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Thesis

By

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UNIVERSITY OF IBADAN

SOCIO-ECONOMIC IMPACTS OF LOCATION OF NOXIOUS FACILITIES IN URBAN AREAS: THE CASE OF LANDFILLS IN LAGOS METROPOLIS

MARCH, 2004

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A THESIS IN THE DEPARTMENT OF GEOGRAPHY SUBMITTED TO THE FACULTY OF THE SOCIAL SCIENCES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF

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ABSTRACT

There is widespread public perception that landfills represent unacceptable risks to human health and the environment. There exists substantial literature relating to the famous not-in-my-back-yard (NIMBY) reactions to landfills siting proposals in many parts of the world. However, empirical studies of perception of landfill impact in Nigerian urban areas are rare. Furthermore, much less is known about individual and community level impacts around existing facilities. This research therefore presents the results of an analysis of the socio-economic impact of landfills on urban populations living in close proximity to landfills in Lagos metropolis.

The aim of the study is to assess the socio-economic impacts of landfills in Lagos metropolis and the variations in these impacts with respect to location and distance from the landfill sites. The study determines the extent to which landfill presence is associated with residents' perception of neighbourhood quality. Also, the study determines the prevalence of psychosocial effects among individuals exposed to landfills and the coping mechanisms employed by individuals in response to impacts experienced. In addition, the study examines the relationship between landfill presence and willingness to pay for improved environmental quality and lastly, the study analyses the impact of landfills on residential property values of adjoining residential apartments.

The conceptual framework is predicated upon recent models used in assessing the socio-economic impacts of noxious facilities. The first, the psychometric model,

provides a signal of impact potential by indicating the relative intensity of risk perception and aversion. The second, contingent valuation provides an ex-ante measure of impacts based on survey responses to hypothetical situation, such as a noxious facility at a given distance to the respondent's residence. The other, hedonic price model is an ex-post measure that can be used to estimate the value of location characteristics such as noxious facility proximity that affects, primarily, property values. The last, model of environmental stress and coping is an approach to investigating environmental risk and reaction by focusing on psychosocial impacts of exposure to environmental contaminants.

Both primary and secondary data were utilized for the study. The secondary data included data on landfills from Lagos State Waste Management Authority (LAWMA) and valuation data from Lagos State Valuation Office (LSVO). However, primary data, collected by means of structured questionnaires, constituted the bulk of data used for the study. The questionnaire elicited information on the socio-economic characteristics of individuals and their perception of the impact of the landfills. The sample size consists of 930 heads of households in the two locations (488 in Olushosun and 442 in Abule-Egba). The sample constitutes 3% of the total 3, 4021 properties within three kilometer radii of the two landfill sites. The distance was stratified into three concentric zones round the two sites; ≤1km, 1.1-2km and 2.1-3km.

The outcome of the study shows that landfills within Lagos metropolis are uncontrolled and do not conform to international standards of landfill operations. The results reveals that the NIMBY syndrome clearly manifests in that respondents consistently placed high premium on negative externalities of landfills. Furthermore, the results show a negative spatial gradient for several measures of concern especially environment and health. However, perceived negative impacts vary among respondents in all the zones around the two sites. For environmental variables, $F = 1.44$ ($P > .05$); $F = 3.38$ ($P < .05$) for Olushosun and Abule respectively. For health variables, $F = 2.87$ ($P > .05$); $F = 5.22$ ($P < .05$) respectively also. Rental values were negatively impacted by proximity to landfill, ($r = 0.45$ and 0.21 respectively), implying a situation where rents increase away from the landfill sites. For the hedonic regression models, $R = 0.594$ ($P = .000$) and 0.641 ($P = .000$) respectively. Generally, anticipated economic benefits and risks are strongly associated with response to landfill siting. Perceived risk is negatively correlated with project support around the two sites. It was also shown that the presence of landfill is associated with willingness to pay for improved environmental quality in the two study locations. Willingness to pay for improved environmental quality declines away from the landfill sites. In terms of coping, many of the respondents engaged in both emotion-focused and action-focused coping mechanisms. The action-focused mechanisms include decision to relocate from the present neighbourhood where the landfills are located.

The findings of this study contribute to our understanding of individuals and community reactions to, and experiences of, landfills and can be used to inform the processes used to site much needed new facilities in the future.

Effets socio-économiques du repérage des facilités toxiques dans les milieux urbains : le cas des décharges d'ordures/enfouissement de déchets dans le métropole de Lagos

Résumé

Selon la perception d'un grand public les décharges d'ordures constituent des risques inacceptables pour la santé humaine et l'environnement. Partout dans le monde, il existe des écrits sur le fameux slogan 'pas dans mon jardin', une réaction contre les décharges d'ordures. Cependant, les études empiriques sur l'impact des décharges d'ordures dans les milieux urbains du Nigeria sont rares. En outre, les impacts au niveau individuel et communautaire, sont peu connus dans le domaine des facilités actuelles. Cette recherche présente les résultats des analyses des impacts socio-économiques des décharges d'ordures chez les populations urbaines résidant très proche des décharges d'ordures. (Olushosun et Abule-Egba) dans le métropole de Lagos.

Des données primaires et secondaires ont été utilisés pour l'étude. Les données secondaires sont composées des données faites par Lagos State Waste Management Authority (LAWMA) et des données d'évaluation venant de Lagos State Valuation Office (LSVO). Alors que les données primaires acquises à travers les questionnaires, constituent la plus grande partie des données utilisées pour l'étude. Les questionnaires portent sur les caractéristiques socio-économiques des individus et leur point de vue concernant les décharges d'ordures. L'échantillon est constitué de 930 chefs de famille dans les deux endroits (488 à Olushosun et 442 à Abule-Egba). L'échantillon constitue 3% d'un total de 3,4021 propriétés à trois kilomètre des deux centres d'enfouissement de déchets. La distance a été stratifiée en trois zones autour des deux centres; ≤1km, 1,1-2km et 2,1-3km.

Le résultat de l'étude a montré que les décharges d'ordures dans le métropole de Lagos ne sont pas contrôlées et ne conforment pas aux standards internationaux des opération d'enfouissement de déchets. Les résultats on révélé que le syndrome de NMBY est clairement manifesté car les personnes interviewés ont négativement parlé de l'extériorisation des décharges d'ordures. Les résultats ont en plus montré des inclinaisons spatiales négatives concernant spécialement l'environnement et la santé. Cependant, les impacts négatifs varie parmi les interwiévés dans toutes les zones autour des deux centres d'enfouissement. Pour l'environnement, F = 1,44 (P >.05); F = 3,38 (P>.05) respectivement pour Olushosun et Abule Egba. Dans le domaine de la santé F = 2,87 (P>.05) ; F = 5,22 (P>.05) respectivement aussi. Les loyers ont été négativement affectés par la proximité des décharges d'ordures, (r = 0,45 et 0,21 respectivement), ceci implique une situation où les loyers augmentent au fur et à mesure que l'on s'éloigne des centres de décharges d'ordures. Pour les models de regression hédonique, R = 0,594 (P = .000) et 0.641 (P = 000) respectivement Généralement, les bénéfices et les risques économiques anticipés dépendent de l'emplacement du centre d'enfouissement de déchets. Le risque perçu correspond négativement au projet non loin des deux centres. On a aussi montré que la présence de décharges d'ordures a rapport à l'acquisition d'un environnement de qualité. La plupart des interviewés se débrouillent emotionnellment et sur le plan d'exécution d'action. L'un des méchanismes d'exécution d'action est de déménager du voisinage des décharges d'ordures.

Les conclusions de cette étude contribuent à notre compréhension des réactions individuelles et communautaires et les expériences vis-à-vis des décharges d'ordures peuvent être utilisées pour faire part des processus utilisés aux autres et afin de pouvoir situer les nouvelles facilities dont on aura besoin dans l'avenir.

Mots clés: décharges d'ordures/enfouissement de déchets; Perception; Risques ; Impact ; Lagos.

CERTIFICATION

I certify that this work was carried out by Mr. Felix Bayode OLORUNFEMI in the Department of Geography, University of Ibadan, Ibadan, Nigeria

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DEDICATION

(i) To the Glory of God, the source of all wisdom

(ii) To my family, who embodies all things good in my life

(iii) To my brother, J. I Olorunfemi, who gave me education

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Felix Olorunfemi

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CHAPTER ONE

INTRODUCTION, STATEMENT OF RESEARCH PROBLEM AND DEFINITION OF CONCEPTS.

1.1 Background to the Study

The perception and evaluation of environment is a complex subject (Jackson *et al*, 1978; Kates, 1971, Wilson, 1994; English and Mayfield, 1972; Fischhoff, 1987, 1981). Not only does the perception and evaluation of a specific environment vary from person to person, it is also subject to change by the person himself in accordance with changing situation. In addition, the background and general attitude of individuals or groups would lead to differing perceptions. The place of residence of an individual and his preference for a specific environment also would differ.

There has been a relatively large body of literature concerning man's perception of environmental events. The works of Burton, Kates, and Whites deal with the way in which individuals and groups perceive such disparate environmental problems as flood hazard, erosion hazard, earthquake hazards, and so forth (White, 1966; Burton, 1968; Kates, 1971). Heathcoate and Saarinen have dealt with perception of drought in a number of areas. (Heathcoate, 1969; Saarinen, 1969). Even though these works did not particularly deal with human induced environmental hazards such as new facilities construction, their importance lies in their insights into the way in which perception affects the decision-making process of the public.

In the developed countries especially the United States and Canada, environmental problems are receiving increasing attention from researchers, policy makers and the public (Wakefield *et al*, 2001; Wakefield and Elliott, 2000; Wakefield, 1998; Wernstedt and Hersh, 1997; Baxter, 1992, 1997; Dunlap *et al* 1992; David Zusuki Foundation, 1998; Freudeberg and Steisapir, 1991; Butel, 1987). In particular, public concern over the possible effects of exposure to environmental contaminants continues to grow in the wake of highly publicized events.

Environmental conditions are often the powerful forces that create limits and opportunities for urban development. Similarly, the various individual and collective human activities that contribute to urban development have numerous positive and negative environmental consequences (Leitmann, 1994). More often than not, the human activities that contribute to a city's development have important consequences for environmental quality. Given the current high rate of urbanization, the challenge of urban environmental management is to safeguard the health, productivity and quality of life of city dwellers that result from their interactions with the physical (built environment) and the natural environments that surround them, as well as from the changes in those environments induced by human activities. In this context, waste management problems have been identified as one of the most important environmental problems facing cities especially in developing countries (Bartone, *et al* 1994). But specifically, many of the current problems with waste management have come from increased waste generation resulting from increasing urban population.

There is need for wastes generated to be properly and safely disposed because of the dreadful consequences of ill-disposed wastes. With the spate of industrial developments coupled with rapid population increase in Nigeria especially in the urban areas, the need for effective waste management strategies becomes very crucial. The widespread dumping of wastes on urban land especially where it is not controlled has serious implications for urban land and environment contiguous to such sites. Associated with management of waste is the siting of waste disposal facilities which is a central issue in waste management. Among these facilities are landfills, waste/sewage treatment plants and incinerators, among others. Landfill has however been recommended as the best facility for handling waste in developing countries (Ziess and Atwater, 1987). Allaby (1988) defined Landfill as the disposal of refuse by tipping it on land. He further expressed that a landfill is controlled where refuse is deposited in prepared site over which earth can be heaped at the end of each day.

Public consensus has long held that landfills are not a favourable usage of land (Mitchell, 1980; Smith and Desvouges, 1986; Carter, 1989, Mitchell and Carson, 1980). As a noxious facility, it is generally perceived as risky because of the inherent negative externalities associated with it. Historically there have been two major thrusts of research concerning the acceptability of facilities that bear risks. First, it has been widely recognized that people accept technology principally because of benefits derived from the technology (e.g., Starr 1969, Fischhoff *et al.* 1981; Freudenbury, 1988)). Some communities have opted to accept hazardous waste facilities, and other potentially noxious facilities precisely because of the economic benefits they tender. Sometimes the acceptance of the facilities seems to be directly counter to the underlying community value system. This view tends to place emphasis on the economic benefits of the facility or technology for the community. Secondly, a school of thought has developed which indicates that technologies that are particularly risky are not acceptable, regardless of the amount of associated benefits (e.g., Flynn *et al.* 1993). These "Locally Undesirable Land Uses" (LULUs) (Popper 1985) are unacceptable at any price. From this perspective, ample evidence has shown that once the "Not-In-My-Back-Yard" (NIMBY) syndrome is established in the siting process, it is difficult to overcome. This view tends to place emphasis on the risks associated with technology as the critical element triggering public outcry, protests and conflict.

More recently, a third view has emerged, which views acceptability as a two-step process (Beck, 1992, 1996; Sokolowska and Tyszka 1995). If the risk associated with a technology is perceived too high, then the technology is deemed unacceptable and rejected. Once the technology is found to be generally acceptable, the benefits are examined as attitudes associated with the technology are formed. Hence, the more benefits that are linked to the technology the more acceptable it becomes. In this manner the risks associated with a technology are critical to unacceptability, while benefits determine the level of acceptability among those that are generally acceptable. Whether risk acceptance is based on benefits, risk or some combination thereof, both risks and benefits are imbued in the type of technology. Therefore, from this perspective the type of technology is expected to be a critical determinant of the acceptance of technology and its inherent risks.

Several implications flow from the organisation and operation of noxious facilities, especially landfills, within cities as most of them are operated in essentially residential neighbourhoods. This is because of the inherent negative externalities that are associated with them. According to Smith (1977), an externality exists when an activity generates side effects not reflected in costs or prices. Externalities can produce benefits that enhance individual well being and also costs in the form of disutilities, but it is negative externalities which attract most attention. Aside from the possible landuse compatibility problem that may arise from siting noxious facilities, certain other environmental. social and economic consequences also flow from this. This environmental disamenity could be serious especially in a purely residential setting. Also, some of these environmental disamenities have indirect effects on property values, and this could be serious, considering that in a purely residential setting, house values and rental values play an important role in the allocation mechanism.

Thus, major landuse issues in solid waste management have been most frequently associated with the stigma of having a major solid waste facility in the neighbourhood (Tabor, 1979, Agbola *et al*, 1995; Olokesusi, 1995, Ostry, 1993; Couch and Roll-Smith, 1994). For instance, in developed countries, designation of a projected-site for a new landfill engenders so much community opposition. This is because of the obvious negative externalities such as unsightliness, odour, vermin and insect proliferation, spread of litter, smoke and noise from heavy machinery at site. These may substantially reduce the standard of living of the local community (Wilson, 1974; Hockman *et al*, 1976). In most instances, the negative externalities outweigh the benefits.

Landfills are commonly considered as a form of nuisance and classified under environmental features which are risky and can reduce land and house values (Nelson *et al*, 1992). For example, Zeiss and Atwater (1987) disaggregated these impacts as physical (environmental change); social (stigma to the image of the host community) political (unfairness to the host community); and economic (property value depreciation). In developed countries, these impacts, being borne by the host community on behalf of the larger society, are sometimes calculated and adequately compensated for to ease decision-making in this area. This is however not the case in developing countries where a little is known about the nature of the impact of landfills on the society and the environment and where there is little or no public consultation in landfill siting processes.

Awareness of the benefits of a healthy environment has however increased in a number of African countries over the last decade. With a heightened awareness has come a need to minimize the negative externalities associated with landfills. Such externalities are accentuated by the uncontrolled nature of landfills in most African cities. Negative physical externalities are manifested in environmental and health effects (Elliott, 1993, Elliott *et al*, 1998). One of the most pronounced environmental effects pertains to groundwater pollution (Bello, 1998; Amusa, 1993; Shafa, 1987; Lee and Jones Lee, 1993,1992, 1994). Since landfills in African cities are uncontrolled, they do not comply with the universal sanitary regulation that refuse must be covered within 24 hours of disposal (Arimah and Adinnu, 1995; Adinnu, 1994). The non-compliance results in a proliferation of insects and rodents that transport disease-carrying agents in their intestinal tracts. It allows blowing of litter and the accompanying inhalation of pathogens that cause infection. It leads to odour and the general environmental degradation associated with landfills. All these consequences have serious health implications. Negative social externalities include the fact that host communities become stigmatised while decreased property values is a major economic impact.

Even though the location of landfills in urban areas is beneficial in that they provide the most efficient and safe means of disposal of wastes generated in urban areas, the perceived environmental costs, both health-related hazards, social and economic impacts associated with the landfills are often confined to the immediate zone of influence of the landfills and extends up to few kilometers. Not much is however known about individual and community level impacts around existing facilities. The thrust of this research is therefore to investigate individual and community level impacts around the two functional landfills (Olushosun and Abule Egba) in Lagos metropolis.

1.2 Statement of Research Problem

Locating environmentally noxious land uses is becoming increasingly problematic in many parts of the world today as opposition to such facilities seems to rise in both frequency and intensity (Hadden, 1991; Zeiss and Lesfrud, 1996; Bourke, 1994; Cutter, 1993; Elliott *et al* 1997; Evans 1990; Evans et al; 1986). Finding solutions to issues in waste disposal is becoming increasingly difficult. The process of siting a waste disposal facility, even for non-hazardous wastes, creates uncertainty, anxiety, and unrest in the surrounding communities. Local populations are becoming increasingly opposed to facilities which they perceive may threaten their environment and their health (Elliott, 1998; Baxter, 1992; Elliott *et al*, 1996; Taylor *et al*, 1991; Taylor *et al*, 1993; Taylor *et al*, 1993; Schmalense, 1975; Olokesusi, 1994, 1996; Alberecht *et al*, 1986).

There is a widespread public perception that landfills represent unacceptable risks to human health and the environment (Washburn *et al*, 1989; Butler and Fukurai, 1989). Issues related to the disposal of waste pose important challenges for many communities not only in the developed countries, but also in developing countries due largely to the perception of risk to human health and the environment. There is a high degree of public awareness of these issues as the popular media frequently contain accounts of NIMBY (Not-In-My-Back-Yard), reactions to LULUs (Locally Undesirable Land Uses)(Munton, 1996, Peele and Ellis, 1987; Armour, 1987; Bailey *et al*, 1989, Olokesusi, 1995; Elliott *et al*, 1993; Petts, 1992; Puschak and Burton, 1983, Ostry, 1993), particularly since the occurrence of high profile toxic contamination events like Love Canal (Levine and Stone,

1986) and Three Mile Island (Baum *et al,* 1982). In particular, public concern over the possible toxic effects of exposure to environmental contaminants continues to grow in the wake of these highly publicized events (Love Canal, Three Mile Island, Bhopal, Chernobil and St. Basile-le-Grande). This is evidenced in the public opinion literature which indicates firstly, that worry and concern about environment and health have increased steadily over the past two decades and secondly, that the increase is associated with widely publicized environmental disasters (Baxter, 1990; Elliott, 1998)

While there is an extensive literature on the impact of hazardous waste facilities such as landfills in the developed countries, only a few exist in African countries (Olokesusi, 1994; Arimah and Adinnu, 1995). Much as these studies are useful for policy formulation and environmental management, very few empirical studies in Nigeria have attempted to ascertain the perception of host communities concerning landfills in general especially in large urban areas. Furthermore, though there exists a substantial literature relating to NIMBY reactions to waste facilities siting proposals, much less is known about individual and community level impacts around existing facilities. Perception of risk plays an important role in the assessment of impact of noxious facilities since it forms the basis of opposition to siting such facilities. Filling these knowledge gaps is essential in the current context of waste management decision-making. The insight gained may provide direction in terms of the need for mitigation measures, as well as serve to reduce the resource input (financial and otherwise) necessary to the siting process. On a broader scale the research will address the larger issues of individual and community well being.

The study will generally shed the desired light on the nature of externalities of noxious facilities in urban areas in Nigeria and indeed Africa. Specifically, there is need to determine the impacts of exposure to environmental stressors (in this case landfills) on human health and well-being. In essence, there is need to increase understanding of the relationships between events, which predicate environmental stress, and the process of psychosocial effects. Furthermore, since property value depreciation is a major negative externality and an often-cited reason for opposition to siting landfills, this study will contribute to the debate on the extent to which landfills will impact property values in African urban environments. These will be achieved through a comparative analysis of the impacts of landfills on urban populations living in close proximity to two landfills (Olushosun and Abule Egba) in Lagos metropolis.

1.3 Aim and Objectives

The study aims at analyzing the impact of landfill as a noxious facility in an urban space by undertaking a comparative analysis of the socio-economic impact of landfills on urban populations living in close proximity to landfills in Lagos. The specific objectives of the study are; to

1. examine the locational characteristics and management of the landfills;

2. determine the extent of psychosocial effects among individuals exposed to landfills and the coping strategies employed by individuals in response to impacts experienced;
3. determine the extent to which the presence of the landfills is associated with residents' perception of neighbourhood quality;
4. examine the relationship between landfill presence and the willingness to pay for improved environmental quality;
5. analyse the impact of landfills on property values adjoining residential apartments;

1.4 Definition of Concepts

1.4.1 The Nature of Externalities in Noxious Facilities.

The concept of externalities is intrinsically spatial (Smith, 1977). Indeed, externalities are sometimes referred to as "neighbourhood effects" or "spillovers" both of which have spatial connotations. An externality exists when an activity generates side effects not reflected in costs or prices. Externalities can produce benefits that enhance individual well-being and also costs in the form of disutillities, but it is the negative externalities which attract most attention. The undesirable side effects of the production process are a matter of great contemporary concern, which are assuming increasing importance in evaluations of real progress. According to Ascitoersk (1971), in today overcrowded world, with its problems of air pollution, sewage and waste disposal, they seem like a characteristic and all-pervading feature of the modern economy.

Increasingly negative side-effects are inherent in the modern capitalist corporation economy; as Galbrait (1975) explains: "it expands numerous types of private consumption with extensive external diseconomies –increased automobile use with its associated emissions and the spreading patina of abandoned and scrapped vehicle carcasses; increased use of package consumer goods with its associated litter of bottles, cans, cartons and non-degradable plastics; increased personal wealth with its increased rewards to larceny and violent assault and hence increasingly unsafe and unpleasant neighbourhoods. And it accords no similar emphasis and support to the public services which make such increased consumption effects underlies the inability of markets to regulate resource allocation, production and consumption in the interests of utilised existence".

The definition of externalities sometimes includes the fact that they are unintended as well as unpriced (Smith, 1977; Harrop, 1973; Burnell, 1985). For the most part they are certainly unplanned in the sense that their precise extent and impact is not determined in the same way as the output and physical distribution of the intentionally produced goods. However, it would be naive to regard the pollution of the air or the disposal of factory effluents in rivers as unintentional for this is usually a deliberate transfer of part of the real cost of production from the producer to society at large. The difficulty of pricing such things is that their general impact on the environment and on human well being is virtually impossible to measure. Indeed the wider external effects of some economic activity, for example agriculture dependent on large-scale use of DDT, may be quite unsuspected by the individuals involved and unknown to society at large until revealed by scientific inquiry. Externalities should thus be viewed as including the unanticipated or unsuspected outcomes of behaviour which often has an element of intentionality.

Most geographical concern with externality has focused on environmental pollution. However. the quality of environment is now being viewed more broadly than in purely physical terms to include its human impact (e.g Coppock and Wilson, 1974; Jackman, 1975). External effects in space become particularly important influences on human well-being in the case of public goods, supposedly equally available to all people in a defined territory. They are in theory indivisible, and cannot be split up for the exclusive use of some people and not others. But geographical space creates impurity in public goods, for in reality any good or service available at a particular point will benefit some more than others, even if all people pay equally for its provision. Those particularly advantaged by location will gain benefits not paid for, while those who live far from the facility will be penalised. Fire stations are often cited as examples of this. Similarly certain nuisances such as noise and air pollution affect some people more than others, including people who reap no gains from the process generating them. In so far as these negative externalities are indivisible and cannot be avoided, they can be thought of as accruing in the nature of public good (Bish, 1971); they are demerit goods (or bad), in the sense that people consume more of them than they would freely choose.

The most important contribution to the geographical analysis of externalities has been made by Harvey (1973). He stresses that all public goods are impure (most environmental assets are defined as public goods (Kluvankova, 1998), and that the consequent externality exists as a "spatial field" effect. Thus, Harvey (1973) stated:

> "We might generalise these spatial fields by distance-decay functions or by diffusion equations (such as those which describe the general field of external costs imposed by a source of atmospheric pollution). These spatial fields of externality effects will vary in intensity and extent, from the influence of a derelict property on the values of adjacent properties to the extensive field of influence of airport noise. Externality fields can be positive or negative or, sometimes as in the case of an airport, both (since an airport is a nuisance from the point of the view of pollution and noise increase but has important benefits for employment and movement). We know very little about the shape and form of these externality fields in an urban environment. But there can be no doubt that their location has a very powerful effect upon the real income of the individual".

The concept of the externality field for nuisances has been examined in some detail by Harrop (1973). The externality field is illustrated graphically in Figure 1.1. Point I is the source of some utility or disutility accruing to the population of the surrounding area. The level of utility or disutility (U) decreases with distance from i. The general distance-decay function may be written:

$$U_j = f(d_{ij}) \qquad (1)$$

Where j is some place other than i. In figure 1 the utility (positive or negative) at j is the vertical distance i to U_j. Expression (1) may be regarded as a special case of the production function, with the level of output of whatever the sources of utility or disutility may be depending on distance from the production location (I) . At a point in space some distance from I, the external effect will cease. This is Z in figure 1.1, or diffusion of the effect in all directions from i, the line I to Z may be rotated about I, to define the externality field in two-dimensional space. This shows the extent of the territory affected. If population is evenly distributed over this territory, the total utility or disutility generated from I will be proportional to the volume of the externality cone formed by the rotation of the triangle iYZ, where Y is the (maximum) level of benefit or nuisance-assumed to be at the source. If population density varies, some parts of the cone will have a denser concentration of utility or disutility than others. The total utility (positive or negative) experienced by the varying numbers of people at any set of places j within the externality field is given by

$$U = \sum_{j=1}^{n} w_j U_j \qquad 2$$

where wj is the local population weighting and U_j is the local level of utility or disutility from (1) above, which is assumed to be measurable on some uniform indicator such as financial cost or benefit. Such a method of calculating the total effect of an externality is analogous to that used in economic geography to identify volume of sales attainable from a market centre, using the concept of the "demand cone" (Losch, 1954; Smith, 1971).

The idea of distance decay in externality effects accords with everyday experience. There is evidence to suggest that some of the more serious side-effects of

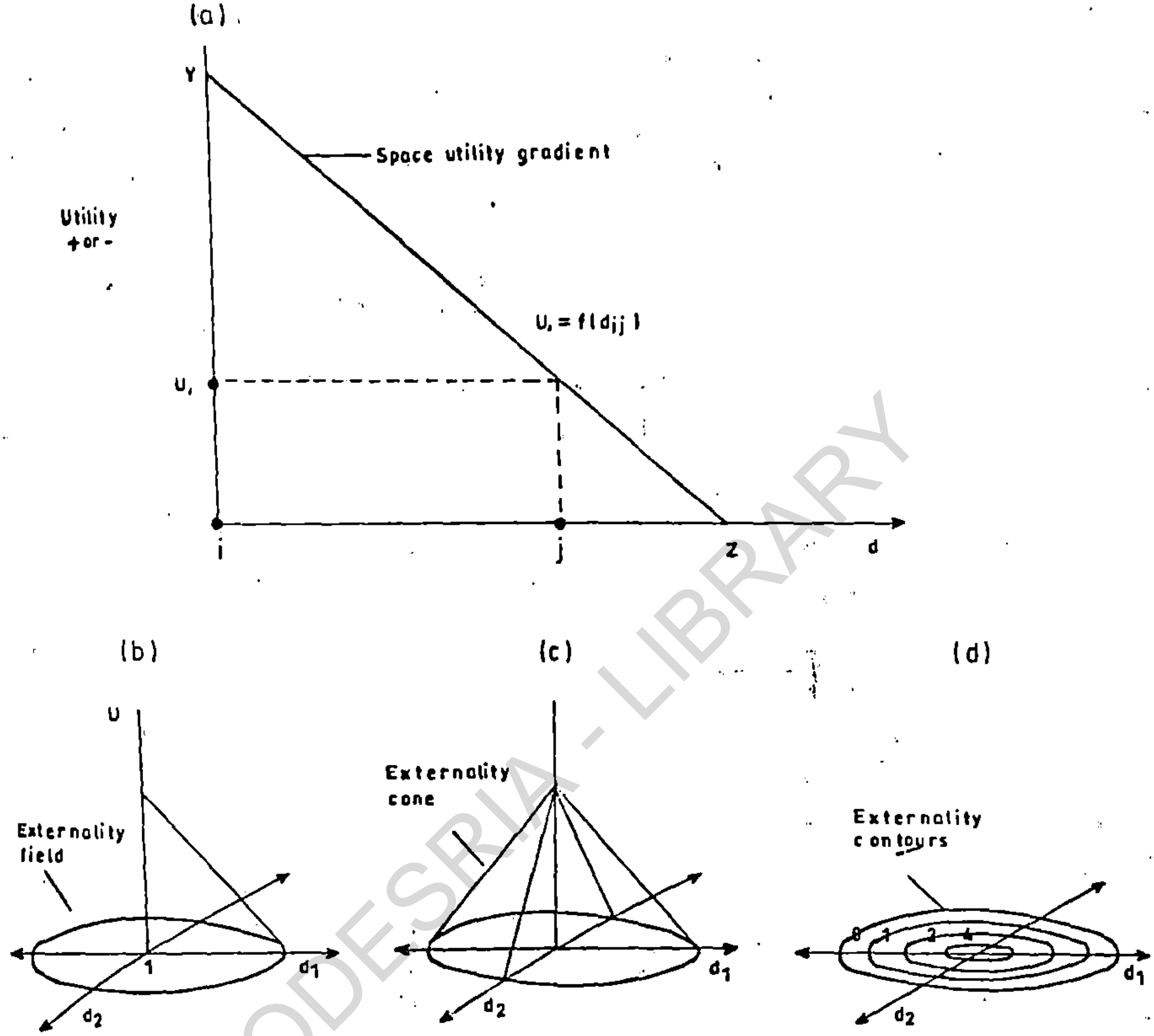

Fig. 1.1: The externality field: the spatial expression of certain utilities and disutilities

(SOURCE: Smith, 1977.)

modern transportation facilities are spatially concentrated. For example, lead poisoning in populations near a motorway junction and mental disturbance among residents of the area surrounding New York's Kennedy Airport (Michelson, 1970)

In some cases the external effect may diffuse more readily in some directions than others. For instance, wind blowing odour from a landfill to certain direction, to distort the regular field suggested in figure 1.1 At a more general level, there is considerable empirical support for regular spatial variations in the incidence of a number of urban disutlities. This study is concerned with the externalities generated by landfills in urban areas in Nigeria with Lagos as the case study. The specific nature and concerns with landfill externalities are discussed in the statement of research problem.

1.4.2 Landfill: A Definition

Sanitary landfill means a controlled operation employing an engineering method in which waste is deposited on excavated land (ordinary or in strip mines), compacted to the smallest practical volume and covered with a layer of soil at the end of each day's operation (Heeramun, 1995). A secure landfill is a carefully engineered depression in the ground (or built on top of the ground, resembling a football stadium) into which wastes are put. The aim is to avoid any hydraulic connection between the wastes and the surrounding environment, particularly groundwater (Lee, 1995). The principal difference between a landfill and a dump is that each day's wastes were supposed to be covered by a few inches of soil. This soil layer reduced the odorous emissions from the landfill associated with the previously deposited waste. The soil layer also reduced to some extent the ability of vermin, such as birds and rodents and disease vectors, such as birds, rodents, insects (flies) etc to gain access to the waste.

Important aspects in the implementation of sanitary landfills include site selection, underground sealing, landfilling methods and operations, occurrence of gases and leachate in landfills and movement and control of landfill gases and leachate. Site selection is perhaps the most difficult obstacle to overcome in the development of a sanitary landfill. Opposition by local citizens eliminates many potential sites. Factors to be considered in evaluating potential sanitary landfill sites include: available land area, haul distance, soil conditions and topography, climatological conditions, surface water hydrology, local environment conditions (e.g. noise, dust, odour, aesthetic), potential ultimate use of the completed sites, public opposition, proximity of major roadway, and speed limits, traffic patterns and congestion, zoning requirements, buffer areas around the site, and historic buildings, endangered species, wetlands and similar environmental factors.

Final selection of a disposal site is usually based on the results of a preliminary site survey, the results of engineering and cost studies and an environmental impact assessment. The day-to-day management of municipal solid wastes is a complex and costly undertaking. The separation of the collection and disposal functions and the adoption of sanitary landfill systems have improved standards. The overall objective of waste management is to minimise the adverse environmental effect caused by the indiscriminate disposal of solid wastes. As discussed by Jones-Lee and Lee (1993), municipal solid wastes contain a wide variety of inorganic (salts and heavy metals), non-degradable organic residues that will be present in the landfill forever i.e., as long as it exists, and will be leachable – dissolve on contact with water, creating a leachate of which small amounts have the potential of polluting large amounts of groundwater, rendering it unusable for domestic water supply use. This is of paramount importance for health, environmental protection, natural resources management and sustainable development.

1.4.2.1 Critical elements in a secure landfill

There are four critical elements in a secure landfill a bottom liner, a leachate collection system, a cover and the natural hydro geologic setting. The natural setting can be selected to minimize the possibility of wastes escaping to groundwater beneath a landfill. The natural setting can be selected to minimize the possibility of wastes escaping to groundwater beneath a landfill. The three other elements must be engineered. Important aspects in the implementation of sanitary landfills include site selection, underground sealing, landfilling methods and operations, occurrence of gases and leachate in landfills and movement and control of landfill gases and leachate. Site selection is perhaps the most difficult obstacles to overcome in the development of a sanitary landfill as discussed above.

The natural hydro geologic setting is important for two (contradictory) reasons. First to prevent wastes from escaping, there we want rocks as tight (water proof) as possible. Yet if leakage occurs, we want the geology to be as simple as possible so we can easily predict where wastes will go. Then wells can be constructed to capture the escaped wastes by pumping. Fractures bedrock is highly undesirable beneath a landfill because the wastes cannot be located if they escape.

A bottom liner for a sanitary landfill may be one or more layers of clay or a synthetic flexible membrane (or a combination of these). The liner effectively creates a bathtub in the ground. If the bottom liner fails, wastes will migrate directly into the environment. There are three types of liners: clay, plastic, and composite. Figure 1.2 shows the typical operational layout for a sanitary landfill.

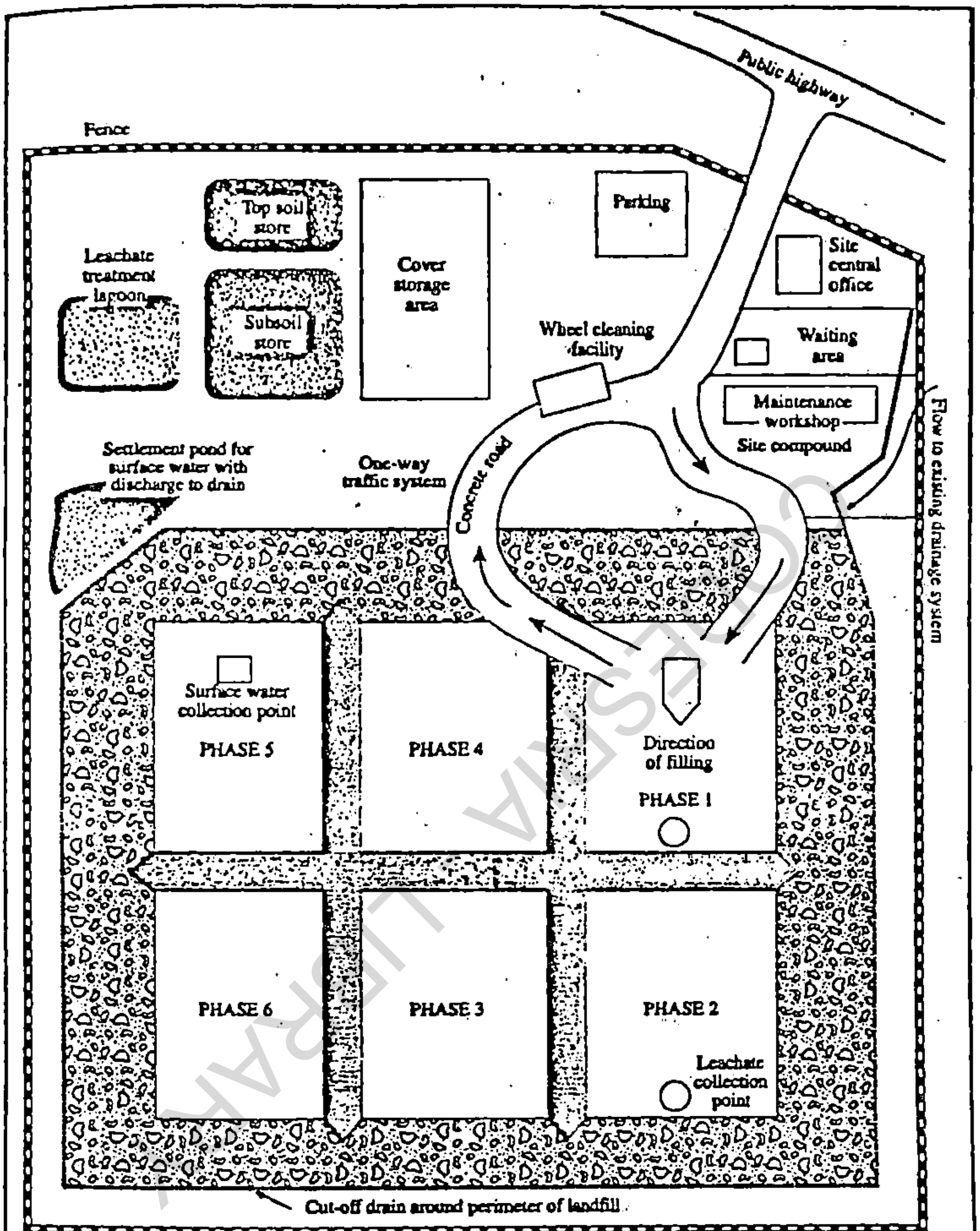

Figure 1.2 : Typical operational layout for a sanitary landfill site
(Source: Department of the Environment 1986)

1.4.2.2 Characteristics of Sanitary Landfill

Flipping refuse on land is the most fundamental method of refuse disposal. Sanitary landfill as a benign method of disposal presupposes a practice carried out without environmental damage as in areas already spoiled and in need of restoration. The source of most wastes is land itself. Removing the raw materials such as mining of minerals. excavation of sand etc has less open holes which cause environmental damage. Tipping wastes into these depressions (with appropriate controls) would be wholly beneficial to the environment. Sanitary landfills or controlled tipping is one of the distinct procedures which can result in little environmental damage, when refuse is tipped on land. The following are the characteristics (requirements) of a sanitary landfill.

First, the tip site should be in a depression, free from running or static water. Secondly, water pollution from expressed liquids must be prevented. For example, this results when wastes are squeezed by pressure of machine or of other refuse heap. This also results from water passage through a landfill or from a run-off (leaches). In the United States of America, the codes controlling the practice (DOE 1971) stipulate that the lowest level of landfill must be at east 3.043 metres above the highest water table. It the strata of rock at this point are not impervious, linear off clay asphalt or sheet plastic or alternatively a porous layer of gravel with suitable fringe pipes, must be laid and the leaches and other liquids led to suitable treatment. This treatment may occur through the liquids being pumped to sewer connection or a holding bass inform which the liquids may be pumped or in which they may be treated (Wilson, 1974).

Thirdly, a sanitary landfill requires escape routes for gases which will result from the process of anaerobic decomposition. For instance, in dumps where no procession for gaseous discharges has been made, potential lethal and explosion as has been found to travel sometimes tens of metres, sometimes, many years after land filling has ceased. These gases (methane being one) tend to accumulate in basements of buildings if precautionary measures have not been taken during design and construction and have caused death by asphciation, by explosion and by fire (Wilson, 1974). Such explosion has occurred in the Sangross area of Oshodi in Lagos metropolis (Bello, 1998).

Fourthly, is the requirement of enclosing the raw refuse in cells. Refuse must be covered within at most 24 hours of being dumped. A cover or cap is an umbrella over the landfill to keep water out (to prevent leachate formation). It will generally consist of several sloped layers: clay or membrane liner (to prevent rain from intruding), overlain by a very permeable layer of sandy or gravely soil (to promote rain runoff), overlain by top soil in vegetation can root (to stabilise the underlying layers of the cover). If the cover is not maintained, rain will enter the landfill resulting in build-up of leachate to the point where the bathtub overflows its sides and wastes enter the environment. The cover provided a safety factor against the hatching of insect laves with at least 15.224 centimetres of cover material. However, the refuse is first compacted by running heavy steel wheeled or tracked vehicles over the surface. The cover material may be loam sand, gravel, power plant ash or other comparatively sterile substance.

The advantages of cover material lie in the fact that it prevents emergence of insects: provides a porous layer through which gases may diffuse to the surface: discourages rats and other vermin's; prevents blowing of litter and dust from landfill surface; and severally limits the spread of fire.

Finally, after a sanitary landfill had been built up in cells to the required final contour, the codes normally require a final covering of at least 60.96 centimetres of loam in which planting may take place. Erection of buildings within 20 years of the completion of a landfill is hazardous as considerable settling can be expected to take place as the organic materials decompose. Accordingly, one of the environmental benefits of sanitary landfill is the probability that they will subsequently be converted to open spaces such as golf courses, parks or even wildlife refuges.

1.4.3 Landfilling Methods

Although various titles are used to describe the operating methods employed at sanitary landfills, only two basic techniques are involved, (Heeranum, 1993). They are termed the area method and the trench method (Fig. 1.3a and b). At many landfilling sites both methods are used, either simultaneously or sequentially. Figure 1.4 shows the schematic diagram of a landfill operation.

Area method: this method is used when the terrain is unsuitable for the excavation of trenches in which to place the solid wastes operationally, the solid waste is deposited on the surface, compacted, then covered with a layer of compacted soil at the end of the

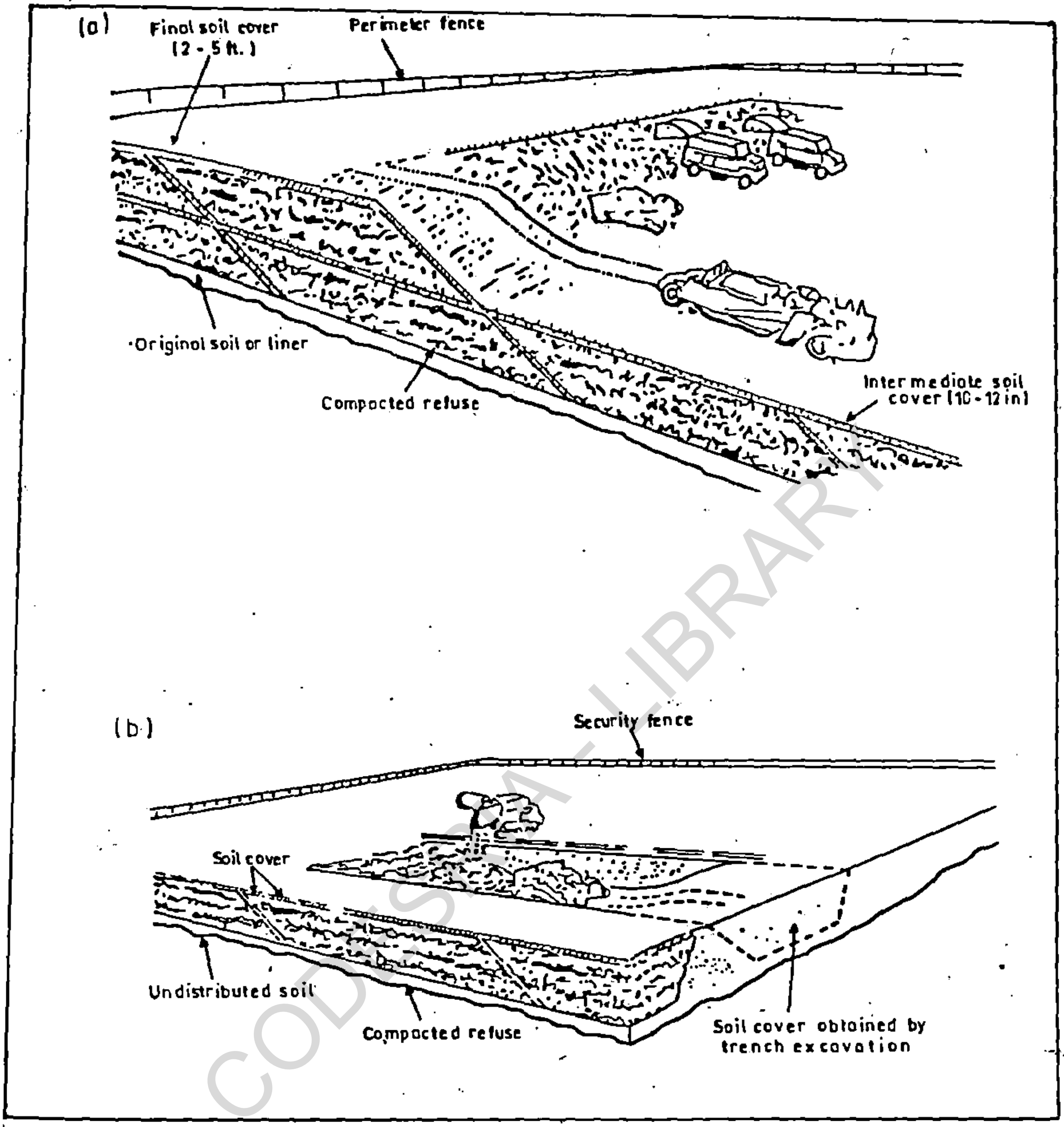

Fig. 1.3 a&b : Area and trench methods for placing solid waste in a sanitary landfill
(SOURCE:- Pfeffer, 1992)

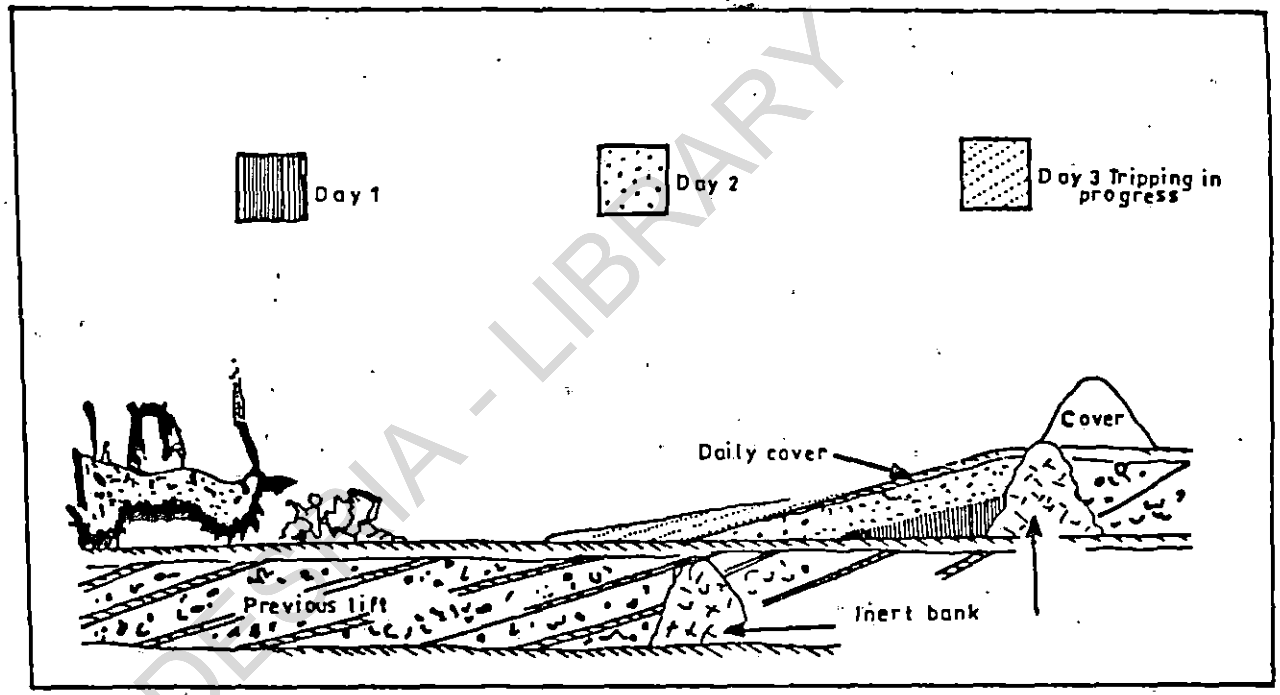

Fig. 1.4 :Schematic diagram of Sanitary Landfill operation.

working day. Use of area method is seldom restricted by topography. The cover materials may be hauled in by trucks or earth–moving equipment from adjacent land or from borrow-pit areas. A completed lift including the cover material is called a cell.

Trench method: this method is used on level or gently slopping land where the water table is low. In this method, a trench is excavated, the solid waste placed in it and compacted, and the soil that was taken from the trench is then laid on the waste and compacted. The advantage of the trench method is that cover materials I steadily available stockpiles can be created by excavating long trenches. or the material can be dug up daily. The depth depends on the location of the groundwater and/or the character of the soil. Trenches is usually at least twice as wide as the compacting equipment so that the treads or wheels can compact all the material in the working area.

A wide range of operational problems can occur at landfills. Some of these problems are listed in Table 1.1

Table 1.1: Common landfill operational problems and their sources/causes

Problem	Source/Causes
Leachate	Pollutants that escape to contaminate surface or groundwater
Fires	Due to self-ignition or mixing of incompatible substances; rupture of drums containing oxidizing substances.
Dust	From wastes, or from dry soil surfaces.
Odours and gases (chiefly methane and carbon dioxide)	From wastes and their decomposition.
Handling hazards	Due to hazardous wastes being accepted. Also a problem if scavengers have access to the site
Vermin	Rats, birds, flies, and other vectors breeding, living or feeding on any food wastes brought onto site and spread disease and nuisance to off-site areas.
Litter and wind-blown rubbish (e.g., plastic and paper)	Often a problem on access roads as well as the site itself.
Visual intrusion	
Noise	
Runoff of sediment-laden or polluted water	
Uneven settling or consolidation	Due to soluble or putrescible wastes, or containers rupturing under pressure.

Source : Rushbrook and Pugh, 1999.

1.5 Justification for the Choice of Study Area

The study area for this research is the Lagos metropolis. However, specific areas where the landfills areas are located are concentrated upon. There are presently three landfills in Lagos namely, the Olushosun, Abule Egba and Solous landfills. However, only Olushosun and Abule Egba landfills have been chosen for this study. Apart from the fact that these two landfills are the most utilized, their contrasting geographical location in medium and high density residential areas respectively and their differences in sizes and operations all combined to justify the choice of the two locations.

The choice of the study area is justified on many grounds. For instance, the waste handling patterns and underlying attitudes of the urban population influences the functioning of municipal solid waste management systems, and these factors are, themselves, conditioned by the people's social and cultural context (Schubleller, 1996). The character of waste management tasks and the technical and organizational nature of appropriate solutions depend a great deal on the economic context of the country and/or city is question and, in fact, on the economic situation in the particular area of a city. The level of development is an important determinant of the volume and composition of wastes generated by residential and other users. Also, municipal solid wastes are principally generated in the urban areas (Lee and Jones-Lee, 1994). Therefore, it is expected that the larger an urban area is, the larger the amount of wastes generated.

Based on the above the Lagos metropolitan area therefore offers an interesting research laboratory to study the impact of landfills. This is because Lagos is a socially heterogeneous city with large variations in environmental quality. Without any shade of doubt, solid waste is currently one of the biggest environmental problems commonly experienced in Lagos metropolis, as in many other Nigerian urban centers (Adedibu, 1983; Faniran, 1982; Fagbenle, 1980; Oluwande, 1974; FME; 1982) (see table 4.8) There is a constant upswing in the annual volume of solid waste generated in various municipal areas in the country. Lagos is however in the lead in the amount of solid waste generated yearly in the country. Reflecting on the factors of solid waste generation, particularly in Lagos, Saka (1997) observed that in Lagos State, waste management problem did not become a noticeable problem until early 1970s when oil-boom era set in, bringing along with it mass importation of manufactured and industrial goods and a conspicuous change in the pattern of consumption and standard of living of urbanized Nigerians. This era also witnessed the mass influx of people from parts of less developed parts of Nigeria and West Africa to Lagos. Consequently, there was a geometric increase in the daily tonnage of waste generated in Lagos when compared with all other urban areas in Nigeria (see Table 1.2).

Another justification for choosing Lagos is the fact that landfill practices has been in Lagos for long now, perhaps earlier than in any other city in Nigeria. Since duration of exposure is very important in the stages/levels of impacts experienced, it was justifiable to select Lagos as the most appropriate for the study. Lastly, since part of the research is to study the impact of landfills on property values, Lagos metropolis is seen as been very suitable for this purpose for two reasons. First, there is comprehensive valuation data for

Table 1.2: Estimated and Projected Volumes of Solid Waste Generation in some Nigerian Cities

Urban Areas	1982	1985	1990	2000
	Tonnes per year			
Lagos	625,399	681,394	786,079	998,081
Ibadan	350,823	382,224	440,956	559,882
Kano	319,935	348,580	402,133	535,186
Kaduna	257,837	280,295	324,084	431,314
Onitsha	242,240	263,929	304,477	386,593
Port-Harcourt	210,934	229,821	265,129	352,853
Osogbo	131,903	143,712	169,719	236,703
Aba	122,923	138,786	142,609	213,552
Jos	99,871	111,905	134,272	197,660
Warri	67,477	75,607	91,396	133,531
Gusau	44,488	48,471	57,243	79,835
Potiskum	15,434	16,816	19,399	28,347
Uyo	12,508	13,628	15,721	20,923
Suleja	9,383	10,514	13,311	21,336
New Bussa	5,690	6,200	7,152	9,518

Source: Nwabugwu, 2001

residential properties in Lagos. Apart from the comprehensive property enumeration carried out in 1991, valuation data are regularly updated by the Lagos State Valuation Office (LSVO). Secondly, property market is well developed in Lagos compared to any other cities in Nigeria (Arimah and Adinnu, 1995, Aluko, 1996). Therefore, it is possible to identify and analyse variations with reference to the presence of the landfills.

The choice of the two landfills (Abule Egba and Olushosun) used for this study is justified on the ground that the differences in the type of operation, site history and surrounding environment are likely to condition local residents' experiences and reactions, and are important aspects of the context in which psychosocial effects of facilities need to be understood. Figure 1.5 is the map of Lagos State showing Lagos metropolis while Figure1.6 shows the location of landfills in the metropolis and the two landfills used for this study. The locational characteristics, operation and site history of the two landfills are discussed in section 4.5. It is important to state here however that the two landfills selected have different attributes both in terms of operation, size, and the surrounding environment. The third landfill, Solous in Ikotun was not included in the study for two reasons. Firstly, the site is quite new and very small compared to the two other landfills.

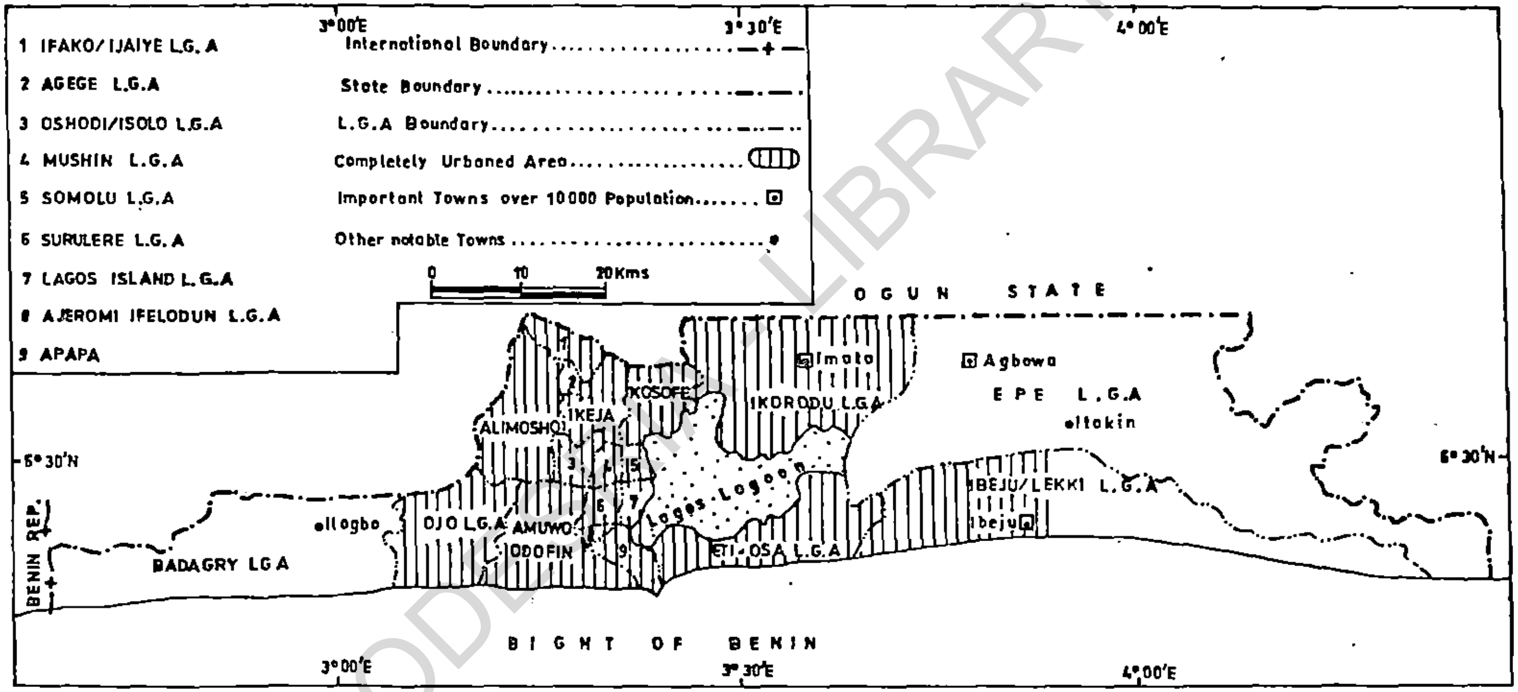

Fig. 1.5 : Lagos State Urbanizing nature

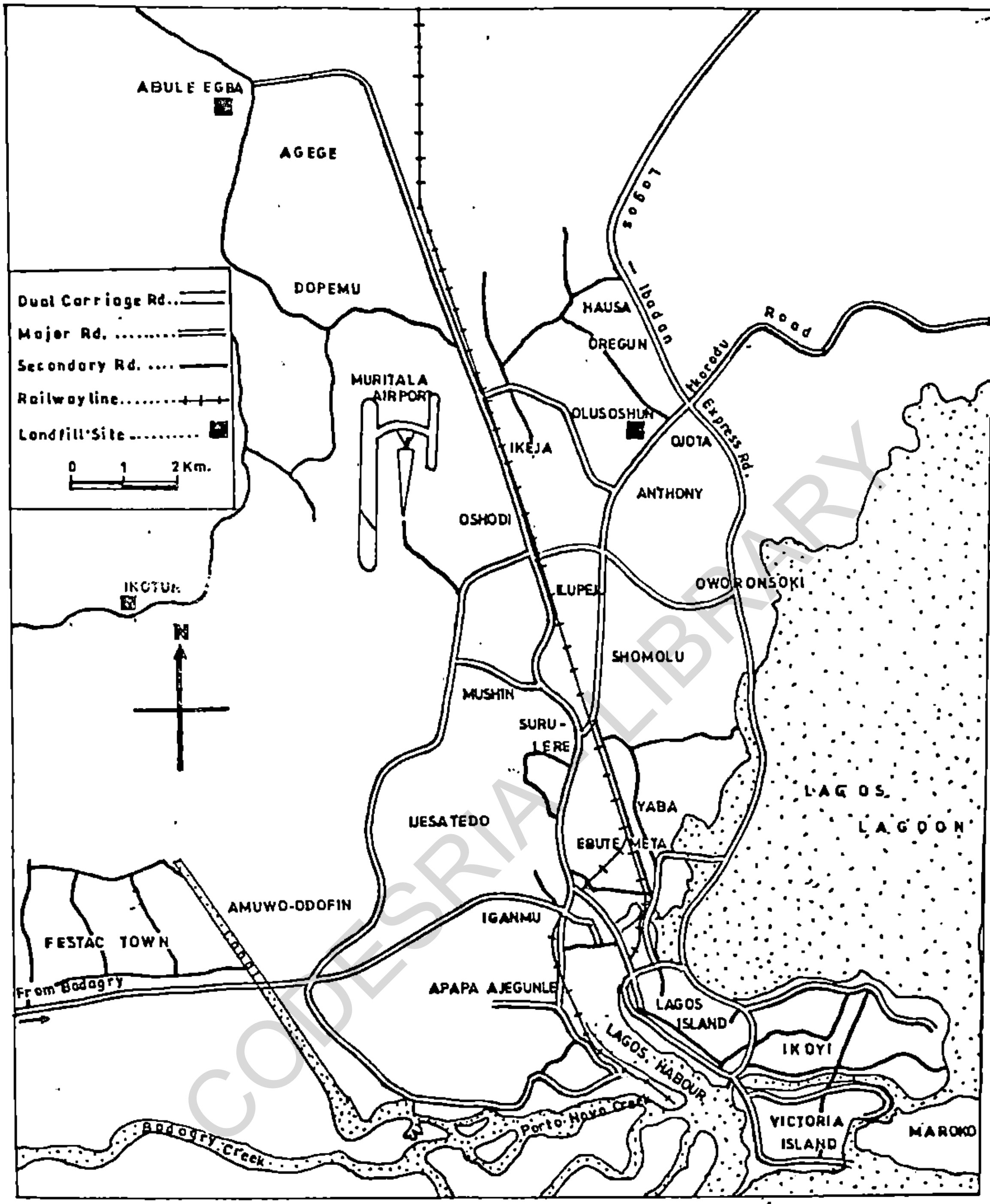

Fig.1.6:Location of Landfill Sites in Lagos Metropolis

1.6 Plan of the Thesis

The thesis is divided into eight chapters. Following this introductory chapter is chapter two which discusses the conceptual framework that guided the study and the review of relevant literature. Chapter three discusses the methodology of the work. This involves the data collection procedures and the method of data analysis. Chapter four involves a discussion of characteristics of the study area and the locational characteristics of the two landfills. In chapter four the impact of landfills on the perception of neighbourhood quality is analysed. Also discussed in this chapter are the socio-economic characteristics of the respondents and their awareness of location and environmental problems caused by landfills. Chapter six discusses the socio-economic impacts of landfills on the respondents with some emphasis on psychosocial impacts as well as the coping mechanisms of respondents with impacts experienced. Chapter seven analysed the impact of landfills on property values of the adjoining residential apartments. The final chapter summarizes the major findings of the study and implications of the research findings.

