ARCN International Journal of Development
ISSN: 2384-5347. Volume 8, Issue 1, (August, 2024) pages 57 – 76
DOI: 2726-4051-0816
arcnjournals@gmail.com
https://arcnjournals.org

Assessment of Waste Water Disposal for Effective Environmental Quality – A Case Study of Selected Wards of Jimeta Adamawa State, Nigeria

[1]Abubakar Abba, [2]Abdullahi Baba Kankamba, [3]Abubakar Mohammed, [4]Ibrahim Mamman
Department of Urban and Regional Planning, Adamawa State Polytechnic, Yola, Nigeria

Abstract: *This research work is aimed at assessing of waste water disposal for effective neighborhood sewer system. Waste disposal and management has been a challenge especially in urban areas. Waste may include domestic liquid waste from residence, industries, or agriculture. it is renewable resource once used can be reclaimed and used again for different beneficial uses. For instance it can be used for irrigation of pubic park, aesthetic field, recreational centres, school yard, irrigation of landscape areas surrounding building. This will reduce overstretching of portable water. Drawing by the data collected in Rumde abd Doubeli ward using method of data collection like questionnaires, interviews field surveys, maps, google earth and GIS. This study identified the socio-economic characteristics of residents in the study area, methods used for waste water disposal in Runde, Doubeli wards of Jimeta town, examine the physical planning problems of domestic waste water disposal in the study area, identified planning problems associated with waste water disposal and planning recommendations for effective.*

Keywords: *Waste Water, Environmental Quality, Physical Planning.*

1.1 Background of the study

Any water that has been adversely affected in quality due to human activities can be regarded as wastewater (Burton and Stensel, 2003). It includes domestic liquid waste from residences, industries or agriculture. It encompasses a wide range of contaminants which can be potentially harmful or concentrations that can lead to degradation in water quality. These potential contaminants include soaps and detergents from bathrooms, food scraps and oil from kitchens and other human activities that involve the use of water. Potable water becomes wastewater after getting contaminated with all or some of the above mentioned potential contaminants.

The main sources of municipal waste water are domestic, commercial establishments, industries, and medical facilities. The waste water consists of organic matter from food preparations, detergents and inorganic materials (EPA, 2000).

Sewage disposal is therefore the return of used water to the environment. Disposal points distribute the used water either to aquatic water bodies such as oceans, rivers, lakes, stream, ponds or lagoons or to land by absorption systems, ground water recharge and irrigation (Farlex,2014).

Sewage disposal methods mean the ways that are available to home and shop owners for the release of waste water into the environment.

Safe disposal of wastewater still remains a serious problem in Nigeria where it has the potential of causing groundwater and surface water contamination and creates environmental pollution.

The effects of untreated or poorly treated wastewater can be detrimental to public health, the environment, and the economy. If implemented under uncontrolled or unregulated circumstances, poorly treated wastewater can be harmful to living beings (if
ingested directly or through irrigated crops) and irrigated soil (due to the chemicals and potential bacteria within the effluent) (Adewumi, *et al.*, 2010).

Wastewater is a complex resource that is both advantageous and inconveniencing in its use. It is a renewable resource that once used can be reclaimed and used again for different beneficial uses. The quality of the once used wastewater and the specific type of reuse determine the level of subsequent treatment needed.
Groundwater contaminations are major occurrences in urban areas and these normally result to epidemic of water borne diseases such as cholera, typhoid fever, gastro-intestinal disorder and so on. These diseases have led to the death of millions of people globally.

In Nigeria, different cities use different methods of sewage disposal, while some cities have organized functional sewage system such as Abuja, Port Harcourt, Kaduna, Calabar and Lagos, other cities like Jimeta-Yola have no defined sewage disposal system and as such operate disorganized and decentralized methods of waste disposal.

In Jimeta Metropolis, particularly Runde, Jambutu and Doubeli wards where this study will concentrate, various forms of environmental degradation are visibly noticed as a result of poor wastewater disposal; these are in form of disposed run-off wastewater on ground, faulted soak away and blocked drainages.

Statement of Problem

According to United Nations Educational, Scientific and Cultural Organization (UNESCO), the global waste water generation is increasing at an exponential rate, as a result of rapid population growth and urbanization. An overwhelmingly large position of African and Asian population still remains without access to sanitation and waste water treatment facilities. A large volume of untreated waste water is dumped directly into our water resources, threatening human health, ecosystems, biodiversity, food security and the sustainability of our water resources (Zandaryaa, 2011)
As reported by Saidu (2012), majority (66.12%) of the residents in Yola town dispose off their untreated sewage in open drainage channels mainly owing to poorly constructed and maintained drains that are inadequate for excessive sewage particularly from kitchens, bathrooms, toilets, etc. Ehunze *et al*, (2005) noted that: It is common sight in Jimeta just like many other Nigerian cities to see people throw wastewater into the streets where they collects as pools of horrid smelling water. Such pools of wastewater are potential breeding sites for disease vectors e.g. mosquitoes and denies a city her aesthetic beauty. Drainages are absent in many streets. Where present, they are not well networked to ensure smooth flow of wastewater. Also people do dispose solid waste e.g. empty water sachets, cans, bottles, food remnants, etc into these wastewater drainages. This results in the blockage of such drains and collection of pools of wastewater in the drains. Stench from such drainages is unpleasant and unhealthy.
Over the years, the problem of poor wastewater disposal system at Runde and Doubeli wards of Jimeta town is worsened by the amount of waste water been disposed off on either narrow drainages erected by individuals or community; or on bare ground has grown steadily in part because of the increasing population and inability of some individuals to provide an effective

drainage channel or good defined system of sewage disposal. It's obvious that the indiscriminate disposal of domestic and commercial waste water at some parts of Runde ward causes eroding of soil, blockage of vehicle accessibility foul-smelling stagnant water among others. The need of this study arises as an urgency to update waste water disposal system at neighborhood level at an affordable and locally prepared sewer system.

