. The low quality water discharged from the WSP can be used in irrigated agriculture (Kanda et al., 2013; Ranieri et al., 2011). This is in consonance with the low quality water reuse policy provision in the National Irrigation Policy (which is, where only low quality water is available, its use shall be encouraged in accordance with the WHO guidelines). The safe use of low quality water further supports and sustains the livelihoods of the urban poor (Drechsel et al., 2008; Ministry of Food and Agriculture, 2011; Orsini et al., 2013; Scott et al., 2004) and therefore supports the National Youth Policy and National Employment Policy's aims of ensuring sustainable employment.

Low quality water reuse in irrigated agriculture however conflicts with the health policies. The National Health Policy emphasises the use of potable or clean water for productive purposes (pages 12 and 37). The Ghana Health Policy further advocates for the need to strengthen water quality monitoring to guarantee public safety. The policy implies that low quality water can be used after treating it to meet drinking water quality standard before use. This suggest that the National Irrigation Policy which provides for the use of low quality water conflicts with the National Health Policy. This could be a major reason for the ineffective implementation of the low quality water reuse policy in Ghana.

Compliance with the WHO guidelines could however alleviate the health risks associated with the use of low quality water in irrigated agriculture. Its strength is that it gives room for the design of adequate and affordable health management measures as well as for the establishment of an effective monitoring system (Abaidoo et al., 2009; Amoah et al., 2011; Andoh et al., 2009). Within the multiple barrier approach, low quality water can either be treated

to safer levels of contamination before application or used without treatment but with strict observance with safer irrigation methods.

Field trials by Abaidoo et al. (2009) and Keraita et al. (2008b) established that the multiple-barrier approach is effective for the mitigation of the health risks associated with low quality water reuse. What emerged from their studies is that each stakeholder along the contamination pathway (i.e. from farm to fork) plays critical roles to reducing the health risks. For instance, vegetable farmers are required to apply a combination of the following farm-based risks reduction measures: (1) three-tank system, (2) simple sedimentation, (3) simple filtration, (4) furrow irrigation, (5) low-cost drip irrigation, (6) reduction of splashing, and (7) cessation before harvest. Vegetable sellers are also required to observe the following market-based risks reduction measures: (1) overnight storage in aerated baskets, (2) washing with clean water, (3) washing with running tap water and (4) removing the outer leaves of the leafy vegetables. Consumers are also required to: (1) apply disinfection (e.g. bleach and potassium permanganate), (2) peel, and (3) cook the vegetables before consumption. A combination of the risks reduction measures can promote the safe use of low quality water in irrigated agriculture.

The conclusion from the policy compatibility analysis therefore is that the conflict between the National Irrigation Policy and National Health Policy only holds true where the multiple barrier approach is not adhered to by the stakeholders along the contamination pathway.

3.2.2. Policy sustainability analysis

The results of the sustainability test (in Table E.1 and Appendix A.2) indicate that the low quality water reuse policy provision directly supports Ghana's socio-cultural and economic development agenda without compromising the environment. The test revealed that low quality water reuse could sustain the livelihoods of the poor urban farmers while compliance with the multiple-barrier approach can protect public health. Low quality water reuse also promotes sustainable water management (Al-Jayyousi, 2003; Bakir, 2001; Rojas-Valencia et al., 2011) as well as contributes to the preservation of underground water (Al-Jayyousi, 2003).

The use of the WSP for the treatment of low quality water helps to retain the natural character of the ecosystem towards sustainable biodiversity utilisation. It also contributes to the protection of aquatic endangered species. Low quality water reuse further helps to mitigate the effects of drought on farming due to its reliability (Scheierling et al., 2010). Farmers will therefore be able to produce all-year-round (Drechsel and Keraita, 2014; Obuobie et al., 2006a) a vital step to building poor urban households' resilience to climate variability. The use of undiluted wastewater has been found to be nutrient-rich which has the potentials of increasing crop output (Scheierling et al., 2010). The farmers' outputs can also be used as inputs in several upstream enterprises (such as restaurants, street kitchens and hotels among others) implying a positive multiplier

Table E.1
Results of the sustainability test.

National Irrigation Policy							
Policy Action: Support best practices for the safe use of <u>low</u> quality water in accordance with WHO <u>2006 edition of the</u> guidelines for the safe use of low quality water, excreta and greywater in agriculture							
SEA Sustainability Criteria (Aims/Objectives)		Performance Score					
		0	1	2	3	4	5
1. Natural resources							
1.1	Supports conservation and sustainable utilisation of water resources						
1.2	Ensures the preservation of quality of groundwater and surface water resources suitable for intended purposes						
1.3	Ensures retention of natural character and function of aquatic ecosystems						
1.4	Ensures protection of biodiversity						
1.5	Ensures protection of endangered species of fauna and flora						
1.6	Prevents discharges (liquid and solid) and disposal of low quality water that adversely affect water bodies						
1.7	Prevents land degradation and soil pollution/infertility						
1.8	Promotes sustainable consumption of inputs – recycling, reduction, reuse (energy, chemicals and other raw materials)						
1.9	Promotes prevention of floods and mitigation of effects of floods/droughts						
1.10	Promotes protection of water basin areas						
2. Socio-cultural conditions							
2.1	Enhances access for all to water in sufficient quantity and quality for basic needs						
2.2	Promotes good hygiene and contributes towards the prevention of water-related diseases						
2.3	Promotes equitable distribution of (water policy) related benefits						
2.4	Guarantees the health of stakeholders						
3. Economic conditions							
3.1	Encourages strong and stable condition in economic growth						
3.2	Encourages the retention of capital and the development of downstream industries, utilising local raw materials						
3.3	Encourages the use of raw materials and services from local industries where possible						

Source: Indicator were adopted from the National Development Planning Commission 2014.

effect. These would also foster financial and human capital retention within the local economy.

