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EVALUATION OF SEWAGE COLLECTION, TRANSPORTATION AND SEWER MAINTENANCE IN WUSE DISTRICT, FEDERAL CAPITAL TERRITORY, ABUJA, NIGERIA.

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ABSTRACT

Sample collection, transportation and sewer maintenance were evaluated for Abuja district. This was done with a view to making necessary suggestions for improvement. The method used was questionnaire administration. Two types of questionnaires were prepared and administered for the operator of the sewer lines (Liquid Waste Department of AEPB) and the resident of Wuse District in the Federal Capital City in Abuja. Analysis of the questionnaire shows that 60% of the respondents are residentials, 30% represents commercial areas and the remaining 10% are institutions. BOD_5 for Hargeysa is 220mg/l while that of the Accra Street is 360mg/l, COD for Hargeysa Street being a secondary sewage line is 228mg/l while that of Accra Street Park is 401mg/l while the DO at Hargeysa Street is 3.10mg/l while that of the Accra Street is 2.20mg/l. Currently the districts have been provided with sewerage system in accordance with the master plan. Some of these sewer lines especially the secondary lines are constantly blocked as a result of human activities.

***KEYWORD**: Collection, maintenance, sewage, sewer, transportation, wastewater.*

1. INTRODUCTION

Once water is used for its intended purposes, impurities are collected and it becomes wastewater. Thus sewage consists of fecal matters and used water from bath, toilet, kitchen and industries etc. These wastewaters are disposed off in our ancient cities on site such as in pit, latrines, soak way / septic tank and cesspool. This system is problematic and cumbersome for communities with large population. With time, the soil gets saturated with decomposed solid effluents of very high pathogenic matter causing ground water pollution. With increase in water consumption, the rate of wastewater generation far exceeds the infiltration capacity of soil. Therefore, management of sewage for Abuja focuses on management of residual wastewater in a manner which utilizes wastewater system. For this purpose the master plan adopted central sewage system for sewage disposal which is the most modern method in thet developed countries of the world. (FCDA, 2006)

This project focuses on the sewage collection, conveyance and maintenance of this facility which is indispensable to the healthy existence of the inhabitant and the environment as it is provided in Federal Capital City, Abuja and regulated by Abuja Environmental Protection Board a government agency.

1.1 Sewage Collection and Transportation:

The concept plan for a sewer is the wastewater collection which is generated from human activities, which are previously disposed off on site such as pits, latrines, soak away / septic tanks and cesspool. These methods with variance of disadvantages become unsuitable due to urbanization and improvement in human behaviour, on site solution to waste water management is considered inappropriate. Septic tank may not be safe for the foundation of structures especially where they are too close to buildings. Broken down septic tanks constitute an eye sore, create unpleasant odor and breading grounds for mosquitoes and other water borne diseases (Veriugovella, 2004). These and other comfort enjoyed from the knowledge that household generated sewage has been taken away from residential area makes central sewage system acceptable in most developed cities of the world and thus applied in the concept plan for Abuja Master Plan.

1.2 Types of Collection Systems

In a conservancy system, human excretes are collected by human agency. Its storage and conveyance are not environmental friendly and could be responsible for spreading of communicable diseases. In a sewer system, adequate water is added to human wastes in a water closet and the sewage flows in conduits (sewers) without creating nuisance. Some of this types of sewers includes storm sewers, combined sewers and sanitary sewers (Veriugovella, 2004).

The Collection System Appurtenances are the structures constructed at a suitable location to connect sanitary sewers. These structures include manholes, drop inlet, to manholes, and building connections (Charttejee, 1987).

1.3 Sewage Transportation

Sewage transportation is a network of conduits (sewers) conveying liquid waste of about 98% waste and less than 2% solid. It consists of building sewers, secondary sewers, main-sewers and trunk sewers. The network pattern follows the natural topography and the layout colonies and streets. The diameters of sewer increases as the sewage are collected from more and more residential units. The sewage treatment plant is located at lower level since they flow by gravity; it is also pertinent to know that they are located far away from the residential area and close to the disposal point (Ovbiebo and Oluwadawunsi, 1999).

The objectives of this study are to determine the acceptability of the sewage system as provided by the administrators of the Federal Capital City, Abuja; to evaluate the effective maintenance of the sewer lines infrastructure and to determine the chemical constituents of the sewage.

2. MATERIAL AND METHODS

Three methods were employed first was the physical inspection of the various sewer lines, manholes and damage lines, the second method employed was the distribution of questionnaires and finally the chemical analysis of the wastewater.