2. Aim and Objectives

Aim

The aim of this study is to assess the domestic wastewater disposal system with a view to improve the environmental quality of the study area

Objectives

1. To identify the socio-economic characteristics of residents in the study area
2. To identify methods used for waste water disposal in Rumde and Doubeli wards of Jimeta town
3. To propose a planning recommendations for effective waste water disposal in the study area

Area of study Jimeta

Jimeta Metropolis is in Yola North L.G.A. It is the operational capital of old Gongola State and currently the capital of Adamawa State of Nigeria. The environmental parameters of Jimeta consists of its situation on latitude 9^0N and, longitude 12^028^i at the bank of River Benue. Yola North L.G.A is bounded by Girei Local Government to the North and Yola South L.G.A. to the South, East and West. Jimeta is located within the lower sub-basin of the Upper Benue valley. The sedimentary rock of this area consists of two major stratigraphic units, the Bima Sandstone and the River Course Alluvium (Ezeigbo *et al*, 1992). The Bima Sandstone is the oldest and the most extensive sedimentary unit in the study area. It covers about 2/3 of the area. The River Course alluvium overlies the Cretaceous Bima Sandstone. It is composed of sand, silty sand, silty clay and pebble horizons. In some areas, the alluvium is composed of river beds and floor plain. Jimeta is composed of 11 wards namely Alkalawa, Ajiya, Doubeli, Gwadabawa, Jambutu, Limawa, Luggere, Karewa, Nassarawo, Rumde and Yelwa.

Housing and Environment

The housing structure in Jimeta is relatively not well planned. Except for Old GRA, Karewa Extension, Bekaji Housing Estate and State Low-Cost Housing Estate areas, the remaining parts, this forms the bulk of the town lack good planning. The streets are poorly connected mainly by alleys popularly called "lungu" in local parlance. Majority of the areas are more or less slums. Even in areas where new houses are cropping up like the Gibson Jalo Road (Army Barrack's Road), there appears to be no proper location of the houses in line with urban planning principles (Ihunweze et.al., 2005).

Climate

The climate condition of Jimeta is characterized by rainy and dry seasons. The rainy season period lasts for about seven months, beginning from April through November, with the rainfall peak in

August. The dry season is accompanied with dust particles as a result of the north east trade wind blowing from Sahara Desert. This wind commonly known as the harmattan has dehydrating effect on human skin. The temperature is normally high throughout the year with mean yearly maximum temperature of about 34.30C and minimum of 21-300C, the average daily hours of sunshine is 7-8 hours. Yola-Jimeta from the above conditions could be said to be amongst the hottest regions of Nigeria.

The west African sub regions is bounded by water on the southern border and by land on the northern side, significantly two different air messes, therefore developed from the oceanic and land surfaces, the warm and the most tropical maritime (MT) air mass originate from the Atlantic oceans while the dry and dusty tropical continental(CT) emanate from the desert. Different air masses.

Weather and climate of Yola-Jimeta, is therefore principally dictated by the migration of the (ITD). The ITD oscillate between the northern and southern borders of Jimeta. Its lowest latitude is about 5-7 degrees N in January/February and the highest is 22-25 degrees N in August. Moderate increase in rainfall in some years, but not regularly due to the depth of the (MT) air mass from the Atlantic Ocean. Yola-Jimeta has a tropical climate marked by dry and rainy seasons.

Vegetation

There are two notable vegetation zones within the state capital, the sub Sudan zone and the northern guinea savannah. The two zones are marked by short grasses and interspersed by short trees commonly found here and there within all grasses and trees located at the north-east region of Nigeria. Yola-Jimeta enjoys these two vegetation belts;

(i) The sub Sudan zone which contribute 60% and
(ii) Guinea savannah zone about 40% of the state land mass.

Vegetation in the savannah zone is characterized by short grasses and trees that vegetate Yola-Jimeta and its environs. Man's activities such as construction, farming, wood gathering, and in some point, livestock grazing etc., has drastically alter the vegetative cover of Jimeta - Yola. This deliberate act maintained by some of the inhabitant of Yola-Jimeta has affected the rain fall pattern which in turn has taken a toll on the water level.

Soil

The soil types of Yola-Jimeta are the litho soil alluvial soil. The alluvial soil is found along the bank of the river Benue and spreads outwards, it has a dark colour, and it has very high water retention capacity. The soil characteristics of Jimeta – Yola serves as a very important factor and a good source for underground water. Jimeta – Yola is an urban settlement resting on one of the most essential natural resources that can shape man's environment and existence if only this abundant water can be properly harness and supply to households, industrial complex, commercial areas etc.

Ethno-Religious, Occupational, Agricultural and Economic Composition

About 80% of the populations of the study area are Fulani, followed by Hausa, Kanuri, Suwa-arabs, Yoruba and others settlers such as Higgi, Chamber, Vere, Michika Igbo etc.

The major occupation in Jimeta are predominantly civil servants due to the administrative nature of the settlement since after independence. There are economic activities such as buying and

selling of goods, small and large scale industrial activities, agriculture and aquaculture activities, furniture making, welding, and rearing of animals' etc.

1.6.6 Infrastructure

The nearby town of Jimeta has a market, zoo, an international airport with national and international flights, NiPost and NiTel offices as well as the main mosque and cathedral. Being a state capital, it is a major transport hub with buses and taxis shuttling to various destination of the country and, and neighboring countries like Cameroun.

The town is home to various institutions of learning, Federal College of Education, Federal Government Girls College, Adamawa State Polytechnic, Aliyu Mustapha Academy, Chiroma Ahmad Academy, Ahmadu Ribadu College, and many other educational institutions. Adamawa has one of the best depots in Nigeria, located about 5 km west on the road to Numan.