CHAPTER TWO

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1 Conceptual Framework

This research is linked to two traditional areas of geographic enquiry: community perception of. and response to, environmental hazards (Cutter, 1993) and, perceived negative externalities associated with noxious land uses (Dear and Taylor, 1982). The conceptual basis for this study, therefore, lies in the fields of medical geography (intersection of individual level biological and behavioural variables with social and environmental factors), (Greenberg, 1993; Elliott *et al* 1998; Wilkinson, 1996), environmental stress theory (Lazarus and Folkman. 1984. Baum *et al*. 1994) and risk perception (Wildavsky and Dake 1990; Slovic, 1987) all of which share a focus on environment and health relationships.

2.1.1 Perception-Based Impacts Assessment Models

Historically, facility impact assessments have focused on the effects of changes in population, employment and economic activity associated with construction and operation. Because of this scope limitation, such assessments have often shown a short-run, net economic benefit for the host region, making intensely negative public reaction to some types and locations of facilities seem unreasonable. Also, the long-run effect of public perceptions of both facility risk and nuisance characteristics on the area's economy and population has not been included. Even though there are no existing theories in geography for the study of perception-based impacts, recent developments in psychological and economic techniques have made it possible to correct this by incorporating public perceptions into projections of direct and indirect impacts from noxious facilities. This section therefore discuses the different methods used in assessing perception-based impacts and which were utilized in this study.

Recognition of the need for more comprehensive assessments of impact and adequacy of community compensation for waste facility siting has led recently to development of several strategies for more explicit treatment of host population preferences. These have included quasi-auction processes (Nieves, *et al*, 1992; Inhaber 1991; 1992) that depend on community self-evaluation of the compensation required to make a noxious facility worth accepting. Suggestions have been made for compensation to be tailored to address specific categories of impacts and perceived risk. (Swallow *et al*, 1992; Gregory *et al*, 1991).

There are three major models that address elements of the psychological and behavioural processes that generate psychosocial and economic impacts as a result of perceived risks of noxious facilities. The first, psychometric model is an extension of attitudinal scale development which provides a signal of impact potential by indicating the relative intensity of risk perception and aversion. In addition, there are two economic models available. One, contingent valuation, provides an ex ante measure of impacts based on survey responses to a hypothetical situation, such as a noxious facility at a given distance from the respondent's residence. The other, hedonic price model, is an ex post measure that can be used to estimate the value of location characteristics, such as noxious facility proximity, that affect local wages and, primarily, land/house prices/values. These models are discussed with examples of their implementation, and an evaluation of their potential and limitations for estimating noxious facility impacts.

2.1.1.1 Psychometric Model

The field of psychology has produced many techniques for measuring attitudes, including both survey and experimental approaches. Some of these have been developed specifically to provide data on the ways in which people typically process information and make decisions under uncertainty (Slovic *et al* 1990; Tonn and Freeman, 1990; Fischoff, 1978) Such psychometric surveys generally have a structure that elicits respondents' perceptions or reveals their thought processes by requiring respondents to rank alternatives or choose among alternative outcomes.

Psychometric models have been applied to diverse topics, such as consumer decision making, adaptations to natural hazard risks, and aversion to noxious facilities. An early study by Golant and Burton (1969) illustrates the potential scope of this method. They asked respondents to rank selected natural, physical and social hazards by the degree to which avoidance was desired. The relative rankings of hazards by persons who had, and had not, experienced them were then compared and relationships analyzed between these rankings and respondents' socio-economic and personality characteristics.

While psychometric models provide information on risk perception and relative risk aversion, they do not indicate the extent of resulting impacts (psychological, social, or economic). What is lacking for hazard impact projection is a linkage between the attitudes described by the psychometric measures and actual physical or behavioral changes. Some works have been done relating an attitudinal measure, location image, location preferences and vacation location choices (Lindell and Earle, 1983) However, this research has not addressed relationships between noxious facility images and actual location choices among locations with and without noxious facilities.

A limited number of psychometric studies focus on aversion to noxious facilities and perceived risks of technological hazards (Lindell and Earle 1983; Kunreuther *et al* 1988; Maderthaner *et al* 1976). In these surveys, nuclear plants and nuclear wastes have consistently received among the highest rankings in regard to perceived risks. This ranking transcends geographical boundaries; the first three studies were conducted in the United States, while the last was conducted in Europe. Some variation in risk evaluations is shown among groups surveyed. However, Lindell and Earle (1983) for instance, found that nuclear engineers as a group are most willing to live near a nuclear plant, while environmentalists are least willing to do so. Maderthaner, *et al* (1976) found that those presently living in close proximity to a nuclear plant rated it as less risky than did those living at a greater distance. Regardless of whether these differences are due to variations in familiarity with the technology or to self-selection into the residential distance groups, they indicate the potential of psychometric techniques to identify differences in risk perceptions among population subgroups.

Few of the psychometric studies to date have both 1) used a national sample and 2) elicited perceptions of a broad range of facility types. Studies either include a variety of facilities but are based on limited samples or are based on a national sample but include only a few facility types (Brookshire and Crocker, 1981; Kunreuther *et al*, 1988). At present there is no analysis available of relative risks perceived in connection with a wide range of noxious facilities. Such a study could reveal differences in risk perceptions across regions and among population subgroups that affect both the feasibility and the impacts of siting new facilities. There is also a possibility that risk perceptions of subgroups will be differentially affected by alternative forms of compensation or methods of providing community control over aspects of facility operation. These issues have not been explored.

Psychometric analysis depends much on people's knowledge about hazards. Knowledge about hazards plays a central role in perception research (Hughes, 1986; Minnerly, 1992, Phillimore and Moffatt, 1994, Winterfeldt, 1992). Knowledge affects risk perception. Research on knowledge and risk perception falls into two major categories and a third smaller class. The first aims at evaluating public grasp of facts about nature and technology for their effect on attitudes toward hazard. The second identified heuristics with which people process information on hazards and thirdly, describing lay people's conceptual frameworks for hazards.

The factual approach has been most common. Most factual studies focused on radiation trying to relate knowledge to public support or opposition to facilities (nuclear power, nuclear waste (Slovic *et al*, 1993) or to individual behaviour (radon testing and mitigation). These studies define knowledge as "correct answers to factual questions.

Such as "what is the name of the process that generates energy in nuclear power plants? And what is the fuel used in nuclear fusion plants? About half of these studies found that people who know more such facts support nuclear power, the other studies found no difference in knowledge among pro and anti-nuclear laypeople, or that anti-nuclear people know more (Rukinski *et al*, 1982, Brown *et al*, 1983, Wilkes *et al* 1985, O'Connor, 1990; Slovic *et al*, 1994, 1991). A few other studies, using similar factual measures, concerned irradiated food (Bord and O'Connor, 1990), ground-water pollution (Hyghes *et al*, 1956), hazardous waste cleaning (Bord and O'Connor, 1992) air pollution (Baird, 1986), hazardous wastes surface water pollution automobile, collisions (Johnson and Balternsperger, 1987), natural radon (Golding *et al*, 1992; Slovic *et al*, 1995) and earthquakes (Wyner and Marn, 1983). Some found more knowledge linked to lower concern about risks (e.g. from hazardous waste site) and more support for a technology's use (e.g. opposing a ban on irradiated food). Others found such relationships weak (e.g. irradiated food, air pollution) or negative (e.g. automobile collisions, earthquakes, and natural radon). From example, those with more facts were likely to demand protection against polluted ground water. In short the link between factual technical knowledge and perceived risk is at best variable.

A second research emphasis has been heuristics that people use to process information. One heuristic is availability, judging an event as more likely if it is easier to recall or imagine. For example, laypeople inexperienced with probabilities seem to overestimate the frequency of low-probability but dramatic hazards (e.g. nuclear power plant accidents), as compared to expert risk estimates. They also under estimate high-probability hazards that are less memorable, like some diseases (Lichtenstien, et al 1978) People's risk perception also seems strongly affected by how a problem is framed or presented. For example, their estimates of death rites varied by whether they were asked for deaths or survivals, rates or frequencies (Fischhoff and Macgregor, 1980). These findings have been widely taken to mean that lay heuristics and statistical illiteracy bias lay risk estimates, and thus evaluations of danger, away from those of experts. Such views ignore warnings by heuristics researchers and others that these problems also affect hazard experts, making comparisons of "accurate" expert and "distorted" lay views misleading (Hynes and Vanmarcke, 1976; Borak and Veillenux, 1982; Freudenburg, 1988; Wynne, 1989; Sharder – Fechette, 1990).

The latest category of knowledge studies tries to describe the conceptual structure of lay hazards knowledge. One study revealed this structure implicitly through surveys revealing that laypeople and experts disagree strongly on many points of toxicology. For example many laypeople do not conceive of exposure as mediating between chemical releases and health effects. Yet both experts and laypeople disagreed among themselves about how animal tests apply to humans (Kraus et al, 1992). A more explicit approach to conceptual structure comes under the rubric of "mental models". A group of U.S. researchers began by assessing experts' conceptual structure for the events leading to a given hazardous outcome (e.g. cancer from natural radon, deaths due to nuclear energy sources in space, damage from floods) (Lave and Lave, 1991; Maharik and Fischhoff, 1992). They then identified concepts members of the public hold on the topic through open-ended interviews and surveys, and compared them with the expert's conceptual structure. German researchers have used a somewhat different approach to study mental models of pharmaceutical drugs (Jungermann *et al*, 1988; Rouse and Morris, 1986). No one has yet explicitly tested how mental models might affect perceived risk (Johnson, 1998).

2.1.1.2 Contingent Valuation

The economic theory have developed techniques of evaluation of items (within the environment) such as noise, odour, aesthetics, etc which in some way affects an individual's enjoyment of life or utility (Lake *et al*, 1998). Economists argue that we can measure the value of a desirable item by looking at how much an individual is willing to pay for it (Turner *et al*, 1994). For instance, individuals do not purchase lower levels of road noise or views without roads. Therefore economists have sought to value such 'goods' by looking at individual's purchases of other items which secure lower noise levels or reduced views of roads. Such a technique is known as hedonic pricing (Freeman 1997; Hufschmidt *et al*, 1983) and has frequently been applied via the property market. Here, controlling for known determinant of property prices, the remaining variation in prices can be related to focus variables, thus providing information on the value of these variables.

Contingent valuation is the term applied to the technique of asking people to place monetary values on goods or environmental changes for which no market exists. It usually involves questions about the amount that a household would be willing pay for an improvement in environmental quality or be willing to accept for a decrease in quality (Nieves, 1996; Pierre and Loomis, 1993; North and Griffin, 1993). Questions can also be framed in terms of likely changes in household behaviours, such as visits to a location, or choice of housing location at alternative distances from a noxious facility. The contingent valuation method depends upon individual responses to contingent situations posited in artificial or experimental markets (Bergston *et al*, 1989; Mitchel *et al* 1989). In a contingent valuation method, respondents preference are solicited through a survey technique to state their willingness to pay (WTP) for a benefit gained from an improvement in environmental quality (in this study an improvement in quality of landfill practices) or for a loss caused by degradation of environmental quality (in this case, reduced property value and health risks).

As Randall, *et al*. (1983) noted in their review of contingent valuation methods, because the respondent is asked to evaluate a hypothetical situation, precise specification is required of the environmental change, the organizational framework controlling it, and the mechanisms for any monetary transfers. Brookshire and Crocker (1981), Smith and Desvouges (1986; 1987) indicate that the degree to which the impact estimates developed by contingent valuation methods correspond to actual impact is dependent on the accuracy and imaginability of the information provided to survey respondents. Though caution is needed in applying this method, the hypothetical nature of contingent market valuation is also the main reason for its value, in that it provides a method of ex ante evaluation of noxious facility impacts.

The type of information that can be obtained from a contingent valuation survey is well demonstrated by Baigler and Moskowitz's (1978) study of the relative importance of perceived risks in willingness to pay for contaminant removal from drinking water. They examine beliefs about contamination of respondents' own drinking water and that of others, and the role of water characteristics such as hardness in determining perceptions of water quality. The effect of providing information about drinking water quality and about relative risks to life and health is also investigated. They find that people are willing to pay more to avoid a given statistical risk if the cause of the risk is specified than if it is not, and that they are willing to pay the most to avoid risks from radioactive contaminants (more than for an unspecified "carcinogen"). This finding illustrates the need to obtain information on perceptions of risks in order to project impacts rather than depending on strictly statistical or technical estimates of risks.

While contingent valuation studies have been used to value a variety of environmental resources and changes in their quantity or quality, few have involved a noxious facility site. In one such survey, Smith and Desvousges (1986) obtained bids for residential area changes in risk levels associated with a hypothetical hazardous waste landfill. The respondents were willing to pay more to reduce risk by a given amount than they were to avoid an equal increase in risk level. The authors attribute this finding (Randall *et al*, 1983) to a property rights effect -- a belief on the part of the respondents that they are entitled to the status quo and should not have to pay to limit risk increases. As a result, when people feel that their rights are violated by the environmental change being evaluated, contingent valuation may not be a reliable measure of impacts.

In spite of the potential for contingent valuation to produce an ex ante measure of noxious facility impacts, applications have been limited by survey costs and the sensitivity of results to question framing. Several types of potential bias have been identified, of which strategic bias has the most serious implications for noxious facility impact projections (Nieves, 1992). This bias occurs when people give responses that do not truly reflect their personal willingness to pay for an environmental change, but seek instead to influence the study's outcome. This type of response is most likely when the respondent expects to be personally affected by a particular environmental change. Several studies have examined the potential for strategic bias. Brookshire and Crocker (1981), and Seller *et al* (1985) conclude that there is no clear evidence of it in practice. Seller, *et al.* (1985) suspect its presence in their results, and Cronin (1982) in a study designed to explicitly test for strategic and other forms of bias, finds significant evidence of it. It also may be operative in a survey dealing with willingness to accept compensation for a high-level radioactive waste repository (for which Nevada is the only candidate location) reported by Kunreuther, *et al.* (1988). They found willingness to accept compensation to increase with hypothetical distance to a repository in a national sample but not in the Nevada sample.

2.1.1.3 Hedonic Price Model

The impact of landfills on property values is examined within the hedonic framework. The hedonic price model, first suggested by court (1939), provides a calculus for dealing with the heterogeneity of a class of differentiated commodities. The thrust of the model, according to Arimah and Adinnu, (1995), is to sub-divide each commodity into as many separated components as are deemed necessary, in order to reflect adequately the existing quality differentials and treat each subdivision as a separate product. The theoretical underpinnings of the hedonic price model can be gleaned from the works of Houthakker (1952), Becker (1965), Lancaster (1966) and Muth (1969). Credit, however, goes to Rosen (1974) for developing a theoretical model for the structural analysis of hedonic prices.

The hedonic model in its classical form as applied to the urban housing market posits that equilibrium in a competitive market implies the existence of a relationship between housing values (such as rents, owners estimate of value, sales, price or appraised value) denoted by P in equation 1 below and a set of attribute indexed from a to n that characterize the dwelling units z (Arimah and Adinnu, 1995)

$$P(z) = P(z, z_2, \text{---------} z_n) \quad \ldots\ldots\ldots \quad 1$$

The housing attributes generally consist of structural attributes (number of rooms, plot size, floor space etc.) denoted by S, neighbourhood/environmental attributes (school quality, noise, air pollution levels, conditions of adjoining roads etc.) denoted by N, and locational attributes which cover distance to the CBD as well as other employment and activity nodes, which are denoted by L. In this case, distance to a landfill is just another housing attribute. Equation 1 can then be rewritten as:

$$P = f(S, N, L) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad 2$$

Hedonic models use price data for a related market to measure the value of environmental goods (or bads) that are not themselves traded in markets, thus providing an estimate of the implicit value that people ascribe to the environmental characteristic. Most applications of hedonic methods have analyzed single-family residence prices, although there have been a few studies involving rental housing prices and, also, wages (Nieves, 1992). The hedonic approach assumes that consumers perceive goods as bundles of features and that goods with all possible combinations of the features are available in the market. For housing, the relevant features are attributes such as age of structure, number of rooms, lot size, garage, fireplaces, neighbourhood characteristics, and environmental conditions such as crime rate, climate and access to recreational opportunities. The implicit value of each of these attributes can be measured by regression analysis of the response of price to the relevant attributes. The implicit attribute price is interpreted as a representative household's willingness to pay for an additional unit of that attribute.

Hedonic models have been commonly used to value disamenities such as air-pollution concentration levels, risks associated with flood plain or earthquake zone locations, and proximity to noxious facilities. In valuing impacts, the hedonic approach estimates the net value of the presence of a disamenity including its effect on employment, local income, traffic, noise, perceived risks, etc. in the long-run (after local markets have adjusted to siting of a facility). Therefore, the finding of a negative implicit price for a noxious facility implies that the value of the associated nuisance effects and perceived risk effects is greater than the value of stimulating effects of the facility on the local economy.

Hedonic methods have been found to produce relatively consistent results across locations (Freeman, 1979, Clark and Cosgrove, 1982) and studies of area-wide environmental conditions have found that many have statistically significant effects on price levels in the market analyzed. Roback's work (1982), which evaluates a variety of amenities and disamenities, is especially important because it examines the relationship between property and labour markets and shows that environmental attributes affect prices in both, simultaneously. Disamenities, such as noxious facilities, can lower property values, or raise wages, or both. Many studies analyzing the implicit prices of perceived risks or nuisances have not addressed the issue of property and wage market interrelationships and, thus, have produced biased implicit price estimates for disamenities. Methods have been developed of estimating unbiased implicit prices for area characteristics using either property (Clark and Cosgroves, 1990; McClelland *et al*, 1990; Michaels and Smith, 1990; Harrrison and Stock, 1984; Grether and Mieszkowski 1980; Blomquist, 1974; Gamble and Downing,1982) or labour market data (Henderson, 1982, Hoehn *et al* 1987) and controlling (in the hedonic regression equation) price levels in the other market. This technique can be used to estimate noxious facility impacts with detailed data for only one market, but may be even more valuable as a means of confirming impact estimates by developing values separately for each market.

Most hedonic property value studies (Clark and Nieves, 1991; McClelland *et al* 1990; Gamble and Downing, 1982; Nelson, 1981; Harrrison and Stock, 1984; Grether and Mieszkowski 1980; Blomquist, 1974; Arimah, 1991; Anderson and Crocker, 1971; Alan *et al*, 1992; Baker, 1986) evaluate the effects of noxious facilities by case studies of one, or several, individual communities. These studies typically focus on identification of property value gradients related to distance from the study facility. While these studies are highly consistent in finding facility proximity to be associated with depressed property values, they do not provide a good basis for generalizing to other sites or projecting impacts for sites that do not yet have a facility. Because the basis of analysis is a single community, these studies do not control for characteristics (that affect property values) which vary across communities, such as population density, climate, and other amenities and disamenities.

Only two of the studies listed use an interregional modeling approach that controls for differences in basic community environment when measuring the effects of noxious facilities; the remainder are limited to a single locality. (This approach has been employed, however, in numerous hedonic analyses of impacts of crime rates, climatic characteristics, etc.) In the first of these, Hoehn, *et.al* (1987) and Nelson (1981) calculate a net impact on wage and property markets combined, for superfund sites and hazardous waste treatment, storage, and disposal sites. This impact measure takes the simultaneous interaction of wage and property markets into account and demonstrates that both types of sites have depressing net effects on the local markets. The second study (Gamble and Downing, 1982, Clark and Nieves, 1991) finds lower property values as the density of each facility type increases, except for hazardous waste sites, radioactive contaminated sites and LNG (liquefied natural gas) storage sites. Net income and property value impacts for seven of the eight facility types studied were found to be negative.

The presence of a landfill can impact property values from both the supply and demand side. Even though land may be relatively inexpensive near a landfill, contractors may be hesitant to build and lenders may be reluctant to extend credit on properties located on or near landfills due to potential legal liabilities. On the demand side, buyers who are aware that a landfill exists in the area and who are concerned about potential nuisance and health problems will either avoid these properties or be induced to purchase them only at a significant discount. Whether the health problems are real or imaginary may not be the critical issue people often act on the basis of perceptions, as well as fact. Furthermore, as summarized in the McClelland *et al* (1990), there is a growing body of evidence to suggest that when faced with low probability risks, people generally tend to either ignore or exaggerate the risks involved

As pointed out by McClelland, risk assessment by individual sellers may have little impact upon housing prices compared to the risk perceptions of the entire neighbourhood. To illustrate, assume most residents in a given neighbourhood are generally unconcerned with the risk or nuisance associated with a landfill. While an individual seller may have a strong aversion to the landfill and be wiling to sell at a sizeable discount, the homeowner may still be able to sell at the current market price and avoid a large loss. This is especially true if potential buyers are not fully aware of the landfill and its associated effects. For example, in the McClelland study, 62% of recent homebuyers indicated that they were unaware o f the landfill at time of purchase.

On the other hand, as the neighbourhood becomes more concerned with the landfill homes prices are likely to decline. To some extent the market experiences a self-fulfilling prophecy. If local residents exaggerate the negative aspects of a landfill and are anxious to leave there at virtually any cost (i.e., neighbourhood flight), the supply of housing offered for sale will be large. If buyers are fully informed about the landfill and its associated risks, they will either avoid the area altogether, reducing demand, or perhaps attempt to benefit from the problem by making substantially below-market offers. Any such decline in prices will be quickly reflected in the appraisal process by local realtors and professional appraisers. Sellers will be encouraged to price their homes even lower to remain competitive and a downward price spiral may develop.

Thus, the nature of the housing stock and attitudes of the local residents can make a significant difference. If the housing stock is generally inexpensive, of lower quality, and owned by residents who are older and perhaps less well educated, local homeowners may simply ignore any nuisance problems and potential future health hazards. If buyers with similar attitudes and risk profiles are attracted to the area, there may be little or no noticeable landfill impact. On the other hand, in areas where the population is younger and better educated, very concerned about health issues and child safety, and has a significant housing investment to protect, the potential adverse landfill impact could be significant.

In a well-known article Muth (1991) postulates decline in house values as the distance from the central business district (CBD) increases. The decline in value reflects increased commuting time and transportation costs required to reach the CBD and the greater availability of land at the urban fringe. The existence of these negative price gradients have been confirmed empirically by various researchers, such as Lie and Brown (1980) and Jackson (1979). While the CBD represents a positive externality a similar argument can be made that a positive price gradient should be observed for housing located near a negative effects of a landfill (e.g., odour, noise, toxic water, etc.) should declines as distance from the landfill increase.

Furthermore, many of the potential problems associated with a landfill relate to negative externalities, such as odour, toxic water, and methane gas which are particularly troublesome when found in concentrated amounts. The volume of air and land surrounding the landfill should act to absorb at least some of these externalities and reduce their nuisance effect. Doubling the distance from a landfill increases the cubic volume of air surrounding the landfill by a factor of eight and increases the land area by a factor of four. Thus, the negative effect of a landfill could decline exponentially as distance increases.

Hedonic estimation techniques have undergone substantial development during the 1980's with the result that many of the earlier studies can at this point be faulted on methodological grounds. In addition, many of the property value study findings may have been affected by the small size of the region studied (Nieves, 1992). Most of these studies find price gradients that decrease with increasing distance from a noxious facility, but lack the basis for determining whether the price level in the whole area differs from that in comparable areas. Wage studies, though based on national samples, have generally not dealt with employment in or near noxious facilities.

In spite of the methodological flaws and limited scope of the existing research, there is a broad consistency to the findings. Within the wage analyses, positive wage differentials for exposure to risks are clearly documented. The property studies generally indicate that values are lower in proximity to noxious facilities. Where the effects of an accident are evaluated (Hoehn *et al* 1987, Clark and Nieves, 1991, Nelson, 1981) no price impacts are found, indicating that public expectations of such accidents consistent with the incident were already fully capitalized into property prices. In addition, there are indications in two studies that found insignificant or positive price impacts, that damage compensation (or expectations of it) may have been responsible for maintaining property values (Clark and Nieves, 1991, Gamble and Downing, 1982). The studies that permit assessment of net impacts on labour and property markets nationally (Lindell and Earle, 1983, Clark and Nieves, 1991, Hoenn *et al* 1987) indicate a net negative effect associated with several types of noxious facilities.

The relevance of the hedonic price model lies in the fact that it expresses property values as a function of not only the quality of structural attributes of property, but as well, neighbourhood and locational attributes.

2.1.1.4 Comparison of Economic and Psychometric Risk Aversion Models

Currently, no contingent valuation studies allow ranking the intensity of public aversion to various types of noxious facilities. One hedonic study (Clark and Nieves, 1991) and two psychometric studies (Stull and Stull, 1991, Lindell and Earle, 1983) provide information for a sufficient variety of facility types to permit comparison of findings on public aversion to facility proximity. The two psychometric studies provide cardinal (absolute) measures, in miles or in population percentage, for public aversion to noxious facilities. Findings of these two studies, while not based on comparable samples or questions, produce a consistent relative ranking for the three facility types that they have in common. The intensity of aversion to nuclear plants is substantially greater than that for petrochemical refineries, which, in turn, is somewhat greater than for coal-fired power plants.

In an empirical study (Hoern *et al*, 1980), the economic impact measures for six facility types showed in 1980 dollars of net annual income and property value response to a one unit increase in facility density (per 100 square miles). This measure shows similar impact magnitudes for nuclear plants and refineries, followed by coal-fired plants, LNG storage facilities, and then by oil-and gas-fired plants. Hazardous waste sites had a positive effect on residential property values in 1980 (before they were publicly identified as "Superfund" sites). Their ranking is the only one that differs substantially from the relative ranking produced by the psychometric studies. These economic impacts represent the net value of economic stimulus effects and the negative impacts of risk aversion and nuisance perception. The hazardous waste sites are apparently associated with economic activity with benefits to the local economy that outweigh any negative impacts due to public risk perception based on site-specific information available in 1980. For the other five facility types, risk and nuisance effects outweigh economic benefits.

The finding of negative impacts in the hedonic valuation of facility sites confirms that public perceptions of risk and nuisance effects have a measurable economic consequence. Determining the magnitude of this impact in addition to the economic stimulus component requires incorporating information regarding public aversion to facilities into economic analyses of facility impacts in such a way that the components can be delineated. A method of accomplishing this (Nieves, 1992) is suggested in the following section.

2.1.2 Model of Environmental Stress and Coping

The basis of what is known about the psychological effects of environmental contamination from hazardous substances began with the study of people's reactions to natural disasters in the 1950s. Psychologists and clinicians recognized that a small number of people exposed to various natural disasters (e.g., fires, hurricanes, and floods) could develop psychological sequelae from the stress such as major depression, chronic anxiety, and post-traumatic stress disorder (PTSD). Current thought among disaster relief workers holds that most people will suffer no or only transient effects from the stress of a natural disaster (i.e., acute stress disorder or, "people reacting normally to an abnormal situation") (ATSDR, 1999).

There are important differences between psychological effects from actual or perceived exposure to chemicals and those resulting from natural disasters. Sociologists and psychologists performing field research in communities near hazardous waste sites have pointed out that unlike a natural disaster—which has a discernible low point followed by a recovery phase when life begins to return to "normal"—life near a hazardous waste site is a more nebulous and uncertain situation. Environmental contamination has no discernible starting point, no distinct low points, may last for many years during the clean-up and remediation process, and, in case of exposure, may result in latent health effects for those people exposed to a hazardous substance (ATSDR, 1999).

The slow onset and recovery from these situations may make adjustment to them more difficult than a sudden, more tangible event such as a natural disaster. Living near a hazardous waste site can breed uncertainty about exposures and subsequent latent health effects (Vyner, 1988) and spark social and political turmoil (Couch, 1991; Edelstein, 1988), all of which serve as additional stressors. Also, exposures to neurotoxic chemicals can cause psychological changes, so it is important to rule out exposures before declaring a health problem to be solely psychologically based.

The psychological and social responses to possible exposure to environmental hazards have many similarities to those seen in natural disasters and emergencies. For both, event-related stress leads to transient disturbances in many people and serious disorders, such as anxiety and depression, in a few. In other words, "normal people reacting normally to an abnormal situation." However, chronic stress can be associated with life living near a hazardous waste site and can be accompanied by "long-lasting elevations in blood pressure, evidence of changes in immune-system function, persisting symptoms of post-traumatic stress disorder (e.g., hyperarousal, frequent and bother-some intrusive thoughts about the accident, and avoidance of reminders of it)" (Baum and Flemming, 1993).

The first quantitative scientific studies of the psychological stress associated with environmental contamination were conducted about the Three Mile Island (TMI) accident. Baum and colleagues (Baum *et al*, 1992) found indicators of psychophysiological effects from stress in the people living near TMI when compared with people in control groups. The psychological effects found in many community members included elevated levels of psychological distress, feelings of perceived threat, and subclinical anxiety and depression. The physical signs of increased stress in the TMI group consisted of small subclinical increases in blood pressure and higher than normal levels of urinary cortisol and norepinephrine metabolites, which are indicators of physical arousal due to psychological stress. This pattern of subclinical psychological and physical symptoms of stress remained elevated for six years after the incident and only returned to normal levels after 10 years (Baum and Flemming, 1983; Milkes and Reed, 1985). Baum *et al* (1993) looked for this same pattern of chronic stress in a community located near a hazardous waste site. The findings were the same. Baum and Fleming concluded that "distress and mental health outcomes also represent major outcomes of environmental disasters."

Further support for the findings at TMI comes from a group of researchers in California who studied the towns affected by the Cantara loop railway spill (Dayal *et al*, 1994). The study looked at the physical, psychological, and psychophysiological reactions of those who experienced exposure to metam sodium as a result of the spill. Psychological assessments of the affected residents showed increased worry and perceived decreases in social support. Biological testing showed changes indicative of chronic stress. Testing also showed greater occurrence of depression, anxiety, and somatic symptoms in the exposed population versus the control population. Researchers felt these outcomes were possibly connected to chronic arousal states. They postulated that "physiological and psychosocial effects of the chemical spill trauma precede long-term physiological manifestations."

Psychosocial impacts research focused on psychosocial impacts of exposure to environmental contaminants (Elliott *et al*, 1993; Elliott and Taylor, 1996; Eyles *et al*, 1991; Bowler *et al*, 1994; Bolger and Eckenrole, 1991). The scope of such research is based on: (a) the awareness and prevalence of psychosocial impacts of exposure; (b) the relative absence of theory and empirical evidence to explain their determinants; and (c) uncertainty as to ways to intervene to effectively reduce their adverse effects on individual and community well being. While past research has concentrated mainly on the physical health effects of exposure to environmental contaminants (e.g. cancer and adverse reproductive outcomes), increasing attention is now being turned to the psychosocial impacts of exposure defined as a complex of distress, dysfunction and disability manifested in a wide range of psychological, social and behavioural outcomes, as a consequence of actual or perceived environmental contamination (Baum et al, 1985; Elliott, 1998).

Although psychosocial impacts are known to occur at different levels of social organization, the focus of this research is on individual level effects. These may include emotional (e.g worry, concern, anger, loss of control, guilt, etc), behavioural (e.g. task performance, help seeking etc), and somantic (e.g. depression etc) effects.

One useful approach for investigating environmental risk and (re)action is environmental stress and coping theory (e.g. Elliott et al., 1999, Evans 1982; Evans and Cohen, 1987; Lazarus and Folkman, 1984). Herein, risk is socially constructed; it is a subjective, cultural construct which is "rooted in daily experience and assessed by reference to experience" (Phillimore and Moffatt, 1999). Traditionally, risk has been measured using psychometric, quantitative risk assessment measures. For example, the classic work by Slovic (1987) used lists of potential risk ranked on a 5-point Likert scale in order to discern variations in risk perception between scientific experts and the lay public (Fischhoff *et al.*, 1981). However, recent research demonstrates that these measures alone do not provide a comprehensive understanding of the relationships between environmental risk, concern, and action (Adams, 1995). This is due in large part to the realization that risk is socially and culturally constructed (Wildavsky and Dake, 1990; Beck, 1992). As a result, there has been a shift toward qualitative approaches to measuring and understanding risk (Baxter *et al.*, 1990a, b).

Baum *et al* (1985) define environmental stress as "a process by which environmental events threaten, harm or challenge an organisms existence or well being and by which the organism responds to this threat". Coping on the other hand is a complex process, influenced by both personality characteristics (Bogler, 1990; Friedman *et al* 1992), situational demands (Folkman and Lazarus, 1986, Heim *et al*, 1993), and the social and physical characteristics of the setting (Mechanic, 1978). As indicated from the various theoretical paradigms of coping, every factor from physiological, psychological, and social to cultural, both affect and are affected by the coping strategies. Psychosocial effects are defined as a complex of distress, dysfunction and disability manifested in a wide range of psychological, social and behavioural outcomes, as a consequence of actual or perceived environmental contamination (Elliott et al, 1993).

A useful psychological model of response to environmental stress is that provided by Lazarus and Folkman (1984). It contends that response to environmental stress is divided into two stages: *primary* appraisal, whereby the individual perceives an environmental stressor as a threat, harm, or a challenge; and *secondary* appraisal, whereby one of two coping strategies is selected:

1) problem-focused coping (e.g. joining citizens action group); or

2) emotion-focused coping (e.g. adjusting attitudes towards the stressor).

Reappraisal occurs as the perception of the stressor or available coping resources changes overtime .

The occurrence of environmental stress the experience of psychological effects, and the choice of coping response are dependent upon four types of mediating factors, relating to the stressor (Vyner, 1988; Evans and Jacobs, 1982, Sims and Beumann, 1983), the individual (Evans and Jacobs, 1982; Sims and Baumann, 1983; Pearlin and Schooler, 1978), the social network (Edelstein, 1988; Flynne, 1978), and the wider community system (Sims, 1983; Edelstein, 1988; Buthel, 1987). Further, it involves an interactive process whereby the mediating factors not only influence psychological effects and responses but also each other. This model is as shown in figure 2.1

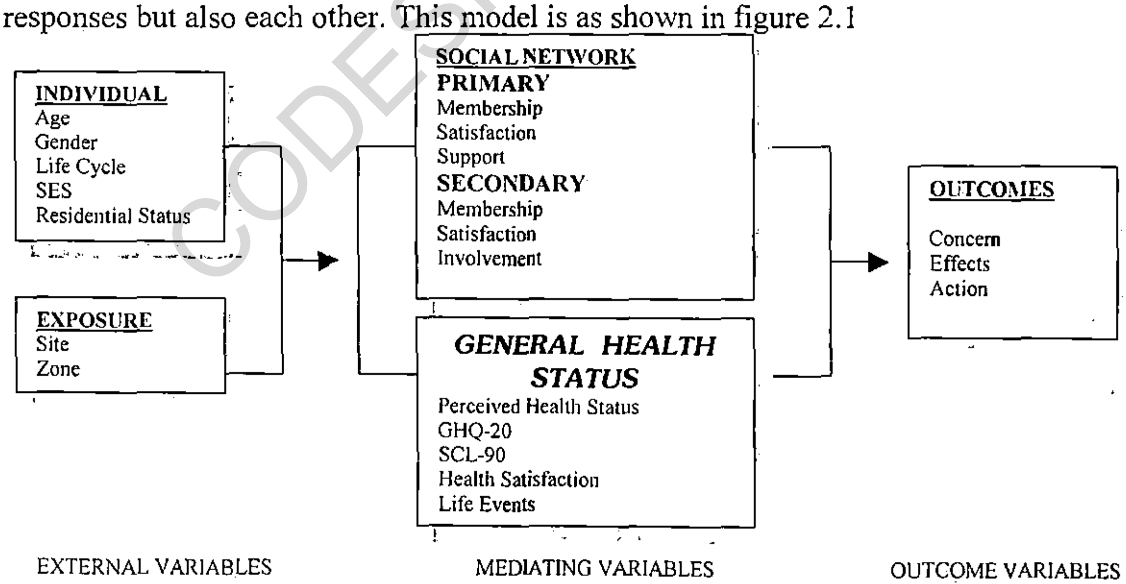

Fig. 2.1: Model of Environmental Stress and Coping
Source: Elliott *et al* (1993)

Psychosocial reactions to environmental contamination, and in this case to waste disposal facilities have been found to occur within community systems (Eyles *et al*, 1993, Elliott *et al*, 1993, Taylor *et al*, 1991, Elliot, 1992, Baxter 1992). They are socially and culturally mediated in complex ways which are to some degree unique to the particular study setting.

Emerging theories of the risk society (Beck, 1992, 1987; Giddens 1990, 1991; Mol and Spaagaren,1993) contribute additional insight to our understanding of individual and community experiences of, and responses to, environmental stressors/risks. The main premise of risk society theory is that the pervasiveness of perceived risk in Western societies signals a fundamental shift in the way individuals view the world. That is, modern risks, which result from the by-products of techno-industrial economic activity (e.g., hazardous waste), are seen as fundamentally different from their historical counterparts, as they represent the 'dark side of progress' as opposed to the dreaded but familiar risks associated with nature (e.g., earthquakes, floods; Beck, 1992a; Gidens, 1990). Modern risks are further differentiated by their association with a human agent culpable for the emergence of the risk, whereas pre-modern risks were traditionally ascribed to acts of God (Wakefield *et al* 2000). The realization that modern risk is the result of techno-economic decision-making by humans driven primarily by a profit motive leads to critical reflection on the once taken-for-granted societal order, a process which Beck and Giddens refer to as "reflexive modernization". The concepts of 'progress' and 'scientific rationality' have been particular victims of this critical exercise, engendering a decline of trust in science and technology and in the creators of that technology. The result is that technological risks are seen as less tolerable and/or justifiable (Beck, 1992).

In response to such environmental threats, Giddens (1990) suggests that coping responses take one of the following forms within the context of the risk society framework. Pragmatic acceptance is characterized by "numbness" towards the issue and withdrawal into everyday life. Beck (1992b) refers to this coping response as "turning inwards", as it involves turning away from the risk and finding solace in commonplace household activities. Sustained optimism is marked by continued faith in science and reason (despite increasing distrust of these at a societal level), and ongoing trust in the pronouncements of scientists and experts, regardless of their credibility. An attitude of cynical pessimism leads to the use of black humour as a protective mechanism, while those who respond with radical engagement work to contest the social and institutional systems responsible for raising the spectre of environmental risk (Giddens, 1990). While each of these coping mechanisms is illustrated in the empirical results presented below, it is important to note that coping is an ongoing process, characterized by reappraisal of the risk as characteristics of the individual and/or risk change over time (Lazarus and Folkman, 1984). Furthermore, particular coping strategies may have their own damaging effects (Cohen *et al.*, 1986) and the overall effectiveness of different coping strategies is not yet known (Unger *et al.*, 1992).

2.2 LITERATURE REVIEW

2.2.1 An Overview of Impact of Landfills on Public Health and the Environment

2.2.1.1 Evolution of Landfilling Practices

Several hundred years ago, in many areas urban and rural dwellers deposited their solid wastes outside their places of residence. Eventually, because of problems of odour, rodents, etc., the garbage in urban areas began to be hauled for disposal to open dumps usually located in nearby, low-value land. Such disposal practices often included burning the garbage. At some locations, such as in California, United States, food waste in the dumps was also used as food for hogs. Eventually the use of municipal solid waste as a source of food for hogs was stopped because of problems with the spread of trichinosis, a disease that is caused by an intestinal nematode (Trichinella spiralis). Hogs became infected with trichina cysts in the raw garbage; people became infected by eating insufficiently cooked pork (Benenson, 1985). While the trichina in pork are readily killed if the pork is sufficiently cooked, eating insufficiently cooked pork results in the release of the organism's cysts in the intestinal track of man or other animals; from there they enter the blood stream and eventually encyst in muscle tissue. Trichinosis is ordinarily not debilitating if the trichina encyst in large, nonsensitive muscles. However, it can cause severe debility and death if the trichina enters vital organs. According to Tchobanoglous *et al.* (1977), in the first half of the 20th century, 16% of the United States' population was infected with trichinosis from eating inadequately cooked pork. At one time, attempts were made to cook garbage destined for dumps in order to reduce the problem with trichinosis transmitted by hogs grazing on garbage. This proved to be an unsatisfactory solution and was abandoned in favor of discontinuing animal grazing on garbage. Michaels (1994) reported that the city of Philadelphia currently conducts a separate pick-up of food wastes, which are then fed to hogs in New Jersey. The wastes are reported to be cooked to reduce the potential for the spread of trichinosis.

The open dumps that were used for solid waste disposal in California until the 1950's, often had severe problems of localized odours, vermin such as rodents and seagulls, potential disease vectors such as flies and rodents; they were also known to cause groundwater pollution in the vicinity of the dump. Beginning in the 1950's the US Public Health Service and a number of states including California began to manage municipal solid waste (which often included industrial waste, both what is now called "hazardous" and "non-hazardous" waste) in what became known as "sanitary landfills."

Sanitary landfills, typically located in low-value land, usually wetlands, were basically open dumps in which the daily garbage was covered with a few inches of soil. The purpose of the soil was to reduce the entrance of vermin, flies, and other nuisance organisms into the waste, and to reduce the rate of release of gases including odors from the landfill. Further, the daily cover tended to control, to some extent, blowing papers and other debris associated with the landfill. Sanitary landfilling as it was initially practiced and was practiced in many areas until recently, did not incorporate any significant provisions to prevent either air pollution from gaseous emissions or groundwater pollution from liquid emissions.

In general, lean and healthy living conditions in societies, towns and villages cannot be achieved without reliable and regular waste collection and disposal. Much effort has been expended, rightly, in progressive cities and towns on improving urban collection services. It is now time to extend this attention to improve the standard of landfill disposal. Open dumping is neither safe nor hygienic. With more forethought it is no longer realistic to simply remove the health risks from waste from city streets and accumulate them in a nearby in a suburb or rural area.

Four categories of health effects can generally be identified from poorly designed and operated waste disposal sites:

1) Direct physical harm arising from collapse of unstable slopes of waste, explosions and fires, asphyxiation, and waste-related transport accidents or similar accident.

2) Bacteriological and protozoal pathogens and similar infective agents arising from the biological contamination of wastes and their subsequent infective transmission to a host. Transmission routes via hand-to-mouth and hand-to-food-to-mouth are the most likely for waste workers and scavengers, while contamination of water supply or uptake through the food chain could affect the general public.

3) Similar transmission routes may apply to chemical contaminants from waste by affecting target organs or regulatory and control within

the body. The chemical inducement of cancers is also a theoretical possibility.

4) The impact of chemical or microbiological contaminants on reproductive activities, notably stillbirth, low birth weights, or specific birth defects, are also known. There have also been incidents of health damage and death from exposure to dumped organic chemical compounds and, even, radioactive materials.

Figure 2.2 shows routes of exposure to hazards caused by open dumping.

One suggested pathway to upgrade, over time, the quality of municipal landfill sites (Rushbrook 1997) is outlined below and illustrated in Figure 2.3.

Stage 1: From open dumping to "controlled dumping." This involves the working area of the site to a more manageable size (say, 2 ha for a modest sized city of 500,000 inhabitant); covering with soil, sand, or any other convenient material, any exposed wastes on unneeded areas of the site; stopping fires, and agreeing about rules of on-site work with scavengers if they cannot be removed completely.

None o f these controlled dumping measures represent a major departure from the operational practices or resources used at an open dump. The advantage is that these operational improvements need little or no additional investment but begin the

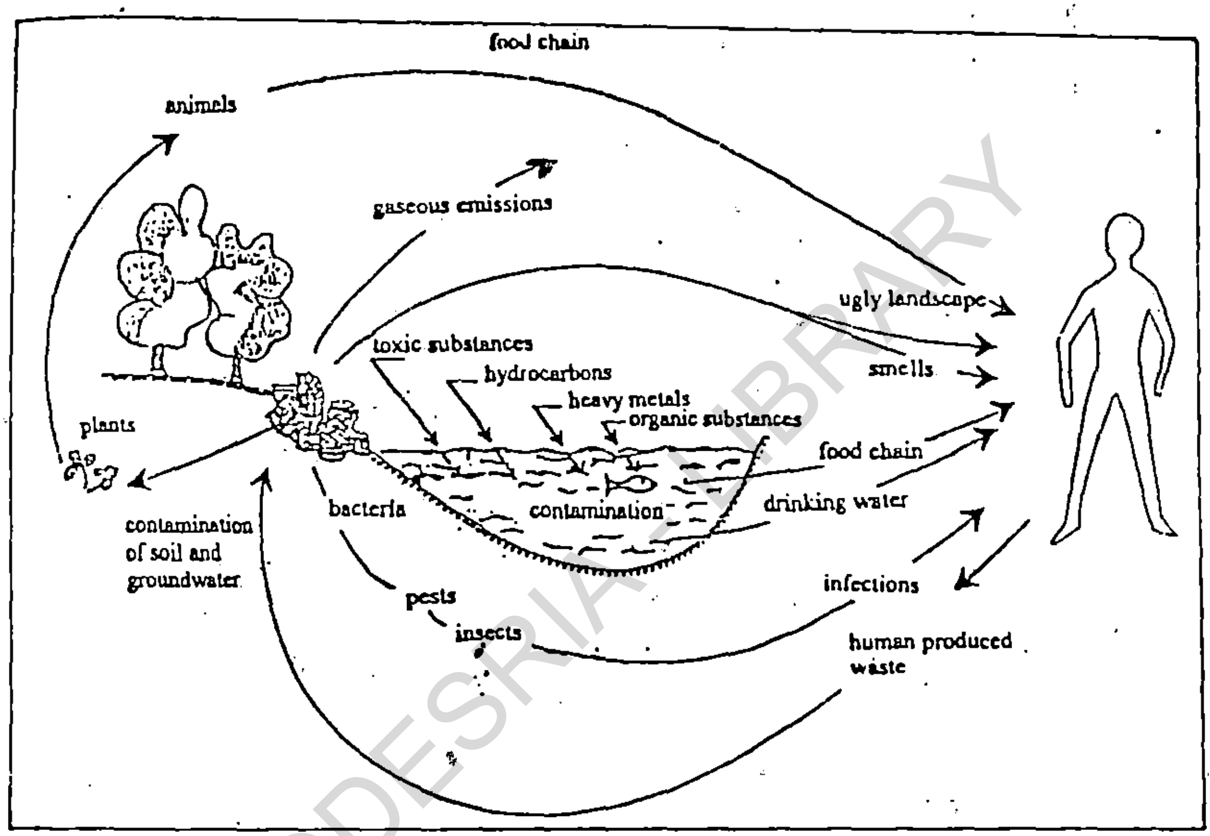

Figure 2.2: Routes of exposure to hazards caused by open dumping
(Source: Oeltzschner 1996)

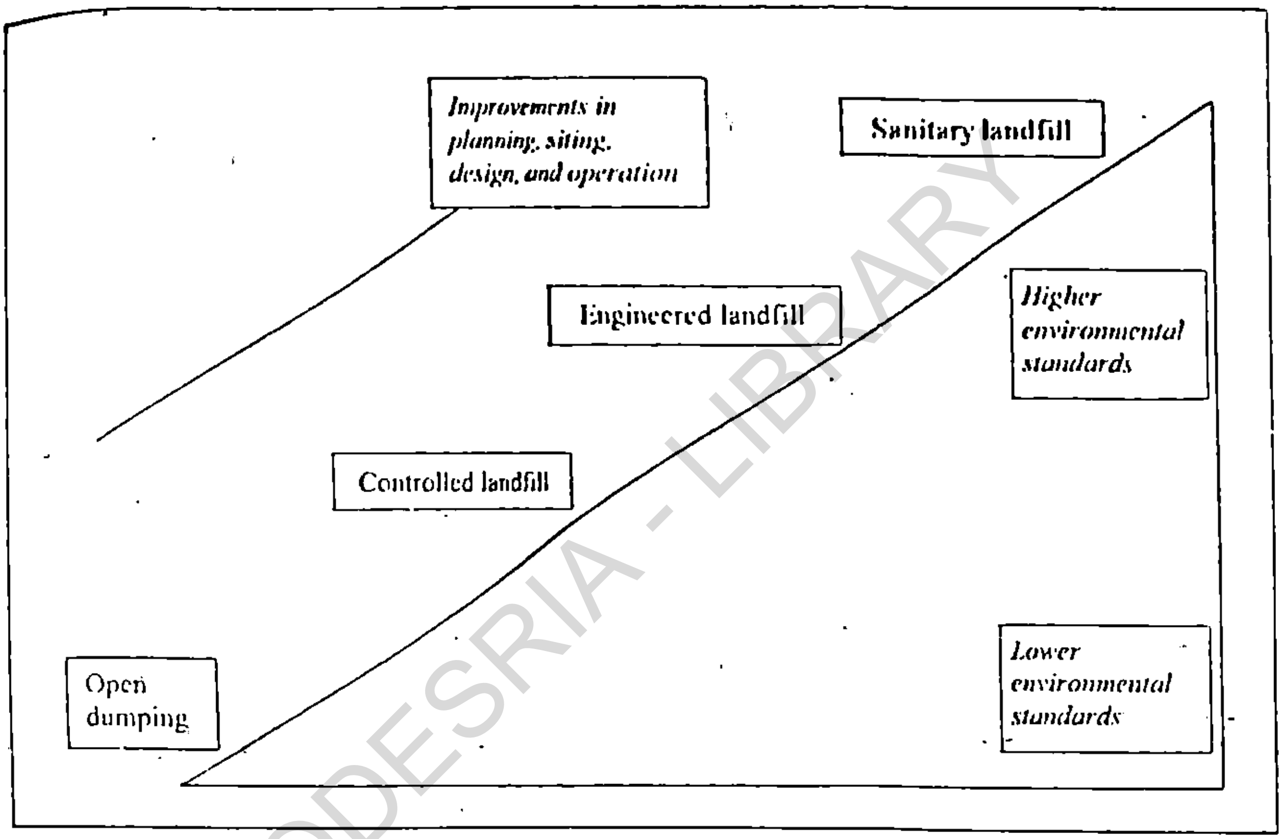

Figure 2.3: Evolutionary improvements in waste management
(SOURCE : Rushbrook and Pugh, 1999)

philosophy of introducing "control" and "isolation" into the waste disposal operation. Since this incremental step is relatively small, the risk of failure perceived by a landfill manager can, equally, be argued to be small.

Stage 2: From controlled dumping to "engineered landfill." This involves the gradual adoption of engineering techniques to control and avoid surface water entering the waste, extract and spread soils to cover wastes, remove leachate into lagoons, spread and compact waste into smaller layers, prepare new parts of the landfill with excavation equipment, and improve the isolation of waste from the surrounding geology. A clear sign that a municipality is progressing through this stage successfully is the routine development of detailed designs prior to new landfills being developed, and the creation of disposal plans showing how a site will be filled with waste over its lifetime and how it will be finished off. Stage 2 represents the longest period in the evolution towards sanitary landfill techniques. It encompasses the gradual accumulation of engineering expertise by those manager most local climate exists that encourages informed learning about waste engineering and gives waste managers an opportunity to try new things.

Stage 3: From engineered landfill to "sanitary landfill." It has to be recognized that some communities and countries will not achieve this stage of landfill development in the foreseeable future. The development to a truly sanitary, as recognized in the higher-income countries, involves the continuing refinement and increasing complexity in the engineering design and construction techniques begun in the engineered landfill stage. In addition, sanitary landfills are more likely to have the pre-planned installation of landfill gas control or utilization measures, extensive environmental monitoring, a highly organized and trained work force, detailed record-keeping by the site office staff, and, where circumstances dictate, on-site leachate treatment to supplement a leachate collection system.

An overriding characteristic in communities operating sophisticated sanitary landfill is the ever-increasing social demand for higher environmental standards. Reflecting society's increasing intolerance with the *concept* to landfill, these standards have become increasingly divorced from the "pure" or simple protection of the pubic from credible health and environmental risks.

Lee and Jones-Lee (1994) discussed potential adverse effects of municipal solid waste (MSW) landfills and other waste management facilities on those who own or use properties near them. Table 2.1, developed from that review, summarizes those impact issues. As discussed by Lee and Jones-Lee, the emissions from MSW landfills, truck traffic, and other problems associated with the normal landfilling approach often results in significant local opposition to the siting of landfills. While essentially all of the potential adverse impacts of MSW landfills on nearby property owners and users can be mitigated by proper siting, landfill operation, closure of the landfill once it is filled, and maintenance for as long as the wastes represent a threat, adequate steps in these areas are rarely taken by those who develop landfills (Lee and Jones- Lee, 1993). A number of the

Table 2.1: Adverse Impact Issues of MSW Landfills and other Waste Management Units on Users/Owners of Nearby Properties

Landfill Impact Issues	Effects
Groundwater and Surface Water Quality; Leachate Migration & Disposal	Public Health, Economics, Aquatic Life, Aesthetic
Migration of Methane and VOC's	Public Health, Explorations, Toxicity to Plants
Illegal Roadside Dumping and Litter near Landfill	Aesthetics, Public Health, Economics
Truck Traffic	Congestion, Air Pollution, Aesthetics, Public Health
Noise	Aesthetics, Public Health
Odours – Dumping & Landfill Gas	Aesthetics, Public Health
Dust and Wind-Blown Litter	Aesthetics, Public Health
Vectors, Insects, Rodents, Birds	Public Health, Nuisance, Aircraft Hazards
Impaired View/Viewshed	Aesthetics
Decreased Property Values	Condemn Future Users of Nearby Properties

Source: Lee and Jones-Lee, 1994

problems associated with landfilling of municipal solid wastes are the direct result of gaseous and liquid (leachate) discharges from the landfill which are transported to or under adjacent properties impairing the use of those properties or associated water resources. Those who generate wastes that are placed in MSW landfills typically do not pay the full real costs that would be associated with management of their wastes so as not to cause adverse impacts on nearby property owners and users.

Lee *et al.* (1994) discussed common problems with the siting of landfills, and Lee and Jones-Lee (1993a, 1994a) discussed approaches that can be used to address the potential adverse effects of landfills to reliably assuage the justifiable concerns expressed by those who own or use properties near a landfill when they learn that a governmental agency has selected their area for a new landfill or for the continued operation of a landfill that had been scheduled to be closed. As discussed by Lee and Jones-Lee (1993a, 1994a) the key issue in the siting of landfills of the type being developed today to properly address many of their potential adverse effects is the provision for an adequate land buffer around the landfill. The landfilling practices of the past and still today do not recognize that the acquisition of sufficient lands about the landfill to dilute the adverse effects of gaseous emissions and some of those associated with operation of landfills should be part of the cost of landfilling of municipal solid waste.

Lee and Jones-Lee (1993a, 1994a) have reported that the sphere of influence of many MSW landfills depends on a variety of factors including the extent of groundwater pollution, odours, and garbage truck traffic that adversely impacts normal traffic flow etc. Hirshfeld *et al.* (1992) reported that property values near MSW landfills are adversely impacted by the landfill for distances of a mile or two from the area where waste deposition occurs. It is certainly not unreasonable to expect that any landfill that is sited without at least one mile and preferably two miles of landfill-owned buffer land between the outermost edge of where waste deposition occurs and adjacent property owners' land will be adverse to those who own or use this property.

For instance in the United States, because of the inadequate resolution of such problems in the past, and the failure to incorporate adequate provisions for their resolution in the future, it has become difficult if not impossible to site additional landfills of the type that have been operated in the past in many areas of the US. This situation is manifested as a national solid waste management crisis. There are few individuals who would not become a NIMBY if a landfill were proposed for their region; landfills of the past and still today are very poor neighbors to those who own or use properties within several miles of the landfill.

2.2.1.2 Landfill Emissions and Impacts

MSW landfills and many industrial non-hazardous waste landfills emit large amounts of landfill gas and leachate ("garbage juice") to the environment. Such emissions can have significant adverse impacts on public health, public safety, groundwater quality, and aesthetic quality of the area near the landfill. A review of these emissions and their impacts according to Lee and Jones Lee (1994) is presented below.

Landfill Gas

On the order of 50% or so of municipal solid waste is potentially usable by bacteria as a source of energy through aerobic and/or anaerobic fermentation reactions. Composting of municipal solid waste is an aerobic process in which part of the degradable organic matter is converted to CO_2, water, and a "stabilized" organic residue (compost). Because of the high demand for oxygen by bacterial respiration in sanitary landfills compared with the available oxygen supply from the atmosphere, the waste in a landfill quickly becomes anoxic (without oxygen, O_2). When sufficient moisture is present, bacteria in the landfill can utilize some of the organic matter through anaerobic fermentation processes. These processes lead to the formation of landfill gas which is typically composed of about 50 to 60% methane and 30 to 40% CO_2. Landfill gas also typically contains on the order of 10% N2 gas which arises from air that enters the landfill, and up to a few percent other gases. One pound of municipal solid waste can generate about 3 ft3 of C02 and 4 ft3 of CH4 over a several-year period.

The rate of landfill gas production depends primarily on the moisture content of the waste. In a typical sanitary landfill, it takes 30 to 50 years to "stabilize" the waste, i.e., to convert the fermentable organics in the waste to landfill gas. At the end of the stabilization period a significant part of the anaerobically fermentable organics have been converted to landfill gas. It has been repeatedly demonstrated that under optimum conditions (shredded waste and addition of moisture (leachate) to the waste), it is possible to reduce the waste stabilization time from 30 to 50 years to 5 to 10 years (Lee and Jones-Lee, 1993b).

