

AN EXAMINATION OF DOMESTIC SEWAGE

DISPOSAL IN GWALLAMEJI,

BAUCHI, BAUCHI STATE

BY

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FOR THE AWARD OF POST GRADUATE DIPLOMA IN
ENVIRONMENTAL MANAGEMENT**

**DEPARTMENT OF GEOGRAPHY
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
NIGER STATE.**

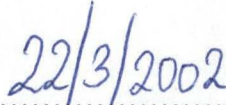
MARCH 2002

DECLARATION

I ENEMMOU CHINWE JOSEPHINE of the Department of Geography, School of Science And Science Education, Federal University of Technology, Minna do solemnly declare that the research work presented for the Post Graduate Diploma in Environmental Management has been carried out by me under the supervision of my supervisor Dr. HALILU AHMED SHABA of the Department of Geography, School of Science And Science Education, Federal University of Technology Minna, Niger State.




.....
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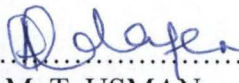
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CERTIFICATION

This is to certify that ENEMMOU .C. JOSEPHINE of the Department of Geography, Federal University of Technology Minna did conduct a Research on Examining Domestic Sewage Disposal in Gwallameji, Bauchi, Bauchi State, and is approved for its contribution to knowledge and literary presentation. In partial fulfilment of the award of Post Graduate Diploma in Environmental Management.


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DEDICATION

This research project is dedicated to my beloved parents Mr. and Mrs. Christopher Enemmou and also to God Almighty who used all means to see me through.

ACKNOWLEDEMENT

Writing a project entails understanding a tedious task, undergoing a tough time of which only the tough comes through as the saying goes "Tough times never last but tough people do. However, to keep being tough one needs encouragement, support and continuous motivation. Numerous indeed are those who in them all, I wish to express my profound gratitude.

I can't but start with expressing my gratitude to the most High God who used all means to see me through to this academic height.

My gratitude goes to my supervisor Dr. Halilu Ahmed Shaba for his advice, directives in providing the most needed counselling to the path of success. I am also grateful to all the members of staff of the Department of Geography Federal University of Technology, Minna, Niger State, most especially Dr Appolonia Okhimamhe, Dr. Nsofor G.N; Professor J. M. Baba, Professor Adefolalo, Dr. (Mrs.) E. A. Odafen for their immense contribution and advice and last but not the least, the head of department Dr M. T. Usman.

I am greatly indebted to Miss Stella for the typing of this project and my course mates especially Ijeoma, Mallam Musa Umar, Abubakar Musa Okpanachi, Appolonia and Dr. Charles for their brilliant suggestion and meaningful criticism, which make this research work a success.

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The present level of sewage delivery however, is still far below the general expectation. The attribute of sewage disposal in Gwallameji left nothing to be desired incognisance of the saying that “Cleanliness is next to godliness”.

It is therefore necessary that domestic sewage are properly disposed using the right facilities and disposal method so as to ensure and safeguard the health of the local community, student and staff of the Federal Polytechnic Bauchi.

1.1 STATEMENT OF THE PROBLEM.

The problem of sewage disposal is as old as humanity itself. Invariably, the origin was due to ignorance of the importance of proper sewage disposal system in Gwallameji which lead to poor hygiene related activities or poor sanitation practice.

Pacy (1981) stated that key point of achieving proper sewage disposal system is the “acceptability of the communities of the disposal facilities”, and that can only be satisfactory achieved by involving the user at all stages of the programme planning and implementation.

Sewage disposal in Nigerian cities, town and villages especially Gwallameji, Bauchi, need proper attention, It is no exaggeration that domestic sewage (soil water and

- iii. Postulate realistic solution/Recommendation for the enhancement of proper domestic sewage disposal in the study area.

1.3 SCOPE AND LIMITATION

This study is mainly concern with the domestic sewage disposal in Bauchi State. The researcher confined herself to Gwallameji as the case study. Even in Gwallameji it is not possible to reach out to every house and every body, hence questionnaires was distributed to the sampled population cutting across randomly selected ward in Gwallameji.

The filed of study of this research project is the examination of domestic sewage disposal in Gwallameji. It is obvious that there are various kinds of sewage such as;

- a. Agricultural sewage
- b. Industrial Sewage
- c. Domestic Sewage etc.

This study is delimited to domestic sewage, which comprises wastewater and soil water. Wastewater refers to water from baths, sinks, used water in kitchen e.t.c. while soil water refers to discharge from soil appliance such as water closet, urinal receptacle, bed pan washer, slope sink e.t.c.

1.4 SIGNIFICANT OF THE STUDY

Since domestic sewage is as a result of man's natural and domesticated activities, the generation of domestic waste material dated back to the origin of humanity from that time there has been an increasing in population.

This study aimed at contributing to the already existing (Environmental Protection Agency Of The Study Area) knowledge about good sanitary environment and aesthetic scenery. This will also call the attention of urban/rural development authority to check lapses in the implementation of building regulation in respect to sewage disposal system/facilities in Gwallameji, to property investor as to the relationship between proper sewage disposal system and the value/worth of their property/premises in term of rent payable.

This research topic was chosen due to the hazardous nature of improper domestic sewage disposal to health and the physical environment in general e.g. domestic sewage (waste water) disposal in an open environment create unpleasant environment and breeding space for mosquitoes which are vectors of malaria and fillariases infection.

Predominantly, the following are the tribes and languages in Bauchi State. The Fulanis, Hausas, Paawa-Gerewas and Paawas, presently there are twenty (20) local government head quarters in the state in which Bauchi local government is one, and Gwallameji is situated in Bauchi local government.

The town Gwallameji was founded in the year 1922 by the man called Jato, who was believed to be a slave. He followed Yakubu (the founder of Bauchi) to Bauchi, Jato was formally living in Kudi Southern part of Bauchi and later moved to Gwallameji.

Like Yelwa, the word Gwallameji means "land deemed suitable for the cultivation of been seed". The indigenes of Gwallameji village were formally living on the present Federal Polytechnic Bauchi ground but were displaced by the Federal Government to give way for the Polytechnic in 1981. Before the establishment of the Polytechnic in Gwallameji, materials used for the construction of buildings were predominantly of mud and thatch for roofing, footpaths reign as access roads. Housing roofed with corrugated zinc were very few and there were virtually nothing like sewage disposal system/facilities in existence then. Defecation of faecal matter are done in near by bush while waste water is disposed in an open space.

The displaced indigenous of the then Gwallameji were paid Compensation for resettlement. Survey has it that after Compensation, a number of people compensated move to the present location of Gwallameji, which is the study area of the researcher (figure 1.1,1.2, and 1.3).

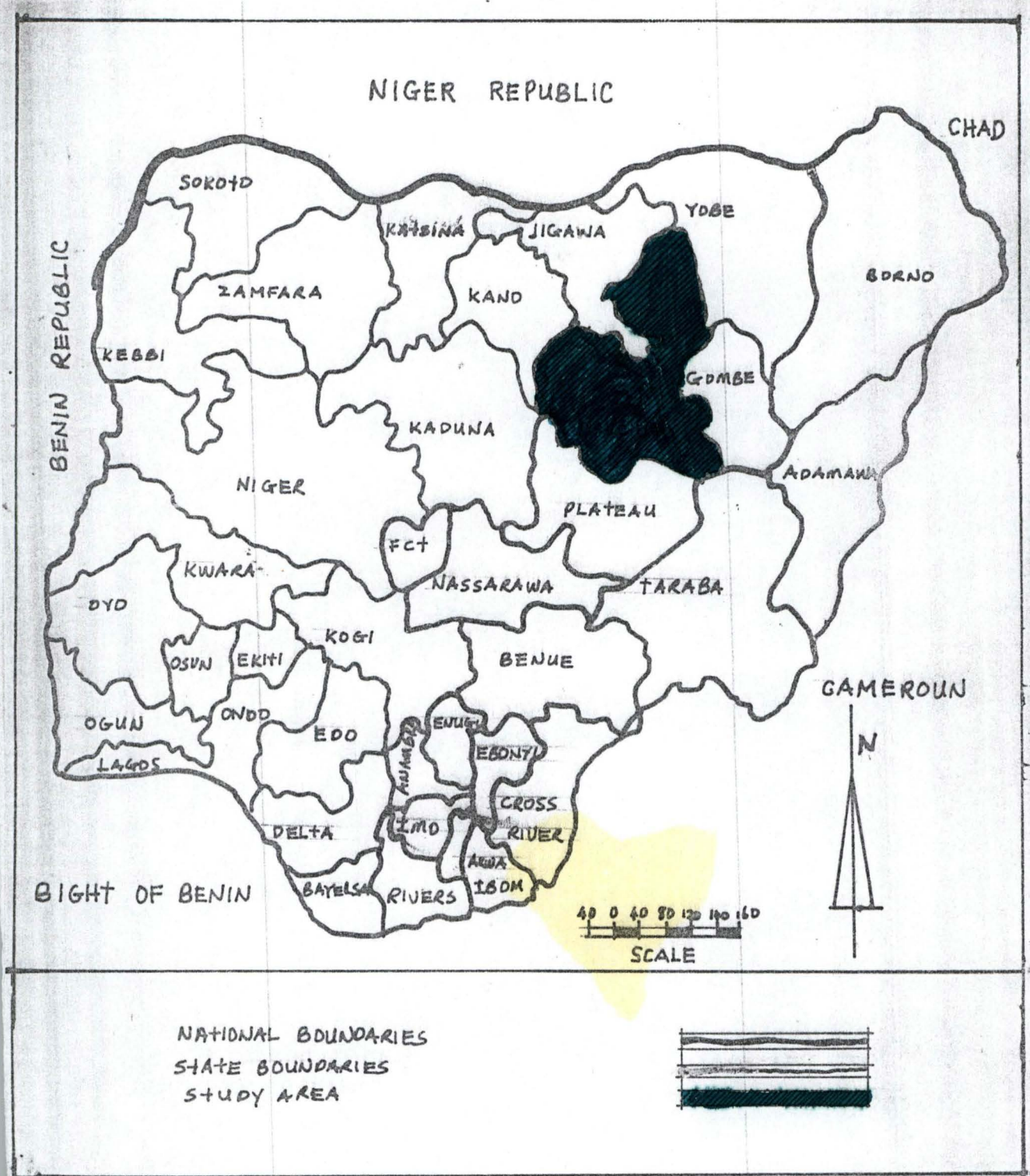


Figure 1.1 Map of Nigeria indicating Bauchi State in the shaded portion

Source: Department of Geography, FUT Minna.