The As-built drawing of sewer reticulation in phase I of Abuja and some selected area at Wuse II and I were collected at Abuja Environmental Protection Board (AEPB).

2.1 Questionnaire

Two types of questionnaires were prepared and administered for the operator of the sewer lines (Liquid Waste Department of AEPB) and the resident of Federal Capital City in Abuja. The questionnaire for the residents was randomly administered while the staffs of Liquid waste were all sampled.

2.2 Collection of Waste Water Samples

Samples from the influent sewerage water coming from the building sewer at Hargeysa Street to the secondary sewer were collected as sample 1. Influent sewerage water coming from the major trunk line was collected at Accra Street Park as sample 2. The effluent treated water discharge to the river was collected at Wupa treatment plant as sample 3.

3. RESULTS AND DISCUSSION

The questionnaire was carefully analyzed and the results presented in percentage after which it is represented in pie chart to meet with standard statistical analysis. Figure 4.1 shows that 60% of the correspondents are residents, 30% commercial areas and the remaining 10% are institutions. This shows that most of the areas where the sewer lines pass through are mainly residential areas from were most of the wastes are generated from.

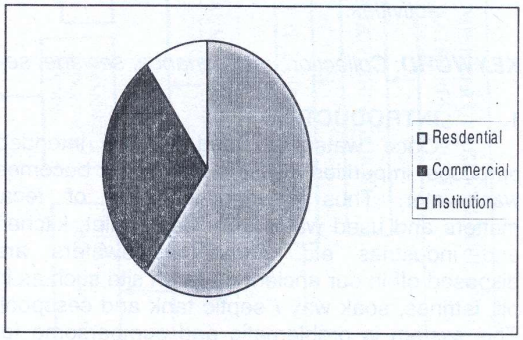

Figure 4.1: Waste generated according to the class of people staying in the area.

Figure 4.2 shows the various waste disposal method in the residential areas which are connected to the central sewer disposal system. It was observed that 90% of the residential houses were connected to the central sewer system while 5% built septic tanks and 3.33% had other methods of disposing their waste. 1.67% could not point out where or how their waste is being disposed.

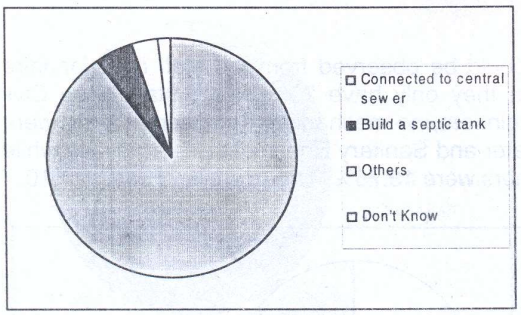

Figure 4.2: Waste disposal methods in residential areas

Figure 4.3 shows waste disposal methods in commercial areas which are connected to the central sewer. It was observed that 83.33% of the buildings were connected while 6.67% built their own septic tanks and 3.33% had other methods of waste disposal. 6.67% of most of the building in this area could not tell how and where their waste is being disposed.

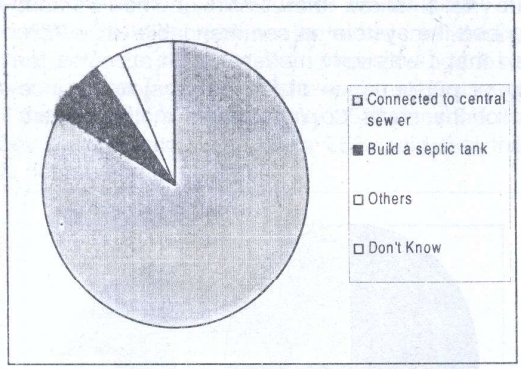

Figure 4.3: Waste disposal methods in commercial areas

Figure 4.4 shows the waste disposal methods used in the various institutions. This shows that 70% of these institution are connected to the central sewer, 20% built septic tanks while 10% do not know how and where their waste is being disposed.

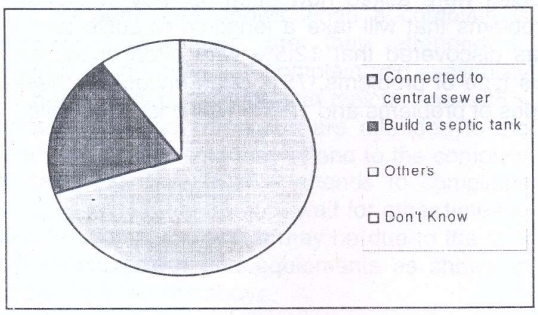

Figure 4.4: Waste disposal methods in the commercial areas.