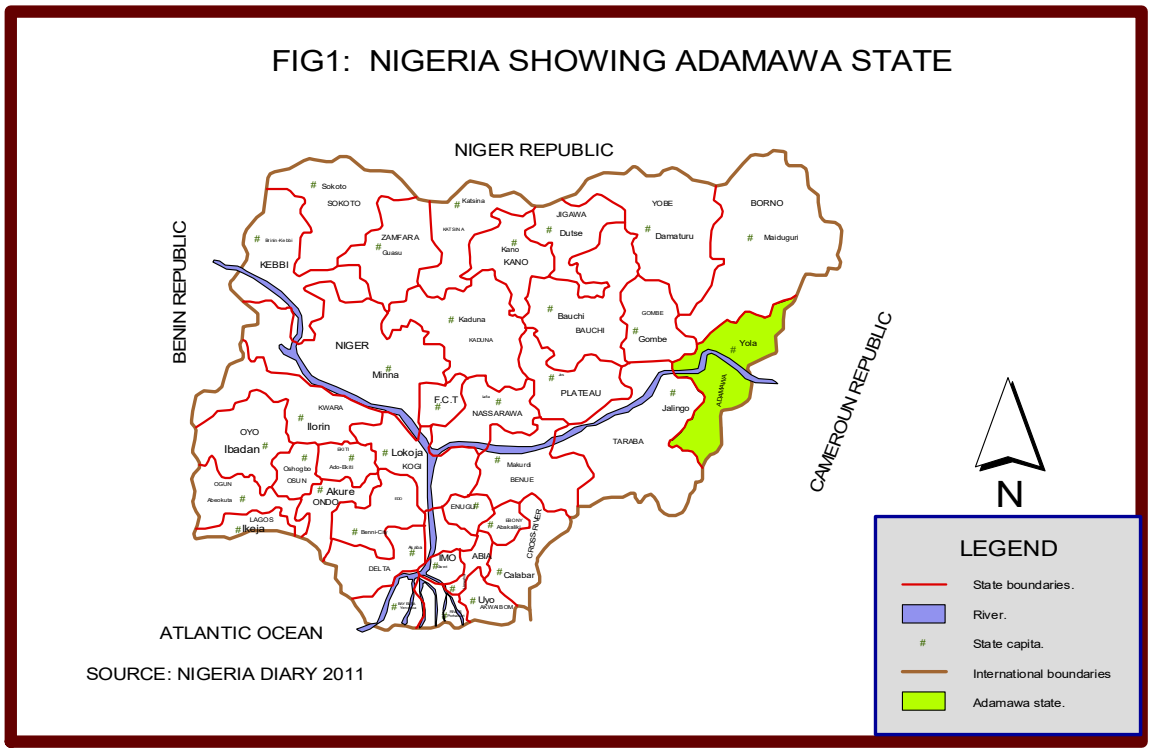

Figure 1.1 Map of Nigeria Showing Adamawa State

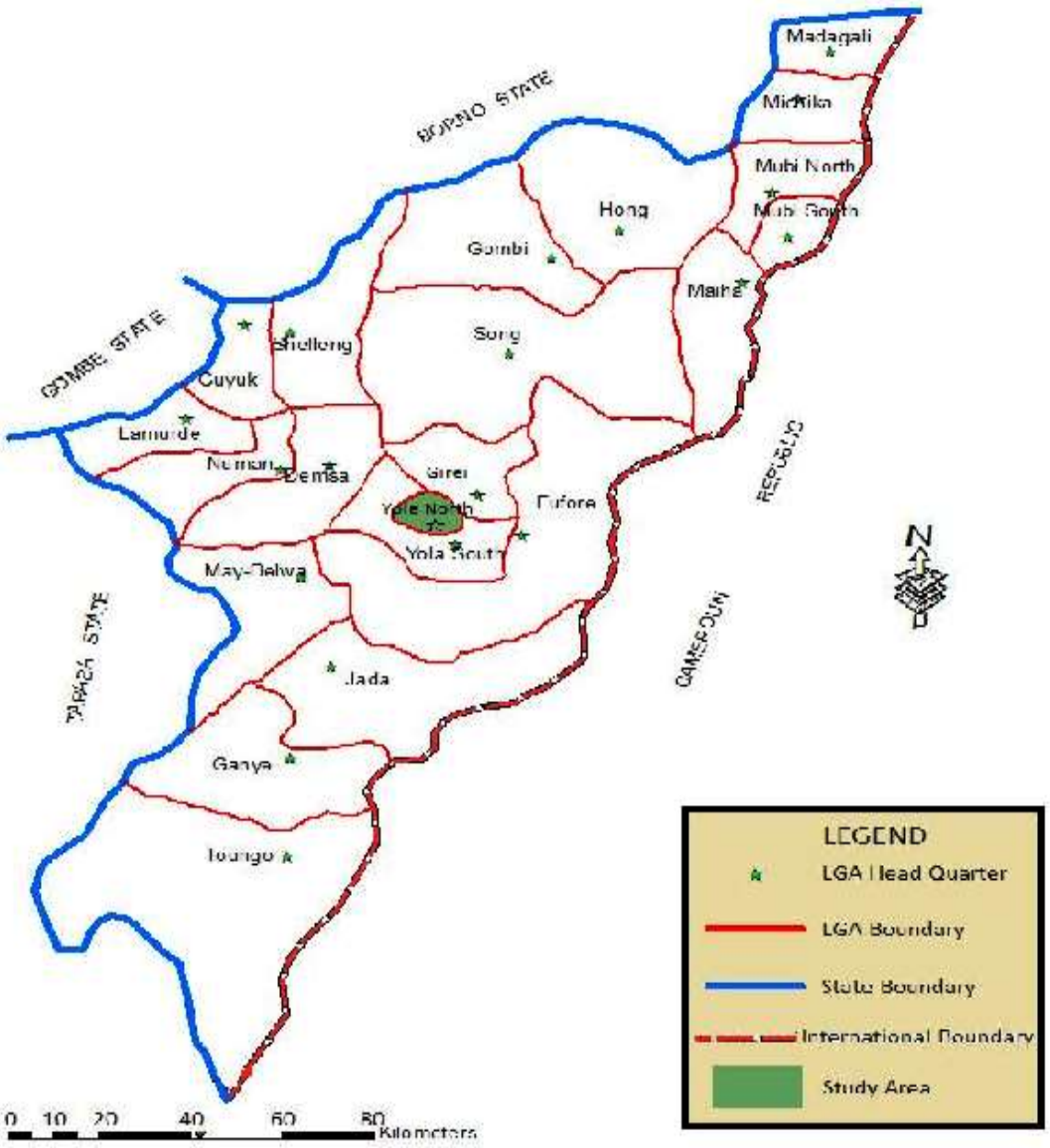

Figure 1.2 Map of Adamawa State showing Jimeta

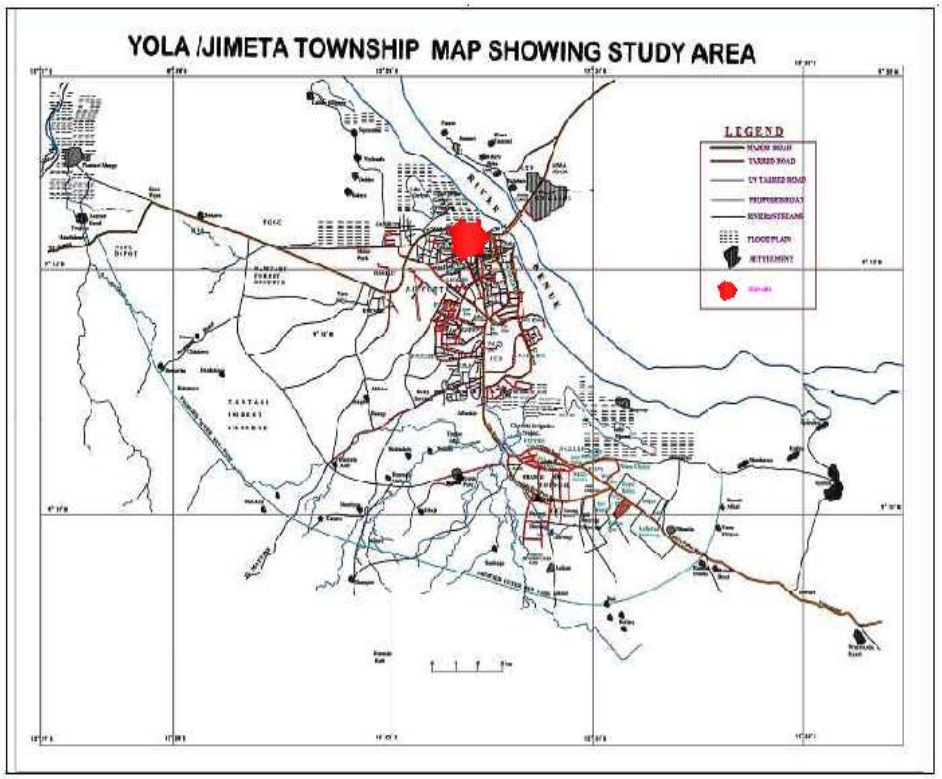

Figure 1.3 Map of Jimeta Showing Study Area

3. Concept of Waste Water

Wastewater is a complex resource that is both advantageous and inconveniencing in its use. It is a renewable resource that once used can be reclaimed and used again for different beneficial uses. The quality of the once used wastewater and the specific type of reuse determine the level of subsequent treatment needed. The reclaimed wastewater can be used for purposes, other than drinking, such as; irrigation of public parks, athletic fields, recreation centers, school yards and playing fields, reservations of highways, irrigation of landscaped area surrounding buildings, fire protection, as well as toilet and urinal flushing in public buildings (Hespanhol, 1992).

According to Waheb (1991), sewage is the collective name for the liquid waste of a community. It consists of: excreta that are faeces and urine; bathroom or bath waste-water; kitchen waste-water; laundry waste-water; rain run-off waste-water and industrial waste-water.

Sullage water is another name for gray water (Sridhar, 2007). It is a domestic waste-water other than that which comes from the toilet with sources from washing, bathing and meal preparations. Domestic sewage originates mainly from people's day-to-day activities

Wastewater Management in Nigeria

There is a significant lack of proper wastewater treatment in most African countries. Untreated wastewater effluent is one of the most common types of pollution found around urban rivers and in groundwater sources in many African cities (Omosa *et al.,*2012). Nigerian cities are expected to participate in the global trend of sustainable environmental improvements or innovations that focus on projects such as water supply and sanitation, solid waste management, air pollution, environmental health, and access to means of livelihood; hence, there is a need for a better understanding of the existing situation of facilities and infrastructures in these cities.

In Aba, one of the Nigeria's commercial cities, Odurukwe (2012), reported that there is no central wastewater system, and there are no septic tanks for domestic wastewater. The sewers for industrial wastewater coming from big industries and the open drains used for the wastewater of medium- and small-scale industries are channeled in such a way that their contents are emptied into Aba River.

The pollution of Aba River is very likely to increase in the next decade. There is inadequate or hardly any treatment of the wastewater produced by the industries, and no
efforts are being made to change this situation.

In Minna, the capital of Niger state, Idris-Nda *et al.* (2013) reported that domestic wastewater management consists of the use of septic tanks, unplanned and partially planned open drainage systems. In their report, about 35% of domestic wastewater
generated goes into the septic tank while the remaining 65% flows freely on ground surface and sometimes forming stagnant pools.