Potential problems associated with landfill gas production and migration according to Lee and Jones-Lee (1994) include explosion (CH_4), vegetation distress ($C0_2$), Odours, property value reduction, physical disruption of cover, toxic gases (VOC's), Vinyl Chloride, groundwater pollution, $C0_2$ in carbonate, Geological Strata and increased TDS. The principal hazard of concern with landfill gas emissions is the potential for explosion of the methane. The lower explosive limit for methane is about 5 %; methane in concentrations above about 5 % in air is explosive. There have been numerous examples of explosions at landfills. There have also been numerous examples of underground migration of landfill gas to nearby properties and sufficient accumulation of landfill gas in buildings to become an explosive mixture which can be set off by a spark. The problems of explosive conditions developing from methane emissions from landfills have stimulated regulatory agencies to require that landfill owner/operators construct landfill gas collection systems that are envisioned, in concept, to collect sufficient landfill gas emissions so that landfill gas is not transported below the ground surface off-site to cause explosive conditions in nearby structures.

Landfill gas can also have adverse impacts on vegetation that is developed on the landfill cover or near the landfill. Typically when the landfill stops receiving wastes, i.e., when it is closed, a cover is installed over the landfill and includes the development of vegetation (grasses) to reduce erosion of the cover. The emission of landfill gas can exclude oxygen from the root zone of vegetation, and thus lead to the death of the vegetation. Many landfill covers that have inadequate landfill gas collection systems have large, non-vegetated areas due to landfill gas emissions through the cover.

The principal problem caused by landfill gas emissions is odour. While methane and C02 are odourless, gas emitted from municipal solid waste contains large amounts of highly odourous compounds that are highly obnoxious to most people at low concentrations. Such odours are emitted during the dumping of the garbage, as well as through the cover of closed landfills that do not have adequate gas collection systems or have systems that do not destroy the odorous gases by incineration which is typically done by flaring of landfill gas. As discussed by Lee and Jones-Lee (1993a), highly odorous conditions from landfills can persist for a mile or more downwind from the landfill. In the many countries today, no attempt is made to control off-site migration of highly odourous gases emitted at the landfill face when dumping is taking place. Also. little attempt is made to control the highly odorous landfill gas emissions while the landfill is accepting waste, i.e., is open to the atmosphere, other than what can be accomplished by covering each day's garbage with a thin layer of soil. The daily soil cover often is only partially effective in controlling gaseous emissions from solid wastes that have been deposited at a landfill on the previous days of operation.

Several papers presented at the Sardinia '93 IV International Landfill Symposium discussed the European experience with landfill odours and the situations that promote long-distance transport of highly malodorous conditions, such as the presence of valleys and periods of near-surface inversions (Christensen *et al.*,1993). Although often little is done in many places to control the malodorous conditions that frequently occur on properties near landfills, a number of European countries have adopted legislation to greatly curtail malodorous conditions from arising from landfills to adversely affect nearby property owners/users.

It has been known for many years that landfill gas contains trace quantities of a variety of highly hazardous chemicals. More recently, Hodgson *et al.*(1992) reported on landfill gas emissions of VOC's (volatile organic compounds) from a group of California municipal landfills. Table 2.2 presents a summary of the results of that study. According to Hodgson *et al.* (1992),"The Landfill Gas Testing Program of the State of California has demonstrated that landfills typically contain toxic VOC regardless of the type of waste they are designated to accept and that off-site migration of landfill gas is a fairly common occurrence."

Table 2.2: Concentrations of Methane and Ten Toxic VOC in Landfill Gas Compared with Concentrations of Methane in Soil Gas at the Perimeter of the Landfill and with Concentrations of VOC in Soil Gas near the House

Compound	Conc. range landfill gas[a] (ppbv)	Conc. range soil gas (ppbv)	Max. soil gas/max. landfill gas
Methane	180,00-	2-1000ppmv	0.002
Dichloromethane	500,000ppmv	(Perimeter)	0.004
1,1,1-	2,500-51,000	<0.1-2000	0.001
Trichioroethane	<10-13,000	1.4-11	0.008
Tetrachloroethyle	620-18,000	23-150	----
ne	<500-19,000	NM[b]	----
Vinyl chloride	<20-850	NM	----
1,2-	<1	NM	----
Dichloroethane	<2-980	NM	----
1,2-	<5	NM	----
Dibromoethane	1,600-8,300	NM	----
Trichloromethane	890-4,500	NM	
Tetrachlorometha			
ne			
Trichloroethylene			
Benzene			

a Landfill gas and perimeter soil gas concentrations are from Lee, (1994).
b Either not measured or not present above limit of detection of ~0.1 ppbv at study site.

Source: Hodgson, A. *et al*, 1992

Lee and Jones-Lee (1993a) discussed the fact that measured, known hazardous chemicals represent a small part of the total gaseous emissions of potentially hazardous chemicals from landfills. There are certainly hazardous chemicals in landfill gas emissions that have not been identified or characterized with respect to their potential public health and environmental significance to plants and animals. They concluded that landfill odours should be used as a tracer of potential public health harm associated with both known and unknown gaseous emissions from municipal landfills. If landfill odours are detected on adjacent properties, there is the potential for significant public health harm associated with odorous and non-odorous chemicals in landfill gaseous emissions.

The public health implications of landfill odours go beyond their being a "nuisance" and their being used as tracers for potentially hazardous chemicals. It is well-recognized in the public health literature that malodorous conditions are detrimental to public health. In his "Critical Review: The Health Significance of Environmental Odour Pollution." Shusterman (1992) summarized the findings of a conference organized by the California Department of Health Services devoted to "The Health Effects of Environmental Odour Pollution," He summarized as follows; Environmental odour pollution problems generate a significant fraction of the publicly initiated complaints received by air pollution control districts. Such complaints can trigger a variety of enforcement activities under existing state and local statutes. However, because of the frequently transient timing of exposures, odor sources often elude successful abatement. Furthermore, because of the predominantly subjective nature of associated health complaints, air pollution control authorities may predicate their enforcement activities upon a judgment of the public health impact of the odor source. Noxious environmental odors may trigger symptoms by a variety of physiologic mechanisms, including exacerbation of underlying medical conditions, innate odor aversions, aversive conditioning phenomena, stress-induced illness, and possible phenomenal reactions. Whereas relatively consistent patterns of subjective symptoms have been reported among individuals who live near environmental odour sources, documentation of objective correlates to such symptoms would require as-yet unproven research tools. Therefore, given our current state of knowledge, any differential regulatory response to environmental odor pollution, which is based upon the distinction between community 'annoyance reactions' and 'health effects,' is a matter of legal - not scientific - interpretation."

In his discussion of the impacts of odours on public health, Shusterman (1992) reported that symptoms include headache, nausea, throat irritation, and sleep disturbance. He also reported that odors can exacerbate pre-existing medical conditions. One of the pre-existing medical conditions that may confer hypersusceptibility to odors is bronchial asthma; odorous conditions are known to trigger asthma attacks. They are also known to augment sensitivity to "morning sickness" or nausea during pregnancy.

Some effects of odours have been studied and are well known. odours may affect well-being by eliciting unpleasant sensations, by triggering possibly harmful reflexes and other physiologic reactions, and by modifying olfactory function. Unfavourable responses include nausea, vomiting, and headache; induction of shallow breathing and coughing; upsetting of sleep, stomach, and appetite; irritation of eyes, nose, and throat, destruction of the sense of well-being and of enjoyment of food, home, and external environment, disturbance; annoyance; and depression. Exposure to some odorous substances may also lead to a decrease in heart rate, constriction of blood vessels of the skin and muscles, release of epinephrine, and even alterations in the size and condition of cells in the olfactory bulbs of the brain. Furthermore, Irrespective of the physiologic mechanism of action, persons who live in malodorous environments report adverse somatic symptoms, such as 'odour-induced' nausea and headache."

In a discussion of the control of odours, including hazardous and toxic odours, Hesketh and Cross (1989) summarized the literature on the impacts of odours on communities. They stated, "In communities close to odorous sources, there may not be excess disease or infirmity, but there certainly is not a state of complete mental, social or physical well-being. This follows from the recognition that prolonged exposure to foul odours usually generates undesirable reactions in people, which can vary from unease, discomfort, depression, headaches, irritation, anger, nausea, vomiting." While it is difficult to identify landfill gas releases as a direct cause of cancer or other diseases, there is no doubt that the highly odorous conditions on properties near MSW landfills are strongly detrimental to public health. Therefore, sufficient controls should be provided so that malodorous conditions do not exist on properties adjacent to or near landfills. Until such time as MSW and other landfills are designed and operated so as to reliably and consistently prevent off-site migration of odors associated with garbage dumping and landfill gas releases, it will be necessary to incorporate sufficient landfill-owned land buffers about landfills for the dissipation (dilution) of odors and thus the avoidance of the public health impacts associated with them.

Another significant concern about landfill gas emissions from municipal and many industrial landfills is their contribution to greenhouse gases (principally methane).

As part of the US EPA's landfill gas emissions program, Thornebe (1991) reviewed air emissions from MSW landfills for background information for proposed standards and guidelines. Subsequently she reviewed the issues of landfill gas (methane) and its role in global climate change (Thornebe, 1994). She pointed out that landfills are considered to be a major source of the greenhouse gas, methane, and noted the need to control landfill gas emissions to reduce the methane input to the atmosphere.

Landfills are typically closed today by the construction of what is characterized as a "low-permeability" cover consisting of a clay layer approximately one foot thick over the top of the solid waste. It has been recognized for many years that a landfill cover of that type will not be an effective barrier to the entrance of moisture into a landfill or to the escape of gases from the landfill. As discussed by Lee and Jones-Lee (1993c), clay and other types of covers for landfills quickly deteriorate from their design permeability characteristics to allow large amounts of water to infiltrate the landfill and gas to escape from the landfill through the cover. Desiccation cracks, differential settling of the wastes that leads to cracks, failure to maintain seals around gas vents and leachate removal pipes that protrude through the cover, plant roots and burrowing animal activities, etc. all serve as significant conduits for passage of water and gas through the cover. As discussed above, increased moisture entering landfills stimulates gas production and leads to even greater adverse impacts from the gaseous releases from the landfill. With the trend toward large, regional mega-landfills, the adverse impacts of landfill gas, including odors and hazardous chemicals, can be greater and more pervasive than those of smaller landfills because of the greater surface area through which gas is emitted.

While it is not possible to quantify the adverse impacts of landfill gases on owners and users of nearby properties, there is no doubt that these impacts are highly significant and contribute to the justified opposition to siting of landfills by those who own or use properties near them. Even with so-called state-of-the-art gas collection systems, there still will be periods during the active life of the landfill associated with the dumping of the garbage when highly offensive odors can migrate for distances of a mile or more downwind of the landfill.

Landfill Leachate

Sanitary landfills are notorious for causing adverse impacts on domestic water supply groundwater quality. It has been well-known since the 1950's that sanitary landfills and municipal dumps have had significant adverse effects on groundwater quality (Todd and McNulty, 1976,; Amusa, 1993; Belllo, 1998; Shafa, 1987). Further, it is also recognized that contamination by municipal solid waste landfill leachate renders groundwater unusable for domestic water supply purposes. By the 1970's it was becoming widely recognized that MSW landfill leachate contained a variety of potentially highly hazardous chemicals that represent a significant public health threat to those who consume waters contaminated by leachate. Further, significant quantities of highly hazardous chemicals are legally disposed of today through the municipal solid waste stream from household, commercial, and industrial activities so that even today's landfills contain VOC's, heavy metals, and other chemicals that are potentially highly hazardous to public health.

Brown and Nelson (1990) discussed toxic constituents in MSW landfill leachates and pointed out that many of the products used in the home and commerce are potentially highly hazardous to public health and the environment. They also presented typical concentration ranges of potentially hazardous organic chemicals and metals in such leachate. For those contaminants having drinking water standards, they compared the median concentrations to those standards. They found that a wide variety of constituents in MSW leachate have concentrations were above existing drinking water standards. Brown and Donnelly (1988) estimated the risk associated with organic constituents in "hazardous waste" landfill leachate and municipal solid waste landfill leachate. They concluded that MSW landfill leachates were only slightly less hazardous than the leachates from "hazardous waste" landfills.

More recently, Jones-Lee and Lee (1993) summarized the characteristics of municipal landfill leachate and discussed their implications for municipal solid waste management for the protection of groundwater quality. Table 2.3 presents a summary of the types of constituents of concern in municipal landfill leachate that can be hazardous or otherwise deleterious to the quality of groundwater used for domestic water supply purposes. These include "conventional pollutants," "priority pollutants" (certain "hazardous" chemicals), and "non-conventional pollutants." Table 2.4 identifies and presents concentrations ranges and "average" concentrations for some of the hazardous and "conventional" pollutants characteristic of conventional municipal solid waste leachate of the early to mid-1980's. It indicates the presence of many known chemicals in concentrations that can readily render a groundwater unusable for domestic water supply purposes.

Included in the "conventional pollutant" classification are high concentrations of biochemical oxygen demand (BOD), total dissolved solids (TDS), NaCl, hardness, H_2S (hydrogen sulfide), ammonia, iron, manganese, etc. The biochemical oxygen demand of municipal landfill leachate on the order of 10,000 mg/L of BOD_5 means that municipal landfill leachate has a tremendous potential to remove the dissolved oxygen from ground waters, converting them to anoxic/anaerobic conditions. Typical ground waters have about 10 mg/L dissolved oxygen; there is little opportunity to resupply the oxygen since it has to come largely from infiltration of precipitation and air migration through the soil. The rendering of a groundwater anoxic/anaerobic can have significant implications for the transport and transformation of constituents in MSW landfill leachate or that may be in the groundwater from other sources as a result of chemical/biochemical reactions that lead to the formation/solubilization of contaminants that are ordinarily not present in oxygenated groundwaters. These include iron, manganese, hydrogen sulfide, various heavy metals, and vinyl chloride. The vinyl chloride that is typically present in MSW landfill leachate arises from anaerobic bacterial dehalogenation of chlorinated solvents such as TCE and PCE.

Table 2.3: Leachate from Municipal Solid Wastes "Garbage Juice"- Highly Concentrated SOUPII of Chemicals -

Conventional Pollutants

Oxygen Demand - TOC, COD

Odorous Chemicals)

TDS
Sodium
Ammonia
Hardness

Iron
Manganese
H2S
Alkalinity

Priority Pollutants

Heavy Metals - Pb, Cd, Hg, Cu, etc

Organics - Solvents, Vinyl Chloride, etc.

Non-Conventional Pollutants

95% of Organics in Leachate

Not Characterized

Hazards Unknown

Transformations Unknown

Source: Lee and Jones-Lee, 1993

Table 2.4: Concentration Ranges for Components of Municipal Landfill Leachate

Parameter	"Typical" Concentration Range	"Average"*
BOD	1,000 - 30,000	10,500
COD	1,000 - 50,000	15,000
TOC	700 - 10,000	3,500
Total volatile acids (as acetic acid)	70 - 28,000	NA
Tota Kjeldahl Nitrogen (as N)	10 - 500	500
Nitrate (as N)	0.1 - 10	4
Ammonia (as N)	100 - 400	300
Total Phosphate (PO_4)	0.5 - 50	30
Orthophospate (PO_4)	1.0 - 60	22
Total alkalinity (as $CaCO_3$)	500 - 10,000	3,600
Total hardness (as $CaCO_3$)	500 - 10,000	4,200
Total solids	3,000 - 50,000	16,000
Total dissolved solids	1,000 - 20,000	11,000
Specific conductance (mhos/cm)	2,000 - 8,000	6,700
pH	5 - 7.5	63
Calcium	100 - 3,000	1,000
Magnesium	30 - 500	700

Sodium	200 - 1,500	700
Chloride	100 - 2,000	980
Sulphate	10 - 1,000	380
Chromium (total)	0.05 - 1	0.9
Cadmium	0.001 - 0.1	0.05
Copper	0.02 - 1	0.5
Lead	0.1 - 1	0.5
Nickel	0.1 - 1	1.2
Iron	10 - 1,000	430
Zinc	0.5 - 30	21
Methane gas	60%	
Carbon dioxide	40%	

All values mg/L except as noted
NA - not available

Source: Lee *et al.* (1986) *From CH2M Hill based on 83 landfills

Jones-Lee and Lee (1993) also discussed the potential importance of what are called "non-conventional" contaminants or pollutants in municipal landfill leachate. MSW landfill leachate contains large amounts of organic carbon that includes a broad array of hazardous, otherwise deleterious, and non-hazardous chemicals that are not characterized for their potential hazards and are not identified or looked for in chemical analysis regimens. Only a few percent of the total organic carbon present in municipal landfill leachate is normally characterized in any groundwater pollution study. The potential hazards to public health and environmental quality associated with most of the organic chemicals contained in leachate are unknown.

Jones-Lee and Lee (1993) discussed the impossibility of eliminating hazardous and otherwise deleterious chemicals from the municipal solid waste stream. Even if all illegal dumping of hazardous waste in municipal landfills were stopped, household hazardous waste derived from products used in everyday activities would still represent a significant source of chemicals for landfill leachate that are potentially highly hazardous to public health. While some areas attempt to address this problem by instituting programs to collect household hazardous waste, such programs will not eliminate hazardous and otherwise deleterious chemicals from MSW landfills. Further, the landfill operators load checking programs which are purported to be designed to keep hazardous waste out of landfill are largely cosmetic and ineffective in preventing large amounts of hazardous chemicals from being present in municipal solid wastes that are deposited today in MSW landfills. Most of the organics present in MSW landfill leachate that are not identified or characterized yet could represent public health hazards to those who would drink leachate-contaminated groundwater. Furthermore, many of the conventional pollutants can be deleterious to the quality of groundwater for use for domestic water supply purposes and therefore, even without hazardous chemicals in leachate, the pollution of groundwater by such leachate would render the groundwater unusable for domestic purposes.

The municipal water supply literature repeatedly documents the importance of controlling the malodorous character of waters. One of the primary reasons the public uses such large amounts of bottled water today for drinking purposes is undesirable odours in municipal drinking waters. Californians are spending more than $1 billion annually for bottled water and special household water treatment devices because of undesirable tastes and odors in municipal supplies as well as concerns about chemical contaminants. Many of the adverse physiological and psychological responses discussed above in association with odorous conditions in landfill gaseous emissions are also applicable to malodorous conditions in drinking water contaminated by landfill leachate. Thus, the contamination of groundwater by landfill leachate is a threat to public health not only because of toxic chemicals that cause disease, but also because of obnoxious chemicals that cause adverse physiological and psychological responses.

WRCB Chapter 15 governing landfilling of municipal solid waste in the United States for example, requires protection of groundwater from all use-impairment including those that might be classified as a "nuisance. The Porter-Cologne Act (WRCB, 1989) defines nuisance as follows:

> *"Nuisancé" means anything which: (1) is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, and (2) affects at the same time an entire community or neighbourhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal, and (3) occurs during or as a result of the treatment or disposal of wastes.*

In addition to containing hazardous and otherwise deleterious chemicals, municipal solid waste streams have contained, and still contain, notable amounts of human and animal fecal material. Domestic wastewater treatment plant sludge and septic tank pumpage have been disposed of in MSW landfills. Approximately 2% of current MSW is disposable diapers, a portion of which contain fecal material. Further, manure from pets and other animals is deposited in MSW landfills. Human and animal fecal material contains bacteria, viruses, and protozoans which if ingested, can readily cause a variety of enteric diseases in people. There is little information on the long-term survival of human enteric pathogens in MSW landfills. The bacteria and enteroviruses would not be expected to persist in a landfill for long periods of time. However, cyst-forming protozoans could represent a long-term threat to the health of those who have contact with MSW and its leachate, and leachate-contaminated waters.

Another important aspect of the public health significance of human pathogens in MSW is the ability of disease vectors such as flies, seagulls, rodents, and other animals commonly present at a landfill, to carry the pathogens from the landfill. While such vectors should be highly effectively controlled at the open dumping face of a landfill, the control of vectors at MSW landfills is typically only partially effective. Therefore, those living or working on, or otherwise using lands within the transport distance of vectors, could acquire enteric disease from the landfill. In general, it is likely that such disease would occur as isolated cases and not necessarily traced to the landfill source because of the vector mode of transport.

Fugitive Dust Emissions

Blowing dust can be a problem for property owners/users near landfills, especially at those landfills having heavily used dirt roads. Dust and other particulate emissions to the atmosphere, such as those from diesel trucks, are of concern to those who own or use properties downwind of dust-generating areas, not only for aesthetic and economic reasons but also for reasons of public health. It is becoming commonly recognized that

PM_{10} particles (particulate matter less than 10 microns in diameter) in dust are a significant health hazard, especially for sensitive populations such as those who suffer from asthma. Active-life operations and post-closure conditions of landfills should not be allowed to create additional atmospheric particulates (dust) on properties adjacent to or near a landfill.

In the past regulatory agencies have allowed landfill owners to spread landfill leachate on roadways to suppress dust. This practice can readily lead to significant surface water pollution by a wide variety of chemical contaminants and pathogenic organisms in the leachate when precipitation events lead to runoff from the areas that have received the leachate. In some areas, the use of leachate for dust control is no longer allowed because of the potential for environmental pollution by contaminants in the leachate. A landfill owner/operator should have responsibility to maintain an appropriate vegetative cover on a closed landfill ad infinitum as part of their responsibility to prevent migration of airborne particulates downwind of the landfill property.

2.2.2 Impact of Landfills on Property Values

This section provides an extensive review of literature on the growing environmental impact literature. But specifically, it summarizes a number of recent studies that specifically address the impact of various types of landfills on homeowners attitudes and housing values. There is a significant amount of empirical literature dealing with the impact on housing value of a variety of environmental issues such as air, noise, and water pollution (Harrison and MacDonald, 1974; Harrison and Rubenfeld, 1979; McMillan *et al*, 1980). At the theoretical level Freeman (1979) surveys the issues relating to hedonic price models used to estimate the impact of environmental factors on housing prices.

Previous research indicates that the presence of a waste site or the designation of a property as a Superfund site can significantly reduce the market values of residential and commercial properties on and surrounding the site (Hartfield,1989; Ketkar,1992; Kohlhase,1992; Macauley et al, 1994; McCluskey, 1988; Mendelsohn, 1992; Michaels and Smith, 1990; McClelland et al, 1990; Nelson et al, 1992; Reichert et al, 1996; Smollen *et al*, 1992; Baker,1988; Deyark, 1975; Diamond, 1980; McLeod, 1980). This diminution of value results when individuals perceive a decrease in the value of the benefits associated with the property, or an increase in the cost of maintaining and owning a property. Sometimes these perceptions result from the physical characteristics and actual health risks of a hazardous waste site, sometimes from inaccurate information about the health risks and cleanup costs, and sometimes from expectations regarding how others will value houses in the neighborhood. Because the observed value of a property is reflected in only one price, it is usually impossible to separate out the specific impact of each of these factors. Nevertheless, it is reasonable to expect that if the site is remediated, property values will recover.

However, researchers have hypothesized that some properties may never fully recover their baseline market values, because they have become "stigmatized" (Wernstedt and Hersh, 1997; Wernstedt *et al*, 1997; Wernstedt and Probst, 1997; Thayer and Rahmaitan; 1992; Smollen *et al*, 1992). In this context, stigma is defined as the loss in property value resulting from a property's bad reputation from being or having once been defective, beyond the cleanup cost or beyond the value of health and environmental harm caused by the pollution. "It is the discount that buyers demand in relation to properties with no history of problems." (Arens 1997) Stigma is an adverse public perception that is often intangible or not quantifiable. Because of stigma, property values may become or remain discounted, even after the real health risks and physical disamenities are removed.

Two possible causes of this stigma are uncertainty and inertia (also referred to as "path dependence" or hysteresis). Inertia reflects a hypothesized uncertainty regarding permanent change in how people perceive a neighborhood and how much they are willing to pay for property in the neighborhood. An extreme example of this is a situation in which a waste site reduces property values to the point where they become affordable to lower-income families and less attractive to higher-income families. This occurrence would lead to a permanent shift in the social structure and house prices of the neighborhood. Although there may be some recovery, a new market price equilibrium would occur at a lower value. Thus, a temporary environmental problem may permanently change the character of the neighborhood.

The uncertainty that contributes to stigma comes from three sources: uncertainty about potential remaining health risks after cleanup, uncertainty regarding the need to do additional remediation work in the future and who will be required to pay for it, and uncertainty regarding how others might perceive the property. The later reflects the expectations of a buyer or seller who thinks the property is clean, but thinks that others in the real estate market may not believe it is. This expectation may become a self-fulfilling prophecy, leading to lower market prices.

Perceptions about uncertainty may be influenced by site management practices employed by responsible parties and public officials, the level of community involvement, and the amount and type of publicity surrounding a site. Uncertainty and negative expectations can be aggravated, if the public or the media lack confidence in the information they receive from site investigators, site managers, responsible parties, and public officials. Review of a number of empirical studies indicates that the negative impact of landfill sites on property values generally ranges from two to eight percent. In some extreme circumstances (e.g., Love Canal), greater property value decrements have been observed, but this situation is rare. Generally, the diminution of value is negatively related to distance; that is, the distance effect on property value decreases as one moves farther away from the site, and becomes negligible at some distance, usually about 4-7 miles from the site. The factors that contribute to these decrements in values vary from one site to another, and can be significantly affected by emotion and by how the story is reported in the media. The following are examples of some key factors that negatively impact value at various sites: perceived health risk, unattractiveness, odour, air pollution, activity and noise (e.g., trucks), threats to drinking water supplies, and potential unknown impacts on future land uses.

The literature provides little empirical evidence of the role of stigma in limiting price recovery. Sometimes, property values partially or fully recover immediately after cleanup, sometimes there is a delay, and sometimes they do not completely recover. It is expected that house price recovery would take some time after completion of site remediation. Since no general temporal pattern of price recovery has been identified, it is difficult to make observations or judgments about the extent of stigma too soon after cleanup is completed. Markets generally take time to adjust to new information, such as the nature and extent of the cleanup. In addition, time patterns are quite variable from one site to another.

McCluskey (1998) hypothesized that a permanent stigma is usually related to a change in the demographic composition of the neighbourhood. For example, during site discovery, investigation and remediation, high-income people move out and are replaced by low-income people. After it is announced that the site has been cleaned up, the high-income people do not return, and the price of properties does not rebound. The hypothesis about the property value rebound being retarded by "inertia" is founded on the appraisal work surrounding "tipping" of residential property values. Using data from one site in Dallas, Texas, McCluskey (1998) estimated that stigma existed for properties within a mile of the site, but not for properties farther away. It is unlikely, however, that economic recomposition plays a major role at most Superfund sites. Few Superfund sites are in high-income neighbourhoods, and low-income neighbourhoods are not amenable to the type of economic recomposition McCluskey defines. In addition, the price effect that results from hazardous waste sites (2% to 8% of house value) is not enough incentive to cause many people in a neighborhood to move, nor to make it more affordable for low-income people.

To shed some light on the role of stigma in retarding or limiting property value recovery, the following sections summarize the findings of several studies and lessons learned from site case histories. In the area of disposal the famous Love Canal environmental disaster and the publicity surrounding the EPA's Superfund have focused a significant amount of attention upon the impact of hazardous wastes sites on property values. For example, Adler et al. (1982) examined the impact of hazardous waste sites on property values in two cities: Pleasant Plains, New York and Andover, Minnesota. The study provided limited support for a negative landfill effect in Pleasant Plains. In another study by Schulze *et al.* (1986), housing markets near three California cities were examined for potential hazardous landfill effects. In only one region did houses within 1000 feet of the site report significant results.

Evidence of some possibility of longer-lasting stigma includes: A 1998 study of a hazardous waste site in Dallas, Texas, showed that although property values showed signs of recovery, it was not 100% for houses within one mile of the site. However, these results must be considered in view of several potentially confounding factors at this site which make the results difficult to interpret (McCluskey 1998):

-- The site includes substantial off-site soil contamination due to air dispersal and the use of slag from the lead smelter as fill around homes.

-- The site was a state site during most of the period of the study.

-- The observation that no rebound resulting from the state-company sponsored cleanup is confounded by the fact that the site was listed on the NPL, and received much publicity during the last time period under study.

-- It is probable that recoveries are not instantaneous, and that rates of recovery differ from one site to another.

-- Public confidence in the environmental authorities is crucial to people's perception of uncertainty of health risk.

A 1996 study indicates that an announcement of cleanup plans did not result in a rebound (Roddewig, 1996). However, the study period does not extend far enough after cleanup to allow the market time to incorporate new information. Properties near a number of landfill sites have been re-zoned from residential to a lower land use, which may imply a permanently lower land value. Examples include Love Canal and the Abtex site in Portsmouth, Virginia. These strategies were due to the selection of containment strategies with lower cleanup goals than those needed for residential use. Although the final values of these properties are lower than their original residential use values, they are greater than the values during remediation. Considering the enormous publicity and political attention surrounding Love Canal, it is surprising that property values of houses adjacent to the site are only 10-15% below the values of comparable houses in the area.

Real estate appraisal and financing literature increasingly addresses how to deal with hazardous waste sites, so that it is no longer a completely uncertain threat. As the market has gained experience with environmentally impaired transactions, some of the panic has worn off and these properties have slowly begun to sell once again (Patchin 1994). A growing portion of the real estate development, finance, insurance, and appraisal industries are developing a knowledge base and other tools for mitigating the effects of stigma associated with hazardous waste sites. In the early 1980s, many investors would automatically reject any involvement with a contaminated property or with a nearby property. Today, the industry has established the expertise to evaluate the risks and costs of impaired properties, so as to adjust their market prices to economically viable levels.

To some extent, stigma can be mitigated by effective site management that includes elements of trust, open communications and joint efforts with stakeholders, careful attention to media relations, and efforts to accelerate the pace of site investigation and remediation.

2.3 Research Hypotheses

The hypotheses that were tested in this study are as follow:

1. There are significant variations in perceived impacts among residents by location and by distance from the landfill sites.
2. Residential property rental values are negatively impacted by proximity to the landfills, that is, rental values in the study area is a function of distance to the landfills.
3. Perception of neighbourhood quality by residents is significantly influenced by their socio-economic characteristics, length of stay in the area, distance from landfill and neighbourhood characteristics
4. Anticipated economic benefits and perceived risks are strongly associated with response to waste facility siting.
5. There is a significant relationship between distance from landfill and willingness to pay for improved environmental quality.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter discusses the research methodology. The methodology involves the data collection procedure and method of data analysis.

3.1. Data Types and Sources

Both secondary and primary data were utilized for this study. The secondary data included data on landfills from LAWMA and valuation data from Lagos State Valuation Office (LSVO). Data collected from LAWMA include information on the locational characteristics of the sites such as the geographic and topographic data. The information on these was collected with the use of two semi-structured questionnaire (one for each of the two landfills) given to LAWMA landfill manager. The topographical and geographical data include size, shape, depth, width and frontage, topography, drainage and runoff characteristics of the sites, nature/type of subsurface soils and subsoil and bedrock characteristics. The second part of the questionnaire elicited information on the management of the landfill sites. Specifically, questions were asked on the capacity of the landfill, age of the landfill, type and number of facilities available, volume of wastes received daily by the landfill and number of staff at each of the landfill sites. These information were used to discuss the locational characteristics and management of the landfill site. The management of landfill sites is particularly important since perceptions about risk may be influenced by site management practices employed by responsible parties and public officials (Jones and Lee, 1993a and b). The questionnaire is shown in appendix II.

Primary data however constituted the bulk of data used for this study. A structured questionnaire was the main instrument used in the collection of the primary data (Appendix1). The questionnaire covered various aspects of the socio-economic characteristics of individuals and their perception of the impacts of the landfills. The questions were, as practicable as possible, precoded mostly in Likert scale format. The choice of location for the interview was based on proximity to the landfills (section 3.2). In other words, only those locations near enough to be likely impacted were included in the study.

The questionnaire was divided into four parts. The first part consists of socio-economic variables. Also, some of the variables of structural, spatial location and neighbourhood of respondent's housing units were also contained in the first part of the questionnaire. Demographic characteristics are associated with people's perceptions of neighbourhood quality and impact of facilities (Campbell *et al* 1976; McClelland *et al*, 1990). Consequently, respondents were asked to categorize their age, sex, educational achievement, status as homeowner or renter, income, and length of residence in the neighbourhood. Educational achievement was particularly important as a surrogate for income, or socio-economic status (Greenberg *et al.* 1992). These demographic characteristics were used as independent variables in some of the statistical analyses (see section 3.2)

The second part elicited information on the awareness of environmental problems caused by landfills, source of information about these problems and the linkage between these problems and the landfills, among others. The third part of the questionnaire addressed the perception of the health and socio-economic impacts of the landfills. The last part of the questionnaire addressed the impact of landfills on house values. As seen in section 2.1.2, three attributes – the structural, locational and neighbourhood, basically affect house values. Therefore, information was elicited on these three attributes. The questionnaire is as shown in appendix I

3.2 Sample Design

The questionnaires were administered on a household basis in the study area. The households interviewed are those who reside within three kilometer radius of each of the landfills. The first stage in the selection of sampled households was the identification of the total number of residential properties that are located within three kilometer radius of the landfill sites. It has been established in the literature that the impact of facilities of this nature are usually confined to between one and five kilometers from where the impact becomes insignificant or unnoticeable e.g. noise and odour (Arimah, 1995; Arimah and Adinnu, 1990, Olokesusi, 1990; Elliott, 1993) The two landfills used for this study (Olushosun and Abule-Egba landfills) are spread within three kilometers radius, in five Local Government Areas of Lagos State as follows:

Olushosun landfill site - Ikeja and Kosofe LGAs;

Abule-Egba landfill site - Alimosho, Agege and Ifako-Ijaiye LGAs

Based on this, property valuation data were collected on these five Local Government Areas from the Lagos State Valuation office. All the Local Government Areas in Lagos state are divided into valuation zones for property assessment. Figure 3.1 is the map of Lagos metropolis showing the five local government areas covered in the study. The valuation data for these five LGAs are presented in Table 3.1.

Table 3.1: Zonal Delimitation of Sampled Local Government Areas

Ikeja Local Govt	Valuation Zones	Areas	Number of Property
	1	Adeniyi Jones, Aromire Av., Obafemi Awolowo Way, Ojora Av. E.t.c.	1207
	2	Aba Johnson Crescent, Abimbola Lane, Adeniyi Jones (Part) Kudeti Str. Talabi Str etc.	409
	3	Acme Crescent , Fagba Cre, New Isheri Rd, Vori Close e.t.c	72
	4a	Abiodun Sobajo Str, Bale Str, Isheri Rd, Obafemi Awolowo way, New Iseri Rd e.t.c.	322
	4b	Ado-odo Str. Belo Str. Babaponmile Str, Mobalaji Bank Anthony way, Valley view Cl, Concord way e.t.c	737
	5	Acme Rd, Akilo Rd, Cocoa Rd, Metal Box Rd, Alh Damson Str, e.t.c	40
	6	Adekunle Fajuyi Cre, Adeniyi Jones Av., Israel Adebajo Cl, Olutoye Cre, e.t.c	99
	7	Ayodele Diyan Str, Akinola Cole Cl, Ladipo Oluwole Str. E.t.c	156
	8	Oba Akran Rd, Adeniyi Jones Av, Ayodele Diyan Str., e.t.c	39

	9	Abeokuta Str, Afisman Drive, Henry Carr, Osifila Str, Obasa Rd, e.t.c	421
	10	Airport Rd, Akerele Str, Araromi Str, Herbert Macaulay Str, Ikorodu Rd, GRA, e.t.c	1196
	11	Aderibigbe Shita Str, Airport Rd, Anishere Sye, Omole Str, Shony highway Bank Anthony, e.t.c	1406
	12	Akintoye Shogunle Sr, Mobolaji Bank Anthony way, Olowu Str, Balogun Str, Unity Rd, e.t.c	1038
	13	Bashiru Oweh, Str., Harold Sodipo Cre, Ipodo Rd, Medical Rd, Police College Ikeja e.t.c	771
	14	Akin Osiyemi Str, Allen Av. Community Rd, Shomoye Tejuosho Str. E.t.c	1582
	15	Ajanaku Str, Folusho Alade Str, Idowu Lane, Opebi Rd. E.t.c	879
	19	Abiodun Jagun Str, Isheri Rd, WEMPO Rd, Ogba Retail market	1619
	20	Adedoyin Str, Isheri Rd, Shonola Str, L.S.D.P.C Phase I, II e.t.c	355
	21	Ajayi rd, Abeokuta Str, Yaya Abatan Str, Abo Aba Rd., e.t.c	1078
	22	Abiodun Soneye Cl, Agidingbi Str, New Isheri Rd., Omole Compound, Golor Str.	994
Ifako-Ijaiye	A Ifako Ogba	Ifako Road, Ijaiye Ogba, College Road, Aina Ajobo Street, Bolode-Oku close, Iju Road	3,834
	B Iju Ifako	Old Akute Road, Balogun Road, Jungle Ndike Street, Gagba Street, Ishaga B/Stop, Ajuwon Road Agbado Road	6,166
	C New Oko-Oba	Agbe Street, Santos Road, Abule-Egba, Shola Martins Road Charity,Olayiwola Road Temple Road	6,196
	D Ojokoro	Abeokuta Exp. Road, AMJE Avenue, Alakuko Area, Unity road Jankara	4,272

		Alagbado Road, Clem Road Yusuf Drive	
Alimosho LGA	1. Oke-Odo Area Office	Aboru, Abule Taylor, Oke-Odo Ajasa, Meiran, Abule Oki, Ilo.	5042
	2. Ipaja Area Office	Ayobo, Ipaja. Abesa, Ikola Awetoro, Command, Bada, Olorunsola, Candos, Mosan	4,300
	3. Ikotun Area Office	Ikotun, Egbe, Agodo, Abaraye, Idimu, Sasa, Santos Layout, Okerube, Ijagemo, Ijegun Orisumbane, LASU Iba Road	8,500
Kosofe LGA	Zone 2	Oworosoki, Ifako, Medina Estate, Soluyi	7,732
	Zone 3	Anthony Village, Mende, Gbagada Industrial Estate, Atunrase Estate	3,150
	Zone 4	Ojota, Ketu, Alagare, Ikozimele 12, Owode Onirm, Ajagunle, Magodo, Sangisa, Olowora, Omole Phase II, Isheri, Ogudu, Agiliti	14,952
Agege LGA	Zone 2	Keke area, Oyewole	3,258
	Zone 3	Oniwaya, Papa Asafa	4,027
	Zone 4	Dopemu road, Ajakaye street, Agege by pass	2,009

Source: Lagos State Valuation Office, Ikeja.

It should be noted that the valuation zones of each local government area are independent of each other. Based on the data above and using the street maps of Lagos, specific areas within the 3 kilometres radius of the landfills were then identified in each of these LGAs. The large number of properties made it difficult to cover all because of limited fund and time. Also, the sample size is based on the statistical belief that where a small sample is selected randomly from a large population, the result will always give a true representation of the area. Also, previous researchers (Aluko, 1996; Arimah and

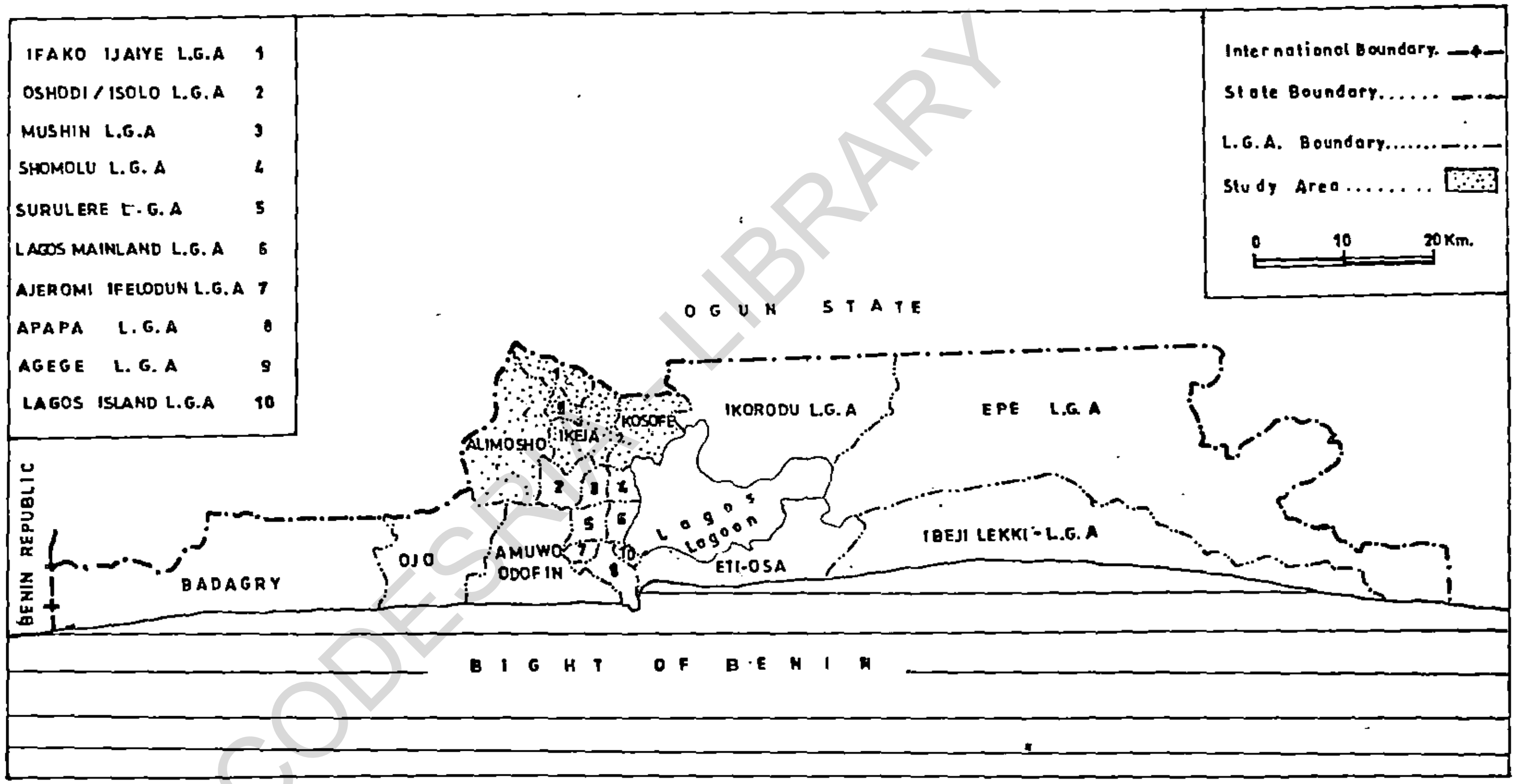

Fig. 3.1 : Map of Lagos State showing Study area.

Adinnu, 1995) utilized 1% in their studies. Less than 1% was utilized by Olokesusi, (1994) and Havlicek, (1985). Therefore, only 3% of the total number of houses identified within the 3 kilometers radius around the landfills were sampled. This is shown in Table 3.2. The selection of the houses covered by the questionnaire was done by both the random and systematic sampling methods in the different areas.

Two separate maps were used as base maps for the sampling. The first map covers the whole area of the metropolitan Lagos. The second map shows the street names of the different areas of the metropolis with the different zones covered by the valuation. The next step was to choose specific number of properties to be sampled along the streets from each zone and this was done by dividing the number of properties in each zone by the number of streets. The selection of the houses from each of the streets chosen then followed. A systematic random sampling was adopted where the random numbers was used by first picking a specific house and then choose the subsequent ones at uniform interval (this interval varies from one zone to the other, depending on the number of property in the zone. In some we had two houses interval and in some we had up to four houses interval). Where a chosen building is not a residential building, the next residential building was chosen. The housing units covered were purely private residential building both owner-occupied and rented. This procedure resulted in the selection of a total of nine hundred and thirty out of the total thirty four thousand and twenty one houses identified within a radius of three kilometers away from the two landfill sites. The summary of this is presented in Table 3.2a and b below.

Table 3.2a: Selection of Sample Size

S/N	LANDFILL	VALUATION ZONE	NUMBER OF PROPERTIES	NUMBER OF PROPERTY SAMPLED
1	Olushosun	Ikeja LGA Zones 5, 14, 15, 21,22	4573	138
2	Olushosun	Kosofe LGA Zone 4	14,952	*350
3	Abule-Egba	Ifako-Ijaiye LGA Zone 3	6196	186
4	Abule-Egba	Alimosho LGA Zone 1	5042	158
5	Abule-Egba	Agege, LGA Zone 2	3258	98
		Total	**34021**	**930**

*The number was reduced from 449 because of many areas that are in this zone which are not close to the landfill at all.

Source: Author's computation.

The distribution of the questionnaire among the different valuation zones in the two locations is shown in table 3.2b. The areas within demarcated kilometer radius (1kilometer and below, 1.1 to 2 kilometer and 2.1 to 3 kilometer) were designated zones1, 2 and 3 respectively.

Table 3.2b: Sampling Distribution among the three Zones in the two study locations

	Olushosun		**Abule Egba**	
	Number	**Percent**	**Number**	**Percent**
1 km and below	158	32.4	180	40.7
1.1-2 km	170	34.8	129	29.2
2.1 – 3 km	160	32.8	133	30.1
Total	**488**	**100.0**	**442**	**100.0**

Source: Author's computation.

3.3 Data Analysis

Data analysis involved the use of appropriate qualitative (descriptive) and quantitative (inferential) statistical techniques as well as Geographical Information systems (GIS) tools. Qualitative analysis helped to capture and understand the point of view and respondents assessment of the impact of landfills on them and the environment across the various locations. The methodology and procedures of qualitative data analysis followed Miles and Hubermann's Qualitative Data Analysis (1996), Dawson *et al* (1993) and Bodgan (1984). Denzin and Lincoln (1994) edited a Handbook of Qualitative research which synthesizes the existing literature and methodology of collecting and analyzing qualitative data, and the art of interpretation, evaluation and presentation of qualitative data. All these literature did not only provide useful input into data analysis but also data collection procedure.

The statistical analysis of data involved basic descriptive univariate statistics (frequency counts, percentages, means, and standard deviation), reliability tests (Alpha) and relevant multivariate and regression techniques. The analysis however relied more on the use of frequency counts, simple percentages and cross tabulations to explain most of the issues involved in the analysis. Multiple regression analysis has been recommended as adequate tools for impact assessment studies (Mohr, 1992). In particular, they help in assessing the extent of relationship between one dependent variable and a number of other independent (or control) variables, and in estimating the extent of change produced in the dependent variable by an independent variable, holding other relevant variables constant (Frankfort-Nachmias and Nachmias, 1996). Multiple regression analysis was used in testing nearly all the hypotheses stated for this work except hypothesis one.

The first hypothesis states that there are variations in impact with respect to location and distance from the landfill site. This hypothesis was tested using a combination of both qualitative and quantitative statistical techniques. The qualitative statistics involved the use of frequency counts and percentages to show how the variation in the gradient of perceived impacts among respondents in the each of the three delimited zones around the landfill sites. Furthermore, t-test was used to test for differences in impacts between the two locations and one-way analysis of variance to test for variation in impacts across zones around each of the two landfills. The impacts were categorized into health, physical and socio-economic.

The second hypothesis states that there is no significant relationship between residential property values and distance to landfill sites. The impact of landfills on property values is examined within the hedonic pricing framework as discussed in section 2.1.3. Measure of residential property value is the monthly housing rent. For renters, this measure has been shown to give an observable and unambiguous measure of housing value (Arimah, 1992). This hypothesis was tested using the hedonic regression. The hedonic regression is of the double-log form. The choice of functional form is based on several considerations: explanatory power, stability and significance of implied relationship; and reduction in the occurrence of heteroscedasticity. The double-log is therefore preferable because it allows for declining marginal prices and interdependencies among housing attributes.

The third hypothesis which states that perception of neighbourhood quality by residents is significantly explained by respondents' socio-economic characteristics, length of stay in the area, distance from landfill and neighbourhood characteristics was tested using multiple linear regression analysis. In this model, neighbourhood quality rating was the dependent variable and socio-economic characteristics of respondents, length of stay in the area, distance from landfill and neighbourhood characteristics were the independent variables. Neighbourhood rating was posed in a likert scale format where 4 represents very good at one extreme and 1 represents very poor at the other extreme.

The fourth hypothesis, which states that anticipated economic benefits and perceived risks are strongly associated with response to waste facility siting, was tested using multiple correlation analysis. The variables correlated to examine the extent of their relationship with each other in the analysis were economic satisfaction with the project, perceived economic need of the area, anticipated economic benefits from landfill siting, perceived risk from the facility and response to project support.

The fifth hypothesis states that there is a significant relationship between distance to landfill and willingness to pay for improved environmental quality was tested using both correlation and regression analysis.

In operationalising the externality field concept (see section 1.4.1), maps were drawn to show the gradient of impact as distance increased away from the landfill sites.

The methods used in constructing these maps are discussed in the relevant sections of the thesis.

CHAPTER FOUR

THE STUDY AREA AND LOCATIONAL CHARACTERISTICS OF OLUSHOSUN AND ABULE EGBA LANDFILLS

4.1 The Study Area

4.1.1 Location of Lagos

Metropolitan Lagos developed from a narrow low-lying Island situated on latitude $6^0 27'$ North and longitude 3^0 28' East along the West African coast. The original settlement of the site on which Lagos grew was first inhabited by fishermen and farmers and was called Eko. This settlement was christened in 1492 as Lago de Kurao by the Portuguese who used it only as a harbour in their attempts at finding a route to the Far East (Folami, 1982).

Lagos comprises the former 70 square kilometres of the Federal Territory of Lagos which was composed of the geographically formed islands of Eko (Lagos Island), Ikoyi, Victoria Island, Iddo-otto, Ijora and Apapa. The central and most developed of this island chain is Lagos Island. It also incorporates the municipal settlements of Ebute-Metta, Yaba, Surulere, Tin-Can Island (Mekuwen) and the Eti-osa areas all of which cover 85.53 square kilometres. From this initial settlements, development has proceeded northward to the mainland up to about latitude 6^0 40' North.

4.1.2 Physical Characteristics

4.1.2.1 Relief and drainage

The patterns of relief and drainage in Lagos generally reflect the coastal location of the state. The coastal lowlands that dominate the state's landscape form part of a wider stretch of the coastal zone of southwestern Nigeria. The main features of these coastal lowlands include:

A the presence of a regular and almost straight sandy barrier beach behind the modern shoreline and;

B fringing Lagoons and a network of creeks that runs roughly parallel to the shoreline.

In addition, the four dominant landform types identified in the state, three relate to the coastal lowlands while the fourth relates to the coastal uplands. These landforms can be broadly classified as follows:

A the regular, almost straight "active" sandy barrier beaches behind the Atlantic shoreline. This poses an average altitude of 2-3 metres;

B the sandy barrier islands within the lagoons and creeks and lagoon marginal depressions;

C the low sandy plains, mash flats and mangrove swamps to the north of the lagoon-creek complex. The average altitude here ranges between 3m and 5 m; and

D the coastal uplands which are relatively higher in altitude and better drained than the foregoing landforms (Abegunde, 1986).

Figures 4.1 and 4.2 are the maps of Lagos showing relief and drainage characteristics respectively.

4.1.2.2 Climate

The location of Lagos in relation to the equator and the gulf of guinea is perhaps the most significant of all the factors influencing the general climatic pattern in the area (Ojo, 1999). For instance, a major effect of the locational characteristics of the state particularly with respect to the Atlantic Ocean is the fact that it is basically under the influence of the maritime tropical (MT) air mass with its associated rain bearing south-westerly winds. This MT airmass is separated from the continental tropical (CT) air with its associated north-easterly winds by the inter-tropical discontinuity (ITD) whose migration northwards or southwards is probably the most significant factor as regards variations in the climate of West Africa in general and Lagos State in particular.

In addition to the influence of the locational characteristics of the state as a major factor in determining the general climatic pattern, the day-to-day weather condition especially the Lagos metropolis are perhaps more directly influenced, at the micro- level by a number of local factors most of which derive from the process of urbanization. Such factors include changes in landuse pattern, the changing of the urban surface drainage as well as the effects of the ever-increasing pollution generating activities such as the emission of pollutants from motor vehicles and the rapidly increasing aviation industry. The state is characterized by a wet equatorial climate in which the rainy season lasts from March to November during which the state is directly under the influence of the MT

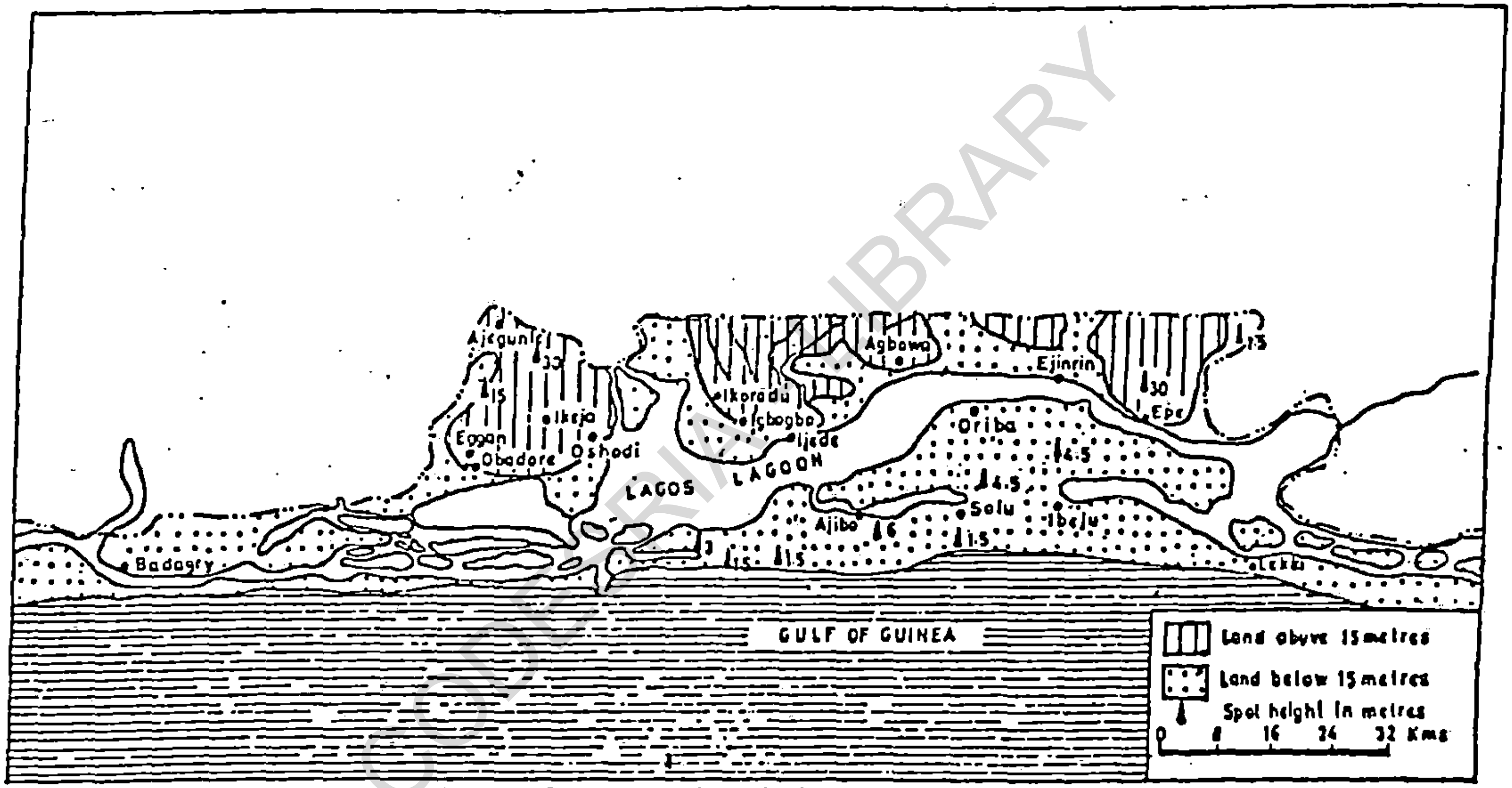

Fig.4.1 . Map of Lagos State showing Relief

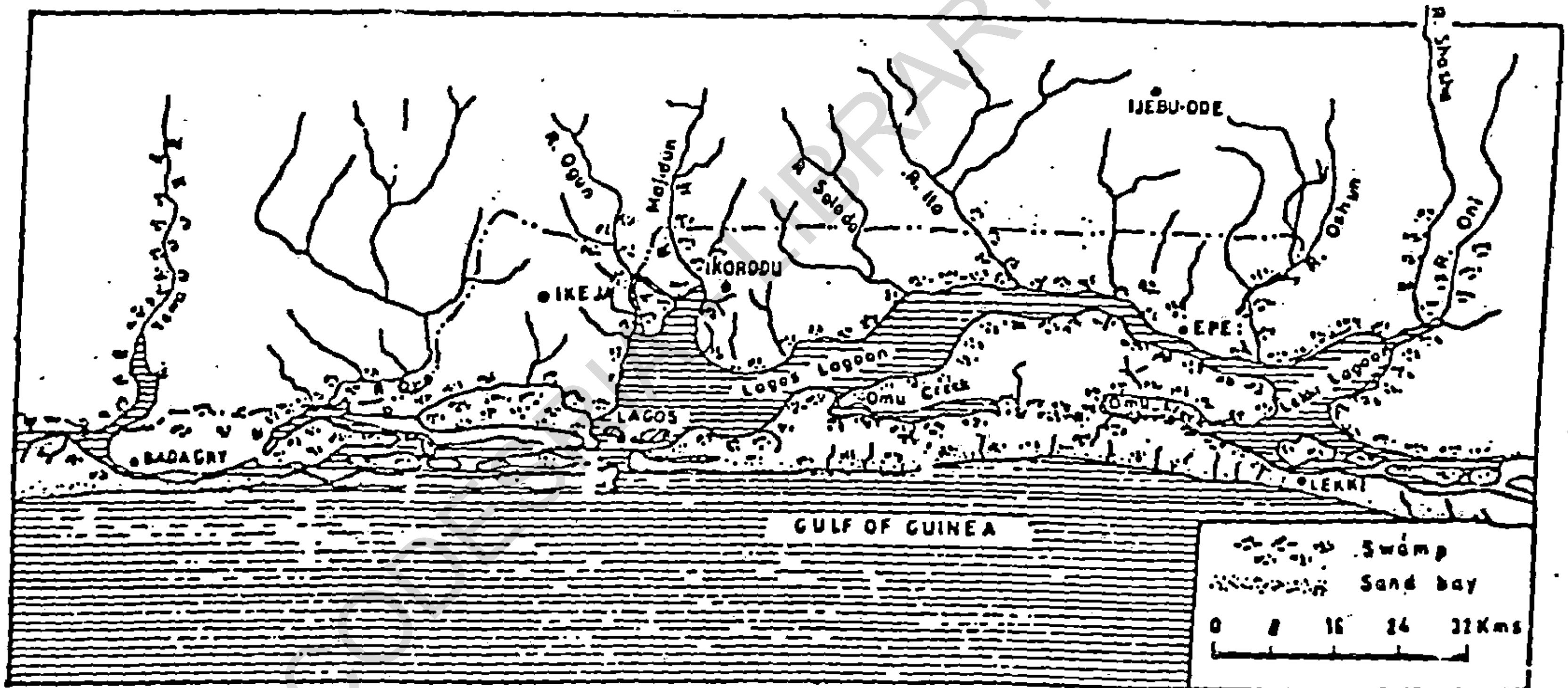

Fig. 4.2 : Map of Lagos State showing Drainage Characteristics

airmass and the associated south –westerly. The occurrence of heavy rains particularly in the peak period, often occasioned by rainy flashy floods, aggravated by poor drainage conditions and the relatively high water table in the coastal lowland areas. The implication of this is the fact that excessive downpour encourages high rate of decomposition of wastes deposited in the landfills and increase in the production of leachate. On the other hand, the increase in the height of water table as a result of much rainfall could bring about increased contamination of underground water by leachate produced from the landfills.

