

Spatial Data Analysis of Solid Waste Management System in Port Harcourt Metropolis after 100 years of its Existence.

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Key words: Spatial data, Solid waste management, Port Harcourt Metropolis, GPS

SUMMARY

During the early years of the discovery of Port Harcourt, it was generally addressed as the “Garden city of Nigeria” because of its neatness and the overwhelming presence of vegetation and flowers all over its metropolis. Along history lane, the presence of piles of refuse dotting the entire city brought about its public criticism as “Garbage city of Nigeria”, as indiscriminate dumping of solid waste such as food waste, paper, polythene, textiles, scrap metals, glasses, wood, plastics, etc at street corners, and gutters became very common. These heaps of refuse do not only affect the aesthetical nature of the city, but also block drains, and obstruct free flow of traffic. This study therefore is targeted at using spatial data to show the nature of solid waste management system in Port Harcourt metropolis after 100 years of its existence. The study involves the collection of primary data from Waste Dumpsites and Collection Points by personal and field observation using Garmin 76 handheld GPS alongside a Digital Camara. These primary data abstracted were analyzed using their photographs and spatial location on the google earth map of Port Harcourt. The research reveals that- waste collection points are scattered in the study area with only two legally approved dumpsites located within the study area, at Elioizu and Rumuolumeni, with another two designated in two neighbouring Local Government areas, Oyigbo and Eleme, etc

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1. INTRODUCTION

1.1 Background of the study

Waste can be described as avoidable materials resulting from domestic, industrial or economic activities for which there is no economic demand, and as such must be disposed (Scidrar 1996), or any substance, solid, semi-solid or gaseous that remains as residue or incidental by-product of processing a substance for which no further use can be found by the organism or system that produces them (Omuta, 1988).

The World Health Organization (WHO) refers to waste as “something which the owner no longer wants at a given time and space and which has no current or perceived market value”. However, waste may be gaseous, liquid, or solid. Whereas gaseous and liquid wastes are free flowing and can easily migrate from one place to another, solid waste is not free flowing.

Solid waste management is therefore defined as the application of techniques to ensure an orderly execution of various functions of collection, transportation, procession treatment and disposal of solid materials (Robinson, 1986). It is a discipline associated with the control of the generation, storage, action transfer and transport, procession and disposal of solid waste in a manner that is in accordance with the best principle of public health, economics, engineering, conservation, aesthetics, and other environmental considerations, and is also responsive to public attribute (vigil S.A 1993).

Poor waste management is a bane to development of any city. Apart from the various diseases and toxic conditions inherent in and derived from waste products, the presence of waste degenerates and degrades the aesthetic value of a city. They harbour flies, fleas, mosquitoes, rat and other disease vectors, which results to malaria, Filariasis, Yellow fever, etc.

Most of these wastes appear to come from domestic sources and are characterized by household waste. This ranges from food waste, paper, polythenes, textiles, wood, glass and plastics. Efforts have been made by Government, non-governmental agencies/organizations and other private sectors to rid the environment of this vexed and depriving prejudicial act.

According to Izeze, many of the current problems associated with waste disposal have resulted from increasing urban population, rapid and haphazard industrialization, poverty cycle, changing consumption pattern' and evitable increasing waste generation. The municipal city of Port Harcourt generates more waste than can be managed, and this situation tends increasing with income levels and its economic development.

1.2 Statement of Problem

In 1985, the Federal Government of Nigeria introduced a major initiative, the Environmental sanitation (clean-up campaign). All residents of Nigeria were mandated to carryout compulsory environmental clean-up every last Saturday of the month. The initiative was good, but its

implementation generated more problems. Garbage/waste from the exercise was dumped along roadsides instead of at the dump site designed by the local authorities for the purpose.

In recognition of the monumental challenges of MSW management in Port Harcourt, the government has attempted to tackle waste management issues through several approaches such as the “task force” approach. This approach involves- the designation of solid waste collection centers on major and public markets, and the use of local contractors/ agencies to evacuate the waste generated.

However, this approach have been found to be counter-productive in the long run as it created more problem due to lack of coordination on the part of government and inadequate solid waste management knowledge of the responsible agencies. Solid waste dumped along roadsides are usually left over a long time to decompose naturally (by micro-organisms), eaten by animals, picked by scavengers or washed away by the flood into larger creeks and rivers, thus affecting the surface water quality (Nweke 2000).