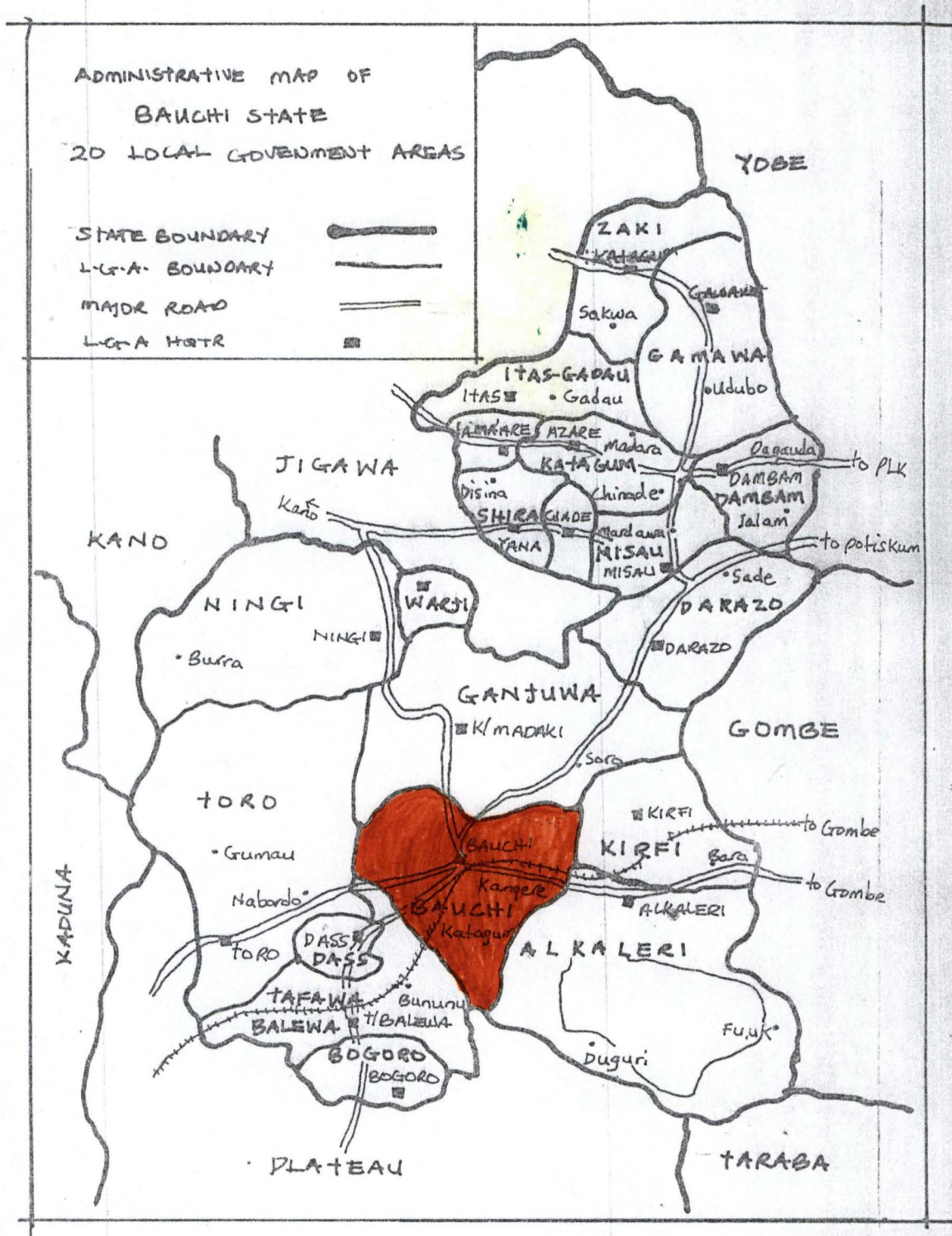


Figure 1.2 Map of Bauchi indicating Bauchi Town in the shaded portion

Source: Ministry of Land and Survey, Bauchi, Bauchi State.

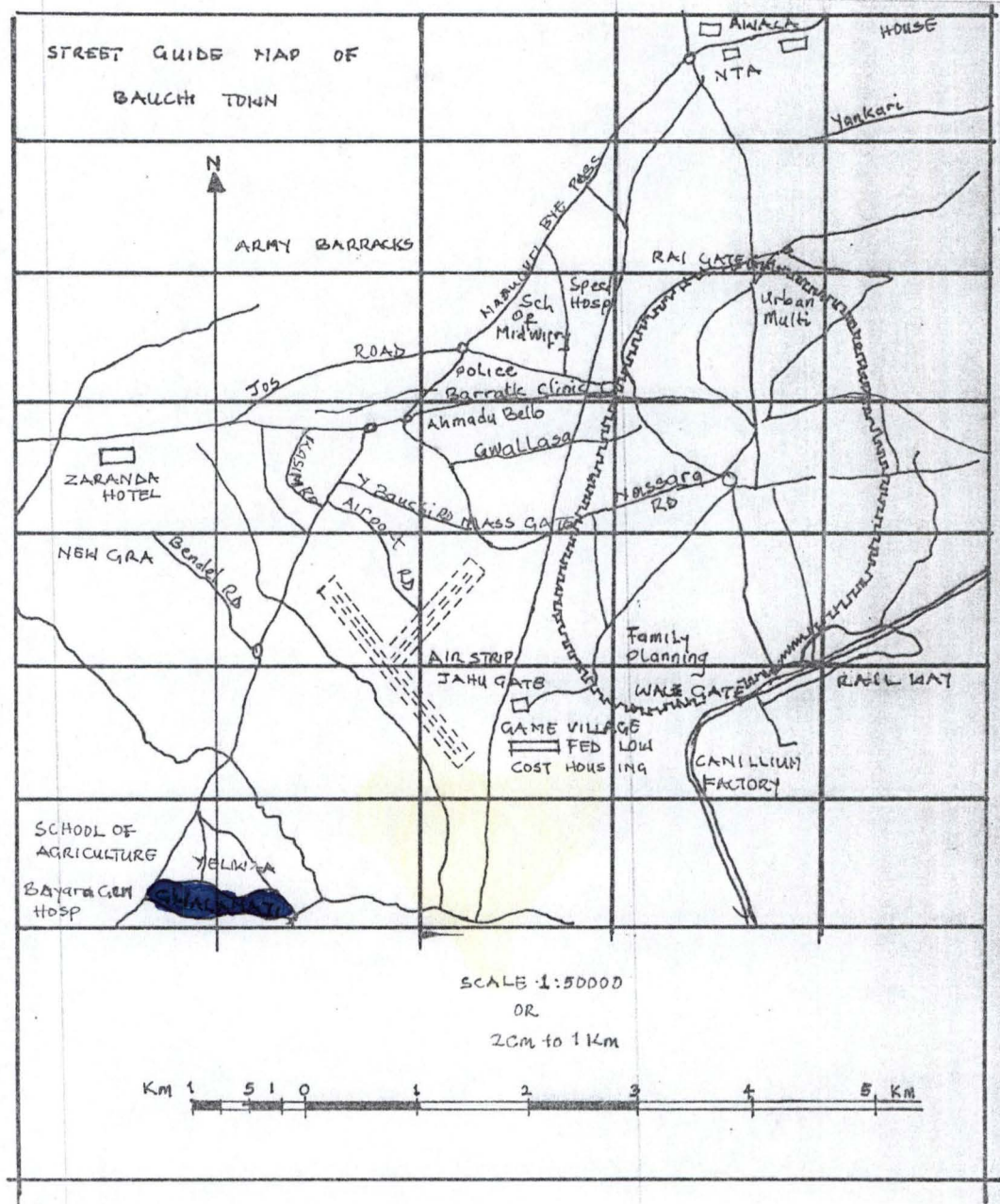


Figure 1.3 Map of Bauchi Town indicating Gwallameji in the shaded portion

Source: Ministry of Land and Survey, Bauchi, Bauchi State.

1.6 DEFINATION OF SPECIAL TERMS

- 1.6.1 **SEWAGE:** This can be defined as waste, either solid or liquid, which includes surface water, wastewater, soil water e.t.c. Conveyed in sewers (conduct) usually underground for the carrying of drainage water and sewage from areas of generation to areas of disposal.
- 1.6.2 **SURFACE WATER:** Leslie (1973) defined it as “the run off natural water from the ground surface including paved areas, roofs and unpaved lands”
- 1.6.3 **WASTE WATER:** Leslie (1973) defined it as “the water not contaminated by soil water or trade effluence, it can be taken as water discharge from baths, sinks, basin and similar appliance.
- 1.6.4 **SOIL WATER:** Leslie (1973) defined it as the discharge from a soil appliance such as water closet, urinal receptacle, bedpan washer, slop sink e.t.c.
- 1.6.5 **WASTE DRAIN:** This can be defined as a drain to receive wastewater and distinct from soil and wastewater (may also receive trade effluence).
- 1.6.6 **FOUL DRAIN:** This can be defined as a drain normally designs to take the discharge of both soil and wastewater (may also receive trade effluence).
- 1.6.7 **WATER CLOSET:** As define in public health Act 1936 section 90, it is a closet having a receptacle for the reception of faecal matter and its deodorisation by the use of water.

- 1.6.8 **SEPTIC TANK:** Leslie (1973) defined it as a common method of disposing sewage, (soil water and waste water) from single properties and small communities, which provide an environment where gross solid may settle out and the stored organic matter may undergo anaerobic decomposition.
- 1.6.9 **SOAK AWAY PIT:** Leslie (1973) defined soak away pit as “a pit dug in permeable ground and suitably prepared to receive water which may then percolate (or soak away) into the surrounding ground”. It can be use to receive surface water, sub-soil water or final effluent from a small sewage treatment works (septic tank).
- 1.6.10 **DRAINAGE:** This can be defined as a system of pipe, trend channel for carrying away water sewage and other unwanted liquid from the proximity of the building.
- 1.6.11 **SANITARY FITTING:** These are appliance installed in a building to facilitate the discharge of soil water and wastewater, these include wash hand basin, bath tubs sink unit, water closet e.t.c.
- 1.6.12 **MANHOLE /INSPECTION CHAMBER:** Leslie (1973) defined it as “a chamber Constructed on a drain or sewer having a removable cover which permits men entry for inspection and testing, maintenance, clearance of obstruction and removal of debris”.

1.6.13 **CESSPOOL:** Section 90 of the public health Act 1936 define cesspool as including a settlement tank for the reception or disposal of foul matter from the building.

1.6.14 **SEWERAGE:** A system of drainage by sewers of a town in other words it can be defined as a system of sewers or drainage of a town.

1.6.15 **SEWER:** It is defined as an underground tunnel that carries off the drainage water and waste matter from a house or town.

CHAPTER TWO

LITERATURE REVIEW

2.0 DOMESTIC SEWAGE: An overview, Pacy reported the use of UNICEF Check-list in India to locate areas where sanitary/disposal systems improvement is derived. Among other things it becomes very obvious that disposal system improvement is desired when people defecate too close to their water source or at an open space where other people walk exposing excreta to flies and when people dispose their waste water in an open space/environment without a soak away pit.

It is important to note that when domestic sewage is not properly dispose, it is difficult to collect waste or sewage at various levels, most especially where there is public sewer. In places where there is no public sewer like in the case of Gwallameji, offensive odour excluding from untreated soil water and wastewater creates untidy environment, leading to flies and mosquito breeding with their attendant consequences.

The attribute of domestic sewage disposal in Gwallameji, left nothing to be desired. Arnold (1978) stated that sanitation and hygiene clearly has much to do with human health and sewage disposal is strongly related to culture". Therefore proper disposal of domestic sewage primary depend on people and how they organise hygiene related

activities. This is because social factor is believed to be responsible for failure of technical sound project. Whenever there is problem of improper disposal system with its attendant consequences, one may be tempted to assumed that improved technology is the answer, but Pacy (1980) had pointed out that technology by itself, alone, does not solve sanitation problem because human factors as related to acceptability of the system are very strong determinant as to whether there would be proper or improper domestic sewage disposal system or good sanitation system and this can only be satisfactorily achieved by involving the user at all stages of programme planning and implementation. The assumption that if the facilities were provided, people in the cause of time would use them could be erroneous.

An increased awareness of the importance of sewage disposal system by the environmental protection Agencies all to be more effective in the future so as to fulfil the assumption. It is obvious that when domestic sewage is properly disposed, it does not only creates aesthetic environment, enrich human dignity, improvement in health, greater productivity but also makes it easy to be used for the production of fertilizer.

Peter (1979) stated that “sludge accumulated during the first stage of disposal formulation, when removed periodically are used for the production of fertilizer” which are used for agricultural purpose, and generally enhances agricultural

productivity thereby enhancing socio-economic development and the country's economy. He further stresses that better fertilizer can be obtained if sludge from septic tank are channelled into biological filter for film oxidation of organic matter and finally from biological filter to humus chamber where it will be improved greatly by the removal of humus. This is known as final treatment, the humus can then be used as fertilizer.

2.1 CAUSES OF IMPROPER DOMESTIC SEWAGE DISPOSAL

There are many factors affecting proper domestic sewage disposal, some of these factors are as follows.