Our conclusion from the compatibility and sustainability analyses is that the low quality water reuse provision in the National Irrigation Policy is consistent with the policy goals and objectives of other sectoral policies as well as support Ghana's sustainable development efforts. There are no inter-policy conflicts and sustainability issues that could constrain the effective implementation of low quality water reuse policy provision in Ghana.

3.3. What are the legislation and regulations that support low quality water use?

3.3.1. Review of national legislation and regulations

Our review of various legislation and regulations (listed in [Appendices B.1 and B.2](#)) revealed that there are no specific legislation which mandate state and non-state institutions to promote the use of low quality water in agriculture. For instance,

we found that the Supreme Military Council Decree 1977 (SMCD 85), which is the legislation that establishes the Ghana Irrigation Development Authority has not given it the mandate to promote low quality water for irrigation. It mandates it to formulate and execute plans and programmes to develop irrigation, and improve livestock and fish culture in Ghana (Section 2 of the SMCD 85). These functions are not clear on the use of low quality water for irrigational purposes. The main debate that was trending at the time of the introduction of the SMCD 85 was that low quality water was harmful and should not be used for irrigation ([Drechsel et al., 2010](#)). Its use was therefore not provided for in the mandate of the Ghana Irrigation Development Authority. In the same vein the Ghana Irrigation Development Authority Regulations 1987 (LI 1350), which provides procedures for managing irrigation projects, has not given the Authority the mandate to promote low quality water reuse in agriculture. Consequently, the Irrigation Development Authority's 'Technical Guidelines for Irrigated Agriculture' which was issued in 2004 is silent on low quality

water reuse in agriculture. The foregoing indicates that the Ghana Irrigation Development Authority does not have the mandate to implement the low quality water reuse provision in the National Irrigation Policy it formulated and pushed for adoption in 2010. Consequently, its programmes of action do not include low quality water promotional activities. The Ministry of Food and Agriculture acknowledges this legislative gap and has subsequently proposed a review of the LI 1350 to support low quality water reuse in agriculture according to the WHO guidelines (MOFA, 2011: 21).

Our review of the National Redemption Council Decree (NRCD) 173 and other supporting legislation revealed that the Ghana Standards Authority is mandated to ensure that the quality of goods produced in Ghana is high. It also promotes industrial and public welfare, health and safety, and as well prohibits the importation into Ghana, foods it has not certified as complying with standards in Ghana. The NRCD 173 and other related Legislative Instruments (LI)⁴ are not clear on the use of low quality water for productive purposes. In a similar vein, the Public Health Act, 2012 ([Act 851] which mandates the Food and Drugs Authority to regulate food, drugs, food supplements, herbal and homoeopathic medicines, veterinary medicines, cosmetics, medical devices, household chemical substances, tobacco and tobacco products is silent on the use of low quality water in irrigated agriculture. However, the Authority's mandate to register food and drugs among other products, and publish codes of practice in connection with matters provided for under the food and drugs law may be useful for the promotion of food safety (Drechsel et al., 2014). This conclusion is reached without giving recognition to the fact that the Authority focuses mainly on manufactured products which exclude the vegetables produced from the low quality water irrigated fields in the cities. Besides the practice takes place in the informal sector which will be difficult to regulate. We found that, due to the Public Health Act's (Act 851) silence on low quality water reuse, none of its official guidelines indicated in Appendix B.2 covers low quality water reuse.

We found from the review of the Ghana Standards Authority's standards on food safety that the authority can help mitigate the risks associated with low quality water. The Ghana Standards Authority's has over 300 standards on food products that ensure safety and quality of products on the market (Drechsel et al., 2014). The authors found that the sections of the standards on food safety follow the Hazard Analysis and Critical Control Point concept. It also touches on hygiene, microbiological, packaging and labelling requirements. What is however clear is that informal urban vegetable farming is not covered in these guidelines. The emphasis on food hygiene can contribute to reducing the health risks at the off-farm stages of the contamination pathway. The limitation however is that the Ghana Standards Authority's staffing numbers are low in the area of food quality (Drechsel et al., 2014).

The Environmental Protection Agency Act 490, 1994 which mandates the Agency to protect and improve the environment in Ghana does not cover low quality water reuse. The Environmental Protection Agency's LI for Environmental Impact Assessment does not also provide for low quality water reuse. The following guidelines issued by the Agency were found to have no provisions for low quality water use in agriculture: (1) guidelines on environmental quality, (2) guidelines on oil and gas, (3) guidelines on aquaculture, (4) guidelines on environmental permitting process, and (5)

guidelines on strategic environmental assessment (SEA). The Agency's approved discharge standards emphasise environmental quality with no direct focus on reuse. Like the Food and Drugs Authority, none of the Environmental Protection Agency's guidelines covers wastewater reuse.

The Ghana Tourism Authority (GTA) which is mandated to register, supervise and regulate the practices and standards of accommodation and catering enterprises in Ghana has a remote link to the safe use of low quality water in agriculture. Our review established that the operations of the Ghana Tourism Authority, like the Ghana Standards Authority, can contribute to mitigating the health risks associated with low quality water reuse. Its impact will be felt at the food handlers' stage of the contamination pathway. This may however not be adequate to protect the health of consumers given the systematic nature of the multiple-barrier approach.