Subsequently, other methods employed include— the semi mechanical system, Contract system and house-to-house collection system. Until 2001, there exists the block collection system whereby the use of a collection vehicles for disposal when a bell is been range was employed. This system primped individual to resume indiscriminate dumping of refuse at corners of streets, road junction, etc. contractors are lined up with the authorities of collecting the refuse from these indiscriminate dumpsites.

This whole management seemed as though a communal collection system with no temporary storage unit provided as a result of lack of space, rather dumped along roadside, resulting to traffic congestion, drainage blockage, etc.

Presently, the Government has established the Rivers State Waste Management Authority (RIWAMA) to carry out a more organized waste management practice in the state. The authority as part of their strategies has designated waste collection points and dumb sites throughout the city.

1.3 Aim and objectives of the Study

1.3.1 Aim of the study

The research is aimed at determining the spatial location of existing waste collection and dump sites in the study area as a means of examining their proximity to residential buildings, roads, public facilities such as church, hospitals, schools, banks, etc.

1.3.2 Objectives of Study

The objectives to achieving the above mentioned aim include:

- i Picking Coordinates of solid waste collection and dumpsites.
- ii Show the spatial location of both the collection and dumpsites on the map of the city.
- iii Examine proximity of the collection and dumpsites to both private and public infrastructural facilities.
- iv Review the Government interventions in the management of waste in the municipal city

1.4 The Study Area

The study covers the entire metropolis of Port Harcourt, the capital of River state and the Head Quarters of the Niger Delta Region of Nigeria. It was established in 1913 as a result of the interplay of three sets of factors namely Geomorphic, political and economical. In accordance with the provision of Nigeria Township ordinance cap 126, Port Harcourt was designated as a second-class township in 1920. Consequent upon national constitutional changes, it becomes the capital of River State in 1976.

The present Port Harcourt is situated at the southernmost part of Nigeria and between longitude $7^{\circ} 00'$ and $7^{\circ} 15'$ East of the Greenwich meridian and Latitude of $4^{\circ} 30'$ and $4^{\circ} 47'$ North of the equator. It is bounded on the Eastern and Western parts by the meandering creeks and to the southern by the first dockyard creek (Bonny River) and mangrove swamps. Towards the north where there is availability of land, it is bounded by Ikwerre L.G.A.

The area was named Port Harcourt after the founder of its Port, the then British Secretary of State of the colonial Masters, Lewis Harcourt.

1.5 Definition of terms

For a more elucidating understanding of this research, a number of terms or word crucial to it is defined.

i Waste- An avoidable material resulting from domestic, industrial or economic activities for which there is no economic demand and as such must be disposed (Scidrar, 1996) or any substance, solid, semi-solid, liquid or gaseous that remains as residue or an incidental by-product of processing of a substance for which no use can be found by the organism or system that produces it.(Omuta, 1988).

ii Solid waste- useless, unwanted or discarded materials that arise from man's commercial, domestic, material, Health care, Agricultural and other economic activities and are not free flowing or cannot be discarded through a pipe (Bridgewater and Lidgreedm 1982).

iii Waste Disposal- process of discarding waste materials that can no longer be used and are regarded as potential to people or environment. It also include the combined operation of production, collection and treatments of waste including storage, tipped or deposit on or below ground, as well as all the transformation utilized for recovery, refuse and recycling.

iv Municipal waste- durable goods, non-durable goods, and containers and packing food waste, it could be form residential, commercial, industrial, and institutions.

v Disposal site- an area designated for waste disposal facilities such as landfills, compost site, incineration plans, recycling station, etc.

vi Collection site- a designated point for temporary waste dumping before taken to the dump site. It operates in form of wastes Bins tank etc.

2. REVIEW OF RELATED LITERATURES

Let us re-examine the extent to which previous studies have been carried out under this subject matter.

2.1 Historical Development of Waste Management in Port Harcourt

The management of municipal solid waste (MSW) has traditionally been the exclusive responsibility of the Local or Municipal Government. The city council (Port Harcourt city council) has historically been responsible for managing MSW generated within the Port Harcourt metropolis (The current Obio/Akpo and Port Harcourt city L.G.As). Consequent upon the introduction of the Environmental Sanitation Authority in 1985, by the Federal Government of Nigeria, whereby all residents in the country is expected to carry out a compulsory environmental clean-up at every last Saturday of each month.