2.1.1 UNIMPLEMENTATION OF ENVIRONMENTAL POLICY

The Bauchi State government enacted certain rules governing domestic sewage disposal, which are to be implemented by the Bauchi State Environmental Protection Agency as the state machinery. The local government through planning authorities of various ministries established building regulation, which gives guidance on meeting regulation on minimum requirement of domestic sewage disposal system. As the Planning Authority guide on sewage disposal system that is required in a property, the Environmental Protection Agency deals with the disposal of domestic sewage from areas of generation to areas of disposal.

For a residence to be a habitable house it must meet the building standard with provision of electricity, pipe borne water, proper sewage disposal system e.t.c. In respect to domestic sewage disposal system the construction requirement stated that “Any system which carries foul water (waste and soil water) from the appliance within the building to a foul out flow shall be adequate”. This is to reduce risk to health and safety of the occupants in the building. Thereby the sewage disposal system should be: -

- a. Convey the flow of foul water (waste and soil water) to an out flow. That is from septic tank to soak away pit.
- b. Be constructed to minimise the risk of blockage or leakage.
- c. Constructed to prevent foul air from the system from entering the building under working condition.
- d. Be ventilated.
- e. Be accessible for clearing blockage

Foul outflow means a sewer, cesspool, septic tank, soak away pit. Septic tank is for conservation of soil matter/water, which under goes treatment of bacteria. The treatment sewage is received by a soak away pit where the soiled water will percolate.

Septic tank should have the following requirements

- a. It should be minimum below the level of the inlet of at least 2700 litres (2.7 ms)
- b. The outlet as well as the inlet pipe should be provide with access for inspection and properly ventilated.
- c. Provision should be made to limit the velocity of the flow to the tank Drain up to 150 mm diameter may be limited by laying the last 12m of the incoming main at a gradient of 1.50 or less or by providing a dip pipe.

In areas where conservancy method such as lavatory/pit latrine and sanplat system are used, the following are considered.

- a. The pit must not be less than 3m with a diameter of 120m.
- b. The ring beam construction and concrete mix of 1:2:2 i.e 1 part of cement, 2 parts of sand and 2 parts of gravel is required.
- c. The pit must not be closed to water source.

These and many others had been enacted in the building regulation in respect to domestic sewage disposal with the view to securing or achieving liveable and aesthetic environment, but has not been well implemented by both the Bauchi state Planning Authority and Bauchi state Environmental Protection Agency in the study area.

2.1.2 THE NATURE OF THE SOIL

Leslie (1973;) Argues that “the nature of the soil and general condition are so variable that the construction of domestic sewage disposal system can be decided on site” where the nature of the ground, changes unexpectedly the construction can collapse and where the nature of the soil does not absorb or percolate water easily in respect to a soak away pit it leads to overflowing of sewage.

2.1.3 IGNORANCE OR LACK OF AWARENESS

Most occupants of residential property especially the local communities are ignorant of the effect of improper sewage disposal system to the environment and their health in general. Most real estate investors and landed property owners are ignorant of the importance of proper domestic sewage disposal system in their property this is because the study area is not an ideal situation where facilities determines the rental value of a property. Every property commands the same rent with or without provision of facilities and services. This is due to high demand and short supply of residential property in Gwallameji.

2.1.4 NON ACCEPTANCE OF THE PROJECT

The local community of Gwallameji not knowing the important and the effect of improper domestic sewage disposal refuse to comply with UNICEF in issues of

2.2.2. ELEPHANTIASIS;

Sandy and Richard (1983) stated that “After many years of re-infection of mosquito carrying fillariasis, the lymphatic system becomes so obstructed that the limbs swells” a condition known as elephantiasis infection which is chronic and series of symptom develop over many years is obtain. This disease does not kill but disfigures and cripples the affected persons.

2.2.3. YELLOW FEVER AND DENGUE

Sandy and Richard (1983;) stated that yellow fever and dengue are transmitted by mosquitoes carrying aedes aegyptic especially in urban area.

2.2.4 RIVER BLINDNESS:

This is a fly borne disease. Onchocereciasis is an infection with filariasis nematode causing a chronic disease, which may lead to blindness. It is popularly known as river blindness.

2.2.5 A VIRAL FEVER AND BACTERIA FEVER

This is a fly borne disease transmitted by lieshmaniasis flies which causes a viral fever, nastily bacteria fever and various disease.

2.2.6 DIARRHOEA

Milk from cow or herd that drinks the expose waste water from bath, causes diarrhoea to the consumers of such milk.

2.2.7 ENTERIC FEVER

Closely following malaria is the enteric fever commonly called typhoid fever. Salmonella typhi and paratyphi are specific human pathogen: it occurs whenever sanitation is poor and the water supply is liable to be contaminated by human excreta and also unhygienic food -handling.

2.3 METHOD OF DOMESTIC SEWAGE DISPOSAL

Peter (1979) stated that where public sewer exist, the simplest and best method of disposing sewage of flows in foul drains directly into the sewers. Where public sewer does not exist as in the case of Gwallameji, The method of domestic sewage disposal include the following.

2.3.1 CONSERVACY METHOD

Escritt (1972;) defined conservancy sanitation as sanitation by keeping foul matter (soil waste) in pit, privies for its periodic removal or emptying. This is applicable in the case of lavatory/pit/sanplat-ventilated latrine.

2.3.1 TREATMENT METHOD

Peter (1979) Argues that “Various and electrical means of sewage treatment have been developed”, both large local authority and small private are base on the system of first (1) Removing suspended soil matter by means of sedimentation, setting or septic tank”. Then oxidizing the organic matter still contained in the liquid by means of biological agencies and finally discharging the final effluent to watercourse. If this is not possible,(surface or subsurface irrigation), The sludge accumulated during the first stage is removed periodically (at six months interval) and form as fertilizer. Sewage under goes the following treatment.

2.3.2.1 PRIMARY TREATMENT

Sewage is allowed to stand in the septic tank, which usually have a capacity of 10 and 48 hours flows. Sludge settles to the bottom and scum from the top and clear liquid called liquor will over flows as new flows comes in. To some degree digestion may take place. This process is the breakdown of the organic content by means of the anaerobic bacteria, which can thrive under the condition of the septic tank. This process reduces the quantity of sludge and render the odourless offensive. At ambient temperature this process can occupy a period of two month or more consequently it can only be partially effective in septic tank. In building regulation of 1985 section 39,

septic tank are treated as cess pool as far as sitting, emptying and construction is concerned.

2.3.2.2 SECONDARY TREATMENT

Sewage or effluent from septic tank is based on oxidation of organic matter by the activity of aerobic bacteria and the best form for a small works is biological filter. Leslie (1973) stated that “The filter is design to receive the tank effluent and bring it into film oxidation of the organic matter takes place during the metabolism of the aerobic bacteria. As the process is aerobic, adequate ventilation of the filter is necessary. Properly designed and maintained, the final effluent suspended solid content within the recommended standard of royal commission on sewage disposal.

2.3.2.3 FINAL TREATMENT

Sewage from a biological filter can be greatly improved. This can be done by giving a final treatment to remove the humus which is a by – product of the bacteria action in the filter bed for small installation without regular supervision, the best method is to be distribute the flow over an area of rough grass or shrubs 1 to 3.5m² per person may be needed depending on the nature of the soil. Provided the regular weekly maintenance is possible a better method is to provide humus chamber similar to septic

tank but of about one quarter the capacity. This humus can be used for or as fertilizer being very much better suited to this purpose than sludge from septic tank.

After these treatment the sewage (soil water) can finally be discharge to the water course if available and approved of the appropriate authority can be sort or obtain.

Where there is no water course effluent may be disposed off below ground provided the soil is reasonably permeable and the water table does not approach 2.7m² to the surface (Figure 2.1, 2.2, 2.3 and 2.4).

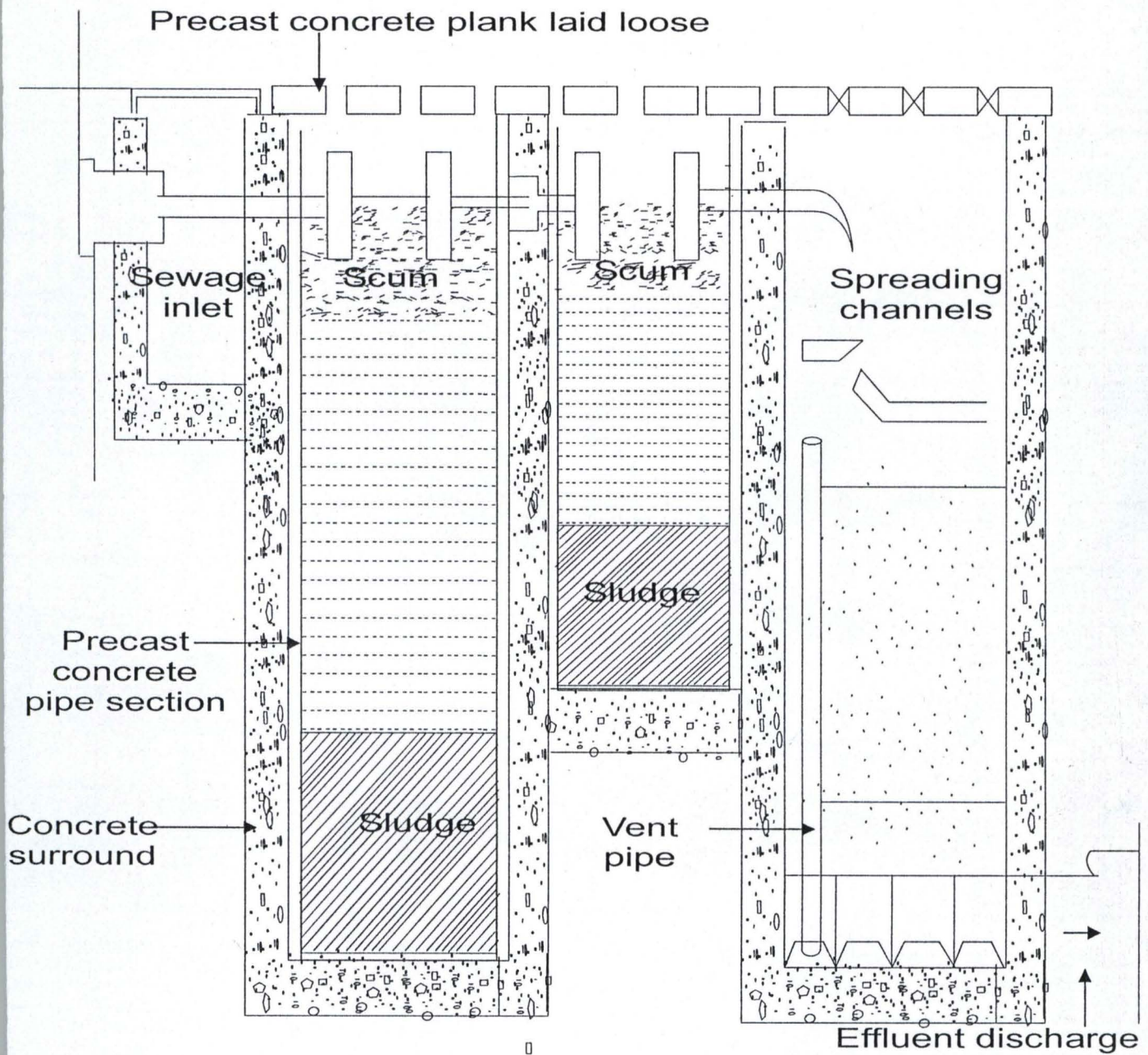


Figure 2.1. Two chamber septic tank with biological filter source Peter (1979).