Figure 4.5 shows the level of problem encountered by the residential, commercial and institutional areas that use the central sewer. 17.44% complained very often about the various problems with the central sewer method of waste disposal, 36.05% complain often, 38.37% complain once in a while, 2.33% do not know if there is a problem or not and 5.81% do not have any problem.

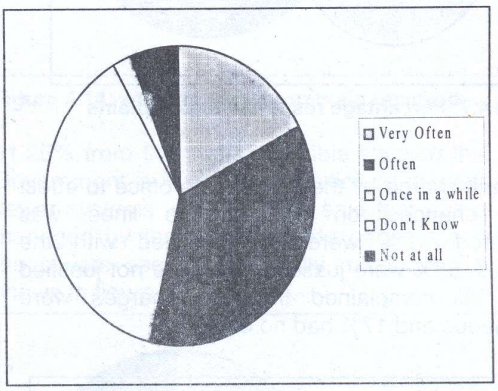

Figure 4.5: Shows problems encountered by area.

Figure 4.6 show the level of satisfaction with the system of operating the central sewer system. 32.56% were very satisfied with the operational methods while 53.49% were satisfied, 8.14% were dissatisfied with the system and 5.81% had no opinion.

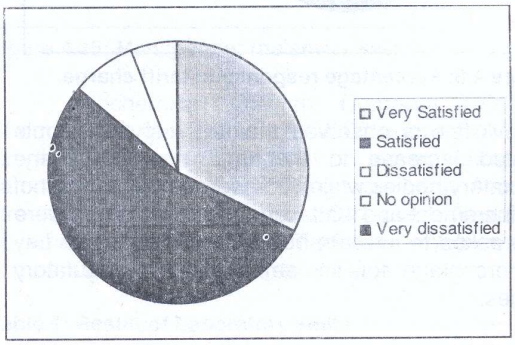

Figure 4.6: Shows the level of satisfaction with the central sewer system.

Majority of the people living within the Federal Capital city usually complain about there problems to some of the bodies that over see the affairs of the central sewer system. Figure 4.7 shows the percentage response to the complains made by the people in the area. 76.79% were satisfied with the positive response to their problem while 10.71% were not satisfied and 12.5% had no comment.

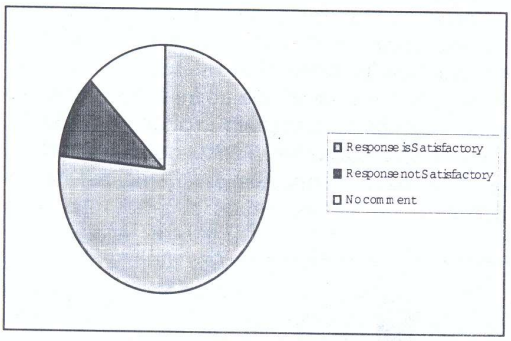

Figure 4.7: Percentage response to complains made.

The tariff charge by the appropriate office to effect these changes on the sewage lines was measured. 12% were very justified with the charges, 58% were justified, 8% were not justified while 5% complained that the charges were outrageous and 17% had no complain.

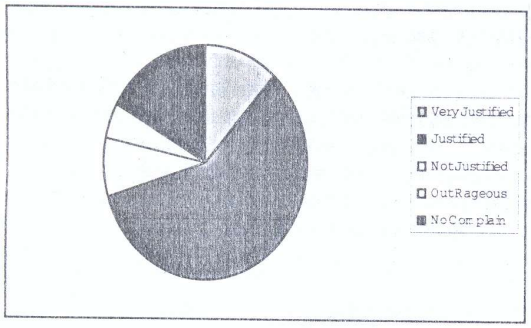

Figure 4.8: Percentage response to tariff charge.

It was observed that 32% of the people wanted increase in the tariff charge by the regulatory bodies while 58% were not in support of the increment and 10% had no opinion. They were also asked to indicate how they are willing to pay in percentage for the service to the regulatory bodies.