In 1986, the Rivers State Environmental Sanitation edict was enacted and from about 1989 in line with agenda 21 which emphasizes the need for all countries to maintain the quality of the Earth's environment and especially achieve environmentally sound and sustainable development that the State Government promulgated the Rivers State Refuse Collection and Disposal Law of 1991 as well as the Rivers State Environmental Protection Agency law of 1991. This gave power to the state government to create particular parastatals to manage MSW, thus eroding the functions of local government council in conflict with paragraph (h) of the fourth schedule of the Nigerian 1999 constitution which maintains the status quo of management of MSW to local government authorities.

The River State Environmental Sanitation Authority (RSESA), a parastatal under the Rivers state ministry of environment was established by the edict to manage the solid waste generated within the metropolis and its environments. One of the major works of the RSESA is to supervise the contractors appointed by the state government to collect and dispose municipal solid waste.

The government provided places and or large bins at market places and at street corners and road junctions for residents to dump their household waste. The solid waste disposal contractors then evaluate these wastes from the collection centre to the provided dump site as described by Ayotamuno and Gobo (2004).

2.1.1 Pre-independence (1912-1960)

From 1913 when waste generation commenced in a notable nature in Port Harcourt, standard dustbins were provided to each household with collection being disposal by vehicles. There were adequate sanitary inspectors and labourers, with the cities councils responsible for waste disposal, the final disposal were by incineration plant.

The effectiveness of the MSW management as of this period can be tagged to be a function of the little population of people (only 5,000) within the city (1915). As at this period the environs of the city were characterized and renowned for its cleanliness and beauty and were christened as the Garden city.

2.1.2 Post Independence period under Eastern Nigeria Government (1960-1964)

After the independence of Nigeria in 1960, the city of Port Harcourt was under the administration of the then Eastern Nigeria Government. The population rate noticed meteoric rise in fame as new areas were built up, some were planned and some not planned, thereby lacking access road. This led to difficulties in organizing an effective primary collection of refuse throughout the city by the usual vehicle collection strategy. Numbers of sanitation

workers become minimal and inadequate to cope with increasing population and unplanned development reducing the much labeled set standard.

2.1.3 The new Rivers State before the second Republic (1967-1979)

After the creation of the state on 27th May, 1967 from the Eastern Nigeria Government, and consequent upon the pronouncement of Port Harcourt as the capital, the populations of the city increased to about 103,000, the consumption activities that breed waste also increase as more problem on how to manage these waste were also noticed.

In 1973, the proposed Diobu was prepared by Nicksons and Borys partners. So far, nothing has been done to implement this plan for the physical development of the area. According to a survey of the then prepared master plan, the approved dumpsite are very far away from residential/commercial household and most of the resident prefer dumping the waste at designated centre .

But with the advent of the oil boom the area noticed influx of population, which altered the original settings of the area, more domestic and commercial waste were produced, creating difficulties in managing them by the local authorities.

2.1.4 During the second Republic (1979-1983)

During this era, the management of solid waste in Port Harcourt assumed greater complexity and management imperfection as a result of rapid population increase. The government in an attempt to manage MSW appointed (5) five environmental contractors to help manage the heap of municipal waste indiscriminate dumping.

The contractors adopted management strategy of households, providing plastic dustbins in low density areas and mobile trucks in high density areas at designated locations in order to clear the waste. Collection was done three times a week costing about Eight million Naira per (N8,000,000) annum, (Udoan, 1987). The afore mentioned contractor's services was poor and so they were relieved of their responsibility in 1982, bringing back city council under the following districts councils to manage waste.

- i. The Port Harcourt city council
- ii. The Trans-Amadi urban council
- iii. The Woji district council
- iv. The Diobu urban council
- v. The Obio/Akpo district council

These councils individually were asked to set up an environmental sanitation task force to manage waste in each of their councils using mostly tippers and pay loaders for collection, transportation and disposal (Ifidi 2000).

2.1.5 Between 1984-1995

During this period, the five districts were dissolved and city management returned back to Port Harcourt City Council. Subsequently, the War against Indiscipline (WAI) was launched. By 7am to 10am every Saturday morning sanitary exercises in the environment were experienced, but was later changed to twice a month.

In order to have authority to manage urban waste service and prosecute defaulters, the State promulgated the edict No.5 of 1986. The authority contracted the supply of truck equipments and their maintenance and technical advice to a West German firm called Sulo. During this

reign, they had staff strength of about nine hundred and thirty (930) as at 1985. But by 1995 the staff strength reduced drastically due to logical and financial inadequacies. (Ifidi, 2000).