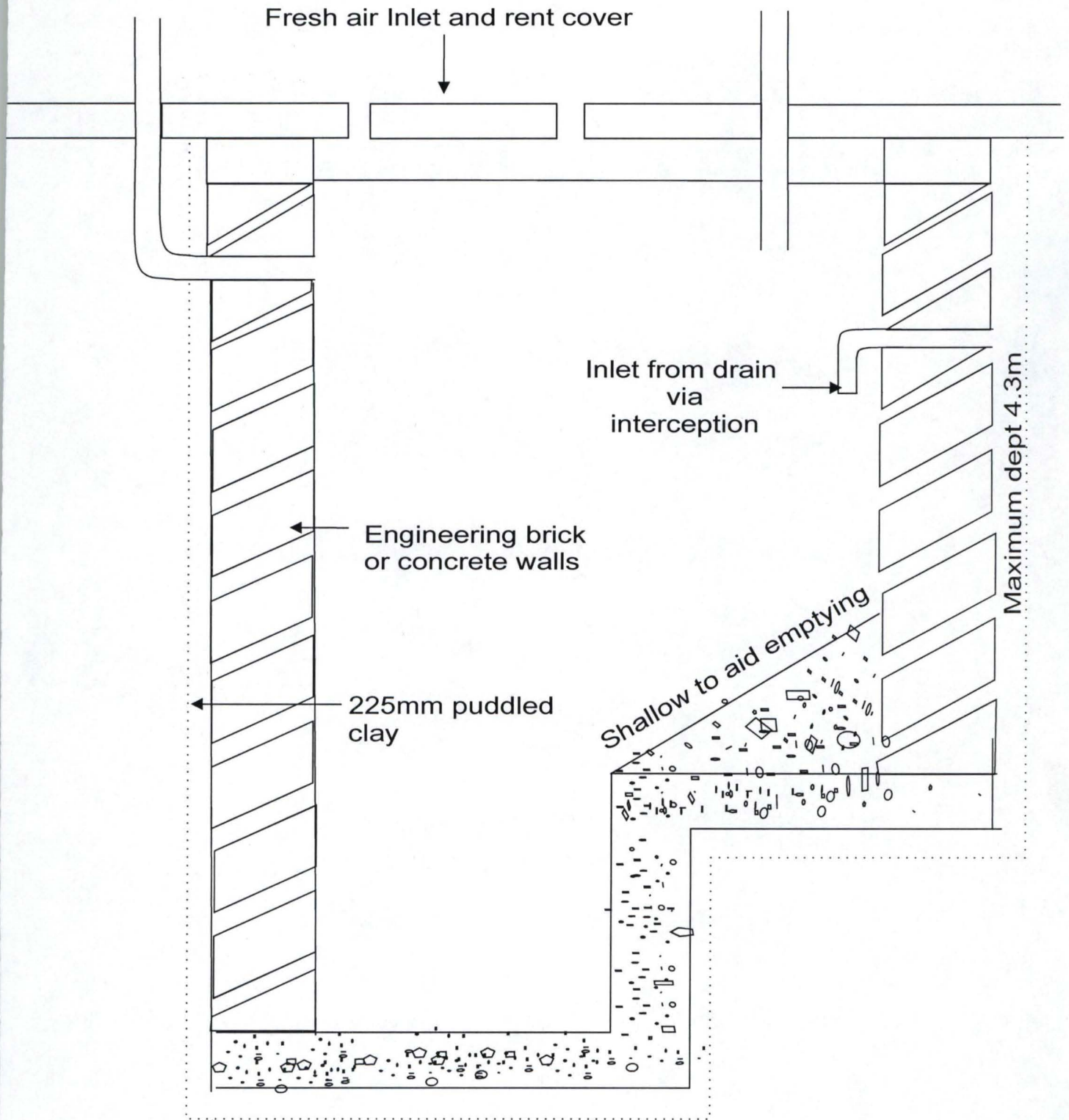


Figure 2.2 cesspool
source Peter (1979)

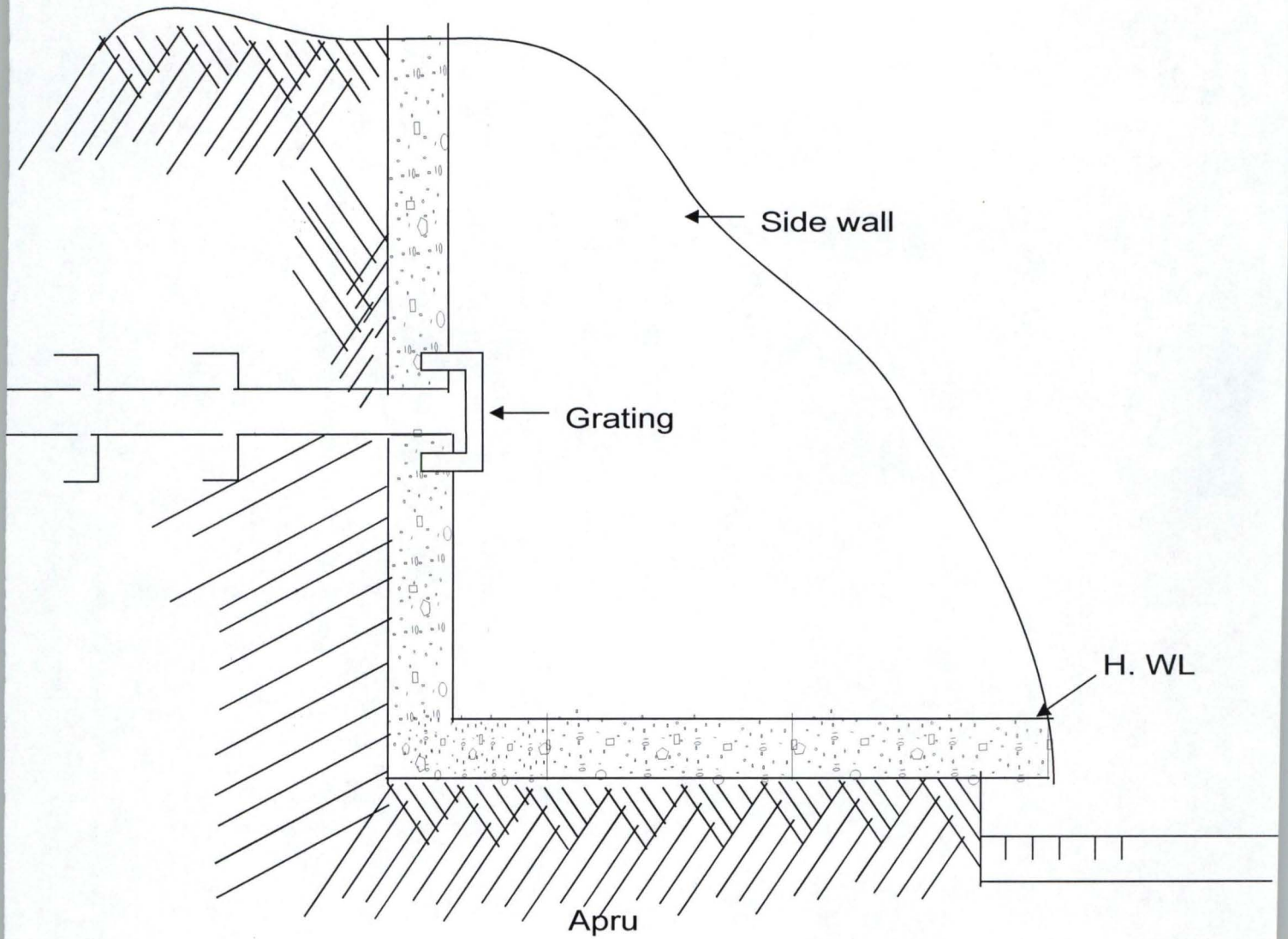


Figure 2.3. Section details of outgo from sewage disposal system to a water course
 source: Peter (1997)

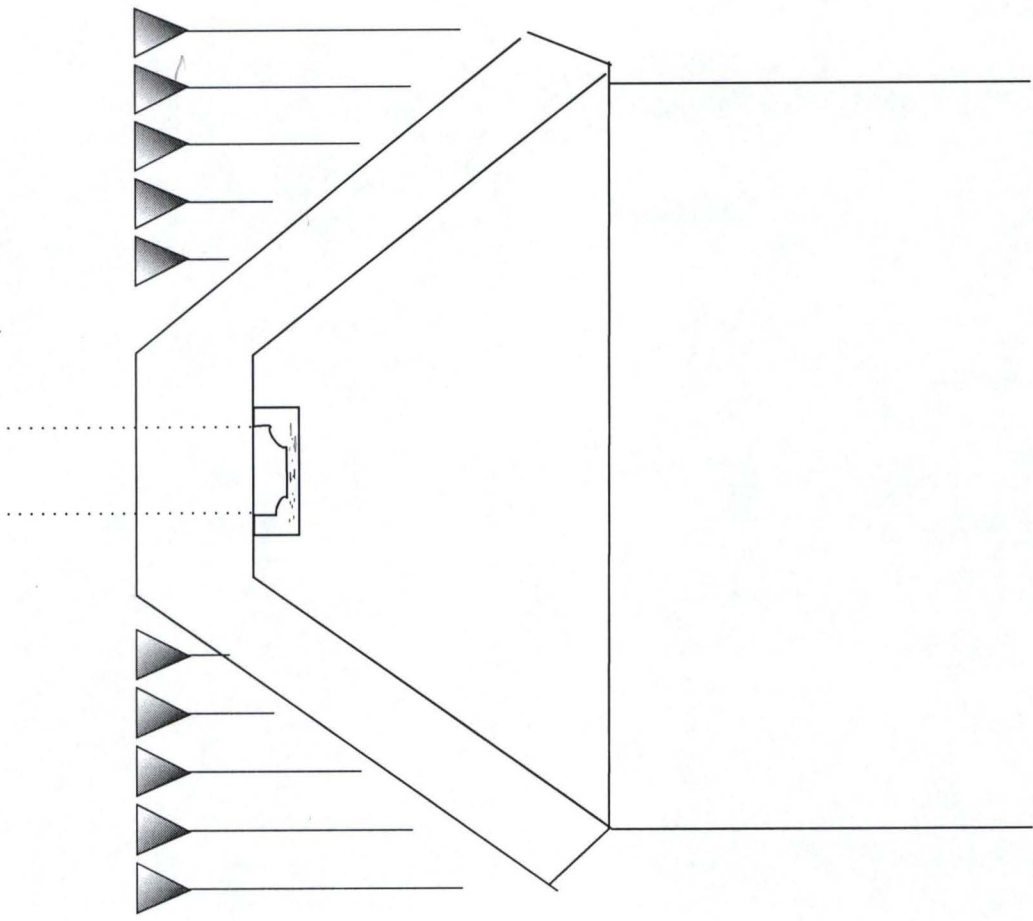


Figure 2.4. Plan discharge to water course.
source: Peter (1997)

2.3.3 DILUTION METHOD

If the volume of water receiving a flow of sewage is sufficiently large, oxidation of organic matter can be achieved by the oxygen dissolved in the water, presently in Nigeria it is not considered appropriate to use this method with rivers, since the population of the catchments areas would make necessary a much greater flow than is available. Many local authorities do dispose sewage, often., after mechanical disfiguration of soil matter directly into tidal waters.

In recent years this method is questioned by some local planning authorities. It is in any case often not practicable for individual building since even if the sea shore form part of the site boundary the outflow arrangement required would involve considerable planning and expenditure. Where this discharge take place under proper condition, when the sewage is effectively purified.

2.3.4 PERCOLATION METHOD

This is the major method or means of disposing waste /used water Via soak away pit.

The water percolate/seep into the soil see figure 2.5.