The mean annual and monthly rainfall as well as the number of rain days exhibits a lot of variability between different locations in the state. The state is characterized by constant high temperatures throughout the year with the mean monthly temperatures fluctuating around 30^0C while the mean monthly minimum temperatures are relatively below 20^0C. High temperature has the tendency of increasing microbial activities within the wastes deposited in the landfills which will also increase the rate of decomposition of wastes in the landfills.

The relative humidity is generally high in the state throughout the year and is not usually less than 75-80 per cent in the coastal areas around Lagos. Figure 4.3 is the map of Lagos state showing rainfall distribution.

4.1.3 Population Growth

Lagos epitomises the phenomenal growth in urban population that is almost typical of most African cities. Estimates made in the latter part of the 18th and the early part of the 19^{th} centuries gave the population as 3,000 in 1800 (Adams, 1900), 20,000 in 1863 and 40,000 in 1864 (Colonial Possessions, 1963 and 19864). Within the first five years after 1966 (see Table 4.1), the population increased by about 14 percent. The population growth rate for the city took a sharp turn in the 20^{th} century. Between 1901 and 1911, the intercensal increase rose from 28.7 to 76.3 percent. The trend in growth in the latter part of the century has been more dramatic (see figure 4.4). In the first 13 years, that is 1950 to 1963, the population of the municipality increased threefold from 230,256 to 665, 246. In 1973, the intercensal percentage decreased from 188.9 percent to 117 percent and by 1988, it decreased further to 50.2 percent. The 1991 census gave a ridiculous low figure of Lagos Island as 335, 300 (Lagos Island and Eti-Osa) and 4, 248,963 when the Lagos Mainland figure is added to it (see Table 4.2)

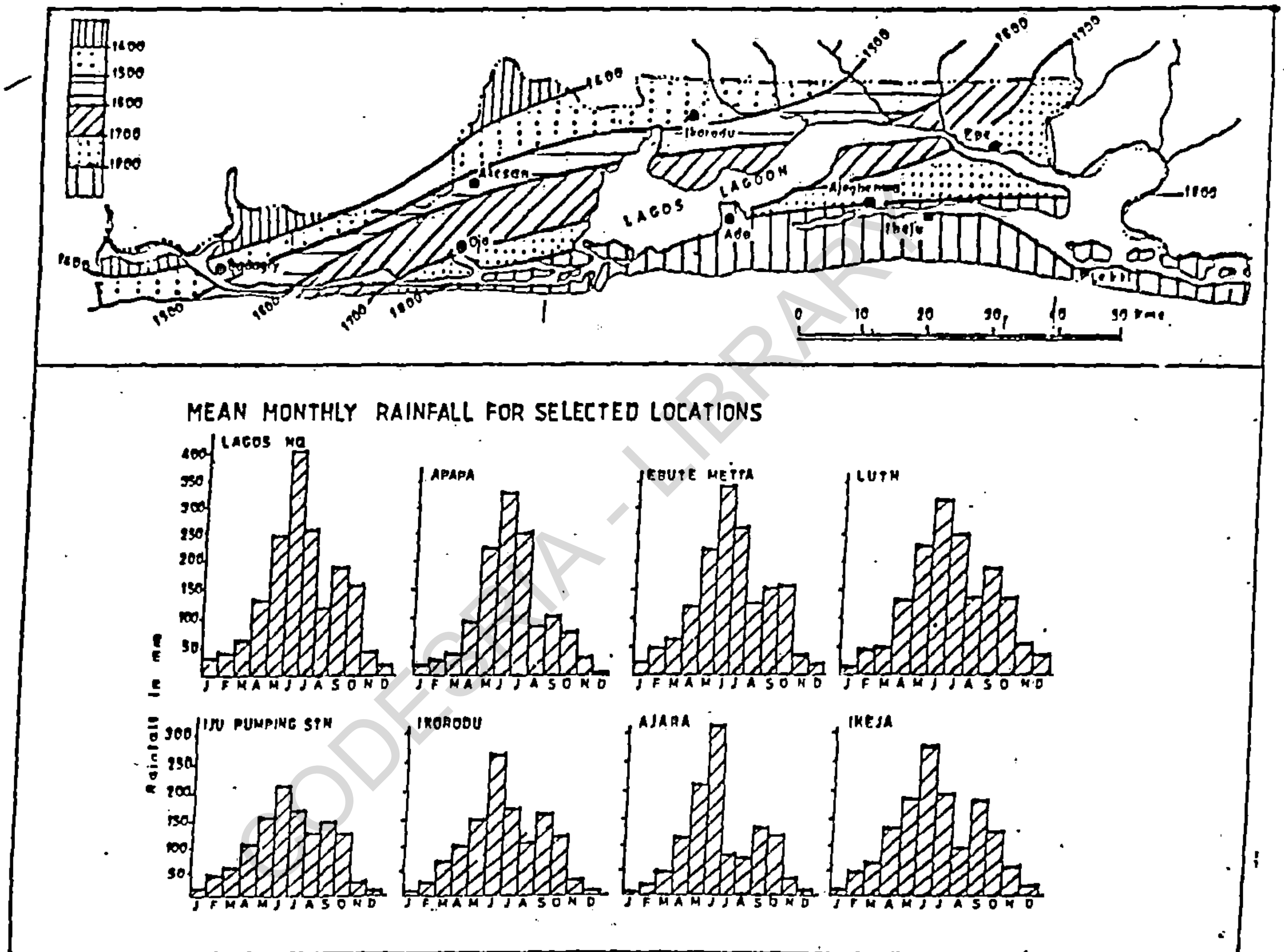

Fig43. : Map of Lagos showing Rainfall Distribution

Table 4.1: Lagos City Population Growth Rate (1866-1991)

Year	Area Covered in km^2	Total Population	Intercensal Percentage Increase or Decrease	Rate Change Per Annum Per 1000 People	Average Intercensal Growth Rate Per Annum	Annual Rate of Increase
1866	3.97	25,083	-	-	-	-
1871	4.01	28,518	13.7	-	-	-
1881	4.01	37,452	31.3	13	-	-
1891	4.01	32,508	13.2	-	-	-
1901	-	41,847	28.7	-	-	2.5
1911	46.62	73,766	76.3	58	-	5.7
1921	52.24	99,690	35.1	31	-	3.1
1931	66.28	126,108	26.5	24	2.3	2.3
1950	70.50	230,256	82.6	32	3.2	3.3
1963	7.50	665,246	188.9	86	8.5	8.8
1973	-	1443568	117.0	-	-	-
1988	405.53	2168163	50.2	-	-	-
1991	405.53	4248963	96.0	-	-	-

Source: Population Census of Nigeria 1931, 1950, 1963 and 1991

Note: - Not available * Projection

However, these figures contradict assumed rates of growth and projections by the Master Plan Unit of the Ministry of Economic Development and Land Matters in 1980 as shown in Table 4.2. Then they estimated the population at 3.779 million in 1978 from which a rate of growth of 9.3 was used to forecast population up to 1979. From 1980 onwards, a declining rate taking into consideration the removal of federal functions from Lagos was used. Thus for 1980, the rate of growth was estimated at 7.27, while between 1985-1990 the assumed rate off growth was 5.6. The rate was 4.37 between 1990 and 2000 A.D. Thus the population of the Metropolis in 1985 would be 6.614 million while in

1990, it was expected to be 88.484 million. The population for 2000 A.D. is expected to be about 12.949 million people, a figure that is said to be conservative

Table 4.2: Lagos State 1991 Population Census

Nos	Local Government	Males	Females	Total
1	Agege	343,456	306,818	650,274
2	Badagry*	60,586	58,118	118,704
3	Epe*	48,530	51,037	99,567
4	Eti-Osa	97,264	73,684	170,948
5	Ibeji-Lekki*	12,139	12,686	24,825
6	Ikeja (1)	340,968	398,794	639,762
7	Ikorodu*	93,214	88,700	181,914
8	Lagos Island	82,121	82,231	164,352
9	Lagos Mainland (2)	458,131	411,470	869,601
10	Mushin (3)	520,758	466,089	986,847
11	Ojo*	538,214	473,594	1,011,808
12	Shomolu	404,147	363,032	767,179
	Total	**2,999,528**	**2,686,253**	**5,685,781**

Source: National population Census, 1992

(1) Including Alimosho*

(2) Including Surulere

(3) Including Oshodi/Isolo

* Local Government not considered as part of Metropolitan Lagos.

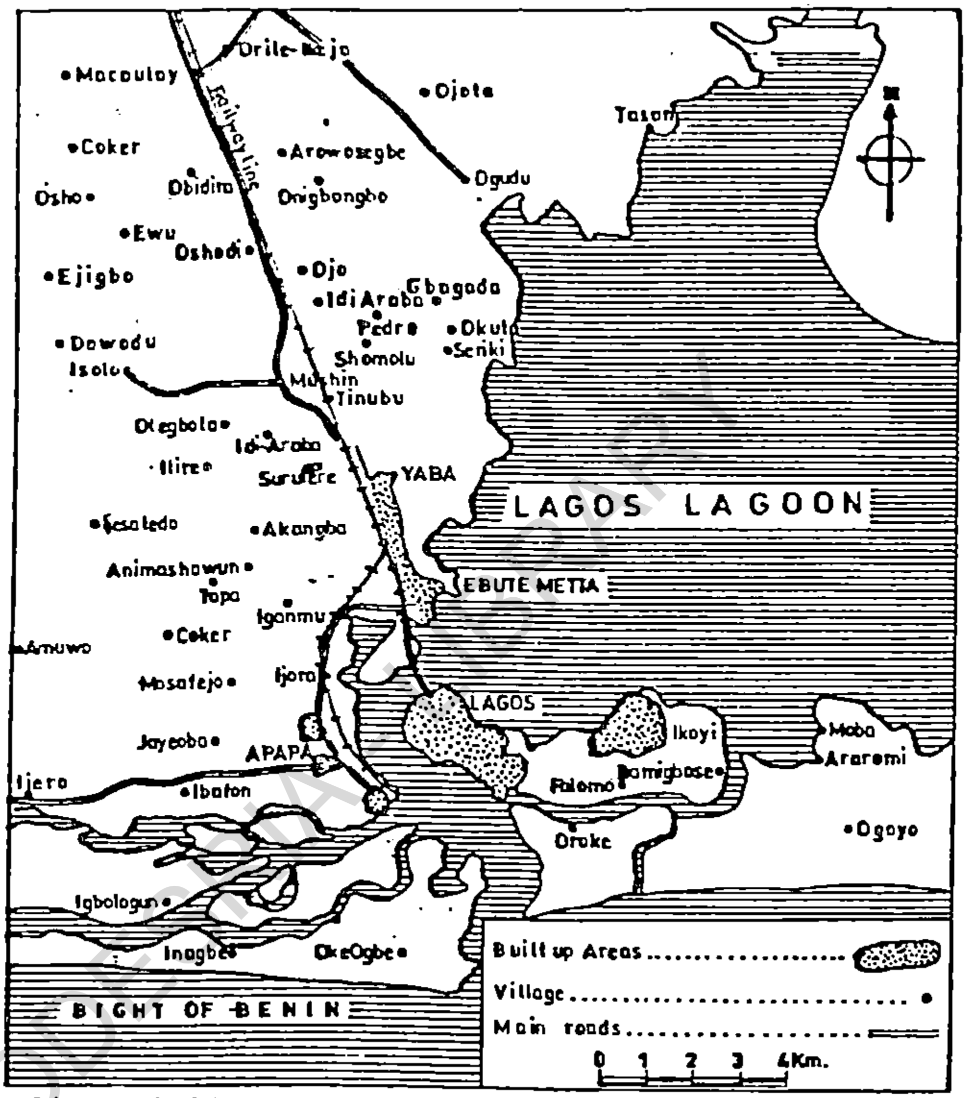

Fig.4.4 ::Built up areas of Lagos metropolis in 1944.

SOURCE:-Land and Survey Dept. Lagos Nigeria, 1945

Table 4.3: Population of Lagos 1978 – 2000

Year	Metro '000	Rate of Growth	Non. Met '000	Total '000	% Metro
1978.	3,779	9.3	521	4,300	87.88
1979	4,133		547	4,680	88.31
1980	4,518	7.27	574	5,092	88.72
1981	4,923		601	5,524	89.12
1982	5,302		627	5,931	89.40
1983	5,677		657	6,634	89.62
1984	6,048		688	6,734	89.81
1985	6,614	5.56	716	7,132	89.96
1986	6,791		747	7,538	90.09
1987	7,178		779	7,957	90.21
1988	7,580		812	8,392	90.32
1989	7,989		847	8,838	90.41
1990	8,406	4.37	884	9,290	90.49
1991	8,787		917	9,740	90.55
1992	9,173		952	10.125	90.60
1993	9,565		988	10,125	90.63
1994	9,975		1,026	11,001	90.67
1995	10,406	4.48	1,063	11,471	90.72
1996	10,861		1,105	11,966	90.76
1987	11,342		1,147	12,489	90.81
1988	11,842		1,191	13,039	90.87
1999	12,384		1,236	13,620	90.92
2000	12,949		1,283	14,232	90.96

Source: Master Plan Project, Lagos State Ministry of Economic Planning and Land Matters, Lagos, Nigeria, 1980 (Ayeni, 1991).

The areal distribution of population in Lagos, 1911-1991 (see Table 4.4) shows that in 1911 Lagos Island constituted 76.8 percent of the population while Mainland District contributed the remaining 23.2 percent unit. In 1952, the population reduced to 49.3 percent in the Island, while the mainland population increased to 28.5 percent. The city outskirts or suburbs which incorporates the new metropolitan settlements constituted the remaining 22.2 percent. The 1963 census gave the areal population distribution as 26.9 percent for Island, 31.9 percent for Mainland District and 41.2 percent for the new settlements. The distribution shows a continuous decrease in population in Lagos city and increase in population towards the hinterlands. This trend is further confirmed by the 1991 census which shows that Lagos Island has 335, 300 population (7.9 percent), Lagos Mainland 869,601 (20.5 percent) and the other Metropolitan settlements 3,044,062 (71.6 percent). Generally, the Lagos Metropolitan population has been on the increase since 1911-1991 (see Table 4.1). The implication of this increasing growth in population for waste management is that there has also been much increase in wastes generated in Lagos compared to any other cities in Nigeria and this has heightened the need for more and bigger landfills in the area to handle wastes generated by the urban population.

4.1.4 Spatial Expansion

Two main factors account for the rapid growth of Lagos Metropolitan population-net migration and natural increase. Immigration has been a much more potent factor accounting for the rapid population growth in Lagos. Lagos was settled by immigrants from the immediate hinterland. These were the Aworis, members of a Yoruba sub-group. They were followed by the Ijebus and later by the Binis from a much farther distance to the south eastern part of the coast. During the era of the slave trade, Lagos became an

Table 4.4: The Areal Distribution of Population in Lagos 1911

		1952 CENSUS		1963 CENSUS		1991 CENSU[S]
Metropolitan Sub-regions	1911 1921 1931 1950	% of Municipal Population	% of the Metro. Pop	% of Municipal Pop.	% of the Metro. Pop.	% of the Metro. Pop.
Lagos Island, Ikoyi and Victoria Island	76.8 77.7 71.6 65.4	63.3	49.3	45.4	26.9	8.4
Mainland District	23.2 22.2 28.4 34.6	36.7	28.5	34.5	54.5	20.4
Outskirts (Mushin, Ikeja, Agege, Somolu, Oshodi, Ajeromi)	- - - -	-	22.2	0.1	41.2	71.2

Source: Compiled by Aluko (1996) from the Population Census of Nigeria 1952, 1963 and 1991.

Table 4.5: Population of Metropolitan Lagos in 1952, 1963 and 1991.

Area	Population 1952	Population 1963	Population 1991	% of Total Population 1991	Average Annual Rate of Growth Per 1,000 People
Lagos-Island					
Ward A	37,450	47,551			23
" B	40,034	49,841			65
" C	74,472	53,450			-
" D	21,761	104,037			158
" E	37,682	158,932	335,300	7.8	140
" F	38,534	95,542			86
" G	17,474	50,753			102
" H	Part of "C"	71,703			-
Mushin	32,079	208,709			185
Oshodi	7,284	20,717	986,847	23.2	97
Itire-Isholo	2,853	30,634			241
Somolu	1,284	64,731	767,179	18.1	
Bariga	477	10,564			
Lagos					

Mainland Ajegunle Aiyetoro Araromi	 6,241 2,633 3,877	 18,363 7,427 19,379	 869,701	 20.5	
Ikeja	6,705	36,923	639,762	15.1	
Agege	12,844	45,986	650,274	15.3	
Total	**343,883**	**1125242**	**4248963**	**100**	

Source: Compiled from population census of Nigeria 1952, 1963, and 1991

Note: Ward C was split in 1963 and from it was carved out Ward

H hence the lower figure recorded for 1963

Figures for Wards C and H added together for calculation

important market for the slaves brought from Porto Novo, Badagry, Hausa and Yoruba lands. However. with the abolition of the slave trade in 1851 and the cession of Lagos to the British government in 1861, which ushered in an improved socio-political era, new groups of migrants were attracted to the city. Such groups included migrants were attracted to the city. Such groups included freed slaves from Brazil, Sierra-Leone, and from the hinterland. European merchants, missionaries, Egba Christian refugees and traders from the interior also came to Lagos for trading, missionary and political reason respectively.

By the end of the 19th century, the built up area of Lagos was approximately 4 square kilometres, the main settled area being the Island. The settlement of the Egba Christian refugees in the Glover layout during this period started the spatial development on the mainland. After 1900, greater strides were made in the areal expansion of the city and by 1911, the Metropolitan Lagos recorded an area of 46.6 square kilometres. By

1921, the built up area of the Island had by then extended in almost all directions, particularly eastward where swamps had to be drained. But between 1921 and 1931 there was a shift in residential expansion to the Mainland as a result of the deteriorating housing conditions on the Island. As a result, the area of the city increased from 46.6 square kilometres in 1911 to 70.5 square kilometres in 1950.

Figure 4.4 shows that almost the whole of Lagos Island has been built up by 1944. The built up area son the Mainland extends from the southeastern portion of Ebute-Metta to Yaba and to some portions of the south-western part of Apapa. Many villages dot the landscape in areas north and west of the Mainland. Within another decade, new areas were being opened up for development. The Lagos Executive Development Board (LEDB) inaugurated in 1948 was instrumental to the building of new Surulere whilst private developers extended their activities to the outskirts of Mushin, Somolu, Ikeja and Apapa Ajegunle area. May of these laces were formerly villages that have over time been turned to important residential suburbs of Lagos.

Figure 4.5 depicts the change that has been brought about in the residential extent by 1964. This expansion process is on the increase; the whole built up area from Ikoyi Island in the Southeastern part of a Lagos Island to Agege in the extreme north forms the Metropolitan Lagos on an area of about 181 square kilometres. Figure 4.5 also shows that the areal extent of the built up areas of Metropolitan Lagos in 1993 is about 405.53 square kilometre. Not only has the rapid rate of the population growth contributed to the areal expansion of the Metropolis, it has also affected the distributional pattern of the people.

With reference to Table 4.5, the major area of population concentration was the Island up to the middle of the century, but this is fast giving place to concentration at the outskirts. Lagos continues to grow with a spiralling population, a constantly extending boundary and ever changing skyline. Hitherto the former Federal capital Territory of Lagos has its boundary at Fadeyi on Ikorodu road, Idi-oro on Agege motor road and Alaiyaiagba market at Ajegunle but today, the whole area has grown into a metropolis extending northwards to incorporate such urban areas as Mushin, Somolu, Bariga, Agboyi, Ikeja, Agege, Ojo, Isheri, Ajegunle and Ketu. At the inception of Lagos State on May 27, 1967, Lagos Island was both the state capital as well as the seat of the Federal Government. However, when Nigeria's federation was restructured into 19 states in 1976, the capital of the state was moved to Ikeja. Lagos state is also made up of five administrative divisions, namely Lagos (Eko), Ikeja, Ikorodu, Epe and Badagry. The divisions were created on May, 31, 1968 and were further divided into local governments. Only two divisions fall within the Metropolitan Lagos, i.e Lagos and Ikeja divisions.

The Lagos division is a highly urbanised division consisting of four local government Islets: Lagos Island, Lagos mainland, Surulere and Eti-osa with the city of Lagos being the pivot of an ever expanding Greater Lagos and the divisional

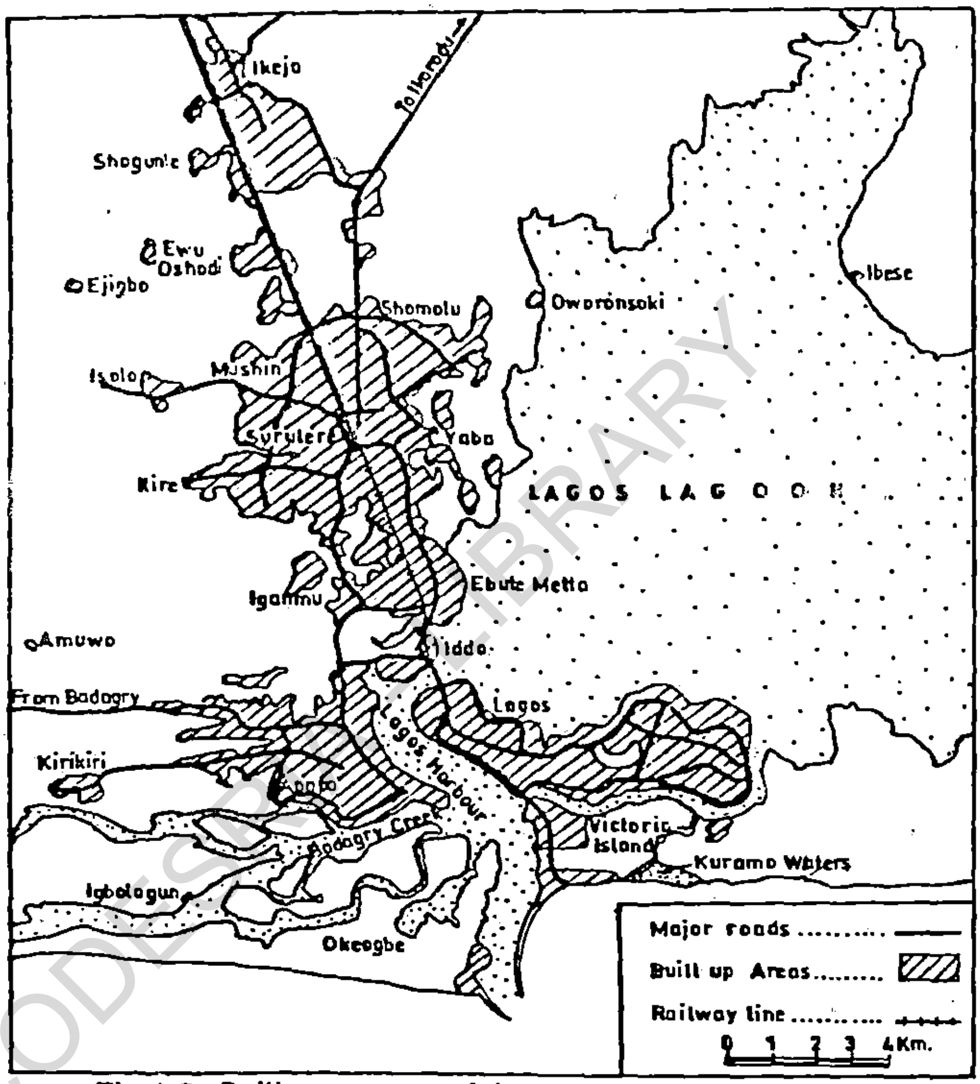

Fig. 4.5: Built up areas of Lagos metropolis in 1964.

SOURCE:- Land and Survey Dept. Lagos Nigeria, 1964.

headquarters. Major settlements in the Division are Tarkwa, Bay, Victoria Island, Lagos Island, Badore, Ikoyi, Iwaya, Surulere and Iponri. Others are Abagbo, Abijo, Ajiran Ogombo, Magun, Ito-Omu, Okun-Aja, Okun-Ibeji, Morakinde. Moba, Alaguntam, Addo, Langbasa, Ilasan, Igbo-Efon, Ikota and Ikale-Elegusi.

Ikeja division consists of six local government authorities namely Agege, Mushin, Alimoso, Oshodi/Isolo, Somolu and Ikeja which serve as the seat of the State Government and also as the divisional headquarters. There are over 50 settlements in the Division including Isolo, Isheri, Ikotun, Ejigbo, Agan, Akesan, Ketu, Ojota, Shangisha, Oworonski, Mushin, Abesan, Igando, Idimu, Ajobo, Iju, Ifako, Agboyi, Ikosi, Somolu, Ipaja, Oregun, Oshodi, Oke-Afa, Ojodu, Ogudu, Bariga, Ilupeju, Obanikoro, Ogba, Aguda, Agege, Dopemu, Ikosi, Abule-Ijesa and Akoka.

The implication of this rapid expansion of the metropolis is that most of the former areas where waste dumpsites were located at the urban fringe has now been eaten up by urban expansion. Also some of the recently sited landfills (for instance the Olushosun landfill site) are now surrounded by new residential housing estates.

4.2 Waste Management Problems in Lagos Metropolis

Waste management is a relatively new issue in environmental protection (Smith, 1993). It is an issue that has arisen out of crisis as communities began to realise that their capacities for waste generation was far exceeding their ability to dispose of that waste. Thus waste management issues are usually accompanied by a sense of fear, perceived health risks and lack of trust in authorities. According to Maclaren (1991), in its simplest terms, the problem of municipal waste is one of an excessive amount of rubbish with the advent of a disposable society. Since the early 1960s, there has been a steady increase in the amount of use of disposable products. The increased use of disposable products is further reflected in the fact that most of the increase in amounts of rubbish since 1960 has been in plastics and paper products.

Waste management poses questions that are very real and tangible to local communities. Unlike other environmental problems that appear remote to everyday life (such as ozone depletion, climatic change and acid rain), waste issues are easily recognisable within the household, the workplace and the community. Therefore, public awareness is high and there is predisposition in most communities for opposition to waste management (Smith, 1993). At the same time, familiarity does not obviate waste issues from being scientifically complex and fraught with uncertainty.

Municipal solid wastes are principally generated in the urban areas (Lee and Jones-Lee, 1994). Waste management problems therefore have been identified as one of the most important environmental problems facing cities especially in developing countries (Bartone *et al*, 1994). Nigeria is not an exemption. According to Filani and Abumere (1983), the most visible and perhaps intractable urban problem in Nigeria pertains to the generation and disposal of solid wastes in the form of heaps and constitutes a common feature in Nigerian cities.

Inadequate municipal solid waste management creates a range of environmental problems if not well handled. According to Schubeller (1996), waste management is an essential task which has important consequences for public health and well being, the quality and sustainability of the urban environment and the efficiency and productivity of the urban economy.

Major cities in Africa are experiencing rapid growth. Lagos, for example, grew sevenfold during 1950-80, mainly because of rural-urban migration. Urban residents make heavy demands on the environment as they generally consume more resources, and generate large quantities of solid waste and sewage. Rapid urbanisation in Lagos increased solid waste generation six fold to about 3.7 million tonnes a year in 1990, plus another half a million tonnes of largely untreated industrial waste. Without any shade of doubt therefore, solid waste is currently one of the biggest environmental problems commonly experienced in Lagos metropolis. As Table 1.2 (page 31) clearly shows, there is a constant upswing in the annual volume of solid waste generated in various municipal areas in the country. Lagos however takes the lead in the amount of waste generated yearly in the country with more of the wastes generated within the residential areas (Table 4.6). This information is also presented in Figures 4.6, 4.7 and 4.8.

The generally rising trend in the volume of waste generated in Lagos stems from the high levels of population explosion, poverty and poorly guided urbanisation and industrialisation. Currently, the rate and intensity of solid waste generation outpace the rate of disposal.

Table 4.6: City Functional Zones and Waste Generation (10^3 kg/yr).

Cities	Residential	Commercial	Industrial	Institutional	Others	Total
Ibadan	38,734	10,355	5,369	384	384	55,224
Lagos	40,650	10,738	4,219	-	384	55,991
Osogbo	38,350	3,835	-	230	-	42,415
Kaduna	18,025	10,534	2,417	-	460	20,019
Suleja	4,986	767	-	652	-	6,405
Kano	24,928	10,738	1,151	2,301	767	39,885
Jos	17,641	1,151	-	-	-	18,792
Potiskum	2,378	345	384	-	-	3,107
Port Harcourt	31,064	12,656	3,835	3,068	767	51,390
Aba	43,719	6,520	4,219	-	-	54,458
Onitsha	28,763	2,186	384	3,452	-	34,785
Uyo	2,531	1,607	384	230	345	5,097
Warri	33,748	7,287	1,534	767	-	43,336
New Bussa	1,265	230	-	230	-	1,725
Gusau	4,219	1,918	-	767	767	7,671

Source: Abumere, 1983.

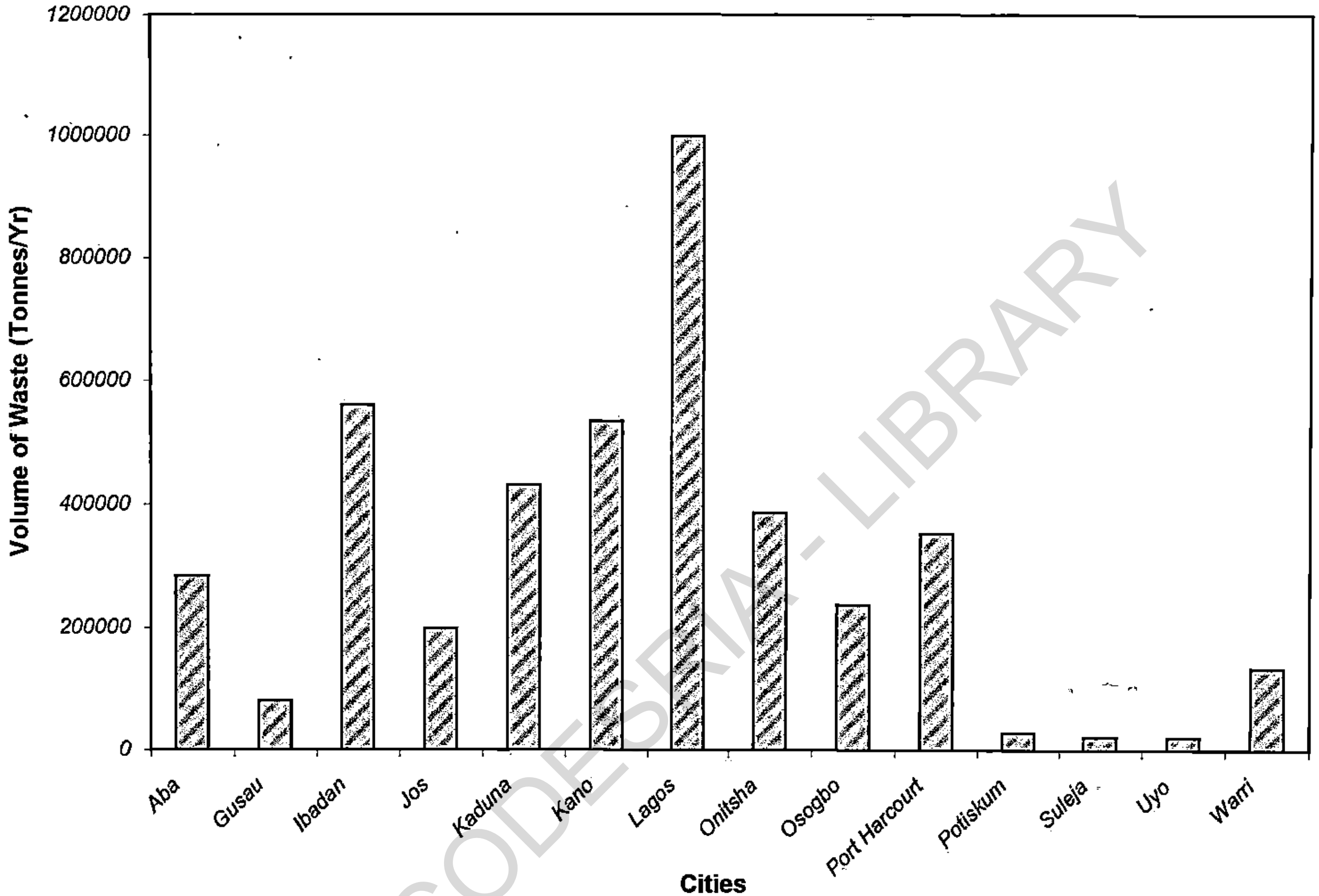

Fig 4.6: Projected Volume of Waste Generation in some Nigerian Cities (Year 2000)

Source: Nwabugwu, 2001

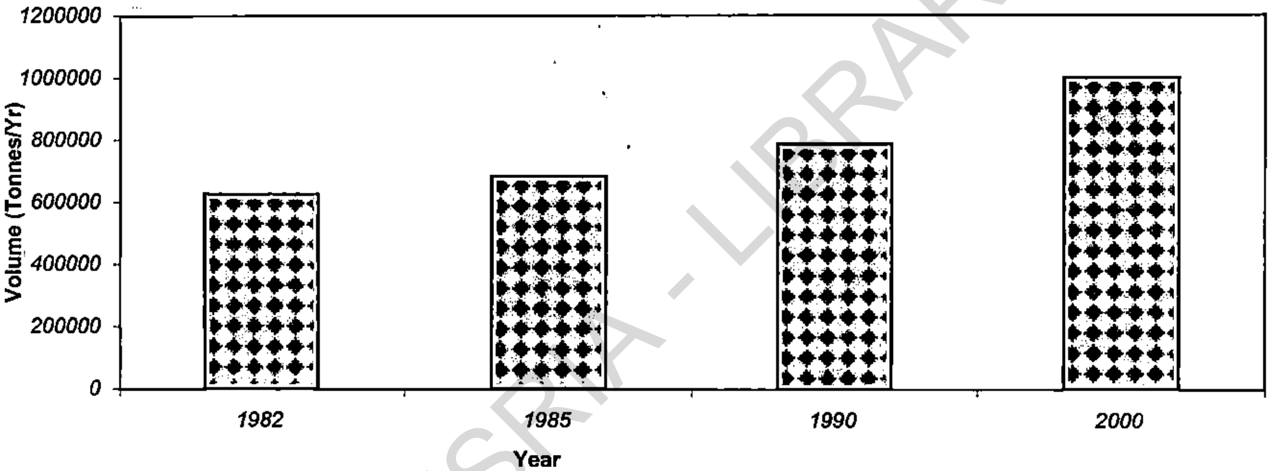

Fig. 4.7: Trend in the Volume of Waste Generated in Lagos (1982-2000)
Source: Nwabugwu, 2001

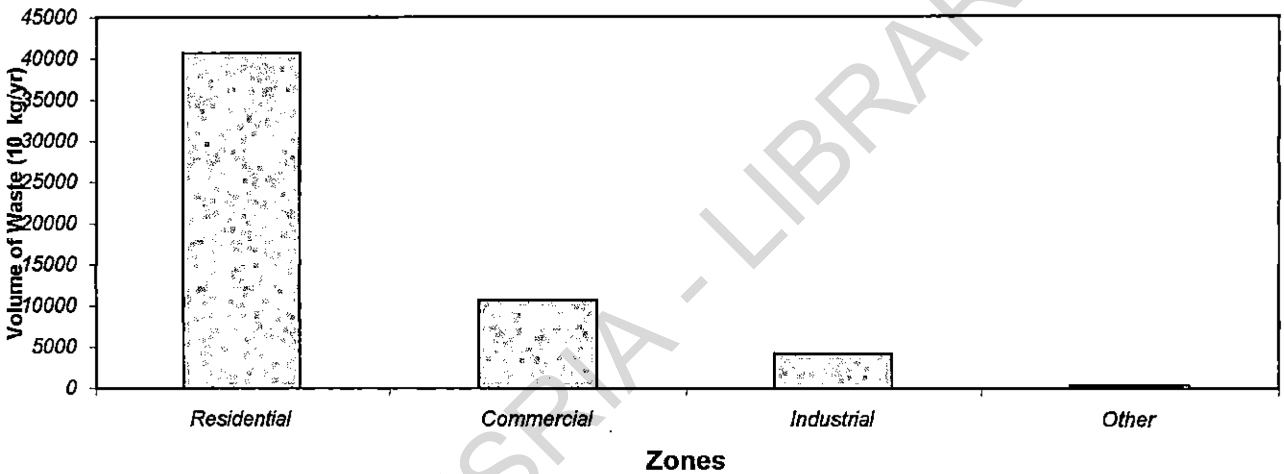

Fig. 4. 8: City Functional Zones and Waste Generation in Lagos
Source: Abumere, 1983

4.3 Developmental/Environmental Problems in Lagos

Lagos state is the most urbanized state in the country (Odumosu and Adedokun, 1987). The domineering presence of Lagos metropolis as the former Federal Capital Territory (FCT), the commercial, nerve center of the country, as well as the capital of Lagos state, which no urban center can boast of, shows the importance of urbanization to the land and people of Lagos state.

The consequences of rapid growth of Lagos metropolitan area make water supply, storm drainage, good roads, dependable electricity, efficient telephone services and area-wide solid waste pick-up and disposal not to be able to keep pace with the expansion of the Lagos metropolis and rapid growth of its population (Odumosu, 1999).

According to Odumosu (1999), developmental problems in the metropolis can be grouped as follow:

1. Problem of rapid urbanization. This indicates rapid concentration of population in an area which will definitely require continual provision of infrastructure facilities for the ever increasing population
2. the problem of poor terrain in almost the entire state. The metropolis is hardly some five metres above sea level; there is therefore the problem of drainage and insufficient firm land upon which to install some of the facilities that can make life tolerable.

3. environmental quality has seriously deteriorated and further rapid unplanned growth of the metropolis hence serious consequences for the quality of life of its inhabitants and for the overall economic and social progress of the country.

It can thus be concluded that Lagos, like many other Nigerian cities, have had a rapid growth. Infact, it can be said that Lagos have had the highest growth rate among all the Nigerian urban centres because of the various factors highlighted above. The rapid growth also brought with it several environmental problems of which waste management problems are among the major and most pressing.

4.4 Landfill Development and Management in Lagos State

4.4.1 Landfill Development in Lagos State

At the inception of Lagos Waste Management Authority (LAWMA) as Lagos State Refuse Disposal Board in 1977, there were five existing Landfill/Dumpsites in operations within Lagos metropolis namely;

1) Pelewura (Adeniji Adele) Lagos Island Local Government
2) Gbagada (Kosofe Local Government)
3) Isolo (Oshodi-Isolo Local Government Area)
4) Achakpo (Ajeromi-Ifelodun Local Government)
5) Ojota (Odo-Iya-Alaro)

These sites were open swamps progressively reclaimed with refuse. The environmental implications of waste management activities on these sites were of secondary importance to the waste being disposed (Adebisi, 2000). The five sites have however been closed to waste operations dating back to 1996.

In recognition of the prime position of Landfill as the final waste disposal means in solid waste management, earth-moving equipment like bulldozers, excavators, etc. were procured for Sanitary Landfill Practice under the World Bank Assisted project in 1988. The package also include the development of Sanitary landfill Infrastructural Facilities to enable the organisation fulfill its complete waste management disposal functions. The equipment delivery and site development commenced in 1988 and were completed in 1992.

Consequent on the above, three sites were proposed for sanitary landfill development in Lagos State:

- Olushosun (42 hectares) in Ikeja Local Government is situated towards the Northern part of the State.
- Abule-Egba (10.5) hectares) in Alimosho Local Government is situated towards the North Western part of the State.
- Solous (3.0 hectares) in Alimosho Local Government is situated towards the South Western part of the State.

4.4.2 Landfill Operations

Ideally, the Authority operates on the 3 Landfill Sites mentioned above; but due to low availability of bulldozer and other earth-moving equipment, only two of these sites is maximally operated. Presently, more than two-third of the municipal waste collected in the State are disposed at the Olushosun and Abule-Egba landfill sites (Adebisi, 2000).

Olushosun Site Status: The site is about 42 hectares with a life span of 35 years from date of establishment in 1992. It is designed for operations as a sanitary landfill

It receives an average of 1,000,000 tonnes of waste annually (see Table 4.7). Sufficient cover materials for waste is also available both in quality and quantity. However, due to lack of necessary earth-moving equipment the waste deposited are not yet covered on daily basis (once three months or more).

The leachate generated from the site is ponded at the lowest level of the void space and often recirculated to reduce groundwater contamination and to increased microbial load for waste decomposition. Proper monitoring programmes for leachate, surface water, groundwater and landfill gas control is therefore inevitable. It is worthy of note that studies have shown that the soil properties of the site which is lateritic in nature provides natural attenuation for water movement and the rate of water percolation conforms with international stands that could protect and prevent under-groundwater contamination.

Abule Egba site status: The site is about 10.5 hectares with a lifespan of about 25 years from date of establishment in 1992. It receives 250,000 tonnes of waste annually. Unlike the Olushosun landfill site, there is no sufficient cover materials in this site. As a result, waste disposed into it are not cover at all. This has increased the amount of odour and the number of flies within the area where it is located. There is no provision for ponding leachate generated from the site therefore the incidence of groundwater contamination cannot be avoided.

4.4.3 State Government Input

The State Government is expends over half a billion Naira on development works on the two landfill sites annually (Adebisi, 2000). The development works include amongst others, construction of all weather access roads, fencing, site office and electrification, etc. The construction works are of immense operational advantages to sanitary landfill practice as follows:

- Improvement in operations techniques i.e. Ramp and Trench methods of landfill operations to ensure ease of manouvering
- Reduction in turnaround time of collection vehicles and subsequent improvement in the efficiency of waste collection.
- Perimeter Fencing will prevent wind blown litters and provide screen for the site thereby improving the site environment's aesthetics.
- there will be improvement in waste harmonization existing presently at Olushosun site to accommodate co-disposal of other biodegradable non-toxic wastes from the industries.

4.4.4: Locational Characteristics of the Landfills

The differences in the type of operation, site history and surrounding environment most often condition local residents' experiences and reactions and are important aspects of the context in which the impact of the facilities need to be understood (Elliott *et al*, 1996; Baxter, 1998). This section therefore examines the locational characteristics of the two landfills. The locational characteristics are the topographical, geographical and geological features of the sites.

The Olushosun landfill site is situated at an excavated site North of the metropolis in Ojota along the Lagos Ibadan expressway. The wastes brought from different parts of Lagos are dumped in the site to progressively fill up the depression. This site receives far more wastes than any other landfills in Lagos. Except the Olushosun village which shares boundary with the site, all other surrounding neighbourhood are well over 200 metres from the site. The communities that are within 3km of the site are Ojota, Ketu, Bashorun Abiola Garden and Oregun. These areas are mostly middle density residential areas with pockets low and high-density residential areas. Figure 4.9 is the map showing land use patterns around the Olushosun landfill site.

According to the Lagos Waste Management Board officials, a major concern over the landfill is the release of smoke into the air due to continual burning of refuse at the sites as often complained by nearby residents. Also, odour is another major problem with the site. This is due to the fact that the wastes deposited there are not covered by earth materials according to international standards. However, the situation at the site has improved recently with the construction of fence and access roads to and on the site. This has considerably reduced the illegal dumping of wastes at the site and indiscriminate dumping of waste along the road which constituted obstruction to traffic.

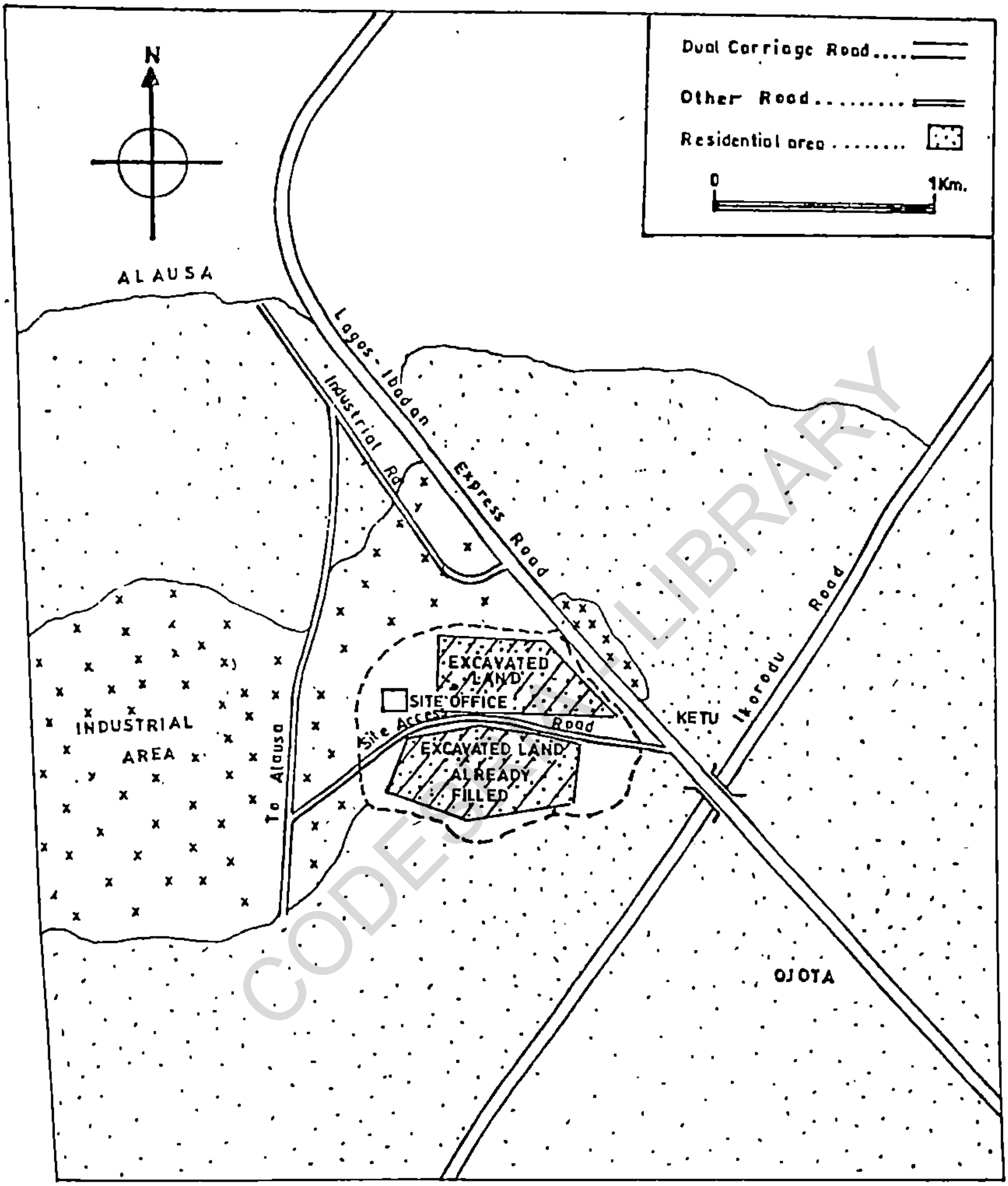

Fig.4.9: Location of Olusosun Landfill showing Landuses around the Site.

The Abule Egba landfill is located along the Oshodi–Sango road in right within a residential neighbourhood. Furthermore, the Oko-Oba market also share boundary with the site. This is contrary to international regulations which requires that buffer zone should be provided between landfill sites and surrounding properties. Unlike the Olushosun landfill, the management of the site is poor. Wastes are dumped indiscriminately along the road, mostly wastes from the market. Recently however, an access road was constructed for vehicles and cart pushers to dump their wastes. Table 4.7 shows the locational characteristics of the two landfills. Figure 4. is a map showing land use patterns around the Abule-Egba landfill site.

Table 4.7: Locational Characteristics of the Landfills

	Olushosun	**Abule Egba**
Size	42.7 hectares	10 hectares
Shape	Hexagonal	Rectangular
Depth	18 metres	8 metres
Width	800 metres	150 Metres
Topography	Sited on an Excavated land	Plain surface
Drainage/runoff characteristics	Well drained	Poorly drained
Nature of soil surface	Lateritic	Lateritic
Sub soil and bedrock characteristics	Laterite based	Laterite based

Source: Fieldwork, 2002

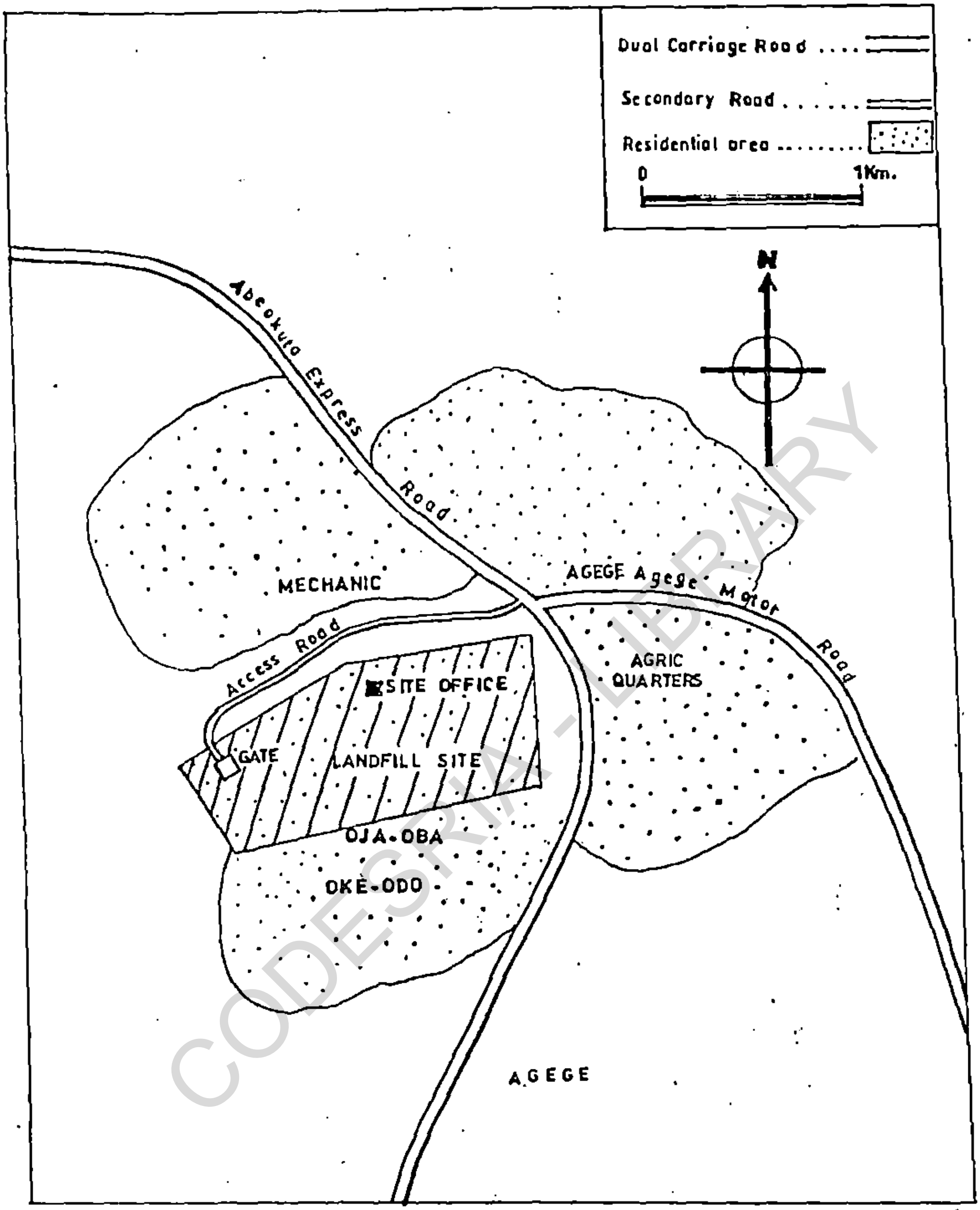

Fig. 4.10: Location of Abule-Egba Landfill showing landuses around the Site.

4.4.5: Operation and Management of the Landfill Sites

Perceptions about landfill impact may be influenced by site management practices employed by responsible parties and public officials charged with the management of such sites and the amount and type of publicity surrounding a site (Lee and Jones-Lee, 1993). The Lagos State Waste Management Authority (LAWMA) is responsible for the management of the landfills in Lagos. Management of landfills is expected to conform to international standards so as to reduce their adverse impacts on nearby residents.

According to Lee and Jones-Lee (1996), the principal difference between a landfill and a waste dump is that each day's wastes are supposed to be covered by a few inches of soil. This soil layer reduced the odourous emissions associated with the previously deposited waste. The soil layer also reduced to some extent the ability of vermin, such as birds and rodents and disease vectors such as birds, rodents, insects (flies) etc to access to the waste. A number of visits to the landfill sites and interview with LAWMA officials revealed that this practice is not yet in place as a result of financial and technical problems. Furthermore, it was revealed that the Abule Egba landfill is designated for use mostly by private refuse collectors. It then became obvious that management practices at the site are very poor. The practice of refuse burning is still very prominent at the two sites. In fact, smoke was among the major complaints by local residents. The activities of scavengers are very prominent at the Abule Egba landfill site. Sometimes, the scavengers persuade the cart pushers to dispose their wastes nearby for them to scavenge for usable materials in the waste. This has again worsened the aesthetics problems derived from the siting and operation of the landfill.

However, some steps have been taken by LAWMA officials to reduce their impact of the Olushosun landfill. These include the spraying of different chemicals to reduce odour and insects and pests at the site, among others. There are personnel at the site who monitor the dumping of refuse and also keep the necessary operations reports. Appendix 4 shows the safety report sheet kept at a typical landfill site. A look at the reports in the Olushosun site shows that many of the items in the report sheet are not recorded. Table 4.8 shows some of the available facilities and labour at the landfill sites.

Table 4.8: Available Facilities and Personnel at the landfill sites

	Olushosun	**Abule Egba**
Capacity	1,000,000 tonnes annually	250,0000 tonnes annually
Type and number of facilities	3 CAT Bulldozers 1 Cat 215 Excavator 1 CAT 950 Pay loader	I FIAT ALLIS Pay loaders
Volume of wastes received daily	5,000 metric	850 metric tonnes
Number of staff at the landfill sites	26	11

Source: Fieldwork 2002

It can then be concluded then that at present, the management of the landfill sites does not conform to international standards for landfill management. This tends to increase the negative impacts arising from the location and management of the landfills. Plates 1 to 4 show some of the characteristics of the two landfills.

Plate 1: **Burning of wastes at the Olushosun landfills site. The smoke that the burning generates can be seen just above the flame.**

Plate 2: Excavated land surface in Olushosun being filled with wastes.

Plate 3: **Residential properties can be seen just behind the Abule-Egba landfill site.**

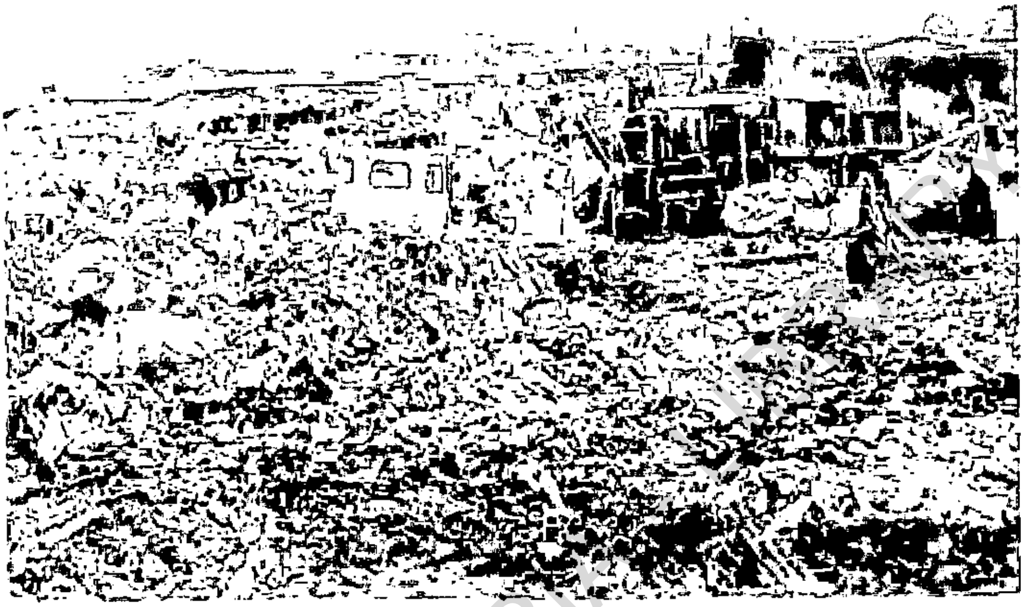

Plate 4: **Residential properties in close proximity to the Olushosun land fill site.**

4.5 Conclusion

This chapter discussed the characteristics of the study area and an examination of the locational characteristics and management of Olushosun and Abule-Egba landfill sites. The study area (Lagos metropolis) as discussed has witnessed tremendous growth in terms of population growth and areal expansion with the attendant environmental and social problems among others. Prominent among the environmental problems are the problems of waste management. The increasing rate of waste generated in the metropolis has called for the construction of landfills to handle the final disposal in an environmentally benign manner. As a result of urban encroachment, the location of these landfills has become more or less inappropriate. They are now within residential neighbourhoods.

The findings reveal that landfills within the metropolis are not well managed and they do not conform to international standards of landfill operations. The non-compliance results to the proliferation of insects and rodents, allow blowing of litter and causes odour and the general environmental degradation associated with refuse dumps.

CHAPTER FIVE

IMPACT OF LANDFILLS ON THE DETERMINATION OF NEIGHBOURHOOD QUALITY

5.0 Introduction

The analysis presented in this section continues the line of research which has associated residents' perception of neighbourhood quality with their perception of prominent land use hazards. The major question here is that to what extent is the location of the landfills associated with residents rating of their neighbourhood? But first the chapter discusses the socio-economic characteristics of respondents and the respondents' level of awareness of location and environmental problems caused by landfills. Then, it measures the impact of landfills on the perception of neighbourhood quality.

5.1 Socio-Economic Characteristics of Respondents

Socio-economic characteristics are associated with people's perception of impact of facilities (Campbell *et al* 1976; McClelland *et al*, 1990). Therefore in this study, a number of socio-economic variables of the respondents were examined. They are; age of household heads, marital status, income, number of persons in the household, education, occupation, length of stay in the area and in the house, type of building occupied by household, and the tenural status of the household (owner occupier or rented), among others. Educational achievement was particularly important as a surrogate for income, or socio-economic status (Greenberg *et al*, 1996). Apart from using these variables to provide a general profile of the respondents, they were also used as independent variables in some of the statistical analyses in the study.

In an attempt to explain that socio economic variables vary among the different zones in the two locations, the degree to which the surveyed data tend to spread about an average value was first examined through the use of mean and the standard deviation. These variables are; age, length of stay in the house and in the area and number of persons in the households. All other variables were analysed through the use of frequencies to describe the spatial variation of the sample size in all the zones.

Table 5.1 shows that the mean age of the household heads was 44.94 and 45.20 in Olushosun and Abule Egba respectively. However there are variations across the zones. This indicates that almost all the respondents were adults who could speak authoritatively on behalf of their family members. Furthermore, the mean number of persons in the household was 5.62 and 6.40 respectively for the two locations. This indicates that the households in the study area are fairly large and considering the fact that most of the houses in the study area are rooming apartments. The implication of this for impact studies is that more people are exposed or are at a risk of suffering from negative impact generated by the landfill. In severe cases, if there are contagious diseases emanating from the operation of the landfill, more people will be vulnerable in households that have more persons in them and this situation may aid the rapid spread of such diseases.

The length of stay in an area is important for two reasons in impact study. Firstly, the longer the duration of exposure to the facility by an individual, the higher the impact suffered. Secondly, the duration of exposure will influence perception of individuals about the impact experienced from the location and operation of the facility. The mean of this variable (length of stay) for the locations were 7.19 and 7.65 years respectively for the two locations. The analysis reveals there are no much difference in this variable among the different zones as shown in table 5.1. Except in Olushosun zone three where the value is slightly lower than the values for the two other zones.