2.2 Characteristics of solid waste

There exist a connotative inter-sparsity between the term refuse and solid waste, although the latter term is preferred. The common materials of solid waste can be classified in several different ways. The point of origin is important in some cases, so classification is done as domestic, institutional, commercial, industrial, street, demolition or construction. When the nature of material is required, classification can be made on the basis of organic, inorganic, combustible, non combustible, perishable, and non perishable fractions.

One of the most useful classifications which are based on the kind of material is cross examined as presented in the table below.

Table 2.8.1: Classification of waste based on the kind of materia

<i>Kind</i>	<i>Composition</i>	<i>Source</i>
Garbage	Waste from preparation, looking and serving of food: market waste, waste from handling, storage and sales.	House holds and Restaurant.
Rubbish	Combustible: paper, cartons, boxes, barrels, wood, excelsior, tree branches, yard training waste, wood furniture. Noncombustible: Meats, tin cans, metal furniture, dirt, glass, etc.	Institutions, and stores, and markets
Ashes	Residue from fire wood/coolers used for cooking and heating and from on – site incineration	Household
Street refuse	Sweeping dirt, leaves, catch basin dirt, content of litter receptacles	Street side/path, vacant lots, open spaces.
Dead animals	Cats, dogs, fishes, cow, chicken, rat, lizards, etc	Slaughters, cracks, household
Abandoned vehicles	Unwanted cars and trunk left on public and open areas.	Mechanics, factories, etc.
Industrial waste	Food processing wastes, Boiler house cylinders, lumber scraps, metal scraps and shaving.	Factories and power plants
Demolition waste	Lumber, pipes, other construction materials from razed buildings and other structure	New construction, remedial projects.
Construction waste	Scrap lumber, pipes,	New construction remodeling.
Special waste	Hazardous solid and liquid; explosives, pathological waste and radioactive materials.	Households, hotels, hospitals, institutions, stores and industries.
Sewage treatment residue	Solid from coarse screening and from grit chambers septic tank sludge.	Sewage treatment plants, septic tanks.

Source— Institution of solid waste, municipal refuse disposal Chicago.

2.3 Methods of Refuse Collection, Transfer and Disposal

Waste management process involves a sequential procedure. Right from the period of collection to the disposal, there exist individual activities and method employed.

2.3.1 Methods of Refuse Collection

Waste can be collected as a practice through the communal collection, door to door collection, curbside collection and block collection.

i. Curbside Collection

This method requires informing the people to throw their garbages at the curbside (road) on a collection day at a specific time to help collection at designated time. In enforcing this, municipal inspectors are appointed to issue penalties to those who forget their bin for too long.

ii. Door to Door Collection

This might involve providing different waste containers for the inhabitants and ask them to separate their garbage as they throw them in. The containers are been emptied by the dumper-placer and refuse collectors and replaced on daily basis.

iii. Communal Collection

It involves the storage units where by people go and dump their waste within the stipulated 24 hours of the day. When the storage units are filled, the collectors either contractor or the council comes to pick them up and immediately replaces another one.

iv. **Block Collection**

Block collection involves the greatest inhabitant participation. The collection vehicles have a designed route which it follows according to schedules individuals are expected to bring out their garbage to the vehicle for discharge. To design an appropriate collection system requires an understanding of the people. The block collection for instance can only be successful where there are people indoors to dispose waste at the time of collection.

2.3.2 Waste Transfer and Haul

Municipal waste collection may be either hauled directly to the disposal site by the collection equipment or it may be transferred by another size or type of equipment for hauling. Transferring waste to larger or more efficient hauling vehicles allows the collectors to minimize time on collection routes and it is necessary where disposal site is far from collections service area.