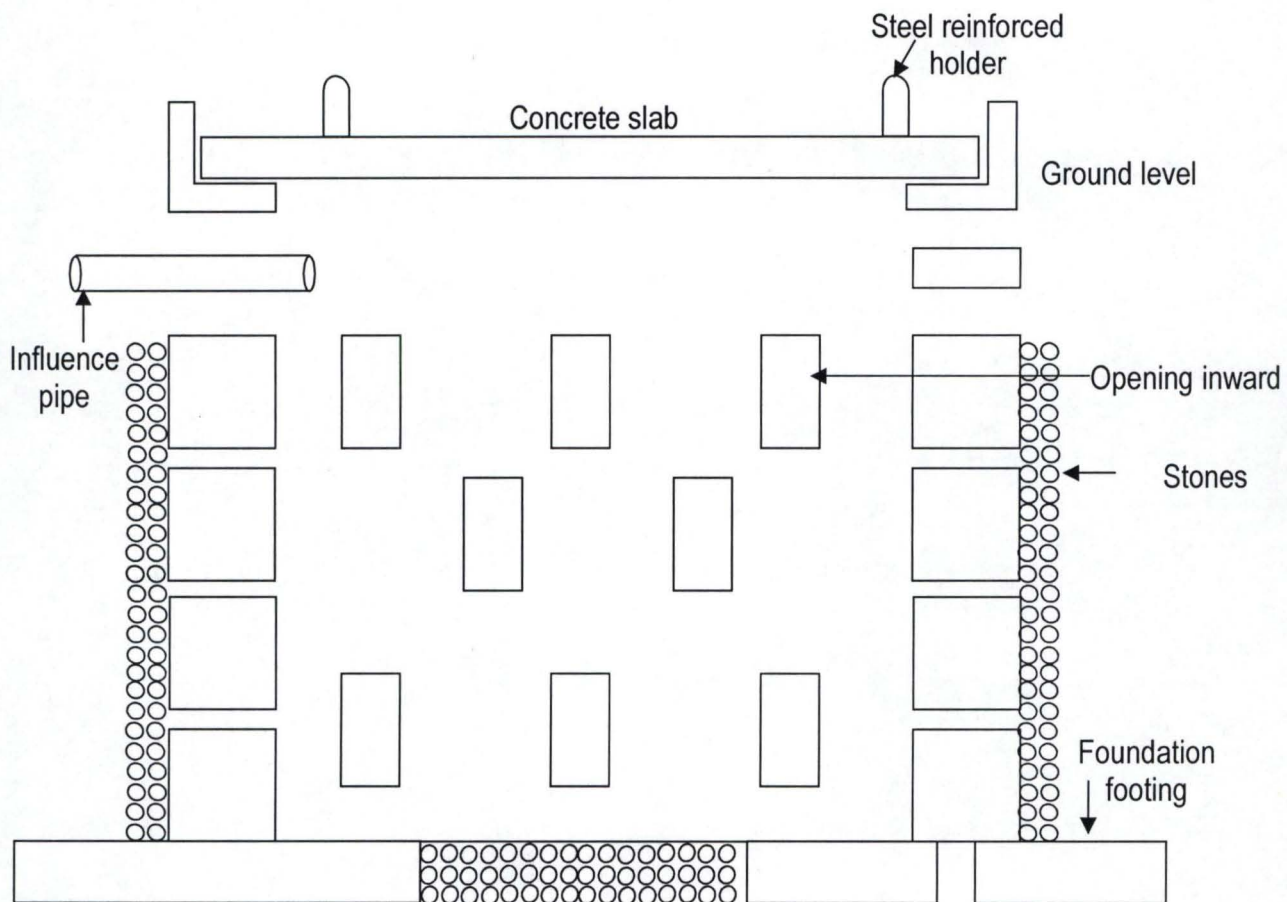


Figure 2.5. sock away pit
 source: Note on environmental science and state service

**2.4 BAUCHI STATE ENVIRONMENTAL PROTECTION RULES, BUILDING
REGULATION AND PUBLIC HEALTH ACT WITH REGARDS TO
DOMESTIC SEWAGE DISPOSAL**

The Bauchi State Environmental Protection Agency rules deal with disposal of sewage from the areas of generation to areas of disposal.

Their rules and regulations are as follow:-

- a. It is mandatory for any building or property use for residential purposes to preserve its sanitary condition and shall not expose the occupant to hazardous condition.
- b. Any vehicle used for conveying sewage must be covered where appropriate so as to prevent the content from littering the road and the environment.
- c. No domestic sewage shall be disposed of in any land fills but in a save manner for good environment.
- d. The official supplies of public water shall direct and maintain the continues operation and maintenance of such water supply facilities so that it shall be safe in quality for ordinary domestic consumption and quality for other domestication i.e. flushing of excreta in water system, bathing e.t.c..
- e. Any proposed plan or specification for water construction work and installation shall be submitted to the Agency for approval.

- f. To forcefully open, seal, seize, collect, keep or detain any property of an offender so as to abate nuisance.

The building regulation and the public Health Act rules deals with the construction and use of sewage disposal system. It is clear from the method of disposal that soil water are discharge to septic tank treated and channel to soak away, while waste/used water are discharge directly to soak away pit.

The use of water closet and septic tank respectively are limited by the following section of the public Health Act.

Section 43 (1) stated that “where plans of building or extension of a building are in accordance with the building bye-law or regulation deposited with the local authority, the authority shall reject the plan unless closet accommodation consisting of one or more water closet. The authority may approve provided that they are satisfied in the case of a particular building or extension.

They may properly dispense with the provision of closet accommodation provided that

- a. Sufficiency water supply and sewer are available.

The authority shall not reject the plan on the ground that the proposed accommodation consists of water closet.

b. If the plan shows that the proposed building is likely to be tenement building, or factory or workshop, in which the person of both sexes will be tenant or employed. The authority shall reject the plan unless the plan shows sex, or the authority are satisfied that in the circumstance of the particular case that they may properly dispense with the provision of such separate accommodation.

Section 37 (3) stated that “a proper drain” for the purposes of this section unless it is proposed to be made, as the local authority or on appeal of the court of summary jurisdiction, may require, either to connect with a sewer or to dispose into septic tank/cesspool. Provided that the subject to the provision of the next succeeding section.

- a. That the sewers is within 30 metres from the site or on the building. It is at this distance that it is reasonable practicable to conduct a drain to communicate therewith and if it is not a public sewer, it is the sewer which the person constructing the drain is entitled to use.
- b. The intervening land is the land through which the person is entitled to construct a drain.

In the above circumstance, the local authority may insist on connecting with their sewer and provision of water closet are clearly set out. There remains circumstance where cesspool or septic tank is accepted. But to be considered proper sanitary condition, on earth closet/water closet must fall

Under the definition in the public Health Act and must comply with the building regulation.

2.5 MAINTENANCE OF DOMESTIC SEWAGE DISPOSAL SYSTEM

Environmental which is the surrounding, must be arrange to protect public health especially through efficient disposal of domestic sewage and maintaining the system.

Sewage disposal management is just like a strain to our ability to focus attention. Leslie (1973) Stated that “To maintain sewage disposal system, the system should be thoroughly cleaned out at the same time and any defects discovered made good” so far as practicable. The system in used should be inspected at intervals not exceeding 3 years. The British standard 8301:1985 describe the following method for cleaning a drainage/sewage system.

2.5.1 ROODING

Should be suitable for maintenance purpose and to avoid damage to pipe work.

2.5.2 JETTING

High pressure jetting is suitable for the use of all available pipe materials.

2.5.3 HYDRAUTIC RAMS COMPRESS AIR OR OTHER GASES.

Shock wave induced and is transmitted by water to the point of blockage, the techniques is more effective if the drain can be surcharge from the point of blockage to a position where equipment can be used.

2.5.4 WORKMANSHIP

White and Webster (1970) stated that “recurring blockage were usually due to imperfection in the system arising from bad installation”. Good supervision is essentially in this field and the supervisory staff should have sound understanding of the basis principles of design to enable them to make objectives decisions on site.

2.5.5 EMPTYING AND CLEANING OF DRAINS

Where there is no public sewer the septic tank should be emptied at the appropriate time or at intervals time. Where conservancy method is used that is lavatory sample ventilated improved toilet/latrine emptying and cleaning is also required at intervals.

2.6 TYPES OF DOMESTIC SEWAGE DISPOSAL SYSTEM.

Barry (1978) Stated that “layout of underground drains depends on whether foul water (soil and wastewater) and surface water combine in the drain system or runs a separate drain system”. Generally foul water is discharged from the water closet, basin and sink and surface water is discharge from precipitation (rain) from roof, road and paved areas.

The combine drain system is used where the public sewer takes both foul water and surface water, as most of the sewers are built during the nineteenth century sewage treatment as at that time was rudimentary or not in existence.

In separate drain system, foul and surface water runs separately in drains system to separate sewers. Sophisticated and expensive sewage treatment developed during this century to the extent that it was advantageous to separate foul water and surface water to avoid the necessary cost of treatment or treating it later.

In the layout of a drainage system, the drain should run in straight lines with a few changes of direction, gradient and junction as practicable to minimize blockage which generally occur at change of direction and pipe to economize in the expenses of junction fitting and man hole. Obviously the layout of domestic sewage disposal system will be affected by the discharge of foul water and surface water into it.

2.6.1 COMBINE SYSTEM

Barry (1978) defines this as “a kind of drain system where both foul water (waste and soil water) and surface water (rain from roofs, roads and padded areas) are discharge to common or combine drain system that in turn discharge to a combine public sewer. In the past, great emphasis where placed on a system of water seal and tents designed to prevent sewer gases and odours entering the building from drains and sewer. This unholy fear drains smells has been taken to extreme and absorb limit that persist to present day. With the high percentage consumption of water today and the mean rain water in the country. It is very unlikely that combine drain flowing freely will cause objectionable smell. Many water seal in form of traps that used against the slight possibility are in themselves expensive and a prime source of blockage.

Depending on the above, ground drainage layout soil water will be discharge to the drains or where a two-pipe system is used then the used or wastewater will be discharge. For economy, foul water (waste and soil water) separate discharges should be run as directly as possible to a single drain line. The traditional method of achieving this by means of an inspection chamber or Manhole preferable outside the building. The chamber is so placed to collect the inlet pipes that discharge to the chamber in the direct of the flow of the drain see figure 2.6.