Table 5.1: Mean Values of Socio-Economic Survey of the Study Area

	OLUSOSHUN								ABULE-EGBA							
[illegible]	*Zone 1*		*Zone 2*		*Zone 3*		*Total*		*Zone 1*		*Zone 2*		*Zone 3*		*Total*	
[illegible]s	*No*	*SD*	*No*	*SD*	*No*	*SD*	No	SD	*No*	*SD*	*No*	*SD*	*No*	*SD*	*No*	[illegible]
	46.45	14.02	46.42	13.94	41.93	12.76	44.94	13.69	45.91	13.73	45.77	12.70	43.61	11.83	45.20	12.
A	7.48	5.91	7.75	6.29	6.29	4.93	7.19	5.77	8.39	6.57	7.27	6.65	7.01	5.18	7.65	6.
SE	7.67	6.32	7.84	6.92	5.98	4.98	7.18	6.19	7.94	6.73	6.17	6.38	6.44	4.95	6.98	6.
LD	5.86	3.37	5.54	3.37	4.53	2.93	5.62	3.11	6.20	3.52	5.94	3.36	6.29	3.30	6.40	3.

Source: Author's Analysis

LAREA = Length of stay in the area

LHOUSE = Length of stay in the house

AGE = Age of head of household

NNHOLD = Number of persons in the household

5.1.1 Sex of Respondents

Table 5.2 shows that males constitute the highest proportion of the total number of respondents in all the zones. The reason for this is that heads of households were the main targets of the interviewers. In most households within the study area, males were found to be the household head. Only in few households (22.0% and 17.0% for Olushosun and Abule Egba respectively) were females heads of households.

Table 5.2: Sex of Respondents

	OLUSHOSUN								ABULE-EGBA							
	Zone 1		*Zone 2*		*Zone 3*		*Total*		*Zone 1*		*Zone 2*		*Zone 3*		*Total*	
	No	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*
Male	*122*	*25.0*	*130*	*26.6*	*129*	*26.4*	*138*	*78*	*151*	*34.2*	*105*	*23.8*	*111*	*25.1*	*367*	*83.1*
Female	*36*	*7.4*	*40*	*8.2*	*31*	*6.4*	*107*	*22*	*29*	*6.6*	*24*	*5.4*	*22*	*5.0*	*75*	*16.9*
Total	*158*	*32.4*	*170*	*34.8*	*160*	*32.8*	*488*	*100*	*180*	*40.7*	*129*	*29.2*	*133*	*30.1*	*442*	*100*

Source: Author's Analysis

5.1.2 Level of Education of Respondents

Those with higher education constitute more than half of the total number of respondents in all the zones in the two locations. For instance in Olushosun, those with secondary education and above constitute 83.3% of the total number of respondents. For Abule-Egba it is 79%. The reason for this is that the level of literacy in urban areas in Nigeria is higher than that of rural areas. Specifically, literacy level is highest in Lagos compared to any other urban areas in Nigeria (Odumosu, 1999). This high level of literacy is considered as being good for this type of study considering the fact that knowledge plays a significant role in perception studies (see section 2.1.1). As seen from Figure 5.1, the educational attainment of heads of households is slightly higher in Olushosun than Abule-Egba.

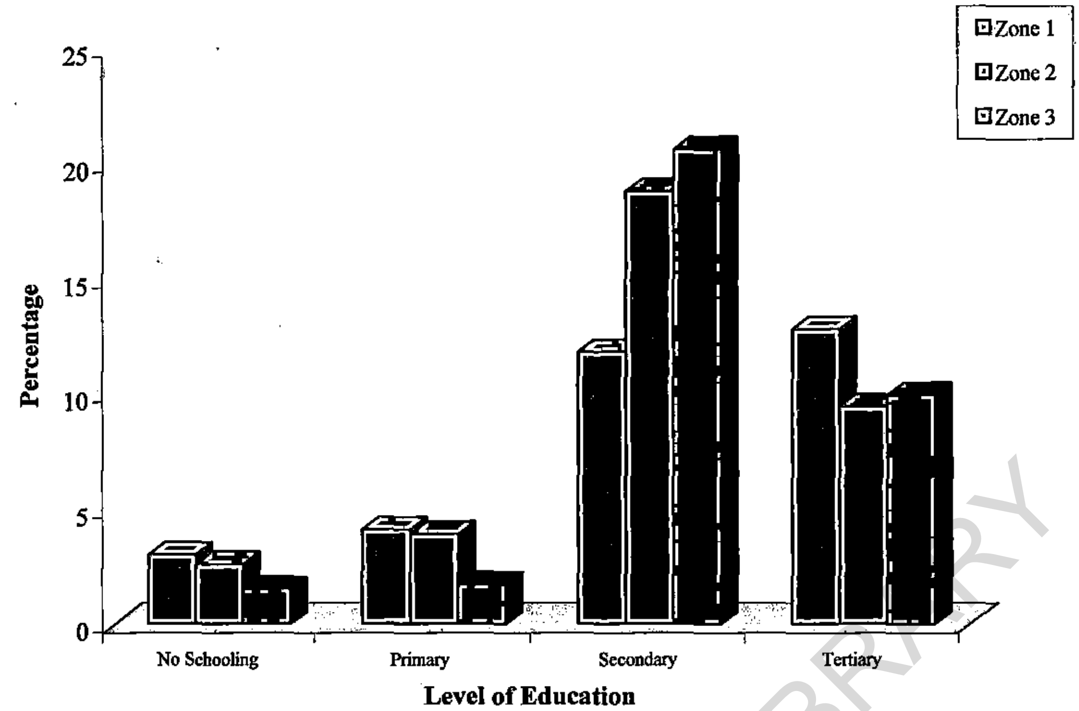

Fig. 5.1a: Education of Respondents (Olushosun)

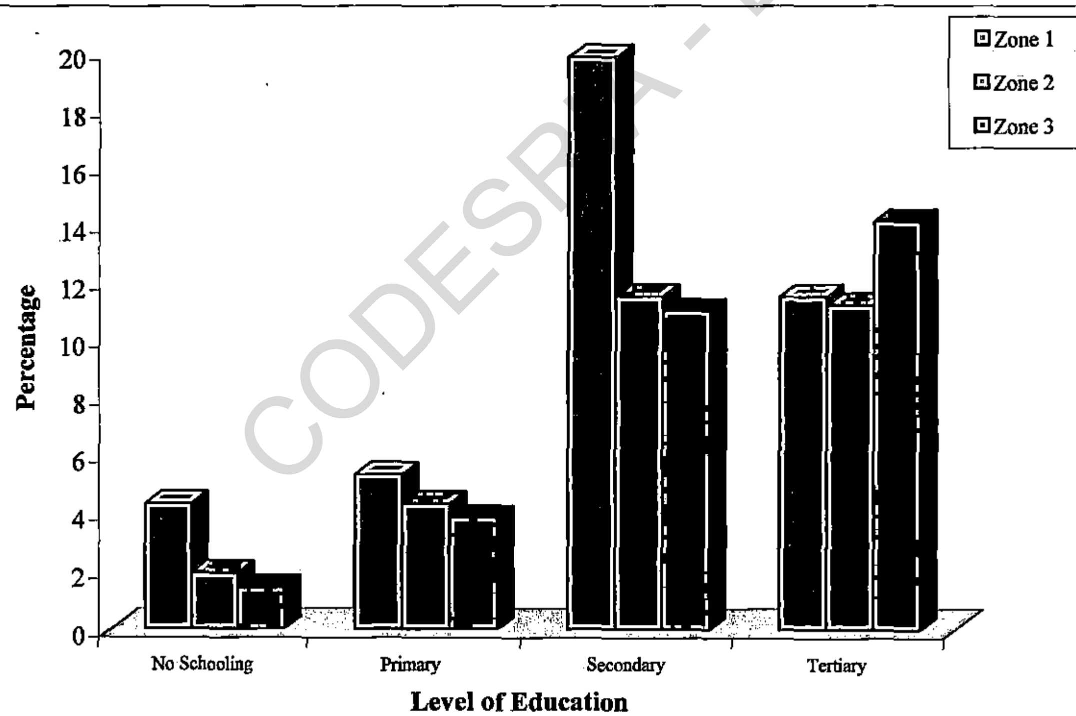

Fig. 5.1b: Education of Respondents (Abule-Egba)

5.1.3 Occupation of Respondents

The occupation of respondents in table 5.3 indicates that there is no much difference in the proportion of respondents engaged in different types of occupation in the two locations. But generally, close to half of the respondents were civil servants (47.9% and 49.4% in Olushosun and Abule-Egba respectively).

Table 5.3: Occupation of Respondents

Occupation	OLUSHOSUN							
	Zone 1		*Zone 2*		*Zone 3*		*Total*	
	No	*%*	*No*	*%*	*No*	*%*	*No*	*%*
Artisans	*12*	*2.6*	*6*	*1.3*	*3*	*0.7*	*21*	*4.6*
Traders	*35*	*7.6*	*45*	*9.8*	*22*	*4.8*	*102*	*22.2*
Civil servants	*78*	*16.9*	*68*	*14.7*	*75*	*16.3*	*221*	*47.9*
Professional/BE	*13*	*2.8*	*24*	*5.2*	*30*	*6.5*	*67*	*14.5*
Pensioners/others	*15*	*3.3*	*16*	*3.5*	*19*	*4.1*	*50*	*10.01*
Total	*153*	*33.2*	*159*	*34.5*	*149*	*32.3*	*461*	*100.0*

Occupation	ABULE-EGBA							
	Zone 1		*Zone 2*		*Zone 3*		*Total*	
	No	*%*	*No*	*%*	*No*	*%*	*No*	
Artisans	*10*	*2.5*	*8*	*2.0*	*13*	*3.2*	*31*	[illegible]
Traders	*51*	*12.6*	*39*	*9.6*	*30*	*7.4*	*120*	[illegible]
Civil servants	*59*	*14.5*	*45*	*11.1*	*42*	*10.4*	*146*	[illegible]
Professional/BE	*19*	*4.7*	*16*	*4.0*	*27*	*6.7*	*62*	[illegible]
Pensioners/others	*24*	*5.9*	*14*	*3.4*	*8*	*2.0*	*46*	[illegible]
Total	*163*	*40.2*	*122*	*30.1*	*120*	*29.3*	*405*	[illegible]

Source: Author's Analysis

This was followed by the traders (22.1% and 29.6% respectively). Artisans account for 7.6% and 7.7% respectively.

5.1.4 Income of Respondents

Analysis of income of the respondents shows that most of the households' heads in all the zones are middle-income earners. About half of the respondents earn between N50,000 and N150,000 annually. This result is not surprising considering the fact that more than two-third of the respondents reside in low to middle income residential areas which are of course one of the attributes of the location of the landfills in the concerned neighbourhood. Table 5.4 shows the income distribution of the respondents

Table 5.4: Income of Respondents

Income	OLUSOSHUN								ABULE-EGBA							
	Zone 1		*Zone 2*		*Zone 3*		*Total*		*Zone 1*		*Zone 2*		*Zone 3*		*Total*	
	No	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*
≤ N30,000	32	8.1	23	5.8	16	4.1	71	18	31	8.2	14	3.7	18	4.7	63	16.6
N30,001-N50.000	14	3.6	16	4.1	13	3.3	43	11	24	6.3	27	7.1	30	7.9	81	21.3
N50,001-N70,000	12	3.0	18	4.6	17	4.3	47	11.9	25	6.6	23	6.1	30	7.9	78	20.6
N80,001-N100,000	24	6.1	18	4.6	25	6.3	67	17	13	3.4	12	3.2	10	2.6	35	9.2
N100,001-N150,000	27	6.9	21	5.3	38	9.6	86	21.8	19	5.0	17	4.5	7	1.8	43	11.3
N150,001-N200.000	3	0.8	7	1.8	18	4.6	28	7.2	17	4.5	14	3.7	5	1.3	36	9.5
>N200,000	17	4.2	19	4.8	16	4.1	52	13.1	21	5.6	7	1.8	15	4.0	43	11.4
Total	139	32.7	122	31.0	143	36.3	394	100.0	150	39.6	114	30.1	115	30.3	379	100.0

Source: Author's Analysis

There is however no much difference in the proportion of respondents in income groups among the various zones. But whereas the middle to high-income earners constitute about 59.1% of the heads of households in Olushosun, it is only 41.3% in Abule-Egba. The reverse is also the case. That is, we have more low-income earners in Abule-Egba than in Olushosun. It would be recalled that educational attainment is higher among heads of households in Olushosun than in Abule-Egba (see 5.1.2). Since education and occupation are important measures of socio-economic status, it can therefore be inferred that the socio-economic status of respondents in Olushosun is higher than those of Abule-Egba.

5.1.5 Marital Status of Respondents

Result of the analysis shows that more than half of the respondents in the two sites were married (70.3% and 80.8% respectively). The large number of married respondents is understandable considering of the fact that we were interested in heads of households. Only in few instances where the head of household was not available for interview that his or her representative, usually an adult in the household was interviewed. The analysis revealed that like most other socio-economic characteristics discussed above, there is no much variation in marital status in the various zones.

Table 5.5: Marital Status Respondents

Marital Status	OLUSOSHUN								ABULE-EGBA							
	Zone 1		*Zone 2*		*Zone 3*		*Total*		*Zone 1*		*Zone 2*		*Zone 3*		*Total*	
	No	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*
Single	*29*	*5.9*	*16*	*3.3*	*15*	*3.1*	*50*	*12.3*	*13*	*2.9*	*10*	*2.3*	*3*	*0.7*	*26*	*5.9*
Married	*106*	*21.7*	*116*	*23.8*	*121*	*24.8*	*343*	*70.3*	*143*	*32.4*	*99*	*22.4*	*115*	*26.0*	*357*	*80.8*
Divorced	*8*	*1.6*	*11*	*2.3*	*5*	*1.0*	*24*	*4.9*	*5*	*1.1*	*10*	*2.3*	*3*	*0.7*	*18*	*4.1*
Others	*15*	*3.1*	*27*	*5.5*	*19*	*3.9*	*61*	*12.5*	*19*	*4.3*	*10*	*2.2*	*12*	*2.7*	*41*	*9.2*
Total	*158*	*32.4*	*170*	*34.8*	*160*	*32.8*	*478*	*100*	*180*	*40.7*	*129*	*29.2*	*133*	*30.1*	*442*	*100.0*

Source: Author's Analysis

5.1.6 Age of Respondents

As indicated earlier, all the respondents are adults as shown by the their mean age. However, the distribution of respondents in various age groups is shown in Figure 5.2. One fact that immediately becomes in the figure is that more than 90% of the respondents were aged 30 years and above in the two locations. For instance, those who are 30 years and below were only 16.7% for Olushosun and 9.6% for Abule-Egba.

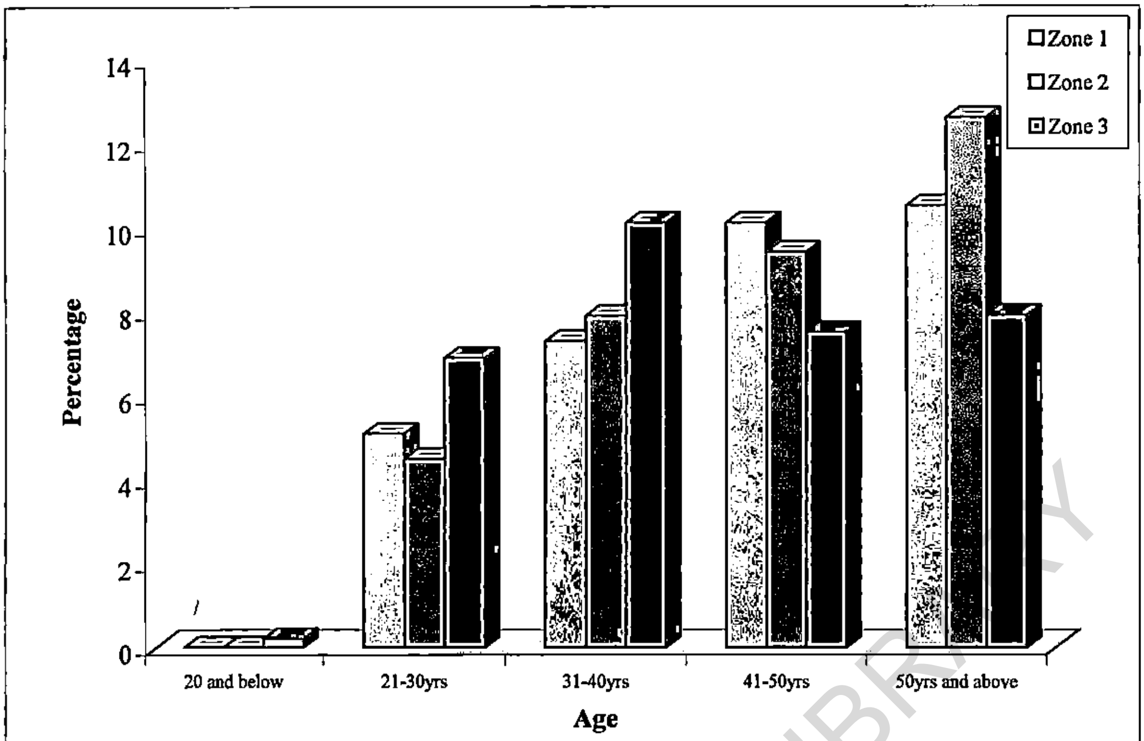

Fig. 5.2a: Age of Respondents (Olushosun)

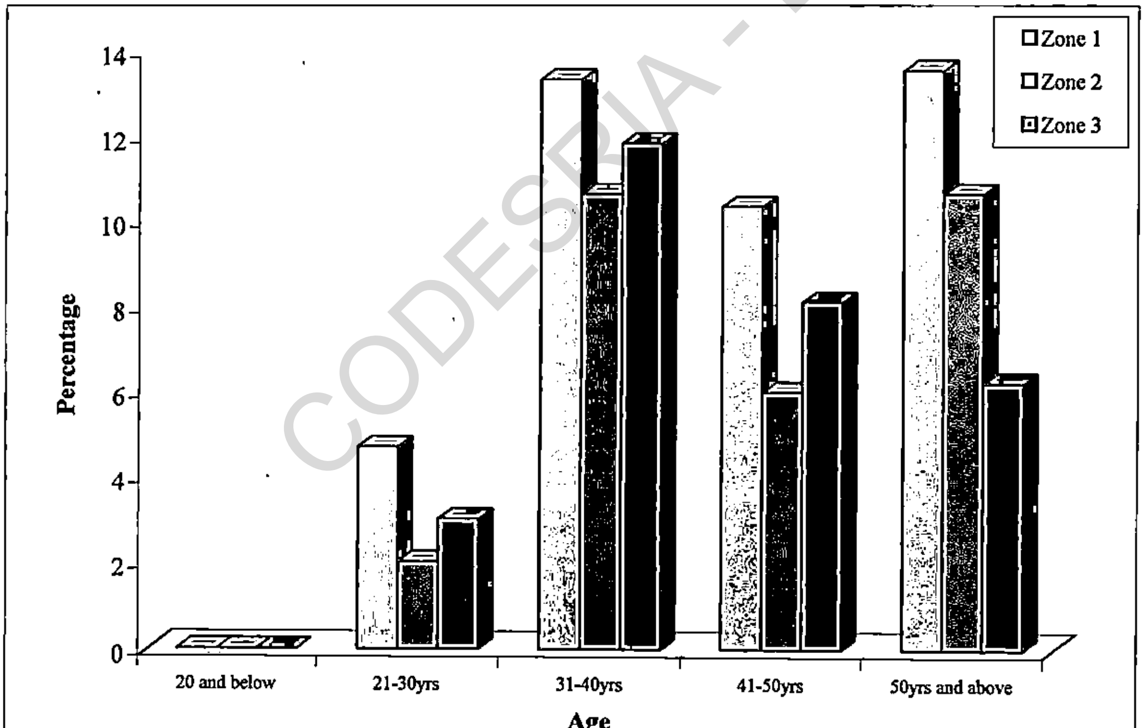

Fig. 5.2b: Age of Respondents (Abule-Egba)

5.1.7 Tenural Status of Respondents

Close to two-thirds of the total number of respondents were tenants in Olushosun. For Abule-Egba it was lower. As shown in Figure 5.3, 68.9% were tenants in Olushosun while in Abule-Egba, it was 56.8%. This implies that there were more home owners in Abule-Egba than in Olushosun. This result is not surprising considering the fact that Abule-Egba are the among the new growth axis within the Lagos metropolis. The variation in tenural status is not really much except in Abule-Egba zone 1 where we have 20.8% home owners. This figure almost equals the total for the two other zones in this location.

The large number of renters in the two locations has some implications for impact study. First it reduces community cohesion in the sense that local attachment will be low. In situations where we have a facility that generate impact, renters find it easier to relocate to other locations that are risk free than homeowners. Secondly, the willingness to pay for environmental quality (contingent valuation) in areas that host locally unwanted landuses (LULUs) have been found to be lower among renters than home owners in many studies.

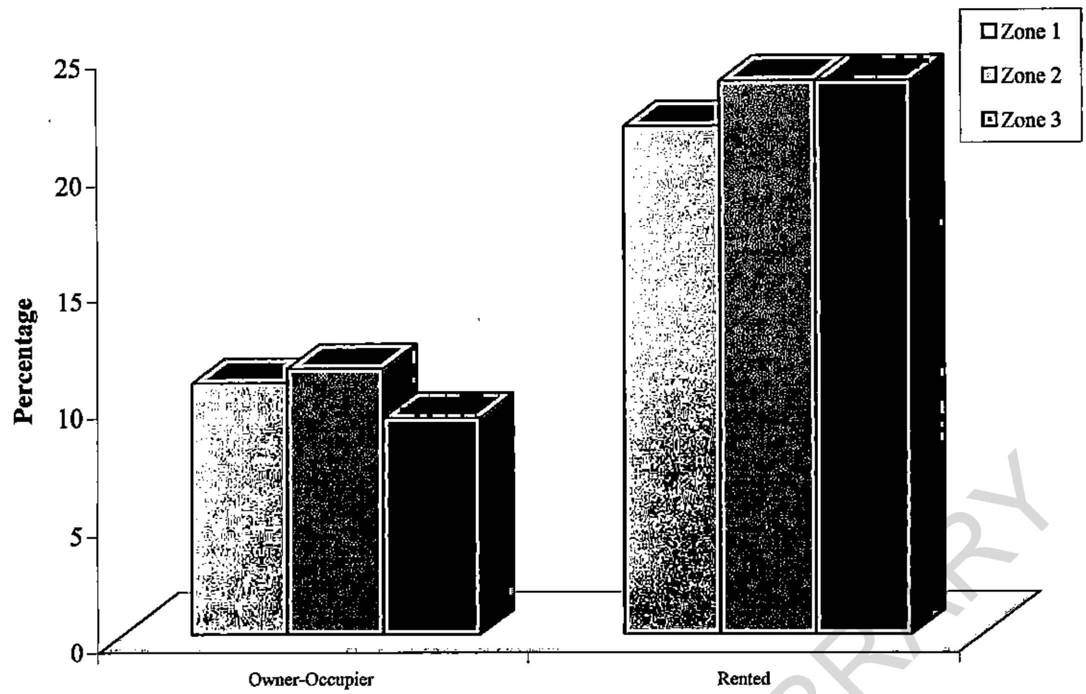

Fig. 5.3a: Tenural Status of Respondents (Olushosun)

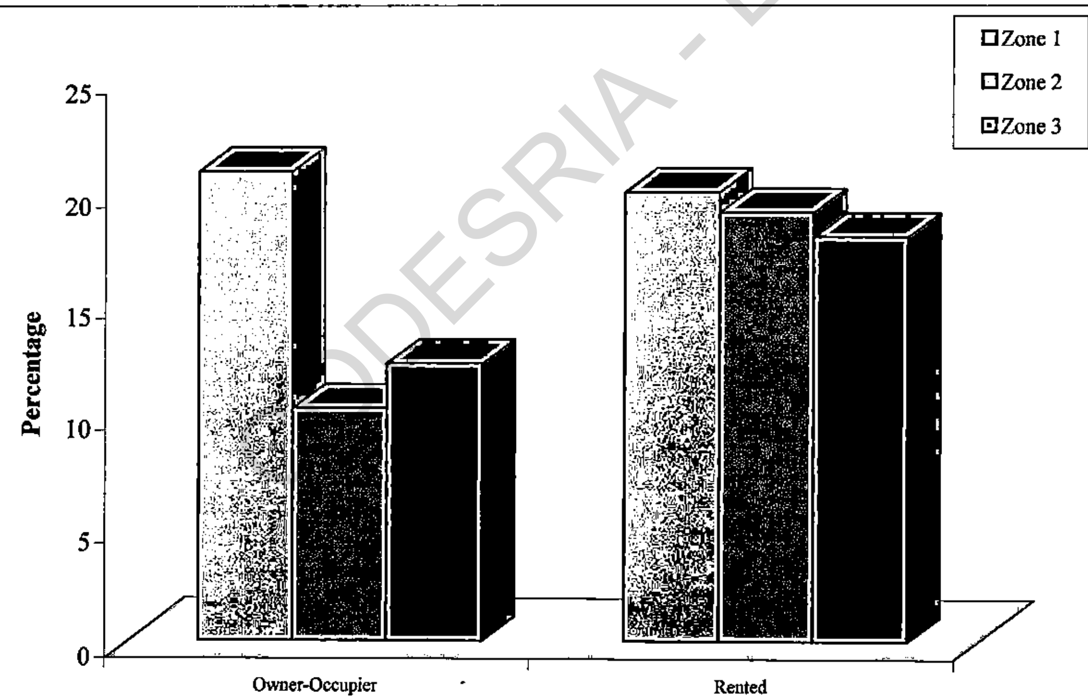

Fig. 5.3b: Tenural Status of Respondents (Abule-Egba)

5.1.8 Type of House Occupied by Respondents

The type of house occupied by individuals is a reflection of his or her socio-economic status. Those with high socio-economic status usually reside in duplexes and self-contained bungalows etc. On the other hand, people of low socio-economic status reside usually in rooming apartment. The research therefore sought to know the type of house occupied by the respondents. Considering the fact that the two locations of study are mostly low to medium income residential areas with few pockets of high-income earners, most of the respondents live in rooming apartments. The analysis of the type of house occupied by the respondents is presented in Figure 5.4. For Olushosun, the proportion of respondents living in rooming apartments were more than half (51%) while for Abule-Egba, it was 45.7%. Again, there is no much difference in the proportion of respondents occupying different types of houses among the zones.

The analysis of the socio-economic characteristics of respondents presented above revealed that there are variations in the various zones and between the two landfill sites. Thus as would be seen in the following sections and subsequent chapters, these characteristics affect the ways the respondents perceive the impacts of the landfills.

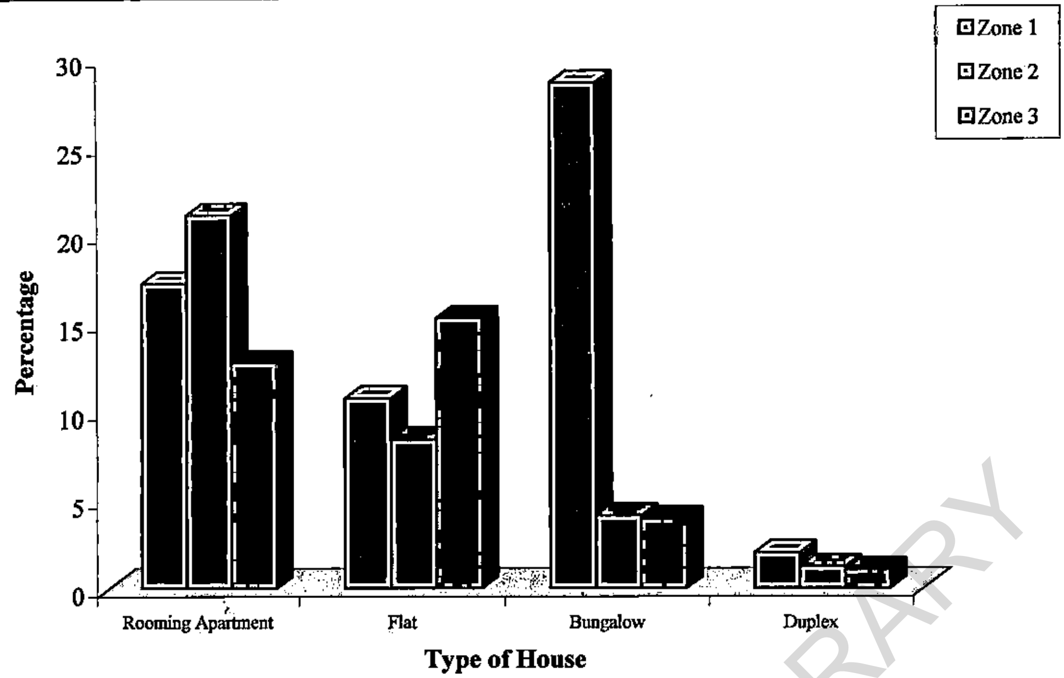

Fig. 5.4a: Type of House Occupied by Respondents (Olushosun)

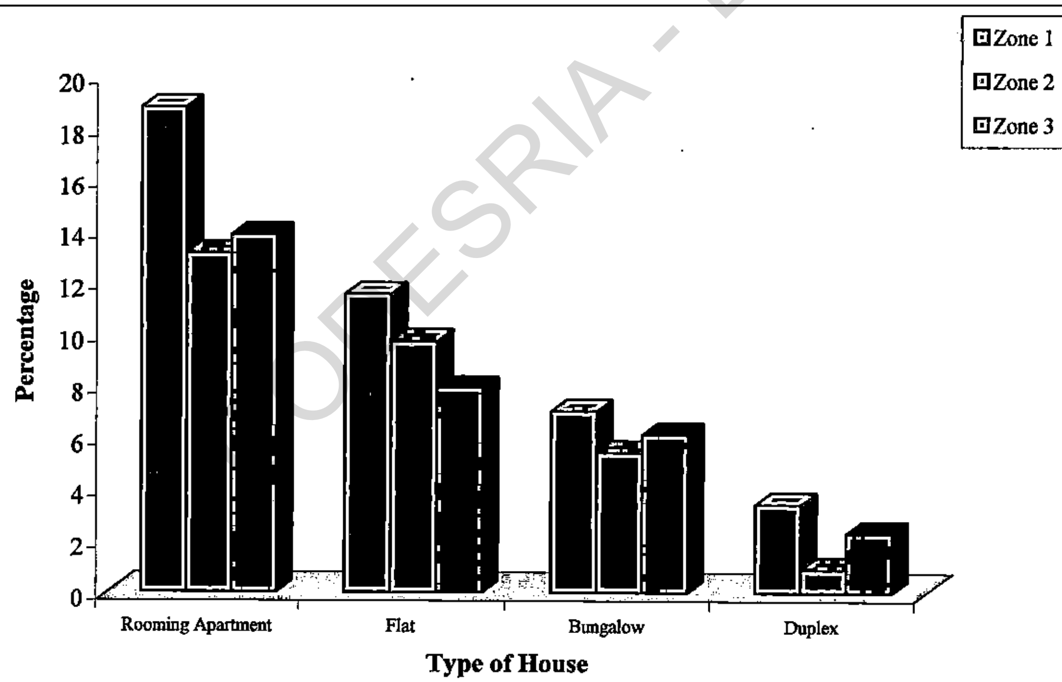

Fig. 5.4b: Type of House Occupied by Respondents (Abule-Egba)

5.2 Awareness of Location and Environmental Problems Caused by Landfill

5.2.1 Perception of Location of the Landfills

Knowledge about hazards plays a central role in perception research. In other words, knowledge affects risks perception. According to Johnson (1996), research on knowledge and risk perception aims at evaluating public grasp of facts about nature of facilities and their effects on attitudes towards environmental hazards or contaminants.

Respondents were asked whether they moved into their present area before or after the landfill was sited. The result of the analysis shows that about one-third of the total number of respondents in both locations (32.9%) moved in after the landfill was sited (37.6% and 28.2% in Olushosun and Abule-Egba respectively). Respondents were then asked about their perception of the location of the landfill. Their responses are as presented in Table 5.6

Table 5.6: Perception of the Location of Landfill

	OLUSHOSUN								ABULE-EGBA							
	Zone 1		*Zone 2*		*Zone 3*		*Total*		*Zone 1*		*Zone 2*		*Zone 3*		*Total*	
	No	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*
A blessing	33	6.77	20	4.10	14	2.87	67	13.7	34	7.69	19	4.30	18	4.07	71	16.06
A curse	24	4.91	33	6.76	21	4.30	78	15.97	25	5.62	31	7.61	34	7.69	90	20.32
A nuisance	118	24.18	107	21.93	96	19.67	321	65.78	106	23.98	61	13.80	73	16.52	240	54.35
NR	5	1.02	10	2.05	7	1.4	22	4.51	15	3.39	18	4.07	8	1.81	41	9.27
Total	180	36.87	170	34.84	138	28.27	488	100.0	180	40.68	129	29.18	133	30.09	442	100.0

Source: Author's Analysis

From the Table, negative attitude to the location of the landfill is highest in zone 1 which is closed to the landfill in the two sites. For instance, 24.18% of the respondents in Olushosun site see the location of the landfill as constituting nuisance in zone 1 compared to 21.93% and 19.67% in zones 2 and 3 respectively. In Abule-Egba landfill site, on the other hand, largest percentage of the respondents (23.98%) also see the location of the landfill as constituting nuisance. Again, this percentage is higher in zone 1 than the other two zones farther away from the landfill (13.8% and 16.5% for zones 2 and 3 respectively). The reason for this result, which is not unexpected, is the fact that those living closer to the landfills are bound to experience the negative externalities from the landfills more than those living farther away.

5.2.2 Impact of Landfills on Residents' Relocation

Often, it has been observed that the location of noxious facilities could engender the movement of people from such area where they are located. Therefore the research sought to know the number of tenants that have changed residence within the past three years and see whether the presence of the landfill is associated with their change of residence. The result of this analysis is presented in the Tables 5.7 and 5.8.

Table 5.7: Number of Tenants that have Changed Residence

	OLUSHOSUN			ABULE-EGBA		
	Zone 1	*Zone 2*	*Zone 3*	*Zone 1*	*Zone 2*	*Zone 3*
Mean	*3.57*	*2.85*	*3.12*	*3.63*	*3.05*	*3.04*
S.D	*2.46*	*1.57*	*1.87*	*2.22*	*1.88*	*1.87*

Source: Author's Analysis

It is clear from table 5.7 that the highest numbers of respondents that have changed residence in the past three years are in zone 1 of the two landfill sites (3.57 and 3.63 in Olushosun and Abule-Egba respectively). It would however be misleading to conclude that the movements are due to the negative impacts of the landfills. Therefore the respondents were specifically asked the reasons for the change of residence by those tenants or members of their households concerned. Their responses are presented in Table 5.8.

Table 5.8: Reasons for Change

	OLUSOSHUN								ABULE-EGBA							
	Zone 1		*Zone 2*		*Zone 3*		*Total*		*Zone 1*		*Zone 2*		*Zone 3*		*Total*	
Reasons	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	
Increase in income	11	3.70	13	4.38	12	4.04	36	12.12	9	3.63	23	9.28	9	3.63	41	16..
Increase in rent	24	8.08	32	10.78	49	16.49	105	35.35	23	9.27	16	6.45	31	12.5	70	28..
Landfill menace	43	14.48	40	13.47	51	17.17	134	45.12	43	17.33	24	9.68	29	11 69	96	38
No Response	5	1.68	10	3.37	7	2.36	22	7.41	14	6.05	18	7.26	8	3.23	41	16..
Total	83	27.94	95	31.99	119	40.14	297	100.0	90	36.28	81	32.6	77	31.02	248	10[illegible]

Source: Author's Analysis

The table reveals that more than one third of those who have changed residence in the last three years in the two locations is due to the menace of the landfill (43.12% and 38.7% in Olushosun and Abule-Egba respectively).

5.2.3 Desire to change Residence

Apart from tenants that have changed their residence, the study also sought to know if respondents would want to change their residence if they have the opportunity and sees by how much this desire is associated with the location and operations of the landfills. The result of this is presented in Table 5.9

Table 5.9: Desire to Change Residence

	OLUSHOSUN						ABULE-EGBA					
	Zone 1		*Zone 2*		*Zone 3*		*Zone 1*		*Zone 2*		*Zone 3*	
	No	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*
Definitely no	*30*	*6.1*	*20*	*4.1*	*28*	*5.7*	*47*	*10.6*	*17*	*3.8*	*7*	*1.6*
No	*28*	*5.7*	*50*	*10.2*	*42*	*5.6*	*32*	*7.2*	*30*	*6.8*	*37*	*8.4*
Undecided	*23*	*4.7*	*30*	*8.0*	*23*	*4.7*	*36*	*8.1*	*35*	*7.9*	*27*	*6.1*
Yes	*52*	*10.7*	*35*	*7.2*	*50*	*10.2*	*34*	*7.7*	*36*	*8.1*	*23*	*5.2*
Definitely yes	*25*	*5.1*	*25*	*5.3*	*17*	*3.5*	*31*	*7.0*	*24*	*5.4*	*26*	*5.9*
Total	***158***	***34.2***	***170***	***34.8***	***160***	***32.8***	***180***	***40.7***	***129***	***29.2***	***133***	***30.1***

Source: Author's Analysis

Table 5.9 shows that more than half of the respondents indicate their desire to change their present residence if given the opportunity. It is also clear from the table that the highest proportions of respondents are in zone 1. For instance. 15.8% of the respondents are willing to change their residence in zone 1 compared to 12.5% and 13.7% in zones 2 and 3 respectively in Olushosun, while for Abule-Egba, it is 14.7% in zone 1 and 12.5%, 11.1% in zones 2 and 3 respectively.

5.3 Landfills and the Perception of Environmental Problems

5.3.1 Relationship between Landfills and Environmental problems in the area

The concerns about public health and environmental quality problems and risks associated with landfills have made it nearly impossible to site new landfills in many parts of the world (Lee and Jones-Lee, 1990). According to Arimah and Adinnu (1995), the siting of landfills often creates a wide range of environmental problems. Awareness of the benefits of a healthy environment has increased in a number of African countries over the last decade. This has often led to stiff opposition to proposals to site new landfills which in turn has resulted in the location of facilities in places already densely developed with commercial and residential facilities, or so called "brown fields" in developed countries (USEPA, 1992).

Lack of support for landfill sitting and perception of impact depend largely on the level of awareness of environmental problems caused by landfills. Specifically, the study intended to determine the extent to which respondents associated the location of the landfills to certain environmental problems in the area. The respondents were asked whether they are aware of any environmental problems in their neighbourhood. Their responses are presented in Table 5.10.

Table 5.10: Awareness of Environmental Problems

	OLUSHOSUN						ABULE-EGBA					
Awareness of Environmental problems	*Zone 1*		*Zone 2*		*Zone 3*		*Zone 1*		*Zone 2*		*Zone 3*	
	No	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*
Yes	*91*	*18.6*	*70*	*14.3*	*84*	*17.2*	*83*	*18.8*	*41*	*9.3*	*58*	*13.1*
No	*67*	*13.7*	*100*	*20.5*	*76*	*15.6*	*97*	*21.9*	*88*	*19.9*	*75*	*17.0*
Total	***158***	***32.3***	***170***	***34.8***	***160***	***32.8***	***180***	***40.7***	***129***	***29.2***	***133***	***30.1***

Source: Author's Analysis

The percentage of respondents that are aware of environmental problems is higher in Olushosun site than Abule-Egba (50.2% and 41.2% respectively). This could be due to the fact that respondents from Olushosun are slightly of higher socio-economic status than the respondents in Abule-Egba. This is particularly true since educational status of Olushosun respondents was found to be slightly higher than that for Abule Egba. As discussed earlier, knowledge is important in the perception of environmental hazards. Furthermore, many of the respondents in Olushosun are aware of environmental problems in their neighbourhood (50.2%) as against 49.8% of those who are not aware. However, the reverse is the case in Abule-Egba where those who are not aware of environmental problems are more than those who are aware (58.8% and 41.2% respectively).

Awareness of specific environmental problems in the neighbourhood by respondents is also important in this study. This is to reveal the extent to which the respondents can actually link some of these environmental problems to the presence of the landfills. This was presented as an open ended question for respondents to mention specific environmental problems they are aware of in their neighbourhood. The summary of their responses is presented in the Table 5.10b and Figure 5.5.

Table 5.10b: Environmental Problems in the Neighbourhood

	OLUSHOSUN						ABULE-EGBA					
	Zone 1		*Zone 2*		*Zone 3*		*Zone 1*		*Zone 2*		*Zone 3*	
	No	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*
Waste Problem	*59*	*12.1*	*56*	*11.5*	*58*	*11.9*	*40*	*9.0*	*26*	*5.9*	*34*	*7.7*
Drainage	*34*	*7.0*	*49*	*10.0*	*23*	*4.7*	*47*	*10.6*	*23*	*5.2*	*37*	*8.4*
Rodents, pests, flies	*37*	*7.6*	*21*	*4.3*	*33*	*6.8*	*27*	*6.1*	*12*	*2.7*	*17*	*3.8*
Smoke, odours	*108*	*22.1*	*132*	*27.0*	*104*	*21.3*	*121*	*27.4*	*102*	*23.1*	*89*	*20.1*
Others	*94*	*19.3*	*121*	*24.8*	*92*	*18.9*	*110*	*24.9*	*100*	*22.6*	*81*	*32.8*

Source: Author's Analysis

From the table, smoke and odour constituted the highest percentage of environmental problems mentioned. The percentage responses range between 27.4% in

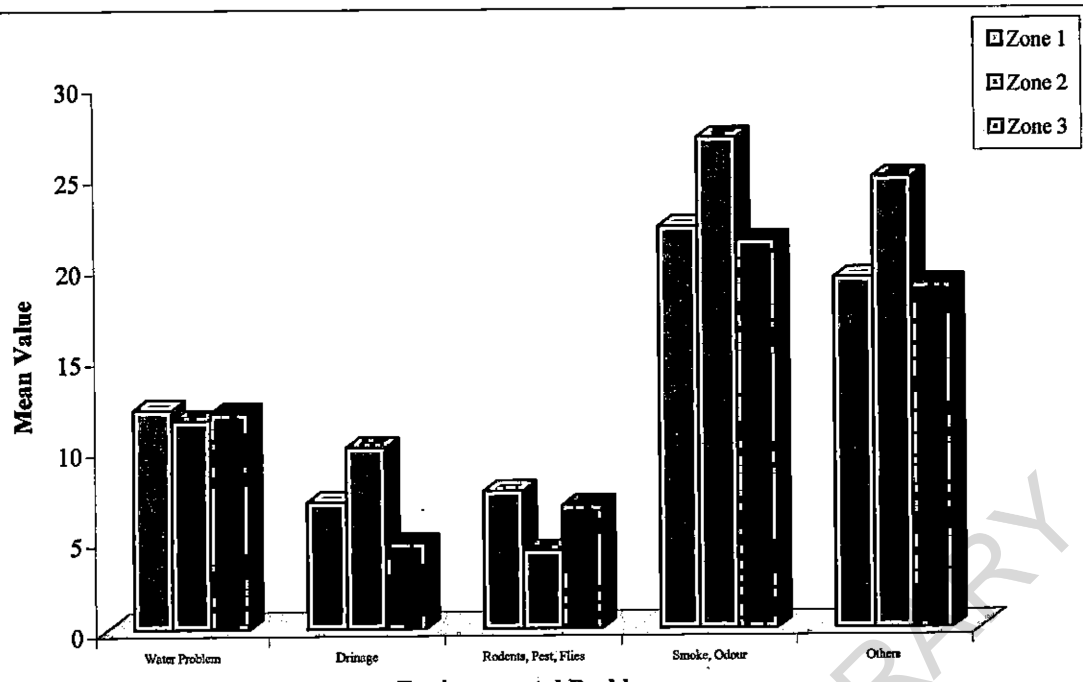

Fig. 5.5a: Environmental Problems in the Neighbourhood (Olushosun)

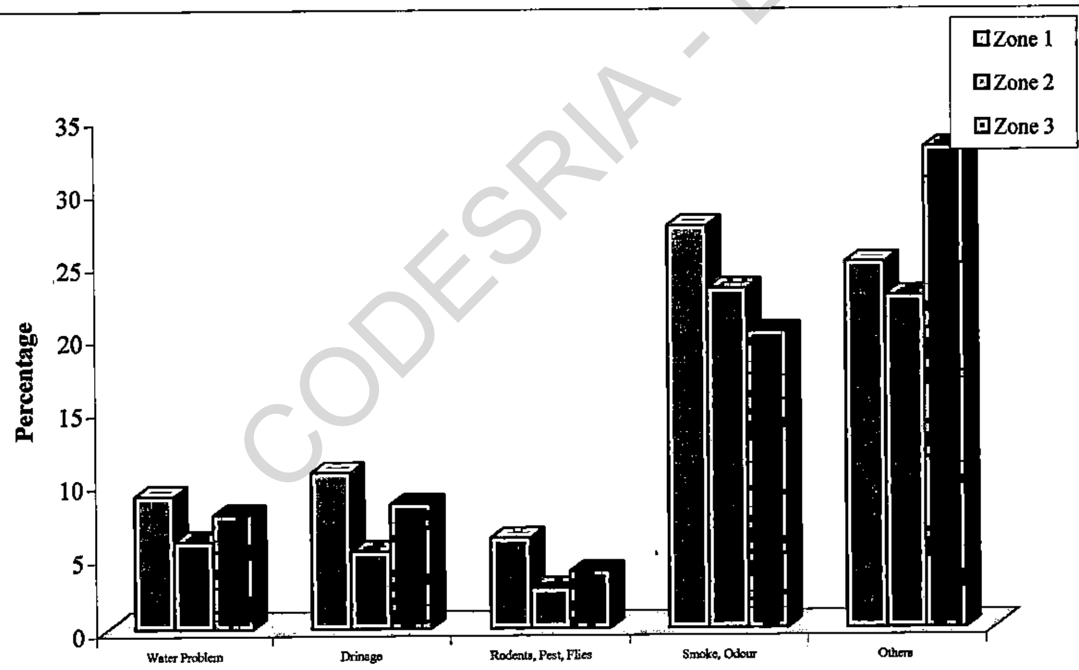

Fig. 5.5b: Environmental Problems in the Neighbourhood (Abule-Egba)

Abule-Egba zone 1 and 20.1% in zone 3. The level of response to problem also showed a steady decrease from zone 1 where it was highest (27.4%) to (20.1%) in zone 3 where it is lowest in Abule-Egba. It can therefore be deduced that those closer to the landfill site experienced this problem the more. For Olushosun however the response to this problem is highest in zone 2 (27%) followed by zone 1 (22%). It can also still be inferred that residents closer to the sites experience these environmental problems more. It will be observed that smoke and odour problems are particularly associated with the location and operation of landfills. Infact, these are some of the major reasons why people have often rejected the location of landfills in their neighbourhood.

Another environmental problem frequently mentioned by the respondents is the presence of flies and pests in the neighbourhood. The frequency of mention of this problem is again highest in zone 1 at both sites (7.6% and 6.1% respectively in Olushosun and Abule-Egba landfill sites). Other environmental problems frequently mentioned by respondents include drainage and waste (especially throwaways) problems

Furthermore, the extent to which the respondents were able to associate these environmental problems with the presence of the landfills was further investigated. Specifically the respondents were asked whether they associate any of the environmental problems they mentioned to the location and operation of the landfills. The summary of their responses is presented in Table 5.11.

Table 5.11: Relationship between Environmental Problems and Location of the Landfills

		OLUSHOSUN						ABULE-EGBA					
		Zone 1		*Zone 2*		*Zone 3*		*Zone 1*		*Zone 2*		*Zone 3*	
		No	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*
Waste Problem	Yes	*43*	*8.8*	*39*	*8.0*	*42*	*8.6*	*35*	*7.9*	*17*	*3.8*	*16*	*3.6*
	No	*115*	*23.6*	*131*	*26.8*	*118*	*24.2*	*145*	*32.8*	*112*	*25.3*	*117*	*26.5*
Drainage	Yes	*28*	*5.7*	*20*	*4.1*	*13*	*2.7*	*24*	*5.4*	*6*	*1.4*	*18*	*4.1*
	No	*130*	*26.6*	*150*	*30.7*	*147*	*30.1*	*156*	*35.3*	*123*	*27.8*	*115*	*26.0*
Rodents Pests	Yes	*126*	*25.8*	*137*	*28.1*	*122*	*25.0*	*139*	*31.4*	*107*	*24.2*	*103*	*23.3*
	No	*32*	*6.6*	*33*	*6.8*	*38*	*7.8*	*41*	*9.3*	*22*	*5.0*	*30*	*6.8*
Smoke, odour	Yes	*113*	*23.2*	*137*	*28.1*	*104*	*21.3*	*120*	*27.1*	*104*	*23.5*	*100*	*22.6*
	No	*45*	*9.2*	*33*	*6.8*	*56*	*11.5*	*60*	*13.6*	*25*	*5.7*	*33*	*7.5*
Others	Yes	*99*	*20.3*	*128*	*26.2*	*94*	*21.3*	*118*	*26.7*	*99*	*22.4*	*88*	*19.9*
	No	*59*	*12.1*	*42*	*6.6*	*66*	*13.5*	*62*	*14.0*	*30*	*6.8*	*45*	*10.2*

Source: Author's Analysis

It is quite clear from Table 5.11 that many of the respondents associated the problems of smoke, odour, rodents and pests with the presence of the landfills in the two locations. The responses to these two categories of environmental problems were higher than the responses to other environmental problems. One can therefore conclude that the level of awareness of environmental problems caused by landfills is higher among residents around the two landfill sites.

The association of the environmental problems with landfills has higher responses among those closer to the landfills in both locations. As discussed earlier, perception of impact depends largely on the level of awareness of problems caused by any given facility. In other ways, knowledge about hazards plays a significant role in the perception of impacts.

5.4 Measurement of Landfill impact on Perception of Neighbourhood Quality

The analysis presented in this section continues research which has associated residents' perception of neighbourhood quality with their perception of prominent land use hazards. The presence of noxious facilities is well known to be associated with the perception of neighbourhood quality (Greenberg *et al,* 1995). According to them these Locally Undesirable Land Uses (LULUs) have been categorized as environmental blights which affect the quality of neighbourhood as well as the health of the residents. Results of previous studies indicated that neighbourhood classified as being of "poor" quality by their residents was perceived as having serious crime and blight problems. Land use and technological hazards were associated with respondents' perceptions that their present neighbourhood was of "fair" quality while residents' perceptions were more negative (worse quality) when neighbourhood had multiple problems than when they had a single physically prominent hazard (Greenberg *et al*, 1995; Greenberg and Schnieder, 1996).

Responses to neighbourhood rating questions indicate the extent to which the landfills have affected attitudes toward the area as a whole. Respondents were asked to rate the quality of their neighbourhood. This is with a view to investigating how the presence of the landfill might be associated with the perception of the quality of their neighbourhood. The responses obtained are presented in Table 5.12.

Table 5.12: Quality of Neighbourhood Rating

	OLUSHOSUN								ABULE-EGBA							
	Zone 1		Zone 2		Zone 3		Total		Zone 1		Zone 2		Zone 3		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
ellent	26	5.80	26	5.80	19	4.25	71	15.85	24	5.80	19	4.59	19	4.59	62	14.98
d	80	17.86	84	18.75	77	18.19	241	54.80	88	21.26	64	15.46	55	13.29	207	50.01
	33	7.37	32	7.14	19	4.24	84	18.75	45	10.87	28	6.78	43	10.39	116	27.89
	12	2.68	6	1.34	25	4.58	43	10.60	13	3.14	7	1.69	9	2.17	29	7
l	**151**	**33.71**	**148**	**33.03**	**140**	**31.25**	**448**	**100**	**170**	**41.07**	**118**	**28.50**	**126**	**30.44**	**414**	**100.0**

Source: Author's Analysis

Many of the respondents perceived the quality of their neighbourhood as either being good or fair. The responses in these two categories are higher than those who perceived their environment as being poor. For instance those who perceive their environment as being good are on the average 15% in all the zones in Olushosun and Abule-Egba. On the other hand, those who view their neighbourhood as being poor constitute the lowest percentage of responses. Their percentage is as low as 1.34% in Olushosun zone 2. The reason for this response would not be unconnected with the fact people, especially in Nigeria urban areas, often shy away from discussing factual issues about their living conditions to others. It is therefore not surprising that even when certain environmental problems are quite visible to the researcher, the respondents would insist that their neighbourhood is good. The respondents, it was observed would only be willing

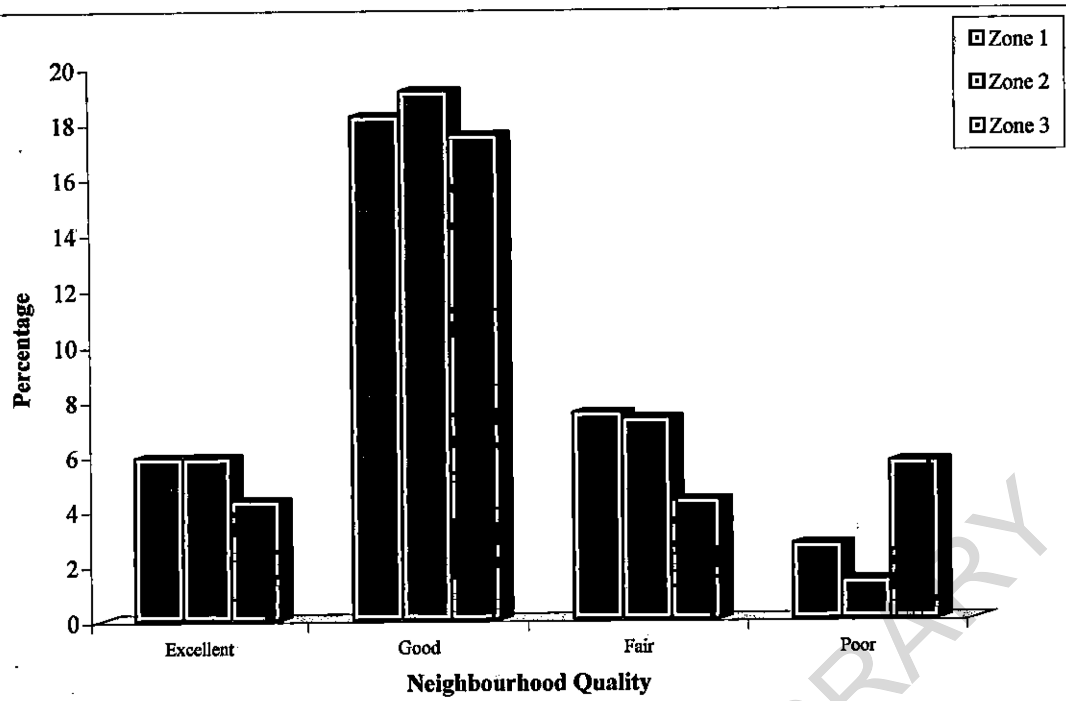

Fig. 5.6a: Rating of Neighbourhood Quality (Olushosun)

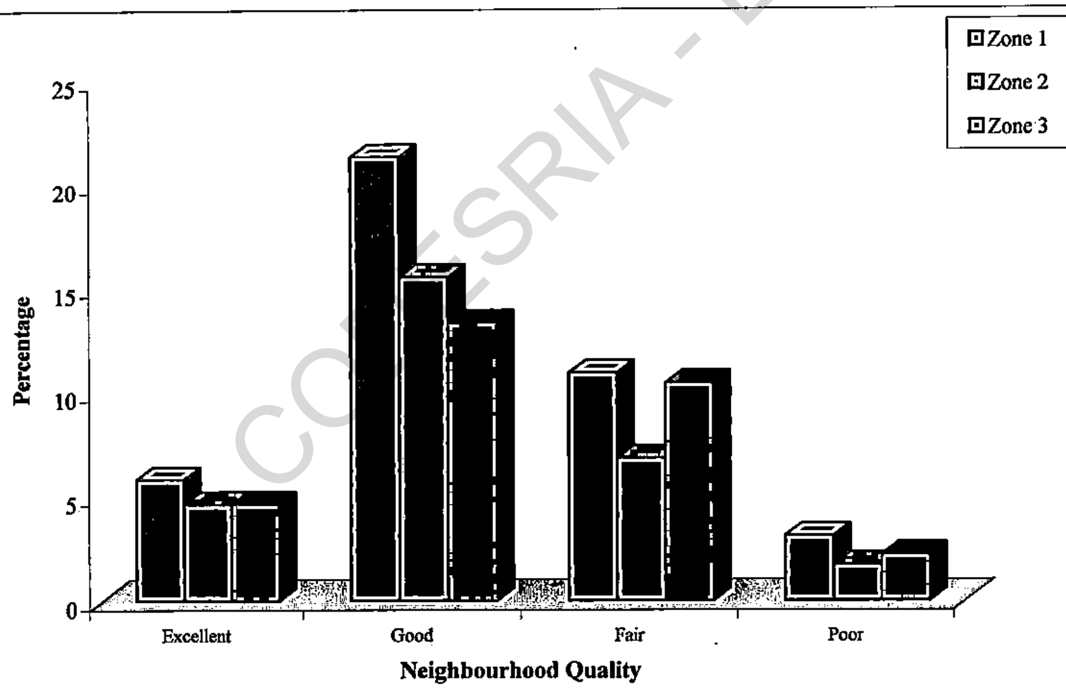

Fig. 5.6b: Rating of Neighbourhood Quality (Abule-Egba)

to divulge the true situation of their living conditions if there is a promise of government intervention in neighbourhood renewal.

Regression analysis was used to determine how socio-economic characteristics of the respondents affect the rating of neighbourhood quality. The basis for this analysis is to examine the extent to which the socio-economic characteristics of respondents as well as some environmental/neighbourhood attributes will affect the rating of neighbourhood quality. In most cases, people with higher education and income stay in better houses and are attracted to good neighbourhoods. Therefore such people often perceive their neighbourhood as being good. Furthermore, people of their status are likely to be more sensitive to environmental hazards in their neighbourhood. There is however the need for empirical verification of these assertions, given the fact that each urban area has it's own social peculiarities and environmental problems. In the case of the neighbourhoods under consideration, the presence of landfills constitute environmental and health hazards.

The variables used for the simple linear regression analysis are presented in Table 5.13.

Table 5.13: Variable list Description of Landfill Impact on the Perception of Neighbourhood Quality

Variable	Description
RATEN	Rating of neighbourhood
DFILL	Distance to landfill
THOUSE	Type of house
EDUC	Level of education
AGE	Age of respondent
INCOME	Income of respondent
LAREA	Length of stay in the area
ROAD	Condition of the road 1 – if the adjoining road is good*
SRESID	Status of residence
REFUSE	Frequency of refuse collection 1 – if garbage is collected frequently*
CRIME	Crime rate in the neighbourhood 1 – if crime rate is high

• otherwise zero

The results of the multiple correlation analysis between the dependent variable (RATEN) and all the independent variables are presented in Table 5.14

As revealed Table 5.14, there is generally low correlation between neighbourhood rating and the independent variables used for the regression analysis. However, the result shows that there is a positive relationship between quality of neighbourhood rating (RATEN) and distance to the landfill (DFILL) (0.072 and .025 respectively for Olushosun and Abule Egba landfill sites). This implies that distance away from the landfills has a positive effect on the perception of neighbourhood quality. This relationship is not as high as expected and this could be due to some of the factors mentioned earlier. One interesting fact that also emerged from the table is the fact there is

Table 5.14 : Zero Order correlation between RATEN and the independent variables

Olushosun

	RATEN	DFILL	THOUSE	LAREA	EDUC	INCOME	SRESID	REFUSE	CRIME	ROAD
RATEN	1.000	.072	.012	-.048	.017	-.018	-.034	.082	-.035	.164**
DFILL		1.000	.060	-.083	.033	.132**	.042	-.036	.118**	-.151**
THOUSE			1.000	.018	-.004	-.008	-.276**	-.107	.010	-.028
LAREA				1.000	.000	.045	-.375**	.011	-.017	.079
EDUC					1.000	.114*	.000	.004	-.009	.012
INCOME						1.000	-.051	-.112*	-.008	.041
SRESID							1.000	.082	.081	-.086
REFUSE								1.000	.150**	.161**
CRIME									1.000	.000
ROAD										1.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Abule-Egba

	RATEN	DFILL	THOUSE	LAREA	EDUC	INCOME	SRESID	REFUSE	CRIME	ROAD
RATEN	1.000	.025	.081	-.118*	..053	.100	.062	.206**	.081	.149**
DFILL		1.000	.004	-.095	.142**	-.080	.097*	-.076	-.042	-.032
THOUSE			1.000	.037	.045	.049	-.188**	.084	.056	.103*
LAREA				1.000	-.057	-.039	-.141**	-.024	-.052	.000
EDUC					1.000	.300**	.128**	.045	-.061	.068
INCOME						1.000	.093	.026	-.086	-.035
SRESID							1.000	.091	.099*	-.070
REFUSE								1.000	.245**	.115*
CRIME									1.000	.135**
ROAD										1.000

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

negative correlation between length of stay in the area (LAREA) and DFILL for both sites (-.048 and -.118 for Olushosun and Abule Egba respectively). The implication of this is that the longer the length of stay in the area, the less likely respondents will perceive the quality of their neighbourhood as being bad. Again, this relationship is not as strong as expected for this result to be taken seriously.