2.3.3 Methods of Waste Disposal

There are various methods of refuse disposal after collection. They include but not limited to incineration, recycling, composting, Resource recovery, sanitary landfill, Hog feeding, source reduction, shredding, pyrolysis, compacting and component separation.

i. Incineration

This method involves disposing waste by a controlled combustion of combustible waste at a very high temperature. There are two systems of incineration namely; the central system and the on-site incineration. The central incineration may be privately or publicly owned and operated, while the on-site is mostly owned and operated by multinational companies like Shell (Alley, 1994).

ii. Composting

Composting of refuse signifies the act of refuse disposal whereby refuse are been buried with or without light soil to produce humans, carbon dioxide, water, heat, etc. it involves the action of bacteria on highly degradable organic matter, animal, crop and food re-mains, which are placed in layer within pits. For effectiveness, the water is sorted to remove non-compostable waste and blended with additive such as egg Shells, sewage shafts at a ration of 3:1:1:1 (SPDC WSM, 2001). It has the disadvantage of difficulties in separating the organic and inorganic materials, transporting compost to farms. It is expensive and can lead to offensive odours if not properly handled.

iii. Landfill

Landfills are engineered containment facilities exhausted and with impermeable geomembrane material to ensure a leaf proof integrity, therefore preventing ground water contamination. It could be classified as sanitary and hazardous waste landfills.

Advantages of Landfills

1. Minimizes odours, and health hazards.
2. Most environmentally sound
3. Simplest and least expensive

4. Create room for recreational activities.

Disadvantages of Landfills

1. Separation of organic from inorganic difficulties.
2. Expensive equipments are involves and lack of farm compost spreading trucks.
3. Landfill site decommissioned may not be stable for any construction of soled structures.

iv. Shredding

This is a mechanical size reduction method, which waste could be converted to smaller pieces. After the shredding process, heaps of solid waste is reduced. This makes possible the accommodation of more quantities of waste in a site not capable of taking such quantities in their original state (Prior to reduction process).

v. Resource recovery (Waste to wealth)

This method of waste disposal which involves the process of converting what has been considered as material to be discarded into use or useable materials as well as wealth. It employs the usual/basic waste disposal principles of separation, sorting, reuse and recycling. The basic objective is to extract targeted components (metal, glass, paper, metal used tires, batteries, plastics, fluorescent tubes, etc).

vi Sources reduction

This is a method capable of preventing or reducing pollution by controlling the amount of waste generated. It tends changing the way products are manufactured, purchased and use so as to generate less waste. This is due by avoiding unnecessary packaging using long lasting products with reuse and durable characteristics. (Olu Andah 2000).

vii Hog feeding

Hog feeding is a recovery act whereby wastes materials are manipulated into feeds for domestic animals and livestock. It still involves the conventional sorting separation, reuse etc.

viii Recycling

This is the reuse of materials to make new products. By reducing the need to harvest, mine and process virgin materials, recycling conserves wood, minerals, oil, energy and water. It saves on landfills expenses and litter clean-up costs pollution, and creates job opportunities.

ix) Pyrolysis

Despite the fact that this method is not practiced in developing countries, it remains a technique of thermal decomposition of organic material in the absence of oxygen and is seen as an alternative to incineration. The bye products of pyrolysis are organic and inorganic solid oil and gases that can be used as fuel and marketable. It is an improved method over incineration because of its ability to shape out flies and shapes.

2.4 Refuse Disposal as proposed by the Port Harcourt Master Plan (1975)

Waste handling according to the master plan of Port Harcourt involves container collection service with a maximum collection time of one week.

But after about 25 years when this was implemented, the nature and the objectives of this master plan was unsustainable because of the meteoric rise in population of the city.

Refuse compacting trucks and the location of containers at strategic places were proposed. Also on the plan, the establishment of one or more treatment plants, establishment of area for

this purpose, the use of landfill technique and composition method due to available technologies at that time was also drawn.

However, the plan failed to state in its land use proposal the size or magnitude of expected refuse in the future due to the increase in population. The master plan also did not state categorically the method(s) of disposing this waste in a more sustainable sense.

3. METHODOLOGY

This involves the procedure followed to realize the aim and objectives of this research. It also focuses on the various methods employed in data analysis.

3.1 Data Collection

Primary and secondary data were used in the study.

3.1.1 Primary data

The primary data were those obtained from field work. They include personal observations and field data obtained from waste collection points and dumpsites using Gamin 76 handheld GPS, a digital camera, alongside some basic surveying instruments.

3.1.2 Secondary data

The secondary data used for this study are obtained by references made on related test books, journals, conference papers, magazines, internet materials, Newsletters, etc.

3.2 Material and Personnel Requirements

3.2.1 Material Requirements

The materials and software used in the course of this project includes—

- i. One Gamin 76 handheld GPS: For data acquisition.
- ii. One vehicle for transportation.
- iii. One digital camera
- iv. Pc based Google earth software
- v. A pc based Laptop
- vi. Pc based Auto CAD 2000 software.
- vii. Geographical calculator (GEOCAL.) programme— for conversions.
- viii. Previous literatures related to the study.