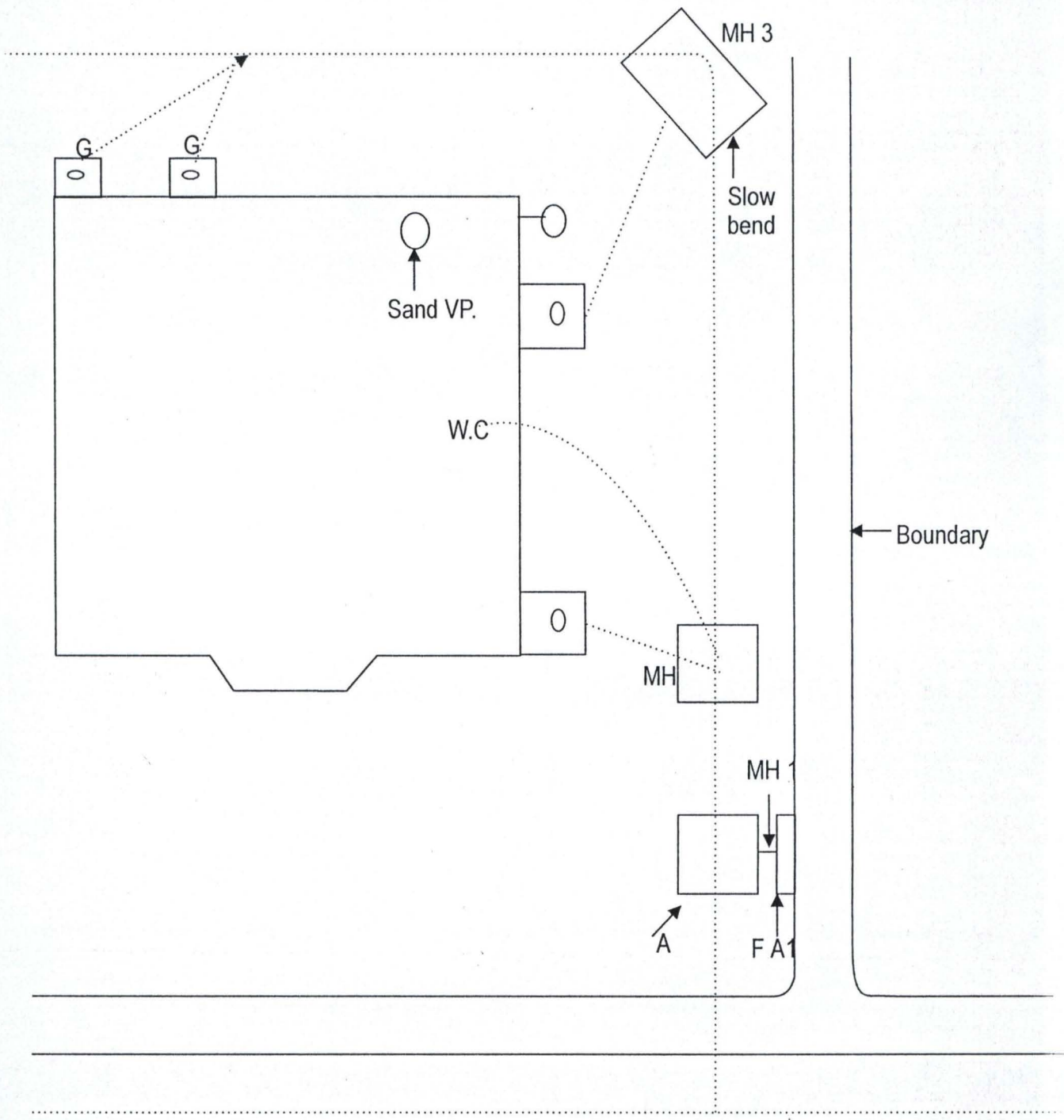


Figure 2.6. Combine sewage disposal system
 source: Leslie(1973)

2.6.2 SEPARATE SYSTEM

Barry (1978) defined this as “a system where two separate system, a waste soil, and surface water drain system discharge separately to foul drain and surface water drain”.

The foul water (waste and soil water) drain system collects the discharge from water closet, basin, bath, and sink e.t.c. and rain fall is discharge to its own drain.

Soil pipe connect directly to the foul water drain as a vent to drain system and waste pipe to gullies. Connection may be directly to the surface water drain without trapped gullies as there are no foul gases or air in the drain or sewer that may cause smell.

The gullies collecting both rain fall from pave area and building do not have a water seal, as there is no likelihood of blockage in the surface water drains, it is not considered necessary to form inspection chamber at all junction, bends and changes of gradient as is the case with foul water drain. Rooting eyes are provided at salient point to facilitate clearing drains and are generally considered adequate for this purpose. See figure 2.7.

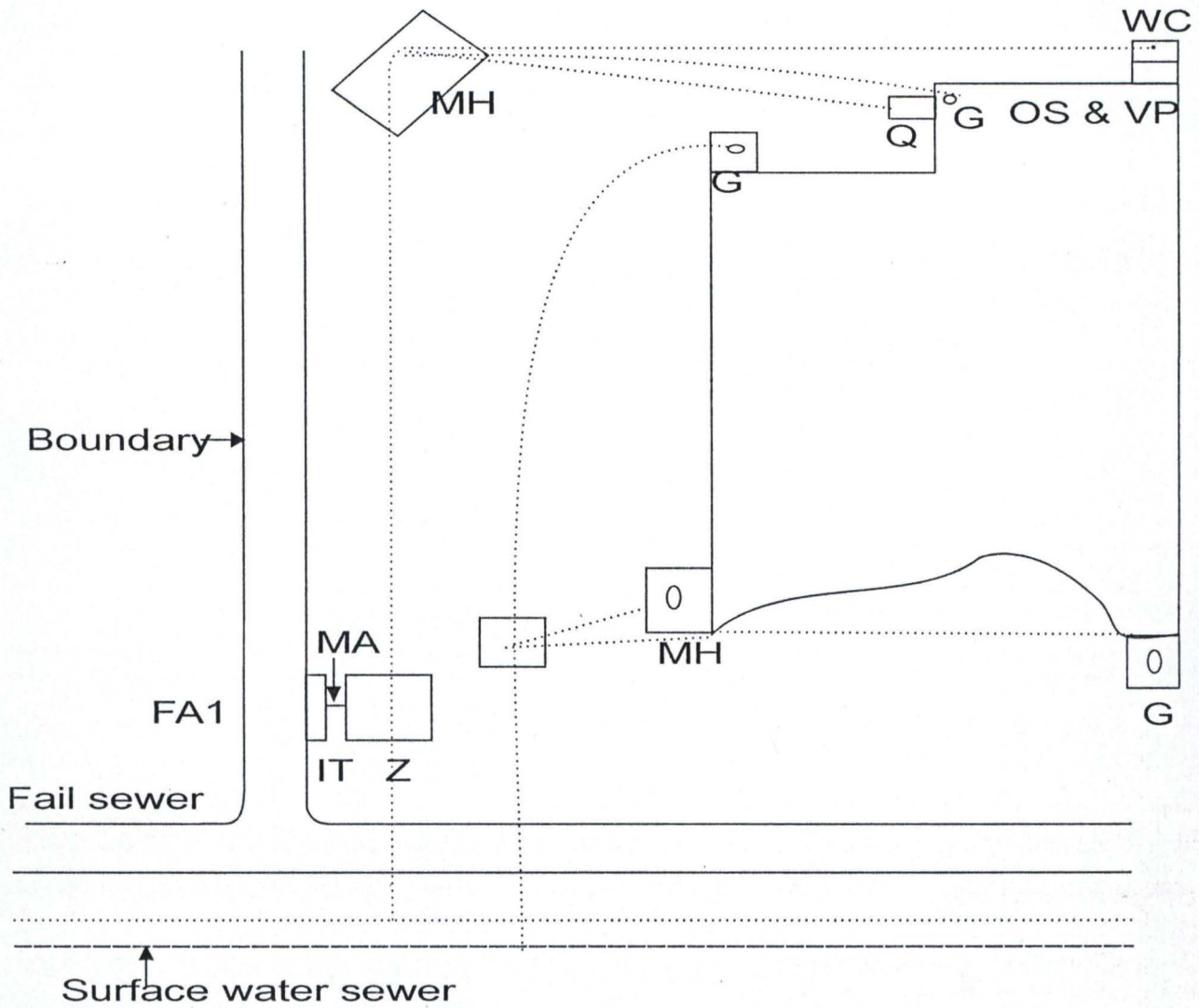


Figure 2.7 separate sewage disposal system
source: Leslie (1973).

LEGEND

- | | | |
|-------|--|--|
| GO | | Gully to receive waste water pipe (back inlet) |
| G | | Gully to receive rain water |
| SO | | Street gully |
| YG | | Yard gully |
| REO | | Rooding eye |
| FAI | | Fresh air inlet |
| ITZ | | Interceptor tap |
| --- | | Surface water |
| W& VP | | Waste water and vent pipe |
| V.P | | Vent pipe |
| MH | | Manhole |
| ---- | | Foul |
| ---- | | Direction of flow |
| S& VP | | Soil and vent pipe |
| W.C | | Water closet. |

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

This chapter deals with research design population and sample of the study area, research instrument, sources of data and method of data analysis.

3.1 RESEARCH DESIGN

It should be noted that the design of a research the basic plan of how the research should be done and it guides the data collection and analysis phase of the research. The design used is the descriptive statistics. This serves as a master plan specifying the method and procedures for collection of data and also describes the type of sewage disposal system and analyses the present state of sewage disposal.

3.2 POPULATION AND SAMPLE

The population of the study area was one hundred and fifty nine premises, which is 85% (percent) residential and 15% (percent) agricultural and commercial. The population is not homogenous, therefore the heterogeneous population was divided into sub population or strata or zone of (53) fifty three each, Gender was the basis for selecting out of the random sampling, as questionnaires was administered in each strata/zone. This method of random sampling is known as stratified sampling techniques.

With the sampling techniques derived, 21% was taken from the general population of 159 premises.

$$\therefore \frac{21}{100} \times \frac{159}{1} = 33$$

That is thirty three (33) premises was selected as sampled premises based on maintenance level of the premises e.g. well maintained, fairly maintained and non/poorly maintain premises. Eleven premises was selected from each strata zones of thirty three and twenty two questionnaires was administered to respondent male and female alike. In each premise, two questionnaire was administered one to male and other to female, to enable accurate realization of data.

Total population of each strata from which sampled was selected is

$$\frac{159}{3} = 53 \text{ premises}$$

Each strata comprise 53 premises number of sampled premises from each strata is

$$\frac{33}{3} = 11 \text{ premises}$$

That is from a general population of 159 which was divided into three zones of 53 premises each, 11 premises was selected from each strata as sampled premises (Figure 3.1).

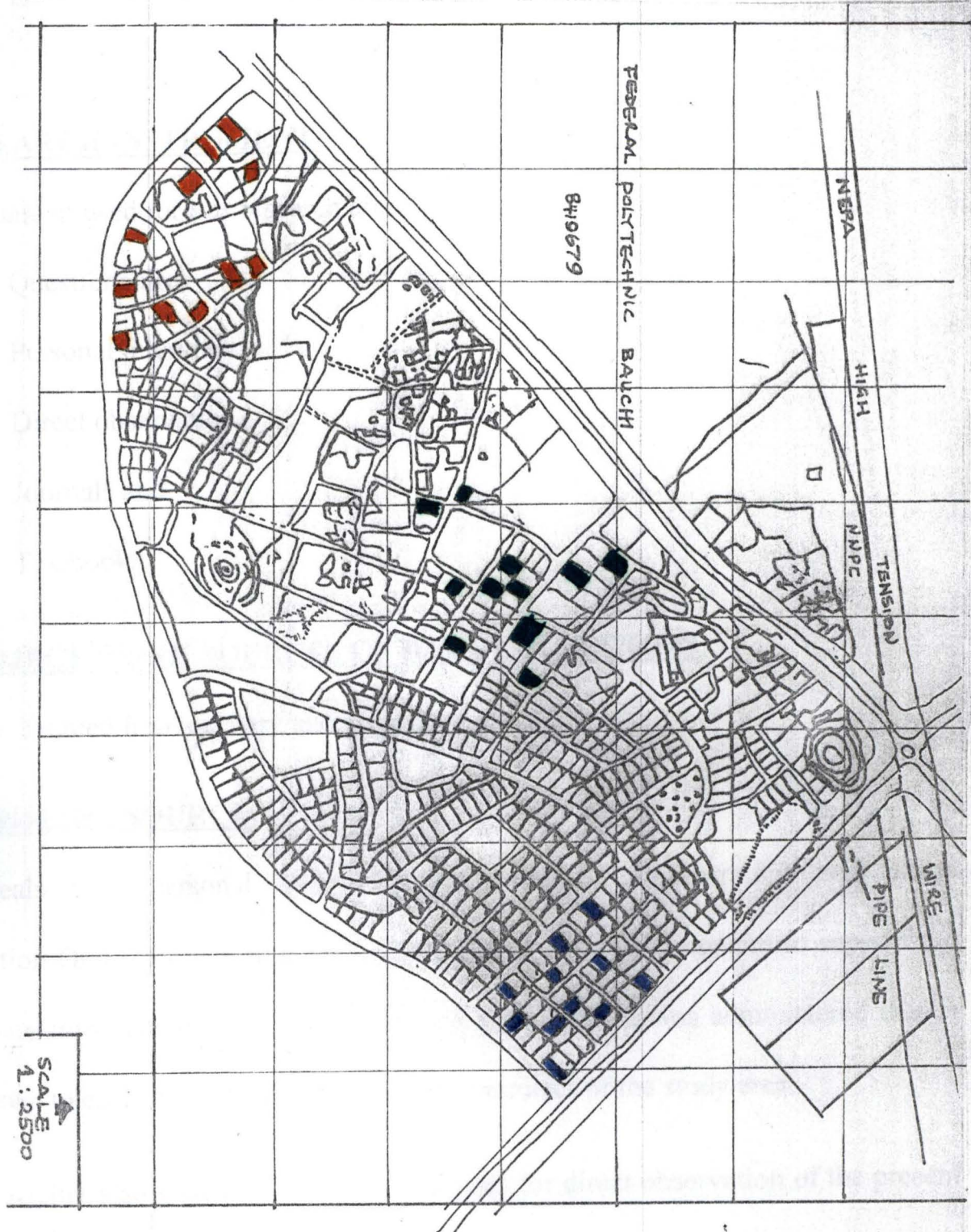


Figure 3.1 Gwallameji high/medium density residential layout indicating the sample premises in each zone. Zone A Zone B Zone C

Source: Ministry of Lands and Survey, Bauchi, Bauchi State.