The residents in some areas resort to the use of unlined channels to convey wastewater away from their residential areas. A result of this method of disposal is a pool of stagnated water at the terminal end and the production of obnoxious odors.

According to Mustapha (2013), in Kano, Nigeria's third largest city, most of the industries do not have wastewater treatment facilities and thus discharge their untreated effluents into the adjoining receiving water bodies; the receiving water courses are now grossly polluted, and the polluted water courses are being extensively used for water supply, irrigation, fishing, and recreation while the only treatment plant in Kano central is nonfunctional.

Adesogan (2013) discovered in his study that only Kaduna has a functional industrial waste water treatment facility (Nigerian Brewery, Kaduna) in the northern part of Nigeria. Similarly, the only functional system in the middle belt is in Abuja, while Benue, Niger, Kogi, Kwara, and Plateau states have non-functional wastewater treatment facilities. Despite the preponderance of wastewater treatment plants in the south, many of the southern States lack functional wastewater treatment systems while some states (Bayelsa, Ondo, Anambra, Ebonyi, Abia, Imo, Cross River, and AkwaIbom) do not have wastewater treatment facilities. It is disheartening to note that Nigerians still dispose wastewater from domestic areas (washrooms, laundries, and kitchen) directly into surface waters without any treatment.

Wastewater from commercial and industrial applications has also experienced the same fate without any plan by most environmental stakeholders to ensure safe disposal. The indiscriminate release of wastewater into the environment in many Nigerian cities has adversely affected sanitation and claimed the lives of many people through diseases such as cholera, hepatitis B, and typhoid (Giwa,2014).

The endocrine-disrupting substances in untreated wastewater can alter the hormone system of human beings, resulting in reproduction predicaments, cancerous growths, and deformations of body organs. In many densely populated areas in Lagos State such as Badagry, Mushin, Oshodi, and Ikorodu, most septic tanks are in dilapidated conditions, leading to severe cases of groundwater contamination.

Lagos State alone generates a massive 1.4 trillion cubic centimeters of wastewater every day, according to government statistics (Giwa, 2014).

Change of attitude toward wastewater management is the key to sustainable management of water resources. Government at all levels needs to embrace implementation of wastewater treatment and reuse programs and policies.

Without this, the preservation of our water resources and the environment for the future (i.e. sustainability) remains an illusion.

Neighborhood Waste Water Management and Re-use

The main sources of municipal waste water are domestic, commercial establishments, industries, and medical facilities. The waste water consists of organic matter from food preparations, detergents and inorganic materials (EPA, 2000).

Domestic wastewater carries organic matter from food preparation, cleaning of clothes and cookware, and human waste. The quantity and characteristics of the sludge generated at a wastewater treatment plant depend on the composition of the wastewater, the type of wastewater treatment used, and the type of subsequent treatment applied to the sludge (Epstein, 2003).`

During the past twenty years, designers and planners have been devising solutions to decrease the demand for water at the building and site level and to prevent flooding. The following innovations can reduce water demand in residential buildings in the developed world by 50 to 85%.

Global Review of Wastewater Reuse

Unregulated wastewater reuse has been in practice for centuries in many parts of the world. The concept of integrated wastewater reuse, however, has received increase attention in recent times due to the degradation of freshwater resources resulting from improper disposal of wastewater and drought and prediction of further droughts from climate change in many arid areas. Furthermore, reuse has gained traction due to increasing competition for freshwater resources, therefore highlighting the need to conserve higher quality water for suitable uses to meet growing industrial,

agricultural and domestic needs. Also, there have been growing demands for greener water strategies and water conservation as well as growing recognition of the resource value of wastewater especially in supplementing freshwater for no potable uses and irrigation and the high costs of supplying sufficient quantities of potable water to arid areas (WHO, 2006; Ilemobade *et al*., 2009).

Wastewater reuse is an important component of both wastewater management and water resource management. It offers an environmentally sound option for managing wastewater that dramatically reduces environmental impacts associated with discharge of wastewater effluent into surface waters. In addition, reuse provides an alternative water supply for many activities that do not require potable quality water and, as such, permits the saved potable water to be used elsewhere. In arid regions where there has traditionally been a scarcity of water, wastewater reuse technology has been successfully implemented via dual reticulation systems.

Examples are in Jordan (Al-Jayyousi, 2003; 2004), Israel (Friedler and Hadari, 2006; Brenner *et al*., 2000), Spain (March *et al.* 2004), Australia (John, 1996; Eric, 1996; Diana *et al*., 1996; Dillion, 2000), and some parts of South Africa (Marilyn, 2006; Adewumi *et al.,* 2010 (a)). In addition, water scarcity experienced globally has led to the embracing of wastewater and other sources of non-potable water in many large urban areas in regions previously considered to have sufficient water sources like China (Junying*et al.*, 2004), Japan (Dixon *et al.,* 1999), Canada (Exall, 2004), Germany (Nolde, 1999), the United Kingdom (UKEA, 2000) and the United States (Okun, 1996).

Sewer Systems

Sewer systems, in order to work properly, need flushing toilets at the source, at least one per home or living unit. At the same time, this requires a dependable water supply, the water of which, after becoming wastewater, needs a disposal system. The installation of flushing toilets together with bath tubs, showers, hand basins, sinks, laundries, with their water supply from a mains network, and their disposal pipe and sewer network requires a well-designed and well managed infrastructure generally known as a plumbing system. Building all the components of a proper sewer system (supply pipes underground, pressure lines with plumbing fittings, as well as drain pipes and sewers) is expensive, and it is vital that they are designed, installed, maintained and managed properly. If the sewer pipes get blocked, or if the sewage treatment works is not well managed, untreated wastewater can reach rivers and cause widespread pollution of water resources that may result in epidemics and unhealthy surroundings.