The regression equation is specified as follows:

$$\text{RATEN}(Y) = b_0 + b_1\,(\text{DFILL}) + b_2\,(\text{THOUSE}) + b_3(\text{EDU}) + b_4\,(\text{AGE}) + b_5\,(\text{INCOME}) + b_6(\text{LAREA}) + b_7(\text{ROAD}) + b_8(\text{SRESID}) + b_9(\text{REFUSE}) + b_{10}\,(\text{CRIME}).$$

The results of the analysis for the model shows that the Regression values (R) for the two sites are not as high as expected (R = 0.332 and 0.350 for Olushosun and Abule Egba respectively). Furthermore, the R^2 values obtained for the two sites are 0.111 and 0.123 respectively. This implies that whereas the variables in the model account for 11.1% of Y (RATEN) in Olushosun, it accounts for 12.3% in Abule Egba. This results is not unexpected considering the fact that Lagos metropolis is characterised by multiple environmental and social problems that vary from one neighbourhood to the other such as traffic, noise, odour etc. Therefore, there could be several other factors that would account for the perception of neighbourhood quality that are not in this model. Such include the general layout of the residential neighbourhoods, drainage, and general appearance of the area. Also some location specific factors, for instance the chaotic traffic situation around the Ojota area, the Oja Oba market with its associated noise in Abule Egba are some of the factors that could affect neighbourhood quality perception.

The analysis of variance was further used to test for the significance of the R values obtained. For Olushosun, the F Ratio is 3.789 while for Abule Egba, it 4.074. Both values are found to be significant at .05.-This analysis is presented in appendix 3a. The regression coefficients for the two landfills are presented in Tables 5.15

Table 5.15: Regression Results for the Model: Landfill Impact on the Perception of Neighbourhood Quality

Regression Coefficients for Olushosun Landfill

Var.	Coeff.	Beta	t-ratio	Prob.	Std Error
DFILL	.152	.153	2.696	.007	.056
THOUSE	1.719	.018	.302	.762	.057
AGE	-1.01	-.163	-2.562	.011	.004
EDUC	-8.11	-.078	-1.387	.166	.058
INCOME	-6.59	-.016	-.279	.780	.024
LAREA	-4.83	-.023	-.491	.624	.010
TENURE	-2.79	-.031	-.487	.627	.057
GARBAGE	2.18	.012	.212	.832	.103
CRIME	-.24	-.144	-2.542	.012	.095
ROAD	.61	.2282	4.027	.000	.151
CONSTANT	2.16	-	5.119	.000	.423

Regression Statistics for Olushosun landfill

Coefficient of multiple determination	0.332
Coefficient of multiple correlation	0.111
Adjusted R square	0.081
Standard Error of the Estimate	0.80
F-ratio	3.789
Degree of freedom	315
Probability of chance	0.000

Regression Coefficient for Abule Egba Landfill

Var.	Coeff.	Beta	t-ratio	Prob.	Std Error
DFILL	5.51	.058	1.023	.307	.054
THOUSE	-9.09	-.001	-.019	.985	.048
AGE	-7.10	-.011	-.185	.854	.004
EDUC	8.91	.098	1.610	.109	.055
INCOME	3.70	.093	1.577	.116	.023
LAREA	-1.54	-.144	-1.885	.060	.008
TENURE	1.02	.013	.217	.828	.047
GARBAGE	.279	.172	2.933	.004	.095
CRIME	.106	.065	1.088	.278	.097
ROAD	.564	.168	2.968	.003	.190
CONSTANT	1.09	-	2.980	.003	.366

Regression Statistics

Coefficient of multiple determination	0.350
Coefficient of multiple correlation	0.123
Adjusted R square	0.093
Standard Error of the Estimate	0.76
F-ratio	4.074
Degree of freedom	301
Probability of chance	0.000

One fact that emerged from Table 5.15 is that the DFILL co-efficient for both sites are positive but very low. However, while the co-efficient for Olushosun is significant, the reverse is the case for Abule Egba. Some other variables that are significant for Olushosun are GARBAGE , AGE, CRIME and condition of adjoining roads (ROAD). For Abule Egba, the significant variables are GARBAGE and condition of adjoining roads (ROAD). The difference in the types of variables that are significant for each landfill sites is due to the fact that socio-economic characteristics of the respondents are slightly different from each other. Also different are the environmental (neighbourhood) settings of each site. Therefore what is perceived as constituting neighbourhood problem in one area is different the other.

The landfill co-efficient (DFILL) for the neighbourhood quality impact model reported in Table 5.15 is indicative of the debate characterising the nature and extent to which landfills will affect neighbourhood quality rating in the midst of other environmental and socio-economic factors. For the two locations, the DFILL coefficients are positive. These results conform to a priori expectation.

The implication of this is that the perception of neighbourhood quality increases away from the landfill sites. In other words, people closer to the landfill sites have a poorer perception of their neighbourhood than those farther away. But as mentioned earlier, we cannot be categorical about this statement since the results are not as strong as expected. Proximity to landfill is viewed as a form of environmental disamenity which can affect neighbourhood quality. The findings are in conformity with those obtained by Nelson *et al*, (1992) and Havlicek (1985). However, some caution is required here. While the DFILL coefficient for Olushosun is significant, it is not significant for Abule Egba. Therefore, further analysis and experimentation are needed to determine the actual distance at which landfill effects become insignificant.

5.5 Conclusion

The analysis in this chapter shows that the respondents were able to link some of the environmental problems in the area to the location and operation of the landfills. As shown in Table 5.11, some of these problems include smoke, odour, flies and rodents. Landfill presence was shown influence the perception neighbourhood quality. even though this relationship was not as strong as expected. However, the regression coefficients for the regression of neighbourhood rating all the independent variables for the two sites were positive and significant. The major summary that can be deduced from this section is that despite the physical prominence of the landfill, poor and fair quality ratings were also associated with multiple other problems, including crime, and sewerage. The results support the hypothesis put forward. The landfill is found to be a distressing environmental hazard in the two locations. This is typical of the results reported in many neighbourhood attitude surveys (Michelson, 1977).

CHAPTER SIX

SOCIO-ECONOMIC IMPACTS OF LANDFILLS IN LAGOS METROPOLIS

6.0 Introduction

This chapter presents results of the analysis of socio-economic impacts of the Olushosun and Abule Egba landfills on population living in close proximity to them. The essence of this is to examine the variations in impacts experienced by location and by distance from the landfill sites. Firstly, some emphasis is laid on psychosocial impacts of exposure defined as a complex of distress, dysfunction and disability manifested in a wide range of psychological, social and behavioural outcomes, as a consequence of actual or perceived environmental contamination (Baum *et al*, 1985; Elliott, 1998). Secondly, the coping mechanisms employed by respondents in response to impacts experienced are analysed. The occurrence of environmental stress, the experience of psychosocial effects and the choice of coping response have been shown to be dependent on four sets of factors related to: (i) nature of the stressor (i.e. hazardous versus non-hazardous; landfill versus incinerators; Evans and Jacobs, 1982; Sim and Baumann, 1983; Vyner, 1988); (ii) the type of individual (e.g. locus of control; Evans and Jacobs, 1982; Pearlin and Schoolar, 1978); (iii) the characteristics of the social network (e.g. strong family/community ties; Eldestein, 1988; Flynn, 1978); and (iv) the wider community context within which the stressor is located (Buttel, 1987; Sim and Baumann, 1983).

Although psychosocial impacts are known to occur at different levels of social organization (Elliott, 1998), the focus of this analysis is on individual level effects.

6.1 Major Sources of Concerns and Worries about the Landfills

6.1.1 Environmental Concerns

One of the major reasons for opposition to siting of landfills is the perceived environmental hazards or contamination that are associated with them. This fear becomes heightened when these landfills are located, in essentially residential neighbourhoods. From the initial (pre-field) oral interview conducted among residents of both sites, the major environmental issues involved in the location and operation of the landfills were revealed by residents. This information coupled with the review of literature on major environmental issues in landfill operation, informed the design of the questionnaire. The questions structured in likert scale format have 5 scales ranging from 1-5. 1 on the 5 – point scale represents not at all and 5 represents very much.

The reliability co-efficient (alpha) for the items is very high (0.849 for Olushosun and 0.882 for Abule-Egba). The descriptive statistics for these variables are presented in Table 6.1 and Figure 6.1.

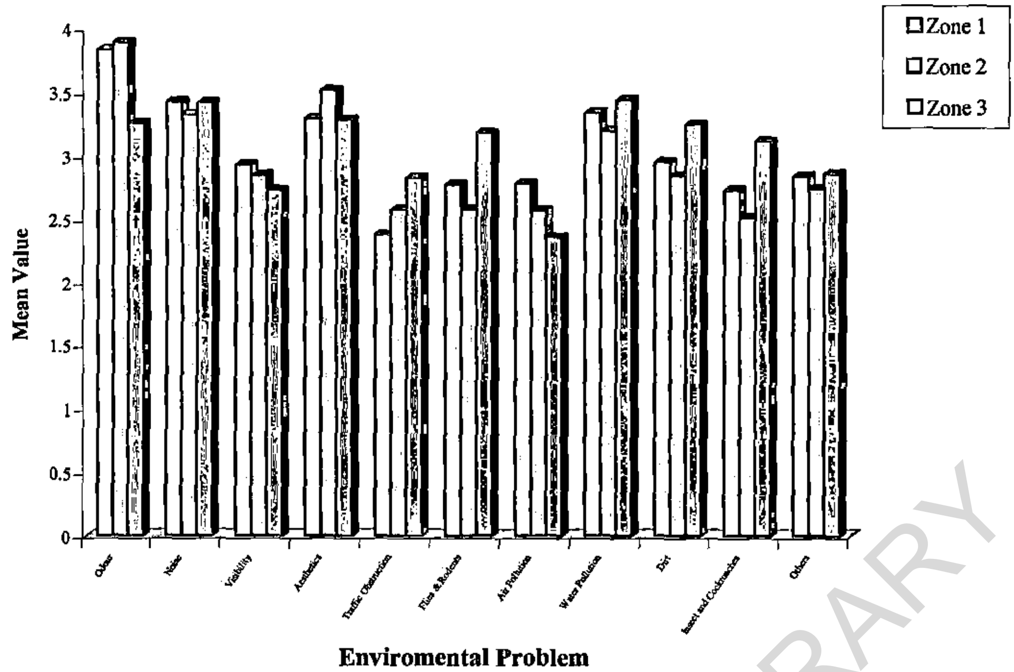

Fig. 6.1a: Major Environmental Concerns with Landfills in Olusoshun

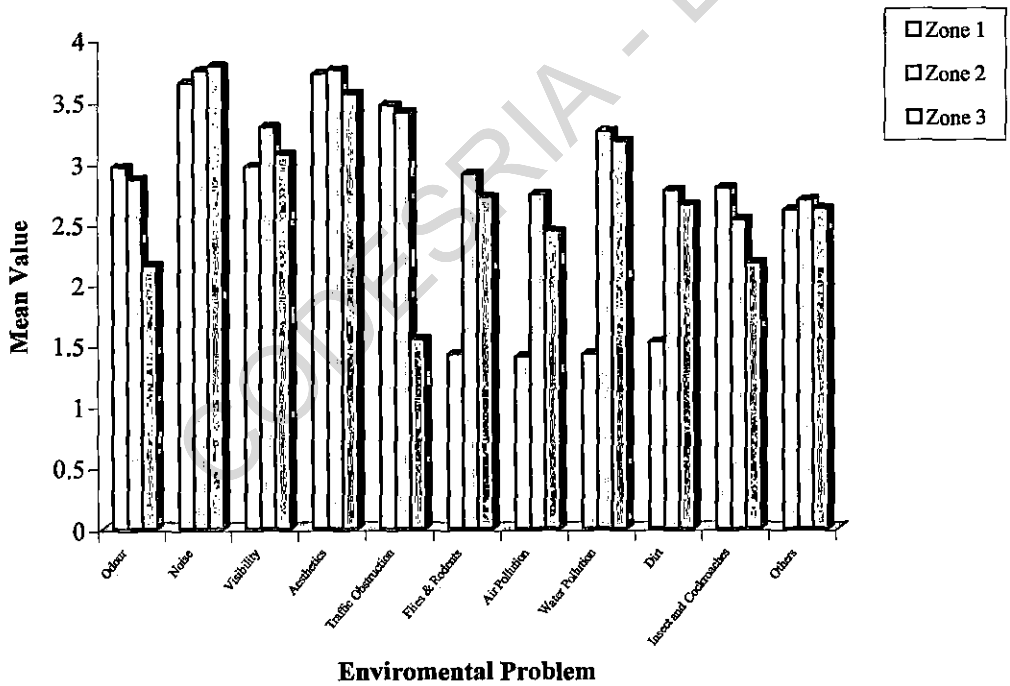

Fig. 6.1b: Major Environmental Concerns with Landfills in Abule-Egba

Table 6.1: Major Environmental Concerns about Landfills

Variables		OLUSHOSUN			ABULE-EGBA		
		Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
Odour	Mean	3.83	3.89	3.26	2.96	2.86	2.15
	Std. Dev	1.46	1.48	1.49	1.58	1.43	1.55
Noise	Mean	3.43	3.33	3.42	3.64	3.74	3.78
	Std. Dev	1.38	1.55	1.41	1.42	1.37	1.30
Visibility	Mean	2.93	2.85	2.73	2.97	3.29	3.07
	Std. Dev	1.46	1.45	1.37	1.55	1.34	1.52
Aesthetics	Mean	3.30	3.52	3.29	3.72	3.75	3.56
	Std. Dev	1.36	1.47	1.46	3.31	1.27	1.26
Traffic	Mean	2.38	2.58	2.83	3.47	3.41	1.54
obstruction	Std. Dev	1.38	1.46	1.22	2.31	1.38	1.51
Flies & rodents	Mean	2.78	2.58	3.19	1.42	2.91	2.72
	Std. Dev	1.40	1.34	1.29	2.31	1.43	1.46
Air pollution	Mean	2.79	2.57	2.36	1.40	2.74	2.44
	Std. Dev	1.35	1.40	1.32	2.96	1.46	1.44
Water pollution	Mean	3.35	3.21	3.45	1.42	3.26	3.18
	Std. Dev	1.31	1.35	1.43	2.63	1.36	1.39
Dirt	Mean	2.96	2.85	3.26	1.52	2.78	2.66
	Std. Dev	1.44	1.40	1.32	1.52	1.50	1.46
Insect and	Mean	2.74	2.52	3.13	2.80	2.54	2.18
cockroaches	Std. Dev	1.30	1.34	1.25	1.33	1.34	1.29
	Mean	2.85	2.75	2.87	2.62	2.70	2.63
Others	Std. Dev	1.25	1.23	1.10	1.17	1.14	1.12

Source: Author's Analysis

As seen in the Table, noise, aesthetics odour and water pollution are the most frequently mentioned environmental problems associated with the location of the landfills. For Abule-Egba site, noise, aesthetics, visibility are the major environmental problems mentioned. Not all the environmental problems showed a marked variation among the different zones. However, odour, visibility, flies and rodents, air pollution, dirt and insect and cockroaches showed a decrease in concern from zone 1 to zone 3. This implies that concerns about these problems are higher among residents closer to the landfill site. Traffic obstruction is particularly found to be a serious problem because the landfill is located by the major roadside. The illegal dumping of wastes, coupled with the activities of cart pushers have seriously led to traffic problem within the area. Oftentimes, motorists have to contest for the narrow lane left for vehicles. This often led to traffic hold up during most part of the day.

Oral interview of the residents closer to the landfill and even the experience during the fieldwork revealed that odour is a major problem with the landfill operation. This is especially true in Abule-Egba where the dumping of wastes into the landfill is very much uncontrolled. This problem becomes even more worrisome considering the fact that the landfill is located in a high-density residential area. This is the basis for the anxiety over the health problems that residents perceive the landfill could cause.

The information in Table 6.1 is presented in Figures 6.2a to h to show the externality field of the major environmental concerns. Since the perceived impacts cannot be uniformly circular due to human and environmental differences, the maps were drawn using the mean values of the major environmental concerns mentioned by respondents in each of the zones around the two landfill sites. The purpose is to show the gradient in perceived impact as distance increases away from the landfills.

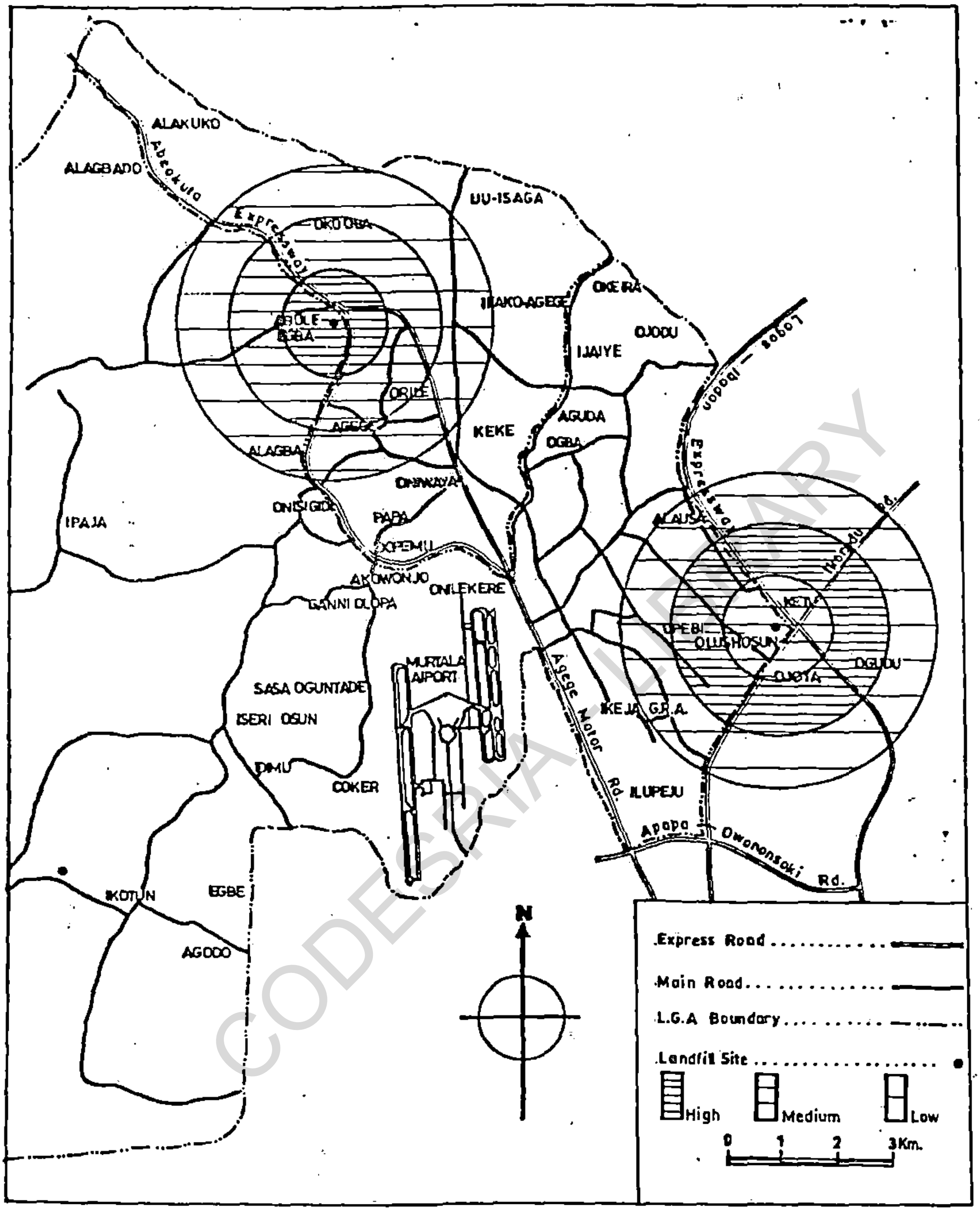

Fig.6.2a : Perception of Environmental Impact of Landfills : Odour

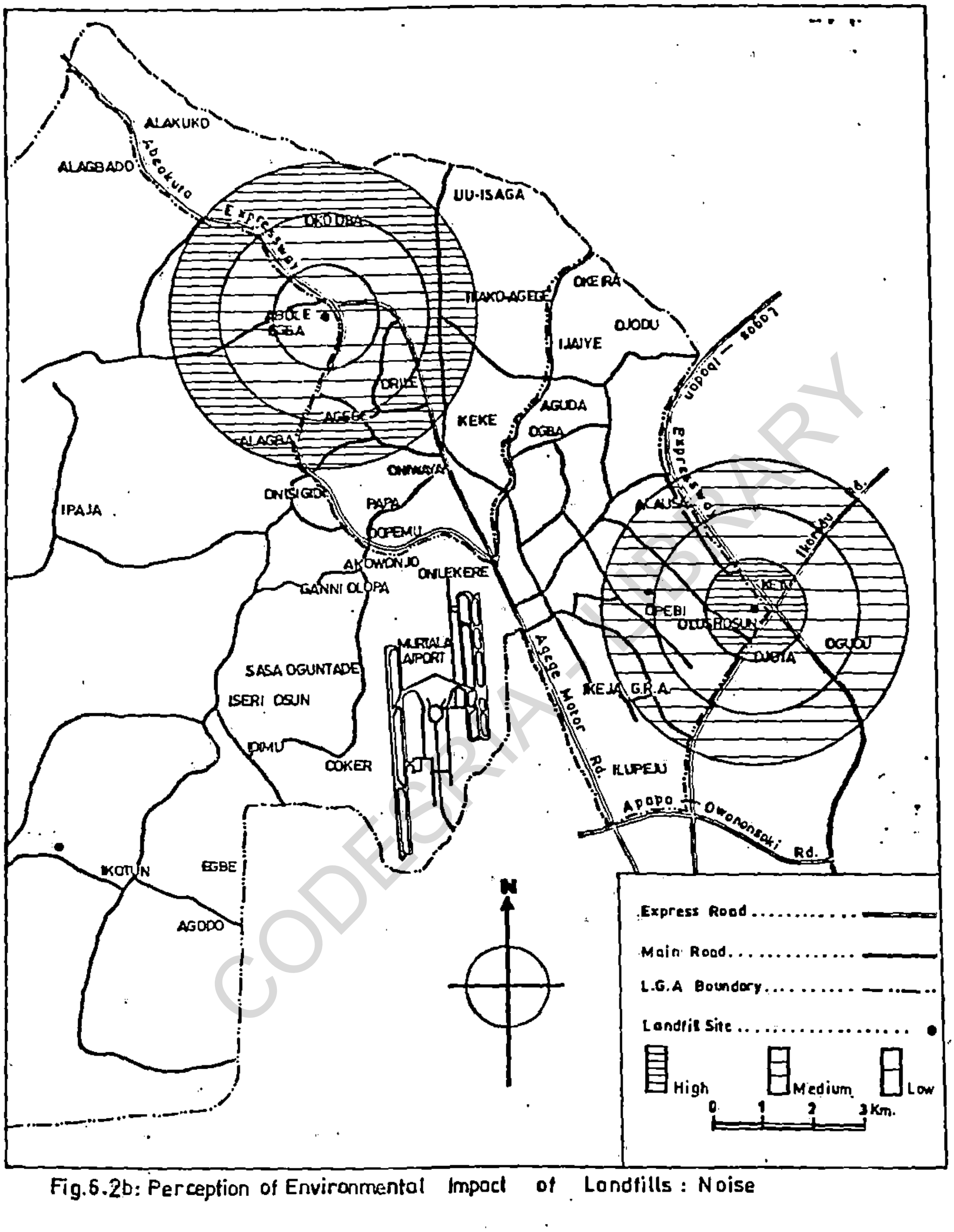

Fig.6.2b: Perception of Environmental Impact of Landfills : Noise

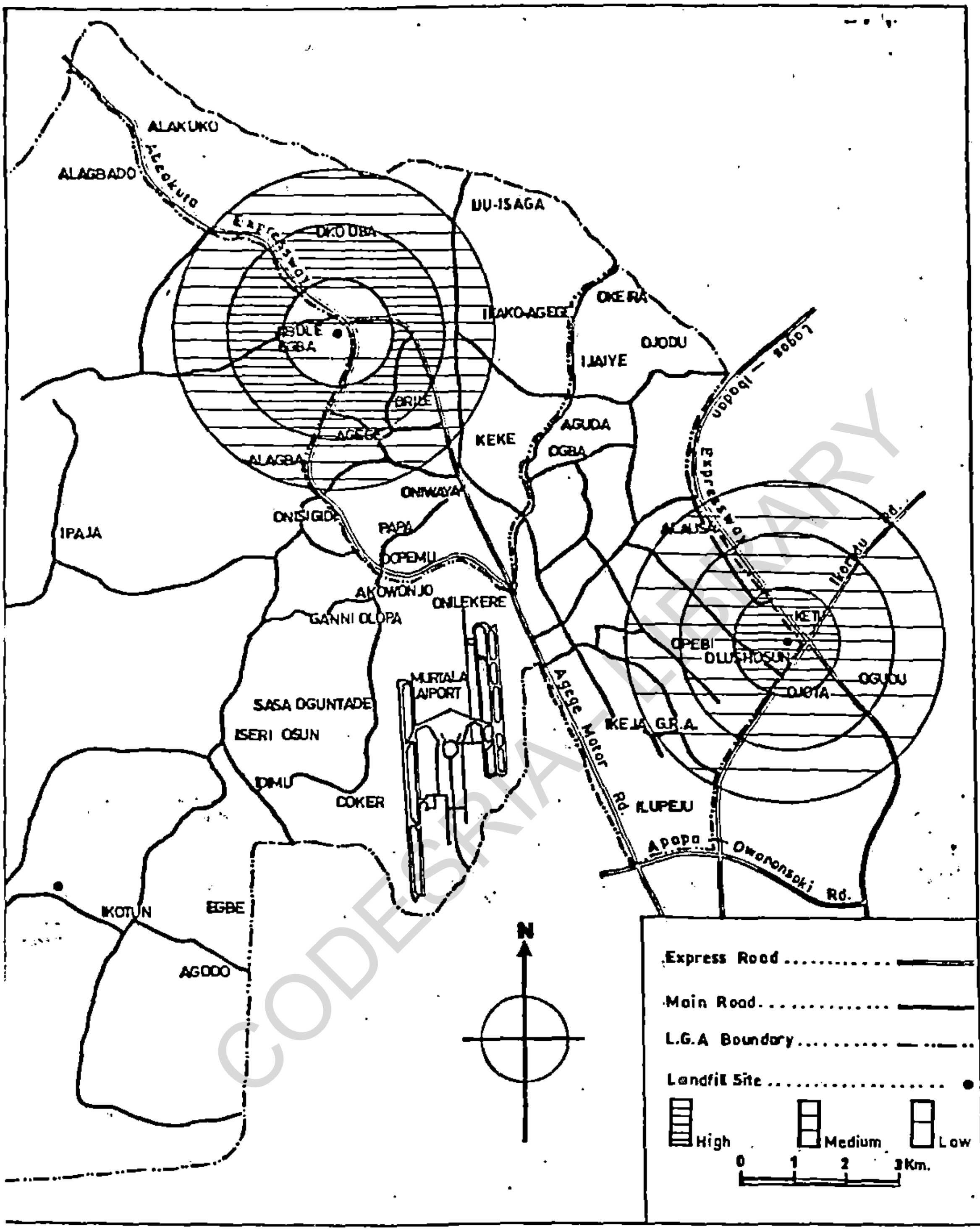

Fig. 6.2c : Perception of Environmental Impact of Landfills : Visibility

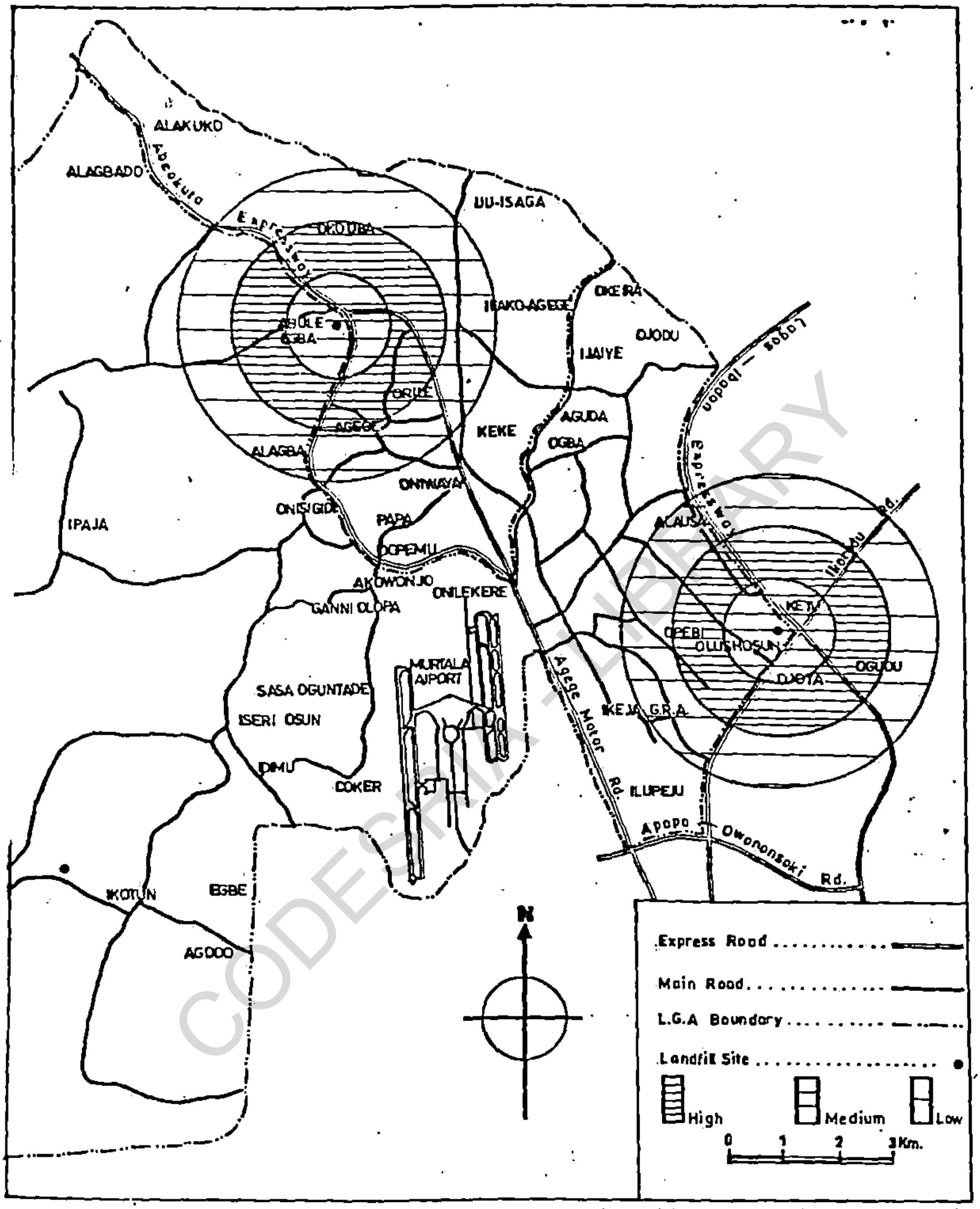

Fig.6.2d : Perception of Environmental Impact of Landfills : Aesthetics

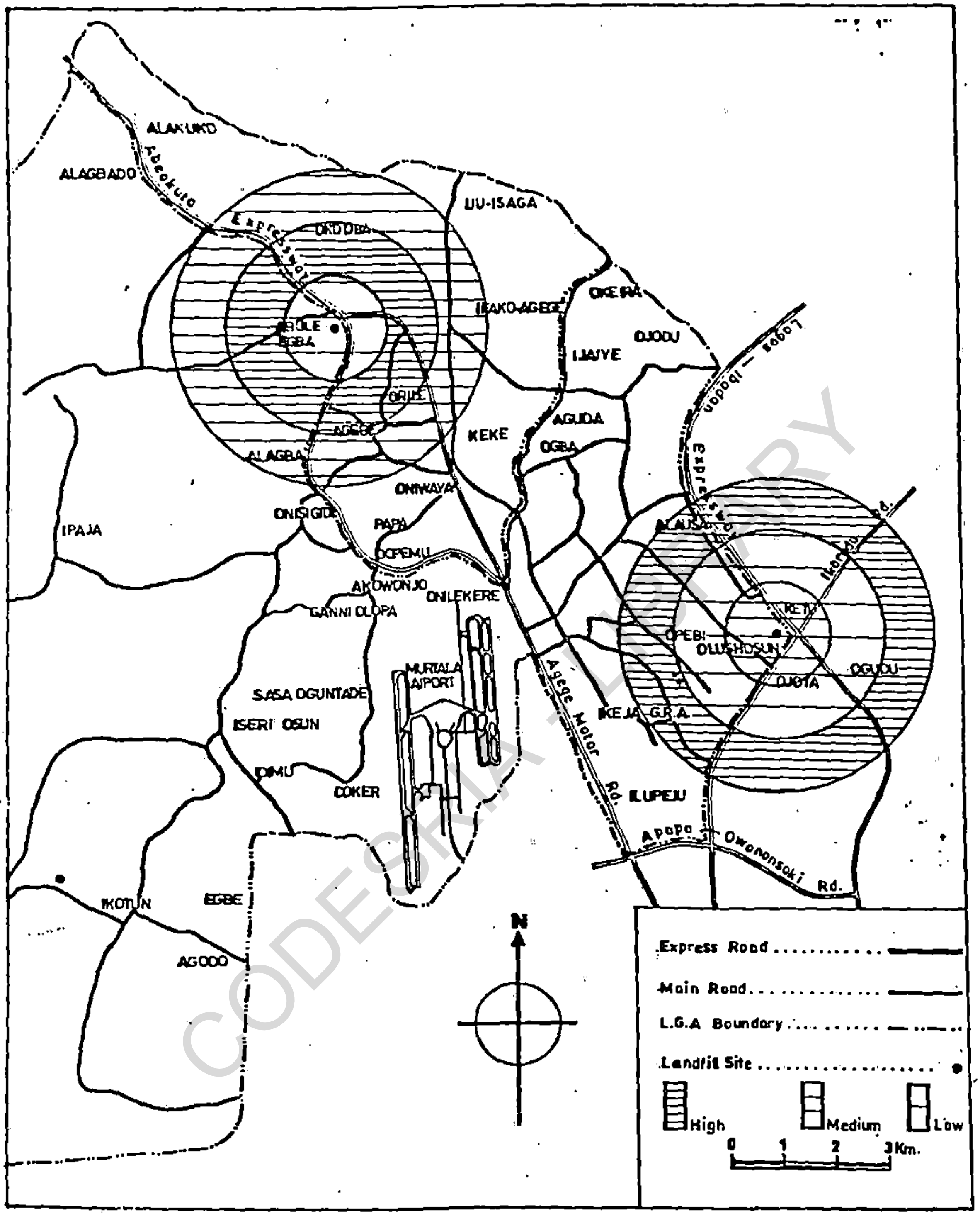

Fig.6.2e : Perception of Environmental Impact of Landfills : Flies and Rodents

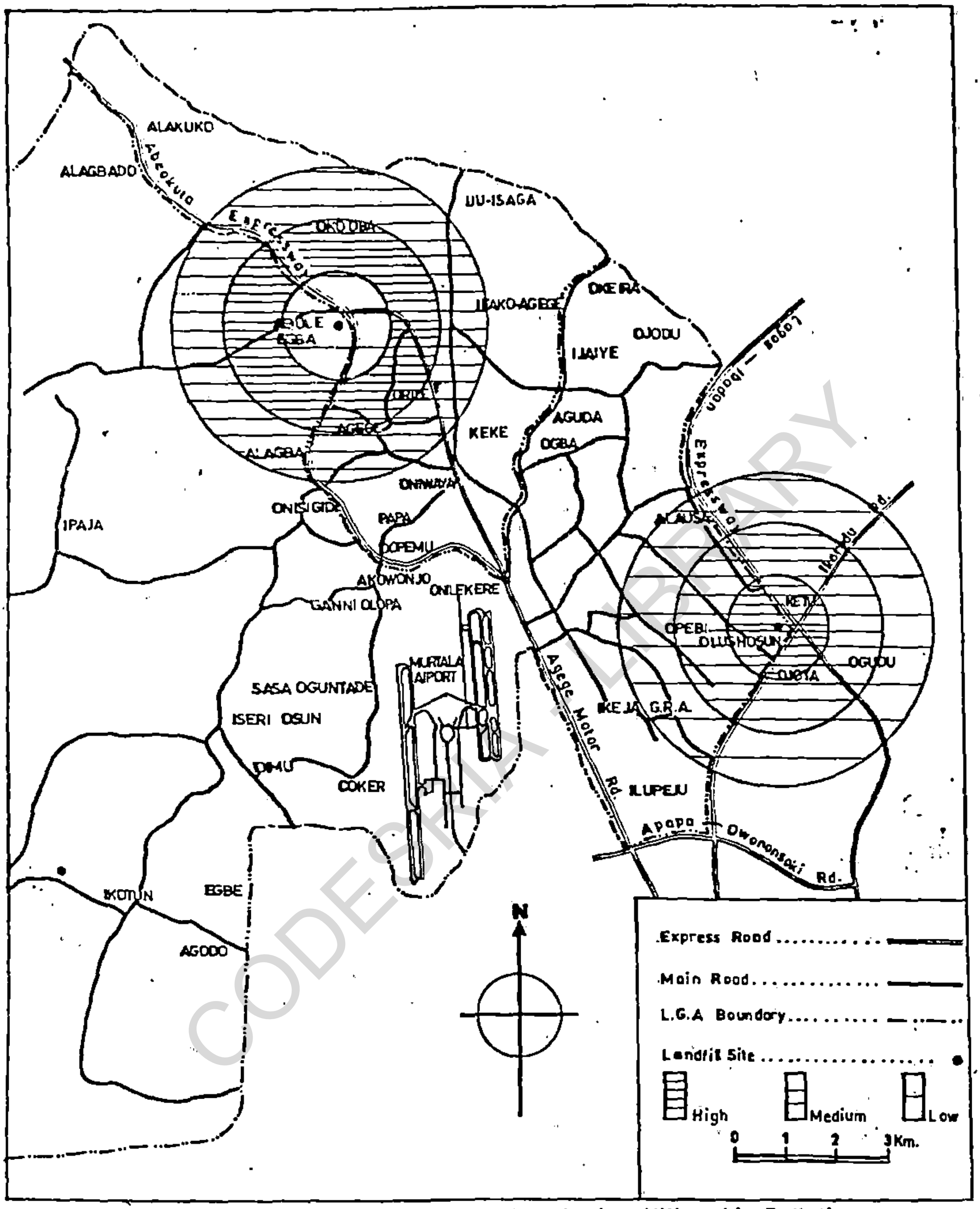

Fig. 6.2f : Perception of Environmental Impact of Landfills : Air Pollution

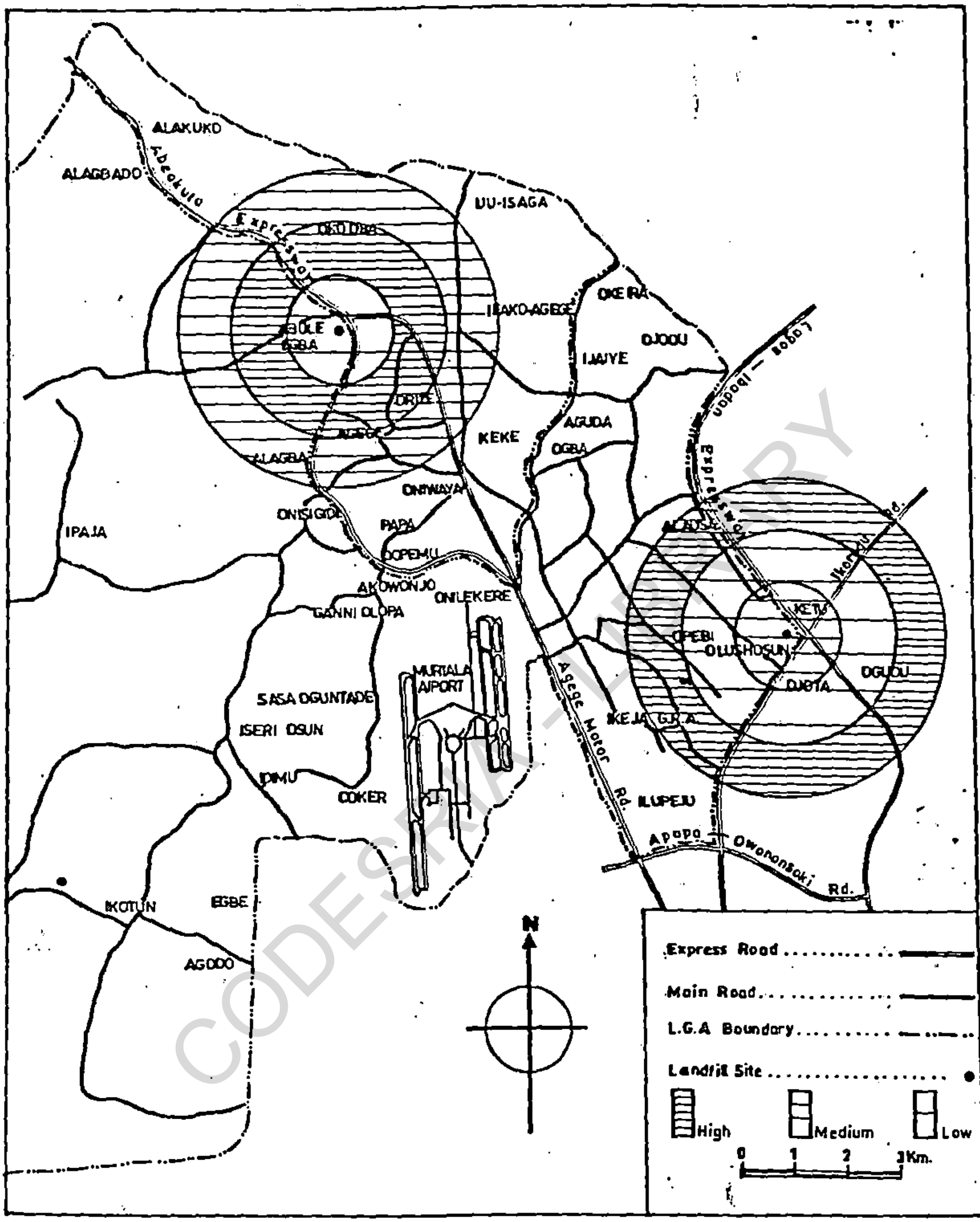

Fig. 6.2g: Perception of Environmental Impact of Landfills : Water Pollution

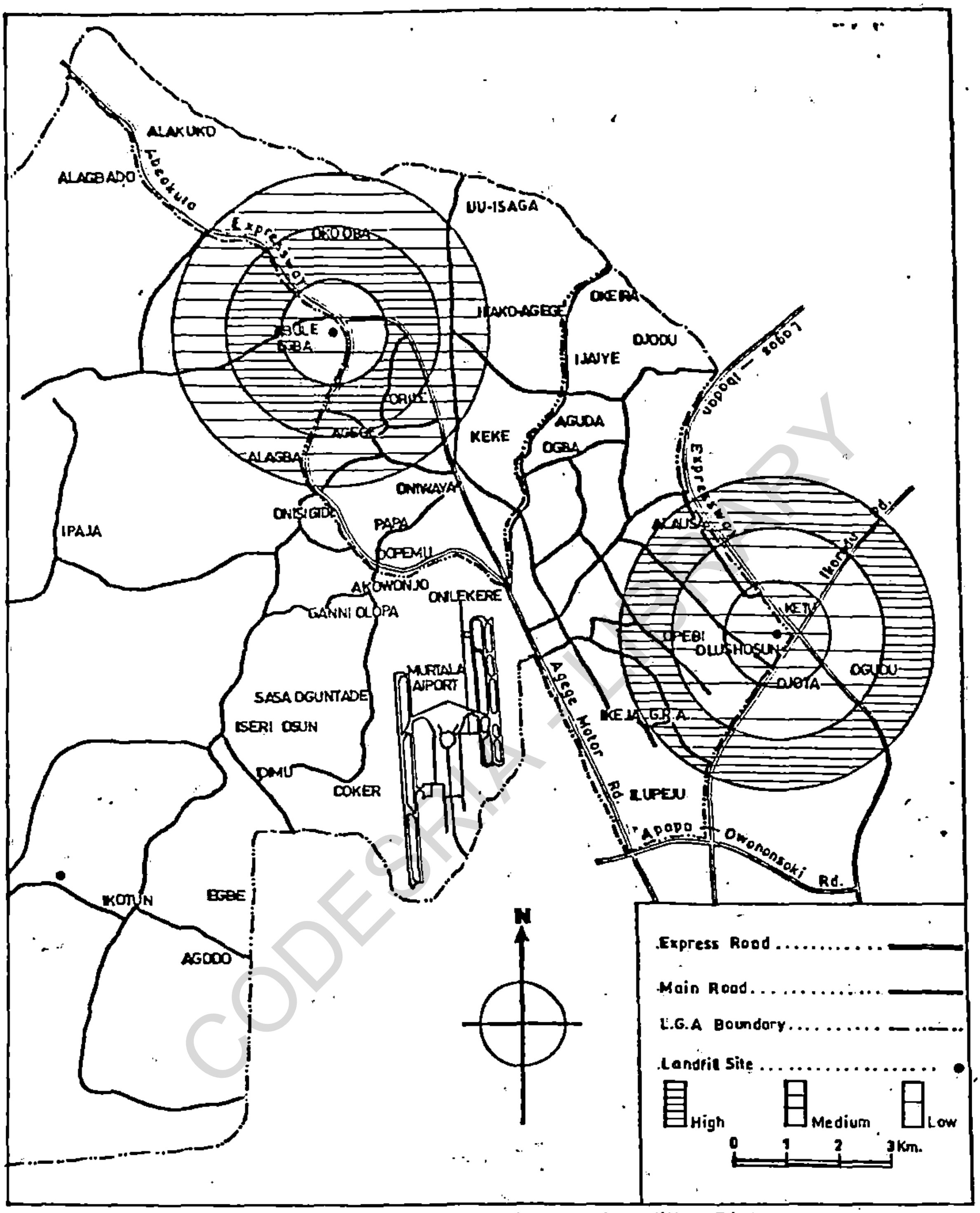

Fig.6.2h : Perception of Environmental Impact of Landfills : Dirt

A one-way analysis of variance was used to test if there is any significant variation in the perception of environmental impacts among residents in different zones in the two locations. The scores of each respondent in his or her response to environmental concerns (odour, noise, visibility, aesthetics, traffic obstruction, flies and rodents, air pollution, dirt, insect and cockroaches) were added to form the variable environmental impact. As mentioned earlier, these concerns were posed in Likert scale format with 1representing not at all and 5 representing very much. Subsequently, a one-way analysis of variance was then used to test for variation where a new variable, environmental impact, was the dependent variable and the three zones was the factor. The result of the analysis is presented in Table 6.2.

Table 6.2: One-Way Analysis of Variance of Environmental Impact Perception

LOCATION			Sum of Squares	df	Mean Square	F	Sig.
Olushosun	ENVIRONMENTAL PERCEPTION	Between Group	263.008	2	131.504	1.437	.239
		Within Group	44397.400	485	91.541		
		Total	44660.408	487			
Abule-Egba		Between Group	737.633	2	368.816	3.383	.035
		Within Group	47864.512	439	109.031		
		Total	48602.145	441			

Source: Author's Analysis

As seen from the analysis, the F values obtained for Olushosun and Abule Egba were 1.437 and 3.383 respectively. The value for Olushosun is, however, not significant while the value for Abule Egba is significant ($P < .05$). This implies that the alternative hypothesis that states that there is a significant variation in the perception of environmental impact of landfills among respondents in the different zones in Abule Egba holds while rejecting the alternative hypothesis for Olushosun. The factors responsible for this differing perception are not much different from those mentioned in section 5.4.

6.1.2 Health Concerns about Landfills

Health risk perception plays an ongoing role in the public response to environmental exposures (Elliott *et al*, 1993; Eyles, 1993; Kasperson *et al*, 1988, Slovic 1987). Essentially, relationships between an environmental contaminant and health are mediated by perceptions of the 'exposure' which are in turn influenced by a host of individual and contextual factors (Kasperson *et al*, 1988, Cutter, 1993). Public opinion literature indicates firstly, that worries and concern about environmental and health has increased steadily over the past two decades and secondly, that the increase is associated with widely publicized environmental disasters (Elliott, 1998). There widespread public perception that landfills represent unacceptable risks to human health and the environment (Washburn *et al*, 1989).

From oral interviews conducted during the reconnaissance survey for the research and during the actual fieldwork, health-related concern was the major impact frequently mentioned by residents. The psychosocial in this regard focused mainly on worries and anxiety about health of the resident. These concerns were more frequently mentioned among residents closer to the landfill site. Respondents were asked to rate their present condition of health. This question was informed by the fact that the location of the landfill can affect the perception of the health status of the respondents. The self-rate health status was a categorical with four categories: excellent, good, fair and poor. The responses from residents in the three zones around the two locations are presented in Table 6.3.

Table 6.3: Respondents' Self Health Rating

	OLUSHOSUN								**ABULE-EGBA**							
	Zone 1		*Zone 2*		*Zone 3*		*Total*		*Zone 1*		*Zone 2*		*Zone 3*		*Tot*	
	No	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	*%*	*No*	
Excellent	*28*	*5.74*	*24*	*4.92*	*30*	*6.15*	*82*	*16.31*	*39*	*21.7*	*18*	*14.0*	*30*	*22.6*	*87*	*1*
Good	*108*	*22.13*	*106*	*21.72*	*85*	*17.44*	*299*	*61.26*	*105*	*58.9*	*88*	*68.0*	*73*	*54.9*	*266*	*6*
Fair	*21*	*4.30*	*29*	*5.94*	*42*	*8.61*	*92*	*18.85*	*34*	*18.9*	*19*	*14.7*	*24*	*18.0*	*77*	*1*
Poor	*1*	*0.20*	*11*	*2.25*	*3*	*0.61*	*15*	*3.08*	*2*	*1.1*	*4*	*3.1*	*6*	*4.5*	*12*	
Total	*158*	*32.37*	*170*	*34.83*	*160*	*32.81*	*488*	*100.0*	*180*	*40.7*	*129*	*29.2*	*133*	*30.1*	*442*	*1*

Source: Author's Analysis

There are no much differences in self-health rating among the respondents in the three zones around the two landfill sites. However, those who rated their health as being good have the highest percentages in all the zones. In Olushosun site, self-health rating tends to show a decrease away from the site. This is not the case in Abule-Egba. Observations during the field interview revealed that generally, people do not want to reveal their true state of health to the interviewers. Some respondents even tied the issue of their health to religion. For example, some people who are obviously sick would confess that they are "strong". These factors affected the rating of health status of many of the respondents.

Respondents were further asked to compare their health to what it was three years ago. Their responses are summarized in the Table 6.4.

Table 6.4: Comparison of Health Status Now and Before

	OLUSHOSUN							
	Zone 1		Zone 2		Zone 3		Total	
	No	%	No	%	No	%	No	%
Improved	48	9.84	35	7.17	50	10.25	133	32.38
About the same	79	16.19	103	21.11	54	10.07	236	43.37
Undecided	14	2.87	11	2.25	43	8.81	68	13.93
Declined	17	3.48	21	4.30	13	2.66	51	10.44
Total	158	32.38	170	35.83	150	31.79	488	100

	ABULE-EGBA.							
	Zone 1		Zone 2		Zone 3		Tot	
	No	%	No	%	No	%	No	%
Improved	38	8.60	33	7.47	35	7.92	106	23.9
About the same	96	21.72	70	15.84	62	14.03	228	51.5
Undecided	20	4.53	14	3.17	17	3.85	51	11.5
Declined	26	5.88	19	4.30	12	2.71	57	12.8
Total	180	40.73	136	30.78	126	28.51	442	10

Source: Author's Analysis

The table reveals that more than one third (43.37%) of the respondents in Olushosun agreed that their health have stayed about the same from what it used to be three years ago while, in Abule-Egba, more than half (51.9%) of the total number of respondents agreed to this. There are however variations in this response among the different zones in the two locations. For instance, the proportion of those who claimed there has not been any change in their health declined from zone 1 to zone 3 in Abule Egba, but this is not the case in Olushosun. In Abule-Egba, there was an increment in the number people that claimed their health has declined somewhat within the past three years. That is, more of the respondents that claimed that their health has declined are in zone 1 (5.88%). In zone 2 and 3, the percentage is 4.30% and 2.71 respectively. This is however not the case in Olushosun. The highest percentage of respondents with declined health is found in zone 2 (4.30%). This is followed by zones 1 (3.48%) and zone 3 (2.66%). It should be noted, however, that most of the responded that remained undecided are those who have not stayed up to three years in their present area.

The essence of the above analysis is to see whether the location of the landfills could have any effect on the perception of change in health status of the respondents. It has been observed that the presence of environmental contaminant could affect the way people perceive changes in their health condition (Elliott *et al*, 1998; Baxter, 1995). Therefore the research sought to examine the impact of the landfills on the perception of health status of the respondents. The result of the analysis is presented in Table 6.5 (see Figure 6.3 also)

Table 6.5: Respondents' Association of landfills with Change in Health Status

	OLUSHOSUN								ABULE-EGBA							
	Zone 1		Zone 2		Zone 3		Total		Zone 1		Zone 2		Zone 3			T
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	
a large extent	28	5.74	16	3.79	9	1.84	53	11.33	13	2.94	71	1.58	22	4.98	42	
some extent	36	7.38	52	10.66	40	9.2	128	25.24	63	14.25	50	11.31	41	9.28	154	3[illegible]
ndecided	17	3.48	20	4.98	45	9.22	82	17.68	25	5.66	20	4.52	18	4.07	63	1[illegible]
a small extent	26	5.33	15	3.73	31	5.35	72	14.41	29	6.56	19	4.30	22	4.98	70	1[illegible]
ot at all	51	10.45	67	13.73	35	7.17	153	31.35	50	11.31	33	7.47	30	6.79	113	2[illegible]
tal	158	35.76	170	36.98	160	32.78	488	100	180	40.72	170	29.18	160	30.1	442	

Source: Author's Analysis

From the table, significant proportion of the respondents did not attribute the change in their health status to the operation of the landfill around the Olushosun site. The highest percentage of respondents in zone 1(10.45%) did not attribute change in their health status to the operation of the landfill at all. This percentage is even higher in zone 2 (13.73%). However, the highest percentage of those that attributed their change in health status to the operation of the landfill to a large extent decreased steadily from zones 1 to 3 (5.74%, 3.79% and 1.84% respectively). This is not the case in Abule-Egba

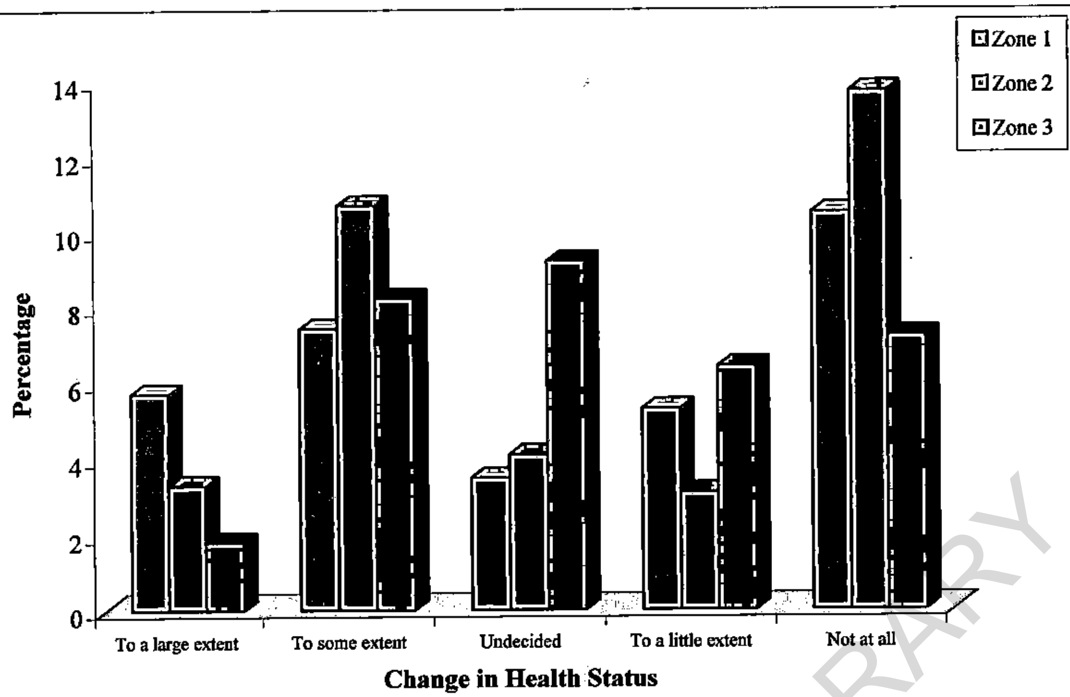

Fig. 6.3a: Operation of Landfill and Change in Health Status in Olusoshun

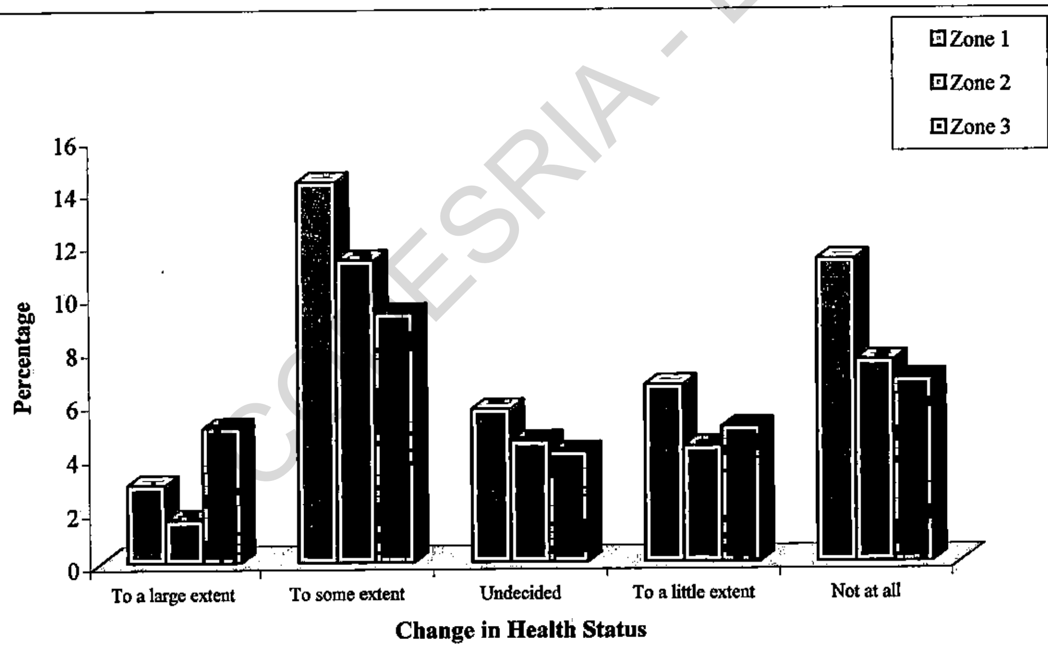

Fig. 6.3b: Operation of Landfill and Change in Health Status in Abule-Egba

where it is 2.94%, 1.58% and 4.98% respectively. But unlike Olushosun too, many of the respondents attributed change in the status of the health to the operation of the landfill.