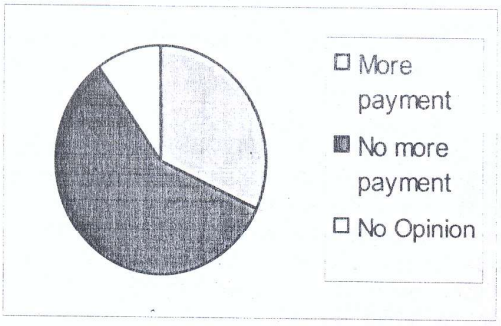

Figure 4.9: Percentage response to increase in payment

It could be observed from the staff questionnaire that they only have 25% of the staff to be Civil Engineers, no mechanical Engineers, 6.25% were Water and Sanitary Engineers, 50% artisans while others were 18.75%. This is shown in figure 4.10.

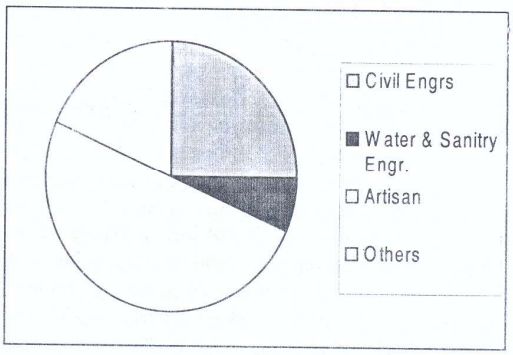

Figure 4.10: Types of Professionals.

Figure 4.11 show that 25% of the workers described the system as commendable while 75% stated that it was very modern which accounts for the poor performance of the entire system since most of the staffs do not believe in the system itself.

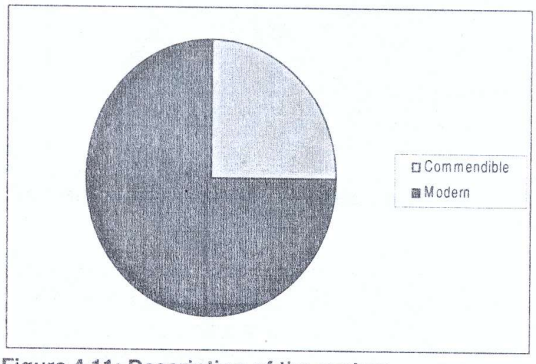

Figure 4.11: Description of the system.

Figure 4.12 shows that the staffs of the regulatory bodies were asked how often do they encounter problems that will take a longtime to solve and it was discovered that 12.5% very often encounter this type of problems, 75% often encounter these types of problems and 12.5% was once in a while.

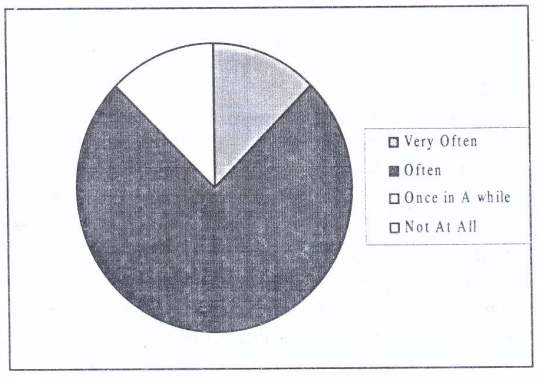

Figure 4.12: Problems encountered by the regulatory bodies.

An assessment of the types of equipments available to carry out maintenance works showed that 12.5% admitted that they have modern equipments to carry out maintenance work while 87.5% had no equipments. This further explains why the people living in such areas are not willing to pay more for the services rendered by the regulatory bodies which further confirms why the complain level is high as there are not enough equipments to carry out the various categories of maintenance. Figure 4.13 shows the staff strength of the regulatory bodies. Only 25% admitted that they have enough staff while 75% said that they do not have enough staffs.

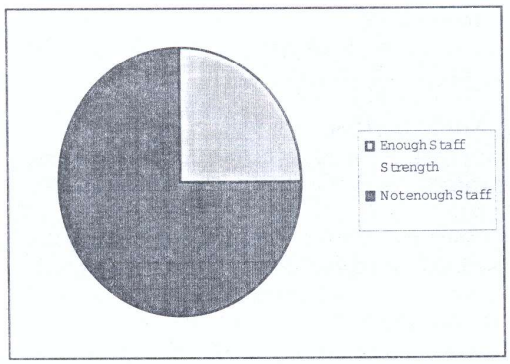

Figure 4.13: Staff strength of the regulatory bodies.

Figure 4.14 shows when a complain is received, how urgent are they attended to depending on the type of complain and availability of the materials to carry out the maintenance. 25% indicated that the complains are attended to the same day, 37.5% said they attend to the complain the following day, 18.75% attends to complains two days later while 18.75% wait for other times to attend to complains which may be due to the lack of both manpower and equipments as shown in the previous figures above.