What we found from our review of the national legislation, regulations and guidelines covered in this paper is that none of them directly provides for low quality water reuse. The obvious reason for this is that almost all of the legislation and regulations covered in this study were introduced at a time that low quality water was perceived as a nuisance to public health. The wholesale adoption of the entire multiple barrier approach may not work in Ghana given that farmers may show resistance against drip-irrigation and pathogen die-off. The water quality problems lead to clogging of drip irrigation systems (Scheierling et al., 2010) whereas the available drip kits in Ghana are too far spaced which reduces cropping density and yields (Drechsel and Karg, 2013). Consumers' desire for fresh vegetables may also undermine farmers' desire to adopt pathogen die-off. Pathogen die-off is known to wither the vegetables. The need to adapt the WHO guidelines to suit local conditions is critical for the effective implementation of the low quality water reuse policy in Ghana.

3.3.2. Review of the bylaws of some selected metropolitan assemblies

Ghana's decentralisation legislation establish Metropolitan, Municipal and District Assemblies as planning authorities at the district level. These planning authorities can enact bylaws to promote or forbid the use of low quality water for productive purposes. In this regard, we reviewed the bylaws of the two largest Metropolitan Assemblies in Ghana. They are the Accra Metropolitan Assembly and Kumasi Metropolitan Assembly. The two have the largest number of vegetable farmers in Ghana (Table A.1), and by implication use more low quality water for irrigation than any other local area in Ghana.

We found that the Kumasi Metropolitan Assembly's bylaws 1995 do not recognise urban agriculture as an economic activity. Provisions in the bylaws which relate to urban agriculture were the 'Control of Poultry and Dwelling House' and 'Cattle Pounds'. The 'Control of Poultry and Dwelling House' stipulates that the number of poultry to be kept in a dwelling-house within the Kumasi Metropolitan Assembly's administration area shall not exceed 200 heads (paragraph 1 (1)). The bylaws further stipulate that the "sanitary conditions of the poultry shall not cause any nuisance, otherwise shall be closed down upon order by the Kumasi Metropolitan Assembly". Furthermore, the litter or droppings of the poultry are to be disposed off in accordance with any governing sanitation rules in the metropolis as the Kumasi Metropolitan Assembly Medical Officer of Health may direct (paragraph 5 (1)). The 'Cattle Pounds', on the other hand, permits people to keep cattle in the Kumasi Metropolitan Area provided such people keep them in a well-maintained and cleaned pen according to the Ministry of Health's sanitary rules/requirements. We found that the Assembly's obsession is to protect public health but not encourage urban agriculture. The provisions are intended to curtail any

⁴ LI 662 Ghana Standards (Certification Mark) Rule, 1970, LI 664 Ghana Standards (Certification Mark) (Amendment) Rule, 1970, LI 1513 Prosecution of Offences under the Weights and Measures Decree, 1975 (NRCD 326) Instrument, 1991, LI 1541 Ghana Standard Board (Food, Drugs and Other Goods) General Labelling Rules, 1992, LI 1549 Weights and Measures (fees) Regulations, 1992, LI 1550 Weights and Measures (Permissible Errors) Regulations, 1992, NRCD 173 Standards Authority Act, 197 and NRCD 326 Weights and Measures Decree, 1975.

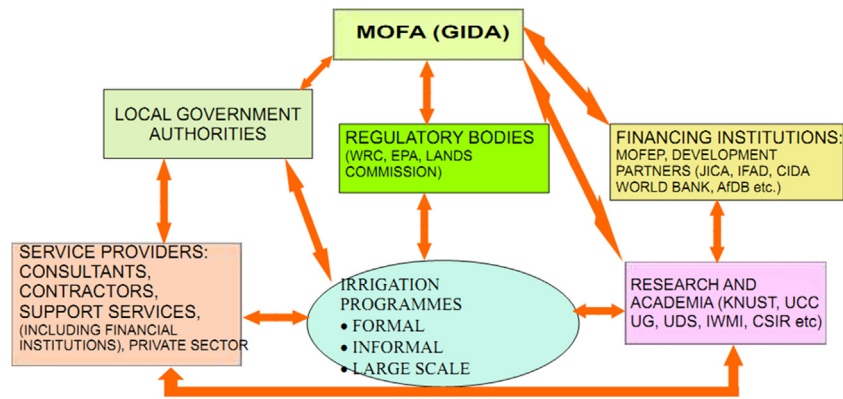


Fig. A.1. Proposed institutional framework for the policy implementation.

Source: Ministry of Food and Agriculture (2011)

possible health risks that may arise from keeping animals (such as poultry and cattle) within the Kumasi Metropolitan Assembly's area of administration. Low quality water reuse is not covered in the bylaws.

The Accra Metropolitan Assembly's bylaw, unlike that of the Kumasi Metropolitan Assembly, provides for the cultivation and sale of crops within its area of administration (Obuobie et al., 2006b). The bylaws in their current state forbid the use of untreated low quality water for irrigational purposes. It states categorically that no person shall be allowed to irrigate crops with effluent from a drain or any premises. Farmers are forbidden, though hardly enforced, from using any surface water which is linked by a drain. The conclusion is that the Accra Metropolitan Assembly's bylaws do not support the use of low quality water in irrigated agriculture. The bylaws follow categorically a water standard-based approach (Drechsel et al., 2014: 208). In this vein, the use of low quality water in agriculture will only be allowed after treating it to meet permissible levels of contamination.

The Ministry of Food and Agriculture with technical support from the International Water Management Institute proposed an amendment to the Accra Metropolitan Assembly's bylaws. The proposed amendment is "no parts of the crops consumed in the fresh or raw state shall be watered or irrigated directly by the effluent from a drain from any premises or any surface water from a drain which is fed from any water from a street drainage, unless appropriate risk reduction measures such as drip irrigation, furrow irrigation and cessation of irrigation prior to harvesting as outlined in the WHO/FAO guidelines (wastewater reuse) of 2006, or simple water treatment options are put in place" (Drechsel et al., 2014: 209).