3.2.1 Personnel Requirements

- | | | | |
|-----|----------------------|---|---------------|
| i | Ajie Ukeame Emmanuel | — | Researcher |
| ii | Dienye Amina | — | Co-researcher |
| iii | Wilson Johnson | — | CAD operator |
| iv | Stanley Banigo | — | Driver |
| v | Emeka Ahamefula | — | Photographer |

4. RESULTS AND DATA ANALYSIS

4.1 Data acquisition

Spatial data of both dumpsites and collection points were acquired using the Garmin 76 handheld GPS. This was achieved under the Clark 1880 Mina Datum in the Nigerian Traverse Mercator (NTM).

Table 4.1 GPS Coordinate of some Solid Waste Data

S/N	Site Type	DOP	Northing	Easting	location
1	CP	8.8	96406	497315	Mgbuoba/Ozuba road Opp. Living truth church.
2	CP	7.4	98524	495290	Old dump site, east/west road by uniport.
3	DS	9.9	96459	496482	Beside Akpor grammar school, Ozuoba
4	CP	8.9	96666	495945	Opp Ap filling station ozuaba/ choba road ozuoba
5	CP	8.4	96978	495465	Front of Christ the king apostolic church rumumolagu town choba
6	DS	6.9	91731	502708	Temporary borrow dumpsite off, orazhi market road, orazhi
7	CP	7.6	97786	493720	Along choba road

CP = Collection Point DS = Dump Site DOP= Dilute of Precision

4.2 Data processing

The Nigerian Traverse Mercator (NTM) Coordinates of the Clark 1880- Mina Datum obtained from the GPS were converted to its Geodetic equivalent and further converted to the Geodetic and Universal Traverse Mercator (UTM) coordinates of the WGS-84 Datum to enhance multiple choices during further procession.

Table 4.2 Converted GPS Coordinates of some selected Solid Waste collection points

S/N	Site Type	DOP	DATUM-MINA MIDBELT				DATUM-WGS-84				Location
			N	E	Lat	Long	N	E	Lat	Long	
1	CP	9.5	99367	493957	4 53 49.04	6 54 27.89	541706.92	267896.51	4 53 51.35	6 54 25.85	Along uniport/ choba road by sammies plaza, uniport
2	CP	7.9	92182	504886	4 49 55.95	7 0 23.08	53451.16	278821.58	4 49 58.29	7 0 20.45	under bridge, rumuola air force junction Aba road
3	CP	8.1	92553	506120	4 50 8.12	7 13.10	534883.15	280167.24	4 50 16.71	7 1 4.06	First bank junction Aba road
4	CP	9.1	92745	506231	4 50.14.38	7 1 6.69	535075.15	280167.24	4 50 17.13	7 1 32.58	Market junction Aba road
5	CP	7.2	93458	508656	4 50 37.63	7 2 25.33	535782.42	282920.87	4 50 39.96	7 2 22.70	First artillery of Aba road
6	CP	8.1	93348	508884	4 50 34.20	7 2 32.74	535676.38	282820.92	4 50 36.53	7 2 30.11	Shell gate back of Aba road

Cp= collection point

4.2.1 Data manipulation

Converted GPS coordinate of both solid waste dumpsites and collection points were stored in Microsoft word 2007 and plotted on the Google earth software.

4.3 Data Presentation

Collection points and dumpsites locations were represented by purple place mark on the Google earth map of Port Harcourt as shown in 4.4 below.

4.4 Data analysis

Open collection points located close to residential buildings, churches, schools, banks, roads, etc are considered inappropriate and dangerous to human, hence, recommended for removal or subsequent replacement with collection carts, as well as those located along roads inaccessible

to haulage. Temporary dumpsites located within built-up areas are also considered inappropriate and recommended for closure.



Fig 4.4—Doza and Scavengers at work at the Elioizu Dumpsite, Port Harcourt.