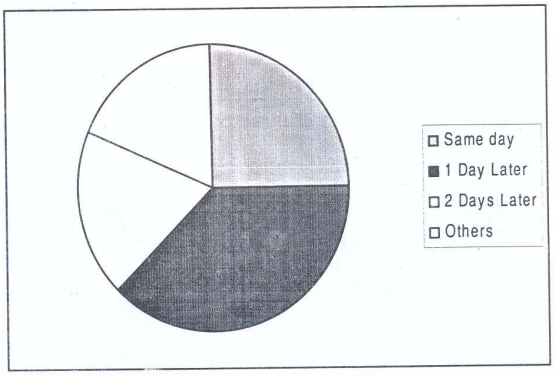

Figure 4.14: Attendance to complain received.

81.25% from the staffs available showed that the Government is in a better position to manage the sewer systems while 18.75% said that it is better managed by the public private partnership while the private sector was totally ruled out. This is shown in figure 4.17.

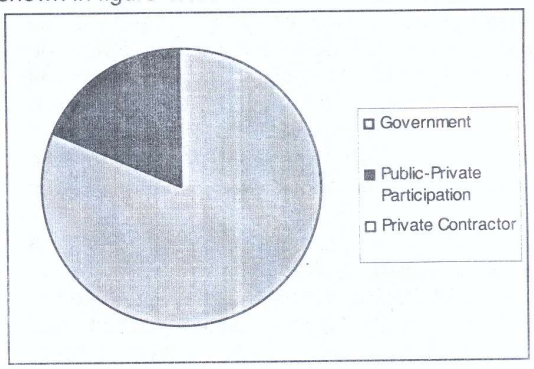

Figure 4.15: Managers of the sewer system.

Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and dissolved oxygen (DO) were carried out on the wastewater samples collected from Hargeysa and Accra streets and at the Wupa treatment plant. Results of which are shown in Table 1 which was compared with the standards of Table 2.

Table 1: Result of Laboratory Tests

S./No.	Area	PARAMETERS	RESULT
1	Hargeysa Street (ISW)	BOD	220mg / l
		COD	228mg / l
		DO	3.10mg / l
2	Accra Street (ISW)	BOD	360mg / l
		COD	401mg / l
		DO	2.20mg / l
3	Wupa (ESW)	BOD	4.10mg / l
		COD	4.60mg / l
		DO	7.20mg / l

Table 2: Standard table of BOD_5.

Type of waste water	BOD_5
Very well treated efficient	3 - 5
Standard effluent (after primary and Secondary treatment)	10 – 30
Badly treated sewage	40 – 80
Strong sewage	400 – 600
Trade effluent (animal and vegetable waste	1000

Source: Miroslav and Viadmir, 1978

Hargeysa Street sewage line is tertiary line which collects the waste water from various plot sewers of the street while Accra Street Park is a primary sewage line that collects the waste from the secondary sewer lines. BOD_5 for Hargeysa is 220mg/l while that of the Accra Street is 360mg/l. Hargeysa street line is 200mm in diameter while that of the Accra Street is 600m in diameter, the high BOD_5 at Accra street is attributed to the large diameter of the pipe that carry high quantity of the sewage. It can be deduce that the higher the diameter, the higher the waste it carries, and the lower the diameter, the lower the waste it carries. Hargeysa is a street where the waste is less in concentration when compared to that of the primary that is collecting from secondary sewage lines.

COD for Hargeysa Street being a secondary sewage line is 228mg/l while that of Accra Street Park is 401mg/l. This is attributed to the high quantity of the waste carried and equivalent of the organic matter is high at Accra Street that is susceptible to oxidation by strong oxidizing agent.

DO at Hargeysa Street is 3.10mg/l while that of the Accra Street is 2.20mg/l that is because the oxygen reduction at Accra is due to high pollution rate of the waste compare to Hargeysa Street.

Wupa treatment plant treats the waste collected from the city of Abuja. The BOD_5 for Wupa treatment plant is 4.10mg/l while the Hargeysa Street and Accra street is 220mg/l and 360mg/l respectively. This shows that, the pollution has reduced drastically to an acceptable limit for BOD_5 valued of the waste waters as shown in Table 2. COD for Wupa treatment plant is 4.60mg/l while that of Hargeysa Street and Accra Street are 228mg/l and 401mg/l respectively. This is as a result of the treatment of the waste before discharge. DO for Wupa treatment plant is 7.20mg/l while that of the Hargeysa and Accra Streets are 5.10mg/l and 2.20mg/l respectively. The high amount of DO at Wupa treatment is as a result of the treatment that yield high oxygen. The lower amount of oxygen is as a result of wastes that displace oxygen.