Personal communications with Dr. Philip Amoah at International Water Management Institute in Accra and Dr. Nelson Obirih-Opareh at the Council for Scientific and Industrial Research in Accra revealed that the Accra Metropolitan Assembly could not ratify the proposed amendment because low quality water use was not supported by any parent law in Ghana. One major reason for the lack of the supportive legislation and regulations, four years after the policy's adoption, is the lack of institutional ownership of the policy formulation and implementation process. We found that the policy was the output of development partner-support projects⁵ led by the International Water Management Institute. Personal communication with Dr. Nelson Obirih-Opareh at the Council for Scientific and Industrial Research in Accra, which is

quoted below, explains the lack of institutional ownership of the policy.

"When the project (referring to RUAF) was running, the International Water Management Institute supported the Ghana Irrigation Development Authority to organise stakeholder meetings which brought together the relevant ministries and government institutions to formulate the low quality water use policy. We established the Multi-Stakeholder Platform where all the important stakeholders were assisted to plan to improve urban agriculture. The institutions were also made to devise strategies to promote the safe reuse of low quality water. None of the institutions however seems to have continued the low quality water reuse promotional activities after the exit of the project".

We argue therefore that the low quality water use policy framework is a paper tiger which will have no significant impact unless supported by legislation and regulations that empower institutions to implement them. Institutional ownership of the policy is also a critical factor that affects its effective implementation.

3.4. Institutional provisions for the policy implementation

The proposed institutional framework for the policy implementation is shown in Fig. A.1. Collaboration between the Ministry of Food and Agriculture and some regulatory agencies and local government bodies (Fig. A.1) is required to implement the policy effectively. This arrangement is necessary because the benefits and risks of promoting the reuse of low quality water cut across several disciplines and subsectors (including but not limited to, health, food and agriculture, water and sanitation, research and development, financing, local governance, and among others).

Our analysis of the institutional arrangement revealed that essential institutions like the Food and Drugs Authority, Ghana Standards Authority and Ghana Tourism Authority have not been identified as stakeholders for the implementation of the low quality water policy. Given the cross-cutting and systematic nature of the WHO guidelines, their inclusion will holistically mitigate the health risks. For instance, (Drechsel et al., 2014) posited that the Ghana Standards Authority is better positioned to steer a policy process to institutionalise the WHO guidelines in Ghana through its Codex Alimentarius. We also find the Ghana Tourism Authority as a critical body that can help monitor compliance with the off-farm risks reduction measures in the WHO guidelines. In this vein, the institutional framework shown in Fig. A.1 appears to concentrate only on irrigation to the neglect of the off-farm stages of the contamination pathway (i.e. market and food handling).

⁵ The Resource Centres on Urban Agriculture and Food Security [RUAF] and World Health Organisation (WHO)/Food and Agriculture Organisation (FAO)/Kwame Nkrumah University of Science and Technology (KNUST) studies on the WHO multiple barrier approach.

Table F.1

Local institutions' awareness and perception about low quality water reuse.

Decentralised institutions	Awareness of the low quality water reuse policy		Low quality water reuse promotional activities		Institutions' perceptions
	No	Yes	No	Yes	
Metropolitan Agricultural Development Unit	✓		✓		"The WHO guidelines come with its own technological requirements that are not possible to localise in Ghana. Wastewater contains some contaminants like pathogens and chemicals that can only be removed through treatment".
Metropolitan Health Directorate	✓		✓		"We are unaware of low quality water reuse policies in Ghana. If there is then we are certainly not involved with its implementation".
Waste management department	✓		✓		"Our mandate is to manage all types of waste in the metropolis. We are however unaware of any policies that provide for its use in an untreated form".
Environmental Health Department	✓		✓		"Low quality water contains E. Coli eggs and other pathogens which contaminate the vegetables they are produced with. In this vein, untreated wastewater use in agriculture is not advisable".
Environmental Protection Agency	✓		✓		"Low quality water should be used after careful treatment. We are interested in seeing a country where wastewater is treated before discharge. In this regard, its use in agriculture will not be a problem".
Food and Drugs Authority, Kumasi	✓		✓		"We do not know of any policies in Ghana that encourage low quality water reuse in untreated form".
Ghana Standards Authority, Kumasi	✓		✓		"Wastewater which by itself is not edible should not be used for agricultural purposes, unless it has been treated to permissible levels of contamination".

Source: Authors' interviews with the institutions.

Our interviews with the Water Resources Commission, Lands Commission and Environmental Protection Agency revealed that, though they have been identified as stakeholders for the implementation of the low quality water policies, they still ascribe to the water quality standards. We found that they are not only unaware of the low quality water policy but also the 2006 edition of the WHO guidelines. We found further that the decentralised institutions in the Kumasi Metropolis, who could have implemented the policy, were also unaware of the low quality water reuse policy (Table F.1). The institutions' unawareness raises questions about the nature and effectiveness of the Ministry of Food and Agriculture's communication strategy as well as the coordination with other sector Ministries and District Assemblies. Without coordination, one ministry may award the best urban farmers while another may prosecute them (Obuobie et al., 2006a) cited in Drechsel et al. (2006): 24.

We identified further that there was no communication plan for the dissemination of the National Irrigation Policy. Furthermore, there have not been any programmes to roll-out the policy as well as the multiple-barrier approach described in the 2006 edition. The overall implication is that mass educational programmes should start with the responsible institutions who perceive low quality water reuse as dangerous. These negative perceptions have the potentials of undermining the policy's implementation. This clearly explains the lack of legislative support for low quality water reuse in Ghana despite adopting the policy four years ago.