Respondents were specifically asked if they were aware of anybody that has sustained injury as a result of the operation of the landfills. For Olushosun site, more respondents in zone 1 were aware of those who have sustained injury as a result of the operation of the landfill (7.79%). This is followed by zone 2 (4.51%) and zone 3 (4.10%) respectively. This result is presented in Table 6.6

Table 6.6: Knowledge of persons Injured as a result of operation of the landfills

	OLUSHOSUN								ABULE-EGBA							
	Zone 1		Zone 2		Zone 3		Total		Zone 1		Zone 2		Zone 3		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Yes	38	7.79	22	4.51	20	4.10	80	16.4	34	7.69	13	2.94	25	5.66	72	16.29
No	122	25.0	136	27.57	150	30.73	408	83.6	146	33.03	116	26.24	108	24.43	370	83.7
Total	160	32.79	158	32.38	170	34.83	488	100	180	40.72	129	29.18	133	30.09	442	99.99

Source: Author's Analysis

In Abule-Egba, the highest percentage of those who are aware of persons who have sustained injury as a result of the operation of the landfill are also in zone 1 (18.9%). Here, injury is mostly in form of cart hitting passers-by or vehicles hitting cart pushers along the road.

Specifically, some major health indicators that could be impacted on by the operation of landfills were measured by seven questions that asked respondents to rate how much the location of the landfills has affected their health. These were measured on a 5-point likert scale where 1 represents not at all and 5 represents very much. The reliability co-efficient (alpha) for Olushosun and Abule-Egba is 0.84 and 0.86 respectively. The result of the analysis is presented in Table 6.7

6.7: Major Health Concerns about Landfills

	OLUSHOSUN						ABULE-EGBA					
	Zone 1		***Zone 2***		***Zone 3***		***Zone 1***		***Zone 2***		***Zone 3***	
	Mean	*S.D*	*Mean*	*S.D*	*Mean*	*S.D*	*Mean*	*S.D*	*Mean*	*S.D*	*Mean*	*S.D*
Psychological Disturbance	*3.01*	*1.35*	*2.94*	*1.56*	*2.52*	*1.53*	*2.57*	*1.41*	*2.82*	*1.50*	*2.52*	*1.49*
Skin Irritation	*3.21*	*1.44*	*3.09*	*1.47*	*3.57*	*1.36*	*2.51*	*1.32*	*3.09*	*1.50*	*2.60*	*1.42*
Water Related disease	*3.49*	*1.34*	*3.07*	*1.36*	*3.76*	*1.47*	*2.64*	*1.38*	*2.98*	*1.45*	*3.02*	*1.41*
Accidents/Injury	*2.75*	*1.30*	*2.59*	*1.44*	*2.08*	*1.22*	*3.24*	*1.33*	*3.88*	*1.27*	*3.63*	*1.20*
Dysentery/Diarrhoea	*3.59*	*1.26*	*3.24*	*1.28*	*3.28*	*1.47*	*3.00*	*1.29*	*3.38*	*1.30*	*3.31*	*1.32*
Headaches/Nausea	*3.80*	*1.31*	*4.01*	*1.30*	*3.91*	*1.10*	*3.62*	*1.31*	*3.74*	*1.34*	*3.71*	*1.29*
Children diseases	*3.43*	*1.46*	*2.90*	*1.51*	*3.11*	*1.62*	*2.69*	*1.38*	*3.04*	*1.62*	*2.68*	*1.52*

Source: Author's Analysis

Perception of health impact is seen to be generally higher among the respondents around the Olushosun site than the Abule-Egba site. Another fact that emerged from the table is that perception of health impact is higher in zone 1 in Olushosun than the other zones. The reverse is however the case in Abule-Egba site where the perception is lower is zone 1 than any other zones. The reason could be the fact that respondents in zone 1 in Abule-Egba generally have a lower socio-economic status than other zones. Likewise, respondents around the Olushosun landfill site generally have a higher socio-economic status than the Abule-Egba site. The major health concerns as revealed by the analysis are headache and nauseous feelings which they link to smoke and oduor coming from the landfills. This had the highest frequency of mention among the respondents in both locations. The information in Table 6.7 is presented in Figure 6.4. Table 6.7 was also used to construct the impact field for the major health concerns about landfills. The principles behind the construction of these maps are similar to those used for figures 6.2a-h . This information is shown in Figures 6.5a to d.

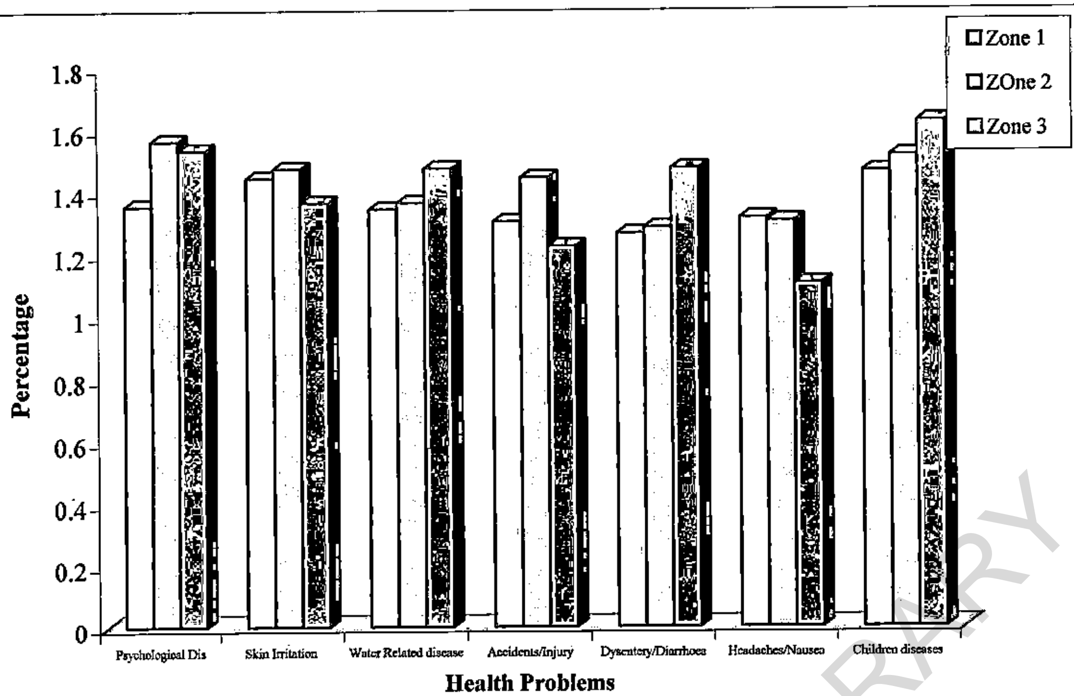

Fig. 6.4a: Major Health Concerns about Landfills in Olusoshun

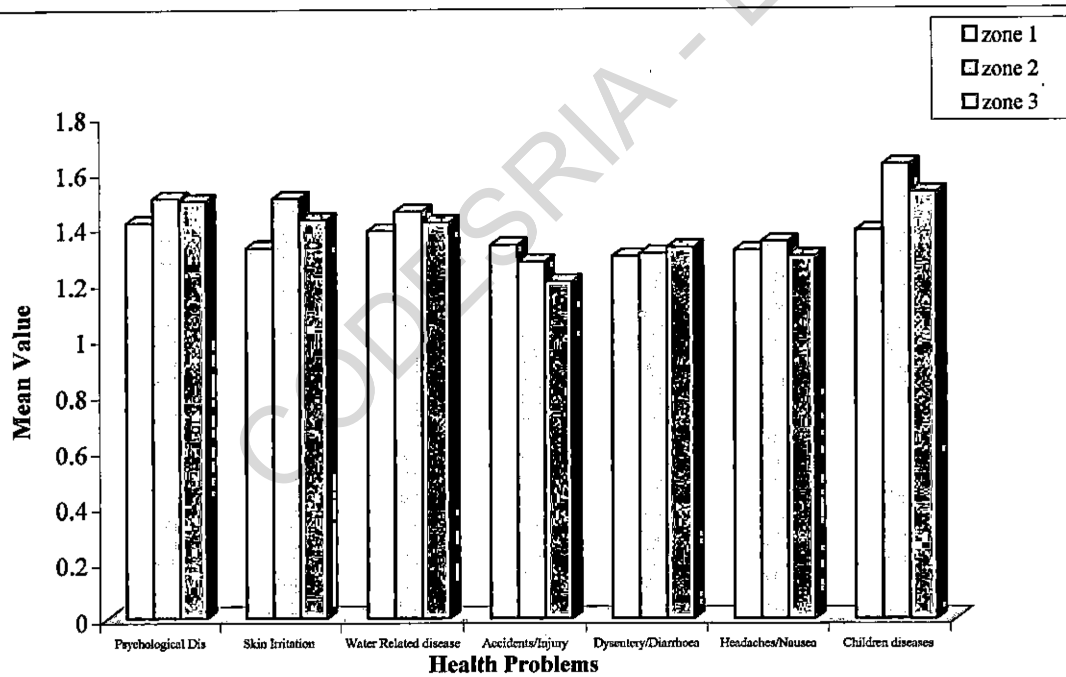

Fig. 6.4b: Major Health Concerns about Landfills in Abule-Egba

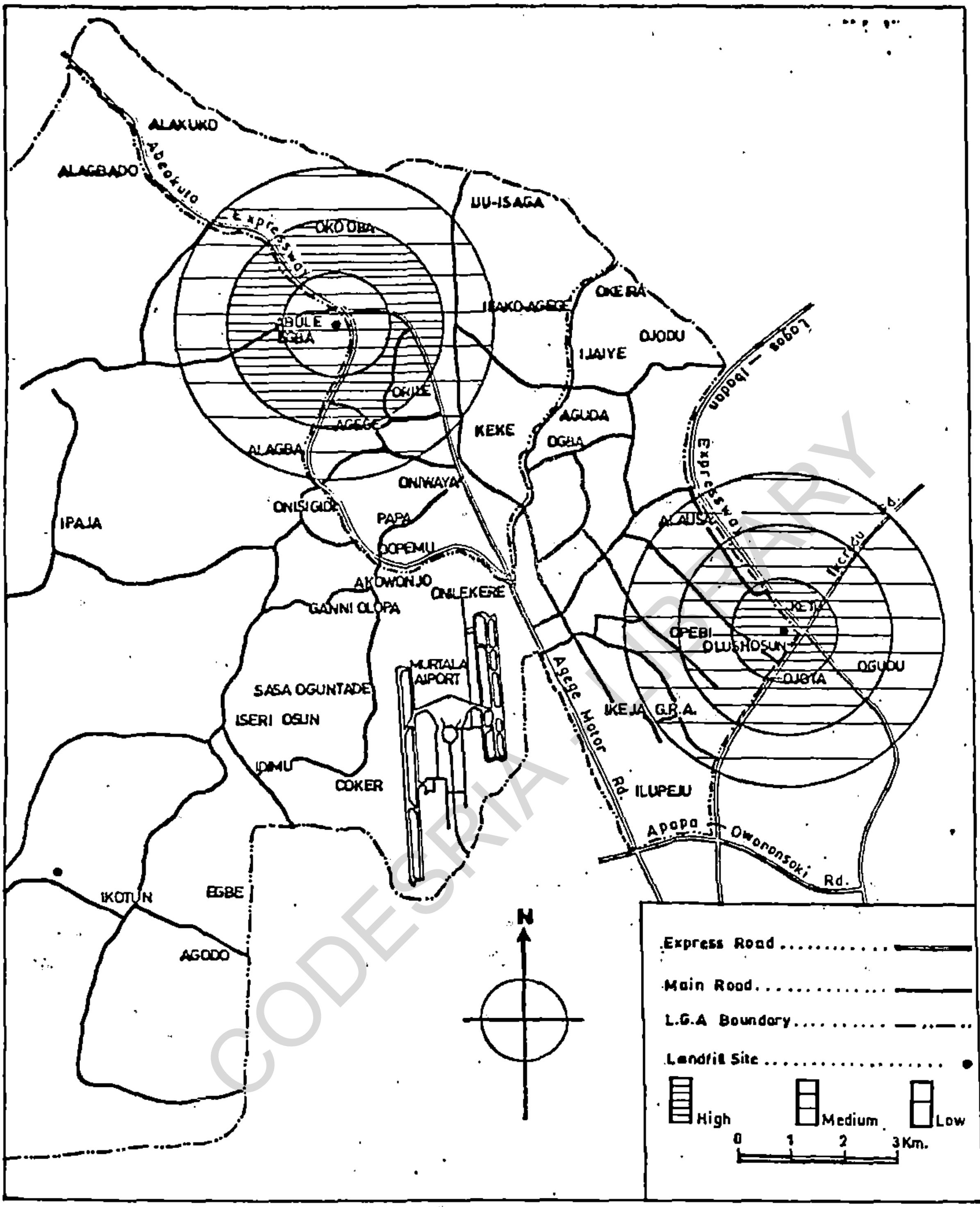

Fig.6.5a: Perception of Health Impact of Landfills : Psychological Disturbance

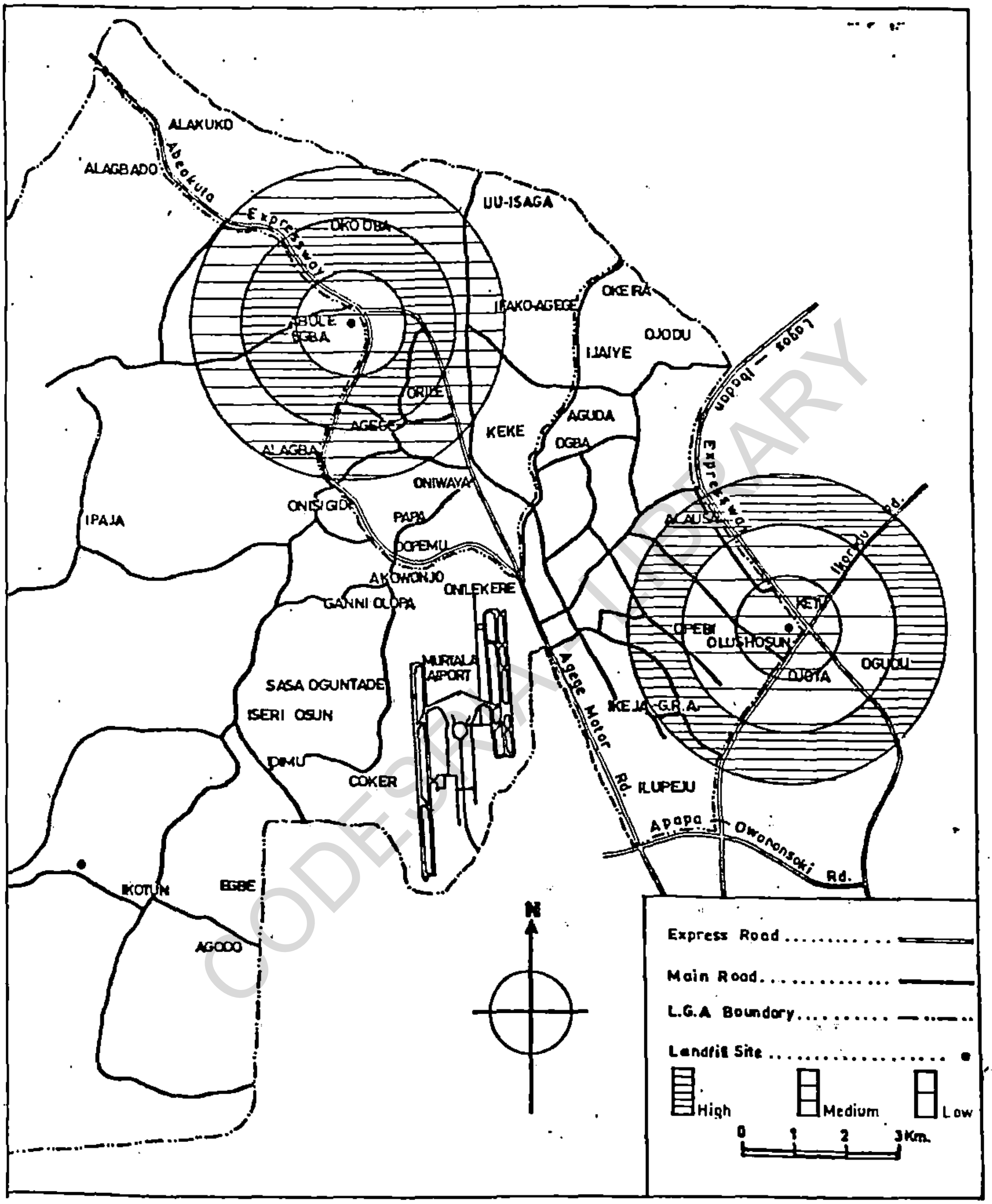

Fig. 6.5b: Perception of Health Impact of Landfills: Skin Irritation

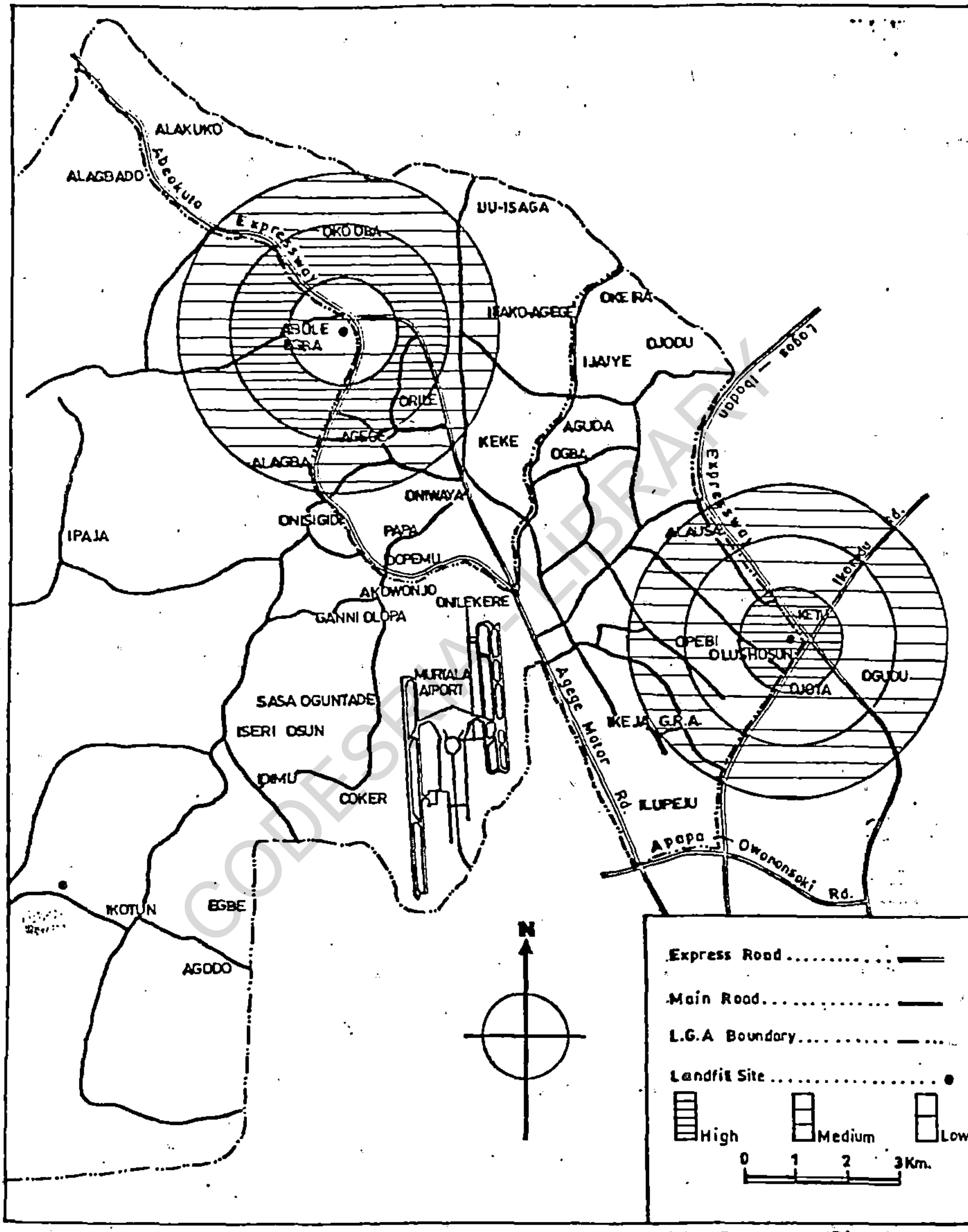

Fig. 6.3c: Perception of Health Impact of Landfills : Dysentary/Diarrhoea.

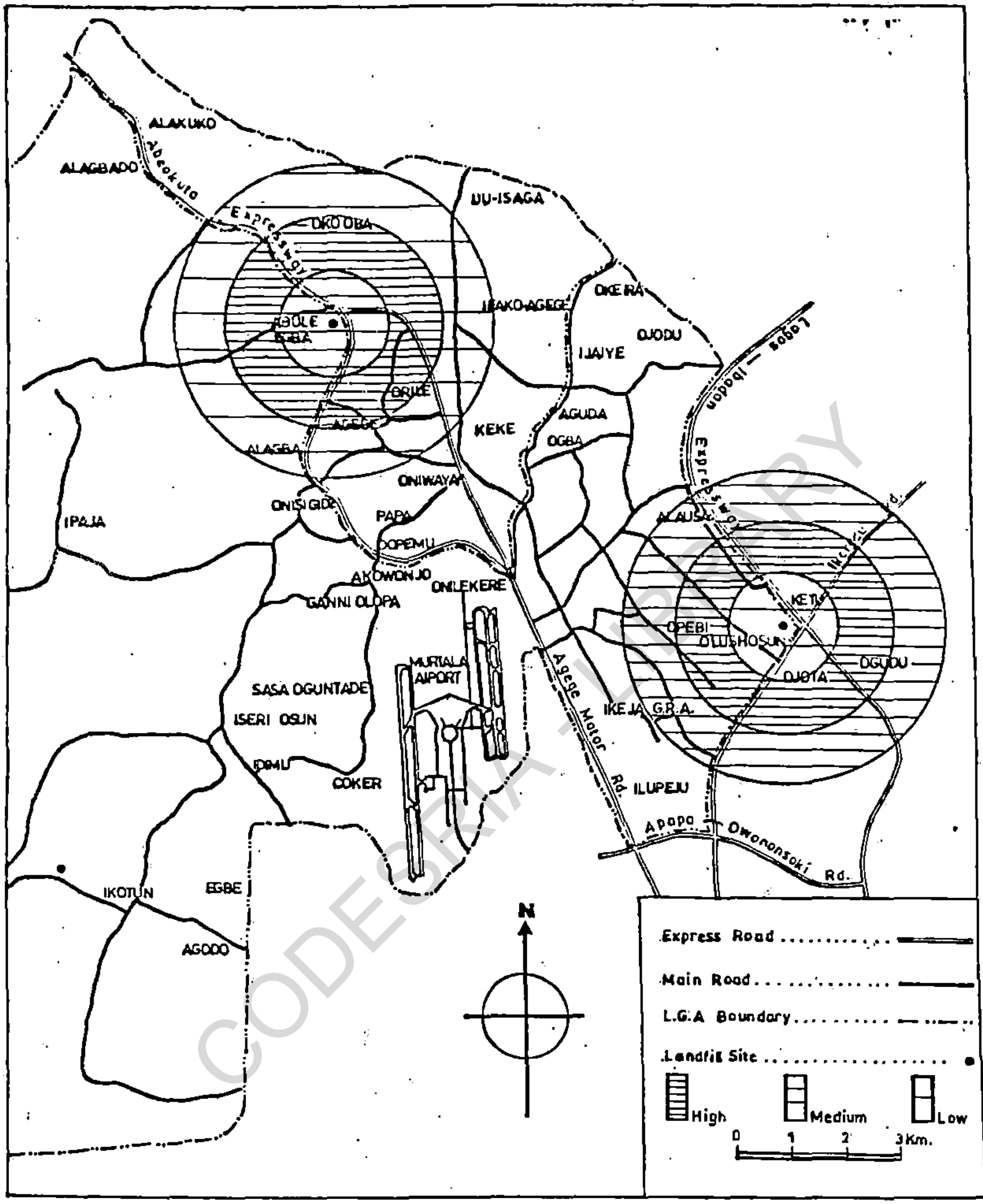

Fig. 6.5d: Perception of Health Impact of Landfills : Headaches/Nausea

A simple correlation analysis was used to establish the relationship between respondents self-rated health and distance from the landfill sites. The correlation was positive for both sites even though the values were low (r=0.28 and 0.13 for Olushosun and Abule-Egba respectively). These values are also not significant at 0.5 confidence level. This result implies that the presence of the landfills has a negative influence on the health rating of respondents.

A one-way analysis of variance was used to test if there is any significant variation in the perception of health impacts among residents in different zones in the two locations. The scores of each respondent in his or her response to health impact perception were added to form the variable health impact. Subsequently, a one-way analysis of variance was then used to test for variation where new variable- health impact was the dependent variable and the three zones were the factor. The result of the analysis is presented in Table 6.8

Table 6.8: One-Way Analysis of Variance of Health Impact Perception

LOCATION			Sum of Squares	df	Mean Square	F	Sig.
Olushosun	HEALTH PERCEPTION	Between Group	279.109	2	139.555	2.870	.058
		Within Group	23585.416	485	48.630		
		Total	23864.525	487			
Abule-Egba		Between Group	524.255	2	262.128	5.229	.006
		Within Group	22004.978	439	50.125		
		Total	22529.233	441			

Source: Author's Analysis

As seen from the analysis, the F values obtained for Olushosun and Abule Egba were 2.870 and 5.229 respectively. The two values are significant. This implies that we can reject the null hypothesis that states that there is no significant variation in the perception of health impact of landfills among respondents in the different zones in the study area.

6.2 Economic Attitudes and Responses to the Location of the Landfills

Five variables were employed to measure general economic attitudes and responses to location of the landfills. Economic satisfaction is measured by three questions that asked respondents to rate their level of satisfaction with economic opportunities (jobs, income and their personal economic situation) on a 5-point scale. The variable is an average of the three questions, whose I represents completely dissatisfied and 5 represents completely satisfied. The reliability co-efficient (alpha) ranges from 0.76 to 0.84. Perceived economic need is an average score of two questions on how important the respondents think it is to improve the local economic situation and economic opportunities. 1 on this scale represents a low need and 5 represents a strong need. For the three zones around the two sites, the reliabilities co-efficient ranges from 0.80 to 0.91.

Anticipated economic benefits is a scale including two that asked respondents local social and economic benefits the area is enjoying as a result of the location of the landfill. The reliability co-efficient for these items ranges from 0.64 to 0.79 across the various zones. On this scale 1 represents no benefits and 5 represents many benefits.

Three questions are combined to create the perceived risk variable. Each natural environmental, health and safety and damage to social life of the community. When scaled, 1 indicates no risk and 5 represents a high level of perceived risk. Together, these questions have a reliability of above 0.65 for all the zones.

The final variable is a hypothetical project support, measured by responses to the question: if the decision were yours, would you allow the building of a landfill near your area. A five-point scale was employed for this question ranging from "definitely no" (1) to "definitely yes (5). Table 6.9 shows the reliability co-efficient of all the variables in the different zones.

Table 6.9: Reliability Co-efficient for General Economic variables.

	OLUSHOSUN			ABULE EGBA		
	Zone 1	*Zone 2*	*Zone 3*	*Zone 1*	*Zone 2*	*Zone 3*
Economic satisfaction	*0.84*	*0.76*	*0.81*	*0.76*	*0.82*	*0.76*
Perceived economic need	*0.91*	*0.84*	*0.83*	*0.80*	*0.83*	*0.90*
Anticipated economic benefits	*0.79*	*0.68*	*0.78*	*0.64*	*0.68*	*0.74*
Perceived risk	*0.69*	*0.84*	*0.84*	*0.73*	*0.80*	*0.84*

Source: Author's Analysis

As seen from the table, the reliability co-efficient is very high for all the variables in the different zones.

The descriptive statistics of the general economic variables and attitudes toward the location of the landfills are presented in Table 6.10

Table 6.10: Descriptive Statistics for the General Economic Variables and Attitudes toward the Location of the Landfills

VARIABLES	OLUSHOSUN			ABULE EGBA		
	Zone 1	*Zone 2*	*Zone 3*	*Zone 1*	*Zone 2*	*Zone 3*
Economic Satisfaction						
Mean	8.67	8.14	8.30	8.17	8.67	8.50
Standard deviation	2.85	2.83	2.83	2.81	3.12	2.82
Perceived Economic need						
Mean	5.80	4.55	4.55	5.76	5.23	4.77
Standard deviation	2.80	2.65	2.39	2.62	2.72	2.70
Anticipated Economic benefits						
Mean	7.10	7.36	7.97	7.95	7.71	7.64
Standard deviation	2.49	2.51	2.30	2.30	2.22	2.38
Perceived risk*						
Mean	7.16	6.21	5.57	6.29	6.80	6.55
Standard deviation	2.76	2.70	3.09	2.86	3.17	3.06
Hypothetical Project support *						
Mean	2.17	1.93	1.85	1.72	2.17	2.17
Standard deviation	1.20	1.06	0.85	0.95	1.15	1.20
Percent definitely not or probably not support						

* Means differ to a statistically (0.05) degree.

Perceived risk differ significantly among the three zones in Olushosun. More importantly, perception of Risk declined from zone 1 to 3 This is not the case in Abule Egba where the perception of risk is higher in zone 2 followed by zone 3. It is lowest in zone 1. The means for this variable do not statistically differ among the three zones.

Economic satisfaction does not differ statistically among the all the zones on the two sites. So also the perceived economic need and anticipated economic benefits. The means range from 8.14 in zone 2 Olushosun to 8.67 in zones 2 and 1 in both Olushosun and Abule Egba. Perceived economic need however has lower means than economic satisfaction. The means range from 4.55 to 5.80 both in Olushosun. The means shows a gradient of decline from zones 1 to 3 in both locations. Another variable that shows higher mean is the anticipated economic benefits. The means range from 7.10 in zone 1, Olushosun to 7.97 in zone 3 also in Olushosun. The high mean value for this variable is not surprising considering the fact that the location of the landfill has brought about construction of access roads and extension of piped-borne water to the areas around the sites. Specifically, the Lagos state government has just newly constructed access roads in and around the two sites. In Olushosun, the access roads now serve as shortcuts to motorists during periods of traffic hold-ups on Ojota expressway. Also, the involvement of private refuse collectors in the use and management of both sites especially the Abule-Egba is perceived to be an economic benefit by the residents. Apart from the refuse contractors, the car pushers that collect wastes in Oja-Oba market and nearby residential apartments are perceived to have benefited economically from the location of the Abule-Egba landfill. It would be seen that the mean for this variable is highest in zone 1 in this location and the mean values decline from zones 1 to 3.

Hypothetical project support shows a statistically significant difference among the zones in Olushosun site. The mean for this variables is however very low for all the zones. The highest mean recorded is 2.17. These are found in three of the 6 zones altogether. The reason for this low means is not surprising since most of the respondents would not support the location of a landfill in their neighbourhood. This is because of high perception of risk associated with the facility was discussed earlier. Support for waste facility siting is shown in Table 6.11

Table 6.11: Support for Waste Facility Siting

	OLUSHOSUN			ABULE EGBA		
	Zone 1	*Zone 2*	*Zone 3*	*Zone 1*	*Zone 2*	*Zone 3*
Definitely no	*50(10.9)*	*62(13.6)*	*50(10.9)*	*84(20.9)*	*34(8.5)*	*40(10.0)*
No	*65(14.2)*	*74(16.2)*	*83(18.2)*	*55(13.7)*	*57(14.2)*	*51(12.7)*
Undecided	*6(1.3)*	-	*1(0.2)*	*9(2.2)*	*5(1.2)*	*9(2.2)*
Yes	*21(4.6)*	*18(3.9)*	*12(2.6)*	*12(3.0)*	*14(3.5)*	*14(3.5)*
Definitely yes	*9(2.0)*	*5(1.1)*	*1(0.2)*	*2(0.5)*	*7(1.7)*	*8(2.0)*
Total	*151(33.0)*	*159(34.8)*	*147(32.2)*	*162(40.4)*	*117(29.2)*	*122(30.4)*
			$X^2 = 21.41, P<.05$			***$X^2 = 23.27, P<.05$***

Source: Author's Analysis

From Table 6.11, it is clear that more than two-third of the respondents in all the zones would not support the building of landfill within their area only very few respondents are undecided about whether they would support such proposal. The proportion of respondents in this category is highest in zone 1 for both sites (1.3 and 2.2 in Olushosun and Abule Egba respectively). A further analysis using chi-square shows that there is a significant difference in project support among the different zones in the two locations (X^2 = 21.41 and 23.37 respectively for Olushosun and Abule-Egba).

Support for waste facility sitting was also examined using the socio-economic characteristics of the respondents. Results shows that the highest percentage of those who would not support sitting waste facility are those with secondary education in Olushosun (54.6%) while in Abule Egba it is also those with secondary education (15.3%) followed by tertiary education (14.2%). For instance, people with high income in both sites do support waste facility sitting facility at all. For instance in Olushosun, the proportion of respondents that said yes to sitting was zero. In Abule Egba, it was also zero. For age, older respondents would not support waste sitting in both sites.

6.2.1 Relationship between Economic Attitude and Support for Siting of Landfill

Correlation analysis was used to show the relationships between the general economic variables. The result of this is shown in Table 6.12

Table 6.12: Correlation between Economic Variables and Support for Landfill Siting.

OLUSHOSUN					
Zone 1	*1*	*2*	*3*	*4*	*5*
Economic satisfaction	-	*.38***	*-.20**	*.30***	*.10*
Perceived economic need		-	*-.17**	*.14*	*.28***
Anticipated economic benefit			-	*-.39***	*-.13*
Perceived risk				-	*-.19**
Hypothetical project support					-
Zone 2	*1*	*2*	*3*	*4*	*5*
Economic satisfaction	-	*.43***	*-.32***	*.09*	*-.14*
Perceived economic need		-	*-.27***	*.11*	*-.08*
Anticipated economic benefit			-	*-.29***	*.10*
Perceived risk				-	*-.04*
Hypothetical project support					-
Zone 3	*1*	*2*	*3*	*4*	*5*
Economic satisfaction	-	*.09*	*-.42***	*.23***	*-.05*
Perceived economic need		-	*-.21***	*-.01*	*.06*
Anticipated economic benefit			-	*-.36***	*-.02*
Perceived risk				-	*-.07*
Hypothetical project support					-
ABULE EGBA					
Zone 1	*1*	*2*	*3*	*4*	*5*
Economic satisfaction	-	*.15*	*-.19**	*.23***	*-.02*
Perceived economic need		-	*-.23***	*.01*	*.22***
Anticipated economic benefit			-	*-.28***	*-.06*

	1	2	3	4	5
Perceived risk				-	.12
Hypothetical project support					-
Zone 2	*1*	*2*	*3*	*4*	*5*
Economic satisfaction	-	.22*	-.26**	.16	-.19*
Perceived economic need		-	-.29**	.17	.01
Anticipated economic benefit			-	-.36**	-.23*
Perceived risk				-	.16
Hypothetical project support					-
Zone 3	*1*	*2*	*3*	*4*	*5*
Economic satisfaction	-	.37**	-.33**	.34	.05
Perceived economic need		-	-.07	.11	-.16
Anticipated economic benefit			-	-.25**	.14
Perceived risk				-	-.05
Hypothetical project support					-

* *correlation is significant at the 0.05 level*
** *correlation is significant at the 0.01 level*

Source: Author's Analysis

As seen from table 6.12, correlation among these variables indicate that the relationship between the general economic attitudes are not as strong as predicted. The highest correlation value obtained in all the zones in the two locations was 0.43. This was the correlation between economic satisfaction and perceived economic need in Olushosun. Economic satisfaction and anticipated economic benefits are negatively correlated in all the three zones in Olushosun. This implies that the benefits residents enjoy from the location of the landfill do not yet measure up to the economic satisfaction expected to be enjoyed from the facility. The same is also true among all the zones in Abule Egba.

Perceived risk is seen from the table to be negatively correlated with hypothetical project support. Except in zones 1 and 2 in Abule-Egba, all other zones in the two sites have negative correlation between the two variables. The inference to be drawn from this is that the more risky a facility is perceived to be, the lower the level of support for the sitting for such facility. As seen earlier, the support for the location of the two landfills is low.

Perceived economic need and anticipated economic benefits are also negatively correlated for all the zones. This again implies that landfills are not perceived to satisfy any economic need in the two areas.

From the above analysis, perception of risks is related to responses to sitting waste facilities. Furthermore, anticipated economic benefits are also clearly related to responses to sitting waste facilities. This finding is consistent with studies suggesting that anticipated economic benefits and perceived risks are key variables in predicting responses to sitting waste facilities especially if the facility is hazardous (Bailey *et al*, 1989, 1992; Krannich, and Little, 1988, 1989). The correlation values for perceived risk and project support are higher in zones closer to the sites (zones 1 for both sites). This implies that residents closer to the landfill sites perceived more risk from the landfill and are therefore more likely to reject proposal for sitting such a facility in the future.

Multiple regression analysis, of all the variables, including the socio-demographic variables maintained a low standardized regression co-efficient. This means that these variable shave a low influence upon response to sitting waste facility. The R obtained for this model for the two sites are 0.28 (R 2.08) and 0.13 R^2 = 0.02) for Olushosun and Abule Egba, respectively. This R value for Olushosun is however significant ($F = 2.75$, P

= .002) while for Abule Egba, it is not significant (F = .52, P = .859). A look at the regression coefficients shows that non of the values is significant for Abule Egba while for Olushosun the coefficients for sex and perceive risk. The values for education of household head, marital status, perceived economic need and perceived risk are positive for Abule Egba site but for Olushosun site, sex, occupation, income, anticipated economic benefits and perceived risk are the variable with positive regression coefficients.

6.3 Coping Mechanisms with Landfill Impacts among Respondents

Coping is a complex process, influenced by both personality characteristics (Bogler, 1990; Friedman *et al*, 1992) situational demands (Folkman and Lazarous, 1986; Heim *et al*, 1993) and the social and physical characteristics of the setting (Mechanic, 1978). As indicated from the various theoretical paradigms of coping, every factor from physiological, psychological, social to cultural, both affect and are affected by the coping strategies. According to Lazarus and Folkman (1984), coping is an ongoing process, characterized by re-appraisal of the risk as characteristics of the individual and/or risk change over time. Furthermore, particular coping strategies may have their own damaging effects (Cohen *et al*, 1986) and the overall effectiveness of different coping strategies is not yet known (Unger *et al*, 1992).

In response to environmental threats, Giddens (1990) suggests that coping responses take one of the following forms within the context of today's risk societies.

Pragmatic acceptance is characterized by "numbness" towards the issue and withdrawal into everyday life. Beak (1992) refers to this coping response as "turning inwards", as it involves turning away from the risk and finding solace in common place household activities. *Sustained optimism* is marked by continued faith in science and reason (despite increasing distrust of these as a societal level), and ongoing trust in the pronouncements of scientists and experts, regardless of their credibility. An attitude of *cynical pessimism* leads to the use of black humours as a protective mechanism, while those who respond with *radical engagement* work to contest the social and institutional systems responsible for raising the specter of environmental risk (Giddens, 1990). The coping strategies employed by respondents in the empirical results presented below reflect some of the coping responses found in the literature.

Sitting a LULU such as a landfill can stress residents of a neighbourhood. A coping response to this can lead them to engage in public activity. Therefore, to measure stress and activism, questions developed by the centre for disease control for behavioural risk factor surveys was used. It asks respondents to indicate if they had engaged in some activities, such as attending a public meeting, voting in a local election, contacting an official about a problem, engaged in sports or recreation, among others. The summary of responses by residents around the two landfill sites is presented in Table 6.13.

Table 6.13: Sources of Coping with landfill Impacts among Respondents

	OLUSHOSUN			ABULE EGBA		
	Zone 1	*Zone 2*	*Zone 3*	*Zone 1*	*Zone 2*	*Zone 3*
Attending public meeting						
Yes	*95(60.1)*	*103(60.6)*	*116(72.5)*	*112(62.2)*	*72(55.8)*	*80(60.2)*
No	*63(39.9)*	*63(39.4)*	*44(27.5)*	*68(37.8)*	*57(44.2)*	*53(39.8)*
Voting in a local election						
Yes	*109(69.0)*	*122(71.8)*	*134(83.8)*	*131(72.8)*	*88(68.2)*	*97(72.9)*
No	*49(31.0)*	*48(28.2)*	*16(16.3)*	*49(27.2)*	*41(31.8)*	*36(27.1)*
Contacting an official about a problem						*60(45.1)*
Yes	*82(51.5)*	*73(42.9)*	*104(65.0)*	*91(50.6)*	*57(44.2)*	*73(54.9)*
No	*76(48.1)*	*97(57.1)*	*56(35.0)*	*81(49.4)*	*72(58.8)*	
Sport						
Yes	*84(53.2)*	*64(37.6)*	*46(28.8)*	*85(47.2)*	*56(43.4)*	
No	*74(46.8)*	*106(62.4)*	*114(71.3)*	*95(52.8)*	*73(56.6)*	*54(40.6)*
						79(59.4)
Vigilante group						
Yes	*65(41.1)*	*55(32.4)*	*67(41.9)*	*63(35.0)*	*36(27.9)*	*45(33.8)*
No	*93(58.9)*	*115(67 6)*	*93(58.1)*	*117(65.0)*	*93(72.1)*	*88(66.2)*
Recreation						
Yes	*84(53.2)*	*66(38.8)*	*79(49.4)*	*98(54.4)*	*46(35.7)*	*64(48.1)*
No	*74(46.8)*	*104(61.2)*	*81(50.6)*	*82(45.6)*	*83(64.3)*	*69(51.9)*

Source: Author's Analysis

From the above results, it is clear that there is no marked variation among the different zones in the coping mechanisms of respondents with the impact of the landfills. Those respondents that have attended one public meeting or the other were more than those who have not attended in all the zones at both sites. This is also true of those who have recently voted in a local election and those who have contacted an official about a problem or the other. For sports, vigilante group and recreation however, the reverse is the case.

Specifically, respondents were asked whether they have at one time or the other made complaints to the authority about the menace of the landfills. This result of this analysis shows that there is a decline in the percentage of respondents that have made one complaints or the other to the authority about the landfill in Olushosun (35%, 32% and 20% respectively in zones 1,2 and 3). This was not the case in Abule Egba. However, the highest percentage of those who have made complaints in Abule Egba are found in zone 1 (27.2%).

The research also sought to know whether the complaints were made by individuals or communities around the landfill sites. More than two-third of the respondents in Olushosun said the complaints were made by communities (83.6%). The same is also true for Abule-Egba (76.8%). This was found to be done in most cases by the landlords association or the most recently formed groups especially development associations mostly made up of youths. In terms of response to these complaints again, more than two-third of the respondent around both sites responded that there were little or no response from authority (68.3% and 72.3% respectively for Olushosun and Abule-Egba).

Many of the respondents interviewed have resulted to emotion-focused coping strategies. This fitted well within the theoretical framework developed within the risk society literature (Giddens, 1990; Beck, 1992). For example, an attitude of pragmatic acceptance was adopted by many of the respondents who seemingly accepted that "what will be, will be and there is nothing we can do about it". Some of the typical responses by respondents also included "we don't have a government", "there is nothing anybody can do about it" etc. Some of the respondents were observed to have "turned inwards" (Beck, 1992), separating their concerns from the routine of everyday life. Those respondents reported that they tried not to think about the landfill in order to remain focused on what they considered more important issues in their lives. This is especially the case among the respondents in zone 1 at the Abule-Egba site. As discussed earlier, more than two-thirds of the respondents ion this zone have low socio-economic characteristics.

This withdrawal into everyday life could be seen as an attempt to mend/preserve one's analogical security (having confidence in the reliability of persons and things is normally maintained by 'bracketing out' unnerving areas of life (Giddens 1990, 1992) by 'bracketing out' the distressing issues associated with the landfills.

Little evidence of the use of sustained optimism as a coping strategy was observed at either sites. While pragmatic acceptance is characterized by a sense of powerlessness with respect to the location of the landfills, sustained optimism is a means of coping whereby respondents abdicate power to 'experts', regardless of their credibility and trust that these experts, and science and "providential reason" more generally, will protect them from negative consequences. The reason for lack of use of sustained optimism is the fact that in Nigerian urban areas, hardly are there information on operations and adverse environmental and social impact of landfills or any other noxious facilities for that matter.

Little evidence of the use of cynical pessimism as a coping strategy was also uncovered at either site. According to Giddens (1990), cynical pessimism does not include all cynicism – instead, it requires the use of "black humous". Therefore, although many of the respondents at both sites were cynical about the landfill, cynical pessimism was not often recorded as a coping strategy because respondents found it difficult to laugh about their predicament.

In all, a variety of coping strategies, both action and emotion-focused were used by respondents. The coping strategies used by respondents do not show any marked differences among the zones around the landfill sites.

Two major issues can be deduced from the analysis of the coping strategies employed by respondents. Firstly, those feeling strongly affected by the landfill were most likely to take actions to reduce impact. Secondly, these same categories of respondents will or had made efforts to relocate from their present residence. An important action-focused strategy in response to the impact of the landfill is the decision to move. Movement in this regard involves changing residence completely from the area where the landfill is located. This is similar to the results obtained from a previous study by Elliott and Taylor, (1996), and Elliott (1992). An analysis on desire to change residence as a result of landfill menace has already been discussed in section 6.1.3. As discussed in that section, more than two-third of the respondents would like to change their residence if given the opportunity. Again, more than two-thirds of those who would want to change residence are in zone 1 at both sites. This indicates that the impact of the landfill is much more associated with the desire to change residence. To avoid careless assumption however, respondents were asked to mention the specific reason why they would want to leave their present neighbourhood. Their responses, presented in Table 6.14. shows that landfill menace is the second most important reason why respondents would want to change their present neighbourhood.

Table 6.14: Reasons for Decision to Change Residence

	OLUSHOSUN			ABULE EGBA		
	Zone 1	*Zone 2*	*Zone 3*	*Zone 1*	*Zone 2*	*Zone 3*
Increase in real income	*38(11.7)*	*44(13.5)*	*27(8.3)*	*32(12.7)*	*23(9.2)*	*80(31.9)*
Increase in house rent	*12(3.7)*	*17(5.2)*	*20(6.1)*	*15(6.0)*	*12(4.8)*	*49(19.5)*
Landfill menace	*25(7.7)*	*24(7.4)*	*30(9.2)*	*30(12.0)*	*21(8.4)*	*79(31.5)*
Others	*34(10.4)*	*24(7.4)*	*31(9.5)*	*23(9.2)*	*7(2.8)*	*43(17.1)*
Total	*109(33.4)*	*109(33.4)*	*108(33.1)*	*100(39.8)*	*63(25.1)*	*88(35.1)*
			X^2*=8.65, P=0.19*			X^2*=6.93, P=0.33*

Source: Author's Analysis

This reason comes after increment in real income which most of the respondents claim will easily make them change their present residence. It would be recalled that most of the respondents are renters who would either want to move to better houses or neighbourhood of move to their own personal houses. There is no marked decline from zone 1 in terms of the percentage of respondents who would want to leave their present neighbourhood in both sites. In all, however, this percentage is incidentally the same (79%) in both sites. Chi-square analysis result shows that the difference in desire to change residence among the respondents in the three zones is not significant around the two sites.

In summary, those respondents choosing to live in their present area did so primarily for two reasons: affordable house rent and the existence of strong social network. In short for many residents, the social and economic benefits of living in their present area outweighed the environmental costs. This is similar to findings of Preston *et al* (1983) in a Canadian study.

6.4 Relationship between Landfill Location and Willingness to Pay for Improved Environmental Quality

The economic theory has developed techniques of evaluation of items (within the environment) such as noise, odour, aesthetics, etc which in some way affect an individual's enjoyment of life or utility (Lake *et al*, 1998). Economists argue that we can measure the value of a desirable item by looking at how much an individual is willing to pay for it (Turner *et al*, 1994). Contingent valuation is the term applied to the technique of asking people to place monetary values on goods or environmental changes for which no market exists. It usually involves questions about the amount that a household would be willing pay for an improvement in environmental quality or be willing to accept for a decrease in quality (Nieves, 1996; Pierre and Loomis, 1993; North and Griffin, 1993). Questions can also be framed in terms of likely changes in household behaviours, such as visits to a location, or choice of housing location at alternative distances from a noxious facility. The contingent valuation method depends upon individual responses to contingent situations posited in artificial or experimental markets (Bergston *et al*, 1989; Mitchel *et al* 1989). In a contingent valuation method, respondents preference are solicited through a survey technique to state their willingness to pay (WTP) for a benefit gained from an improvement in environmental quality (in this study an improvement in quality of landfill practices) or for a loss caused by degradation of environmental quality (in this case, reduced property value and health risks).

Respondents were asked to indicate their willingness to pay for an improved environmental quality in their neighbourhood. The basis of this question is the fact that their present neighbourhood already has an environmental contaminant (the presence of the landfills). The analysis of response to this question is presented Table 6.15.

Table 6.15: Willingness to Pay for Improved Environmental Quality

	OLUSHOSUN			ABULE EGBA		
	Zone 1	*Zone 2*	*Zone 3*	*Zone 1*	*Zone 2*	*Zone 3*
Yes	*115(26.5)*	*93(21.4)*	*73(16.8)*	*119(29.5)*	*85(21.0)*	*83(20.5)*
No	*26(6.0)*	*59(13.6)*	*68(35.3)*	*43(10.8)*	*31(7.7)*	*43(10.6)*
Total	*141(32.5)*	*152(35.0)*	*141(32.5)*	*162(40.1)*	*116(28.7)*	*126(31.2)*

Source: Author's Analysis

Table 6.15 reveals that the presence of the landfill could be associated with willingness to pay for improved environmental quality. The proportion of those in this category clearly shows a decline from zone 1 to zone 3 in Olushosun (26.5%, 21.4% and 16.8%). In this same location, the proportion of those not willing to pay for environmental improvement clearly decreased from zones 1 to 3. For Abule – Egba, there is also a decline in willingness to pay from zones 1 to 3 (29.5%, 21.0% and 20.5%). Contingent valuation also emphasizes the specific amount people would be willing to pay for improvement in environmental quality. Therefore, apart from wanting to know whether people will be willing to pay for improvement in environmental quality, the research sought to know the specific amount respondents will be willing to pay. About 143 respondents did not respond to this question in Olushosun and in Abule-Egba. These non-responses were therefore treated as missing cases in the analysis. Table 6.16 presents the analysis of the various amount respondents would be willing to pay monthly.

Table 6.16: Amounts Respondents are willing to Pay

	OLUSHOSUN			ABULE EGBA		
	Zone 1	*Zone 2*	*Zone 3*	*Zone 1*	*Zone 2*	*Zone 3*
Less than N100	*58(19.0)*	*49(16.1)*	*26(8.5)*	*72(24.7)*	*33(11.3)*	*47(16.2)*
N101-N300	*42(13.8)*	*40(13.1)*	*39(12.8)*	*31(10.7)*	*36(12.4)*	*20(6.9)*
N301-N500	*19(6.2)*	*12(3.9)*	*5(1.6)*	*16(5.5)*	*9(3.1)*	*8(2.7)*
>N500	*6(2.0)*	*3(1.0)*	*6(2.0)*	*6(2.1)*	*10(3.4)*	*3(1.0)*
Total	*125(41.0)*	*104(34.1)*	*76(24.9)*	*125(43.0)*	*88(30.2)*	*78(26.8)*

Source: Author's Analysis

One fact that emerged from this table is that respondents are not generally wiling to pay much for actions to improve environmental quality. The reason for this may not be unconnected with the general economic situation in the country. However, the amount respondents are willing to pay for improve environmental quality drastically decreased from lower amount to higher amount in zones 1 to three in the two locations. Also, the amount people are willing to pay also decreased from zone 1 to zone 3 in the two locations. Two facts emerged from the analysis. Firstly, as discussed earlier, the location of the landfill is very much associated with willingness to pay for improved environmental quality. This reflected in the result of the analysis as the proportion of respondents willing to pay decreased consistently from zone 1 to zone 3 in the two locations. Secondly, people are not generally willing to pay high amount for environmental amelioration.

The results of correlation analysis between WTP and distance to the landfills showed that there is a positive correlation between the two variables (0.25 and 0.068 respectively for the two sites). The result of the multiple correlation analysis is presented in Table 6.17.

Table 6.17: Multiple Correlation Analysis between WTP and Socio-Economic Characteristics of Respondents

OLUSHOSUN

	WTP	AGE	NHHOLD	TENURE	AGE	EDUC	MS	DFILL	INCOME
WTP	-								
AGE	-.028	-							
NHHOLD	-.042	-.305**	-						
TENURE	-.078	-.243*	-.104*	-					
AGE	-.046	.883**	.281**	-.233**	- -				
EDUC	.054	-.196**	-.096*	.000	-.196*	-			
MSTATUS	.182**	.164**	.096*	-.073	.140**	-.092*	-		
DFILL	.251**	-.109*	-.150*	.042	-.16*	.033	.059	-	
INCOME	-.016	.019	-.123*	-.051	.020	.114*	-.109*	.132*	-

ABULE-EGBA

	WTP	AGE	NHHOLD	TENURE	AGE	EDUC	MS	DFILL	INCOME
WTP	-								
AGE	-.045	-							
NHHOLD	-.136**	.205**	-						
TENURE	-.096	-.154**	-.099*	-					
AGE	-.069	.918*	.206**	-.154**	-				
EDUC	-.067	-.196**	-.049	.128**	-.217**	-			
MSTATUS	.052	.072	.031	.020	.009	.008	-		
DFILL	.068	-.068	.022	.097*	-.071	.142**	.008	-	
INCOME	-.039	.043	-.084	.093	.006	.300**	-.026	-.080	-

Furthermore, regression analysis was used to examine the influence of socio-economic status and the factor of the landfill presence on WTP. The essence of this is to see whether the effect of the landfill presence could be more important in the willingness to pay for improved environmental quality.

The variables used for the model are shown in Table 6.18.

Table 6.18: Variable list description of Landfill Impact on Willingness to Pay for Environmental Improvement

Variable	Description
WTP	1 – If Willing to pay*
DFILL	Distance to Landfill
LAREA	Length of stay in the area
INCOME	Annual income of the respondent
NHHOLD	Number of people in the household
AGE	Age of respondent
TENURE	Tenural status of respondent
EDUC	Level of Education of respondent
MSTATUS	Marital status of respondent
SEX	1- If Respondent is a male*
EDUC	Level of Education of respondent

* otherwise zero

The regression statistics for this analysis is summarized below

Regression Statistics for Olushosun

Coefficient of multiple determination	0.358
Coefficient of multiple correlation	0.128
Adjusted R-square	0.102
Standard error of the estimate	0.437
F-ratio	4.915
Degree of freedom	310
Probability of chance	.000

Regression Statistics for Abule-Egba

Coefficient of multiple determination	0.236
Coefficient of multiple correlation	0.056
Adjusted R-square	0.026
Standard error of the estimate	0.434
F-ratio	1.882
Degree of freedom	295
Probability of chance	.054

Source: Author's Analysis

For this regression model where the dependent variable is WTP, the R obtained for Olushosun and Abule Egba are 0.36 and 0.24 respectively while the R^2 for both sites are 12.8% and 5.6% respectively for both sites. These values are very low. As stated in previous regression models, there are many factors outside the socio-economic factors that would influence willingness to pay. For instance the political situation in the country. Many of the respondents are of the opinion that even if they are willing to pay, the money will not be utilized for the purpose it was meant for, given the current level of corruption in government and public institutions. However, results of the analysis of variance for the two sites show that these regression values is significant only for Olushosun (F values = 4.46 and 1.88 respectively for the two sites). For these two models, the Beta coefficients revealed that for the two sites, that landfill is the most important variable affecting WTP (0.25 and 0.06 for Olushosun and Abule Egba respectively). The *T-test* values for these co-efficient is however only significant for Olushosun. Also, for Olushosun, the only other significant factor is MSTATUS while for Abule Egba, the two significant factors are TENURE and NHHOLD. The analysis is presented in appendix3.

So from these analyses, it is obvious that the presence of the landfill and its associated environment impacts is an important factor contributing to respondents' willingness to pay for any environment in their neighbourhood. This conclusion may however be subjected to further research in the sense that other environmental and even socio-political factors may also affect people's willingness to pay for environmental improvement and there may also be need to compare this willingness in different areas with none or many environmental problems.

6.5 Conclusion

This chapter has shown that there are variations in the perceived impacts of landfills among residents around the two landfill sites. The effects of landfills are not expected to be uniformly circular since a host of factors, such as weather conditions (primarily wind direction), truck traffic, and the quality of landfill management, combine to determine the ultimate direction and extent of any potential landfill effect. However, not surprisingly, this chapter showed that there is a negative gradient of major impact categories from the landfill as analysed. In other words, the farther from the landfills, the weaker the impact of the nuisance factors associated with the landfills. Furthermore, the various coping mechanisms of respondents were also analysed. Many of the respondents were found to engage in emotion-focused and action-focused coping mechanisms. The action-focused mechanisms were shown to include decision to relocate from the present neighbourhood where the landfills are located. Thus, two major issues can be deduced from the analysis of the coping strategies employed by respondents. Firstly, those feeling strongly affected by the landfill were most likely to take actions to reduce impact. Secondly, these same categories of respondents will or had made efforts to relocate from their present residence. The result of the analysis clearly shows that willingness to pay for improved environmental quality declines away from the landfill sites. This implies that those living closer to the landfills will be willing to pay for environmental improvement. The relationships are however not as strong as expected.

The two regression models used in testing the hypotheses on landfill impact on neighbourhood impact perception and willingness to pay showed that the major factors used in the model did not provide much explanation for the dependent variables (i.e willingness to pay and neighbourhood quality rating). However, the landfill coefficients had higher weights and mostly positive for all the models.

Perceived risk was found to be negatively correlated with support for landfill siting. The inference to be drawn from this is that the more risky a facility is perceived to be, the lower the level of support for the siting for such facility.

CHAPTER SEVEN

IMPACT OF LANDFILLS ON RESIDENTIAL PROPERTY VALUES

7.0 Introduction

This chapter examines the impact of the two landfills (Olushosun and Abule Egba) on property values of the adjoining residential apartments. Landfills are known to have adverse impact on property values in areas where they are located. The impact on landfills on property values is examined within the hedonic pricing framework as discussed in section 2.1.1.3. The relevance of the hedonic price model lies in the fact that it expresses property values as a function not only of the quality of structural attributes of property but as well as neighbourhood and locational attributes. All residential properties are treated with their rental values and this is consistent with Linneman's (1981) view that the annual value of all properties can be analysed from rental information. Furthermore the major attractions to the present neighbourhood where the respondents currently live are also examined.