When the toilet is flushed, a certain volume of dilution and carrying water and the waste (sewage) flow by gravity into and along a household sewer pipe set at a certain slope or gradient underground. Bath, laundry, dishwasher water also flows along the same system. The waste water from several living units flows in diluted form, but containing also grease and soap from the individual sewer pipes into an underground sewer main, running alongside the street or outer boundary of the living units.

Street sewers gravitate towards and connect with a main out-fall sewer, which joins the wastewater treatment works. The only driving force is the water from the flushing toilets, bathtubs, and sinks, flowing under the influence of gravity and taking the wastewater with it. It is implicit that the water supply must be sufficient to activate this.

Sewage Disposal Types

According to Jordan M. (1993), Sewage is disposed of in South Africa mainly in two ways viz: Removal in a waterborne sewer systems (sewerage) or disposed via an on-site sanitation system (pit latrines or septic tanks). The former has become standard practice in built-up areas, most cities and industrial complexes. The latter still has preference in rural areas, small villages and special inhabitant areas. Public transportation generally makes use of a third system, mainly found in airlines, long distance trains, caravans, etc.: chemical toilet. Disposal at sea is generally practice after primary treatment on shipboard on ocean voyages.

In Katsina metropolis, as is the case with many State capital cities in Nigeria there is no functional centralized sewage system. What exists is a decentralized system where every resident constructs outlets at ground level to discharge waste water (Ibeaka C., 2014). Ladan S. (2014) however, noted that it is this decentralized system that have brought about five different methods of sewage disposal in Katsina metropolis with examples below:

Septic Tank

This is a large air-tight hole in the ground lined with bricks or concrete with an inlet pipe for incoming sewage and outlet pipe for treated sewage. The tank has a removable concrete cover with air vents for gases to escape. Sewage entering the tank is decomposed anaerobically by bacteria. This method is more hygienic as the sewage does not come out to the ground surface and do not occupy floor area on the roadsides or impair the beauty of the surroundings (Garg, 2004)

Municipal Wastewater Sources and Characteristics

Municipal wastewater comprises of domestic (or sanitary), trade, industrial wastewaters, and storm water runoffs (EPA, 2005) Wastewater originates mainly from domestic, industrial, groundwater, and meteorological sources and these forms of wastewater are commonly referred to as domestic sewage, industrial waste, infiltration, and storm-water drainage (Mara *et al.,* 1998). Municipal wastewater is comprised of domestic (or sanitary) wastewater, industrial wastewater, infiltration and inflow into sewer lines, and storm water runoff. Domestic wastewater refers to wastewater discharged from residences and from commercial and institutional facilities (Epstein, 2003). The wastewater is treated in such a way that undesirable substances are separated from the water. The first treatment is often mechanical and it removes the bigger particles from the wastewater. Substances can also be removed biologically, which is often the case in for example nitrogen and carbon. According to Casey, 1997, chemical treatment is sometimes used and it encourages small particles and dissolved substances to form larger particles, which facilitate separation.

Most new sewerage systems collect sanitary wastewater and storm wastes separately, whereas older combined systems collect both sanitary wastewater and storm water together. Organic components may consist of carbohydrates, proteins, fats, greases, surfactants, oils, pesticides, phenols, etc., while inorganic components may consist of heavy metals, nitrogen, phosphorus, sulfur and chlorides (Mara, 2004).

Industrial Wastewaters

Hammer, 2003 pointed out that storm water runoff also contributes to the pollutant load of municipal wastewaters and consideration should be given to modification in industrial processes, segregation of wastes, flow equalization, and waste strength reduction. The Environmental Management and coordination Act (EMCA, 1999) was enacted to enable for the creation of a legal

arm and to provide framework for the efficient environmental management in Kenya. Legislative mechanism for the determination and control of pollution is well developed in Kenya, which in the case of water quality is contained in the EMCA, 1999 and Environmental Management and Coordination Act (water quality regulations), 2006. The regulations and control on the use of water for trade and industrial purposes and the disposal of the resultant wastes is contained in section 3 of (EMCA, 1999).

Environmental Management and Co-ordination (water quality) regulations, 2006 legal notice no. 120**,** section 13. (1) states that , *Every owner or operator of a trade or industrial undertaking issued with a licence by a local authority or sewerage service provider to discharge effluent into any existing sewerage systems shall comply with the standards set out in the Fifth Schedule to these Regulations.* These stipulate the allowable limits for discharge of industrial waste to the sewerage system.

Wastewater Sludge

Sludge is a valuable source of nutrients and trace elements important for plant growth, and can improve the chemical and physical properties of soils (Dominica *et al.,* 2009). Although these benefits have a great practical meaning, it must be taken into account that sludge may contain organic, inorganic, and biological pollutants from the wastewaters of households, commercial establishments, and industrial facilities and compounds added or formed during various wastewater treatment processes (Dominica *et al.,* 2009). Such pollutants include inorganic contaminants (e.g. metals and trace elements), organic contaminants (e.g. polychlorinated biphenyls, dioxins, pharmaceuticals and surfactants), and pathogens (bacteria, viruses and parasites).

Biosolids composition depends on wastewater constituents and treatment processes where the resulting properties will determine application method, rate and the degree of regulatory control required (EPA, 1999). According to Casey, (1997), sludge originates from different stages at the wastewater treatment process and has a varying content of inorganic and organic substances in both a liquid phase and a solid phase. The quantity and characteristics of the sludge generated at a wastewater treatment plant depend on the composition of the wastewater, the type of wastewater treatment used, and the type of subsequent treatment applied to the sludge. Apart from the substances that enters the treatment plant, of which some will sediment directly in the mechanical treatment, the sludge also contains micro organisms produced in the biological treatment step and added chemicals used in the chemical treatment step (Mara *et al.* 1998). Pharmaceutical products such as antibiotics and hormones in the influent wastewater are other substances that also eventually end up in the sludge (EPA, 1999). According to Epstein, (2003), metals, living organisms, organic substances and nutrients are all mixed together. Modern wastewater treatment plants are subject to a number of physical, chemical and biological treatment processes.