4. Conclusions and recommendations

Ghana appears to be the first and only country in sub Saharan Africa to have adopted the 2006 edition of the WHO guidelines for the safe use of low quality water, excreta and greywater in agriculture. The low quality water reuse policy is not only consistent with most sectoral policies but also supports the sustainable development agenda of Ghana. The policy framework is however

incomplete without supportive legislation and regulations. The policy document has not seen any effective implementation.

The lack of institutional ownership of the low quality water reuse policy was found to partly account for the lack of regulations and ultimately the ineffective implementation of the policy in Ghana. This is evident in the lack of commitment on the part of relevant national institutions to enact supportive legislation and regulations, and introduce incentives to ensure that the policy is legally binding and attractive. This is further evident in the national institutions' failure to continue to promote low quality water reuse activities in Ghana after the exit of the supports from development partners which led to the policy formulation. Very minimal efforts have been made to create public awareness of the low quality water policy and the WHO guidelines in Ghana. Above all, many of the relevant institutions still have negative perceptions about low quality water reuse in unrestricted agriculture while at the same time the implementation responsibilities appear to have been given to several institutions. The perception issues have implications for the wholesale adoption of the WHO guidelines, whose systematic nature requires the involvement of several institutions to implement the policy. These negative perceptions will undermine the effective implementation the policy.

We recommend, based on the foregoing that, the Ministry of Food and Agriculture in collaboration with all the relevant stakeholders covered in this paper should collaborate to develop a strategic plan and communication strategy with clear mandates, responsibilities, budget lines and monitoring and evaluation frameworks for the policy implementation. The strategic plan and communication strategy should adapt and institutionalise the WHO guidelines. This should begin by enacting a parent law to support low quality water reuse for agricultural purposes. This parent law will then facilitate the amendment of bylaws that forbid the use of low quality water in agriculture or inclusion of low quality water reuse provisions in existing bylaws. Farm-based risks reduction measures such as drip irrigation, furrow irrigation, pathogen die-off and low-cost treatment options should be institutionalised.

The strategic plan will yield significant results if the relevant national and local institutions and the general public are sensitised on the multiple-barrier approach. This will help diffuse their negative perceptions about low quality water reuse in agriculture. These institutions will then educate the public on the application of the risks reduction measures and monitor compliance. In this regard, the Agricultural Extension Directorate will monitor compliance with the farm-based risks reduction measures while the Environmental Health Directorate monitors compliance with the market-based risks reduction measures. The Ghana Tourism Authority, Food and Drugs Authority and Ghana Standards Authority will also ensure that food handlers comply with recommended hygienic practices.

The supportive legislation, regulations and guidelines should not only indicate punishments for non-compliance but also incentives and rewards. The incentives could be in the form of loans, safety certificates and land tenure security among others to the farmers. These farmers can also be guaranteed regular sources of market for their produce. For instance, in Vietnam, farmers who are producing safer vegetables by adopting safer irrigation practices qualify for loans and safety certificates. These farmers have been able to establish market channels which eliminated intermediate actors (middle men and women) in the food supply chain. The growing middle class have begun discriminating against those who do not heed to the safe methods of production. These have impacted on transparency, consumer contact and profits (Drechsel and Karg, 2013: 13). Land tenure security coupled with other incentives will encourage farmers to invest in their farms. Our recommendation is that District Assemblies in Ghana, who are the planning authorities, should mainstream urban agriculture in their land use plans as the case is in Cotonou and Seme-Kpodji in Benin, Bamako in Mali and Niamey in Niger. In these places, lands have been dedicated to urban agriculture (Drechsel et al., 2006).

Our long-term recommendation is that wastewater should be treated before discharge. This is essential given that Ghana's economic conditions keep improving (from low income to lower-middle income status) and therefore the risks posed by the use of untreated water may move from microbiological to heavy metals, metalloids and endocrine disruptors. The Environmental Protection Agency in collaboration with District Assemblies (Waste Management Department and Environmental Health Department) should therefore ensure that households and industries treat their effluent before discharge. All these recommendations will thrive on an integration of the policy into the broader water resources management context supported with legislation and regulations with clear institutional mandates and responsibilities as well as punishments and incentives for compliance or otherwise.

Acknowledgements

The authors are most grateful to the "Safe Water for Food Project (SaWaFo)" funded by Danida for supporting the study. We also acknowledge the immense contributions of Messrs Alfred Atimba and Michael Osei Asibey. They helped in the compilation of the national policy and legislative documents. The authors are most grateful to Dr Philip Amoah of the International Water Management Institute (IWMI) and Dr. Nelson Obirih-Opareh of the Council for Scientific and Industrial Research, Accra for availing themselves to be interviewed.