4. CONCLUSION

In the cause of this project; numerous problem facing use of central sewer system in Wuse District of FCT in particular are noted as follows:

i. currently the districts have been provided with sewerage system in accordance with the master plan.
ii. some of these sewer lines especially the secondary lines are constantly blocked as a result of human and constructional activities, for instance in Kitwe Street, Accra Street, Ladi Kwali Street;
iii. some terminal lines are within the district as a result of constructional error, for example Ademola Adetokunbo by penniel Appartment;
iv. also constructional error of provision of elbows at junctions and connection points are noted, for instance at khatoum street, Wuse zone;
v. indiscriminate use of sewage system that often lead to non – biodegradable materials, polyether and rags causing persistence blockage in the sewer lines;
vi. lack of adequate modern equipment, like the multipurpose master canal truck, camera inspection truck;
vii. lack of adequate and prompt maintenance of infrastructure;
viii. pollution of the stream as a result of sewage blown out /blockage.

RECOMMENDATION.

In proffering solution to the problems facing the sewerage system in FCC, it is recommended as follows:-

i. manholes should be provided on the secondary sewer lines at places of elbows, junctions and connection point for ease of maintenance;
ii. action should be expedited to ensure that terminal manholes are adequately linked to the network;
iii. companies and other commercial organizations should be mandated to provide their own treatment facilities and thereby discharge the final effluent to the sewers;
iv. hotel and other restaurant should be mandated to construct grease and oil traps to ensure that fat and oil that moved to sewers is minimized;
v. monitoring of sewer line should be more effective by the regulatory body and abuse of infrastructure be dealt decisively;

vi. adequate equipment must be provided to ensure that sewer networks are flush and wash periodically;

Vii repairs, relaying and adequate maintenance of infrastructure must be carried out Immediately problems are reported or noted.

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APPENDIX

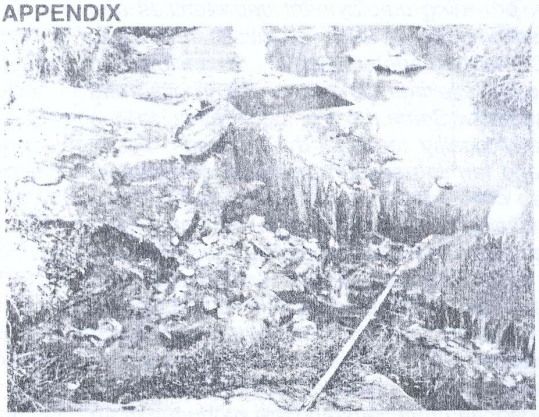

Fig 1 Multiple line Joint man hole

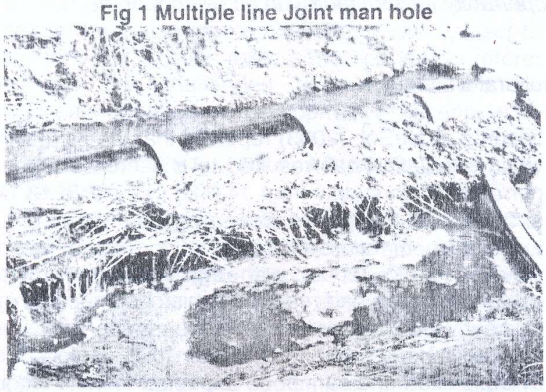

Fig 2 Blocked sewer line

Fig 3 Relaying of sewer line

Fig 4 Evacuating waste water from man hole

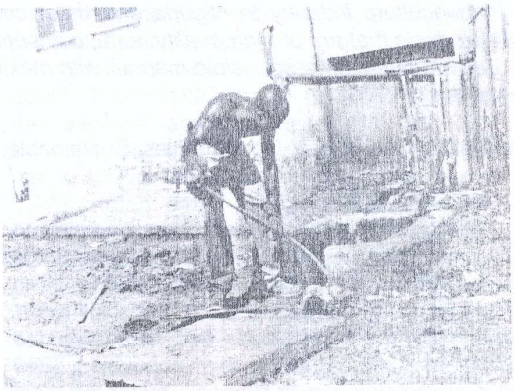

Fig 5 De-silting of manhole