Source— Researcher’s field work 2011

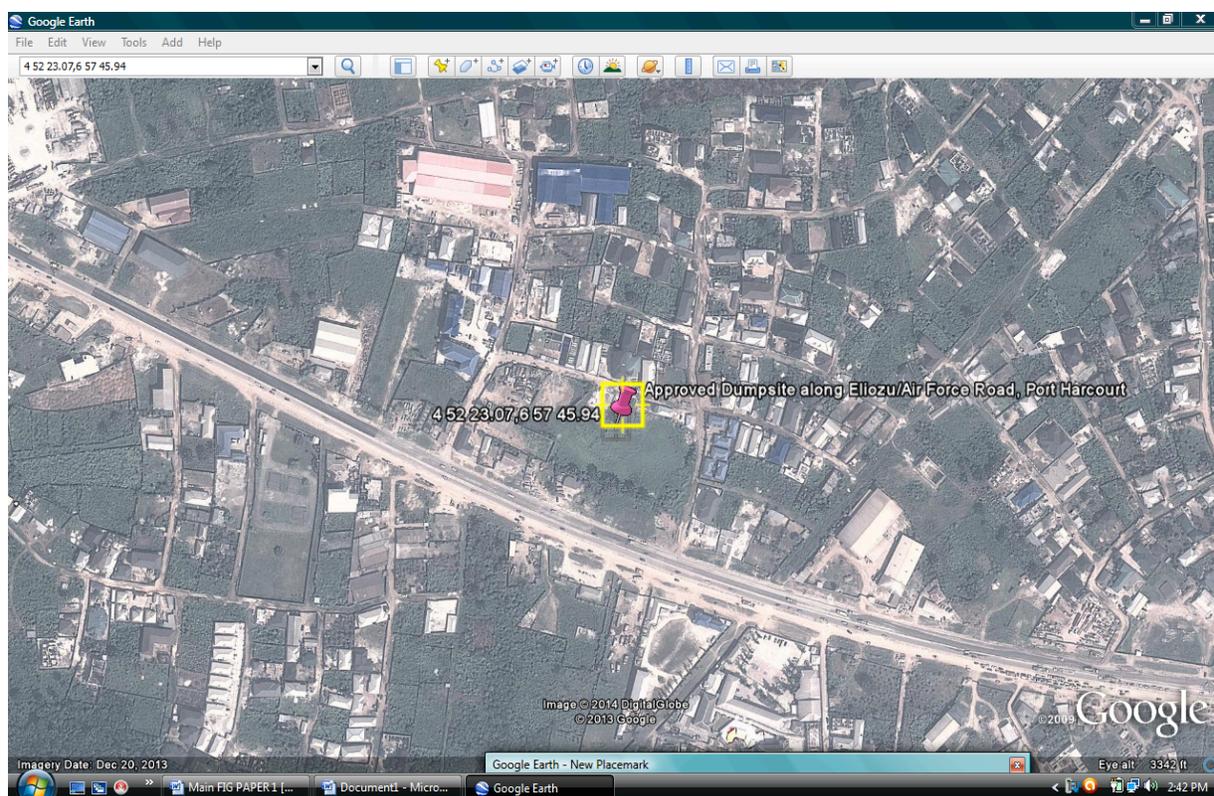


Plate 2— Spatial location of Elioizu dumpsite, Port Harcourt.

Source— googleearth.com



Plate 3—Waste Evacuation along Ada George Road, by Okilton Bus-stop, Port Harcourt.
Source— Researcher's field work 2011