7.1 Characteristics of Sampled Properties

7.1.1 Age of Building

Table 7.1 reveals the general picture of the variable between the zones. There are clear indications as to how the age of the dwelling units vary across the zones

Table 7.1: Age of Building

ge of uilding	OLUSHOSUN								ABULE-EGBA							
	Zone 1		Zone 2		Zone 3		Total		Zone 1		Zone 2		Zone 3		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
and below	24	5.15	21	4.51	26	55.58	71	15.24	45	10.84	32	7.71	29	6.99	106	25.54
-20	70	15.02	77	16.52	63	13.52	210	45.06	61	14.69	56	13.49	56	13.49	173	41.67
-30	47	10.09	50	10.73	56	12.02	153	32.84	52	12.53	30	7.25	29	6.99	111	26.77
-40	12	2.58	12	2.58	8	1.72	32	6.88	8	1.93	4	0.96	13	3.13	25	6.02
tal	153	32.84	160	34.34	153	32.84	466	100.02	166	39.99	122	29.41	127	30.6	415	100.0

Source: Author's Analysis

As seen from the analysis, most of the dwelling units aged between 11 and 12 years (15.0%, 16.5% and 13.5% in zones 1, 2 and 3 respectively in Olushosun site). This was also the case in Abule Egba where the proportions were 14.7%, 13.5% and 13.5% respectively in zones 1 to 3. Furthermore, following the age group 11-20, another significant proportion of the dwelling units fall between ages 21 and 30 in the three zones in Olushosun. This, same pattern is also found in Abule-Egba. Those building that are age 31 and above constitute the lowest percentage. This observation is not surprising since both areas are recently developed urban fringes within the metropolis.

7.1.2 Plot Size

The plot size of a building depicts the size of the house, the use to which the house is put into or the wealth of the owner. For instance, in high-income residential areas, plot sizes are usually bigger to make room for gardens or haven. Table 7.2 displays the plot sizes of various dwelling units in all the zones.

Table 7.2: Plot Size

ot Size	OLUSOSHUN								ABULE-EGBA							
	Zone 1		Zone 2		Zone 3		Total		Zone 1		Zone 2		Zone 3		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	
by 30m	14	3.10	17	3.78	16	3.55	33	8.40	47	10.43	12	3.05	9	2.29	54	13.
by 36m	78	17.29	78	17.29	60	13.31	67	17.05	216	47.89	58	14.76	54	13.74	179	45.
by 36m	40	8.87	48	10.64	41	9.09	37	9.41	129	28.6	31	7.89	45	11.45	113	28.
30 by 36m	10	2.22	15	3.33	34	7.53	20	5.09	59	13.08	15	3.82	12	3.05	47	11.
tal	142	31.48	158	35.03	151	33.48	157	39.95	451	100.0	116	29.52	120	30.53	393	10

Source: Author's Analysis

As seen in the table, plot size 18 by 36m are most common in all the zones in Olushosun and Abule-Egba. They show a consistently higher percentage over other plot sizes. There are more smaller plot sizes in Abule-Egba especially in zones 2 and 3 (3.1% and 2.3%) respectively. Also, larger plot sizes constitute the lowest percentages in Olushosun except in zone three.

7.1.3 Source of Regular Water Supply

Availability of water both for drinking and other domestic uses is one of the major attraction to a house. Often, availability of water supply is often advertised as one of the qualities of a house for intending tenants. The source of regular water supply among the house sampled is shown the Table 7.3.

Table 7.3: Source of Water Supply

Source of Water Supply	OLUSHOSUN								ABULE-EGBA							
	Zone 1		Zone 2		Zone 3		Total		Zone 1		Zone 2		Zone 3		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Pipe-borne	43	9.2	43	9.2	22	4.7	20	4.8	108	23.1	11	2.6	12	2.9	43	10.3
Well	55	12.0	56	12.0	46	9.9	106	25.4	157	33.9	63	15.0	72	17.2	241	57.6
Bore hole	48	10.3	58	13.0	35	7.0	39	9.3	141	30.3	36	8.6	36	8.6	111	26.5
Others	4	0.9	9	1.9	46	9.9	9	2.2	59	12.7	7	1.7	7	1.7	23	5.6
Total	150	32.4	166	35.1	149	31.0	174	41.7	465	100	117	27.9	127	30.4	418	100

Source: Author's Analysis

Well water is the most regular source of water supply in all the zones in both sites. This is not surprising because there is much dependence on the use of well within Lagos metropolis generally. Tenants see a house without well in the metropolis as not being good enough. Apart from well, borehole is another major source of water supply especially in Olushosun where they show a higher percentage in all the three zones. Also, pipe borne water is an important source of water supply among the houses in Olushosun whereas for Abule-Egba, they show low percentages. For instance in Olushosun, the lowest percentage 4.7% (in zone 3) is higher than the highest percentage in Abule-Egba 4.8% (in zone 1).

7.1.4 Type of Toilet Facility

The type of toilets found in house units are shown in Table 7.4. Water closet, which is the most modern type of toilet, constitutes the highest percentage of toilets found in the houses in both sites. We have more houses with pit latrine in Abule-Egba than in Olushosun.

Table 7.4: Type of Toilet Facility

Type of Toilet Facility	OLUSHOSUN								ABULE-EGBA							
	Zone 1		Zone 2		Zone 3		Total		Zone 1		Zone 2		Zone 3		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Pit	25	5.7	33	7.6	15	3.4	73	16.7	37	9.7	32	8.4	45	11.8	114	29.9
Water closet	97	22.3	106	24.0	110	25.3	313	71.6	88	23.2	77	20.3	69	18.2	234	61.7
Pail latrine	19	4.4	15	3.4	11	3.0	45	10.8	12	3.2	7	1.8	9	2.4	28	7.4
Bush	-	-	-	-	4	0.9	4	0.9	2	0.5	2	0.5	-	-	4	1.0
Total	141	32.4	154	35.0	140	32.6	435	100	139	36.6	118	31.0	123	32.4	380	100

Source: Author's Analysis

However bush latrine is not a common type of toilet facility in both sites. For instance, in Olushosun, it is only in zone 3 where we have 0.9% of the houses having bush latrine. In Abule-Egba, it is also found in 0.5% of houses in both zones 1 and 2. The response to this showed consistently low percentages among the various zones in the two locations. This is not surprising given the fact that property owners are expected to provide basic facilities in the house since toilet facility is one of the major considerations when seeking for accommodation by would-be tenants.

7.2 Respondents' Reasons for Staying in their Present Houses

Questions were asked about neighbourhood characteristics that might attract people to a neighbourhood. The United States Department of Commerce's biannual American Housing Survey (AHS) (Greenberg *et al*, 1995) provided the format for the survey questions in this section. Although the AHS focuses primarily on housing conditions, it also asks respondents about bothersome neighbourhood conditions. It also asks about neighbourhood characteristics that might attract people. Using their question format, their set of potentially attractive characteristics were posed as dichotomous variables. Respondents were asked it they live in the neighbourhood because it was convenient to their job, to friends and relatives the availability of leisure activities, public transportation, a hospital, shopping, good schools and affordable house rents. This essence of this is to see if these attractions were powerful enough to make residents overlook the presence of the landfills in their neighbourhood. Table 7.5 reveals the reasons why respondents chose to live in their present area in spite of the presence of the landfills. For Olushosun, these reasons include; job convenience, (70.7%), availability of good schools (perhaps for children or wards) (69.9%), ease of transportation (68.0 percent) and affordable rent (61.9%). These were the most important reasons why

Table 7.5: Respondents' reasons for living in the Present Location

	OLUSHOSUN								ABULE-EGBA							
	Zone 1		Zone 2		Zone 3		Total		Zone 1		Zone 2		Zone 3		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Convenient to my job																
Yes	114	23.4	111	22.7	120	24.6	345	70.7	88	19.9	61	13.8	88	19.9	237	53.6
No	44	9.0	59	12.1	40	8.2	143	29.3	92	20.8	68	15.4	45	10.2	205	46.4
Convenient to friends and relative																
Yes	95	19.5	93	19.1	60	12.3	248	50.8	72	16.3	48	10.9	73	16.5	193	43.7
No	63	12.9	77	15.8	100	20.5	240	49.2	108	24.4	81	18.3	60	13.6	249	56.3
Availability of leisure activities																
Yes	90	18.4	75	15.4	75	15.4	240	49.2	49	11.1	41	9.3	42	9.5	132	29.9
No	68	13.9	95	19.5	85	17.4	248	50.8	131	29.6	88	19.9	91	20.6	310	70.1
Ease of transportation																
Yes	111	22.7	118	24.2	103	21.1	332	68.0	70	15.8	64	14.5	66	14.9	200	45.2
No	47	9.6	52	10.7	57	11.7	156	32.0	110	24.9	65	14.7	67	15.2	242	54.8
Good schools																
Yes	107	21.9	113	23.2	121	24.8	341	69.9	73	16.5	65	14.7	68	15.4	206	46.6
No	51	10.5	57	11.7	39	8.0	147	30.1	107	24.2	64	14.5	65	14.7	236	53.4
Good hospital																
Yes	95	19.5	96	19.7	100	20.5	291	59.6	62	14.0	62	14.0	56	12.7	180	40.7
No	63	12.9	74	15.2	60	12.3	197	40.4	118	26.7	67	15.2	77	17.4	262	59.3
Shopping/market																
Yes	109	22.3	106	21.7	69	14.4	284	58.2	92	39.0	66	14.9	78	17.6	236	53.4
No	49	10.0	64	13.1	91	18.6	264	41.5	88	19.9	63	14.3	55	12.4	206	46.6
Affordable rent																
Yes	94	19.3	95	19.5	113	23.2	302	61.9	85	19.2	64	28.4	76	17.2	22	50.9
No	64	13.1	75	15.4	47	9.6	186	38.1	95	21.5	65	14.7	57	12.9	217	49.1
Other activities																
Yes	63	12.9	67	13.7	52	10.7	182	37.3	56	12.7	50	11.3	57	12.9	163	36.9
No	95	19.5	103	21.1	108	22.1	306	62.7	124	28.1	79	17.9	76	17.2	279	63.1

respondents chose live in their present houses. There is however variations in reasons given by respondents in the different zones. In Olushosun zone 1, the most important reasons given were job convenience (23.4%) and ease of transportation (22.7%). In zone 2 the reasons were ease of transportation (24.2%) and availability of good schools (23.2%). Lastly in zone 3, the reasons were availability of good schools (24.8%) and job convenience (24.6%).

For Abule-Egba, the most important reasons were job convenience (53.6%), availability of good schools and ease of shopping. These two reasons both had 53.4 per cent. Again there are slight variations in these reasons across the zones. For instance a zone 1, the reasons were ease of shopping (39.0%) and job convenience (19.9%). In zone 2, the reasons wee affordable rent (28.4%) and ease of shopping (14.9%). Lastly, in zone 3, the reasons were job convenience (19.9%) and ease of shopping (17.6%).

7.3 Measurement of Landfills Impacts on Property Value

The housing attributes generally consist of structural attributes, neighbourhood/environmental attributes and locational/accessibility variables. Structural variables define the fabric of each building and the plot upon which it is built (e.g. number of rooms, kitchens, number of floors, age of building etc). Neighbourhood/environmental variables describe the characteristics of the local area in which the property is located (e.g crime rate, condition of local roads, noise, odour, presence of social amenities etc). Previous studies have shown that neighbourhood attributes are related to the level of social deprivation in an area (Castairs and Morris, 1992). Accessibility/locational variables define the ease with which local amenities can be reached from the property and for this study, schools, religious centers, shops and workplace were considered. The measure of accessibility was taken as estimate of travel distance (in kilometres) to each of these facilities.

Measure of residential property value is the monthly housing rent. For renters, this measure has been shown to give an observable and unambiguous measure of housing value (Arimah, 1992). The variable of variable of primary interest is distance to landfill site. This was measured as the distance along a straight line from the residential property to the centre of the landfills. If households are unaware of the disamenity effects of the landfill, renter values will be unaffected by proximity to the landfill. If, on the other hand, renters interpret proximity to a landfill as a disamenity, this will be capitalized into rental values. Following Michaels and Smith (1990), this variable serves as a proxy for two effects: the disamenity characterising landfills and the perception of risk. The other variables to be used are representatives of the structural, locational and neighbourhood attributes of housing. These variables are comparable with the conventional housing attributes used in hedonic price studies (Arimah, 1995)

This hypothesis was tested using the hedonic regression. The hedonic regression are of the double-log form. One of the basic issues in hedonic theory is determining the correct specification of the functional form of the hedonic relationship. A fact that emerges from the literature is that the relationship between housing values and the bundle of attributes is non-linear (Rosen 1974; Harrison and Rubenfeld, 1978). There is theoretic support for a functional form that incorporates some interaction/interdependencies among the various housing attributes (Butler, 1982; Megbolugbe and Frank, 1987). The choice of functional form is based on several considerations: explanatory power, stability and significance of implied relationship; and reduction in the occurrence of heteroscedasticity. The double-log is therefore preferable because it allows for declining marginal prices and interdependencies among housing attributes. The variables that were used for the regression are specified as follow:

Y (MRENT)	Monthly housing rent (in Naira)*
X_1 (AOB)	Age of building
X_2 (TOB)	Type of building
X_3 (NF0)	Number of floors
X_4 (NBATH)	Number of bathroom
X_5 (PSIZE)	Plot size
X_6 (DFILL)	Distance of building to landfill site
X_7 (NNHOLD)	Number of persons in the household
X_8 (DWORK)	Distance to workplace by head of household
X_9 (CRIME)	1 – If crime level in the neighbourhood is high**
X_{10} (ACESS)	1 – If accessibility to neighbourhood facilities is good**
X_{11} (ROAD)	1 – If adjoining road is good**
X_{12} (GARBAGE)	1 – If garbage is collected frequently**

* Monthly housing rent was expressed as the current value of Naira

** Otherwise zero.

The regression equation is then specified as follows:

$$Ln(MRENT) = b_1Ln(AOB) + b_2Ln(TOB) + b_3Ln(NF) + b_4(NBT) + b_5Ln(PSIZE) + b6Ln(DFILL) + b_7Ln(NNHOLD) + b_8Ln(DWORK) + b_9(CRIME) + b_{10}(ACCESS) + b_{11}(ROAD) + b_{12}(GARBAGE).$$

7.3.1 Definition of Variables Used for the Hedonic Regression

The dependent Variable (MRENT)

The monthly rent paid was used as the dependent variable (Y), and expressed in the current value of the Naira. For renters, this measure has been shown to give an observable and unambiguous measure of housing value (Arimah, 1992; Arimah and Adinnu, 1995; Linneman, 1981).

Independent variables

Much as we are interested in the marginal effect of distance of buildings on rental values, it is impossible to exclude other seemingly interactive variables. Thus, several other independent variables are included in the analysis. These variables, together with their operational definitions, and the hypotheses concerning the relationship between each independent variable and the dependent variable are presented below.

Age of Building (AOB)

Essentially, the age of building provides information on when it was constructed, and this is measured in years. In this study, it is expected that the rent of a building would be influenced by the age of a building, new buildings are expected to attract higher rents due to higher construction costs and improved structural and aesthetic features.

Type of Building (TOB)

This variable measures the structural pattern of the dwellings. The types are bungalow, duplex, flat and Brazilian/rooming houses. Detached bungalows and duplexes are expected to attract higher rents than flats and rooming houses.

Number of Floor (NFO)

This particular variable is a slight extension of the preceding one, in that it measures the total number of floors in each type of building. Very often, single floor detached buildings that are flats, are usually more expensive to rent than 4-flat type. Three and four–storey buildings are often relatively cheaper too. A bungalow for instance, generally has one floor, while typically a duplex building has two floors. Where variations from these norms exist, they are usually indicated.

Accessibility to Neighbourhood facilities (ACCESS)

This variable simply used numbers (i.e dummy variables) to indicate the Accessibility of the house to Neighbourhood facilities. Houses that are more accessible to neighbourhood facilities often attract higher rents.

Plot size (PSIZE)

Normative physical planning principles contend that residential plots should not be of the size. Large plots are expected to cost more and so attract higher rental values, depending however, on the type and size of building including available amenities.

Distance of Building to landfill Site (DFILL)

The great significance of the distance variable in planning and geographic studies has been treated in detail by Olsson (1965). However, the literature review in this study discussed the distance variable vis-à-vis hazardous facilities. The definition of distance as used and measured in this study has already been discussed in the early part of this section.

There are other variables used in the analysis which are not defined here. They are broadly defined as being neighbourhood or locational attributes of a house. These include frequency of waste collection, condition of roads, distance to workplace by head of household, crime level in the neighbourhood and access to neighbourhood facilities among others

A multiple correlation analysis of both the dependent and all the independent variables, presented in Table 7.6, shows that distance to landfill is both positively and negatively correlated with most of the hedonic housing variables. In particular, however, monthly rent has a positive relationship with distance of building from the landfill site which tentatively renders this particular hypothesis valid (r = 0.20 and 0.02 for both Olushosun and Abule Egba). Even though the r values are not as strong as expected, it conforms to *a priori* expectation that property values appreciates as one moves away from landfill site. In other words, proximity to landfill is viewed as a form of housing disamenity. This result implies that rental values increase as distance increases from the landfill site. In other words, houses closer to the landfill sites attract lower rental values. But unlike Abule Egba, the r-value for Olushosun is significant. The results obtained in this analysis are not surprising considering the fact that there is acute shortage of residential apartments in Lagos. Therefore, landfill or any other noxious facility in the neighbourhood may not play any significant influence residential choice especially for low and middle income earners.

Table 7.6 : Zero Order correlation between MRENT and the independent variables

OLUSHOSUN

	MRENT	AOB	THOUSE	DFILL	TENURE	PSIZE	NHHOLD	DWORK	GABAGE	ACCESS	CRIME	ROAD
MRENT	1.000	.075	.509**	.023	.196**	.176*	.133	.148*	-.019	-.103	.005	.009
AOB		1.000	.016	.027	-.025	.146**	.031	-.102*	-.065	.057	-.044	.018
THOUSE			1.000	.004	.076	.046	.167**	.122*	.084	.160**	.056	.103*
DFILL				1.000	.004	.107*	.024	-.059	-.076	-.074	-.042	-.032
TENURE					1.000	.126*	.145**	.115*	.155**	.047	.095	.021
PSIZE						1.000	.176**	.083	-.085	-.170**	-.044	-.018
NHHOLD							1.000	.101*	.155**	-.020	.068	.023
DWORK								1.000	.079	.079	.064	-.043
GABAGE									1.000	.199**	.245**	.115*
ACCESS										1.000	.176**	.091
CRIME											1.000	.135**
ROAD												1.000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

ABULE-EGBA

	MRENT	AOB	THOUSE	DFILL	TENURE	PSIZE	NHHOLD	DWORK	GABAGE	ACCESS	CRIME	ROAD
MRENT	1.000	.002	.418**	.201**	-.032	.233**	-.060	.149**	-.157**	-.060	.120*	-.030
AOB		1.000	.036	-.003	.007	-.061	.046	-.152**	-.034	-.124**	-.117*	.105*
THOUSE			1.000	.060	-.046	.072	.052	.193**	-.107*	-.056	.010	-.028
DFILL				1.000	-.133**	.167**	-.096*	.156**	-.036	-.031	.118**	-.151**
TENURE					1.000	-.135	-.034	-.044	-.014	-.038	-.045	.042
PSIZE						1.000	-.016	.296**	-.121**	-.204**	.106*	-.255**
NHHOLD							1.000	.033	.130**	.085	.085	.108*
DWORK								1.000	-.039	.106*	.076	-.155**
GABAGE									1.000	.128**	.150**	.161**
ACCESS										1.000	.095*	.148**
CRIME											1.000	.000
ROAD												1.000

Hedonic Regression Analysis

The results of the hedonic regression show that *R*-values are fairly high for the two sites. For Olushosun, it is 0.518 (R^2 = 26.9%) while for Abule-Egba it is 0.598 (R^2 = 35.7%). The summary of the result is presented in the Table 7.7 below.

Table.7.7: Hedonic Regression Results for landfill Impact on Property Values

Olushosun Landfill Results

Var	Coeff	Beta	t-ratio	Prob	Std. Error
THOUSE	*1.146*	*.384*	*6.580*	*.000*	*.174*
LNDFILL	*1.045*	*.130*	*2.180*	*.030*	*.479*
NHHOLD	*-6.05*	*-.082*	*-1.419*	*.157*	*.043*
AOB	*.-1.74*	*-.006*	*-.099*	*.921*	*.175*
PSIZE	*0.393*	*.145*	*2.342*	*.020*	*.168*
DWORK	*4.411*	*.025*	*.404*	*.687*	*.109*
CRIME	*.512*	*.112*	*1.882*	*.061*	*.272*
GABAGE	*-.506*	*-.107*	*-1.793*	*.074*	*.282*
ACESS	*-.126*	*-.025*	*-.432*	*.666*	*.292*
ROAD	*.468*	*.069*	*1.163*	*.246*	*.403*
TENURE	*2.818*	*.055*	*.967*	*.334*	*.029*
CONSTANT	*-.432*	-	*-.482*	*.630*	*.897*

Regression Statistics

Coefficient of multiple determination	*0.518*
Coefficient of multiple correlation	*0.269*
Adjusted R-square	*0.235*
Standard error of the estimate	*2.00*
F-ratio	*7.976*
Degrees of freedom	*250*
Probability of chance	*0.000*

Abule-Egba Landfill Results

Var	Coeff	Beta	t-ratio	Prob	Std. Error
THOUSE	*1.072*	*.512*	*7.580*	*.000*	*.141*
LNDFILL	*.385*	*.052*	*.776*	*.439*	*.496*
NHHOLD	*-3.29*	*-.053*	*-.755*	*.452*	*.044*
AOB	*.140*	*.061*	*.898.8*	*.371*	*.156*
PSIZE	*.122*	*.050*	*.706*	*.481*	*.173*
DWORK	*.219*	*.146*	*2.133*	*.034*	*.102*
CRIME	*-4.08*	*-.010*	*-.137*	*.891*	*.297*
GABAGE	*2.056*	*.005*	*.074*	*.941*	*.279*
ACESS	*-.889*	*-.215*	*-3.091*	*.002*	*.288*
ROAD	*-.697*	*-.081*	*-1.212*	*.227*	*.575*
TENURE	*.135*	*.148*	*2.199*	*.029*	*.061*
CONSTANT	*.864*	-	*-.865*	*.388*	*.998*

Regression Statistics

Coefficient of multiple determination	*0.598*
Coefficient of multiple correlation	*0.357*
Adjusted R-square	*0.311*
Standard error of the estimate	*1.71*
F-ratio	*7.784*
Degrees of freedom	*165*
Probability of chance	*0.000*

Source: Author's Analysis

The hedonic regression results obtained for the two sites is not surprising considering the fact that though there is dearth of residential apartments in Lagos metropolis because of the ever increasing population, the uncontrolled nature of the landfills have made them a facility to avoid as much as possible. However, the fact that the landfills, especially the Abule-Egba landfill is located in low-income residential area, houses there often attract low rents and are therefore affordable to low income earners. The argument here is that there is a gradient of rent increment as one moves away from the landfill sites.

For the Olushosun landfill site, the standardized beta coefficients for the variables used in the model showed that type of house (THOUSE) and distance to landfill (DFILL), respectively, are the most important explanatory variables in the model. The t-values for both variables are significant. For Abule Egba however, the t-value for DFILL is not significant. The important explanatory variables in this model are THOUSE, TENURE, DWORK and DFILL.

7.4 Conclusion

This chapter sought to investigate the impact of the two landfills on property values in the two different locations. The general picture of the two locations is one in which proximity to the landfill negatively affects housing rent. Negative relationships were established between distance from landfill site and monthly rent paid.

These results conform to theoretical expectations and are largely consistent with previous North American studies. These results have practical implications for the siting of landfills in Nigerian urban areas. Of course, it is tempting to suggest that in order to minimize the negative externalities, landfills should be located as far away as possible from human settlements. This may, however, not suffice; given the scarcity of urban land in most urban areas especially Lagos and the fact that overtime, new settlements will eventually spring up around the landfills. The question that still needs to be addressed are: How can the negative landfill effects on adjoining residential apartment be minimized? One way, as observed by Nelson et al. (1992) is for landfill an operator to buy up houses and land surrounding the landfill facilities. While this is possible in developed countries, it is hardly feasible in developing countries. There, private and public waste management organizations are beset with many serious financial, technical, managerial, personnel, and logistic problems.

This situation can only be redressed by pragmatic landfill design and proper management of landfill within the urban areas. Such design and management should enhance the sanitary and aesthetic condition of the landfill as well as minimize the generation of methane and lactates. All these effects will go a long way to ensure that landfills in Nigerian urban areas are environmentally benign. This, in turn, will ameliorate the negative impacts of landfills within the urban areas.

CHAPTER EIGHT

SUMMARY AND CONCLUSION

8.1 Summary of Findings

There is widespread public perception that landfills represent unacceptable risks to human health and the environment (Washburn *et al*, 1989). Perceptions of environmental risk have militated against hazardous waste facilities such as landfills in North America and other developed countries. The spate of rejections led to the now famous "not-in-my-backyard" (NIMBY) syndrome in environmental planning and management literature.

There exists substantial literature relating to NIMBY reactions to siting proposals in many parts of the world. However, empirical studies of perception of landfill impact in Nigerian urban areas are rare. Furthermore, much less known about individual and community level impacts around existing facilities. This research therefore presents the results of a comparative analysis of the impact of landfills in urban populations living in close proximity to two landfills (Olushosun and Abule Egba) in Lagos.

This work has shown that there are variations in landfills impacts among residents around the landfills sites. The effects of landfills are not expected to be uniformly circular since a host of factors, such as weather conditions (primarily wind direction), truck traffic, and the quality of landfill management, combine to determine the ultimate direction and extent of any potential landfill effect.

However, not surprisingly, work showed that there is a negative gradient of major impact categories, especially environment and health, away from the landfills. In other words, the farther from the landfills, the weaker the impact of the nuisance factors associated with the landfills. It is not surprising then that level of perceived negative impacts was high among residents closer to the landfill sites in the two locations. The present research also revealed that landfills within Lagos metropolis are uncontrolled and do not conform to international standards of landfill operations. The non-compliance results in a proliferation of insects and rodents, allow blowing of litter and causes odour and the general environmental degradation associated with refuse dumps. This confirmed the earlier findings by Arimah and Adinnu, (1995) in an earlier study of Achapo landfill (now closed) in Lagos.

The results revealed that the NIMBY syndrome manifests itself. For example, although was the explicit rejection of the landfills found in any of the zones of study, respondents consistently placed high premium on its adverse effects. The empirical analysis showed that the respondents were aware of one environmental problem or the other in their neighbourhood and many of them were actually able to link some of these environmental problems to the location and operation of the landfills especially odour, aesthetics, flies and rodents etc. In other words, respondents were conscious of the possible negative externalities from waste facility siting especially if such facilities are sited nearby. In the context of their daily lives as a whole, the landfills remain a source of dislike and/or annoyance tc the nearby residents.

Perceived risk was negatively correlated with support for landfill siting. The inference to be drawn from this is that the more risky a facility is perceived to be, the lower the level of support for the siting for such facility. However, the perception of risks also differed among all the zones in the two locations.

Analysis showed that the presence of the landfill and its associated environmental impacts is an important factor contributing to respondents' willingness to pay for any environmental (quality) improvement in their neighbourhood. The proportion of those who were willing to pay for improved environmental quality clearly showed a decline from zones 1 to zone 3 in both sites. Results of chi-square test indicate that there was significant difference in willingness to pay for improved environmental quality based on respondents' socio-economic characteristics.

The results of the analysis for the landfill impact on neighbourhood quality rating regression model showed that the Regression values (R) for the two sites are fairly high (0.536 and 0.689 for Olushosun and Abule Egba respectively). Furthermore, the R^2 values obtained for the two sites are 0.431 and 0.512 respectively. The landfill co-efficient (DFILL) for the neighbourhood quality impact model obtained is indicative of the debate characterising the nature and extent to which landfills will affect neighbourhood quality rating in the midst of other environmental and socio-economic factors. For the two locations, the DFILL coefficients are positive. These results conform to a priori expectation. The implication of this is that the rating of neighbourhood quality increases away from the landfill sites. In other words, people closer to the landfills would rate the quality of their neighbourhood lower than those far away. Proximity to landfill is viewed as a form of environmental disamenity which can affect neighbourhood quality. This finding conformed to those obtained by Nelson *et al*, (1992) and Havlicek (1985).

Furthermore, the various coping mechanisms of respondents were also analysed. Many of the respondents were found to engage in emotion-focused and action-focused coping mechanisms. The action-focused mechanisms were shown to include decision to relocate from the present neighbourhood where the landfills are located. This fitted well within the theoretical framework developed within the risk society literature (Giddens, 1990; Beck, 1992). For example, an attitude of pragmatic acceptance was adopted by many of the respondents who seemingly accepted that "what will be, will be and there is nothing we can do about it". Thus, two major issues were deduced from the analysis of the coping strategies employed by respondents. Firstly, those feeling strongly affected by the landfill were most likely to take actions to reduce impact. Secondly, these same categories of respondents will or had made efforts to relocate from their present residence. The results obtained here are consistent with the transactional model of environmental stress proposed by Lazarus and Folkman (1984). They confirm that individual response to a stressor is an iterative process of primary and secondary appraisal and reappraisal. In particular, they provide new evidence on the factors affecting the reappraisal process to support and elaborate the previous suggestion by Baum and others (1982) that most individuals perceive threat, cope with it and adapt to it. Moreover, consistent with Edelstein's (1988) postulates regarding the effects of toxic exposures, the findings indicating factors that can reduce anticipatory fears in the light of the actual experience of living with a landfill. They also underline that appraisal and reappraisal are contingent on context (Lazarus, 1993) and the circumstances of operation which can result in the diminution of perceived risk (Kasperson *et al*, 1988). In reaching these conclusions, it is important to keep in mind that the reappraisal process for residents is on-going and not lose sight of the fact that, for many, latent concerns remain which an incident at the landfill or change in operating practices could accentuate and thereby further aggravate the negative perception and attitudes revealed by this analysis.

The general picture of the two locations is one in which proximity to the landfill negatively affects housing rent. A multiple correlation analysis of both the dependent and all the independent variables shows that distance to landfill is both positively and negatively correlated with most of the hedonic housing variables. In particular, however, house rent has a positive relationship with distance of building from the landfill site. This result implies that rental values increase as distance increases away from the landfill sites. In other words, houses closer to the landfill sites attract lower rental values. This rendered the impact of landfills on property value hypothesis valid. The results of the hedonic regression show that *R*-value is fairly high for the two sites. For Olushosun, it is 0.518 ($R^2 = .235$) while for Abule-Egba it is 0.598 ($R^2 = .357$). The coefficients for DFILL (distance from landfill) in the two locations are positive but while the t-test value for Olushosun was significant, that of Abule was not significant.

8.2 Implications of the Study

There results conform to theoretical expectations and are largely consistent with previous North American studies. This result has practical implications for the siting of landfills in Nigerian urban areas. Of course, it is tempting to suggest that in order to minimize the negative externalities, landfills should be located as far away as possible from human settlements. This may, however, not suffice, given the scarcity of urban land in most urban areas especially Lagos and the fact that overtime, new settlements will eventually spring up around the landfills. The question that still needs to be addressed are: How can the negative landfill effects on adjoining residential apartment be minimized? One way, as observed by Nelson *et al*. (1992) is for landfill operators (the government) to buy up houses and land surrounding the landfill facilities.

While this is possible in developed countries, it is hardly feasible in developing countries. There, private and public waste management organizations are beset with many serious financial, technical, managerial, personnel, and logistic problems.

Proximity to a landfill is negatively capitalized into property values. This situation can only be redressed by pragmatic landfill design and proper management of landfill within the urban areas. Such design and management should enhance the sanitary and aesthetic condition of the landfill as well as minimize the generation of methane and leachates. All these effects will go a long way to ensure that landfills in Nigerian urban areas are environmentally benign. This, in turn, will ameliorate the negative impacts of landfills within the urban areas.

A major implication of the results from this study is that future siting of hazardous facilities could become very problematic since those whose communities are expected to host the facilities are becoming familiar with the negative externalities. Given this scenario, solid waste managers may be forced to site landfills in distant rural locations from the urban centers. Consequently additional disposal cost will have to be borne by haulage firms which will in turn pass the cost to consumers.

Potential applications of the research findings are linked to the purpose of the research: to determine the impacts of exposure to environmental contaminants on individuals and communities which in the future could be used to develop strategies to reduce their adverse effects. The findings of this study contribute to two bodies of literature. The first is the literature related to the siting of noxious facilities and particularly waste disposal facilities (e.g. Munton, 1996). It also contributes to the environmental stress literature. Finally, these findings can contribute to our understanding of individuals and community reaction to and experiences of, landfills and can be used to inform the processes used to site much needed new facilities.

8.3 Policy Recommendations

Since Nigerians are sensitive to landfill sites as exemplified by this study and this mode of waste disposal being the most prevalent in the country, there is indeed, a need for policy recommendations. Perhaps, solid waste problem is the most pressing environmental problem being faced by urban dwellers, urban managers as well as urban planners (Olokesusi, 1987, 1994). The removal and disposal of solid wastes generally, impose costs on individuals and the local community. These costs can vary and be a significant portion of public expenditures, more so, at a time of rising competing demands and dwindling fiscal resources. Consequently, in the light of the findings of this study, the following recommendations are made for tackling some of the identified problems and issues.

1. There is the need for further studies on the locational characteristics and operational modes of existing landfill sites in the country. Such studies become relevant, as they are likely to reveal whether or not the landfill sites should be de-commissioned or relocated. The rationale for such relocation would be to reduce the negative impact of the sites on the society and environment.

2 Following from 2 above, is the necessity to provide Environmental Impact Statements (EIS) for all new large-scale landfill sites in the country. In the EIS, consideration should be given not only to the material aspects of development and environment, but also to those groups in the society that are likely to be affected by the development proposals. This is because the fundamental issues of today ought to involve environmental protection and social equity.

3. Existing and all future landfill sites should be designed, and operated under appropriate physical planning and engineering standards. Such standards relate to solid waste transportation, accessibility, tipping, quantity and depth of sand (15cm) to be spread within 24 hours of tipping, and provision of fencing around the sites. With respect to the landfills studied, these standards are not yet met.

4. Re-cycling of solid wastes should be encouraged as much as possible, because of benefits such as employment generation, reduction of disposable waste load and reduction in contamination levels. Since scavenging is already well entrenched in the society, better organizational approach by registration, re-cycling of waste for money and so on should be encouraged. Also the scavengers should be examined by health specialists periodically and treated.

5. Following from 5 above, is the need to regulate the solid waste materials to be collected and disposed of. This objective can be achieved through the following means:

   a. enforcement of screening process that will identify materials that are known to cause toxic responses in man, flora and fauna and prevent same from being disposed by landfill;

   b. effluent monitoring of all municipal landfill discharges to surface water; and

   c. enforcement of FEPA's effluent limit regulations as they relate to solid waste leachates.

8.4 Areas of Further Research

While there exists a substantial literature relating to NIMBY reactions to siting proposals in the developed countries, this is not the case in many African countries where much less is known about individual and community level impacts around existing facilities especially in the urban areas. This study has shown that in urban Nigeria, just like in other parts of the parts of the world, there is a widespread public perception that landfills represent an unacceptable risk to human health and the environment. However, additional comparative, as well as longitudinal research is needed to fully understand how individuals and communities respond to waste facilities siting, and how these responses change overtime. This type of research will bring out more interesting result in a situation where the characteristics of the study area are different. Furthermore, this type of research can also be extended by comparing the differing perceptions between an area where a landfill is located and where it is not within the same urban area and by comparing differing perception between urban and rural areas on noxious facilities siting and impact.

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APPENDIX I

UNIVERSITY OF IBADAN
DEPARTMENT OF GEOGRAPHY

Dear Respondent,

This questionnaire is meant for an ongoing Postgraduate research in the University of Ibadan. It is designed to elicit information on your perception of the impact of landfill (waste dumpsite) located close to your residence here. Kindly take time to respond to the questions sincerely. All information given will be treated in strict confidence.

Thank you.

PART A

1. Location..
2. Street name...
3. Distance to landfill site ....
4. Status of residential neighbourhood

   i) High density ☐ ii) Low density ☐
   iii) Medium density ☐

5. Type of House
   i) Rooming apartment ☐ ii) Flat ☐ iii) Bungalow ☐
   iv) Duplex ☐ iv) Others ☐

6. Tenant's status
   i) Owner occupier ☐ ii) Family joint owner ☐ iii) Rented ☐

7. How long have you been living in this house? ....
8. How long have you been living in this area?.......................
9. Did the household move in

   i) Before the landfill was sited here? ☐
   ii) After the landfill was sited here? ☐

10. Sex of household head

i) Male. ☐ ii) Female ☐

11. Age of household head ....

12. Education attainment of household head

i) No schooling ☐ iii) Secondary ☐
ii) Primary ☐ iv) Tertiary ☐

13. Occupation of household head

i) Unskilled worker ☐ ii) Skilled worker ☐
iii) Trader ☐ iv) White collar worker ☐
v) Administrative ☐ vi) Retired/ pensioner ☐

14. Annual income of household head (Naira)..

15. Marital status of head of household

i) Single ☐ iii) Divorced ☐
ii) Married ☐ iv) Others ☐

16. Number of persons in the household ....

17. Monthly house rent paid (in Naira)...................

18. Number of tenants that have changed residence in the unit in the past 3 years ....

19. Reasons for change

(i) Increase in real income ☐ ii) Increase in house rent ☐
(ii) Landfill menace ☐ iv) Others ☐

20. How do you perceive the location of the landfill in this area?

i) A blessing ☐ ii) A curse ☐
iii) A nuisance ☐

21. Given the opportunity, would you like to change your residence from this area?

i) Definitely no ☐ ii) No ☐ iii) Undecided ☐
iv) Yes ☐ v) Definitely yes ☐

22. If yes, why?

i) Increase in real income ☐ ii) Increase in house rent ☐
iii) Landfill menace ☐ iv) Others ☐

23. Would you support building a hazardous waste facility near your area?
i) Definitely no ☐ ii) No ☐ iii) Undecided ☐
iv) Yes ☐ v) Definitely yes ☐

PART B

24. Have you noticed the presence of environmental problems in this area?
Yes ☐ No ☐

25. If yes, which environmental problems are you aware of in your area?
....
....
....

26. Which of the problem(s) above do you think is (are) caused by landfill?
....
....
....
....

27. Please rank these problems in order of importance
....
....
....

28. How much do you think the location of the landfill has contributed to the following?

		VERY MUCH	MUCH	UNDECIDED	NOT MUCH	NOT ALL
i	Odour					
ii	Noise					
iii	Visibility/Smoke					
iv	Aesthetics					
v	Traffic obstruction					
vi	Presence of flies and rodents					
vii	Air Pollution					
viii	Water pollution					
ix	Dirt					
x	Insects and Cockroaches					
xi	Others					

29. Please indicate the extent to which each of the following sources of information contributed to your knowledge about the environmental problems caused by landfills

SOURCES	VERY MUCH	MUCH	UNDECIDED	NOT MUCH	NOT AT ALL
Radio/TV					
School					
Churches					
Mosque					
Community leaders					
Officials of LGA					
Officials of LAWMA					
Personal experience					
Others (specify)					

30. Are you willing to pay money for environmental protection, if asked to do so?
Yes ☐ ii) No ☐

31. If yes, how much are you willing to pay every month? ....

32. Rate the quality of your neighbourhood
i) Excellent ☐ ii) Good ☐ iii) Fair ☐ iv) Poor ☐

33. Indicate whether you engage in any of these activities

		Yes	No
i.	Public meeting		
ii.	Voting in a local election		
iii.	Contacting an official about a public problem		
iv.	Sports		
v.	Vigilante group		
vi.	Recreation		

34. What are your reasons for staying in this area?

		Yes	No
i.	Convenient to my job		
ii.	Convenient to friends and relatives		
iii.	Availability of leisure activities		
iv.	Ease of transportation		
v.	Good schools		
vi.	Good hospitals		
vii.	Shopping/marking		
viii.	Affordable house rents		
ix.	Other public activities		

PART C

35. How would you describe the present condition of your health?
ii) Excellent ☐ ii) Good ☐ iii) Fair ☐ iv) Poor ☐

36. Comparing your health now to what it was three years ago, would you say it has
i) Improved ☐ ii) Stayed about the same ☐ iii) Undecided ☐
iv) Declined somewhat ☐ v) Declined very much ☐

37. To what extent would you attribute the change in your health status to the operations of the landfill?
i) To a large extent ☐ ii) To some extent ☐ iii) Undecided ☐
iv) To a little extent ☐ v) Not at all ☐

38. By how much do you think the landfill can affect the health of the residents of this area?

		VERY MUCH	MUCH	UNDECIDED	NOT MUCH	NOT AT ALL
i.	Psychological disturbance					
ii.	Skin irritation					
iii	Water related diseases					
iv	Child related diseases					
v	Accidents/Injury					
vi	Change in water quality/taste					
vii	Personal injuries					

PART D

39. What is your level of satisfaction with the following economic opportunities provided by the location and operation of the landfill?

		COMPLETELY DISSATISFIED	DISSAT ISFIED	UNDECI DED	SATISFIED	COMPLETELY SATISFIED
i	Jobs					
ii	Income					
iii	Personal economic situation					

40. How important do you think the landfill is needed to improve the economy and economic opportunities of this area?

		LOW NEED	FAIRLY LOW NEED	UNDECIDED	FAIRLY STRONG NEED	STRONG NEED
i	Improvement of the economy of this area					
ii	Improvement of economic opportunities					

41. Rate the level of **benefits** you think this area is enjoying as a result of the location of the landfill

		MANY BENEFITS	SOME BENEFITS	UNDECIDED	LITTLE BENEFIT	NO BENEFIT
i	Provision of infrastructures e.g. roads, water supply etc					
ii	Provision of social amenities e.g. playing grounds, schools etc					

42. Rate the level of **risk** you perceive the landfill will create as a result of its location in this area

		VERY HIGH RISK	HIGH RISK	UNDECIDED	LOW RISK	NO RISK
i	Health and safety					
ii	Damage to the ecosystem					
iii	Social life of community					

43. Do you know anybody that has been injured as a result of the operation of the landfill?
i) Yes ☐ ii) No ☐

44. Do you think the siting of landfill has created social stigma on the status of your community?
i) Yes ☐ ii) No ☐

45. Any complaint(s) made in respect of the landfill site to the authority?
i) Yes ☐ ii) No ☐

46. If yes, what was the response? ....

....

...

47. Was the complaint made by individual or by the entire community?
i) Individual ☐ ii) Community ☐

48. How would you describe the level of management of the landfill site?
i) Highly satisfactory ☐ ii) Satisfactory ☐ iii) Undecided ☐
iv) Unsatisfactory ☐ v) Highly unsatisfactory ☐

PART E

49. Age of building (in years)
i) 10 and below ☐ ii) 11-12 ☐ iii) 21-30 ☐
iv) 31-40 ☐ v) Above 40 ☐

50. Plot size
i) 15m by 30m ☐ ii) 18m by 36m ☐ iii) 30m by 36m ☐
iv) Larger than 30m by 36m ☐

51. Source of regular water supply
i) Pipe-born ☐ ii) Well ☐ iii) Borehole ☐ iv) Other ☐

52. Type of toilet facility in use in the house
i) Pit ☐ ii) Water closet ☐ iii) Pail latrine ☐ iv) Bush ☐

53. Number of bathrooms in the house ....

54. Indicate the location of the following in respect to where you live

		LESS THAN 1KM	1-2KM	3-5KM	6-10KM	ABOVE 10KM
i	Place of work					
ii	Your children's school					
iii	Place of shopping					
iv	Place of recreation					
v	Place of worship					

55. When you look at the condition of your house and your environment, how would you evaluate them using the following variables?

		VERY GOOD	GOOD	POOR	VERY POOR
1	Appearance of the house				
2	Maintenance of the house				
3	Comfort and Convenience of the house				
4	Frequency of water supply				
5	Regularity of electricity				
6	Condition and quality of Kitchen facilities				
7	Condition and quality of toilet facilities				
8	Condition and quality of bathroom facilities				
9	Frequency of refuse/garbage collection				
10	Accessibility to the house				
11	Incidence of crime				
12	Accessibility to neighbourhood facilities (e.g. schools, markets, etc)				
13	Condition of the road				
14	Police protection				
15	Size of rooms				
16	Availability of Nursery/Pry school				

Thank you for your time.

APPENDIX II

QUESTIONNAIRE FORMAT FOR LAGOS STATE WASTE MANAGEMENT AUTHORITY (LAWMA) OFFICIALS.

Dear Sir.

This questionnaire is designed to elicit information on the locational characteristics and management of the Olushosun and Abule Egba landfill sites. The information given will be utilised strictly for academic purpose only. Be assured. therefore, of the confidentiality of the data.

Thank you.

Locational Characteristics of the Landfill Sites

1. Size ....
2. Shape ....
3. Depth ....
4. Width and frontage ....
5. Topography ....
6. Drainage and runoff characteristics of the site ....
   ....
   ....
7. Nature of type of surface soil ....
   ....

....

8. Subsoil and bedrock characteristics ....

....

....

Management of the Landfill Sites

9. Date landfill was established ....

10. Capacity of the landfill ....

11. Type and number of equipment available ....

....

....

12. Volume of waste received daily by the landfill ....

13. Number of staff at the landfill site ....

....

14. Any complains from residents about your operations at the landfill sites?

Yes ☐ No ☐

15. If yes, how frequent are these complains made?

....

16. What were your reactions to such complains? ....

....

....

17. Any form of consultation with local residents before the landfills were constructed? Yes ☐ No ☐

18. Any form of impact assessment before the landfills were constructed?

Yes ☐ No ☐

19. Kindly mention some of the measures taken to reduce the environmental impacts of the landfill (e.g. odour and aesthetics)

....

....

....

APPENDIX III a

Regression
LOCATION = Olushosun

Variables Entered/Removed[b,c]

Model	Variables Entered	Variables Removed	Method
1	VAR00125 ROAD, VAR00012 EDUCATION, VAR00008 L AREA, VAR00005 THOUSE, VAR00123 CRIME, VAR00014 ANNUAL INCOME, VAR00003 DFILL, VAR00121 GABAGE, VAR00006 TENURE, VAR00011 AGE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: VAR00061 QUALITY OF NEIGHBOURHOOD

c. VAR00002 LOCATION = Olushosun

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.332[a]	.111	.081	.80

a. Predictors: (Constant), VAR00125 ROAD, VAR00012 EDUCATION, VAR00008 L AREA, VAR00005 THOUSE, VAR00123 CRIME, VAR00014 ANNUAL INCOME, VAR00003 DFILL, VAR00121 GABAGE, VAR00006 TENURE, VAR00011 AGE

b. VAR00002 LOCATION = Olushosun

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23.571	10	2.357	4.074	.000[a]
	Residual	168.366	291	.579		
	Total	191.937	301			

a. Predictors: (Constant), VAR00125 ROAD, VAR00014 ANNUAL INCOME , VAR0000 L AREA, VAR00121 GABAGE , VAR00003 DFILL , VAR00006 TENURE, VAR00005 THOUSE, VAR00123 CRIME, VAR00012 EDUCATION, VAR00011 AG

b. Dependent Variable: VAR00061 QUALITY OF NEIGHBOURHOOD

c. VAR00002 LOCATION = Abule Egba

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.090	.366		2.980	.003
	VAR00003 DFILL	5.511E-02	.054	.058	1.023	.307
	VAR00005 THOUSE	-9.09E-04	.048	-.001	-.019	.985
	VAR00011 AGE	-7.10E-04	.004	-.011	-.185	.854
	VAR00012 EDUCATION	8.908E-02	.055	.098	1.610	.109
	VAR00014 ANNUAL INCOME	3.703E-02	.023	.093	1.577	.116
	VAR00008 L AREA	-1.54E-02	.008	-.114	-1.885	.060
	VAR00006 TENURE	1.022E-02	.047	.013	.217	.828
	VAR00121 GABAGE	.279	.095	.172	2.933	.004
	VAR00123 CRIME	.106	.097	.065	1.088	.278
	VAR00125 ROAD	.564	.190	.168	2.968	.003

a. Dependent Variable: VAR00061 QUALITY OF NEIGHBOURHOOD

b. VAR00002 LOCATION = Abule Egba

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	24.339	10	2.434	3.789	.000[a]
	Residual	195.899	305	.642		
	Total	220.237	315			

a. Predictors: (Constant), VAR00125 ROAD, VAR00012 EDUCATION, VAR00008 L AREA, VAR00005 THOUSE, VAR00123 CRIME, VAR00014 ANNUAL INCOME, VAR00003 DFILL , VAR00121 GABAGE , VAR00006 TENURE, VAR00011 AGE

b. Dependent Variable: VAR00061 QUALITY OF NEIGHBOURHOOD

c. VAR00002 LOCATION = Olushosun

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.163	.423		5.119	.000
	VAR00003 DFILL	.152	.056	.153	2.696	.007
	VAR00005 THOUSE	1.719E-02	.057	.018	.302	.762
	VAR00011 AGE	-1.01E-02	.004	-.163	-2.562	.011
	VAR00012 EDUCATION	-8.11E-02	.058	-.078	-1.387	.166
	VAR00014 ANNUAL INCOME	-6.59E-03	.024	-.016	-.279	.780
	VAR00008 L AREA	-4.83E-03	.010	-.032	-.491	.624
	VAR00006 TENURE	-2.79E-02	.057	-.031	-.487	.627
	VAR00121 GABAGE	2.182E-02	.103	.012	.212	.832
	VAR00123 CRIME	-.241	.095	-.144	-2.542	.012
	VAR00125 ROAD	.607	.151	.228	4.027	.000

a. Dependent Variable: VAR00061 QUALITY OF NEIGHBOURHOOD

b. VAR00002 LOCATION = Olushosun

LOCATION = Abule Egba

Variables Entered/Removed[b,c]

Model	Variables Entered	Variables Removed	Method
1	VAR00125 ROAD, VAR00014 ANNUAL INCOME , VAR00008 L AREA, VAR00121 GABAGE , VAR00003 DFILL , VAR00006 TENURE, VAR00005 THOUSE, VAR00123 CRIME, VAR00012 EDUCATION, VAR00011 AGE[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: VAR00061 QUALITY OF NEIGHBOURHOOD

c. VAR00002 LOCATION = Abule Egba

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.350[a]	.123	.093	.76

a. Predictors: (Constant), VAR00125 ROAD, VAR00014 ANNUAL INCOME , VAR00008 L AREA, VAR00121 GABAGE , VAR00003 DFILL , VAR00006 TENURE, VAR00005 THOUSE, VAR00123 CRIME, VAR00012 EDUCATION, VAR00011 AGE

b. VAR00002 LOCATION = Abule Egba

APPENDIX III b

Regression
LOCATION = Olushosun

Variables Entered/Removed[b,c]

Model	Variables Entered	Variables Removed	Method
1	VAR00125 ROAD, VAR00107 NBATH, VAR00123 CRIME, VAR00005 THOUSE, VAR00122 ACCESS , VAR00016 NHHOLD, VAR00103 AOB, VAR00121 GABAGE , VAR00142 LNDFILL, VAR00104 PSIZE, VAR00108 DWORK[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: VAR00017 MRENT

c. VAR00002 LOCATION = Olushosun

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.518[a]	.269	.235	2.00

a. Predictors: (Constant), VAR00125 ROAD, VAR00107 NBATH, VAR00123 CRIME, VAR00005 THOUSE, VAR00122 ACCESS , VAR00016 NHHOLD, VAR00103 AOB, VAR00121 GABAGE , VAR00142 LNDFILL, VAR00104 PSIZE, VAR00108 DWORK

b. VAR00002 LOCATION = Olushosun

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	350.120	11	31.829	7.976	.000[a]
	Residual	953.769	239	3.991		
	Total	1303.888	250			

a. Predictors: (Constant), VAR00125 ROAD, VAR00107 NBATH, VAR00123 CRIME, VAR00005 THOUSE, VAR00122 ACCESS , VAR00016 NHHOLD, VAR00103 AOB, VAR00121 GABAGE , VAR00142 LNDFILL, VAR00104 PSIZE, VAR00108 DWORK

b. Dependent Variable: VAR00017 MRENT

c. VAR00002 LOCATION = Olushosun

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.432	.897		-.482	.630
	VAR00005 THOUSE	1.146	.174	.384	6.580	.000
	VAR00142 LNDFILL	1.045	.479	.130	2.180	.030
	VAR00016 NHHOLD	-6.05E-02	.043	-.082	-1.419	.157
	VAR00103 AOB	-1.74E-02	.175	-.006	-.099	.921
	VAR00107 NBATH	2.818E-02	.029	.055	.967	.334
	VAR00104 PSIZE	.393	.168	.145	2.342	.020
	VAR00108 DWORK	4.411E-02	.109	.025	.404	.687
	VAR00123 CRIME	.512	.272	.112	1.882	.061
	VAR00121 GABAGE	-.506	.282	-.107	-1.793	.074
	VAR00122 ACCESS	-.126	.292	-.025	-.432	.666
	VAR00125 ROAD	.468	.403	.069	1.163	.246

a. Dependent Variable: VAR00017 MRENT

b. VAR00002 LOCATION = Olushosun

LOCATION = Abule Egba

Variables Entered/Removed[b,c]

Model	Variables Entered	Variables Removed	Method
1	VAR00125 ROAD, VAR00016 NHHOLD, VAR00103 AOB, VAR00142 LNDFILL, VAR00107 NBATH, VAR00005 THOUSE, VAR00121 GABAGE , VAR00122 ACCESS , VAR00108 DWORK, VAR00104 PSIZE, VAR00123 CRIME[a]		Enter

a. All requested variables entered.

b. Dependent Variable: VAR00017 MRENT

c. VAR00002 LOCATION = Abule Egba

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.598[a]	.357	.311	1.71

a. Predictors: (Constant), VAR00125 ROAD, VAR00016 NHHOLD, VAR00103 AOB, VAR00142 LNDFILL, VAR00107 NBATH, VAR00005 THOUSE, VAR00121 GABAGE , VAR00122 ACCESS , VAR00108 DWORK, VAR00104 PSIZE, VAR00123 CRIME

b. VAR00002 LOCATION = Abule Egba

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	249.209	11	22.655	7.784	.000[a]
	Residual	448.236	154	2.911		
	Total	697.446	165			

a. Predictors: (Constant), VAR00125 ROAD, VAR00016 NHHOLD, VAR00103 AOB, VAR00142 LNDFILL, VAR00107 NBATH, VAR00005 THOUSE, VAR00121 GABAGE , VAR00122 ACCESS , VAR00108 DWORK, VAR00104 PSIZE, VAR001 CRIME

b. Dependent Variable: VAR00017 MRENT

c. VAR00002 LOCATION = Abule Egba

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.864	.998		.865	.388
	VAR00005 THOUSE	1.072	.141	.512	7.580	.000
	VAR00142 LNDFILL	.385	.496	.052	.776	.439
	VAR00016 NHHOLD	-3.29E-02	.044	-.053	-.755	.452
	VAR00103 AOB	.140	.156	.061	.898	.371
	VAR00107 NBATH	.135	.061	.148	2.199	.029
	VAR00104 PSIZE	.122	.173	.050	.706	.481
	VAR00108 DWORK	.219	.102	.146	2.133	.034
	VAR00123 CRIME	-4.08E-02	.297	-.010	-.137	.891
	VAR00121 GABAGE	2.056E-02	.279	.005	.074	.941
	VAR00122 ACCESS	-.889	.288	-.215	-3.091	.002
	VAR00125 ROAD	-.697	.575	-.081	-1.212	.227

a. Dependent Variable: VAR00017 MRENT

b. VAR00002 LOCATION = Abule Egba

Regression

LOCATION = Olushosun

Variables Entered/Removed[b,c]

Model	Variables Entered	Variables Removed	Method
1	MSTATUS , L AREA, ANNUAL INCOME , EDUCATION, DFILL , SEX , PERSONS IN THE HOUSEHOLD RECODED, TENURE, AGE RECODED[a]		Enter

a. All requested variables entered

b. Dependent Variable: ENVIRONMENTAL PROTECTION

c. LOCATION = Olushosun

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.358[a]	.128	.102	.437

a. Predictors: (Constant), MSTATUS , L AREA, ANNUAL INCOME , EDUCATION, DFILL , SEX , PERSONS IN THE HOUSEHOLD RECODED, TENURE, AGE RECODED

b. LOCATION = Olushosun

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.455	9	.939	4.915	.000[a]
	Residual	57 526	301	.191		
	Total	65.981	310			

a. Predictors: (Constant), MSTATUS , L AREA, ANNUAL INCOME , EDUCATION, DFILL , SEX , PERSONS IN THE HOUSEHOLD RECODED, TENURE, AGE RECODED

b. Dependent Variable: ENVIRONMENTAL PROTECTION

c. LOCATION = Olushosun

Coefficients[a,b]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.775	.235		3.297	.001
	DFILL	.138	.031	.252	4.511	.000
	EDUCATION	5.164E-02	.032	.089	1.595	.112
	ANNUAL INCOME	-7.938E-03	.013	-.034	-.607	.544
	TENURE	-6.684E-02	.030	-.132	-2.251	.025
	SEX	7.417E-02	.064	.065	1.165	.245
	L AREA	-2.035E-03	.005	-.024	-.382	.703
	AGE RECODED	-2.224E-02	.026	-.053	-.845	.399
	PERSONS IN THE HOUSEHOLD RECODED	-1.018E-02	.038	-.016	-.267	.790
	MSTATUS	8.218E-02	.034	.136	2.396	.017

a. Dependent Variable: ENVIRONMENTAL PROTECTION

b. LOCATION = Olushosun

LOCATION = Abule Egba

Variables Entered/Removed[b,c]

Model	Variables Entered	Variables Removed	Method
1	MSTATUS , ANNUAL INCOME , AGE RECODED, DFILL , TENURE, PERSONS IN THE HOUSEHOLD RECODED, SEX , EDUCATION, L AREA[a]		Enter

a. All requested variables entered

b. Dependent Variable: ENVIRONMENTAL PROTECTION

c. LOCATION = Abule Egba

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.236[a]	.056	.026	.434

a. Predictors: (Constant), MSTATUS , ANNUAL INCOME , AGE RECODED, DFILL , TENURE, PERSONS IN THE HOUSEHOLD RECODED, SEX , EDUCATION, L AREA

b. LOCATION = Abule Egba

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.185	9	.354	1.882	.054[a]
	Residual	53.785	286	.188		
	Total	56 970	295			

a. Predictors: (Constant), MSTATUS , ANNUAL INCOME , AGE RECODED, DFILL , TENURE, PERSONS IN THE HOUSEHOLD RECODED, SEX , EDUCATION, L AREA

b. Dependent Variable: ENVIRONMENTAL PROTECTION

c. LOCATION = Abule Egba

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.579	.211		7.479	.000
	DFILL	3.481E-02	.031	.066	1.118	.264
	EDUCATION	-4.187E-02	.031	-.084	-1.342	.181
	ANNUAL INCOME	1.048E-03	.014	.005	.077	.939
	TENURE	-6.159E-02	.026	-.138	-2.330	.020
	SEX	-3.163E-02	.074	-.026	-.429	.668
	L AREA	-6.064E-03	.005	-.082	-1.301	.194
	AGE RECODED	-2.330E-03	.028	-.005	-.084	.933
	PERSONS IN THE HOUSEHOLD RECODED	-6.988E-02	.033	-.128	-2.116	.035
	MSTATUS	2.261E-02	.040	.034	.570	.569

a. Dependent Variable: ENVIRONMENTAL PROTECTION

b. LOCATION = Abule Egba

Correlations

LOCATION = Olushosun

APPENDIX IV

Area Superintendent's Weekly Safety Report in Respect of Site Reference Numb.r...... ....

	Inspected	Defects found
Fence and gates		
Notice boards		
Amenity unit		
Garage		
Site machines		
Access roads		
Cover material		
Refuse fully covered		
Working faces		
Excavations		
Fires		
Leachate		
Ponding		
Culverts/drains		
Shafts		
Stability of tipped areas		
Stability of original site face		
Proximity of power lines		
Rodents		
Insects		
Site monitoring points		

Date ....

Operations Superintendent ....

Assistant Operation Managers .. ..

Operations Manager ....