Appendix A. Results of the strategic environment analyses

A.1. Record sheet for the policy compatibility analyses

Policy documents	Score	Explanation for the score
NIP and FASDEP II	1	A review of FASDEP II revealed that urban agriculture is regarded as a significant component of the livelihood strategies of the urban poor as well as contributes to urban food security. The policy recognises that practitioners lack access to secured lands and good quality irrigation water. In this vein, FASDEP II intends to accelerate the provision of irrigation infrastructure to the urban and peri-urban farmers. The objective is not only to sustain urban agriculture but also manage the health risks associated with the use of contaminated water for irrigation. The study sees the two policy documents as highly consistent and complementary. The irrigation infrastructure FASDEP II intends to develop dovetails with the effluent treatment policy strategies in the NATIRP. Furthermore, the safe use of low quality water is tailored to the irrigation needs of urban vegetable farmers. This complements FASDEP II intent of developing irrigation schemes tailored to the needs of all categories of farmers. The policies on irrigation in the two documents are compatible.
NIP and NESSAP	1	NESSAP mainstreams the reuse of liquid and solid waste. It intends to accomplish this by developing regulations to support waste reduction, re-use, recycling and recovery. A review of the policy documents further revealed that NESSAP recommends the use of Waste Stabilisation Ponds (WSP) for the treatment of large volumes of night soil and septage in order to minimise the pollution of water bodies in the urban areas by the poor liquid waste disposal practices. The study recognises the two policy documents as compatible particularly on the basis that they encourage the alternative use of low quality water. While NIP encourages low quality water use according to the WHO guidelines, NESSAP emphasises food hygiene which also aims at minimising the health risk associated with the reuse of liquid waste.
NIP and NDP	0	The overarching goal of the NDP "is to improve and sustain the health of the population of Ghana by ensuring the rational use and access to safe, effective, good quality and affordable pharmaceutical products". The study sees no direct relationship between two policy documents. NIP aims to encourage the reuse of low quality water while NDP safeguards the use of pharmaceutical products. The correlation, even if there is, is weak and remote.
NIP and NUP	1	The study considers the degree of compatibility and consistency between NIP and NUP to be very high. One of the policy objectives of NUP is to facilitate a balanced re-distribution of urban population through myriad activities among them is the development and implementation of proper waste management measures with focus on waste reduction, recycle and reuse. Thus, NIP's encouragement of low quality water reuse is reinforced in the NUP making the two policy documents complementary. NUP's policy objective of promoting urban economic development further makes provision for urban agriculture. This claim is further supported by NUP's policy action to develop and use open spaces, green belts and other ecologically sensitive areas for appropriate recreation and urban farming. The land access problems of urban farmers identified in the NIP are to be resolved through the development and implementation of integrated land use management systems of which agricultural land uses will be factored.

Appendix A (Continued)

Policy documents	Score	Explanation for the score
NIP and NHP	–1	The NHP posits that improvements in environmental hygiene and sanitation, access to safe water, and safe food and nutrition among others are the means to achieving healthy population. The NHP identifies the attributes of healthy environment to include the following: (1) access to clean water and sanitation, (2) reduced risk of contamination of food and water include quality of air, water and soil. In this regard, one of the key policy action areas in the NHP is to promote healthy environments in order to ensure that people live long, healthy and productive lives. The foregoing indicates that the NHP, though silent on the productive reapplication of low quality water, does not encourage its use in any way without treating it to meet quality standards. The deduction is underpinned by the possibility of contaminating the vegetables produced with untreated low quality water. Furthermore, the producers and other stakeholders along the low quality water continuum are exposed to myriad risks after consuming the vegetables. The study concludes that for the policies to be compatible there should be some measures to mitigate the health risks associated with the use of untreated low quality water in irrigated agriculture.
NIP and NWP	1	The NWP is based on the premise that access to sustainable water can contribute significantly to addressing several development problems in Ghana. The overarching goal of the NWP is to provide a framework for the sustainable development of Ghana's water resources, promote and encourage water use efficiency techniques in agriculture and reduce transmission losses of water in irrigation systems. The NIP is consistent with the NWP in that the former seeks to manage the health risks associated with the use of contaminated water for irrigation agriculture while the latter provides an overall framework for the sustainable development of the water resources of Ghana, based on the principles of Integrated Water Resources Management (IWRM). NIP thus provides the necessary details to support the Water for Food Security policy objective of the NWP.
NIP and NLP	1	The NLP was introduced to address some of the fundamental problems associated with land management in the country. The NLP has several cardinal principles one of which is "the principle of optimum usage for all types of land uses, including human settlements, industry and commerce, agriculture, forestry and mining, the protection of water bodies and the environment in the long term national interest". This principle is consistent with the NIP's policy action of encouraging the reuse of low quality water as well as encouraging MMDAs to have dedicated lands for urban and peri-urban agricultural purposes. Dedicating urban and peri-urban lands to urban agricultural purposes can lead to security of tenure and will in turn encourage farmers to invest in their lands. The study thus treats the two policy documents as complementary.

Appendix A (Continued)

Policy documents	Score	Explanation for the score
NIP and NYP	1	The NYP recognises the youth as an important resource for national development. The NYP accepts that the agricultural sector is the highest contributor to Gross Domestic Product (GDP) in Ghana. It thus stresses on the need to develop strategic measures to improve the agricultural sector and achieve relative self sufficiency. The NYP dovetails well with NIP's food security objective. The NIP's intent of sustaining the livelihoods of urban agriculturists is highly consistent with the NYP's policy actions of increasing livelihood options, ensuring optimum natural resource use, and expanding investment space for irrigated production. The study regards to two policy documents as compatible.
NIP and NEP	1	The purpose of the NEP is to achieve full employment by enabling all men and women who are available and willing to work, to attain secured and sustainable livelihood through productive and freely chosen employment and work. The NEP, like the other policies, recognises that the agricultural sector plays kingpin roles in the promotion of national development. The policy recognises the need for irrigation schemes to support all-year-round farming which is in tandem with the NIP's strategy of supporting best practices for the safe use of low quality water for irrigation. The study thus sees the two policy documents as complementary.