Photograph 1: Improper disposal of faecal/soil waste

Source: Filed Survey (4/11/2001)



Photograph II: Improper disposal of waste water

Source: Filed Survey (4/11/2001)

Table 4.2 SUMMARY OF DOMESTIC SEWAGE DISPOSAL IN THE THREE ZONES OF THE STUDY AREA

Zones	Total number of rooms sampled	Total number of occupant	Average occupant per room	Total number of toilet	Total number of bathroom	Number of persons per toilet and bathroom		Percentage of the peoples anal cleaning material water tissue		Percentage of premises that are without adequate disposal facility	Percentage of premises that disposes it soil & waste water property	Percentage that disposes its waster water improperly	Disposal interval per annum	Average number of toilet and bathroom	
A	184	245	2	37	39	6	6	35	65	-	12%	3%	1	3	3
B	176	227	2	33	33	7	7	59	41	-	12%	30%	0.5	3	3
C	180	237	2	19	23	12	10	48	52	9	0	34%	1	1	1
TOTAL										9%	24%	67%			

Source: Field survey 4/11/2001

4.3 DATA ANALYSIS

Using table 4.2 there is an average of 2 persons per room and at about 6 persons to a toilet in zone A 35% of the occupant uses water as their anal cleaning materials while about 65% uses tissue.

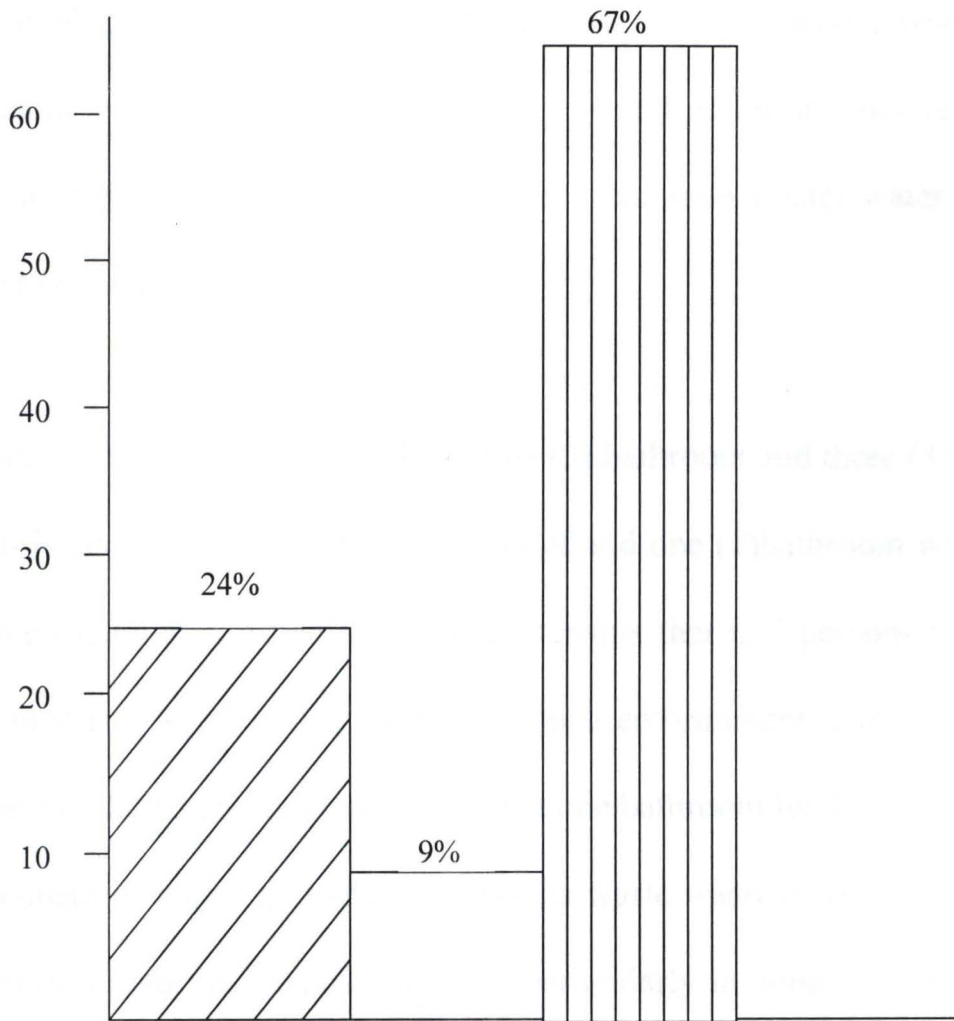
With regards to disposal facilities e.g. (toilet and bathroom with soak away pit), zone A has adequate disposal facilities particularly toilet only 3% disposes its waste water in an open environment.

In zone B, there is also an average of 2 persons per room and at about 7 persons to a toilet and bathroom. 59% of the occupant uses water as their anal cleaning materials while about 41% uses tissue with regards to disposal facility, 30% premises disposes its waste water in an open environment which is not proper and has a lot of health implementation.

In zone c, there is also an average of 2 persons per room at about 12 persons to a toilet this is why there is high rate of wrong faecal/excrete disposal in this zone most premises has no toilet, precisely 9% premises in this zone has no disposal facility. 48% of the occupant uses water as their anal cleaning materials while 52% uses

FIGURE 4.1 GENERAL PRESENTATION OF DOMESTIC SEWAGE

DIPOSAL IN GWALLAMEJI



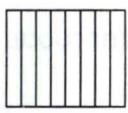
Source: Filed Survey (4/11/2001)



24% premises in the sampled premises disposes its waste water and water properly



9% premises in the sampled area dispose its wastewater and soil water improperly



67% premises in the sampled area disposes its waste water improperly and soil water properly

have willing occupant. The Environmental Protection Agency should also carry out their sanitation inspection and penalise property owners who does not meet the standard requirement with respect to building regulation.

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APPENDIX I
PRESENTATION OF DOMESTIC SEWAGE DISPOSAL IN ZONE A GWALLAMEJI

S/NO	NAME OF PREMISES	TYPES OF BUILDING	NUMBER OF ROOMS	NUMER OF OCCUPANT	TYPE OF TOILET	ANAL CLEANING MATERIALS		NUMBER OF TOILET BATHROOM		NUMBER OF SOAK AWAY SEPTIC		DISPOSAL INTERNAL
						WATER	TISSUE					
1	Abuja complex	Tenement	36	50	W.C	10	40	4	4	2	2	Annually
2	Mandella	Tenement	48	60	W.C	20	40	8	8	1	2	Annually
3	Farm lodge phase I	Bungalow	3 bedroom	9	W.C	-	4	2	2	1	1	Annually
4	Farm lodge phase II	Tenement	8	10	Lavatory	2	8	1	1	-	-	Two yearly
5	Youth inn	Charlet	11	Not Stable	Lavatory	-	-	3	3	-	-	Two yearly
6	Formal natural beauty product factory phase I	Bungalow	3 bedroom	10	W.C	6	4	3	3	1	1	Yearly
7	Phase II	Bungalow	4 bedroom	12	W.C	5	7	3	3	1	1	Three yearly
8	Bunny camp	Tenement	26	30	Lavatory	14	16	5	7	-	-	Yearly
9	Aminu Kano	Tenement	27	30	Lavatory	10	20	4	4	-	2	Yearly
10	Sadam Useni phase I	Tenement	7	12	W.C	7	5	2	2	Combine system		Two yearly
11	Phase II	Tenement	11	20	W.C	11	19	Multi purpose				Two yearly
	Total		184	245		85	160	37	39			

Source: FILED SURVEY 4/11/2001

APPENDIX II
PRESENTATION OF DOMESTIC SEWAGE DISPOSAL IN ZONE BGWALLAMEJI

S/NO	NAME OF PREMISE	TYPE OF BUILDING	NUMBER OF ROOMS	NUMBERS OF OCCUPANT	TYPE OF TOILET	ANAL CLEANING MATERIALS		NUMBER OF TOILET BATHROOM		NUMBER OF SOAK AWAY SEPTIC		DISPOSAL INTERNAL
						WATER	TISSUE					
1	Destiny	Tenement	23	30	W.C	10	20	4	4	1	1	Two yearly
2	1004	Tenement	14	16	Lavatory	8	8	2	2	-	-	Annually
3	Sadaunna	Tenement	21	25	Lavatory	12	13	4	3	-	-	Two yearly
4	Ramat House I	Tenement	19	25	Lavatory	10	15	5	5	-	-	Three yearly
5	Ramat House II	Tenement	12	15	Lavatory	10	5	2	2	-	-	Annually
6	Satellite	Tenement	24	30	Lavatory	20	10	6	6	-	-	Four yearly
7	Tubless	Tenement	12	20	Lavatory	10	10	1	2	-	-	Yearly
8	T. Sakara	Tenement	20	26	Lavatory	20	6	4	4	-	-	Three yearly
9	Owels	Tenement	17	20	Lavatory	13	7	3	3	-	-	Three yearly
10	5005	Tenement	6	10	Lavatory	3	7	1	1	-	-	Two yearly
11	Manager lodge phase 2	Tenement	8	16	Lavatory	6	10	1	1	-	-	Two yearly
	Total		176	227		132	95	33	33			

Source: Field Survey 4/11/2001

APPENDIX III
PRESENTATION OF DOMESTIC SEWAGE DISPOSAL IN ZONE “C” GWALLAMEJI

S/NO	NAME OF PREMISE	TYPE OF BUILDING	NUMBER OF ROOMS	NUMBERS OF OCCUPANT	TYPE OF TOILET	ANAL CLEANING MATERIALS		NUMBER OF TOILET BATHROOM		NUMBER OF SOAK AWAY SEPTIC		DISPOSAL INTERNAL
						WATER	TISSUE					
1	Net house	Tenement	26	31	Lavatory	26	5	2	2	-	-	Yearly
2	Zik complex	Tenement	24	30	None	-	30	-	1	-	-	-
3	Kaltungo	Tenement	4	6	None	-	6	-	1	-	-	-
4	Aso Rock	Tenement	20	30	Lavatory	17	13	5 multi-purpose		-	-	Three yearly
5	1004 Ba-Ashiga	Tenement	9	17	Lavatory	-	17	1	1	-	-	Two yearly
6	Ndogu	Tenement	10	13	None	-	13	-	1	-	-	-
7	Victoria Island	Tenement	32	40	Lavatory	20	20	2	4	-	-	Yearly
8	2010 Ba-Ashiga	Tenement	19	25	Lavatory	13	12	3	3	-	-	Two yearly
9	Dc State House	Tenement	20	27	Lavatory	10	17	3	3	-	-	Two yearly
10	Zion Complex	Tenement	3	3	Lavatory	1	3	1	1	-	-	Four yearly
11	Independence villa	Tenement	13	15	Lavatory	2	13	2	2	-	-	Three yearly
	Total		180	237		88	149	19	23			

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or without disposal facilities command same rental values due to limited supply. It is unfortunate that at about 90% occupant in Gwallameji are student, regardless of their educational background and awareness as to the effect of improper domestic sewage disposal still occupies premises without adequate provision of domestic sewage disposal system just because they had no alternatives.