Wastewater treatment processes range from preliminary treatment, primary treatment, secondary treatment, advanced or tertiary treatment to sludge treatment The solids produced after gravitational settling of the settleable solids in primary treatment are called primary sludges and are highly odiferous with high content of pathogens (Epstein, 2003). After primary treatment, the most popular secondary treatment method is the activated sludge process which has an objective of mixing the wastewater with the active biomass which assimilates the organic fraction and reduces the demand for oxygen (Epstein, 2003).

Sewage Flow into Storm Water Drainages

This is the method by which residents dig or construct small outlets at ground level which were used to discharge waste water into storm water drainages constructed by the State Government.
In some houses very close to the storm drainages the sewage flow in directly while in other areas some meters away the sewage has to travel to reach the drainages. Some of these drainages are found along major roads and others are found within residential areas.
However inside all these drainages the sewage does not flow freely as waste materials of different kinds and sizes fall into the drainages choking and blocking sewage flow.

Sewage Flow into Open Ground

This is the method used in new residential areas that new buildings of homes were still being constructed.

Sewage Flow into Streams

This is the method by which sewage flow into four streams found in the metropolis. This method of discharging sewage into streams is similar to what is obtained in other developing countries where rivers and streams are little more than open sewers (Cunningham, 2010)

Sewage Flow into Water Ponds

This is the method by which sewage is directed to flow into the several water ponds found within the metropolis. Houses that have water ponds behind them simply direct sewage pipes and outlets into the ponds.

Sewage Treatment

Sewage treatment consists generally of primary (physical) and secondary (chemical and biological) treatment. The two main communal sewage removal systems, off-site and on-site,on are described below:

Waste Water Management and Reuse

The effective management of any wastewater flow requires an accurate knowledge of its characteristics. These characteristics, according to Burks and Minnis, 1994, are necessary to facilitate the effective design of wastewater treatment and disposal system, and also to enable the development and application of water conservation and waste load reduction strategies. The quality of wastewater may be defined by its physical, chemical and biological characteristics. Physical parameters include; temperature, pH, electrical conductivity, colour, odour, and turbidity. Insoluble contents such as oil and grease, solids (suspended or dissolved) and inorganic fractions also fall into this category (Burks and Minnis, 1994).
Wastewater reuse is an important component of both wastewater management and water resource management. It offers an environmentally sound option for managing wastewater that dramatically reduces environmental impacts associated with discharge of wastewater effluent into surface waters. In addition, reuse provides an alternative water supply for many activities that do not require potable quality water and, as such, permits the saved potable water to be used elsewhere. In arid regions where there has traditionally been a scarcity of water, wastewater reuse technology has been successfully implemented via dual reticulation systems.

Examples are in Jordan (Al-Jayyousi, 2003; 2004), Israel (Friedler and Hadari, 2006; Brenner *et al*., 2000),

4. METHODOLOGY

Type of Data Required

The following set of data was required to address the objectives of this study:

Physical Data of the study area:

This includes information on precise geographic locations of the study area, identify the nature and effect of the physical arrangement to the residents. Following set of data are required under this category:

1. Locational map of the study area to provide the exact spatial reference
2. Spatial arrangement of housing units as well as waste water disposal means from individual housing/commercial units such as street side drains, septic tank, cesspit pit toilet, water closet, open space etc.

Socio-economic Data of the residents

This includes number of households/housing units that uses each of the identified various methods of wastewater disposal, marital status, household size, and reason for using the chosen way of wastewater disposal.

Institutional and literature Data

This involves obtaining information on sewage management from relevant government agencies on wastewater management, disposal and provision of facilities. Ministry of Environment, Public Health Department, Adamawa State Urban Planning and Development Authority and Yola North Local Government Authority will be consulted. Relevant literatures on wastewater management and planning have also be reviewed to serve as conceptual basis for the research

Sources of Data

As outlined in the data required for the study, the primary data will involve site visit to get familiar with the area; observe the physical features and socio-economic activities around, take photograph of existing condition of the site, identify likely boundary of the area, administering of questionnaire and oral interview, taking coordinate of appropriate location.

The secondary data to be obtained for this research includes review of relevant existing study on wastewater disposal, planning and management from published and published thesis, published journals, textbooks, and internet searches. Information on planning standards and principles, wastewater management are among the data to be reviewed.

5. Method Data Collection

In this study, Data to be obtained was from the interviews, review of literature, personal field survey and questionnaires to analyze for the process of this research in the study area. Photographs, maps using Arc GIS and Goggle Earth, interview and quantitative analysis of the field data. The study of the literatures gives a good theoretical background on the sewage, sewer systems and

wastewater treatment and management. Furthermore, street side drains, the major domestic grey water facilities will be studied in the streets earlier earmarked for household/housing unit's survey.

Questionnaires will also be administered to household heads/representative, shop owners, heads and staff of Ministry of Environment, Public Health Department, Adamawa State Urban Planning and Development Authority and Yola North Local Government Authority on methods and satisfaction of wastewater disposal, as well as the role of these government agencies and the public in the evacuation of street side drains and toilet facilities and implementation of environmental laws, final disposal system and problems encountered.