A.2. Record sheet for the National Irrigation Policy Sustainability Test

National irrigation policy, strategies and regulatory measures To raise productivity of irrigation water Policy action description: Support best practices for the safe use of low quality water in accordance with World Health Organisation (WHO) Guidelines for the safe use of low quality water, excreta and greywater in agriculture		
Criteria – basic aims and objectives	Score	Reasons
Natural resources Supports conservation and sustainable utilisation of water resources	5	The activity strongly supports the objective as the best practices for the safe use of low water would help conserve and sustain the utilisation of water resources. This would help raise productivity of water for irrigated agriculture
Ensures the preservation of quality of groundwater and surface water resources suitable for intended purposes	5	Supporting the best practices for the safe use of low quality water in accordance with the guidelines would strongly support/ensure that the quality of groundwater and surface water is preserved

National irrigation policy, strategies and regulatory measures To raise productivity of irrigation water Policy action description: Support best practices for the safe use of low quality water in accordance with World Health Organisation (WHO) Guidelines for the safe use of low quality water, excreta and greywater in agriculture		
Criteria – basic aims and objectives	Score	Reasons
Ensures retention of natural character and function of aquatic ecosystems	4	Supporting the best practices for low water (treating water/storing) would strongly ensure the retention of natural character and function of aquatic ecosystems
Ensures protection of biodiversity	4	Supporting the best practices for the safe use of low quality water in accordance with the guidelines strongly supports the aim of ensuring the protection of biodiversity
Ensures protection of endangered species of fauna and flora	0	Supporting the best practices for the safe use of low quality water is neutral. No known endangered species will be protected.
Prevents discharges (liquid and solid) and disposal of low quality water that adversely affect water bodies	5	The best practices for the safe use of low quality water will strongly support the aim of preventing discharges and disposal of waste water to adversely affect other water bodies
Prevents land degradation and soil pollution/infertility	4	Adopting the best practices of waste water would prevent the pollution of the soil and degraded lands
Promotes sustainable consumption of inputs – recycling, reduction, reuse (energy, chemicals and other raw materials)	5	The adoption of the best practices of safe use of low water ensures the sustainable consumption of low quality water (recycling and reuse). This therefore strongly supports the aim
Promotes prevention of floods and mitigation of effects of floods/droughts	4	The aim of preventing floods and the effects of floods/droughts would be strongly achieved if the best practices for safe use of low quality water is adopted as this would ensure all year access to water for agriculture and other uses
Promotes protection of water basin areas	4	Ensuring the support of the best practices would promote the protection of water basins areas
<i>Socio-cultural conditions</i>		
Enhances access for all to water in sufficient quantity and quality for basic needs	4	The best practices encompasses treatment which reduces/releases pressure on freshwater to meet basic needs
Promotes good hygiene and contributes to prevention of water-related diseases	5	Adopting the best practices for the safe use of low quality water would the aim the aim of promoting good hygiene and reduction in water related diseases

National irrigation policy, strategies and regulatory measures To raise productivity of irrigation water Policy action description: Support best practices for the safe use of low quality water in accordance with World Health Organisation (WHO) Guidelines for the safe use of low quality water, excreta and greywater in agriculture		
Criteria – basic aims and objectives	Score	Reasons
Promotes equitable distribution of (water policy) related benefits	4	This strongly supports the aim in the sense that the Water Policy recognises the various cross-sectoral issues related to water-use and the links to other relevant sectoral policies such as those on sanitation, health, agriculture, transport and energy.
Guarantees the health of stakeholders	4	Observance of the MULTIPLE BARRIER APPROACH in the WHO guidelines reduces the health risks associated with the use of untreated low quality water in irrigated agriculture.
<i>Economic conditions</i>		
Encourages strong and stable condition in economic growth	4	Agriculture is regarded as the sector that contributes greatly to GDP despite the challenges confronting the sector. Putting in place the best practices for the safe use of low water would promote irrigated agriculture and ensure “all-year-round agricultural activities” which would encourage a strong and stable condition in economic growth
Encourages the retention of capital and the development of downstream industries, utilising local raw materials	4	The activity supports the aim. Capital is retained on “purchasing” water. Best safe use water practices makes quality water available for industrial use at relatively cheaper cost and required quantity to help develop the industries
Encourages the use of raw materials and services from local industries where possible	4	Vegetables produced by these farmers are used as inputs in the street kitchens and restaurants. Agro-processors also depend on the produce from the farmers to run their enterprises.

Appendix B. A list of legislation, regulations, guidelines and manuals reviewed

B.1. Legislation and guidelines reviewed in this paper

- i. The Supreme Military Council Decree (SMCD) 85 which establishes the Ghana Irrigation Development Authority to formulate and execute plans and programmes to develop irrigation, and improve livestock and fish culture in Ghana.
- ii. The Ghana Irrigation Development Authority Regulations 1987 (LI 1350).
- iii. The National Redemption Council Decree (NRCD) 173.
- iv. The Public Health Act, 2012 (Act 851).
- v. The Environmental Protection Agency Act 490, 1994.
- vi. The Environmental Assessment Regulations, LI 1652.

- vii. The Legislative Instruments for Environmental Impact Assessment.
- viii. LI 662 Ghana Standards (Certification Mark) Rule, 1970,
- ix. LI 664 Ghana Standards (Certification Mark) (Amendment) Rule, 1970,
- x. LI 1513 Prosecution of Offences under the Weights and Measures Decree,
- xi. 1975 (NRCD 326) Instrument, 1991,
- xii. LI 1541 Ghana Standard Board (Food, Drugs and Other Goods) General Labelling Rules, 1992,
- xiii. LI 1549 Weights and Measures (fees) Regulations, 1992,
- xiv. LI 1550 Weights and Measures (Permissible Errors) Regulations, 1992,
- xv. NRCD 173 Standards Authority Act, 197
- xvi. NRCD 326 Weights and Measures Decree, 1975.
- xvii. Accra Metropolitan Assembly by-laws.
- xviii. Kumasi Metropolitan Assembly by-law.