One of the major implication of improper domestic sewage disposal, particularly in most Bashigated complex in zone B e.g. 1004 Ba-shiga complex that uses lavatory, this lavatory is constructed close to their source of water (well) thereby contaminating their water, causing water pollution with its subsequent attendant effect on health. Another implication is that waste water being disposal in an open environment in zone B and C create breeding space for vector which has negative effect on the health of the occupant in Gwallameji these two implication leads to high rate of water borne disease, malaria and unpleasant environment in Gwallameji.

The researcher therefore suggested that all bodies concerned particularly the institution authority (Federal Polytechnic) should make provision for adequate hostel accommodation, thereby reducing the demand for residential houses in Gwallameji, so that there will be difference in rental values of houses with or without disposal facility and the property owners will adjust by providing adequate disposal facility so as to

tissues, which will also be thrown/left on the open space with the excreta this create unpleasant environment.

The present state of domestic sewage disposal Gwallameji is unsatisfactory considering the number of toilet and bathroom provided to the number of occupant/users and also considering how wastewater is being disposed, 67% premises disposes this improperly.

3.4.2 SECONDARY SOURCE

This deals with information obtained from published and unpublished document e.g. seminars, conference, lecture, property journals, e.t.c. and textbooks.

3.5 METHOD OF DATA ANALYSIS

Descriptive statistics and percentage grading analysis was use to analyses method and provision of sewage disposal system and correlation was used via average to compare and contrast the improper and proper disposal on which conclusion was deduced that domestic sewage disposal in Gwallameji is inadequate e.g.

0 - 39	F = Fail
40 - 44	E = Pass
45 - 49	D = Pass
50 -59	C = Credit
60 - 69	B =Credit
70 - 100	A = Excellent

CHAPTER FOUR

4.0 DATA PRESENTATION AND ANALYSIS

Data collected from the survey are on domestic sewage disposal in Gwallameji for clear, logical presentation and analysis; the data are presented in statistical manner. This enables the researcher to evaluate data intelligently. It also furnishes a technique of comparism at other places, interpret conditions and simplify complex mass data and present them in an easily understandable form.

The descriptive statistics was applied to enable the researcher present data in tables while correlation enables the researcher to reach a conclusion about domestic sewage disposal in the entire population base upon the sampled premises taken from the population.

Table 4.1. PRESENTATION OF NUMBER OF ADMINISTERED QUESTIONNAIRES, NUMBER RETURN AND NUMBER NOT RETURNED.

Number of administered questionnaire	66	100%
Total number return	50	76%
Total numbered not returned	16	24%

Source: Field Survey (4/11/2001)

This table shows that the researcher administered sixty six (66) questionnaire, fifty (50) were returned while the rest sixteen (16) were not returned.

3.3 RESEARCH INSTRUMENT

The instrument used for this research are:

- Questionnaire,
- Personal interview,
- Direct observation,
- Journals and
- Textbooks.

3.4 PROJECT WORK SOURCES OF DATA COLLECTION

Data was sourced from primary and secondary source.

3.4.1 PRIMARY SOURCE

This deals with personal interview, questionnaire administration and direct observation Oral interview was conducted coupled with questionnaire to support the inadequate information, sixty six number of questionnaire was administered that is twenty two to each strata/zone in the sampled premises of the study area.

The researcher also visited the sampled premises for direct observation of the present state of domestic sewage disposal it was observed that most premises discharge/dispose their use water in an open environment and also dispose the faecal waste on the open environment/space. See plate I and II

CHAPTER FIVE

5.0 SUMMARY OF FINDING, CONCLUSION AND RECOMMENDATION

This chapter summaries the finding by the researchers her conclusion and recommendation so as to improve or enhance domestic sewage disposal in Gwallanmeji.

5.1 SUMMARY OF FINDINGS

Through out the preceding chapters, the aim of the researcher was to examine the domestic sewage disposal (soil and waste water) in Gwallanmeji. From the sample taken the researcher reduced a conclusion that sewage disposal in Gwallanmeji is unsatisfactory, the disposal of faecal waste/soil waste either to a closet and finally to septic tank or lavatory can be said to be satisfactory since only 9% of the sampled premises disposes their faecal waste in an open-environment. It was also reduced that improper domestic sewage disposal in Gwallameji create unpleasant and polluted environment with its attendance consequences on the occupants health.

5.2 CONCLUSION

The need to identify the contributions of groups concern with environmental issue is stressed. Gwallameji as a social, political and educational potential for producing good environmental action plan, the mistake of other towns can be learnt through the use of incentives, legislation and public enlightenment.

The various relevant parastatals (Bauchi state Environmental Protection Agency and local Authority should set up land information system where such information related to environmental quality can be deposited and retrieved amongst themselves with the view of encouraging proper sewage disposal system through the real estate investors / owners of landed property.

5.3 RECOMMENDATIONS:

The environment can be maintained to the advantage of man through the following.

- There is need to enhance awareness to all property investors as to the importance of domestic sewage disposal system to the value of their property and its life span. The UNICEF in trying to create these awareness also by practical zing what they say by the construction of sampled Sam plate lavatories and soak away pit. In doing this the Gwallameji

communities should be involved so as to continue where the UNICEF stopped.

- Environmental Protection Agency as the watchdogs of the environment they should inspect the environment, advice the government on laws and its enforcement. The composition of these Agency should be professionals acquainted with the knowledge on environmental issues, that is the technical know how so as to follow up matters related to environmental laws by the Bauchi state Environmental Protection Agency. The body of professionals in environmental issues should be given the responsibility of keeping the environment clean.
- Since the Environmental Protection Agency are assign with the responsibility of keeping a clean and safe environment, there should be adequate and proper inspection of premises with the view of maintaining a qualitative environment. There is also the need to inspect premises without disposal system, taking a further step by penalising the property owners by collecting fees that could construct disposal system or more so as to boost their moral to provide these facilities for the full enjoyment of the property by the occupier. This measure should be taken so as to achieve an integrated rather than piece meal solution.

- There should be strict enforcement of the existing rules regarding to domestic sewage disposal system, to this end the Local Government Planning Authority should not approve any plan that does not conform with the building regulation in respect to domestic sewage disposal system for example not approving any plan that do not provide provision for the construction of sewage disposal system (lavatory, water closet, soak away and septic). For the plan that had provision for sewage disposal system construction, it should be at least 3 metres away from the building so that it will not affect the foundation of the building and contamination of their source of water (well) where pipe borne water is not available.
- The local authority should also make available arrangement to means of getting rid domestic sewage from the proximity of the premises where public sewer do not exist.
- The institution authorities (Federal polytechnic) should make provision for adequate hostel accommodation to reduce the demand for residential houses in Gwallameji so that there will be a difference in rental values of houses with and without disposal system so that the property investors will adjust by providing adequate disposal facilities.

APPENDIX IV

**DEPARTMENT OF GEOGRAPHY
FEDERAL UNIVERSITY OF TECHNOLOGY
P.M.B 65
MINNA
NIGER STATE**

**QUESTIONNAIRE DESIGN TO ASSIST IN OBTAINING INFORMATION
OR DATA FOR RESEARCH WORK.**

**PROJECT TOPIC : AN EXAMINATION OF DOMESTIC SEWAGE DISPOSAL IN
G WALLAMEJI, BAUCHI, BAUCHI STATE.**

The purpose of this study is purely academic for research work in partial fulfilment of the requirement for the award of Post Graduate Diploma in Environmental Management

Your co-operation is hereby humbly solicited for in supplying data, honest information that is needed. Be rest assured that such data would be treated strictly confidential. It would be appreciated if you would kindly give answer to the following questions.

1. DATE..... LOCATION/RESIDENTIAL ADDRES.....

.....TIME

2. TYPES OF RESIDENCE /BUILDINGS (i) FLAT (ii) TENAMENT

(iii) OTHERS SPECIFIC

3. RENT PAYABLE

4. NUMBER OF ROOMS IN THE COMPOUND/FLAT.....
5. TYPES OF TOILET (i) PIT (ii) VIP (iii) W.C (iv) OTHERS
SPECIFY.....
6. NUMBERS OF TOILETS.....
7. TYPES OF ANAL CLEANING MATERIAL (i) WATER
(ii) TOILET ROLL (iii) HARD PAPER (iv) LEAVES
(v) OTHERS SPECIFY
8. TYPES OF BATHROOM (i) OPEN AND FENCED
(ii) OPEN NOT FENCED (iii) WALLED AND ROOFED
(iv) WALLED BUT NOT ROOFED (v) OTHERS SPECIFY.....
9. NUMBER OF BATHROOMS
10. NUMBER OF THE BATHROOM FACILITY (i) SHOWER
(ii) BASIN (iii) OTHERS SPECIFY
- (11) TYPES OF KITCHEN (i) WALLED AND ROOFED
(ii) OPEN SPACE (iii) OTHERS SPECIFY
- (12) NUMBER OF KITCHEN
- (13) NATURE OF THE KITCHEN FACILITY (i) SINK
(ii) OPEN SPACE/NO SINK (iii) OTHERS SPECIFY
- (14) SOURCE OF WATER (i) WELL (ii) BOREHOLE
(iii) PIPE BORNE WATER (iii) OTHER SPECIFY

SECTION B

15. IS THERE ANY SEWAGE DISPOSAL SYSTEM IN THE RESIDENCE

YES NO

16. IF YES STATE TYPE (i) SOAK AWAY PIT (ii) SEPTIC TANK

(iii) CONSERVACY PIT (iv) OPEN SPACE

(v) OTHER SPECIFY

17. NUMBER OF SOAK AWAY PIT/SEPTIC TANK (i) ONE

(ii) TWO (iii) ABOVE TWO

18. HOW OFTEN ARE THEY EMTIED AND CLEANED? (i) DIARY

(ii) WEEKLY (iii) FORTNIGHTLY (iv) MONTHLY

(v) ANNUALLY

19. IS IT ADEQUATE FOR YOUR CONFORT

20. WHOSE SERVICE DO YOU EMPLOY IN EMTYING YOUR SYSTEM?

(I) DIRECT LABOUR (ii) LOCAL GOVERNMENT

(iii) STATE GOVERNMENT (iv) FEDERAL GOVERNMENT

21. DOES THE PROVISION OF PROPER DOMESTIC SEWAGE DISPOSAL

ENHANCE THE PROPERTY VALUE? (i) YES (ii) NO

SECTION C

IF NO SEWAGE DISPOSAL SYSTEM IN YOUR RESIDENCE FILL BELOW.

21. WHICH ALTERNATIVE MEANS DO YOU EMPLOY IN DISPOSING YOUR

SEWAGE? (i) WASTE WATER

(ii) SOIL WASTE /FEACAL MATTER

22. WHY DON'T YOU HAVE A SEWAGE DISPOSAL FACILITY?.....

.....

23. WHAT ARE THE EFFECT OF NOT HAVING SEWAGE DISPOSAL SYSTEM TO YOUR

(i) HEALTH

(ii) ENVIRONMENT.....

(iii) RENTAL VALUE

24. WHAT IS YOUR IMPRESSION ABOUT THE GENERAL STATE OF SANITATION IN

GWALLAMEJI? (i) GOOD (ii) FAIR

(iii) BAD (iv) VERY BAD

25. BRIEFLY GIVE IN YOUR OPINION HOW BEST YOU THINK THE SITUATION COULD BE IMPROVED?.....

.....

.....

.....

.....

THANK YOU