Sampling Frame and Sample Size

The sample structure for this study consists the selected unplanned areas or neighborhood in the study area. "The planned wards of Jimeta include the wards where houses are relatively modern, well-planned streets, and facilities such as water supply, sanitation, well-constructed streets, etc are available to residents. These wards are Alkalawa, Gwadabawa and Karewa wards. The unplanned wards are those where such facilities are not provided at all or not adequately provided. They are areas that have little or no form of planning. They include, Ajiya, Doubeli, Jambutu, Limawa, Luggere, Nassarawo, Rumde and Yelwa wards. (Ihunweze *et.al*. 2005)." The selected areas areas are: Doubeli and Rumde wards of Jimeta metropolis. Problem of wastewater disposal was more noticeable under these wards within Jimeta town, due to the absence of appropriate wastewater disposal facilities in many of the areas under the study.

The total number of 160 questionnaires have been administered for this study. Bailey (1994), argue that at least 30 cases seems to be the bare minimum for study in which statistical data analysis has been done. Thus, the sample size of this study will be reasonably large and consistent with Bailey argument whereby 50 households has been selected from each ward, and 10 respondents from government agencies.

Sampling Technique

The techniques adopted for this study are stratified random sampling and purposive sampling. Respondents from households and shop owners have been randomly selected based on wards strata, the strata includes Doubeli and Rumde. Purposive sampling technique have been employed on data needed from heads and staff of Ministry of Environment, Adamawa State Urban Planning and Development Authority and Yola North Local Government Authority.

Data Processing

Data collected have been coded and then entered in SPSS program and cleaned to check for the outliers and descriptive statistics have been carried out for analyzing the socio-economic characteristics of the respondents. Furthermore, Microsoft have been used for quantitative techniques analysis

6. Method of Data Analysis

Descriptive and inferential statistics have been used in analyzing the data collected. Data on public awareness and participation, efforts of government in wastewater management, and the state of wastewater drainages, were analyzed using descriptive statistics.

7. Discussion of Findings

1. Forty Three percent of households in the study area are above six person per house. This implies the teeming number of population in the study area that subsequently affect the wastewater generation.
2. About 50 percent of the household heads are living on average of 1000 naira per day, which in turn affects the financial necessities of their immediate families as well as community orientation like provision of sanitary facilities.
3. Average households in the study area are consuming about 200 litres of water per day. This depicts volume of water been used as well as the expected waste water to be generated.
4. About 40 percent of households are disposing their waste water in open surface, while 36 percent are discharging the waste water in mostly narrowly constructed public drainages provided by individuals. This causes the stagnation of wastewater at almost everywhere in the study area.
5. Many households in the study area are reusing the wastewater especially for washing and flushing of toilets.
6. According Adamawa State Environmental Protection Agency, Waste water generated by commercial users is mostly toxic than the one generated from domestic uses in the study area.
7. Continues disposal of waste water on open space and narrowly constructed drainages in the study area, mostly from domestic and shop owners has caused the following planning challenges which includes pool of stagnant water that hosts many vectors like mosquitoes; overfload of drainages; blocking of vehicular movement among others.
8. Pool of stagnant waste water on open space/streets blocks vehicular movement to many parts of Rumde and Doubeli areas with average size of 4 x 5 meters in densely areas.
9. Inadequate drainages in Rumde has caused few existing ones that are mostly constructed by individuals with average width of 0.5 to 1 meter to over-flood and cause difficulty in accessibility
10. The entire communities are on adverse risk of health due to poor sanitation and stagnation of waste water almost everywhere, leads to various ailments to particularly children like malaria and darhiaria.
11. Lack of community participation in provision an effective drainage network that will convey the entire waste water out the study area
12. Poor disposal of wastewater on the streets has cause the community to lose its aesthetic nature of decent settlement.

7. Planning Recommendations on Effective waste water disposal

The need to have an orderly society is uncompromising. Therefore, to mitigate or tackle the problem of indiscriminate waste water disposal in Rumde and doubeli communities. Following planning recommendations are imperative foe effective waste water management at the community level:

1. Community participation is highly needed to establish a well networked drainage that can convey the waste water out of the community or managed for the benefit of the community
2. Establishing an individual household water reuse of waste water should be promoted within a house so as to minimize the poor disposal.
3. Government Agencies responsible for provision of drainages should provide adequate and closed drainages at every street of the study area.
4. R

outine fumigation and bacteria killing should be encouraged on every stagnant waste water pool within the community.

5. A sewer system can be established for collecting the entire waste water of the communities and be re-used for other purpose such as irrigation
6. Where possible, every individual house should have a soakaway system that can convey the domestic waste water to the ground

Conclusion

As a result of the volume of wastewater generated in this area and the challenges posed to the environment and to the inhabitants, coupled with the fairly good physico-chemical composition, this wastewater can be re-used for other purposes. The benefits of collecting wastewater in this area are numerous; the collected wastewater could be recycled for all domestic activities except cooking and drinking which fortunately accounts for only 4% of water usage in the study area. Wastewater re-use involves passing the wastewater through a treatment system, which involves the removal of solids, inorganic and organic compounds, bacteria and algae and subsequent conversion into economically acceptable water. Wastewater re-use in this area will allow effluents to be disposed of without danger to human health or unacceptable damage to the natural environment.

Wastewater system options are best selected in conjunction with broader, comprehensive community planning efforts to ensure that overall community goals are being met, such as environmental protection and land use goals. The planning process includes an analysis of the physical, social, economic, cultural, and environmental characteristics of the planning area.

In many communities, results of wastewater planning efforts will indicate that the best option is choosing several alternatives, which are decentralized onsite wastewater systems in one part of the community, decentralized cluster systems in other sections, and a centralized facility in another part of the community.

Wastewater services to small communities require the adoption of cost effective solutions which are affordable to the community and national economies.

Development of these services requires improved planning processes which tailor the solutions to the social, cultural, environmental and economic circumstances in the target areas.

Accelerated extension of wastewater management services to small communities is essential to address concerns over the water scarcity, water pollution and protection of public health.

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