The following guidelines and manuals were also reviewed:

- i. The Ghana Irrigation Development Authority's 'Technical Guidelines for Irrigated Agriculture' which gives more details on how to effectively manage water.
- ii. The following Environmental Protection Agency's guidelines for ensuring environmental quality: (i) guidelines on environmental quality, (ii) guidelines on oil and gas, (iii) guidelines on aquaculture, (iv) guidelines on environmental permitting process, and (v) guidelines on strategic environmental assessment (SEA).
- iii. Environmental Protection Agency Manual on Health Promotion, (December 2001),
- iv. Management of Environmental Sanitation Services Guidelines (March 2002) by the Ministry of Local Government and Rural Development (MLGRD).
- v. The Manual on Prosecution (May 2002).
- vi. The Best Practice Environmental Guidelines Series Number Three.
- vii. Manual for the Preparation of District Waste Management Plans in Ghana (July 2002).
- viii. Environmental Protection Agency/MLGRD Manual on Environmental Health Inspections (October 2002).
- ix. The Environmental Sanitation Services Monitoring Guidelines (January 2003).
- x. The Manual for the Operation of Septage Treatment Plants (May 2003).
- xi. Health Care Waste Management in Ghana.
- xii. The Ministry of Health Policy and Guidelines for Health Institutions (2006).
- xiii. Several Food and Drugs Authorities guidelines listed below were reviewed.

B.2. FDA guidelines to ensure the safety of food and drugs in Ghana

Area	Available guidelines
Food evaluation and registration	General guidelines labelling requirements for pre-packaged food Guidelines for the registration of pre-packaged foods
Food enforcement	Guidelines for the advertisement of pre-packaged foods Guideline for the safe disposal of unwholesome food products Code of practice for the storage of pre-packaged food in a dry warehouse

Area	Available guidelines
Food safety management	Guidelines for the registration of pre-packaged foods
	Guidelines for code of practice for cold storage facilities
	Guideline for the safe disposal of unwholesome food products
	Guidelines for the licensing of dry food storage facilities/warehouse
	Guidelines for repackaging of food product(s)
	Guidelines for the labelling of pre-packaged foods\
	Guidelines for code of hygienic practice for food service establishment in the hospitality industry
	Guidelines for handling food borne disease outbreaks
	Guidelines for the licensing of food service establishment
	Code of practice for cold storage facilities
Animal products and bio safety	Code of practice for meat markets or shops
	Code of practice for meat processing facilities
	Code of practice for slaughter houses/slabs
	Code of practice for the transportation of meat
	Guidelines for risk assessment of genetically modified food and feed
Food industrial service support	Guidelines for licensing of cold storage facilities
	Guidelines for licensing of meat shop
	Guidelines for licensing of meat transport vehicles
	Guidelines for licensing of slaughter house slab
	Code of practice for the manufacture, packaging, transportation, storage and sale of iodised salt in Ghana
	Guideline for the export of palm oil
	A guide for managers on the prohibition of smoking in public places
	Guidelines for importation of controlled substances
	Guidelines for the importation of tobacco products
	Specifications for the no-smoking sign
Drugs division tobacco substance abuse	Returns on narcotic drugs and psychotropic substances imported
	Guideline for registration of herbal medicinal. Products
	Guidelines for registration of homoeopathic medicines
	Guidelines for the registration of food supplements
	FDA BR [batch release] hepatitis a virosomal
Herbal	Guidelines for batch release of BCG vaccine
	FDA BR [batch release] hepatitis a (inactivated and absorbed)
	FDA BR [batch release] influenza
	FDA BR [batch release] measles vaccine
	FDA BR [batch release] polio
	FDA BR [batch release] hepatitis b
	FDA BR [batch release] whole cell DTP
	FDA BR [batch release] rabies
	Guideline for registration of biological products in Ghana
	Guidelines for registration of bio-similar products in Ghana
Biological blood products	Guidelines for registration of world health organisation (who) pre-qualified biological products
	Guidelines for fast track registration of who prequalified medicinal products

Area	Available guidelines
Clinical trials	Guidelines for conducting clinical trials of medicines, food supplements, vaccines and medical devices in Ghana Guidelines for good clinical practice in Ghana
Safety monitoring	Guidelines for conducting pharmacovigilance inspections Guidelines for selection of qualified person for pharmacovigilance Guideline for reporting adverse reaction Guidelines for surveillance of adverse events following immunisation in Ghana
Drug enforcement	Guidelines for licensing of manufacturing industries (drugs, cosmetics, household chemical substances and medical devices) Guidelines for licensing of wholesalers, importers, exporters and distributors of regulated products Guidelines for safe disposal of defective and expired drugs, cosmetics, household chemical substances and medical devices Guidelines for selection of authorised person in the pharmaceutical and chemical industry Guidelines for the advertisement of drugs, herbal medicines, cosmetics, medical devices and household chemicals Guidelines for good distribution practices for drugs, cosmetics, medical devices and household chemical substances
Cosmetics and household chemical substances	Guidelines for the advertisement of drugs, cosmetics, household chemicals and medical devices Guidelines for importation of cosmetics and household chemical substances Guidelines for the registration of cosmetics and household chemical substances in Ghana
Medical devices	Requirements for labelling of products Guideline for importation of medical device Guideline for importation of medical device Guidelines for the advertisement of drugs, cosmetics, household chemicals and medical devices
Drugs registration	Guidelines for registration of allopathic drugs (human and veterinary) – CTD format Guidelines for stability testing of active pharmaceutical ingredients and finished pharmaceutical products Template labelling Template patient information leaflet Template summary of product characteristics Variation guidelines for allopathic medicines Guidelines for conducting bioequivalence studies Guidelines for the fast track registration of who prequalified medicinal product.
CTD guidelines	Guidelines for registration of allopathic drugs (human and veterinary)

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