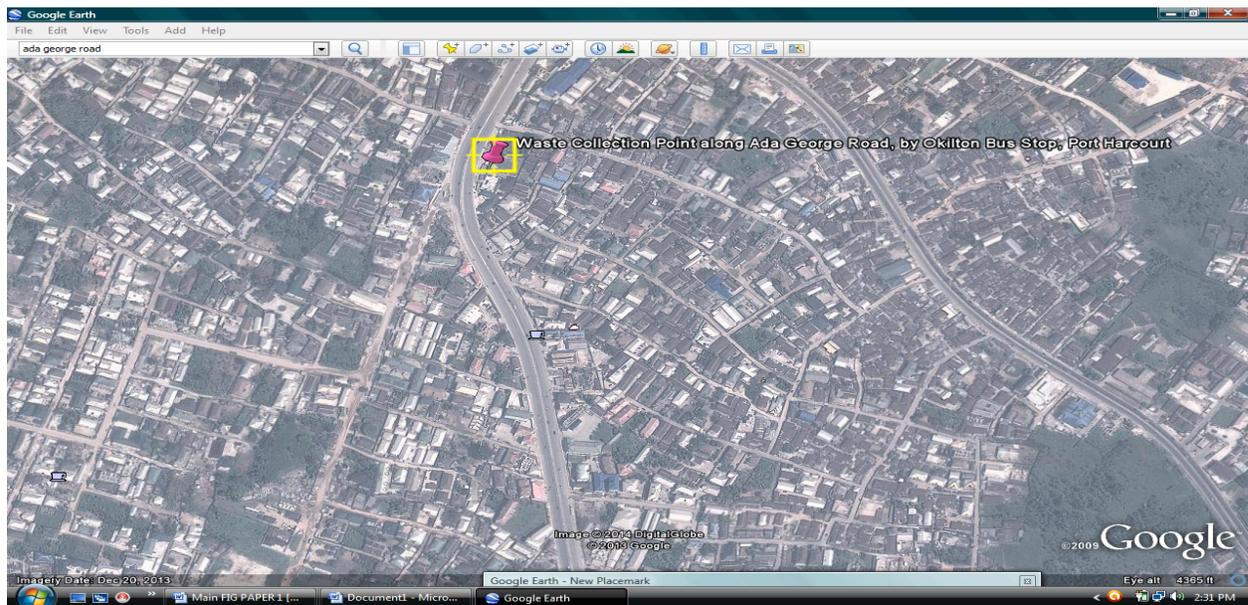


Plate 4— Spatial location of collection point along Ada George Road, by Okilton Bus-stop, Port Harcourt
Source— googleearth.com

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusions

Increasing urbanization is bound to increase the amount of a city produces. Management of solid waste by Government organization has not been successful but rather poor in most Nigerian urban centers, including Port Harcourt. The amount of uncontrolled waste is most likely to increase with increasing urbanization. The sensitization of the community is also

essential to achieving the above stated of solid waste management. The public apathy can be altered by awareness building campaigns and educational measures.

5.1.1 Problem encountered

- (i) It was not easy to get very close to the dumpsites when collecting the field data using the GPS. This was as a result of the unsafe and unpleasant conditions of the dumpsites.
- (ii) GPS reception sometimes is very difficult, mostly due to poor weather condition.
- (iii) It is stressful to get the digital map of Port Harcourt for the study.
- (v) Searching for collection point was a very enormous and painstaking task.

5.1.2 Findings

The research revealed that— waste collection points are scattered in the study area with only two legally approved dumpsites located within the study area, at Elioizu and Rumuolumeni, and another two designated in two neighbouring Local Government Areas, Oyigbo and Eleme— only the landscape method of disposal is practiced— method of waste haulage have drastically improved as compactors are now been used against the hitherto ugly open trucks.

In consonance with the dictates of the study, it is eminent to state that— The delay in clearing the garbage sometimes leads to congestion of roads— uncontrolled waste often end up in drains, causing blockage which results in flooding— waste in open dump sites can cause severe aesthetic nuisance in term of smell and appearance.

The study further reveals that in battling the waste management challenges, the State Government has recently signed into law, an act establishing the Rivers State Waste Management Authority (RIWAMA).

Solid waste disposal time has been recently restricted between 7pm to 5am daily, while the compulsory monthly Environmental sanitation exercise has been shifted from the first to the last Saturday of every month, to run concurrently with other neighbouring States.

5.5 RECOMMENDATIONS

In consonant with the fact that “growth does not appear everywhere at the same time, it manifest itself in points or poles of growth with variables terminal effect for the economy as a whole” (D.C Ogbonna 2007).

The study recommends the following in form of policies;

- i Government should as a matter of statutory obligation make provision for more dumpsites strategically located at the outskirts of the city. This will give waste disposal contractor multiple choices of disposal rather than traveling far away.
- iii Government should revert to the old system adopted by the Fedelis Oyakhilome led administration— which provides every street a refuse bin for the emptying of waste and to be collected regularly for final disposal by contracting firm in charge of the zone, instead of the present open space road side dumping and collection.
- v For effective public participation in the area of Environmental sanitation, Government should communicate with relevant stakeholders via advertisement and public enlightenment campaigns.

- vi At the end of every month, government should organize competition in which after inspection of the premises and award prices given to the neatest household, neighbourhoods, hospital, school, bank, market, etc. The prices must be attractive and results announced via the media in order to encourage public participation. This was the case in Britain (1991) organized by its cleaning council.
- vii Refuse sorting should be encouraged at the source of generation through public enlightenment.

REFERENCE

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